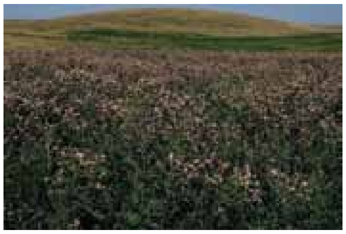
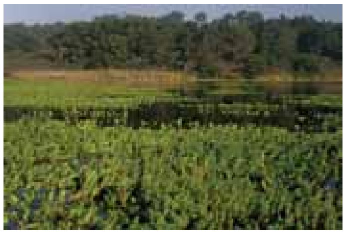
Final Environmental Impact Statement

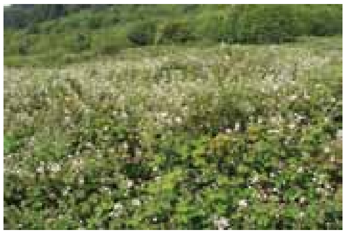
Bureau of Land Management

Vegetation Treatments Using Herbicides on BLM Lands in Oregon

Volume 1







BLM

Oregon State Office

July 2010

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BLM/OR/WA/AE-10/077+1792

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Cover: Southeast of Richland, Oregon along the Brownlee Reservoir (Snake River), a rancher views vast stands of medusahead (a noxious weed). The area is mixed BLM/private ownership (photographer: Matt Kniesel).

Because science cannot, in any practical sense, assure safety through any testing regime, pesticide use should be approached cautiously.
(EPA scoping comment, July 28, 2008)

Our present technologies for countering invasive non-native weeds are rudimentary and few: control by biological agents, manual eradication, mechanized removal, fire, and herbicides. All have limitations; all are essential (Jake Sigg, California Native Plant Society 1999)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965
Portland, Oregon 97208

IN REPLY REFER TO:

9015 (OR932)

July 30, 2010

Dear Reader:

Thank you for your interest in the management of public lands in Oregon. Enclosed is the *Final Environmental Impact Statement (Final EIS) for Vegetation Treatments Using Herbicides on BLM Lands in Oregon*. The Proposed Action, Alternative 4, would allow for the use of 16 herbicides east of the Cascades and 13 herbicides west of the Cascades to treat noxious and invasive plants; treat any vegetation needed to control pests and diseases in State-identified control areas; treat any vegetation to meet safety and operation objectives in administrative sites, recreation sites, and rights-of-way; and treat any vegetation to achieve habitat goals specified in approved Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, or Conservation Agreements for Federally Listed, proposed for listing, or Bureau Sensitive species.

The *Draft EIS for Vegetation Treatments Using Herbicides on BLM Lands in Oregon* was released for public comment in October 2009. Approximately 1,050 comments were received on the Draft EIS, and the ideas presented in these comments were used to improve the analysis presented in the Final EIS.

The Notice of Availability for this Final EIS is expected to be published in the *Federal Register* on or about July 30, 2010. A Record of Decision is expected to be signed 30 to 90 days after publication of the Notice of Availability of the Final EIS. A separate Notice of Availability for the Record of Decision will also be published in the *Federal Register* and its publication date will begin a 30-day appeal period. The appeal process will be described in the Notice of Availability for the Record of Decision and in the Record of Decision itself.

For further information, or to receive a printed copy of this EIS, please visit the project website at http://www.blm.gov/or/plans/vegtreatmentseis/, email orvegtreatments@blm.gov, or write to the Vegetation Treatments EIS Team at Vegetation Treatments EIS Team, P.O. Box 2965, Portland, Oregon 97208-2965.

Sincerely,

Edward W. Shepard
State Director,
Oregon/Washington

Enclosure

Vegetation Treatments Using Herbicides on BLM Lands in Oregon Final Environmental Impact Statement

Bureau of Land Management

July 2010

Responsible Official: Edward W. Shepard, Oregon/Washington Bureau of Land Management State Director

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Copies of this document are also available online at http://www.blm.gov/or/plans/vegtreatmentseis/. Printed copies or a CD version can be obtained by contacting the Vegetation Treatments EIS Team at Vegetation Treatments EIS Team, PO Box 2965, Portland, Oregon 97208-2965, or at orvegtreatments@blm.gov.

Notice

The Record of Decision is expected to be issued in 30 to 90 days. The responsible official is the BLM Oregon/Washington State Director (see title page). Since this EIS is not specifically about grazing, forest management, or resource management planning, the appeal procedures for general public land issues will apply. Therefore, a 30-day appeal period will follow issuance of the Record of Decision. The applicable appeal procedure will be described in detail in the Record of Decision. Applicable regulations can be found at 43 CFR § 4.411, 43 CFR § 4.21, 43 CFR § 4.401.

Abstract

The BLM proposes to increase the number of herbicides available for use on BLM lands in Oregon, and to expand their use beyond the noxious weed management program. Noxious weeds are spreading on BLM lands at the rate of 144,000 acres per year. The existing BLM vegetation management program (Alternative 2) is unable to effectively address the rate of spread or treat all species. New herbicides are available that would better control weeds, better meet other vegetation management objectives, and have fewer adverse effects on humans and the environment. This EIS examines three alternatives that would meet the need: Alternative 3 would add eight herbicides west and nine herbicides east of the Cascades, to the four herbicides already being used to control noxious weeds. Herbicide use would be expanded to include the treatment of other invasive plants and the treatment of native plants to control invasive pests and diseases; Alternative 4 would add 9 and 12 herbicides and add (to the uses described in Alternative 3) native vegetation control in rights-of-way, administrative sites, and recreation sites, and conduct habitat improvement specified in interagency Conservation Strategies for Special Status species; and, Alternative 5 would add 14 herbicides statewide to the four already being used, and expand herbicide use to include any vegetation management objective except livestock forage and timber production. A Reference Analysis of no herbicide use is also included for comparison purposes. The decision will be based on which alternative best: controls noxious and other invasive weeds; protects developments from encroaching vegetation; maintains wildlife and other habitats; reduces fire risk; complements weed control work on adjacent lands; protects flora, fauna, and human health; controls exotic plant pests and diseases; and, minimizes treatment costs and economic losses. The analysis indicates: noxious weeds would infest 1.9 to 2.2 million fewer acres under the Action Alternatives 3 and 4/5 respectively; that Alternative 4 and 5 would save $1 million per year just in right-of-way, administrative site, and recreation site weed treatments; and, under all alternatives and with Standard Operating Procedures and PEIS Mitigation Measures in place, risks to humans and resources are generally low to negligible. Some additional potential mitigation is identified by the analysis. Potential additional monitoring is also identified. The preferred alternative is Alternative 4.

Acronyms / Abbreviations

ACEC	Area of Critical Environmental Concern
AgDrift	An aerial dispersal model used in pesticide registration
a.i.	active ingredient
ALS	Acetolactate Synthase
AML	Appropriate Management Level
ANSI	American National Standards Institute
ARI	Aggregated Risk Index
ATV	All-Terrain Vehicle
BA	Biological Assessment
BEA	Bureau of Economic Analysis
BEE	With triclopyr, Butoxyethyl ester
BLM	Bureau of Land Management
BO	Biological Opinion
CALPUFF	An atmospheric pollution dispersion model
CBI	Confidential Business Information
CDC	Center for Disease Control and Prevention
CEC	Cation Exchange Capacity
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWMA	Cooperative Weed Management Areas
DEIS	Draft Environmental Impact Statement
DO	Dissolved Oxygen
DOI	Department of the Interior
EA	Environmental Assessment
EEC	Estimated Exposure Concentration
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENSO	El Nino-Southern Oscillation
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
F	Fahrenheit
FEIS	Final Environmental Impact Statement
FIA	Forest Inventory Analysis
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FLPMA	Federal Land Policy and Management Act
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
HFRA	Healthy Forests Restoration Act
HHRA	Human Health Risk Assessment

HMA	Herd Management Area
HQ	Hazard Quotient
ICBEMP	Interior Columbia Basin Ecosystem Management Project
INFISH	Inland Fish Strategy (an aquatic conservation strategy)
IRAT	Individual Risk Assessment Tool
ISSSSP	Interagency Special Status / Sensitive Species Program
IVM	Integrated Vegetation Management
LC50	Lethal Concentration to 50% of the Population
LD50	Lethal Dose to 50% of the Population
LOAEL	Lowest Observed Adverse Effects Level
LOC	Level of Concern
MCL	Maximum Contaminant Levels
MM	Mitigation Measure
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NCA	National Conservation Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NCHS	National Center for Health Statistics
NCIPC	National Center for Injury Prevention and Control
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effects Level
NO_X	Nitrogen Oxides
NP	Nonylphenol
NPE	Nonylphenol Polyethoxylate (a surfactant)
NRCS	Natural Resources Conservation Service
O_3	Ozone
O&C Act	Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-Highway Vehicle
ONA	Outstanding Natural Area
OSHA	Occupational Safety and Health Administration
OSU	Oregon State University
PACFISH	Pacific Anadromous Fish Strategy (an aquatic conservation strategy)
PAR	Pesticide Application Record
PDO	Pacific Decadal Oscillation
PEIS	Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (2007)
PER	Programmatic Environmental Report
PFC	Proper Functioning Condition
pH	Potential of Hydrogen (measure of acidity)
PM	Particulate Matter
POEA	Polyoxyethylenamine (a surfactant)

PRPA	Paleontological Resources Protection Act
PSD	Prevention of Serious Degradation
PUR	Pesticide Use Report
PVT	Potential Vegetation Type
R-11	Nonylphenol Ethoxylate (an adjuvant)
RED	Reregistration Eligibility Decision
RfD	Reference Dose
RMP	Resource Management Plan
RNA	Research Natural Area
ROW	Right-of-Way
RQ	Risk Quotient
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
TI	Toxicity Index
TIP	Tribal Implementation Plan
TEA	With triclopyr, triethyamine salt
TEP	Threatened, Endangered, or Proposed
TMDL	Total Maximum Daily Load
TRV	Toxicity Reference Value
TSP	Total Suspended Particles
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
UTV	Utility Vehicle
UV	Ultra-violet
VOC	Volatile Organic Compound
VRM	Visual Resource Management
WUI	Wildland-Urban Interface
WSA	Wilderness Study Area
WSR	Wild and Scenic River

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Summary

Introduction

This Final Environmental Impact Statement (FEIS) presents the environmental consequences, at the programmatic scale, of a proposal to increase the number of herbicides available to the nine Bureau of Land Management (BLM) districts in Oregon for use in their existing noxious weed, invasive plant, and other vegetation management programs. The BLM in Oregon has been limited to the use of four herbicides[1] since 1987, and their use is limited to the treatment of noxious weeds (FEIS:3[2]).

> ***Terminology*:**
>
> **Invasive plants** (or weeds) are non-native aggressive plants with the potential to cause significant damage to native ecosystems and/or cause significant economic losses.
>
> **Noxious weeds** are a subset of invasive plants that are county-, State-, or Federally- listed as injurious to public health, agriculture, recreation, wildlife, or any public or private property.

The BLM manages approximately 15.7 million acres in Oregon, or about 25 percent of the land in the State. Vegetation management to meet the Federal Land and Policy Management Act's public lands management policies and to satisfy the mandates of other laws, policy, and management plans takes place annually on thousands of acres of BLM lands in Oregon (FEIS:4). The BLM and its cooperators[3] manage vegetation on thousands of acres per year to maintain or restore forest and rangeland health; provide sustainable habitat for Special Status and other species of plants and animals; reduce the risk of wildland fire; and, provide for safe use and access to a variety of authorized developments. For these treatments, a full range of non-herbicide treatment methods are described in existing management plans, have been analyzed in existing National Environmental Policy Act (NEPA) documents, and are currently in use to achieve vegetation management objectives (FEIS:6).

In 1984, the BLM was prohibited from using herbicides in Oregon by a U.S. District Court injunction issued in Northwest Coalition for Alternatives to Pesticides, et al. v. Block, et al. (Civ. No. 82-6273-E). The injunction stemmed from a court decision that the BLM had not conducted a worst-case analysis for the herbicides being used at that time. Following completion of an EIS addressing four herbicides for the treatment of noxious weeds, the injunction was modified by the court in November 1987 (Civ. No. 82-6272-BU). The injunction permits the use of the four herbicides analyzed, and limits their use to the control of noxious weeds (FEIS:3).

In 2007, the BLM national office completed the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS) and related Record of Decision, making 18 herbicides available for a full range of vegetation treatments in 17 western states including Oregon. Oregon cannot implement that decision, however, until and unless the District Court injunction is lifted (FEIS:3).

1 2,4-D, dicamba, glyphosate, and picloram

2 References in the *Summary* refer to the page numbers in the body of the Final EIS.

3 Cooperators: Leasees, permittees, and others with authorized uses or occupancy on BLM lands.

The BLM in Oregon has decided not to petition the court with the PEIS, but to prepare an Oregon-specific programmatic EIS, tiered to the PEIS. This EIS was prepared primarily:

1) To address the U.S. District Court injunction in a single programmatic document, and;
2) Because unlike the other western states, most of the herbicides proposed for use have not been used on Oregon BLM lands for more than 20 years, if at all.

Neither of those conditions applies to the other 16 western states, which were using up to 20 herbicides for a full range of vegetation management objectives prior to the 2007 Record of Decision for the PEIS (FEIS:4).

The EIS does not examine specific treatments. Additional NEPA analysis at the district or project level will analyze the effects of specific project proposals (FEIS:3).

What Action is Proposed?

The Proposed Action (Alternative 4) would add 9 of the nationally-approved herbicides west of the Cascades and 12 east of the Cascades[4] to the 4 already in use (Table S-4). In addition, it would expand their use beyond noxious weed treatments to include: the control of all invasive plants; the control of pests and diseases; the control of native and other non-invasive vegetation in rights-of-way, administrative sites, and recreation sites; and, the treatment of vegetation to achieve habitat goals specified in interagency Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, or Conservation Agreements for Federally Listed and other Special Status species (FEIS:7-8, 31-32). No aerial application would be permitted west of the Cascades (FEIS:31).

It is estimated that herbicide use would increase from 16,700 acres per year under the No Action Alternative (Alternative 2) to 45,200 acres per year under the Proposed Action (Alternative 4) (FEIS:78). Because newer, more target-specific herbicides would be used, the average pounds per acre of herbicide applied, would decrease about 30 percent (FEIS:80). All but 3,000 acres of the estimated increase would be east of the Cascades, and 11,000 acres of the increase is estimated to be imazapic applications on invasive annual grasses, including medusahead and cheatgrass, primarily to help with restoration of native plants following wildfires or prescribed burns (FEIS:83). Approximately 9,000 acres of the increase would treat native and other non-invasive vegetation causing safety and maintenance issues on rights-of-way, administrative sites, or recreation sites (FEIS:83-84). These treatments are now done with non-herbicide methods (FEIS:84), and using herbicides would save about $1 million per year (FEIS:342), and have a collateral benefit of killing undetected invasive plants near roads and other high-use areas and thus preventing them from being moved elsewhere (FEIS:136-137).

An estimated 5,700 acres of the proposed increase would go to improving habitat for Federally Listed or other Special Status species (FEIS:78), mostly in sagebrush habitats east of the Cascades (FEIS:256, 83). Herbicides would also be available to treat native plants to control exotic pests and diseases in State-identified control areas, like the area currently quarantined for Sudden Oak Death in southwestern Oregon (FEIS:31). In that area, tanoak stumps near Sudden Oak Death infestations would be treated to prevent resprouting, depriving the pathogen its preferred host (FEIS:162).

4 Districts east and west of the Cascades identified different program needs because of differences in vegetation types and weed occurrence.

Why is the Action Needed?

Noxious weeds and other invasive plants are difficult to control. Many species simply cannot be controlled with manual and mechanical treatments alone because their roots are deep and readily re-sprout, because they are in areas where soil disturbance is not acceptable, access limitations prevent effective control, or because they would simply reseed into mechanically disturbed sites. Many plant species are not effectively controlled by the four herbicides currently available to BLM in Oregon. In spite of an aggressive Integrated Vegetation Management program using all available treatment methods, these plants are spreading, habitats are being degraded, and hazardous fuel buildup is increasing. About 1.2 million of the 15.7 million acres of BLM lands in Oregon are currently infested with noxious weeds at some level,[5] and they are spreading at an estimated rate of 12 percent per year (Appendix 7). Ecological damage from extensive noxious weed infestation is often permanent. Adverse effects include displacement of native plants; reduction in habitat and forage for wildlife and livestock; loss of habitat for Federally Listed and other Special Status species; increased soil erosion and reduced water quality; reduced wilderness and recreation values; reduced soil productivity; and changes in the intensity and frequency of fires (FEIS:6-7).

There are also specific management situations where *native* and other non-invasive vegetation is going untreated or only partially treated because available vegetation management methods are inefficient or costly. The management of encroaching vegetation within road, power line, pipeline, and other rights-of-way and developments is being conducted with non-herbicide methods at a higher cost on BLM lands than on adjacent non-BLM lands where herbicides are available. The additional costs and reduced effectiveness ultimately affect utility subscribers and/or subtract from funds available for other vegetation treatments. Mechanical methods can also spread invasive plants. Western juniper is spreading into other native shrub/grass communities, capturing available soil water, and altering soils in ways that inhibit retention and reestablishment of native plants in those communities. The plant pathogen Sudden Oak Death is getting a foothold in southwest Oregon, threatening to kill tanoaks and other plants throughout the State and lead to plant quarantines on a variety of nursery plants (FEIS:7).

To better meet BLM's noxious weed and other vegetation management responsibilities, there is an underlying *Need* for more effective vegetation control measures. Because all other known non-herbicide methods are available and being used to the extent practicable within existing funding and capabilities, the *Need* for more effective control measures translates to a proposal to make more herbicides available for use on public lands administered by the BLM in Oregon (FEIS:7).

What Would it Mean Not to Meet the Need?

To answer that question, a No Action Alternative (Alternative 2) was analyzed. Noxious weeds would continue to spread at an estimated rate of 12 percent (144,000 acres per year), and infest about 5.9 million acres or one-third of the BLM lands in Oregon, in 15 years (FEIS:133, 138). Millions of acres of imperiled sagebrush habitat would be converted to medusahead and cheatgrass, which are invasive annual grasses with little habitat or forage value (FEIS:274) and prone to regular intense fires that remove all other vegetation and endanger rural communities (FEIS:277). The BLM would continue to try, without herbicides, to control tanoak on its portion of the State quarantine area for Sudden Oak Death in southwest Oregon. Tanoak is a prolific sprouter, and the continued persistence of Sudden Oak Death at the quarantine area is thought to be at least partially related to BLM's inability to control that sprouting with herbicides (FEIS:161). If Sudden Oak Death escapes the quarantine area and spreads unchecked as it has in California, ecological damage from the loss of most tanoak and several other host trees throughout western Oregon and possibly into Washington would be severe. Such a spread would also

5 "Infestations" range from monocultures of invasive weeds to a few stems per acre.

cost Oregon's nursery industry an estimated $28 to $259 million per year in lost export opportunities, quarantines, and cleaning (FEIS:160).

Management of native and other non-invasive vegetation in rights-of-ways, administrative sites, and recreation sites would continue without herbicides, costing $1 million more per year than with herbicides (FEIS:342), and causing ground disturbances that exacerbate the spread of invasive plants (FEIS:136, 252). About 3,700 acres per year of habitat improvement opportunities for Special Status species would be forgone (FEIS:83-84).

A "no herbicides" Reference Analysis is also analyzed to help set a benchmark from which to compare herbicide use effects (FEIS:27). Overall, treatments without herbicides are more expensive and less effective at controlling noxious weeds (FEIS:136, 340). Under the Reference Analysis, noxious weeds are projected to spread to 8.6 million acres in 15 years (about one-half of the BLM lands in Oregon) (FEIS:138).

Are There Other Alternatives that Would Meet the Need?

Three action alternatives are identified that would meet the *Need* and meet some or all of the *Purposes*. In addition to the Proposed Action (Alternative 4):

Alternative 3 would add eight and nine herbicides, west and east of the Cascades respectively, to the four currently being used (Table S-4). It would permit herbicides to be used on invasive plants other than noxious weeds, such as cheatgrass. This alternative would also make herbicides available to treat any vegetation as necessary to control pests and diseases in State-identified control areas, such as that for Sudden Oak Death in southwestern Oregon (FEIS:30). Herbicide use would be expected to increase from 16,700 acres under the No Action Alternative (Alternative 2) to 30,300 acres under Alternative 3 (FEIS:78), although total pounds of herbicide used would decrease about 35 percent (at the typical rate) because many of the additional herbicides are used in much lower quantities (FEIS:80). More than 80 percent (11,000 acres), of the increase would be to treat the invasive annual grasses medusahead and cheatgrass east of the Cascades, usually to facilitate native plant restoration following wildfire or prescribed fire (FEIS:83). The herbicides available under this alternative would be effective on almost all of the known invasive plants in Oregon (FEIS:136). Alternative 3 would meet the *Need* and many of the *Purposes*.

Alternative 5 would add 14 herbicides to the four already being used (Table S-4), and make them available for any vegetation management objective except livestock forage or timber production. As with all the alternatives, treatments must be permitted by the product label and be consistent with the product's Oregon registration (FEIS:28). The analysis estimates that herbicide use under this alternative would be about 50,000 acres per year, an increase of about ten percent (4,800 acres) from the Proposed Action (Alternative 4) (FEIS:78). Most of this increase would go to additional habitat improvements east of the Cascades (FEIS:83). All of the elements of the Proposed Action (Alternative 4) are included in this alternative, so both Alternatives 4 and 5 would meet the *Need*, and meet all eight *Purposes* to varying degrees.

What Factors Will be Used in Making the Decision Between Alternatives?

The decision by the BLM Oregon/Washington State Director will be based on the degree to which the selected alternative meets the *Need* and *Purposes* (FEIS:11). The *Need* is *to better meet BLM's noxious weed and other vegetation management responsibilities, there is an underlying need for more effective vegetation control measures* (FSEIS:12).

The eight *Purposes* to be variously achieved by the selected alternative are:

1. *Control invasive plant species to protect native ecosystems and the flora and fauna that depend on them.*
2. *Protect the safety and function of BLM and other authorized infrastructures by controlling encroaching native and other non-invasive vegetation.*
3. *Manage native vegetation to provide sustainable habitats for wildlife, fish, and native plants, particularly those included in the Special Status Species Program.*
4. *Manage vegetation to reduce the risk that large-scale high-intensity fires will unacceptably damage resources and human developments.*
5. *Cooperatively control invasive plants so they do not infest or re-infest adjacent non-BLM lands.*
6. *Prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public, to desirable flora and fauna, and to soil, air, and water.*
7. *Control plant pests and diseases by removing their native plant hosts when necessary to meet Oregon Department of Agriculture-identified control objectives.*
8. *Minimize treatment costs and improve treatment effectiveness, so resource and economic losses from invasive plants and other vegetation growth are reduced and more of the* Need *can be met within expected funding* (FEIS:8-12).

What are the Effects of the Alternatives?

The Herbicides

In order to identify the potential effects of herbicide use, the annual acres to be treated with each herbicide and with each non-herbicide method were estimated for each alternative. Weed and other vegetation management specialists from the Oregon State Office and the nine district offices in Oregon made predictions of annual treatment levels for the next 10 to 20 years assuming current budget trends (FEIS:77-78). Those totals are summarized below, displayed for BLM districts west and east of the Cascades (Table S-1).

Table S-1. Estimated Annual Treatment Acres with Herbicide and Non-Herbicide Methods, West (W) and East (E) of the Cascades (FEIS:77-78)

	Reference Analysis	Alternative 2 (No Action)	Alternative 3	Alternative 4 (Proposed Action)	Alternative 5
Number of Herbicides	0	4	W: 12 E: 13	W: 13 E: 16	18
Herbicide Acres	0	W: 7,000 E: 9,700	W: 8,000 E: 22,300	W: 10,000 E: 35,200	W: 10,200 E: 39,800
Non-Herbicide Treatment Acres	W: 8,600 E: 33,500	W: 6,400 E: 22,400	W: 6,600 E: 21,500	W: 4,630 E: 12,075	W: 4,560 E: 10,430
Total Treatment Acres	W: 8,600 E: 33,500	W: 13,400 E: 32,100	W: 14,600 E: 43,800	W: 14,630 E: 37,175	W: 14,760 E: 50,230

The *potential* for each of the 18 herbicides to have adverse effects is identified as *risk*. A Risk Assessment process established risk ratings for each herbicide for various categories of fish, wildlife, plants, workers, and the public based on specific (unguarded) exposure scenarios. Although the Proposed Action would result in some increased *risk* associated with the proposed increase in the use of herbicides, it would be limited by the implementation of Standard Operating Procedures and PEIS Mitigation Measures specifically designed to limit exposures (FEIS:93). Thus, the likelihood of actual adverse effects is low, and for every resource, the analysis indicates the effects of invasive weed spread are more adverse (Table 2-6, *Purpose* 1). The broader array of herbicides available for use would also allow for the selection of one that is most effective at accomplishing the weed control objective with the least amount of risk to nearby non-target resources including soil, air, and water (FEIS:11, 233).

Noxious Weed Effects and Rate of Spread

To help examine the effects of the spread of noxious weeds, the analysis also estimated the current spread rate for noxious weeds, and estimated how the different alternatives might be expected to change that rate (FEIS:135-137).

The list of adverse effects of noxious weeds and other invasive plants is long and varied (FEIS:133-134, 598-602). For example, they displace native species and degrade the ecosystems that depend upon them (FEIS:147-149). Many lack fibrous root systems or adequate foliage cover, so they do not protect soils from rain splash or overland flow (FEIS:178-179). Many have allelopathic effects (FEIS:281, 362). Many are poisonous to wildlife, livestock, wild horses, and burros (FEIS:270). Some invade stream banks but do not hold the soils, increasing siltation of spawning gravels and reducing water quality (FEIS:230). They displace riparian vegetation, reducing stream shading and the deposition of microfauna and detritus into streams that support the food chain (FEIS:230). They act as barriers that limit human and wildlife passage (FEIS:134). The invasive annual grasses increase fire occurrence and intensity, removing sagebrush plant communities (FEIS:139-104, 274). They make rangeland unusable, displacing forage for livestock grazing and destroying ranches (FEIS:264). They clog waterways and shade out native aquatic vegetation (FEIS:131).

Under Alternative 2 (No Action), herbicide and non-herbicide methods can be effective on 104 of the 120 State-listed noxious weeds in Oregon. Treatments under this alternative are estimated to be 60 percent effective; that is, they eliminate the treated weed so it does not require retreatment an estimated 60 percent of the time (FEIS:136). This means 45,000 acres of annual treatments translates to 27,300 acres where the weed is controlled and would not spread (FEIS:137). Since these treatments focus on new satellite populations, new weeds, newly infested drainages, or the edges of expanding populations where weed spread would become exponential, 27,300 acres of control translates to 273,000 fewer infested acres in 15 years (FEIS:137-138).

Effective control is estimated at 30 percent for the Reference Analysis, where non-herbicide methods are only effective against about one-third of the noxious weeds. Alternative 3 includes effective controls for 116 of the 120 State-listed noxious weeds in Oregon; effectiveness is estimated at 80 percent (FEIS:136). Finally, it is estimated that the 9,300 acres of native vegetation control in rights-of-way, administrative sites, and recreation sites in Alternatives 4 and 5 would incidentally control or avoid spreading undetected noxious weeds on 25 percent of those treatments, or 2,350 acres per year (FEIS:136-137). Applying these calculations to each of the alternatives results in the following 15-year noxious weed spread parameters (Table S-2).

Table S-2. Projected Annual Noxious Weed Spread and Acreage Change for Each Alternative (FEIS:137-138)

Alternative	Gross treatment acres	Treatment effectiveness	Effectively treated acres	Annual spread in 15 years	Total acres infested in 15 years	15- year acre change from No Action	Portion of OR BLM lands infested 15 years
Reference Analysis	42,100	30%	12,630	14%	8,600,000	+2.7 million	1/2
2 (No Action)	45,500	60%	27,300	12%	5,900,000	0	1/3
3	58,400	80%	46,720	7%	4,000,000	-1.9 million	1/4
4 (Proposed Action)	58,400	80%[1]	49,070	6%	3,700,000	-2.2 million	1/5-1/4
5	58,400	80%[1]	49,070	6%	3,700,000	-2.2 million	1/5-1/4

[1] Plus the 2,350 acres incidentally gained from treating native vegetation in rights-of-way, recreations sites, and administrative sites.

Human Health and Safety

Nationally, the BLM has selected 18 herbicides from among hundreds available, picking those needed to accomplish the objectives while having the least risk to humans and the environment (FEIS:58). The additional herbicides that would become available under Alternative 3 are generally less toxic than those currently being used (FEIS:48-49, 94-104, 354-356).

At typical rates, 2,4-D (Alternatives 2 through 5) is identified as having a moderate risk, and bromacil, diuron, and tebuthiuron (Alternatives 4 and 5) are identified as having risks ranging from none to high, depending upon the exposure scenario (FEIS:104, 354-356). Diquat has a low risk in some occupational scenarios, and triclopyr and diquat have a low risk in at least one of the accidental exposure scenarios evaluated (FEIS:102-103). All six of these herbicides have a PEIS Mitigation Measure that limits application to typical rates if feasible (FEIS:59-61).

Nearly all use of bromacil, diuron, and tebuthiuron would be east of the Cascades (FEIS:77), and bromacil and diuron would be used mostly where complete vegetation control is needed, such as for reducing fire hazard in unstaffed communications and other non-public developed sites, or to keep vegetation from growing into pavement edges (FEIS:62). Diquat is only available in Alternative 5 and projected use is low (FEIS:77); it is expected to be used only where one of the other five available aquatic herbicides would not work (FEIS:238).

Summary of the Major Effects of Each Alternative

While there is a potential for adverse resource and human health effects from various elements of the alternatives, the Standard Operating Procedures and PEIS Mitigation Measures would, by design and when coupled with site-specific analysis and project design, reduce risk to the point where significant adverse effects at the programmatic scale would be unlikely (FEIS:93). Even Federally Listed and other Special Status species were deemed not at significant risk because of required pre-project clearances, consultation requirements, and/or additional buffer requirements (FEIS:155-156, 235-238, 245).

The acres estimated to be treated by each herbicide or non-herbicide method under each alternative and displayed in Chapter 3's *Background for Effects Analysis* section on Table 3-3 are integral to the following summary of the major effects of each alternative. Selected parameters for the alternatives relevant to the effects comparison are displayed on Table S-3.

Table S-3. Selected Parameters for Each Alternative Relevant to the Effects Comparison (FEIS:77-78, 80, 138)

Parameter	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Number of Herbicides Available	0	4	W: 12 E: 13	W: 13 E: 16	18
Invasive Plant Herbicide Annual Treatment Acres/Lbs	0	16,700 acres 23,010 lbs[2]	30,300 acres 14,830 lbs	30,300 acres 14,830 lbs	30,300 acres 14,830 lbs
Invasive Plant Non-herbicide Annual Treatment Acres	42,100	28,800	28,100	28,100	28,100
Native Plant Herbicide Annual Treatment Acres/Lbs	0	0	250[1]	14,900 acres 19,865 lbs	19,700 acres 23,445 lbs
Rate of Spread at 15 years	14%	12%	7%	6%	6%
Difference in noxious weed infested acres in 15 year compared to the No Action Alternative	Up 2.7 million	0	Down 1.9 million	Down 2.2 million	Down 2.2 million

[1] Pest and disease control in State-identified control areas only.
[2] Noxious weeds only.

Reference Analysis: No Herbicide Use. A no-herbicides strategy would provide effective control for about one-third of the noxious weed species (FEIS:136), potentially precluding effective control around high priority Federally Listed and other Special Status species' sites (FEIS:149, 235-236, 251-252), traditional gathering areas (FEIS:286-287), and high-public use sites where weeds could be picked up and transported (FEIS:132-133, 304). Control activities can be hazardous to those doing the weed treatments (FEIS:344-345), result in soil disturbance that can lead to reinvasion (FEIS:136), put cultural (FEIS:286-287) and soil resources (FEIS:185) at risk and cost more per acre (FEIS:340). Weed spread is predicted to increase under this strategy as the BLM and its neighbors become less successful (FEIS:139). Weeds are projected to infest 2.7 million more acres in 15 years than under the No Action Alternative (Alternative 2) (FEIS:138) – negatively affecting virtually every resource from wildlife to visual quality (Chapter 4). The human environment would suffer because of decreased water quality (FEIS:203-204), decreased wildlife (FEIS:254) and other elements of ecological diversity (FEIS:131-134), decreased access to natural resources (because of barriers like blackberries along streams) (FEIS:305), long-term changes including loss of species or populations (FEIS:151), loss of productivity (FEIS:281), and altered soil chemistry (FEIS:134). Social acceptance of this alternative is likely to be varied based on different views regarding the consequences of herbicide use and invasive weed spread (FEIS:324-327).

Alternative 2: (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only. This alternative would provide effective control for 104 of the 120 State-listed noxious weed species in Oregon, but would not include tools effective on some invasive and noxious weeds including the invasive annual grasses (FEIS:136). Medusahead and cheatgrass occupy 600,000 and 5 million acres respectively (FEIS:271). Wildfire in these grasses would continue to convert remaining sagebrush habitats, decrease range carrying capacity for wildlife, wild horses, and livestock, and increase the risk of wildfire (FEIS:277). The four herbicides available under this alternative generally present some risk to one or more elements of the environment (FEIS:94-99), and many are used at a site for two or three consecutive years because they are not completely effective, compounding adverse environmental effects (FEIS:117). Repeatedly using the same herbicides also increases the likelihood that weeds resistant to that herbicide will take over the site (FEIS:155). Cooperative weed management strategies across ownerships would continue to be problematic since BLM neighbors use a wider variety of other herbicides (FEIS:153, 258). Current 2,4-D use would continue to present a moderate risk to applicators (FEIS:356), non-noxious invasive weeds like cheatgrass cannot be treated with herbicides (FEIS:10, 152, 277), and noxious weeds would continue to spread at 12 percent or 144,000 acres per year on BLM lands in Oregon (FEIS:137). At this rate, noxious weeds are predicted to occupy one-third of all BLM lands in 15 years, causing proportionate losses in habitat (particularly for sage grouse and other sage steppe species), wild horse and livestock grazing, watershed protection, recreational opportunities, and other resource uses (Chapter 4). Social acceptance of this alternative would likely be fairly high (FEIS:324-327). Aerial application would be permitted west and east of the Cascades (FEIS:30).

Alternative 3: Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases. This alternative would go much of the way toward accomplishing most of the *Purposes*. The availability of eight and nine additional herbicides west and east of the Cascades respectively would provide effective controls for 116 of the 120 noxious weed species (FEIS:136). The weed spread rate would eventually be reduced to 7 percent and infested acres in 15 years would be reduced by 1.9 million acres when compared to the No Action Alternative (Alternative 2) (FEIS:136-138). The BLM would have access to most of the herbicides used by neighbors, counties, and weed control boards, making cooperative projects more feasible and providing an incentive for better control across all ownerships (FEIS:153, 258). Having control tools effective on most noxious weeds in Oregon increases the likelihood that weed control efforts to protect Special Status plant and animal species' habitats and traditional use areas would be successful (FEIS:149, 235-236, 251-252). Although acres treated with herbicides would increase (FEIS:78), pounds of herbicide (FEIS:80) and acres treated with moderate or high risk herbicides (FEIS:48-49) would both go down substantially. Potential adverse effects of noxious weeds to wildlife

(FEIS:255), water (FEIS:204-205), and grazing- and recreation-dependent communities would all be reduced (FEIS:324-327). Air quality would be most adversely affected under this alternative (FEIS:168); the availability of imazapic would make prescribed burning a viable tool for restoring sage steppe habitats (FEIS:83, 255). Many wildfires and prescribed burns in invasive annual grasses simply return to these grasses unless an effective follow-up herbicide treatment and reseeding is used (FEIS:277).

The ability to use herbicides to help control Sudden Oak Death or other State-identified pests and diseases would provide the State and other cooperators a unified, potentially more successful, approach to protecting ecosystems and the nursery industry from this pathogen (FEIS:161-162). The cost per acre of effectively treated noxious weeds would be reduced 20 percent (FEIS:340). The acres treated with herbicides that are a moderate risk to applicators (2,4-D) would be reduced by about 50 percent (FEIS:356). Potential adverse effects to fish and wildlife would be reduced when compared to the No Action Alternative (Alternative 2) Table 2-5). Social acceptance of this alternative is likely to be high (FEIS:324-327). No aerial application would be permitted west of the Cascades (FEIS:30).

Alternative 4: (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat invasive Weeds plus Limited Additional Uses. This alternative is predicted to reduce noxious weed spread to 6 percent per year and result in 2.2 million fewer infested acres in 15 years when compared to the No Action Alternative (Alternative 2) (FEIS:136-138). Herbicide use would reduce native and other non-invasive vegetation control costs in rights-of-way, administrative sites, and recreation sites by nearly $1 million per year (FEIS:342). These treatments would slightly reduce dust and vehicle emissions (FEIS:168) and reduce the likelihood of occupational injuries by reducing mechanical (chainsaw, etc.) treatments on steep wooded slopes when compared to the No Action Alternative (Alternative 2) (FEIS:331, 344-345), but would increase the potential for an herbicide spill or misapplication. They would also preclude the need to separately spray noxious weeds along roads prior to mowing (FEIS:316), and incidentally control 2,350 acres per year of unidentified or low-priority noxious weed populations along roadsides and other areas where there is a high likelihood of their being picked up and moved by vehicles (FEIS:136-137). Alternative 4 would also provide herbicides for about 5,700 acres of habitat improvement for Federally Listed and other Special Status species identified in interagency Conservation Strategies, 65 percent of which would be new opportunities currently deemed impractical without herbicides (FEIS:84).

Of the additional herbicides added by this alternative, bromacil, diuron, and tebuthiuron have the highest risk to humans (FEIS:356), fish (FEIS:234), and for diuron, wildlife (FEIS:256). All but diuron are both pre- and post-emergent (FEIS:59-61), with most applications being restricted to east of the Cascades where they would be used to treat vegetation along roads, pipelines, pump stations, and other non-cropland areas (FEIS:77). Some of the tebuthiuron would be applied to sagebrush at low rates to improve sage grouse habitats (FEIS:256). PEIS Mitigation Measures restrict application to typical rate if feasible, specify avoiding aerial application of bromacil and diuron, and specify increased buffers on water and Federally Listed and other Special Status species' habitats (Appendix 2). Finally, the social acceptance of using any herbicides to treat native vegetation along public roads would likely be less than the social acceptance for Alternative 3, at least west of the Cascades (FEIS:326). No aerial application would be permitted west of the Cascades (FEIS:31).

Alternative 5: **Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives.** This alternative would add 4,900 acres of herbicide use above what is proposed for Alternative 4 (FEIS:78), and would make herbicides available for any treatment objective except livestock forage and timber production (FEIS:32). Most of this increase would be for additional habitat improvement projects east of the Cascades (FEIS:207). It would also make all 18 BLM-approved herbicides available throughout the State, with 4,300 acres of the increase (when compared to Alternative 4) split between 2,4-D and imazapic (FEIS:77-78). Aerial application would be permitted west and east of the Cascades (FEIS:32). Additional habitats would benefit as not all western juniper and rabbitbrush encroachment expected to be treated under this alternative is within Special Status species' habitats covered by Alternative 4 (Proposed Action) (FEIS:257). Social acceptance of approving herbicide use for a fairly unspecified group of projects may not be high (FEIS:325-327).

Can Any of the Adverse Effects be Mitigated?

The analysis indicates that by using the Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2), the potential for adverse effects is low (FEIS:93). Where the potential for adverse effects is identified, potential mitigation measures are identified and will be considered by the decision-maker (FEIS:50-53).

Many potential mitigation measures are variations on measures already adopted by the PEIS. Some suggest limitation on application rates or methods for several of the herbicides with risks identified in Risk Assessment documents (FEIS:50-53).

What Monitoring is Necessary?

Where the BLM is already using herbicides, formal monitoring is required by various BLM manuals. Environmental Protection Agency and Oregon Department of Agriculture annual reporting is also required, and relevant Endangered Species Act consultation documents typically include monitoring requirements. This monitoring includes implementation monitoring, relying in particular on Pesticide Use Proposal documents for every application, followed by Pesticide Application Records filled out within 24 hours of each application. Both documents have sufficient detail to determine if all planning and application requirements are met. The BLM is currently implementing a National Invasive Species Information Management System (NISIMS), which will provide tools for data collection and long-term Bureau-wide analysis and statistics for invasive plant infestations and treatments (Appendix 3).

Effectiveness monitoring includes visiting every application site again after treatment, and maintaining weed maps. Biological control agent releases are also monitored, and monitoring is required of any BLM activity judged to have a moderate or high likelihood of spreading noxious weeds (Appendix 3).

In addition to existing monitoring, the selection of one of the action alternatives could create a changed circumstance or condition (e.g. a concern over a potential environmental effect) that would suggest a need for additional monitoring. Those circumstances might include the use of the newly adopted herbicides with different ecological risks than the four herbicides currently used, more acres being treated, more acres being treated in proximity to people or susceptible environmental resources, more use of broadcast spraying with its potential for drift, or simply increasing the use of "new" herbicides above EIS-estimated levels as weed specialists become more familiar with their advantages. To respond to this potential need, the monitoring appendix suggests a five-year examination of weed spread to see if the selected alternative is making the expected difference, and monitoring of the application of herbicides identified in the analysis as high risk to a particular resource in a particular setting (Appendix 3).

These potential new monitoring needs are identified as optional in the Monitoring appendix (Appendix 3), and the decision-maker will identify selected monitoring when the Record of Decision is signed (FEIS:12).

Which Alternative is Preferred?

Alternative 4, the Proposed Action, is the Preferred Alternative. It meets the *Need*, and meets all eight *Purposes* to some degree. Like Alternative 3, the additional, generally newer, herbicides are more target-specific, can be used in lower doses, and are generally less likely to adversely affect non-target plants and animals than the four herbicides currently in use. The additional herbicides would also be effective against a wider array of invasive plants, including the invasive annual grasses medusahead and cheatgrass, as well as other weeds for which there are currently no effective controls available to the BLM in Oregon (FEIS:50).

The ability to treat vegetation encroaching on rights-of-ways, recreation sites, and administrative sites with herbicides under Alternative 4 would reduce the cost for these regular maintenance treatments by about $1 million per year, would reduce ground disturbance that can encourage invasive plants, and would eradicate small undetected populations just getting established along roads and other public use areas. Alternative 4 would also allow the use of herbicides for improving habitat for Federally Listed and other Special Status species like sage grouse (FEIS:50).

Alternative 5 would have the same benefits as Alternative 4, and it would make herbicides available for the full range of resource management activities except livestock forage and timber production. Alternative 5 is estimated to increase herbicide use by ten percent from Alternative 4, and most of this increase would be expected to go toward additional habitat improvement projects not practical without herbicides. However, there is a lower need for herbicides for these activities, and the alternative departs from the narrow program clarity and focus requested by many of the scoping comments (FEIS:50).

Table S-4. Herbicides Available Under Each Alternative (FEIS:59-61)

Herbicide	**Characteristics and Target Vegetation**	**Reference Analysis**	**Alt 2** No Action	**Alt 3**	**Alt 4** Proposed Action	**Alt 5**
Herbicides Currently Approved for use on BLM Lands in Oregon (for noxious weed control only)						
2, 4-D	Selective; common targets include annual and biennial broadleaf weeds, kochia, whitetop, perennial pepperweed, Russian thistle and knapweed, sagebrush, and rabbitbrush.		√	√	√	√
Dicamba	Selective; common targets include knapweeds, kochia, and thistles.		√	√	√	√
Glyphosate	Non-selective; common targets include grasses (including Italian ryegrass), sedges, broadleaf weeds, and woody shrubs.		√	√	√	√
Picloram	Selective; common targets include perennial and woody species, knapweeds, starthistle, thistle, bindweed, leafy spurge, rabbitbrush, rush skeletonweed, and poison oak.		√	√	√	√
Additional Herbicides Proposed for Use in One or More of the Action Alternatives						
Bromacil	Non-selective; common targets include annual grasses and broadleaf weeds, cheatgrass, puncturevine, ragweed, wild oat, dandelion, quackgrass, and wild carrot.				E	√

Herbicide	Characteristics and Target Vegetation	Reference Analysis	Alt 2 No Action	Alt 3	Alt 4 Proposed Action	Alt 5
Chlorsulfuron	Selective; common targets include thistles, wild carrot, giant horsetail, poison hemlock, Russian knapweed, marestail, perennial pepperweed, puncturevine, tansy ragwort, common tansy, common teasel, dalmation toadflax, yellow toadflax, whitetop, and dyers woad			E	E	√
Clopyralid	Selective; common targets include thistles, common burdock, knapweeds, yellow starthistle, oxeye daisy, hawkweeds, prickly lettuce, dandelion, cutleaf teasel, kudzu, and buffalobur.			√	√	√
Diflufenzopyr + Dicamba	Selective; common targets include knapweeds, kochia, and thistles.					√
Diquat	Non-selective; common targets include giant salvinia, hydrilla, and watermilfoils.					√
Diuron	Selective; common targets include annual grasses (including bluegrass) and broadleaf weeds, lambsquarters, kochia, and Russian thistle.				√	√
Fluridone	Selective; common targets include hydrilla and watermilfoils.			√	√	√
Hexazinone	Selective; common targets include annual and perennial grasses and broadleaf weeds, brush, and trees.			√	√	√
Imazapic	Selective; common targets include cheatgrass, leafy spurge, medusahead, whitetop, dalmation toadflax and russian knapweed.			√	√	√
Imazapyr	Non-selective; common targets include annual and perennial broadleaf weeds, brush, trees, saltcedar, Russian olive, and tanoak.			√	√	√
Metsulfuron methyl	Selective; common targets include whitetop, perennial pepperweed and other mustards, and biennial thistles.			√	√	√
Sulfometuron methyl	Non-selective; common targets include cheatgrass, annual and perennial mustards, and medusahead.			√	√	√
Tebuthiuron	Selective; common targets include sagebrush (thinning).				E	√
Triclopyr	Selective; common targets include saltcedar, purple loosestrife, Canada thistle, tanoak, and Himalayan blackberry.			√	√	√

E - Only allowed in BLM Districts east of the Cascades

Chapter 1

Changes Between Draft and Final EIS

The following changes were made to Chapter 1 between the Draft and Final EIS. Minor corrections, explanations, and edits are not included in this list.

Changes were made to:

- Clarify the *Purposes*;
- Better describe the basis for the 1984 court injunction;
- Note that a June 2009 Stipulated Agreement vacates the 1984 injunction effective when any administrative appeals to the Record of Decision for this Final EIS have been resolved;
- Note that the Record of Decision will be signed 30 to 90 days after issuance of the Final EIS, and not concurrently with it as previously planned;
- Help clarify that the overarching context for all of the alternatives is the BLM's Integrated Vegetation Management policy;
- Broaden the qualifying habitat treatments under the Proposed Action to include treatments specified or referenced in delisting and monitoring plans for (formerly) Federally Listed species;
- Note that the decision-maker could modify the selected alternative by adding features from other alternatives, removing certain herbicides, or making other changes, if the environmental effects of such changes are reasonably discernable in the Final EIS;
- Add a new section - *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* - that describes Environmental Protection Agency, State, and other ongoing activities, such as herbicide registration and monitoring. Some of the items in this section were moved from the *Cumulative Impacts* section in the Draft EIS;
- Move the *Conflicts and Consistency with Other Plans* section from Chapter 4 to Chapter 1; and,
- Describe the public review process for the Draft EIS.

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Chapter 1
Purpose and Need

Introduction

This Environmental Impact Statement (EIS) was prepared by the Bureau of Land Management (BLM) Oregon State Office to analyze, at the programmatic scale, a proposal to increase the number of herbicides[1] available to the nine BLM districts in Oregon (Figure 1-1) for use in their existing noxious weed, invasive plant, and other vegetation management programs. This EIS does not analyze any specific treatments nor will the decision authorize specific projects. Future vegetation control projects utilizing herbicides proposed by BLM districts within Oregon will be subject to district or project level (site-specific) analyses and decisions under the National Environmental Policy Act (NEPA)[2]. Those site-specific analyses will tier to this EIS and be subject to the limitations imposed by the Record of Decision for this EIS. This EIS does not propose or examine the use of herbicides specifically for livestock forage or timber production. This EIS does not propose to amend district Resource Management Plans (RMPs).

> ***Terminology*:**
>
> **Invasive plants** (or weeds) are non-native aggressive plants with the potential to cause significant damage to native ecosystems and/or cause significant economic losses.
>
> **Noxious weeds** are a subset of invasive plants that are county-, State-, or Federally- listed as injurious to public health, agriculture, recreation, wildlife, or any public or private property.

In 2007, the BLM National office completed the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS) and related Record of Decision, making 18 herbicides available for a full range of vegetation treatments in 17 western states. In western states other than Oregon, the BLM is implementing the Record of Decision for the PEIS by directly tiering to it at the field office level. However, the BLM in Oregon is currently unable to implement the 2007 Record of Decision because of a 1984 U.S. District Court injunction issued following a finding in Northwest Coalition for Alternatives to Pesticides, et al. v. Block, et al. (Civ. No. 82-6273-E) that the BLM had not prepared Worst Case Analyses for the herbicides being used at that time. The injunction was subsequently modified by the court in November 1987 (Civ. No. 82-6272-BU) after preparation of the missing analyses.[3] The injunction permits the use of only four herbicides[4], and limits their use to the control and eradication of noxious weeds.[5]

1 The term "herbicide" is used in this EIS to mean active ingredient (a.i.), and not trade name or formulation.

2 BLM policy does not permit herbicide use under a categorical exclusion. A site-specific Environmental Assessment or Environmental Impact Statement must be prepared.

3 Worst Case Analyses are no longer required by NEPA.

4 2,4-D, dicamba, glyphosate, and picloram

5 The injunction was amended June 22, 2009 to permit the use of glyphosate to kill tanoak to control Sudden Oak Death in 2009 and 2010, and to control European beach grass in 2009 to 2011 in the New River Area of Critical Environmental Concern where it is encroaching on suitable habitat for three Special Status plants (US District Court 2009). The amendment also vacates the injunction upon resolution of any administrative appeals to the Record of Decision for this EIS.

This Oregon-wide EIS has been prepared primarily to address BLM herbicide use in Oregon in a single programmatic document, because, unlike the other western states, many of the herbicides proposed for use have not been used on Oregon BLM lands in the past 20 years. Prior to the 2007 Record of Decision for the PEIS, western states other than Oregon were using up to 20 different herbicides to meet a full range of vegetation management objectives. In those states, the Record of Decision removed six and added four for a net decrease of two herbicides. The action alternatives in this EIS would make up to 18 herbicides available to a program currently limited to four, and currently limited to noxious weed control. This EIS tiers to the PEIS and incorporates its entire analysis as Appendix 1. For the most part, pertinent analysis and conclusions of the PEIS are summarized into the body of this EIS for easier reference. This EIS also provides additional details about proposed herbicide use (and related effects) in Oregon.

This is a Final EIS. The Record of Decision, expected to be signed in 30 to 90 days, will be subject to a 30-day appeal period before the decision can be implemented. The decision-maker for this EIS will be the Oregon/Washington BLM State Director.

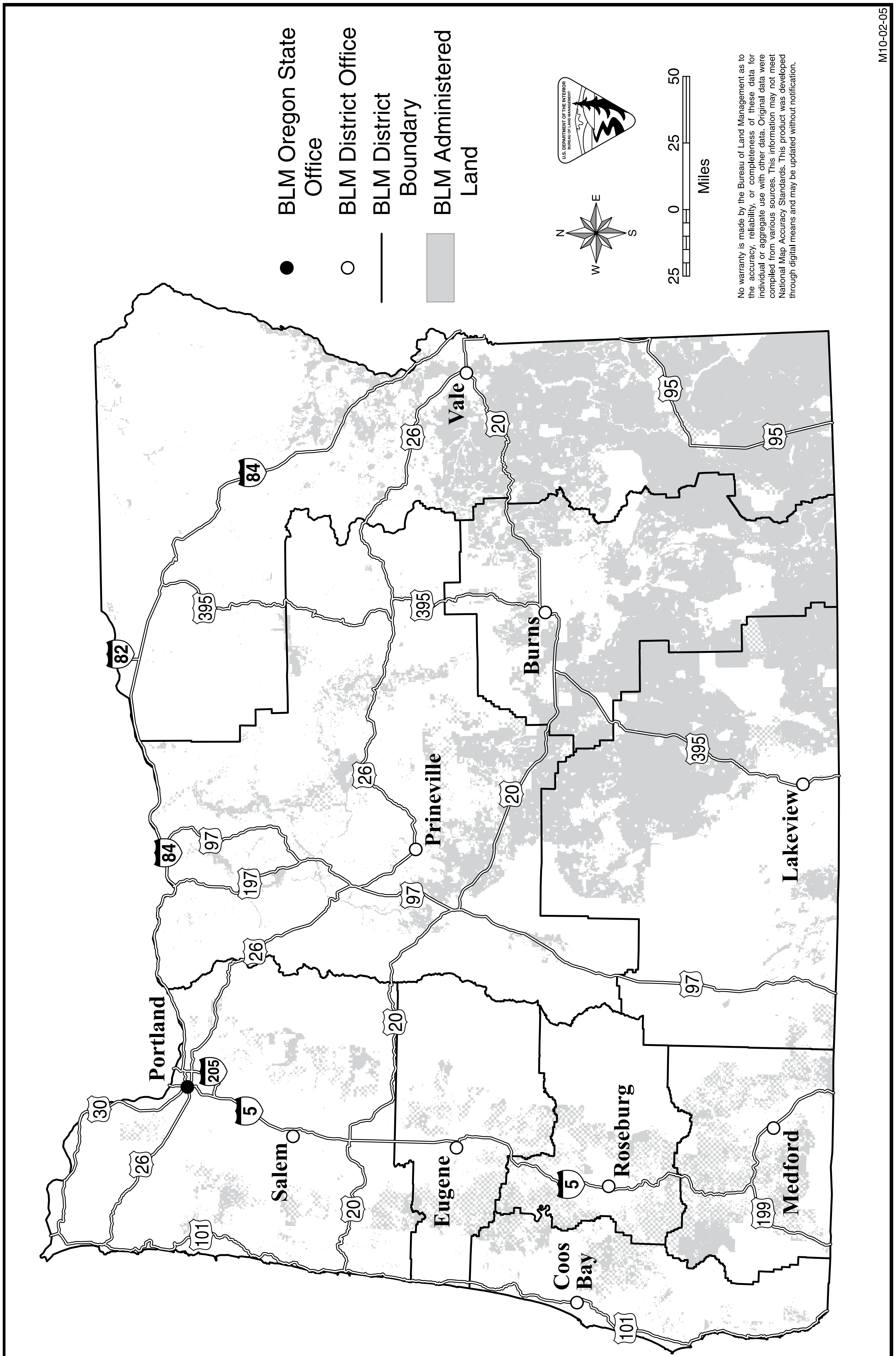
Background

The BLM manages approximately 15.7 million acres in Oregon, or about 25 percent of the land in the State. For the most part, these lands are either public domain lands managed under the Federal Land Policy and Management Act (FLPMA) or revested lands of the Oregon and California Railroad and reconveyed Coos Bay Wagon Road Grant Lands, specified for Department of the Interior management by the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act) of 1937. Although these two acts provide for different management priorities, both result in BLM providing for various land uses and outputs, and accommodating various developments for the public good. These include, but are not limited to, utility corridors, access roads, mining, grazing, timber production, recreation, and communications sites. These human uses and developments, and the vegetation management in support of them, have resulted in changes to native plant communities. While many of those vegetation changes have been intentional and beneficial, some have occurred at the expense of ecosystem health. These include the expansion of noxious weeds and other invasive plants and the build-up of hazardous fuels. Active vegetation management can mitigate some of these undesirable changes. Developments such as roads, utility corridors, and recreation sites also bring with them an expectation that encroaching vegetation will be managed to protect investments and maintain public safety.

Numerous laws and policies direct and authorize the BLM to manage vegetation. The FLPMA and other laws provide a broad vegetation management mandate. The FLPMA directs the BLM to manage public lands "in a manner that will protect the quality of scientific, scenic, historic, ecological, environmental, air and atmospheric, water resources and archeological values…" (43 U.S.C. § 1701(a)(8)). In all, over 150 different authorities or policies direct vegetation management on lands administered by the BLM (BLM lands). Vegetation management can be used to improve land health and habitat, reduce fire risk, and preserve infrastructure (PEIS: Chapter 1).

Some Federal laws specifically direct the BLM and other agencies to aggressively manage invasive plants and other vegetation to improve ecosystem health and reduce fire risk. In particular, two weed control acts, the Carlson-Foley Act of 1968 (43 U.S.C. §§ 1241-1243) and the Plant Protection Act of 2000 (7 U.S.C. § 7702), authorize the BLM to manage noxious weeds and to coordinate with other Federal and State agencies in activities to eradicate, suppress, control, prevent, or retard the spread of any noxious weeds on Federal lands. The Federal Noxious Weed Act of 1974 (7 U.S.C. § 2814(a)) established a program to manage undesirable plants, implemented cooperative agreements with State agencies, and established integrated management systems to control undesirable plant species. The Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. § 7781) established a program to provide assistance through states to eligible weed management entities to control or

FIGURE 1-1. LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT IN OREGON



eradicate harmful non-native weeds on public and private lands. The Public Rangelands Improvement Act of 1978 (43 U.S.C. § 1901(b)(2) requires the BLM to manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible. The Healthy Forests Restoration Act of 2003 (16 U.S.C. §§ 6501-6591) directs the BLM to take aggressive actions to reduce catastrophic wildfire risk on public lands, and places an emphasis on protecting adjacent at-risk communities.

State and County laws also provide requirements for vegetation management. State laws require the State and private landowners to cooperate on noxious weed control, and give the State authority to declare noxious weed emergencies that require landowners to immediately control specified weeds (ORS 570-500). The Oregon Department of Agriculture takes the lead in identifying and setting priorities for noxious weed control. The Oregon Department of Agriculture coordinates closely with Federal and local entities and private landowners and often does the actual control work on BLM and other lands under cooperative agreements. BLM's participation in these coordinated efforts helps keep weeds on BLM lands from invading neighboring lands, and vice versa.

Vegetation management to meet FLPMA's public lands management policies and to satisfy the mandates of other laws, policy, and resource management plans takes place annually on thousands of acres of BLM lands in Oregon. While the emphasis for noxious weeds is on prevention, control measures for noxious weeds are conducted on 22,000 acres annually using mechanical, biological, manual, fire, herbicides, and other methods. Similarly, the BLM and/or its cooperators manage vegetation on thousands of acres per year to restore forest and rangeland health; provide sustainable habitat for Federally Listed[6] and other Special Status species[7], and other plants and animals; reduce the risk of wildland fire; and, provide for safe use and access to a variety of authorized developments. For these treatments, a full range of non-herbicide treatment methods are described in existing resource management and related plans, have been analyzed in existing NEPA documents, and are currently in use to achieve vegetation management objectives (Appendix 6).[8] However, for herbicide use, the BLM in Oregon is limited by the 1984/87 U.S. District Court injunction to the use of four herbicide active ingredients: 2,4-D, dicamba, glyphosate, and picloram for noxious weed control only.

The *Need*

Invasive plants are continuing to spread at an increasing rate, and for many species, there is no effective means of control currently available to the BLM in Oregon. The ability of non-herbicide methods to effectively meet all vegetation management objectives is limited. Most non-herbicide treatments are generally more expensive than the herbicide treatments, and are limited by access requirements such as slope; many species simply cannot be controlled with manual, mechanical, biological, or other non-herbicide treatments because their roots are deep and readily re-sprout; they are in areas where soil disturbance is not acceptable; access limitations prevent treatment; or, they would simply reseed into disturbed sites. For many noxious weeds, the four herbicides currently available to the BLM in Oregon do not result in effective control.

6 Listed as threatened or endangered under the Endangered Species Act.

7 Special Status species include Federally Listed and proposed for listing as threatened or endangered, and Bureau Sensitive species.

8 Currently used non-herbicide methods are also discussed in detail in the *Final Vegetation Treatments on BLM Lands in the 17 Western States Programmatic Environmental Report (PER),* which is available on the EIS website.

In spite of an aggressive Integrated Vegetation Management program using all available treatment methods, *invasive plants* are spreading, habitats are being degraded, and fuel buildup is increasing. About 1.2 million of the 15.7 million acres of BLM lands in Oregon are currently infested at some level[9] with noxious weeds, and at least 5 million more are infested with other invasive plants. They are continuing to spread at an estimated rate of 10 to 15 percent per year (Appendix 7), increasing adverse effects to various valued resources. Ecological damage from extensive noxious weed infestations is often permanent. Adverse effects include displacement of native plants; reduction in habitat and forage for wildlife and livestock; loss of Federally Listed and other Special Status species' habitat; increased soil erosion; reduced water quality; reduced soil productivity; reduced wilderness and recreation values; and, changes in the intensity and frequency of fires (USDA 2005a). Invasive plants also spread to adjacent non-BLM lands, increasing control costs for affected landowners and degrading land values.

There are also specific management situations where *native and other non-invasive vegetation* is going untreated or only partially treated because available vegetation management methods are inefficient or costly. The management of encroaching vegetation within road, power line, pipeline, and other rights-of-way and developments is being conducted with non-herbicide methods at a higher cost on BLM lands than on adjacent non-BLM lands where herbicides are available. The additional costs and reduced effectiveness ultimately affect utility subscribers and/or subtract from funds available for other vegetation treatments. Mechanical methods can also spread invasive plants. Western juniper is spreading into other native shrub/grass communities, capturing available soil water, and altering soils in ways that inhibit retention and reestablishment of native plants in those communities. The plant pathogen Sudden Oak Death is getting a foothold in southwest Oregon, threatening to kill tanoaks and other plants in the State, and leading to plant quarantines on a variety of nursery plants.

To better meet BLM's noxious weed and other vegetation management responsibilities, there is an underlying need for more effective vegetation control measures.

Proposed Action

Because all other known non-herbicide methods are available and being used to the extent practicable within existing funding and capabilities, the *Need* for more effective control measures translates to a proposal and alternatives to make more herbicides available[10] for use on public lands administered by the BLM in Oregon. The Proposed Action[11] would make 13 herbicides available to the BLM west of the Cascades and 16 herbicides available east of the Cascades[12] (Table 2-2 in Chapter 2) in order to better meet their noxious weed and other vegetation management responsibilities. These include the four herbicides currently available for noxious weed control.

The proposed herbicides are all included within the 18 herbicides approved in 2007 for use by the BLM in the other 16 western states. Uses would be in compliance with the PEIS Mitigation Measures and Standard Operating Procedures adopted for use in the 17 western states by the Record of Decision for the PEIS (see Appendix 2), as well as by current Department of the Interior and BLM Integrated Vegetation Management policies and priorities. All herbicide uses would comply with all applicable laws and restrictions, and would only be used for the lands and uses for which they are labeled and registered with the State of Oregon.

9 Ranging from monocultures to a few plants per acre.

10 Actual use would depend upon subsequent district or project level analyses and decisions under NEPA.

11 The Proposed Action is Alternative 4; see Chapter 2 for description of the alternatives.

12 Districts west of the Cascades are Salem, Eugene, Roseburg, Coos Bay, and Medford. Districts east of the Cascades are Lakeview (including the Klamath Falls Resource Area), Prineville, Burns, and Vale.

Selection of the Proposed Action would allow the BLM to choose from 13 or 16 herbicides (west and east of the Cascades respectively):

- To treat noxious weeds and other invasive plants as necessary to meet Integrated Vegetation Management objectives;
- To treat any vegetation to meet safety and operation objectives in administrative sites, recreation sites, and rights-of-way;
- To treat any vegetation as needed to control pests and diseases in State-identified control areas, such as Sudden Oak Death in southwest Oregon; and,
- To treat any vegetation to achieve habitat goals specified in approved Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, or Conservation Agreements[13] for Federally Listed or other Special Status species.

The overarching context for all of the alternatives is the BLM's Integrated Vegetation Management policy. For invasive plants, this policy emphasizes prevention of noxious weeds and other invasive plants as the first line of defense. Under this policy, the BLM uses a variety of prevention methods including employee and public education, requiring weed-free seed in restoration and other revegetation projects (USDI 2006c), encouraging weed-free hay for use by pack stock, and cleaning project vehicles and other equipment before it enters BLM managed lands. Integrated Vegetation Management policy also requires the use of cost-effective methods that pose the least risk to humans, natural and cultural resources, and the environment (USDI 2007c). See *Integrated Vegetation Management* in Chapter 3 for additional detail.

Alternatives to the Proposed Action

Using a broader array of herbicides would positively affect the BLM's ability to meet its various vegetation management responsibilities, but could potentially expose the environment to negative effects from the herbicides themselves. Alternatives to the Proposed Action seek to examine different mixes of these positive and negative effects by considering various numbers of herbicides and considering different mixes of management objectives for which these herbicides could be used. The action alternatives range from making 12/13 herbicides available (west/east of the Cascades) for invasive plants and pest and disease control only (Alternative 3), to an alternative that examines the use of all 18 herbicides analyzed in the PEIS and approved for use in the other 16 western states for all vegetation treatment needs except those specifically designed to improve livestock forage or timber production (Alternative 5). A No Action Alternative (Alternative 2) and a "no herbicides" Reference Analysis are also examined.

The Purposes

The *Purposes* are objectives to be achieved by the Proposed Action and the other action alternatives. The *Purposes* include the issues identified during scoping. No alternative would meet all *Purposes* completely. The selected alternative will be the one that the Oregon/Washington BLM Director determines meets the *Need* and best meets the *Purposes.*

13 Conservation Strategies and Agreements are explained in Chapter 2.

1. Control invasive plant species to protect native ecosystems and the flora and fauna that depend on them.

Although current management efforts strive to prevent the introduction of weeds and control existing infestations, noxious weeds continue to spread at an estimated rate of 10 to 15 percent per year on BLM lands due in part to limited funding and lack of effective control methods. An estimated 1.2 million acres of the 15.7 million acres of BLM lands in Oregon are currently infested with State-listed noxious weeds, and approximately 5 million more are infested with other invasive plants (mostly cheatgrass) (Appendix 7). Invasive plants crowd out native and other non-invasive plants; reduce habitat and forage for wildlife (including Federally Listed and other Special Status species) and livestock; increase soil erosion; reduce water quality; and, alter soil chemistry and productivity. As of June 2010, the Oregon State list of noxious weeds includes 120 species (Appendix 7: Table A7-1). These are a subset of invasive plants deemed so potentially harmful that the Oregon Department of Agriculture has a program "to protect Oregon's agricultural industry and natural resources by preventing and limiting the spread and impact of invasive exotic plant species (noxious weeds) which displace and compete with native and other non-invasive plant species. These invasive plants affect all Oregonians directly or indirectly through impacts on agricultural and forest economies and on other resources such as fish, wildlife, recreation and overall watershed health" (ODA 2009a). The economic impact of invasive plants is substantial. A 2008 report prepared for the Oregon Invasive Species Council estimates the production losses, fire damage, and control costs for just 21 of the noxious weed species in Oregon to be $120 million per year, and estimates the annual cost of invasive plants in Portland, Oregon to be $10 to 31 million per year (Cusack and Harte 2008:1).

The BLM manages a wide variety of unique and irreplaceable ecosystems in Oregon from native grasslands in eastern Oregon to old growth forests in western Oregon. The BLM manages some of the only intact habitat for some wildlife and plant species found in Oregon such as sage grouse, northern spotted owls, Malheur wire-lettuce, and Kincaid's Lupine. In addition to the importance of keeping these larger landscapes free of noxious and invasive weeds is the additional challenge of preventing the spread of these plants into the many specially designated areas on BLM lands in Oregon such as Wilderness, Wilderness Study Areas, Wild and Scenic Rivers, Research Natural Areas, Areas of Critical Environmental Concern and National Monuments.

Preventing noxious and invasive species from entering BLM lands that are currently weed free and from entering specially designated areas is of critical importance not only to the species that depend on these unique systems but to the broader objective of promoting and maintaining biological diversity and ecosystem health.

2. Protect the safety and function of BLM and other authorized infrastructures by controlling encroaching native and other non-invasive vegetation.

Human developments also create a need to manage native and other non-invasive vegetation. Safe campground use is hampered by native plants like stinging nettles and poison oak, vegetation growth along roads breaks up pavement and reduces sight distances, and vegetation growing into power lines, transmission towers, and other BLM-managed or authorized improvements hamper function and become a danger to the structures themselves. Public and private improvements bring obligations to provide for safe access and to protect taxpayer and cooperator investments. Currently, management of encroaching native vegetation on BLM lands in Oregon relies exclusively on manual, mechanical, cultural, and other non-herbicide control methods. These methods are often less effective and/or more costly than using herbicides. For example, if herbicides were available to treat cut tree stumps under power lines so they would not re-sprout, herbaceous shrub species would begin to dominate these sites, substantially reducing the need to do regular tree cutting and other vegetation control treatments.

3. Manage native vegetation to provide sustainable habitats for wildlife, fish, and native plants, particularly those included in the Special Status Species Program.

Decades of fire suppression, human uses, climate change, and other factors have altered the structure of native plant communities even in areas without invasive plants. For example, fire suppression has resulted in a many-fold increase in the number of western junipers in eastern Oregon when compared with historic levels. Western juniper uses soil moisture to the detriment of surrounding native plants and stream flow. Chemicals in the western juniper's dropped needles prevent many other plants from growing, resulting in increased bare ground and soil erosion that changes the site potential for years or decades. Even if the western juniper is removed, the site may no longer support the plants that were present prior to the western juniper expansion (Dysart et al. 2008). Sagebrush communities critical to the success of nesting sage grouse are being altered, reducing their value as nesting habitat. The use of herbicides could facilitate restoration of habitats for nesting sage grouse and other species. Encroachment of trees and shrubs into grassland meadows threaten the Federally Listed plant Cook's Lomatium. BLM 6840 policy and interagency Conservation Strategies and Agreements for Federally Listed and other Special Status species require the BLM to manage for sustainable habitats for those species.

4. Manage vegetation to reduce the risk that large-scale high-intensity fires will unacceptably damage resources and human developments.

An unnaturally high risk of wildfire in the west is attributable to many factors, but some species of invasive plants have particularly exacerbated this risk. On nearly one-third of the BLM lands in Oregon today, the non-native and invasive annual grasses cheatgrass and medusahead have replaced or significantly encroached on native bunchgrass plant communities (Appendix 7). Native bunchgrass communities remain relatively green throughout most of the summer and resist fire. Invasive annual grasses mature and dry out earlier and burn more intensely and far more often than the native grasses. These fires eventually eliminate shrubs in these ecosystems. The resultant shift and simplification of the plant community has severely reduced the diversity of the natural flora and fauna community. The flammability of these altered ecosystems makes them especially hazardous in the wildland urban interface. Currently, the herbicides available to BLM in Oregon are not effective at controlling medusahead and cheatgrass,[14] hampering restoration efforts and endangering human developments.

5. Cooperatively control invasive plants so they do not infest or re-infest adjacent non-BLM lands.

Neighboring landowners are negatively affected by invasive plants (including State- and county- listed noxious weeds) spreading from BLM lands. For example, 71 percent of Malheur County is administered by the BLM. The active control of dozens of species of noxious weeds and other invasive plants by private landowners and County weed control personnel can be frustrated by seed coming from nearby uncontrolled weed infestations on public lands. Productive ranches have been lost to invasive plants, and these losses can disrupt the viability of ranching-dependent communities. A 1993 economic study in Grant County showed the annual economic impact to livestock grazing was $326,000 and losses would climb to over $3.96 million [2009 dollars] without increased weed management (Test 1993). During scoping for this EIS, County employees, elected officials, and weed board members spoke out universally in favor of increased noxious weed and other invasive plant control on BLM lands.

Further, invasive plants are most effectively controlled by groups of landowners working in a coordinated fashion. Currently, County Weed Boards, Cooperative Weed Management Areas, Oregon Department of Agriculture, and others cooperate with the BLM on jointly funded integrated weed control projects. The effectiveness and

14 Cheatgrass cannot be sprayed under current direction even if an effective herbicide were available, because it is not listed as a noxious weed.

efficiency of these projects is compromised for all concerned when the BLM cannot use the same tools being used by the rest of the cooperators. The problem is not just that County and State weed control personnel must switch to BLM-approved herbicides at the property line. Sometimes they must completely stop vegetation control efforts because it is often not practical to change to a different control method at each property line. Without the appropriate herbicides and cooperative efforts, adjacent landowners will continue to shoulder the burden of weed control while seed sources expand on adjacent public lands. In addition, cooperating with other landowners also helps prevent the spread of weeds onto public lands.

6. Prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public, to desirable flora and fauna, and to soil, air, and water.

The use of herbicides in wildland settings is not without risk. Although many of the herbicides proposed for use in this EIS are less toxic than many household products,[15] their application can put non-target plants, animals, applicators, and the public at risk. Additionally, there may be adverse effects to soil organisms and water. In general, having more herbicides available increases the likelihood of successfully controlling the target species while minimizing the effects to non-target plants and other species (USDA 2005a:4-18). The benefits of more options include: 1) reduced potential for herbicide resistance; 2) increased potential for finding an appropriate, cost-effective, site-specific treatment; 3) more efficient application of *all* control methods; and, 4) use of (generally) newer, less toxic herbicides. These in turn lead to lower human and ecosystem risk.

Non-herbicide treatments have risks as well. For example, mechanical treatments can break down soil structure, increase compaction, create dust, increase siltation in nearby streams, damage desirable as well as undesirable plants, and potentially re-create the site disturbance that facilitated the invasive plant issue in the first place. Mechanical methods also make noise, use fossil fuels, and raise worker safety concerns. Repeated chainsaw cutting of woody vegetation under power line rights-of-way, for example, can increase worker injury risk.

7. Control plant pests and diseases by removing their native plant hosts when necessary to meet Oregon Department of Agriculture-identified control objectives.

Pests and diseases can threaten native plant species and the plant communities of which they are a part. These pests and diseases are most likely to take the form of insects and pathogens. If not contained, these agents can spread geographically by various dispersal mechanisms as well as by human movement of plant products. Many of Oregon's plants are also used by the nursery industry and transported worldwide. An uncontrolled infestation of a serious pest could lead to a quarantine affecting the host and related plants. When these events happen, the Oregon Department of Agriculture declares it a State priority and identifies control areas. Although control efforts typically utilize insecticides, fungicides, traps, and other non-herbicide means (which are currently available to BLM), sometimes control strategies include killing the host vegetation around the pest population. The efficiency and success of such control can depend on the herbicide used. Sudden Oak Death control is an example of such a strategy.

Sudden Oak Death was first detected in southwest Oregon in 2001, where it was killing tanoak, and infecting rhododendron and evergreen huckleberry on nine sites totaling 40 acres. The Oregon Department of Agriculture quarantined the area and the Forest Service, BLM, private forest managers, and the Oregon Department of Agriculture have worked aggressively since 2001 to control this disease by, in part, removing host tanoak from around known infestations. This job is not as effective without herbicides; tanoak is a prodigious sprouter and sprouts are readily reinfected. Despite control efforts, the disease had spread to 178 acres by 2007. However, specialists believe it can be brought under control with help from herbicide treatments.

15 See Table 3-11 in Chapter 3.

8. Minimize treatment costs and improve treatment effectiveness, so resource and economic losses from invasive plants and other vegetation growth are reduced and more of the* Need *can be met within expected funding.

There are substantial differences in both the cost and effectiveness of the various control methods. The affordability and effectiveness of hand pulling is limited to small infestations or small areas, and is only effective on certain species. Mobilization of heavy equipment may be more expensive than using spray equipment. Control of hundreds of acres of invasive grasses may be most achievable with herbicides, since ground-disturbing methods are often ineffective and can exacerbate the conditions that led to the problem. Finally, the use of the right herbicide can achieve control with one or few treatments, while some other control method may require annual or even multi-annual treatments. If herbicide use is avoided, it reduces the amount of control work that can be completed, and it reduces the area that can be treated before seed dispersal[16]. A purpose is to improve treatment effectiveness and reduce treatments costs. There is a finite amount of funding available, and savings in one control area can be used in another. Often the most effective long-term control is achieved by a combination of herbicide and non-herbicide treatments.

Decision to be Made

The decision to be made by the Oregon/Washington BLM State Director is whether to select the Proposed Action (Alternative 4) or another alternative, and determine if any additional mitigation or monitoring is to be applied. The decision-maker may also modify the selected alternative by adding features from other alternatives, removing certain herbicides, or making other changes, if the environmental effects of such changes are reasonably discernable in the EIS. The decision will be based on the degree to which the selected alternative meets the *Need* and *Purposes*. Because of the differences between the alternatives, the selection will effectively determine which, if any, additional herbicides will be available for use by the BLM in Oregon, and what vegetation management objectives they could be used for.

Scoping

Scoping is the term used to identify issues, concerns, and opportunities associated with the proposed action in an EIS. Public involvement in the scoping process began when the Notice of Intent to prepare an *Environmental Impact Statement (EIS) for Vegetation Treatments Using Herbicides on BLM Lands in Oregon* was published in the *Federal Register* (73[121]:35408–35409) on June 23, 2008. The Notice of Intent announced that this EIS would evaluate the effects of using up to 18 nationally approved herbicide active ingredients for treatment of noxious weeds; for treatment of invasive vegetation and other weeds in administrative sites, recreation sites, and rights-of-way; for treatment of forest pests and diseases; and to achieve non-commodity landscape health objectives. The Notice of Intent indicated that the BLM was seeking comments to help identify the relevant issues and environmental concerns, identify possible alternatives, and help determine the scope of this EIS. The Notice of Intent was also posted to the project website at http://www.blm.gov/or/plans/vegtreatmentseis/, and a press release was mailed to media outlets across the State, including print, radio, and broadcast media. At the same time, approximately 17,000 postcards were mailed out to individuals, groups, government agencies, and tribes identified from Oregon BLM districts and Oregon National Forests' "interested public" lists as potentially interested in this EIS. These postcards, in addition to announcing the project and asking recipients if they wished to be on the project mailing list, noted there would be public meetings across the State in July to solicit ideas for issues (identified herein as *Purposes*) and alternatives to consider in this EIS.

16 As noted in the *Noxious Weeds and Other Invasive Plants* section in Chapter 4, the time between easily recognizable flowering and seed set can be very short, and BLM districts can be more than a million acres.

The scoping period closed July 28, 2008. During the scoping period, the BLM held 12 public scoping meetings in Oregon, one at or near each of the nine BLM District Offices and in Klamath Falls, Baker City, and Portland, to describe the proposal and solicit ideas for issues and alternatives to be considered in this EIS. Approximately 40 non-BLM persons attended these meetings and most contributed comments verbally. Eighty scoping "letters" were also received during or shortly after the scoping period via letters, postcards, email, phone calls, and via the comment page on the project website. These letters helped the BLM define the alternatives to be considered and the eight *Purposes* to be addressed in this EIS and used by the decision-maker.

In addition to scoping comments, the BLM received postcards or emails from approximately 1,200 persons or groups asking to be on the project mailing list. Nine agencies, including the Oregon Department of Agriculture and the Bonneville Power Administration, received written and phone invitations to be formal cooperators with the BLM in the preparation of this EIS. Although they were supportive of the Proposed Action, all declined. In addition, 13 American Indian Tribes received letters explaining the project and the potential for effects to significant gathering areas and other resources, and extending an invitation to initiate government-to-government consultation. Follow-up phone calls to these tribal governments were made by the BLM districts reiterating these messages (see the *Paleontological and Cultural Resources* section in Chapter 4 for more detail about Tribes).

Public Review of the Draft EIS

On October 2, 2009, all of the persons who asked to be on the mailing list, sent scoping comments, or are required to get Environmental Impact Statements because of their positions (e.g., elected officials), were sent either a Draft EIS, *Summary*, Compact Disk, or email advising them that the Draft EIS was posted on the project website, depending upon the preference they stated when they asked to be on the list. The default document was a printed copy of the *Summary* if no choice was specified. The public comment period for the Draft EIS started with a Federal Register notice (74[190]:50986–50987) published on October 2 and ran through December 1, 2009. Agencies, officials, and the public were invited to comment of the Draft EIS. During the 60-day public comment period, 803 communications were received in the form of letters, postcards, and emails (collectively referred to as letters). The BLM continued to accept and process issues in letters received between December 2 and the completion of public comment analysis on January 6, 2010. During this time, the BLM received and processed an additional 240 letters of comments.

Letters were received from a variety of interests including individuals, organizations (including watershed councils), businesses, and Federal, State, and local (including soil and water conservation districts) government agencies. Letters were received from 10 states, as well as from India, but the majority of letters originated from Oregon. Substantive comments were identified, summarized, and combined into 312 unique comment statements. Responses were prepared, resultant new information was added to the EIS, and EIS language was clarified. Appendix 10 contains the comment statements and responses, organized to follow the order of the Final EIS. Responses to letters received from Federal, State, and local governments are included in Appendix 10, and their letters are displayed in their entirety in Appendix 11.

Consultation

For the PEIS, the BLM consulted with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) as required under Section 7 of the Endangered Species Act (PEIS:Chapter 5 and Appendix G). The BLM prepared a formal initiation package that included: 1) a description of the program, Federally Listed species, species proposed for Federal Listing, and critical habitats that may be affected by the program; and, 2) a *Biological Assessment for Vegetation Treatments on Bureau of Land Management Lands in 17 Western States*.

That Biological Assessment evaluated the likely impacts to Federally Listed species, species proposed for listing, and critical habitats from the proposed use of herbicides and other treatment methods, and identified management practices to minimize impacts to these species and habitats.

The FWS issued a Letter of Concurrence on September 1, 2006 that concurred that the proposed action as described in the PEIS and Biological Assessment, with all Standard Operating Procedures and PEIS Mitigation Measures, would not likely adversely affect any Federally Listed species under the jurisdiction of the FWS. In addition, the FWS recognized that any future site-specific actions carried out under the PEIS would undergo additional consultation as appropriate.

The Biological Opinion issued by the NMFS on June 26, 2007 concluded that the proposed action as described in the PEIS and Biological Assessment was not likely to jeopardize the continued existence of endangered and threatened salmon and trout, threatened green sturgeon and threatened southern resident killer whales. Since the PEIS does not authorize any site-specific actions, subsequent Section 7 review on proposed site-specific vegetation treatments will be required. There is no incidental take[17] identified or exempted by the Biological Opinion. If take is anticipated for site-specific treatments then the amount or extent of take will be identified during consultation for those proposed treatments.

Like the PEIS, this programmatic EIS does not authorize site-specific actions or amend Resource Management Plans. In addition, the three action alternatives in this EIS are the same as, or subsets of, the selected alternative in the PEIS. Therefore, this EIS is incorporating the PEIS Biological Assessment by reference (50 CFR 402.12(g)). Information about Federally Listed species in Oregon and a list of the Special Status species in Oregon are included in Appendix 5. Informal consultation with the FWS (50 CFR 402.13), and formal consultation with NMFS (50 CFR 402.14), are expected to confirm and apply the PEIS consultation results to this EIS. Specific treatment projects that tier to this EIS will be subject to site-specific consultation as appropriate.

Government and/or decision makers of the American Indian tribes were sent a scoping letter seeking their input and offering the opportunity for formal government-to-government consultation for the preparation of this EIS. The Bureau of Indian Affairs also received the tribal scoping letter. In total, 13 tribal scoping letters were sent and personal contact was pursued with each tribe.

For the PEIS, the BLM consulted with the affected State Historic Preservation Offices (SHPOs) as part of Section 106 consultation under the National Historic Preservation Act to determine how proposed vegetation treatment actions could affect cultural resources. Formal consultations with the Oregon SHPO and potentially affected Indian tribes also may be required during implementation of projects at the local level.

Related Plans and Analyses

Other NEPA documents integral to this EIS are described below. In addition, over 8,000 pages of detailed Risk Assessments have been prepared to evaluate the ecological and human risk for wildland use of each of the 18 herbicides addressed in this EIS. These Risk Assessments are adopted from the PEIS, the 2005 Forest Service *Pacific Northwest Region Invasive Plant Program EIS* (USDA 2005a), and the 1991 Final EIS for *Vegetation Management on BLM Lands in Thirteen Western States* (USDI 1991). These Risk Assessments are included in this EIS as Appendix 8 (uncirculated) and are further described in Chapter 3.

17 “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

2007 National PEIS

This EIS tiers to the June 2007 Final *Vegetation Treatments Using Herbicides on BLM lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS) and its September 29, 2007 Record of Decision. The PEIS and its Record of Decision apply to Oregon, but implementation is limited by the current U.S. District Court injunction. The analysis in the PEIS is fully incorporated into this EIS as Appendix 1, and major conclusions of that analysis are incorporated by reference (and usually brought forward into the body of this EIS, particularly in Chapter 4, for easier reference by the reader and the decision-maker).

Resource Management Plans

The public lands within the nine BLM districts in Oregon are covered by 18 Resource Management Plans (RMPs) and accompanying environmental impact statements. The RMPs contain direction for allocated uses, protection for resource values, and objectives for vegetation management. The RMPs acknowledge the problem of noxious weeds and contain objectives for their control (Appendix 6). However, they are not prescriptive about control methods, tools, seasons, or other treatment parameters. The alternatives in this EIS address the herbicide component of these control activities. None of the alternatives in this EIS would amend any of the RMPs; they would only provide options to conduct activities already included in the RMPs (Appendix 6).

In addition to direction to control noxious weeds, RMPs contain direction for, or otherwise assume, the management of vegetation to control hazardous fuels; improve or maintain habitat, riparian areas, and visual resources; maintain rights-of-way and other infrastructure; and, to meet other objectives[18]. Methods described and/or assumed to be used to accomplish this direction include: prescribed and wildland fire for resource benefits; manual treatments such as grubbing or pulling; mechanical treatments such as disking, chopping, cutting, and blading; biological controls including insects or pathogens; and, (in general) the use of herbicides. These non-herbicide methods are included in the analysis in this EIS only to the extent necessary to display the relative environmental differences between the proposed additional use of herbicides and the alternative methods currently being used. A detailed examination of non-herbicide methods is in the June 2007 *Final Vegetation Treatments on BLM Lands in 17 Western States Programmatic Environmental Report* (PER), available on the EIS website at http://www.blm.gov/or/plans/vegtreatmentseis/.

Seed Orchards

In 2005, the BLM completed three *Integrated Pest Management EISs* covering the Tyrrell Seed Orchard in the Eugene District, the Horning Seed Orchard in the Salem District, and the Provolt and Sprague Seed Orchards in the Medford District. Those EISs propose to use several herbicides to manage native vegetation in the seed orchards, and those EISs included detailed analyses of that proposed use, including Ecological and Human Health Risk Assessments. Records of Decision were signed in December 2005 and February 2006. Those Records of Decision approved use of those herbicides pending the lifting of the 1984/87 District Court injunction (USDI 2005a, b, c, 2006a, b).

In 1996, the Forest Service completed an Environmental Assessment for *Pest Management for Dorena Seed Orchard* (USDA 1996). The Dorena Genetics Resource Center, Umpqua National Forest, is located on land administered by the Eugene District BLM. The Environmental Assessment, which assessed risk to environmental

18 RMPs also address vegetation management for livestock forage and timber production, but the BLM is choosing not to address those two topics in this EIS to simplify and clarify the analysis.

and human health, proposes use of two herbicides for management of the seed orchard and nursery facilities. A Decision Notice was signed in March 1996.

The herbicide use proposed by the Seed Orchard decisions is included in this EIS as part of the administrative site treatment acres in Alternatives 4 and 5, and the environmental effects predicted in the Seed Orchard EISs are included in the resource sections in Chapter 4 of this EIS. Any meaningful differences between the Seed Orchard analyses and this EIS are identified in this EIS, and the Seed Orchard Records of Decision will be either confirmed or modified by the Record of Decision for this EIS.

Additional herbicides made available to the BLM in Oregon by the Record of Decision for this EIS would also be available to the seed orchards (pending district or site-specific analysis). Herbicide use at the seed orchards is not constrained by the limitation on "timber production" common to all alternatives.

Existing and Future Project-Level Planning

Each district has completed one or more Environmental Assessment documents describing their noxious weed control program. These documents are generally tiered to the 1985 Northwest Area Noxious Weed Control Program EIS and its 1987 Supplement (USDI 1985a, 1987), either directly or indirectly through their respective Resource Management Plans. The existing Environmental Assessments for Prineville, Lakeview, and Burns also specifically tier to the 1991 *Vegetation Treatment on BLM Lands in Thirteen Western States* EIS. Environmental Assessment treatment plans are updated annually to reflect the shifting nature of noxious weed populations and the control efforts needed to contain them.

This is a programmatic EIS for using herbicides as part of the vegetation management program on public lands administered by the BLM in Oregon, and is intended to be applicable for approximately 10 to 20 years. To implement the resultant decision at the project level, new site-specific analyses and documentation tiered to this and other applicable EISs will be completed by each district. Until those site-specific assessments are completed and in use, vegetation management including the use of 2,4-D, dicamba, glyphosate, or picloram for noxious weed control will be governed by the existing district Environmental Assessments, constrained by the Standard Operating Procedures and PEIS Mitigation Measures adopted by the PEIS Record of Decision.

The EIS does not set weed treatment priorities or approve projects. Specific treatment needs and resource protection priorities are identified in district Resource Management Plans, district weed management Environmental Assessments, and other site-specific plans. Prior to any specific herbicide treatment, site-specific analyses would be conducted, with the opportunity for public comment. These site-specific analyses would identify the potential effects of specific herbicide treatments. Deferring site-specific analysis of actual herbicide treatment proposals is consistent with NEPA, since without the ability to identify, among other things, the specific location of an undetermined treatment, it is impossible to identify what the potential site-specific effects of such a project might be. Nothing in NEPA, FLPMA, or the Resource Management Plans requires the BLM to propose an actual herbicide activity plan or site-specific proposals at this time; site-specific vegetation management proposals that include an herbicide component will be developed at a later date based on the alternative selected from the EIS. Finally, the acreage and herbicide application figures used for analysis purposes in this EIS are estimates only, made for the purposes of describing potential statewide risks and effects.

Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon

2004 Court-Ordered Buffer Around Salmon and the Settlement Agreement to Complete Consultation on 37 Pesticides

On July 2, 2002, in a case involving the Washington Toxics Coalition and the EPA, the District Court for the Western District of Washington found that the EPA had not consulted with National Marine Fisheries Service (NMFS) regarding the potential effects to Federally Listed salmon for 55 pesticides. By December 2004, the EPA had completed assessments of these 55 pesticides, determining 37 were potentially harmful to these anadromous fish and initiating consultation with NMFS. Three of the herbicides analyzed in this EIS are among these 37 (2,4-D, diuron, and triclopyr butoxyethyl ester (BEE)).

In January 2004, in response to the NMFS consultations having not been completed, the same court ordered buffer zones be applied to salmon supporting waters, noting pesticide application buffer zones are a common, simple, and effective strategy for avoiding jeopardy for Federally Listed salmonids. The court, however, provided for exceptions to the buffer strip requirement, including "programs authorized by the NMFS" (EPA 2007e), which includes actions that could occur under the alternatives in this EIS. The exceptions state that only a one-yard buffer strip is required for "Use of a pesticide undertaken as part of a specific agency action" where authorized through consultation with NMFS.

In addition, a Biological Assessment has been prepared for the activities addressed in the PEIS, and herbicide-specific buffers for Federally Listed and other Special Status fish species are established in the Biological Assessment for the PEIS, and these have been incorporated into Appendix 5 of this EIS. Consultation on this EIS is underway. Suggested conservation measures include a restriction on the use of triclopyr BEE in areas where Federally Listed and other Special Status aquatic species may occur, and restrictions on diuron and triclopyr BEE where off-site drift or surface runoff may occur into habitat that supports Federally Listed aquatic species or species proposed for listing. These proposed restrictions are more stringent than those imposed by the Court. The Biological Assessment prepared for the PEIS (and incorporated into this EIS) also states that site-specific consultation with NMFS and/or U.S. Fish and Wildlife Service will be required for use of herbicides likely to adversely affect Federally Listed species, or species proposed for listing.

Because herbicide registration consultation between EPA and NMFS had not been completed, NMFS was taken to court. In July 2008, a settlement was reached in NW Coalition for Alternatives to Pesticides et al. v. NMFS. The settlement requires NMFS to complete consultation on the 37 pesticides and to design measures that will minimize adverse impacts.

Potential Consultation Lawsuit Regarding 394 Pesticides

On January 28, 2010, the Center for Biological Diversity filed notice of intent to sue the EPA for failing to initiate consultation with NMFS and U.S. Fish and Wildlife Service for 394 pesticides potentially affecting 887 Federally Listed species. The notice also alleges the EPA has violated the Migratory Bird Treaty Act by registering pesticides that are known to kill and harm migratory birds. The listed pesticides include 11 of those evaluated in this EIS (2,4-D, bromacil, dicamba, diflufenzopyr, diquat, diuron, fluridone, hexazinone, imazapyr, picloram, and triclopyr). The EPA had 60 days to respond (CBD 2010), although as of June 2010, no response had been issued.

Petition to Cancel all Registrations of 2,4-D

On November 6, 2008, the Natural Resources Defense Council (NRDC) petitioned the EPA to revoke all tolerances[19] and cancel all registrations for 2,4-D. As a part of the petition, NRDC asserts that the EPA did not consider the full spectrum of potential human health effects associated with 2,4-D in connection with EPA's reassessment of the existing 2,4-D tolerances, and EPA's ecological risk assessment including:

- information on the endocrine disrupting effects of 2,4-D;
- information on the neurotoxicity related to 2,4-D exposure;
- information that products containing 2,4-D are mutagenic;
- data showing that dermal absorption of 2,4-D is enhanced by alcohol consumption, sunscreen, and DEET, which the EPA's exposure assessment failed to include; and,
- information about adverse developmental effects at doses below those included in EPA's risk assessment for exposure of infants to 2,4-D in breast milk.

The EPA has sought comment on the petition, but a final decision has not been reached. The BLM will comply with the final decision.

EPA's risk assessment of 2,4-D and findings on whether the tolerances for 2,4-D comply with the safety standards are contained in a June 2005 Reregistration Eligibility Decision (RED) document[20] for 2,4-D (EPA 2005a). The RED determined that 2,4-D containing products are eligible for reregistration provided that: (i) current data gaps and confirmatory data needs are addressed; (ii) the risk mitigation measures outlined in this document are adopted; and (iii) label amendments are made to implement these measures. The mitigation and label amendments are adopted onto the labels. The additional requested data are expected in 2010.

Sulfometuron Methyl Reregistration Eligibility Decision (RED)

In the November 12, 2008 Federal Register, the EPA announced that its sulfometuron methyl RED was available for review and comment. In the RED, the EPA proposes to:

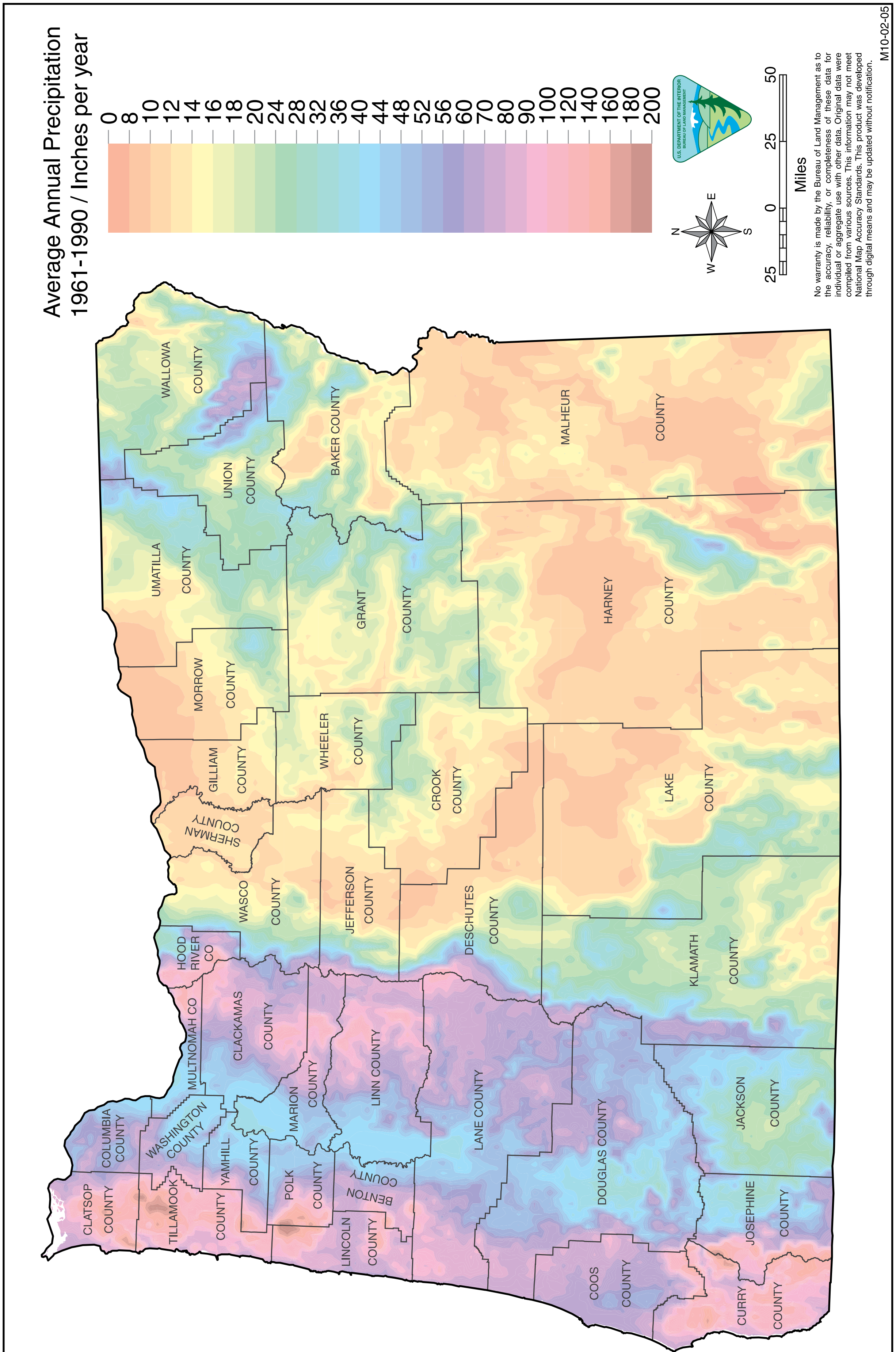
- prohibit sulfometuron methyl in counties with an annual rainfall of less than 10 inches;
- prohibit use within 100 feet of water; and,
- prohibit use on powdery dry soil or light sandy soil when it is predicted that there is less than a 60 percent chance of rainfall within 48 hours (EPA 2008b).

A final decision from the EPA has not been issued. A decision to adopt the proposed standards would particularly affect sulfometuron methyl application in Malheur County (in the Vale District) and Sherman County (in the Prineville District) where annual precipitation is 9.64 inches and 9.15 inches, respectively. Figure 1-2 shows average annual precipitation in the State.

19 Tolerances are limits permitted in food or water.

20 See Chapter 3 for more information about REDs.

FIGURE 1-2. AVERAGE ANNUAL PRECIPITATION 1961-1990



Oregon Priority Persistent Pollutant (P3) List

The 2007 Oregon Legislature passed Senate Bill 737, which requires the Oregon Department of Environmental Quality to develop a list of priority persistent bioaccumulative toxics (Priority Persistent Pollutant (P^3) List) to guide the Oregon Department of Environmental Quality's pollution prevention efforts. A priority persistent pollutant is a substance that is toxic and either persists in the environment or accumulates in the tissues of humans, fish, wildlife, or plants. The Oregon Department of Environmental Quality's Final P^3 List identifies 118 toxic pollutants, divided into two categories (ODEQ 2009b). None of the 18 herbicides discussed in this EIS are on the P^3 list; they do not meet specific toxicity, persistence, and /or bioaccumulation criteria for inclusion.

Oregon Department of Environmental Quality Toxics Reduction Strategy

The Oregon Department of Environmental Quality's draft Toxics Reduction Strategy is expected in 2011 and aims to use a comprehensive, integrated, cross-media approach to reduce the risk to human health and ecological life from toxic pollutants in Oregon's environment. The draft Priority Toxics Focus List (produced during the concept phase of this Strategy) identifies program priorities for three of the 18 herbicides addressed in this EIS, 2,4-D, glyphosate, and diuron. All three will be analyzed for their effects to land quality as household hazardous wastes, and to water quality because they are Pesticides of Interest (see the *Water Resources* section for more information) and are on the Willamette Toxics Monitoring Program Analyte List. In addition, diuron is on the Drinking Water Source Monitoring Program Contaminant List.

The Proposed Action (Alternative 4) would reduce the use of 2,4-D and glyphosate. Standard Operating Procedures and PEIS Mitigation Measures do not allow the use of diuron near water. If these herbicides were identified as toxics needing further reduction, the BLM would follow any direction on these herbicides.

EPA Endocrine Disruptor Screening Program (EDSP)

Endocrine disruptors are chemicals that interact with and disrupt the hormones produced or secreted by human or animal endocrine systems, which regulates growth, metabolism, and reproduction. A variety of chemicals have been found to disrupt the endocrine systems of animals in laboratory studies, and evidence shows that endocrine systems of certain fish and wildlife have been affected by chemical contaminants, resulting in developmental and reproductive problems. Based on this and other evidence, Congress passed the Food Quality Protection Act in 1996, requiring that EPA initiate EDSP on materials for their potential to affect the endocrine systems of humans and wildlife. Materials to be tested include pesticides, commercial chemicals, cosmetic ingredients, food additives, nutritional supplements, and certain mixtures. EPA issued the first test orders (Tier 1 testing) for pesticides to be screened for their potential effects on the endocrine system on October 29, 2009 (EPA 2010). Testing will eventually be expanded to cover all pesticides.

Because the available laboratories and resources for screening and testing cannot handle the potentially large number of chemicals that may be subjected to screening and testing under the EDSP at one time, EPA needed to develop a strategy for prioritizing chemicals for screening. Priority was ultimately based on the chemical's relatively high potential for human exposure rather than using a combination of exposure- and effects-related factors. The list of chemicals selected for initial screening includes pesticide active ingredients and High Production Volume chemicals used as pesticide inerts (EPA 2007f). Of the herbicides included in this EIS, 2,4-D and glyphosate are included in the initial list of 67 chemicals to get Tier 1 screening. The EPA notes that "Nothing in the approach for generating the initial list provides a basis to infer that by simply being on this list these chemicals are suspected to interfere with the endocrine systems of humans or other species, and it would be inappropriate to do so" (EPA 2009b).

Rulemaking to Require Disclosure of All Pesticide Ingredients

On December 23, 2009, the EPA published an Advance Notice of Proposed Rulemaking, seeking ideas for greater disclosure of inert ingredients in pesticides, and inviting comments on various regulatory and voluntary steps to achieve this broader disclosure. The 60-day comment period was extended an additional 60 days to April 23, 2010 (EPA 2009d). Pertinent new information will be incorporated, as it becomes available, into site-specific analyses.

Pending EPA Action to Address Pesticide Drift

On November 4, 2009, EPA issued proposed guidance for new pesticide labeling to reduce off-target spray and dust drift. The actions detailed in EPA's draft Pesticide Registration (PR) Notice on Pesticide Drift Labeling are intended to improve the clarity and consistency of pesticide labels and help prevent harm from pesticide drift. The draft PR Notice proposes labeling statements and formats intended to improve communication of drift management requirements to pesticide applicators and as a result, to improve protection of people and other non-target organisms and sites from potential adverse effects that may be caused by off-target pesticide drift. The recommended statements would appear on products whose application may result in drift.
The draft PR Notice contains:

1. A general drift statement that varies according to product type. The general drift statement prohibits drift that could cause an adverse effect to people or any other non-target organism or site.
2. Examples of risk-based, product-specific drift use restrictions, along with formats for presenting these statements on product labeling. On a pesticide-by-pesticide basis, based on individual product use patterns, EPA will evaluate scientific information on risk and exposure from pesticide drift. These assessments will help the EPA determine whether product-specific use restrictions are needed to protect people, wildlife, water resources, schools, or other susceptible sites from potential harm. These restrictions could include no-spray buffer zones, or requirements related to droplet or particle size, nozzle height, or weather conditions at the time of application.
3. Guidance to applicants and registrants about the process for implementing the new statements and formats on product labeling.

The EPA believes the use of these statements and formats on labels will provide users consistent, understandable, and enforceable directions about how to protect human health and the environment from harm that might result from off-target pesticide drift. The comment period for the proposed guidance runs until March 5, 2010 (EPA 2009e).

The EPA had previously defined spray or dust drift as the physical movement of pesticide droplets or particles through the air at the time of pesticide application or soon thereafter from the target site to any non- or off-target site. Spray drift shall not include movement of pesticides to non- or off-target sites caused by erosion, migration, volatility, or windblown soil particles that occurs after application unless specifically addressed on the product label with respect to drift control requirements (EPA 2001c).

Conflicts and Consistency with Other Plans

The CEQ regulations (40 CFR 1502.16) require a discussion of

> …possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.

This EIS does not propose to amend Resource Management Plans. It examines a proposal to make additional herbicides available to existing vegetation management programs. Their actual use would be considered at the site-specific scale, and need to be consistent with the management objectives for special management areas and other statute and Resource Management Plan-designated direction. Use would be consistent with requirements and objectives stated in Resource Management Plans (Appendix 6).

Herbicide use would be consistent with EPA and Oregon Department of Agriculture registration. Use potentially conflicting with reserved treaty rights of American Indian tribes would be subject to government-to-government consultation. Having additional herbicides, however, would facilitate efforts to protect these areas from noxious weeds and other invasive plants.

The Forest Service in Region 6 (Oregon and Washington) adopted an invasive plant control strategy in 2005 involving the use of ten herbicides (USDA 2005a). It is likely the two agencies would cooperate where logical control areas cross administrative boundaries. The two agencies already share analyses, personnel, and other information.

Alternatives 4 and 5 would specifically facilitate, not conflict with, habitat management needs described in FWS Recovery/Delisting Plans and interagency Conservation Strategies for Federally Listed and other Special Status species (Chapter 2). The availability of imazapic under Alternatives 3-5 would facilitate the reduction of fire-prone invasive annual grasses in the wildland urban interface east of the Cascades and in the Siskiyou Biome, furthering the objectives of the 2000 National Fire Plan (USDA, USDI 2000b).

The Lane County Board of Commissioners, with the collaboration of the Oregon Department of Transportation has adopted a Roadside Vegetation and Last Resort Policy (resolution #09-4-8-16) which aims to reduce herbicide use along roads in Lane County. The Board resolution states, "…that persistent herbicide exposure is now recognized as hazardous and recommends a reconsideration of routine and "residual" herbicides sprays as a roadside maintenance practice." Although the Proposed Action (Alternative 4) proposes to use few acres of "residual" herbicides for rights-of-way maintenance west of the Cascades, the resolution has the potential to affect some Alternative 4 roadside treatments. The resolution would not affect noxious weed treatments on BLM lands, even along roadsides, because residual herbicides are not proposed for noxious weed control.

A variety of local plans and Federal and State initiatives could potentially affect implementation of projects at the site-specific scale. Examples include the Coastal Zone Management Act, the Coastal Barriers Protection Act, and rural fire district hazardous fuel management plans. The action alternatives in this EIS would only make available additional tools for meeting vegetation management objectives already described in BLM Resource Management Plans, activity plans, and policy. Since Resource Management Plans already consider local plans, and since herbicide use and invasive plant management is already an emphasis of the Oregon Department of Agriculture and other departments, it is unlikely that the action alternatives would be in conflict with these local plans in a way that would be significant at the programmatic scale. Any differences can be addressed during site-specific planning

Chapter 2

Changes Between Draft and Final EIS

The following changes were made to Chapter 2 between the Draft and Final EIS. Minor corrections, explanations, and edits are not included in this list.

Changes were made to:

- Clarify that the action alternatives are all set in the context of Integrated Vegetation Management, and that all include the BLM's emphasis on prevention, early detection, rapid response, and using the most appropriate methods to protect the environment;
- Change the "no herbicides" Alternative 1 to a "Reference Analysis" to remove confusion about whether it was being considered as a viable alternative for meeting the *Need* and *Purposes;*
- Clarify that the prohibition on "commodity" objectives only prohibits the use of herbicides specifically for livestock forage or timber production, which was the original intent;
- Add "other plans listed in recovery or delisting plans" to the qualifying Conservation Strategies which serve as the basis for qualifying habitat improvement treatments under Alternative 4 (Proposed Action);
- Make sulfometuron methyl available west of the Cascades in Alternatives 3 and 4 because it has a shorter half-life and fewer adverse effects than other herbicides available for treating invasive annual grasses like cheatgrass;
- Add additional alternatives to the *Alternatives Eliminated From Detailed Study* section, in response to various suggestions received during the public comment period that were outside the scope of the analysis;
- Change the *Comparison of the Effects of the Alternatives* section from a narrative summary format to a table comparison format, to better comply with CEQ regulations and better show the differences between the alternatives;
- Show the acres of high and moderate risk herbicides by alternative and resources group (birds, mammals, fish, human health, etc.); and,
- Remove potential mitigation measures that duplicated label requirements, Standard Operating Procedures, and PEIS Mitigation Measures in Appendix 2, and clarify the remainder so their objective is clear and they are implementable.

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Chapter 2
The Alternatives

Introduction

This Chapter presents the No Action and three action alternatives, and well as a no-herbicide Reference Analysis. The three action alternatives would: a) make varying numbers of additional herbicides[1] available as part of the BLM's existing vegetation management program for noxious weeds, invasive plants, and other vegetation, and b) make those herbicides available for meeting various vegetation management objectives. These action alternatives would only add herbicides to non-herbicide treatment methods[2] already being used in the existing Integrated Vegetation Management programs.[3] This EIS only identifies and analyzes non-herbicide treatments to the extent necessary to understand the trade-offs and cumulative effects of the proposal to add herbicides to the existing program.

The alternatives in this EIS would only make the herbicides available for BLM district consideration. The alternatives do not address any site-specific proposal, and no project would be implemented without additional site-specific analysis and decision record. However, future herbicide use levels have been estimated for each alternative and are presented as assumptions in Chapter 3 for effects analysis.

The Reference Analysis

A Reference Analysis was included in the Draft EIS as "Alternative 1," but calling it an alternative was misleading since it would not meet the *Need* or *Purposes* and thus would not be selected. It was included for comparison purposes, to set a baseline for the herbicide portion of the analysis. The Reference Analysis examines the management of vegetation with non-herbicide methods. Non-herbicide methods include, but are not limited to, fire, manual, mechanical, State-approved biological control agents, directed livestock grazing, and seeding and planting for control of invasive vegetation. Reference Analysis features and effects are displayed on tables for comparison purposes with the No Action and three action alternatives throughout the EIS.

***Terminology*:**

Invasive plants (or weeds) are non-native aggressive plants with the potential to cause significant damage to native ecosystems and/or cause significant economic losses.

Noxious weeds are a subset of invasive plants that are county-, State-, or Federally- listed as injurious to public health, agriculture, recreation, wildlife, or any public or private property.

1 The term "herbicide" is used in this EIS to mean active ingredient (a.i.), and not trade name or formulation.

2 Currently used non-herbicide vegetation treatment methods include (but are not limited to) mechanical (e.g., mowing, blading, or chainsaws), manual (e.g., pulling or grubbing), fire, bio-controls (e.g., released insects or pathogens), directed livestock, and seeding or planting for weed control.

3 See Chapter 3 for a description of Integrated Vegetation Management and treatment methods.

Elements Common to All Alternatives

Applicable Lands

The alternatives in this EIS would apply to public lands administered by BLM in Oregon. They would apply to the BLM and to permit holders, lessees, cooperators, or applicants for temporary or long-term use permits on these lands.

Legal and Policy Requirements

Federal, State, and local laws, BLM policy, resource management plans, and all herbicide label requirements will be adhered to. Herbicides may be used only for the objectives and type of vegetation for which they are registered, as displayed on the herbicide label. The herbicides must be registered with the EPA and the State of Oregon. Although there are over 100 different herbicide active ingredients registered in Oregon under more than a thousand different trade names or formulations, the 18 herbicide active ingredients (herbicides) addressed in this EIS are limited to the active ingredients and formulations (brands) approved (listed for use) by the BLM National Office. Herbicides may be applied only by BLM and/or State certified pesticide applicators.[4] BLM has a policy against using petroleum-based adjuvants (including surfactants) or other additives.

Standard Operating Procedures

A variety of Standard Operating Procedures for herbicide use were adopted by the Record of Decision for the PEIS for use in the 17 western states. Those Standard Operating Procedures, with minor edits for clarity, are displayed in Appendix 2 and are made a part of all alternatives. Standard Operating Procedures reduce or avoid adverse effects to environmental and human resources from vegetation treatment activities. They are based on guidance found in BLM manuals and handbooks, regulations, and standard agency and industry practices. The list is not all encompassing, but is designed to give an overview of practices that would be considered when designing and implementing a vegetation treatment project on public lands (PER:2-29). Effects described in this EIS are predicated on application of the Standard Operating Procedures unless a site-specific determination is made that their application is unnecessary to achieve their intended purpose or protection, or unless the parent handbook or policy direction evolves and the new direction would continue to provide the appropriate environmental protections.

Mitigation Measures Adopted by the Record of Decision for the PEIS

As with the Standard Operating Procedures, a variety of mitigation measures for herbicide use were adopted by the Record of Decision for the PEIS for use in the 17 western states. They are displayed, with minor edits for clarity, in Appendix 2 and are made part of all alternatives. They are generally referred to herein as PEIS Mitigation Measures to separate them from the potential mitigation identified as *Potential Mitigation* at the end of this Chapter. Like the Standard Operating Procedures, application of the PEIS Mitigation Measures is assumed in the analysis. However, for PEIS Mitigation Measures, site-specific analysis, the use of Individual Risk Assessment Tools (see Chapter 3), or evolution of the PEIS Mitigation Measures into handbook direction at the National level, would be permitted to identify alternative ways to achieve the expected protections.

4 Non-motorized application of non-restricted herbicides may be done by uncertified personnel if they are working under the supervision of a certified applicator.

Conservation Measures for Federally Listed Species

The Biological Assessment for the PEIS includes Conservation Measures for Federally Listed species. In consideration of these Conservation Measures and other elements of the PEIS, the U.S. Fish and Wildlife concurred with the BLM's finding of "not likely to adversely affect proposed or listed endangered or threatened species of proposed or designated critical habitat" (Record of Decision for the PEIS, Appendix C). These measures are included in Appendix 5, referenced within PEIS Mitigation Measures in Appendix 2, and are assumed to apply to those species and habitats. In many cases, these measures duplicate Standard Operating Procedures and PEIS Mitigation Measures in Appendix 2.

The Alternatives

The alternatives add to existing non-herbicide methods by providing a range of both the number of herbicides to be available for use, and the areas/treatment objectives that they can be used for. They range from Alternative 2 (No Action) which limits herbicide use to four herbicides and noxious weeds only, to Alternative 5, which would permit the use of the 18 herbicides selected for use by the BLM nationally, and permit them to be used to achieve any management objective except livestock forage or timber production. Each alternative adds herbicides or uses when compared to the one preceding it. For example, all uses and herbicides permitted under Alternative 2 are included in Alternative 3, but Alternative 3 adds additional herbicides as well as the types of plants that may be treated. Similarly, all treatments and herbicides included in Alternative 3 are available in Alternative 4, but Alternative 4 adds additional treatment objectives when compared to Alternative 3. This "adding" effect is shown graphically in Table 2-1, along with the types of plants and management objective they apply to. All alternatives exclude herbicide use specifically for livestock forage or timber production,[5] and Alternatives 3 and 4 do not permit aerial application west of the Cascades.

Table 2-1. Herbicide Treatments by Alternative and Treatment Objective

Plant type	**Treatment Objective**	**Reference Analysis (no herbicides)**	**Alt. 2 (4 herbicides)** No Action	**Alt. 3 (12/13[1] herbicides)**	**Alt. 4 (13/16[1] herbicides)** Proposed Action	**Alt. 5 (18 herbicides)**
Noxious / Invasive only	Noxious Weeds		√	√	√	√
	Invasive Plants			√	√	√
All Other Vegetation (natives and non-invasive non-natives)	Pest and Disease Control			√	√	√
	Right-of-Way, admin, and recreation				√	√
	Habitat in Conservation Strategies				√	√
	All other treatments					√

[1] West/East of the Cascades

5 This is not to infer invasive plants would not be controlled wherever they occur to protect any BLM resource values, but to say that control would not be focused or exclusively driven by livestock or timber growth objectives, nor would any *native* vegetation be controlled specifically to favor more desirable livestock forage or timber growth.

The No Action Alternative

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Continue to use only four herbicides (2,4-D, dicamba, glyphosate, and picloram; Table 2-2), and these only for State-, Federal-, or county-listed noxious weeds. [6] Use only non-herbicide methods for the management of (non-noxious) invasive plants and other vegetation. Aerial application would be permitted west and east of the Cascades.

This alternative is required by CEQ regulations for comparison purposes, and is not expected to meet the *Need*.

The Action Alternatives

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Make available 12 herbicides west of the Cascades (2,4-D, clopyralid, dicamba, fluridone, glyphosate, hexazinone, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr) and 13 herbicides east of the Cascades[7] (chlorsulfuron and the 12 herbicides available west of the Cascades; Table 2-2):

- To treat noxious weeds and other invasive plants as necessary to meet Integrated Vegetation Management objectives; and,
- To treat any vegetation, as necessary, to control pests and diseases in State-identified[8] control areas, such as the Sudden Oak Death[9] quarantine in southwest Oregon.

No aerial application would be permitted west of the Cascades.

Alternative 3 Treatment Examples

- Treatment of cheatgrass (invasive) to reduce fire risk within the wildland urban interface or to create “green” fuel break zones by restoring areas to perennial, more fire-resistant native or other non-invasive species.
- Treatment of spotted knapweed (noxious) to improve the forage and cover for deer in their winter range.
- Treatment of tanoak as needed to control Sudden Oak Death in southwest Oregon.
- Treatment of medusahead (noxious) to facilitate burned area rehabilitation.
- Treatment of gorse (noxious) on roadsides.

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6 The number of herbicides (four) and what they can be applied to (noxious weeds) is limited by the 1984/87 injunction. A June 19, 2009 court order slightly modified the injunction for 2009-2011 (see Chapter 1).

7 Based on district-identified need. See the *Differences in the Number of Herbicides Proposed East and West of the Cascades* in Chapter 3. Herbicide information is on Table 3-1 in Chapter 3. District boundaries are used to separate east and west. The Lakeview-Medford district boundary only nominally follows the Cascade crest but these districts are wholly considered east and west respectively, for the purposes of the herbicide numbers and analysis in this EIS.

8 Oregon Department of Agriculture

9 Sudden Oak Death is the only currently known example of a treatment that would be proposed under this clause.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Make available 13 herbicides west of the Cascades (2,4-D, clopyralid, dicamba, diuron, fluridone, glyphosate, hexazinone, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr) and 16 herbicides east of the Cascades (bromacil, chlorsulfuron, tebuthiuron, and the 13 herbicides available west of the Cascades; Table 2-2):

- To treat noxious weeds and other invasive plants as necessary to meet Integrated Vegetation Management objectives.
- To treat any vegetation as needed to control pests and diseases in State-identified control areas, such as Sudden Oak Death in southwest Oregon.
- To treat any vegetation to meet safety and operation objectives in administrative sites, recreation sites, and rights-of-way.
- To treat any vegetation to achieve habitat goals specified in approved Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, or Conservation Agreements (collectively referred to as Conservation Strategies) for Federally Listed[10], proposed for listing, or Bureau Sensitive species (Special Status species).

No aerial application would be permitted west of the Cascades.

Administrative sites, recreation sites, and rights-of-way include:

- Linear utility transmission systems, including multi-purpose corridors;
- BLM and other authorized road or railroad rights-of-way;
- Oil and gas production or gas storage agreement areas and facilities;
- Geothermal, wind, or solar energy production areas and facilities[10];
- Pumped storage hydro-power production areas and facilities[10b];
- BLM authorized common-material or rock quarries and storage areas (although most vegetation management at such sites is for invasive plant control);
- Federal, State, local or tribal designated fire suppression equipment sites and staging areas including helispots;
- Cell phone, microwave, and other transmission sites;
- Mines;
- BLM and Forest Service seed orchards and progeny test sites;
- Public purpose lease areas, including airstrips, schools, parks, etc.;
- Interagency special management areas (e.g., reservoirs, military training, etc.);
- Watchable Wildlife, Adventures in the Past, Wild Horse Herd Viewing, Outstanding Natural Areas and other BLM designated interpretive sites;
- BLM offices, fire stations, and other facilities;
- Developed campgrounds, picnic areas, trails, overlooks, OHV staging or parking areas, hang-gliding areas and boat facilities; and,
- Other administrative and operational sites needed for wildfire suppression, law enforcement, search and rescue, inventory, research, resource monitoring or other authorized administrative uses.

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10 Federally Listed means designated as threatened or endangered under the Endangered Species Act.

10b As of July 2010, there are no approved wind, solar or pumped storage facilities on Oregon BLM lands, but such projects might be developed in the future. A proposed wind energy project is under consideration on the Baker Resource Area.

Conservation Strategies and Conservation Agreements:

Current language at http://www.fs.fed.us/r6/sfpnw/issssp/ describes these two documents as shown here. This language could be updated, but the types of species included are not expected to change.

Conservation Strategies capture and condense all of the known information about the biology and ecology of a species including taxonomy, range, distribution, and habitat descriptions. They often identify important inventory, research, and monitoring information that may be relevant for further understanding of the species or for adaptive management purposes. They also provide information on how and when to manage a site. Strategies address how to manage the species and/or habitat to maintain viability or persistence of the species. They describe how individual sites/populations should be managed, and can also identify which sites/populations are needed to meet the viability, persistence, or conservation goal for the species. These documents typically cover either a significant portion or the entire range of the species, and may be created by one field unit, one agency, or be interagency in nature, but agreed upon by all administrative units the Strategy covers. Conservation Strategies should be coordinated with BLM State/Forest Service Regional Office planning and conservation leads.

Conservation Agreements outline procedural assurance necessary to reduce, eliminate, or mitigate specific threats. Agreements are usually Memorandums of Understanding agreed upon by Federal agencies (Forest Service, BLM, FWS, or NOAA Fisheries) and may include States and private entities. They are typically broad-scale, giving general guidance on how to manage for a species. The objective of Conservation Agreements is to identify management that will avoid a trend towards listing under the Endangered Species Act. Agreements are typically voluntary non-binding documents that may be cancelled at any time.

Alternative 4 Treatment Examples:

Consistent with Integrated Vegetation Management and other priority-setting tools, and in addition to treatments permitted under Alternative 3, treatments under this alternative could include:

- Control of alder encroaching on power lines.
- Treating poison oak, poison ivy, stinging nettles, or other plants that create an unacceptable human risk in recreation sites such as campgrounds (typically when campgrounds are closed or access to treated areas is restricted).
- Treatment of native sagebrush to improve sage grouse nesting habitat.
- Removing western juniper to make more water available to meet habitat goals specified in an approved Recovery Plan for a Federally Listed fish.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Make available 18 herbicides both east and west of the Cascades (Table 2-2) for the full range of vegetation management objectives and uses approved nationally in the Record of Decision for the PEIS and currently available for implementation on BLM lands in the 16 other western states except for projects specifically designed to improve livestock forage or timber production. Aerial application would be permitted west and east of the Cascades.

Alternative 5 Treatment Examples:

Consistent with Integrated Vegetation Management and other priority setting tools, and in addition to treatments permitted under Alternatives 3 and 4, treatments under this alternative could include:

- Wildland urban interface community protection vegetation treatments that are designed to reduce the risk of wildfire to the community and/or its infrastructure developed collaboratively with the community.
- Treatments of any vegetation as needed to restore or maintain healthy, diverse, resilient, and productive native plant communities.
- Treatments to improve habitat for non-Special Status fish and wildlife.

Table 2-2. Herbicides Available Under Each Alternative

Herbicide	**Reference Analysis**	**Alt 2** (No Action)	**Alt 3**	**Alt 4** (Proposed Action)	**Alt 5**
Herbicides Currently Approved for use on BLM Lands in Oregon (for noxious weed control only)					
2, 4-D		√	√	√	√
Dicamba		√	√	√	√
Glyphosate		√	√	√	√
Picloram		√	√	√	√
Additional Herbicides Proposed for Use in One or More of the Action Alternatives					
Bromacil				E	√
Chlorsulfuron			E	E	√
Clopyralid			√	√	√
Diflufenzopyr + Dicamba					√
Diquat					√
Diuron				√	√
Fluridone			√	√	√
Hexazinone			√	√	√
Imazapic			√	√	√
Imazapyr			√	√	√
Metsulfuron methyl			√	√	√
Sulfometuron methyl			√	√	√
Tebuthiuron				E	√
Triclopyr			√	√	√

E: Only allowed in BLM districts east of the Cascades.
Formulations are limited to those on the BLM National list of approved herbicides.
See *The 18 Herbicides* section and Table 3-1 (Chapter 3) and Appendix 9 for further information about these 18 herbicides.

Alternatives Eliminated From Detailed Study

No Use of Acetolactate Synthase (ALS)-inhibiting Herbicides

This alternative was suggested during scoping for this EIS. ALS-inhibitors[11] work by inhibiting the enzyme acetolactate synthetase (ALS), resulting in inadequate supplies of the branched chain amino acids (leucine, isoleucine and valine). The alternative may have been suggested in part because a BLM application of sulfometuron methyl on a burned area in Idaho was implicated in widespread damage to adjacent private croplands following a dust storm (see *Cumulative Impacts* section in Chapter 4). Standard Operating Procedures designed to prevent such an event are included in this EIS.

An alternative with no use of ALS-inhibitors was analyzed in the PEIS, which is incorporated into this EIS as Appendix 1. It was not selected because these herbicides are potentially less harmful to plants, animals, and humans than other herbicide active ingredients proposed. In addition, the BLM would lose the ability to effectively control such aggressive species as perennial pepperweed and hoary cress, and to a lesser extent, saltcedar, as well as cheatgrass (Record of Decision for the PEIS:4-11).

ALS-inhibiting herbicides are, as a group, the least toxic herbicides to the environment and human health evaluated in this EIS, and some of the most problematic invasive weeds are best controlled with these herbicides. For example, such control would require multiple applications of picloram versus a single application of imazapic for leafy spurge control; multiple applications of 2,4-D or triclopyr versus single applications of imazapyr for saltcedar control; and, multiple applications of 2,4-D or dicamba versus imazapic or metsulfuron methyl for perennial mustard control (PEIS: Appendix I). Excluding these five herbicides would not meet the *Need* and *Purposes* because of the number of weeds for which there would be no effective control, and would lead to the use of some herbicides with higher risks to humans and/or the environment.

No Aerial Application of Herbicides

This alternative seeks to reduce the likelihood of inadvertent application to riparian and other non-target areas, and reduce perceived risk. This alternative was considered in the PEIS and rejected because large expanses of cheatgrass and other weeds in remote areas or areas with rugged terrain would be difficult and cost-prohibitive to treat. In addition, using ground-based methods in rugged terrain would increase injury and herbicide exposure risks for workers (Record of Decision for the PEIS:4-11). However, Alternatives 3 and 4 prohibit aerial application west of the Cascades for a variety of reasons. The high density of streams, seeps, and other water bodies, coupled with dense vegetation, can make water difficult to avoid. Nearly all lands west of the Cascades are within source water protection areas for public water systems (Figure 4-6), and there are an uncountable number of individual domestic water intakes. Steep varied terrain coupled with tall vegetation (including dead trees) can force pilots to fly relatively high, increasing the risk of drift to water, non-target plants, and other non-target areas, and making surface waters harder to see from the air. There are also fewer large monocultures of invasive plants on the west side proposed for herbicide treatments.

11 Chlorsulfuron, metsulfuron methyl, sulfometuron methyl, imazapic, and imazapyr are the ALS-inhibitors being considered for use by this EIS.

Reduce Management Activities Implicated in Weed Spread

This alternative, suggested during scoping and again by public comments on the Draft EIS, would curtail or restrict various management and public use activities taking place on BLM lands in order to reduce weed spread. Grazing, mining, logging, and off-highway vehicle use were most-often suggested as contributing to weed spread, but camping, hiking, wildfire control, boating, and all other activities on or near BLM lands were also suggested. This alternative is not considered in detail because a reconsideration of the level of various land uses is the purview of the land management planning process described in the Federal Land Policy and Management Act (FLPMA). A variety of management uses are authorized and directed by the FLPMA, by the O&C Act, and by other policy and direction. While these activities variously contribute to the spread of weeds (and in some cases, to their control), it is the role of each district's Resource Management Plan to identify an appropriate mix of public uses and management practices consistent with land capability, long-term productivity, and ecosystem health. The potential for an activity to contribute to resource degradation (such as the spread of noxious weeds and other invasive plants) is one consideration in determining appropriate uses. Noxious weed control is a management emphasis specified in all Resource Management Plans (see Appendix 6).

It is pertinent to note that management activities are not always adverse with respect to noxious weed spread. It is in the interest of persons holding grazing permits, for example, to help manage their allotments to prevent their degradation by noxious weeds. Early-season grazing of cheatgrass can retain soil moisture and help maintain native and other non-invasive vegetation. A determination of the relative contribution of all BLM land uses to the introduction and spread of noxious weeds is beyond the scope of this analysis, thus the EIS does not suggest reconsideration of the level of timber harvest, grazing, OHV use, and other uses of BLM lands because they are implicated in invasive weed spread.

At the project scale, BLM policy requires that when a proposed management activity (such as a timber sale or road construction) has a moderate or high risk for establishing noxious weeds, BLM must prescribe follow-up monitoring as well as identify project actions that need to be taken in order to reduce or prevent the spread of noxious weeds (USDI 1992b).

Use Vinegar, Salt, and other Household Products

This alternative was suggested during scoping. There are one or more EPA-registered herbicide formulations that have vinegar as the active ingredient, but they are not registered with the State of Oregon and/or they are not included on BLM's list of herbicides approved for use on BLM wildlands. The limited number of registered target plants, lack of widespread use on non-BLM lands, and relatively little experience with environmental effects precludes the BLM from investing in the risk assessment process for these herbicides. The process for proposing, analyzing, and adopting additional herbicides is outlined in Appendix 4, and a vinegar herbicide could be considered in the future.

Some other household products were not considered because Oregon State Law prohibits the use of any material to control, kill, limit, or repel plants or animals unless it is registered with the State as a pesticide and such use is consistent with the label. Certain household materials are registered pesticides. For example, Clorox Ultra is registered for killing the oospores of the root disease *Phythophthora lateralis* (Port-Orford-cedar root disease), and borax is registered for use on tree stumps to prevent the root disease *Fomes annosus*. Pesticide registration and rigorous analysis is required; being a food or household product is not necessarily evidence it would not have unacceptable adverse environmental effects. Salt, for example, is more toxic to parts of the environment and to human health than some of the herbicides included in the action alternatives. See also the *Toxicity Comparison with Household Products* section in Chapter 3.

Increase the Use of Non-Herbicide Methods

This alternative proposes to meet the underlying *Need* for more effective vegetation control measures by increasing the use of non-herbicide methods such as using volunteers and hiring hand crews. This alternative was not considered in detail because all effective known non-herbicide methods are already available to the BLM in Oregon and are being used wherever practical; some plant species (such as Canada thistle and gorse) are not effectively controlled without herbicides because small root parts re-sprout readily; non-herbicide methods have site impacts such as soil disturbance and damage to non-target species; and, most manual treatments are expensive and thus decrease the total work that can be accomplished with available funding. Volunteers can be difficult to use in remote areas, on larger projects, and on weeds that are difficult to identify or remove. All of the action alternatives within the EIS are set in the context of Integrated Vegetation Management and existing BLM policies for selecting treatment methods, so non-herbicide methods will be employed to the extent practicable.

Reconsider Other BLM Management Practices that Encourage the Spread of Invasive Plants, such as OHV Use or Policies on the use of Weed Free Feed.

Consideration of other ways to control the spread of invasive weeds is ongoing. Many ideas, such as requiring weed free feed, are integral to broader programs or uses and are more appropriately left to land management planning or related area-wide plans such as district transportation plans or Wilderness management plans. Controlling the spread of noxious weeds is a consideration in all such planning – e.g., see Appendix 6 for existing district-specific direction regarding noxious weed control. Reconsideration of this existing direction, or of planning more appropriately left to different scale planning, is outside the scope of this EIS. The Proposed Action (Alternative 4) in this EIS assumes all other Integrated Vegetation Management policies and planning direction are in place and remain emphasized.

The proposed increase in the number of herbicides to control invasive plants would double the effectiveness of the invasive plant control program while lowering the total pounds of herbicides applied, and lowering the risks to human health and other elements of the environment, when compared with the No Action Alternative (Alternative 2). Broader changes to the BLM's strategy for controlling invasive plants, as suggested by this alternative, would not change the relative comparison between the alternatives in this EIS. The relative benefits of one of the alternatives over the other, as reflected in the analysis, would not be significantly altered, for example, by a change to weed free pack-stock feed, or a reduction in OHV use. While such actions might slow the spread of invasive weeds, they would not significantly change the need for the BLM to efficiently control some weeds with herbicides, and for those herbicides to be the most efficient and environmentally friendly.

Increase Funding to Pay for Additional Non-Herbicide Control Treatments

This alternative would not use herbicides, and attempt to accomplish the vegetation management objectives by increasing funding to pay for vegetation treatments with more expensive non-herbicide methods. This alternative is not considered in detail because if additional funding were received, it would be most appropriate to increase accomplishments, not fund more expensive methods. The weed control need easily exceeds current capabilities. The analysis indicates that even with access to additional herbicides, the noxious weed spread rate would only be reduced by half. The "current budget trends" assumption used in the EIS permits a realistic comparison of alternatives at one budget level, rather than attempting to compare alternatives based on future budget assumptions, some of which may be speculative. Nothing in the EIS precludes the BLM from pursuing and receiving increased funding for weed control (although herbicide use significantly above that estimated in this analysis might require re-evaluation).

Consider the Use of Different Herbicides Other than the 18 Being Considered

This alternative would use some of the more than 100 herbicide active ingredients registered for use in Oregon in more than 1,000 product formulations. This alternative was not considered because herbicides used on BLM lands must be approved by the BLM National Office, and must, by policy, be subject to detailed ecological and human health risk assessments for wildland applications to help satisfy the requirements of NEPA. Neither the BLM nor the EPA considers the EPA registration process adequate for predicting all environmental harm in wildland uses. The 18 being considered in this EIS are those for which the Forest Service or BLM have current Risk Assessments, and that have been analyzed in the PEIS and deemed appropriate for BLM use by the Assistant Secretary, Lands and Mineral Management, Department of the Interior (Record of Decision for the PEIS). The process for proposing, evaluating, and adding additional herbicides to those approved by BLM nationally is described in Appendix 4. Because of the high cost of the risk assessment process, selection of ones to add includes a determination of broad or high-priority need.

Use the Same Herbicides as the Forest Service

This alternative seeks to reduce human health and environmental risk by excluding 2,4-D and other herbicides not included in the 2005 Forest Service decision for Oregon and Washington. This alternative is not considered in detail for several reasons.

First, the Forest Service's Pacific Northwest Region Invasive Plant Program EIS focused only on invasive plants, so its focus is comparable only to Alternative 3 in this EIS (herbicides added by BLM Alternatives 4 and 5 are included to accomplish objectives not included in the Forest Service EIS). Eighty-three percent of the acres in Alternative 3 are expected to be accomplished with the same herbicides as approved by the Forest Service, and another 12 percent would be accomplished with 2,4-D (Table 3-3). Only 5 percent are estimated to be accomplished with other herbicides. In general, these additional herbicides would be applied in specialized cases or where weed populations had begun to show resistance to first-choice herbicides. As noted in the EIS, having additional herbicides does not necessarily mean more acres would be treated, but it does increase the options available for avoiding locally sensitive resources values. The Forest Service decided not to select 2,4-D at the programmatic scale. For this and other reasons, the BLM considered removing 2,4-D from one or more of the action alternatives and decided to retain it (see Appendix 12).

Second, as described in Appendix 12, the removal of 2,4-D in particular would reduce the effectiveness of Alternative 3 at reducing noxious weed spread by at least one percent. That is, instead of reducing weed spread from the current 12 percent to 7 percent, the reduction would be only to 8 percent or higher. This is at least 300,000 additional acres infested in 15 years when compared to Alternative 3 with 2,4-D.

Finally, the decision-maker can decide to exclude individual herbicides from the selected alternative. The possibility of such an action is described in the *Decision to be Made* section in Chapter 1.

Permit the Use of All EPA Tested and Approved Herbicides

This alternative would permit the use of all herbicides approved by the EPA for wildland uses. The alternative is not considered in detail because the United States Court of Appeals for the Ninth Circuit has found EPA registration procedures to be inadequate to meet the wildland applications hard look requirements of NEPA. Thus, the process for making herbicides available to the BLM includes an expensive Risk Assessment process.

Because of the costs of such assessments, candidate herbicides are selected based on being registered for vegetation that BLM needs to treat, being apparently compatible with protecting wildland ecosystem values, and that appear to offer advantages over herbicides currently available. Risk Assessments build upon the EPA registration information by adding information from the scientific literature, and considering applications in wildland settings that appeared to be "minor" in the EPA registration process. The BLM nationally maintains a list of Risk Assessments it considers to adequately cover wildland use, and periodically conducts literature searches to check the accuracy of less recent Risk Assessments. From these, the BLM maintains a list of specific products known to contain only these materials and to not contain inerts and other ingredients not used by the BLM by policy. The list of approved herbicides and formulations is updated annually. Those approved in 2010 are shown in Appendix 9, Table A9-2. Use of other herbicides is limited to experimental uses. The process for adding herbicides to the BLM National list is described in Appendix 4.

Permit the Use of Herbicides for the Full Range of BLM Management Responsibilities Including Livestock Forage and Timber Production

This alternative would allow the use of herbicides for the full range of multiple uses including timber and livestock forage production. This alternative is not considered in detail in order to simplify and clarify the analysis. Although the treatments addressed in the EIS are estimates of future treatments and the EIS does not approve treatments, the potential for relatively broad-scale treatments of native vegetation to favor other, sometimes non-native, vegetation could substantially broaden and complicate the analysis of effects. Exclusion of these treatments does not preclude the BLM from proposing and examining additional herbicide uses in the future.

Comparison of Alternatives

This section provides a descriptive summary of the alternatives and their environmental effects in a comparative form, in order to directly address the issues and provide a clear basis for choice among options. Table 2-3 summarizes the differences between the alternatives. Table 2-4 summarizes the herbicide treatment acres estimated to occur under each of the alternatives. Table 2-5 compares and contrasts the alternatives on the basis of the environmental effects to individual resources (described in more detail in Chapter 4). Table 2-6 compares and contrasts the alternatives on the basis of their contribution toward accomplishment of the eight *Purposes*.

The Reference Analysis and Alternatives

The Reference Analysis, No Action Alternative, and the three action alternatives include a range of herbicides from zero to 18, include a range of management objectives herbicides can be used for ranging from none to everything except livestock forage and timber production. Each subsequent alternative retains the herbicides and objectives from the one preceding it, and adds herbicides and objectives. The three action alternatives are all consistent with the selected alternative in the 2007 Record of Decision for the PEIS. The herbicide objectives, and the additive structure, are shown on Table 2-3, Comparison of the Features of the Alternatives.

Table 2-3. Comparison of the Features of the Alternatives

Standard	Reference Analysis (no herbicides)	Alt. 2 (No Action) (4 herbicides)	Alt. 3 (12/13 herbicides[1])	Alt. 4 (Proposed Action) (13/16 herbicides[1])	Alt. 5 (18 herbicides)
Noxious weeds	Use non-herbicide methods.	Herbicides[2] available to control State, Federal, or county-listed noxious weeds.			
Invasive plants	Use non-herbicide methods.		Herbicides[2] available to control any invasive plant.		
Pest and Disease Control	Use non-herbicide methods.		Herbicides[2] available to control any (including native) vegetation as necessary to control pests and diseases in State-identified control areas.		
Administrative sites, Recreation sites, Rights-of-Way	Use non-herbicide methods.			Herbicides[2] available to treat any (including native) vegetation to meet safety and operation objectives in administrative sites, recreation sites, and rights-of-way	
Habitat goals in Conservation Strategies	Use non-herbicide methods.			Herbicides[2] available to treat any (including native) vegetation to achieve habitat goals specified in approved Conservation Strategies for Federally Listed or other Special Status species.	
All other vegetation management	Use non-herbicide methods.				Herbicides[2] available to accomplish any vegetation management objective except livestock forage and timber production.

[1] West/East of the Cascades. See Table 2-2.
[2] Herbicides available in addition to existing non-herbicide methods.

Estimated Annual Treatment Acres Under Each Alternative (Table 2-4)

To support the effects determinations, the acres to be treated with each herbicide, and with each non-herbicide method, were estimated for each alternative. Weed and other vegetation management specialists from the Oregon State Office and the nine district offices in Oregon estimated annual treatment levels for the next 10 to 20 years assuming current budget trends. Those totals are summarized on Table 2-4.

Table 2-4. Estimated Annual Treatment Acres Under Each Alternative

	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Herbicide treatments					
Number of Herbicides	0	4	12 west /13 east[1]	13 west/16 east	18
Herbicide use limited to:	n/a	Noxious Weeds only	Invasive Plants, Pest & Disease Control	Invasive Plants, Administrative and Recreation sites, Rights-of-Way, Special Status species' habitats	Any vegetation management objective except Timber and Livestock Forage Production
Annual Herbicide Treatment Acres[2]	0	16,700	30,300	45,200	50,000
Non-herbicide treatments, invasive plants only (estimated annually)					
Mechanical/Manual Methods (invasive plants only)	8,600	5,700	5,400		
Directed Livestock	8,800	2,800	2,800		
Prescribed Fire (as part of restoration/ control treatments)	3,700	5,700	12,500		

[1] West/East of the Cascades
[2] Estimated herbicide treatment acres are listed by herbicide, and split east and west of the Cascades, on Table 3-3 in Chapter 3.

Comparison of the Effects of the Alternatives (Table 2-5)

Herbicides can be uniquely hazardous, so particular attention has been given to analyzing the potential for adverse effects (risk) of each herbicide. Ecological and Human Health Risk Assessments have been prepared (Appendix 8), and results have been synthesized into risk categories for various scenarios representing possible exposures from BLM applications. “High,” “moderate,” and “low” risk categories for each herbicide for various species including humans are the synthesized result of those analyses (see Chapter 3, *Risk Assessments*), and these risk categories are displayed in the tables at the end of Chapter 3. The estimated herbicide use acres and their highest risk categories (even if only for one exposure scenario) are included for each resource on Table 2-5, and the herbicides responsible for the “high” and “moderate” ratings are identified. It is important to remember these are “risks” based on exposures modeled in Risk Assessments, and that where these ratings are higher than 0, the ratings guided the development of Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) designed to keep actual exposures below what would potentially result in significant adverse effects. Even Federally Listed and other Special Status species were deemed not at significant risk because of required pre-project clearances, consultation requirements, and/or additional buffer requirements.

To help describe why the BLM would accept any risk whatsoever, two other effects related to differences between the alternatives were also examined:

1. The EIS includes an estimate of the current noxious weed spread rate and how the Reference Analysis and action alternatives might be expected to change that rate (Table 2-5). Since noxious weeds adversely affect most resources, the analysis contrasts the level of weed-related adverse effects between the alternatives. The analysis indicates that although there are some increased environmental risks associated with increases in the use of herbicides (substantially limited by the Standard Operating Procedures and PEIS Mitigation Measures), there are more adverse effects predicted from the spread of noxious weeds. Having more herbicides available for use would increase the options for selecting the most appropriate treatment to accomplish the weed control objective while minimizing risk to human health and nearby non-target resources including soil and water.
2. Non-herbicide methods are not without environmental risk. Since the use of herbicides affects the acres treated with non-herbicide methods, adverse effects from non-herbicide treatments are estimated as well.

For native vegetation treatments under the Alternatives 4 and 5, favorable and adverse environmental effects are similarly contrasted (Table 2-5).

Response of the Alternatives to the Purposes (Table 2-6)

In Table 2-6, the environmental effects summarized in Table 2-5 (and elsewhere in the EIS) have been brought to bear directly on the eight *Purposes* identified in Chapter 1. This is probably the most important comparison in this section; Chapter 1 notes that no alternative would meet all *Purposes* completely and that the selected alternative will be the one that meets the *Need* and best meets the *Purposes*.

Table 2-5. Comparison of the Effects of the Alternatives

Resource Section Effects Parameters	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Noxious Weeds and Other Invasive Plants					
Estimated Spread Rate in 15 years	14%	12%	7%	6%	6%
	(Generally, the more herbicides available, the more likely there is one appropriate to the local situation and weed spread can be reduced.)				
Noxious weed acres in 15 years[1]	8.6 million	5.9 million	4.0 million	3.7 million	3.7 million
Alternative has tools to effectively control:	About 1/3 of 120 State-listed noxious weeds	104 of 120 State-listed noxious weeds	116 of 120 State-listed noxious weeds, plus other invasive plants	116 of 120 State-listed noxious weeds, plus other invasive plants	117 of 120 State-listed noxious weeds, plus other invasive plants
Native and Other Non-Invasive Vegetation					
Herbicide risks to terrestrial plants[3]	None		ALS-inhibitors pose highest risk to non-target plants because of their extremely low effective dose rates.		
Acres of High risk herbicides	0	22,800	21,100	33,900	37,800
Acres of Moderate risk herbicides	0	0	11,500	14,000	16,000
Acres of Low risk herbicides	0	0	0	0	0
Acres of 0 risk herbicides	0	0	0	0	0
Herbicide risks to aquatic plants[3]					
Acres of High risk herbicides	0	0	700	3,900	5,100
Acres of Moderate risk herbicides	0	8,500	21,000	27,600	32,200
Acres of Low risk herbicides	0	8,400	6,500	10,100	10,200
Acres of 0 risk herbicides	0	5,900	4,700	6,600	6,600
Non-herbicide methods	More soil disturbance encourages invasive plants (highest in Reference Analysis; potential collateral damage to non-target plants). Risk proportional to soil-disturbing treatments (see Table 2-4).				
Invasive Plants	Weeds displace native plant communities and threaten Special Status species habitats. Adverse effect proportional to weed spread.				
			Control of invasive annual grasses helps protect at-risk sagebrush communities.		
Pests and Diseases (Sudden Oak Death)					
Native Host Control	38% reinfection of tanoak sprouts		6% reinfection of tanoak sprouts		
Air Quality and Climate Change					
Effect of Climate Change	Increased CO_2 will favor many invasive plants.				
Emissions: Partic. (tons)	936	884	982	378	378
Emissions: CO_2 (tons)	12,313	18,660	40,393	40,059	40,059
Soil Resources					
Herbicides	None	Herbicides can harm soil crusts; picloram (Alt 2), chlorsulfuron(Alt 3), metsulfuron methyl (Alt 3), and tebuthiuron (Alt 4) create short-term soil organism decline.			
			ALS-inhibitors can bind & travel with soils		
				Three soil-active persistent herbicides (bromacil, diuron, and tebuthiuron) added; bare soil susceptible to erosion.	
Herbicide half-lives in soil	N/A	10, 14, 47, & 20-300 days	10 to 300 days	10 to 360 days	10 to 1000 days

Table 2-5. Comparison of the Effects of the Alternatives (continued)

Resource Section Effects Parameters	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Non-herbicide methods	Compaction and disturbance highest with mechanical and directed livestock. Adverse effect proportional to acres treated.				
Invasive Plants	Weeds harm soils by reducing cover (which causes erosion), and by changing chemical composition. Effect is proportional to weed spread (see Table 2-4).				
Water Resources					
Herbicides	N/A	Herbicide pathways to water include runoff, drift, direct application, and leaching.			
				Road ditches can deliver right-of-way-used persistent diuron to streams in Alternatives 4 and 5.	
Known groundwater contaminants	N/A	2,4-D, dicamba, picloram	2,4-D, dicamba, picloram, hexazinone	2,4-D, dicamba, picloram, hexazinone, diuron, bromacil, tebuthiuron (and diquat in Alt 5)	
Invasive Plants	Adversely affect water resources by affecting bank stability, sediment, stream temperature, and dissolved oxygen, and pH. Aquatic invasive plants can accelerate eutrophication. Effect is proportional to weed spread.				
Wetlands and Riparian Areas					
Herbicides	N/A	Picloram and glyphosate with POEA most likely to cause adverse effects (see *Water Resources*, *Wildlife Resources*, & *Fish*).		Picloram, glyphosate with POEA, diuron, bromacil, and tebuthiuron most likely to cause adverse effects.	
Non-herbicide methods	Impossible to control many reeds and other marsh plants				
Invasive Plants	Displace native habitat (especially critical east of the Cascades), expose stream banks to erosion, reduce shading, or clog waterways. Adverse effect is proportional to weed spread.				
Fish					
Herbicide risks to fish[3]					
Acres of High risk herbicides	0	0	0	1,400 (diuron)	1,600 (diuron, diquat)
Acres of Moderate risk herbicides	0	14,400[2] (2,4-D, glyphosate with POEA)	7,000 (2,4-D, glyphosate with POEA, fluridone)	10,600 (2,4-D, glyphosate with POEA, fluridone, bromacil)	12,800 (2,4-D, glyphosate with POEA, fluridone, bromacil)
Acres of Low risk herbicides	0	3,800	1,500	3,000	3,000
Acres of 0 risk herbicides	0	4,600	24,400	33,200	36,700
Non-herbicide methods	Mechanical and directed livestock disturbance can lead to erosion and sedimentation. Adverse effect is proportional to acres treated.				
Invasive Plants	Habitat and food alteration, changes to aquatic plants, reduced shading, changes to vegetation-dependant insects and their proximity to water. Adverse effects proportional to weed spread.				
Wildlife Resources					
Herbicide risks to mammals[3]					
Acres of High risk herbicides	0	8,500 (2,4-D)	4,000 (2,4-D)	6,800 (2,4-D, diuron)	8,900 (2,4-D, diuron)
Acres of Moderate risk herbicides	0	14,300 (dicamba, glyphosate, picloram)	7,600 (dicamba, glyphosate, picloram, hexazinone, triclopyr)	14,200 (dicamba, glyphosate, picloram, hexazinone, triclopyr, bromacil, tebuthiuron)	15,700 (dicamba, glyphosate, picloram, hexazinone, triclopyr, bromacil, tebuthiuron, diquat, diflufenzopyr + dicamba)
Acres of Low risk herbicides	0	0	6,000	8,100	8,200
Acres of 0 risk herbicides	0	0	15,300	19,100	21,300
Herbicide risks to birds[3]					
Acres of High risk herbicides	0	0	0	0	200 (diquat)
Acres of Moderate risk herbicides	0	19,000 (2,4-D, dicamba, glyphosate)	9,900 (2,4-D, dicamba, glyphosate, triclopyr)	16,500 (2,4-D, dicamba, glyphosate, triclopyr, diuron)	19,000 (2,4-D, dicamba, glyphosate, triclopyr, diuron)

Table 2-5. Comparison of the Effects of the Alternatives (continued)

Resource Section Effects Parameters	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Acres of Low risk herbicides	0	3,800	4,900	9,400	10,200
Acres of 0 risk herbicides	0	0	18,100	22,300	24,700
Herbicide risks to aquatic invertebrates[3]					
Acres of High risk herbicides	0	0	300 (fluridone)	1,700 (fluridone, diuron)	1,900 (fluridone, diuron, diquat)
Acres of Moderate risk herbicides	0	0	0	1,200 (bromacil, tebuthiuron)	1,900 (bromacil, tebuthiuron)
Acres of Low risk herbicides	0	5,900	2,700	4,000	4,000
Acres of 0 risk herbicides	0	16,900	29,900	41,300	46,300
Herbicide risks to insects[3]					
Acres of High risk herbicides	0	0	0	0	0
Acres of Moderate risk herbicides	0	5,900 (glyphosate)	4,900 (glyphosate, triclopyr)	9,800 (glyphosate, triclopyr, diuron, tebuthiuron)	11,000 (glyphosate, triclopyr, diuron, tebuthiuron, diquat)
Acres of Low risk herbicides	0	12,300	7,200	12,200	14,500
Acres of 0 risk herbicides	0	0	19,800	24,600	27,000
Non-herbicide methods	Disturbance (noise) effects can exceed those from herbicides. Collateral habitat damage from mechanical or directed livestock can exceed those from herbicides, with effects proportional to acres treated with these two methods.				
Invasive Plants	Invasive plants decrease terrestrial, riparian, and aquatic habitat quality, decreasing wildlife numbers and species' diversity. Adverse effect is generally proportional to weed spread, and can particularly devastate east side riparian and Special Status species' habitats.				
			Control of invasive annual grasses could slow sage grouse habitat decline.		
Herbicide use on native vegetation for habitat improvement	None	None	None	For Federally Listed and other Special Status species	For all species
Livestock, Wild Horses and Burros					
Herbicide risk to forage	N/A	Low risk of adverse effects.			
Herbicide risks to livestock and wild horses and burros (same as mammals)[3]					
Acres of High risk herbicides	0	8,500 (2,4-D)	4,000 (2,4-D)	6,800 (2,4-D, diuron)	8,900 (2,4-D, diuron)
Acres of Moderate risk herbicides	0	14,300 (dicamba, glyphosate, picloram)	7,600 (dicamba, glyphosate, picloram, hexazinone, triclopyr)	14,200 (dicamba, glyphosate, picloram, hexazinone, triclopyr, bromacil, tebuthiuron)	15,700 (dicamba, glyphosate, picloram, hexazinone, triclopyr, bromacil, tebuthiuron, diquat, diflufenzopyr + dicamba)
Acres of Low risk herbicides	0	0	6,000	8,100	8,200
Acres of 0 risk herbicides	0	0	15,300	19,100	21,300
Non-herbicide methods	No adverse effects identified.				
Invasive Plants	Invasive plants can reduce grazing capacity 35 to 90 percent; some allotments will likely be at risk of closing because of weed-related reductions in grazing capacity in the next decade. Wild horses would move to other areas as forage capacity declines, causing livestock grazing conflicts. Adverse effects are proportional to weed spread.				

Table 2-5. Comparison of the Effects of the Alternatives (continued)

Resource Section Effects Parameters	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Fire and Fuels					
Invasive Plants /Native Vegetation	Invasive annual grasses remain major fire hazard.		Imazapic controls invasive annual grasses, allowing sagebrush habitat-protecting treatment strips, and wildland urban interface-protecting grass reduction, and restoration burns.		
				Roadside use, and soil-active herbicide used around developments, reduces fire risk to improvements.	
Timber					
Herbicide & Non-herbicide methods	No significant collateral damage to timber production identified under any alternative.				
Invasive Plants	Regeneration cost increases and timber growth reductions attributable to some species (e.g., Portuguese broom); thorny species reduce access; vehicle and equipment cleaning required.				
Paleontological and Cultural Resources					
Herbicides	N/A	Human exposure in traditional tribal use areas possible (see *Human Health and Safety* section), increasing in Alts 4 and 5.			
Herbicide and Non-herbicide treatments	Potential for impacts to paleontological and cultural resources through mechanical or chemical damage, and disturbance-related erosion. Risk proportional to activity levels, but low in sites heavily disturbed by development such as roads and communication sites.				
Invasive Plants	Adversely affect cultural uses and traditional gathering; adversely affect artifacts by decreasing cover and increasing erosion, changing soil pH. Effect proportional to weed spread.				
Visual Resources					
Herbicides	N/A	Visual effect of invasive weed control generally not noticeable regardless of treatment method.		Roadside treatments may be more or less obtrusive with herbicides depending on species, size, and season.	
Non-herbicide methods					
Invasive Plants	Invasive plants generally considered less visually desirable. Adverse effect proportional to weed spread.				
Wilderness and Other Special Areas					
Herbicide and Non-herbicide treatments	No significant differences between alternatives.		Additional herbicides especially beneficial in areas like Wilderness where mechanical treatments are rarely, if ever, allowed.		
Non-herbicide methods	Mechanical controls usually not appropriate in Wilderness.				
Invasive Plants	Weed spread generally compromises management objectives; adverse effect is proportional to weed spread.				
Recreation/Interpretive Sites					
Herbicides	N/A	Public exposure low, treating invasive plants only.		Public exposure/site closures potentially higher due to ability to treat native vegetation within recreation sites.	
Non-herbicide methods	No significant difference between alternatives.				
Invasive Plants	Recreation enjoyment compromised by invasive plants (access, ecosystem health). Effect proportional to weed spread.				
Other Vegetation				Better control of native vegetation, including poison oak, encroaching on developed sites.	
Administrative Sites, Roads, and Rights-of-Ways					
Herbicides	N/A	Little effect; noxious weed/invasive plant only.		Roadside native vegetation maintenance as well as incidental noxious weed control effect.	
Non-herbicide methods	Current direction; permit holder's and road department's maintenance more difficult .			Would be continued where herbicides are not appropriate.	
Ability to control noxious weeds and competing native veg.	Noxious weed control efforts would be frustrated. Continue mowing natives.	Permit/right-of-way holders could control about 104 of 120 noxious weeds. Continue mowing natives.	Permit/right-of-way holders could control about 116 of 120 noxious weeds. Continue mowing natives.	Herbicides available to control about 117 of the 120 State-listed noxious weeds, and to do safety and maintenance control of native vegetation. Better allows road departments to continue herbicide treatments along road corridors regardless of property boundary.	
Social and Economic Values					
Concern over the spread of invasive plants from adjacent BLM lands	Neighboring land values could be reduced, forage and other vegetation values would be harmed, and weed control costs for neighboring landowners or other agencies would increase. Adverse effects would be proportional to weed spread. Concern highest east of the Cascades.				

Table 2-5. Comparison of the Effects of the Alternatives (continued)

Resource Section Effects Parameters	Reference Analysis	Alt. 2 (No Action)	Alt. 3	Alt. 4 (Proposed Action)	Alt. 5
Concern about herbicides as a threat to resource values and human health	None	Moderate concern, more west of the Cascades, tempered by importance of noxious weed control and limited acres	Moderate concern, more west of the Cascades. Acres up but total herbicide pounds and risk down when compared with Alt. 2	High concern, more west of the Cascades, because acres up, and use on admin sites, recreation sites, and rights-of-way creating unknown public exposure	Highest concern, more west of the Cascades, for reasons in Alt. 4 plus some level of unspecified treatment objectives, although most increase is east of the Cascades
Favor herbicides as a benefit to resource values	Concerns invasive plants reduce commodity, non-commodity, and non-market values, and also worried about excessive control costs. Alternative 3 reduction in weed spread perceived as substantial improvement. Alternatives 4 and 5 viewed as adding additional benefits.				
Environmental Justice					
Minority and low income groups herbicide exposure	None	Limited based on directed noxious weed/invasive plant treatments.		Higher, based on general roadside and habitat treatments involving native plants.	
Subsistence resources used by low income and tribes	Subsistence resources are reduced by invasive plants. Adverse effect proportionate to weed spread.				
Implementation Costs					
Cost per effectively treated noxious weed acre (all methods)	$565	$240	$193	$193	$193
Right-of-way/ admin/ recreation treatments	$2.016 million	$2.016 million	$2.016 million	$1,085 million	$1,085 million
Non-Quantified Costs	Value losses and/or increased operating costs for timber, special forest products, habitat, public access, grazing, recreation, mineral, vegetation, and fuels management. Adverse effects proportional to weed spread.				
Non-Quantified Gains	Commodity and non-commodity values and recreation opportunities are proportionate to weed reduction.				
			Fire protection increased	Fire protection increased and Special Status species' habitat improvement	
Human Health and Safety					
Herbicide risks to worker and public health[4]					
Acres of High risk herbicides	0	0	0	2,600 (diuron, bromacil, tebuthiuron)	3,300 (diuron, bromacil, tebuthiuron)
Acres of Moderate risk herbicides	0	8,500 (2,4-D)	4,000 (2,4-D)	5,400 (2,4-D)	7,500 (2,4-D)
Acres of Low risk herbicides	0	4,600	3,200	5,700	6,300
Acres of 0 risk herbicides	0	9,700	25,700	34,500	37,000
Non-herbicide methods	Non-herbicide methods have risks of injury and death, including from chainsaws, prescribed fire smoke and burning, and equipment rollover.				
Risks from invasive plants	None identified.				

[1] Gross acres.
[2] Worst case. Rating is for terrestrial glyphosate (with POEA). Aquatic-labeled glyphosate is required near water, and used in many other areas.
[3] Highest risk from Risk Category tables at the end of Chapter 3, not including accidental & spill exposures. Includes maximum application rates even if PEIS Mitigation Measures recommend against it. Standard Operating Procedures and PEIS Mitigation Measures mitigate or minimize risks.
[4] Typical rate; includes all exposure scenarios.

Table 2-6. Response of the Alternatives to the *Purposes*

Purpose/Parameter	**Reference Analysis**	**Alt. 2** (No Action)	**Alt. 3**	**Alt. 4** (Proposed Action)	**Alt. 5**
1. Control invasive plant species to protect native ecosystems and the flora and fauna that depend on them.					
Noxious weed annual spread rate/infested acres in 15 years	14%	12%	7%	6%	6%
	8.6 million	5.9 million	4.0 million	3.7 million	3.7 million
Invasive plant impacts to ecosystems	Invasive plants displace native plants including those Federally Listed or other Special Status species, degrade or eliminate habitats, poison and expose soils to erosion, weaken stream banks thus increasing sedimentation, remove stream shading and insects that serve as fish forage, increase fire risk, clog waterways, and reduce production capacity, and reduce neighboring land values. For every resource, these effects are more adverse than the risks associated with the proposed herbicides.				
Habitat Improvement		Currently only non-selective glyphosate available for medusahead removal.	Herbicides would be available to selectively control invasive annual grasses including cheatgrass and medusahead, making a combination prescribed-fire-herbicide-seeding treatment effective at removing these grasses and restoring native plants.		
Alternative has tools to effectively control:	About 1/3 of 120 State-listed noxious weeds	About 104 of 120 State-listed noxious weeds	About 116 of 120 State-listed noxious weeds, plus invasives	About 116 of 120 State-listed noxious weeds, plus invasives	About 117 of 120 State-listed noxious weeds, plus invasives
2. Protect the safety and function of BLM and other authorized infrastructures by controlling encroaching native vegetation.					
Control vegetation to meet safety and maintenance objectives around developments, along roads, and within rights-of-way.	Native vegetation management needs in and around developments, along BLM roads, and within rights-of-way for highways, pipelines, transmission corridors, and others would continue to be conducted with non-herbicide methods such as mowing, scraping, or armoring the site.			Herbicides could replace manual/mechanical treatments on an estimated 9,300 of the tens of thousands of acres already being treated annually, saving the BLM and permit/right-of-way holders about $1 million annually.	
				Herbicide availability would increase permit and right-of-way holders' efficiency by making control methods consistent with non-BLM portions of permit/right-of-way.	
				Herbicides prevent vegetation encroachment on pavement edges, and are an efficient way to reduce fire-prone vegetation at communication sites and other non-public use developments.	
3. Manage native vegetation to provide sustainable habitats for wildlife, fish, and native plants, particularly those included in the Special Status Species Program.					
Management of native vegetation to improve habitats.	Continue habitat improvement projects using manual, mechanical, fire, and other non-herbicide methods.			Herbicides could target specific vegetation to meet habitat objectives described in Conservation Strategies for Special Status species (est. 5,700 acres, mostly east of the Cascades)	Herbicides could target specific vegetation to meet habitat management objectives (est. less than an additional 4,800 acres when compared to Alt 4, mostly east of the Cascades)

Table 2-6. Response of the Alternatives to the *Purposes* (continued)

Purpose/Parameter	**Reference Analysis**	**Alt. 2** (No Action)	**Alt. 3**	**Alt. 4** (Proposed Action)	**Alt. 5**
4. Manage vegetation to reduce the risk that large-scale high-intensity fires will unacceptably damage resources and human developments.					
Control invasive annual grasses in the Sagebrush Steppe and lower elevations in the Siskiyou Biome to reduce wildfire impacts to habitats and communities.	The reduction of fire behavior characteristics would be relatively labor-intensive, and benefits would be localized to the area treated. Glyphosate can be used on medusahead (but not cheatgrass) under Alternative 2 (No Action), but such use is limited because it also kills remnant native plants.		Herbicides would increase the effectiveness of greenstripping – a proactive technique to reduce the magnitude of the cheatgrass-wildfire cycle by growing fire-resistant vegetation at strategic locations in order to slow or stop the spread of wildfires. Herbicides would be available to reduce the risk of fast-moving, intense grass-fueled fires within the wildland urban interface.		
Treat native vegetation around administrative sites to help keep wildfires from destroying structures and other improvements.	Non-herbicide treatments include mowing, scraping, paving or rocking, or accepting a higher risk of loss to fire (and temporary loss of utility services).			Permits use of persistent, soil–active herbicides to control native plants within rights-of-way and other remote sites at risk to fire. Issue is mostly east of the Cascades, or within mountaintop communication sites. (Other native fuels treatments under Alternative 5 possible but rare.)	
5. Cooperatively control invasive plants so they do not infest or re-infest adjacent non-BLM lands.					
Ability to conduct efficient cross-ownership area-wide invasive plant control projects.	Very difficult, as most adjacent landowners use herbicides for much of their invasive plant control.	Difficulty in conducting cross-ownership projects contributes to reduced (60%) control efficiency. Some cooperators choose to use BLM's four herbicides for simplicity.	Cooperative control efforts could take place on BLM lands because most of the herbicides already being used by these groups on adjacent lands would be available. Effective control covering entire geographically logical areas would be available for more weed species. Adjacent landowners will be more effective at controlling species of weeds that BLM has been unable to treat under the No Action Alternative (conceivably reducing total use). State and private control dollars may go farther if treatments are more uniformly applied and thus more effective. Better meets State laws requiring noxious weed control.		
Noxious weed control benefit from roadside native plant control.	Non-herbicide mowing and scraping less likely to incidentally remove undetected noxious weeds than herbicides; cause ground disturbance then subject to invasion; and mowing equipment or graders have the potential to move noxious weeds.			Native plant control along roads by permit/right-of-way holders like Oregon Department of Transportation would further reduce noxious weed spread.	
6. Prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public, to desirable flora and fauna, and to soil, air, and water.					
Total herbicide acres[1]	0	22,800	32,900	48,200	54,100
Total herbicide lbs (typical rate)	0	23,010	14,830	34,695	38,275
Average herbicide lbs/acre	0	1.01	0.45	0.72	0.71
Acres of high and moderate-risk herbicides by resource:[3]		Risk categories are based on modeled scenarios. Standard Operating Procedures and PEIS Mitigation Measures are designed to minimize these risks.			
Terrestrial/aquatic plants	0	Herbicides are designed to kill plants. Almost all have a high or moderate risk of killing non-target plants if they are sprayed.			
Fish	0	14,400[2]	7,000[2]	12,000[2]	14,400[2]
Mammals, Wild Horses	0	22,800	11,600	21,000	24,600
Birds	0	19,000	9,900	16,500	19,200
Aquatic Invertebrates	0	4,600	1,300	4,500	5,400
Insects	0	5,900	4,900	9,800	11,000

Table 2-6. Response of the Alternatives to the *Purposes* (continued)

Purpose/Parameter	**Reference Analysis**	**Alt. 2** (No Action)	**Alt. 3**	**Alt. 4** (Proposed Action)	**Alt. 5**
Average	0	13,340	6,940	12,760	14,920
% of No Action Alt.	0%	100%	52%	96%	112%
Average % of total herbicide acres that are treated with high or moderate-risk herbicides.	N/A	59%	21%	26%	28%
Cumulative Impacts	Widely dispersed use, less than 1% of State's herbicide use on 25% of the acres, reduces likelihood of cumulative effects.				
Acres of high and moderate risk for human health:[4]	Risk categories are based on modeled scenarios. Standard Operating Procedures and PEIS Mitigation Measures are designed minimize these risks.				
Workers and public	0	8,500	4,000	8,000	10,800
% of No Action Alt.	0%	100%	47%	94%	127%
% of total herbicide acres that are treated with high or moderate-risk herbicides.	N/A	37%	12%	17%	20%
7. Control plant pests and diseases by removing their native plant hosts when necessary to meet Oregon Department of Agriculture-identified control objectives.					
Native Host Control	38% reinfection of tanoak sprouts, infestation continues to spread slowly.		6% reinfection of tanoak sprouts, could lead to containment of the infestation.		
8. Minimize treatment costs and improve treatment effectiveness, so economic losses from invasive plants and other vegetation growth are reduced and more of the *Need* can be met within expected funding.					
Percent of invasive plant treatments expected to result in final control	30%	60%	80%	80%	80%
Effectively treated invasive plant acres[5]	12,630	27,300	46,160	46,160 (plus 2,350 acre benefit from native plant right-of-way treatments)	46,160 (plus 2,350 acre benefit from native plant right-of-way treatments)
Cost per effectively treated acre	$565	$240	$193	$193	$193

[1] This is the total of the acres treated with each herbicide. It is larger than the gross treatment acres in Table 3-3 because acres treated with tank mixes are double or triple counted, once for each herbicide applied.
[2] Worst case. Numbers assume terrestrial glyphosate (with POEA). Aquatic-labeled glyphosate is used near water, and used in many other areas.
[3] Not including accidental & spill exposures. Includes maximum application rates even if PEIS Mitigation Measures recommends against it.
[4] Typical rate; includes all exposure scenarios.
[5] Effectively treated acres are the portion of the annual program not expected to need retreatment because final control objectives have been achieved.

The Preferred Alternative

Alternative 4, the Proposed Action, is the Preferred Alternative. It meets the *Need* and best meets all eight *Purposes*. Like Alternative 3, the additional, generally newer, herbicides are more target-specific, can be used in lower doses, and are generally less likely to adversely affect non-target plants and animals than the four herbicides currently in use. The additional herbicides would also be effective against a wider array of invasive plants, including the invasive annual grasses medusahead and cheatgrass, as well as other weeds for which there are currently no effective controls available to the BLM in Oregon.

The ability to treat native and other non-invasive vegetation encroaching on rights-of-ways, recreation sites, and administrative sites with herbicides under Alternative 4 would reduce the cost for these regular maintenance treatments by about $1 million per year, would reduce ground disturbance that can encourage invasive plants, and would control small undetected populations just getting established along roads and other public use areas. Alternative 4 would also allow the use of herbicides for improving habitat for Federally Listed and other Special Status species like sage grouse.

Alternative 5 would have the same benefits as Alternative 4, and it would make herbicides available for the full range of resource management activities except livestock forage and timber production. Alternative 5 is estimated to increase herbicide use by ten percent from Alternative 4, and most of this increase would be expected to go toward additional habitat improvement projects not practical without herbicides. However, there is a lower need for herbicides for these activities, and the alternative departs from the narrow program clarity and focus requested by many of the scoping comments.

Potential Mitigation

Introduction

Mitigation measures avoid, minimize, rectify, reduce, or compensate for adverse environmental impacts of management actions (40 CFR 1508.20). NEPA implementing regulations require agencies to "…include appropriate mitigation measures not already included in the proposed action or alternatives" and include a discussion of "means to mitigate adverse environmental impacts" (40 CFR 1502.14(f) and 1502.16(h)). The regulations also require that in the Record of Decision, the responsible officials "state whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not" (40 CFR 1505.2). Consistent with those requirements, mitigation measures are identified and described here for all potential adverse effects identified for the Proposed Action (Alternative 4). Mitigation measures do not include "don't do" or "select another alternative," as these choices are addressed by other alternatives and/or may not meet the *Need* and *Purposes* for the Proposed Action.

The following potential mitigation measures were identified to respond to adverse effects identified in this EIS. If a resource section in Chapter 4 is not shown below, it means the potential for adverse effects to that resource were deemed negligible, or no practicable mitigation measures were identified that would mitigate the effects identified. The mitigation measures listed below are in addition to mitigation measures identified in the PEIS, adopted by the Record of Decision for the PEIS, and listed in Appendix 2 and considered a part of all of the alternatives. In an attempt to avoid confusion, those mitigation measures are referred to herein as PEIS Mitigation Measures.

The decision-maker's decision to reject, modify, or apply each of the following mitigation measures to the selected alternative will be described in the Record of Decision. The decision-maker may decline to select identified mitigation measures because the adverse effect it is supposed to address is acceptable in light of the potential for increased cost or decreased effectiveness of the selected alternative, and/or because the decision-maker believes other measures will adequately address the concern.

Potential Monitoring, Appendix 3

Part II of the Monitoring Appendix (Appendix 3), presents potential monitoring measures designed to track implementation and effectiveness of the program changes that might result from the selection of one of the action alternatives. Although no reduction in adverse effects can be attributed to monitoring per se, the proposals in that section should be selected or rejected in the Record of Decision at the same time as the potential mitigation measures.

Potential Mitigation[12]

Soil Resources

- To avoid the loss of finer-sized soil particles and avoid having herbicide-treated soils blown or washed off-site, avoid exposing large areas of wind-erosion group 1 or 2 soils (see Figure 4-5) during the windy season. Mitigation measures could include the use of selective herbicides to retain some vegetation on site; reseeding so cover is present before the windy season affects dry soils; staggering treatment of strips until stubble regrows enough to provide an acceptable filter strip; rescheduling treatments away from the windy season; or, other measures to prevent wind erosion on these soil groups.

Water Resources

- To protect domestic water sources, no herbicide treatments should occur within 100 feet of a well or 200 feet of a spring or known diversion used as a domestic water source, unless a written waiver is granted by the user or owner.
- Where diquat applications would be used on vast enough areas that de-oxygenation from plant decomposition would cause unacceptable effects to aquatic fauna, either 1) remove treated vegetation or 2) the area would be treated in swaths over several months time to minimize de-oxygenation of the water due to plant decomposition.
- Site-specific analyses for roadside treatments should specifically consider that drainage structures lead to streams, and that normal buffer distances, herbicide selection, and treatment method selection may need to be changed accordingly, particularly where those ditches are connected to streams with Federally Listed or other Special Status species.
- Buffer intermittent stream channels when there is a prediction of rain (including thunderstorms) within 48 hours.
- Proposals to boom or aerially spray herbicides within 200 feet of streams that are within 1,000 feet upstream from a public water supply intake, or spot apply herbicides within 100 feet of streams that are within 500 feet upstream from a public water supply intake, will include coordination with the ODEQ and the municipality to whom the intake belongs.

12 Potential mitigation was not identified for some resources because Standard Operating Procedures and PEIS Mitigation Measures were adequate, no adverse effects were identified, or no additional mitigation was available.

Fish

- Use of adjuvants with limited toxicity and low volumes is recommended for applications near aquatic habitats.

Wildlife Resources

- Impacts to wildlife from herbicide applications can be reduced by treating habitat during times when the animals are not present or are not breeding, migrating or confined to localized areas (such as crucial winter range).
- Herptile (amphibian and reptile) and mollusk mortality due to vegetation management can be minimized by conducting activities during the winter hibernation or estivation period. If management is to occur in occupied habitat during the active season, the following approaches should be considered to minimize impacts:
  - Avoid control work when herptiles and mollusks are most active;
  - Leave some habitat untreated to provide refugia: untreated portions could be treated in subsequent seasons; and,
  - Avoid treatments that would curtail herptile spring and fall migrations to and from breeding or wintering habitats.
- When treating native plants in areas where herbivores are likely to congregate, choose herbicides with lower risks due to ingestion.
- Where there is a potential for herbivore consumption of treated vegetation, apply bromacil, dicamba, imazapyr, and metsulfuron methyl at the typical, rather than maximum, application rate to minimize risks.
- Where possible, design native vegetation treatment areas to mimic natural disturbance mosaics. Patchiness is usually beneficial to most wildlife, and patchiness is usually tolerated by species that prefer contiguous habitat.
- Use of adjuvants with limited toxicity and low volumes is recommended for applications near aquatic habitats.

Livestock

- Where there is a potential for livestock consumption of treated vegetation, apply bromacil, dicamba, imazapyr, metsulfuron methyl, and tebuthiuron at the typical, rather than maximum, application rate to minimize risks to livestock.

Wild Horses and Burros

- Where there is a potential for wild horse or burro consumption of treated vegetation, apply bromacil, dicamba, imazapyr, and metsulfuron methyl at the typical, rather than maximum, application rate to minimize risks.
- Do not broadcast spray 2,4-D, clopyralid, diflufenzopyr + dicamba, diuron, glyphosate, hexazinone, picloram, or triclopyr where wild horses have unrestricted access to treated areas, or reduce risks to wild horses from these herbicides by herding wild horses out of treatment areas.
- To limit adverse effects to wild horses and burros, particularly through the contamination of food items, treatments should not exceed 15 percent of any Herd Management Area at any given time.

Social and Economic Values

- For herbicides with label-specified re-entry intervals, post information at access points to recreation sites or other designated public use or product collection areas notifying the public of planned herbicide treatments in languages known to be used by persons likely to be using the area to be treated. Posting should include the date(s) of treatment, the herbicide to be used, the date or time the posting expires, and a name and phone number of who to call for more information.
- Consider the potential for treatments to affect communities from herbicide-contaminated resources originating from BLM, such as subsistence resources or water used downstream for human or agricultural uses.
- Coordinate with and/or notify neighboring landowners who may want to treat, or are already treating, adjacent lands.

Environmental Justice

- To the extent permitted by normal contracting authority, ensure materials safety data sheets and other informational or precautionary materials are available in languages spoken by the work crews implementing treatments. This includes but is not limited to material such as Occupational Safety and Health Administration standards along with agency, industry and manufacturers' recommendations and Human Health and Safety Standard Operating Procedures and mitigation measures or equivalent.

Human Health and Safety

- Consideration should be given to herbicides other than 2,4-D; use of 2,4-D should be limited to situations where other herbicides are ineffective or in situations in which the risks posed by 2,4-D can be mitigated.
- Do not apply triclopyr by any broadcast method.
- Do not apply bromacil, diuron, or tebuthiuron when there is a potential for picking sprayed fruit. Do not broadcast spray onto vegetation more than a foot tall when and where public contact is likely, such as on tall grass or low brush around developed sites and other high use areas.

Chapter 3

Changes Between Draft and Final EIS

The following changes were made to Chapter 3 between the Draft and Final EIS. Minor corrections, explanations, and edits are not included in this list.

Changes were made to:

- Clarify the existing Integrated Vegetation Management and Resource Management Plan context for the proposed increase in the number of herbicides available for use;
- Add more information about the specific uses of each of the 18 herbicides;
- Add additional information about adjuvants and inerts;
- Clarify why there are different herbicides proposed for east and west of the Cascades;
- Add additional information about how vegetation treatment methods are selected;
- Add information about drift as a potential herbicide exposure pathway;
- Add additional descriptive material about the high, moderate, and low categories used on the risk tables;
- Add toxicity information about some common household materials to help set the context for risk and exposure;
- Add information about specific herbicides so the reader could better understand the objectives of having specific herbicides available;
- Update ecological and human health risks for triclopyr, hexazinone, and 2,4-D based on Risk Assessments developed since the PEIS was written; and,
- Correct certain ecological and human health risks for dicamba to reflect findings of the Forest Service Risk Assessment. The risk ratings in the Draft EIS were based on a BLM Risk Assessment that considered dicamba in combination with diflufenzopyr.

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Chapter 3
Background and Assumptions for Effects Analysis

Introduction

This EIS tiers to the 2007 National *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), which is incorporated into this EIS as uncirculated Appendix 1. This appendix is available online at the web addresses listed on the Appendix 1 cover page in the appendices of this EIS, or may be obtained on compact disk or printed copy by contacting the BLM via phone, email, or mail (see title page). An attempt is made to summarize and include all parts of the PEIS analysis pertinent to an examination of the potential significant environmental effects of the alternatives. However, additional details about methodology, background material, and references remain in the PEIS, and readers seeking additional information are encouraged to refer to the corresponding sections in the PEIS. In each case, the decision about the detail to bring forward or otherwise include in this EIS was based primarily on its applicability to the *Purposes* presented in Chapter 1.

The three action alternatives presented in this EIS fit completely within PEIS Alternative B (the alternative selected in the Record of Decision for the PEIS) in that they present the same or fewer herbicides than considered in Alternative B, apply them to all or fewer acres than were assumed in Alternative B, and consider those herbicides for fewer of the treatment objectives included in Alternative B. All Standard Operating Procedures included in Alternative B, as well as all PEIS Mitigation Measures, apply to these alternatives. Therefore, the potential for adverse human health or environmental effects resulting from actual application of herbicides should, at the programmatic scale, fall generally within those described in the PEIS for Alternative B. Apparent differences from PEIS-identified effects are generally attributable to: 1) examination of Oregon-specific conditions at a finer scale than in the PEIS, and 2) lower levels of vegetation control than assumed in the PEIS.

Background for Effects Analysis

This EIS addresses large, regional-scale trends and issues that require integrated management across broad landscapes. It also addresses regional-scale trends and changes in the social and economic needs of people. This analysis does not identify site-specific effects because projects have not been identified and because site-specific information is not essential for determining the effects of broad-scale management direction. As noted in Chapters 1 and 2, site-specific issues would be addressed through NEPA analysis at the district or project level. This EIS does not analyze specific projects.

The action alternatives in this EIS would only make additional herbicides available to vegetation management programs already described in Resource Management Plans and other local plans. The EIS does not propose new activities, nor does it propose to constrain existing activities. Because vegetation management is already being done in support of Plan objectives, and because herbicides are already being used as one method of treating noxious weeds, a complete examination of whether or not to conduct vegetation management or whether to conduct activities with some other method, would be moot. Alternative methods are already being used to the extent practicable. This Chapter attempts to describe how the additional herbicides would be applied, using the existing vegetation management priorities and process (Integrated Vegetation Management) as the context. Non-herbicide methods are addressed only to the extent their conduct would change as a result of the herbicide use that would occur under each of the alternatives. Non-herbicide methods are otherwise addressed in existing RMPs, and in the *Final Vegetation Treatments on BLM Lands in 17 Western States Programmatic Environmental Report.*

The 18 Herbicides

The 18 herbicides proposed for use in this EIS are a subset of the hundreds of herbicides registered for use in the U.S. They were chosen by the BLM nationally for maximum effectiveness against wildland weeds and least environmental and non-target species' risks. Table 3-1 shows information about each herbicide that affects how it would be used. Additional information about the herbicides and the plants they control is in Appendix 9 and listed below.

Herbicides can be categorized as selective or non-selective (see Table 3-1). Selective herbicides kill only a specific type of plant. For example, an herbicide selective for broadleaved plants can be used to manage such species while maintaining desirable grass species in rangeland communities. Non-selective herbicides kill all types of plants, and thus must be applied only to the target species. Herbicides can be used selectively to control specific types of vegetation (e.g., killing invasive weeds), or non-selectively to clear all vegetation on a particular area (e.g., keeping a roadway clear of vegetation).

Some herbicides are post-emergent, which means they can be used to kill existing vegetation; others are pre-emergent, which stops vegetation before it grows (e.g., prohibiting seeds from germinating) (Table 3-1). Resource-specific discussions of the uses and risks associated with each herbicide are included in each of the resource sections in Chapter 4.

Formulations (brands) and adjuvants are limited to those on the BLM National list of approved herbicides and adjuvants, which is reviewed and updated at least annually (see Appendix 9 for the 2010 version). This list identified herbicides that are known to be consistent with the formulations analyzed in the Risk Assessments and otherwise suitable for wildland use.

Table 3-1. Herbicide Information

				Types of BLM Lands Where Use is Permitted						Application Rate (lbs/acre/year)		Available under Alternative[4]							SPISP II Rating[8] (Leaching Potential)		
Herbicide Representative Trade Names[1]	**Common Targets**	**Selective to Plant Types**	**Pre/post Emergent** **Point of Application**	Rangeland	Forest Land	Riparian or Aquatic	Oils, Gas, & Mineral Sites	Rights-of-Way	Recreation & Cultural Sites	Typical	Max[2]	Alt. 2 - No Action	Alt. 3	Alt. 4 - Proposed Action	Alt. 5	**Aerial Spray[5] Allowed**	**K_{oc}[6]**	**Solubility[7] (mg/l)**	**PLP[9]** Leaching	**PSRP[10]** Solution Runoff	**PARP[11]** Adsorbed Particle Runoff
2, 4-D Many, including Amine, Hardball, Unison, Saber, Salvo, Aqua-Kleen, and Platoon	Annual and biennial broadleaf weeds. *Kochia, whitetop, perennial pepperweed, Russian thistle and knapweed, sagebrush, rabbitbrush.*	broadleaf	Post Foliar	√	√	√	√	√	√	1	(1.9)	√	√	√	√	Yes	20-100	33,900	Inter-mediate	Inter-mediate	Low
Bromacil Hyvar	Annual grasses and broadleaf weeds. *Cheatgrass, puncturevine, ragweed, wild oat, dandelion, quackgrass, wild carrot.*	no	Pre and post Soil				√	√	√	4	(12)			E	√	No	32	700	High	High	Inter-mediate
Chlorsulfuron[3] Telar	*Thistles, wild carrot, giant horsetail, poison hemlock, Russian knapweed, marestail, perennial pepperweed, puncturevine, tansy ragwort, common tansy, common teasel, dalmation toadflax, yellow toadflax, whitetop, dyers woad*	broadleaf	Pre and early post Soil or foliar	√			√	√	√	0.047	0.141		E	E	√	Restricted[13]	40	7,000	High	High	Inter-mediate
Clopyralid[3, 12] Transline, Stinger, Spur	*Thistles, common burdock, knapweeds, yellow starthistle, oxeye daisy, hawkweeds, prickly lettuce, dandelion, cutleaf teasel, kudzu, buffalobur*	broadleaf	Post Foliar	√	√		√	√	√	0.35	0.5		√	√	√	Yes	2	1,000	High	Inter-mediate	Low
Dicamba Vanquish, Banvel, Diablo, Vision, Clarity	*Knapweeds, kochia, and thistles.*	broadleaf, woody plants	Pre and post Foliar	√			√	√	√	0.3	2	√	√	√	√	Yes	2	400,000	High	Inter-mediate	Low
Diflufenzopyr + Dicamba Overdrive, Distinct	*Knapweeds, kochia, and thistles.*	broadleaf	Post Foliar	√			√	√	√	0.2625	0.4375				√	No					
Diflufenzopyr																No	87	5,850	Low	Inter-mediate	Low
Diquat Reward	*Giant salvinia, hydrilla, and watermilfoils.*	no	Post Aquatic			√				1	(4)				√	Restricted[14]	1,000,000	718,000	Very Low	Low	High

Table 3-1. Herbicide Information (continued)

Herbicide Representative Trade Names[1]	Common Targets	Selective to Plant Types	Pre/post Emergent / Point of Application	Types of BLM Lands Where Use is Permitted: Rangeland	Forest Land	Riparian or Aquatic	Oils, Gas, & Mineral Sites	Rights-of-Way	Recreation & Cultural Sites	Application Rate (lbs/acre/year): Typical	Max[2]	Available under Alternative[4]: Alt. 2 - No Action	Alt. 3	Alt. 4 - Proposed Action	Alt. 5	Aerial Spray[5] Allowed	K_{oc}[6]	Solubility[7] (mg/l)	SPISP II Rating[8] (Leaching Potential): PLP[9] Leaching	PSRP[10] Solution Runoff	PARP[11] Adsorbed Particle Runoff
Diuron Direx, Karmex	Annual grasses (including *bluegrass*) and broadleaf weeds. *Lambsquarters, kochia and Russian thistle.*	annual weeds, some perennials	Pre / Soil				√	√	√	6	(20)			√	√	No	480	42	Inter-mediate	High	Inter-mediate
Fluridone Avast!, Sonar	*Hydrilla and watermilfoils*	submersed plants	Post / Aquatic				√			0.15	(1.3)		√	√	√	Yes	1,000	10	Low	Inter-mediate	Inter-mediate
Glyphosate[3] Many, including Rodeo, Mirage, Roundup Pro, and Honcho	Grasses (including *Italian ryegrass*), sedges, broadleaf weeds, and woody shrubs.	no	Post / Soil or foliar	√	√	√	√	√	√	2	7	√	√	√	√	Yes	24,000	900,000	Very Low	High	High
Hexazinone Velpar	Annual and perennial grasses and broadleaf weeds, brush, and trees.	grasses, broadleaf, woody plants	Pre and post / Soil or foliar	√	√		√	√	√	2	(4)		√	√	√	Yes	54	33,000	High	High	Inter-mediate
Imazapic[3] Plateau, Panoramic	*Cheatgrass, leafy spurge, medusahead, whitetop, dalmation toadflax and Russian knapweed.*	some broadleaf and grasses	Pre and post / Soil	√	√		√	√	√	0.0313	0.1875		√	√	√	Yes	137	2,200	High	High	Inter-mediate
Imazapyr[3] Arsenal, Stalker, Habitat, Polaris	Annual and perennial broadleaf weeds, brush, trees. *Saltcedar, Russian olive, tanoak*	no	Pre and post / Soil or foliar	√	√	√	√	√	√	0.45	1.25		√	√	√	Yes	100	>11,000	High	High	Inter-mediate
Metsulfuron methyl[3] Escort, Patriot, PureStand	*Whitetop, perennial pepperweed and other mustards and biennial thistles.*	broadleaf, woody plants	Post / Soil or foliar	√	√		√	√	√	0.03	0.15		√	√	√	Restricted[13]	35	9,500	High	High	Inter-mediate
Picloram[3] Triumph, OutPost, Tordon	Perennial and woody species. *Knapweeds, starthistle, thistle, bindweed, leafy spurge, rabbitbrush, rush skeletonweed, and poison oak.*	broadleaf, woody plants	Pre and post / Foliar	√	√		√	√	√	0.35	1	√	√	√	√	Yes	16	200,000	High	High	Inter-mediate
Sulfometuron methyl[3] Oust, Spyder	*Cheatgrass, annual and perennial mustards, and medusahead.*	no	Pre and post / Soil or foliar		√		√	√	√	0.14	0.38		√	√	√	No	78	70	Inter-mediate	High	Low

Table 3-1. Herbicide Information (continued)

				Types of BLM Lands Where Use is Permitted						Application Rate (lbs/acre/year)		Available under Alternative[4]							SPISP II Rating[8] (Leaching Potential)		
Herbicide Representative Trade Names[1]	**Common Targets**	**Selective to Plant Types**	**Pre/post Emergent** **Point of Application**	Rangeland	Forest Land	Riparian or Aquatic	Oils, Gas, & Mineral Sites	Rights-of-Way	Recreation & Cultural Sites	Typical	Max[2]	Alt. 2 - No Action	Alt. 3	Alt. 4 - Proposed Action	Alt. 5	**Aerial Spray[5] Allowed**	**K_{oc}**[6]	**Solubility**[7] (mg/l)	**PLP**[9] Leaching	**PSRP**[10] Solution Runoff	**PARP**[11] Adsorbed Particle Runoff
Tebuthiuron Spike	*Sagebrush (thinning)*	broadleaf, woody plants	Pre and post Soil	√			√	√	√	0.5	(4)			E	√	Restricted[15]	80	2,500	High	High	Inter-mediate
Triclopyr[3] Garlon, Renovate, Element	*Saltcedar, purple loosestrife, Canada thistle, tanoak, Himalayan blackberry*	broadleaf, woody plants	Post Foliar	√	√	√	√	√	√	1	(10)		√	√	√	Yes	20 (salt) 780 (ester)	435	High	High	Inter-mediate

[1] See Appendix 9 (Additional Information About the 18 Herbicides) for the full list of herbicide trade names allowed for use on BLM Lands in Oregon, including formulations with 2 or more active ingredients.

[2] Parentheticals denote herbicides that are limited, by PEIS Mitigation Measures, to typical application rates, where feasible.

[3] These, and sethoxydim, are approved for use by the Forest Service in Oregon and Washington (USDA 2005b).

[4] √ indicates herbicides that would be available statewide; E indicates herbicides that would be available only to districts east of the Cascades

[5] Aerial spraying not allowed for any districts west of the Cascades under Alternatives 3 and 4.

[6] K_{oc}: Soil organic carbon sorption coefficient of an active ingredient in mg/L. For a given chemical, the greater the K_{oc} value, the less soluble the chemical is in water and the higher affinity the chemical has for soil organic carbon. For most chemicals, a higher affinity for soil organic carbon (greater K_{oc}) results in less mobility in soil

[7] Solubility indirectly relates to runoff potential, if solubility number is low runoff potential is high

[8] SPISP II = Soil Pesticide Interaction Screening Procedure version II, which is a NRCS model that calculates leaching potential from basic soil properties (USDA 1994b).

[9] PLP - Pesticide Leaching Potential indicates the tendency of a pesticide to move in solution with water and leach below the root zone. A low rating indicates minimal movement and no need for mitigation. PLP is calculated according to a WIN-PST algorithm, and then the resulting rating is adjusted for type of spraying being conducted.

[10] PSRP - Pesticide Solution Runoff Potential indicates the tendency of a pesticide to move in surface runoff in the solution phase. A rating as calculated according to a WIN-PST algorithm indicates the potential for pesticide loss in solution runoff. Ratings are adjusted according to type of spraying being conducted.

[11] PARP - Pesticide Adsorbed Runoff Potential indicates the tendency of a pesticide to move in surface runoff attached to soil particles. A rating as calculated according to a WIN-PST algorithm indicates potential for pesticide movement adsorbed to sediment. Ratings are adjusted according to type of spraying being conducted.

Data source: USDA 2006a

[12] The State of Oregon limits the use of clopyralid. OAR 603-057-0378 states, "Any application or use of a pesticide product known to contain the active ingredient clopyralid to a location other than an agricultural site, forest site, right-of way site, golf course site, or non-turf area of a park or recreation site is prohibited. Regardless of application or use sites specified on individual product labels, no application or use may be made to lawn or turf areas such as residential lawns, commercial and public turf plantings, school grounds, parks, cemeteries or recreational areas other than golf courses."

[13] Only allowed when no other means of application are possible.

[14] Not allowed in wetland or riparian areas (allowed in aquatic areas).

[15] Not allowed in traditional use areas; not allowed in areas where tebuthiuron drift could reach aquatic Special Status species (further than ~100 ft from riparian areas).

Herbicide Uses

To supplement the herbicide information presented on Table 3-1, Appendix 9, and elsewhere, the following information about the specific uses of each herbicide is provided to help the reader understand how each would contribute to achieving the different management objectives identified in each of the action alternatives.

2,4-D (available under all alternatives) is effective on a wide range of broadleaf weeds while protecting most grasses. While having additional herbicides available can allow for more target specific control, having one herbicide that controls a vast range of vegetation could reduce operator error that can occur while mixing and applying herbicides. The Oregon BLM has used 2,4-D without incident to human health for 23 years. In addition, adding a small amount of 2,4-D to a tank mix can improve the effectiveness of the other herbicides and reduce resistance. Additional information about 2,4-D can be found in Appendix 12. 2,4-D is available under the No Action Alternative (Alternative 2); use of 2,4-D drops statewide under all of the action alternatives.

The primary use for *diuron* (available under Alternatives 4 and 5) would be in communications sites such as cell phone, radio, television tower sites, electrical substations, or similar facilities where no vegetation is desired. A bare ground herbicide would permit treatments of these sites every 2-3 years (see the *Administrative Sites, Roads, and Rights-of-Way* section in Chapter 4). It also has use as a site-preparation tool for nursery beds. *Bromacil* (available under Alternatives 4 and 5), like diuron, is a non-selective herbicide that kills all vegetation. The primary use for bromacil would be in communications sites such as cell phone, radio, television tower sites, electrical substations, or similar facilities where complete vegetation control is desired to reduce fire risk and maintenance costs.

Fluridone (available under Alternatives 3, 4, and 5) is an aquatic herbicide that requires prolonged plant contact, so it can only be used on aquatic plants in still water. It would be used primarily on Brazilian waterweed, elodea, hydrilla, and watermilfoil.

Diquat is an aquatic herbicide that is included only in Alternative 5. Of the 18 herbicides analyzed in the PEIS, this is the only herbicide that can control giant salvinia, which has not been found in Oregon.

Hexazinone (available under Alternatives 3, 4, and 5) would be primarily used in administrative sites, utility and road rights-of-way, and along the deer exclosure fence lines at the seed orchards where vegetation must be removed to facilitate maintenance. It could also be used on African rue, a bushy invasive perennial that is toxic to people and livestock.

Glyphosate (available under all alternatives) is being used on broadleaf weeds and woody species and has been used to treat medusahead in eastern Oregon. However, it is a non-selective herbicide and can harm desirable plants, so use has been limited to areas where this is an acceptable treatment. Glyphosate could be used on administrative sites, rights-of-way, and recreation sites under the Proposed Action (Alternative 4). Glyphosate and 2,4-D have been the only two aquatic herbicides available to the BLM for the past 23 years, and use would decrease as more aquatic herbicides became available.

Imazapyr (available under Alternatives 3, 4, and 5) is an ALS-inhibitor that is effective against brushy and woody species such as saltcedar and Russian olive. It would also be used on tanoak to control sudden oak death. At high doses, it is an effective bare ground herbicide that could be used in areas other bare ground herbicides are not registered for. It is used to treat African rue, Japanese knotweed, and leafy spurge.

Tebuthiuron (available under Alternatives 4 and 5) would primarily be used at low rates to thin sagebrush to improve habitat for sage grouse and other species. It could also be used at high rates as a bare ground herbicide.

Imazapic (available under Alternatives 3, 4, and 5), an ALS-inhibitor, is especially effective against the invasive annual grasses such as cheatgrass and medusahead, which infest more than 5 million acres in eastern Oregon. At low rates, it is selective for these grasses, leaving the perennial herbaceous species critical for restoration. The BLM does not currently have an effective method of treating these fire-prone invasive annual grasses. Like imazapic, *sulfometuron methyl* (available under Alternatives 3, 4, and 5) an ALS-inhibitor, is effective against cheatgrass and medusahead. It has a shorter half-life than imazapic, which speeds restoration efforts. However, sulfometuron methyl is not applied aerially, and is not registered for use in rangeland, and a current EPA proposal would limit its use in drier areas (see Chapter 1). This would limit its use on grasses to invasive grasses occurring in woodlands and forest openings. In addition, sulfometuron methyl is effective on mustards and can harm desirable forb species. In high doses, it would be used on road rights-of-way as a bare ground herbicide.

Dicamba (available under all alternatives) has been used extensively on thistles and perennial pepperweed; in combination with 2,4-D on mustards and knapweeds; and, in combination with picloram for rush skeletonweed. Use would drop under the action alternatives, and chlorsulfuron and metsulfuron methyl would be used for many of these treatments. However, dicamba provides good burn-down right up to seed set, which extends the treatment window. *Diflufenzopyr + Dicamba* is included only in Alternative 5. It would be used for many of the same species as dicamba. It can be used in a mixture with picloram, triclopyr, and clopyralid, allowing for a reduced rate of these chemicals.

Chlorsulfuron (available under Alternatives 3, 4, and 5) is an ALS-inhibitor that is effective against grasses and broadleaf plants such as whitetop, perennial pepperweed, Mediterranean sage, and thistles. It is often mixed with 2,4-D to reduce the likelihood of developing plant resistance and to produce more immediately visible results. It can also be used on toadflax and knapweeds. *Metsulfuron methyl* (available under Alternatives 3, 4, and 5) has similar targets and effects as chlorsulfuron, but can cause more harm to desired meadow grasses. It could be used on perennial pepperweed, whitetop and other mustards, and blackberries. It can also be used to control conifer trees under power lines.

Picloram (available under all alternatives) has been used on rush skeletonweed, knapweeds, toadflax, and thistles, and provides good residual control. Use would decrease under any of the action alternatives, and clopyralid, which is more selective, would likely be used instead. However, it is also effective on western juniper and could be used to improve sage grouse habitat. *Clopyralid* (available under Alternatives 3, 4, and 5) would target many of the same species as picloram, but is more selective. It is effective on knapweeds and Canada thistle, while minimizing risk to surrounding desirable brush, grass, and trees.

Triclopyr (available under Alternatives 3, 4, and 5) is effective on woody plants, and would be used on saltcedar, Russian olive, blackberries, brooms, and other shrubs. It is the preferred treatment for purple loosestrife, and could be used to control woody species in recreation sites. Triclopyr BEE, the ester formulation, is more effective at smaller doses, but is more toxic to fish.

Adjuvants, Impurities, and Other Ingredients

Adjuvants are compounds added to the formulation to improve its performance. They can enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant, for example. Adjuvants also include selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants (including surfactants) are not under the same registration guidelines as are herbicides.

Adjuvants can be included as part of an herbicide product, or they can be packaged separately and mixed with an herbicide before application. Applicators follow adjuvant label instructions and warnings, and select adjuvants with low toxicity and low application volumes; in general, adjuvants compose a relatively small portion of the volume of herbicide applied. A national list of adjuvants approved for use on BLM lands is included in Appendix 9. Specific risks from adjuvants to fish, wildlife, and human health are addressed in their respective resource sections in Chapter 4.

Three specific adjuvants currently or previously used by the BLM have been identified as toxic – NPE, R-11, and POEA. A Risk Assessment has been completed for one commonly used non-ionic surfactant type, nonylphenol polyethoxylate (NPE) (Bakke 2003). NPE is formed through the combination of ethylene oxide with nonylphenol (NP), and may contain small amounts of un-reacted NP. NP and NPE are weakly estrogenic in aquatic and terrestrial organisms (1000 to 100,000 times weaker than natural estrogen). NP and NPE are not toxic to soil microbes. NP is toxic to many aquatic organisms (EPA 2007b).

The adjuvant R-11 is a nonylphenol ethoxylate that is acutely toxic to aquatic life (Stark and Walthall 2003) and is suspected to be an endocrine-disrupting chemical (Bakke 2003). The BLM has suspended the use of R-11 in its herbicide applications and it is not evaluated further here.

The adjuvant polyoxyethyleneamine (POEA) is an adjuvant present in some formulations of glyphosate, and is toxic to fish. It was present in the glyphosate evaluated for the Risk Assessments, and thus risks ratings on the Risk Assessment summary tables at the end of this Chapter include the risk from POEA.

Inert compounds (also called "other ingredients") are those that are intentionally added to a formulation to aid in handeling or application, but are not intended to affect the target species. These ingredients are added to the formulation to facilitate its handling, stability, or mixing. Inert ingredients are not currently listed on the label. Although confidential business information protects the identity of inert ingredients, they were made available for the nine BLM-evaluated herbicides during preparation of the PEIS. Of those, none were on the EPA's toxicity List 1 or 2, Inert Ingredients of Toxicological Concern and Potentially Toxic Inert Ingredients respectively. Twelve were on List 3, Inerts of Unknown Toxicity (some of these may have moderate to high potential toxicity), and over 50 were on List 4, Inerts of Minimal Toxicity. As described in Chapter 1, the EPA has embarked on rulemaking that would make the identity of other ingredients more public.

Impurities are inadvertent contaminants in the herbicide usually present because of the manufacturing process. Some have the potential to be of toxicological concern. Risk Assessments, however, examine commercial formulations so many effects from impurities (and manufacturer-included adjuvants and inerts) should be reflected in the risk categories displayed at the end of this Chapter.

Differences in the Number of Herbicides Proposed East and West of the Cascades

Under Alternatives 3 and 4, districts east and west of the Cascades identified different program needs. Differences in the number of herbicides available on the east and west of the Cascades under these alternatives are based on differences in native vegetation types and invasive plant occurrence, management objectives, environmental conditions such as fire risk, and the prevalence of watercourses west of the Cascades. For example, a persistent, soil-applied herbicide could be used along roadsides east of the Cascades to remove fire-prone dry grasses, while the same herbicide would not be used west of the Cascades because the risk of roadside grass fires is low, bare ground in roadside borrow ditches would erode, and roadside applied persistent herbicides might end up in nearby streams.

Aerial Application

Aerial application is prohibited under Alternatives 3 and 4 west of the Cascades for a variety of reasons. The high density of streams, seeps, and other water bodies, coupled with dense vegetation, can make water difficult to avoid. Nearly all lands west of the Cascades are within source water protection areas for public water systems (Figure 4-6), and there are an uncountable number of individual domestic water intakes. Steep varied terrain coupled with tall vegetation (including dead trees) can force pilots to fly relatively high, increasing the risk of drift to water, non-target plants, and other non-target areas, and making surface waters harder to see from the air. There are also fewer large monocultures of invasive plants on the west side proposed for herbicide treatments.

Provision for Adding Herbicides in the Future

Additional herbicides beyond the 18 included in the Record of Decision for the PEIS could become available for BLM use in the future if: 1) they are registered by the EPA for use on one or more of the Oregon land types[1]; 2) the BLM (nationally) determines that the benefits of use on public lands outweigh the risks to human health and the environment; 3) they meet the evaluation criteria to ensure that the decision to use the active ingredient is supported by scientific evaluation through human health and ecological risk assessments and NEPA documentation; and, 4) they are included in appropriate site-specific analysis. These evaluation criteria and how they are processed at the National level are discussed in more detail in Appendix 4. Aminopyralid (e.g., Milestone®) has been suggested by numerous BLM offices as the next candidate to be considered for this process. No "future" herbicide is assumed or analyzed in this EIS.

A previously unknown invasive plant species or the development of a resistant patch of weeds could indicate a need for one of the 18 herbicides not included in the selected alternative. Since the 18 herbicides have been analyzed in the PEIS and in this EIS under Alternative 5, additional statewide programmatic analysis would be unnecessary. Potential use of these herbicides would be addressed at the appropriate scale in site-specific NEPA. For example, the noxious weed giant salvinia can only be controlled with diquat, which would not be available if Alternative 4 were the selected alternative. Giant salvinia has not been found in Oregon or a neighboring state. If it were to be found at a single site in Oregon, it could be addressed in site-specific analysis supplementing this EIS.

Assumptions and Information about Treatment Acres

Integrated Vegetation Management

Most BLM and BLM-authorized vegetation management is done by, or in support of, rangeland management, forest management, riparian management, wildlife and fisheries management, wildland fire management, and/or the maintenance of infrastructure. Types of herbicide treatments that may be conducted in support of these programs under one or more of the alternatives include invasive weed control, habitat improvement, habitat improvement for Federally Listed and other Special Status species, restoration of riparian habitats, hazardous fuels reduction, and the control of vegetation encroachment into rights-of-way and other developments. The BLM's overarching vegetation management goal is:

> Through an interdisciplinary collaborative process, plan and implement a set of actions that improve biological diversity and ecosystem function and which promote and maintain native plant communities that are resilient to disturbance and invasive species. Healthy functioning plant communities will enhance the ability to attain economic benefits on public lands (PEIS:2-1).

1 Forestland; rangeland; riparian or aquatic; oil, gas, and mineral sites; rights-of-way; and, recreation and cultural sites (see Table 3-1 for more information).

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) directs Federal agencies to use an integrated pest management approach to manage pests (including vegetation), stating "Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks" (7 U.S.C. § 136r-1).

In order to control and manage invasive plants and unwanted vegetation, BLM uses an Integrated Vegetation Management approach. This approach involves the use and coordination of a variety of management techniques that are guided by numerous BLM and Department of the Interior manuals[2]. These include BLM Handbook H-1740-2, Integrated Vegetation Management (USDI 2008a); BLM Manual 9015, Integrated Weed Management (USDI 1992b); BLM Manual 9011, Chemical Pest Control, (USDI 1992c); BLM Manual 9014 Use of Biological Control Agents of Pests on Public Lands (USDI 1990); BLM Manual 9220 Integrated Pest Management[3] (USDI 1981); Department of the Interior Manual 517 DM 1, Pesticides, Integrated Pest Management Policy (USDI 2007c); and, 609 DM Weed Control Program (USDI 1995b).

The goal of Integrated Vegetation Management is to prevent the spread of noxious weeds and other invasive plants, to eradicate early-detected noxious weed species in areas where certain weeds have not yet become established, and to control weeds where they have become established (PEIS:2-3). It is important to understand the entire Integrated Vegetation Management approach, because it is only in this context that the proposal to increase the number of available herbicides must be viewed. The Integrated Vegetation Management components described in this section will continue to apply to whichever alternative is selected.

Planning and Analysis

In Oregon, each BLM district prepares a planning document in compliance with NEPA and BLM Manual 9015 that outlines the Integrated Vegetation Management actions they will be conducting. These weed management plans place an emphasis on preventing the establishment and spread of new infestations through pre-project surveys, prevention stipulations, early detection and responding rapidly to new infestations. In addition to the districts' weed management plans, during all NEPA planning processes for ground disturbing projects and projects that have the potential to alter plant communities, the districts are required to assess the risk of introducing noxious weeds.[4] If, through this analysis, it is determined that there is a moderate or high risk of spread, the districts are required to identify actions to be taken to reduce or prevent the spread of noxious weeds and to conduct monitoring after the completion of the project to prevent noxious weed establishment on previously uninfested sites (USDI 1992b).

In Oregon, each BLM district has also identified a natural resource specialist with responsibility for managing the invasive plants and implementing the district's Integrated Vegetation Management strategy. These specialists help ensure that invasive plant management issues and concerns are integrated into all of BLM's programs, policies, and actions.

2 Manuals are updated so specific actions or language referenced in this section could change. It is not expected that the overall use of an Integrated Vegetation Management approach would be removed.

3 Integrated Vegetation Management is a subset of integrated pest management, so for this EIS the terms are essentially interchangeable.

4 Other invasive plants should also be included in this analysis, but current handbook direction does not require it.

Prevention and Education

One of the most important elements of the BLM's Integrated Vegetation Management approach is raising internal and external awareness of the threats of invasive plants and unwanted vegetation and promoting prevention actions. This includes conducting trainings for the public, employees, and contract personnel that teach weed identification, prevention, and effective control techniques. The BLM is actively involved in outreach efforts to raise awareness through such means as coordination and cooperation with the Oregon Department of Agriculture, counties, Cooperative Weed Management Areas, the Cooperative Extension Service, and others to create and present educational materials, brochures, traveling weed information displays, and other education materials. Prevention techniques that are encouraged or required include equipment and vehicle washing, avoiding entry into infested areas, and using weed-free seed, hay, and other materials. Additionally, districts are directed to prepare Weed Prevention Schedules annually to outline weed prevention practices and responsibilities. BLM cooperates with the State for weed prevention and control. Prevention and early detection programs have been shown to have benefit-cost ratios as high as 30:1 and more (Radke and Davis 2000).

Early Detection Rapid Response

The BLM places a management emphasis on preventing the establishment of invasive plants into weed-free areas. BLM trains employees to identify invasive plants and to report new infestations so they can be addressed as quickly as possible. The objective is to prevent the weeds from becoming established and spreading.

In areas where noxious weeds are established, the Oregon Department of Agriculture classifies them as either Class A or Class B, and they are managed based on that classification (USDI 1992b). Class A weeds are non-native, have a limited distribution, and pose a serious threat to landscape function. Class A weeds receive the highest priority for management with the objective of complete control or eradication. Class B weeds are also non-native and are determined to be potentially harmful, but they may be more common in some regions of the State. The goal is to control the spread of Class B weeds, decrease their population size, and eliminate the weed if possible.

The BLM uses this weed classification system along with the Federal Noxious Weed List (USDA 2006c) and county weed lists to help prioritize their treatments. Other factors that influence which infestations are going to receive treatment include the aggressiveness of the weed species, the size of the infestation, the threat it poses to the surrounding ecosystem, and the BLM's potential to be effective in treating the infestation.

Early detection rapid response efforts increase the likelihood that invasions will be addressed successfully while populations are still localized and population levels are not beyond that which can be contained and eradicated. Adding an invasive plant to the State's noxious weed list is not immediate; early detection and rapid response frequently targets invasive weeds before they are listed as noxious.

Coordination with Partners

The BLM works closely with private landowners, county weed boards, watershed councils, soil and water conservation districts, Cooperative Weed Management Areas, State agencies and other Federal agencies in an effort to increase weed prevention and treatment effectiveness. These close working relationships allow for technology and information sharing, more accurate weed inventories, the identification of monitoring and research needs, more effective outreach and control treatments, and a more efficient use of limited resources in the management of weeds.

State and County Level Coordination

The BLM is required to coordinate project plans with State and local agencies under several acts, including the Clean Air Act, the Sikes Act, FLPMA, and Section 106 of the National Historic Preservation Act. The BLM coordinates closely with State resource management agencies on issues involving the management of public lands, the protection of fish and wildlife populations, (including Federally and State Listed threatened and endangered species), noxious weeds and other invasive plants, fuels and wildland fire management, and herbicide application. Herbicide spills are coordinated with State and local water quality agencies to ensure emergency actions and cleanup comply with applicable water quality standards, and do not result in unacceptable surface or ground water contamination.

Local and State agencies work closely with the BLM to manage weeds on local, State, and Federal lands, and often conduct weed treatments on public lands. The BLM participates in exotic plant pest councils, State vegetation and noxious weed management committees, State invasive species councils, county weed districts, and Cooperative Weed Management Areas found throughout the State. Most Oregon counties have a weed management program and official contact person. The Oregon Department of Agriculture Weed Control Program coordinates closely with the BLM, Forest Service, and others in the listing of noxious weeds, and serves as the primary lead in setting control priorities in the State.

The Healthy Forests Restoration Act directs the Forest Service and BLM to develop an annual program of work for Federal land that gives priority to authorized hazardous fuel reduction projects that provide for protecting at risk communities or watersheds. The recommendations made by Community Wildfire Protection Plans are taken into account by the agencies in accordance with Healthy Forests Restoration Act, which gives priority in allocating funding to communities that have adopted these plans, or that have taken measures to encourage willing property owners to reduce fire risk on private property.

Cooperative Weed Management Areas

Cooperative Weed Management Areas (CWMAs) are composed of local, private, State, and Federal interests. CWMAs typically center on a particular watershed or similar geographic area in order to pool resources and management strategies in the prevention and control of weed populations. Much of the BLM's on-the-ground invasive plant prevention and management is done directly or indirectly through CWMAs. The BLM participates in numerous CWMAs throughout Oregon.

Treatment Methods

The Department of the Interior integrated pest management policy states that, "Bureaus will accomplish pest management through cost-effective means that pose the least risk to humans, natural and cultural resources, and the environment" and requires bureaus to "[e]stablish site management objectives and then choose the lowest risk, most effective approach that is feasible for each pest management project" (USDI 2007c), and "Determine, for each target pest, the possible courses of action and evaluate relative merits for controlling the pest with the least adverse effects on the environment" (Chemical Pest Control Handbook, BLM Manual 9011 - USDI 1992c).

In treating noxious weeds, the BLM has a variety of tools available including the use of traditional State-approved biological controls (such as the use of insects, parasites, and pathogens that reduce the vigor, competitiveness and/or reproductive capacity of the noxious weed), the use of manual and mechanical methods (such as hand-pulling, mowing or tilling), burning, seeding or planting species that compete with the weeds, and the application of herbicides. Selection of a vegetation treatment method is based upon several parameters, which may include the following:

- management program/objective for the site;
- historic and current conditions;
- opportunities to prevent future problems;
- opportunities to conserve native and other non-invasive vegetation;
- effectiveness and cost of the treatment methods;
- success of past restoration treatments or treatments conducted under similar conditions or recommendations by local experts;
- characteristics of the target plant species, including size, distribution, density, life cycle, and life stage in which the plant is most susceptible to treatment;
- non-target plant species that could be impacted by the treatment;
- land use of the target area;
- proximity to communities;
- slope, accessibility, and soil characteristics of the treatment area;
- weather conditions at the time of treatment, particularly wind speed and direction, precipitation prior to or likely to occur during or after application, and season;
- proximity of the treatment area to susceptible areas, such as wetlands, streams, or habitat for plant or animal species of concern;
- potential impacts to humans and fish and wildlife; or,
- need for subsequent revegetation and/or restoration.

Herbicides are often the most effective control method:

- on pure stands of a single weed where desirable and non-target plants are scarce or absent;
- for rhizomatous weed species that would otherwise require repeated cutting or pulling for control;
- on plants whose characteristics make them difficult or impossible to remove with non-herbicide methods[5];
- in areas where non-herbicide methods are cost prohibitive;
- in areas where non-herbicide methods have unacceptable adverse impacts to native plants;
- in areas where heavy soil disturbance is not acceptable;
- for species located in remote areas or limited access where non-herbicide methods are not feasible; or,
- in combination with other control treatments (for example, woody species like saltcedar, Russian olive, and Siberian elm can be controlled by cutting stems close to the ground in the fall and then spraying or wiping the stems with an herbicide registered for this use).

In those instances where it is determined that the use of herbicides is the most appropriate tool to treat noxious weeds or other unwanted vegetation, BLM districts prepare a Pesticide[6] Use Proposal (PUP) and complete or reference the environmental analysis that analyzes the effects of the type of treatment being proposed. The PUP and associated NEPA analysis document the relative merits of controlling the noxious weed using other methods, describes why the use of herbicides is the most appropriate treatment method, and, if applicable, how it will be used as part of an overall Integrated Vegetation Management strategy for that site (for example, an area may be sprayed with an herbicide this year and it will be followed up with hand pulling of any weeds found the following growing season) (USDI 1992c). The PUP identifies and describes the location of the area to be treated, the target species, and the herbicide and application rate and method to be used, as well as describing all anticipated impacts to non-target species and susceptible areas. It also evaluates the relative benefits to be derived from the use of

5 For example, Canada thistle root fragments readily resprout.

6 A pesticide is any substance that is used to control, prevent, destroy, repel, or mitigate a pest. This includes herbicides, insecticides, rodenticides, and fungicides.

the herbicide against the potential risks posed by their use. Completed PUPs are submitted through the District Manager to the Oregon State Office for review and approval. All herbicides are applied by certified applicators[7]. A Pesticide Application Record is completed within 24 hours of the application documenting environmental conditions at the time of treatment as well as actual herbicide use, treatment method, equipment used, and personnel present.

Restoration

Weed control plans should include a strategy for rehabilitating the site to prevent reoccurrence of the invasive plant to the greatest extent possible. Passive restoration or rehabilitation after control of small infestations usually involves allowing surrounding native plants to reseed or grow to reoccupy the site. Seeding or planting is generally an element of larger invasive weed control projects, or may be used as a prevention treatment following disturbances where invasive plants are anticipated. The season and nature of any site disturbance associated with the weed control effort should be designed to favor the recovery of desirable natives and discourage reinvasion with weeds. Minimizing site disturbances is one reason to select herbicide use over mechanical or other methods.

Monitoring

Appendix 3 describes implementation and effectiveness monitoring requirements from BLM Manual Section 9011. Implementation monitoring may also be specified in the local Resource Management Plan and/or the Biological Assessment or Opinion associated with the project. Implementation monitoring may be accomplished by: reviewing the Pesticide Application Records (PAR) completed at the time of treatment; comparing the PAR with the Pesticide Use Proposal (described above) or project NEPA decision; or, reviewing the PAR to ensure compliance with all Standard Operating Procedures and mitigation measures. The PAR documents the actual rate, time, and location of application as well as other factors and considerations, allowing a determination of whether actual application was consistent with plans and requirements documented in the site-specific NEPA decision or Pesticide Use Proposal. The 9011 Handbook also provides technical guidance on post-treatment evaluations for pesticide applications to occur within two years of treatment (USDI 1992c). Effectiveness monitoring can be formal or informal and typically compares vegetation characteristics of a site before and after treatment. Effectiveness monitoring typically includes recommendations for additional monitoring and weed control actions. See Appendix 3 for additional information about existing and potential monitoring.

Reporting

The Pesticide Application Records for applications on BLM lands are compiled by the BLM and used to develop State, National, and Environmental Protection Agency summaries and reports.

Herbicide Treatment Methods

Department of the Interior policy states, "[W]here it is determined the use of herbicides is the most effective tool choose the lowest risk, most effective approach that is feasible for each pest [and manage] through cost-effective means that pose the least risk to humans, natural and cultural resources, and the environment" (USDI 2007c).

7 Non-motorized application of non-restricted herbicides may be done by uncertified personnel if they are working under the supervision of a certified applicator. See Assumptions about Herbicide Treatments later in this Chapter for more information.

Herbicide application methods depend upon: the treatment objective (eradication, containment, or reduction); accessibility, topography, and size of the treatment area; characteristics of the target species and the desired (non-target) vegetation; location of susceptible areas and potential environmental impacts in the immediate vicinity; anticipated costs; equipment limitations; and meteorological and vegetative conditions of the treatment area at the time of treatment.

Herbicide application schedules are designed to minimize potential impacts to non-target plants and animals, while meeting the objective of the vegetation treatment program. The application timing and rates depend upon the target species, the presence and condition of non-target vegetation, soil type, depth to the water table, presence of other water sources, the label requirements, health risks, and other factors.

Herbicides can be applied with a variety of methods. Table 3-2 shows different methods, along with the percent that they have been used in the past. This is expected to change under the action alternatives with the addition of imazapic for treating large areas infested with invasive annual grasses; see the *Treatment Acres, Gross Acres and Net Acres, and Pounds of Herbicides to be Applied* section later in this Chapter for more information.

Table 3-2. Herbicide Application Methods on BLM Lands in Oregon

Herbicide Application Method	**Percent of Total Use (2000-2007)**
Aerial	***7%***
Helicopter	5%
Fixed Wing	2%
Ground Application	***93%***
Back pack foliar spray	39%
ATV / UTV / Truck off-road	33%
ATV / UTV / Truck on an existing road	20%
Cut stump / wick / wipe / hack and squirt	2%

Herbicides can be applied aerially with helicopters or fixed-wing aircraft[8]. Operation of helicopters is more expensive than operation of fixed-wing aircraft, but helicopters are more maneuverable and can fly closer to the ground over uneven terrain. Helicopters also are more effective for treating target vegetation in areas with multiple vegetation types. Between 2000 and 2007, application by helicopter accounted for approximately 5 percent of herbicide application on BLM lands in Oregon, and fixed-wing aircraft accounted for about 2 percent. All of these applications were east of the Cascades. Herbicides are applied aerially in areas that are hard to reach by ground (because of terrain or remote access) and in areas where the expanse of a monoculture of invasive weeds can be best controlled by this broadcast method (e.g., treatments of medusahead east of the Cascades).

8 Aerial application is not permitted west of the Cascades under Alternatives 3 and 4. Standard Operating Procedures and PEIS Mitigation Measures prohibit aerial application of certain herbicides like sulfometuron methyl.

All other herbicide application on BLM lands in Oregon has been done by ground application. Thirty-nine percent of herbicides on BLM lands in Oregon are applied with a backpack foliar sprayer. This is usually done only in small areas, in areas inaccessible by vehicle, and in areas where weeds are scattered. A backpack sprayer is used because it can target specific plants, so that effects to non-target species can be kept to a minimum. Backpack sprayers are generally levered not motorized.

Herbicides may also be basally applied with a spray bottle, wick (wiped on), or wand (sprayed on). Herbicides can be applied to trees around the circumference of the trunk on the intact bark (basal bark), to cuts in the trunk or stem (frill, or "hack and squirt"), to cut stems and stumps (cut stump), or injected into the inner bark. From 2000-2007, these types of spot treatment methods accounted for approximately 2 percent of herbicide application on BLM lands in Oregon.

The remainder (about 53 percent) of herbicide application on BLM lands in Oregon has been done with spreaders or hand-held sprayers attached to vehicle-mounted tanks. Spray tank sizes vary from 15-25 gallons on an all-terrain vehicle (ATV) or utility vehicle (UTV), to 100 or more gallons on a truck. Using a large tank provides the advantage of less loading and mixing of herbicides, which, in turn, leads to less accidental spills and a more accurate rate of application. About three-fifths of ATV /truck applications have been done off-road with a hand-held sprayer attached to a small tank, and the remaining two-fifths on an existing road, trail, or right-of-way. Most of these applications have been spot treatments (e.g., hand-held sprayers connected by hose to the tank); fewer have been done with spreaders or booms. Under Alternatives 4 and 5, there would likely be an increase in boom applications from an ATV or truck, and a corresponding decrease in mowing along roadways.

An indeterminate percentage (less than one percent) of treatments might be done by horseback. This would likely occur in areas where ATV access was not practical (e.g., susceptible habitat, Wilderness areas, areas with steep terrain), but where a larger tank size was needed.

Non-Herbicide Treatment Methods

This EIS addresses making various herbicides available to BLM's existing vegetation management program. Non-herbicide treatments are already addressed in Resource Management Plans and related project NEPA analyses, and discussed in the National Vegetation Treatments Programmatic Environmental Report (PER). However, to assist in cumulative effects analyses, descriptions of non-herbicide treatment methods are included here. (Non-herbicide treatment acres for invasive plants are included on Table 3-3)

As with herbicide application methods, the type of non-herbicide treatment method chosen depends on the treatment objective (eradication or reduction); accessibility, topography, and size of the treatment area; characteristics of the target species and the desired vegetation; location of susceptible areas and potential environmental impacts in the immediate vicinity; anticipated costs; equipment limitations; meteorological and vegetative conditions of the treatment area at the time of treatment; and, other factors.

This EIS defines manual methods as non-motorized; all mechanical methods include motorized equipment.

Manual methods such as pulling, digging, and grubbing weeds, can be used to control some invasive plants, particularly if the population is relatively small. These techniques can be extremely specific, minimizing damage to desirable plants and wildlife species, but they are generally labor and time intensive. Treatments must typically be administered several times annually to prevent the weed from re-establishing. In the process, laborers may trample vegetation and disturb soil, providing prime conditions for re-invasion by the same or other invasive plants. Manual techniques can be effective for small infestations and/or where a large pool of labor is available. They can be used in combination with other techniques, for example, when shrubs are pulled and cut, and re-sprouts and seedlings are treated with herbicides or fire several weeks or months later (Tu et al. 2001).

Mechanical methods include weed whackers, chainsaws, chaining, blading, disking, and mowing, including flail mowing, and boom mowers. Some of these methods (e.g., chainsaws and weed whackers) can be more target-specific than others; all methods share some of the drawbacks that manual methods do (need of repeat treatment, disturbed vegetation and soil disturbance can promote invasive weeds, disturbance to non-target species, etc). These methods are the typical methods currently used along rights-of-way. Mechanical treatments in rights-of-way have the potential to spread a small invasive plant infestation across many miles.

When using mechanical and manual methods, all equipment and clothing is normally cleaned and inspected before being moved off-site. This lessens, but does not eliminate, the possibility of spreading the weed(s) to the next worksite.

<u>Directed Livestock</u> can reduce weed abundance at a particular site. However, grazing will rarely, if ever, eradicate invasive plants. Grazing animals may be particularly useful in areas with limited access, severe slopes, or where herbicides cannot be applied (e.g., near water). Animals are brought into an infested area at a time when they will be most likely to damage the invasive plants without causing unacceptable damage to the desirable species or environment. An example would be to time livestock grazing of cheatgrass prior to emergence of native grasses so the native grasses can grow in the absence of cheatgrass competition.

Some animals do not graze uniformly, but can be focused in a specific area with the use of fences, molasses, or salt licks (Tu et al. 2001). Targeted grazing usually does not kill the plants, just suppresses growth, spread, and reproduction. It can be used in addition to seeding to restore native habitat. As with many other treatments, directed livestock can be most effective when used in combination with other treatments.

Biological Control (biocontrol) is the use of non-native insects, pathogens, or other organisms to feed upon, parasitize, or otherwise interfere with a targeted weed species. Plant-eating insects, nematodes, mites, or pathogens can be effective at killing or weakening weed species. They often keep the weed in balance when they occur in the original native community from where the weed originated. Absence of these natural community controls is often what allows a weed to spread and become invasive in its new habitat. Introducing control agents is strictly managed because they have inherent risks to the ecosystem. Most of the species used for biological control are host-specific and are not known to attack non-target species. Biological controls will seldom remove an invasive plant entirely, but can dampen its reproduction, spread and extent, and keep it in some sense of balance compared to other plants in that community. Ideally, biocontrol agents are host-specific and will die once they kill their host. However, some biocontrol programs have resulted in irreversible harm to untargeted (non-pest) organisms and to ecological processes (Tu et al. 2001). Introduced (alien) biocontrols are always vigorously tested by the Federal Animal and Plant Health Inspection Service and approved by the State before use is allowed, to ensure that they are not likely to become pests themselves. Table A7-2 in Appendix 7 indicates noxious weeds targeted for biocontrol treatments.

The most effective *prescription fires* for weed control are typically those administered just before flower or seed set, or at the young seedling/sapling stage. Like other treatments, timing is critical and is dependent on characteristics of the weed, desirable plants, soil moisture, and environmental conditions. Other treatment methods are often used in conjunction with fire, including the use of herbicides and/or seeding. In some cases, prescribed burns can unexpectedly promote an invasive, particularly when their seeds are adapted to fire, or when they resprout vigorously. Most successful weed control efforts using burning include native plant seeding and the restoration of historical (natural) fire regimes.

Invasive plants often move into places where the native vegetation has been disturbed by vehicles, fire, grazing, herbicide treatments, etc. Revegetation of a disturbed site is a key component of weed management, particularly when a site does not have a suitable seed source to establish healthy functioning vegetation. *Seeding and planting* can be used to control weed problems by establishing the desired plant species. It is often used as a follow up to other treatment methods or as a preventative treatment following wildfire (Colorado Natural Areas Program et al. 2000).

Treatment Acres, Gross Acres and Net Acres, and Pounds of Herbicides to be Applied

Treatment Acres – All Methods

Estimates of the number of acres to be treated annually with each herbicide and non-herbicide methods under each alternative are displayed in Table 3-3. Estimates are shown in acres so that they can be compared to each other and to other non-herbicide treatments. They were developed by district experts having knowledge of local treatment histories and of existing and expected invasive plant and other vegetation control needs, and assuming current budget trends. However, as with acreage projections in the PEIS, the estimates presented in Table 3-3 are approximate and used only as a guide for the analysis. The accuracy of estimates is limited by the uncertain nature of future invasive weed spread rates, and by uncertainties about future program funding and emphasis. Estimates for the Reference Analysis and Alternatives 1 and 2 are probably more precise than those for Alternatives 4 and 5, in part because portions of Alternatives 4 and 5 rely on funding sources not currently directed toward invasive plant control. All estimates were rounded upward to help ensure future use was adequately analyzed. The estimates are projected to apply for the next 10 to 20 years. Actual annual treatment levels could also vary from year to year based on changes in program emphasis or priorities, fluctuations in annual budgets, opportunities for cost savings with partnerships, and the availability of external funding.

Table 3-3. Estimated[1] Annual Treatment Acres West/East[7] of the Cascades for Each Alternative.

Herbicide	**Reference Analysis:** No use of herbicides	**Alt 2** (No Action): Use 4 herbicides to treat noxious weeds	**Alt 3:** Use 12-13 herbicides to control invasive weeds and pests and diseases	Management objective: vegetation treatment in rights-of-way, admin. sites, and recreation sites *under Alt. 4*	Management objective: vegetation treatment for habitats in Conservation Strategies *under Alt. 4*	**Alt 4:** (Proposed Action) Use 13-16 herbicides to control invasive weeds, pests and diseases, and meet other management objectives[2]	**Alt 5:** Use 18 herbicides to control vegetation
Herbicides Currently Approved for use on BLM Lands in Oregon (for noxious weed control only)							
2, 4-D	NA	W: 1800 E: 6700	W: 2100 E: 1900	W: 200 E: 700	W: 100 E: 600	W: 2300 E: 3100	W: 2300 E: 5200
Dicamba	NA	W: 100 E: 4500	W: 200 E: 800	W: 100 E: 600	W: 0 E: 100	W: 200 E: 1400	W: 200 E: 1400
Glyphosate	NA	W: 5200 E: 700	W: 2300 E: 400	W: 300 E: 1000	W: 200 E: 100	W: 2700 E: 1300	W: 2700 E: 1300
Picloram	NA	W: 200 E: 3600	W: 400 E: 1100	W: 100 E: 200	W: 0 E: 1300	W: 500 E: 2500	W: 500 E: 2500
Additional Herbicides Proposed for Use in One or More of the Action Alternatives							
Bromacil	NA	NA	NA	W: NA E: 700	W: NA E: 0	W: NA E: 900	W: 100 E: 900
Chlorsulfuron	NA	NA	W: NA E: 3300	W: NA E: 900	W: NA E: 0	W: NA E: 4100	W: 100 E: 4100
Clopyralid	NA	NA	W: 300 E: 1400	W: 0 E: 700	W: 100 E: 0	W: 300 E: 2000	W: 300 E: 2000
Diflufenzopyr + Dicamba	NA	NA	NA	NA	NA	NA	W: 100 E: 100
Diquat	NA	NA	NA	NA	NA	NA	W: 100 E: 100
Diuron	NA	NA	NA	W: 100 E: 1200	W: 0 E: 0	W: 100 E: 1300	W: 100 E: 1300
Fluridone	NA	NA	W: 200 E: 100	W: 0 E: 0	W: 0 E: 0	W: 200 E: 100	W: 200 E: 100

Herbicide	**Reference Analysis:** No use of herbicides	**Alt 2** (No Action): Use 4 herbicides to treat noxious weeds	**Alt 3:** Use 12-13 herbicides to control invasive weeds and pests and diseases	Management objective: vegetation treatment in rights-of-way, admin. sites, and recreation sites *under Alt. 4*	Management objective: vegetation treatment for habitats in Conservation Strategies *under Alt. 4*	**Alt 4:** (Proposed Action) Use 13-16 herbicides to control invasive weeds, pests and diseases, and meet other management objectives[2]	**Alt 5:** Use 18 herbicides to control vegetation
Hexazinone	NA	NA	W: 100 E: 100	W: 200 E: 100	W: 100 E: 0	W: 200 E: 100	W: 200 E: 100
Imazapic	NA	NA	W: 500 E: 11000	W: 100 E: 400	W: 100 E: 2300	W: 500 E: 13500	W: 500 E: 15500
Imazapyr	NA	NA	W: 1200 E: 300	W: 500 E: 100	W: 100 E: 600	W: 1600 E: 1000	W: 1600 E: 1100
Metsulfuron methyl	NA	NA	W: 500 E: 2000	W: 100 E: 400	W: 0 E: 100	W: 600 E: 2300	W: 600 E: 2300
Sulfometuron methyl	NA	NA	W: 100 E: 400	W: 0 E: 500	W: 100 E: 100	W: 100 E: 900	W: 200 E: 900
Tebuthiuron	NA	NA	NA	W: NA E: 100	W: NA E: 300	W: NA E: 300	W: 100 E: 800
Triclopyr	NA	NA	W: 1500 E: 700	W: 600 E: 800	W: 100 E: 700	W: 2200 E: 1900	W: 2300 E: 2200
Total Herbicide[3]	**NA**	**W: 7000 E: 9700**	**W: 8000 E: 22300**	W: 1900 E: 7400	W: 200 E: 5500	**W: 10000 E: 35200**	**W: 10200 E: 39800**
Mechanical[4]	W: 4100 E: 1000	W: 3300 E: 200	W: 3000 E: 200	*See Management of Native and Other Non-Invasive Vegetation later in this Chapter[9]*			
Manual[4]	W: 2900 E: 600	W: 2000 E: 200	W: 2000 E: 200				
Rx Fire[4] (Invasive Weed Control)	W: 600 E: 3100	W: 600 E: 5100	W: 400 E: 12100				
Biocontrol[4,5]	W: 200 E: 200	W: 200 E: 100	W: 100 E: 100				
Directed Livestock[4]	W: 100 E: 8700	W: 100 E: 2700	W: 100 E: 2700				
Seeding or planting[4]	W: 1100 E: 20100	W: 1300 E: 16300	W: 1400 E: 21400				
Total Treatments[3,6,8]	**W: 8600 E: 33500**	**W: 13400 E: 32100**	**W: 14600 E: 43800**				

[1] Numbers rounded up to the nearest 100.

[2] Management objectives in this case refer to vegetation treatment in rights-of-way, administrative sites, and recreation sites, and treatment for habitats in Conservation Strategies. Alternative 4 combines Alternative 3 with these management objectives; however, columns may not add due to rounding, and the ability to use additional herbicides under Alternative 4 that are not available under Alternative 3.

[3] Totals are not the total of the acres in the column. This is because:
- Tank mix treatments using two or more herbicides mixed together are shown as acres for each herbicide used, but the total would reflect the area of that treatment; or,
- Treatments could be performed on the same acre multiple times a year (e.g., spraying and then seeding), and the total counts those acres once.

[4] Non-herbicide treatments only include estimated acreage of noxious weeds and invasive plants. Alternatives 4 and 5 treat other native vegetation, and no attempt was made to estimate non-herbicide treatments of other vegetation. See *Management of Native and Other Non-Invasive Vegetation* later in this Chapter.

[5] Biocontrol numbers indicate releases, not acres.

[6] Totals for the Reference Analysis and Alternatives 2 and 3 are for invasive plants only.

[7] West of the Cascades is indicated with a W; east of the Cascades is indicated with an E.

[8] Acres are gross acres rather than net acres.

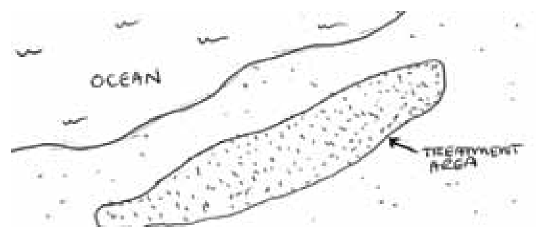
[9] Non-herbicide invasive plant treatments would continue under Alternatives 4 and 5 as described in Alternative 3. Treatments of native vegetation with herbicides would replace some non-herbicide treatments and this is described in the *Management of Native and Other Non-Invasive Vegetation* section later in this Chapter.

Gross Acres and Net Acres

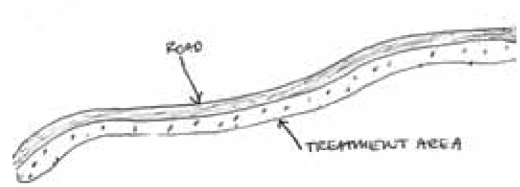
Gross acres are the area within which the plants are treated; the net acres are the actual area covered by the target plants where herbicide is applied. An example from the Klamath Falls Resource Area Pesticide Application Records (PAR) 1,414 gross project acres and less than 15 net acres spot treated. Other treatments may have a ratio of 1:1. Internal BLM reporting requires that all herbicide application to be reported as a minimum of one acre; that is, treating one plant is reported as treating one acre, treating ¼ acre is reported as 1 acre, and treating 1 acre is reported as 1 acre.

Examples of treatments from Pesticide Application Records (PAR)

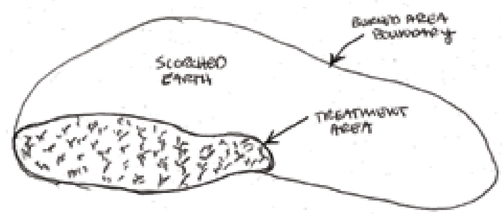
Example 1: Herbicide treatments on European beachgrass following an 80-acre mechanical treatment (bulldozer and disc) where the distribution of re-sprouting beachgrass is relatively uniform across the treatment area (tending towards a monoculture). The PAR indicates that a tractor mounted 40' boom completed the treatment in 4 hours and with a total of 78 acres treated.
Gross acres = 80; Net acres = 78



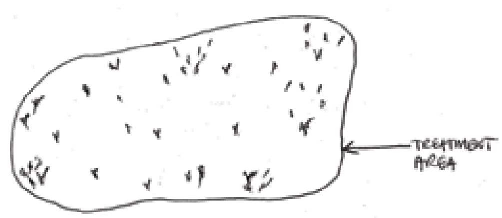
Example 2: Scotch broom along 2 miles of road where clusters of plants are seldom separated by more than 10 feet. The width of the treatment area averages 20 feet. The PAR indicated that a crew of three with a truck mounted tank and two hand sprayers completed treatment in five hours and reported two acres of treatment.
Gross acres = 5 acres; Net acres = 2 acres



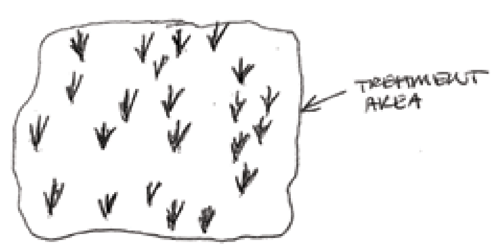
Example 3: Medusahead rye sprouting following a late summer burn in a uniform pattern across the area (tending towards a monoculture, with an absence of desirable grasses and forbs). Fire maps indicate there are 8,100 acres within the 35,000-acre burn with these characteristics. Aerial application is selected as the most effective method to complete this large-scale treatment. The PAR indicates 19 hours of airtime with total treatment acreage of 7960 acres.
Gross acres 8100; Net acres = 7960



Example 4: A 43-acre area has an infestation of dyer's woad. The PAR states that approximately 800 plants were treated by a crew of three using backpack sprayers in an 8-hour period, with a total of 11 acres treated within the treatment area.
Gross acres = 43; Net acres 11



Example 5: A seasonal wetland (dry) contains a 114-acre infestation of perennial pepperweed. The PAR indicates approximately 2,300 plants were treated in an 6 hour period with a spray buggy and 20' boom, with a total of 37 acres treated within the infestation.
Gross acres = 114; Net acres = 37



Pounds of Herbicide to be Applied

BLM and Forest Service Risk Assessments analyze a typical rate of application and a maximum rate of application. Maximum rates are the pounds per acre that can be sprayed, and are defined by the EPA and printed on the herbicide product label or are set by BLM policy. Typical rates vary by application type, and may be different for the BLM than those for lawn care companies or agricultural companies. These additional herbicides are often more effective at lower dosages; while acres of herbicides applied go up between Alternative 2 (No Action) and Alternative 3, total pounds of herbicides decrease substantially. Table 3-4 shows typical (for wildland use) and maximum rates for each herbicide, and the estimated annual pounds that each would total under each alternative (based on the estimated annual treatment acres shown on Table 3-3). PEIS Mitigation Measures limit use of some herbicides to their typical rate (where feasible) (see Table 3-4 footnote).

Table 3-4. Estimated Annual Pounds of Herbicides that Would be Applied at Typical and Maximum Application Rates East/West of the Cascades for Each Alternative.

Herbicide	lbs/acre at typical rate	lbs/acre at maximum rate	Alternative 2 (No Action)		Alternative 3		Alternative 4 (Proposed Action)		Alternative 5	
			lbs at typical rate	lbs at max. rate	lbs at typical rate	lbs at max. rate	lbs at typical rate	lbs at max. rate	lbs at typical rate	lbs at max. rate
Herbicides Currently Approved for use on BLM Lands in Oregon (for noxious weed control only)										
2, 4-D	1.0	1.9[1]	W: 1800 E: 6700	W: 3420 E: 12730	W: 2100 E: 1900	W: 3990 E: 3610	W: 2300 E: 3100	W: 4370 E: 5890	W: 2300 E: 5200	W: 4370 E: 9880
Dicamba	0.3	2.0	W: 30 E: 1350	W: 200 E: 9000	W: 60 E: 240	W: 400 E: 1600	W: 60 E: 420	W: 400 E: 2800	W: 60 E: 420	W: 400 E: 2800
Glyphosate	2.0	7.0	W: 10400 E: 1400	W: 36400 E: 4900	W: 4600 E: 800	W: 16100 E: 2800	W: 5400 E: 3000	W: 18900 E: 10500	W: 5400 E: 3000	W: 18900 E: 10500
Picloram	0.35	1.0	W: 70 E: 1260	W: 200 E: 3600	W: 140 E: 385	W: 400 E: 1100	W: 175 E: 875	W: 500 E: 2500	W: 175 E: 875	W: 500 E: 2500
Additional Herbicides Proposed for Use in One or More of the Action Alternatives										
Bromacil	4.0	12.0	NA	NA	NA	NA	W: NA E: 3600	W: NA E: 10800	W: 400 E: 3600	W: 1200 E: 10800
Chlorsulfuron	0.056	0.25	NA	NA	W: NA E: 185	W: NA E: 825	W: NA E: 230	W: NA E: 1025	W: 6 E: 230	W: 25 E: 1025
Clopyralid	0.35	0.5	NA	NA	W: 105 E: 490	W: 150 E: 700	W: 105 E: 700	W: 150 E: 1000	W: 105 E: 700	W: 150 E: 1000
Diflufenzopyr + Dicamba	0.2625	0.4375[2]	NA	NA	NA	NA	NA	NA	W: 26 E: 26	W: 44 E: 44
Diquat	1.0	4.0	NA	NA	NA	NA	NA	NA	W: 100 E: 100	W: 400 E: 400
Diuron	6.0	20.0	NA	NA	NA	NA	W: 600 E: 7800	W: 2000 E: 26000	W: 600 E: 7800	W: 2000 E: 26000
Fluridone	0.15	1.3	NA	NA	W: 30 E: 15	W: 260 E: 130	W: 30 E: 15	W: 260 E: 130	W: 30 E: 15	W: 260 E: 130
Hexazinone	2.0	4.0	NA	NA	W: 200 E: 200	W: 400 E: 400	W: 400 E: 200	W: 800 E: 400	W: 400 E: 200	W: 800 E: 400
Imazapic	0.0313	0.1875	NA	NA	W: 16 E: 344	W: 94 E: 2063	W: 16 E: 423	W: 94 E: 2531	W: 16 E: 485	W: 94 E: 2906
Imazapyr	0.45	1.25	NA	NA	W: 540 E: 135	W: 1500 E: 375	W: 720 E: 450	W: 2000 E: 1250	W: 720 E: 495	W: 2000 E: 1375
Metsulfuron methyl	0.03	0.15	NA	NA	W: 15 E: 60	W: 75 E: 300	W: 18 E: 69	W: 90 E: 345	W: 18 E: 69	W: 90 E: 345
Sulfometuron methyl	0.14	0.38	NA	NA	W: 14 E: 56	W: 38 E: 152	W: 14 E: 126	W: 38 E: 342	W: 28 E: 126	W: 76 E: 342
Tebuthiuron	0.5	4.0	NA	NA	NA	NA	W: NA E: 150	W: NA E: 1200	W: 50 E: 400	W: 400 E: 3200
Triclopyr	1.0	10.0	NA	NA	W: 1500 E: 700	W: 15000 E: 7000	W 2200 E: 1900	W: 22000 E: 19000	W: 2300 E: 2200	W: 23000 E: 22000
Estimated annual total lbs:			W: 12300 E: 10710		W: 9320 E: 5510		W: 12038 E: 22657		W: 12734 E: 25541	

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

[2] The maximum label rates are 0.4375 lbs/acres for oil and gas sites, rights-of-way, and recreation. The maximum label rates for rangeland are 0.35 lbs/acre.

Pesticide Use Reports

The annual Pesticide Use Reports (PURs)[9] for 2006-2008, shown in Table 3-5, show actual statewide net acres, gross acres, and pounds of herbicides used. The percent of typical and maximum rate decreased in 2008 in part because the PEIS Record of Decision lowered the rates from those in previously applicable direction[10].

Table 3-5. 2006-2008 Oregon BLM Pesticide Use Reports Summary

	Acres			Lbs of Herbicides		
Herbicide	Net acres	Gross Acres	Net as % of Gross	Lbs of Herbicides	Percent of Typical Rate	Percent of Maximum Rate
2008						
2,4-D	4,341	6,493	67%	6,812	105%	55%
Dicamba	1,017	2,031	50%	937	185%	23%
Glyphosate	5,248	5,290	99%	2,302	22%	6%
Picloram	4,433	5,895	75%	2,477	120%	42%
total	15,039	19,709	76%	12,528		
2007						
2,4-D	3,573	5,167	69%	7,737	150%	79%
Dicamba	1,227	2,521	49%	1,264	201%	25%
Glyphosate	2,859	2,931	98%	1,569	27%	8%
Picloram	1,151	1,617	71%	1,118	197%	69%
total	8,810	12,235	72%	11,688		
2006						
2,4-D	2,729	3,634	75%	6,022	166%	87%
Dicamba	636	1,303	49%	641	197%	25%
Glyphosate	3,038	3,075	99%	2,606	42%	12%
Picloram	780	1,232	63%	766	177%	62%
total	7,128	9,244	78%	10,035		

Pest and Disease Control in Alternative 3

Herbicide use in Alternative 3 would be limited to noxious weeds and other invasive plants, and to an estimated 250 acres per year to treat native vegetation in State-identified control areas as necessary to stop non-native pests and diseases. Because these treatments are so incidental to the main theme of Alternative 3, and represent less than one percent of the total herbicide use proposed for Alternative 3, many references to Alternative 3 describe it as being limited to the control of invasive plants.

Assumptions about Herbicide Treatments

Most invasive weed treatments target new species, new or small populations of existing species, and advancing edges of larger populations in order to keep weeds from infesting new drainages and other geographic areas (see *Noxious Weeds and Other Invasive Plants* section in Chapter 4). In addition, most weed treatments are spot

9 The PUR is the compilation of the PARs at the State level for EPA reporting.

10 Typical and maximum rates were previously set by the May 1991 Final EIS for Vegetation Treatments on BLM Lands in Thirteen Western States for districts east of the Cascades, and the December 1985 Northwest Area noxious Weed Control Program EIS for districts west of the Cascades.

treatments directed at specific plants, and non-target damage is limited to the immediately surrounding area, if it happens at all. However, some acres are so infested with weeds (particularly annual grasses such as cheatgrass and medusahead, or weeds such as purple loosestrife or spotted knapweed) that they have become a monoculture. Monocultures are often broadcast treated with booms.

Sites that are too heavily infested with weeds for spot treatments are less likely to be treated with herbicides unless there are broader objectives requiring an unusually large investment, such as Federally Listed or other Special Status species' habitat, campground, designated special area, and so forth. If site management objectives make treatment of heavily infested sites worthwhile, those same objectives will dictate the use of selective herbicides and extra effort to retain native plants, and/or prompt restoration.

Table 3-2 (*Herbicide Application Methods on BLM Lands in OR*) earlier in this Chapter shows types of application methods, and at what rate (percentage) they have been used under the current program. The use of additional herbicides and additional vegetation treatment as described in the action alternatives would change those application rates. Under Alternative 3, cheatgrass and medusahead (invasive annual grasses that have infested more than 5 million acres in Eastern Oregon) would often be best controlled by aircraft application on the acres where desirable and non-target plants are absent or sparse (e.g., after large fires where these grasses are expected to dominate). Vegetation surrounding the perimeter of the infestation would likely be more varied, and herbicide application on the perimeter would likely happen on the ground. Table 3-6 shows the expected aerial and ground application percentages for each alternative.

Table 3-6. Ground and Aerial Herbicide Application

	Herbicide Application					
		Alternatives 3, 4[1], and 5		Alternatives 4[1] and 5		Alternative 5
Application Method	Alt 2 (No Action)	Imazapic treatments east of the Cascades (primarily for controlling medusahead and cheatgrass)	All other herbicide treatments under Alt 3	Management objective: vegetation treatment in rights-of-way, admin. sites, and recreation sites under Alt. 4[1]	Management objective: vegetation treatment for habitats in Conservation Strategies under Alt. 4[1]	Additional treatments proposed under Alt 5
Aerial[2]	7%	90%	7%	2%	7%	7%
Ground	93%	10%	93%	98%	93%	93%

[1] Alternative 4 is the Proposed Action

[2] Aerial applications would be only allowed east of the Cascades under Alternatives 3 and 4.

Under Alternatives 2 and 3, herbicide application would happen with methods that would seek to avoid all non-target vegetation; that is, native (non-invasive) vegetation would be avoided with the use of selective herbicides or selective application methods. Under Alternatives 4 and 5, some applications would be to control all vegetation in administrative sites and recreation sites, which would likely change application selectivity. Under power lines west of the Cascades, a goal is to establish low growing vegetation and to prevent tree re-sprouting. This would most likely be done with spot or selective treatments. However, on roads, application would likely be performed by a truck with a mounted sprayer, as the goal would be to remove most vegetation, including vegetation invading pavement edges and vegetation that limits visibility. Most treatments on administrative or recreation sites would be spot treatments; however, some would use application methods and herbicides that would remove all vegetation. Habitat improvements, allowed under Alternatives 4 and 5, would be selective in order to keep desired vegetation.

Total treatment acres are similar under the Reference Analysis and Alternative 2; most acres that would be treated with herbicides under Alternative 2 (No Action) would be treated through other methods under the Reference Analysis. Fire would increase by more than 300 percent and manual and mechanical methods would increase by about 150 percent.

Herbicide treatment acres are estimated to increase by 13,600 acres annually (nearly double the acres) between Alternatives 2 and 3, but use of the four herbicides available under Alternative 2 (No Action) would decrease 52 to 83 percent under Alternative 3. A majority of the increase in Alternative 3 is because of the availability of imazapic, which would be used on an estimated 11,500 acres annually, primarily east of the Cascades, to control monocultures of invasive annual grasses such as cheatgrass and medusahead. These acres are shown as an estimated annual average; at least some of the imazapic use would be to prevent invasive grass reinvasion after major fires and a 50,000-acre treatment every 6 or 8 years would be a possible scenario. It would also be used to reduce invasive grass fuels hazards in the wildland urban interface around rural communities, and as part of a fire-imazapic-seeding restoration treatment. Monocultures of invasive plants could be treated with a boom; the majority of the treatments under Alternative 3 would be done with selective methods. Seeding and planting and prescribed fire would increase significantly between Alternatives 2 and 3. These acres would often be duplicative to acres of herbicide treatments and would be part of restoring invasive weed monocultures to native vegetation.

Alternative 4 (the Proposed Action) would, in addition to invasive plant treatments, add 2,000 acres annually west of the Cascades and 12,800 acres annually east of the Cascades. One-third of this would be for habitat improvements in Conservation Strategies; the remainder would be for administrative site, right-of-way, and recreation site treatments. Right-of-way treatments would usually be accomplished by the permit holder (e.g., the power or pipeline owner).

Alternative 5 allows the use of herbicides for any objective other than livestock forage and timber production. The acres (200 acres annually west of the Cascades and 4,700 acres annually east of the Cascades) that could be treated under Alternative 5 but not under any other alternative are primarily additional habitat improvement projects (e.g., reducing western juniper encroachment into important sagebrush habitat).

Under all alternatives, about 50 percent of the 2,4-D acres shown on Table 3-3 would be at low doses (oz. per acre) as part of a tank mix with other herbicides.

Management of Native and other Non-Invasive Vegetation

In addition to invasive plant treatments listed for Alternative 3 on Table 3-3, Alternative 4 (Proposed Action) would permit the use of herbicides for native and other non-invasive vegetation treatments for rights-of-way, administrative sites, recreation sites, and limited habitat improvement treatments. Alternative 5 would allow the treatment of native vegetation for any objective except livestock forage or timber production. Herbicide treatments for native vegetation control would be 15,100 acres under Alternative 4 and 20,000 acres under Alternative 5 (see Table 3-7).

Table 3-7. Estimated Annual Herbicide Treatment Acres under Alternatives 3, 4[1], and 5

	Invasive Plant Treatment		Native Vegetation Treatment									
	Alternatives 3,4,5		Alternative 3		Rights-of-way, administrative sites, and recreation sites (under Alternative 4)		Conservation Strategies		Total Alternative 4		Alternative 5	
Method	West[2]	East[2]	West	East	West	East	West	East	West	East	West	East
Herbicides	8,000	22,300	250[3]	250[3]	1,900	7,400	200	5,500	2,100	13,000	2,300	17,700

[1] Alternative 4 is the Proposed Action
[2] West/East of the Cascades
[3] Pest and disease control in State-identified control areas only.

No attempt was made to quantify the total acres of non-herbicide native vegetation treatments already occurring on BLM lands in Oregon because such treatments cover a variety of objectives, are in the magnitude of a hundred thousand acres per year, and most are not affected by the alternatives. However, for the portion of those acres that would start being treated with herbicides under Alternatives 4 and 5, the following substitution assumptions would apply:

- For rights-of-way, administrative sites, and recreation sites, the BLM and cooperators have been accomplishing needed work with non-herbicide methods. The 9,300 acres proposed for herbicide use for these objectives under Alternatives 4 and 5 shown on Table 3-7 likely represent similar acres of non-herbicide treatments under the Reference Analysis and Alternatives 2 and 3 but are not included on Table 3-3. For comparison purposes, it is assumed that 90 percent of this work is currently done mechanically; the majority of the acres are in road maintenance (cleared now with mowers) and power line rights-of-way (generally mowers or large trees cleared with chainsaws). The remaining 10 percent is accomplished manually (e.g., poison oak in campgrounds).
- Of the acres proposed for herbicide use to accomplish habitat improvement objectives under Alternative 4 (Proposed Action) and various objectives under Alternative 5, about 35 percent would replace treatments already being done with non-herbicide methods (e.g., chaining western juniper), and 65 percent represent new opportunities (habitat treatments not currently being done because of high cost, unacceptable effects, or logistical issues). It is assumed that treatments currently being done through mechanical and manual means are in about the same proportion as treatments of invasive plants under Alternative 3: 60 percent mechanical, and 40 percent manual.

Table 3-8 shows the application of the above assumptions. However, because the total amount of native vegetation treated through non-herbicide means is unknown, the table only shows the *change* in how native vegetation is treated under each alternative. These numbers are not totals; they merely show how acreages increase or decrease in relation to the No Action Alternative (Alternative 2). For example, under Alternative 4 (Proposed Action), 13,000 acres of native vegetation east of the Cascades would be treated with herbicides. Because of this, 7,905 acres *would not* be treated mechanically and 1,520 acres *would not* be treated manually. Under Alternative 3, which does not allow the treatment of native vegetation with herbicides[11], those acres, and an unknown number of other acres, would continue to be treated with mechanical and manual methods. These numbers *do not* affect the acres of invasive plants treated through mechanical and manual means; invasive plant

11 Except for pest and disease control in State-identified control areas.

Table 3-8. Estimated Change in Native Vegetation Annual Treatment Acres

Method	Total Native Vegetation treated under the Reference Analysis and **Alternatives 2** (No Action) and **3** (No Action)		Treatment of native vegetation on rights-of-way, administrative sites, and recreation sites under Alternative 4		Treatment of native vegetation for habitats as described in Conservation Strategies under Alternative 4		Total Native Vegetation treated under **Alternative 4** (Proposed Action)		Additional Treatments allowed under Alternative 5		Total Native Vegetation treated under **Alternative 5**	
	West[1]	East	West	East	West	East	West	East	West	East	West	East
Herbicides	0	0	1900	7500	200	5500	2100	13000	200	4700	2300	17700
Mechanical	NA	NA	-1710	-6750	-42	-1155	-1752	-7905	-42	-987	-1794	-8892
Manual	NA	NA	-190	-750	-28	-770	-218	-1520	-28	-658	-246	-2178
Net change in total native vegetation acres treated	-	-	0	0	130	3575	130	3575	130	3055	260	6630

[1] West / East of the Cascades

treatments in Alternative 3 are assumed to remain constant through Alternatives 4 and 5.

Applicator Certification

Per BLM Policy, all herbicide application is carried out by certified applicators or under the direct supervision of a certified applicator. Certified applicators must attend pesticide training and successfully complete a comprehensive certification exam to receive a three-year certification. Certification is issued by the BLM's National Office, and a roster of certified pesticide applicator personnel is maintained in the National Office (USDI 1992c). In addition, the Oregon BLM hires contractors that are certified and licensed by the Oregon Department of Agriculture, Pesticides Division, which requires similar training and certification.

Risk

EPA Labels

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) establishes procedures for the registration, classification, and regulation of all herbicides. Before any herbicides may be sold legally, the EPA must register it. The EPA may classify an herbicide for general use if it determines that the herbicide is not likely to cause unreasonable adverse effects to applicators or the environment, or it may be classified for restricted use if the herbicide must be applied by a certified applicator and in accordance with other restrictions. The herbicide label is a legal document specifying allowable uses;

EPA terms

LD_{50}	Lethal Dose to 50% of the population
LOC	Level of Concern
NOAEL	No Observed Adverse Effect Level
LOAEL	Lowest Observed Adverse Effect Level

BLM terms

RQ	Risk Quotient
ECC	Estimated Exposure Concentration
TRV	Toxicity Reference Value
ARI	Aggregated Risk Index

Forest Service Terms

HQ	Hazard Quotient
RfD	Reference Dose
TI	Toxicity Index

all applicators that apply herbicides on public lands (i.e., certified applicators or those directly supervised by a certified applicator) must comply with the application rates, uses, handling, and all other instructions on the herbicide label, and where more restrictive, the rates, uses, and handling instructions developed by the BLM.

In addition to sub-chronic and chronic toxicity, EPA herbicide registration looks at the acute toxicity of an herbicide. Acute toxicity is the most common basis for comparing the relative toxicities of herbicides. Acute toxicity can be measured by LD_{50}[12]. LD_{50} (LD = lethal dose) represents the amount of herbicide that results in the death of 50 percent of a test population. Therefore, the lower the LD_{50}, the more toxic the herbicide. Table 3-9 shows the three categories that the EPA uses for classifying herbicides (USDI 1992c).

In addition, the EPA has established Levels of Concern (LOC) for herbicides, which is the dose of the herbicide above which effects would be expected. The LOCs are used by EPA for registration, and to indicate potential risk to non-target organisms and the need to consider regulatory action (EPA 2007c). In the absence of information indicating otherwise, the LOC is generally 1/10th of the Lowest Observed Adverse Effect Level (LOAEL); that is, the lowest dose level where there was a statistically significant increase in frequency or severity of adverse effects[13] to the test organism. In some cases, no adverse reaction happens at any dose (or at any reasonable dose), and the LOC is the No Observed Adverse Effect Level (NOAEL). LOCs include uncertainty factors based on the amount and nature of the toxicity testing on which they are based.

Acute toxicity: The quality or potential of a substance to cause injury or illness shortly after exposure through a single or short-term exposure.

Chronic toxicity: The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

Table 3-9. Herbicide Label Categories

Categories	Signal Word Required on Label	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LD_{50} (mg/kg)	Probable Oral Lethal Dose for 150 lb Human
I – Highly Toxic	DANGER, POISON, skull & crossbones	Up to and including 50	Up to and including 200	Up to and including 0.2	A few drops to a teaspoonful
II – Moderately Toxic	WARNING	From 50 to 500	From 200 to 2000	From 0.2 to 2	Over one teaspoonful to one ounce
III – Slightly Toxic	CAUTION	From 500 to 5000	From 2000 to 20,000	From 2 to 20	Over one ounce to one pint or one pound.

Risk Assessments

One of the *Purposes* identified in Chapter 1 is: *6. Prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public, to desirable flora and fauna, and to soil, air, and water.* To help address this *Purpose*, this EIS relies on BLM and/or Forest Service-prepared Human Health and Ecological Risk Assessments for the 18 herbicides analyzed in this EIS. These Risk Assessments are included in this EIS as *Appendix 8: Risk Assessments* (uncirculated). The Risk Assessments are used to quantitatively evaluate the probability (i.e., risk) that herbicide use in wildland settings might pose harm to humans or other species in the environment. As such, they address many of the risks that would be faced by humans, plants, and animals, including Federally Listed and other Special Status species, from the use of the herbicides. The level of detail in the Risk Assessments far exceeds that normally found in EPA's registration examination.

12 or LC_{50} (lethal concentration) in the case of aquatic organisms.

13 Lethal or sub-lethal.

Risk is defined as the likelihood that an effect (injury, disease, death, or environmental damage) may result from a specific set of circumstances. It can be expressed in quantitative or qualitative terms. While all human activities carry some degree of risk, some risks are known with a relatively high degree of accuracy because data have been collected on the historical occurrence of related problems (e.g., lung cancer caused by smoking, auto accidents caused by alcohol impairment, and fatalities resulting from airplane travel). For several reasons, risks associated with exposure to herbicides (at least in wildland settings) cannot be so readily determined. The Risk Assessments help evaluate the risks resulting from these situations.

Risk Assessments are necessarily done on a surrogate species in laboratory conditions, identified to represent a species group, as toxicological data does not exist for most native non-target species. Survival, growth, reproduction, and other important sub-lethal processes of both terrestrial and aquatic non-target species were considered. Assessments considered acute and chronic toxicity data. Exposures of receptors[14] to direct spray, surface runoff, wind erosion, and accidental spills were analyzed.

Most of the Human Health and Ecological Risk Assessments were developed by the BLM for the 2007 PEIS, or by the Forest Service (FS) for the 2005 *Pacific Northwest Region Invasive Plant Program EIS* (see Table 3-10). Three Human Health Risk Assessments used in this EIS (bromacil, diuron, and tebuthiuron) were used in BLM's 1991 *Vegetation Treatment on BLM Lands in Thirteen Western States EIS* and recent literature has been examined to ensure these Risk Assessments remain current. The Risk Assessments, related separate analyses, and the PEIS includes analysis of degradates and other ingredients for which information is available and not constrained by confidential business information (CBI) restrictions. Preparing a risk assessment for every conceivable combination of herbicide, tank mix, adjuvants (including surfactants), and other possible mixtures is not feasible, as the BLM cannot prepare hundreds of risk assessments, and the cost would be exorbitant. To the degree a toxic substance is known to pose a significant human or ecological risk, the BLM has undertaken analysis to assess its impacts through Risk Assessments. More detailed information about uncertainty in the Risk Assessment process is included in Appendix 13.

When evaluating risks from the use of herbicides proposed in a NEPA planning document, reliance on EPA's herbicide registration process as the sole demonstration of safety is insufficient. The U.S. Forest Service and BLM were involved in court cases in the early 1980s that specifically addressed this question (principally Save Our Ecosystems v. Clark, 747 F.2d 1240, 1248 (9th Cir. 1984) and Southern Oregon Citizens v. Clark, 720 F. 2d 1475, 1480 (9th Cir. 1983)). These court decisions and others affirmed that although the BLM can use EPA toxicology data, it is still required to do an independent assessment of the potential risks of using herbicides rather than relying on FIFRA registration alone. The Courts have also found that FIFRA does not require the same examination of impacts that the BLM is required to undertake under NEPA. Further, Risk Assessments consider data collected from both published scientific literature and data submitted to EPA to support FIFRA product registration, whereas EPA utilizes the latter data only. The EPA also considers many wildland herbicide uses to be minor. Thus, the project-specific application rates, spectrum of target and non-target organisms, and specialized exposure scenarios evaluated by the BLM are frequently not evaluated by EPA in its generalized registration assessments.

The Risk Assessments are the source for much of the individual herbicide information presented in each of the resource sections in this EIS, including the high-moderate-low risk categories shown in tables. Individual Risk Assessment Tools are being developed for each herbicide, to assist field managers in translating risks to project design parameters. The use of those Individual Risk Assessment Tools is explained in *Use of Individual Risk Assessment Tools During Implementation* later in this Chapter.

14 An ecological entity such as a human, fish, plant, or slug.

Table 3-10. Human Health and Ecological Risk Assessment Sources

<table>
<tr><th rowspan="2">Herbicide</th><th colspan="2">Ecological Risk Assessments</th><th colspan="3">Human Health Risk Assessments</th></tr>
<tr><th>2007 BLM PEIS[1]</th><th colspan="2">2005 FS EIS[2] (Ecological & Human Health)</th><th>2007 BLM PEIS[1]</th><th>1991 BLM EIS[3]</th></tr>
<tr><td>2,4-D[4]</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Bromacil</td><td>√</td><td colspan="2"></td><td></td><td>√</td></tr>
<tr><td>Chlorsulfuron</td><td>√</td><td></td><td>√[5]</td><td></td><td></td></tr>
<tr><td>Clopyralid[4]</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Dicamba</td><td></td><td>√[6]</td><td></td><td>√</td><td></td></tr>
<tr><td>*(Diflufenzopyr + dicamba)*</td><td>√</td><td colspan="2"></td><td></td><td></td></tr>
<tr><td>Diflufenzopyr</td><td>√</td><td colspan="2"></td><td>√</td><td></td></tr>
<tr><td>Diquat</td><td>√</td><td colspan="2"></td><td>√</td><td></td></tr>
<tr><td>Diuron</td><td>√</td><td colspan="2"></td><td></td><td>√</td></tr>
<tr><td>Fluridone</td><td>√</td><td colspan="2"></td><td>√</td><td></td></tr>
<tr><td>Glyphosate</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Hexazinone[4]</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Imazapic</td><td>√</td><td colspan="2"></td><td>√</td><td></td></tr>
<tr><td>Imazapyr</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Metsulfuron methyl</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Picloram</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
<tr><td>Sulfometuron methyl</td><td>√</td><td colspan="2"></td><td>√</td><td></td></tr>
<tr><td>Tebuthiuron</td><td>√</td><td colspan="2"></td><td></td><td>√</td></tr>
<tr><td>Triclopyr</td><td></td><td colspan="2">√</td><td></td><td></td></tr>
</table>

1 2007 PEIS: Risk Assessments developed for the 2007 *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement*.

2 2005 FS EIS: Risk Assessments developed for the 2005 *Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement*. These Risk Assessments cover both human health and ecological.

3 1991 BLM EIS: Human Health Risk Assessments adopted with the 1991 *Vegetation Treatments on BLM Lands Record of Decision*, and originally developed for the Forest Service's 1988 *Managing Competing and Unwanted Vegetation Final Environmental Impact Statement* as part of a Human Health Risk Assessments that covers 16 herbicides.

4 The Risk Assessments used in the PEIS were updated and the most recent version has been used in this EIS.

5 The BLM prepared a chlorsulfuron Ecological Risk Assessment, so only the human health portion of the FS Risk Assessment was used in this EIS.

6 The BLM's Ecological Risk Assessment only analyzes the use of dicamba in conjunction with diflufenzopyr. The BLM in Oregon plans to use dicamba without diflufenzopyr; hence, the Forest Service dicamba Risk Assessment was used for the ecological portion of the analysis.

Drift

Assuming non-target animals and plants are not directly sprayed, drift is the process most likely to result in herbicides getting onto non-target plants and animals, as well as getting onto non-target areas such as stream channels. Drift, defined as that part of a sprayed herbicide that is moved from the target area by wind while it is still airborne, is primarily dependent upon the elevation of the spray nozzle, droplet size and air movement. The smaller the droplet, the longer it stays suspended and the farther it can travel. Drift is one exposure scenario examined in the Risk Assessments and summarized on the risk tables at the end of this Chapter.

Spray drift can be reduced by increasing droplet size since wind will move large droplets less than small droplets (Table 4-18). Droplet size can be increased by: 1) reducing spray pressure; 2) increasing nozzle orifice size; 3) using special drift reduction nozzles; 4) using additives that increase spray viscosity; and, 5) using rearward nozzle orientation in aircraft. Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants described above. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. They reduce the percentage of smaller, lighter particles, which are most apt to drift. Standard Operating Procedures for air quality provide techniques for controlling drift, including specifying selection of equipment that produces 200-800-micron diameter droplets.

Drift includes droplets and vapor. In general, however, herbicides have very low vapor pressures and BLM spray mixtures do not produce much vapor. One study showed that with more volatile insecticides, little or no vapor drift was detected 9-27 meters downwind for insecticides with vapor pressures less than 1x10^{-4} mm Hg (Woodward et al. 1997). All of the herbicides covered by the EIS have very low vapor pressures (maximum is 4x10^{-6} mm Hg and they range to as low as 5.5x10^{-16} mm Hg; Vencill et al. 2002).

High, Moderate, and Low Risk in BLM and Forest Service Risk Assessments

The Risk Assessments attempt to measure both acute toxicity and chronic toxicity. Chronic toxicity is difficult to measure, especially in humans, but shows the results of sub-lethal doses that could result in cumulative deposits that could cause long-term problems in a vital body function. There is no standard measure for chronic toxicity.

BLM Ecological Risk Assessments

The BLM Ecological Risk Assessments established a Risk Quotient (RQ) for every herbicide and defined risk categories as follows:

0	No Risk	RQ < most conservative LOC for the species
L	Low Risk	RQ = 1 to 10 times the most conservative LOC for the species
M	Moderate Risk	RQ = 10 to 100 times the most conservative LOC for the species (generally equal to LOAEL to 10-times LOAEL)
H	High Risk	RQ > 100 times the most conservative LOC for the species

The RQ is calculated using the Estimated Exposure Concentration (EEC) and the Toxicity Reference Value (TRV). The EEC is the dose that an organism would be exposed to under the test scenario; e.g., *consumption* would indicate the amount of herbicide eaten on a sprayed material (a cow eating only sprayed grass for a day, for example), *direct spray* indicates that the organism was sprayed directly with a wand or was in a flight path (a non-target plant species, for example). The TRV is the toxicity of the herbicide – usually the LOAEL or NOAEL. The RQ is the EEC divided by the TRV. An uncertainty factor can be brought in if it is thought that a species (or a particular individual within the species) is particularly susceptible to herbicide use, or that the single dose does not represent long-term exposure.

For example, the TRV (the dose that can be consumed with a potentially adverse effect) for a mule deer consuming vegetation contaminated with bromacil is 170 milligrams per kilogram of body weight per day (a mule deer weighs an estimated 70 kg). Assuming a daily consumption rate of 6.2 kg of forage, all contaminated with bromacil sprayed at the typical application rate (4 lbs/acre), the EEC (the amount of herbicide that the mule deer will be exposed to by eating the contaminated vegetation) is 33.7 milligrams per kilograms of body weight per day. Therefore, the RQ is 33.7 mg/kg divided by 170 mg/kg, or 0.198, which is a risk category of 0 (or no risk).

Tank Mixes **-** The BLM evaluated risks from mixing two herbicides together in a tank mix. The BLM assumed that products in a tank mix act in an additive manner. Therefore, to simulate a tank mix of two herbicides RQs for those two herbicides were combined (see Appendix 8; diquat, fluridone, and tebuthiuron are not generally tank mixed by the BLM and were not included in the analysis). The application rates within the tank mix are not necessarily the same as those of each individual active ingredient applied alone. The percent of RQs exceeding LOCs for each of the ten BLM herbicide active ingredients was compared to the percent of RQs exceeding LOCs for tank mixes, to determine whether additional risks were predicted for tank mixes.

<u>BLM Human Health Risk Assessments</u>
The BLM Human Health Risk Assessments used the Aggregated Risk Index (ARI) and defined risk categories as follows:

0	No Risk	Majority of ARIs > 1
L	Low Risk	Majority of ARIs < 1 but > 0.1
M	Moderate Risk	Majority of ARIs < 0.1 but > 0.01
H	High Risk	Majority of ARIs < 0.01

The ARI is a formula for combining LOCs for all exposure avenues (oral, dermal, inhalation), each with different uncertainty factors, and comparing them with the exposure levels that would occur in the scenarios in the Risk Assessments. ARIs less than 1 indicate a concern from at least one of the exposure avenues (EPA 2001b:51-55).

<u>Forest Service Risk Assessments</u>
The Forest Service Risk Assessments are very similar to the BLM's. The Forest Service Risk Assessments established a Hazard Quotient (HQ) for every herbicide and established risk categories as follows:

0	No Risk	HQ < LOC for the species
L	Low Risk	HQ = 1 to 10 times the LOC[1] for the species
M	Moderate Risk	HQ = 10 to 100 times the LOC for the species
H	High Risk	HQ > 100 times the LOC for the species

The HQ is calculated using the Reference Dose (RfD) and the Toxicity Index (TI). The RfD is the dose that an organism would be exposed to under the test scenario; the TI is the toxicity of the herbicide and the HQ is the RfD divided by the TI. An uncertainty factor can be brought in if it is thought that a species (or a particular individual within the species) is particularly susceptible to herbicide use, or that the single dose does not represent long-term exposure.

[1] As noted in the previous discussion, LOCs are generally set at 1/10th of the LOAEL. Thus, an HQ of 1 to 10 times LOC is equivalent to an HQ of 0.1 to 1 in the 2005 Forest Service Invasive Plant EIS (USDA 2005a:4-73). The Forest Service EIS goes on to explain "The threshold is intended to help reviewers distinguish moderate risks (HQ=2 to 10 [HQ = 20-100 in this EIS]), which could in most cases be mitigated through exposure-reducing project design criteria from significant health risks (HQ>10 [HQ>100 in this EIS]) that could be difficult to mitigate if Worst-Case situations occur at the project level. For specific situations where a HQ>10 [HQ>100 in this EIS] is identified, the specific physiologic effect and the relationship between the NOAEL and the LOAEL may be evaluated to more precisely determine whether a toxic effect is actually likely to occur (Durkin, personal communication)." (USDA 2005a:4-73).

Figure 3-1 shows the basis for Risk Assessments, which consists of the following parts:

- *Hazard Identification*: what are the dangers inherent with the herbicide? (e.g., endocrine disruption, cancer causing, etc.)
- *Exposure Assessment*: who could come into contact and how much? (specific exposure scenarios)
- *Dose Response Assessment*: how much is too much? At what dose are observable effects observed?
- *Risk Characterization*: indicates whether or not there is a plausible basis for concern (HQ or RQ).

FIGURE 3-1. BASIS FOR RISK ASSESSMENTS

Stated another way, the lower range for the L, or low, risk category is theoretically the level at which an effect began to be discernable in testing or modeling (theoretically, because uncertainty factors have the effect of reducing the dose identified as having the adverse effect). The minimum identified effect may have been skin or eye irritation, leaf damage, and so forth. Uncertainty factors are added to address hypersensitive individuals, or accommodate uncertainties in the measurements, such as inferring effects to one species based on actual tests on other species. Uncertainty factors are typically multiples of 10, so the assumed Lowest Observable Effects (LOAEL) dose could have been inflated 10, 100, or even 1,000 times for uncertainties. Thus, exposure of the average individual to the dose identified as having an effect probably would not. Nevertheless, the L or low rating indicates risks start at that point. Moderate risk categories indicate risk starts at doses one-tenth those of the low ratings; high is one-hundredth of the testing scenario dose. Testing scenarios are severe – e.g., soaking the test animal – so Standard Operating Procedures and PEIS Mitigation Measures such as buffers, wind speed limits, and so forth, as well as required safety equipment, limit exposure to substantially less than tested doses. For herbicides with moderate and high risk categories for a particular receptor, special cautions are implemented. For example, buffers for Special Status plant species are as large as 1,500 feet for some herbicides (Table A2-1). The low, moderate, or high human health risk categories shown on Tables 3-16 through 3-21 are more conservative than the EPA ratings used to apply the Caution, Warning, or Danger/Poison signal words to herbicide labels.

The Risk Assessments are summarized on tables showing herbicide risk categories at maximum and typical application rates to vegetation, wildlife, and humans, in a variety of application scenarios. Tables 3-12 and 3-13 show herbicide risks to vegetation, from BLM and Forest Service Risk Assessments respectively. Tables 3-14 and 3-15 show herbicide risks to wildlife, fish, and aquatic invertebrates. Tables 3-16 and 3-17 show the risks to human health (worker and public, respectively) from herbicides analyzed with the PEIS. Table 3-18 and 3-19 show worker and public exposure scenarios for Forest Service-evaluated herbicides, and Tables 3-20 and 3-21 reflect the 1991 BLM risk categories for the remaining worker and public human health scenarios. Further information about the Human Health Risk Assessments can be found in the *Human Health and Safety* section of Chapter 4.

Uncertainty in the Risk Assessment Process

The Risk Assessments conducted by the BLM and Forest Service incorporate various conservative assumptions to compensate for uncertainties in the risk assessment process. Within any of the steps of the human health risk evaluation process, assumptions were made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk evaluation process. Regulatory risk evaluation methodology requires that conservative assumptions be made throughout the risk assessment process to ensure that public health is protected. This conservatism, both in estimating exposures and in setting toxicity levels likely led to an exaggeration of the real risks of the vegetation management program to err on the side of protecting human health and other species.

Cumulative effects of long-term use of herbicides may have different outcomes than risk assessments can anticipate. Although identification of adverse effects from chronic exposures is one of the parameters examined in the risk assessment process, it is possible there are long-term sub-lethal effects on reproductive or migratory behavior from low concentrations of herbicides or additives that are not documented in the Risk Assessments.

See additional information about uncertainty near the end of Appendix 13.

Use of the Individual Risk Assessment Tools During Implementation

As noted in Appendix 2, site-specific analysis or Individual Risk Assessment Tools (IRATs) can be used to determine alternative ways to meet PEIS Mitigation Measure objectives. IRATs are one tool to assist in translating risks to project design parameters. IRATs are currently being developed for the BLM Risk Assessments, and are scheduled for completion in 2012. The IRATs create the ability to do project-specific risk assessments. Individual project parameters (information about herbicide application, workers, fish and wildlife, and native vegetation), can be input into the IRATs, which then calculate RQs and HQs. The IRATs isolate the computations from the discussions of the computations, and are intended as a tool to make risk assessment calculations easier to understand and review, allowing for more project specific mitigation measures.

Toxicity Comparison with Household Products

It might help to put toxicity and risk in perspective to consider them in the context of risks associated with common household products. Herbicides are any agent used to kill plants or inhibit their growth. As such, they are designed to target highly specific biological or biochemical processes within plants, such as photosynthesis and production of branch-chain amino acids. Mammals (humans included) do not photosynthesize or produce branch-chain amino acids, so materials that target photosynthesis or branch-chain amino acid production have no place to bind in mammals. With no place to work, they are often excreted in urine within 24 hours of the exposure. This flushing of the herbicide does not allow concentrations to build up within the body to toxic levels. For these reasons, herbicides often have higher LD_{50} values than many commonly used or consumed products (Table 3-11) (Fishel et al. 2009).

Table 3-11. Comparison of oral LD_{50} values[1] for commonly used herbicides and consumer goods.

Chemical	LD_{50}
Nicotine	9
Caffeine	192
Bleach	192
Tylenol	338
Household ammonia (10%)	350
Codeine	427
Diquat	500-5,000
Triclopyr	600-1,000
Tebuthiuron	644
2,4-D	700
Hexazinone	1,000
Glyphosate	2,000-6,000
Dicamba	2,700
Table salt	3,000
Picloram	3,000-5,000
Diuron	3,750
Bromacil	4,000
Clopyralid	4,700
Diflufenzopyr	>5,000
Imazapic	>5,000
Imazapyr	>5,000
Metsulfuron methyl	>5,000
Chlorsulfuron	6,000
Fluridone	>10,000
Alcohol	10,300
Vitamin C	11,900
Baking Soda	14,220
Sulfometuron methyl	>17,000
Water	80,000

[1] LD_{50} calculated on rats, as milligrams of substance per kilogram of body mass.

Methodology for Assessing Effects

This analysis is tiered to, and borrows analysis from, the 2007 *Final Vegetation Treatments Using Herbicides of BLM Lands in 17 Western States Programmatic Environmental Impact*

Statement (PEIS). In addition, information was used from the Risk Assessments (see earlier in this Chapter, Appendix 8, and Tables 3-12 through 3-21), the 2005 Forest Service *Pacific Northwest Region Invasive Plant Program* EIS (USDA 2005a), and other sources cited throughout the document. Effects consider implementation of BLM policy, Standard Operating Procedures, and PEIS Mitigation Measures. Effects in Chapter 4 consider the effects of:

- contact or ingestion of an herbicide;
- invasive plants; and,
- non-herbicide treatments.

Standard Operating Procedures, PEIS Mitigation Measures, Risk, and the Potential for Adverse Effects

The BLM has a long history with herbicides. As a result, numerous handbooks and other policy materials have been developed governing the use of these herbicides. For the PEIS, direction from these policies was gathered and labeled as Standard Operating Procedures (see Appendix 2). While the risks listed in Tables 3-12 through 3-21 (and discussed in Chapter 4) are for unprotected exposures described in the Risk Assessments, effects conclusions for each resource described in the PEIS and this EIS are predicated on application of the Standard Operating Procedures or that a site-specific determination is made that their application is unnecessary to achieve their intended purpose and protection.

The PEIS examined (and the Record of Decision selected) an alternative using 18 herbicides for a full range of vegetation treatment objectives in the 17 western states. CEQ regulations require an EIS to identify mitigation measures for all identified adverse effects, if they are available. The various resource sections in the PEIS all identify various levels of risk or adverse effects, and each section identified one or more mitigation measures. These were in addition to the Standard Operating Procedures. The Record of Decision for the PEIS adopted *all* of these mitigation measures. Like the Standard Operating Procedures, the PEIS Mitigation Measures are included in Appendix 2 and apply to all alternatives in this EIS. Since the alternatives in this EIS are subsets of the alternative selected by the Record of Decision for the PEIS, and all adverse effects identified by the PEIS were mitigated where practicable, there should be few or no adverse effects expected from implementation of any of the action alternatives in this EIS. That is essentially what the effects examination confirms. Most of the “effects” discussions in this EIS for the use of herbicides are, for the most part, identifications of risks identified by the Risk Assessments and other literature without Standard Operating Procedures and PEIS Mitigation Measures applied.

The *potential* for adverse effects from the use of herbicides are, in many of the resource sections in Chapter 4, expressed as zero or no, low, moderate, and high *risk*. These are quantified terms (see *Risk Assessments* earlier in this Chapter) summarizing the results of scenarios modeled by the Risk Assessments and summarized on Tables 3-12 through 3-21. Where Risk Assessment scenarios resulted in a moderate or high risk, that risk is reported in Chapter 4 as a *potential adverse effect*, or *risk*. It is important to understand, however, that such risks almost always generated corresponding PEIS Mitigation Measures during the PEIS process (if there were not already Standard Operating Procedures designed to avoid the adverse effects). Therefore, most of the *potential* for adverse effects (or *risks*) discussed in Chapter 4 are followed by the conclusion that implementation of the Standard Operating Procedures, PEIS Mitigation Measures, and site-specific analysis (during which the Risk Assessments or Individual Risk Assessment Tools will be specifically consulted) should make the likelihood of actual adverse effects negligible, *de minimus*, or at worst “minimized”. Additional Conservation Measures in Appendix 5 apply to Federally Listed and proposed species and critical habitat.

Occasionally the resource sections will use unquantified comparison terms such as less than, slightly, lower, and greater. These are typically relative statements *within* the Risk Assessment-defined terms of low, moderate, and high.

Table 3-12. BLM-Evaluated Herbicide Risk Categories for Vegetation

Application Scenario	BROM[1] Typ[2]	BROM[1] Max[2]	CHLOR[1] Typ	CHLOR[1] Max	DIQUAT Typ	DIQUAT Max	DIURON Typ	DIURON Max	FLUR[1] Typ	FLUR[1] Max	IMAZ[1] Typ	IMAZ[1] Max	OVER[1] Typ	OVER[1] Max	SULFM[1] Typ	SULFM[1] Max	TEBU[1] Typ	TEBU[1] Max
Direct Spray																		
Terrestrial plants	H[3] [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	M [1:1]	H [1:1]	NE	NE	L [1:1]	M [1:1]	M [1:1]	H [1:1]	0 [1:1]	L [1:1]	M [1:1]	H [1:1]
Special status terrestrial plants	H [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	NE	NE	L [1:1]	M [1:1]	H [1:1]	H [1:1]	H [1:1]	H [1:1]	M [1:1]	H [1:1]
Aquatic plants pond	H [1:2]	H [2:2]	M [1:2]	M [2:2]	H [2:2]	H [2:2]	H [2:2]	H [2:2]	0 [2:2]	0 [2:2]	L [1:2]	L [2:2]	M [1:2]	M [1:2]	H [2:2]	H [2:2]	L [2:2]	M [2:2]
Aquatic plants stream	H [2:2]	H [2:2]	M [2:2]	M [2:2]	H [2:2]	H [2:2]	H [2:2]	H [2:2]	0 [2:2]	0 [2:2]	L [2:2]	M [2:2]	M [1:2]	H [1:2]	H [2:2]	H [2:2]	M [1:2]	H [1:2]
Accidental Spill to a Pond																		
Aquatic plants pond	NE	H [1:1]	NE	H [1:2]	NE	H [2:2]	NE	H [1:1]	NE	L [2:2]	NE	H [2:2]	NE	M [1:1]	NE	H [2:2]	NE	H [2:2]
Off-Site Drift																		
Terrestrial plants	M [3:6]	M [3:6]	M [5:12]	M [8:12]	L [7:12]	M [7:12]	0 [5:6]	L [4:6]	NE	NE	0 [18:18]	0 [13:18]	0 [5:6]	0 [4:6]	0 [12:12]	0 [12:12]	0 [6:6]	0 [4:6]
Special status terrestrial plants	M [3:6]	H [3:6]	M [7:12]	M [7:12]	M [7:12]	M [7:12]	M [3:6]	H [3:6]	NE	NE	0 [17:18]	0 [13:18]	L [3:6]	L [4:6]	H [5:12]	H [8:12]	0 [5:6]	L [3:6]
Aquatic plants pond	0 [9:12]	L [7:12]	0 [24:24]	0 [24:24]	NE	NE	L [8:12]	M [6:12]	NE	NE	0 [36:36]	0 [34:36]	0 [12:12]	0 [12:12]	L [13:24]	L [12:24]	0 [12:12]	0 [12:12]
Aquatic plants stream	0 [8:12]	L [6:12]	0 [24:24]	0 [22:24]	NE	NE	L [6:12]	M [6:12]	NE	NE	0 [36:36]	0 [33:36]	0 [8:12]	0 [6:12]	L [14:24]	L [10:24]	0 [12:12]	0 [12:12]
Surface Runoff																		
Terrestrial plants	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	NE	NE	0 [42:42]	0 [42:42]	NE	NE	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]
Special status terrestrial plants	0 [39:42]	0 [38:42]	0 [42:42]	0 [42:42]	NE	NE	0 [38:42]	0 [34:42]	NE	NE	0 [42:42]	0 [42:42]	0 [34:42]	0 [33:42]	0 [32:42]	0 [28:42]	0 [38:42]	0 [34:42]
Aquatic plants pond	M [70:84]	H [45:84]	0 [64:84]	0 [53:84]	NE	NE	M [50:84]	H [64:84]	NE	NE	0 [80:84]	0 [62:84]	0 [70:84]	0 [67:84]	L [42:84]	L [38:84]	0 [65:84]	L [55:84]
Aquatic plants stream	0 [45:84]	L [55:84]	0 [80:84]	0 [77:84]	NE	NE	L [35:84]	L [39:84]	NE	NE	0 [84:84]	0 [83:84]	0 [84:84]	0 [84:84]	0 [69:84]	0 [60:84]	0 [84:84]	0 [74:84]
Wind Erosion																		
Terrestrial plants	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	NE	NE	0 [9:9]	0 [9:9]	NE	NE	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]
Special status terrestrial plants	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	NE	NE	0 [9:9]	0 [9:9]	NE	NE	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]	0 [9:9]
Aquatic plants pond	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Aquatic plants stream	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] BROM = Bromacil; CHLOR = Chlorsulfuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = (Diflufenzopyr + dicamba) Overdrive®; SULFM = Sulfometuron methyl; and TEBU = Tebuthiuron.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] Risk categories: = 0 = No risk (majority of RQs < most conservative LOC for non Special Status species); L = Low risk (majority of RQs 1-10x most conservative LOC for non Special Status species); M = Moderate risk (majority of RQs 10-100x most conservative LOC for non Special Status species); H = High risk (majority of RQs >100 most conservative LOC for non Special Status species); and NE = Not evaluated. The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. See more information at the risk tables in Chapter 4 of the Ecological Risk Assessments (ENSR 2005b-k) to determine the specific scenarios that result in the displayed level of risk for a given receptor group. The number in brackets represents the number of RQs in the indicated risk category: number of scenarios evaluated.

Table 3-13. FS-Evaluated Herbicide Risk Categories for Vegetation

	2,4-D		Dicamba		Clopyralid		Glyphosate[1]		Hexazinone		Imazapyr		Metsulfuron		Picloram		Triclopyr[1]	
	Typ[2]	Max[4]	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max
Terrestrial Plants																		
Direct spray, susceptible plants	H[3]	H	H	H	H	H	M	H	H	H	H	H	H	H	H	H	H	H
Direct spray, tolerant plants	L	L	0	0	0	L	L	M	M	M	M	M	L	M	L	M	NE	NE
Off-site drift, low boom, susceptible plants	0 [4:6]	L [3:6]	L [3:6]	H [3:6]	L [4:6]	L [3:6]	0 [5:6]	L [3:6]	L [3:6]	L [3:6]	L [4:6]	M [3:6]	L [4:6]	M [4:6]	M [3:6]	M [4:6]	L [3:6]	M [3:6]
Off-site drift, low boom, tolerant plants	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [5:6]	0 [6:6]	0 [5:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	NE	NE
Off-site drift, aerial, susceptible plants	0 [3:6]	M [3:6]	M [3:6]	H [3:6]	H [2:6]	M [2:6]	L [3:6]	M [2:6]	M [3:6]	M [2:6]	M [2:6]	H [2:6]	M [2:6]	H [2:6]	L [3:6]	M [3:6]	M [2:6]	H [2:6]
Off-site drift, aerial, tolerant plants	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [6:6]	0 [5:6]	0 [4:6]	L [3:6]	0 [4:6]	0 [3:6]	0 [5:6]	0 [4:6]	0 [6:6]	0 [5:6]	NE	NE
Surface runoff, susceptible plants	0 [22:30]	0 [18:30]	0 [22:30]	0 [22:30]	0 [23:30]	0 [23:30]	0 [30:30]	0 [30:30]	0 [18:30]	0 [17:30]	0 [18:30]	0 [18:30]	0 [21:30]	0 [18:30]	0 [21:30]	0 [22:30]	M [13:30]	H [13:30]
Surface runoff, tolerant plants	0 [30:30]	0 [30:30]	0 [30:30]	0 [30:30]	0 [30:30]	0 [30:30]	0 [30:30]	0 [30:30]	0 [22:30]	0 [22:30]	0 [30:30]	0 [30:30]	0 [25:30]	0 [22:30]	0 [30:30]	0 [27:30]	NE	NE
Aquatic Plants																		
Accidental spill, susceptible macrophytes	L	M	NE	NE	H	H	M	M	H	H	H	H	H	H	0	0	H	H
Accidental spill, susceptible algae	H	H	H	H	L	L	NE	NE	H	H	M	H	M	H	M	M	H	H
Accidental spill, tolerant algae	L	M	0	L	0	0	NE	NE	H	H	0	0	L	M	0	0	NE	NE
Acute exposure, susceptible macrophytes	0	0	NE	NE	0	0	0	0	M	H	L	L	L	L	0	L	L	M
Acute exposure, susceptible algae	L	M	0	L	0	0	NE	NE	H	H	0	0	0	0	0	0	NE	NE
Acute exposure, tolerant algae	0	0	0	0	0	0	NE	NE	L	M	0	0	0	0	0	0	NE	NE
Chronic exposure, susceptible macrophytes	L	L	NE	NE	0	0	0	0	M	M	0	0	0	0	0	0	0	L
Chronic exposure, susceptible algae	M	M	0	0	0	0	NE	NE	M	M	0	0	0	0	0	0	NE	NE
Chronic exposure, tolerant algae	0	0	0	0	0	0	NE	NE	0	L	0	0	0	0	0	0	NE	NE

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Risk categories for the more toxic formulations are presented here.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] 0 = No risk (HQ < LOC); L = Low risk (HQ = 1 to 10 x LOC); M = Moderate Risk (HQ = 10 to 100 x LOC); H = High risk (HQ > 100 LOC); and NE = Not evaluated. Risk categories are based on upper estimates of hazard quotients and the LOC of 1.0. If more than one scenario is involved in an exposure pathway (i.e., off-site drift and surface runoff), then the number of scenarios with the given risk category (out of the total number of evaluated scenarios) is displayed in parentheses. The reported risk category is that of the majority of the HQs for all the scenarios. As a result, risk may be higher than the reported risk category for some scenarios within each category. For more information, see the individual Forest Service Risk Assessments.

[4] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

Table 3-14. BLM-Evaluated Herbicide Risk Categories for Wildlife, Fish, and Aquatic Species

Application Scenario	BROM[1]		CHLOR[1]		DIQUAT		DIURON		FLUR[1]		IMAZ[1]		OVER[1]		SULFM[1]		TEBU[1]	
	Typ[2]	Max[2]	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max
Direct Spray																		
Non Special Status species																		
Small mammal – 100% absorption	0[3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pollinating insect – 100% absorption	L	L	0	0	L	L	L	M	0	0	0	0	0	0	0	0	0	0
Small mammal – 1st order dermal absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish pond	L	L	0	0	L	L	M	M	0	0	0	0	0	0	0	0	0	0
Fish stream	L	M	0	0	L	M	H	H	0	L	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	M	H	M	H	0	L	0	0	0	0	0	0	0	L
Aquatic invertebrates stream	0	L	0	0	H	H	M	H	0	L	0	0	0	0	0	0	L	M
Special Status species																		
Small mammal – 100% absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pollinating insect – 100% absorption	L	L	0	0	L	M	L	M	0	0	0	0	0	0	0	0	L	M
Small mammal – 1st order dermal absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish pond	L	L	0	0	L	H	M	H	0	M	0	0	0	0	0	0	0	0
Fish stream	M	M	0	0	M	M	H	H	0	L	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	M	H	M	M	0	H	0	0	0	0	0	0	L	L
Aquatic invertebrates stream	0	L	0	0	H	H	M	H	0	L	0	0	0	0	0	0	L	M
Indirect Contact with Foliage After Direct Spray																		
Non Special Status species																		
Small mammal – 100% absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	L
Small mammal – 1st order dermal absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Special Status species																		
Small mammal – 100% absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	L	0	L	0	0	0	0	0	0	0	0	0	L
Small mammal – 1st order dermal absorption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ingestion of Food Items Contaminated by Direct Spray																		
Non Special Status species																		
Small mammalian herbivore – acute	0	L	0	0	0	L	0	L	0	0	0	0	0	0	0	0	0	0
Small mammalian herbivore – chronic	0	L	0	0	L	M	L	M	0	0	0	0	0	0	0	0	0	L
Large mammalian herbivore – acute	0	L	0	0	0	M	0	L	0	0	0	0	0	0	0	0	0	L
Large mammalian herbivore – chronic	L	M	0	0	L	M	M	H	0	0	0	0	L	M	0	0	0	L
Small avian insectivore – acute	0	0	0	0	0	M	0	L	0	0	0	0	0	0	0	0	0	L
Small avian insectivore – chronic	0	0	0	0	0	M	0	L	0	0	0	0	0	0	0	0	0	0
Large avian herbivore – acute	0	0	0	0	0	L	0	L	0	0	0	0	0	0	0	0	0	0
Large avian herbivore – chronic	0	L	0	0	L	H	0	M	0	0	0	0	0	0	0	0	0	0
Large mammalian carnivore – acute	0	L	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0
Large mammalian carnivore – chronic	0	0	0	0	0	0	L	L	0	0	0	0	0	0	0	0	0	0
Special Status species																		
Small mammalian herbivore – acute	0	L	0	0	0	L	0	L	0	0	0	0	0	0	0	0	0	M
Small mammalian herbivore – chronic	0	L	0	0	L	M	L	M	0	L	0	0	0	0	0	0	0	L
Large mammalian herbivore – acute	0	M	0	0	L	M	0	M	0	0	0	0	0	0	0	0	0	L
Large mammalian herbivore – chronic	L	M	0	0	L	M	M	H	0	0	0	0	L	M	0	0	0	L
Small avian insectivore – acute	0	0	0	0	L	M	0	L	0	0	0	0	0	0	0	0	0	0
Small avian insectivore – chronic	0	0	0	0	0	M	0	L	0	0	0	0	0	0	0	0	0	0

Application Scenario	BROM[1]		CHLOR[1]		DIQUAT		DIURON		FLUR[1]		IMAZ[1]		OVER[1]		SULFM[1]		TEBU[1]	
	Typ[2]	Max[2]	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max
Large avian herbivore – acute	0	L	0	0	0	M	0	M	0	0	0	0	0	0	0	0	0	L
Large avian herbivore – chronic	0	L	0	0	L	H	0	M	0	0	0	0	0	0	0	0	0	0
Large mammalian carnivore – acute	0	L	0	0	0	L	0	L	0	0	0	0	0	0	0	0	0	0
Large mammalian carnivore – chronic	0	0	0	0	0	0	L	L	0	0	0	0	0	0	0	0	0	0
Accidental Spill to Pond																		
Non Special Status species																		
Fish pond	NE	M	NE	0	NE	H	NE	H	NE	M	NE	0	NE	0	NE	0	NE	L
Aquatic invertebrates pond	NE	L	NE	0	NE	H	NE	H	NE	H	NE	0	NE	0	NE	0	NE	L
Special Status species																		
Fish pond	NE	M	NE	0	NE	H	NE	H	NE	M	NE	0	NE	0	NE	0	NE	M
Aquatic invertebrates pond	NE	M	NE	0	NE	H	NE	H	NE	H	NE	0	NE	0	NE	0	NE	L
Off-Site Drift																		
Non Special Status species																		
Fish pond	L	L	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Fish stream	L	M	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates stream	0	L	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Special Status species																		
Fish pond	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Fish stream	0	M	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates stream	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Surface Runoff																		
Non Special Status species																		
Fish pond	0	0	0	0	NE	NE	0	L	NE	NE	0	0	0	0	0	0	0	0
Fish stream	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates stream	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Special Status species																		
Fish pond	0	0	0	0	NE	NE	0	L	NE	NE	0	0	0	0	0	0	0	0
Fish stream	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates pond	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0
Aquatic invertebrates stream	0	0	0	0	NE	NE	0	0	NE	NE	0	0	0	0	0	0	0	0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] BROM = Bromacil; CHLOR = Chlorsulfuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = (Diflufenzopyr + dicamba) Overdrive®; SULFM = Sulfometuron methyl; and TEBU = Tebuthiuron.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] Risk categories: 0 = No risk (majority of RQs < most conservative LOC for non Special Status species); L = Low risk (majority of RQs 1-10x most conservative LOC for non Special Status species); M = Moderate risk (majority of RQs 10-100x most conservative LOC for non Special Status species); H = High risk (majority of RQs >100 most conservative LOC for non Special Status species); and NE = Not evaluated.

The risk category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. See the risk tables in Chapter 4 of the Ecological Risk Assessments (ENSR 2005b-k) to determine the specific scenarios that result in the displayed level of risk for a given receptor group.

Table 3-15. FS-Evaluated Herbicide Risk Categories for Wildlife, Fish, and Aquatic Species

	2,4-D		Dicamba		Clopyralid		Glyphosate[2]		Hexazinone		Imazapyr		Metsulfuron Methyl		Picloram[3]		Triclopyr[4]	
Application Scenario	**Typ[5]**	**Max[1]**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**	**Typ**	**Max**
Acute/Accidental Exposures																		
Direct spray, small mammal, 1st order absorption	0[6]	L	0	O	0	0	0	0	0	0	0	0	0	0	0	0	L	M
Direct spray, small animal, 100% absorption	L	M	L	M	L	L	L	M	L	L	0	L	0	L	L	L	L	M
Direct spray, bee, 100% absorption	L	L	NE	NE	0	0	L	M	L	L	0	L	0	0	0	L	L	M
Consumption of contaminated fruit, small mammal	L	L	0	L	0	0	0	L	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated grass, large mammal	M	M	L	M	0	L	L	M	L	L	0	L	0	L	L	M	L	M
Consumption of contaminated grass, large bird	L	L	L	M	0	0	L	L	L	L	0	L	0	0	0	0	L	M
Consumption of contaminated water, small mammal, spill	L	L	0	L	0	0	0	L	0	0	0	0	0	0	0	0	0	L
Consumption of contaminated water, small mammal, stream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated insects, small mammal	M	H	L	M	L	L	L	M	L	L	0	L	0	L	L	M	L	M
Consumption of contaminated insects, small bird	L	M	L	M	0	0	L	M	L	L	L	L	0	0	0	0	L	M
Consumption of contaminated small mammal, predatory mammal	M	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
Consumption of contaminated small mammal, predatory bird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish, predatory bird, spill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish (susceptible species) – accidental spill	H	H	0	L	L	L	H	H	L	L	M	H	0	L	H	H	L/H	M/H
Fish (tolerant species) – accidental spill	M	M	0	0	0	0	H	H	0	L	0	L	0	0	L	L	NE/NE	NE/NE
Fish (susceptible species) – acute exposure, peak EEC	M	M	0	0	0	0	M	M	0	0	0	0	0	0	L	L	0/M	0/H
Fish (tolerant species) – acute exposure, peak EEC	0	0	0	0	0	0	L	M	0	0	0	0	0	0	0	0	NE/NE	NE/NE

Aquatic Invertebrates – accidental spill	L	M	L	M	L	M	M	H	L	L	0	L	0	0	L	M	L/M	H/H
Aquatic Invertebrates – acute exposure, peak EEC	0	0	0	0	0	0	L	L	0	0	0	0	0	0	0	0	0/L	0/M
Chronic Exposures																		
Consumption of contaminated vegetation, small mammal, on- site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated vegetation, small mammal, off- site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated vegetation, large mammal, on- site	L	L	0	0	0	0	0	L	L	M	0	0	0	0	0	0	L	M
Consumption of contaminated vegetation, large mammal, off -site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
Consumption of contaminated vegetation, large bird, on-site	0	0	0	0	0	L	0	L	0	0	0	0	0	0	0	L	L	M
Consumption of contaminated vegetation, large bird, off-site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated water, small mammal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish, predatory bird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish – chronic exposure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/0	0/0
Aquatic invertebrates – chronic exposure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/0	0/0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

[2] Risk levels for the more toxic glyphosate formulation are presented here.

[3] Susceptible and tolerant aquatic invertebrates were evaluated for picloram. Information is presented for susceptible aquatic invertebrates.

[4] Fist value is for triclopyr acid formulation (TEA) and second value is for triclopyr butoxythel formulation (BEE).

[5] Typ = typical application rate; and Max = maximum application rate.

[6] Risk categories: 0 = No risk (HQ < LOC); L = Low risk (HQ = 1 to 10 x LOC); M = Moderate risk (HQ = 10 to 100 x LOC); H = High risk (HQ > 100 LOC); and NE = Not evaluated. Risk categories are based on upper estimates of hazard quotients and the BLM LOCs of 0.1 for acute scenarios and 1.0 for chronic scenarios. The reader should consult the text of this section of the individual Forest Service Risk Assessments to evaluate risks at central estimates of hazard quotients.

Fish susceptible species include coldwater fish, such as trout, salmon, and Federally Listed species. Fish tolerant species include warm water fish, such as fathead minnows.

Table 3-16. BLM-Evaluated Herbicide Risk Categories for Workers

Receptor	Diflufenzopyr			Diquat			Fluridone			Imazapic			Sulfometuron Methyl		
	Typ[1]	Max	Accid	Typ	Max	Accid	Typ	Max	Accid[2]	Typ	Max	Accid	Typ	Max	Accid
Plane - pilot	NE[3]	NE	NE	L	M	H	0	0	L-H	0	0	NE	0	0	NE
Plane - mixer/loader	NE	NE	NE	M	H	H	0	L	L-H	0	0	NE	0	0	NE
Helicopter - pilot	NE	NE	NE	L	M	H	0	0	L-H	0	0	NE	0	0	NE
Helicopter - mixer/loader	NE	NE	NE	M	H	H	0	L	L-H	0	0	NE	0	0	NE
Human/backpack - applicator/mixer/loader	0	0	NE	L	M	H	0	0	L-H	0	0	NE	0	0	NE
Human/horseback - applicator	0	0	NE	L	L	H	0	0	L-H	0	0	NE	0	0	NE
Human/horseback - mixer/ loader	0	0	NE	0	L	H	0	0	L-H	0	0	NE	0	0	NE
Human/horseback - applicator/mixer/loader	0	0	NE	L	M	H	0	0	L-H	0	0	NE	0	0	NE
ATV - applicator[4]	0	0	NE	0	L	H	0	0	L-H	0	0	NE	0	0	NE
ATV - mixer/loader	0	0	NE	0	L	H	0	0	L-H	0	0	NE	0	0	NE
ATV - applicator/mixer/ loader	0	0	NE	0	L	H	0	0	L-H	0	0	NE	0	0	NE
Truck - applicator[4]	0	0	NE	0	M	H	0	0	L-H	0	0	NE	0	0	NE
Truck - mixer/loader	0	0	NE	0	L	H	0	0	L-H	0	0	NE	0	0	NE
Truck - applicator/mixer/ loader	0	0	NE	0	M	H	0	0	L-H	0	0	NE	0	0	NE
Boat - applicator	NE	NE	NE	0	0	H	0	0	L-H	NE	NE	NE	NE	NE	NE
Boat - mixer/loader	NE	NE	NE	0	0	H	0	0	L-H	NE	NE	NE	NE	NE	NE
Boat - applicator/mixer/ loader	NE	NE	NE	0	0	H	0	0	L-H	NE	NE	NE	NE	NE	NE

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.

[2] For all worker receptors accidentally exposed to fluridone, there is low risk from exposure to solutions mixed with water to the typical application rate, moderate risk from exposure to solutions mixed with water to the maximum application rate, and high risk from exposure to concentrated solutions (prior to mixing with water).

[3] Risk categories: 0 = No risk (majority of ARIs > 1); L = Low risk (majority of ARIs >1 but < 0.1); M = Moderate risk (majority of ARIs > 0.1 but < 0.01); H = High risk (majority of ARIs < 0.01); and NE = Not evaluated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See the *Vegetation Treatments Programmatic EIS Human Health Risk Assessment Final Report* (ENSR 2005l) for the range of risk levels for each scenario.

[4] ATV and Truck categories include spot and boom/broadcast application scenarios.

TABLE 3-17. BLM-EVALUATED HERBICIDE RISK CATEGORIES FOR THE PUBLIC

Receptor	Diflufenzopyr			Diquat			Fluridone			Imazapic			Sulfometuron Methyl		
	Typ[1]	Max	Accid	Typ	Max	Accid	Typ	Max	Accid	Typ	Max	Accid	Typ	Max	Accid
Hiker/hunter (adult)	0[2]	0	0	0	L	L	0	0	0	NE	NE	NE	NE	NE	NE
Berry picker (child)	0	0	0	0	L	L	0	0	L	NE	NE	NE	NE	NE	NE
Berry picker (adult)	0	0	0	0	L	L	0	0	0	NE	NE	NE	NE	NE	NE
Angler (adult)	0	0	0	0	L	L	0	0	0	NE	NE	NE	NE	NE	NE
Residential – contaminated water (child)	0	0	0	L	L	M	0	0	L	NE	NE	NE	NE	NE	NE
Residential – contaminated water (adult)	0	0	0	0	L	M	0	0	L	NE	NE	NE	NE	NE	NE
Native American (child)	0	0	0	0	L	L	0	0	0	0	0	0	0	0	0
Native American (adult)	0	0	0	0	L	L	0	0	0	0	0	0	0	0	0
Swimmer (child)	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0
Swimmer (adult)	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.

[2] Risk categories: 0 = No risk (majority of ARIs > 1); L = Low risk (majority of ARIs >1 but < 0.1); M = Moderate risk (majority of ARIs > 0.1 but < 0.01); H = High risk (majority of ARIs < 0.01); and NE = Not evaluated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See the *Vegetation Treatments Programmatic EIS Human Health Risk Assessment Final Report* (ENSR 2005l) for the range of risk levels for each scenario.

Table 3-18. FS-Evaluated Herbicide Risk Categories for Workers

Treatment Method	Risk Categories																			
	2,4-D[1]		Dicamba		Chlorsulfuron		Clopyralid		Glyphosate		Hexazinone		Imazapyr		Metsulfuron Methyl		Picloram		Triclopyr[1]	
	Typ[2]	Max[4]	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max
General Exposures																				
Directed foliar and spot treatments (backpack)	L[3]	M	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	L
Broadcast ground spray (boom spray)	L	M	0	L	0	L	0	0	0	0	0	L	0	0	0	0	0	0	0	L
Aerial applications (pilots and mixer/ loaders)	L	M	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	L
Accidental/Incidental Exposures																				
Wearing contaminated gloves, 1 minute	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wearing contaminated gloves, 1 hour	M	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
Spill on hands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spill on lower legs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Where different formulations exist, risks reported are the most conservative.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] Risk categories: 0 = No risk (majority of HQs < 1); L = Low risk (majority of HQs >1 but < 10); M = Moderate risk (majority of HQs > 10 but < 100); H = High risk (majority of HQs > 100); and NE = Not evaluated. Risk categories are based on central HQ estimates. To determine risk for lower or upper HQ estimates, see the individual herbicide Risk Assessments (SERA 2005b). Risk categories are based on comparison to the HQ of 1 for typical and maximum application rates.

[4] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

TABLE 3-19. FS-EVALUATED HERBICIDE RISK CATEGORIES FOR THE PUBLIC

Treatment Method	Hazard Quotient																			
	2,4-D[1]		Dicamba		Chlorsulfuron		Clopyralid		Glyphosate		Hexazinone		Imazapyr		Metsulfuron		Picloram		Triclopyr[1]	
	Typ[2]	Max[4]	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max
Acute/Accidental Exposures																				
Direct spray - child, entire body	0[3]	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
Direct spray - woman, lower legs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	M
Dermal - contaminated vegetation, woman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L
Consumption of contaminated fruit	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L
Consumption of contaminated water - pond, spill	M	M	0	L	0	0	0	0	0	L	0	0	0	0	0	0	0	L	0	L
Consumption of contaminated water - stream, ambient	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish - general public	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish - subsistence populations	L	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chronic/Longer-term Exposures																				
Consumption of contaminated fruit	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish - general public	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumption of contaminated fish - subsistence populations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Where different formulations exist, risks reported are the most conservative.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] Risk categories: 0 = No risk (majority of HQs < 1); L = Low risk (majority of HQs >1 but < 10); M = Moderate risk (majority of HQs > 10 but < 100); H = High risk (majority of HQs > 100); and NE = Not evaluated. Risk categories are based on central HQ estimates. To determine risk for lower or upper HQ estimates, see the individual herbicide Risk Assessments (SERA 2005b). Risk categories are based on comparison to the HQ of 1 for typical and maximum application rates.

[4] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

Table 3-20. BLM 1991-Evaluated Herbicide High Risk Scenarios for Workers

Treatment Method	Bromacil			Diuron			Tebuthiuron		
	Typ[1]	Max	Accid	Typ	Max	Accid	Typ	Max	Accid
Aerial pilot	R,C[2]	S,R,C	NA	S,R	S,R	NA	R	S,R	NA
Aerial mixer-loader	S,R,C	S,R,C	NA	S,R	S,R	NA	R	S,R	NA
Aerial fuel truck operator	0	0	NA	0	S,R	NA	0	S	NA
Backpack applicator	0	S,R	NA	S	S,R	NA	0	S,R	NA
Ground mechanical applicator	0	S,R	NA	S	S,R	NA	0	S,R	NA
Ground mechanical mixer-loader	0	S,R	NA	S	S,R	NA	0	S,R	NA
Ground mechanical applicator/mixer-loader	0	S,R	NA	S	S,R	NA	0	S,R	NA
Hand applicator	0	S,R	NA	S	S,R	NA	R	S,R	NA
Skin spill, concentrate	NA	NA	S,R,C	NA	NA	S,R	NA	NA	0
Skin spill, mixture	NA	NA	S,R,C	NA	NA	S,R	NA	NA	S,R
Direct spray, person	NA	NA	S,R	NA	NA	S,R	NA	NA	S,R

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental application.

[2] Risk categories: 0 = No risk; S = Systemic risk; R = Reproductive risk; C = Cancer risk; and NA = Not applicable. Marked scenarios are those that result in high risk under the given herbicide. High risks are defined as those exposures that may result in a margin of safety (MOS) < 100 or a cancer risk greater than one-in-one million. The MOS is the NOEL divided by the dose; therefore, the larger the MOS, the smaller the estimated human dose compared to the animal NOEL, and the lower the presumed risk to human health.

In the earlier BLM EISs, risk estimates were presented separately for different land uses (rangeland, public domain forestland, oil and gas sites, rights-of-way, and recreation and cultural sites). In this table, the scenario is marked if any of these land uses showed a high risk for the specific herbicide.

Table 3-21. BLM 1991-Evaluated Herbicide High Risk Scenarios for the Public

Treatment Method	Bromacil	Diuron	Tebuthiuron
	Accidental Application		
Direct spray, person	S,R	S,R,C	S,R
Drinking directly sprayed water	0	S,R,C	R
Eating fish from directly sprayed water	S,R	S,R,C	0
Immediate reentry, hiker	0	S,C	0
Immediate reentry, picker	S,R	S,R,C	S,R
Eating directly sprayed berries	S,R	S,R,C	S,R
Angler	0	C	0
Nearby resident	0	C	0
Drinking water contaminated by a jettison of mixture	S,R	S,R,C	S,R
Drinking water contaminated by a truck spill	S,R	S,R,C	S,R

Risk categories: 0 = No risk; S = Systemic; R = Reproductive; C = Cancer; and NA = Not applicable. Marked scenarios are those that result in high risk under the given herbicide. High risks are defined as those exposures that may result in a margin of safety (MOS) < 100 or a cancer risk greater than one-in-one million. The MOS is the NOEL divided by the dose; therefore, the larger the MOS, the smaller the estimated human dose compared to the animal NOEL, and the lower the presumed risk to human health.

In the earlier BLM EISs, risk estimates were presented separately for different land uses (rangeland, public domain forestland, oil and gas sites, rights-of-way, and recreation and cultural sites). In this table, the scenario is marked if any of these land uses showed a high risk for the specific herbicide.

Chapter 4

Changes Between Draft and Final EIS

The following changes were made to Chapter 4 between the Draft and Final EIS. Minor corrections, explanations, and edits are not included in this list.

Changes were made to:

- Update ecological and human health risks for triclopyr, hexazinone, and 2,4-D based on Risk Assessments new since development of the PEIS, and make resultant updates to the acres-by-risk table in the *Human Health and Safety* section;
- Correct certain ecological and human health risks for dicamba to reflect findings of the Forest Service Risk Assessment. The risk ratings in the Draft EIS were based on a BLM Risk Assessment that considered dicamba in combination with diflufenzopyr;
- Add additional subjects in the *Incomplete and Unavailable Information* section;
- Add specific discussions about *Changes in Herbicide Use on Adjacent Non-BLM Lands Resulting From the BLM Alternatives, Cumulative Effects of Insect Spraying*, and *Previous Herbicide Use* to the *Cumulative Impacts* section early in the chapter;
- Move the description of some of the ongoing registration actions from the *Cumulative Impacts* section in this chapter to the *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1;
- Change “Alternative 1” to “Reference Analysis” because there is no longer an Alternative 1;
- Add information about potential effects to collectable mushrooms;
- Add information about the risks to plants of using ALS-inhibiting herbicides;
- Add recent information about the effects of herbicide treatments on the slowing of Sudden Oak Death;
- Add an *Effects of the Alternatives on Climate Change: Greenhouse Gas Emissions and Carbon Storage* section;
- Add information about wind-erodible soils and provide a map;
- Add information in the *Water Resources* and *Fish* sections about State water sampling programs and results;
- Add recent research on the potential effects of the adjuvant POEA on amphibians, fish, and human health;
- Clarify that much of the administrative site and rights-of-way herbicide use on BLM lands is along State highways and county roads, and would be applied by those agencies;
- Move the *Conflicts with Other Plans* section to Chapter 1; and,
- Make edits in response to numerous public comments received about the Draft EIS.

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Chapter 4 Affected Environment and Environmental Consequences

This Chapter presents information about those aspects of the human environment that are likely to be most directly affected by the management prescribed in the alternatives, and that will be used to determine which alternative meets the *Need* and best meets the *Purposes* described in Chapter 1. This Chapter presents the direct, indirect, and cumulative effects of management under the four alternatives and the Reference Analysis. The information presented in this Chapter forms the scientific and analytic basis for the *Comparison of the Effects of the Alternatives* section in Chapter 2. Effects described as "common to all alternatives" typically apply to the no-herbicide Reference Analysis as well, unless otherwise stated.

This document is a programmatic EIS, and while many of the effects are most appropriately considered at this scale and all effects are described in sufficient detail to facilitate a reasoned choice from among the alternatives, the ability to provide specific details about some effects is necessarily limited. However, the alternatives in this EIS do not authorize any activities. The conduct of management activities must still comply with applicable environmental laws at the site-specific level, which include provision for public notice, comments, appeal, and consideration of site-specific resources of all kinds.

In addition to considering the potential for adverse environmental effects from herbicides, the individual resource sections in this Chapter examine the environmental implications of the various levels of weed control that would be expected to be achieved by the different alternatives. To facilitate these discussions, the *Noxious Weeds and Other Invasive Plants, Native and Other Non-Invasive Vegetation, Pests and Diseases (Sudden Oak Death), Air Quality,* and *Climate Trend, Projections, and Implications* sections are presented first, in order to quantify differences between the alternatives in terms of native ecosystems protected or invasive plant spread reduced.

Incomplete and Unavailable Information

Like the PEIS, this EIS is a programmatic document that addresses the broad impacts associated with the Proposed Action (Alternative 4) and alternatives to the Proposed Action. Environmental impacts are assessed at a general level because of the broad land area analyzed in this EIS. As noted during the public scoping meeting in Portland on July 18, 2008 "It will be hard to evaluate non-target impacts because they usually require specifics about application." Site-specific impacts will be assessed in NEPA documents prepared for district projects and programs by local BLM offices and tiered to this document.

The analyses of impacts of the use of herbicides in this EIS are based on the best and most recent information available. As is always the case when developing management direction for a wide range of resources, not all information that might be desired was available. The Council on Environmental Quality (CEQ) Regulations provide direction on how to proceed with the preparation of an EIS when information is incomplete or unavailable:

"If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement: 1) a statement that such information is incomplete or unavailable;

2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; 3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and 4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." For the purposes of this section, "reasonably foreseeable" includes "impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason" (40 C.F.R. 1502.22 b).

Addressing this last point first, it is understood that many prudent individuals view herbicides, either individually or in combination with other chemicals already added to the environment, as having a potential for the aforementioned "catastrophic consequences." To address this concern, the BLM and Forest Service have supplemented the EPA herbicide registration information with over 8,000 pages of Environmental and Human Health Risk Assessments (Appendix 8). Risk assessments sort through the credible research to deal with uncertainty in interpretation and extrapolation of data. Risk assessments determine for a set of assumptions whether there is a basis for asserting that a particular adverse effect is possible. Prediction of potential toxic effects from single or synergistic exposure to herbicides and their adjuvants, inerts, and degradates, natural and synthesized, necessarily involves incomplete and unavailable information regarding the complexity and unpredictability of potential multiple exposures[1]. To address these uncertainties, the Risk Assessments use the most conservative observed response and then apply uncertainty factors at each step. The combination (product) of these uncertainty factors can be in the tens of thousands in cases where test results were sparse or uncertain; the factors applied at each step depend on the level of confidence at that step that the results will apply to the full range of potentially affected individuals. Additionally, the BLM added a factor of ten when applying Ecological Risk Assessment results to Federally Listed and other Special Status species, since they are by definition more susceptible because adverse effects are likely to be more significant. The results of the Risk Assessments have been quantified into low, moderate, and high risk categories representing the likelihood of adverse effects if the tested scenario is experienced (e.g., direct spray). However, the likelihood of experiencing an adverse effect predicted by the low, moderate, and high risk categories may be tens to thousands of times less for the average individual because of the uncertainty factors applied, even if the tested scenario is experienced.

Risk assessments test or model a range of plausible scenarios including spills and direct applications on non-target organisms, but exposure beyond those modeled is possible. A by-the-book aerial application of sulfometuron methyl was done on a 20,000-acre three-month old wildfire area in south-central Idaho in November 2001. Winter rains were expected to carry the herbicide into the soil where it would prevent cheatgrass from overtaking returning native plants. An unusual combination of dry weather and strong winds carried herbicide-treated ash and soil onto adjacent farmlands, severely damaging thousands of acres of the following years' crops. Herbicides killing non-target plants would be the most common unplanned effect, herbicides are designed to kill plants. Adverse effects to other organisms is less likely, but not impossible. The EPA's sulfometuron methyl Reregistration Eligibility Decision (RED) published in 2008 includes application constraints designed specifically to avoid a repeat of the Idaho incident (see the *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1). Standard Operating Procedures also prohibit applying sulfometuron methyl aerially.

For other types of environmental effects, the primary results of unavailable information is the inability to quantify certain impacts. Where quantification was not possible, impacts have been described in qualitative terms. A summary of existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable adverse impacts on the human and socioeconomic environment (and support the BLM's evaluation of such impacts)

1 See Appendix 13 for a discussion of uncertainty in the risk assessment process.

has been included in this Chapter, in Chapter 3, in the PEIS (Appendix 1 of this EIS), in other appendices that accompany this EIS, and in supporting documents that were prepared for the PEIS that have been included on the BLM website at http://www.blm.gov and on the EIS project website at http://www.blm.gov/or/plans/vegtreatmentseis/.

Knowledge is, and always will be, incomplete regarding many aspects of terrestrial and aquatic species, forestlands, rangelands, the economy, and society. However, central ecological relationships are well established, and a substantial amount of credible information about ecosystems in the project area is known. The alternatives were evaluated using the best available information. While additional information may add precision to estimates or better specify relationships, new or additional information is unlikely to significantly change the understanding of the relationships that form the basis of the effects analysis presented in this Chapter.

Locations of future projects are largely unknown, as they will be determined later. For this EIS analysis, acreage estimates have been separated between west and east of the Cascades, because the type of vegetation, the spread of invasive weeds, and the likelihood of working near water is substantially different between these two general areas of the State. Beyond that, local site-specific land use plans and activity plans will identify the priorities for each district.

One resource for which information is incomplete or unavailable is social and economic costs of invasive and noxious weeds. These costs are only now being understood and quantified by economists and vegetation scientists at local and regional scales. Related to this problem is the uncertainty in projecting invasive weed spread. As noted in the *Noxious Weeds and Other Invasive Plants* section, individual species could have, in retrospect, been eradicated or reduced to one or two percent of ultimate acreages within watersheds or other locally defined areas, if they had been controlled when populations were only a few plants or acres. Expecting identification of many such opportunities is reasonable; many small populations are spreading now because the effective treatments are currently not available. Estimating the ecological value of such control efforts is also possible at the species and small watershed scale. However, the translation of these opportunities to an overall description of long-term vegetation changes for each alternative and a resultant ecological gain for each alternative is necessarily qualitative. The *Noxious Weeds and Other Invasive Plants* section later in this chapter address this point further, noting that the estimates of weed spread rate for the different alternatives involves many assumptions, and thus the projected differences in infested acres after 15 years should be viewed not so much as predictions of what would occur over time, but as reasonable approximations of the relative differences between the alternatives.

As noted in the *Air Quality* section, the science is lacking to develop a complete carbon budget principally due to the lack of information on belowground carbon dynamics in all ecosystems and very limited information on aboveground carbon dynamics in rangeland ecosystems. Although information to more thoroughly analyze carbon is unavailable, one of the known qualitative trade-offs are that activities that can restore healthy functioning ecosystems, including treatments to reduce invasive plants, tend to increase carbon sequestration. The analysis points out that the Proposed Action (Alternative 4)'s replacement of roadside mowing with herbicide use should decrease fossil fuel use. These factors point to the Proposed Action having favorable effects on climate change and long-term air quality when compared to the No Action Alternative (Alternative 2), but the difference is qualitative and likely so small as to play little role in influencing the choice between the alternatives.

Herbicide use rates on immediately adjacent non-BLM lands are unknown, and therefore cumulative effects at the small watershed scale are impossible to quantify. However, statewide herbicide use levels described in the *Cumulative Impacts* section in this Chapter indicate the proposed BLM use would be less than one percent of all use in the State (on 25 percent of the State's area). This, and the application of Standard Operating Procedures and PEIS Mitigation Measures, the proposed application methods, and the expected size and distribution of the treatment sites, indicates little if any contribution to cumulative off-site effects even at small geographic scales. In fact, the control of invasive plants on BLM lands has the potential to reduce herbicide use on adjacent non-BLM lands (see *Cumulative Impacts* section in this Chapter).

Finally, the analysis does not describe the implications of eliminating individual herbicides within Alternative 3 with respect to future weed spread. Table A9-2 provides information about which herbicide effectively controls which target plant, and several of the potential target plants are readily susceptible to only one herbicide. Beyond this, the implications of losing a single herbicide are discussed more qualitatively. For example, the EIS notes that having additional herbicides increases the opportunity to select one that will meet the vegetation control objectives while minimizing adverse effects at that particular treatment site. The removal of the sulfonylureas would increase the pounds of alternative herbicides needed. The EIS could have attempted to identify the high-priority control species and then analyzed, individually, the implications of excluding certain herbicides from Alternative 3. The EIS did not attempt such an analysis in part because: a) priorities will likely change over the 15-year life of the EIS; b) there is no complete inventory of all invasive plant populations so priorities and emphasis might change with additional information; c) the needs and priorities of the Oregon Department of Agriculture, cooperators, and adjacent landowners will vary by geographic area and time; and d) the estimate of future noxious weed spread rate under Alternative 3 is too gross to reveal the implications of loss of individual herbicides. On this last point, the Appendix 12 discussion of 2,4-D estimates the removal of 2,4-D from Alternative 3 would change the weed spread rate prediction from seven percent per year to more than eight percent, because 2,4-D is so effective, either singly or as a part of tank mixes, on so many weeds. This estimate is possible because of the experience and projected uses of 2,4-D. No specific estimate is attempted for the other herbicides for the reasons stated above.

Accidental Spill or Misapplication

Spills happen when valves fail, when vehicles or handheld equipment tips over or falls into water bodies, when applicators forget herbicides are present in equipment, and so forth. Standard Operating Procedures, job hazard analyses or risk management assessments, safety and handling plans, designated travel routes, mixing rules, separated equipment, and other processes are designed to minimize spill occurrence, but the alternatives propose to treat thousands of acres in an area where there are thousands of streams and lakes present. Many of the invasive plants are in the riparian zones or even in water, so some amount of herbicide mix gets near water.

The *Fish*, *Wildlife Resources*, *Native and Other Non-Invasive Vegetation,* and *Water Resources* sections address spill scenarios that represent worst-case potential impacts to a pond and to a stream[2]. The scenarios, addressed in the Ecological Risk Assessments (see Appendix 8), are a truck and a helicopter spilling entire loads (200-gallon spill and 140-gallon spill, respectively) of herbicide mixed for the maximum application rate into a ¼ acre, 1-meter-deep pond, and into a small but perennial fish-bearing stream. The pond scenario is the one discussed in the PEIS Vol. II:C-22, and analysis in that volume examines the pond concentration against the Risk Assessments' toxicity endpoints for the fish, aquatic invertebrates, and non-target aquatic plants. For that analysis, the concentration of herbicide in the pond water is based on the concentration in the spilled solution, the volume spilled, and the volume of the pond assuming instantaneous mixing.

Spills directly onto soil would likely have fewer adverse effects than spills into water. Under this situation, the site would be assessed for a connection to ground or surface water and the soil isolated or removed. This type of remedial action is generally conducted by an environmental services crew contracted for such work or in connection with the State of Oregon Department of Environmental Quality's (ODEQ) Emergency Response Program.

2 Risk Assessments do not evaluate stream spills because the herbicide concentrations would be dependent on flow rate and the distance from the spill. Spills lethal in ponds would be expected to be lethal in streams for some distance.

Spilling the contents of an application tank or helicopter load is the largest event reasonably foreseeable without being speculative. The potential impacts of larger spills have not been estimated. Although a larger event is possible, the variables of which herbicide, how much, and where, become speculative when focused to individual resources. Effects of a spill of normally transported and mixed quantities could vary from slight to significant depending upon these variables. Larger spills could include barrels of product (up to 55 gallons) dropped, ruptured, punctured, or even lost, with effects similar to spilling 400 gallons of mix. Herbicides could be deposited in waterways by a vehicle accident at a stream or river crossing, or by a mixing/drafting error although Standard Operating Procedures require mixing and loading operations to be done in areas where an accidental spill would not contaminate an aquatic body. Spill plans are required for all herbicide projects, are on site during operations, and include requirements that responsible local and State agencies are immediately notified. Clean up, mitigation, and site rehabilitation is required.

In addition to the possibility of spills, there is a possibility of accidental application contrary to the prescription or the label. Increasing the number of herbicides will, at least in the short term, result in field offices using herbicides that are less familiar to them, leading to errors or to non-label applications, and unexpectedly damaging non-target plants. However, the availability of more target-specific herbicides, effective in lower quantities, would more likely have the opposite effect, that of reducing average pounds per acre applied and reducing less effective and repeated applications that attempt to control weeds for which the currently available four herbicides are less effective. Site-specific planning and the use of certified applicators should limit non-label applications.

Uncertainties including spills and accidental applications are discussed in the Risk Assessments for each herbicide (Appendix 8), and the risk levels for such events are included on risk tables applicable to the specific resource sections.

Cumulative Impacts

Cumulative impacts to the environment are defined in the CEQ regulations as those that result from the incremental effects of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes them (40 C.F.R. 1508.7). In general, the effects of past actions are considered in *Affected Environment* discussions for each resource section. In each resource section in this Chapter, the various types of direct and potentially cumulative effects are identified by considering the following possible sources of effects for each resource and for this EIS as a whole:

1. The Proposed Action;
2. Existing actions (already doing some of the same thing);
3. Past actions (effects previously imparted by other actions);
4. Other present actions (other things going on in the effects area);
5. Reasonably foreseeable actions; and,
6. Mitigation of adverse effects that cannot be avoided with the selected alternative.

These types of effects are not necessarily separated or labeled in each resource section in this Chapter. Because this is a statewide programmatic document covering the estimated level of future herbicide use in Oregon (that will be subsequently covered by district or project site-specific analysis), this entire analysis is itself a cumulative effects analysis.

Past, present, and reasonably foreseeable future actions that are not directly related to the alternatives but that potentially bear on the effects of the alternatives presented in this EIS are described here:

Changes in Herbicide Use on Adjacent Non-BLM Lands Resulting From the BLM Alternatives

Adjacent private landowner values and uses would benefit from improved invasive weed control on BLM lands because weed spread onto adjacent non-BLM lands would be reduced if overall weed spread on BLM lands were reduced. In addition, weed control would be more efficient for private owners and BLM managers combined, because additional herbicides would make cooperative, cross-boundary treatments more feasible. It would seem to follow, then, that one effect could be reduced herbicide use on adjacent BLM lands. Such a reduction could be significant in places like Malheur County where BLM lands make up more than 70 percent of the landscape, and in the checkerboard O&C lands west of the Cascades. The effects analysis for Alternatives 4 and 5 in the *Timber* section suggests such benefits would occur even for right-of-way treatments in checkerboard lands under Alternative 4 (Proposed Action).

Cumulative Effects of Insect Spraying

In 2009, APHIS and/or the Oregon Department of Agriculture sprayed insecticides on 34,000 acres of BLM lands for the control of grasshoppers. This spraying has been an annual event; the treated area varies in size and area from year to year. There is also a potential to spray for Mormon crickets, although no acres were treated for this insect in 2009. Most insecticide treatments on BLM lands in Oregon are likely to be spatially or temporally separated from most herbicide treatments proposed in this EIS, so virtually few organisms except, conceivably, plants, would be expected to have active doses of both materials at the same time. Any overlaps of concern should be identified in site-specific analyses; ongoing noxious weed treatments would be a consideration during insecticide spray planning in part because of the widespread use of noxious weed biological controls. Cumulative adverse effects to humans or other elements of the environment are most likely when two pesticides share a common mechanism of toxicity. That is, they both affect an organism the same way. Cumulative effects assessments conducted by the EPA typically *begin* by grouping pesticides by mechanism of toxicity (EPA 2002). Because insecticides and herbicides work so differently, even a concurrent application would be unlikely to result in significant additive environmental effects when both products are applied within label limits. Synergism is not impossible however; the 2,4-D Risk Assessment reports that 2,4-D induced cytochrome P450 (a natural animal enzyme that processes toxins) in the southern armyworm (*Spodoptera eridania*) caused synergistic effects on insecticide toxicity (Kao et al. 1995). In addition, exposure to 2,4-D caused decreased carbaryl and permethrin insecticide toxicity.

Oregon Department of Agriculture's Pesticide Use Reporting System

In July 2009, the Oregon Department of Agriculture published an annual report compiling the second full year of reporting under Oregon's Pesticide Use Reporting System. For non-household use pesticides, Oregon State law requires self-reporting. There were many problems identified in this reporting system, including:

- many (if not most) businesses and commercial users[3] didn't realize that they were required to report their pesticide use;
- there was difficulty correctly identifying the pesticide used;
- funding didn't allow the Oregon Department of Agriculture to follow up on every report; and,
- people were not familiar with the online reporting system, had varying computer skills, or had no online access.

3 Includes all uses except household use.

These errors could have caused overestimates or underestimates in the final reported numbers. In addition, these estimates do not include pesticides used in households[4], a possibly significant figure. However, applicators filed nearly 343,000 reports of pesticide use totaling 19,696,784 pounds of pesticides including fungicides, herbicides, insecticides, rodenticides, and others. This is 645 times the pounds of herbicides the BLM would apply under the Proposed Action (Alternative 4).

Twenty percent of this total was the soil fumigant metam-sodium, with most of that being applied to the farmlands along the Columbia River in the northern part of the State east of the Cascades. The herbicide glyphosate (the active ingredient in Roundup®) was reported at 1,914,143 pounds of active ingredient (ODA 2009b), or more than 957,000 acres if the typical rate[5] is assumed. Table 4-1 shows the reported pounds in Oregon for herbicides included in this EIS. Included are their numerical rank in the Oregon report in terms of pounds applied (if they were in the 100 most-used pesticides), and equivalent acres calculated from the BLM typical application rate and, for comparison purposes, the estimated acres of the same herbicide expected to be applied by the BLM under the Proposed Action (Alternative 4) and its percent of the 2008 Oregon total. (The BLM manages about 25 percent of the lands in Oregon.) Agricultural uses are included in the Oregon totals; the table does not attempt to compare like uses.

Table 4-1. 2008 Oregon-Wide Use of the 18 Herbicides Analyzed in this EIS and Comparison with BLM Proposed Action (Alternative 4)

Herbicide and rank[1]	Lbs Reported by the Oregon Department of Agriculture	Assumed Acres Statewide[2]	Estimated Acres under Alt 4 (Proposed Action) on BLM Lands	% of OR acres that BLM Proposed Usage Would Represent
2. Glyphosate	1,914,144	957,072	4,000	0.42%
7. 2,4-D	778,878	778,878	5,400	0.69%
13. Diuron	385,174	64,196	1400	2.18%
25. Triclopyr	125,542	125,542	4,100	3.27%
31. Hexazinone	105,284	52,642	300	0.28%
34. Dicamba	96,964	323,213	1,600	0.50%
50. Clopyralid	48,592	138,834	2,300	1.66%
59. Imazapyr	29,859	66,353	2,600	3.92%
83. Sulfometuron methyl	16,866	120,471	1,000	0.83%
99. Bromacil	11,189	2,797	900	32.18%
Picloram	5,891	16,831	3,000	20.37%
Metsulfuron methyl	5,252	175,067	2,900	1.66%
Diquat	2,334	2,334	0	0.00%
Chlorsulfuron	2,006	42,681	4,100	9.61%
Tebuthiuron	720	1,440	300	20.82%
Imazapic	314	10,032	14,000	139.68%
Fluridone	22	147	300	209.79%
Diflufenzopyr + Dicamba	No data	No Data	0	0%

[1] Rank is only known for the herbicides included in Oregon Department of Agriculture's list of 100 most used Pesticides
[2] Reported pounds divided by the BLM typical application rate.

4 The report includes a household component. 1,717 households in Oregon agreed to track their pesticide use over the course of the year. Response and reporting consistency was poor, and the the Oregon Department of Agriculture did not extrapolate that information out to make any general conclusions about household pesticide use.

5 Typical application rates for each herbicide are shown on Table 3-4.

Forest Service's Invasive Plant Program

The Forest Service manages about 22 percent (14.5 million acres) of the land in Oregon. The Forest Service's Invasive Plant Program proposes to treat approximately 29,058 acres with herbicides in Oregon and Washington annually to control invasive plants. Herbicides available for use by the Forest Service include chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr, all of which are analyzed in this EIS, and sethoxydim. The Region 6 (Forest Service in Oregon and Washington) Invasive Plant Program's EIS was finished in 2005 (USDA 2005a) and the Record of Decision was signed October 2005 (USDA 2005b). Individual National Forests are in the process of completing site-specific analyses tiered to that decision.

Previous Herbicide Use

Past herbicide use by the BLM will contribute little to cumulative herbicide effects. The BLM has been limited by the 1984/87 court injunction to only spraying noxious weeds with four herbicides. This means most treatments have been spot treatments, not broadcast sprays. The four herbicides themselves are all moderately persistent in water, and not persistent (2,4-D) to persistent (picloram) in soils, which means that all of them would have broken down somewhere between ten days to a year after application. These herbicides have been applied in such a way as to avoid effects to non-target species. Herbicides on BLM lands are not generally reapplied in the same location year after year, as policy does not allow repeated treatments with a method that has been shown to be ineffective (USDI 1992b).

Being limited to four herbicides has contributed to the spread of invasive plants because of restrictions and/or limitations on the plants that can be controlled and the places that they can be used. Limiting the number of herbicides can also contribute to some invasive plants becoming resistant to certain herbicides. These issues are discussed in the *Noxious Weeds and Other Invasive Plants* section.

Environmental Setting

The BLM manages about 15.7 million acres in Oregon, or about 25 percent of the lands in the State. About 2.3 million of these acres lay west of the Cascades, about 2.1 million of which was assigned to the BLM by the O&C Act of 1937 to be managed primarily for sustained timber production. These lands are also managed for wildlife habitat, recreation, and so forth (see *Background* in Chapter 1).

Most BLM lands east of the Cascades more closely resemble BLM lands in other western states, and include dry forest and sagebrush steppe of the high desert. These lands are managed for a variety of uses including habitat, watershed protection, recreation, livestock grazing, and oil, gas, and mineral development. Information about these other uses, as well as about special lands designations, is presented in resource sections in this Chapter.

Current Climate[6]

A discussion of the current climate and weather patterns in Oregon is important to the understanding of the broad vegetative communities (or biomes) within the State; how invasive plant trends might affect that vegetation; and, how expected climate change might affect invasive plant trends and thus affect the need for changes in management.

6 General sources for this section include Taylor and Hatton (1999), OCS (2009), and WRCC (2009).

The Pacific Ocean exerts a strong influence on the climate across Oregon, with a stronger influence west of the Cascades than on the eastern side. This maritime influence moderates winter minimum and summer maximum temperatures. The abundant moisture incorporated into the air masses that move across the Pacific is largely responsible for the abundant rainfall over western Oregon and at higher elevations of the eastern portion of the State. The occurrence of extreme low or high temperatures is generally associated with the occasional incursion of continental air masses.

A series of mountain ranges affect precipitation amounts across the State. The Coast Range runs north-south down the full length of the State; the Cascade Range runs north-south from the Columbia River to within 50-75 miles of the California border; and, the Blue Mountains run northeast-southwest from the Snake River to the John Day and Deschutes Rivers. Other mountain ranges include the Siskiyou Mountains in southwest Oregon, and the Steens Mountain in southeast Oregon. The mountain ranges generally increase in elevation from west to east and from north to south. As a result, moisture entering the State from the Pacific Ocean is progressively removed from the air masses as they rise, cool, and condense to cross the various ranges. Precipitation amounts are highest along the coast and lowest in the rain shadow of the Steens.

A maritime climate characterizes the coast and northwestern part of the State. This area has very mild winters and the coolest summers in the State. Temperatures have the least diurnal and annual variation along the coast. High temperatures rarely exceed 90° F and low temperatures rarely drop below 0° F, with average winter minimums mostly above 32° F. August is usually the warmest month and January the coldest month. Precipitation averages 100-200 inches on the coast, 30-60 inches in the Willamette Valley and 80-120 inches on the western slopes of the Cascades. Most precipitation falls in November through March, as rain below 1300 feet elevation and snow above 4900 feet elevation. The 1300-4900 foot elevation band is known as the transient snow zone with winter precipitation falling as a mix of rain and snow. The coast is frequently cloudy or foggy throughout the year while clouds and fog are much less common in summer in northwest Oregon. Thunderstorms are rare, peak in May and are usually wet. The Columbia River pierces both the Coast and Cascade ranges, allowing some of the maritime influence to reach northeastern Oregon, with the influence stronger in winter than in summer.

The more complex terrain of the Siskiyou Mountains results in less influence from the marine air, even though the Rogue and other rivers flow into the Pacific Ocean. As these rivers cross through the coastal part of the mountains, the river valleys narrow considerably, limiting the ability of the marine air to penetrate inland in summer. Because of this (coupled with its lower latitude), southwest Oregon has a Mediterranean-type climate. Summers in southwest Oregon are among the warmest in the State, although winter temperatures are generally mild. High temperatures commonly exceed 90° F in summer while low temperatures rarely drop below 0° F, although the average minimum temperature is below 32° F. July is usually the warmest month and January the coldest month. Precipitation amounts and timing are similar to that of northwest Oregon, although generally on the low end of the range. Most winter precipitation falls as rain below 1300 feet elevation and snow above 4900 feet elevation and a mixture in the transient snow zone. Winters tend to be cloudy and summers quite sunny. Thunderstorms occur 12-18 times per year, peaking in August with many storms between mid-July and mid-September producing little rain (dry thunderstorms).

Eastern Oregon has a more continental climate similar to that of the northern Rocky Mountains in the north and the Great Basin in the south. The Blue Mountains limit the penetration of marine air into the southeastern part of the State at all times of the year. Eastern Oregon is generally higher in elevation than western Oregon, which tends to moderate summer temperatures somewhat but results in cold winters. Eastern Oregon has the highest diurnal and annual temperature variation in the State. High temperatures in summer commonly exceed 90° F and low winter temperatures often drop below 0° F with average minimum temperatures generally well below 32° F. July is the warmest month in north-central and southeast Oregon while August is generally the warmest month in south-central and northeast Oregon. January is the coldest month. Average annual precipitation ranges from 5 to 30 inches with higher amounts in the higher elevations of the Steens and Blue Mountains. Most winter precipitation falls as snow above 4900 feet, rain below 1300 feet, and a mix of rain and snow in between. Overall, eastern Oregon has more sunny days throughout the year than western Oregon. Summer thunderstorms occur 12-18 times per year, peaking in August. Storms between mid-July and mid-September tend to be dry.

Oregon is subject to a variety of severe weather events that help set the ecological limits for various native and non-native plants. Among these are cold snaps, heat waves, and drought. Cold snaps tend to occur when arctic air moves west of the Rocky Mountains and into eastern Oregon with occasional events reaching as far as the Oregon coast. A cold snap occurs over a several day period, often with both daily maximum and minimum temperatures dropping through the period. Twenty major cold snaps have occurred in the State between 1898 and 1999. Cold snaps may affect only a small portion of the State or the entire State. January is the most common month for cold snaps, followed by December and early February.

Heat waves occur when most or all of the State lies under strong high pressure that brings descending warming air and clear skies resulting in temperatures well above average for the time period affected. Occasional very hot days tend to be more common than multi-day (two or more days) heat waves in western Oregon. Thirty-five multi-day heat waves have been documented between 1898 and 1999. In eastern Oregon, the hottest temperatures during heat waves typically occur in river valleys. Heat waves have occurred in every month except January, but the hottest temperatures and longest heat waves typically occur in June through August.

Drought is difficult to define with much precision; identifying the beginning and end of a drought is even more difficult. Most commonly, drought is defined relative to its duration and impacts on agriculture or hydrology, or for regulatory purposes. This analysis uses hydrological, or meteorological, drought. The hydrological definition includes multiple time scales (seasonal, annual, and multi-year) and all aspects of water supply (precipitation, stream flow, groundwater, and so forth). All of Oregon is subject to seasonal drought in summer, normally a very dry period with high inter-annual variation in precipitation amounts across the State. For ecological considerations, most plant and animal species can readily survive a one-year, or annual, drought.

Multi-year droughts can alter many ecosystem processes and lead to various changes in plant and animal communities. Since winter and spring precipitation dominate Oregon's climate, below-average precipitation in these months has a much greater impact than below average precipitation in summer and fall. The Palmer Drought Severity Index, which incorporates precipitation, runoff, evaporation, and soil moisture, is the most widely used indicator of hydrological drought. The Index[7] indicates five significant multi-year droughts have affected all or part of Oregon since 1900. The worst drought remains the 1928-1941 period, the Dust Bowl era, which affected the entire State. Eastern Oregon was affected by severe drought from 1959 to 1964 while western Oregon was affected from 1976 through 1981. Another statewide drought occurred from 1985 through 1994. A third statewide drought began in 1999 and likely ended in 2005 in western Oregon but apparently has not ended in eastern Oregon.

Two very important drivers of Oregon's climate, particularly in winter and spring are the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) (Mote et al. 2004). The cycle for ENSO is 2-7 years and for PDO is 20-30 years. While ENSO primarily affects ocean conditions in the equatorial Pacific, PDO affects ocean conditions in the central and northern Pacific. Together, these two phenomena affect the strength

7 The Palmer Drought Severity Index has numerous shortcomings in large part due to its inability to handle snow adequately. It remains the most widely used indicator in large part due to the length of record. The Standardized Precipitation Index addresses many of the shortcomings of the Palmer index and is becoming more widely used, but the period of record is short, as it has only been used since 1993.

and location of the Aleutian Low in winter and subsequent storm tracks. When both ENSO and PDO are in the same phase (cool-cool or warm-warm), the effects on Oregon's climate are magnified; when both are in opposite phases (cool-warm or warm-cool) the effects are somewhat cancelled. During the warm phase of either, the Aleutian Low tends to deepen and cause the storm track to split around the Pacific Northwest, resulting in warm, dry winters. However, a moderate strength El Niño event is more likely to lead to that outcome. A strong El Niño event also causes the Aleutian Low to shift eastward, bringing warm, wet winters to Oregon. The wettest winters with the highest snowpack tend to occur when both ENSO and PDO are in their cool phases.

Biomes

Because biophysical and biological characteristics vary widely on BLM lands in Oregon, it is helpful to divide the analysis area into smaller, more homogeneous areas for analysis. The PEIS to which this EIS tiers uses ecoregions adapted from Bailey (1998, 2002) to delineate areas with similar climatic conditions, geomorphology, and soils. These factors influence the composition and functioning of vegetative communities, and thus such regions can be expected to have sufficiently consistent responses in susceptibility and effects of invasive plants and vegetation treatments to facilitate effects presentations.

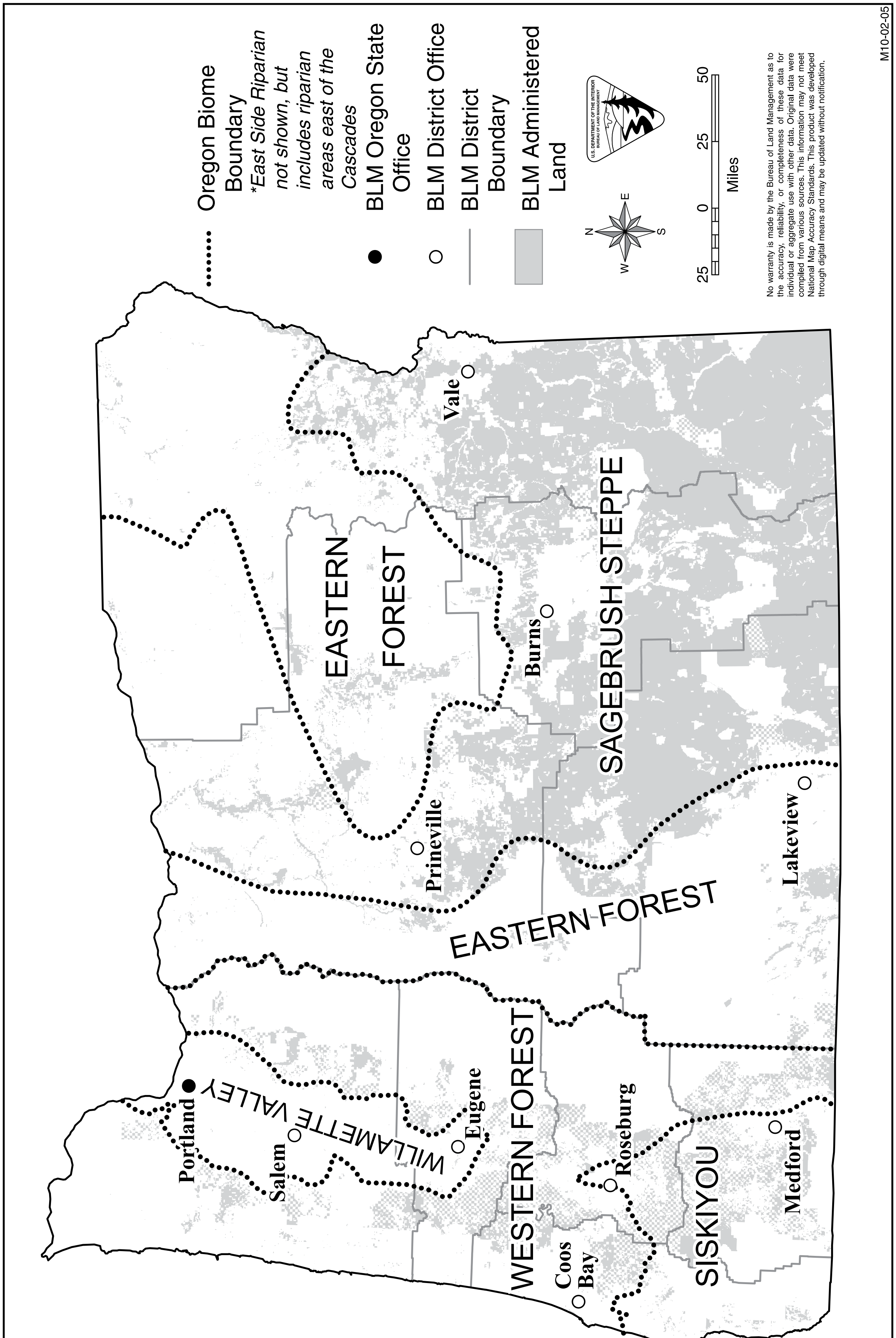
For analysis in this Oregon-specific EIS, six biomes are identified in part by subdividing ecoregions used in the PEIS, and in part tiering to physiographic provinces used in the 1994 Northwest Forest Plan applicable primarily to lands near to or west of the Cascades. Five of the biomes are shown in Figure 4-1; the sixth is the East Side Riparian Biome, consisting of the riparian habitat that closely follows perennial and in some cases, intermittent streams in the dry eastern part of the State. The biomes provide a context for describing other elements of the affected environment later in this Chapter. However, these biomes are combined and/or split as needed to appropriately describe resource effects in this Chapter. Table 4-2 shows the amount of land managed by the BLM by biome.

The composition and distribution of plant communities in Oregon has been influenced by many factors, including climate, drought, fire, browsing by wildlife, domestic livestock grazing, settlement, mining, development, and cultivation. Other activities that have a direct or indirect effect on plant communities include logging, recreational activities, and development of rights-of-way including road construction and maintenance. In addition, competition with non-native invasive plant species has resulted in the loss of native plant communities. Climate trends, projections, and implications are discussed later in this Chapter.

Table 4-2. BLM Lands by Biome

Biomes	Acres of BLM Land	% of Total BLM Land
West of the Cascades	2,334,000	15
Western Forest	1,482,600	9
Willamette Valley	19,100	less than 1
Siskiyou	832,200	5
East of the Cascades	13,377,400	85
Eastern Forest	1,150,700	7
Sagebrush Steppe	11,618,500	74
East Side Riparian	608,200	4

Figure 4-1. Oregon Biomes



Sagebrush Steppe Biome

Description and trend - Plant communities occurring in this region are adapted to dry summers and cold winters. Elevations range between 2,500 and 8,000 feet. Precipitation ranges between eight and sixteen inches and occurs primarily during the winter. Three major sagebrush plant communities are generally identified: Wyoming big sage, mountain big sage, and low sage. An assortment of shrub species is associated with each sagebrush community, and understory vegetation throughout the type is typically dominated by a mixture of perennial bunch grasses such as bluebunch wheatgrass, and forbs. These plant communities are both relatively resistant to, and adapted to, low intensity wildland fire, generally having a mean fire return interval of 20 to 100 years depending on climate and site productivity (Miller et al. 2000, Wright and Bailey 1982). In any event, recent unnaturally high-intensity wildfires (caused at least in part by invasive annual grasses like cheatgrass) have substantially reduced or removed sagebrush and its seed from burned areas, although most other shrub and understory species in a healthy sagebrush steppe community will reseed or resprout after fire.

Native sagebrush plant communities benefit watersheds by providing vegetative litter, which serves as a nutrient source, provides soil surface protection by reducing impacts of precipitation, and traps surface water allowing for percolation into the soil profile. Healthy plant communities discourage encroachment of invasive plants. However, healthy sagebrush steppe communities are rapidly disappearing due to invasion of non-native plants (especially cheatgrass), high-intensity wildfires, and encroachment of western juniper, and other disturbances. Sagebrush communities have been identified as one of the most threatened land types in North America, and as much as half of this land type has already been lost in the Great Basin (SageSTEP 2009).

The onset of settlement of western lands in the late 1800s and introduction of livestock grazing on public land through the early 1930s, combined with fire suppression, has greatly affected the native plant communities in eastern Oregon (Miller and Wigand 1994). Largely unmanaged grazing during this time and the introduction of non-native plant species resulted in declines of native perennial grass species and establishment of competitive (and often invasive) grasses. Invasive annual grasses have a competitive advantage because of their ability to utilize limited moisture early in the growing season, and because of their short life spans culminating in prolific seed production. Their rapid growth and short life spans also result in the production of fine flammable fuels that contribute to an increase in the spread and intensity of wildfires. Repeated wildfires result in the loss of sagebrush over large areas, leaving these areas dominated by invasive annual grasses. This conversion results in the loss of sagebrush obligate species, leading to an overall loss of species' diversity. Roughly five million acres of the Sagebrush Steppe and Eastern Forest biomes are estimated to be occupied by invasive annual grasses (Figure 4-7).

Prior to European settlement, native western juniper were primarily confined to rocky ridges or surfaces with sparse vegetation (Barney and Frischknecht 1974). The suppression of periodic fire has helped contribute to a four-fold expansion of western juniper since 1930 into 6.4 million acres in eastern Oregon (Thompson 2007). Western juniper's high water usage and allelopathic effects completely eliminate native perennial grass, shrubs and forbs, and even ponderosa pine, and create a challenging environment in which to restore native plant communities (Miller et al. 2005). The elimination of native plants by encroaching western juniper results in increased erosion and decreased soil available for plants to reestablish. An estimated five million acres in eastern Oregon are currently occupied (Miller et al. 2005) with an unnaturally high population of western juniper.

Land ownership patterns - In the southern two-thirds of this biome, the BLM is the predominant landowner. Intermingled private lands are dominated by agriculture, ranching, and their associated communities. Adjacent ranchers often hold permits to graze livestock on BLM lands, and grazing-related infrastructure developments are often on BLM lands under permit. Boundaries between private and public lands are often discernable by no more than a fence, if at all, and vegetation migrates readily between ownerships. Successful invasive weed control and other vegetation management is typically a cooperative effort between private owners, weed control districts, weed boards, local governments, and the BLM.

Eastern Forest Biome

Plant communities occurring in this region are adapted to dry summers and cold winters. Elevation is between 2,500 and 8,000 feet. Precipitation ranges between 10-27 inches and occurs primarily during the winter (Franklin and Dyrness 1988). Plant communities are dominated by various species of coniferous trees, with ponderosa pine in the lower elevations and western larch and grand fir in the higher elevations. Lodgepole pine is also present, particularly close to the Cascades between Highway 97 and the crest. A mixture of perennial bunch grasses and forbs is the most common associated vegetation. This associated vegetation also often includes sagebrush, bitterbrush, and various other shrubs, particularly under the more open ponderosa stands and between forested sites. Low flat areas often associated with water can be dominated by perennial grass/forb communities, and most of these are private lands dating from early homesteading. Variation in plant communities at the local scale is influenced by differences in soil types, moisture regimes, weather patterns, cold air drainage pockets that preclude successful conifer regeneration, and grazing and fire history.

Frequent natural fires historically kept the pine stands open, regenerated the lodgepole pine before it began to naturally decline about age 80, and kept the fir restricted to higher elevations. Recent decades of fire suppression coupled with harvesting of larger pines have resulted in higher-than-normal stocking that includes dense understories, drought-susceptible fir, and the buildup of downed logs and limbs. This denser forest shades out the shrub/forb/grass understory vegetation and otherwise changes the structure and composition of the plant community and its dependent wildlife. The accumulation of biomass and understory fuel ladders result in frequent stand replacing wildfires. These unnaturally intense fires kill most trees regardless of size, setting back succession and allowing invasive plants to get a foothold. Nearly 100 percent of east side pine forests have invasive annual grasses in the understories (Donnegan et al. 2008), but they do not materially affect the relatively fire resistant pines and other conifer species.

Forest management activities are conducted to promote forest stand health and resiliency to fire, insects, and disease. Treatments include thinning to reduce densely canopied young forests, fuels reductions of overstocked stands resulting from many years of fire suppression, fire salvage to reduce fuels and capture surplus mortality, and/or uneven age stand management to restore pre-settlement stand conditions. During 2005 -2007, an average of 2.3 million board feet (MMBF) of timber was offered for harvest each year, and an average of 2.0 MMBF was harvested (2,450 acres per year).

East Side Riparian Biome

Riparian-wetland areas occupy approximately 4 percent of public land acres in eastern Oregon, but contain some of the most productive and highly prized resources in this part of the State. The functions of wetland and riparian areas include water purification, stream shading, buffering effects of flooding, stream bank stabilization, ground water recharge, and habitat for aquatic, semi-aquatic, and terrestrial plants and animals (EPA 2005b). Riparian zones include the green zones along flowing water features such as rivers, streams, and creeks (Gebhardt et al. 2005) and many standing water features such as lakes, ponds, and seeps. Ephemeral streams where water flows for only brief periods during storm runoff events typically do not support a full suite of riparian vegetation or benefits.

Species present include but are not limited to cottonwoods, aspen, and other *Populus* species (often genetically distinct by drainage), alder, willows, dogwood, water birch, conifers, and their associated shrubs, forbs and grasses (although some riparian areas are characterized by grass and forb communities)(Crowe et al. 2004). This vegetation is immediately associated with the stream channel and associated wetlands, and typically contrasts starkly with the surrounding upland vegetation.

The BLM defines Proper Functioning Condition (PFC) for wetland and riparian areas to be functional when adequate vegetation, landform, or large woody debris is present (Prichard et al. 1993):

1) to support adequate vegetation, landform, or debris to dissipate energies associated with wind action, wave action, and overland flow from adjacent sites thereby reducing erosion and improving water quality;
2) filter sediment and aid floodplain developments;
3) improve floodwater retention and groundwater recharge;
4) develop root masses that stabilize islands and shoreline features against cutting actions;
5) restrict water percolation;
6) develop diverse ponding characteristics to provide the habitat and the water depth, duration and temperature necessary for fish production, water bird breeding, and other uses; and,
7) support greater biodiversity

PFC assessment does not take into consideration the habitat value of the area for fish and wildlife.

The BLM in eastern Oregon administers 8,508 miles (467,840 acres) of riparian areas of which 38 percent is at PFC; less than 34 percent is functioning at risk; 2 percent is non-functional, and 26 percent is unknown. There are also 140,328 acres of wetland of which 93 percent is at PFC and the balance is unsurveyed (USDI 2007b).

Siskiyou Biome

Geography and Physical Environment - The Siskiyou biome encompasses the physically and biologically diverse Klamath Mountains in southwest Oregon. The terrain is highly dissected with elevation ranging from less than 1,000 feet in valley bottoms to 4,000 to 6,000 feet on ridge crests, with some peaks as high as 8,000 feet. The region generally experiences mild wet winters with long dry hot summers, commonly referred to as a Mediterranean climate. The biological diversity is attributed to the varying annual precipitation amounts, elevation ranges, topography, the type of parent material or underlying soils, and soil moisture (Strothmann and Roy 1984).

Vegetation communities can be separated into three main forest types: oak woodlands and savannah, mixed conifer/evergreen forest, and coastal forest (Agee 1993). Oak woodlands, savannahs, and shrublands typically occupy drier sites at lower elevations. Grass-dominated[8] savannahs may have up to 30 percent canopy cover of trees. Mesic (moist) oak woodlands may show greater canopy closure of California black oak or Pacific madrone, while drier non-clay sites show increased domination by shrubs. Common tree species include oaks (mostly black and white oak), Pacific madrone, and conifers (predominantly ponderosa pine and some Douglas-fir and cedars). The shrub layer consists of buckbrush, birch-leaf mountain-mahogany, manzanita, and poison oak.

Mixed conifer/evergreen forests in this biome typically include an overstory of mixed conifers, with conifers and sclerophyllous[9] broadleaved trees in the under-story. The most dominate species is Douglas-fir. Depending on the elevation, topography, and annual precipitation, other dominant or co-dominant species could include tanoak, ponderosa pine, sugar pine, and Pacific madrone. A variety of other trees may also be present including hardwoods (such as canyon live oak, black oak, and chinquapin) and conifers (such as incense-cedar in the lower elevations, Jeffrey pine on serpentine, western hemlock, grand fir and white fir in mid to upper elevations, Port-Orford-cedar and Pacific yew on moist or coastal sites and within riparian areas, and knobcone pine on recent burns). Understory communities (low shrub and herb layers) are usually not well developed but can include poison oak, Oregon grape, California honeysuckle, vine maple, oceanspray, California hazel, and wildrose (Strothmann and Roy 1984). Riparian areas are similar but with an increase in hardwoods such as big leaf maple

8 Most commonly Roemer's fescue and/or Idaho fescue.

9 Hard-leaved evergreen shrubs that are adapted to the hot summer.

and dogwood. After stand-replacing fires, succession to conifers can be slow, often going through evergreen hardwood or dense evergreen chaparral stages first (Strothmann and Roy 1984).

The coastal forest lies in a thin band along the coast. Mature forests are co-dominated by Sitka Spruce, western hemlock, and western redcedar (Agee 1993). Douglas-fir, true fire, and Port-Orford-cedar are found as secondary species, while red alder may dominate disturbed sites, and black cottonwood and big leaf maple can be found in riparian areas (Agee 1993). The understory may include salmonberry, salal, red huckleberry, and vine maple. Slightly more inland and on the lower drier valleys, Douglas-fir is the climax species while Pacific Silver fir and western hemlock occur in the higher elevations. The coastal forest shares many density and structural characteristics with the Western Forest Biome further north, but coastal forests in the Siskiyou Biome include Port-Orford-cedar, tanoak, and a few redwood.

Disturbance trends - At most sites away from the coast, frequent low and mixed severity natural and anthropogenic (American Indian) fires historically played a critical role in determining species' composition and structure (Agee 1993). Low intensity fires in the oak woodlands, savannahs, and mixed-conifer forest controlled regeneration of fire-intolerant species, promoted fire-tolerant species, maintained an open forest structure, reduced forest biomass, decreased density-related insect and disease mortality, and helped maintain habitats for species that utilize open stand structure (Graham et al. 2004). Fires affected soil properties, watershed hydrology, and forest stand dynamics. Oak woodlands, savannahs, and the lower elevation drier mixed-conifer forests were burned frequently by American Indians (Agee 1993) much more so than lightning. These fires were of low intensity and usually of short durations, carried by surface layer fuels such as grasses, forbs, leaves and needles, maintaining open prairies and savannahs, and reducing the understory vegetation and surface fuels.

In the oak woodlands, savannahs, and mixed-conifer forest, intensive fire suppression efforts in the last 60 years has resulted in considerable fuel accumulation in some areas, and substantial shifts in tree species' composition and forest stand structure. This shift has led to increasing the density of shrubs and oaks thereby transforming the savanna into woodlands, and has resulted in an expansion of Douglas-fir and shrubs in the oak woodlands (Agee 1993). Fire exclusion in the drier mixed conifer forest has contributed to an increase in understory vegetation, permitting vast areas to accumulate uncharacteristically high levels of ladder fuels, which contribute to an increased risk of high-severity, stand replacement fire (Graham et al. 2004). As a result, these changes have made forests more susceptible to large, high-severity fires such as the 2002 Biscuit Fire, which burned over 500,000 acres of forest.

In the more moist coastal and higher elevation forests, fire was less frequent but typically burned at higher intensity resulting in a high-severity fire regime and larger fires (Agee 1993, Frost and Sweeney 2000). These fires also resulted in patch diversity, but at a much larger scale than patches occurring in the low and mixed fire severity landscapes. These natural forest patches contributed to the diversity of the broader landscape (USDA, USDI 2007:149). Less frequent high-severity fires occurred in the forest adjacent to the coastal forests and in some rare cases during periods of prolonged drought in the Sitka Spruce coastal forest (Agee 1993). Wind events historically played a greater role in the Sitka Spruce coastal forest in creating forest openings and regeneration (Agee 1993).

Land ownership and use - Land ownership patterns as well as public and commercial use in this biome substantially contribute to the risk of invasive plant spread. At higher elevations and in some areas nearer the coast, large sections of continuous public lands occur on National Forests. However, at lower elevations much of the land is a fragmented checkerboard pattern of lands managed by the BLM, State of Oregon, private timber companies, other private owners, and tribes. Home building and other development has increased urbanization of oak woodlands, savannahs, and lower elevation mixed conifer-forest into what is commonly referred to as the wildland urban interface. This urbanization and appurtenant increase in wildland use has increased wildfire occurrence and off-highway vehicle and other recreational use, all of which contribute to the introduction and spread of invasive plants.

Western Forest Biome

Geography and Physical Environment - The Western Forest Biome is dominated by the coast range that reaches 4097 ft in elevation, and the lower elevations on the west slope of the Cascades (where BLM lands are generally below 4,000 ft.) Both mountain ranges are north-south trending, generally separated north of Eugene by the Willamette Valley (Figure 4-1). Geologic conditions in the coast range are highly variable, but typically comprised of older basalt and newer marine sedimentary formations.

Most of the biome is rugged with steep canyons. Precipitation and temperature interact with physiography to provide the setting for hydrologic processes and disturbance events. Tributary streams are short with steep gradients. The Willamette River drains the northeastern half of the biome. The remainder is drained by rivers flowing directly to the Pacific (Umpqua, Nestuca, etc.). Streamflow peaks are generally caused by winter rainfall and from spring snowmelt.

Vegetation - Abundant precipitation and mild temperatures allow highly productive coniferous and deciduous forests to dominate. Complex, multi-storied evergreen forests occupy much of the region, with species' composition varying by altitude and climate. At lower elevations, Douglas-fir, western hemlock, western red cedar, grand fir, Pacific silver fir, and Sitka spruce are the dominant conifer tree species. In the Coast Range, Sitka spruce dominates the immediate coast, while a mosaic of Douglas-fir, western hemlock and western red cedar dominate inland areas. Douglas-fir plantations of various ages up to 50 years are common and even more prevalent on intermingled private lands that are intensively managed. Sitka spruce/western hemlock forests occur where climatic conditions are dominated by maritime influence.

Hardwood species occur sparsely throughout this type of forest and are often found in disturbed or riparian habitats. Hardwoods include red alder, bigleaf maple, and, on warmer drier sites, Pacific madrone and giant chinquapin (Franklin 1988). Understory species include salal, oceanspray, western swordfern, redwood sorrel, Cascade barberry, and Pacific rhododendron. Understory community composition varies with locality, but similar understories are found in both mature and less mature forests.

Vegetation in pre-forest succession is heterogeneous and reflects logging, fire, and other disturbance history. Woodland ragwort and fireweed are common herbs that are found the first years after fire or other disturbance. The herbaceous community is succeeded by shrubby species such as perennial vine maple, trailing blackberry, low Oregon grape, Pacific rhododendron, and various ceanothuses. Diversity and biomass of herbs and shrubs declines once the canopy closes.

Non-forested areas account for about four percent of this biome (105,000 acres), and include rock outcrops, cliffs, talus areas, grasslands, shrublands, herbaceous wetlands, vernal pools/ponds, bodies of open water (e.g., ponds, small lakes, reservoirs, and rivers), coastal dunes/open sand, coastal grasslands, and salt marshes.

Riparian and wetland areas occur throughout the biome. Red alder, willow, and other broadleaf species dominate floodplains and recent mass movement (slide) areas. Although riparian areas serve as important habitat for some wildlife species, they are not as important to most wildlife as riparian areas east of the Cascades because the vegetation and moisture difference from the surrounding landscape is not so pronounced. Some key ecological processes that shape riparian and wetland areas are tree growth and mortality (which affect stream shade, nutrient input, and large wood delivery), hydrology (floods and groundwater), landslides, and sediment routing. These factors have great influence on the ability of aquatic habitat to support fish populations (Meehan 1991, OWEB 1999). Aquatic ecosystems in this biome are naturally dynamic, changing over time due to natural events as wildfires and large storms, and the subsequent floods, hillslope failures, landslides, and debris flows (Haynes et al. 2006, Naiman et al. 1992).

Disturbance trends – Before the 1970s, large wood was generally considered a nuisance or hazard in streams. Large wood was systematically removed from streams to benefit river navigation, prevent or decrease flooding effects, enhance log transportation, and improve fish passage (Maser and Sedell 1994 cited in Reich et al. 2003). In the wetter northern portion of this biome (particularly in the coast range), high-intensity stand-replacing fires and/or major wind events may be separated by hundreds of years. Regular small-scale events (gap dynamics) are caused by insects, slides and floods (evidence of historic mass movements is ubiquitous), windthrow, and disease. Recent timber harvest has changed the dominant vegetation, with most harvest units having been replaced with even-aged stands of Douglas-fir.

The primary natural disturbance event in the southern part of the biome is wildfire. Historically, frequent low or mixed-severity fires limited the expansion of less fire-tolerant species such as true firs. Recent exclusion of fire has resulted in expansion of these species into the surrounding ecosystems. The resultant overstocking has led to more insect mortality, and has increased fuels supporting a trend toward more intense fires (USDA 2005a; USDA, USDI 2007).

An extensive road network has contributed to an increase in slide events, wildfires, and the increasing soil and vegetation disturbance. These disturbance events, coupled with high human use, have introduced and spread invasive plants like Scotch broom, gorse, English ivy, and Himalayan blackberry to forestland. These non-native plants typically reduce native-plant diversity and prevent or delay the regeneration of native vegetation.

Land ownership and use - BLM lands here are primarily used for timber production and recreation. Land ownership patterns as well as public and commercial use in this biome substantially contribute to the risk of spreading invasive plants. At higher elevations and in some areas nearer the coast, large sections of continuous public lands occur on National Forests. However, at lower elevations much of the land is a fragmented checkerboard pattern of lands managed by the BLM, State of Oregon, private timber companies, other private owners, and tribes. The population centers in the nearby Willamette Valley contribute to increased wildfire occurrence, timber harvest, off-highway vehicle and other recreational use, and grazing, all of which contribute to the introduction and spread of invasive plants.

Willamette Valley Biome

Geography and Physical Environment - The Willamette Valley Biome is a lowland approximately 150 miles north-to-south, and 60 miles wide. Prior to European settlement, the broad, Willamette Valley was characterized by rolling prairies, widely-spaced fire-tolerant oak, Douglas-fir, and ponderosa pines, and extensive wetlands, all maintained by extensive American Indian burning. Willamette Valley landforms are terraces and floodplains, interlaced and surrounded by rolling hills. European settlement ended most of the burning, and Douglas-fir, western hemlock, and western red cedar forests encroached onto the lower hills and edges of the valley, creating much of the conifer forests visible today (Johannessen et al. 1971). Some oak savannah remains, but most have been developed for agricultural and urban uses. Oregon white oak woodlands and prairies are now remnant patches. Deciduous shrubland, often established following fire or other disturbance, can be found scattered in coniferous forest areas in small to large patches. These shrublands can persist for decades or longer before succeeding to woodland, then forest.

Native west side grasslands are found in dry, upland prairies and savannas or on grass- and forb-dominated cliffs, bluffs and balds, which often have a minor component of Oregon white oak, Douglas-fir and/or ponderosa pine. Moist meadows can occur in small valleys. Bunchgrasses dominate the grasslands, while a combination of sedges, rushes and bunchgrasses dominate natural meadowlands. Many of these have been invaded by non-native grasses.

Disturbance trends - Conversion for urban and agricultural uses is the ultimate disturbance, because the site no longer returns to forest, prairies, or wetlands. The amount of conversion was substantial during settlement, but Oregon's land-use system now limits such changes. Little remains of some of the native grassland communities. Farming, recreation, and other human activities along with a well-developed road system readily spread invasive plants in this biome.

Land ownership and use - BLM lands occupy only a small portion of this biome, generally along the hilly west, south, and east margins. Productive soils and a temperate climate make it the most important agricultural area in Oregon.

Noxious Weeds and Other Invasive Plants

Affected Environment

Invasive plants (or weeds) are non-native aggressive plants with the potential to cause significant damage to native ecosystems and/or cause significant economic losses. They successfully compete with native plants for light, water, soil nutrients, and space, resulting in their dominance of the plant community and the displacement of native plants and the fauna that depend on them. Invasive plants can cause profound changes to native ecosystems including changes in seral progression, habitat, nutrient cycling, water availability, soil qualities, soil productivity, and fire regimes. Ecological damage from extensive noxious weed infestations is often permanent (Dewey 1995). The spread of invasive plants threatens the structure and function of many ecosystems worldwide (Higgens et al. 1996, Heywood 1989:31-34). There are estimated to be over 1,030 species of non-native plants in Oregon (Oregon Flora Project 2008), and 225 of them are considered invasive by the BLM in Oregon. Not all non-native plants are considered invasive. Indeed over 90 percent of our food crops are non-native to the United States. There are approximately 2,000 non-native plants estimated to be in the U.S. (OTA 1993).

Noxious weeds are a subset of invasive plants that are County, State, or Federally Listed as injurious to public health, agriculture, recreation, wildlife, or any public or private property. Noxious weeds are regulated by State and Federal laws, such as the Federal Noxious Weed Act of 1974 and the Oregon noxious weed quarantine administrative rule (OAR 603-052-1200). The quarantine rule prohibits import, transport, propagation, or sale of State listed noxious weeds and plants on the Federal Noxious Weed List (7 C.F.R. 360.200) because they are detrimental to agriculture, natural resources, and/or public health. These weeds choke out crops, destroy range and pasture lands, clog waterways, affect human and animal health, and threaten native plant communities. Designating additional noxious weeds is a continuous process. The number of noxious weeds listed by the State of Oregon increased 40 percent between 1991 and 2001.

Traits of Invasive Plants

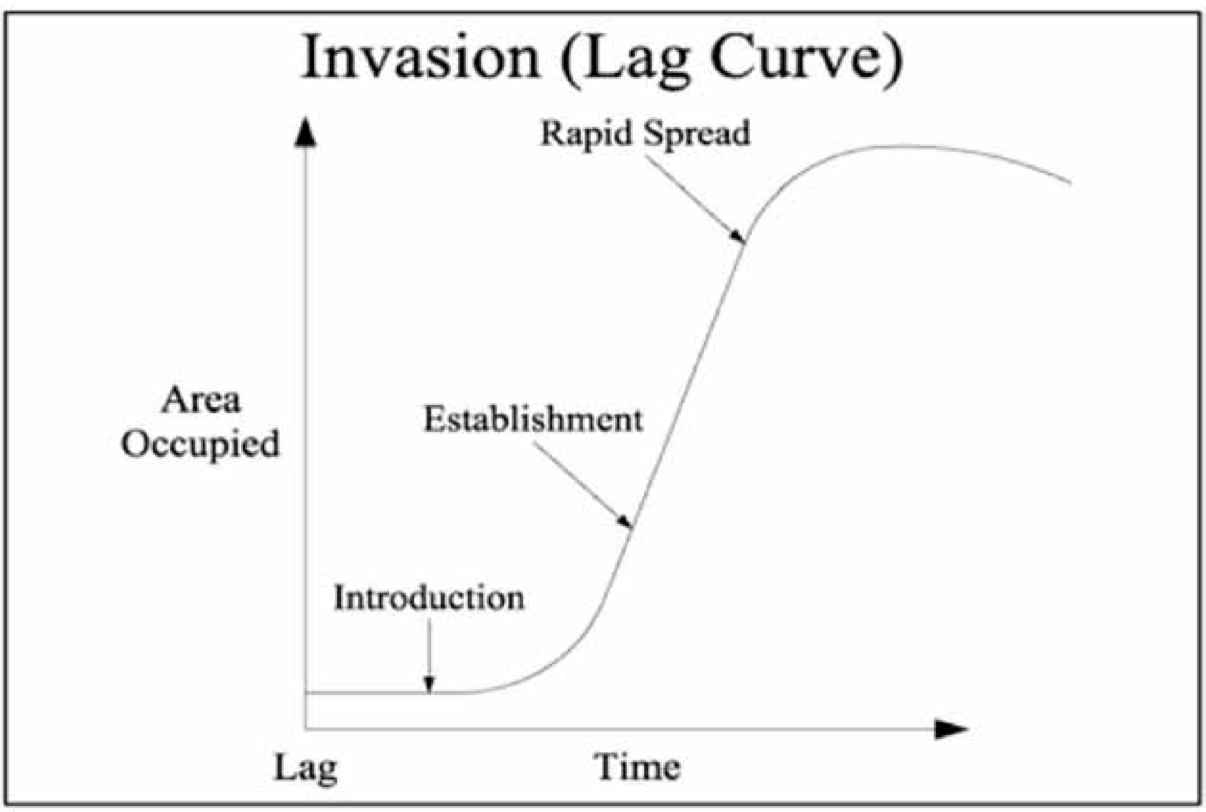
Noxious weeds and other invasive plants have biological traits that enable them to colonize new areas and successfully compete with native species. While not all invasive plants share all of these traits, most have one or more that allow them to compete successfully. These traits include deep tap roots or extensive root systems; little surface foliage (allowing the plants to grow later in the summer than most native rangeland plants); earlier growth and reproduction than most natives; seeds that remain viable near the soil surface for decades; adaptations for spreading long and short distances; production of many seeds from one plant; long lifespan; ability to delay flowering; ability to reproduce vegetatively; tolerance for a wide range of physical conditions; rapid growth; self pollination; ability to compete intensively for nutrients; and production of toxic compounds that negatively affect neighboring plants (USDA 2005a). Once established, these species can dominate due to the absence of the insects, pathogens, disease, and herbivores that keep them in balance in their native ecosystems.

Mechanisms of Invasion

Invasive plants can enter Oregon from other countries in shipping containers, on vehicles, on or in various products or packing materials, on clothing, with other plants or soil, as contaminants in seed mixes, or can be brought in intentionally as ornamentals or to accomplish some management objective. They also enter Oregon from neighboring states, and move great distances within the State on off-road and other vehicles, on camping and other recreational equipment, on pack stock and livestock, in hay and other feed crops, on construction equipment, on the wind, on animals including within feces, and as intentionally moved ornamental or medicinal plants or inadvertently within the soil of such plants (USDI 1996). Infestations begin mostly on disturbed sites, such as at trailheads, along roads and trails, firebreaks or burned areas, landing pads, oil and gas development sites, timber harvest areas, wildlife and/or livestock concentration areas, and campgrounds. Linear disturbances such as roads, pipelines, and fences can serve as corridors for weed spread. Weeds at public use sites are more likely to be spread to additional areas.

The plant invasion process occurs in three phases: introduction, establishment, and spread. Once an introduction occurs, a delay or lag phase often takes place while an invasive plant becomes established. The length of this initial phase varies, but it can last for up to 100 years (Hobbs and Humphries 1995). This phase is followed by a period of rapid growth that continues until the invasive species reaches the bounds of its new range (Figure 4-2, Mack et al. 2000).

FIGURE 4-2. RELATIONSHIP BETWEEN AREA OCCUPIED BY INVASIVE SPECIES AND TIME.



Once an invasive plant is introduced, control programs are most effective if they identify and eradicate the infestation while it is still in the introduction phase. Control efforts in this phase can prevent future infestations on tens to hundreds of times more acres (Radke and Davis 2000:25). Regular field surveys attempt to detect as many populations in the introduction (or early establishment) phase as possible. Once a weed is well established, not only is it more numerous and likely to have contributed heavily to the soil seed bank, native plants critical to successful restoration on control sites may have been severely reduced or eliminated. Eradication at this point quickly becomes impractical.

Maintaining cover of native and other non-invasive plant species on public lands is critical to halting the spread of noxious weeds. In a 45-year study of a sagebrush steppe landscape in Idaho, areas with the highest cover of native species exhibited the greatest resistance to invasion by cheatgrass (Anderson and Inouye 2001). Open and disturbed plant communities are more likely to be invaded, while undisturbed forests are less invaded (Rejmanek 1989:389-390). However, shifts in plant communities resulting from climate change, whether those shifts occur rapidly through increases in stand-replacing wildfire or more gradually through increased mortality in the native ecosystem, will favor increased expansion of invasive plants (see the *Climate Trends, Projections, and Implications* section in this Chapter). Natural, climate driven, or human-caused ground-disturbances increase the likelihood of invasive weeds becoming established. Planned BLM management activities potentially creating a moderate or high risk of establishing invasive plants must include a plan for their prevention, monitoring, and control (Appendix 3) (USDI 1992b).

Weed Infestations in Oregon

In 2007 it was estimated that noxious weeds infest 1.2 million of the 15.7 million acres of BLM administered lands in Oregon, and are spreading at an annual rate of about 12 percent or 144,000 acres per year (Appendix 7). At this rate, acres infested[10] with noxious weeds will double in about eight years. As noted in the *Integrated Vegetation Management* section in Chapter 3, a full range of direct control practices with and without herbicides is currently being implemented on just over 20,000 acres per year, mostly targeted at infestations still in the introduction or early establishment phase, or on the perimeter of larger infestations, where they have a disproportionately beneficial effect on the long-term spread rate. Without this control, the current spread rate would certainly be higher. However, certain weed species cannot be effectively controlled with methods or tools currently available to the BLM in Oregon.

For about 25 species of noxious weeds already well established in the State, weed control in Oregon has included the release of bio-controls in the form of insects and pathogens from the weed's native lands (see Table A7-1) (OSU 2009). While these agents do not eliminate the weed, they often reduce its density enough to reduce ecological damage and allow native and other non-invasive plants to survive.

There are 120 species on the Oregon noxious weed list in June 2010 (Appendix 7). Six of these are estimated to infest more than one million acres each statewide (all ownerships): yellow starthistle, Scotch broom, Himalayan blackberry, quackgrass, field bindweed, and Canada thistle. Another eight are estimated to infest more than 100,000 acres statewide: perennial pepperweed, medusahead rye, St. Johnswort, diffuse knapweed, poison hemlock, English ivy, bull thistle, and tansy ragwort. Oregon loses more than $83 million annually to just 21 noxious weeds (Radke and Davis 2000).

10 "Infested" means anything from a single individual to a monocultures of noxious weeds, so the 1.2 million acres is gross acres. Radke and Davis' (2000) examination of 21 noxious weeds in Oregon (all ownerships) suggested a gross to net ratio of about 5:1. Adverse effects to various resources described within this Chapter usually vary by the level of infestation. Nevertheless, adverse effects are *proportional* to the acres expected to become infested under each alternative.

Additional examples include:

- Purple loosestrife is present in 32 of Oregon's 36 counties. One mature plant can produce 2.7 million seeds per year the size of ground pepper. It also spreads vegetatively; disturbance to underground stems or roots during incomplete plant removal initiates bud growth (WA Dept of Ecology a).
- Spotted knapweed has invaded 34 of Oregon's 36 counties. It suppresses surrounding native plants by altering soil chemistry, forming monocultures that have resulted in changes to elk migration routes. During a 12-year period ending in 2001, spotted knapweed expanded 42-fold, and yellow starthistle expanded 11-fold.
- Blackberry infests many riparian areas and is beginning to occur east of the Cascades. It limits human and wildlife access to streams, outcompetes native riparian species, and the resultant monoculture provides poor soil cover and stream bank protection, resulting in increased sedimentation and damage to water quality and spawning gravels.
- Scotch broom-related reductions in timber volume within Oregon have been valued at over $47 million annually (Radke and Davis 2000:19-20).
- Yellow starthistle makes rangeland unusable, closing grazing allotments, ruining ranches, and displacing wildlife.
- Some noxious weeds like gorse, Scotch broom, and medusahead are highly flammable. In 1936, the town of Bandon, Oregon, was destroyed and 11 citizens killed by a fire propagated by gorse, a highly flammable plant introduced 70 years earlier (Simberloff 1996). This species is still being battled along the Oregon and California coasts.

Other (non-noxious) invasive plants, particularly cheatgrass (*Bromus tectorum*) infest at least 5 million additional acres of BLM lands in Oregon. Cheatgrass, (like noxious medusahead rye), is an invasive annual grass that grows, seeds, and matures and dries early in the summer. This pattern depletes soil moisture needed by native plants, and results in flashy fuels that burn regularly – also eliminating native species. The seeds survive the burning, so the ecosystem is rapidly converted from a perennial bunchgrass/forb/shrub community relatively resistant to fire, to a monoculture of unpalatable[11] annual grasses that burn regularly. In addition to the ecological damage, the fire hazard created by these grasses threatens communities and other infrastructure improvements.

See *Additional Information About the Ecological Damage Caused by Invasive Plants* in Appendix 7.

BLM cooperates with the Oregon Department of Agriculture, local weed boards, adjacent landowners, and others to control infestations. The State assigns noxious weeds to two lists depending upon statewide management objectives (Appendix 7: Table A7-1). A-list weeds are likely to occur in Oregon or do occur in Oregon at a low enough level that eradication is possible statewide. B-list weeds are more common and widespread, at least in some areas of Oregon. Additionally, a T-list includes weeds from either the A or B list for which the State has targeted funding.

Environmental Consequences

Noxious weeds and other invasive plants typically have characteristics that enhance their survival at the expense of native and other non-invasive species. Their structure and development is such that they use more moisture, provide less soil protection, alter soil chemistry, are unpalatable to wild horses and livestock, do not support native fauna, and have various other negative effects on the natural or current environment. In order to help

11 to wildlife and livestock

quantify these effects, this section attempts to estimate the differences between the alternatives in terms of how well they will or will not change the rate of spread of noxious weeds on BLM lands, and thus how they will affect the total acres infested with noxious weeds at some point in the future. The importance of these estimates cannot be overstated. Although the various resource sections in this Chapter identify some additional risk to the human environment from the proposal to increase the number of herbicides and the management activities they may be used for on BLM lands in Oregon, the environmental and even human health risks associated with the continued increase of noxious weeds must likewise be considered.

While projections of weed spread in this section are based on considerable published data, it is acknowledged that attempts to quantify future weed spread require many assumptions. Some of these assumptions may not be entirely accurate, either because management emphasis may change or because the assumptions themselves are simply flawed. Therefore, the projections in this section should be viewed not so much as predictions of what will occur over time, but as reasonable approximations of the relative differences between the alternatives.

Efforts by academia and others to develop spread rate models for individual plants have been unsuccessful because of the number of variables involved and the inability to predict propagule movement by humans. Therefore adverse effects from individual invasive plants are described more qualitatively than quantitatively in this EIS. Predicting general relationships for noxious weeds as a group, however, is possible.

Noxious Weed Spread Rate by Alternative

The following estimates are for noxious weeds only. Invasive plants are not included because their spread rate was not part of most "current rate" spread estimates gleaned from several sources (Denton 2009), because invasive plant control efforts under the alternatives are expected to be devoted primarily to noxious weeds, and because noxious weeds are typically the most damaging environmentally and economically. There are many other invasive plants infesting Oregon that are also a problem on BLM lands – particularly cheatgrass. The estimates are based on acres projected to be treated under each of the alternatives (Table 3-3), which assume current budget trends.

Acres of Noxious Weed Control Treatments by Alternative

Table 3-3 in Chapter 3 shows the annual acres of herbicide and non-herbicide control treatments projected to take place under each of the EIS alternatives for the next ten to twenty years. Under the No Action Alternative (Alternative 2) projected (gross) treatments for the control of noxious weed and other invasive plants total 45,500 acres (Table 4-3), of which 16,700 are expected to be done with herbicides (Table 3-3). Most or all of these treatments (and certainly all of the herbicide treatments) are likely to be focused on noxious weeds.

Total (gross) control acres under the Reference Analysis are estimated to be 42,100 acres, none using herbicides. Approximately 75 percent of the herbicide treatments under of Alternative 2 (No Action) would still be conducted, but with non-herbicide methods under the Reference Analysis. The remaining 20 percent would not be conducted because many noxious weeds are simply not effectively controlled with non-herbicide methods and because such methods typically cost more and all treatments are limited by budget constraints.

The increase in the number of herbicides that would be available under Alternative 3 would mean additional weed species could be treated effectively. Weeds currently being treated with the four herbicides under Alternative 2 (No Action) could be treated more efficiently with additional herbicides, and some expensive non-herbicide treatments currently being done would be replaced by herbicide treatments. The annual acres of herbicide and non-herbicide invasive plant control treatments under Alternative 3 through 5 are projected to be 58,700 gross acres, most of which are expected to be focused on noxious weeds.[12]

12 One thousand annual treatment acres using imazapic under this alternative are expected to be used on cheatgrass, which is an invasive plant but not a State-listed noxious weed. Numbers used in effectiveness projections discussed in this section are for noxious weeds only.

Percent of Treatments that Result in "Effective Control"

Weed control treatments are not 100 percent effective at controlling all treated populations. Under any alternative, some level of retreatment may be necessary to achieve complete control. A five-acre treatment, for example, would be monitored, and a portion of the acres might require retreatment. The amount of retreatment necessary is largely a function of how likely treatments are to control the target weed on the first try.

Reference Analysis – No Herbicide Use: Two-thirds of the noxious weeds in Oregon cannot be effectively controlled with non-herbicide methods (Appendix 7: Table A7-1). Non-herbicide methods (particularly mechanical and directed livestock treatments) are also more likely to disturb soils (which leads to reinvasion) and can transport weeds off site. In addition, many woody species resprout if controlled with non-herbicides methods. The Wallowa-Whitman National Forest Invasive Plant Treatments Draft EIS (USDA 2009b:107) estimates efficiency of their mostly non-herbicide No Action Alternative at 25 to 35 percent. The estimated efficiency of the Reference Analysis in this EIS is 30 percent. In other words, weeds would be controlled on 30 percent of the acres treated under a no herbicides strategy.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only: The efficiency of Alternative 2 is limited (though not nearly as severely as the no-herbicide Reference Analysis) because only four herbicides are available. Sixteen of the State listed noxious weeds cannot be effectively treated under this alternative (Appendix 7: Table A7-1). Treatments for these species do not eradicate the infestation but are often conducted anyway because they reduce vigor or retard seed development and thus slow the spread. The estimated efficiency of treatments under Alternative 2 is 60 percent of the total acres treated. In other words, weeds would be controlled on 60 percent of the acres treated under Alternative 2. Difficulty in conducting cooperative projects (because many herbicides cannot be used on BLM lands) contributed to this 60 percent. In addition, the inability to treat other invasive plants with herbicides increases the likelihood additional plants will become well established before they are declared noxious weeds.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases: Under Alternative 3, the wider range of herbicide options would increase the effectiveness of the average treatment. Although some level of retreatment would still take place, the additional herbicides would substantially improve the chances the weed would be controlled by a treatment. With the additional herbicides available, this alternative could effectively control 116 of the 120 State listed noxious weeds (Appendix 7: Table A7-1), as well as cheatgrass and other invasive annual grasses. Non-herbicide methods could be more focused where they are effective, or used in conjunction with herbicides and thus all treatments under this alternative would be more efficient. More effective cross-boundary cooperative projects contribute to the efficiency. Some new invasive plants would be identified and controlled before they are listed as noxious weeds. The estimated efficiency of this alternative is 80 percent.

The efficiency of the alternative translates the gross treatment acres listed on Table 3-3 to *effectively treated acres* (Table 4-3). The effectively treated acres are those that control the weeds on the site and prevent future weed spread.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses and Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives: Alternatives 4 and 5 assume the same 57,700 acres of noxious weed treatments as Alternative 3 (and thus the same efficiency), but add 9,300 acres of herbicide use to control native and other non-invasive plants encroaching on rights-of-way, administrative sites, and recreation sites (Table 3-3). These sites are typically managed in an early seral or disturbed condition favorable to noxious weeds. These areas are also likely to become infested with noxious weeds and other invasive plants since seeds are more readily transported into access corridors by human activity. Thus, the 9,300 acres of herbicide treatments targeted at native and other non-invasive plants in these areas under Alternative 4 (and 5) are assumed to also (incidentally) control additional noxious weeds missed by noxious weed control efforts under Alternative 3.[13] It is estimated 25 percent of these rights-of-way and related treatments, or 2,350 acres, will incidentally treat these undetected noxious weeds (Table 4-3). This 25 percent estimate includes a de facto weed control effect from simply replacing existing mechanical vegetation controls with herbicide treatments, reducing the likelihood that the maintenance equipment itself will spread weeds down the road. It also includes the effect that having fewer noxious weeds near travel corridors and recreation sites reduces the likelihood of weeds being spread along and from these sites.

Alternative 5 adds two additional herbicides and 4,800 acres of additional vegetation treatments (primarily habitat improvement), but these are not expected to substantially increase the noxious weed control acres from those calculated for Alternative 4 (Proposed Action).

Table 4-3. Projected Annual Acres of Effective Noxious Weed Control by Alternative

Alternative	Gross Treatment Acres	Efficiency Percentage	Tentative Effectively Treated Acres	25% Right-of-Way Treatment Benefit	Total Effectively Treated Acres
Reference Analysis	42,100	.30	12,630	n/a	12,630
2 (No Action)	45,500	.60	27,300	n/a	27,300
3	57,700	.80	46,160	n/a	46,160
4 (Proposed Action)	57,700	.80	46,160	2,350	48,510
5	57,700	.80	46,160	2,350	48,510

Effects of Early Treatments

As noted earlier, in 2007 it was estimated that noxious weeds infested 1.2 million acres of BLM lands in Oregon, and they are spreading at an estimated rate of 12 percent, or 144,000 acres, each year (Appendix 7). This spread rate is assumed to be partly a function of, or in equilibrium with, the No Action Alternative (Alternative 2) level of weed control treatments. Therefore, differences in the level of effective treatments between Alternative 2 and the other alternatives can be expected to result in changes to the 12 percent current annual rate of spread.

Alternative 3 would effectively treat 18,860 more acres each year than Alternative 2 (from Table 4-3). At a minimum, these acres would directly reduce the 144,000-acre annual weed spread to 125,140 acres and thus the spread rate to 10.5 percent. However, because BLM weed treatments under all alternatives are only a portion of the 144,000-acre annual weed spread, weed treatments do not target the average acres. Typical treatments target new species, new or small populations of existing species, and advancing edges of larger populations in order to keep weeds from infesting new drainages and other geographic areas (containment)[14]. These treatments effectively keep populations from moving into the establishment phase where their spread rate becomes exponential, and thus the treatments reduce future infested acres many times more than is represented by the direct acres treated. Control efforts in the introduction and early establishment phase of an invasion (Figure 4-2) can prevent future infestations on tens to hundreds of times more acres than are actually controlled.

13 This same 9,300 acres is treated with non-herbicide methods under the Reference Analysis and Alternatives 2 and 3, but mowing and other general non-herbicide right-of-way maintenance treatments would not be expected to remove noxious weeds completely.

14 An unquantified number of treatment acres are also devoted to actually reducing the perimeter of larger infestations from priority areas. In addition, an estimated 440,000 acres of biocontrols are established on BLM lands in Oregon, affecting about 30 well-established noxious weed species.

A precise relationship between control at this point and future spread reduction depends upon the species and the situation. Stopping a typical noxious weed from entering Oregon would be expected to have hundreds of times the benefit of the actual treatment acres. Numerous examples exist of a few plants, or a few acres, becoming hundreds and thousands in 10 to 20 years (Radke and Davis 2000:25). More likely, the invasion would be slowed or kept out of certain areas for years or decades. Radosevich (2007) notes, for example, attempts to reduce the overall (regional) spread of a noxious weed species are usually more effective if control tactics are focused on satellite populations originating from large patches. Radosevich also reports that Cousens and Mortimer (1995) and Moody and Mack (1988) suggest that the preferred containment strategy would be to remove satellite populations as they occur, since these populations expand more rapidly and potentially cover greater area than the front of a source population[15]. Because of this relationship, it is estimated that each acre of effective annual control would translate to a reduction of at least 10 times that amount of infested acres at some year in the future (Appendix 7, Denton 2009).

Effects of the Alternatives on Spread Rate and Infested Acres in 15 Years

There would be a lag time before seeing the 10 times reduction. The decrease in noxious weeds the first year would be no more than the 18,860-acre annual effective treatment acre difference between Alternatives 2 and 3. The complete 10 times (188,600 acres) reduction benefit would accrue gradually as those acres are, in effect, kept off the establishment part of the Invasion Curve (Figure 4-2). For this analysis, the benefit has been distributed over a 15-year period. That is, 100 acres of effective control treatments in 2010 are assumed to have reduced noxious weeds by a cumulative 1000 acres by 2025. Since treatments happen annually, they cumulatively would reduce weed spread so that the 18,860-acre annual program would be preventing 188,600 acres of annual infestation by year 15. By year 15, the annual spread rate would decrease to 7 percent and 1.9 million fewer acres would be infested with noxious weeds when compared to the No Action Alternative (Alternative 2) (Appendix 7).

Using the same relationships for the other alternatives and the Reference Analysis, the spread rate and acres infested at 15 years is estimated (Table 4-4).

Table 4-4. Projected Annual Noxious Weed Spread Rates and Acreage Changes for Each Alternative

Alternatives	Treatment Effectiveness	Effectively treated acres	% annual spread in 15 years	Change in annual spread (acres)[1]	Total acres infested in 15 years[2]	15 yr acre change from No Action
Reference Analysis	30%	12,630	14%	+14,670 to +146,700	8,559,713	+2.7 million
2 (No Action)	60%	27,300	12%	0	5,864,535	0
3	80%	46,160	7%	- 18,860 to -188,600	4,008,058	-1.9 million
4[3] (Proposed Action)	80%[4]	48,510	6%	-21,210 to -212,100	3,689,048	-2.2 million
5[3]	80%[4]	48,510	6%	-21,210 to -212,100	3,689,048	-2.2 million

[1] The effect of a change in control rate from Alternative 2 takes 15 years to be realized. Change in spread is smallest in the first year, increasing by a factor of 10 in 15 years.
[2] May be worst case. Actual invasion would be capped by biological saturation.
[3] Because Alternative 5 adds additional herbicides, it is more likely to effectively control noxious weeds. The amount of this difference is not quantified but is unlikely to lower the annual spread rate a whole percentage point.
[4] Plus the 2,350-acre incidental gain from treating such things as roadsides, administrative sites, and recreation sites.

15 Such control strategies have been likened to controlling spot fires out in front of a wildfire to reduce its spread rate.

Assumptions and calculations are explained in more detail in Appendix 7, *Noxious Weed Spread Rate References and Calculations*. The above estimates do not reflect increases in infestation rates likely to result from climate change (See the *Climate Change, Projections, and Implications* section in this Chapter). While climate change would be expected to increase the weed spread rate under all alternatives, it would also tend to increase the differences between the alternatives.

None of the alternatives in this EIS are predicted, by themselves, to achieve a "no net increase" in noxious weeds condition because, under current budget trends and priorities, many well-established infestations such as yellow starthistle east of the Cascades, or blackberry west of the Cascades, are not being aggressively treated on all ownerships, or are being treated primarily with biological controls.

Neighboring landowners and other cooperators (the State Department of Agriculture, Weed Boards, etc.) would be affected by implementation of any of the action alternatives in ways that could affect the weed spread rates calculated above. With additional herbicides available to the BLM, effective control covering entire geographically logical control areas would be available for more weed species. Adjacent landowners will be more effective at controlling species of weeds the BLM has been unable to treat under the No Action Alternative (Alternative 2). State and private control dollars may go further if treatments are more uniformly applied and thus more effective.

Changes in budget, program emphasis, efficiency, and other factors could affect these estimates, but those changes can only be assumed to affect each of the alternatives similarly, and thus not substantially affect the relative difference between the alternatives.

Native and Other Non-Invasive Vegetation

Affected Environment

This section addresses native vegetation, primarily native vascular plants, nonvascular plants (e.g., mosses) as well as lichens, fungi, and other non-invasive plants such as crops.

The Pacific Northwest is among the more diverse regions in North America in environment and vegetation. Natural vegetation types vary from dense coastal forests of towering conifers through woodland and savannah to shrub steppe (Franklin and Dyrness 1988). The present-day composition and distribution of native flora is influenced by many factors including physical (e.g., climate, wind, geology, topography, elevation, latitude, slope, exposure), natural disturbance (e.g., wildlife use, insects, disease, fire, flood), and human management patterns (e.g., cultivation, development, domestic livestock grazing, fire suppression). A brief introduction to the native plant communities in Oregon is in the *Biomes* section earlier in this Chapter.

Vegetation Considerations by Biome

<u>Sagebrush Steppe</u>: The sagebrush steppe ecosystem is considered to be one of the most imperiled of all ecosystems in the United States, with less than 10 percent retaining its historical structure and composition (Thompson 2007). Invasive plants lead to degradation, fragmentation, and loss of sagebrush communities. Invasive annual grasses, particularly cheatgrass (*Bromus tectorum*) are perhaps the greatest threat to sagebrush habitat in lower elevations (Thompson 2007). Native bunchgrasses and forbs have been replaced by cheatgrass on

millions of acres in Oregon[16], which in turn fuel wildland fires, killing native sagebrush, forbs and bunchgrasses that are not adapted to frequent intense fire. As cheatgrass and other invasive plant infestations increase, more native plant species are at risk of local or regional extirpation, as few sources of native seed are maintained. Another serious threat to native shrubs, forbs, bunchgrasses and habitats of the sagebrush steppe is the several-fold expansion of western juniper (*Juniperus occidentalis*), a native species previously restricted by fire. Western juniper depletes soil moisture and prevents the growth of other plants (Miller and Angell 1987).

Eastern Forest Biome: Native plant communities in the Eastern Forest Biome have suffered reductions in biodiversity and forage production due to invasive plants. Some native bunch grasses, forbs, and shrubs in this biome have been replaced by noxious weeds and other invasive plants such as cheatgrass, medusahead rye, Mediterranean sage, Scotch thistle, and knapweeds. Nearly 100 percent of forest inventory plots in this type showed invasive annual grasses (Donnegan et al. 2008). Ponderosa pine forests are also being threatened by the unnatural expansion of native western juniper at lower elevations. Juniper expansion results in reduced shrub abundance and reduced ground water, and contributes to loss of riparian plant species (Bedell et al. 1993).

East Side Riparian Biome: (See the *Wetlands and Riparian Areas* section in this Chapter).

Siskiyou Biome: The Siskiyou Biome has a Mediterranean climate with a strong marine influence. It has a combination of soil types including large areas of serpentine; the Siskiyou Biome is one of the most botanically diverse in North America (Stein et al. 2000). Approximately 2/3 of the known rare plants and fungi in western Oregon occur in the Siskiyou biome. This botanical diversity was a major reason for the creation of the Cascade-Siskiyou National Monument in 2000. Unique plant communities in the Siskiyou biome are threatened by starthistles, knapweeds, thistles, brooms, puncture vine, knotweeds, Dyers woad, leafy spurge, loosestrife, false brome, yellow flag iris, and Sudden Oak Death.

Western Forest Biome: Dense shade producing forests are the least likely areas to provide opportunities for sun-loving invasive plants to establish (Quigley and Arbelbide 1997); however, the introduction of shade tolerant weeds, as well as openings associated with disturbances, have lead to threats to native plants in this biome. A recent forest inventory shows 47 percent of plots in the coast range and 68 percent of plots in the western Cascades (all ownerships) have invasive plants present, and 6.2 percent of all plant cover in forests is easily identifiable non-native plants. The inventory sample plots indicate Himalayan blackberry is the most common invasive plant, covering 149,000 acres of forestland (Donnegan et al. 2008b). New openings can become infested before native succession can occur. Scotch broom has been shown to have the greatest documented economic impact to native plants in Oregon, by effectively reducing tree growth and forest production (Radke and Davis 2000). Numerous other invasive plants including plants that thrive in forests, such as English ivy, false brome, and garlic mustard adversely affect the native species in this biome. In addition to forests, the Western Forest Biome includes diverse habitats such as sand dunes, meadows, marshes, bogs, rock outcrops, and woodlands that support unique native plant communities and are threatened by invasive plants.

Willamette Valley Biome: Most native vegetation of the Willamette Valley biome has been transformed by cultivation, timber harvest, development, and invasive plants. With only remnant populations of native plants remaining, many unique Willamette Valley plant communities are imperiled. These tracts tend to be fragmented and degraded by invasive plants. Hedgehog dogtail grass, medusahead and various thistles are examples of invasive plants that have replaced native species; however, Himalayan blackberry has consumed more acres than any other non-native species (Donnegan et al. 2008). Loss of native plant communities in the Willamette Valley has lead to the Federal listing of Kincaid's lupine, Golden paintbrush and Willamette Valley daisy (USDI 2008c).

16 About 5 million acres on BLM lands east of the Cascades (see Figure 4-7 in the *Fire and Fuels* section later in this Chapter).

Susceptibility of Plant Communities to Damage from Invasive Plants

The susceptibility of native plant communities to invasion by non-native species is directly associated with the site capacity to support various plants (potential vegetation types), disturbances or stresses, the condition of the existing plant community, and the biological traits of the invader (Davis et al. 2000) as well as the potential for introduction of non-native seed or propagules. Potential Vegetation Types (PVT) have been identified based primarily on soil qualities, climate, aspect, and historic plant species. The PVTs displayed here (Table 4-5) correlate strongly with the biomes and are adapted from the 2005 Pacific Northwest Region Invasive Plant Program EIS. That EIS used classifications developed by Forest Service Ecologist Jan Henderson west of the Cascades, and potential vegetation groups developed for the Interior Columbia Basin Ecosystem Management Project (USDA, USDI 2000b; Quigley and Arbelbide 1997).

A major conclusion of the ICBEMP analysis was that, in general, grasslands, riparian areas, and relatively dry, open forests are more susceptible to invasive plants than are dense moist forests, high montane areas, and serpentine areas. The former have frequent gaps in the plant cover which favor establishment of most invasive plants, whereas the latter have relatively closed plant cover or have extreme climate or soils, which are tolerated by fewer species (Quigley and Arbelbide 1997).

Table 4-5 and Figure 4-3 provide a summary of potential vegetation types found on BLM lands in Oregon, and their expected susceptibility to invasion by invasive plants.

Table 4-5. Potential Vegetation Types

Potential Vegetation Type	Description (*Biomes*)	Percentage of BLM Lands in Oregon	Susceptibility to Invasion Rating[1]
Agricultural	Cropland/hay/pasture (*East of the Cascades*)	less than 1	High
Alpine / Cold Forest	Alpine shrub-herbaceous (*Sagebrush Steppe*). Mountain hemlock, Pacific silver fir, Shasta red fir, Subalpine fir, Lodgepole pine (*in the Siskiyou*), Western white pine (*primarily in the Western Forest, but also in Eastern Forest and Sagebrush Steppe*)	less than 1	Low
Cool Shrub	Characterized by mountain big sagebrush and shrubs, grasses, forbs, and sedges. It is limited by moisture availability due to low rainfall and/or shallow soils (*primarily in Sagebrush Steppe. Also appears in Eastern Forest*)	11.2	Moderate to High
Dry Grass	Includes native grasslands, seeded grasslands, and cropland hay pasture. Characterized by bunchgrasses (*primarily in Sagebrush Steppe. Also appears in Eastern Forest*)	1.2	High
Dry Shrub	Dominated by sagebrush but bunchgrass/forbs present. At lower elevations than cool shrub (*Sagebrush Steppe*)	66	High
East Side Dry Forest	Douglas-fir, Ponderosa pine, Lodgepole pine (*East side of the Cascades*)	3.6	Moderate to High
East Side Moist Forest	Vegetation includes transitional areas between drier, lower elevation forest, woodland types, and higher elevation forest types in cold forests. The dominant overstory species found in this group include grand fir, Douglas-fir, cedar, and hemlock. (*Primarily in Eastern Forest. Also appears in Sagebrush Steppe*)	less than 1	Moderate to High

Potential Vegetation Type	Description (*Biomes*)	Percentage of BLM Lands in Oregon	Susceptibility to Invasion Rating[1]
East Side Riparian	Shrub: mountain riparian low shrub, saltbrush riparian, willow, alder, sedge. Woodland: Cottonwood with willow, ponderosa pine, Douglas-fir, aspen. On many sites, the non-native species have become well established, commonly replacing native species or exerting large influences on the functional dynamics of existing habitats. The linear nature of the riparian corridor makes it highly susceptible to invasion. (*East Side Riparian*)	1	High
Serpentine	Forest: Jeffrey pine, Western white pine, Port-Orford-cedar. Non-Forest: Serpentine barrens and fens (*Siskiyou*)	less than 1	Low
Westside Dry Forest	Similar to East Side Dry Forest. Douglas-fir, Ponderosa pine, Oregon white oak (*Siskiyou and Western Forest*)	6	High
Westside Moist Forest	White/Grand fir, Tanoak (*Siskiyou and Western Forests*)	1.9	Low
Wet Forest	Western hemlock, Sitka spruce (*Western Forest*)	6	Low
Woodland	Dominated by western juniper. These sites generally have low water availability due to shallow soils (*primarily in Sagebrush Steppe. Also appears in Eastern Forest*)	less than 1	Moderate to High
Total		100% or 15,734,988 acres	

[1] **High** = high susceptibility to invasion. Invasive plant species invades the cover type successfully and becomes dominant or co-dominant even in the absence of intense or frequent disturbance.
Moderate = moderate susceptibility to invasion. Invasive plant species is a "colonizer" that invades the cover type successfully following high intensity fires or frequent disturbance that affects the soil surface or removes the normal canopy.
Low = low susceptibility to invasion. Invasive weed species are less likely to establish because the cover type does not provide suitable habitat.

Endangered, Threatened, and other Special Status Plant Species

Species designated as Special Status by the BLM include 1) those listed or proposed for listing as endangered or threatened under the Endangered Species Act, and 2) species designated by the State Director as Bureau Sensitive and requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the Endangered Species Act. These are managed under provisions of the BLM's Special Status Species Program (USDI 2008d). BLM policy objectives are: 1) to conserve and or recover Federally Listed species and the ecosystems on which they depend so that Endangered Species Act protections are no longer needed for these species, and 2) to initiate proactive conservation measures that reduce or eliminate threats to other Special Status species to minimize the likelihood of and need for listing of these species under the Endangered Species Act. BLM management activities must be conducted to minimize or eliminate threats affecting the status of the species or to improve the condition of the species' habitat by ensuring that activities are carried out in a way that does not lead to a need to list the species under the Endangered Species Act. Potentially habitat-disturbing projects require pre-project clearances for Special Status plants. Clearances can include proposed project review for potential habitat and/or project site surveys. Conservation Measures included in Appendix 5 and referenced in the PEIS Mitigation Measures in Appendix 2 apply to Federally Listed and proposed threatened and endangered species and their proposed or designated critical habitat.

The Oregon BLM Special Status Species Program list (January 2008) includes 483 vascular plants, 44 fungi, 26 lichens and 43 bryophytes (Appendix 5). Of these, 17 species of vascular plants are Federally Listed under the Endangered Species Act as "threatened" or "endangered," and require formal consultation with the Fish and

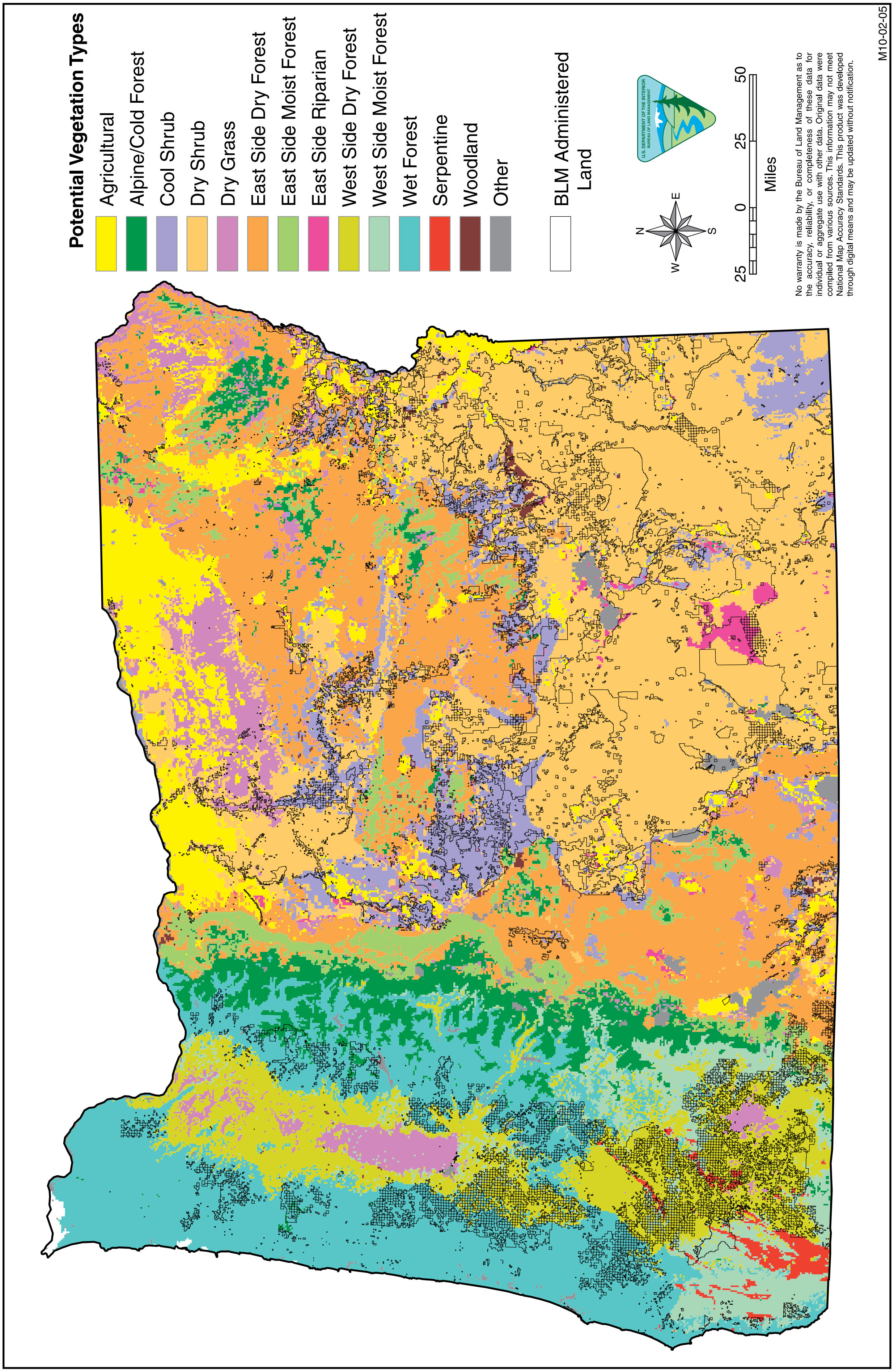


FIGURE 4-3. POTENTIAL VEGETATION TYPES

Wildlife Service if proposals are likely to adversely affect the species. Information from the PEIS Biological Assessment about the Federally Listed species has been incorporated into Appendix 5 of this EIS.

Survey and Manage

Within the range of the northern spotted owl[17], *Survey and Manage* requirements apply to some Special Status species as well as to additional plants, fungi, lichens, and bryophytes. The standard generally requires management for species' persistence at known sites and, where practical, requires a clearance survey prior to potentially harmful management activities.

Environmental Consequences

The four alternatives (and the Reference Analysis) are predicted to result in various levels of effects to non-target (native and other non-invasive) plant species and plant communities. Those effects are presented in this section in the following three distinct categories:

- *Effects of herbicides on non-target plants* - Non-target native and other non-invasive plants can be adversely affected by herbicides directed at nearby invasive plants and other target vegetation.
- *Effects of invasive plants on native and other non-invasive plants* - Native and other non-invasive plants are adversely affected by infestations of invasive plants. The degree to which the alternatives slow the spread of invasive plants has a corresponding and generally proportionate beneficial effect on the retention of functional native plant communities.
- *Effects of non-herbicide treatments on non-target plants* **-** Non-target plants can be adversely affected by non-herbicide treatment methods directed at nearby invasive plants and other target vegetation.

Effects Common to All Alternatives

Effects of Herbicides on Non-Target Plants

Herbicides have the potential to harm non-target plants, including plants that are culturally important, Federally Listed or otherwise designated as Special Status species, and those included in Survey and Manage. Some damage to non-target plant species from herbicide application is probable despite cautious planning and implementation. Herbicide impacts to non-target plants depend on (but are not limited to) the herbicide used, its selectivity, application rate, concentration, relative toxicity to the plants in the treatment area, likelihood of exposure, timing and method of application, environmental conditions during application, and plant stage of growth. Herbicide treatments impact non-target plants through direct application, overspray, off-site movement, and/or accidental spills. Potential impacts include mortality, reduced productivity, and abnormal growth. Risk to off-site plants from spray drift is greater under scenarios with application from greater heights (i.e., aerial application) or when air temperature or movement is high. Risk to off-site plants from surface runoff and movement through soil (leaching) is influenced by precipitation rate and timing, soil type, and application area. Measures taken to limit exposure, such as selective application methods (e.g., spot spraying, or wiping), typical application rates-that are less than the maximum allowed on the label (Table 3-1), drift reduction agents, and application restrictions based on environmental conditions (wind, precipitation, temperature, etc.), reduce the off-target movement of herbicides. Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) are designed to minimize risk to non-target species including crops, vineyards, and orchards.

Few studies were found on the impact of herbicides to fungi. In studies using rates similar to amounts proposed for use on BLM lands, fungi seem relatively unaffected by herbicides (Busse et al. 2003, Huston et al. 1998b).

17 For BLM, generally west of the Cascades and the western portion of the Klamath Falls Resource Area.

The risk of herbicide contamination to wild edible mushrooms (e.g., chanterelles, matsutakes, porcinis) is expected to be limited because proposed herbicide use would be focused primarily on invasive plants infestations and rights-of–ways, rather than healthy forests where these species are dependent on the roots of conifer trees.

Site-specific project design can minimize risks to non-target plants. Design considerations include the abundance and distribution of target versus non-target plant species, stage of growth (phenology) of plants, and the size of the treatment area, as well as physical features like soil moisture, timing of precipitation, air temperature, wind speed, and other factors.

Residential lands and agricultural lands, where crops (including orchards, vineyards, and pastures) are grown are protected from BLM applied herbicides by Standard Operating Procedures (see Appendix 2) that include no-spray buffers, drift reduction measures and other practices that minimize or eliminate herbicide drift or off site movement.

Certain herbicides target specific types of plants (Table 3-1), so collateral damage to non-target plants will depend upon their susceptibility to that herbicide. For example, dicamba targets broadleaf plants, so damage to perennial grasses would not be expected during normal use. Tables 3-12 and 3-13, the Risk Assessments (Appendix 8), and the following section summarize the potential effects to plants by active ingredient. The herbicides are grouped by their mode of action.

<u>*ALS-Inhibitors*</u>: *Chlorsulfuron*, *metsulfuron methyl*, and *sulfometuron methyl* (sulfonylureas) and *imazapic* and *imazapyr* (imidazolinones) work by inhibiting the activity of an enzyme called acetolactate synthase (ALS), which is necessary for plant growth. These five herbicides are effective at very low dosages (half ounce to a few ounces per acre). Because of their high potency and longevity, these herbicides can pose a particular risk to non-target plants. Off-site movement of even small concentrations of these herbicides can result in extensive damage to surrounding plants, and damage to non-target plants may result at concentrations lower than those reportedly required to kill target invasive plants (Fletcher et al. 1996). In addition, a predominant problem with ALS-inhibiting herbicides is that they can quickly confer resistance to weed populations, particularly where they are used extensively as the primary weed control method in cropping systems.

<u>*Synthetic auxins:*</u> *Picloram*, *clopyralid*, *triclopyr*, *dicamba,* and *2,4-D* mimic naturally occurring plant hormones called auxins. They kill plants by destroying tissue through uncontrolled cell division and abnormal growth.

In the Pesticide Re-registration Fact Sheet–Picloram (1995), the EPA noted that *picloram* poses very substantial risks to non-target (broadleaf and woody) plants. The EPA also noted that picloram is highly soluble in water, resistant to biotic and abiotic degradation processes, and mobile under both laboratory and field conditions. They stated that there is a high potential to leach to groundwater in coarse textured soils with low organic material. Plant damage could occur from drift, runoff, and off-site where ground water is used for irrigation or is discharged into surface water (EPA 1995). The contribution from irrigation is considered inconsequential relative to off-site drift and runoff (SERA 2003b). Labeling restrictions resulting from these findings were implemented to reduce effects.

Because picloram persists in soil, non-target plant roots can take up picloram (Tu et al. 2001), which could affect revegetation efforts. Lym et al. (1998) recommended that livestock not be transferred from treated grass areas onto susceptible broadleaf crop areas for 12 months or until picloram has disappeared from the soil without first allowing seven days of grazing on an untreated green pasture. Otherwise, urine may contain enough picloram to injure susceptible plants. To a lesser degree, this can occur with other active ingredients such as 2,4-D, glyphosate, and imazapic.

Clopyralid is more selective and less persistent than picloram. Clopyralid is relatively non-toxic to aquatic plants; however, accidental spills may result in temporary growth inhibition of aquatic plants. As with picloram, clopyralid has little effect on grasses and members of the mustard family. Overall effects to non-target plants from normal application of clopyralid are likely to be limited to susceptible plant species in or very near the treatment area.

Triclopyr is a selective systemic herbicide. It is used on broadleaf and woody species. It is commonly used against woody species in natural areas (Tu et al. 2001). Susceptible species could be impacted by drift from 100 feet (typical BLM application rate) to 1000 feet (maximum BLM application rate) (SERA 2003c).

Two forms of triclopyr could be used with differing degrees of effects. Triclopyr BEE (butoxyethyl ester) is more toxic to plants than triclopyr TEA (triethylamine salt). The triclopyr BEE form is more apt to damage plants from runoff than other forms (SERA 2003c). Both forms have been found to decrease the relative long-term abundance and diversity of lichens and bryophytes. Newmaster et al. (1999) stated that drift from triclopyr could affect the sustainability of populations of lichens and bryophytes, where these ingredients reduced abundance. Typical application rates in aerial spraying were found to reduce abundance by 75 percent, variable by species. Colonists and drought-tolerant species were more resistant than the mesophytic forest species, which means that aerial applications of triclopyr could essentially push back the successional stage on non-vascular communities.

Triclopyr BEE was found to inhibit growth of three types of ectomycorrhizal fungi associated with conifer roots at concentrations of 1,000 parts per million in laboratory experiments (Estok et al. 1989). Busse et al. (2003) found no inhibition of ectomycorrhizal formation in a laboratory experiment using this active ingredient. Newmaster et al. (1999) reported that moss and lichen abundance and richness were not or nearly not affected at six months, one year, or two years after treatment except when very high rates of triclopyr were used.

2,4-D (salts and esters) is a selective herbicide that kills broadleaf plants, but not grasses. It has a long history of use and is relatively inexpensive. Direct spraying of non-target plant species is the highest potential for damage due to 2,4-D application. Drift could damage non-target species close to the application site (much less than 100 feet) although some species such as grapes are more susceptible. One study determined that 2,4-D could affect three species of ectomycorrhizal fungi in laboratory experiments (Estok et al. 1989).

Dicamba is a selective, systemic herbicide that can affect some annual, biennial, or perennial broadleaf and woody species as well as annual grasses. Susceptible plants are likely to be damaged by direct sprays and drift. The greatest risks to aquatic plants are associated with runoff, but are highly site specific. Wind erosion may cause impacts in arid regions (SERA 2004g). Drift may cause damage to susceptible species at distances less than 100 feet from the application site. Vaporized or volatilized dicamba can affect non-target plants. Vaporization does affect vegetation, but much more study in air concentration-duration relationships needs to be done to quantify the level of effects. Vaporization potential will be dependent on atmospheric stability and temperature. Dicamba vapor has been known to drift for several miles following application at high temperatures (Cox 1994).

<u>Photosystem Inhibitors</u>: *Bromacil*, *diuron*, *hexazinone*, *tebuthiuron,* and *diquat* kill target plants by disrupting photosynthesis. *Bromacil* and *diuron* are non-selective, broad-spectrum systemic herbicides, which are lethal to all plants. Both pose a high risk to non-target species in the immediate vicinity of the treatment area.

Hexazinone has differential toxicity to plants and is effective against woody species. It is primarily absorbed through the roots of the plant.

Tebuthiuron is relatively non-selective against broadleaf plants, woody plants, and grasses. Tebuthiuron can be selective at low rates of application where it is used to thin sagebrush stands allowing more herbaceous species to thrive in the interspaces. Only the highest application rates of tebuthiuron produced an effect on non-target mycorrhizal fungi but there was no measurable effect of any level of tebuthiuron on germination of spores collected after six months (Allen and West 1993).

Diquat would be used by BLM only on aquatic weeds. It kills the plant parts that it comes in contact with, but does not kill the roots, so it is effective only for single season control. It is non-selective and is used in water sources where few native aquatic plants are present.

EPSP Synthase Inhibitor: *Glyphosate* prevents plants from synthesizing three aromatic amino acids including a key enzyme, EPSP (5-enolpyruvylshikimate-3-phosphate). Glyphosate is a non-selective, systemic herbicide that can damage all groups or families of non-target plants to varying degrees, most commonly from off-site drift. Plants susceptible to glyphosate can be damaged by drift up to 100 feet from the application site at the highest rate of application proposed. Species that are more tolerant are likely to be damaged at distances up to 25 feet (SERA 2003a). Non-target species are not likely to be affected by runoff or absorption from soil. Glyphosate strongly adsorbs to soil particles, which prevents it from being taken up from the soil by plant roots (Tu et al. 2001, SERA 2003a).

Field studies conducted using glyphosate found no effects to plant diversity in an 11-year study on site preparation using herbicides, though the structural composition and perennial species' presence were changed (Miller et al. 1999). Newmaster et al. (1999) reported that moss and lichen abundance and richness were not or nearly not affected at six months, one year, or two years after treatment except when very high rates of glyphosate and triclopyr were used.

Glyphosate was found to inhibit growth of three types of ectomycorrhizal fungi associated with conifer roots at concentrations of 1,000 parts per million in laboratory experiments (Estok et al. 1989). Houston et al. (1998) documented responses of below-ground fungal community structure (richness, diversity, composition) were similar in untreated and treated (with glyphosate and triclopyr) stands although total fungal abundance was not changed, isolation frequencies (the abundance measure used) in organic soil of two fungal species decreased when samples were collected two years after herbicide treatments.

Carotene Inhibitor: *Fluridone*, an aquatic herbicide, kills target plants by preventing them from synthesizing food; however, at low concentrations native pondweeds may escape harm (Farone and McNabb 1993). It is used primarily to control Eurasian water milfoil (present in Oregon) and hydrilla, (which is not yet known in Oregon but present in surrounding states). Fluridone must remain in contact with target aquatic species for an extended period for effective control and poses only low risk from a spill at maximum application rate to plants in a pond. Risks to terrestrial plants could not be evaluated due to lack of toxicity testing. Off-site deposition rates suggest that small amounts of the herbicide would drift offsite potentially affecting terrestrial plants.

Auxin transport inhibitor: *Diflufenzopyr* acts by disrupting the delicate auxin balance needed for plant growth. It is selective for annual broadleaf weeds and suppression of annual grasses and perennial broadleaf weeds. Although diflufenzopyr is a weak herbicide, when formulated with dicamba, it can reduce the amount of herbicide needed from 1-2 pounds per acre of dicamba alone to .26-.35 pounds per acre of diflufenzopyr + dicamba.

Effects of Invasive Plants on Native and Other Non-Invasive Plants

Native plant communities are in dynamic balance, where plants, animals, and organisms keep each other in check. Each plant is part of a complex food chain; break one of the links and others are likely to be adversely affected. One disappearing plant can take with it up to thirty other species that depend on it, including insects, higher animals and even other plants (Wood 1996). Invasive plants are typically introduced into these ecosystems without the plants, animals, and diseases they evolved with, giving them a competitive advantage. The resulting invasion displaces native and other non-invasive plants, adversely affecting the composition and structure of the plant community and thus the other elements of the ecosystem dependent upon it. Adverse effects begin gradually and are often well underway by the time the effects become apparent or significant. At that point, restoration is expensive and often not possible because of the loss of the supporting ecosystem components such as soil depth and water table. Once a threshold is exceeded, permanent loss of historical plant association and the organisms that depend on them occurs (Appendix 7). The impact of invasive plants can be permanent when economic and environmental factors limit the ability of a managing agency to restore the ecosystem to a healthy state (NAS 2002). The fewer invasive plants present, the more likely it is that restoration is possible.

Society is dependent upon native ecosystems. The ability of Oregon's landscapes to produce goods and services including clean water and air is dependent upon the healthy functioning of Oregon's native plants and ecosystems. Noxious weeds have infested 1.2 million acres of native ecosystems on BLM lands in Oregon, and other invasive plants, notably cheatgrass, have infested 5 million more, eliminating or substantially reducing the natural function and productivity of those lands for the foreseeable future.

Remaining native ecosystems are currently stressed by increasing demand for goods and services, heavy visitor use, human development, altered fire regimes and increased fire intensities, climate shifts, and the rapid spread of invasive plants. The anthropogenic rate of species' invasions far exceeds the natural background rate and is accelerating (Lodge and Shrader-Frechette 2003). Exotic [non-native] plants were rated as one of the six primary elements of global change (Vitousek et al. 1997). The International Union for the Conservation of Nature (IUCN)[18] notes that a significant proportion of species now considered extinct were driven to extinction by invasive species, and generally ranks invasive species as one of the top ten threats to currently threatened species (IUCN 2008). Noxious weed infestations are expanding and are estimated to be infesting 144,000 additional acres each year on BLM lands in Oregon.

Many invasive plants modify invaded sites, so that the site becomes inhospitable to the original plant community. Saltcedar and perennial pepperweed are known to extract salts from deep in the soil and deposit it on the surface making the site unsuitable for native plants. Knapweeds and starthistles are known to increase sheet erosion and produce chemicals that prevent other species from germinating (Boersma et al. 2006). Reed canarygrass decreases species' diversity, and reduces the structural complexity of the plant community through its aggressive, rapid growth and ability to eliminate safe sites for the establishment of native plants (Hovick and Reinartz 2007). Grasses in particular can limit the establishment and growth of woody species (D'Antonio and Vitousek 1992). Grass invasions prevent the re-establishment of forests following abandonment of agricultural and pastoral land (D'Antonio and Vitousek 1992).

Most invasive plants are known for forming monocultures, but even where invasive plants do not ultimately dominate plant communities, they can adversely influence succession. For example, Scotch broom initially forms a dense canopy on harvested forest sites, shading out regenerating conifers and other plants. As the broom ages and the canopy opens, there is a partial recovery of ground cover, though not by all pre-existing species (Smith 1994). Shade tolerant Himalayan blackberry germinates under dense Scotch broom plants and frequently becomes dominant on those sites. Blackberry fruit is a seasonal food source for introduced starlings and rats and the vines shelter them from predation. Even after the blackberries overtake the Scotch broom, long-lived scotch broom seed remains viable for decades, ready to respond to future disturbances.

Natural disturbances are important to ecosystem renewal, and invasive plants alter historic disturbance regimes. Many plant communities are adapted to fire cycles, with fires maintaining the full range of successional stages, species, and habitats. Invasive plants can interfere with this process by maturing, drying and then burning earlier in the season, burning more often, and burning hotter. They also directly compete with the various native plant seedlings that would have naturally followed the disturbance. Similarly, landslides, high flows, and stream bank erosion are natural processes that shape stream courses and deposit large wood in streams. When invasive plants prevent native plants from repopulating these disturbed sites, accelerated erosion and watershed degradation is the result. Even in old-growth forests where the most common natural disturbance pattern is the small gaps created as individual large trees die or fall, invasive plants are interfering with the reestablishment of the native hardwoods and conifers important to maintaining the multi-layered structure of these stands (Hobbs and Huenneke 1992).

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18 The IUCN, also known as the World Conservation Union, is the world's main authority on on the conservation status of species. The IUCN is comprised of 83 states, 108 government agencies, 766 Non-governmental organizations and 81 international organizations and about 10,000 experts and scientists from countries around the world. The IUCN Red List is widely considered the most objective and authoritative system for classifying species in terms of the risk of extinction.

Flying squirrels and other spotted owl prey species, for example, rely on the cover provided by this intermediate crown layer to reach and utilize the upper forest crown layer; prey species and owl numbers decrease when this layer is not present. This natural process is threatened by noxious weeds such as tansy ragwort, thistles, and rush skeletonweed, which can be spread great distances by wind, even in forestlands. Weed seeds are also carried by water and wildlife (Asher and Spurrier 1998).

Native ecosystems on BLM lands may also suffer when invasive plants spread from BLM lands. Adjacent landowners may control these weeds with less environmentally friendly methods or products, or by using more herbicides to combat invading plants than would be needed if all ownerships were participating. Collateral damage may occur near property lines, and landscape-scale values such as watershed or wildlife values may be degraded by these well-intended treatments, particularly west of the Cascades where the checkerboard ownership often means the BLM manages no more than 50 percent of any watershed. In addition, native and other non-invasive plants including crops on adjacent lands can suffer irreparable damage when uncontrolled invasive plants from BLM lands move across property lines. Private ranches east of the Cascades have been abandoned after native and other non-invasive forage and croplands were taken over by invasive plants, and tens of thousands of dollars of effort have not been able to restore them (Asher and Spurrier 1998).

Federally Listed and other Special Status species are particularly at risk from noxious weeds and other invasive plants. Rare species generally display narrow ecological amplitudes, keeping them geographically restricted and unable to compete over a wide range of site conditions. When invasive plants invade those sites, fragmentation of populations and extirpation often result. Although the protection of sites known to be occupied by Special Status species is a priority for BLM weed control efforts, success of those efforts will vary depending upon the likelihood of those sites being invaded and whether effective weed control tools are available.

The degree to which these effects apply to the various alternatives is primarily a function of, and directly proportional to, the number of acres that will become infested with weeds under each alternative. Adverse effects caused by weeds currently apply to the 1.2 million acres of BLM lands in Oregon currently infested with noxious weeds, and to more than 5 million acres infested with other invasive weeds – primarily cheatgrass. As described in the *Noxious Weeds and Other Invasive Plants* section in this Chapter, the various alternatives are predicted to affect the spread rate of noxious weeds and thus the acres projected to be infested in 15 years (Table 4-6). These projections are designed to show the relative difference between the alternatives in this EIS, and may not apply if funding levels or other factors change from current levels.

Table 4-6. Projected Noxious Weed Spread Rates and 15-Year Infested Acres for Each Alternative[1].

Alternatives	% annual spread of noxious weeds in 15 years	Total acres noxious weeds in 15 years[2]	Acreage difference from No Action	Proportion of BLM lands infested in 15 years
Reference Analysis	14%	8,559,713	2.7 million more	1/2
2 (No Action)	12%	5,864,535	0	1/3
3	7%	4,008,058	1.9 million less	1/4
4(Proposed Action)	6%	3,689,048	2.1 million less	1/5-1/4
5[3]	6%	3,689,048	2.1 million less	1/5-1/4

[1] Noxious weeds currently infest 1.2 million acres of BLM lands in Oregon.

[2] Calculated from spread rate; does not reflect the potential for biological saturation.

[3] Because Alternative 5 adds additional herbicides, it is more likely to effectively control noxious weeds. The amount of this difference is not quantified but is unlikely to lower the annual spread rate a whole percentage point.

Effects of Non-Herbicide Treatments on Non-Target Plants

Under each alternative, half or more of the invasive plant treatments are projected to be done without herbicides. These treatments can have less risk to non-target plants and provide effective control for about 1/3 of the noxious weeds in Oregon. However, non-herbicide treatments have their own set of potential environmental effects. The extent to which non-herbicide treatment methods directly affect non-target plants varies by the amount and method of treatment as well as the treatment timing, site conditions, and relative abundance of plants present. Minimizing impacts to native and other non-invasive plants allows them to recapture the site more quickly and reduces the need for additional weed control treatments.

<u>Manual</u> treatments tend to be selective and result in minimal damage to non-target plants including minor trampling, breakage and occasional mortality to individuals, as well as light soil disturbance that could increase the germination of any seeds present. Manual treatments are labor intensive and usually only practical on small areas.

<u>Mechanical</u> treatments involving chainsaws or similar hand operated equipment can be focused on target plants, thus having similar effects as manual treatment. Mechanical treatments like mowing are typically non-selective, and remove or damage target and non-target plants alike. Mechanical treatments have limited use for noxious weed control unless coupled with other treatments. Machinery can disturb vegetation and soil, prepare seedbeds, spread seeds, and increase sprouting and reproduction from root fragments. Mechanical treatments (and other ground-disturbing treatment such as directed livestock) can break up soil crusts. As discussed in more detail in the *Soil Resources* section in this Chapter, biological crusts provide several important functions within, and on, the surface of soil in arid and semiarid environments such as the Sagebrush Steppe and Eastern Forest Biomes. The major components of the crust are cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens. Disturbance of crusts can come about through trampling, fire, or burial by windblown soil.

<u>Prescribed Fire</u> is normally used for weed control only on heavily infested sites, because most invasive plants are adapted to fire and readily invade disturbed sites. Prescribed fire for weed control[19] can be most effective if followed by herbicide treatments of new weed germinates; seeding of native species is usually required. Native species adapted to fire may remain, and the selection of a follow-up herbicide would be designed to minimize damage to remaining native plants where possible. Adverse effects to native plants include injury, mortality, nutrient flush or loss of nutrients, reduced shading, and potential increases of invasive plants.

<u>Directed livestock grazing</u> can effectively reduce the vigor and seed production of invasive weeds, but is not likely to supply long-term control. Multiple treatments from directed livestock may increase risks to native plants by reducing vigor and seed production of non-target species and the ground disturbance can increase the potential for reinvasion and damage soil crusts. Alternately, disturbance from directed grazing could provide positive benefits by preparing a seedbed for seeding competitive native species.

<u>Seeding or Planting</u> is used to restore native vegetation or introduce desirable vegetation. The effect of these treatments varies from simply adding seed via aerial broadcast to destruction of existing vegetation. Typically, a rangeland drill is used to seed, with only minor damage to existing plants. Successful revegetation can be difficult on rangelands due to arid and semiarid conditions, and minimal seedbed preparation (to maintain existing native plants) leading to increased competition. Native seed collected on site protects the genetic integrity of local

19 This discussion does not include the prescribed fire used on tens of thousands of acres per year to manage fuels and native vegetation levels. Some prescribed fires can have both objectives however, such as the spray, prescribed fire, and restoration scenario planned for several thousand acres per year on cheatgrass and medusahead to reduce fire hazard in the wildland urban interface under Alternatives 3-5 using imazapic.

alleles. Native seed from other locations could alter locally evolved adaptations; however, non-native seed may be used following NEPA analysis that documents the need for other than native seed (USDI 1992a), primarily to protect the soil resource and subsequent site potential.

Effects by Alternative

Reference Analysis – No Herbicide Use

Effects of Invasive Plants on Native and Other Non-Invasive Plants: In general, the loss of native plants, and the goods and services they provide, would be proportional to the acres projected to become infested under this alternative. Under the no-herbicide Reference Analysis, the rate of spread of noxious weeds is projected to increase to 14 percent annually (up from the current 12 percent), and noxious weeds are projected to occupy approximately 1/2 of all BLM lands in Oregon within 15 years (Table 4-6). These numbers do not include the current five million acres infested with other invasive plants that would continue to spread at an increased rate under a no-herbicide strategy as well. Approximately 2/3 of the noxious weeds in Oregon cannot be effectively controlled with non-herbicide methods (Appendix 7: Table A7-1); therefore, native ecosystems being invaded by those species would suffer a higher level of infestation and resultant adverse effects than under alternatives with herbicide use. For example, aggressive, non-native grasses like medusahead, cheatgrass and hedgehog dogtail would continue to invade imperiled sagebrush and oak woodlands in the Sagebrush Steppe, Willamette Valley, and Siskiyou Biomes relatively unchecked, because effective treatments would not be available without herbicides. Similarly, the Warner Wetlands and numerous riparian areas would continue to be over-run by perennial pepperweed, whitetop and saltcedar as effective treatments would be unavailable. Japanese knotweed, Himalayan blackberry, and non-native grasses would continue to invade and degrade riparian areas and susceptible habitats like the West Eugene Wetlands. Federally Listed and other Special Status species would be particularly at risk because of the BLM's inability to effectively respond to specific weed threats.

Effect of Non-Herbicide Treatments on Non-Target Plants: Non-herbicide methods for the control of invasive plants are highest under this strategy, 42,100 acres versus 28,800 under the No Action Alternative (Alternative 2), as districts replace 75 percent of the Alternative 2 herbicide acres with non-herbicide methods. An estimated 3,600 acres of this increase would be direct seeding. Seeding with native species is expected to have minimal negative effect on native plant communities. In the absence of herbicides for weed control, districts east of the Cascades would increase the use of directed livestock grazing by 6,000 acres over current levels controlling weeds but causing some collateral damage to native plants. Mechanical and manual treatment methods would also increase, 1,600 and 1,300 acres per year (59 and 46 percent) respectively, compared to the No Action Alternative, potentially increasing short-term damage to, and loss of, non-target plants, especially with non-selective mechanical methods.

The potential adverse effects of prescribed fire for weed control (e.g., loss of non-target species, site disturbance) would be reduced under this alternative, as the use of this method decreases 2,000 acres per year because follow-up herbicides would not be available.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Effects of Herbicides on Non-Target Plants: The four herbicides available under this alternative have risks to non-target plants (Tables 3-12 and 3-13). Treatments to slow the spread of noxious weeds would hamper restoration of habitats if non-target plants were seriously damaged or destroyed. However, treatments using selective herbicides would typically have less risk of harming non-target plant types than non-selective herbicides. Most applications would be spot spraying to directly target the noxious weed plants. Since herbicide use in this alternative is limited to noxious weeds, broadcast applications would be limited to expanses (monocultures) of noxious weeds. Other invasive plants, like cheatgrass, would usually not be controlled with herbicides because no selective herbicide is available that would protect native forbs and shrubs.

Effects of Invasive Plants on Native and Other Non-Invasive Plants: In general, the loss of native plants would increase proportional to the acres projected to become infested. Under Alternative 2, noxious weeds are projected to continue spreading at a rate of 12 percent annually, and approximately 1/3 of all BLM lands in Oregon are projected to be infested within 15 years (Table 4-6). This does not include the current five million acres infested with other invasive plants that would continue to spread under this alternative. These averages would apply to most but not all plant communities. Sixteen of the 120 State listed noxious weeds cannot be effectively controlled with the four herbicides or the non-herbicide methods available under this alternative, and herbicides cannot be used on invasive plants such as cheatgrass. Most significantly, perhaps, the invasive annual grasses medusahead and cheatgrass would continue to spread unchecked, converting additional remnant sagebrush steppe, oak savannah, and other dry habitats to annual grass monocultures. These monocultures increase the fire hazard in many wildland urban interfaces. Restoration treatments of susceptible wetlands and riparian habitats are also hampered, as the four herbicides available under this alternative are not very effective at controlling saltcedar, watermilfoil, hydrilla, perennial pepperweed, and other noxious weeds occurring in these areas. Native plant communities infested with these species will suffer loss of native species and alteration of community function in the long term almost regardless of the level of effort or priority given to their conservation. Habitats of Federally Listed and other Special Status species (Appendix 5) would be particularly at risk from these invading non-native species because of their limited geographic range and narrow ecological amplitude.

Effect of Non-Herbicide Treatments on Non-Target Plants: Effects would remain essentially unchanged from current levels, and would be as described under effects common to all alternatives. Treatment methods creating soil disturbance and likely to result in some mortality among native plants include 6,100 acres of prescribed fire, 2,800 acres of directed livestock, 3,500 acres of mechanical treatments (including chainsaws), 2,200 acres of manual treatments, and seeding if it relies on non-native seed. Since non-herbicide methods are often implemented where herbicide damage to adjacent plants or other resource values would be unacceptable (e.g., Special Status plants), it is likely that collateral mechanical damage to those same resources from non-herbicide treatment methods would be more significant than the same level of damage in an average landscape. Such effects would be unavoidable, and would be balanced with the benefits of weed control during NEPA analysis at the project-specific level.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Effects of Herbicides on Non-Target Plants: Of the additional 13,600 acres that would be treated with herbicides under this alternative when compared to Alternative 2 (No Action), 11,000 acres would be with imazapic east of the Cascades to control monocultures of invasive annual grasses. Imazapic has a low-to-moderate risk of harming non-target plants (Table 3-12), and at low rates, can be used to control these grasses with little adverse effect to remaining non-target native forbs and shrubs. This would significantly aid restoration efforts where these grasses only partially occupy the site. Acres of 2,4-D, picloram, glyphosate, and dicamba would decrease under this alternative compared to Alternative 2 (Table 3-3), and the additional eight herbicides west of the Cascades and nine herbicides east of the Cascades are mostly selective herbicides that would allow for more target-specific treatments, decreasing the risk to non-target plant types.

Effects of Invasive Plants on Native and Other Non-Invasive Plants: In general, the loss of native plants would be proportional to the acres projected to become infested. Under Alternative 3, the rate of spread of noxious weeds is projected to decrease to 7 percent annually (down from the current 12 percent), infesting approximately 1/4 of all

BLM lands in Oregon in 15 years (Table 4-6). This does not include the five million acres currently infested with other invasive plants that would continue to spread (presumably at a slightly decreased rate) under this alternative. These spread rates would apply to most plant communities, since this alternative could effectively target 116 of the 120 State listed noxious weeds in Oregon.

With the ability to effectively control almost all noxious weeds and other invasive plants would come the ability to more consistently protect native plant communities in specific geographic areas, such as traditional food gathering areas or in Special Status species' habitats. The herbicides available under this alternative would also make cooperative projects with adjacent landowners more feasible, resulting in better protection for Special Status and other native plant communities both on and off BLM lands.

Effect of Non-Herbicide Treatments on Non-Target Plants: The methods and acreage of non-herbicide invasive plant control treatments is similar to Alternative 2 (No Action) except for a projected 7,000 acre increase in prescribed fire and corresponding 5,000 acre increase in seeding or planting, both related to the availability of imazapic for the control of medusahead rye, cheatgrass, and other invasive annual grasses. With imazapic, it becomes practical to restore medusahead-infested sites primarily in the Sagebrush Steppe Biome by burning, spraying, and seeding. One objective of some of these treatments would be to reduce the annual grass fire hazard adjacent to communities and other developments. Any increase in negative effects to non-target species (from Alternative 2) would be related to this 7,000-acre increase in burning. The combination of treatments would reduce the survival of native herbaceous and woody species that were not adapted to fire. Remnant perennial bunchgrasses and forbs would likely survive burning and spraying, benefiting from reduced competition and the increase in available nutrients. Additional restoration would rely on the success of seeded species. Sites would generally only be worse off if the seeding fails.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects of Herbicides on Non-Target Plants: Under Alternative 4, an additional 14,800 acres of herbicide treatments would occur when compared to Alternative 3. Nearly two-thirds of these additional treatments would be to treat native or other non-invasive vegetation in rights-of-way, administrative sites, and recreation sites. In rights-of-way, treatment is more likely to be done by boom spray (or similar broadcast method) rather than applying herbicides to individual plants. The risk to non-target plants from direct herbicide spray is moderate to high for almost all of the herbicides available under this alternative (Tables 3-12 and 3-13). Some of the herbicides available are relatively non-selective (Table 3-1), and would kill all inadvertently treated plants in the treatment area. Diuron, glyphosate, hexazinone, imazapyr, and sulfometuron methyl would be used statewide, and bromacil and tebuthiuron would only be used east of the Cascades. However, the use of herbicides in rights-of-way, administrative sites, and recreation sites may have negligible effects on native plants as these habitats are currently managed in early seral condition (primarily by mechanical methods). That said, early seral Special Status species that are growing on roadsides and similar sites *because* they are maintained in an early seral condition with non-herbicide treatments such as mowing would be at risk of damage from herbicides. Policy-required pre-project clearances would mitigate most of this risk.

Under this alternative, herbicides would be used on an estimated 5,700 acres annually to restore habitats as described in Conservation Strategies for Federally Listed and other Special Status species. While herbicides used could have risk to non-target plants, applications would be specifically designed to improve overall habitat conditions.

Other effects of herbicides on non-target plants under this alternative would be the same as described for Alternative 3.

Effects of Invasive Plants on Native and Other Non-Invasive Plants: In general, the loss of native plants would be proportional to the acres projected to become infested. Under Alternative 4, the rate of spread of noxious weeds is projected to decrease to 6 percent annually (down from the current 12 percent), and approximately 1/5-1/4 of all BLM lands in Oregon would be infested within 15 years (Table 4-6). This does not include the five million acres currently infested with other invasive plants that would continue to spread (presumably at a slightly reduced rate) under this alternative. The additional herbicides available under this alternative (one west of the Cascades; three east of the Cascades) are generally designed for vegetation control in rights-of-ways and other developed areas. Because right-of-way treatments would incidentally control noxious weeds and other invasive plants on primary spread routes, the benefit to native plant communities is higher than Alternative 3, with 300,000 fewer acres projected to be infested with noxious weeds in 15 years.

Effect of Non-Herbicide Treatments on Non-Target Plants: The amount of non-herbicide treatments projected to take place for the control of invasive plants, and their effect on non-target plants, is the same as for Alternative 3. However, this alternative would also make herbicides available to control native and other non-invasive vegetation along rights-of-ways, administrative sites, and recreation sites. Such treatments would reduce non-herbicide treatments currently being done in those areas on an acre-for-acre basis (see Table 4-7 below, adapted from Table 3-8 in the *Management of Native and other Non-Invasive Vegetation* subsection of the *Assumptions about Herbicide Treatments* section in Chapter 3). The alternative would also make herbicides available for certain habitat improvements, reducing current non-herbicide treatments by about 35 percent of the proposed herbicide acres. The assumed net change in treatment acres when compared to Alternative 3 is shown in Table 4-7.

Table 4-7. Estimated Change in Native[1] Vegetation Annual Treatment Acres by Treatment Method under Alternative 4 (Proposed Action) When Compared to Alternative 2 (No Action)

Method	Treatment of native vegetation on rights-of-way, administrative sites, and recreation sites under Alternative 4		Treatment of native vegetation for habitats as described in Conservation Strategies under Alternative 4		Total native vegetation treated under Alternative 4	
	East[2]	**West[2]**	**East**	**West**	**East**	**West**
Herbicides	7,500	1,900	5,500	200	13,000	2,100
Mechanical	-6,750	-1,710	-1,155	-42	-7,905	-1,752
Manual	-750	-190	-770	-28	-1,520	-218
Net change in total native vegetation acres treated	0	0	3,575	130	3,575	130

[1] And other non-invasive vegetation.
[2] East/West of the Cascades.

For the rights-of-ways, administrative sites, and recreation sites, herbicide use does not reduce non-herbicide treatment risks to non-target plants, because current non-herbicide treatments are within the disturbed clearing limits for rights-of-way anyway. An exception might be thought to occur where a Federally Listed species occurs within one of these disturbed areas. However, such a site, if known, would be protected under all treatment scenarios, so there would be no effect.

For identified habitat improvement treatments, the reduction in mechanical and manual treatment acres would reduce the likelihood of soil disturbance and related damage to existing native plants (and soil crusts) on nearly 2,000 acres. Since these treatments would be specifically designed to restore native habitats, and would involve Special Status species for whom habitat improvement efforts would necessarily require a particularly low level of risk, the likelihood of significant or long-term damage to native plants would be very low.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects of Herbicides on Non-Target Plants: The effects of this alternative to non-target native plants would be similar to the effects described under Alternative 4 (Proposed Action). East of the Cascades, acres of 2,4-D and imazapic (both selective herbicides) would both increase by 2,000 acres; however, there is low to moderate risk to non-target plants that are directly sprayed with imazapic, and no to low risk for off-site drift. Two additional herbicides (diflufenzopyr + dicamba and diquat) become available east of the Cascades and five additional herbicides (diflufenzopyr + dicamba, diquat, bromacil, chlorsulfuron, and tebuthiuron) become available west of the Cascades. All but dicamba have a moderate to high risk of harming non-target vegetation when directly sprayed; for dicamba these risks would be limited to susceptible plants. However, given the limited number of acres that would be sprayed with these, additional adverse effects would be limited.

Effects of Invasive Plants on Native and Other Non-Invasive Plants: In general, the loss of native plants would be proportional to the acres projected to become infested. Like Alternative 4 (Proposed Action), the spread rate of noxious weeds under Alternative 5 is projected to decrease to a rate of 6 percent annually (from the current 12 percent), and approximately 1/5 to 1/4 of all BLM lands in Oregon would be infested within 15 years. This does not include the five million acres currently infested with other invasive plants, that would continue to spread (but presumably at some reduced rate) under this alternative. The additional herbicides available under this alternative (five west of the Cascades; two east of the Cascades when compared with Alternative 4) would provide options for weed control and help prevent infestations from developing resistance to specific herbicides[20]. Nevertheless, this increase would not be expected to change the BLM's ability to reduce the spread of noxious weeds and other invasive plants by a full percentage point, so the gain is not estimated.

Effect of Non-Herbicide Treatments on Non-Target Plants: The effects of this alternative to non-target native plants is similar to those described under Alternative 4 (Proposed Action), except that the additional 4,800 acres of herbicide use would be expected to reduce current non-herbicide treatments by about 1,700 acres (Table 4-7). For identified habitat improvement treatments, the reduction in mechanical and manual treatment acres would reduce the likelihood of soil disturbance and related damage to existing native plants. Since these sites may not be infested with noxious weeds or other invasive plants, the likelihood of damage to native plants is higher; however, treatments would be designed to increase these more desirable species, so the short-term impact should result in long-term improvements in habitat and land health. Fuel reductions and other treatments could also be conducted with herbicides under this alternative, and potential effects to non-target vegetation would be a site-specific consideration.

Endangered, Threatened, and other Special Status Plant Species

Vegetation management practices have the potential to affect Special Status plants, and to a lesser degree, Survey and Manage species within the range of the northern spotted owl. Any management action focused on preventing, reducing, or eliminating the spread of noxious weeds and invasive plants will directly or indirectly benefit these species.

Effects from vegetation treatments are similar for all Special Status and Survey and Manage plants. Federally Listed and other Special Status species are more at risk from herbicides because their populations may be limited

20 More specifically, having more than one herbicide available to treat a specific weed species helps prevent the treated population from persisting in the form of a few individuals (and their progeny) that may be materially resistant to a particular herbicide.

in geographic scope, and thus damage to individuals may have population implications. Pre-project clearances and protection of occupied or assumed occupied habitats required by Special Status Species Program and Survey and Manage direction should prevent most or all adverse effects. The vast majority of treatments can be designed to reduce or eliminate adverse effects to these species; however, adverse effects could occur under any alternative for some treatment methods on some individuals. Some projects would have short-term adverse effects to individual plants in order to gain long-term benefits for the species. For example, habitat improvement projects or reducing competition from invasive plants may injure individual plants. In most cases effects to individuals would be mitigated by Standard Operating Procedures, PEIS Mitigation Measures, and Conservation Measures from the PEIS Biological Assessment (e.g., no-herbicide buffers, timing of treatments, use of selective herbicides, exclosures, spot treatments that avoid Special Status plants, or avoiding or prohibiting aerial applications).

In general, plants in the sunflower, legume, and mustard families tend to be more susceptible to broadleaf herbicides. Therefore, there may be increased risk from these herbicides for Federally Listed species such as Kincaid's lupine, and Applegate's milk-vetch in the legume family; Willamette valley daisy and Malheur wire-lettuce of the sunflower family; and, MacDonald's rock-cress and Howell's spectacular thelypody of the mustard family. The ALS-inhibiting herbicides are highly active, and extremely low concentrations could injure Special Status or Survey and Manage plants. Chlorsulfuron may cause severe reduction in seed production of some non-target crops if they are exposed at critical stages of development (Fletcher et al. 1993). Rare or susceptible annual plants in particular may suffer if they are unable to produce seed due to exposure to chlorsulfuron. Conservation measures for these herbicides are designed to prevent damage to Federally Listed species (see Appendix 5). Buffer distances up to 900 feet are prescribed. Metsulfuron methyl is known to be harmful to commercial onion crops of the lily family, so other plants in that family like western lily and Gentner's fritillary may be more readily affected by this herbicide. Another study reported that risks to non-target plants associated with ALS-inhibitors are similar to those associated with other herbicides used at higher application rates (Obrigawitch et al. 1998).

Pests and Diseases (Sudden Oak Death)

Affected Environment

The action alternatives, Alternatives 3 through 5, would make herbicides available to the BLM in Oregon "to treat any vegetation, as necessary, to control pests and diseases in State-identified control areas, such as Sudden Oak Death (*Phytophthora ramorum*) in Southwest Oregon." The pests and diseases in these cases are not plants that could be eradicated with herbicides, but fungi, insects, oomycetes, and other pests and diseases infecting or infesting native or other plants. Most of the time, such pests can be directly treated with fungicides, insecticides, and other pesticides or with non-pesticide methods. Occasionally, as in the case of Sudden Oak Death (currently infesting sites in southwestern Oregon), no effective direct control method is available and the best control available involves removing the host plant species. Such treatments would only be applied in those areas, and for those species, for which the Oregon State Department of Agriculture has specified a control area. Sudden Oak Death in Curry County is the only such area and species currently identified by the State for control.

In contrast, for example, BLM and other land managers sometimes remove Port-Orford-cedar from roadsides to help prevent the spread of Port-Orford-cedar root disease. This is not a State-identified control need, and the alternatives do not include herbicide use for such treatments.

Because Sudden Oak Death is the only currently known example of a treatment that would be proposed under this portion of these alternatives, a discussion of Sudden Oak Death is included here as both an example of, and as the foreseeable application of, this aspect of Alternatives 3, 4, and 5. Treatment of future infestations of different pathogens would require, at minimum, a determination of whether this or another EIS adequately addressed the potential effects of herbicides proposed for use, and would require appropriate site-specific analysis to address other aspects of the proposed treatment.

Sudden Oak Death Characteristics and Dispersal Strategy

Sudden Oak Death is caused by *Phytophthora ramorum*, a recently described, invasive pathogen of unknown origin (Rizzo et al. 2002, Ivors et al. 2004, Rizzo and Garbelotto 2003, Rizzo et al. 2005, Werres et al. 2001). Millions of oaks (*Quercus* spp.) and tanoaks have been killed by this pathogen in the forests and wildland urban interface of coastal California since the disease became evident in the mid 1990s (Meentemeyer et al. 2008). By 2004, the disease had inundated the California coastline extending 750 km [466 miles] (Meentemeyer et al. 2004). The northern-most infestation in California is near Redway in southern Humboldt County. Sudden Oak Death was detected in Curry County in southwestern Oregon in 2001, where it was killing tanoak and infecting Pacific rhododendron and evergreen huckleberry (Goheen et al. 2002). The infestation remains contained to this one area of Oregon, although other strains of the pathogen were detected in, and eradicated from, approximately 60 Oregon nurseries between 2003 and 2007 (ENTRIX, Inc. 2008).

Often referred to as "fungi," *Phytophthora* species are "water molds" that are closely related to marine algae (Erwin and Ribeiro 1996). Favored by moist conditions, *Phytophthora* species include some of the world's most notorious plant pathogens. Most *Phytophthora* species are root pathogens; however, *P. ramorum* predominantly affects aboveground plant parts such as leaves, needles, boles, green twigs, and woody stems (Davidson et al. 2003, Hansen et al. 2008). Over 100 plant species are known hosts including native forest species such as tanoak, oaks in the red oak group such as California black oak, Douglas-fir, coast redwood, Pacific rhododendron, evergreen huckleberry, and Pacific madrone as well as important commercial nursery species such as rhododendron, camellia, Pieris, and laurel (USDA, USDI 2008). In Oregon, the list of native plants that have been found infected in the wild is much shorter; tanoak, evergreen huckleberry and Pacific rhododendron are usually the only infected species; occasionally Oregon myrtle and Douglas-fir have been found infected in areas with high inoculum levels (Hansen et al. 2008).

P. ramorum is apparently well adapted to the mild, wet conditions of the Pacific Coast (Hansen et al. 2008). Its current distribution in California mirrors the range of coast redwood. In Oregon forests, the pathogen has only been detected within 10 miles of the Pacific Ocean in the Siskiyou Biome, where the climate is wet and mild in winter and warm and dry in summer with frequent fog. Oregon's infested area falls within the Mixed-Evergreen Zone as defined by Franklin and Dyrness (1988). Tanoak, often with Douglas-fir, dominates the infested sites. Plant community associations are characteristic of the warm and wet environments of the Tanoak Series (Atzet et al. 1996).

The pathogen produces small sacs (sporangia) of swimming spores (zoospores) that readily break off and can be spread in rain splash, drip, stem flow, and wind. Multiple generations of spores may be produced during wet weather periods. It also makes thick-walled resting spores (chlamydospores) in infected plant parts that allow it to survive heat and drought and persist for months in soil and plant debris (Hansen et al. 2008).

In the forest, tanoak twigs and leaves are first infected in the upper crown. New growth in the spring is highly susceptible as are recently formed tanoak sprouts. Zoospores swim through water films on the surface of leaves or stems until they settle, germinate, and penetrate into the plant. New sporangia are formed on infected leaves and twigs in wet weather and may wash or splash down the stem. The trunk cankers that kill the tree apparently originate from spores washed down from above. Rhododendrons and huckleberries, and occasionally other hosts growing beneath or adjacent to infected trees, may be infected.

Longer distance spread in forests is facilitated by turbulent transfer of sporangia dislodged from upper crown infections in clouds and wind-driven rain (Hansen et al. 2008). Most newly infected trees are found within about 300 to 600 feet of previously infected trees, a pattern consistent with wind and rain dispersal. However, new disease sites have been detected up to 3 miles from nearest known infested areas. *P. ramorum* can also be moved over extreme long distances (continental, global scales) in infected nursery stock (Goheen et al. 2006).

Regulations and Control

P. ramorum is subject to both State (ORS 603-052-1230) and Federal (7 C.F.R. 301.92) quarantine regulations that restrict the human-assisted movement of hosts from infested areas into disease-free areas. Fourteen contiguous coastal counties in California are currently under quarantine. In Oregon, a 160 square mile area in and around the city of Brookings in Curry County, is currently subject to quarantine regulations.

Oregon State regulations also require eradication of the pathogen when it is found on State or private holdings. As a result, the Oregon Department of Agriculture and the Oregon Department of Forestry have been involved in an aggressive eradication program since 2001. The objective of the eradication program is to eliminate *P. ramorum* from all known sites and to prevent the pathogen from becoming established in native wildland forests by eliminating the pathogen or by eliminating the plants that carry the pathogen, at each newly detected infestation. This disease control program is not automatically enforced or applied to Federal lands. However, Federal land managers administering National Forests and BLM lands in Curry County recognize that success of the local *P. ramorum* eradication effort depends on the application of control treatments across the landscape without regard to land ownership, and have cooperated in this effort since 2001.

Treatment History in Oregon

When *P. ramorum* was first discovered in southwest Oregon forests in 2001, there were nine infested forest sites ranging in size from 0.5 to 11 acres and totaling 40 acres on non-industrial private forest lands, industrial private forest lands, and Federal forest land administered by the BLM. A nine-square mile quarantine area was established around the area of infestation. *P. ramorum* probably was present at one forest location as early as 1998 (Hansen et al. 2008).

Initial eradication treatments involved cutting, piling, and burning infected plants and all nearby potentially infected or exposed host vegetation within a 50 to 100-foot radius buffer zone. Treatment monitoring revealed that the buffer area was inadequate to capture localized spread of the pathogen and that newly emerging sprouts from cut infested tanoaks were highly susceptible to infection and were maintaining the pathogen on infested sites (Hansen et al. 2008). A variety of methods to control tanoak sprouting were attempted including backpack spraying of new sprouts, manually cutting, piling, and burning new sprouts, and stump-top application of herbicides to prevent sprouting. The use of injected herbicides imazapyr or glyphosate to prevent sprouting of all tanoak stems one inch diameter and larger, where possible (on State, private, and National Forest lands), has been incorporated into the preferred treatment prescription since 2003. Buffer zone treatments have been increased and now include an area within a 300-foot radius of known infected plants or larger, depending upon the proximity to the quarantine boundary or other infected plants. Upon completion of tanoak removal and burning, most sites have been planted with non-host hardwood or conifer seedlings.

To date, over 730 tanoaks in Curry County have been found infected since 2001 on approximately 200 acres (Table 4-8). Altogether, approximately 2300 acres, including approximately 200 acres of BLM land, have been treated (Kanaskie 2009). Since the first finding of Sudden Oak Death in Oregon in 2001, eradication of the disease has eliminated *P. ramorum* from some treatment areas, but it continues to appear in new locations in and near the regulated area in Curry County. In 2006 and 2007, the disease expanded considerably, probably due to consecutive years of unusually wet spring and early summer weather. Because of this expansion, Oregon's Curry County quarantine area was increased to 160 square miles in January 2008. Disease levels were slightly reduced in 2008.

Table 4-8. Sudden Oak Death in Oregon Forests

Year	Number of tanoaks infected with *P. ramorum*	Number of new disease patches	Area of new disease patches each year[1] (acres)
2001	100+	9	36
2002	85	12	8
2003	49	12	12
2004	30	9	10
2005	49	9	18
2006	143	36	40
2007	160	60	54
2008	122	63	23

[1] includes new infested sites and expansion of existing eradication sites

The net effect of the Oregon eradication program has been a dramatic reduction in the rate of disease spread as compared to similar areas in California where there is no comprehensive control program. *Phytophthora ramorum* was detected at low levels in tanoak forests in southern Humboldt County, CA in 2001 and was subjected to similar environmental conditions, including moist spring and early summer weather in 2005 and 2006. In the four-year period from 2004-2007, the cumulative estimated infested area in Humboldt County grew from 123 acres to approximately 4,500 acres, an increase of 3,658 percent. By comparison, aggressive treatment in Oregon, while not completely controlling the pathogen, has substantially slowed disease progression. In Oregon in 2004, 70 infested acres were detected; by 2007, this number had increased by 182 percent to 128 infested acres.

Environmental Consequences

Effects Common to All Alternatives

Like noxious weeds, negative environmental effects are predicted to result from both the spread of *P. ramorum* and its control treatments, with or without the use of herbicides.

Effects from the Spread of *P. ramorum* (Sudden Oak Death)

The spread of *P. ramorum* poses a potentially serious threat to forest ecosystem function, habitats, fire behavior, landscape aesthetics, and the horticultural and timber industries (Goheen et al. 2006, Rizzo and Garbelotto 2003, Appiah et al. 2004, Hansen et al. 2008). Rizzo and Garbelotto (2003) speculate that the "broad host range of *P. ramorum*, the variability of symptoms between different hosts, and the pathogen's aerial dispersal suggest that it has the potential to cause a cascade of long-term landscape changes." In the California counties where Sudden Oak Death was first discovered, the disease has already adversely affected ecosystem functions, increased fire and safety hazards and reduced property values in developed areas (Rizzo and Garbelotto 2003, Appiah et al. 2004).

Tanoak occurs on approximately 1 million acres in Oregon across four southwestern Counties (Curry, Coos, Douglas, and Josephine) with an estimated stocking of 81 trees per acre greater than 8 inches in diameter (FIA data). Its deep taproot and lateral root configuration contribute substantially to slope stability. It is used by a variety of wildlife species for cover and forage. Its acorns are considered an important winter food for deer, bears, rodents and several bird species. Tanoak is also a substantial component of Nesting/Roosting/Foraging habitat used by northern spotted owls in Southwest Oregon (USDI 2008b). A small proportion of northern spotted owl nests in southwestern Oregon are in tanoak trees. A substantial reduction in the tanoak component due to

P. ramorum-caused mortality would be expected to proportionally reduce the quality and quantity of tanoak dominated habitat and the abundance and availability of food items for the spotted owl. Tanoak, as well as other species affected by *P. ramorum*, including evergreen huckleberry, is also considered to be of cultural importance to American Indians with ties to coastal environments.

Increased spread to areas outside the current quarantine area will increase the size of the quarantine area itself. While tanoak is limited in range to southwest Oregon, other susceptible hosts such as Pacific rhododendron and evergreen huckleberry occur all along the Pacific Coast into British Columbia. Increased regulated area represents more restrictions on the flow of products and affects larger numbers and types of forest product users. Costs to affected industries include lost revenues associated with collecting and selling special forest products, increased manufacturing costs associated with debarking or kiln drying of logs, increased labor associated with removing soil and twigs from logs or other wood products, increased labor costs for sanitation measures, and costs associated with inspections and additional shipping documentation. Infested nurseries bear the cost of destroying infected plant materials and are not reimbursed for revenues lost. The implications, real or perceived, of the disruption and higher costs of doing business within a quarantine area can be far reaching and of international scope. Other countries often choose to regulate plant materials at the genus level, which would mean many non-host species have the potential to be regulated as well as the numerous species that are known hosts. Certain products may even be refused on the international market. There is also currently a perception among property owners that private property values are reduced inside quarantine areas.

Nursery stock represents nearly a billion dollar industry in Oregon and is the State's most valuable agricultural commodity (ENTRIX, Inc. 2008). The 2,100 registered nursery and greenhouse grower operations in Oregon export out of State more than 75 percent of the nursery stock produced. The total economic impact of the nursery and greenhouse industry in Oregon in 2002 was estimated at $1.69 billion in output, $1.04 billion in value added, and 21,554 jobs. The first known detection of *P. ramorum*-infected nursery plants in Oregon occurred in 2003. Six infested nurseries were found that year. Since then, in the years 2004 to 2007, there have been an average of approximately 13.5 nurseries infected annually (COMTF). Federal rules enacted in 2004 and updated in 2007 require *P. ramorum* inspections for all nurseries shipping out of State and specific testing procedures for nurseries with susceptible species or in a quarantine area. Potential losses to the nursery industry, including those associated with lost market share and reduced consumer confidence is estimated in the range of $28.16 million to $259.20 million per year.

Surveys for *P. ramorum* are underway in forests and nurseries in other parts of North America as well as throughout Europe. Risk assessments indicate that large areas of oak forests in the southern Appalachian region of eastern North America, as well as in oak and beech forests in Europe, are at high risk for the establishment of the pathogen and losses associated with subsequent mortality. Potential impacts of this pathogen to ecosystem health and function and to economics and trade go well beyond the oak and tanoak forests of the Pacific Coast.

Effects of Treatment

The effect of treatment are based on the site disturbance and clearing associated with treatment of the infested areas, including the effects of herbicides used in those treatments. The current treatments include: 1) glyphosate injection of tanoak on National Forest and imazapyr on private, to prevent resprouting, 2) cutting of infected host species (common examples are tanoak, rhododendron, and evergreen huckleberry) 3) creating a buffer area, and 4) burning the cut vegetation (USDA, USDI 2008).

The zone of eradication includes all infected plants and those uninfected host plants in a buffer zone that extends out up to 300 feet from the infected plant(s). Host plant species to be treated would be determined based on host species affected at the site or information from recent research. Buffer zone delimitation is based on current understanding of short-distance spread of the pathogen (USDA, USDI 2008). Treatment areas beyond 300 feet would be applied on occasion to treat outlying infections found on the outer edge of the quarantine, if there is a need to increase the distance due to higher incidence of infections in that area, or monitoring shows a need to extend the treatment area. Treatment sites may also extend beyond the 300 feet to allow for logical treatment boundaries to accommodate falling of trees, adequate burning boundaries when broadcast burning, and ownership boundaries where the adjacent landowner has created a fuel hazard from their Sudden Oak Death treatment. Multiple infestations within close proximity to each other would be buffered by up to 300 feet to create a single treatment site. Treatment sites may be smaller than 300-feet extensions from infected plants when adjusted for natural breaks, changes in plant community, and topography.

Effects (to Vegetation)[21] by Alternative

Reference Analysis – No Herbicide Use and Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

With the exception of calendar year 2010,[22] control treatments would continue as they are now; herbicides would not be used on the BLM portion of the infestation. Imazapyr and glyphosate would continue to be used to kill tanoaks and prevent resprouting[23] on the 90 percent of the control area that is not on BLM lands. Chainsaws and follow-up sprouting control would continue to be used to kill tanoak in the 10 percent of the control area on BLM lands. Because of the multicyclic nature of the pathogen, most sites are treated within 1 to 10 weeks of disease confirmation. However, newly emerging sprouts from cut tanoaks are highly susceptible to infection and are capable of maintaining the pathogen on infested sites. As such if they are not killed, the goal of eradicating the pathogen is not achieved. Maintenance of the pathogen on a given site increases the probability of spread to uninfested sites via natural or human-assisted means.

Monitoring data from early Sudden Oak Death eradication treatments in Oregon suggests that localized spread (the creation of new disease centers from nearby infected plants) will occur when the pathogen remains viable on a site. One to two new infection centers resulted from those sites where the pathogen was known to survive. Manual treatment of sprouts essentially delays treatment effectiveness when compared to herbicide treatment. Manual treatment of sprouts is not done for some time, perhaps as long as a year after cutting, because it takes this long for sprouts to develop to a stage where it is practical to treat them. Multiple treatments may be necessary if stumps subsequently resprout. Estimated contract costs for manual treatment of tanoak sprouts is $690/acre.

Treatments in Curry County that make use of herbicides are more effective at controlling the pathogen than the treatment currently used on BLM lands. It has been the opinion of pathologists that the approach currently used by BLM without herbicide use is 15 to 30 percent less effective than the herbicide approach. In 2008-2009, pathologists established 119 plots around the stumps of the known-infected tanoak trees that had been cut, and examined all host vegetation remaining on the sites. Six percent of the 106 plots on private lands had infected tanoak re-sprouts (post-treatment) using herbicide in some form (injected, stump-top application or sprout spray). Thirty-eight percent of 13 plots on BLM lands where herbicide was not used had infected tanoak re-sprouts (post-treatment). While the small non-herbicide sample size reduces the statistical strength of the apparent trend, the data nevertheless supports pathologist's earlier impressions that herbicide use reduces the number of infected sprouts post treatment, thus reducing the potential for continued spread of the disease.

Continuing to treat tanoak without herbicides on BLM lands can thus be expected to result in additional infestations, potentially several times more, than would occur using herbicides. These additional infested acres would be treated

21 Other resource effects from Sudden Oak Death control are included in their respective effects sections in this Chapter.

22 The 1984/87 injunction preventing the use of herbicides on native species was amended June 22, 2009 to permit the use of glyphosate to kill tanoak to control Sudden Oak Death in calendar years 2009 and 2010. No herbicides were used by the BLM for this purpose in 2009, but they are proposed for 2010.

23 Tanoak is a notoriously vigorous resprouter, quickly regenerating multiple fast-growing stems from every cut stump.

by cutting and burning all infected tanoaks. The area that would be disturbed by control activities and the loss of tanoak would be expected to similarly increase for the indefinite future. The likelihood of totally eradicating the infestation from Oregon, which is the goal, is substantially less than under Alternatives 3 though 5.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases; Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses; and, Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

The herbicides imazapyr and glyphosate would be available for use in killing tanoaks or other host species and/or treating cut stumps to control *P. ramorum* on BLM lands. Other BLM-approved herbicides may be considered for use as Sudden Oak Death treatment methods evolve, or if future State-identified control areas involve different species. Under a proposed cooperative plan to step up efforts to eradicate the pathogen from Oregon, BLM treatments are estimated at 250 acres per year. Herbicide would be expected to be manually applied to frills chopped in the boles of tanoak trees, daubed or spot sprayed on cut stumps, and/or spot sprayed on sprouting foliage at cut stumps. If the infestation continues to spread, these acres would be expected to increase.

Herbicide treatments to prevent tanoak sprouting are more effective in eliminating *P. ramorum* from infested sites, because sporangia, zoospores, and/or chlamydospores remaining on site readily reinfect the sprouts and continue to occupy the site and reproduce. The estimated contract costs for injected herbicide treatment of tanoak stems is $300-600/acre.

Chainsaw control of sprouting stumps would be all but eliminated under these alternatives. Achieving the cooperating agencies' goal of removing the pathogen from Oregon is far more likely; and all agencies would be expected to more aggressively fund and pursue that goal if it is made more achievable. Site disturbances from the falling, piling, and burning of tanoak would be similar to such disturbances under Alternative 2 (No Action). These disturbances would be less under these alternatives only to the degree that the acres in need of treatment would be less under these alternatives in the long term.

<u>*Measures to reduce the potential effects of herbicides on fish (see Fish Section)*</u>: In July 2008, the BLM and Forest Service prepared a Programmatic Biological Assessment for submission to the National Marine Fisheries Service that described the potential for 2008-2013 control efforts to affect Federally Listed Coho and Chinook salmon within the Southwestern Oregon Province. That Biological Assessment determined the following treatments and protection measures would result in no effect to Federally Listed species.

> "Where allowed and feasible, all tanoak (*Lithocarpus densiflorus*) and other hosts with stems meeting minimum requirements suitable for injection (approximately 1 inch in diameter and greater) within the eradication zone would be injected with the chemical aquatic-labeled glyphosate using a method referred to as "hack and squirt." This method would employ a single tool that injects the herbicide directly into the stem with little to no chance for a spill. Once the tanoak is dead (approximately two weeks), it is cut. Only daily quantities of aquatic-labeled glyphosate would be transported to the project site. Aquatic-labeled glyphosate would not be applied if rain is likely to occur within 24 hours. Spill prevention, hauling, staging, mixing, loading, cleaning, application equipment, and storage requirements would be implemented.
>
> "An Oregon Licensed applicator with forestry, aquatic, and right-of-way categories would be utilized. All herbicide mixing would be done in the presence of an agency Project Inspector. Equipment cleaning and storage and disposal containers would follow all applicable State and Federal laws. The licensed herbicide applicator would prepare a written herbicide Spill Contingency Plan in advance of the actual aquatic-labeled glyphosate application, then submit it to the Authorized Officer prior to operations, and keep a copy with each crew. An agency approved Spill Containment Kit would be on-site during all stages of applications" (USDA, USDI 2008:20).

These measures are consistent with the treatment expected under Alternatives 3-5.

Air Quality

Affected Environment

Because air pollution can directly pose health risks and cause significant welfare effects to humans, management and improvement of air quality in the U.S. is an important regulatory goal. The Clean Air Act, originally passed in 1955 and amended several times since, establishes a mandate to reduce emissions of specific pollutants via uniform Federal standards. Under the Act, the EPA identifies criteria pollutants, sets regulatory standards for those pollutants, and approves State and tribal implementation plans (SIPs and TIPs). States and tribes enforce the standards set by EPA and can delegate that authority to local air pollution control boards. States and tribes can set more stringent standards than the National Ambient Air Quality Standards (NAAQS) but cannot relax standards.

The EPA set primary and secondary NAAQS (Table 4-9). The primary NAAQS protect the health of susceptible individuals and the secondary NAAQS protect the general welfare of the public, including visibility in Class I areas (EPA 2007a). Different averaging periods are established for the criteria pollutants based on their potential health and welfare effects. The six pollutants currently regulated are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb), and particulate matter (PM).

Particulate matter is a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles over a wide range of sizes. For regulatory purposes, particulate matter is further classified by the particle's aerodynamic diameter. PM_{10} includes all particulate matter with an aerodynamic diameter of 10 microns or less and is referred to as inhalable PM. $PM_{2.5}$ includes all particulate matter with an aerodynamic diameter of 2.5 microns or less, called fine PM, and is by definition a subset of PM_{10}. Studies have shown more serious health effects associated with $PM_{2.5}$; therefore, EPA promulgated more stringent standards for this class of particulate matter.

Table 4-9. Primary and Secondary National Ambient Air Quality Standards (NAAQS)

Criteria Pollutant	Averaging Period	NAAQS	
		Primary	Secondary
NO_2	Annual	0.053 ppm	0.053 ppm
CO	1-hour	35 ppm	---
	8-hour	9 ppm	---
PM_{10}	24-Hour	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	24-hour	35 µg/m^3	35 µg/m^3
	Annual	15 µg/m^3	15 µg/m^3
SO_2	3-hour	---	0.5 ppm
	24-hour	0.14 ppm	---
	Annual	0.03 ppm	---
Lead	Quarter	1.5 µg/m^3	1.5 µg/m^3
	Rolling 3-month Average	0.15 µg/m^3	0.15 µg/m^3
O_3	8-hour	0.075 ppm	0.075 ppm

All areas of the nation have been classified based on their status with regard to attaining the NAAQS. The EPA designates an area as being in attainment for a criteria pollutant if ambient concentrations of that pollutant are below the NAAQS, or being in non-attainment if criteria pollutant concentrations violate the NAAQS. Once non-attainment areas comply with the NAAQS, they are designated as maintenance areas. Areas classified as non-attainment must implement a plan to reduce ambient concentrations below the NAAQS. Areas where insufficient data are available to determine attainment status are designated as unclassified, and are treated as attainment areas for regulatory purposes.

In general, the air quality in Oregon is good but with persistent problem areas where strong inversions tend to trap either CO or particulate matter at certain times of the year (Table 4-10). In mid-September 2008, EPA proposed listing Oakridge and Klamath Falls, Oregon and some of the area surrounding these two communities as non-attainment for $PM_{2.5}$. No such listing had been made as of June 2010.

Table 4-10. Non-Attainment and Air Quality Maintenance Areas in Oregon

Pollutant	Non-Attainment	Maintenance
Ozone (8-hour standard)	None	Portland Metro – service district boundary Salem – central transportation study area
CO	Salem – central transportation study area	Grants Pass – central business district Klamath Falls – urban growth boundary Medford – urban growth boundary Portland Metro – service district boundary Eugene-Springfield – urban growth boundary
PM_{10}	Eugene-Springfield – urban growth boundary Oakridge – urban growth boundary	Grants Pass – urban growth boundary Klamath Falls – urban growth boundary Lakeview – urban growth boundary Medford-Ashland – Rogue Valley La Grande – urban growth boundary

Visibility Protection in Mandatory Federal Class I Areas

Visibility protection in mandatory Class I areas is the most significant aspect of the human welfare part of the Clean Air Act standards. The EPA promulgated the Regional Haze Rule in 1999 to further improve visibility in mandatory Federal Class I National Parks and Wilderness areas. Mandatory Class I areas include National Parks over 6000 acres in size and wilderness areas over 5000 acres in size that were in existence on August 7, 1977 plus any subsequent additions to those areas or any wilderness areas designated as Class I in their enabling legislation. All areas that have not been designated Class I are designated as Class II areas. Oregon has 12 mandatory Class I areas and potential to affect up to 5 mandatory Class I areas in adjoining states (Table 4-11). Oregon does not have any non-mandatory Class I areas nor are there any in close proximity to the Oregon border in surrounding states.

In all mandatory Class I areas, improvement in visibility must be made every 10 years for the 20 percent most impaired (haziest) days, regardless of current condition, and there must be no degradation for the 20 percent best (clearest) days, until the National visibility goal is reached in 2064. State and tribal implementation plans (SIPs and TIPs) outline how reasonable progress towards this goal will be achieved and demonstrated. Section 308 of the Regional Haze Rule provides nationally applicable provisions of the rule in the development of SIPs and TIPs.

Table 4-11. Mandatory Class I Areas in Oregon and Nearby in Adjoining States

State	Class I Area	Land Manager
Oregon	Mt. Hood Wilderness	USDA Forest Service
	Mt. Jefferson Wilderness	USDA Forest Service
	Mt. Washington Wilderness	USDA Forest Service
	Three Sisters Wilderness	USDA Forest Service
	Crater Lake National Park	USDI National Park Service
	Diamond Peak Wilderness	USDA Forest Service
	Kalmiopsis Wilderness	USDA Forest Service
	Mountain Lakes Wilderness	USDA Forest Service
	Gearhart Mountain Wilderness	USDA Forest Service
	Strawberry Mountain Wilderness	USDA Forest Service
	Eagle Cap Wilderness	USDA Forest Service
	Hells Canyon Wilderness	USDA Forest Service
Washington	Mt. Adams Wilderness	USDA Forest Service
	Goat Rocks Wilderness	USDA Forest Service
Idaho	Hells Canyon Wilderness	USDA Forest Service
California	Lava Beds Wilderness	USDI National Park Service
	Redwood National Park	USDI National Park Service

Environmental Consequences

The PEIS estimated that up to 70,280 acres of BLM-managed lands may be treated with herbicides in Oregon annually[24], and analyzed the resultant potential adverse effects from vehicle emissions and herbicide drift on air quality. That analysis made emissions estimates for carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NO_x), total suspended particulates (TSP), particulate matter 10 microns and 2.5 microns in size (PM_{10} and $PM_{2.5}$, respectively) and volatile organic compounds (VOCs). Lead, ozone and sulfur oxide emissions from herbicide use are very low and not included in the final analysis. Volatile organic compounds are substances emitted as gases from a variety of solid and liquid substances, including wildland fuels as they burn and herbicides. Effects are also described in terms of the Prevention of Significant Deterioration (PSD) criteria, although these criteria are intended for use on chronic point sources of pollution and not sporadic dispersed sources.

Although non-herbicide treatments were analyzed, these were not included in the PEIS, but were available as a supporting report to the PER *Annual Emissions Inventory for BLM Vegetation Treatment Methods* (ENSR 2005a). This report also details the assumptions and analysis methods used. The emissions estimates include emissions from internal combustion engines used in both transportation and project implementation and fugitive dust from driving on unpaved roads and wind erosion. In Oregon, estimated total annual emissions in the PEIS included 5 tons of CO, 0.57 tons of NO_x, 28.77 tons of TSP, 6.97 tons of PM_{10}, 0.99 tons of $PM_{2.5}$, and 0.34 tons of VOCs from treating 70,280 acres annually with herbicides. Carbon dioxide emissions from treating with herbicides are zero.

This air quality analysis builds on the analysis conducted for the PEIS. That analysis estimated emissions arising from prescribed burning; exhaust from ground vehicles used for transportation and operations, exhaust from chainsaws, and fugitive dust from driving on unpaved roads and from wind erosion off disturbed soils. Exhaust emissions did not include that from aircraft (fixed wing airplanes and helicopters). Fugitive dust emissions did not include that arising from actual treatment operations, such as dust kicked up by mowers and bulldozers/road bladers.

24 Alternative 5 (which is equivalent to the PEIS preferred alternative), estimated Oregon herbicide use at 50,000 acres per year. The Proposed Action (Alternative 4) would treat 45,000 acres annually.

Fugitive dust has not been included in any environmental analyses conducted to date in Oregon. In large part, this lack is because fugitive dust from roads or land management operations has not been identified as a significant concern or issue by members of the public, the EPA, or the Oregon Department of Environmental Quality. In large part, this lack of concern is because fugitive dust from driving on unpaved roads or from land management operations tends to remain in close proximity to the source. The distance particles are dispersed depends on both particle size, how high the particles are lofted, and wind speed. Most particles generated by soil are 10 microns and larger and are not lofted more than a few feet, limiting their dispersion potential. Most road dust, for example, lands within about 10 feet of the road. (In contrast, most particles from prescribed fire are 2.5 microns and smaller and can be lofted hundreds to thousands of feet in the convection column, allowing for long distance and widespread dispersion of these particles).

At present, the only form of carbon emissions that is regulated is CO. The PEIS includes CO_2 emissions as well from prescribed burning and from diesel exhaust. However, neither the PEIS nor this analysis includes a complete carbon budget. At present, the science is lacking to develop a complete carbon budget principally due to the lack of information on belowground carbon dynamics in all ecosystems and very limited information on aboveground carbon dynamics in rangeland ecosystems. Although carbon cannot be thoroughly analyzed, one of the known qualitative trade-offs are that activities that can restore healthy functioning ecosystems, including treatments to reduce invasive plants, tend to increase carbon sequestration (Verburg et al. 2004, Bradley et al. 2006, Prater et al. 2006). This factor may be critical in rangeland ecosystems as conversion to annual grass dominance results in creation of a carbon source, while shrub-steppe vegetation is a carbon sink with more carbon stored below-ground than above.

All alternatives cover only the emissions from activities covered in this environmental analysis. Emissions from prescribed burning are the primary contributor to air quality concerns. Emissions from biocontrol, livestock and seeding or planting are negligible and not included. Since the analysis is based on emissions estimates used in the PEIS to maintain consistency and comparability, emissions from prescribed fire, mechanical, manual and herbicide operations include emissions from exhaust and fugitive dust. The emissions from exhaust and fugitive dust were included since it was not possible to remove these elements from the data provided in the PEIS and retaining the emissions would maintain comparability with the National estimates for Oregon.

The potential air quality effects of the alternatives in this analysis were determined by calculating the tons per acre emissions for PM_{10}, $PM_{2.5}$, CO, CO_2, NO_x, SO_2, and VOCs from the selected alternative in the PEIS for prescribed fire, mechanical, manual, and herbicide treatments. Total suspended particulates were not included in this analysis as these differ very little from the PM_{10} estimates for smoke, the most significant contributor to particulate emissions. Lead was also not included as lead emissions were minor or zero for the various treatment methods. Total emissions by pollutant for each treatment method were divided by the acres in Alternative B of the PEIS (the selected alternative) to estimate the tons per acre of emissions. For prescribed fire, only the values from eastern Oregon were used as these included less smoldering combustion. This result was then multiplied by the estimated acres on Table 3-3 for prescribed fire, mechanical, manual and herbicide treatments in each alternative.

Effects Common to All Alternatives

Fugitive dust from driving on unpaved roads is not expected to measurably alter air quality in mandatory Class I areas or in air quality non-attainment or maintenance areas. The potential toxic effects of spray drift are covered elsewhere in this document. Effects to air quality from herbicide treatments are somewhat less than the National estimate as fewer acres are treated under all alternatives than were estimated in the PEIS. The highest emissions from manual treatments are CO, which largely comes from the exhaust of transportation vehicles, although manual emissions are minor relative to prescribed burning and mechanical treatments. All alternatives include a mix of treatment methods that are dispersed throughout the year, although lowest in winter, and across the entire State. Given this dispersion in time and space, it is not possible to determine if any alternative could result in a violation of NAAQS.

Prescribed burning, 80 to 97 percent of which would be in eastern Oregon in this analysis, would most likely take place in late summer or early fall so that the follow-up seeding would have the advantage of winter precipitation to enhance germination and establishment. Direct effects to air quality from burning annual grasses are of very short duration due to the lack of smoldering. Emissions are quickly dispersed and diluted, therefore, are not expected to impair visibility in any mandatory Class 1 areas. There is some potential for short-term (1-4 hours, depending on individual treatment unit size) adverse effects to the Klamath Falls and Lakeview air quality maintenance areas since both communities are located at or near the bottom of a basin where air flow out of the basin is restricted during inversions and on very cold days. Potential air quality effects will also be analyzed as part of project-specific environmental analysis and BLM policy requires that all prescribed fire burn plans address smoke management, regardless of location. Oregon State law prohibits the regulation of rangeland burning under the State smoke management rules; nonetheless, most BLM districts voluntarily comply with the Oregon Smoke Management Plan.

Table 4-12 summarizes the expected emissions by alternative; these estimates are based on those in the PEIS. Alternative 3 has the highest emissions of all pollutants. In comparison with statewide emissions for Oregon from 2002, the latest year for which data are available (EPA 2007d), the particulate emissions for Alternative 3 are 0.2% of the 2002 statewide emissions. Carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), and Volatile Organic Compound (VOCs) emissions in Alternative 3 are <0.1% of 2002 statewide emissions. All other alternatives would result in fewer emissions. No statewide data are available for carbon dioxide, however, the relative proportion is likely similar to the criteria pollutants.

Table 4-12. Emissions from Vegetation Treatments

Emissions from herbicide treatment only						
		Total Emissions (tons)				
Pollutant	**Oregon Estimated from the PEIS**	**Reference Analysis**	**Alternative 2** (No Action)	**Alternative 3**	**Alternative 4** (Proposed Action)	**Alternative 5**
PM_{10}	6.97	0	1.66	3.00	4.47	4.96
$PM_{2.5}$	0.99	0	0.24	0.43	0.64	0.70
CO	5.00	0	1.11	2.02	3.00	3.33
NO_x	0.57	0	0.13	0.23	0.34	0.38
VOCs	0.34	0	0.08	0.14	0.21	0.23

Emissions from prescribed fire, mechanical, and manual treatments[1]					
	Total Emissions (tons)				
Pollutant	**Reference Analysis**	**Alternative 2** (No Action)	**Alternative 3**	**Alternative 4** (Proposed Action)	**Alternative 5**
PM_{10}	936.46	884.48	981.78	378.42	378.42
$PM_{2.5}$	406.00	401.39	495.95	254.00	254.00
CO	509.46	757.04	1,635.59	1,633.50	1,633.50
CO_2	12,312.90	18,660.42	40,392.59	40,058.75	40,058.75
NO_x	33.13	42.62	79.12	70.12	70.12
SO_2	6.99	10.22	21.47	20.87	20.87
VOCs	46.65	66.86	141.90	141.17	141.17

[1] No estimates were included in the PEIS

Effects by Alternative

Reference Analysis – No Herbicide Use

This strategy would have the highest emissions from mechanical treatments, the lowest from prescribed fire, and no emissions from herbicide treatments. Particulate emissions are the second highest of all the alternatives. Particulate emissions are highest in the mechanical treatments largely due to fugitive dust and diesel exhaust. CO and CO_2 emissions are the lowest of all the alternatives. Prescribed burning is responsible for the bulk of the CO and CO_2 emissions, although diesel emissions under mechanical treatments account for nearly 500 tons per year of CO_2 emissions. Fewer acres are treated using prescribed fire than in the No Action Alternative (Alternative 2) since prescribed fire for weed control is normally used in conjunction with some herbicide applications; if the herbicide is not used, there is no need to burn. Mechanical treatments partially replace some of the prescribed burning that would have occurred under the No Action Alternative.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Emissions from this alternative provide the main baseline against which the other alternatives are compared. Prescribed burning is the main source of CO, CO_2, NO_x, SO_2, and VOC emissions. Mechanical treatments are the main source of PM_{10} and $PM_{2.5}$ emissions, largely due to mechanical treatments of road rights-of-way and habitat improvement/ecosystem restoration treatments. Manual treatments and herbicide application result in few emissions of the pollutants analyzed. This level of emissions would continue if none of the action alternatives are selected.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

This alternative has the highest emissions of all pollutants analyzed. Under this alternative, the use of imazapic is expected to increase the use of prescribed fire by an estimated 6,800 acres. Prescribed fire would be used as preparation treatment, primarily in eastern Oregon, in a three-step treatment regimen for controlling invasive annual grasses. However, mechanical methods are still used to treat an estimated 9,300 acres of roadways and 11,395 acres of other vegetation. As a result, emissions of particulate matter, CO and CO_2 are the highest due to the large increase in prescribed burning and only minor decreases in mechanical treatments over the No Action Alternative (Alternative 2).

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

In this alternative, the number of acres treated using prescribed fire and manual methods are the same as in Alternative 3. However, the number of acres treated mechanically declines as herbicide treatments are substituted. As a result, the fugitive dust and exhaust-related emissions decline substantially, particularly PM_{10}, $PM_{2.5}$, and CO_2 relative to the emissions in Alternative 3. The emissions of PM_{10} and $PM_{2.5}$ in this alternative are the lowest of any of the alternatives. Carbon monoxide, CO_2, NO_x, SO_2, and VOC emissions are only slightly less than Alternative 3, largely because prescribed fire is the primary source of these pollutants.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

The effects of Alternative 5 are very similar to Alternative 4 (Proposed Action). Emissions are increased slightly over Alternative 4 due to the inclusion of an additional 4,800 acres of herbicide treatments for habitat improvement/ecosystem restoration. Otherwise, emissions from prescribed fire, mechanical and manual methods are the same as Alternative 4.

Climate Trends, Projections, and Implications

See the *Environmental Setting* section at the beginning of this Chapter for information about the current climate.

Observed Climate Trends

Mote (2003b) documented many changes in the Pacific Northwest[25] climate. Over the past 100 years, temperatures have increased but at slightly different rates. In the maritime climatic zone, which includes the coast, northwest Oregon and southwest Oregon in this study, average annual temperatures have increased 1.6° F while the central zone, which includes eastern Oregon, has seen average annual temperatures increase by 1.5° F. Increases have generally been higher at higher elevations. Temperatures have increased the most in winter (January-March) and least in fall (October-December), with temperatures also increasing substantially in summer (July-September) in the maritime climatic zone. The 1990s were the warmest decade in the 20th Century.

Precipitation has also increased, although much less so in the maritime climatic zone. This zone includes many stations that show little change or slight decreases in western Oregon. Unfortunately, the data for eastern Oregon includes only stations in the Blue Mountains and Columbia Basin and none in central or southern Oregon. Overall, precipitation has increased 2-4 inches. This amount is relatively insignificant along the Oregon coast and northwestern Oregon but highly significant in eastern Oregon. Most of this increase occurred before 1945. Spring (April-June) precipitation has increased the most across the Pacific Northwest. Summer precipitation has increased some 70 percent in the central climatic zone, but this increase is insignificant given that summer precipitation is already very low in this zone.

These observed changes in precipitation and temperature are beginning to manifest in other aspects of Oregon's climate. Below 5900 feet elevation, the amount of snow on April 1, typically the peak of snow accumulation, has declined by as much as 60 percent since 1950, coinciding with increased temperatures and despite increased precipitation (Mote 2003a). Less winter precipitation is falling as snow in the Cascades and Blue Mountains (Knowles et al. 2006) and spring snowmelt is occurring earlier (Westerling et al. 2006). Aridity in the interior western United States, which includes eastern Oregon, has been increasing since 1900 (Cook et al. 2004). On a global basis, the number of cold days, cold nights, and frost have become less frequent while the number of hot days, hot nights, and heat waves have become more frequent (IPCC 2007), although these trends have not been analyzed specifically for Oregon.

Climate Change Projections

The Climate Impacts Group (CIG) (2008) at the University of Washington recently released the latest projections for the climate of the Pacific Northwest. This forecast is based on 20 general circulation models and on two emissions scenarios – B1 (lower emissions) and A1B (higher emissions). By 2100, CO_2 concentrations are expected to range from 549 ppm under the B1 scenario to 970 ppm under the A1B scenario. These concentrations would be approximately 2 to 3.5 times, respectively, the pre-industrial CO_2 concentration of 280 ppm. Projections for the resulting impact on temperature have greater certainty than for precipitation.

In general, the climate in Oregon will be warmer, but not significantly wetter. Temperatures are expected to warm by 0.5° F per decade into the 2050s, with future changes depending on the emissions scenario used. Average annual temperature will increase 2.2° F (1.1-3.4° F) by the 2020s, by 3.5° F (1.6-5.2° F) by the 2040s and by 5.9° F (2.8-9.7° F) by the 2080s relative to the 1961-1990 average. As early as the 2020s this change could be outside

25 The Pacific Northwest (in this instance) is defined as all of Oregon, Washington, and Idaho, southern and central British Columbia and part of western Montana.

the range of variability observed in the 20th Century. All seasons will be warmer with the largest temperature increase in summer (June-August).

Only small changes in precipitation are expected. The average annual precipitation could increase only 1-2 percent (-10 percent - +20 percent). By the 2020s, winter (December-February) precipitation may increase, although it is more likely to increase by the 2080s. Summer precipitation is expected to decrease.

Hydrological drought is expected to become more common due to increased temperatures and decreased snowpack. The Aleutian Low and storm track across the North Pacific are expected to shift north and intensify, likely increasing the frequency of large-scale storms and bringing more intense precipitation into the Pacific Northwest in winter (Leung et al. 2004, Salathé 2006). Most of this intense precipitation will fall in western Oregon and the Blue Mountains and most of the change is expected to occur in the second half of the 21st century (Salathé 2006).

These projected trends in temperature and precipitation have implications for other aspects of climate as well. The observed trend for less snow in winter and earlier snowmelt will likely continue. Increasing temperatures indicate the transient snow zone will rise in elevation and potentially all but the highest peaks in the Cascades could fall within this snow zone (Leung et al. 2004). The growing season will likely shift to earlier in the year, although it is much less clear if the length of the growing season will increase, decrease or remain unchanged. The length and intensity of the summer seasonal drought will likely increase. Cold snaps will likely happen less often, although they may be just as severe as past cold snaps given the source of the cold air. Heat waves and hot extremes are very likely to become more frequent (IPCC 2007). Multi-year droughts are expected to become more frequent and last longer (Cook et al. 2004). Summer may have more clear days (Leung et al. 2004).

These projections include a number of uncertainties. Generally, regional climate models can produce very different results from general climate models, even though the general climate models form the basis for the regional models. The differences arise from the generation of general climate model used as a basis, differences in model parameterization and differences in model resolution (Christensen et al. 2007). Ensemble modeling and forecasts can help reduce some of this source of uncertainty (Leung et al. 2004). High elevation terrain is not well represented in most models, potentially leading to an underestimation of warming at higher elevations associated with snow-albedo feedback (Christensen et al. 2007). How changing ocean conditions will affect ENSO and PDO remains unknown (Christensen et al. 2007, CIG 2008). Current models have not yet incorporated new information on the accelerating rate of atmospheric CO_2 growth (Canadell et al. 2007). Other events, such as the Asian dust storms, have only recently been identified as potentially impacting the climate of western North America (Zhang et al. 2007) so have not been adequately incorporated into climate models either.

The alternatives themselves could affect climate change, but the differences between the alternatives are slight and potentially speculative. As noted in the *Air Quality* section, the science is lacking to develop a complete carbon budget principally due to the lack of information on belowground carbon dynamics in all ecosystems and very limited information on aboveground carbon dynamics in rangeland ecosystems. Although carbon cannot be thoroughly analyzed, one of the known qualitative trade-offs are that activities that can restore healthy functioning ecosystems, including treatments to reduce invasive plants, tend to increase carbon sequestration. That section points out that Alternative 4 (Proposed Action)'s replacement of roadside mowing with herbicide use should decrease fossil fuel use. These factors point to the Proposed Action having favorable effects on climate change and long-term air quality when compared to the No Action Alternative (Alternative 2), but the difference is qualitative and likely so small as to play little role in influencing the choice between the alternatives.

Implications of Climate Change on Invasive Plants

In response to increased temperatures, longer hotter summers, earlier snowmelt, and resultant increased hydrologic droughts, plants will migrate north and upslope (Tausch 2008, Middleton 2006). Existing plant communities likely will disappear and new plant communities will form based on differential migration rates; differential responses to temperature, precipitation and increasing carbon dioxide ($CO_{2)}$; and differential responses to competition (Best et al. 2007, CIG 2004:4). Changing weather patterns and the resultant shifts in plant communities will both favor invasive plants.

Many invasive plants originate from Mediterranean climates,[26] and have wide ecological amplitudes, two features that make them successful in Oregon and will make them more successful in the future. For example, many invasive plants are more likely than native plants to have a deep taproot, sparse foliage, or other characteristics for surviving long hydrologic droughts.[27] Some species may respond more to temperature changes, some more to precipitation changes, and some to the joint change in temperature and precipitation (CIG 2008).

There is also evidence that rising CO_2 can preferentially select for invasive plant communities (Ziska and George 2004:427, Patterson 1995). The rise in CO_2 increases photosynthesis, for a "fertilizer effect." Ziska and George (2004:436) found doubling CO_2 increased biomass 34 percent if moisture, nutrients, and light were not limiting. One of the common responses to rising CO_2 is an increase in belowground root growth relative to aboveground shoot growth (Ziska and George 2004:439). Thus, the CO_2 fertilizer effect favors plants with a taproot, or higher root/shoot ratio than other plants, both of which are often characteristic of invasive plants.

High CO_2 has altered weed herbicide resistance: Canada thistle (a species that reproduces asexually from belowground organs) grown at high CO_2 levels becomes resistant to glyphosate (Ziska et al. 2004). If high CO_2 affects other weeds similarly (increases herbicide resistance while enhancing belowground biomass storage), those species will become increasingly competitive with native species and harder to kill, resulting in changes to communities, and thus ecosystem process.

General warming and a decreased incidence of killing frosts will allow the spread of invasive plants currently limited by a low tolerance to freezing. Warming will allow additional invasive plants to enter Oregon.

The shift in plant communities upslope and to the north is essentially a disturbance that makes an increasing number of niches available. The same characteristics that make invasive plants successful at invading other disturbances will likely give invasive plants an advantage during this migration.

Other factors will exacerbate this "disturbance": increased fire frequency and intensity; anthropogenic disturbances; and severe weather disturbances. For example, climate shifts will cause fuel loads to accumulate and dry earlier in the growing season (not counting the increased loading from drought-related mortality). Research suggests some weeds including cheatgrass grown at higher CO_2 levels burns hotter, not just because of additional carbon storage, but also because of a higher carbon ratio (Blank et al. 2006). Thus wildfires in cheatgrass and potentially other invasive plant-filled communities would be expected to burn hotter in the future, all else being equal. Hotter wildfires are more likely to remove even fire-resistant native plants, and then invasive plants are more likely to invade the resultant burned areas (USDA 2005a:3-21).

Anthropogenic disturbances will have the same effect, contributing to the disturbance and stress caused by the climate shift and creating more opportunities for invasive plants. Similarly, as native plants thin and soils become

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26 A type of climate characterized by hot, dry, sunny summers and a winter rainy season.

27 Long seasonal soil moisture decreases resulting from earlier snowmelt and longer, hotter dry seasons.

poorly protected, increased storm intensities are more likely to disturb soils. For each disturbance, climate shifts may have decreased the ability of local native plants to compete with invasive ones, or even to be used in subsequent restoration. It is not clear, however, if disturbances will compound the effects of climate change or simply trigger them.

Site-specific changes may be quite different than described above. However, a general conclusion, based on the preponderance of current literature, suggests, "most of the important elements of global change are likely to increase the prevalence of biological invaders" (Dukes and Mooney 1999:138). The temperature and CO_2 changes predicted for Oregon in the coming decades will increase the spread of invasive plants and, to some degree make them harder to control. Plants already geographically restricted and/or stressed, such as those rare species listed under the Endangered Species Act or otherwise included in the Special Status species Program, will become more vulnerable to invasive plants than they are today, because of climate change. This increased level of risk is in addition to the risk that will result as invasive plants occupy more acres in Oregon.

Effects of the Alternatives on Climate Change: Greenhouse Gas Emissions and Carbon Storage

As well as resulting in the emissions of greenhouse gasses (see *Air Quality*), the alternatives also have potential implications to climate change. While the effects of any one action or even a group of actions may be very small, climate change is being driven by the cumulative impacts of the sheer number of very small actions. For example, while a single motor vehicle contributes a negligible amount of greenhouse gases compared to the volume of the atmosphere, the cumulative effects of millions of motor vehicles over several decades has been substantial (IPCC 2007).

Cumulative effects from the alternatives arise from two different primary effects: 1) the greenhouse gases emitted in conjunction with the types of treatments and numbers of acres treated and 2) the impact the treatments have on the plant communities treated and their carbon budgets. The feedback link between vegetation and climate has long been recognized, although the current generation of general circulation models (GCMs) and dynamic general vegetation models (DGVMs) lack the capability to include this feedback much below the biome level (e.g., conifer forest, grassland, etc.)(Neilson 1995, Bachelet et al. 2001, Sitch et al. 2003, Woodward and Lomas 2004, IPCC 2007).

Table 4-12 (Emissions from Vegetation Treatments) in the *Air Quality* section discloses the estimates of carbon monoxide and carbon dioxide from the different mix of treatment methods and acres treated in each alternative. The remainder of this discussion focuses on the implications for carbon storage as a factor in climate change.

Both carbon storage and carbon emissions are a function of the total biomass on a given site, and the difference between gains from photosynthesis and losses from respiration, or net ecosystem exchange (NEE) (IPCC 2007). By altering the species' composition and total biomass on a site, the alternatives can affect whether NEE is positive or negative and over what time scales. Another cumulative impact is whether any shifts in species' composition increase or decrease resistance to or resilience from another disturbance that can also affect NEE over the short- or long-term (Obrist et al. 2003, Prater et al. 2006, IPCC 2007). The highest carbon storage capacity occurs in forests, followed by juniper woodlands, sagebrush-steppe, salt desert shrub, and annual grasslands. Biological soil crusts can be a significant factor in the carbon fixing capability of some juniper woodlands, sagebrush-steppe and salt desert shrub (Eldridge 2000, Belnap 2003, Housman et al. 2006) but annual grasslands typically have no biological soil crusts due to the frequency of fire (Belnap 2003, Hilty et al. 2004, Housman et al. 2006).

Carbon-flux studies in both forests and sagebrush-steppe indicate that both systems are net emitters of carbon in dry years (carbon sources) and net storers of carbon in wet years (carbon sinks) with forests usually functioning as carbon sinks in average years as well (Obrist et al. 2003, Hunt et al. 2004, Prater et al. 2006, Wharton et al. 2009). Invasive annual grasslands are carbon sources (Obrist et al. 2003, Prater et al. 2006).

By convention, carbon is assumed to comprise about 50% of the total biomass of any given plant. At present, there are few reliable estimates of the total biomass of any biome, plant community, or plant species. The most reliable estimates are for the aboveground portion of commercially important conifer species and the least reliable estimates are for belowground storage, shrubs, herbaceous plants, and biological soil crusts. Alternatives that maintain or increase the the extent of late-successional biological soil crusts or control or reduce invasive plants, maintain or enhance net carbon storage capacity on BLM-managed lands. Alternatives that reduce the extent of late-successional biological soil crusts or permit invasive plants to spread reduce net carbon storage capacity on BLM-managed lands.

In most cases, whether biomass and overall carbon storage capacity is increased, maintained, or decreased through the use of herbicides is not known due to the lack of data that would allow comparisons between the biomass on a site dominated by an invasive or unwanted plant verses a site dominated by a native plant community. For example, knapweeds and thistles are typically taller than most native tall bunchgrasses, such as bluebunch wheatgrass, and therefore may contain more aboveground carbon. Those species that are taprooted likely contain less carbon belowground than a tall bunchgrass, but it is much less clear if rhizomatous species contain more, less, or about the same belowground carbon as a tall bunchgrass. The amount of both above and belowground carbon in a stand of reed canarygrass may well be very similar to a stand of cattails but may be greater than mixed stands of cattails, reeds, and sedges. The few cases where this information is known with a higher degree of confidence are discussed below.

Invasive annual grasses support less biomass both above and belowground than the native grasses and woody plants they displace. Invasive annual grasslands are most common in eastern Oregon but can be found in western Oregon as well. Alternative 2 (and the Reference Analysis) would allow invasive annual grasses to continue spreading at or nearly their full biological potential, reducing the carbon storage capability on BLM-managed lands with the greatest effect in eastern Oregon. Carbon emissions from the respiration of soil organisms would increase until the carbon previously stored belowground by the native plant community is mineralized (Obrist et al. 2003, Norton et al. 2004, Bradley et al. 2006, Prater et al. 2006). The availability of herbicides effective on these invasive annual grasses under Alternatives 3 through 5 would slow the rate of loss to invasive annual grasslands. Overall carbon storage capacity would continue to decline, but at a slower rate than under the Reference Analysis and Alternative 2 (No Action).

Juniper woodlands store more carbon aboveground than sagebrush-steppe. The differences in belowground storage are less clear due to differences in root types, total root mass and root turnover rates. As western juniper canopy cover increases, sagebrush and other shrub biomass decreases (Miller et al. 2005). On sites with a restrictive soil layer close to the surface, grass and forb biomass also decrease as western juniper canopy cover increases (Miller et al. 2005). In such locations, surface erosion also tends to increase, removing biological soil crusts and carbon stored in soil layers as the top layer of soil is lost. The effect of reducing western juniper on carbon storage capability is uncertain but may be neutral on sites with a restrictive layer close to the surface and reduced on other sites. Under the Reference Analysis and Alternatives 2 and 3, western juniper expansion would continue as long as the climate remains favorable for this species with an overall increase in aboveground carbon storage. There would also be increased erosion risks on sites with a restrictive soil layer close to the surface. Under Alternatives 4 and 5, some treatments are intended to reduce western juniper resulting in a decrease in carbon storage capability and maintenance of existing erosion risks.

Himalayan blackberry, which is a semi-woody invasive plant commonly found in western Oregon, contains more aboveground biomass and carbon than the grasses and forbs it displaces in grasslands, savannahs and open forests. Aboveground carbon storage would be enhanced where Himalayan blackberry is allowed to continue spreading at its full biological potential. Alternatives 2 through 5 could potentially reduce carbon storage capability to the degree they are used to reduce the extent of Himalayan blackberry west of the Cascades. However, since some blackberry controls are already available under Alternative 2 (No Action), the amount of blackberry control is not expected to vary significantly between the alternatives.

Along with the general lack of detailed information concerning existing carbon storage and storage capability is the fact that climate responses to changes in greenhouse gas emission and storage rates is nonlinear (IPCC 2007) making any assessment of potential effects of the alternatives on climate itself largely speculative.

Soil Resources

Affected Environment

Soil is a dynamic medium consisting of varying levels of sand, silt and clay particles, organic matter, and soil organisms, both large and small (e.g., earthworms, bacteria and fungi). Soil functions to hold nitrogen, phosphorus, and herbicides in place, keep them out of surface water, and deliver nutrients and water to plants, as they need them. Soil filters, buffers, degrades, immobilizes, and detoxifies organic and inorganic materials, including herbicides, other manufactured products, and materials from atmospheric deposition (USDA 1997).

Soil texture (the proportional amount of sand, silt, and clay constituents) and organic matter affect the movement of water and herbicides into and through a given soil. Coarser textured soils (those with high amounts of sand) allow faster movement of water into and through them compared to fine textured (clay) soils. Clay textured soils have higher rates of surface runoff than sandy soils. Silty or clay textured soils and those with high levels of organic matter have greater surface areas that can absorb and hold greater amounts of herbicides when compared to coarse textured soils. Organic matter and clay particles have different positive and negative charges (cation exchange capacity, CEC) that provide the adsorbing mechanism. The bond between the herbicide and particle can be lost if other mechanisms within the soil are great enough to break the bond.

The USDA National Resources Conservation Service (NRCS) differentiates soils by diagnostic horizons[28] (layers) or features that reflect soil-forming processes. On BLM lands in Oregon, there are four major and five minor soil orders (Figure 4-4). Each of the biomes may contain several or all of the soil orders because of various combinations of local soil forming factors. The four major soil orders (based on abundance in Oregon) are:[29]

Aridisols are soils found east of the Cascades (primarily in the Sagebrush Steppe biome) that have developed under low moisture regimes. Above ground vegetation is sparse; thus organic matter accumulations are low (less than 2 percent), and the ability of these soils to filter, store and process herbicides is limited to the upper soil layers. Herbicide degradation by sunlight (photo degradation) would be high but biological degradation would be low unless adequate moisture for processing by organisms was present.

28 Soil horizons, ordered from top to bottom include: the O horizon (organic matter); the A horizon (surface soil); the B horizon (subsoil); and, the C horizon (substratum).

29 Soil Order information for State of Oregon summarized from USDA (1999) and USDA (2006a). Major/minor split based simply on abundance on BLM lands in Oregon.

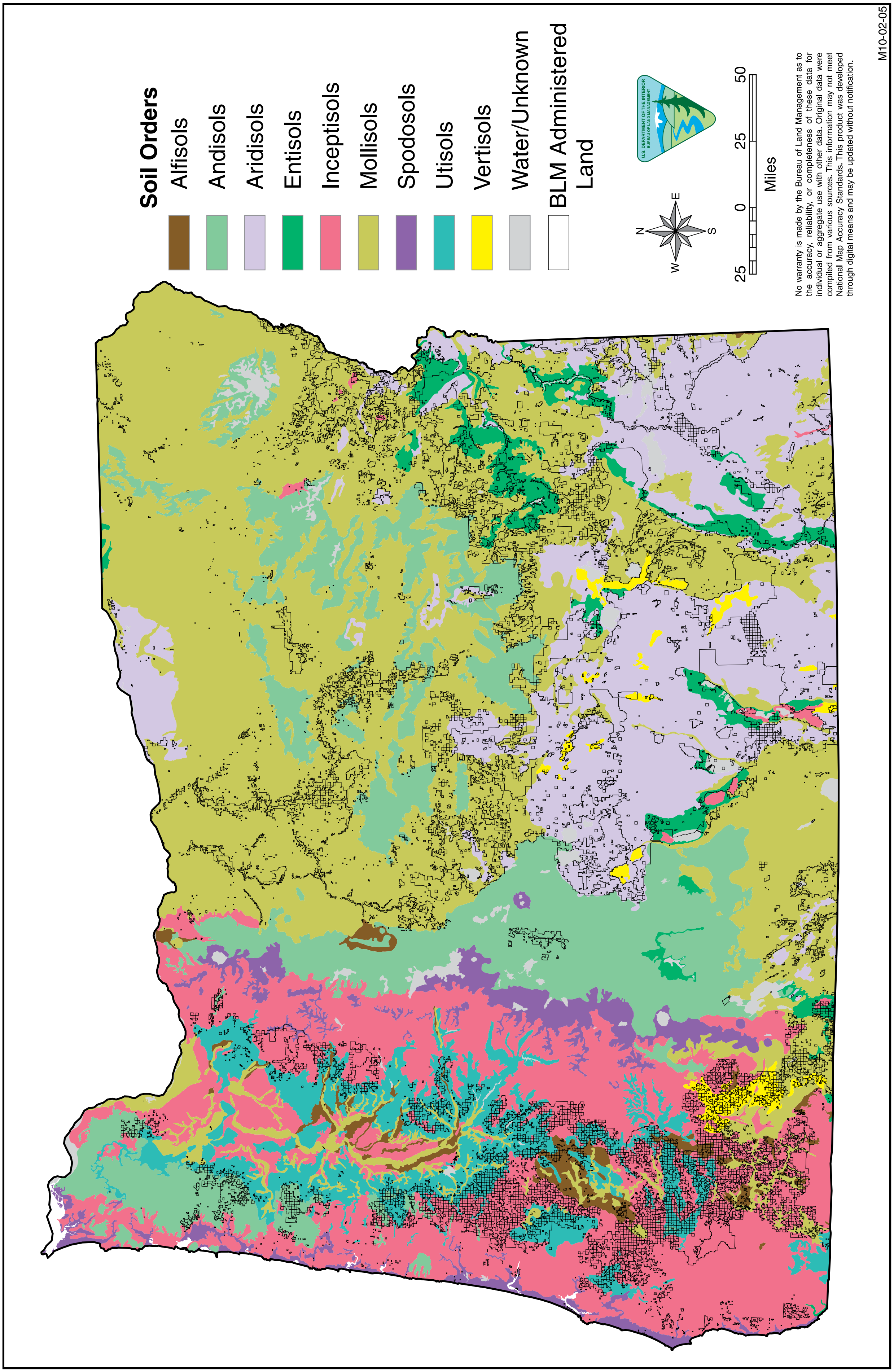

FIGURE 4-4. SOIL ORDERS

Mollisols are productive soils rich in organic matter from the dense root systems of prairie grasses. They cover much of the Eastern Forest and Sagebrush Steppe biomes and are found in the Willamette Valley and Southern Siskiyou Mountains. Their origin from windblown or weathered basalt parent materials allows some to be prone to wind erosion if not stabilized by growing vegetation. Their high organic matter content (Table 4-13) binds herbicides and provides degradation by soil organisms, helping reduce the risk of groundwater contamination.

Inceptisols are generally young mineral soils with high infiltration rates and low amounts of clay. Herbicide transport to lower depths of soil and groundwater or streams would occur if it were not already tied to vegetation or organic matter at the surface. They often support coniferous and deciduous forests as well as rangeland vegetation, and are found primarily in the Western Forest and Willamette Valley biomes with a small percentage in the Siskiyou biome.

Entisols occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development, such as dunes, steep slopes, and flood plains. These soils are sandy in all layers, and are subject to wind erosion if vegetation is lacking. Most occur east of the Cascades.

The five minor (less abundant) Soil Orders are:

Ultisols support forest vegetation in the Willamette Valley and Siskiyou Biomes. They have properties that allow processing and storage of herbicides such as high amounts of clay, organic matter, and good drainage.

Andisols formed on volcanic ejecta and have a high natural productivity. They are prominent in the Cascades with minor occurrence in the Blue Mountains. The ability of these soils to process (that is, to bind, degrade, and store) herbicides is high, as moisture, plant growth, and binding sites would be high in the silt portion of most soils.

Vertisols have high clay content, pronounced changes in volume with moisture changes, cracks that open and close periodically, and evidence of soil movement. Vertisols are problematic for herbicide application due to the cracking and movement, but may bind herbicides due to high clay contents.

Alfisols are developed in semiarid to moist areas where weathering has leached clay minerals and other constituents out of the surface layer and into the subsoil, where they can hold and supply moisture and nutrients to plants.

Spodosols are soils with a B (subsoil) horizon consisting of an accumulation of black or reddish materials that have a high CEC, important for binding herbicides within the soil. These sandy soils have good drainage properties along with high organic matter contents that tend to bind and process herbicides well. These are found primarily on the forested coastal lands and beach areas of the BLM west of the Cascades. They are also the prime areas for growing cranberries on the coast.

Organic Matter - On any soil, the amount of organic matter is key to maintaining structure, allowing water and air to infiltrate to low depths, and providing a source of energy to microbial communities. Many herbicides readily bind to organic matter. Organic matter levels greater than 2.5 to 3 percent may tie up soil-applied herbicides prior to them being delivered to the plant. Some labels recommend increasing the amount of herbicide to the maximum rate in these situations. Soil orders found in the west side of the State, such as Inceptisols, Spodosols and Ultisols, contain considerably more organic matter than the Mollisols or Aridisols of the east side.

Clay has more surface area per volume and provides binding sites for herbicides and water, supporting herbicide breakdown by microorganisms (see below). However, as the percentage of clay in a given soil increases the potential for compaction and increased runoff also increases. If the soil becomes nearly all clay, as in the case of

Table 4-13. Soil Order Properties and Extent on BLM Lands

Soil Order	**Estimated Acres on BLM Lands** (% of total)	**Average Percent Organic Matter**[1]	**Average Percent Clay**[1]	**Average T Factor**[2] **(Tons/Ac/Yr of Soil Loss Allowed)**	**Average Wind Erosion Group Rating** (1= High, 8=Low [3]) Range { }	**Average Water Erosion Risk Rating K Factor**[4] (L<M<H)	**Average pH value (range)**
Major Orders							
Aridisols	6,913,000 (43.9)	1.67	18.2	2.7 (1-5)	5.59 {1-8}	.31 (M)	7.47 (6.8 – 8.5)
Mollisols	5,051,000 (32.1)	2.92	21.0	2.9 (1-5)	6.46 {1-8}	.25 (M)	6.86 (5.4 – 9.0)
Inceptisols	1,401,000 (8.9)	6.14	21.7	3.0 (2-5)	6.8 {4.1-8}	.22 (M)	5.88 (4.5 – 8.8)
Entisols	1,055,000 (6.7)	2.23	18.5	4.4 (2-5)	4.95 {3-8}	.31 (M)	7.63 (5.1 – 9.0)
Minor Orders							
Ultisols	523,000 (3.3)	4.68	27.7	3.5 (2-5)	6.88 {6-8}	.26 (M)	5.66 (5.4 – 6.4)
Andisols	297,000 (1.9)	6.04	16.9	3.0 (2-5)	5.69 {2-7}	.22 (M)	5.72 (4.4 – 7.3)
Vertisols	181,000 (1.1)	5.62	34.1	4.6 (2-5)	7.68 {6-8}	.23 (M)	7.05 (6.5 – 7.6)
Alfisols	66,000 (0.4)	3.37	15.6	3.3 (3-5)	4.85 {3-7}	.18 (L)	6.02 (5.9 – 7.0)
Spodosols	12,000 (0.1)	7.28	14.8	4.8 (3-5)	6.2 {6-8}	.30 (M)	5.06 (5.0 – 5.2)
Unknown	233,000 (1.5)	--	--	--	--	--	

[1] Average Organic Material and Clay contents derived from A horizon for all soils within the order, not the entire profile

[2] T Factor: Tolerable amount of soil loss (tons per acre per year) prior to reduced productivity

[3] Wind Erosion Groups rate the tons per acre soil loss potential for wind erosion on 70 percent-plus unvegetated soil. Ratings are: 1 = 160-310 per tons/acre/year; 2 = 134 tons; 3 and 4= 86 tons; 5 = 56 tons, 6 = 48 tons; 7 = 38 tons; and, 8=0 tons (USDA 1999)

[4] K Factor Erosion Risk Rating: Low- .05 to .2, Med .21 to .40, Hi .41+. Erosion factor K appears in the Universal Soil Loss Equation (Wischmeier and Smith 1978) as a relative index of susceptibility of bare cultivated soil to particle detachment and transport by rainfall.

(Data derived from USDA 2009a)

Vertisols, seasonal drying and wetting can produce wide deep cracks in the soil and herbicides can end up going deep into the soil and not necessarily on the weeds they are intended to remove.

Erosion Risk - Soils are rated by NRCS for a tolerable amount of loss before productivity is reduced. For example, Aridisols and Mollisols can lose less than 3 tons of soil per acre per year before their long-term productivity would be reduced (see T-Factor, Table 4-13). These soils also have low average wind erosion group ratings (5.6 to 6.5) if 70 percent or more of their surface becomes exposed. Since many invasive weeds provide poor soil cover, and weed treatments (particularly prescribed fire or the use of persistent pre-emergent herbicides) can leave soils exposed greater than a 70 percent level, the NRCS rating provides an indicator of certain types of risks. In addition to the potential for productivity loss through wind or raindrop erosion, erosion can move herbicides off site if they are attached to soil particles.

Biological Crusts provide important functions within, and on the surface of, the soil, such as improving soil stability and reducing erosion, fixing atmospheric nitrogen, and contributing nutrients for plants. Crusts are made up of organisms living at the surface of soils in semiarid and arid environments such as those in the Sagebrush Steppe and Eastern Forest biomes. The major components of the crust are cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens. These crusts can cover up to 70 percent of the soil spaces not occupied by vascular plants in arid regions. The Aridisols have this important soil covering and protection mechanism. Individual components of the crusts become reduced during herbicide applications thus the crusts lose some ability to function as a soil protection and a nutrient cycling mechanism.

Macro and Microorganisms are extremely important to proper functioning soil processes. Fungi and bacteria microorganisms convert complex organic compounds (including herbicides) into simpler ones that can be used by other plants and organisms for growth. The macro-organisms such as insects, worms, arthropods, and even burrowing animals mix the upper organic matter into the lower soil level for processing by the microorganisms found between soil particles. Soil temperature, moisture levels, and type of vegetation all affect the presence and activity of soil organisms (USDA 2004).

Environmental Consequences

Soil has the capacity to filter, buffer, degrade, immobilize, and detoxify herbicides. Soil properties that specifically bind herbicides or water to surfaces of the soil or organic matter are crucial to the soil's ability to detoxify herbicides. The three most important soil properties are soil clay content, organic matter content, and the acidic or alkaline nature (pH) of the soil. These govern the ability of a soil to provide an environment for organisms and water to filter, buffer, degrade, or otherwise store or breakdown the various herbicides. Changes to soil properties because of non-herbicide or herbicide treatments, or noxious weeds, is considered an adverse effect on soil function.

Effects Common to All Alternatives

Biological Crusts: Disturbance of soil crusts results in decreased soil organism diversity, nutrient cycling, soil stability, and organic matter. Crust disturbance can come about through trampling, fire, or burial by windblown soil. Invasive weeds generally establish themselves on the areas where crusts have been broken and soil is exposed, either by mechanical or animal disturbance or possibly an erosional event that buries them. It is possible that some[30] herbicides could reduce the individual components of the crust and thus affect their ability to function as soil protection and cycling mechanisms.

Macro and Microorganisms: Herbicides probably affect few soil organisms directly (USDA 2004). However, there is only limited research on the toxicity of many herbicides to most soil organisms. Of the 18 herbicides proposed for use in one or more of the alternatives, four (chlorsulfuron, picloram, metsulfuron methyl and tebuthiuron) have some effect on soil organisms, generally reducing but not eliminating local populations for a limited period of time[31]. Eight herbicides (2,4-D, clopyralid, dicamba, diuron, fluridone, glyphosate, sulfometuron methyl, and triclopyr) have no or slight adverse effect on soil organisms, with some showing increases after herbicide treatments. There are no known studies for effects from imazapic to soil organisms. Very little if any study of soil organisms has been conducted on six herbicides (bromacil, diflufenzopyr, diquat, hexazinone, and imazapyr). Of the studies that have been conducted, effects have been demonstrated but at application rates many times higher than the typical rates proposed for use on Oregon BLM lands, or the decrease in soil organisms is temporary. Populations have increased in some situations.

30 Various studies have been done on individual algae species present in soil crusts; however, only a handful of the studies focused on herbicides that the BLM is proposing, and of those, results were variable. Positive, neutral, and negative effects were attributed to 2,4-D; positive and negative effects were attributed to diuron and diquat; neutral and negative effects were attributed to picloram; negative effects were attributed to bromacil; and, positive effects were attributed to 2,4-D + picloram (Metting 1981). Metting cites several authors who caution against extrapolating this information to the field.

31 This lasts for anywhere from a few days to three weeks. Population levels can be reduced for up to two months if rates exceed typical field application rate or if coupled with secondary applications of a second herbicide.

If herbicides reduce macro and microorganisms, herbicides will persist in the soil longer as other means (e.g., hydrolysis) may become the primary breakdown mechanism. If noxious weeds have changed the soil chemical or moisture contents in a manner that changes the variety or overall amount of these organisms, herbicide persistence may be extended. Finally, disturbance from mechanical treatments or animal traffic particularly on wet soils could compact the surface layer to a point that these organisms would lose their ability to degrade the applied herbicides.

Erosion and Compaction are closely related. Compaction decreases soil pore space and increases soil density, decreasing productivity and reducing the ability of the soil to infiltrate water. Without the infiltration of water into the soil, soil organisms or water bound to soil particles cannot interact with the herbicides to break them down. Decreased infiltration means more water running across the surface, eroding soils (particularly those particles loosened by raindrop impact) and potentially moving herbicides off site. Traffic on the surface, be it wheeled or tracked vehicles, animals, or human feet can cause compaction as well as disturbance of the soil. Bare or compacted soils can be colonized by noxious weeds more readily than native plants, as weeds tend to be more adapted to establishing on such altered sites.

Vegetation is the most significant factor in controlling erosion because it intercepts precipitation, reduces rainfall impact, restricts overland flow, and improves infiltration. Noxious weed infestations have been shown to increase soil erosion in comparison to soil occupied by native grass species (Lacey et al. 1989). Weeds have less capacity to dissipate the kinetic energy of rainfall, overland flow, and wind that causes soil erosion, when compared to the native species on the site (Torri and Borelli 2000, Fryrear 2000).

East of the Cascades, wind is the primary element of erosion. Wind can remove soil particles under certain conditions of low vegetative cover, dry soil, high percentage of fine clays, and sufficient wind velocity. While wind erosion on rangelands is difficult to quantify, the presence of natural vegetation and soil crusts on most rangelands is generally sufficient to keep wind erosion from becoming a serious problem. Erosion selectively removes organic matter and the finer-sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil 1999). Herbicides bound to soil particles can be transported off-site by blowing soils, negatively affecting non-target areas. According to NRCS data, soils rated as Group 1 or 2 for wind erosion risk are most likely to demonstrate this condition. These soils make up 445,000 acres of BLM lands primarily in the Deschutes, north part of Lake and the south portion of Jefferson Counties. A portion of these acres also reside in Umatilla, Klamath, Morrow, Gilliam, and Clackamas counties (Figure 4-5).

Parameters that Affect the Fate of Herbicides in Soils: The ability of soils to hold and breakdown herbicides is affected by soil biological processes (organisms and plant uptake), physical parameters (adsorption, photo degradation, volatilization, hydrolysis, and leaching), and physical parameters (climate and vegetation cover). Characteristics of the 18 herbicides that influence the effectiveness of these parameters and processes are shown on Tables 4-14 and 3-1.

The rate at which an herbicide degrades is expressed as the half-life. The half-life is the amount of time it takes for half of the herbicide to be converted into other chemical components, or its concentration is half of its initial level. The half-life of an herbicide can be affected by its formulation, soil type, and environmental conditions (e.g., temperature, moisture). The fate of the herbicide before it degrades is affected by plant uptake, soil sorption, leaching, and volatilization.

Plant uptake is outside the scope of this discussion (see the *Native and Other Non-Invasive Vegetation* section earlier in this Chapter) and volatilization occurs when the herbicide releases into the air. Leaching is caused by movement in water, which is affected by how tightly the herbicide is bound to the soil particles. Herbicides degrade or break down into elements such as carbon, oxygen, hydrogen, and nitrogen. Some may form intermediate compounds. On the plant or soil surface, primary breakdown is by photolysis or volatilization. In the soil, microorganisms metabolize the herbicide, it is broken down by water (hydrolysis), or it is moved through the soil in water-leaching.

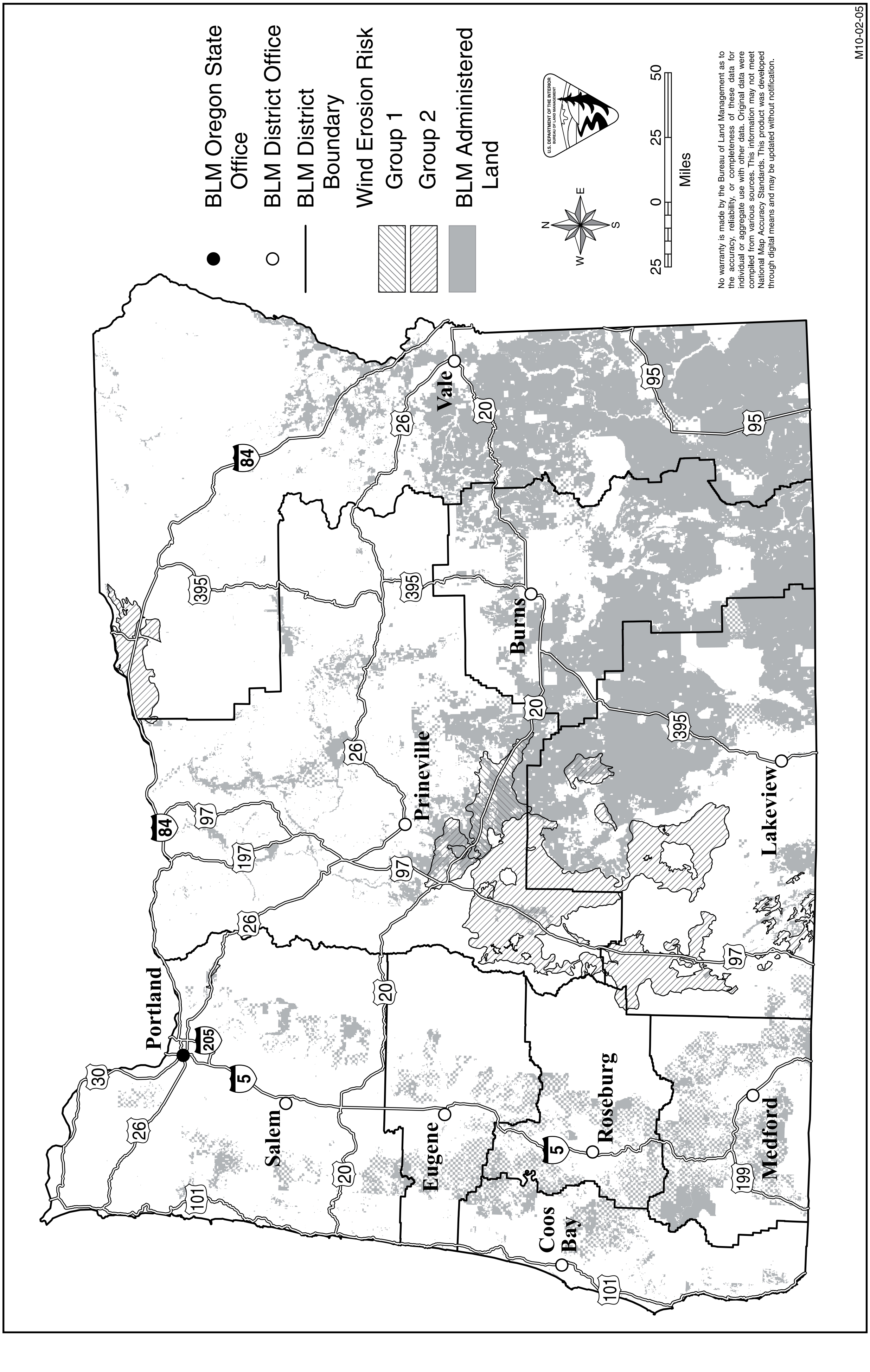

Figure 4-5. Wind Erosion Risk Groups 1 and 2

The ability of a soil to bind to an herbicide (while it breaks down) is based on its adsorption affinity. Herbicides vary in how tightly they are adsorbed to soil particles. K_{oc} measures the affinity for herbicides to "sorb" to organic carbon. The higher the K_{oc} value, the stronger the tendency for the herbicide to attach to, and potentially move with, the soil. The K_{oc} value listed in the table below is a measure of the number of milliliters of the individual herbicide that can be bound by one gram of organic matter. Herbicide K_{oc} values greater than 1,000 ml/g indicate strong adsorption to soil whereas low K_{oc} values (less than 500) tend to allow movement with water more so than movement adsorbed to sediment. Off-site movement is also affected by the formulation of the herbicide, soil properties, rate and method of application, frequency and timing of rainfall or irrigation, and depth to ground water.

Herbicides can be either selective or non-selective. Selective herbicides remove only specified types of plants such as broadleaf, grasses, or a subset of those. Spot treatments with any herbicide, or broadcast treatments using selective herbicides, will retain some degree of cover and root masses on the site, reducing or preventing the potential for surface erosion. Herbicides can also be applied directly to the soil, usually decreasing the risk of drift (when compared with foliar sprays) and more quickly binding the herbicide to soil particles. Generally, the soil-applied herbicides included in this EIS are relatively persistent. They are applied before vegetation sprouts out of the ground (a pre-emergent herbicide),

Soil/herbicide interaction parameters are included on Table 4-14 as well, and are described in the table footnotes.

Table 4-14. Selected Characteristics that Affect the Fate of Herbicides in Soils

Herbicide	Half-life in Soils (days)	Fate in Soils (Persistence Rating[1] based on half-life)
2,4-D	10	Rapid microbial degradation 1-4 weeks (Non-Persistent)
Bromacil	60 but may be up to 240	Degrades with biological activity in anaerobic soil but slow in aerobic soil (Moderately Persistent to Persistent)
Chlorsulfuron	40	Relatively rapid degradation by microbial and chemical actions, trace amounts have extreme bioactivity (Moderately Persistent)
Clopyralid	40	Biodegradation is rapid in soil, reducing the potential for leaching or runoff. Possible release of herbicide from decaying plants with uptake by other plants (Moderately Persistent)
Dicamba	14	Mobile in soil but easily degraded by microbes(Non-Persistent)
Diflufenzopyr	2 to 14	Biodegradation, photolysis, and hydrolysis are the primary mechanisms that remove diflufenzopyr (Non-Persistent)
Diquat	1,000	Quickly and irreversibly adsorbed to soil colloids, thus no soil activity (Very Persistent)
Diuron	90	Microbial degradation generally only one season (Moderately Persistent)
Fluridone	21	Adsorption increases with clay content, organic matter, cation exchange capacity, and decreasing pH (Non-Persistent)
Glyphosate	47	Tightly adsorbed and rapidly degraded by microbes, thus no soil activity (Moderately Persistent)
Hexazinone	90	Organic matter does not affect adsorption. Relatively low affinity for soil particles, dissolves in soil water. Bio-degradation is an importation fate (Moderately Persistent to Persistent)
Imazapic	120 to 140	Primarily bio-degradation. Sorption to soil increases with decreasing pH and increasing organic matter and clay content (Persistent)
Imazapyr	25 to 141	Adsorption is affected by aluminum and iron in soil more than by clay and organic matter, subject to microbial degradation except in cool temperatures (Moderately Persistent to Persistent)
Metsulfuron methyl	30	Hydrolysis and microbial degradation, with the latter being the only major pathway in alkaline soils (Non-Persistent)
Picloram	20-300	Very slow microbial degradation and some photolysis. Persistent for a year or more (Moderately Persistent to Persistent)
Sulfometuron methyl	20	Relatively rapid microbial and chemical degradation. Trace amounts have extreme bioactivity (Non-Persistent)
Tebuthiuron	360	Microbial degradation (Very Persistent)
Triclopyr	46	Degradation primarily through microbial metabolism, photolysis, and hydrolysis. As plants die, release of triclopyr can occur and can then be taken up by other plants. (Moderately Persistent)

[1] Persistence based on half-life in soils except for fluridone which is residency in water, 3 categories: non persistent -- less than 30 days; moderately persistent -- 30 to 100 days; and persistent -- greater than 100 days (Extoxnet PIP)

Additional Information about the Fate and Effects of Herbicides

2,4-D has a very short half-life that averages 10 days in moist soil. Its fate is dependent on soil acidity or alkalinity (pH). A soil pH of 7.0 is neutral. Acid soils measure between 1 and 7 on the pH scale whereas alkaline soils measure between 7 and 14. 2,4-D on a Spodosols would resist to degradation, but on a Mollisols, it would readily degrade in a warm and moist environment. 2,4-D is readily broken into simpler components in alkaline soils but the break-down is slower in acidic soils. Temperature affects degradation as well, with slower break-down in cold or dry soils or where microbial organisms are not present. Warm, moist soils previously treated with 2,4-D have been shown to dissipate the herbicide more rapidly due to the presence of bacteria that degrade it (Oh and Tuovinen 1991, Smith and Aubin 1994, Shaw and Burns 1998, all cited in Tu et al. 2001). Furthermore, most studies of the effects of 2,4-D on microorganisms concluded that the quantity of 2,4-D reaching the soil from typical applications would probably not have a serious negative effect on most soil microorganisms (Bovey 2001).

Bromacil is applied to soil where it binds, or adsorbs, only slightly to soil particles, is soluble in water, and is moderately to highly persistent. Its half-life is about 60 days, but may be as much as 8 months in aerobic soils (Wauchope et al. 1992). Soil persistence is longer in soils with high organic matter (National Library of Medicine 2002, Extoxnet 1993). Leaching is dependent on the soil type and the amount of rainfall or irrigation water. The potential for bromacil to leach and contaminate groundwater is greatest in sandy soils. In normal soils, it can be expected to leach to a depth of 2 to 3 feet (National Library of Medicine 2002). There is limited research on the toxicity to most soil organisms. However, one soil bacterial isolate that can biodegrade bromacil has been identified (Chaudhry and Cortez 1988).

Chlorsulfuron degrades in acidic soil by hydrolysis, but is more stable in neutral soils. As with most biodegradation rates, the higher the pH, the slower the herbicide breaks down. The higher the temperature, soil moisture, organic matter content, and microbial biomass, the faster it breaks down. Chlorsulfuron is only mildly toxic to terrestrial microorganisms and effects are short term (transient) (SERA 2004a).

The herbicide can remain active for more than a year. Sarmah et al. (1999) observed that the rate of chlorsulfuron degradation in alkaline subsoils was slow. They concluded that under conditions conducive to leaching in alkaline systems, prolonged persistence of chlorsulfuron in the soil profile is possible. It is likely that in some soils dissipation rates could be slower than the reported average, including arid soils with high pH and low organic matter. Such longevity could occur on the slightly (pH 7.4-7.9) and moderately (pH 7.9- 9.4) alkaline soils within the Aridisols, Mollisols, Inceptisols, and Entisols soil orders.

Clopyralid is unstable in soil and is considered moderately persistent based on its half-life. It will leach under favorable conditions such as wet, sandy soils like Inceptisols or Andisols as it does not bind to soil tightly. However, biodegradation is rapid in soil and thus the potential for leaching or runoff is low. Clopyralid can persist in plants and therefore can be introduced into the soil when plants die, therefore killing other plants.

Diuron is a moderately persistent herbicide with low to moderate mobility in soil, depending upon the level of organic matter available for it to adhere to. Decomposition is principally through biodegradation and occurs in both anaerobic and aerobic conditions. As degradation occurs, the breakdown product 3,4-DCA also persists and exhibits higher toxicity to some receptors[32]. Waterfleas are negatively affected but it is unknown if it affects soil crustaceans. Bacteria and fungi have been found to degrade this herbicide and population levels within the soil may increase. Thus, effects to them may be positively correlated. One study found adverse effects on bacteria diversity at concentrations of 25 mg/L and diversity seemed to decrease in soil treated with diuron (Giacomazzi

32 An ecological entity such as a human, fish, plant, or slug.

and Cochet 2004). According to the European Food Safety Authority's Conclusion on the Peer Review of Diuron (EFSA 2005), the risk from label applications to bees, non-target arthropods, and soil micro- and macro-organisms including earthworms is considered low for diuron and its metabolites.

Dicamba is moderately persistent in soil. The half-life of dicamba in soil is typically 1 to 4 weeks. Under conditions suitable for rapid metabolism, the half-life is less than 2 weeks. Metabolism by soil microorganisms is the major pathway of loss under most soil conditions. The rate of biodegradation increases with temperature and increasing soil moisture, and tends to be faster when soil is slightly acidic. When soil moisture increases above 50 percent, the rate of biodegradation declines. Dicamba slowly breaks down in sunlight. Volatilization from soil surfaces is probably not significant, but some volatilization may occur from plant surfaces. It is stable to water and other chemicals in the soil. Dicamba does not bind to soil particles and is highly soluble in water. It is therefore highly mobile in the soil and may contaminate groundwater. In humid areas, dicamba will be leached from the soil in 3-12 weeks (Howard 1991). The breakdown product is 3,6-dichlorosalicylic acid that is adsorbed strongly to soils but is moderately toxic to earthworms (IUPAC 2009).

Diflufenzopyr: Biodegradation, photo-degradation, and hydrolysis are the primary mechanisms that remove diflufenzopyr from soil. It is not considered persistent. Diflufenzopyr appears to be soluble enough that transport in surface runoff is possible, especially in neutral to alkaline soils.

Diquat is readily adsorbed to clay soil surfaces, becoming effectively immobilized by soils with high clay content. Diquat is resistant to anaerobic and aerobic biodegradation, possibly in part because it adsorbs so well to soil particles. It is considered a highly persistent herbicide with a half-life of 3 years or longer.

Fluridone is an aquatic herbicide that adsorbs to the surface area of sediment particles within the water column. Particles with greater clay content, organic matter content, cation exchange capacity, and lower pH are more reactive. Some studies have found fluridone can persist on dry soils longer and may last up to a year, but fluridone is an aquatic herbicide not proposed for use on dry sites. Persistence rating of non-persistent is based on time remaining in an aquatic environment. Volatilization can occur slowly on wet soils but not dry ones. No toxicity to earthworms was found when tested with rates up to 1,000 times the typical use rate.

Glyphosate binds tightly to soil particles. This binding increases with increasing clay content, organic matter and decreasing soil pH. Glyphosate is biodegraded by soil organisms and many use it as a source of carbon. There is little information indicating that it is harmful to soil microorganisms and may benefit some (Busse et al. 2004).

Hexazinone has a low affinity for soil particles and dissolves in soil water. It has a low to moderate persistence based on a 90-day half-life. Soil organic matter does not affect adsorption. Soil organisms do not appear to be affected by hexazinone (based on soil respiration and nitrogen cycles) when applied at the recommended application rate, and the capacity for beneficial mycorrhizal fungi to infect conifer seedlings was unaffected (Busse et al. 2004).

Imazapic is moderately persistent in soils and has not been found to move laterally with surface water. Most imazapic is lost through biodegradation. Sorption to soil increases with decreasing pH and increasing organic matter and clay content. Little is known concerning the effects of imazapic on soil organisms or processes.

Imazapyr does not readily bind to mineral soils, but is likely to bind relatively strongly to organic soil. Imazapyr may persist in soil for a prolonged period in relatively arid regions, and does not bind tightly to alkaline soils with low organic matter. Imazapyr can be released from treated plants into the soil, where it remains active and can kill non-target plants (Tu et al. 2001). There are no studies on the effects of imazapyr on soil invertebrates, and incomplete information on the effects on soil microorganisms (USDA 2007a). Field studies indicate that imazapyr remains in the top 20 inches of soil and do not indicate any potential for imazapyr to move with surface water. In forest field studies, imazapyr did not run off and there was no evidence of lateral movement. Modeling results indicate imazapyr runoff is highest in clay and loam soils with peaks after the first rainfall. Imazapyr percolation is highest in sandy soils (SERA 1999, Vencill et al. 2002).

Metsulfuron methyl has the principal modes of degradation of hydrolysis and microbial degradation, with the latter being the only major pathway in alkaline soils (Sarmah et al. 1998). Degradation rates are affected by soil temperature, moisture content, and soil pH. The chemical will degrade faster under acidic conditions, and in soils with higher moisture content and higher temperature (Smith 1986). Half-lives in acidic or neutral soils vary from 5 to 190 days (Sarmah and Sabadie 2002, SERA 2004e). In alkaline soils, adsorption is very low and leaching potential is high. This is likely to result in increased persistence in alkaline soils such as the Aridisols, Mollisols, or Entisols.

At surface application rates of 0.04 to 0.067 lb/ac (between typical and maximum rates), decreases in soil bacteria were apparent for 3 days but reversed completely after 9 days. Biodegradation of metsulfuron methyl increased as soil moisture increased from 20 percent to 80 percent of field capacity, and half-life decreased when temperature was raised from 20° to 30°C (Ismail and Azlizan 2002).

Picloram is broken down primarily through photolysis and biodegradation mechanisms of dissipation (USDA 2000b). Picloram adsorbs to clay particles and organic matter, but if the soil contains little clay or organic matter, picloram is easily moved by water. Picloram has been reported to remain active in soil at levels toxic to some plants for more than 1 year at typical application rates (SERA 2003b). The half-life of picloram in soil is reported to vary from 1 month under favorable environmental conditions to more than 4 years in arid regions (USDA 2000b). Picloram can be persistent in plants. When plant parts containing picloram degrade, they may release it into the soil, where it can kill other plants.

The persistence of picloram in soil is dependent on soil moisture and temperature; warm and moist soils degrade this herbicide readily. Picloram dissipates most slowly when soils are alkaline, fine textured, and low in organic matter. Picloram degrades more rapidly under anaerobic than aerobic conditions and at lower application rates (USDA 2000b). There does not appear to be a defined threshold for picloram toxicity to soil microorganisms (SERA 2003b).

Sulfometuron methyl is broken down through hydrolysis and biodegradation. The half-life is short (Table 4-14). It has been found to move readily through coarse textured soils such as sand and sandy loams under field conditions, but Trubey et al. (1998) demonstrated it is immobile under field conditions and does not pose a threat to groundwater. Little is known about the effects to soil organisms; however, Busse et al. (2004) demonstrated that this herbicide does not alter the capability of mycorrhizal fungi to infect roots even at concentrations detrimental to seedling growth.

Tebuthiuron is resistant to abiotic degradation and biodegradation. Its field half-life ranges from 2 weeks to over 33 months making it a highly persistent herbicide. It has a low adsorption affinity to soil, with some adsorption occurring as organic matter and clay content increase. It is mobile in soil and has been detected in groundwater. Soil organisms (mycorrhizal spore density) have been reduced initially after applications in Utah under a soft brome vegetation type (Allen and West 1993). However, Mostafa and Helling (2003) found no affect to such spores 6 months after herbicide application.

Triclopyr is manufactured in two forms: a triethyamine salt (TEA) and a butoxyethyl ester (BEE). Both forms degrade readily in sunlight to the parent compound, triclopyr acid, which is also photodegradable. A study of photolysis found the half-life of triclopyr acid on soil under midsummer sun was two hours (McCall and Gavit 1986). Degradation occurs primarily through microbial metabolism, but photolysis and hydrolysis can be important. Therefore, in general, moist soils with high organic matter content support the highest rates of metabolism. Johnson et al. (1995) found that microbial degradation of triclopyr was significantly higher in moist versus dry soils, and at 30ºC versus 15ºC. Photodegradation can be particularly important in water. Johnson et al. (1995) found triclopyr acid dissolved in water had a half-life due to photolysis of one to 12 hours. They also found that sunlight plays a role in the rate of microbial metabolism of triclopyr, as microbial metabolism slowed when soil was deprived of light. The average half-life of triclopyr acid in soil is 30 days (Tu et al. 2001). Triclopyr can be persistent in plants and when they die, release of triclopyr can kill other plants. No information is available for toxicity of triclopyr acid in soil.

Effects by Alternative

Reference Analysis – No Herbicide Use

Under the Reference Analysis, weeds on approximately 42,000 acres would be controlled through manual and mechanical means, with prescribed fire, directed livestock, biocontrol, and seeding and planting the methods of choice. All but biocontrol can be mildly to intensively site disturbing. Site productivity would be reduced where erosion and compaction occur, particularly on the Vertisols, Ultisols, and Inceptisols. Wind erosion on excessively bared soil orders that have low T Factor[33] ratings such as the Aridisols and Mollisols could result in the loss of valuable surface nutrients, organic matter, and overall productivity. The bare soil would also be prone to re-colonization from remaining seed or nearby weeds not eliminated by the treatment.

Directed livestock (three times higher under this strategy than under any other), and mechanical treatments (1,600 to 2,000 acres higher than under any of the alternatives) can compact the soil where repeated passes of machines and animals occur on overly moist or wet soils (e.g., the wetter riparian areas, upslope early in the spring, or immediately after intense thunderstorms). As discussed earlier in this section, compaction directly degrades soils, inhibits plant growth, and decreases infiltration which leads to overland water flow and related erosion. Not all mechanical treatments would expose soil to erosion processes; chainsaw use is included in these acres for example.

The use of fire as a treatment method is expected to be reduced by 2,000 acres (35 percent) compared to the No Action Alternative (Alternative 2), which would reduce the number of burned acres. However, without follow-up herbicides, success of subsequent seeding will be variable and weed effects to soils could continue. Adverse soil effects directly from the burning would be limited, as controlled burning of weed sites is normally done at lower intensities than most wildfires. Lower intensity fires leave more of the existing organic matter in place and avoid deep heating of the soil that may kill microorganisms and reduce site productivity.

Fewer weed acres would be treated under this strategy, and it is predicted that treatments would be 30 percent effective. Implications to soils include the need to retreat about 70 percent of treatment areas, compounding adverse effects of treatments, and weeds would spread at a faster than current rate. Noxious weed spread is projected to increase to 14 percent per year without herbicides, and infest 2.7 million more acres in 15 years than under Alternative 2 (No Action; Table 4-4 in the *Noxious Weeds and Other Invasive Plants* section in this Chapter). On these acres, invasive plants would continue to alter vegetation types and organic matter levels (both on and within the soil). Weeds can out-compete native vegetation and lead to increased soil exposure; resultant increased erosion would remove soil and nutrients. Changes to the type and abundance of various soil microorganisms because of lower organic matter contents would be expected to hinder processing and storage of water or cycling organic matter into nutrients for plant growth. Weeds can out-compete native species in part

33 T Factor: Tolerable amount of soil loss (tons per acre per year) prior to reduced productivity.

because they have high nutrient uptake rates and can deplete soil nutrients to very low levels, especially in cases where weed species initiate spring growth prior to native species and exploit nutrient and water resources before native species are actively growing (Olson 1999).[34] Any of these changes would result in less productive lands for native vegetation and reduce the potential for restoring the original vegetation community, often permanently.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Under this alternative, invasive plants would be treated on approximately 45,500 acres; 16,700 acres (37 percent) with herbicides. This alternative would have the lowest overall number of acres potentially exposed or disturbed with non-herbicide methods of all of the alternatives. The lowered level of disturbance would benefit soils; reducing soil disturbance would reduce adverse effects to soil functions when compared with the other alternatives. Treatments baring soils could result in wind and rain erosion. However, the vast majority (93 percent) of treatments between 2000 and 2007 have been applied with ground-based equipment or with the use of backpack sprayers, trucks, or ATVs off road. These traditionally have been spot treatments that do not completely remove vegetation from extensive areas at any one time. Even the remaining 7 percent that has been applied aerially is usually done with selective herbicides designed to retain the native plant component of the infested area, providing some protection from either wind or rain erosion.

Picloram has a 90 day half-life, but may remain active in soil at levels toxic to some broadleaf plants for about one year at typical application rates (Extoxnet PIP). 2,4-D, dicamba, and glyphosate have half-lives between 10 and 50 days in the soil. Picloram is the only herbicide under this alternative that is documented to affect soil organisms in a negative way (USDA 2005a:4-110). 2,4-D may increase bacteria that degrade the herbicide (Oh and Tuovinen 1991 cited in Tu et al. 2001). Busse et al. (2004) determined that both direct and indirect soil microbial characteristics in the top 4 inches of soil were generally unchanged after 9 to 13 years of continuous vegetation control by glyphosate. Thus, soil quality would not be degraded using herbicides other than picloram to control noxious weeds under this alternative.

The highest risk of herbicide movement under this alternative would be for dicamba or picloram used on Alfisols, Entisols, Spodosols, and Andisols or other orders with sandy soil textures or low amounts of organic matter. Under these conditions, these herbicides are easily moved by water both laterally and vertically through surface runoff or leaching respectively. It is generally accepted that 2,4-D is rapidly inactivated in moist soil; however, its persistence is largely dependent on pH.

The use of prescribed fire for weed control would create an erosion risk for temporarily bared soils. Follow-up use of glyphosate[35] could extend the time the soil would be bare, increasing the risk of erosion, notably from wind since these treatments are generally done on porous soils on gentle terrain east of the Cascades.

This alternative is projected to result in about 5.8 million acres, or one-third, of the BLM lands in Oregon being infested with noxious weeds in 15 years, and at least an additional five million acres being infested with cheatgrass. The negative effects of these weeds to soils (see Reference Analysis) would far exceed the negative effects likely from any of the weed control treatments envisioned under this alternative.

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34 For example, leafy spurge displaces native vegetation in prairie habitats through shading and usurping available water and nutrients. Leafy spurge also secretes toxins that prevent the growth of other plants near it. Once present, this aggressive invader can completely overtake large areas of open land.

35 Glyphosate can be effective on some annual grasses, but PEIS Mitigation Measures limits use on rangeland to spot treatments.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Adverse effects from herbicides proposed for Alternative 3 are expected to be slightly more than or equal to those from the four herbicides in Alternative 2 (No Action); acres would increase but total pounds of herbicide applied would be down 35 percent and available herbicides include herbicides that are less toxic to slightly toxic to soil organisms. Any additional risk would be related to herbicides with the longest persistence rate or herbicides that can become mobile after use. The proposed 11,500 acres of imazapic and 1,500 acres of imazapyr may adversely affect soil functions compared to herbicides used in Alternative 2, because of their unknown impact to soil organisms, their mobility, and their ability to release from dead plant material and kill other vegetation. Imazapic on medusahead has an advantage over the currently used glyphosate, because it is more selective for invasive annual grasses, thus better retaining remaining ground cover of shrubs and perennial annual grasses that help protect soils. Sulfometuron methyl may be used on invasive annual grasses west of the Cascades in place of imazapic partly because it has a half life of 20 days rather than 130, making it more environmentally friendly and allowing restoration to proceed quickly (rather than leaving bare ground exposed to the rains).

West of the Cascades, a minor reduction (100-300 acres) in mechanical and fire treatments will occur in this alternative when compared to Alternative 2 (No Action). Planting treatments increase by 100 acres and manual treatments remain the same. Thus, no change in risk between Alternatives 2 and 3 is expected.

East of the Cascades, the 7,000-acre increase in prescribed fire under this alternative, when compared to the No Action Alternative (Alternative 2), would increase the risk of wind and water erosion until these areas supported vegetation capable of anchoring the top surface of the soil from the effects of wind and water removal (one to two growing seasons). Using mechanical means (range drills) for a portion of the additional 5,000 acres of seeding or planting would increase soil disturbance as well. However, this increase would be minor as soil Standard Operating Procedures and PEIS Mitigation Measures would minimize adverse effects of soil disturbance. If aerial seeding is used, that increased risk of soil disturbance would not occur (although aerial seeding may not be as effective).

The projected reduction of weed-infested acres by 1.9 million acres in 15 years compared to the No Action Alternative would provide benefits to soils that would more than offset the soils risks described here.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects described for Alternative 3 also apply to this alternative with the following exceptions. Herbicide treated acres would increase about 50 percent when compared with Alternative 3, although most of those acres would be along rights-of-way and around administrative and recreation sites. Increased risks would be incurred from the use of bromacil, diuron, and tebuthiuron because these herbicides persist longer, have greater risk of runoff, and are non-selective when compared to other proposed herbicides in Alternative 3. The effect to soil resources would include a greater area of exposure (thus possible erosion) and longer residence time of the herbicide in the soil, which would thus reduce biological organisms and their nutrient cycling processes. Some of these effects would be resolved once native vegetation returns to the sites in the next several growing seasons, although some disturbed sites would be maintained in a somewhat vegetation free state, to protect adjacent structures and other improvements. If similar acreage was treated with non-herbicide methods to remove the vegetation, it would involve mechanical equipment and expose soil to erosion and compaction risks that would be greater than herbicide risk.

This alternative is projected to prevent noxious weed infestations on an additional 2.2 million acres when compared to the No Action Alternative (Alternative 2), further reducing the adverse noxious weed effects described under the Reference Analysis.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects under this alternative would be similar to those for Alternative 4 (Proposed Action). An additional 5,000 acres would be treated with herbicides, mostly as habitat improvement treatments having little or no effect on soils, as they would occur on the drier eastside Aridisols or Mollisols. The availability of all 18 herbicides would include minor additional use (0-200 acres) of most herbicides. Effects from diquat and diflufenzopyr + dicamba would be minor considering the limited use proposed. The increased use of imazapic by 2,000 acres would slightly elevate risks to soils but not the increased use of 2,4-D.

Cumulative Effects

In general, declines in soil productivity are directly associated with greater loss of soil through erosion and displacement, loss of soil organic matter, changes in vegetation composition, removal of whole trees and branches, and increases in bulk density from compaction. Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) would prevent soil productivity loss, and any degradation of soils from the herbicide applications proposed in this EIS would be *de minimus* in the context of other management activities and events (including invasive plant spread) likely to occur on the same sites.

Water Resources

Affected Environment

Water resources are classified as surface water or groundwater. Surface water resources include rivers, streams, lakes, ponds, reservoirs, and wetlands. The major river system in Oregon is the Columbia with the main tributaries of the Willamette River in the west, the Deschutes and Snake River to the center and east. The Klamath River flows from southern Oregon into northern California. The west side of the Coast Range and southwestern Oregon has many short steep streams that drain directly to the Pacific Ocean. Southeastern Oregon has some closed basins that do not drain into any external system.

Groundwater occurrences are of two types: unconfined shallow aquifers within unconsolidated sediments and deeper aquifers with a confining layer above (USGS 1994).

Aquatic Conservation Strategy standards and guidelines for Riparian Reserves have been included in all resource management plans through the Northwest Forest Plan (USDA, USDI 1994a) west of the Cascades and at Klamath Falls. Resource Management Plans east of the Cascades and outside of Klamath Falls include their own riparian management direction and best management practices[36] to protect and improve water quality and riparian function. Each district follows INFISH (USDA 1995b) direction wherever bull trout or its designated Critical Habitat are present, and each follows PACFISH (USDA, USDI 1995) direction wherever Federally Listed anadromous salmonids are present. Standards and guidelines in the PACFISH and INFISH strategies are designed to provide for the attainment of riparian management objectives, which improves and protects riparian areas and water quality.

36 Manual-directed standard operating procedures and other standing direction are often referred to as best management practices, particularly when they apply to water.

Flows

There are 6,728 miles of perennial stream and 13,679 miles of intermittent streams on BLM land in western Oregon and 2,453 miles of perennial and 33,835 miles of intermittent streams on BLM land in eastern Oregon. In general, the high flows are found in western Oregon from October through May with highest flows likely from winter rains. In eastern Oregon, highest flows are found in the spring from snowmelt. In both areas, rare peak flows occur with a rain-on-snow event at low to mid-elevations. Low flows occur in the summer when precipitation is low and water withdrawals (generally for irrigation) are at their highest. The timing, magnitude, duration, and spatial distribution of peak flows helps create and sustain riparian and aquatic habitat (USDA et al. 1993).

Water Quality

Water quality standards are established to protect beneficial uses of the State's waters. Beneficial uses are assigned by basin in the Oregon Administrative Rules for water quality. For the State of Oregon, beneficial uses include (ODEQ 2009a):

- domestic water supply
- fishing
- industrial water supply
- boating
- irrigation
- water contact recreation
- livestock watering
- aesthetic quality
- fish and aquatic life
- hydropower
- wildlife and hunting
- commercial navigation and transportation

For streams on BLM lands, fish and other aquatic life is the most common beneficial use, although BLM-origin waters also supply water districts and private residences.

303(d) Streams

Section 303(d) of the Clean Water Act requires that states develop a list of water bodies that do not meet water quality standards and submit the list for approval to the EPA. The Oregon Department of Environmental Quality (ODEQ) developed its most current 303(d) list in 2004/2006.

By direction of the Federal Clean Water Act, where water quality is limited, the ODEQ develops Total Maximum Daily Load (TMDL) plans to improve water quality and to support the beneficial uses of water. The BLM is recognized as a designated management agency for implementing the Clean Water Act (as amended) on BLM administered lands within the TMDL management plan. The BLM provides information, analysis, and site-specific planning efforts to support State processes to protect and restore water quality. Pollutant standards not being met on one or more BLM steams are:

Temperature: Temperature is the most widespread water quality impairment on BLM land (Table 4-15). Well-shaded streams often have cooler stream temperatures due to reduced input of solar energy (Brown 1969, Beschta et al. 1987, Holaday 1992, Lee et al. 2004). Conditions that can produce highly shaded streams include:

- Riparian areas with fully developed vegetative cover over the channel;
- Deep narrow channels with overhanging banks; and/or,
- Streambeds, banks, and floodplains that capture bed load and woody debris, providing channel cover and groundwater interaction.

Table 4-15. Miles of BLM Streams on ODEQ 303(d) List

ODEQ 303(d) listed pollutant	Miles impaired
Temperature	1711
Dissolved oxygen	206
Bacteria	64
Sediment	61
Metals	50

High solar path and air temperatures coinciding with low rainfall and low stream flow during the summer months are key factors causing elevated stream temperatures within the analysis area. South-facing aspects and lower elevations tend to create drier and hotter conditions, which serve to further elevate temperatures.

Dissolved Oxygen: High loading of organic matter and nutrients, combined with sediment and increased water temperature can deplete dissolved oxygen in small streams (Ringler and Hall 1975). Growth of algae with associated fluctuations in night and day respiration can lower dissolved oxygen at night. This process is limited to low-gradient streams with high algae growth. The ability of water to hold oxygen decreases with increased water temperature, altitude, or dissolved solids.

Bacteria: Bacteria occurs naturally in water, with sources often associated with the aquatic and terrestrial biotic populations. Land management introduction of bacteria has common sources linked to recreation and livestock grazing. Concentrated uses by humans and livestock in the riparian and channels can elevate bacteria populations presenting risk to downstream uses such as domestic water consumption and recreation.

Sediment: Landslides and roads are the most common route for sediments to enter streams. Fine-grained sediments associated with roads that cross or parallel streams are the greatest management related problem for water quality. Roads may divert water and sediment from natural paths directly to a stream depending on road ditch line connection to streams, number of relief culverts, and number of stream crossings (Wemple et al. 2001).

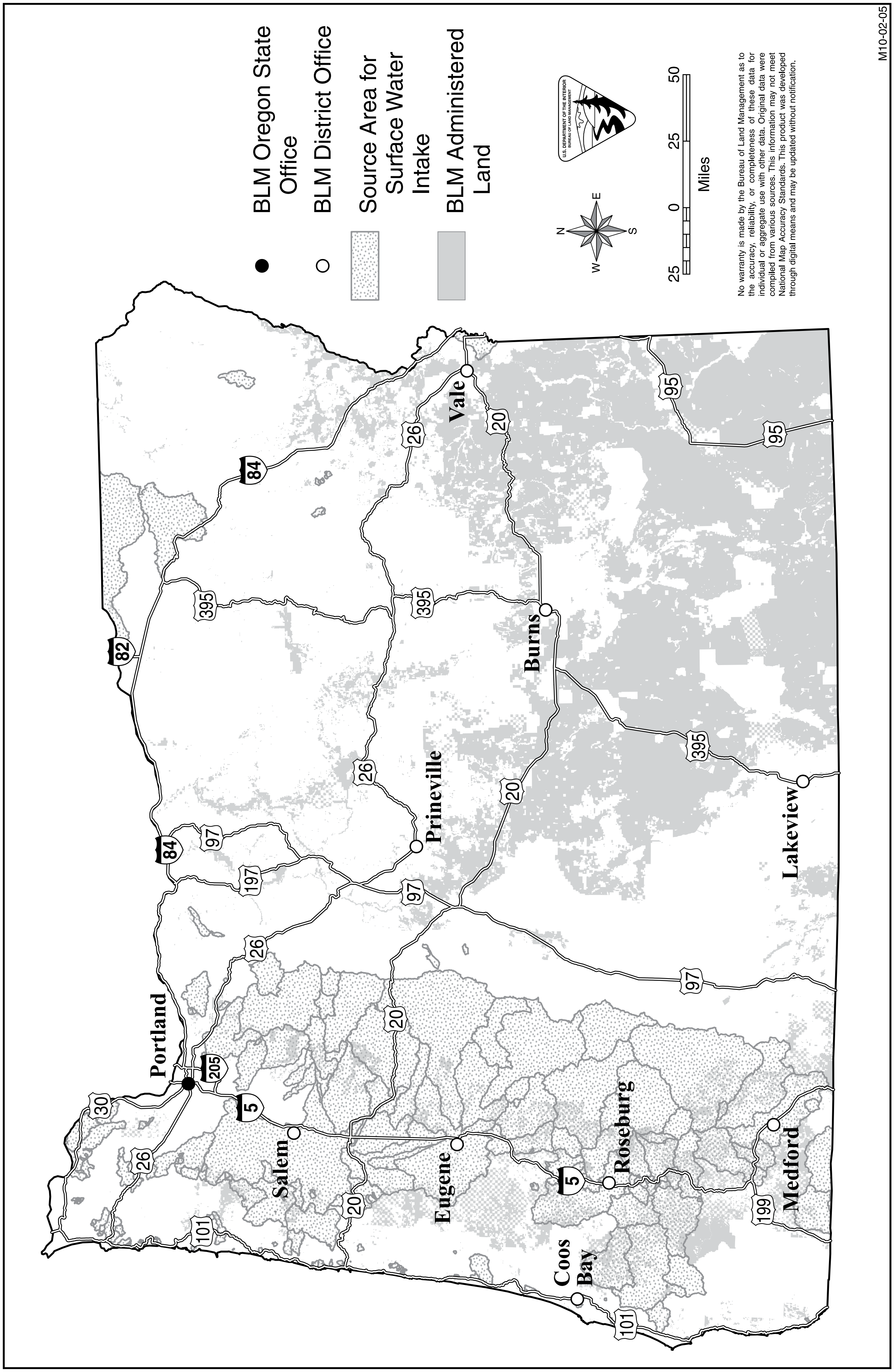
Metals: Metals (including copper, lead, mercury, nickel, silver, and zinc) are most common around mining, agriculture, and natural sources found in certain rock types. Mercury is the most common metal of concern.

Pesticides: While no segments of streams or water bodies on BLM managed land are on the 303(d) list for herbicides, a few water bodies within the state are listed. According to the Oregon Pesticide Management Plan for Water Quality Protection (2008), most of the 303(d) listings for herbicides are due to "legacy" pesticides that are no longer marketed, such as DDT/DDE, aldrin, dieldrin, chlordane, and heptachlor. There are a few water bodies listed for currently used pesticides: chlorpyrifos (Indian Creek, Lenz Creek, and Neal Creek in the Hood River watershed plus West Fork Palmer Creek in the Yamhill River watershed), guthion, (Neal Creek), and pentachlorophenol (Willamette River) (ODEQ 2006). None of these pesticides are proposed for use under this EIS.

Source Water Protection

The 1996 Safe Drinking Water Act amendments require the identification and management of source water protection areas for public water systems (Figure 4-6). States are required to develop source water assessments for public drinking water supplies including both surface and groundwater sources. These watersheds are usually in rural settings and do not involve industrial contaminant sources.

Figure 4-6. Source Water Protection



The ODEQ has recommended that BLM establish direct communication with Public Water System operators or community liaisons downstream of BLM planned projects with potential to affect water quality. BLM would consult with all interested communities during site-specific analysis. To protect public water supplies (PWS), the ODEQ also generally recommends 100 or 200 feet stream buffers within 500 to 1,000 feet of a PWS intake, and suggests that BLM's management in municipal watersheds/aquifers should support the overall goal of providing the highest quality water possible downstream at intakes and wells.

In addition to public water systems, private residences sometimes use springs and streams on adjacent BLM land for domestic water supplies.

The EPA has set a maximum concentration for specific herbicides in potable water (Table 4-16; EPA 2009c). At this time, no maximum concentrations for potable water have been set for the other herbicides.

Table 4-16. Maximum Herbicide Concentration Allowed in Potable Water

Herbicide	**Potable water standards (µg/l)**
2,4-D	70
glyphosate	700
picloram	500
diquat	20
bromacil	0.90
hexazinone	210

Herbicides in Oregon

The Oregon State Legislature (2007) passed Senate Bill 737, which required ODEQ to develop a list of priority herbicides based on persistent bioaccumulative toxics with a documented effect on human health. The list includes 118 toxic pollutants (ODEQ 2009b). None of the 18 herbicides proposed under this EIS are included because they do not meet specific criteria for toxicity, persistence or bioaccumulation potential.

Cooperative Agreement with EPA

As part of a Cooperative Agreement with the EPA, Oregon Department of Agriculture must report on the status of pesticides found in ground and surface water. Using the definitions and parameters described below, the State annually selects and prioritizes Pesticides of Interest and Concern using the following criteria:

- Previous water quality monitoring data (both within Oregon and surrounding states);
- Pesticide toxicity to environmental and human health;
- Established water quality standards or benchmarks;
- The potential to occur in surface & ground water based on the pesticide's physical and chemical properties; and,
- Pesticide use, land use patterns, and Best Management Practices applied in key watersheds.

<u>*Pesticides of Interest (POI)*</u>: The Pesticides of Interest list represents those pesticides that have the potential to occur in ground or surface water at concentrations approaching or exceeding a Federal, State, or Tribal human health or ecological reference point. The following herbicides are among those proposed for use under this EIS and are on the POI list: 2,4-D, clopyralid, glyphosate, dicamba, diuron, hexazinone, imazapyr, picloram, metsulfuron methyl, sulfometuron methyl, tebuthiuron, and triclopyr. Through the use of Standard Operating

Procedures (Appendix 2) and PEIS Mitigation Measures implemented at the project level, BLM applications are not expected to reach concentrations above any established reference point.

Pesticides of Concern (POC): A pesticide of concern is a pesticide which is determined to approach or exceed (or likely to approach or exceed) a human health or environmental reference point in a local area, thus posing possible risks to human or ecological life. In most cases, an evaluation is based on available monitoring data from within the state. A POC is prioritized and elevated to a higher management level to ensure that concentrations are maintained or reduced below an established reference point. The POC reference point quantifies Oregon's efforts to manage pesticides that have been identified as posing a risk to water resources. *None of the herbicides discussed in this EIS are included on the POC list.*

Herbicides and Monitoring in Oregon

Herbicides were the most common pesticides found in several studies covering wide areas in Oregon to quantify pesticide presence in either surface or ground water (Barbash et al. 1999, Wentz et al. 1998, ODA 2008, ODEQ 2009a). A USGS National Ambient Water Quality Assessment (NAWQA) study detected 2,4-D, bromacil, dicamba, diuron, glyphosate and triclopyr in water samples (Wentz et al. 1998).

Table 4-1 shows the 2008 Oregon wide use of the 18 herbicides analyzed in this EIS and compares pounds used and acres treated with BLM use under the Proposed Action (Alternative 4). While the BLM manages approximately 25 percent of the land in Oregon, it would use less than 1 percent of the herbicides used compared to the 2008 total.

In 2008, the Oregon Department of Environmental Quality initiated a long-term program to monitor surface waters for toxic pollutants. Monitoring objectives were to collect data on pollutants known to present a substantial threat to human health or aquatic life and to gather information about the occurrence of chemicals of emerging concern in the Willamette River Basin. Water samples and fish were collected from mainstem and tributary locations throughout the basin and analyzed for a wide range of organic pollutants and metals. Herbicides were the class of pesticides most commonly found in water samples. Of the herbicides addressed in this EIS, diuron was found in many samples collected at locations throughout the basin. There is no numeric water quality criterion established for diuron at this time. Concentrations are highest in streams when rain soon after application washes it off plants into streams. In eastern Iowa, concentrations of herbicides were highest in late spring and early summer when intense rains occurred soon after application (Kalkhoff et al. 2000). On Oregon BLM lands, Standard Operating Procedures preclude applications immediately prior to rain.

Groundwater

Groundwater is commonly available from shallow wells in unconsolidated aquifers that consist primarily of sand and gravel but contain variable quantities of clay and silt. Many large-yield public-supply and irrigation wells, and thousands of domestic wells, access these types of aquifers, generally in areas of privately owned land. In many places, deeper wells produce water from underlying volcanic rocks, usually basalt (USGS 1994). A nationwide study by the USGS found that herbicides occur most frequently in shallow groundwater in agriculture and urban areas (Gilliom and Hamilton 2006).

According to the Oregon Pesticide Management Plan for Water Quality Protection (ODA 2008), between 1980 and 2000 ODEQ conducted 45 groundwater quality assessments in Oregon. These assessments covered approximately 6.4% of the total land and 30.8% of the area where groundwater is used. The data provided a general rating of the overall quality of the groundwater resources available for use as drinking water. The data show that nitrate is the most commonly detected contaminant, followed by pesticides, volatile organic compounds, and bacteria, respectively.

Groundwater can recharge through rain or snow or along losing reaches of streams.[37] There are also more localized areas where groundwater lies above the regional ground water table due to a lens of impermeable rock or soil. These often discharge as seeps or springs on a hillside (OWRD 2003).

Susceptibility of aquifers to contamination relates to geology, depth to groundwater, infiltration rates, and solubility of contaminants. The shallow unconfined aquifers are at greater risk from surface contamination due to rapid infiltration from the surface to the water table. The Willamette Valley, Snake River Basin, and Columbia Plateau all have elevated levels of nitrates and pesticides in groundwater (Eldridge 2004). These are major agricultural areas where pesticide use is subsequently different than uses that would occur on BLM lands.

Environmental Consequences

A primary issue for this analysis is the potential for herbicides to enter streams and affect water quality for aquatic species and domestic water sources. Surface and ground waters on and adjacent to BLM lands are susceptible to contamination from herbicide applications through direct application, drift, spill, leaching, washing (erosion, overland flows), or the deposition of treated soils or vegetation matter into waters. The likelihood and significance of this contamination is influenced by the herbicide, adjuvants, temperature, wind, application method, soils, rainfall, water use, and other factors.

Effects of Herbicides on Water Resources

Herbicides used for both Aquatic and Terrestrial Vegetation Control

2,4-D: Some salt forms of 2,4-D are registered for use in aquatic systems. 2,4-D is a known groundwater contaminant[38] although potential for leaching into groundwater is moderate by its being bound to organic matter and its short half-life. Concentrations of up to 61 mg/L have been reported immediately following direct application to water. Concentrations as low as 0.22 mg/L can damage susceptible plants (Que Hee and Sutherland 1981 cited in Tu et al. 2001).

In terrestrial applications, most formulations of 2,4-D do not bind tightly with soils, and therefore have a moderate potential to leach into the soil column and to move off site in surface or subsurface water flows (Johnson et al. 1995 cited in Tu et al. 2001). In a study on groundwater in small shallow aquifers in Canadian prairies, 2,4-D was detected in 7 percent of 27 samples (Wood and Anthony 1997).

Diquat would be applied to remove emergent, floating, or submerged aquatic vegetation. In aquatic systems, diquat (ionic) adsorbs to sediment, suspended solids, and aquatic vegetation, and becomes immobilized (Simsiman and Chesters 1976). Thus, diquat is ineffective in turbid waters. Loss of diquat from aquatic systems, both through photolysis and biodegradation, is possible, but only when the herbicide is not adsorbed to solid surfaces. When adsorbed, the herbicide is protected from biodegradation and photolysis (Howard 1991). Aquatic half-lives of 1 to 2 days have been reported for diquat, because of sorption onto particulates and sediments (National Library of Medicine 2002). Diquat is a known groundwater contaminant. It has a moderate potential to leach into the groundwater.

37 Segments where water seeps out of the stream and into the ground water, as opposed to segments where seeps and springs contribute to stream flow.

38 Has been detected in groundwater. Does not necessarily mean levels have exceeded any established health standard or allowance.

Fluridone would be applied to ponds, lakes, canals, and reservoirs, but has limited use in flowing water because it works through contact maintained over several weeks. Water quality is not degraded when fluridone is used at a concentration of less than 20 ppb, and there are no label restrictions against swimming, fishing, or drinking treated water (WA Dept of Ecology 2002). Whole-lake treatments using fluridone are possible because the herbicide does not cause a rapid plant kill, which would otherwise result in oxygen-depleted water and reduced water quality.

Photodegradation in aquatic systems is an important loss pathway for fluridone (British Crop Protection Council and The Royal Society of Chemistry 1994). Fluridone is stable to hydrolysis, volatilizes slowly from water, and adsorbs to suspended solids and sediments (EPA 1986, Tomlin 1994, ENSR 2005g). Fluridone has low potential to leach to groundwater and is not known to contaminate groundwater. It does have high potential to be transported in surface runoff.

Glyphosate, which is registered for aquatic use, would be applied to wetland and emergent aquatic vegetation. Strong adsorption to soil particles and organic matter slows microbial degradation, allowing glyphosate to persist in aquatic environments in bottom sediments (half-life of 12 days to 10 weeks)(Goldsborough and Brown 1993, Extension Toxicology Network 1996a, all cited in Tu et al. 2001).

While glyphosate is very water soluble it is unlikely to enter waters through surface runoff or subsurface flow because it binds strongly to soils, except when the soil itself is washed away by runoff; even then, it remains bound to soil particles and generally unavailable (Rueppel et al. 1977, Malik et al. 1989, all cited in Tu et al. 2001). Studies that are more recent found solution-phase glyphosate in 36 percent of 154 stream samples, while its degradation product, aminomethylphosphonic acid, was detected in 69 percent of the samples.

Glyphosate may stimulate algal growth at low concentration; Austin et al. (1991) have suggested that this could contribute to eutrophication of waterways. However, the study has more implications in streams flowing through agricultural and urban areas where glyphosate is shown to be relatively common, although additional phosphates from those same areas might mask the effect. The amount of glyphosate expected to reach streams from BLM terrestrial applications would be expected to have no noticeable effect on eutrophication.

Some glyphosate formulations contain polyethoxylated tallow amine (POEA) surfactant, which is substantially more toxic to aquatic species than glyphosate or other surfactants that may be used with glyphosate (SERA 2003a). In the Risk Assessment, the toxicity of glyphosate is characterized based on the use of POEA surfactant, either in the formulation or added as an adjuvant in a tank mixture (SERA 2003a).

Imazapyr is registered for use in aquatic systems, including brackish and coastal waters, to control emergent, floating, and/or riparian and wetland plants. Imazapyr is water soluble and potentially mobile (SERA 2004d). Imazapyr is rapidly degraded by sunlight in aquatic solutions, with a half-life of approximately 2 days that decreases with increasing pH (Mallipudi et al. 1991, Mangels 1991, all cited in Tu et al. 2001). Imazapyr does not appear to degrade in anaerobic systems, such as wetland soil or lake or pond sentiments, and will bind strongly to peat (American Cyanamid 1986).

In their literature review of imazapyr, Tu et al. (2001) found no reports of imazapyr contamination in water despite its potential for mobility. It is not known to be a groundwater contaminant. Battaglin et al. (2000) stated that little is known about its occurrence, fate, or transport in surface water or groundwater. In one study, imazapyr (from terrestrial applications) was detected in 4 percent of the 133 samples taken from streams, but was not detected in reservoirs or groundwater.

Triclopyr: The two forms of triclopyr, a triethyamine salt and a BEE, behave very differently in water. Both forms are used to control woody riparian vegetation. However, only the triethylamine salt form of triclopyr is registered for use for selective control of floating, immersed, and submersed aquatic plants. Both forms readily degrade to the acid form, which is the active form in plants. No adverse effects on water quality were observed following triclopyr triethyamine salt applications in two studies of whole-pond applications in closed systems (no water exchange; Petty et al. 2001).

The triethyamine salt form of triclopyr is soluble in water and photodegrades in several hours with adequate sunlight. The rate of degradation in water is generally dependent on water temperature, pH, and sediment content.

The BEE form (terrestrial use only, not registered for aquatic application) is not water-soluble and can partition into organic materials and be transported to sediments, where it is persistent. Alternatively, bound ester forms can degrade through hydrolysis or photolysis to triclopyr acid (Smith 1976 cited in Tu et al. 2001), which will diffuse into the water column and continue to degrade (Tu et al. 2001).

Herbicides Used for Terrestrial Vegetation Control

Bromacil is mobile in soil and is a known groundwater contaminant. It can be persistent in most aquatic environments because it is stable to hydrolysis, and photodegradation occurs rapidly only under alkaline conditions (ENSR 2005b). The environmental hazards section of current product labels includes a groundwater advisory warning users not to apply bromacil in areas with permeable soils in order to protect water quality. Biodegradation is a major loss mechanism in aerobic and anaerobic aquatic systems. Bromacil is not expected to partition to suspend particles or sediments in aquatic systems, but will remain dissolved in the water column and has a high potential to leach into the groundwater.

Chlorsulfuron is persistent and mobile in some soils. In aquatic environments, the environmental fate of chlorsulfuron is related to pH and temperature. Hydrolysis rates are fastest in acidic waters and slower in more alkaline systems (Sarmah and Sabadie 2002). As hydrolysis rates drop, biodegradation becomes the mechanism affecting the breakdown of chlorsulfuron. Aquatic dissipation half-lives from 24 days to more than 365 days have been reported (ENSR 2005c), with a shorter time reported for flooded soil (47 to 86 days) than anaerobic aquatic systems (109 to 263 days; SERA 2004a). Chlorsulfuron is not known to be a groundwater contaminant, but has a high potential to leach into the groundwater.

Clopyralid does not appear to bind tightly to soil and will leach under favorable conditions. However, leaching and subsequent contamination of groundwater appear to be minimal (SERA 2004b), which is consistent with a short-term monitoring study of clopyralid in surface water after an aerial application (Rice et al. 1997a cited in SERA 2004b). Clopyralid is not known to be a common groundwater contaminant, and no major off-site movement has been documented. Clopyralid does not bind with suspended particles in water; biodegradation in aquatic sediments is the main pathway for dissipation. The average half-life of clopyralid in water has been measured at 9 and 22 days (Dow AgroSciences 1998).

Dicamba: Because dicamba is mobile in soil, terrestrial application of this herbicide can result in groundwater and surface water contamination. Biodegradation is the major mechanism for dicamba degradation in water. Dicamba is a known groundwater contaminant, and has a high potential to leach into groundwater. The EPA has set health advisory concentration levels for dicamba (e.g., 300 µg/L for 1-day exposures), but has not set maximum concentration limits for potable water. A regional study of pesticides in shallow groundwater in Delaware, Maryland, and Virginia detected dicamba in groundwater at low concentrations, generally less than 3 µg/L (ppb) (Koterba et al. 1993).

Diflufenzopyr appears to be soluble, with transportation from surface runoff following application, particularly when diflufenzopyr is applied on soils with neutral to alkaline pH. However, based upon proposed uses, fate characteristics, and model predictions, the EPA does not expect diflufenzopyr to occur in drinking water in significant quantities (EPA 1999). Diflufenzopyr is not a known groundwater contaminant.

Biodegradation, photolysis, and hydrolysis are important mechanisms in removing diflufenzopyr from aquatic systems. Its half-life is less than 1 month, with hydrolysis and photolysis rates higher in acidic environments. The aquatic dissipation half-life for diflufenzopyr is 25 to 26 days in aerobic and 20 days in anaerobic conditions. Diflufenzopyr's expected half-life in small ponds is estimated at 24 days. These factors suggest that diflufenzopyr would be removed from an aquatic environment relatively rapidly if contamination occurred (EPA 1999).

Diuron is a known surface water and groundwater contaminant. The U.S. Geological Survey (USGS) National Ambient Water Quality Assessment Program analyzed pesticide occurrence and concentrations for major aquifers and shallow groundwater in agricultural areas and found diuron in 71 percent of 2,608 samples (Thurman et al. 1999). The maximum concentration of diuron was 0.34 ppb (µg/L). The EPA recently placed diuron on the drinking water contaminant candidate list[39] (EPA 2008a).

In aquatic systems, biodegradation and photodegradation appear to be the primary loss mechanisms for diuron. An aquatic biodegradation half-life of 33 days has been reported for aerobic systems. Aquatic dissipation half-lives have been reported ranging from 3 to 10 days in anaerobic pond sediment to 177 days in a drainage ditch. Diuron is stable to hydrolysis and is unlikely to volatilize from aquatic systems (EPA 2001a). Diuron is expected to adsorb to suspended solids and sediments (National Library of Medicine 2002).

At a poorly drained field site along an intermittent stream in Oregon, diuron and its transformation product, DCPMU (3-(3,4-dichlorophenyl)-1-methyl-urea), were detected in the stream at a maximum concentration of 28 µg/L, and were detected in shallow groundwater immediately adjacent to a tributary stream at 2 to 13 µg/L. Movement through soil transported the herbicide and its metabolite to the stream, while surface runoff removed less than 1 percent of the applied herbicide (Field et al. 2003).

Hexazinone and its degradates persist, are highly mobile, and are readily washed into surface waters. Hexazinone has been identified as a groundwater contaminant in seven states. The EPA requires a groundwater advisory on all product labels stating that hexazinone must not be used on permeable soils. In areas where irrigation water is contaminated with hexazinone or where groundwater discharges to surface water, hexazinone residues in water could pose a threat to plants.

In surface water, hexazinone resists photodegradation (Neary et al. 1983 cited in Tu et al. 2001). Hexazinone does not bind strongly to particulates or sediments. The main method of degradation is by microorganisms in soils. The average half-life of hexazinone in soils and water is 90 days (Tu et al. 2001). Hexazinone has been detected in streams near terrestrial application sites up to 30 days after treatment, and reported in runoff up to 6 months post-treatment in a forestry dissipation study (Neary and Michael 1996; Michael et al. 1999). Neary et al. (1984, 1993, all cited in Tu et al. 2001) concluded that hexazinone was diluted in the mainstream flow to very low concentrations in forested watersheds.

Imazapic: In aquatic systems, imazapic rapidly photodegrades with a half-life of 1 to 2 days (Tu et al. 2001). Since aerobic biodegradation occurs in soils, aerobic biodegradation is likely important in aquatic systems. Aquatic dissipation half-lives have been reported from 30 days (water column) to 6.7 years in anaerobic sediments (SERA 2004c). Little is known about the occurrence, fate, or transport of imazapic in surface water or groundwater (Battaglin et al. 2000). However, according to the herbicide label for Plateau, in which imazapic is the active ingredient, it is believed to be a groundwater contaminant (BASF 2008).

39 The other 17 herbicides discussed in this EIS are not on this list.

Metsulfuron methyl is stable to hydrolysis at neutral and alkaline pHs and has a half-life of three weeks in acidic systems (Extoxnet 1996b). The persistence of metsulfuron methyl (initial concentration 10 µg/L) was investigated using in situ enclosures in a woodland/boreal forest lake, and the half-life was estimated at approximately 29 days (Thompson et al. 1992). Metsulfuron methyl is not known to be a groundwater contaminant, although it has a high potential to leach into the groundwater.

Picloram can move off site through surface or subsurface runoff, and has been detected in the groundwater of 11 states (Howard 1991). Picloram does not bind strongly with soil particles and is not degraded rapidly in the environment (Tu et al. 2001). Concentrations in runoff have been reported to be great enough to damage crops, and could cause damage to certain submerged aquatic plants (Forsyth et al. 1997 cited in Tu et al. 2001).

Picloram may degrade through photolysis, especially in non-turbid and moving water. Woodburn et al. (1989, cited in Tu et al. 2001) found that the half-life of picloram in water was 2 to 3 days but the EPA reported it stable to hydrolysis and unlikely to degrade in ground water, even over several years (EPA 1995). Maximum picloram runoff generally occurs following the first significant rainfall, after which runoff concentrations drop to levels that persist up to two years post-application (Scifres et al. 1971, Johnsen 1980, Mayeux et al. 1984, Michael et al. 1989, all cited in Tu et al. 2001).

Sulfometuron methyl degrades quickly by hydrolysis in acidic water, but is stable in neutral water. Biodegradation and photolysis are major loss pathways in aquatic systems, where hydrolysis rates generally are slow. Aquatic dissipation half-lives are estimated at 1 to 3 days to 2 months in aerobic systems, and several months in anaerobic sediments (Extoxnet 1996c). Sulfometuron methyl is not known to be a groundwater contaminant. In one surface water study, sulfometuron methyl was detected in 2 percent of 133 samples taken from streams.

Tebuthiuron persists in the environment and has been found as a groundwater contaminant. It has a low sorption to soil. In a study of 71 streams, it was detected in 16 percent of 134 samples but not detected in groundwater (Battaglin et al. 2001). Tebuthiuron degrades slowly in aquatic systems.

Routes for Off-Site Movement of Herbicides

Runoff, Drift, Direct Application, and Leaching

The major routes for herbicide contamination of water are runoff from a large rainstorm soon after application, drift into streams from spraying, direct application, and leaching through soil into shallow ground water or into a stream.

Runoff

Monitoring studies and fate and transport research often find low, but detectable levels of herbicides concurrent with or immediately after (1) herbicide application and (2) the first or the first few rain-induced runoff events after application (Berg 2004:3)[40].

Berg reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through runoff if a large rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered. If a large rainstorm occurs after herbicide application, sediment contaminated

40 Many or all of the referenced studies were broadcast forest and rangeland treatments, and they were not randomly selected. The point of the reference is not that herbicides "often" enter streams, but to identify the two most likely times of that entry if it is to occur at all.

by herbicide could be carried into streams. As most herbicide application occurs in the spring through the fall, during the dryer season, the probability of a large rainstorm soon after application of herbicides is low at any particular site.

Berg's (2004) compilation of monitoring studies on herbicide treatments with various buffer widths showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California buffers between 25 and 200 feet generally resulted in no detectable concentrations of herbicide in monitored streams with detection limits of 1-3 mg/m^3 (ppb) (Berg 2004).

In South Carolina, ground applications of the herbicides imazapyr, picloram and triclopyr had no detectable concentrations of herbicide in monitored streams with buffers of 30 meters (~100 feet) (USDA 2003a). No detection limits were given.

The USGS in partnership with the Oregon Department of Transportation studied runoff of herbicides along roads (similar to treatment of native and other non-invasive vegetation that would be permitted under Alternatives 4 and 5) (Wood 2001). The study was conducted on runoff associated with several herbicides (Krovar (diuron and bromacil), sulfometuron methyl, and glyphosate) along a road in western Oregon simulating rainfall at 1/3 inches an hour at 1, 7 and 14 days after treatment. Samples collected at the shoulder of the road had concentrations of 372-6132 µg/l of diuron the first day after application, and from 23 to 28 µg/l two weeks later. Concentrations of glyphosate were similar at 323-736 µg/l the first day after application and 16-41 µg/l two weeks after application. Sulfometuron methyl had the lowest concentration consistent with its lower application rate. Concentrations ranged from 119-253 µg/l the day after application and from 10-15 µg/l two weeks later. In the fall, the road was again sprayed and the ditch line of the road was checked during natural rainstorms for three months. Sulfometuron methyl was found in concentrations of 0.1 to 1 µg/l along the shoulder and from 0.3 to 0.1 µg/l in the ditch line but was below detectable limits in the stream. Glyphosate was not found at the shoulder, ditch line, or stream. This study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application. In addition, this study also indicates that diuron and sulfometuron methyl may persist in the environment as they were above detectable limits along the shoulder of the road the entire duration (three months) of the study.

Standard Operating Procedures require a minimum 10-foot stream buffer for hand treatments of upland labeled herbicides near a stream, 25-foot buffer for broadcast spray from a truck, and 100-foot buffer for aerial applications (Appendix 2, *Wetland and Riparian Areas*).

A summary of selected herbicide parameters affecting the potential for off-site movement is presented in Table 3-1. Herbicide persistence in water is presented on Table 4-17. Persistence (longevity in the environment), soil adsorption (how well it binds to soils) and solubility (how well it dissolves in water) are three properties of herbicides that affect their likelihood to move offsite.

Table 4-17. Herbicide Persistence in Water

Herbicide	Persistence
Aquatic Use Herbicides	
2,4-D	Moderate
Diquat	High
Fluridone	Low
Glyphosate	Moderate
Imazapyr	Moderate
Triclopyr TEA	Moderate
Terrestrial Use Herbicides	
Bromacil	Moderate
Chlorsulfuron	Moderate
Clopyralid	Moderate
Dicamba	Moderate
Diflufenzopyr	Low
Diuron	Moderate
Hexazinone	High
Imazapic	High
Metsulfuron methyl	Moderate
Picloram	Moderate
Sulfometuron methyl	Low
Tebuthiuron	High
Triclopyr BEE	Moderate

Source: Vogue et al. (1994)

Drift

<u>Soil Erosion</u>: Wind erosion can carry herbicide to streams on soil particles. Soil movement is heavily dependent on wind speed, topography, and surface cover on the soil. To estimate potential transport by wind erosion, the Risk Assessments

used average soil losses ranging from 1 to 10 tons per hectare per year. For a given herbicide, model-estimated transport by wind erosion was far less than off site movement of herbicide associated with surface runoff on clay soils, and similar to off-site losses associated with drift at a distance of 500 feet or more from the application site. Movement of herbicides from wind erosion would be expected to be minimal in western Oregon due to the dense groundcover and more limited treatment sites. It would be expected to be more important in drier areas east of the Cascades in larger treatment areas. See *Soil Resources* for additional information of wind erosion risks.

Aerial Application: Aerial application is the least targeted type of application and is the method of application for approximately 7 percent of the herbicide used on BLM land in Oregon (see the *Herbicide Treatment Methods* section in Chapter 3). Drift from aerial applications is the process most likely to result in herbicides getting onto non-target areas such as stream channels. This is primarily dependent upon the elevation of the spray nozzle, droplet size and air movement. The smaller the droplet, the longer it stays suspended and the farther it can travel.

Spray drift can be reduced by increasing droplet size since wind will move large droplets less than small droplets (Table 4-18). Droplet size can be increased by: 1) reducing spray pressure; 2) increasing nozzle orifice size; 3) using special drift reduction nozzles; 4) using additives that increase spray viscosity; and, 5) using rearward nozzle orientation in aircraft.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants described above. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. They reduce the percentage of smaller, lighter particles, which are most apt to drift. Standard Operating Procedures for air quality provide techniques for controlling drift, including specifying selection of equipment that produces 200-800-micron diameter droplets.

Table 4-18. Drift Distance Versus Drop Diameter (NDSU 1993)

Droplet Diameter (microns)	**Type of Droplet**	**Airborne Time**	**Lateral Distance Traveled** in 10 foot height & 3 mph wind speed
5	Fog	66 minutes	3 miles
20	Very Fine Spray	4.2 minutes	1,100 feet
100	Fine Spray	10 seconds	44 feet
240	Medium Spray	6 seconds	28 feet
400	Coarse Spray	2 seconds	8.5 feet
1,000	Fine Rain	1 second	4.7 feet

The Washington State Department of Ecology and Oregon Department of Forestry have monitored aerial application of herbicides in forest settings[41]. The purpose of both studies was to look at the effectiveness of buffers protecting water quality in streams within herbicide treatment areas. The Washington study looked at many factors in addition to stream buffers that affected the concentration of herbicides in streams within treatment areas.

The Washington study collected herbicide samples at seven sites on small streams (Rashin and Graber 1993). Buffers were 50 feet on flowing streams and no buffers on small stream channels assumed to be dry. Peak herbicide concentrations ranged between 0.2 and 7.55 µg/l. Maximum 24 hour averages were between 0.13 and 3.25 µg/l. Runoff samples collected at four sites 2 to 24 days after application had concentrations between 0.17 and 2.49 µg/l.

41 Such an application would be rare under alternatives examined in this EIS. The alternatives do not include treatments with timber production objectives.

The Washington study attributed the majority of herbicide introduction in buffered streams to swath displacement, drift, and secondary contribution from overspray of small stream channels mistakenly assumed to be dry. This study recommended buffers of between 15 to 25 meters (45-75 feet) for upwind streams and 75 to 90 meters (225-270 feet) for streams downwind of applications.

The State of Oregon requires buffers of 60 feet for aerial application of herbicides near fish bearing streams or streams used for domestic water supplies. For the Oregon study, two streams outside this category also received 60-foot buffers (actual on the ground buffers ranged from 60 to 100 feet). Most of the samples (21 sites, and 105 post spray samples) had a detection limit of 1 µg/l. None of these samples had concentrations at detectable limits. Five sites (25 samples) had detection limits of 0.04 to 0.5 µg/l. Most samples were still below detectable limits, but 7 of the 25 samples tested between 0.9 and 0.56 µg/l (Dent and Robben 2000).

All aerial applications of herbicides will comply with EPA label restrictions and State regulations. Standard Operating Procedures applicable to all alternatives (Appendix 2, *Wetland and Riparian Areas*) require a minimum of 100-foot stream buffers for aerial sprays to reduce drift to streams.

Direct Application

Spray Monitoring: Washington State monitoring reports were looked at for 2003-2006 (WA Dept of Ecology 2003-2006). Many sites showed no detection after spraying. The site with the highest detection was a small pond where 1/3 acres of parrot's feather was sprayed with glyphosate. The results were 343 µg/l one hour after treatment and 53 µg/l 24 hours later. This is under the threshold for glyphosate in potable water and under the 500 µg/l used for acute toxicity index for fish.

Lakes, Reservoirs, and Wetlands: Herbicides affect lakes and wetlands differently than streams. Dilution by flow or tributary inflow is generally less effective in lakes. Dilution is partially a function of lake size, but dilution could be rapid in small lakes in rare instances where they have large water contributing areas. Decreases in herbicide concentration in lakes, ponds, and other lentic water bodies are largely a function of chemical and biological degradation processes rather than of dilution. Evaporation of water from a lake's surface can concentrate chemical constituents. As vegetation within water dies, the oxygen level within the lake can decrease.

Injection Monitoring: Knotweed stem-injection sites were also monitored by Washington States Department of Ecology. Three sites had no detectable concentrations in the water one hour or 24 hours after injection. The two sites with detectable concentrations were under the threshold for potable water (Table 4-19).

Accidental Spill: Concentrations of herbicides in streams as a result of an accidental spill depend on the rate of application and the streams' ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991). An herbicide transportation and handling plan is required for all herbicide control projects. This plan would address spill prevention and containment.

Table 4-19. Glyphosate Concentration in Washington Streams 1 Hour and 24 Hours After Injection

Year	1 hour (µg/l)	24 hour (µg/l)
2004	50	10
2005	12.1	3.8
2005	ND	ND
2006	ND	ND
2006	ND	ND

ND = Not Detected

Leaching

Groundwater: Groundwater contaminated from surface water treatments is generally minimal for many herbicides because decomposition of herbicide by microbial action and other processes is quicker than the time taken for herbicide-laden water to move from surface waters to groundwater (Berg 2004). Travel time to groundwater decreases as the depth to groundwater decreases, and generally, the depth to groundwater is least in spring and greatest in late summer. If spring rains come shortly after herbicide application and the water table is close to the surface, a greater potential for groundwater contamination exists (Mahler et al. 2002).

The shallower the depth to groundwater, the less soil there will be to act as a filter and the less chance for degradation or adsorption of herbicides (Berg 2004). In humid regions, groundwater may be only a few feet below the surface of the soil. If rainfall is high and soils are permeable, water carrying dissolved herbicides may take only a few days to percolate downward to groundwater. In arid regions, groundwater may lie several hundred feet below the soil surface, and leaching of herbicides to groundwater may be a much slower process (Alabama Cooperative Extension 1999 cited in Berg 2004).

The potential for herbicides reaching groundwater to result in adverse effects depends upon concentration level and subsequent human and environmental exposure. Detections alone, while potentially indicative of a need for controls, do not necessarily indicate a detectable effect (see *Maximum Herbicide Concentration Allowed in Potable Water;* Table 4-16).

Lakes Reservoirs and Wetlands: Herbicides affect lakes and wetlands differently than streams. Dilution by flow or tributary inflow is generally less effective in lakes. Dilution is partially a function of lake size, but dilution could be rapid in small lakes in rare instances where they have large water contributing areas. Decreases in herbicide concentration in lakes, ponds, and other lentic water bodies are largely a function of chemical and biological degradation processes rather than of dilution. Evaporation of water from a lake's surface can concentrate herbicide constituents. As vegetation within water dies, the oxygen level within the lake can decrease.

Accidental Spill: Concentrations of herbicides in streams as a result of an accidental spill depend on the rate of application and the streams' ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991). An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

Effect of Invasive Plants on Water Resources

Invasive plants can create or exacerbate conditions that reduce water quality. Reed canarygrass is a common invader of wetlands and riparian areas. Purple loosestrife is another species that occupies stream banks, canals, and shallow ponds. Many other species can occupy either riparian or upland habitat. For example, herb Robert, Himalayan blackberry and scotch broom can all occupy either upland or riparian habitat. Many invasive plants grow quickly and densely allowing them to out-compete native vegetation. Invasive plants are difficult to control in riparian areas as they thrive in the moist environment. Invasive plants can affect water quality by affecting bank stability, sediment, stream temperature, dissolved oxygen, and pH (USDA 2005a), and can increase runoff and increase peak flows (Lacey et al. 1989 cited in Dewey et al. 1995:622). See the *Wetland and Riparian Areas* section for additional information.

Japanese knotweed is one of the invasive plants that has the potential to affect stream functioning. Japanese knotweed is a creeping perennial that grows in the spring and summer and dies back with the first hard frost. Knotweed resprouts following cutting, mowing, and digging. Japanese knotweed has poor bank holding capacity, which leads to more bank erosion and sedimentation of streams in high winter flows (USDA 2005a). While knotweed may provide some shade, native streamside hardwoods and conifers are much taller and provide more dense shade, so knotweed-dominated areas may be associated with higher water temperatures than areas with native forest communities. Knotweed spreads rapidly in flood prone areas such as the Pacific Northwest. Knotweeds tolerate a wide variety of substrates from cobbles to fine soils (Tu and Soll 2004).

Upland invasive plants are also found along streams where they can colonize a range of sites. Himalayan blackberry is the most widespread and economically disruptive of all the noxious weeds in western Oregon (ODA 2008). It aggressively displaces native plant species and dominates lower elevation riparian habitats. Like knotweed, it has poor bank-holding capacity, leading to erosion and altered stream channel morphology.

Total vegetative cover can be reduced on weed-infested sites where strong invaders outcompete native vegetation. Diffuse and spotted knapweeds are found along many eastern Oregon streams. Weed infested soil has been shown to be more susceptible to erosion than soil occupied by native grass species (Lacey et al. 1989). Soil erosion in a simulated rainfall test more than doubled in spotted knapweed-dominated rangeland areas when compared to natural bunchgrass/forb grasslands (Lacey et al. 1989).

Eastern Oregon is losing shrubland due to expansion of western juniper. The integrity and extent of riparian vegetation have changed and been fragmented in response to forest conversion and disturbance (Miller et al. 2005). Western juniper removes water from most of the soil profile, decreasing discharge to streams. Reducing western juniper cover has been shown to increase understory vegetation and infiltration and reduce erosion (Miller et al. 2005, Pierson et al. 2007, Peterson and Stringham 2008).

Medusahead, knapweeds, and cheatgrass can lead to shortened fire cycles followed by increased soil erosion and stream sedimentation.

In addition to the aquatic emergent species discussed above, lakes and wetlands may have invasive submerged species such as Eurasian watermilfoil. These species are becoming common invaders of aquatic ecosystems, outcompeting native vegetation. For example, Eurasian watermilfoil was introduced to Oregon coastal lakes about 40 years ago (PSU 2000). Eurasian watermilfoil multiplies rapidly and forms canopies over the native plants, literally choking out native plants and severely restricting recreational activities. In addition, it degrades water quality and fish habitat, accelerates eutrophication (over-abundance of nutrients), and lowers amounts of oxygen in the water.

Effects by Alternative

Reference Analysis – No Herbicide Use

This strategy would not use herbicides and therefore would not have the potential to contaminate water with herbicides[42]. Many treatments would occur by other methods: primarily fire, livestock, mechanical, or manual treatments (Chapter 3). Fire without herbicides generally needs to be used several years in a row to be effective (Tu et al. 2001). Use of fire has potential for increased sediment input to streams depending on if large storms occur before other vegetation becomes established. Directed livestock has potential for localized effects to water

42 BLM waters could still be affected by herbicide use on adjacent lands.

quality if used near a stream. The effects would be increased fecal coliform and increased fine sediment. Effects could potentially include trampling of banks affecting the width to depth ratio of the stream. Effectiveness of these treatments depends on the species being treated, the timing of treatment, and the size of the infestation. This strategy would use directed livestock on 8,800 acres, a threefold increase from the No Action Alternative (Alternative 2). Wheeled and tracked mechanical treatments can have similar effects, but are less likely to be near the streams. Manual treatments can be effective for small infestations of non-rhizomatous species. When near streams, pulling weeds could increase sediment input to streams when compared to the No Action Alternative, but pulling and cutting can also increase mulching when plants can be left on site.

Many non-herbicide treatments are not effective with many of the invasive plants. Certain species such as knotweeds are not controllable without herbicides. Knotweeds have roots and rhizomes with depths of up to 7 feet and spread of more than 20 feet from the parent plants (Boersma et al. 2006). Knotweeds are found most thickly in western Oregon but are present in small areas in eastern Oregon also.

Invasive plants are typically less effective at maintaining stable stream banks than native plant species. Most invasive plants also provide less stream shading than native hardwoods and conifers. Invasive plants are expected to spread at the fastest rate (14 percent), and ultimately infest more acres, under this strategy.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

The four herbicides used under this alternative include three known groundwater contaminants: picloram, dicamba and 2,4-D. Picloram is a high-risk herbicide for aquatic resources but is preferred in many situations because it is a selective herbicide that represses reestablishment of target invasive plants. Some of the invasive plants found in Oregon are not effectively controlled by the four herbicides available. For example, the four herbicides are ineffective at treating saltcedar (Appendix 7: Table A7-1). A mature saltcedar consumes as much as 800 liters of water per day -- 10 to 20 times the amount used by native species it tends to replace (Cooperrider 1995).

While glyphosate is available to treat emergent species such as knotweeds and yellow flag iris, no herbicides are available to treat submerged plants such as Eurasian watermilfoils and hydrilla. These plants degrade water quality by eutropification that can lead to lower oxygen levels in the water. Noxious weeds are expected to continue to spread at approximately 12 percent per year under this alternative, and infest about 1/3 of BLM lands in 15 years.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

This alternative would use herbicides on an additional 13,600 acres, (mostly east of the Cascades), but because the additional herbicides are effective at smaller doses, total pounds of herbicide would go down 35 percent (at the typical rate). Use of the four herbicides presently used would go down as other herbicides were used instead. For example, clopyralid (low risk to aquatic ecosystems) can frequently be substituted for the use of picloram. However, the greater number of acres treated increases exposure, adding risk of both surface and groundwater contamination by herbicides. Standard Operating Procedures require that areas with shallow groundwater and areas of groundwater-surface water interaction be identified to reduce impacts to groundwater from the application of herbicides.

Three of the additional herbicides in this alternative[43] would be used to treat aquatic emergent or submergent plants giving this alternative greater potential to treat invasive aquatic plant species than Alternative 2 (No Action). The 1.9 million fewer infested acres in 15 years than Alternative 2 translates to fewer degraded stream banks, riparian areas, and watersheds.

43 Fluridone, imazapyr, and triclopyr

Effects of Riparian and Aquatic Treatments: Restoring native plants would improve riparian stability where invasive plants like Himalayan blackberries and knotweeds have colonized along stream channels and out-competed native species. However, invasive plants removal could exacerbate stream instability as well as remove stream shading; these effects could last until the native vegetation replaced the treated vegetation; planting is often used to shorten this time. BLM policy requires restoration plans under site-specific analysis to account for these effects, and prescribe mulching, seeding, and planting as needed to revegetate riparian and other treated areas (USDI 2008a:52). Speeding restoration of such management-exposed stream banks with willow planting or other measures is common BLM practice.

Imazapyr has an aquatic formulation that is frequently used to control knotweeds and saltcedar. Triclopyr is used to control broadleaf species and saltcedar in riparian areas. Removing invasive riparian and aquatic plants can result in improved water quality where blooms of invasive plants lead to low dissolved oxygen, and where invasive plants within riparian areas have lead to increased erosion and sedimentation. Monitoring data for emergent treatments show that the amount of herbicide entering water from treatments is generally below levels of concern (LOC) for potentially exposed aquatic organisms.

Fluridone is an aquatic herbicide available to control submerged aquatics including Eurasian watermilfoils and hydrilla. This herbicide can only be used in still waters such as ponds and lakes. It is proposed for 100 acres east of the Cascades and 200 west of the Cascades. In Washington, it is considered effective at controlling Eurasian watermilfoil without affecting drinking water quality or recreation (WA Dept of Ecology 2002). Fluridone is slow acting and is used at low concentrations on both submergent and emergent plants. As the plants die off slowly, there is not a large concentration of decaying organic matter added to the water at one time so it is less likely to deoxygenate the water than other aquatic herbicides.

There is low risk to drinking water from treatment with imazapyr, glyphosate, triclopyr, or fluridone even in the case of accidental spills. 2,4-D is considered moderate risk for drinking water under accidental spill scenarios (see *Human Health and Safety* section in this Chapter).

Effects of Upland Treatments: Buffers are effective at reducing the movement of herbicide to streams (Berg 2004, Dent and Robben 2000, Rashin and Graber 1993). The potential for impacts from herbicide drift would be reduced by the Standard Operating Procedure requiring minimum 10-foot hand spray, 25-foot vehicle, and 100 foot aerial buffers between treatment areas and water bodies (Appendix 2). Standard Operating Procedures require that buffers based on herbicide properties and site-specific data would be developed using the Ecological Risk Assessments for project level analysis. Parameters to be considered include the herbicide physical properties and off-site movement potential shown on Table 4-17.

Roads often parallel streams or have stream crossings. Roads can act as extensions of stream networks with roadside ditches having low but measurable herbicide concentrations months after treatment (Wood 2001). Since vehicles are a major invasive weed vector, a high percentage of invasive weed treatments are along roadsides. Herbicides used in these areas could reach streams even when buffers to the actual stream are applied. Standard Operating Procedures such as stream buffers reduce potential impacts to water quality from herbicide applications but do not specifically address ditches. Overall exposure would be increased under this alternative compared to Alternative 2 (No Action) because more acres would be treated, but the total pounds would be lower, especially for those herbicides of highest concern to water quality.

This alternative would add about 7,000 acres of additional prescribed fire treatments to the 5,100 acres found under Alternative 2 (No Action), increasing the potential for storms to deliver sediments to streams. These treatments are in a dryer part of Oregon where many stream channels run seasonally, so few perennial streams are likely to be adversely affected by treatments. Where perennial streams are affected, those effects would be temporary; long-term effects would be positive as vegetation provides riparian shading and reduces runoff and erosion.

Local and temporary increases in stream flows could occur in areas where large acreages of a monoculture such as cheatgrass, medusahead, starthistle, or knapweed would be treated with herbicides or prescribed fire. This would typically last one season or until native vegetation became reestablished.

Hexazinone is only proposed for 200 acres but is persistent and mobile. It has been reported in runoff up to six months post treatment (Tu et al. 2001). Hexazinone is considered a high risk for groundwater contamination.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Alternative 4 would treat the same noxious weeds as Alternative 3 and would add treatments of native and other non-invasive vegetation on rights-of-way, administrative and recreation sites, and permit habitat restoration specified in Conservation Strategies for Special Status species. This Alternative would permit the use of more types of herbicides and would be expected to treat more acres with herbicides and use more pounds of herbicides, when compared with Alternative 3. The additional acres treated would increase the risk of contamination of domestic water sources (although as with other uses, required buffers and other Standard Operating Procedures would minimize this risk). The three added herbicides (bromacil, diuron, and tebuthiuron east of the Cascades, and an estimated 100 acres of diuron west of the Cascades) are all known groundwater contaminants. The same Standard Operating Procedures discussed under Alternative 3 would be used to minimize risks.

<u>Effects of Riparian and Aquatic Treatments</u>: Riparian and aquatic treatments have the same advantages and risks as discussed under Alternative 3.

<u>Effects of Upland Treatments</u>: The treatment of invasive plants has the same advantages and risks as Alternative 3. The treatment of native and other non-invasive vegetation would add treatment of 13,000 acres east of the Cascades and 2,100 acres west of the Cascades. This alternative would treat rights-of-way, replacing mowing in an assumed 1 to 1 ratio. As more roads and rights-of-way (and thus more ditch lines) are treated, there is more potential for herbicide to enter water. Buffers would apply at stream crossings to minimize the amount of herbicide entering streams. The added herbicides, bromacil, diuron, and tebuthiuron, are commonly used for control of vegetation along roads and rights-of-way on non-BLM lands. These are all persistent and mobile herbicides. Standard Operating Procedures include buffers to minimize impacts to water quality and the requirement under site-specific projects to minimize impacts to water quality.

Diuron was the 13th most commonly used pesticide in the State of Oregon in 2008 (Table 4-1). Diuron was found at low concentrations; less than 1 microgram per liter, which is 10 to 100 times less than the EPA benchmark for fish and invertebrates. There is no numeric water quality criteria established for diuron at this time (ODEQ 2008). BLM would use diuron only under Alternatives 4 and 5. The estimated use in western Oregon would be approximately 100 acres (800 acres for the whole state), a small fraction of the acres treated in Oregon (see Table 4-1). Standard Operating Procedures and PEIS Mitigation Measures include minimum buffers for use of upland labeled herbicides near water based on application type (Appendix 2). In addition, for project level analysis, Standard Operating Procedures include the guidance to develop further refined buffer widths based on herbicide properties and site-specific conditions to minimize impacts to water quality. Buffers limit the transport of herbicide from upland treatments to water (Berg 2004, Dent and Robben 2000, Rashin and Graber 1993).

Where western juniper is removed as part of a Conservation Strategy-prescribed treatment, there is a potential to increase stream flows, benefiting aquatic organisms and increasing riparian vegetation (Miller et al. 2005, Pierson et al. 2007, Peterson and Stringham 2008). Improved riparian condition improves resiliency to storm events.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Alternative 5 would make 18 herbicides available for a full range of vegetation management objectives except livestock forage and timber production. The effects would be about the same as those discussed under Alternative 4 (Proposed Action) except as follows. Approximately 5,000 more acres would be treated with herbicides, with most of the increase used for habitat improvement east of the Cascades. This alternative would add diquat for treatment of aquatic plants. This alternative would lower the noxious weed spread rate to 6 percent, the same as Alternative 4. The additional acres treated would slightly increase the risk of contamination of human water sources; most of the risk is expected east of the Cascades. Standard Operating Procedures discussed under Alternative 3 and used under this alternative also to minimize risk to human water sources.

Effects of Riparian and Aquatic Treatments: Effects of treatment of emergent and aquatic invasive plants would be similar to Alternative 4 (Proposed Action) with the addition of one aquatic herbicide. Diquat is a known groundwater contaminant and has a maximum concentration level of 0.20 µg/l for potable water. Diquat is an aquatic herbicide with potential to deoxygenate water if large areas are treated due to plant decomposition. However, only 100 acres of treatment are proposed with this herbicide east and west of the Cascades. This is 0.25 percent of treatments east of the Cascades and 1 percent of treatments west of the Cascades. This herbicide is proposed for use in large part because it is the only herbicide available to BLM that will control giant salvinia. Giant salvinia is not known to occur in Oregon at this time, and current climate conditions in Oregon appear to be outside of its ecological amplitude.

Effects of Upland Treatments: The higher number of acres treated would add to the risk of herbicide impacting water quality although due to Standard Operating Procedures such as stream buffers, the risk is minimized. Most of the 5,000 additional treatment acres under this alternative would be upland treatments, and could use any of the 18 herbicides registered for terrestrial use.

Additional acres of western juniper treatment are likely to be controlled under this alternative as a habitat improvement treatment, with a potential for localized increases in flow where large acreages are treated within a single drainage.

Summary of Effects to Water Quality

With Standard Operating Procedures and PEIS Mitigation Measures the same for all alternatives, the differences between alternatives for water quality are dependent on the acres treated and the pounds of herbicides applied, balancing the treatment of invasive plants. Alternatives 4 (Proposed Action) and 5 are higher risk for water quality due to the pounds of herbicide used and the fact that they treat recreation areas which are frequently found near water. Alternative 3 would treat more acres than Alternative 2 (No Action) but would use fewer pounds of herbicide, and would treat fewer acres with moderate risk herbicides. Therefore, Alternative 3 is likely to have the least risk to water quality from the use of herbicides.

Cumulative Effects

Herbicide use occurs on other Federal, State, and County lands, private forestry lands, rangeland, agricultural land, utility corridors, and road rights-of-way. Table 4-1 compares the pounds of each herbicide projected to be applied under the BLM Proposed Action (Alternative 4) with the amount of those herbicides used on all ownerships statewide. BLM manages 25 percent of the land in Oregon and would use less than 1 percent of the herbicides under the Proposed Action compared to the total use of these herbicides in Oregon. The use of herbicides by BLM is usually a small amount of the total use in any large watershed given the mixed ownerships.

Washington State stream monitoring following application of herbicides to treat emergent vegetation (Table 4-19) has resulted in no detection or levels below drinking water standards (Table 4-16) and therefore no increase in cumulative effects. In 2000, the Oregon Department of Forestry completed a study of aerial pesticide applications, indicating that water resources, aquatic organisms, and riparian management areas were being adequately protected under current rules (which are less strenuous than the Standard Operating Procedures associated with this EIS) (Dent and Robben 2000).

In addition, many of the added herbicides pose fewer risks to humans, fish, and wildlife than those available under the No Action Alternative (Alternative 2). The BLM's contribution to downstream effects is minimized with Standard Operating Procedure implementation such as required buffer widths and limits on application methods. Use of additional project-specific mitigation measures would limit the extent and duration of direct and indirect impacts and, therefore, the addition of cumulative effects.

Treatment of invasive plants can improve water quality where riparian function improves and where vegetation or stabilized banks provide shading. Alternatives 3-5 target the same acres of invasive plants while Alternatives 4-5 treat additional native and other non-invasive vegetation (and incidentally control additional noxious weeds; see the *Noxious Weeds and other Invasive Plants* section earlier in this Chapter). With additional acres treated, particularly along roads, there is an increased potential for off-site movement of herbicide to affect water quality.

Wetlands and Riparian Areas

Affected Environment

Wetlands are generally defined as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation that is typically adapted for life in saturated soil. Wetlands include bogs, marshes, wet meadows, estuaries, and swamps. To be designated as a wetland, the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual requires:

- The substrate is predominately undrained hydric soil, or the soil possesses characteristics that are associated with reducing soil conditions;
- The area is inundated either permanently or periodically at a mean water depth of less than 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation; and,
- The land supports predominately hydrophytes. Hydrophytes are macrophytic plants with the ability to grow in water or on a substrate that is at least periodically deficient in oxygen (anaerobic) as a result of excessive water content and depleted soil oxygen levels (Environmental Laboratory 1987).

In Oregon, the BLM manages 153,814 acres of wetlands; over half of the BLM wetlands found in the lower 48 states and about one percent of the BLM lands in Oregon. Ninety-three percent are considered to be functioning properly; the remaining seven percent have not been inventoried (USDI 2007b). The BLM defines properly functioning wetlands as those that (Prichard et al. 2003):

1) support adequate vegetation, landform, or debris to dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
2) filter sediment and aid floodplain development;
3) improve floodwater retention and groundwater recharge;
4) develop root masses that stabilize islands and shoreline features against cutting action;

5) restrict water percolation;
6) develop diverse ponding characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, water bird breeding, and other uses; and,
7) support greater biodiversity.

Wetlands partially on BLM lands range from coastal estuaries to isolated marshes within the Sagebrush Steppe Biome experiencing less than ten inches of precipitation per year.

Riparian Areas occur adjacent to streams and rivers and are directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

BLM lands in Oregon contain just over 8,000 acres of riparian areas, with 38 percent functioning properly, 34 percent functioning at risk, 2 percent non-functional, and 26 percent uninventoried (USDI 2007b:Table 2-2). The benefits of these areas far exceed their relatively small acreage. The functions of wetland and riparian areas include water purification, stream shading, flood attenuation, shoreline stabilization, groundwater recharge, and habitat for aquatic, semi-aquatic, and terrestrial plants and animals (Lewis et al. 2003). In semi-arid areas east of the Cascades, even intermittent streams provide opportunities for increased native vegetation and the associated benefits.

As indicated in the *East Side Riparian Biome* section earlier in this Chapter (and applicable to drier parts of Oregon west of the Cascades as well, such as in the Siskiyou Biome), there are physical, chemical, and biological linkages or interrelationships that are unique to wetland and riparian areas east of the Cascades and in the Siskiyou Biome. Soils within riparian areas typically contain more organic matter, clay particles, and of course moisture than adjacent uplands, generally allowing them to hold and process herbicides more efficiently than upland soils. Organic matter in riparian soils can also help promote water quality benefits such as denitrification (EPA 2005c). Riparian vegetation is typically more diverse and more abundant than, and is easily distinguished from, that in adjacent uplands. Topography helps accentuate a rapid decline in soil moisture as one moves away from most streams.

Unlike the moist Western Forest Biome where plant production may not change significantly from riparian to upland, the limited availability of water in the remainder of the State causes native plant production to be concentrated in and around wetland and riparian areas. Probably the most important characteristic of semi-arid wetlands and their buffers is the increased diversity and productivity of native deciduous trees and shrubs as compared to surrounding semi-arid grasslands (City of Boulder 2007). Riparian areas tend to be one of the few locations in semi-arid landscapes that possess dense, multilayered vegetation including trees, shrubs, and herbaceous species which provide important cover for terrestrial wildlife. Abundant leaf litter from the cottonwoods and other woody species provides food for aquatic insects. Cottonwoods and other riparian trees shade streams and provide large woody debris that dissipates stream energy and supplies cover for fish.

The Warner Wetlands near Hart Mountain in Lake County, for example, is critical to nesting waterfowl and other wildlife, and is infested with perennial pepperweed. It is BLM's biggest cooperative weed control project with Oregon Department of Agriculture. Annual nesting success of ducks in this wetland has been positively correlated with the success of perennial pepperweed control. Remnant native Willamette Prairie vegetation, including seven Federally Listed species (6 plants and 1 butterfly), is threatened by invasive plants in the West Eugene Wetlands. Non-herbicide methods of control are relatively ineffective against invasive plants in wetlands in part because of difficulty working effectively on wet and saturated soils.

All wetlands and riparian areas are susceptible to invasive plants. High flow events as well as fire, wind, and human activities create disturbances invasive plants can exploit. Birds, recreationists, stream flow, wind, and other vectors readily supply the seed. Aquatic invasive plants such as reed canary grass, purple loosestrife, saltcedar, and Japanese knotweed grow in water or along banks, displace native plants, and adversely affect riparian functions (see *Water Resources*). Japanese knotweed has poor bank holding capacity, which leads to more bank erosion and sedimentation of streams in high winter flows (USDA 2005a). While knotweed may provide some shade, native streamside hardwoods are much taller and provide more dense shade, so knotweed-dominated areas may be associated with higher water temperatures than areas with native forest communities. Knotweed spreads rapidly downstream in flood prone areas such as the Pacific Northwest. Knotweeds tolerate a wide variety of substrates from cobbles to rich soils (Tu and Soll 2004).

Purple loosestrife is an aggressive invasive plant that outcompetes native vegetation and forms monocultures in the infested wetlands. It grows quickly and spreads by roots, stem fragments, or seeds (Boersma et al. 2006:76). On smaller streams, purple loosestrife can increase fine sediment deposition, smothering spawning gravels, and decreasing channel capacity (USDA 2005a).

Reed canarygrass is extremely aggressive and often forms persistent monocultures in wetlands and riparian areas. Infestations threaten the diversity of these areas, since the plant chokes out desirable plants and grows too densely to provide adequate cover for small mammals and waterfowl. Where the reed canarygrass grows in water, it can slow the movement of water carrying sediment and lead to increased siltation along drainage ditches and streams. Salmon spawning streams can have the gravels covered with silt and no longer be suitable for spawning. Once established, reed canarygrass is difficult to control because it spreads rapidly by rhizomes (WA Dept of Ecology b).

Upland species are also found along streams where they can colonize a range of sites. Himalayan blackberry is the most widespread and economically disruptive of all the noxious weeds in western Oregon. It aggressively displaces native plant species and dominates riparian habitats (ODA 2008). Himalayan blackberry loses its leaves in the winter and the bare canes do not protect stream banks from rain-splash or high flow erosion in the same manner as native trees or wetland vegetation. The shallow root system does not protect the banks from being undercut. Once undercut, the stream banks collapse under the weight of the brambles; widening the channel. Steep banks, high erosion rates, and dense summer shade from the blackberry thickets make it more difficult for native vegetation to re-colonize the exposed banks (Bennett 2006).

Eastern Oregon has experienced a recent five-fold spread of native western juniper that has adversely affected riparian areas by decreasing groundwater available to small and intermittent streams. Stream flows have decreased and many riparian miles have been lost in the past 50 years due to the additional water used by encroaching western junipers. Removal of these western junipers has been the focus of several projects in the Prineville area as a means to return streams to their historic flows.

Environmental Consequences

Wetland and riparian area species and function can potentially be adversely affected by herbicide use, by non-herbicide invasive weed control measures, and by the increase of noxious weeds and other invasive plants. As with the other resources discussed in this Chapter, the various alternatives can potentially increase the risk in one or more of these categories while decreasing the risk in other(s).

Effects Common to All Alternatives

Fate of Herbicides in Wetlands and Riparian Areas

Herbicide drift, runoff, soil erosion, or ground water leaching could affect wetlands and riparian areas. The risk would be related to the amount, selectivity, persistence of the herbicide, application methods, timing of the application in relation to climatic conditions, and the plant species present. Accidental spills or unintended applications to wetlands and riparian areas would be the greatest risk and have the most impact. Herbicides dissipate in wetlands and riparian areas by water transport, chemical or biological degradation, and adsorption and immobilization in soils. Herbicides applied upland and adjacent to wetlands but moving into the wetland may experience increased persistence and degradation times compared to those expected in the upland area. Soil and water properties in wetlands or riparian areas differ from upland areas and thus the capacity to adsorb, transport, and transform herbicides may be affected. Soil temperatures, amount of organic matter and degree of saturation may change duration and storage of herbicides. Soil pH and level of oxygen present in a soil may increase or decrease degradation of herbicides. Generally, anaerobic degradation processes are much slower than the degradation processes in well-drained soils where oxygen is present (Table 4-20).

Herbicides Used for Both Aquatic and Terrestrial Vegetation Control

Six herbicides are registered for aquatic use by the EPA and approved for such use by the BLM nationally: 2,4-D (salt forms, not esters), diquat, fluridone, glyphosate, imazapyr, and triclopyr. Cautions for each herbicide vary in the aquatic environment.

2,4-D: The principle hazard is unintended spraying or drift to non-target plants; spot treatments applied according to the labeled rate do not substantially affect native aquatic vegetation or significantly change species' diversity (USDA 2005a, WA Dept of Ecology c). Kuhlmann et al. (1995) found no biodegradation of 2,4-D under anaerobic (sulfate reducing) conditions in a laboratory experiment of sediments and groundwater. In aerobic riparian soils that have a high content of organic material, an active microbial community, high pH values, and high temperatures, toxic effects are limited because of rapid degradation of 2,4-D. 2,4-D may inhibit shoot and/or root growth of macrophytes in aquatic systems (Roshon et al. 1999).

TABLE 4-20. HERBICIDE HALF-LIFE IN ANAEROBIC SOILS

Herbicide	Half life in Anaerobic Soil (days)
2,4-D	333
Bromacil	144-198
Chlorsulfuron	109-263
Clopyralid	>1000
Dicamba	Not Determined
Diflufenzopyr	20
Diquat	>1,000
Diuron	5-100
Fluridone	4-270
Glyphosate	12-70
Hexazinone	30-180
Imazapic	>1000
Imazapyr	>500
Metsulfuron methyl	338
Picloram	>500
Sulfometuron methyl	60
Tebuthiuron	Not Determined
Triclopyr TEA	<1

Diquat is used in ponds, lakes, canals, and reservoirs where no non-target species are present. It is a non-specific herbicide that kills plants on contact but does not kill roots, so it is used for single season control of submerged aquatic plants. It is persistent in the environment (up to 3 years) but is quickly adsorbed to soils and sediments, immobilizing it and rendering it unlikely to contaminate leachate or runoff. It is not used to treat large areas at one time, because decomposition of treated plants may deoxygenate water, potentially resulting in negative effects to aquatic fauna.

Fluridone is a non-selective, slow-acting herbicide used in low concentrations to control submerged and emergent vegetation in ponds or reservoirs, lakes and canals where long-term contact with the target plants can be maintained to achieve control (not flowing waters). It photo-degrades, volatilizes slowly from water, and adsorbs to suspended solids and sediments.

Glyphosate would be used along shorelines and banks to control grasses, herbaceous plants and some broadleaf trees and shrubs, and is approved for emergent aquatic vegetation in wetlands and estuaries. It may move into surface water with eroded soil particles (although it is unlikely it will dislodge from the particles and become active) where it rapidly dissipates from surface water by biodegradation and adsorption. Freshwater aquatic macrophytes and algae are reported to be susceptible to low amounts (20 mg/l concentrations).

Imazapyr is approved for wetlands, riparian areas, brackish (salty) and coastal waters. Used on saltcedar, cordgrass, reed canarygrass, phragmites, and waterlily, it may also remove non-target vegetation. Residual soil contamination with imazapyr could be prolonged in some areas, possibly resulting in substantial inhibition of plant growth (SERA 2004d). Imazapyr is not likely to degrade in anaerobic soils or sediments, and has been shown to strongly bind to peat (American Cyanamid 1986, SERA 2004d).

Triclopyr generally controls woody species in an upland environment but can be used in wetlands and riparian areas that go dry for part of the year. It can also be used for spot treatment of Eurasian watermilfoil at low application rates, and purple loosestrife in riparian areas, as it does not damage native grasses and sedges. Only the TEA (acid) form is approved for selective control of submersed aquatic vegetation. Triclopyr BEE (ester form) is hazardous to aquatic life forms in maximum concentrations or spill situations where runoff to open water may occur.

Herbicides Used For Terrestrial Vegetation Control

Other herbicides may be used on or near intermittent streams during the dry season, or would be used to control vegetation outside of riparian areas using buffer widths applicable to the herbicide being used. However, non-target wetland and riparian areas could be exposed to herbicides through a variety of routes, including accidental spills or direct spray, local spray drift from adjacent target areas, surface water runoff, and soil erosion (Karthikeyan et al. 2003). Risks to wetland and riparian non-target species would depend on a number of factors, including the amount, selectivity, and persistence of the herbicide used; the application method used; the timing of the application; and the plant species present. Risks to wetlands and riparian areas from surface runoff would be influenced by precipitation rates, soil types, and proximity to the application area. Some herbicides (e.g., sulfometuron methyl) that adsorb readily onto clay soil particles could be carried off site in runoff situations, increasing their risk of affecting vegetation in wetlands and riparian areas.

Unintentional applications can have severe negative impacts on wetland and riparian systems. In particular, accidental spills near wetland and riparian areas could be particularly damaging to wetland and riparian vegetation. Spray drift can also degrade water quality in wetland and riparian areas and could damage non-target vegetation.

Bromacil is not selective, and accidental exposure could injure riparian shade trees and other non-target wetland and riparian vegetation. Bromacil is mobile and has the ability to persist in wetland environments.

Chlorsulfuron is effective at low concentrations and is prone to leaching. Hydrolysis rates are the fastest in acidic waters and are slower as the pH rises (Sarmah and Sabadie 2002). When hydrolysis rates drop, biodegradation becomes the primary loss mechanism. Strek (1998a, b) studied the dissipation of chlorsulfuron in an anaerobic sediment/water system; biodegradation progressed much more slowly than in aerobic soil systems, with a half-life greater than 365 days.

Clopyralid is relatively non-toxic to aquatic plants. Overall, effects to non-target wetland and riparian vegetation from normal application of clopyralid are likely to be limited to susceptible plant species in or very near the treatment area, and could be avoided by maintaining an adequate buffer between the treatment area and wetland and riparian areas (SERA 2004b). Clopyralid is not likely to affect aquatic plants via off-site drift or surface runoff pathways unless spilled.

Dicamba direct spray and drift scenarios pose a moderate to high risk to susceptible terrestrial plants. Susceptible aquatic algae are at high risk from an accidental spill scenario and from direct exposure at maximum rates. Tolerant algae are at low risk from accidental spill at maximum rate. In water, biodegradation is the major mechanism for dicamba degradation. Dicamba is mobile in soils and is therefore likely to reach surface water and groundwater. The rates of dicamba degradation were generally more rapid in the surface than in the subsurface soil microcosms. The study indicated that some riparian wetland soils possess limited potential to degrade dicamba (Pavel et al. 1999).

Diflufenzopyr is not approved for the treatment of aquatic plants, but poses a low risk to riparian species and aquatic plants via off-site drift.

Diuron: Under the Risk Assessment's accidental direct spray and spill scenarios, diuron is a high risk to aquatic plants. Off-site drift typically poses low to moderate risk to aquatic plants at the typical and maximum rate respectively (ENSR 2005f). (Diuron use west of the Cascades is expected to be low and limited to specialized circumstances.)

Hexazinone exposure poses a moderate to high risk for aquatic plants from acute and chronic exposures at both the typical and maximum application rates. Aquatic algal species are also susceptible to hexazinone exposure. It is also likely that aquatic macrophytes are susceptible, based on the effects of hexazinone on algae and terrestrial plants (SERA 1997).

Imazapic risk to aquatic plants from accidental spills of imazapic is moderate to high at the maximum application rate and low to moderate at the typical application rate (there is no acute risk to aquatic plants in standing water at the typical application rate). Aquatic plants are generally not at risk from off-site drift of imazapic, except when applied aerially at the maximum application rate with a buffer of 100 feet or less. Imazapic rapidly degrades through photodegradation in aquatic systems (SERA 2004c).

Metsulfuron methyl poses a low risk to aquatic macrophytes from acute exposure at upper exposure limits (SERA 2004e). Metsulfuron methyl is stable to hydrolysis at neutral and alkaline pHs. Larsen and Aamand (2001) evaluated biodegradation of metsulfuron methyl (25 µg/L) under anaerobic and aerobic conditions in sandy sediments; the herbicide did not biodegrade under any of these conditions.

Picloram toxicity to aquatic plants varies substantially among different species. There is low risk to susceptible aquatic macrophytes from acute exposure to picloram at the maximum application rate. Because picloram does not bind strongly to soil particles and is not rapidly degraded in the environment, it has a high potential for being transported to wetland and riparian areas.

Sulfometuron methyl poses a high risk to aquatic plants from accidental direct spray and spills, and a high risk to susceptible and aquatic plants from drift. It poses a low risk to terrestrial plants from drift. Aquatic plants in standing water are typically at low to moderate risk for adverse effects from surface runoff scenarios.

Sulfometuron methyl should not be applied during high winds, as drift could cause extensive damage to vegetation at a substantial distance from the application site.

Tebuthiuron poses a high risk of adverse effects to aquatic plants under Risk Assessment spill scenarios, and potentially a high risk for adverse effects from direct spray scenarios. Aquatic plants are not at risk for adverse effects under scenarios involving off-site drift of tebuthiuron; however, surface runoff typically poses a risk to submerged aquatic plants for herbicide treatments at the maximum application rate, and at the typical application rate in sandy soils. Tebuthiuron is resistant to hydrolysis and photolysis in aquatic systems; however, some photodegradation has been reported at alkaline conditions (pH=9), and tebuthiuron is expected to biodegrade slowly in aquatic systems.

Noxious Weeds and other Invasive Plant Effects

For terrestrial weeds, the various levels of weed control predicted to be achieved by each alternative (Table 4-4 in the *Noxious Weeds and Other Invasive Plants* section in this Chapter) will variously reduce or limit weed-induced changes to wetland and riparian vegetation, soil water content, and erosion in wetlands and riparian areas adjacent to streams. Removing species like blackberry, saltcedar, or even western juniper upslope will allow native species to recolonize the near stream-bank or uplands. Native wetland and riparian species are adapted to the unique relationship of inundation of plants or soil by water for various portions of the year and respond well or survive such inundations. Restoration or maintenance of upslope native vegetation in western juniper encroachment areas would allow water to return to the groundwater system and contribute to seasonal or perennial flows, helping maintain and/or restore riparian areas.

For aquatic weeds, six herbicides are registered for use in aquatic environments, and each is effective on specific weeds. Glyphosate may be used along shorelines for species such as purple loosestrife, reed canarygrass, giant reed, and cattail, as well as for floating aquatic species such as waterlily. It is also used to control grasses, herbaceous plants, and some broadleaf trees and shrubs in riparian areas. Imazapyr is used to treat emergent and floating plants as well as saltcedar. It is used on cordgrass, reed canarygrass, and floating plants such as waterlily. Triclopyr can be effective as a spot treatment for Eurasian watermilfoil because it is relatively selective for this species at low application rates. It can also be used to treat purple loosestrife, as it does not damage native grasses and sedges. Fluridone, 2,4-D, and diquat are effective treatments for Eurasian watermilfoil, and diquat also controls water-thyme, water hyacinth, and is the only herbicide available for giant salvinia, which is not known to be in the State of Oregon at this time.

Effects by Alternative

Reference Analysis – No Herbicide Use

Directed livestock use would be expected to increase 6,000 acres east of the Cascades, when compared to the No Action Alternative (Alternative 2), and some portion of this increase could occur within riparian and wetland areas. Directed livestock trampling on wet soils could cause soil compaction and a breakdown of soil aggregates, with a resultant loss of soil porosity, air and water movement, and increased density that increases resistance to infiltration. Increased compaction and disturbance within the wetlands could increase sediment being delivered to the stream or water body network. Wheeled or tracked mechanical equipment would cause the same effects as livestock.

Mechanical treatments using chainsaws and weed whackers, and manual pulling, could result in cut or pulled plants covering the treatment area and making erosion less likely after treatment, although weeds that produce vegetatively or that are approaching seed set are normally bagged and removed.

There would be no effective control available for about 2/3 of the noxious weeds (Appendix 7: Table A7-1), and non-herbicide control treatments are generally difficult to implement in riparian areas. Specific weeds in riparian areas such as blackberry, Japanese knotweed, and reed canary grass would continue to spread essentially unchecked. The noxious weed spread rate would be expected to increase to 14 percent, increasing the likelihood of weeds infesting susceptible riparian habitats.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Of the four herbicides available under this alternative, most riparian and wetland treatments would be done using aquatic formulations of 2,4-D or glyphosate. 2,4-D has moderate to high risks of negatively affecting non-target vegetation, and up to moderate risks for some scenarios for water quality, fish, and wildlife habitats. Glyphosate has moderate risks under several of the same Ecological Risk Assessment exposure scenarios[44] (see respective resource sections in this Chapter). The rapid decay of these herbicides particularly in wetland soils that have high organic matter, high pH, and slow or no water movement during application, limits the impacts to root tips and aquatic life forms that are found in this environment (Voth et al. 2006).

Directed livestock trampling on wet soils and its resultant adverse effects on soils and water quality (see Reference Analysis) could occur, as some portion of the 2,800 acres estimated for this alternative may be directed toward riparian areas, particularly as grazing often must occur before seed set. Manual and mechanical effects described under the Reference Analysis would occur, but at slightly lower rates.

Control methods including the four herbicides available under this alternative would effectively control 104 of the 120 State listed noxious weeds in Oregon, although the remaining 16 include hydrilla, creeping yellow cress, waterweed, saltcedar, watermilfoil, perennial pepperweed, and other riparian pests. Weeds would be expected to continue spreading at about 12 percent per year, and infest 1/3 of the BLM lands in Oregon in 15 years. Since wetlands and riparian areas provide favorable invasive weed habitat, it is expected they would become similarly infested.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

The additional eight or nine herbicides available under this alternative (west and east of the Cascades respectively, when compared to the four available under Alternative 2) would permit substitution of lower risk herbicides that would be effective at lower rates. 2,4-D and glyphosate projected annual acres would decrease by more than half when compared to Alternative 2 (No Action), while the replacement herbicides trigger very few moderate risks for fish or wildlife, and only one high (fluridone at maximum rates creates a high risk to Special Status aquatic invertebrates in the direct spray to pond scenario; Tables 3-14 and 3-15). Moderate risks are limited to fluridone at the maximum application rate for fishponds, and hexazinone at typical and maximum rates for several categories of wildlife. Projected use of these two herbicides statewide is 500 acres per year total, with all hexazinone use expected to be outside of riparian areas.

Effects of non-herbicide treatments would be about that same as described under Alternative 2 (No Action) with the possible exception of the effects of prescribed fire for weed control. The 7,000 additional acres for such treatment, all east of the Cascades, would most likely be outside of riparian areas. Burning could release ash and other nutrients that could blow or be washed to nearby water, but the amount of material released from burning invasive annual grasses would not be expected to noticeably affect riparian area function.

Sixteen of the 120 State listed noxious weeds in Oregon could be effectively controlled with the tools and herbicides that would be available under this alternative. Further, the projected reduction of the noxious weed

44 And high risk to vegetation, and to fish under spill scenarios.

spread rate to seven percent would reduce the occurrence of new infestations by 40 percent when compared to the No Action Alternative (Alternative 2).

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Potential adverse herbicide effects described under Alternative 3 would also apply to this alternative. The additional treatment objectives added by this alternative would increase the use rates for several herbicides when compared to Alternative 3. While most pose low risk to riparian and wetland values, glyphosate use along rights-of-way would increase an estimated 1,000 acres on the east side, potentially increasing exposure to riparian areas and wetlands where roads and other rights-of-way cross or closely parallel these areas (although SOPs require the use of aquatic formulation glyphostate in riparian areas). Glyphosate has up to high risks of negatively affecting non-target vegetation (at maximum rates), and some (terrestrial) formulations have up to high risks for fish and wildlife in certain scenarios. The addition of diuron statewide, and tebuthiuron and bromacil east of the Cascades, could also increase risks to riparian habitats, as all three additional herbicides are known groundwater contaminants. Bromacil and diuron pose a moderate risk to non-target plants and to various categories of aquatic and terrestrial fish and wildlife from off-site drift.

The decrease in noxious weed spread rate to about one-half of its current rate would benefit riparian areas and wetlands by proportionately decreasing the likelihood of future infestations. Statewide, 2.2 million fewer BLM acres are expected to be infested with noxious weeds in 15 years when compared with the No Action Alternative (Alternative 2), with a proportionate decrease of 22,000 acres within the wetland and riparian areas.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

This Alternative is substantially the same as Alternative 4 (Proposed Action) with respect to riparian and wetlands, except for the availability of diquat. Diquat is added to this alternative for giant salvinia and as a substitute for fluridone if a site becomes resistant or some other factor prohibits that use. Two hundred acres of treatment are projected for analysis purposes. Diquat would only be used in water by BLM (although it is EPA registered for some terrestrial uses). It is a known groundwater contaminant and considered a high hazard to fish, aquatic invertebrates, and large birds, and a moderate risk to various other wildlife groups and non-target plants (it does not usually kill roots).

Fish

Affected Environment

Fish are an important cultural, economic, and recreational resource on public lands in Oregon. Declining populations of fish have been a management concern. A number of species or stocks have special management status as Federally listed, proposed for listing, or are otherwise designated as Special Status (see Appendix 5). The PACFISH (USDA, USDI 1995) and INFISH (USDA 1995b) amendments to resource management plans in 1995 east of the Cascades, and the Aquatic Conservation Strategy standards and guidelines for Riparian Reserves as part of the Northwest Forest Plan (USDA, USDI 1994a) west of the Cascades respond to concerns for the continued existence of a number of species.

The Magnuson-Stevens Fishery Conservation Act requires the identification of habitat “essential” to conserve and enhance Federal fishery resources that are commercially fished. Essential Fish Habitat (EFH) is defined as those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity (50 C.F.R. 600.10). EFH is located on portions of seven of the nine BLM districts in Oregon. EFH for Chinook and Coho salmon includes all streams, lakes, ponds, wetlands tributaries and other water bodies currently viable and most of the habitat historically accessible to these fish (Pacific Fishery Management Council 2004).

The BLM in Oregon administers lands directly affecting approximately 4,586 miles of fish-bearing streams and over 277,946 acres of reservoirs and natural lakes. Fish habitats range from small isolated desert springs in southeast Oregon to large inland and coastal rivers, such as the Columbia, Rogue, and Umpqua and their tributaries.

Fish and Their Habitat

The most significant group of native fishes found in Oregon, in terms of their ecological, cultural, and commercial importance, is the salmonid family. All members of this group, which includes salmon, trout, char, and whitefish, require relatively pristine, cold freshwater habitats during part or all of their life cycles. Therefore, they are heavily dependent on the conditions of the surrounding forests and rangelands to ensure their survival (Meehan 1991).

Salmonid productivity within a freshwater system is dependent on the underlying stream productivity during the period of use by salmonids during their life cycle. Five general factors determine the suitability of aquatic habitat for salmonids: flow regime, water quality, habitat structure, food (energy) source, and biotic interactions.

All salmonids require suitable habitat for spawning, incubation, and rearing. Generally, adult salmon require spawning gravel (less than 2 inches in diameter) and overhead stream bank or vegetative cover from predation. Eggs and newly hatched salmon (alevins) require stable gravel, cool (less than 57° F), and highly oxygenated water (Meehan 1991). Bull trout, which tend to spend most, if not all of their life in inland waters, require water less than 42° F for spawning and rearing of newly hatched young. Salmonids prefer cold water, and temperatures above 77° F are lethal to most species in this family (Meehan and Bjornn 1991).

Migrant salmonids pass through several distinct habitats while traveling to and from feeding or breeding habitats, utilizing the full extent of the watershed. The importance of each habitat type differs by species. Chinook salmon, for example, spawn in the mainstem of a river. Upon emerging from the gravel, individuals either start their migration to the sea within their first year (ocean-type) or mature within rivers for 2 to 3 years before migrating to sea (stream-type). In contrast, resident trout populations, such as rainbow, bull, and cutthroat trout, may spend their life (5 to 6 years) in various freshwater systems, including small streams or lakes, and do not migrate to the sea (Meehan and Bjornn 1991).

Various fish species have been introduced into aquatic systems throughout Oregon. Most of the non-native species have been introduced to promote sport-fishing opportunities. Some were introduced illegally. Introduced salmonids (such as brook, brown, lake, and hatchery-raised rainbow trout), centrarchids (such as bass and sunfish), and percids (such as walleye) now support many, if not most, of the non-native sport fishing opportunities within these regions (Mills 1994).

Setting - Aquatic Systems

Due to the topographical, geological, vegetative, and climatic variation across the analysis area, considerable variation in aquatic systems exists. Five general settings for aquatic systems present on BLM lands within Oregon are discussed below.

The aquatic community consists of macrophytes (large aquatic plants) and phytoplankton (free-floating algae), macroinvertebrates (aquatic insects and clams), fish, birds, and mammals (such as muskrats and otters). All of these organisms are interrelated in the aquatic community through the food chain. Organisms that play a role in the aquatic community require a certain set of physical and chemical conditions to exist, such as nutrient requirements, oxygen, light, and space.

Aquatic food chains are dependent on primary production as a source of energy within the ecosystem. For aquatic systems, primary production can occur in the water or out of the water in riparian areas. Numerous invertebrate species feed directly on primary producers through feeding functions such as grazing, scraping, shredding, and collecting. Other invertebrate and fish species feed on these invertebrates, which then become food for fish or other predators.

Great Basin

A portion of the western Great Basin is found in south-central Oregon and covers most of Lake and Harney counties. Streams in this area never reach the ocean, but are instead confined, typically resulting in terminal lakes, marshes, or sinks that are saline. The fish in this area are adapted to extreme conditions, and many have limited or very limited ranges. Trout are found in both lakes and streams at all elevations within the basin in Oregon (ODFW 2005), with chubs and suckers found in isolated lower reaches. Several of these are Federally Listed (see Appendix 5).

The most significant problem facing the low elevation (desert) fish is the limited water supply. Many desert fishes have a tenuous hold on survival under natural conditions, occurring only in the few permanent springs, rivers, and lakes, and their existence has been placed in doubt by human activities (Deacon and Williams 1991).

Coast Range River Systems

Coast range river systems are relatively short systems, with a high drainage density and flowing directly into the Pacific Ocean. Annual precipitation levels are high, with frequent high water events occurring throughout fall, winter, and spring seasons. Summer flows are provided by subsurface storage and thunderstorm events. Native fish species typically present include sculpin, coastal cutthroat trout, Coho salmon, Chinook salmon, chum salmon, rainbow trout, steelhead, southern green sturgeon, lamprey, and a few minnow and sucker species. As in all stream systems throughout the region, complex life history assemblages are often present for salmonid and lamprey species, including resident, fluvial, and anadromous life history strategies. Juvenile anadromous salmonids rear in fresh water for a few months to more than two years, depending on species and adult migration timing. Non-native species sometimes present include striped bass, smallmouth bass, and American shad. Coastal aquatic food chains are generally more detritus based[45] than inland systems.

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45 Small streams are often shaded from direct sunlight, inhibiting primary production from algae or macrophytes. Bacteria and fungus decompose the leaves and wood entering the stream from the forest, and in turn are eaten by shredder organisms. The smaller particles (detritus) shredded by the insects, and also their feces, in turn become food for other organisms downstream.

Several fish stocks in this area are Federally Listed (Appendix 5). Factors negatively affecting fish habitat include forest management, agriculture and livestock management, dams and barriers, urban and industrial development, mining, and estuary degradation.

Cascade Mountain River Systems

Cascade Mountain river systems are generally longer than coast range systems, with a moderate to high drainage density, and may drain directly into the Pacific Ocean or to the Willamette or Columbia Rivers. Rivers found in this region include in part the Klamath, upper Rogue, upper Umpqua, McKenzie, Sandy, and upper Deschutes. Annual precipitation levels are moderately high, but vary considerably, depending on elevation and season. Summer flows are provided by snowmelt, subsurface storage, and thunderstorm events. At higher elevations, above migration barriers, native fish species typically present include coastal cutthroat trout, rainbow trout, sculpin, and dace. Bull trout[46] are also present in some locations. Below migration barriers, Coho salmon, Chinook salmon, and steelhead are generally present, and some minnow and sucker species are occasionally present. Other less common native fish species are also present. Non-native fish species often include brook trout and, occasionally, brown trout. Food chains are more detritus based at higher elevations, with increasing contributions from primary production[47] within the stream occurring at lower elevations.

Several fish species or stocks in this area are listed as threatened (Appendix 5). Contributing factors are similar to factors negatively affecting fish habitat within the Coast Range River System but also include hybridization, ocean conditions, potential overfishing, and other factors.

Eastside Rangeland Stream Systems

Stream systems occurring on rangelands east of the Cascade Mountains are long and widely spaced. The vast majority drain into the Columbia River, and a few drain into the Snake River and Great Basin. Major rivers in this area include the lower Deschutes, lower John Day, and Owyhee. The climate is generally arid, and annual runoff patterns tend to be dominated by annual spring snowmelt. Many headwater channels are located in isolated mountain ranges. Summer flows are provided by snowmelt, subsurface storage, and thunderstorm events. Native fish species are generally rainbow trout, steelhead, Chinook salmon, bull trout, and several minnow and sucker species. Catfish and other less common native fish species are also present. Non-native fish species often include smallmouth bass and sunfish. Primary production is important to the food chain in these stream systems.

As with other stream systems in the State, several species/stocks are Federally Listed (see Appendix 5). Threats include hydropower development, water withdrawals, irrigation diversions, siltation, and pollution, commercial and sport harvest, predators and altered predator dynamics, degraded riparian and instream habitat, water temperature, influences of hatchery fish, and non-point source pollution.

Eastside Mountain Stream Systems

Eastside mountain streams occur in mountain ranges east of the Cascade Mountains and include the upper Deschutes, John Day, and Walla Walla rivers. They are generally either the headwaters of eastside rangeland stream systems, or flow directly into the Columbia River system. Most precipitation occurs during the winter months as snow, and annual runoff generally follows a classic snowmelt pattern. Native fish species are generally

46 Bull trout, *Salvelinus confluentus*, is a char of the family Salmonidae and native to northwestern North America. It was historically part of the "Dolly Varden" (*S. malma*), but was re-classified as a separate species in 1980.

47 Primary productivity is the process by which organisms (autotrophs) make their own food from inorganic sources using solar energy to carry out metabolic processes and build cellular material.

rainbow trout and steelhead, but Chinook salmon, bull trout, and a few minnow and sucker species may also be present. Many Federally Listed and other Special Status fish species found in this region (see Appendix 5) are also found in the Rangeland Stream Systems and are partially dependent on conditions in both areas. Food chains are similar to those found in the Cascade Mountains, but may have a higher primary productivity component.

Environmental Consequences

Effects to fish can come from the vegetation treatments proposed under the alternatives, and from the differences in future levels of invasive plants predicted for those alternatives. Although the fish species considered in this document have a variety of different habitat requirements and different abilities to tolerate changes to those habitats, there are some broad effects that treatments would be likely to have on all aquatic habitats and species. In general, any activity with the potential to alter aquatic habitats or water quality would also have the potential to affect fish found in those habitats.

Invasive plants or vegetation treatments may affect habitat important to one or more specific fish life history requirements. For instance, the spawning, rearing, and feeding requirements of a particular fish species may be different and specific within that species' habitat. Therefore, effects must consider multiple life stages and thus the multiple habitat needs of a particular species.

All else being equal, the potential to adversely affect fish species that are narrowly endemic would be greater than the potential to affect species that are broader ranging. Standard Operating Procedures require vegetation treatments to be fine-tuned at the site-specific level to ensure that these narrow endemics are not negatively affected.

In general, the alternatives proposed in this analysis would be expected to have short-term negative and long-term beneficial effects on aquatic habitats. With the Standard Operating Procedures and PEIS Mitigation Measures, it is anticipated that negative effects would be minimized. Most herbicide uses proposed by the alternatives, those reducing the effects of invasive plants or improving habitat, would have long-term beneficial effects on fish and their habitats.

Effects Common to All Alternatives

The intensity and extent of treatment effects to fish and their habitat will vary, depending on several factors including the amount of area treated; soil type, proximity of the treatment to water, hydrologic regime and weather conditions during and after treatment; temperature, channel morphology and large woody debris; and biota present in surface water.

Herbicide Effects

The potential for effects on fish because of herbicide treatments would vary by the extent and method of treatment and herbicide used. Herbicides could enter water bodies and come into contact with fish or elements of the food chain on which they depend through drift, runoff, leaching, wind transport, accidental spills, and direct spraying. Potential impacts include mortality, reduced productivity, abnormal growth, and alteration of critical habitat. In general, risk to fish from spray drift is greater with narrower buffer zones, greater application rates, and greater application heights (i.e., aerial application or ground application with a high boom). Risk to fish from surface runoff is influenced by precipitation rate, soil type, groundwater depth, and application area. There would be a risk to fish associated with most accidental exposure scenarios (i.e., direct spray or spill into a water body).

Persistent herbicides (e.g., picloram) adsorbed to soil particles could also be carried off-site by water, affecting fish in nearby aquatic areas.[48] Application rate was a major factor in determining risk, with higher application rates more likely to pose a risk to fish under the various exposure scenarios.

Herbicides may be toxic to aquatic plants and invertebrates, thus indirectly affecting fish by reducing primary production or the trophic structure of invertebrate communities. Low concentrations of herbicides can affect benthic[49] algae communities (McCain et al. 2000). The variation in toxicity to aquatic organisms between different formulations for the same herbicide can be substantial (SERA 2003a). In addition, timing of application can result in different effects. For example, a springtime application of glyphosate at recommended rates in a lake ecosystem, where dissolved oxygen levels are low or water temperatures are elevated, could be hazardous to young fish because decaying plants could lower dissolved oxygen levels (Folmar et al. 1979).

All of the herbicides pose some risk to non-target terrestrial and aquatic plants, and damage to riparian and aquatic plants may affect fish. The *Native and Other Non-Invasive Vegetation* and *Wetland and Riparian Areas* sections in this Chapter discuss these risks, as well as herbicide application practices that can be used to reduce risk. Species that depend on non-target plant species for habitat, cover, and/or food may be indirectly impacted by a possible reduction in terrestrial or aquatic vegetation. For example, accidental direct spray, off-site drift, and surface runoff may negatively affect terrestrial and aquatic plants, reducing the cover and food available to fish within the stream.

Endocrine disrupters: The EPA reports effects of endocrine disruption in animals can "include abnormal thyroid function and development in fish and birds; decreased fertility in shellfish, fish, birds, and mammals; decreased hatching success in fish, birds, and reptiles; demasculinization and feminization of fish, birds, reptiles, and mammals; defeminization and masculinization of gastropods, fish, and birds; decreased offspring survival; and alteration of immune and behavioral function in birds and mammals." There are some data indicating 2,4-D may be endocrine disrupting (EPA 2005a, SERA 2006), and this evidence is being pursued further. There are also studies showing developmental and thyroid effects, possibly from endocrine disruption, for sulfometuron methyl (SERA 2004f). Triclopyr and glyphosate have been evaluated for endocrine disrupting effects, and the weight of evidence indicates that these herbicides cause no specific toxic effects on endocrine function (SERA 2002). 2,4-D and glyphosate are included in the EPA's first list of chemicals to be screened for endocrine disruption, although inclusion on that list is based only on exposure and does not indicate any evidence of risk (see *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1).

Exposure Scenarios

Water Contamination from Drift: Herbicide drift is one of the mechanisms of herbicide movement when applied as a spray. Drift or off-target movement can result in unintended injury to non-target plant species, contamination of surface waters, and contamination of ecologically susceptible areas. Drift occurs when fine droplets of liquid herbicide become windborne and are transported to adjacent areas. It is a physical process that depends on droplet size, weather, and topography rather than specific properties of an herbicide. The herbicide droplets can be subsequently deposited on surface waters that either contain aquatic species or serve as runoff conduits to water containing aquatic species. Risk Assessments predicted off-site drift and resulting water body (pond and stream) concentrations using the computer model AgDrift.

48 Ecological Risk Assessments predicted no or low (diuron) risk to fish because of wind transport of herbicides on soil particles under all evaluated scenarios.

49 Benthic: Of or relating to or happening on the bottom under a body of water.

Drift studies typically focus on broadcast treatments using boom or aerial application. Drift associated with backpack (directed foliar applications) is likely to be comparatively low although studies quantitatively assessing drift after backpack applications were not found. Application pressure, nozzle size, nozzle type, spray angle, and spray volume are all factors in determining droplet size. The risk of off-site effects from spray applications (aerial, boom, and backpack) would most likely be related to drift. PEIS Mitigation Measures and Standard Operating Procedures applicable under all alternatives would reduce the risk of surface water contamination from spray drift. For example, one Standard Operating Procedure requires the use of spray equipment delivering 200- to 800-micron diameter droplets. A 200 micron droplet would be expected to drift about 30 feet if dropped from an altitude of 10 feet in a 3 mile-per-hour wind (see *Water Resources* section, Table 4-18).

In certain situations, contamination of susceptible areas, wetlands, and open waters may occur during aerial spraying. Two herbicides included in Alternatives 3, 4, and 5 (chlorsulfuron and metsulfuron methyl) are of particular concern in drift situations because of the higher potential for impacts to non-target vegetation, which can affect fish habitat and food. The risk of direct mortality from these two herbicides is low. However, Alternatives 3 and 4 would not permit aerial application of any herbicide west of the Cascades, and chlorsulfuron and metsulfuron methyl aerial applications are limited by PEIS Mitigation Measures to areas with difficult access, where no other means of application is possible. Alternative 2 (No Action) does not allow the use of chlorsulfuron, metsulfuron methyl, and sulfometuron methyl.

<u>Water Contamination from Runoff, Leaching, and Percolation</u>: All herbicides can potentially enter streams and other water bodies through water transported by runoff, leaching, or percolation. Rain events could transport herbicides to waterways, and convey them to aquatic species' habitat. Soil type and herbicide stability, solubility, and toxicity can determine the extent to which an herbicide will migrate and affect surface waters and groundwater. For example, picloram is highly soluble and readily leaches through sandy soil. It is also resistant to biotic and abiotic degradation processes, and can move from target plants, through roots, down into the soil, and into nearby non-target plants. Although relatively non-toxic to humans and other terrestrial species, picloram is moderately to slightly toxic to juvenile or early developing fish.[50] Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) would help protect riparian vegetation when using picloram by requiring appropriate treatment buffers. Glyphosate and 2,4-D, though very soluble, bind well with organic matter in soils. Glyphosate is not easily leached; 2,4-D leaching potential is considered moderate. All of the herbicides proposed for use under all of the alternatives are susceptible to transport in surface runoff, especially if applications are followed immediately by high rainfall events. However, Standard Operating Procedures preclude most applications if rain is imminent.

Exposure to herbicides is plausible for fish under each alternative. Alternative 5 poses the highest likelihood of exposing fish to herbicides, and Alternative 2 (No Action) has the lowest likelihood of exposure. Actual effects will vary depending on the herbicides used, site-specific conditions, and the design of the project. Appropriate project design and application of Standard Operating Procedures will minimize or avoid exposure of fish to herbicides under all alternatives.

<u>Water Contamination from Accidental Spills</u>: The most common reason for fish-kills due to herbicide application is from the accidental entry of the herbicide into a stream or pond or the indirect effect of lowered dissolved oxygen (DO) in the water resulting from plant kill and resultant decay. Fish populations can withstand the everyday fluctuations of DO but many types of fish cannot tolerate prolonged periods of low DO. When large amounts of aquatic plants are killed by an herbicide application the decaying vegetation and lack of oxygen production may cause DO to become so low that fish cannot survive in the water and a fish-kill occurs. If an

50 Stehr et al. (2009) reported juvenile rainbow trout had a picloram related 96-hour LC50 of 41 ppm and juvenile bull trout 24 ppm.

herbicide that is effective on higher plants and not phytoplankton is used, the potential for a fish-kill can be minimized because phytoplankton will continue to produce oxygen. The likelihood of fish-kills is less in cooler water because it can hold more oxygen than warm water.

The risk to fish from spill scenarios in a small pond or small stream are addressed in the Ecological Risk Assessments and displayed on the risk tables. Adverse effects to fish decrease with distance downstream or away from the spill site because of mixing.

The Potential for Synergistic Toxicity of Different Pesticides in the Aquatic Environment

Pesticide mixtures are common in the aquatic environment, including lakes, rivers, streams, and other surface waters that support aquatic life (Gilliom 2007). The cumulative toxicological impacts of pesticide mixtures are of particular concern for salmon and steelhead populations that are currently Federally Listed.

Extensive surface water monitoring for pesticides, as part of the U.S. Geological Survey (USGS) National Water Quality Assessment program (NAWQA), has shown that current-use pesticides are frequently detected in salmon-supporting river systems (Laetz et al. 2009). Furthermore, pesticides often occur in mixtures with other pesticides. Analysis of NAWQA monitoring data found that more than 90 percent of water samples from urban, agricultural, and mixed-use streams contained two or more pesticides (Gilliom 2007). The toxicological effects of these mixtures on the health of salmon are largely unknown (Laetz et al. 2009).

To define the extent to which insecticides in mixtures interact, Laetz et al. (2009) exposed juvenile Coho salmon (*Oncorhynchus kisutch*) to all possible binary combinations of the insecticides diazinon, malathion, and chlorpyrifos and the insecticides carbaryl and carbofuran. Although the authors did not study the effects of herbicides on these fish, these results have important implications for Ecological Risk Assessments, particularly those that focus on the toxicity of individual chemicals as the basis for estimating impacts to imperiled aquatic species. Although the importance of multiple stressors is widely recognized in aquatic ecotoxicology (Eggen et al. 2004), pesticide mixtures continue to pose major challenges for natural resource agencies (Gilliom 2007; Lydy et al. 2004). Salmon exposed to mixtures containing some of the most intensively used insecticides in the western United States showed either concentration-additive or synergistic neurotoxicity as well as unpredicted mortality. This implies that single insecticide assessments will systematically underestimate actual risks to Federally Listed species in salmon-supporting watersheds where mixtures of pesticides occur.

Most insecticide treatments on BLM lands in Oregon are likely to be spatially or temporally separated from most herbicide treatments proposed in this EIS, so virtually no organisms except, conceivably, plants, would be expected to have active doses of both materials at the same time. Cumulative adverse effects to humans or other elements of the environment are most likely when two pesticides share a common mechanism of toxicity. That is, they both affect an organism the same way. Cumulative effects assessments conducted by the EPA typically *begin* by grouping pesticides by mechanism of toxicity (EPA 2002). Because insecticides and herbicides work so differently, even a concurrent application would be unlikely to result in significant synergistic environmental effects when both products are applied within label limits.

Effects of BLM-Evaluated Herbicides

As described under *Risk Assessments* in Chapter 3 and Appendix 8, BLM or Forest Service Risk Assessments are available for the 18 herbicides analyzed in this EIS. For fish, the essential biological requirements (i.e., survival, growth, and reproduction) are the attributes to be protected from herbicide exposure. Ecological Risk Assessment endpoints, for the most part, reflect direct effects of an herbicide on fish, but indirect effects were also considered. The measures of effect associated with the assessment endpoints generally consisted of acute and chronic toxicity data (from herbicide registration documents and from the available scientific literature) for the most appropriate surrogate species.[51] Resultant benchmarks are referred to as toxicity reference values (TRVs).

Exposure scenarios for risk reporting were selected based on actual BLM herbicide usage under a variety of conditions. The exposure scenarios considered are shown on Table 3-14.

A major potential problem associated with herbicide use is off-site drift to non-target resources. Herbicides drifting off site may eventually reach water bodies and contaminate fish. The AgDrift computer model was used to estimate off-site herbicide transport due to spray drift. The GLEAMS computer model was used to estimate off-site transport of herbicides in surface runoff and root zone groundwater transport. The CALPUFF computer model was used to predict the transport and deposition of herbicides sorbed (i.e., reversibly or temporarily attached) to wind-blown dust. Each model simulation was approached with the intent of estimating the maximum herbicide exposure concentration that could result from the given exposure scenario.

Bromacil is a non-selective, broad-spectrum, systemic herbicide that can be persistent in aquatic systems. It is not registered for use in riparian and aquatic systems. Bromacil does not tend to bioconcentrate appreciably in fish tissue. Bromacil poses a low to moderate risk to fish in streams and ponds under typical and accidental direct spray and spill scenarios.

Off-site drift of bromacil generally does not pose a risk to fish in streams or ponds (Table 3-14). Surface runoff poses no risks to fish in streams, but could pose a low acute and chronic risk to fish in ponds (there is a low chronic risk associated with the typical application rate, in watersheds with sand or loam soils and 10 to 50 inches per year of precipitation). Because bromacil has a higher affinity for water than organic carbon, it is likely to run off from soils into water bodies. Because of the non-selective nature of bromacil and its likelihood for runoff, it is not normally applied near water bodies, especially ponds.

Chlorsulfuron is a selective, ALS-inhibitor herbicide. It is not registered for use in aquatic systems. Chlorsulfuron's physical and chemical properties suggest that it is highly soluble in water, and is likely to remain dissolved in water and runoff from soils into water bodies. In addition, this herbicide has a long half-life in ponds, but is not likely to bioconcentrate in aquatic wildlife. However, none of the evaluated scenarios, including accidental direct spray and spill of chlorsulfuron, pose any risk to fish in streams and ponds.

Diflufenzopyr is a selective, systematic post-emergence herbicide active ingredient. It is not registered for use in aquatic environments. The physical and chemical properties of diflufenzopyr suggest that this herbicide would be removed from an aquatic environment relatively rapidly following contamination and would not appreciably bioconcentrate in fish tissue. The Ecological Risk Assessment shows that diflufenzopyr does not pose a risk to fish under any of the Ecological Risk Assessment scenarios.

Diquat is a non-selective, contact herbicide the BLM would use only to control aquatic plants.[52] Plant species controlled using diquat include Eurasian watermilfoil, water-thyme, water hyacinth, and giant salvinia.

One study reported the likelihood of bioconcentration in aquatic species, but other studies suggest that diquat's bioconcentration potential is minimal (Howard 1991, Petit et al. 1995, MacKay et al. 1997). An accidental spill of diquat would pose a high risk to fish. Direct spray of diquat to ponds, as would occur with typical aquatic applications, would pose a low risk to fish (Table 3-14). Direct spray to streams, which are not typical application sites, would pose a low risk to fish. Because diquat is an aquatic herbicide, risk to aquatic organisms via off-site drift and surface runoff scenarios was not evaluated.

51 e.g., bluegill sunfish for warm water species and rainbow trout for coldwater species.

52 Diquat is also registered for certain terrestrial uses, but BLM does not propose non-aquatic use.

Given the short-term risks of diquat to fish, this herbicide is used on a restricted basis, and then only in ponds that support very few native aquatic species because they are dominated by invasive plants or contain species not effectively controlled with other herbicides. Other aquatic herbicides evaluated in this EIS (fluridone, 2,4-D, and imazapyr) also pose relatively low risk to fish and would be used instead of diquat when native aquatic species are present, as appropriate.

Diuron is a broad-spectrum herbicide with a relatively short half-life and little to no impact on measured water quality variables (Perschbaucher et al. 2004). It would not be used in riparian or aquatic habitats. Previous studies suggest that diuron tends to remain in the soil rather than moving into groundwater or running off into water bodies (Mueller-Warrant and Griffith 2005).

Diuron has a low to moderate tendency to bioaccumulate in aquatic organisms (National Library of Medicine 2002). Call et al. (1987) found the bioaccumulation in fathead minnows (*Pimephales promelas*) to be between 144 and 157 times the concentration in the surrounding water, with 76 percent eliminated within 24 hours after return to clean water. These results suggest that diuron has a low tendency to bioaccumulate in these fish. Accidental direct spray and spill scenarios pose a moderate to high risk to fish (Table 3-14). When applied at the typical or maximum application rate, off-site drift of diuron poses no to low risk to fish. At the maximum application rate, off-site drift of diuron poses low risk to fish in streams and ponds under most application scenarios with a buffer distance of 100 feet or less. According to the Ecological Risk Assessment, surface runoff poses low risk to fish in ponds in the majority of scenarios. Surface runoff also poses a low risk to fish in streams in watersheds with at least 25 inches of rain per year (mostly at the maximum application rate). In all cases, effects would be less likely in watersheds with loam soils.

Fluridone is a slow-acting, broad-spectrum aquatic herbicide that can be used selectively for management of aquatic species, including water-thyme and Eurasian watermilfoil. As fluridone is relatively non-persistent, it is not expected to affect water quality for a substantial period of time (Muir et al. 1980).

Fluridone has little tendency to bioaccumulate in fish (Washington Department of Health 2000). An accidental spill of fluridone poses moderate risk to fish. Direct spray of fluridone over a pond at the maximum application rate poses a low risk to fish. Accidental direct spray of fluridone over a stream (aquatic herbicides are not typically applied to streams) at the maximum application rate poses no or low risk to fish. Because fluridone is an aquatic herbicide, off-site drift and surface runoff scenarios were not evaluated.

Imazapic, an ALS-inhibitor, is a selective, systemic herbicide. It would not be used for treatment of aquatic vegetation, but could be used in riparian areas. Leafy spurge and the perennial mustards would be target species.

The average half-life for imazapic in a pond is 30 days, and this herbicide has little tendency to bioaccumulate in fish (Barker et al. 1998). According to the manufacturer's label, imazapic has a high runoff potential from soils for several months or more after application. Accidental direct spray and spill scenarios generally pose no risk to fish when imazapic is applied at either the typical or maximum application rate. Risk Assessments show fish are not at risk from off-site drift or surface runoff of imazapic.

Diflufenzopyr + dicamba is a selective, systematic herbicide, with low residence times in water bodies and a low bioconcentration potential (National Library of Medicine 2002). Diflufenzopyr + *dicamba* application does not pose a risk to fish under any application scenario (also see toxicity studies under dicamba and diflufenzopyr).

Sulfometuron methyl, an ALS-inhibitor, is a broad-spectrum, pre- and post-emergent herbicide. It is not approved for use in aquatic systems, but could be used to treat perennial pepperweed, hoary cress, and other weeds associated with riparian systems if the application was made far enough from water to ensure that the active ingredient did not get into the water. Sulfometuron methyl has a relatively low residence time in aquatic systems, and bioaccumulation in aquatic organisms has not been detected (Extoxnet 1996c). According to Ecological Risk Assessments, there would be no risks to fish associated with the use of sulfometuron methyl under any of the evaluated scenarios.

Tebuthiuron is a relatively non-selective herbicide absorbed by plant roots through the soil. Tebuthiuron has little tendency to bioaccumulate in aquatic organisms (National Library of Medicine 2002), but may have a moderate residence time in water bodies (over 1 year in anaerobic conditions).

Under an accidental spill scenario, tebuthiuron would pose a low risk to fish in ponds. Fish are not at risk from accidental direct spray, off-site drift, and surface runoff.

Effects of Forest Service-Evaluated Herbicides

2,4-D has formulations that are registered for use on aquatic vegetation, including water hyacinth and Eurasian watermilfoil, and as a tank mix partner to control purple loosestrife. The toxicity of 2,4-D to fish is relatively low (Norris et al. 1991). Risk is greater under scenarios of direct application to water bodies or accidental direct spills. The ester forms of 2,4-D (including the BEEs found in Aqua-Kleen) are approximately 200 to 1,000 times more toxic to fish than the amine forms, when toxicity is measured by acute (24- to 48-hour) LC-50 values. While these esters are chemically stable, they are short-lived in natural water because of biological degradation. At the typical application rate, 2,4-D poses a low risk to fish, while at the maximum application rate, 2,4-D poses a moderate risk to fish under scenarios of accidental direct spray or spill to a stream and pond. Routine (non-spill) acute and chronic exposure scenarios do not pose a risk to fish.

Clopyralid is a selective herbicide most effectively used post-emergence for the control of broadleaf weeds. It is not registered for aquatic vegetation treatment, but can be used in riparian areas if the application does not affect standing water. Clopyralid is used to treat teasel, common cocklebur, and several species of thistles and knapweeds that could be found in riparian areas. Based on limited acute bioassays, clopyralid appears to be relatively non-toxic to fish. The Risk Assessment only predicted risks to aquatic organisms associated with accidental spill scenarios, with low risk to fish for the typical and maximum application rates.

Dicamba is not registered for use in aquatic environments. The Ecological Risk Assessment shows a low risk to susceptible fish under the spill scenario at the maximum rate, and no risk to fish under other exposure scenarios. Off-site drift and surface runoff of dicamba also present no risk to fish.

Glyphosate is a non-selective systemic aquatic herbicide. It can be applied as a broadcast, spot, stem injection, or wipe application, and is effective in controlling purple loosestrife, cattail, and in some situations, saltcedar. In general, glyphosate is immobile in soil, being readily adsorbed by soil particles and subject to microbial degradation (Norris et al. 1991). This immobility reduces the potential for glyphosate to enter water bodies during runoff.

Based on bioassays, technical grade glyphosate is classified as non-toxic to practically non-toxic in freshwater fishes (EPA 1993). Some formulations are more toxic to fish than technical grade glyphosate. At the typical application rate, the less toxic formulation of glyphosate poses little risk to fish, except under accidental spill scenarios, for which there is a low to moderate risk to fish. At the typical application rate, the more toxic (non-aquatic) formulation of glyphosate poses a high risk to fish under accidental spill scenarios, and a low risk under routine acute exposure scenarios (moderate risk to susceptible fish species). At the maximum application rate, the less toxic formulation of glyphosate poses a low risk to fish under acute exposure scenarios. Accidental spills for the maximum application rate pose moderate to high risk to fish. At this same application rate, the more toxic formulation of glyphosate poses a high risk to fish under accidental spill scenarios, and moderate risk to fish under acute exposure scenarios. Based on these data, the EPA classified glyphosate formulation as moderately toxic to practically non-toxic to freshwater fishes (SERA 2003a).

Hexazinone: According to Ecological Risk Assessments, there is no risk to fish in ponds or streams associated with any exposure scenario for hexazinone (accidental spill scenarios were not modeled).

Bioassays on the active ingredient hexazinone and commercial formulations that include hexazinone indicate that commercial formulations are substantially less toxic than the active ingredient alone, even when exposures are normalized for hexazinone levels (Wan et al. 1988).

Imazapyr is an ALS-inhibiting herbicide used in the control of a variety of grasses, broadleaf weeds, vines, brush species, and aquatic vegetation. It is effective in the control of saltcedar, which dominates many riparian systems in the West. Imazapyr is relatively non-toxic to fish (SERA 2004d). At the typical and maximum application rates, imazapyr poses no risk to fish in streams or ponds under acute and chronic exposure scenarios. For the typical application rate, moderate risk is predicted for susceptible fish species for accidental spill scenarios. For the maximum application rate, high risk to susceptible fish and low risk to tolerant fish are predicted for accidental spill scenarios.

Metsulfuron methyl is a selective ALS-inhibiting herbicide used pre- and post-emergence in the control of many annual and perennial weeds and woody plants. It is not registered for use in aquatic situations, but can be applied in riparian areas if the herbicide does not come into contact with water (SERA 2004e). Overall, metsulfuron methyl appears to have a very low potential to cause any adverse effects in aquatic animals. According to the Ecological Risk Assessments, metsulfuron methyl poses almost no risk to fish in streams and ponds under accidental, acute, and chronic exposure scenarios involving application of typical and maximum rates (although an accidental spill at the maximum application rate poses a low risk to susceptible fish species).

Values from 96-hour LC_{50} values for acute toxicity in bluegill sunfish and rainbow trout ranged from approximately 150 mg/L to 1,000 mg/L for both species (SERA 2004e). In rainbow trout, signs of sub-lethal toxicity include erratic swimming behavior, lethargy, and color change at concentrations around 100 mg/L, with a no observable effects concentration (NOEC) of 10 mg/L (SERA 2004e). One investigation did not observe any effects on rainbow trout hatching, larval survival, or larval growth over a 90-day exposure period, at a NOEC of up to 4.5 mg/L (Kreamer 1996 cited in SERA 2004e). The NOEC of 10 mg/L for sub-lethal effects in rainbow trout is approximately 100 times more susceptible than bluegill sunfish that has a NOEC of 1,000 mg/L.

Picloram acts as a plant growth regulator. It would not be used to control aquatic vegetation. The acute and chronic toxicity of picloram has been assayed in various species of fish. Based on studies, the EPA classified picloram acid as moderately toxic to freshwater fish (SERA 2003b).

According to the Ecological Risk Assessments, when applied at either the typical or the maximum application rate, picloram poses low risk to susceptible fish species under acute exposure scenarios. Under accidental spill scenarios, risks to susceptible fish are high; risks to tolerant fish are low (for both application rates).

Triclopyr is a selective, systemic herbicide used on broadleaf and woody species, including woody species found in riparian and aquatic areas, such as saltcedar, willows, and purple loosestrife. Commercial formulations of triclopyr may contain the acid form (TEA) or the BEE form; these triclopyr derivatives are evaluated separately in the Forest Service Risk Assessment. The risk characterizations for aquatic animals differ for triclopyr TEA and triclopyr BEE. When applied at the typical or maximum application rate, triclopyr TEA poses no risk to fish in streams or ponds under acute and chronic exposure scenarios. Under an accidental spill scenario, there would be low risk to fish. When applied at the typical rate, triclopyr BEE would pose a moderate risk to fish under acute exposure scenarios, and a high risk to fish under a scenario involving an accidental spill into a stream or pond. Triclopyr acid would pose a moderate risk to fish under an accidental spill scenario involving the maximum application rate. Triclopyr BEE would pose a high risk to fish under acute exposure scenarios at the maximum rate, and high risk to fish because of an accidental spill into a stream or pond.

Some effects may be anticipated for fish under certain conditions. While there is a major difference in the potential hazards posed by triclopyr TEA forms (which are registered for aquatic use) and triclopyr BEE forms (which are not registered for aquatic use) to fish, there are no significant differences among species in terms of susceptibility to the various agents. Sub-lethal effects of triclopyr BEE on salmonids occur at concentrations between 0.32 and 0.43 mg/L, where fish were lethargic, while behavioral changes to triclopyr TEA would occur at 200 mg/L. Subchronic toxicity in fathead minnows (at the embryo-larval stages) was observed when the fish were subjected to 140 mg/L of triclopyr TEA for 28 days (Mayes et al. 1984, Mayes 1990, all cited in SERA 2003c). This study found that survival of these minnows was greatly reduced at this toxicity level.

Although triclopyr BEE is more toxic than triclopyr TEA, the risk of triclopyr BEE to fish is low, as this form will rapidly hydrolyze to triclopyr acid, lowering risk to fish.

Summary of Herbicide Effects

The risk characterization process of the Ecological Risk Assessment suggested that chlorsulfuron, diflufenzopyr, diflufenzopyr + dicamba, and sulfometuron methyl shows no risk associated with use of these herbicides under any of the evaluated scenarios, including accidental direct spray or spill. There is no risk from dicamba exposure scenarios except for a low risk for the spill scenario at the maximum application rate. Imazapic does not pose a risk to fish, except when directly sprayed over a stream at the maximum application rate. There is no risk to fish associated with off-site drift of bromacil or tebuthiuron. Under surface runoff scenarios, diuron can present a moderate to high risk to fish if applied at the maximum application rate. The risks to fish associated with application of aquatic herbicides to ponds and streams is greater for diquat than for fluridone, which when applied at the typical application rate only poses a risk in streams (aquatic herbicides are not typically applied to streams; therefore, this is an accidental scenario).

The ALS-inhibiting herbicides evaluated in this EIS are chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, and sulfometuron methyl (all but imazapyr are terrestrial herbicides). These herbicides are considered highly potent to plants and are applied at low application rates because only small concentrations are necessary to damage plants. However, the process they inhibit is unique to plants. There is low risk associated with direct spray of imazapic or imazapyr at the maximum application rate. However, this risk is similar to or less than risks associated with the other evaluated herbicides, and could be avoided by applying at the typical application rate. Their very low typical rates could mean there is less risk of off-site transport associated with their use.

Adjuvants, Degradates, Inert Ingredients, and Tank Mixes

Adjuvants: The BLM reviewed toxicity data for adjuvants, such as surfactants and anti-foam agents, to assess risks to fish. In addition, the GLEAMS model was used to evaluate the risks associated with polyoxyethylenamine (POEA), a surfactant found in some glyphosate formulations that is more toxic to fish than glyphosate itself. This adjuvant is of greatest concern in terms of potential effects to fish. Using the GLEAMS model, the BLM predicted the portion of an adjuvant that would potentially reach an adjacent water body via surface runoff.

Based on GLEAMS modeling for POEA, risks to aquatic organisms were not predicted for the majority of pond and stream scenarios involving exposure to this adjuvant. However, risks were predicted (using the most conservative acute endangered species LOC) for applications at a distance of 0 feet from the water body. This scenario, which essentially assumes a direct application to the water body with no dilution or drift, is highly conservative and highly unlikely under BLM application practices. Risks to Federally Listed and other Special Status aquatic organisms in streams and ponds were also predicted for aerial applications of POEA at the maximum rate at a distance of 100 feet from the water body. However, it is unlikely that the BLM would apply glyphosate formulations containing POEA in an area known to contain Special Status aquatic species. Because of a lack of physical chemical property information, POEA was not modeled for leaching properties and runoff to water bodies. Therefore, there is some uncertainty associated with risk to fish from this exposure.

Some sources (Muller 1980, Lewis 1991, Dorn et al. 1997, Wong et al. 1997) generally suggest that the acute toxicity of surfactant and anti-foam agents to aquatic life ranges from 1 to 10 mg/L, and that chronic toxicity ranges as low as 0.1 mg/L. This evaluation indicates that, for herbicides with high application rates, adjuvants have the potential to cause acute, and potentially chronic, risk to aquatic species. More specific modeling and toxicity data would be necessary to define the level of uncertainty. Use of adjuvants with limited toxicity and low volumes near aquatic habitats would mitigate this risk.

Degradates: Degradates may be more or less mobile and more or less toxic in the environment than their source herbicides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent herbicides and degradates makes prediction of potential impacts challenging. For example, a less toxic, but more mobile, bioaccumulative or persistent degradate may have a greater adverse impact due to residual concentrations in the environment. The BLM conducted a detailed analysis of degradates for herbicides proposed for use under the herbicide treatment program. Several databases, including EPA's ECOTOX database (EPA 2009a), were searched, and relevant aquatic toxicity data for degradates were identified and considered in the Risk Assessments (Appendix 8).

In most cases, predicted risks to fish from degradates would likely be less than risks from the active ingredients diquat, diuron, imazapyr, and metsulfuron methyl predicted in Ecological Risk Assessments. For some degradates associated with 2,4-D, diuron, fluridone, and triclopyr, selected aquatic species may be more susceptible to the degradate than to the active ingredient. These findings should be considered in the context of herbicide use practices, the concentration of degradate relative to the parent compound, the process of degradate production, and the body of available toxicity data. For instance, in most cases, the increased toxicity of the degradate may be offset by the fact that only a minute amount of the degradate is produced, which would likely disperse rapidly in an active aquatic system.

Other Ingredients: Relatively little toxicity information was found on inert ingredients during preparation of the BLM Ecological Risk Assessments. A few acute studies on aquatic or terrestrial species were reported. No chronic data, no cumulative effects data, and almost no indirect effects data (food chain species) were found for the inerts in ten herbicides examined. However, some of the inerts, particularly the EPA List 3 compounds (inert ingredients of unknown toxicity) and unlisted compounds, may potentially be moderately to highly toxic to aquatic species (based on information in Material Safety Data Sheets or published data).

Based on GLEAMS modeling of a generalized inert compound in a "base case" watershed, concentrations of inert ingredients exceeded concentrations of herbicide active ingredients under all stream and pond scenarios. In general, greater exposure concentrations of inerts occurred under higher application rates, exceeding 1 mg/L for the maximum pond application scenario. These results suggest that inerts associated with the application of herbicides may contribute to acute toxicity to fish if they reach the aquatic environment. However, given the lack of specific inert toxicity data, this statement may overestimate their potential toxicity. It is assumed that toxic inerts would not represent a substantial percentage of the herbicide, and that minimal impacts to the environment would result from these inert ingredients. Standard Operating Procedures and PEIS Mitigation Measures should make adverse effects to fish negligible.

Tank Mixes: Risk Assessment analysis of tank mixes indicates that risks to fish vary by tank mix. The risks to fish associated with applications of tank mixes of bromacil plus sulfometuron methyl, and diflufenzopyr + dicamba is no greater than those associated with applications of bromacil, imazapic, or diflufenzopyr alone. Risks to fish for a tank mix of chlorsulfuron and diuron are greater than those for chlorsulfuron (but not diuron) alone, and risks for a tank mix of sulfometuron methyl and bromacil are greater than for bromacil applied alone. There is some uncertainty in this evaluation because herbicides in tank mixes may not interact in an additive manner; this may overestimate risk if the interaction is antagonistic, or it may underestimate risk if the interaction is synergistic. In addition, other products may also be included in tank mixes and may contribute to the potential risk.

Invasive Plant Effects

Riparian systems are being invaded by non-native species, which are generally detrimental to native aquatic species. Potential adverse effects to aquatic species are also described in part under the *Water Resources* and *Wetlands and Riparian Areas* sections in this Chapter. Invasive plants are generally less efficient at holding soil in place, and cause water-quality problems. Whenever the water quality of a fish-bearing stream is affected, so are fish. Specifically, fish are affected by turbidity, sedimentation, loss of large organic debris, loss of shading (and associated temperature increases), and exposure to hazardous substances. Erosion increases turbidity and sedimentation that can reduce fish feeding success. Severe cases of sedimentation can keep fry (early-stage fish) from emerging, or fill in or reduce the deeper pools preferred by fish, especially trout.

In riparian areas, invasive plants (e.g., Himalayan blackberries, reed canary grass, saltcedar, Japanese knotweed) often support fewer native insects than native plant species, which could affect food availability for insectivorous fish species, such as salmonids. The replacement of native riparian plant species with invasive plants may adversely affect stream morphology (including shading and instream habitat characteristics), bank erosion, and flow levels. Invasive plants break down the complex natural vegetative physical structure and interfere with natural processes.

Problematic invasive plants that could be treated by the BLM using herbicides include water-thyme and Eurasian watermilfoils, which are found in ponds, lakes, and streams; and perennial pepperweed, saltcedar, knapweed, and thistles, which are found in riparian habitats. These species displace native vegetation and decrease species' diversity. Dense concentrations of aquatic plants can reduce light penetration and lower the concentration of dissolved oxygen in the water and can upset the balance of the fish community by providing too much cover for small fish (Payne and Copes 1986). Many invasive riparian plants form monocultures that crowd out more desirable native plant species.

Treatments that reduce or slow the spread of noxious weeds and other invasive plants would decrease the incidence of these adverse effects. Alternative 2 (No Action) is predicted to result in about 1/3 of BLM lands in Oregon becoming infested with noxious weeds in 15 years, with Alternative 3 about 1/4, and Alternative 4 (Proposed Action) closer to $1/5^{th}$. These proportions would be expected to apply or be similar for riparian areas; weeds could spread even faster in these areas because of flood disturbances, water transport, and affinity of many plants for wetter areas.

Non-Herbicide Treatments Effects

Manual and Mechanical Treatments: Certain manual and mechanical treatments within riparian areas that disturb soil, such as grubbing and pulling, carried out over a large area, may lead to increased erosion and stream sedimentation. Resultant sedimentation may adversely affect fish by covering eggs or spawning gravels, reducing prey availability, or directly harming fish gills, reducing stream carrying capacity for fish. However, the risk of harm to aquatic ecosystems due to fine sediment production from manual treatment or use of motorized hand tools is low, and short-term, resulting in effects likely to be localized and minor. However, depending on the scale of treatment, pulling significant numbers of large plants or treating large riparian areas with motorized hand tools may moderately increase the risk to fish. Cut vegetation not in danger of contributing invasive plant seeds or sprouting matter to the site (including any cut non-target vegetation) left on the treatment site can reduce the potential for erosion and subsequent sediment delivery to streams or other water bodies.

The risk of harm to fish from use of wheeled or tracked machinery will vary, depending on the extent of treatment area and proximity to aquatic environments; vehicle tracks can compact soils and divert waters. Fish are temporarily affected when water is affected by turbidity, sedimentation, and local increases in surface water runoff. However, all wheeled equipment (including OHVs containing spray mix and other herbicide application equipment) would normally be kept well away from riparian areas to minimize aquatic effects and the risk of water-affecting spills. Some kinds of equipment, such as walking brush-cutters, are designed to minimize ground disturbance.

Power-tool use near water can potentially cause water contamination with minor amounts of chainsaw oil or minor fuel spill. An oil skim on water, while highly unlikely, can deplete oxygen levels and cause fish kills. This effect is more likely for fish living in ponds than for fish living in rivers or streams, since the flow of water in streams would move and disperse small amounts of oil.

Directed Livestock: The use of livestock to control invasive plants requires a highly specialized operation, often involving animals that are "trained" to forage on the target plant, and usually involving temporary fencing to keep the animals within the target area. The livestock species, grazing intensity, and management of the grazing animals used to treat invasive plants are different from grazing for livestock production. The specific use of livestock in this type of control effort has not been utilized extensively in riparian areas or near aquatic ecosystems. Current techniques for using directed livestock as an invasive plant treatment tool are not likely to have adverse effects on riparian areas and aquatic environments.

Prescribed Fire for Weed Control: The risk of harm to fish from prescribed fire for weed control depends on fire intensity, timing, and land form, among other factors. Prescribed burning has the potential to bare large areas of soil, and thus increase both surface erosion and sedimentation of streams. Heavy runoff from burned areas can increase water pH, indirectly affecting aquatic biota. Site-specific implementation of Standard Operating Procedure would help prevent this method from being used where significant adverse stream effects would occur (PER:2-31).

Biological Controls and Seeding/Planting: No adverse effects to fish are anticipated from either of these non-herbicide processes.

Effects by Alternative – Non-Special Status Fish

Reference Analysis – No Herbicide Use

Under the no-herbicide Reference Analysis, fish would not be affected by BLM-applied herbicides.[53] Effects could stem from other vegetation treatment methods however. Ecosystem benefits resulting from vegetation treatment would be reduced under this strategy when compared to the No Action Alternative (Alternative 2), in part because about 2/3 of the noxious weeds cannot be effectively controlled without the use of herbicides. Treatment methods, such as mechanical methods and prescribed fire can result in soil disturbance and sedimentation in aquatic bodies, and retreatment in the same areas is more likely because a single treatment is less likely to adequately achieve control.

Specifically, it is often difficult to control or eradicate some species, such as aquatic species and those that resprout from rhizomes, by means other than herbicide application. For example, Eurasian watermilfoil forms a dense mat that crowds out native aquatic plants and degrades fish habitat (Bossard et al. 2000), and in some cases herbicide treatments, including the use of 2,4-D, diquat, and fluridone, are more effective than other treatments, such as mechanical harvesters that tend to fragment and spread the weed. The only alternatives to herbicide treatment of submersed vegetation are mechanical or manual removal; water drawdown on controlled reservoirs, lakes, and ponds; and flooding with salt or brackish water. These treatments generally are not as effective as herbicide treatments at controlling many invasive aquatic plants (Gettys et al. 2009). Management under the Reference Analysis would be most likely to leave some invasive aquatic plants largely uncontrolled, potentially resulting in displaced native species and degraded and reduced fish habitat.

Non-herbicidal treatments are generally less effective than herbicides on many terrestrial riparian species as well. Knotweed is not controllable without using herbicides because the plant has roots and rhizomes that extend to depths of up to seven feet and spread out over distances of 20 feet or more. Bennett (2006), after reviewing several methods used to eliminate blackberries, found that without the use of herbicides, projects were generally not successful at eradication nor cost effective.

Without the use of herbicides, noxious weed populations are projected to increase 14 percent per year and occupy 2.7 million more acres of BLM lands in 15 years than the No Action Alternative (Alternative 2). The spread of noxious weeds and other invasive plant populations would cause further damage to susceptible native plant communities, including riparian communities that directly or indirectly provide habitat for fish.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Effects to fish would be similar to those that are presently occurring. Sixteen of the 120 State listed noxious weed species are not effectively controlled by the four herbicides or other methods available under this alternative, and herbicides cannot be used to treat non-noxious invasive plants.

<u>Herbicide Effects</u>: Based on Forest Service Ecological Risk Assessments, chronic (long-term) and acute (short-term) exposures modeled for all herbicides in this alternative except acute exposure for glyphosate did not exceed the NOEC for any fish. For glyphosate, the Ecological Risk Assessment modeling predicted low to moderate risks from acute exposures at typical and maximum application rates.

It is unlikely that the use of herbicides proposed in this alternative would cause fish kills at the concentrations likely to occur in water. Mortality to fish is also not expected or likely from operational use, because dilution,

53 There would still be herbicides in the system, even on BLM lands, because of herbicide use on adjacent lands.

degradation, adsorption, and other factors reduce the amount of herbicide that could enter a water body. In rare circumstances, high concentrations of herbicides could wash into streams from rainfalls shortly after herbicide application along road ditches or other surfaces that rapidly generate overland flows, or because of an accidental spill. In such instances, localized fish kills are plausible in small tributary streams or small enclosed water bodies where contaminated flows would not be readily diluted. Dicamba presents a risk (low) only for susceptible fish under the accidental spill scenario at the maximum rate.

Invasive Plant Effects: Noxious weeds would be expected to continue spreading at about 12 percent per year on BLM lands in Oregon. In addition, the inability to treat other non-noxious invasive plants with herbicides increases the likelihood additional plants will become well established before they are declared noxious weeds. The spread of invasive plant populations at current rates would continue to cause damage to native plant communities, including riparian communities, which directly or indirectly provide habitat for fish. The continued spread of invasive plant populations will have harmful effects on fish.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Herbicide Effects: Based on Ecological Risk Assessments, chronic (long-term) and acute (short-term) exposures modeled for chlorsulfuron, clopyralid, fluridone, hexazinone, imazapic, metsulfuron methyl, and sulfometuron methyl (seven of the herbicides added by this alternative to the four discussed in Alternative 2 – No Action) did not exceed the NOEC for any fish (Table 3-14 and Table 3-15). Two herbicides in this alternative and not included in Alternative 2, imazapyr and triclopyr, were found to have high risk under certain scenarios. Imazapyr was found to have high risk for susceptible (coldwater) fish in an accidental spill scenario at the maximum exposure. Modeling for triclopyr found a high risk to susceptible (coldwater) fish in the accidental spill scenario at both the typical and maximum application rates, and a high risk for susceptible (coldwater) fish in the acute exposure scenario.

Based on the results of the Ecological Risk Assessments, it is unlikely the fish species would be harmed by herbicide use proposed in this alternative.

As this alternative proposes to treat 13,600 more acres than Alternative 2 (No Action), it could potentially result in greater exposure to fish. However, 12,600 acres of this increase will occur in eastern Oregon uplands generally away from streams. The BLM's ability to use up to nine additional herbicides (see Table 3-3), and thus reduce the total pounds of herbicide applied by 35 percent (Table 3-4), would reduce risks to fish when compared to the No Action Alternative (Alternative 2). For example, fluridone shows no risks to fish at typical application rates and could replace other aquatic herbicides currently used by the BLM on public lands. In addition, the use of glyphosate would decrease more than 50 percent under this alternative.

Imazapic, chlorsulfuron, clopyralid, and metsulfuron methyl would primarily be used east of the Cascades, but could still provide benefits greater than those under the No Action Alternative. These herbicides could be used to control biennial thistles, annual and perennial mustards, knapweeds, starthistle, and cheatgrass. These invasive plant species degrade riparian and upland habitats and can contribute to shortened fire cycles, followed by soil erosion and sedimentation.

Under accidental direct spray, spill, and off-site drift scenarios modeled in the Ecological Risk Assessment, imazapic presents a very low or no risks to fish, similar to chlorsulfuron, and sulfometuron methyl but lower than the risks associated with other herbicides currently being used.

Ecological Risk Assessments for chlorsulfuron, imazapic, and sulfometuron methyl predict no risk to fish from direct spray, off-site drift, surface runoff, or accidental spill to a pond (Table 3-14). For the surface runoff scenarios, risks to fish were not predicted for chlorsulfuron, fluridone, imazapic, and sulfometuron methyl. Glyphosate and triclopyr do present risk to fish under some application scenarios. Each of the four currently available and nine additional herbicides that would be available under this alternative has different properties (e.g., mode of action), different suggested uses, and is most effective/least risky in different scenarios. This suggests that the more herbicides available for use, the more opportunities there would be to select one or more during project-level design that would present the least risk to fish while accomplishing the specific weed control objective.

Fluridone is an aquatic herbicide that would be available under this alternative to control submerged aquatics including Eurasian watermilfoils and hydrilla. The fluridone Ecological Risk Assessment (Table 3-15) predicts no risk to fish from direct spray in a pond (fluridone is not used in streams). However, the Ecological Risk Assessment predicts risk to fish may occur when fluridone is spilled directly into a pond. Fluridone is slow acting and is used at low concentrations on both submergent and emergent plants. As the plants die off slowly, there is not a large concentration of decaying organic matter added to the water at one time so it is less likely to deoxygenate the water and kill fish than other aquatic herbicides.

It is very unlikely that implementation of aquatic vegetation control under this alternative will result in a fish-kill. Fish have avoidance mechanisms and are mobile allowing them to move to other parts of a lake or stream in order to avoid adverse conditions. However, under certain circumstances such as an accidental spill in an enclosed water body or small fish-bearing stream, fish-kills could occur.

The effects of using glyphosate for control of Sudden Oak Death are expected to be *de minimus* because the Biological Assessment specifies use of the less toxic form and specifies other project design criteria protective to fish (see the *Pest and Diseases* section earlier in this Chapter.

<u>*Invasive Plant Effects*</u>: Under this alternative, the noxious weed spread rate is projected to be reduced to 7 percent per year, and noxious weeds are projected to infest 1.9 million fewer acres of BLM lands in 15 years than the No Action Alternative (Alternative 2). Although Alternative 3 would prevent more invasive plant infestations, their continued spread would continue to damage native plant communities, including riparian communities that directly or indirectly provide habitat for fish. This continued, albeit reduced, spread would have harmful effects on fish.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

This alternative could result in potential adverse effects to fish if subjected to long-term exposure. However, acute (short-term) herbicide exposures to aquatic organisms are not likely to result in harm under foreseeable conditions, and the expected reductions in adverse fish effects from the additional control of invasive plants exceeds the potential herbicide risk to fish.

<u>*Herbicide Effects*</u>: Based on Ecological Risk Assessments, bromacil, diuron, and tebuthiuron[54] modeling predicted risks to fish in certain scenarios (Tables 3-14 and 3-15). Bromacil has a low or moderate risk at typical and maximum application rates for most scenarios modeled with the exception that it had no risk to fish in the surface runoff scenario for a pond or stream. Diuron has high or moderate risk to fish in most scenarios modeled. No and low risk to fish from diuron was found for the off-site drift or surface runoff scenarios. For tebuthiuron, no risks to fish were recorded except for low risk during an accidental spill to pond at maximum application rate. The use of these materials along rights-of-way could pose additional exposure opportunities for fish as roadside ditches

54 These are the three additional herbicides that would become available under this alternative, in addition to those discussed under Alternatives 2 and 3.

and unobserved culverts and seeps could lead to nearby streams, particularly if materials are not well bound by the onset of the next precipitation event. However, little use of these materials is proposed west of the Cascades where these conditions are most likely to be encountered.

Other herbicide use would increase as well. The acres of 2,4-D, glyphosate, and picloram would approach No Action Alternative (Alternative 2) levels, as these material would be used to treat native and other non-invasive vegetation along rights-of-way and in habitat improvement areas. The risk to fish from herbicides would be higher under this alternative than under Alternatives 2 and 3 because of additional acres treated, additional pounds used, and use of boom spraying along roads. Required application of Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) minimize this risk, and overall adverse effects are predicted to be less under this alternative because of the additional reduction in the spread of noxious weeds.

Invasive Plant Effects: Under this alternative, the noxious weed spread rate is projected to decrease to 6 percent per year, and noxious weeds are projected to infest 2.2 million fewer acres in 15 years than under the No Action Alternative (Alternative 2). Although invasive plants would continue to spread under Alternative 4, that spread would be minimized and native riparian communities that directly or indirectly provide habitat for fish would be more likely to remain uninfested.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Herbicide Effects: As this alternative proposes to treat slightly more acres and use more herbicides than Alternative 4 (Proposed Action), there is a slightly greater potential for negative effects to fish. Based on Ecological Risk Assessments, diquat has a moderate risk to fish from direct spray to a stream at maximum application rates, and high risk for the accidental spill to pond scenario. However, diquat is an aquatic herbicide so it is not used where fish kill must be avoided. The Ecological Risk Assessment for diflufenzopyr + dicamba found no risks to fish in any of the scenarios modeled.

Although the effects to fish in this alternative are very similar to Alternative 4, this alternative would result in the highest likelihood of adverse effects to fish because it proposes the most treatments (300 percent more acreage than would be treated with herbicides under the No Action Alternative (Alternative 2), and 68 percent more pounds using the typical application rate). However, based on the results of the Ecological Risk Assessments, it is unlikely the fish species would be harmed by the herbicide use proposed in this alternative.

Invasive Plant Effects: The spread of invasive plants and its effects on fish habitat would be essentially the same as under Alternative 4 (Proposed Action).

Effects by Alternative – Special Status Fish

There are potential risks to Federally Listed, proposed for listing, and other species designated by the BLM State Director as Special Status fish species (managed under the Special Status Species Program). Although the predicted risks for adverse health effects to individual fish are the same as those predicted for non-Special Status fish, the associated population-and species-level effects would be much greater for many Special Status fish species because of their limited/fragmented distribution and limited population size. Risks to Special Status fish would be minimized by following Standard Operating Procedures and PEIS Mitigation Measures in Appendix 2 including those specific to Special Status fish, Protective Measures in Appendix 5, and following the BLM's Special Status Species Program policies.

The invasion and spread of non-native plant species into aquatic and riparian habitats may affect certain populations of Special Status fish. An overview of the ways in which non-native aquatic and riparian plants may affect aquatic habitats is presented earlier in this section. Numerous Federally Listed fish are threatened by the changes in water quality and flow that may result from weed infestations. Salmon, for example, require a high level of dissolved oxygen, which is reduced when aquatic weeds such as Eurasian watermilfoil and water-thyme invade an aquatic system. A decrease in dissolved oxygen associated with the encroachment/excessive growth of vegetation has also been listed as a threat to the Foskett specked dace in south-central Oregon (USDI 1985b). For species such as these, herbicide treatments to reduce coverage of non-native plant species in aquatic and riparian habitats would likely improve habitat over the long term.

Numerous Special Status fish, however, are most threatened by changes in water levels and quality associated with development, upslope land use practices, and groundwater pumping, and the expansion of non-native fish populations. For most fish, invasions of non-native plant species into riparian and aquatic habitats have not been listed in Conservation Strategies and other documents as threats to the species' survival. For these fish, health risks and increased inputs of chemicals into the water associated with herbicide spraying could outweigh any habitat improvements resulting from minimized weed infestations. In addition, some herbicide treatments could have short-term adverse effects on Special Status fish by killing non-target vegetation and reducing the overall cover of riparian vegetation that regulates water temperature through shading.

Adverse effects to water quality from the spread of invasive plants vary by alternative as described earlier in this section. Damage to watersheds, stream banks, and riparian areas by invasive plants is more significant for Special Status fish because populations are already weakened or stressed.

A more conservative LOC of 0.05 was used to determine risks to Special Status fish. The potential effects of herbicides on Special Status fish could be greater than the effects on non-Special Status fish and other aquatic organisms (an LOC of 0.1 was used for non-Special Status species), as shown in Tables 3-14 and 3-15.[55] Aquatic herbicides with the greatest likelihood of affecting Special Status fish during a normal application to an aquatic habitat include diquat and the more toxic formulation of glyphosate. Normal aquatic applications of 2,4-D and imazapyr would not pose a risk to Special Status fish.

Terrestrial herbicides with the greatest likelihood of affecting Special Status fish because of a spill, drift, accidental direct spray into an aquatic habitat, or surface runoff are diuron, picloram, and the more toxic formulation of glyphosate. According to Ecological Risk Assessments, there would be no risks to fish associated with chlorsulfuron, diflufenzopyr, imazapic, diflufenzopyr + dicamba, or sulfometuron methyl. Dicamba shows a risk (low) for susceptible fish in the spill scenario at maximum rates.

Reference Analysis - No Herbicide Use

There would be no impacts from herbicide exposure from BLM vegetation treatments. Effects from non-herbicide treatments would be similar to those described earlier for non-Special Status fish.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Noxious weeds would continue to spread at current rates, and control of weed infestations in aquatic and riparian areas would continue to be limited by the availability of only two aquatic herbicides, glyphosate and 2,4-D. Current adverse effects to Special Status fish would continue; the degree of benefit to Special Status fish,

55 Risks for BLM-evaluated herbicides, Table 3-14, were calculated with a lower LOC as described. For FS-evaluated herbicides, the "susceptible" category was used as a proxy for special status fish.

particularly species that are currently threatened by infestations of non-native plants, would likely be lower than under the action alternatives. However, short-term adverse impacts to habitats that support Special Status fish (such as increased water temperatures) would be lower as well. The degree of benefits versus impacts to these habitats from treatments would largely depend on where the treatments occurred.

Considering acreage alone, it is likely that Special Status fish would be exposed to herbicides far less under this alternative than under the other herbicide-use alternatives (Alternatives 3, 4, and 5). However, Standard Operating Procedures and PEIS Mitigation Measures protect these species and their habitat from harm under all alternatives, which should minimize differences in risk to Special Status species.

Under this alternative, 2,4-D and glyphosate could be used in aquatic and riparian habitats. The herbicides not registered for aquatic use (picloram and dicamba) could also be used in riparian areas, provided the herbicide did not contact the water and required buffers were implemented. Of these herbicides, only glyphosate is likely to pose toxicological risks to Special Status fish during a normal application, but only if the more toxic formulation is used, or the less toxic formulation is applied at the maximum application rate. In all areas with Special Status fish, typical rate application of the less toxic aquatic form of glyphosate is normally specified. Although there would be risks to fish in accidental spill scenarios, continuing to use these herbicides to treat riparian and aquatic vegetation would pose a low risk to Special Status fish.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

The greater number of acres expected to be treated in aquatic and riparian habitats than under Alternative 2 (No Action) could potentially result in greater impacts to Special Status fish. However, risk from normal use would remain minimal, provided only the less toxic formulation of glyphosate was applied at typical application rates. The availability of additional herbicides, including five registered for aquatic or riparian use, could reduce risks to fish. For example, fluridone shows no risks to fish at typical application rates and could replace other aquatic herbicides currently used by the BLM on public lands under certain conditions. Chlorsulfuron, imazapic, and sulfometuron methyl pose no risk to fish. Therefore, these herbicides would provide the BLM with additional low-risk options for treating near Special Status fish.

Acute (short-term) herbicide exposures to Special Status fish are not likely to result in harm under foreseeable conditions under this alternative. Since more terrestrial herbicides would be used under this alternative when compared to the No Action Alternative (Alternative 2), risks associated with accidental spill of those herbicides in or near a water body, and accidental direct spray into a water body, would be greater. However, the total acres of moderate risk herbicides applied would be about one-half of those treated under Alternative 2 (Table 2-5).

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

This alternative includes the use of 2,4-D, dicamba, glyphosate, picloram, clopyralid, diuron, fluridone, hexazinone, imazapic, imazapyr, metsulfuron methyl, sulfometuron methyl, and triclopyr State-wide, and bromacil, chlorsulfuron, and tebuthiuron east of the Cascades. As this alternative proposes to treat more acres and use more herbicides, there are greater positive and negative effects to Special Status fish.

The herbicides used in riparian and aquatic areas to treat invasive vegetation, as well as the quantity of herbicides used and the methods of application, would not be substantially different than for Alternative 3. Risks to Special Status fish from these herbicides and uses would remain minimal at typical rates, because only aquatic-labeled glyphosate would be used near water bodies. However, since additional, generally more toxic herbicides would be made available for native and other non-invasive vegetation treatments (albeit away from water bodies), risks associated with accidental spill of those herbicides in or near a water body, and accidental direct spray into a water body, would also be greater than under Alternatives 2 and 3.

Roads often parallel streams or have multiple stream crossings. Roads often act as extensions of stream networks with roadside ditches sometimes having low but measurable concentrations months after treatment (Wood 2001). Herbicides used along road rights-of-way could reach streams even when buffers to the actual stream are applied. Picloram and the more toxic formulations of glyphosate are the biggest risks. Having a greater number of herbicides from which to choose, and recognition of this issue during project design, including consideration of Special Status species and the application of Standard Operating Procedures and PEIS Mitigation Measures, would reduce potential impacts to water quality from herbicide applications.

Acute (short-term) herbicide exposures to aquatic organism are not likely to result in harm under foreseeable conditions, and the expected reductions in adverse fish effects from the additional control of invasive plants exceeds the potential risk to fish from the proposed herbicide applications.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Based on acreage, this alternative would entail the greatest amount of herbicide exposure to Special Status fish. Although a slightly greater amount of herbicides would be used in aquatic and riparian habitats than under the other alternatives (most additional treatments under Alternatives 4 and 5 would be outside of riparian areas), risks to Special Status fish from their normal use would remain minimal, provided glyphosate was only applied at typical application rates, and only the less toxic formulation was used. However, since more terrestrial herbicides would be used under this alternative as well, risks associated with accidental spill of those herbicides in or near a water body, and accidental direct spray into a water body, would also be greater than under the other alternatives.

Diquat would become available under this alternative. Diquat would likely be used only where the other five aquatic herbicides would not accomplish weed control objectives, specifically giant salvinia if it were to be found on BLM lands in Oregon. Direct spray would pose low to high risks to fish (including Special Status fish) during a normal application, depending on the application rate and type of aquatic habitat. Use of diquat in place of other aquatic herbicides would likely increase the incidence of adverse health effects to aquatic organisms per area treated. Diflufenzopyr + dicamba, which would also become available under this alternative, poses no risk to fish.

Acute (short-term) herbicide exposures to aquatic organisms are not likely to result in harm under foreseeable conditions.

Cumulative Effects

Existing Controls

A number of Federal, State, local, and tribal resource management and monitoring programs have been established to protect environmental resources and, in cases where there is existing environmental impairment, to effect restoration. The assessment of cumulative impacts recognizes the existence of these programs and assumes that the mandate under which each program was established will continue. The cumulative effects analysis assumes in part that these programs effectively avoid or mitigate the environmental impacts that they are designed to address.

Fish as an Indicator of Ecosystem Health

Fish, the dominant aquatic vertebrate in the analysis area, constitute a key component of aquatic systems on public lands in Oregon. Fish are a critical resource to humans and as such have influenced the development, status, and success of social and economic systems in Oregon. Aquatic organisms such as insects and other aquatic invertebrates provide food for fish. The health of fish and other aquatic organisms is often indicative of the health of the watershed. Fish and other aquatic organisms are often more susceptible than humans and wildlife to herbicides and other chemicals in their environment, and thus can be an indicator of the water quality standards. Today, the rapid expansion of invasive plants across public lands is a threat to ecosystem health and one of the greatest challenges in ecosystem management.

Past Effects and Their Accumulation

Cumulative impacts to fish and the lakes, ponds, wetlands, and riparian areas that provide habitat for fish on public lands and throughout Oregon have occurred from human-caused disturbance factors, including natural resource extraction, recreation, fire exclusion, construction of roads, dams, and hydropower facilities, agriculture, and urbanization. In addition to these and natural disturbances, use of wetland and riparian areas by livestock and wild horses has degraded habitat values. Water withdrawal from ditches and diversions have affected fish habitat on public and other lands. Overfishing has been blamed for the declines in some fish populations (USDA, USDI 2000a). The introduction of non-native game fish has also affected some native fish populations.

BLM surveys show that about 50 percent of inventoried riparian habitat on BLM lands in Oregon lack characteristics necessary for "proper" functioning condition (see *Wetlands and Riparian Areas* section). Proper functioning riparian areas have the necessary physical and structural components to dissipate stream energy associated with high water flows, as well as conditions that support a diverse and healthy population of fish and other aquatic organisms.

The permitting process and the regulatory environment for protecting fish have improved over time and are generally effective. Proper construction and placement of bridges and culverts have greatly reduced adverse effects but have not eliminated them. Little is known about the effects of water withdrawals from lakes on fish. Some fish have been harmed or killed during water extraction, but these numbers have been small and have not accumulated (USDI 2005d). The rate of loss of wetland and riparian areas has slowed with the passage of Federal, State, and local regulations that strive to protect wetland and riparian habitat. There has been some improvement in the functional quality of wetland and riparian areas on public lands in Oregon, a trend that is likely to continue.

During the early years of the BLM, most resource conservation and management was focused on upland sites. An increased emphasis on wetland and riparian habitat protection began in the 1960s. In the 1970s, FLPMA was passed (1976) and the BLM began preparing land use plans to better manage natural resources on public lands. Land use plans set goals and objectives for natural resource management and identify priority watersheds on which to focus restoration efforts. In addition, the BLM is assessing the condition of wetland and riparian areas, and conducting restoration efforts in areas that are less than proper functioning.

Past weed control efforts by the BLM, other Federal and State agencies, private landowners, and/or businesses (particularly the agricultural industry) have resulted in the application of thousands of tons of herbicides and other pesticides to the environment (see Table 4-1). As discussed earlier in this section, some of these herbicides break down relatively quickly in the environment or are not harmful to aquatic organisms at typical application rates. However, some herbicides are harmful to aquatic organisms, and may persist in the environment for many months.

Invasive Plants

The spread of invasive plant species is one factor that degrades habitat for aquatic organisms. Within riparian shrublands, there has been extensive conversion to areas dominated by exotic grasses and forbs. This conversion has made these areas more susceptible to fire (which further degrades the resource) and reduced their value to aquatic organisms (USDA, USDI 2000a). BLM efforts to restore watersheds including managing and controlling noxious weeds and other invasive vegetation would help to reduce erosion and sedimentation and restore native plant communities. Restoration of native vegetation should improve riparian habitat and moderate stream temperatures and water flows. In addition, the ability of the BLM in Oregon to use aquatic herbicides to control aquatic weeds would benefit lakes and ponds and the aquatic organisms that use these habitats.

Streams cross multiple jurisdictions, including private land, along their entire course. In many cases the condition of the stream habitat off of public lands and on private or other jurisdiction lands is unknown and could be of lower quality. Dams and other diversions found in the Columbia River and most other major rivers in Oregon also limit access to upriver habitats and alter occupied habitats for certain anadromous fish and other species. Thus, restoration of native vegetation and natural ecosystems may be most immediately beneficial to resident fish rather than migratory fish that travel off public lands to meet part of their life requisites (USDA, USDI 2000a).

Cumulative Effects of the Alternatives

Although herbicide treatments can lead to the harm or even death of fish and aquatic organisms, application of herbicides is not expected to result in significant mortality to fish. However, while the amount of herbicides expected to reach water is expected to be very low under any of the alternatives, and site-specific treatment design and required Endangered Species Act consultation will attempt to prevent adverse effects to Federally Listed species, the BLM cannot conclude with certainty that herbicides could not potentially reach fish-bearing streams and cause adverse effects.

Most studies of herbicide effects on fish observe the effect of short-period exposures to high concentrations of herbicides, rather than the low concentrations over an extended period more likely to be found in streams, lakes, and ponds. Therefore, chronic effects to fish would not be readily apparent. There is also potential for an accidental spill or inadvertent improper use of herbicides to result in the contamination of water, thereby adversely affecting fish.

The adverse effect of invasive plants is apparent and growing rapidly. Based on the number of acres treated, short-term adverse impacts are nearly the highest under Alternative 4 (Proposed Action). However, long-term improvements to the health and productivity of fish would be greatest under Alternative 4 and least under the Reference Analysis and Alternative 2 (No Action). The number of acres treated under Alternatives 4 and 5 and their associated short and long-term effects would be similar, while Alternative 3 would treat fewer acres than the Proposed Action but probably has the lowest likelihood of adverse effects to fish. Most treatments under the Proposed Action would occur on uplands, but fish would also benefit from upland treatments located near aquatic habitats.

Herbicide use already occurs on BLM and other Federal, State, and County lands, private forestry lands, rangeland, agricultural land, utility corridors, and road rights-of-way. Table 4-1 shows a comparison of the pounds of herbicides projected to be used by the BLM under Alternative 4 (Proposed Action), with the pounds of those same herbicides used on all ownerships statewide in 2008. The proposed use of herbicides by BLM is a small amount of the total use in the State or even any large watershed, given the mixed ownership. This use, conducted under the Standard Operating Procedures and PEIS Mitigation Measures, and following site-specific analysis and appropriate consultation, is unlikely to contribute substantially to downstream effects.

Wildlife Resources

Affected Environment

This section addresses the amphibians, birds, mammals, mollusks, aquatic and terrestrial invertebrates, and reptiles found on BLM lands in Oregon, collectively called wildlife.[56] Over 700 species have been documented in the State (all ownerships) including 31 amphibians, 478 birds, 139 mammals, 35 reptiles, and an uncountable number of invertebrates (Johnson and O'Neil 2001:2). In addition to resident wildlife, the Pacific Flyway[57], covering much of Oregon, serves migratory birds. Federally Listed and other Special Status species receive special protection during management activities as needed (Appendix 5). For the BLM in Oregon, these include 13 amphibians, 45 birds, 24 mammals, 2 reptiles, and more than 60 invertebrates (mollusks, arthropods, etc.). Conservation Measures included in Appendix 5 and referenced in the PEIS Mitigation Measures in Appendix 2 apply to Federally Listed and other Special Status species and their proposed or designated critical habitat.

Within the range of the northern spotted owl, additional species are subject to *Survey and Manage* requirements. These requirements generally include management for population persistence at known sites and, for those whose characteristics make clearance surveys practical, pre-disturbance surveys prior to potentially harmful management activities. The potential for herbicide exposure is somewhat reduced for species included in Survey and Manage because all are believed to be late-successional or old-growth forest associates (or remnant snags and logs). Most Survey and Manage species deemed at risk from management activities and locatable with surveys have also been designated as Special Status species.

Birds, particularly migratory birds, have experienced precipitous declines since European settlement due to multiple causes, including habitat loss, over-utilization, and more recently, changes to natural disturbance patterns (Hunter et al. 2001, USDI 2008e). Invasive plants (and animals) contribute to their decline. Migratory birds are also subject to the Migratory Bird Treaty Act. BLM management under this Act focuses primarily on long-term habitat conditions (USDI 2009b), and provides guidelines when projects may affect populations or their habitats. In addition, BLM is a partner in the Partners in Flight cooperative and considers Partners in Flight guidelines, conservation strategies, and technical reports in project planning and implementation.

Oregon BLM supports a rich assemblage of mammals. They include big game species such as big horn sheep, elk, deer, pronghorn, black bear, cougars, coyotes, and many small-to-medium sized mammals such as mustelids (weasels, fishers, martens, skunks), rodents (squirrels, mice, rats, shrews, rabbits) and bats. Mammal populations and distributions in Oregon have been influenced by management and a variety of anthropogenic and natural habitat alterations. Mammals that are adaptable and tolerant of human activities, such as coyotes, have increased in number and distribution. Those that are restricted to unique habitats (such as big hornsheep or pronghorn) have decreased.

Invertebrate biodiversity and habitat relationships are poorly researched (King and Porter 2005). Lattin (1993) estimates that 6,000 arthropod species may be found in Pacific Northwest old growth forests. Over 3,400 different species are known from a single 6,400 ha site in Oregon, but information on them is rudimentary. There are three Federally Listed invertebrates in Oregon (Appendix 5). Microorganisms are discussed in the *Soil Resources* section in this Chapter.

56 Fish may also be considered wildlife, but they are covered in a separate section.

57 The Pacific Flyway is a major north-south route of travel for migratory birds in the Americas, extending from Alaska to Patagonia. Every year, migratory birds travel some or all of this distance both in spring and in fall, following food sources, heading to breeding grounds, or travelling to overwintering sites.

The Oregon Special Status Species Program list, which includes all Federally Listed species, currently includes 14 Lepidoptera. Remaining populations of these rare butterflies and moths are in fragmented remnants of habitat, and population size is very low in most occupied locations (Schultz 2001, Stoner and Joern 2004). The adult stage is very short; the entire nectaring period of a small population of some butterflies can be less than 10 days. However, individuals of larger populations generally mature at different times, which extends that population's nectaring season. The history of other life phases and their habitat relationships are less known. Some, but not all, Lepidoptera are affiliated with specific native plants.

Adult honeybees are used as a surrogate for invertebrates in Risk Assessments. Exotic (non-native) bees have been shown to favor exotic plant species, and can differentially allow the exotic vegetation to compete against native plants (Goulson 2003). There are more than 3500 species of native solitary bees in North America, and many more invertebrate native pollinators that can be influenced by weeds and weed treatments (Greer 1999). The balance of invertebrates (predators, herbivores, and nectar-feeders) can be disturbed if too much of one group of plants (for instance, broad-leaf or flowering forbs) are removed during their life cycle or native invertebrates may be replaced by non-native species if the spread of invasive plants is not controlled.

Mollusks are prey for birds and small mammals (Dunk et al. 2004) and serve other important ecological functions by breaking down vegetative litter. From a global conservation perspective, mollusks represent 20 percent of all threatened animals, and 37 percent of known animal extinctions since 1600 A.D. (Seddon 1998 cited in Dunk et al. 2004). Approximately 69 percent of freshwater mussels in North America are extinct, imperiled, or vulnerable to extinction (Stein et al. 2002). Most Oregon mollusks are food generalists, and do not seem to be affiliated with unique plant types (Duncan, N. pers. comm.). They are active and most vulnerable during wet times of the year. Snails and slugs have moist skin that can make them more susceptible to toxic qualities of water-dissolved chemicals. Some herbicides have low toxicity to mollusks.

BLM lands in Oregon support both terrestrial and aquatic forms of amphibians (frogs and salamanders), which are moist-skinned cold-blooded animals that breathe through their skin. Diverse habitats on BLM lands in Oregon also support a wide variety of reptiles (snakes, turtles, and lizards). Like amphibians, they are cold-blooded animals, but unlike amphibians, have scaly skin and are more tied to terrestrial habitats such as rock outcrops. Reptiles and amphibians are collectively called "herptiles."

There are several weeds thought to adversely affect herptiles including Eurasian watermilfoil, purple loosestrife, saltcedar, and cheatgrass (Pilliod and Wind 2008). None of the herptiles are currently Federally Listed. Habitat connectivity among populations is a concern for all the herptiles (Pilliod and Wind 2008). Restricting management activities around water offers some protection for the species that use riparian or water habitats, but both reptiles and amphibians move well away from waterways during their life cycle. (Not all herptiles are water associated.) Amphibian declines have received more attention in terms of research and publicity, but Gibbons et al. (2000) suggests reptiles may be exhibiting declines that are even more precipitous. Both are adversely impacted by invasive plants (including invasive fauna as well as weeds) (Hinton and Scott 1990 cited in Gibbons et al. 2000), and are vulnerable to the treatments to control weeds. Reptiles, particularly the Special Status painted turtle and western pond turtle, have long seasonal metamorphosis periods when they are particularly susceptible to all types of management activities.

The natural environment is in constant change due to natural events: seasonal and temporal climate, successional development, fire, wind, drought, flood, insect, and disease. Nearly all Oregon native wildlife is dependent upon some mosaic of habitat created and maintained by those natural disturbances. Anthropomorphic (human) activities have complicated the disturbance pattern and brought irreversible changes to the natural environment. Humans have introduced non-native plants and animals—including both beneficial and invasive plants.

Wildlife Considerations by Biome

Sagebrush Steppe

BLM lands currently account for 70 percent of the remaining sage grouse habitat in Oregon (Hagen 2005). Shrubland and grassland birds, representing an important component of the biodiversity of the western United States, are declining faster than any other group of species in North America (Saab and Rich 1997, Paige and Ritter 1999, Dobkin and Sauder 2004). Species dependent on sagebrush ecosystems (Brewer's sparrow, Sage Sparrow, Sage Thrasher) may be important predictors of ecological degradation. The sagebrush ecosystem throughout the Great Basin has been described as one of the most endangered in the United States (Noss et al. 1995). Several authors identify invasive plants as one risk factor (Wisdom et al. 2005:6, Paige and Ritter 1999:8). Connelly et al. (2004) reported 31 percent of original sage grouse habitat has been converted to areas dominated by invasive cheatgrass, medusahead, knapweed, and yellow starthistle.

In a central Nevada study, Wisdom et al. (2005) documented 26 bird species and 28 mammals that use sagebrush lands for cover and food. Vander Haegen et al. (2001) concluded that 49 of the 103 species (44 birds, 26 mammals, 20 reptiles, 9 amphibians) in the sagebrush biome may be sagebrush obligates. Amphibian species richness and density in sagebrush ecosystems is low due to dry conditions and lack of open water. Vander Haegen et al. (2001:239) documented that sites dominated by native plants have more closely associated wildlife habitat relationships than those dominated by exotics.

Many high desert species time their activities to avoid climatic extremes to allow them to capitalize on spotty resources such as food or water when they are available. During times of scarce resources or harsh weather, species such as marmots, pygmy rabbits, ground squirrels, and burrowing owls may burrow or estivate. They can be especially vulnerable to herbicide exposure if limited food or water is contaminated during their metabolically active period when they are ingesting large amounts of food or water in a short time.

Sagebrush habitats dominated by cheatgrass or medusahead monocultures do not provide usable habitat for sage grouse and other sagebrush related species. Rowland et al. (2005) evaluated 40 vertebrate species in the Great Basin and Nevada for risk to displacement from cheatgrass by using risk models and quantifying habitat for those species. They described 36 percent of habitat at high risk and 25 percent at moderate risk of displacement from cheatgrass (Rowland et al. 2005:156). All but five of those species occur on BLM lands in Oregon (although the Oregon percentages of habitats at risk would be different). Spotted knapweed and many other noxious weeds also degrade wildlife habitat in the sagebrush biome. The increase in invasive annual grasses has increased wildfire risk as compared to the native shrubland. Rabbitbrush can sprout after a fire that would kill sagebrush (Hammond 1995 cited in Montana FWP 2008), causing rabbitbrush to be more prevalent than would be found in a healthy sagebrush community. Western junipers have increased in sagebrush-dominated communities at higher elevations to further degrade sage grouse (Hagen 2005) and mule deer habitat (Clements and Young 1997). A diverse mosaic of different sagebrush species and other shrubs is described for healthy sagebrush systems (Rowland 2004).

Eastern Forest

Wildlife communities are relatively unstudied in the eastern forests, as compared to coastal west side forests, or east side riparian communities, and much of the limited research has focused on ungulates (Sallabanks et al. 2001). Wildlife habitat matrices (Johnson and O'Neil 2001) identify 287 vertebrate species associated with (but not necessarily obligates of) east side interior forests and woodlands, which is fewer species than riparian or west side forests, but more species than those associated with alpine/subalpine habitats. The eastern dry forest hosts over a dozen amphibians, 130 birds, 80 mammals, and 20 reptiles. The majority of birds in the Eastern Forest biome are foliage-gleaners that glean insects and fruit from vegetation—not from the ground (Sallabanks et al.

2001). Herbivory (domestic and wild ungulates) has influenced the understory vegetation in eastern dry forests by suppressing shrub canopies and biomass accumulation, particularly through selective suppression of N-fixing plants (Sallabanks et al. 2001).

East Side Riparian

This biome is specific to the east side in this EIS, but many of the riparian relationships remain true in west side riparian habitats as well. Riparian areas are diversity "hotspots," supporting some of the richest species assemblages of any habitat association (Kauffman et al. 2001). Riparian zones are critical wildlife habitats in the high desert of southeast Oregon (Thomas 1979), and the Blue Mountains (Thomas 1979). Thomas identified 285 of the 378 terrestrial vertebrate species in the Blue Mountains use or are directly associated with riparian habitats. Over 80 bird species were documented in a 1.5-mile stream reach in northeast Oregon (Kauffman et al. 1982). Kauffman et al. (2001) reported 319 of 593 (53 percent) of wildlife species in Oregon and Washington were riparian associates, including many wildlife species included on the Special Status Species Program list.

Siskiyou

This biome has a diversity of wildlife and habitats not usually found in such a limited area. Oregon Department of Fish and Wildlife (2005) identifies the Siskiyou mixed conifer forests and woodlands as the most diverse forest habitats in Oregon. The Klamath Mountains are considered a herptile "hotspot" by Bury and Pearl (1999), supporting 38 native species of amphibians and reptiles, higher than any similar-sized mountain range in the Pacific Northwest (Olson et al. 2001). Sixty-five Special Status species are documented or suspected in the Siskiyou Biome. The highest avian species richness west of the Cascade crest in Oregon and Washington occurs in the Klamath Mountains (Ralph et al. 1991). The Klamath-Siskiyou ecoregion is an area of "extraordinary biodiversity," rated "among the world's most outstanding temperate coniferous forests" (DellaSala et al. 1999). DellaSala et al. (1999) analyzed 2,377 terrestrial animals (including snails, butterflies, birds, mammals, reptiles and amphibians), and 168 (or 7 percent) were found nowhere else.

Western Forest (including riparian)

More than 300 vertebrate species are associated with the structurally diverse Oregon western forest biome, making it one of the most species-rich areas in Oregon (Olson et al. 2001). Amphibians make up approximately 13 percent of the total wildlife species in the montane region (which includes the Willamette Valley and Siskiyou Biomes in this EIS) (Olson et al. 2001). Mollusks (snails and slugs) are abundant in number and diversity in the moist habitats of the western forest biome.

Road density is high, and most BLM lands are in a checkerboard ownership pattern interspersed with private industrial lands or rural residential. The patchiness that results from land use and ownership patterns has fragmented older forests which serve as habitat for species such as the Pacific-slope flycatcher, varied thrush and Vaux's swifts (Brown 1985), but this fragmentation also provides edge and structural diversity for many other wildlife species such as willow flycatchers, white-crowned sparrows, song sparrows and spotted towhees. Microhabitats in the lush moist vegetation next to water support many forest riparian species (bats, shrew, marten, waterfowl, and amphibians).

The checkerboard ownership, intensive land use, and extensive road network increases the risk of invasive plant establishment. Some weeds such as Himalayan blackberry and Scotch broom dominate large portions of the western forest landscape. The large amount of water close to human activity also facilitates introduction of water-associated noxious weeds, such as purple loosestrife and yellow flag iris, which threaten the viability of the many aquatic species in this biome.

Willamette Valley

Less than one percent of the BLM lands in Oregon are in this biome, but nearby BLM lands in the Western Forest Biome can be similar to this biome. Habitat connectivity is one of the greatest concerns for wildlife associated with the Willamette Valley, and isolated populations of many rare species remain. Invasive plants are a primary factor adversely affecting survival of isolated populations of rare wildlife in the Willamette Valley.

Oak Habitats

There are oak woodland components in all of the biomes in western Oregon. Oak habitats are important habitat to many Oregon wildlife species. The ODFW has recognized the importance of this habitat in the Oregon Conservation Strategy (ODFW 2005). Oaks are important to wood ducks, band-tailed pigeons, California quail, varied thrush, jays, Lewis and acorn woodpeckers, black bear, squirrels, mice, raccoons, and deer (ODFW 2005). Oak habitats generally have open grass-dominated understories and most have been degraded by annual grasses and exotic shrubs to varying degrees. Oaks also have shallow root systems, making them vulnerable to mechanical disturbance. Non-native species can suppress the seedlings of oaks, pines and other native species (Polster 2004).

Environmental Consequences

The likelihood of significant adverse effects to wildlife from contact with the herbicide uses proposed in the action alternatives is negligible at the population scale. The herbicides are formulated to affect plants, and have been selected to have some of the lowest (or no) demonstrable wildlife toxicity of licensed herbicides, do not bioaccumulate in wildlife, and are quickly degraded in wildland settings. The EPA manual summarizes “Many modern herbicides kill weeds selectively by impairing metabolic processes that are unique to plant life. For this reason, their systemic toxicities in mammals are generally low. The water-soluble herbicides are not retained in body tissues for long periods, as were the old lipophilic organochlorine insecticides such as DDT.”

Risk Assessments (Chapter 3 and Appendix 8) indicating moderate or high risk to wildlife help guide application of buffers and other measures to reduce the likelihood of contacting individual animals with hazardous doses. Requirements for site-specific pre-project clearances for Federally Listed and other Special Status species also help prevent adverse effects to rare species, providing habitat and/or occupancy information to project planners so protection measures can be prescribed. Local biologists would use herbicide Risk Assessments that consider Special Status species to be 10-times more susceptible to herbicides than other wildlife, to help choose herbicides with lesser toxic risk to that particular class of rare species or choose more selective application methods to avoid or reduce herbicide contact. Despite efforts to reduce exposure, an occasional non-Federally Listed wildlife individual may be exposed to doses above the LOC. Impacts would vary by individual and circumstance, but adverse effects would not be expected to be significant to the population level. Similarly, the few wildlife Survey and Manage species not requiring pre-disturbance surveys may be harmed if they are sprayed.

Four categories of potential effects are addressed in this section; a) the potential for adverse health effects from the herbicides, b) effects of habitat change either from the spread of invasive plants, or c) as collateral damage from the weed treatments, and d) disruption effects (noise and other disturbances) from the vegetation treatments. The responses of wildlife species and wildlife communities to habitat changes and to disturbance can be variable, complex, interactive, and difficult to accurately predict.

Effects Common to All Alternatives

Effects from direct contact or ingestion of herbicides

Herbicides have the potential to directly harm wildlife individuals, populations, or species (USDA 2005a) through toxic reactions. Terrestrial animals might be exposed to any applied herbicide from direct spray, the ingestion of contaminated material (vegetation, prey species, or water), or indirect contact with contaminated vegetation. Aquatic animals can be exposed to the six herbicides approved for aquatic use (2,4-D, diquat, fluridone, glyphosate, imazapyr and triclopyr), and from off-site drift or runoff from terrestrial herbicides.

Toxic effects can include death, damage to organs, changes to body weight or growth rates, reduced reproduction, reduced survival of offspring, increased risk of predation, and behavioral (sub-lethal) changes that reduce fitness.

In practice, most BLM weed treatment would be specifically targeted at weeds through direct spray or hack and squirt, or at native and other non-invasive vegetation along rights-of-way through boom applications, and not applied to extensive acreage across all occupied wildlife habitat. It is likely that larger animals and birds would avoid the treatment area during treatment because of noise and activity. Animals that temporarily leave the treatment area have reduced risk of directly ingesting the herbicide while grooming, or from ingesting herbicides on vegetation or prey (insects or other animals that were directly sprayed), because most of the herbicides proposed in this EIS have a very short active period where wildlife toxicity could occur. The few studies of herbicides on mollusks indicate they have relatively high resistance to toxic effects of herbicides in the environment, although their moist skin facilitates exposure to herbicides in soil and water.

Standard Operating Procedure buffers on wetlands and riparian habitats can reduce risks to herptiles in their aquatic form, but may not be large enough to protect herptiles from exposure when they are in terrestrial habitats. Turtles and frogs use upland habitat several hundred feet or more from water at certain times of their lives (Bishop and Pettit 1992 cited in Govindarajulu 2008). Most of the limited research of herbicides on amphibians has been on tadpoles or fish surrogates. Several recent studies of herbicide effects on amphibians suggest adverse effects of glyphosate, but the studies used a commercial version of glyphosate that included the surfactant POEA (Relyea 2005a, b, Relyea et al. 2005, Relyea 2009). Aquatic animals in water are more vulnerable to exposure from herbicides used for aquatic vegetation than terrestrial species because they are less likely to find untreated alternate habitat for refugia, although species and developmental stages vary significantly in their susceptibility.

Some sessile animals, such as mollusks and other invertebrates, ground-dwelling mammals, or pre-fledgling birds could be restricted to the treatment area. These organisms could be adversely affected by broad scale treatments using herbicides with moderate to high toxicity.

Accidental exposure from off-site drift or spill is also possible. Spill scenarios are included in the Risk Assessments.

Herbicides can be absorbed by plants (and biodegraded in the plant's processing of the herbicide), are degraded by microorganisms rapidly, can be degraded by UV exposure, or are diluted and broken-down into non-toxic by-products by contact with water or air. Some of the active mechanisms of herbicides are affected by temperature as well. Some herbicides have strong affinity to soil particles, which can further reduce active herbicide contact with wildlife (see *Soil Resources* section). Herbicides can change the pH of water that might have indirect effects on wildlife that use that habitat (Relyea and Hoverman 2006).

ALS-inhibitors: ALS-inhibitors (including chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, and sulfometuron methyl, all of which are included in Alternatives 3, 4, and 5[58]) work by inhibiting a biological pathway that exists only in plants and not in animals, thus making the ALS-inhibitors among the lowest risk herbicides for wildlife (CIS 2009).

Adjuvants: Some sources (Muller 1980, Lewis 1991, Dorn et al. 1997, Wong et al. 1997) generally suggest that the acute toxicity of surfactant and anti-foam agents to aquatic life ranges from 1 to 10 mg/L, and that chronic toxicity ranges as low as 0.1 mg/L. This evaluation indicates that, for herbicides with high application rates, adjuvants have the potential to cause acute, and potentially chronic, risk to aquatic species. More specific modeling and toxicity data would be necessary to define the level of uncertainty. Use of adjuvants with limited toxicity and low volumes near aquatic habitats would mitigate this risk.

Endocrine disrupters: The EPA reports effects of endocrine disruption in animals can "include abnormal thyroid function and development in fish and birds; decreased fertility in shellfish, fish, birds, and mammals; decreased hatching success in fish, birds, and reptiles; demasculinization and feminization of fish, birds, reptiles, and mammals; defeminization and masculinization of gastropods, fish, and birds; decreased offspring survival; and alteration of immune and behavioral function in birds and mammals." Of the herbicides analyzed, 2,4-D and the surfactant NPE have been identified as potentially having estrogenic effects (USGS 1998, Bakke 2003). Triclopyr and glyphosate have been evaluated for endocrine disrupting effects, and the weight of evidence indicates that these herbicides cause no specific toxic effects on endocrine function (SERA 2002). Sulfometuron methyl can cause malformations in amphibians (SERA 2004f), but whether the malformations are caused by endocrine disruption, cellular toxicity, or other pathways has not been reported.

2,4-D is a possible endocrine disrupter (see *Endocrine Disrupters*) and is one of the more toxic herbicides for wildlife of the foliar-use herbicides considered in this EIS. The ester form is more toxic to wildlife than the salt form. Ingestion of treated vegetation is a concern for mammals, particularly since 2,4-D can increase palatability of treated plants (USDA 2006b) for up to a month following treatment (Farm Service Genetics 2008). Mammals are more susceptible to toxic effects from 2,4-D, and the sub-lethal effects to pregnant mammals were noted at acute rates below LD_{50}. Birds are less susceptible to 2,4-D than mammals, and the greatest risk is ingestion of contaminated insects or plants. The salt form is practically non-toxic to amphibians, but the ester form is highly toxic. It can be neurotoxic to amphibians; although not all amphibians respond the same (e.g., toads were more susceptible than leopard frogs). There is little information on reptile toxicity, although one study noted no sexual development abnormalities. It presents low risk to honeybees (Table 3-15), but little information is available for other terrestrial invertebrates. Parasitic wasps may be affected, which could result in changes to community structure by favoring damaging insects controlled by parasitic wasps.

Dicamba: No adverse effects on mammals are plausible for either acute or chronic exposures of dicamba. At the highest tested rate, there are adverse reproductive effects possible for acute scenarios consuming contaminated vegetation. There is little basis for asserting that adverse effects in aquatic animals is plausible. Limited studies on dicamba suggest it is practically non-toxic to amphibians and honeybees. Amphibians are as tolerant as the fish to the acute toxicity of dicamba, and aquatic invertebrates appear to be somewhat more susceptible to dicamba than fish or amphibians. Dicamba has no adverse effects on birds for acute or chronic exposures, although highest tested application rates had possible adverse reproductive concerns for acute scenarios involving birds consuming contaminated vegetation or contaminated insects (SERA 2004g).

Glyphosate is a low toxicity herbicide, widely used for terrestrial applications and is approved for aquatic use. Toxicity to most wildlife groups is very low, so much so that NOAEL levels are used because the LD_{50} were

58 Chlorsulfuron is not available west of the Cascades under Alternatives 3 and 4.

not found at high doses in many cases. Observed effects had to do with reduced feeding efficiency and reduced weight gain. Glyphosate adheres to soil, is degraded by soil bacteria, and does not bioaccumulate. Formulas vary in toxicity: 1) technical grade (pure) glyphosate is much less toxic than some of the commercial formulations; 2) commercial glyphosate formulations with the surfactant POEA are similar in toxicity to the surfactant POEA alone; 3) glyphosate herbicide formulations, such as Rodeo®, that are formulated without a surfactant are much less toxic than formulations with the surfactant POEA; 4) glyphosate herbicides with alternative surfactants would be much less toxic to frogs than Roundup Original/Vision® (Mann and Bidwell 1999, Perkins et al. 2000, Edginton et al. 2004a, Howe et al. 2004, all cited in Govindarajulu 2008, Relyea 2006). These studies support the conclusion that the toxic effect of POEA-containing glyphosate herbicides is due to POEA rather than to the active glyphosate ingredient. Ephemeral wetlands important to amphibians may not be protected by standard buffers (Govindarajulu 2008). There may be short-term adverse effects to terrestrial and aquatic amphibians where POEA formulations of glyphosate are used. Effects would vary by species and by developmental stage (Relyea 2005a (lethal impact); Relyea et al. 2005). Larval amphibians were more susceptible in some studies (Relyea 2005b), but less so in other studies (Thompson et al. 2004). Glyphosate has not been tested on a wide range of amphibians, nor does EPA require the testing of surfactants. Proprietary labels do not always identify the surfactants used. Pre-project clearance evaluations for Special Status or Survey and Manage amphibians will help project planners choose appropriate weed treatments that have lower chance of adverse effects where these amphibians are likely to occur. In any event, a PEIS Mitigation Measure specifies avoiding using glyphosate formulations containing POEA, or seeking the use of formulations with the least amount of POEA, to reduce risks to amphibians (Appendix 2).

Picloram: Studies on birds, bees, and snails generally support picloram as relatively nontoxic to terrestrial animals. The few field studies indicated no change to mammal or avian diversity following picloram treatment. Variations in different exposure assessments have little impact to risk through ingestion, grooming or direct contact. Maximum rates have higher risk to mammals due to contaminated grass or insects. No information was found in the literature about picloram's effect on reptiles (SERA 2003b).

Bromacil is an herbicide often used where maintenance of bare ground is desired. It poses a low toxicity hazard to terrestrial mammals, birds, and honeybees. It poses zero to low toxicity risk to mammals that ingest treated vegetation over time under plausible treatment scenarios, assuming they remain in the treatment area, and alternate food is unavailable. BLM's application scenario reduces the risks of herbivore ingestion. There is practically no risk to invertebrates (ENSR 2005b).

Chlorsulfuron is an ALS-inhibitor; a group of herbicides that has the lowest risk to all groups of wildlife of the herbicides evaluated. All likely application scenarios are below the LOCs for wildlife groups under tested scenarios, even under spill or off-site drift scenarios. It is unlikely to cause any adverse effect on aquatic animals (Table 3-14). No studies on amphibians or reptiles were found (SERA 2004a).

Clopyralid is useful in treating starthistle, thistles, and knapweeds, which are noted as damaging to wildlife habitat. Clopyralid is unlikely to pose risk to terrestrial mammals. All of the estimated mammalian acute exposures are below the acute NOEL; mammalian chronic exposures are below the chronic NOEL. It is relatively "harmless" to earthworms (Dow AgroSciences 1998) and 14 of 17 insect parasites and predatory mites (Hassan et al. 1994 cited in SERA 2004b). There was no mortality to bees at relatively high doses. Four of 18 direct spray scenarios resulted in exposure levels below the estimated NOEL. Large and small birds have some risk of ingestion of contaminated food but hazard quotients are below the level of concern for all exposure scenarios. No studies on amphibians/reptiles were found. Clopyralid is one of the herbicides with lower toxic risks (SERA 2004b).

Diflufenzopyr + dicamba: Diflufenzopyr has slightly more toxic impacts to wildlife than dicamba based on evaluations in the Ecological Risk Assessment. The mixture has a moderate residual effect that could affect insects and mammals through ingestion but insect lethal effects are unlikely. It is practically non-toxic to aquatic invertebrates and has low toxicity to honeybees. Risk Quotients for terrestrial wildlife were all below the most conservative LOC of 0.1 (acute endangered species), indicating that accidental direct spray impacts are not likely to pose a risk to terrestrial animals. The mixture is practically non-toxic to birds, but there are some concerns for ingestion of contaminated thistle or knapweed manifesting in reproductive effects at high application rates. There are chronic and acute ingestion concerns for mammals as well (Table 3-14). Aquatic invertebrates are more susceptible to dicamba than fish. One study on dicamba indicates it is practically non-toxic to amphibians (ENSR 2005d, i).

Diquat is approved for aquatic use and is one of the more toxic herbicides evaluated in this EIS. It is moderately toxic to mammals through dermal contact and ingestion. The risks are greater for large mammals and large avian herbivores compared to smaller animals and birds, particularly with maximum application rates (Table 3-14). There are high risks to aquatic species sprayed with diquat. There are moderate to high risks identified for aquatic invertebrates at typical and maximum rates, and low toxicity to terrestrial invertebrates. Diquat is one of two herbicides evaluated in this EIS with high categories at both typical and maximum rates for Special Status species, partly related to aquatic exposure scenarios (ENSR 2005e).

Diuron is approved for ditch banks, but will not be used in riparian areas. It has a low to moderate tendency to bio-accumulate (Extoxnet 1996a). It has been rated as a surface water and groundwater contaminant (*Water Resources* section in this chapter). Acute direct spray risks on food were low for most mammal and bird scenarios, but exceeded the LOC for all scenarios at the maximum rate. Some chronic scenarios presented a high risk. Diuron has low to moderate risks to pollinators at typical and maximum rates respectively, and moderate to high risk for aquatic invertebrates. Diuron was listed as a risk under most direct spray and ingestion of contaminated food scenarios (ENSR 2005f).

Fluridone is used for submerged weeds that threaten aquatic wildlife such as watermilfoils. It has a low tendency to bioaccumulate (in fish). Fluridone exhibits low toxicity to most terrestrial mammals and small mammals may be more susceptible than large. Acute oral exposure of fluridone is practically non-toxic to birds and practically non-toxic to honeybees. Fluridone is one of the aquatic herbicides with the highest risk factors; however, at typical rate it is less toxic to fish and aquatic organisms than diquat, and has very low risk to other wildlife forms (Table 3-14). Application timing could avoid most susceptible (water-associated) stages of amphibian development, if this information is available for resident herptiles at the treatment site (ENSR 2005g).

Hexazinone: The commercial formulas are less toxic than hexazinone by itself and the liquid form is more toxic than granular. For granular formulations, none of the hazard quotients for mammals exceed a level of concern even at the highest application rate. For liquid formulations of hexazinone, hazard quotients exceed the level of concern at all application rates and all of the scenarios involving residue rates for contaminated vegetation or insects (Fletcher et al. 1994). Hexazinone and its degradates are persistent and highly mobile and hexazinone has been identified as a groundwater contaminate in some states. Bullfrogs were slightly more susceptible to behavioral change (diminished response to prodding) than leopard frogs over a 9-day study but amphibian studies were not adequate to determine the $LD_{50.}$ Hexazinone poses zero to moderate risk to mammals for ingestion under both acute and chronic scenarios (Table 3-15). Birds are more tolerant than mammals (SERA 2005c).

Imazapic is an ALS-inhibitor that rapidly metabolizes and does not bioaccumulate. It is effective against medusahead, leafy spurge, and cheatgrass, which adversely affect wildlife habitat. Imazapic is not highly toxic to most terrestrial animals. Mammals are more susceptible during pregnancy and larger mammals are more susceptible than small mammals. Imazapic has low toxicity to honeybees. No adverse short-term exposure risks to birds were noted for imazapic, but some chronic growth reduction was noted. None of the risk categories for susceptible or non-susceptible shows any ratings that exceed the LOC. Imazapic is one of the lowest toxic risks to wildlife of herbicides evaluated in this EIS along with other ALS-Inhibitors (SERA 2004c).

Imazapyr is approved for aquatic use and is an ALS-inhibitor. There was no bioconcentration in aquatic Daphnia and toxicity is apparently low. There is a lack of information on dose levels that demonstrate harm to mammals, amphibians, or birds. Effects of field studies (Brookes et al. 1995) suggest observed changes to birds and mammals following treatment are habitat related, and not due to toxic effects. Imazapyr is one of the least toxic aquatic herbicides evaluated (except for accidental spill for susceptible fish). Imazapyr is only slightly more toxic than the other ALS-inhibitors, all of which are the least toxic of any of the herbicides evaluated (SERA 2004d).

Metsulfuron methyl is an ALS-inhibitor that does not appear to bioaccumulate. Metsulfuron methyl can be effective for invasive weeds that are unsusceptible to other herbicides. None of the acute or chronic exposure scenarios exceeded the LOC at the typical rate, and few exceeded LOC at maximum rate. Metsulfuron methyl has very low toxicity to birds for direct spray and consumption; no mortality of acute spray on honeybees; and, aquatic invertebrates do not appear to be susceptible. One study on Rove beetle indicated reduced egg hatching. Daphnia are relatively tolerant. Like other ALS-inhibitors, it is one of the least toxic of herbicides evaluated (SERA 2004e).

Sulfometuron methyl is an ALS-inhibitor. Sulfometuron methyl could be used to control weeds in riparian areas when no water exposure is likely. It is highly toxic to aquatic plants. The Ecological Risk Assessments indicated no risks to aquatic invertebrates from any scenario. All scenarios indicate no rating that exceeded the LOC, although it may be moderately toxic to amphibians. Sulfometuron methyl has the lowest risk to all groups of wildlife of the herbicides evaluated (with other ALS-inhibitors). Site-specific evaluations prior to treatment could reduce potential risks to amphibians possibly occurring in riparian treatment areas (SERA 2004f). Sulfometuron methyl can cause malformations in amphibians (SERA 2004f), but whether the malformations are caused by endocrine disruption, cellular toxicity, or other pathways has not been reported.

Tebuthiuron: Direct spray of tebuthiuron at the typical rate is not likely to pose risks to small mammals, although there are some risks to birds at typical and maximum rates—primarily due to ingestion of contaminated food. It has low acute toxicity to insects and direct spray is not a concern to aquatic invertebrates. Off-site drift issues related to tebuthiuron are unlikely to affect aquatic wildlife, but accidental spray exceeded LOC for aquatic invert risk in ponds or streams. At low rates, tebuthiuron can help restore ecological mosaics in sagebrush ecosystems important to sage grouse and pygmy rabbits (Crawford et al. 2004, ENSR 2005k).

Triclopyr is approved for aquatic use and can be used on saltcedar, watermilfoil, and purple loosestrife, all species known to adversely affect wildlife habitat. Triclopyr, as triethylamine (TEA) salt and butoxyethyl ester (BEE), is covered in the Risk Assessments. Some formulations of the TEA salt of triclopyr have been labeled for aquatic weed control. Triclopyr TEA is less toxic to wildlife than triclopyr BEE. The major metabolite of triclopyr, 3,5,6-trichloro-2-pyridinol (TCP) has about the same toxicity as triclopyr. At the upper range of exposures, hazard quotients for triclopyr exceed the LOC for large mammals, but average hazard quotients do not exceed the LOC for any exposure scenario. Triclopyr acid is practically non-toxic to slightly toxic to birds and triclopyr TEA and triclopyr BEE are practically non-toxic to birds. Consumption of treated vegetation (and insects) is the greatest concern for birds or mammals. Of aquatic-approved herbicides evaluated in this EIS, triclopyr risk is about average. Using less toxic formulas reduces risk (SERA 2003c).

Habitat Change Resulting from Invasive Plants

The International Union for the Conservation of Nature (IUCN) notes that a significant proportion of species now considered extinct were driven to extinction by invasive species, and generally ranks invasive species as one of the top ten threats to currently threatened species (IUCN 2008).

Loss and degradation of habitat is a major contributor to native wildlife population declines (PIF 2002, Noss et al. 1995). Native bird diversity has been positively correlated with native plant diversity (by volume), but had no or negative correlation with exotic vegetation (Mills et al. 1989, Germaine et al. 1998). Wilcove et al. (1998) documented that invasive species have adversely affected approximately 46 percent of the plants and animals Federally Listed as endangered species (USDA 2003b). Severe weed infestations can cause declines in native diversity, habitat quality, and ecosystem function (Asher 2000, Lacey and Olsen 1991). Russian knapweed infestations resulted in severe reductions of kangaroo rat and ground squirrel populations in Wyoming (Johnson et al. 1994). Spotted knapweed invasion was found to reduce available elk winter forage 50 to 90 percent (Duncan 1997). Herbivores avoided leafy spurge (Trammell and Butler 1995). The thorns and seedpods of many invasive plants can kill or injure wildlife (Archer 2001). Bats and hummingbirds have been killed by entrapment on burdock seedheads (burrs) (Raloff 1998).

Weeds can particularly devastate riparian wildlife habitat. Thompson et al. (1987) found that muskrats and long-billed marsh wrens leave marshes infested by purple loosestrife. Mammal, reptile, and amphibian populations were reduced when habitat was invaded by weeds (Duncan et al. 2004). Saltcedar reduced habitat for some birds, reptiles and mammals (Zavaleta 2000) but more human-communal species such as crows, magpies and mourning doves were more common in saltcedar sites (Harmon et al. 2006). Non-native weeds can choke out native species and fill-in open water areas to adversely impact amphibians, which prefer a proportion of open water in their habitat (Brotherson and Field, 1987, Dudley 2000, Horton 1977). Haycock (1999) reported that Oregon spotted frog populations are threatened by the invasion of reed canary grass that reduces open-water habitat in their shallow marsh habitats.

Some wildlife apparently benefit from, or at least tolerate, invasive plants, but invasive plants seldom provide wildlife the same food and cover quality as native species. American goldfinch and red-winged blackbird utilize purple loosestrife (Kiviat 1996, Thompson et al. 1987); non-native chukar will utilize cheatgrass early in the spring (Csuti et al. 1997), and; elk, deer and rodents eat rosettes and seed heads of spotted knapweed and dandelion. Forage quality is reduced in weedy habitats (Bedunah and Carpenter 1989, Rice et al. 1997b, Trammell and Butler 1995), and functional cover for many species of wildlife is reduced. The few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000).

Recruitment and survival of juvenile sage grouse (Special Status) is considered to be positively correlated to the historic amount, distribution and pattern of sagebrush habitat (Connelly et al. 2004), which is negatively affected by the increase in invasive annual grasses (Hagen 2005, Wisdom et al. 2005) and the increase in western juniper expansion (Hagen 2005, Wisdom et al. 2005, Suring et al. 2005). The increase in western juniper increases perches for predatory birds, which increases predation (lethal population impacts) on sage grouse. Annual invasive grasses increase fire frequency beyond the historic fire interval and often results in an annual grass/fire system that prevents sagebrush reestablishment. This changes disturbance patterns, which lowers the fitness of most of the native sagebrush wildlife species such as sage grouse, pygmy rabbits, and Brewer's sparrows (all Special Status), and increases chronic lethal impacts on those species.

Western pond turtles (Special Status) require bare, sandy soil near water to dig nests in which to deposit eggs. The eggs need the thermo-regulation of the non-vegetated soil to mature. Purple loosestrife, Himalayan blackberry, and other noxious weeds can quickly overtake bare soil in riparian areas, changing the solar regulation processes. Turtles are forced to lay eggs that don't mature, move further from riparian areas (increasing predation), or fail to nest at all (Hays et al. 1999).

Leafy spurge invades grasslands and changes the vegetative structure. Changes are beneficial for western meadowlarks but adverse for savannah and grasshopper sparrows (Scheiman et al. 2003).

Some invasive plants (such as knapweed) contain chemical compounds that make the plant unpalatable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen, or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999). Invasive plants can act as a population sink by attracting a species and then exposing them to increased mortality or failed reproduction (Chew 1981). For example, Schmidt and Whelan (1999) reported that native birds increased their use of exotic honeysuckle and buckbrush shrubs over native trees, even though nests built in the exotic shrubs experienced significantly higher mortality rates.

Maintenance or improvement of conditions and processes found in healthy native ecosystems would have beneficial long-term effects to the native wildlife that are associated with that ecosystem, particularly rare species. Alternatives that protect or restore the greatest number of acres of native vegetation (see Table 4-4 in the *Noxious Weeds and Other Invasive Plants* section) would have correspondingly greater benefits to wildlife populations, particularly when Standard Operating Procedures and PEIS Mitigation Measures reduce or avoid short-term adverse effects. One of the two objectives of the BLM's Special Status Species policy is "to initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA" (USDI 2008d).

Habitat Change Resulting from Vegetation Treatments

Native wildlife may use invasive plants but they are seldom dependent upon them; they would typically fare better with native plants. Invasive plants such as blackberries are still more detrimental to native wildlife habitat than the benefits they provide because they displace more valuable native fruiting shrubs. Some of the species benefitting from invasive plants are actually exotics such as starlings. There is potential for localized adverse effects to wildlife habitat from weed control treatments resulting from the collateral damage to native species. The potential for such habitat changes to adversely affect species would depend upon the vegetation species affected, the percent of native vegetation within the home range/population of a species that is affected, the importance of that vegetation to the resident wildlife, and the availability of unaffected vegetation in the treatment area.

Few broad-scale treatments of native vegetation are anticipated to be conducted under any of the alternatives unless they are specifically designed to benefit wildlife habitat (Chapter 3, *Assumptions about Herbicide Treatments*). Invasive plant treatments are generally directed only at noxious weeds and other invasive plants, either by treating only the invasive plant or by using a selective herbicide. The objective of those treatments is to remove weeds and restore native (or other non-invasive) vegetation. Treatments are designed to reduce damage to native vegetation and reduce unnecessary site disturbance that favors reinvasion by invasive plants.

Most weed treatments are spot treatments directed at specific plants. Collateral damage to native habitats is insignificant or limited to the immediate area. The BLM uses non-herbicide methods with care, by design, or uses the smallest amount of herbicide that will kill the weed, so that the risk of non-target mortality is low. The *Native and Other Non-Invasive Vegetation* section in this Chapter notes that the risk to non-target plants from herbicide treatments is less under the action alternatives than under the No Action Alternative (Alternative 2). Some habitats are so infested with weeds they offer little suitable habitat for native wildlife. It is unlikely that sites too heavily infested with weeds for spot treatments but still retaining enough native vegetation to serve as important habitat for native wildlife species, would be treated unless there are over-riding objectives, such as restoration of Special Status species' habitat or special use areas.

Disturbance to Wildlife in or Near the Treatment Areas

Both herbicide and non-herbicide treatments have the potential to disturb wildlife. Disturbance may disrupt normal behavior to the extent survival of adults is impaired or reproduction compromised depending on the intensity of disturbance, extent of habitat affected, duration of the activity, and whether the activity occurs during a vulnerable time such as when the animal is restricted to a nest, breeding area, or winter range. If an animal is frightened from its habitat, displacement away from habitat can be as short as a few hours or as much as several days. Disturbance can be most significant for rare species such as the pygmy rabbit, because effects to individuals can adversely affect already reduced populations in fragmented habitat.

Vehicle Use: Up to 33 percent of herbicide application is anticipated from vehicles (ATV/Trucks) off roads (Chapter 3), and 20 percent is predicted to occur from existing roads. OHVs are used almost exclusively to carry mix tanks for individuals on foot to spot-spray target weeds. The vehicles travel slowly to avoid accidents and spills, reducing the potential for adverse effects when compared to other types of vehicle effects. Equipment (e.g., mowers) and vehicles can also hit or injure ground nesting birds, amphibians, reptiles, invertebrates and small mammals and their nests, particularly sessile mollusks or wildlife like grouse that "hide and cower." Vehicles can break down pygmy rabbit "tunnels" through the sagebrush making the rabbits more vulnerable to predation. Raptors and corvids have learned to follow human pathways and prey on ground nesting birds, causing increased mortality. OHVs or small crews of individuals doing spot-treatments would likely have negligible disturbance impacts to most common wildlife. Clearances for Federally Listed and other Special Status species would identify the important habitats of rare species so potential disturbance/disruption to those areas could be avoided, at least during the most vulnerable periods of the year.

Manual/Mechanical/mowing/planting treatments may involve chainsaws and motorized equipment that have the potential to disturb or disrupt species during vulnerable life stages. Manual treatments are more likely to require repeated treatments (and cause increased disturbance risks). Mowing/chaining, plowing have disruption potential due to noise, and also could kill or injure sessile or slow-moving wildlife such as mollusks, worms or non-flying insects, newly-born young, or immobile life forms such as eggs that are in the direct path of ground-disturbing machinery. The extent of direct injury is dependent on the duration of the disturbance, the footprint of the ground-disturbing/habitat changing treatment, time of year of the activity, the density and vulnerability of native wildlife in the treatment area, and acres affected.

Directed livestock has some potential for disturbance because the activity is intensive and highly focused. Directed livestock grazing would likely occur in areas where weed density has already severely degraded native wildlife habitat. Disturbance to native wildlife would be insignificant and short-term.

Biological controls would have negligible disturbance effects occurring when biological agents are released, and monitored.

Prescribed Fire for Weed Control: Most native wildlife populations have adaptive mechanisms that facilitate their resilience to natural disturbances. Russell et al. (1999) summarized the literature on herptile (and other wildlife) responses to fire and noted that most wildlife can avoid harm by leaving the treatment area or by burrowing. Although there is potential for some harm or mortality during vulnerable periods (snake skin-shedding was mentioned), they cite Means and Campbell (1981) "it is illogical that animals associated with fire vegetation are not themselves at least behaviorally adapted to resist mortality by fire" and cite Lyon et al. (1978), Wood (1981): "high levels of fire-induced mortality also appear to be uncommon in many species of birds and mammals." Prescribed fire, which often occurs earlier in the season or during wetter times of the year than wildfire, might occur during breeding seasons and thus might have more potential to kill or injure immobile species, eggs, and young.

Herbicide application has disturbance potential. Foot traffic from people using backpack sprayers or daubing herbicide is similar to foot traffic disturbance from manual methods (hand pulling). Crews work slowly and wildlife have time to move out of the way (USDA 2005a). The disturbance effects of power sprayers and motorized equipment could be considered similar to that of chainsaws, although crews might move through an area more quickly. The disturbance from boom-sprayers is similar to vehicle and OHV effects, but boom sprays would generally be used only along roads and other rights-of-way. Aerial applications can cover large areas and be intense, but disturbance at any one area is of short duration. Wildlife varies in their sensitivity to over-flight disturbance, but most response would be indirect and related to wildlife leaving cover or food for various periods.

Effects by Alternative

Reference Analysis – No Herbicide Use

Disturbance Effects: Not using herbicides would result in a net decrease of 3,400 acres of habitat treated annually compared to the No Action Alternative (Alternative 2), so the potential of short-term impacts to wildlife in the treatment area would decrease. No herbicide impacts would result to wildlife from BLM activities under this alternative. Compared to the No Action Alternative, the 1,600-acre increase in mechanical treatments, particularly those with ground-disturbing potential such as plowing/disking or chaining, would have greater disturbance potential to native wildlife in the treatment area than any of the alternatives. Some sites would be disturbed several times to meet the same weed treatments result, since the effectiveness of treatments without herbicides is predicted to average 30 percent.

Invasive Plant Effects: Because non-herbicide methods are not particularly effective at controlling about 2/3 of the noxious weeds in Oregon (Appendix 7: Table A7-1), a no-herbicide strategy would reduce opportunities to control several weed groups that adversely affect wildlife habitat. These groups include the annual grasses which have severely affected the sagebrush ecosystem (sage grouse, pygmy rabbits), Oak Woodlands (Columbia white tail deer, other ungulates, upland game birds), and the Siskiyou Biome (Mardon skipper). This strategy would also preclude the use of pre-emergent herbicides that can be effective in restoring wet meadow habitats, where soil or ground-disturbing effects would preclude plowing/disking, or where such post-treatment herbicide treatments are needed after mechanical treatments to prevent new (or different) weed invasion. Limiting the tools available for restoration activities could result in important wildlife habitat being untreated because successful native habitat restoration would not be assured.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Herbicide and Non-Herbicide Treatment Effects: The four herbicides available under this alternative include two of the six herbicides proposed in this EIS that have high risk categories to wildlife (including aquatic invertebrates): 2,4-D and glyphosate. Glyphosate can be moderately toxic to amphibians, most likely due to the surfactant POEA. The current 12 percent rate of spread increases the number of acres that may be exposed to increased disturbance resulting from treatments and a higher chance of adverse exposure to herbicides from treatments. The use of broad-spectrum herbicides like glyphosate increases the risk of damage to non-target vegetation important to wildlife. Glyphosate and 2,4-D are the only herbicides under Alternative 2 authorized for aquatic weeds, and each has the possibility of adverse impacts to amphibians. Glyphosate may be a poor choice for aquatic weeds because it dilutes rapidly in water, and can adhere to soil particles at label rates before it reaches levels toxic to target plants.

Invasive Plant Effects: The inability to control invasive plants that are not yet listed as noxious weeds increases the chance that new invasive plants might become well established prior to being controlled; thus, habitats are more difficult to protect. In addition, none of the herbicides under Alternative 2 are selective against annual grasses, so medusahead and cheatgrass would continue to degrade sage grouse and other habitats. Approximately 1/3 of the BLM lands in Oregon are projected to be infested with noxious weeds in 15 years, with a corresponding decrease in their value to wildlife. Restoration and recovery for rare species could be deterred when invasive plants invade their habitat.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Herbicide Effects: The wider choice of herbicides available under this alternative would increase the likelihood that a more target-specific herbicide could be used to reduce collateral damage in or near the treatment area. Alternative 3 includes the use of three herbicides that had risk levels below the Level of Concern (LOC) for all evaluated wildlife under all scenarios: chlorsulfuron, imazapic and sulfometuron methyl.

Alternative 3 adds three more herbicides approved for use in aquatic habitats, facilitating the selection of herbicides with less toxic effects to aquatic wildlife. The likelihood of having an herbicide that can be used to treat invasive plants within habitats occupied by rare wildlife species would be substantially increased under this alternative. The addition of imazapyr as an aquatic herbicide allows use of an herbicide with zero risk to aquatic invertebrates at typical application levels (Table 3-15). It would provide an alternative to glyphosate where there may be amphibian concerns.

Invasive Plant Effects: More habitat would be protected under this alternative and more weeds could be curtailed before they become established, compared to the No Action Alternative (Alternative 2); noxious weeds are projected to infest 1.9 million fewer acres in 15 years. Alternative 3 also would extend herbicide treatments to invasive plants not yet listed as noxious weeds. Sagebrush Steppe Biome wildlife would benefit from imazapic to control cheatgrass and medusahead; none of the treatment measures or herbicides available in Alternative 2 are as effective at controlling these invasive annual grasses. Tebuthiuron could help restore essential sagebrush mosaic seral patterns. The additional herbicides expand integrated vegetation management options, such as combining herbicides following burns to reduce the chance of target weeds from re-establishing, or other weeds from invading the burn site.

Disturbance Effects: Additional herbicides provide managers with more flexibility to tailor treatments to benefit wildlife by allowing use of herbicides with wider seasonal windows (making avoidance of susceptible wildlife periods more feasible), and facilitating greater opportunities to implement integrated vegetation management strategies that combine herbicides and non-herbicide treatments to more specifically meet ecological goals. Herbicides have lower ground-disturbing effects, so there would be less chance of disturbance to microsites for mollusks, reptiles, birds, and invertebrates.

Sudden Oak Death: Treating Sudden Oak Death-infested native habitat with herbicides could reduce, but not avoid, the adverse effects to wildlife caused by treating Sudden Oak Death under Alternative 2. Sudden Oak Death occurs in late seral coniferous forests in western Oregon that is also essential habitat for the Federally listed marbled murrelet and northern spotted owl. The non-herbicide treatment for Sudden Oak Death includes cutting of infested plants and susceptible plant species, and repeated burning (USDA, USDI 2008). The intensive and repeated treatment for Sudden Oak Death under non-herbicide methods has adverse disturbance effects on both of these species. The loss of vegetation and habitat inherent to Sudden Oak Death treatment cannot be avoided, but repeated mechanical and permanent ground disturbance related to treatment of Sudden Oak Death areas could be reduced with the use of herbicides, and the higher likelihood of control will benefit wildlife. Many of the host species affected by Sudden Oak Death are also important for wildlife forage and structure. See the *Pests and Diseases* section for more details about Sudden Oak Death.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects include all those described for Alternative 3, in addition to the following:

Effects of Herbicides: Many of the Conservation Strategies identify weeds and habitat degradation as a factor contributing to the rare status of the species. The ability to use herbicides for certain habitat improvements would increase the number of acres treated for wildlife recovery. For example, low-dose application of tebuthiuron can be an effective herbicide to help restore sagebrush mosaics in sage grouse restoration (Olson and Whitson 2002, Johnson et al. 1996). The use of herbicides as a restoration tool for wildlife habitat can reduce or avoid the adverse effects associated with fire or mechanical methods.

Alternative 4 would also make herbicides available to treat rights-of-way, administrative sites, and recreation sites. Treating native and other non-invasive vegetation on these sites would increase the risk of herbicides on plants being ingested by wildlife. Diuron, bromacil, and tebuthiuron become available under this alternative, although diuron and bromacil are normally applied to soil or very low growing vegetation where the maintenance of bare ground is the objective. Diuron has a higher risk than some of the herbicides available under Alternatives 2 and 3, primarily for ingestion situations for mammals, but it also has lower risk for birds at the typical rate than some of those same herbicides. Bromacil is one of the herbicides with lowest risk to invertebrates, and is one of the least impactful of herbicides that have risks for Special Status species. Ingestion for most wildlife is unlikely because bromacil will be used as a pre-emergent herbicide. Tebuthiuron has no more than low category for typical application rates in all exposure scenarios including those to Special Status species. Some animals, like deer, will seek out openings, such as rights-of-way because they provide lower growing succulent plants. Bears and other large mammals often use road or power line rights-of-way for travel because the reduced vegetation is easier to navigate, and raptors will often hunt along the openings. Exposure through ingestion of herbicide-contaminated forage is increased if diuron is applied to forage vegetation in these areas.

Effects of Invasive Plants: Wildlife habitat would benefit from the reduced spread of noxious weeds and other invasive plants; noxious weeds are projected to infest 300,000 fewer acres in 15 years under Alternative 4 than under Alternative 3.

Effects of Treatment: Herbicides are projected to be used on 9,300 acres to meet native and other non-invasive vegetation control objectives in and adjacent to rights-of-way and other developments. These objectives are currently being met with other non-herbicide methods. Roadsides would most likely be sprayed with low boom nozzles fixed to vehicles on the road; power line and other linear rights-of-way could be treated similarly using existing access roads, and in some instances east of the Cascades, aerial application could be used. Disturbance effects to wildlife are low at many of these sites because the development often displaces animals that are susceptible to noise and activity away from these areas, limiting their exposure, or they become habituated to it. In any event, herbicide application activities would be no more disturbing than current non-herbicide treatments.

Continued maintenance of early seral vegetation under power lines can be beneficial to some species. A symposium of papers evaluating rights-of-way across the United States and Canada included several studies where rare species used or even benefitted from right-of-way habitat and vegetative treatments (including herbicide treatments) on those areas (Goodrich-Mahoney et al. 2000). Wildlife could be adversely affected by herbicides and/or habitat change when sites are treated, but it is the maintenance of current conditions that keeps the early seral habitat from being converted to less favorable conditions due to natural succession.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects include all those described for Alternative 4 (Proposed Action), in addition to the following.

Effects of Herbicides: The moderate residual effect of diflufenzopyr + dicamba could affect insects and mammals in treatment areas because of proposed use in forest and rangeland situations. Diquat is one of the most hazardous herbicides for wildlife proposed in any of the alternatives, but use is limited to aquatic applications where it could be used to control giant salvinia if it were to enter Oregon or as a back-up for one of the other aquatic herbicides if they were to become ineffective. The effects on desirable aquatic wildlife would be evaluated at the site-specific level. Additional site-specific mitigation could be applied, where appropriate, to reduce effects. In the case of both herbicides, the proposed use is low.

Effects of Treatments: Approximately 4,800 additional acres would be treated under Alternative 5, and these could be for a full range of vegetation management objectives except livestock forage and timber production. Most of this increase is expected to go to additional wildlife habitat improvement treatments not included in Alternative 4 (Proposed Action). Native vegetation such as rabbitbrush and western juniper could be treated in this scenario, for example, to help restore healthier native sagebrush habitats.

Alternative 5 has the greatest opportunity for wildlife habitat improvement treatments, and potentially the greatest positive effects to wildlife. Re-establishing ecosystems to be sustainable under fire disturbance could have long-term benefits to the wildlife populations in those ecosystems. Wildlife habitat improvement treatments that restore complex mosaic shrub/forb/bunchgrass communities would generally be beneficial to sagebrush-dependent wildlife (Crawford et al. 2004). Any adverse effects would be considered at the site-specific level. There could be potential short-term impacts from the treatment of native shrubs such as rabbitbrush, which can be locally important to pollinators (Stephen, B. pers. comm.), or to herbivores where in the late season more palatable vegetation is unavailable (Clements and Young 1997). Treatments designed to reduce fire risk may have short-term adverse impacts to wildlife. Vegetation changes that are sufficient to reduce fire risks can be more extensive and intensive than weed treatments, and thereby have a greater chance of reducing native vegetation important to local wildlife for the short-term.

Cumulative Effects

Native wildlife in Oregon has been influenced by dozens of stressors since the onset of European settlement. Habitat continues to be lost to natural and anthropogenic disturbances, resulting in highly fragmented habitat for most wildlife species and population levels decreased from historic levels. Wildlife that prefer or tolerate human activities and habitat changes such as coyotes and ravens have increased, often outcompeting less adaptable wildlife. Invasive plants and animals reduce native wildlife survival and contribute to unhealthy ecological systems, unbalanced communities, and decreased connectivity.

Use of herbicides, fungicides, fertilizers, and insecticides contribute to the landscape levels of chemicals in the environment (Table 4-1). Some of the more toxic (generally non-BLM) chemicals can accumulate in wildlife over the long-term (Belden et al. 2006). Several other herbicides such as alachlor, diquat, glyphosate, picloram, and 2,4-D also have been detected in surface and ground water, and the EPA has assigned MCLs to all of them

(Stevenson et al. 1997). Field studies of herbicide effects are few and some unforeseen risks may exist (Blus and Henny 1997). There is a chance of additive chemical reactions in downstream waterways from combining off-site herbicides from BLM projects with runoff from more dangerous insecticides used in intermingled private agricultural lands. The BLM reduces this risk as much as possible by using targeted application methods, herbicides with low persistence and low toxicity, and establishing buffers around susceptible areas.

BLM lands make up 25 percent of the lands in Oregon, a high percentage of the habitat for native wildlife remaining in Oregon, and 70 percent of the remaining Oregon sage grouse habitat (Hagen 2005). The addition of more tools to control weeds under any of the action alternatives would improve opportunities to more effectively work cooperatively across multiple ownerships. Neighbors may be more inclined to treat weeds adjacent to BLM if the BLM lands were also treated and were not a source population for reintroduction of noxious weeds. Weed treatment partnerships would be more effective within logical control areas.

The Proposed Action (Alternative 4) is projected to result in 2.2 million fewer acres of noxious weeds over the No Action Alternative (Alternative 2). When used in conformance with the Standard Operating Procedures and PEIS Mitigation Measures, and after site-specific analysis, the herbicide risks to wildlife appear to be less than the documented effects of additional infestations of invasive plants. Although use of some of these herbicides may pose some risk to individuals within a wildlife population in some cases, the reduction or slowing of invasive plants at this magnitude will benefit wildlife populations and vegetation community health on a landscape scale.

Livestock

Affected Environment

Approximately 14 million acres of public lands in Oregon are open to livestock grazing, with use levels established in land use or resource management plans and administered through the issuance of grazing permits/leases. The majority of the grazing permits issued by the BLM involve grazing by cattle, with fewer and smaller grazing permits for other kinds of livestock (primarily sheep and horses).

The BLM conducts grazing management practices through BLM Manual Handbook H-4120-1 (Grazing Management; USDI 1984a). Management of livestock grazing is authorized and enforced through both permits and leases. The grazing permit establishes the allotment(s) to be used, the total amount of use, the number and kind of livestock, and the season of use. Term grazing permits/leases may also contain terms and conditions as appropriate to achieve management and resource condition objectives. Allotment management plans further outline how livestock grazing is to be managed to meet multiple-use, sustained yield, and other needs and objectives, as identified in the resource management plans.

Rangeland Health Standards and Guidelines for Livestock Grazing Management for Oregon and Washington were approved by the Secretary of the Interior in August 1997 (USDI 1997). The standards are expressions of the physical and biological condition or degree of function necessary to sustain rangeland ecosystems. The standards, designed to comply with 43 C.F.R. 4180, direct management toward the maintenance and restoration of physical function and biological health of rangeland ecosystems. The five standards are:

1) watersheds are in or making significant progress towards properly functioning physical condition in uplands areas;
2) watersheds are in or making significant progress towards properly functioning physical condition in wetland-riparian areas;

3) ecological processes including the hydrologic cycle, nutrient cycle, and energy flow are maintained;
4) water quality complies with State water quality standards; and,
5) significant progress is being made toward restoring or maintaining habitats for all Special Status species.

Reviews of rangeland health standards are often conducted when grazing permits or leases expire, particularly when those permits or leases are within Clean Water Act section 303(d)-listed streams or Essential Fish Habitat watersheds.

Public lands provide an important source of forage for many ranches, especially during spring and summer months, allowing private lands to be devoted to the production of feed sources and resources to sustain operations the remainder of the year. Grazing on these lands helps support the agricultural component of many communities scattered throughout the west. As of February 2009, the total number of grazing permits/leases in Oregon was 1,286, with 1,022,645 Animal Unit Months (AUMs) authorized (USDI 2009a). Most grazing is east of the Cascades. Authorized livestock grazing west of the Cascades is limited to portions of Josephine and Jackson Counties. The 88 grazing leases in these two counties have a composite authorized or allowable use of up to 15,220 animal unit months (AUM) on an estimated 329,995 acres. Actual livestock AUM use west of the Cascades is generally far less due to variations in individual operator preferences, seasonal availability of forage, and other factors. Some leases are inactive and others are planned to be phased out over time (i.e., 49,423 acres, 2,714 AUMS, and 11 grazing leases in the Cascade Siskiyou National Monument in Josephine County).

Livestock consume annual and perennial native and introduced grass species, and seasonally utilize forbs and some shrubs. Healthy plant communities support current livestock grazing levels. Invasive plants reduce forage for livestock, degrade plant community health, and result in reduced capacity to sustain existing grazing levels. A combination of invasive plants and shorter fire return intervals[59] can further limit forage use from year-round, to seasonal, or to none at all.

Some grazing permit holders are seeking, or have, organic certification. Herbicide use within these allotments could conflict with this objective.

Environmental Consequences

This section addresses the reasonably foreseeable effects of the alternatives on livestock grazing on BLM lands in Oregon. The effects of the alternatives on other ecological functions of rangelands are described in other resource sections in this Chapter. It is recognized that all alternatives exclude herbicide use specifically for livestock forage production. That means that herbicide use proposals will not, either as an objective or as an evaluation criterion, have a site-specific forage production purpose. Noxious weed (and pest and disease) treatments are driven instead by weed control objectives including stopping new weeds from getting a foothold, preventing existing weeds from spreading to new areas, protecting or restoring susceptible areas such as Special Status species' habitats, and preventing weeds from spreading to adjacent non-BLM lands. Such treatments could occur in grazing areas in part because invasive plants can occur anywhere and in part because disturbed sites are favored by most noxious weeds and other invasive plants, and livestock can serve as a vector.

Nevertheless, noxious weed control efforts are going to affect future grazing numbers, much the same way control efforts will affect such things as water quality, and visual resources. Economic effects, including those resulting

59 Reference is to the cycle of invasive annual grasses like cheatgrass, and their effect of substantially shortening natural fire return intervals at the expense of native (and more palatable) vegetation.

from lost productivity on grazing lands within the State are one criterion the State uses when considering whether to designate non-native plants as noxious weeds. To the degree BLM noxious weed treatments contribute to the control and elimination of weeds the State and neighboring landowners have identified as needing control, Chapter 1's *Purpose* number 5 of cooperatively controlling invasive plants so they do not infest or reinfest adjacent non-BLM lands, will be furthered.

Effects to livestock from the Proposed Action (Alternative 4) or one of the other action alternatives could result from direct or indirect contact with the herbicides, from inadvertent reductions in forage amount and preferred forage type, and from the reduction of noxious weeds and restoration of native vegetation.

Effects Common to All Alternatives

Effects of Herbicides on Livestock

The extent of direct and indirect impacts to livestock from herbicides would vary by the application method, herbicide used, physical features of the terrain including the presence of forage, and the weather conditions at the time of application. Possible adverse direct effects to individual animals include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. The impacts of herbicide use on individual livestock would depend directly on the susceptibility of each species to the particular herbicides used, how the individual animal was exposed to the herbicide, and indirectly to the degree to which a species or individual is positively or negatively affected by changes in rangeland conditions, including forage quality and availability. Livestock would have a greater chance of being adversely impacted by herbicide use if the pasture or use area was partially or completely sprayed because they would have greater exposure to herbicides through direct contact with the herbicide upon application or indirect contact via dermal contact with vegetation or ingestion of vegetation.

When herbicide labels prohibit grazing, or risks are otherwise anticipated, exposure is typically reduced by the removal of livestock during vegetation treatments, scheduling treatments when livestock are not present, temporarily fencing the treated area, or herding the livestock away from the treatment area and shutting off water or using other techniques to keep them away. However, the grazing permit holder would be adversely affected in the short term because of the area being temporarily unavailable for grazing purposes. Additionally, in the short term, there could be impacts to the sale and consumption of livestock because of mandatory restrictions (quarantine) associated with the use of herbicides. During the interim period, the permit holder may incur additional costs for replacement forage and/or a loss of income. Livestock may experience greater impacts in systems where herbicide transport is more likely, such as areas where herbicides are aerially sprayed adjacent to rangeland, dry areas with high winds, or areas where rainfall is high and soils are porous; however, these scenarios have not been modeled. The degree of interception by vegetation, which depends on site and application characteristics, would also affect direct spray impacts.

The impacts of herbicide use on livestock would be site and application specific, and as such, site assessments would have to be performed, using available impact information, to determine an herbicide use strategy that would minimize impacts to livestock.

Effects of BLM-Evaluated Herbicides

According to BLM Risk Assessments, herbicide exposure scenarios of direct spray, spill, and indirect contact with foliage after direct spray do not pose a risk to small mammals (large mammals were not modeled, but have a smaller surface area to body weight ratio, so are less likely to be impacted by these scenarios than small mammals; Table 3-14). Several herbicides do pose a risk to large mammalian herbivores under a scenario of ingestion of food items contaminated by direct spray, and these are presented below. The receptor chosen for the large mammalian herbivore was a 154-pound mule deer.

Bromacil does not present a risk to small mammals via direct spray or indirect contact with foliage after direct spray (Table 3-14; ENSR 2005b). These scenarios are very conservative because they assume 100 percent absorption and because small mammals have a relatively large surface area for absorption of herbicide. Therefore, it is unlikely that bromacil would affect larger livestock under these scenarios. Low chronic risk for large mammal ingestion at the typical rate, and low acute and moderate chronic risks for ingestion scenarios at the maximum application rate suggest direct spray of bromacil onto rangeland could pose a risk to livestock consuming sprayed vegetation, particularly if applied over large areas. However, bromacil is a non-selective herbicide that is not registered for application on rangelands or other livestock grazing areas where some vegetative cover is desired, suggesting that under typical use bromacil would not affect livestock. Any risk would come from off-site transport of bromacil to livestock grazing areas or treatment of vegetation in accessible rights-of-way. Use of bromacil in spot applications or over small areas is not likely to affect livestock. Based on label directions, there are no restrictions on livestock use of treated areas.

Chlorsulfuron risk quotients for mammals for all modeled scenarios were below the conservative LOC of 0.1, indicating that direct spray and ingestion of sprayed vegetation is not likely to pose a risk to livestock (Table 3-14; ENSR 2005c). Based on label directions, there are no restrictions on livestock use of treated areas.

Diflufenzopyr is not proposed for use alone. Risk quotients for terrestrial animals were all below the most conservative LOC of 0.1, indicating that direct spray of diflufenzopyr is not likely to pose a risk to livestock (Table 3-14; ENSR 2005d). Based on label directions, there are no restrictions on livestock use of treated areas.

Diquat: Low chronic risks for ingestion scenarios at typical rates, and low to moderate chronic and acute risks at maximum rate (Table 3-14; ENSR 2005e) suggest that livestock could be at risk from the short- and long-term consumption of vegetation contaminated by diquat. However, use on BLM lands would be limited to aquatic applications; diquat is not registered for rangelands. Thus, the likelihood of exposure of livestock to diquat is minimal. Livestock that feed exclusively in riparian areas where drift might be present on riparian grasses, and/or drink water from ponds treated with diquat, are potentially at risk. However, labels require livestock to be removed from areas with such exposures.

Diuron: There were no acute risks but low to moderate chronic risk if food was directly sprayed at the typical application rate; there would be low acute risk and moderate to high chronic risk if food was sprayed at the maximum application rate (Table 3-14; ENSR 2005f). However, because diuron is a non-selective herbicide not likely to be broadcast where vegetation is desired, and not registered for use on rangelands, exposure to livestock would be limited. Any exposure would likely be limited to rights-of-way use, off-site drift, or surface runoff. Based on label directions, there are no restrictions on livestock use of treated areas.

Fluridone: Risk quotients for large terrestrial animals were below the most conservative LOC of 0.1 for all scenarios (Table 3-14; ENSR 2005g). These results indicate that accidental direct spray or drift of this aquatic herbicide would be unlikely to pose a risk to livestock.

Imazapic: Risk quotients for terrestrial animals were all below the most conservative LOC of 0.1, indicating that direct spray or drift of imazapic would be unlikely to pose a risk to livestock (Table 3-14; ENSR 2005h). Based on label directions, there are no restrictions on livestock use of treated areas.

Dicamba + diflufenzopyr poses a low chronic risk to large mammalian herbivores that consume plants contaminated by direct spray at the typical application rate and a moderate risk for ingestion scenarios involving direct spray at the maximum application rate (Table 3-14; ENSR 2005i). Because it is proposed for use in rangelands and has moderate residual activity, livestock may be at risk from the application of this herbicide, particularly if it is sprayed throughout the range area. Based on label directions, there are no restrictions on livestock use of treated areas.

Sulfometuron methyl: This herbicide is relatively non-selective and would be used on rights-of-way, but it is not registered for sites that are grazed. Risk quotients for terrestrial animals were all below the most conservative LOC of 0.1, indicating that direct spray or drift of sulfometuron methyl would be unlikely to pose a risk to livestock (Table 3-14; ENSR 2005j).

Tebuthiuron: For large mammalian herbivores ingesting food items contaminated by tebuthiuron, there would be a low acute and chronic risk if the food was directly sprayed at the maximum application rate (Table 3-14; ENSR 2005k). The strength of this herbicide is its use as a habitat modifier in the BLM shrub reduction program; it is relatively non-selective but does not tend to harm grasses present. Therefore, impacts to livestock would be unlikely with intended use of this herbicide. According to the label for at least one formulation which has tebuthiuron as an active ingredient, if a treated area is to be used for haying or grazing, no more than 5 pounds per acre of formulation should be applied and the product should not be applied more than once per year.

Effects of Forest Service-evaluated Herbicides

Risk information for the following eight herbicides is taken from Ecological Risk Assessments completed by the Forest Service prior to BLM's completion of the PEIS. As part of its Risk Assessments, the Forest Service developed worksheets (SERA 2005b), which allowed the BLM to assess the risks of the herbicides using its own maximum application rates and LOCs (rather than the Forest Service rates and LOCs), and to parallel the BLM Risk Assessment process as much as possible. However, modeled risk scenarios for terrestrial animals may be different from those used for the BLM-evaluated herbicides, depending on the specificity of available toxicity data. The assessment of impacts below is presented using the Forest Service upper estimates of Hazard Quotients (HQ), to maximize the conservatism of the assessment. In addition, it should be noted that the HQs developed by the Forest Service (as well as the BLM) are already conservative for many reasons (e.g., assumption of 100 percent dermal absorption, assumption of 100 percent of diet contaminated, use of most sensitive values for exposure and dose/response assessments). Referenced risk quotients are displayed on Table 3-15.

2,4-D presents a low to moderate acute risk to livestock under several of the direct spray, ingestion, and spill scenarios, and a moderate chronic risk for large mammals for consumption of on-site contaminated vegetation under both typical and maximum rate (SERA 2006). The Risk Assessment suggests that because large livestock eating large quantities of grass and other vegetation are at risk from routine exposure to 2,4-D and because 2,4-D is considered for use in rangeland, it should not be applied over large application areas where livestock would only consume contaminated food. According to label directions for one formulation, dairy animals should be kept out of areas treated with 2,4-D for 7 days. Grass for hay should not be harvested for 30 days after treatment. Meat animals should be removed from treated areas 3 days prior to slaughter. Similar restrictions may be in place for other formulations.

Clopyralid: Large mammals face low acute risks from direct spray and from consumption of contaminated grass at the typical and maximum application rates. The maximum application rate also poses a low chronic risk to large mammals consuming on-site contaminated vegetation. All risks identified fall within the lowest risk category; adverse effects to livestock are unlikely with expected exposure scenarios. According to label directions, there are no restrictions on grazing or hay harvest following application at labeled rates, but livestock should not be transferred from treated grazing areas to susceptible broadleaf crop areas without first allowing for 7 days of grazing on untreated pasture.

Dicamba: The ingestion of food items contaminated by direct spray of dicamba at the typical and maximum application rate would pose a low and moderate acute risk to large mammalian herbivores respectively, and no chronic risk (Table 3-15). Because dicamba is proposed for use in rangelands and forestlands and does have moderate residual activity, livestock may be at risk, particularly if it is sprayed throughout the range area. Based on label directions, there are no restrictions on livestock use of treated areas, other than for lactating animals.

Glyphosate presents a low to moderate acute risk to livestock under several of the direct spray, ingestion, and spill scenarios, and a low chronic risk for large mammals for consumption of on-site contaminated vegetation under the maximum rate (SERA 2003a). Ingestion of treated grasses could represent a risk, but glyphosate is non-selective and kills grass, suggesting that spot applications in rangeland would be the most appropriate use of this herbicide (although risk could occur if invasive grasses were treated when they were young and palatable). Spot applications would reduce risks associated with consumption of contaminated vegetation, as fewer non-target areas would be impacted by direct spray or spray drift. Based on label directions, there are no restrictions on livestock use of treated areas.

Hexazinone: Applications of hexazinone at the typical and maximum application rates would pose a low to moderate acute risk to livestock under several exposure scenarios, and a low to moderate chronic risk to large mammals under the on-site consumption of contaminated vegetation scenario at typical and maximum rates respectively (SERA 1997). According to label directions, livestock should not be grazed, nor forage or hay cut, on treated areas for 60 days after application.

Imazapyr applications at the typical application rate should not pose a risk to livestock (SERA 2004d). The maximum application rate, however, would pose a low risk under the direct spray of a small animal and consumption of contaminated vegetation by large mammal scenarios. Imazapyr is not registered for use in rangelands; therefore, it is unlikely that impacts via direct spray or consumption of contaminated vegetation would occur. Based on label directions, there are no restrictions on livestock use of treated areas.

Metsulfuron methyl applications at the typical application rate should not pose a risk to livestock (SERA 2004e). Applications at the maximum application rate pose a low acute risk to small animals under scenarios involving 100 percent absorption of direct spray and to large mammals under scenarios involving consumption of contaminated vegetation. Metsulfuron methyl is registered for use in rangeland, but impacts to livestock are unlikely if the typical application rate is used. However, a supplemental label restricts the application on rangelands to 0.06 ounces active ingredient per acre.

Picloram poses a low to moderate risk for applications at the typical and maximum application rates for 100 percent absorption of direct spray by a small animal and acute exposure through consumption of contaminated vegetation by a large mammal (SERA 2003b). Picloram is registered for use in rangeland, and can be applied over large areas heavily infested with weeds, as its primary targets are broadleaf and woody species. Therefore, it might be used to manage certain broadleaved plants without impacting native or other desirable grasses, but with the potential to expose livestock. Picloram has a number of restrictions on use in areas grazed by livestock or used for cutting hay. In general, livestock should not be grazed on treated areas, nor should hay be cut, for 2 weeks after treatment.

Triclopyr presents low to moderate risk to livestock under several acute, and two chronic, scenarios, particularly through the consumption of contaminated vegetation (SERA 2003c). Because risk categories were determined using calculated HQs for the two evaluated forms of triclopyr (triclopyr acid and triclopyr BEE) are the same, no differentiation is made between these two forms in this section. Triclopyr can be used in rangelands to selectively manage woody species without impacting native or other desirable grasses, so broadcast treatments could create exposure scenarios if livestock are not removed or the treatment area is limited in scope. There are few grazing restrictions for triclopyr, except for lactating dairy cattle. Hay should not be harvested within 14 days of application. Although cattle can graze at any time, they would be removed from treated areas at least 3 days prior to slaughter.

Effects of Treatments on Forage

Possible adverse indirect effects from increasing herbicide use include reductions in forage amount and preferred forage type. However, analysis displayed in the *Native and Other Non-Invasive Vegetation* section in this Chapter indicates the risk to non-target plants is generally low and not dissimilar to the risk from non-herbicide treatments. As discussed in the *Assumptions about Herbicide Treatments* section in Chapter 3, broadcast treatments of invasive plants generally occur only with selective herbicides or in areas where invasive plants have essentially eliminated the native species. In any event, range conditions would generally benefit from the control of invasive plants, and any adverse native vegetation changes would begin to disappear within one to two growing seasons after treatment.

Effects of Noxious Weeds on Livestock

The spread of invasive plant populations would likely have harmful effects on livestock. Many studies and repeated landowner experiences show that weeds commonly reduce livestock carrying capacity from thirty-five percent to ninety percent (Hilken 1980, USDA 1994a). Yellow starthistle forms solid stands that dramatically reduce forage for livestock and wildlife. This species causes a fatal neurological disorder (chewing disease) when ingested by horses (USDA 2005a:3-9). Spotted knapweed has been found to reduce grass production from 60-90 percent (Harris and Cranston 1979, Bedunah and Carpenter 1989, Wright and Kelsey 1997) decreasing carrying capacity for livestock and lowering the quality of winter range habitat for wildlife (Rice et al. 1997a). Rangeland that contains excessive or unpalatable brush cover is less useful for grazing and has reduced carrying capacity for domestic livestock. Similarly, capacity for cattle grazing decreases proportionately with loss of forage caused by weed infestation. Economic returns in terms of improved grazing value typically exceed herbicide treatment costs on lands where herbicides are used to control weeds (Olson 1999). In addition, some noxious weeds are toxic to livestock including common tansy, leafy spurge, Russian knapweed, common St. Johnswort, and yellow starthistle.

Treatments that maintain or reduce the cover of noxious weeds and restore native and other forage vegetation on grazed lands would benefit livestock by increasing (or at least slowing the decline of) the number of acres available for grazing and the quality of forage. Decline in range condition from invasive weeds would be proportional to the acres projected to become infested over time. The differences between the alternatives could be expected to have differing effects on grazing capacity over the long term.

Effects by Alternative

Reference Analysis – No Herbicide Use

Under the Reference Analysis, livestock would not be affected by BLM herbicide use. Primary impacts would stem from other vegetation treatment methods and/or from the spread of noxious weeds and other invasive plants.

Effects of Invasive Plants: Without herbicides, there would be an increase in the spread of invasive plants, increasing the rate at which invasive plants replace native plant communities other non-invasive vegetation that livestock depend on for forage. Invasive plants are projected to occupy 2.2 million more acres in 15 years under the no-herbicide Reference Analysis than under the No Action Alternative (Alternative 2), damaging desirable plant communities including rangeland communities that provide forage for livestock. Other factors can exacerbate these effects on particular acres. Only about 1/3 of noxious weeds can be effectively controlled using non-herbicide methods. For example, it is often difficult to eradicate some species (e.g., resprouting shrubs or invasive annual grasses) by non-herbicide methods. In addition, non-herbicide methods can be impractical over large areas or in some situations because of cost, time, or public concerns. Large-scale non-herbicide treatments can adversely affect native plants, soils and other resources, and lead to a higher likelihood of reinvasion than spot or selective herbicide treatments.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

<u>Effects of Herbicides</u>: Although herbicides would be applied to fewer acres under this alternative than under any of the action alternatives, the potential toxicity of the four herbicides available under this alternative keep this alternative from having the least risk for livestock. As noted under *Effects Common to All Alternatives* above, 2,4-D and glyphosate present risks to mammals from direct spray and from consumption of contaminated grass at the typical and maximum application rates. Inadvertent spraying of grass and other forage near treated invasive weeds, as well as drift and other avenues, could result in exposure. Picloram also presents low to moderate risks under some exposure scenarios, and dicamba presents a low to moderate risk under food contamination scenarios for typical and maximum rate respectively.

<u>Effects of Invasive Plants</u>: Under the No Action Alternative (Alternative 2), native plant communities would continue to be impacted by cheatgrass and medusahead spread, decreasing plant diversity, habitat quality, and productivity thereby reducing forage for livestock and wildlife. Medusahead rye is a noxious weed infesting an estimated 600,000 acres of BLM lands in Oregon; it is considered non-forage for livestock as high silica content and other attributes render it unpalatable. The invasive cheatgrass infests another 5 million acres and except for a very few weeks early in the season, is similarly unpalatable. The frequency and intensity of wildland fire would increase as plant communities continue to become more infested with these two invasive annual grasses. Noxious weeds would continue to expand at their current rate, and are projected to infest about 1/3 of the BLM lands in Oregon in 15 years.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

<u>Effects of Herbicides</u>: Although the acres projected to be treated with herbicides nearly double when compared to the No Action Alternative (Alternative 2), total pounds of herbicides applied would decrease 35 percent at the typical rate. Use of the four herbicides available under Alternative 2 would decrease by 60 to 80 percent, and herbicides generally less toxic to livestock would be used. For example, approximately 1/3 of the projected herbicide use under this alternative would be with imazapic, an herbicide with no measured risk to livestock under any of the exposure scenarios, and for which no grazing label restrictions apply. Similarly (from Effects Common above):

- Chlorsulfuron, fluridone, and sulfometuron methyl risk quotients were all below the most conservative LOC indicating that direct spray would not likely pose a risk; and,
- Imazapyr and metsulfuron methyl under typical application rates had no risk to livestock predicted under any scenario.

For the other two herbicides available under this alternative, hexazinone presents a low to moderate risk for some scenarios, but it is typically utilized for treatment of woody species and is semi-selective with spot application, so risk to livestock under normal applications may be lower than those predicted by the Risk Assessment. Triclopyr presents low risk through consumption of contaminated vegetation at the typical rate and moderate risk at the maximum rate. It is utilized in rangelands due to selectivity for woody species, and has low residual activity.

The reduced application rates and prohibition of using aerial applications west of the Cascades would substantially reduce the impacts of off-site drift to livestock, an exposure scenario that is not specifically modeled for the BLM herbicides. (Consumption of contaminated vegetation off-site was modeled for most of the Forest Service herbicides, with no risk demonstrated to livestock for any of these herbicides, except dicamba, and for triclopyr when applied at the maximum application rate.) The increased number of herbicides available under this alternative would lower risk to livestock because more choices would be available to meet site-specific concerns including the presence of livestock.

Effects of Invasive Plants: Noxious weeds are projected to infest 1.9 million fewer acres under this alternative than under the No Action Alternative (Alternative 2). The option to use more selective and effective herbicides for noxious weed control would assist in the eradication of new infestations on BLM lands and also slow the spread of larger noxious weed infestations from public land into non-Federal commercial rangelands. Alternative 3 would provide herbicides that could be used to control invasive annual grasses such as cheatgrass and medusahead, which have displaced native grassland communities and negatively impacted livestock grazing patterns, seasons of use, and overall operations. This would indirectly help control other invasive plants that are either the result of large grass-related fires, or that are otherwise fire dependent and out-compete native vegetation in establishing dominance in fire-disturbed sites.

The lack of an aerial spray option west of the Cascades could result in large areas of rangeland remaining untreated, which could negatively affect livestock habitat and forage in these areas over the long term.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects described for Alternative 3 would also apply to Alternative 4. Additional effects are described below.

Effects of Herbicides: This alternative is projected to increase acres treated with herbicides by 2.7 times when compared with the No Action Alternative (Alternative 2), but increase the total pounds of herbicides used only 52 percent (at typical rate). Much of the increase is from three herbicides not registered for use on rangeland and new to this alternative for vegetation control in rights-of-way and other developments. Bromacil, diuron, and tebuthiuron are relatively long-lasting non-selective pre-emergent herbicides that would be used for complete vegetation control in and near developments where vegetation is already being kept at a minimum to protect the investment and function of the developments. Treatment of recreation and administrative sites under this alternative would have little or no impact on livestock since they have limited or no access to these sites, but treatments on unfenced rights-of-way and other developments could result in livestock exposure. None of the three additional herbicides represent a risk to livestock from direct spray or dermal contact with treated vegetation. Ingestion of treated foliage does present risk however; tebuthiuron presents a low risk from mammal ingestion scenarios when applied at the maximum rate, and bromacil presents low to moderate risk, and diuron presents low to high risks, under several of the ingested vegetation scenarios.

There would also be an increase in acres treated with most of the herbicides available under Alternative 3 along rights-of-way where native and other non-invasive vegetation control would better meet maintenance objectives (see *Administrative Sites, Roads, and Rights-of-Way* in this Chapter). Use of the four Alternative 2 (No Action) herbicides would remain lower under this Alternative than under Alternative 2.

Wildlife habitat improvement treatments to meet goals specified in Conservation Strategies (e.g., tebuthiuron applications to thin sagebrush) could pose a risk to livestock; such risks will be considered at the site-specific scale. The availability of 13 to 16 herbicides would provide options for reducing this risk, since about half of the herbicides available have little or no identified risk to livestock. Tebuthiuron in particular is expected to be used in low doses to effect structural changes in sagebrush, but such doses present no identified risk to livestock.

Forage and the Effects of Invasive Plants: The small areas subject to total vegetation removal, such as around administrative sites and communications facilities, should have little to no effect on the availability of livestock forage. These areas are already low in forage production, as they are currently subject to manual or mechanical cutting. In addition, livestock may already be excluded by fences. Range conditions would benefit from additional control of noxious weeds. Incidental control of noxious weeds during herbicide rights-of-way treatments are projected to reduce the acres infested with noxious weeds in 15 years another 300,000 acres when compared to Alternative 3 (See Table 4-4 and Appendix 7).

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects described for Alternative 4 (Proposed Action) would also apply to Alternative 5. Additional effects are described below.

Effects of Herbicides: It is estimated that an additional 4,800 acres would be treated with herbicides under this alternative when compared to Alternative 4, with 2,4-D and imazapic estimated to each account for 35 percent of the increase. Treatments would be primarily for wildlife habitat improvement east of the Cascades, although a variety of resource management objectives may be accomplished except those designed specifically for livestock forage or timber production. Potential livestock exposure would be greatest under this alternative. Imazapic presents no identified risk to livestock, but 2,4-D presents risks to mammals from direct spray and from consumption of contaminated grass at the typical and maximum application rates.

The two additional herbicides available under this alternative are projected to each be used on 200 acres annually. Diflufenzopyr+dicamba risk quotients are all below the most conservative LOC indicating direct spray would not pose a risk to livestock. Consumption of vegetation contaminated by direct spray of diquat at the typical rate poses low chronic risk and moderate acute and chronic risk at the maximum application rate; therefore, livestock could be at risk from short and long-term consumption of contaminated forage. However, because this is an aquatic herbicide that is not proposed for use in terrestrial areas, and because the label requires exclusion of livestock, the likelihood of livestock exposures is minimal. There is a concern for livestock feeding in wetland-riparian areas where the herbicide would be utilized; risk could be reduced through herding or fencing animals out of treatment areas until the herbicide has dissipated.

Forage and the Effects of Invasive Plants: Because Alternative 5 involves the most treatment acres, it could also have the greatest short-term adverse impact on livestock grazing operations through temporary closures, although wildlife habitat improvement treatments might similarly benefit livestock. Benefits to livestock from the control of noxious weeds and other invasive plants would be similar to those described for Alternative 4 (Proposed Action).

Cumulative Effects

Loss of native vegetation and declining ecosystem health on public lands due to noxious weeds and other invasive vegetation[60] has contributed to reductions in the ability of public lands to support livestock grazing. Livestock grazing itself has caused some of these changes. The increased demand for multiple uses on public lands has further affected vegetative communities, impacting the land's ability to support current levels of

60 And their effect on fire regimes.

livestock use. Restoring ecosystem processes and rangeland health by reducing invasive plant spread helps create and/or maintain plant communities resistant to disturbance and capable of producing livestock forage. However, even with treatment, noxious weeds and other invasive plants would continue to spread. The BLM would continue to modify grazing to attain rangeland health standards.

Proposed herbicide use on BLM lands would be a small portion of the existing pesticide use statewide (Table 4-1). In general, any herbicide effects to water and other BLM resources will be cumulative to effects from non-BLM uses.

Wild Horses and Burros

Affected Environment

The BLM manages wild horses and burros on public land through the Wild Free-Roaming Horse and Burro Act of 1971. Wild horses and burros are managed on 18 Herd Management Areas (HMAs) covering 2.6 million acres of BLM lands and another 134,000 acres of National Forest, the majority of which is in Harney, Lake, and Malheur counties. The Act mandates that wild horses and burros can only be managed in areas where they were found in 1971. Public lands inhabited by wild horses or burros are closed to grazing under permit or lease by domestic horses and burros, but are otherwise open to (and mostly covered by) permits and leases for other livestock grazing. Public lands are the primary source of forage for wild horses in eastern Oregon. Typically, the BLM does not feed or water the animals, but does intervene during extreme drought, fire, or freezing weather, and may relocate animals or remove them from the range during extreme conditions.

Each HMA has an Appropriate Management Level (AML), which is an estimate of the number of wild horses and burros that public lands can support while maintaining a thriving natural ecological balance. The combined AMLs for the 18 HMAs in Oregon is 1,340 to 2,655 animals. Wild horse herds grow at an average rate of 20 percent annually. Animals that exceed the AML or that stray onto non-designated public and/or private lands are removed (USDI 2007a). As of 2008, wild horse and burro numbers were estimated to be 3,605 animals (about 30 of which were burros), and the AML was being exceeded in 10 of the 18 HMAs. Excess animals damage range conditions, adversely affecting other commodity and non-commodity resource values and generally increasing the likelihood of invasive plant establishment. Herd sizes are managed primarily by periodically gathering surplus animals. Fertility control is also being used in some HMAs as a means to reduce the population growth rate. In FY 2008, 225 wild horses were adopted in Oregon. The main holding facility for wild horses in Oregon is located in Harney County just west of Burns, Oregon. The facility serves as a short-term holding area prior to distribution to other states for adoption, and includes a public viewing area. Wild horses and burros in Oregon represent about 5 percent of the total population on BLM lands in ten western states, with the highest numbers being in Nevada (46 percent) and Wyoming (13 percent).

Environmental Consequences

The proposed increase in the number of herbicides available and the types of vegetation management activities they could be used for could affect wild horses through direct and indirect exposure to herbicides that could harm their health, or through temporary decreases in amount of food available. However, any of the action alternatives would be expected to improve (or at least slow the decline of) the amount and quality of forage available, potentially increasing the carrying capacity of the HMAs and reducing other resource conflicts.

Effects Commons to All Alternatives

In addition to the following discussions, effects described in the *Livestock* section would generally apply to wild horses and burros.

Herbicide Effects

The extent of direct and indirect effects to wild horses or burros would vary by the amount of herbicide placed on vegetation that is used as forage (which is affected by the formulation and the extent and method of treatment), the toxicity of the herbicide, physical features of the terrain, weather conditions, and the time of year (e.g., newborn foals and burros would be susceptible during foaling season, with March through June being a critical period). Potential adverse direct effects to individual animals because of exposure to herbicides include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. Wild horses and burros would have a greater chance of exposure to herbicides—either via direct contact with the herbicide upon application or indirect contact via dermal contact with vegetation or ingestion of vegetation—if their range extent was partially or completely sprayed. However, these animals are wide ranging, and HMAs are often larger than 30,000 to 40,000 acres for Oregon herd areas. Most treatments would be less than 200 acres, treat only the invasive plant portion of the vegetation, or be on recently burned areas (e.g., imazapic on newly burned areas to control invasive annual grasses).

Wild horses or burros may also experience greater impacts under conditions where herbicide drift is more likely, such as in areas where herbicides are aerially sprayed adjacent to herd management areas. The BLM and Forest Service Risk Assessments suggested several possible common scenarios where herbicides could affect wild horses (Appendix 8). Wild horses consume large quantities of grass and are thus at relatively greater risk for harm than smaller wildlife or wildlife that feed on other herbaceous vegetation, seeds, or fruits, which may have less herbicide residue than grass (Fletcher et al. 1994), at least where broad-scale applications of selective herbicides have been made on invasive plants over native grasses. Thus, 100 percent grass grazing scenarios were specifically modeled in the Risk Assessments. However, reaching Ecological Risk Assessment-identified risk levels would be unlikely unless the animal forages exclusively within the treatment area for an entire day.

Herbicide exposure to wild horses and burros would also be limited in the following two scenarios. Areas that are fenced are generally not accessible to wild horses and burros. In addition, any aerial application would cause wild horses to disperse from the immediate area of application for unspecified periods unless a sole water source is in the treatment areas. Population management generally consists of aerial census and use of helicopters for gather/removal operations, so wild horses have a strong tendency to flee when aircraft come in close proximity to the herds.

The discussion of the individual herbicides in the *Livestock* section also applies to wild horses and burros.

Forage, Invasive Plant, and Other Effects

Adverse indirect effects could include reductions in preferred forage or forage amount. Forage reduction or disturbance (particularly aerial) may cause wild horses to move out of herd management areas and onto lands that are not legally designated for wild horse and burro management where there may be competition for forage with domestic livestock.

Many HMAs are currently above AMLs. Noxious weed infestations can greatly reduce the land's carrying capacity for wild horses, which tend to avoid weeds that have low palatability from defenses such as toxins, spines, and/or distasteful compounds (DiTomaso et al. 2006). In addition, some noxious weeds (e.g., horsetail, wild mustard, poison hemlock, tansy ragwort, yellow starthistle, and common St. Johnswort) are poisonous to horses. Grazing can be an effective means of managing certain invasive plants in HMAs. However, if vegetation is overgrazed (e.g., as a result of horses in excess of the AML), direct invasive plant control treatments such as those involving the use of herbicides may be required to return vegetation to a more desirable composition that can be maintained by grazing. Successful weed removal would directly benefit wild horses and burros over the long term.

Treatments that reduce the risk of atypically frequent or high-intensity wildfire would also benefit wild horses. Rangeland weeds that increase the risk of high-intensity wildfire include cheatgrass, medusahead, diffuse knapweed, and perennial pepperweed. Uncontrolled, high intensity wildfires can remove forage from large tracts of rangeland, reducing its suitability for wild horse and burro grazing. In some instances, BLM has gathered all wild horses in those areas and placed them in temporary holding until resource restoration objectives were met, and then returned the horses to those areas.

Effects by Alternative

Reference Analysis – No Herbicide Use

Wild horses and burros would not be affected by BLM herbicide use. However, this no-herbicide strategy would be expected to have the greatest continued spread of invasive plants that would replace native plant communities that wild horses and burros depend on as forage. Non-herbicide treatments would be effective on smaller areas for some species, but ineffective on other species that can only be controlled with herbicides alone or in combination with other methods.

<u>Invasive Plant Effects</u>: Without the use of herbicides, invasive plant infestations are projected to continue to spread, probably at increasing rates. The increase of invasive plant populations would cause further damage to susceptible native plant communities, including rangeland communities that provide forage for wild horses, particularly in situations where other treatment methods would not be effective or feasible (e.g., large tracts of rangeland or grassland dominated by invasive, re-sprouting shrubs; or areas without enough fine fuels to carry prescribed fires). The spread of invasive plant populations would be expected to have harmful effects on wild horses; the capacity for wild horse grazing decreases proportionately with loss of forage caused by weed infestations. Noxious weeds that are toxic to wild horses, including common tansy, leafy spurge, Russian knapweed, common St. Johnswort, and yellow starthistle would increase, further reducing forage and herd viability.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

<u>Herbicide Effects</u>: Impacts to wild horses or burros (positive and negative) would be similar in nature to those that have occurred in the past 18 years. Although herbicides would be applied to fewer acres under this alternative than under any of the action alternatives, the potential toxicity of the four herbicides available under this alternative keep this alternative from having the least risk for wild horses and burros. 2,4-D and glyphosate present risks to mammals from direct spray and from consumption of contaminated grass at the typical and maximum application rates. Inadvertent spraying of grass and other forage near treated invasive weeds, as well as drift and other avenues, could result in exposure. Dicamba and picloram also presents low to moderate risks under some exposure scenarios. The primary targets for these two herbicides are broadleaf and woody species, so it can be used to target species infesting native or other desirable grass species without affecting the grass. Grazing of these sprayed grasses by horses could result in exposure.

Invasive Plant Effects: Under the No Action Alternative (Alternative 2), native plant communities would continue to be impacted by cheatgrass and medusahead spread, decreasing plant diversity, habitat quality, and productivity thereby reducing forage for wild horses and burros. Medusahead rye is a noxious weed infesting an estimated 600,000 acres of BLM lands in Oregon; it is considered poor forage as high silica content and other attributes render it unpalatable. The invasive cheatgrass infests another 5 million acres and except for a very few weeks early in the season, is similarly unpalatable. The frequency and intensity of wildland fire would increase as native plant communities become more infested with these two invasive annual grasses. Noxious weeds would continue to expand at their current rate, and are projected to infest about 1/3 of the BLM lands in Oregon in 15 years. Given the rate of new weed infestations and spread of established weeds, some HMAs could be functionally lost to grazing by wild horses in the next ten years.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Herbicide Effects: Under this alternative, total pounds of herbicides applied would decrease 35 percent when compared to Alternative 2 (No Action). In addition, use of the four herbicides available under Alternative 2 would decrease by 60 to 80 percent, and herbicides generally less toxic to wild horses and burros would be used. For example, approximately 1/3 of the projected herbicide use under this alternative would be with imazapic, an herbicide with no measured risk to wild horses under any of the exposure scenarios. Similarly,

- Chlorsulfuron, fluridone, and sulfometuron methyl risk quotients were all below the most conservative LOC indicating that direct spray would not likely pose a risk; and,
- Imazapyr and metsulfuron methyl under typical application rates had no risk to wild horses predicted under any scenario, and imazapyr is not registered for rangeland application and therefore it would be unlikely that wild horses would either eat contaminated vegetation or come in direct contact with it.

For the other two herbicides available under this alternative, hexazinone presents a low to moderate risk for some scenarios, but it is typically utilized for treatment of woody species and is semi-selective with spot application, so risk to wild horses and burros under normal applications may be lower than those predicted by the Risk Assessment. Triclopyr presents low risk through consumption of contaminated vegetation at the typical rate and moderate risk at the maximum rate. It is utilized in rangelands due to selectivity for woody species, and has low residual activity.

The increased number of herbicides available under this alternative would lower risk to wild horses and burros because more choices would be available to meet site-specific concerns including the presence of wild horses and burros.

Invasive Plant Effects: Noxious weeds are projected to infest 1.9 million fewer acres on BLM lands statewide under this alternative than under the No Action Alternative (Alternative 2), proportionately benefitting the 2.6 million acres of BLM HMAs. The option to use more selective and effective herbicides for noxious weed control would assist in the eradication of new infestations on BLM lands. Alternative 3 would provide herbicides (particularly imazapic, with no rated risk to wild horses) to control invasive annual grasses such as cheatgrass and medusahead, which have displaced native grassland communities and changed wild horse and burro grazing patterns, seasons of use and overall herd behavior. This would indirectly help control other invasive plants that are either the result of large grass-related fires, or that are otherwise fire dependent and out-compete native vegetation in establishing dominance in fire-disturbed sites. Although this would not necessarily restore native grasslands and result in increases in available forage for wild horses, it would reduce the spread of invasive plants.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects described for Alternative 3 would also apply to Alternative 4. Additional effects are described below.

<u>*Herbicides Effects*</u>: This alternative adds three herbicides for vegetation control in rights-of-way and other developments. Bromacil, diuron, and tebuthiuron are relatively long-lasting non-selective pre-emergent herbicides that would be used for complete vegetation control in and near developments where vegetation is already being kept at a minimum to protect the investment and function of the developments. They are not registered for use on rangeland. Treatment of recreation and administrative sites under this alternative would have little or no impact on wild horses and burros since access is often limited and human activity would be avoided. However, drift and treatments of unfenced rights-of-way and other developments could result in exposure. None of these three additional herbicides represent a risk to wild horses from direct spray or dermal contact with treated vegetation. Ingestion of treated foliage does present risk however; tebuthiuron presents a low risk from mammal ingestion scenarios when applied at the maximum rate, and bromacil presents low to moderate risk and diuron presents low to high risks under several of the ingested vegetation scenarios.

There would also be an increase in acres treated with most of the herbicides available under Alternative 3 both along rights-of-way where selective vegetation control would better meet maintenance objectives (see *Administrative Sites, Roads, and Rights-of-Way* in this Chapter). Use of the four Alternative 2 (No Action) herbicides would remain lower under this Alternative than under Alternative 2.

Habitat improvement treatments to meet goals specified in Conservation Strategies could pose a risk to wild horses; such risks would be considered at the site-specific scale. Some of these treatments would be done aerially, which would cause horses to leave the area. The availability of 13 to 16 herbicides would provide options for reducing risk, since about half of the herbicides available have little or no identified risk to horses. Tebuthiuron in particular is expected to be used in low doses to effect structural changes in sagebrush, but such doses present no identified risk to horses.

<u>*Invasive Plant Effects*</u>: The small areas subject to total vegetation removal, such as around administrative sites and communications facilities, should have no effect on the availability of forage. These areas are already low in forage production, and horses and burros do not typically forage close to developments. Range conditions would benefit from additional control of noxious weeds. Incidental control of noxious weeds during herbicide rights-of-way treatments are projected to reduce the acres infested with noxious weeds in 15 years another 300,000 acres when compared to Alternative 3 (See Table 4-4 and Appendix 7).

The ability to use herbicides for certain habitat improvement projects would reduce the adverse effects of current non-herbicide methods including the risk of escaped habitat-improvement prescribed fires.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects described for Alternative 4 (Proposed Action) would also apply to Alternative 5. Additional effects are described below.

<u>*Herbicide Effects*</u>: It is estimated that approximately 4,800 additional acres would be treated with herbicides under this alternative when compared to Alternative 4 (Proposed Action), with 2,4-D and imazapic estimated to each account for 35 percent of the increase. Treatments would be primarily for habitat improvement, although a

variety of resource management objectives may be accomplished except those specifically for livestock forage or timber production, and a portion of these projects would be in HMAs. Potential wild horse exposure would be greatest under this alternative. Imazapic presents no identified risk to wild horses and burros, but 2,4-D presents risks to mammals from direct spray and from consumption of contaminated grass at the typical and maximum application rates.

Two additional herbicides are available under this alternative, and are projected to each be used on 200 acres annually. Diflufenzopyr + dicamba risk quotients are all below the most conservative LOC indicating direct spray would not pose a risk to wild horses. Consumption of vegetation contaminated by diquat direct spray at the typical rate poses low chronic risk and moderate acute and chronic risk at the maximum application rate, therefore wild horses and burros could be at risk from short and long-term consumption of contaminated forage. However, because this is an aquatic herbicide that is not proposed for use in terrestrial areas, the likelihood of wild horse and burro exposure is minimal. There is a concern for horses feeding in wetland-riparian areas where the herbicide would be utilized; this risk could be reduced by herding animals out of treatment areas.

Invasive Plant Effects: Benefits to wild horses from the control of noxious weeds and other invasive plants would be similar to those described for Alternative 4 (Proposed Action). Although this program component would not necessarily restore native grasslands and result in increases in available forage for wild horses and burros, it is likely that it would reduce the spread of invasive plants, particularly onto non-Federal grazing lands. Wild horses and burros would be expected to benefit from a portion of habitat improvement projects expected to be conducted under this alternative.

Cumulative Effects

Loss of native and other non-invasive vegetation and declining ecosystem health on public lands due to noxious weeds and other invasive vegetation[61] has contributed to reductions in the ability of public lands to support wild horses and burros. The wild horses and burros themselves have caused some of these changes. The increased demand for multiple uses on public lands has further affected vegetative communities, affecting the land's ability to sustain current levels of wild horse use. Restoring ecosystem processes and balancing wild horse use and rangeland health reduces invasive plant spread and helps create and/or maintain plant communities resistant to disturbance. However, even with treatment, noxious weeds and other invasive plants would continue to spread. BLM would continue to manage wild horses within AMLs to attain rangeland health standards.

Proposed herbicide use on BLM lands would be a small portion of the existing pesticide use statewide (Table 4-1). In general, any herbicide effects to water and other BLM resources will be cumulative to effects from non-BLM uses.

Fire and Fuels

Affected Environment

With the exception of cheatgrass, medusahead, and other invasive annual grasses (primarily in the Sagebrush Steppe Biome), the effects of invasive plants on fire frequency and intensity are mixed and generally subdued. The potential effects of invasive plants on fire regimes and fire behavior is largely dependent on the structure and characteristics (flammability) of the plants themselves, and their indirect effect of altering the abundance and arrangement of native plant fuels. Invasive plants may reduce fuels in ways that suppress the spread of fire

61 And their effect on fire regimes.

in ecosystems where fire is desirable; or may increase hazardous fuels in ways that increase fire intensity or frequency in ecosystems where it is not (Brooks et al. 2004).

In western Oregon's grasslands and oak woodlands, natural[62] fire frequency, fire line intensities, and fire spread are reduced when non-native forbs (such as spotted knapweed and yellow starthistle) become the dominate species. Similarly, these fire characteristics decrease when the non-native perennials Scotch broom and Himalayan blackberry are present in forest openings, riparian areas, recreational sites, and along roadsides. Plant characteristics such as coarser stems, higher fuel moisture content, reduced fuel continuity, and decreased ignitability reduce fire behavior and allow for quicker initial containment of fires by suppression resources. Perennial grasses such as reed canarygrass found in western Oregon wetland prairies tend to increase fuel loading, increasing fire intensities and spread. These changes are localized.

Invasive plants in the Western Forest Biome are generally neither flammable nor continuous enough to constitute a major fuel hazard or to have significantly altered the fire regime. Exceptions exist: gorse is credited with having contributed to a fatal wildfire burning downtown Bandon in 1936 (Simberloff 1996) for example, and reducing fire risk may occasionally be a weed treatment objective in this biome, but these exceptions are not particularly significant to the differences between the alternatives in this EIS.

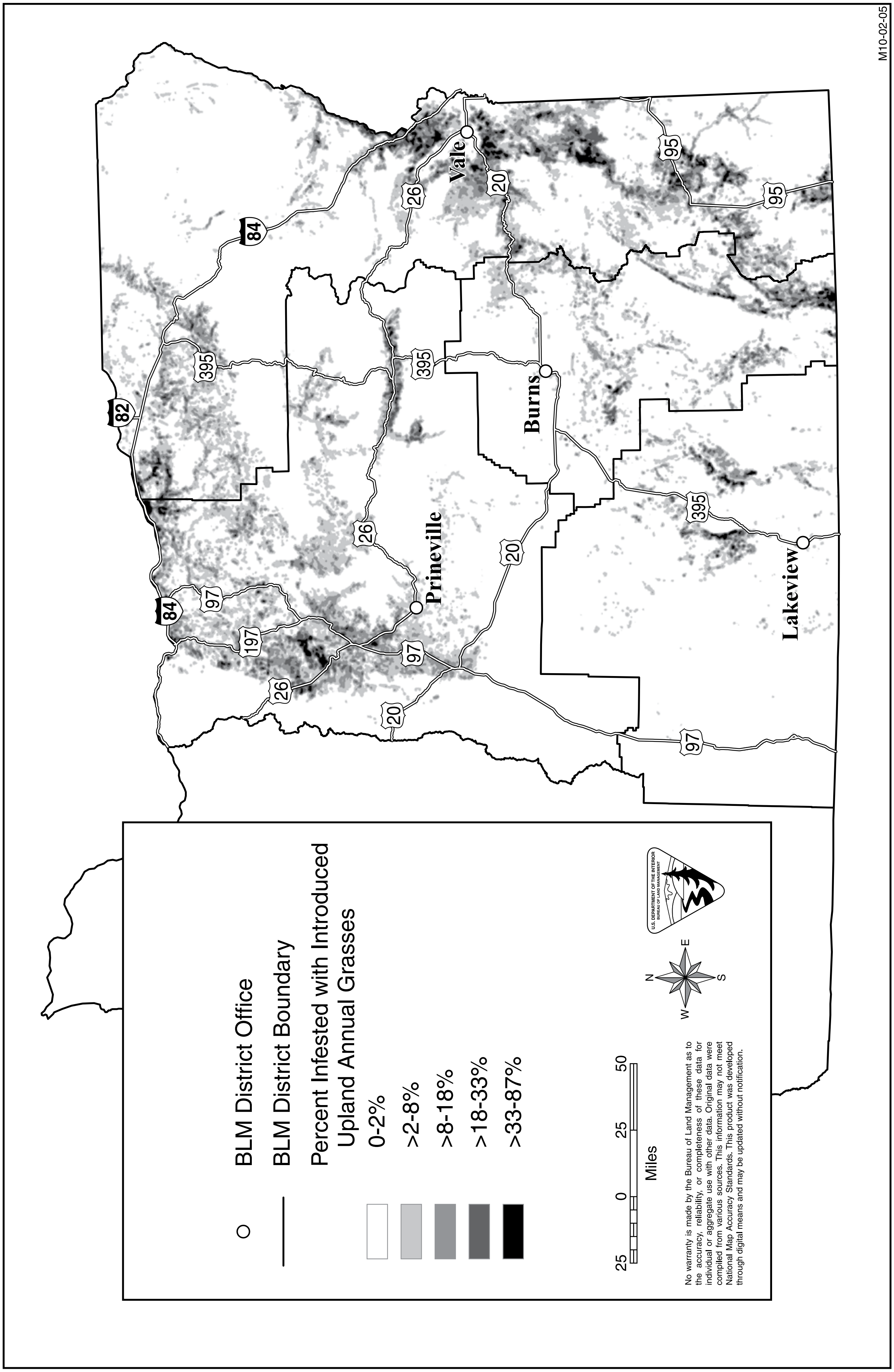
In the Siskiyou, Willamette Valley, and Eastern Forest Biomes, a historic fire return internal of less than 10 years was common on many sites and helped maintain oak savannahs and open pine stands. Invasion by non-native annual grasses has not substantially changed these fires except perhaps to increase their intensity in the most open areas at the lowest elevations (Medford area for example). While the diversity of these ecosystems is certainly threatened by the dominance of the invasive plants and by increased wildfire intensity as well, there is not a substantial increase in the fire danger or change in the long-term fire regime attributable to the invasive plants themselves in these vegetation types. Control of invasive plants in these plant communities to reduce wildfire risk is not a need identified in this EIS.

In the Sagebrush Steppe Biome invasive annual grasses have not just increased fuel loading, they have become sufficiently established to create a self-sustaining cheatgrass-wildfire regime. Plant invasions that alter fire regimes typically do so by altering more than one fuel or fire regime property (Brooks et al. 2004). When an invasive plant with a different fire regime is established enough to dominate the landscape, its intrinsic characteristics and effects on native plants combine to alter fuel properties sufficiently to shift the historic fire regime outside of the reference range of variation. If the new fire regime favors the dominance of the invasive plants causing new fuel conditions and negatively affecting native species, an invasive plant/fire regime cycle becomes established (Zouhar et al. 2008).

Native sagebrush plant communities in the Sagebrush Steppe Biome were historically made up of sagebrush, separated by native forbs and bunchgrasses that retained moisture long into the dry summer season and existed in discontinuous bunches, often separated by areas of soil crust (see *Soil Resources* section in this Chapter). Natural fire return intervals in this type were 32 to 70 years (Quigley and Arbelbide 1997:797). In the past 130 years, large areas of these sagebrush communities have experienced a total vegetation conversion to fire-prone invasive annual grasses, which has converted vast landscapes of native sagebrush steppe to non-native annual grasslands (Menakis et al. 2003). The noxious weed medusahead and invasive cheatgrass infest over 5 million acres on BLM lands in eastern Oregon (Figure 4-7). Effects in the Eastern Forest Biome are not as severe. However, in the Sagebrush Steppe Biome, these grasses can increase horizontal fuel continuity and create a fuel bed more conducive to ignition and spread, and have been shown to increase fire frequency and size as well as expand the seasonal window of burning (Zouhar et al. 2008). These grasses have increased fuel continuity across large areas of contiguous landscape, supporting more frequent and more intense fast-moving fires that are initially difficult to contain and result in large landscape fires.

62 "Natural" in this context includes pre-European anthropogenic fires.

Figure 4-7. Invasive Annual Upland Grasses East of the Cascades



Environmental Consequences

The BLM treats hazardous fuels using a variety of non-herbicide methods on tens of thousands of acres per year in Oregon. A full discussion of that program is outside the scope of this analysis; the portion of such treatments potentially done with herbicides is small, approximately 1 to 5 percent. Currently allowed herbicide treatment of *noxious* weeds (Alternative 2) could have a fuels treatment objective, but the four herbicides currently available are not capable of controlling the most pressing case of the invasive annual grasses in the Sagebrush Steppe Biome and elsewhere. Alternatives 3-5 would add imazapic and other herbicides capable of treating this fuels problem. Herbicide treatments of *native* and other non-invasive vegetation to meet fuels reduction objectives would be permitted under Alternative 5, but are unlikely to occur.

Herbicides would be used as part of an integrated vegetation management approach. Treatment goals would include reducing fire intensity and spread rates to protect resource values and to increase firefighter and public safety, and restoring fire adapted ecosystems or fire regimes through the modification of vegetation (fuels) structure and composition. Herbicides would be used to help achieve these goals in a number of different ways:

- As a standalone treatment or in combination with other vegetation treatments to change the vegetation structure and composition to reduce fire behavior characteristics (rate of spread, fire line intensities) and facilitate suppression actions;
- As a follow up or maintenance treatment to mechanical or prescribed fire treatments or post wildfire rehabilitation treatments, to either further reduce the fuels hazard or to help control new or existing invasions from occurring or spreading; and/or
- To create strategically placed breaks in vegetation (fuel) continuity adjacent to wildland urban interface (WUI) communities or where treatment of the entire affected area would be either impractical or too expensive.

<u>Fuels Treatment Program</u>: Prescribed fires and other fuels treatments create disturbances that can be exploited by noxious weeds and other invasive plants. Similarly, wildfire suppression techniques can introduce or spread invasive plants. The potential for various BLM activities to spread noxious weeds is outside the scope of this analysis; these are ongoing programs already covered by integrated vegetation management policies designed to prevent and control spread. For example, a management activity with a moderate or high risk of spreading noxious weeds is required to have a noxious weed risk assessment that identifies actions to be taken to reduce or prevent the spread of noxious weeds (USDI 1992b, Appendix 3 of this EIS). The degree to which these and other ongoing management practices might contribute to the spread of invasive plants is considered in the spread rate analysis in the *Noxious Weeds and Other Invasive Plants* section earlier in this Chapter.

Effects Common to All Alternatives

In western Oregon under all alternatives, localized weed treatments would occasionally have a fuels reduction co-objective. More likely, weed treatments would occur as a secondary maintenance treatment or as a preventive measure in areas previously treated for hazardous fuels within the WUI, or to reduce invasions of particularly flammable species along roadsides or within recreational sites and areas of special concern like the Cascade-Siskiyou National Monument.

In eastern Oregon, there would be a focus on fuels reduction and restoration of large grass-invaded areas to reduce severe fire behavior by restoring natural fire adapted ecosystems. Treatments that would help with the reduction of fire would include fuel breaks within the WUI or through the center of large infested areas to help support suppression efforts.

The effects of herbicides either as a standalone treatment or in combination with prescribed fire, manual or mechanical treatments to reduce fire behavior characteristics of invasive annual grasses are generally localized to the areas treated. Under each of the alternatives, proposed fuel treatment acres are only a small portion of the identified infested areas, and would have little to no effect on the estimated acre annual spread rate. Typical treatments are likely to be focused on new or small populations of existing species, advancing edges of larger populations, or the use of a brown stripping (removal of vegetation) within or adjacent to WUI or large infested areas.

The most significant parameters for comparing the alternatives is the net change in plant communities dominated by invasive annual grasses, and the ability to remove and restore those plant communities to protect high interest areas such as the WUI. As discussed in the *Noxious Weeds and Other Invasive Plants* section earlier in this Chapter, the alternatives would variously slow the spread of noxious weeds statewide. Cheatgrass, however, is not part of the weed spread rate calculations because it is widespread and not listed as a noxious weed. The difficulty in effectively eradicating the noxious weed medusahead is given, in that section, as a reason for pessimism in the calculations. Therefore, the 4 million acre difference in predicted noxious weed infested acres between the Reference Analysis and Alternative 5 in 15 years (Table 4-4) could overstate the relative differences between the alternatives for fire risk; the invasive annual grass spread rate may not be significantly affected by the various alternatives. The primary difference between the alternatives would be the ability to reduce fuels and/or restore more fire-resistant ecosystems on specific sites of interest.

Effects by Alternative

Reference Analysis – No Herbicide Use and Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Under the Reference Analysis and Alternative 2 (No Action), manual treatments would be the most effective treatment in removing annual grasses. The reduction of non-native annual grasses through mechanical and prescribed burning would be limited, however, and dependent on the current condition of the fire regime prior to treatment, the intensity, severity, size, and seasonality of a fuel treatment, and site factors such as, topography, soil characteristics, and weather conditions (Zouhar et al. 2008). Mechanical methods could create non-vegetated or brown stripping in the WUI when opportunities to use prescribed fire are limited. These areas would likely require annual maintenance or retreatment to remain effective in reducing the fire risk to communities. This cost is likely to keep treatments small in scale, providing protection to limited areas of the WUI.

Prescribed burning can be used to suppress invasive annual grasses in the short term. However, sagebrush steppe is very susceptible to reestablishment and increases in abundance of annual non-native grasses after prescribed burning unless the site initially had a sufficient component of native perennials to naturally reestablish (Zouhar et al. 2008). If a wildfire initially promoted non-native and invasive plants, then using prescribed fire alone to reduce the invasion is not likely to be effective. Fire is sometimes more effective when used in combination with other treatments (Zouhar et al. 2008). For example, burning cheatgrass and medusahead is most useful as a seedbed preparation technique if followed by immediate seeding of desirable (usually native) species. These areas need to be planted within a year of the burning or they can become reinvaded (Zouhar et al. 2008). Under Alternative 2 (No Action), annual retreatment with herbicides could be utilized to maintain mechanical non-vegetated or brown stripping breaks, reducing the cost of maintaining these areas, and increasing their effectiveness at reducing fires.

Glyphosate is sometimes used for medusahead control, but does not reduce the seedbank. Because glyphosate in non-selective, it removes native shrubs and forbs needed to help restore the site. As with prescribed fire, active restoration is usually required. Actual fuel hazard reduction benefits, even in the short term, are limited.

The reduction in the severity of fire behavior characteristics (rate of spread, fire line intensities) under the Reference Analysis and Alternative 2 would be relatively labor-intensive, and benefits would be localized to the area treated.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Herbicides that would become available under this alternative include pre-emergents (e.g., imazapic) that would control invasive annual grasses including cheatgrass and medusahead, making a combination prescribed fire-herbicide-seeding treatment effective at removing these grasses and restoring native plants. This treatment could be used to meet a variety or restoration objectives but significant to this discussion, the treatment would reduce the risk of fast-moving intense grass-fueled fires when applied to meet fuel reduction objectives within the WUI.

Herbicides would also increase the effectiveness of greenstripping – a proactive technique to reduce the magnitude of the cheatgrass-wildfire cycle by growing fire-resistant vegetation at strategic locations in order to slow or stop the spread of wildfires (Quigley and Arbelbide 1997:801), and would increase the likelihood of successfully working with adjacent landowners on fuel breaks and related treatments.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

The effects described for Alternative 3 would also apply to Alternative 4. Alternative 4 would also permit the use of herbicides for the control of native and other non-invasive plants around administrative sites. Objectives for vegetation treatments around administrative sites such as communications sites and other remote structures include keeping wildfire from entering the developed area of the site and destroying structures and other improvements. The use of persistent pre-emergent non-selective herbicides such as diuron for these treatments would likely be more effective than regular non-herbicide treatments, because better long-term control would be achieved.

Other herbicide treatments permitted under Alternative 4 including most treatments along rights-of-ways would probably be neutral regarding their effect on wildfire. For example, it is not clear that sprayed vegetation would be any more or less flammable than mown vegetation. Bare-ground treatments immediately adjacent to some roadsides east of the Cascades could reduce the incidence of wildfires coming from vehicles, and reduce road damage from wildfires.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

In addition to all treatments permitted under Alternative 4 (Proposed Action), Alternative 5 would make herbicides available for any vegetation treatment except livestock forage or timber production. In unusual circumstances, this might include treatments of native plants to reduce fuel loading.

Timber

Affected Environment

This section addresses the reasonably foreseeable effects of the alternatives on timber volume production from BLM lands in Oregon. The effects of the alternatives on the broad ecological function of forests are included in the *Native and Other Non-Invasive Vegetation* section elsewhere in this Chapter.

All alternatives exclude herbicide use specifically for timber production. That means that herbicide use proposals will not, either as an objective or as an evaluation criterion, have a site-specific timber volume production purpose. The noxious weeds and other invasive plants and pest control portion of the alternatives focus on stopping new weeds from getting a foothold, preventing existing weeds from spreading to new areas, and protecting or restoring susceptible areas such as Special Status species' habitats. Such treatments could occur in recently harvested timber sale units in part because any area is susceptible to invasion, and in part, because site disturbances and increased sunlight to the ground increases the likelihood of infestation.

Weed control efforts have the potential to affect future timber growth, much the same way control efforts will affect water quality, visual resources, and so forth. Economic effects, including those resulting from lost productivity on forestlands within the State are one criterion the State uses when considering whether to designate non-native plants as noxious weeds. The action alternatives propose to control Sudden Oak Death, for example, even though the objective of that control is both environmental and economic (with respect to the potential for protection of timber volume, nursery sales, and other commodity production). To the degree BLM noxious weed treatments contribute to the control and elimination of weeds the State and neighboring landowners have identified as needing control, the *Purpose* (Chapter 1) of cooperatively controlling invasive plants so they do not infest or reinfest adjacent non-BLM lands, will be furthered.

Existing Timber Volume Production

East Side Dry Forests and Other Woodlands

On most BLM forests east of Highway 97 in central Oregon, forest management activities are conducted to promote forest stand health and resiliency to fire, insects, and disease. Treatments include thinning to reduce densely canopied young forests, fuels reductions of densely stocked stands resulting from many years of fire suppression, fire salvage to reduce fuels and capture surplus mortality after wildfires, and/or uneven age stand management to restore pre-settlement stand conditions. While an average of four million board feet (MMBF) per year has recently been harvested in the Eastern Forest Biome (two million from the portion of the Klamath Falls Resource Area east of Highway 97 and two million from all other), timber volume production per se is not an objective of these treatments.

Similarly, some of the Resource Management Plans (RMPs) include management prescriptions and allowable commercial forest product sales from woodlands, specifically western juniper.

While the presence of invasive plants certainly affects the health and function of these dry forests and may change the need for stand treatments using timber sales, those effects are more appropriately addressed in the *Native and Other Non-Invasive Vegetation* section in this Chapter.

Western Oregon Including O&C Lands

Under the six RMPs adopted in 1995 for BLM districts west of the Cascades, and that portion of the Klamath Falls Resource Area west of Highway 97, 607,600 acres[63] (about 28 percent of the area's 2.2 million acres of forested lands) are managed for regularly scheduled timber harvest totaling slightly over 200 MMBF per year. The remaining forested areas are managed primarily as Late-Successional Reserves and Riparian Reserves that produce some timber when thinning and other treatments are needed to achieve those area's specific management objectives.

63 These are the lands suitable for regularly scheduled timber harvest in the Matrix and Adaptive Management Area land use allocations. Various standards and guidelines applicable to these lands reduce actual acres treated.

Invasive Plants on Timberlands

A recent compilation of invasive plant information from permanent inventory plots spread across all forestlands in Oregon found invasive plants[64] made up 6 percent of the crown cover in Oregon forests, and more than 17 percent in seedling/sapling stands less than 5 inches dbh. The percentage of inventory plots with one or more invasive plants present ranged from 100 percent in the Blue Mountains to 47 percent in the Coast Range (Donnegan et al. 2008:63-64). Cheatgrass was the most common invasive plant in Oregon forestlands (all ownerships) at 196,000 acres, and Himalayan blackberry was second at 149,000 acres (all ownerships). Himalayan blackberry is the most common invasive plant in western Oregon. A 2008 compilation by the BLM reported 130 invasive plants and 61 noxious weeds on BLM lands west of the Cascades and the Klamath Falls Resource Area, with the highest density on the Medford District.

The BLM manages 12.3 percent of Oregon's forestlands (Donnegan et al. 2008:19). Because BLM forests are typically low elevation, and are arranged in a checkerboard pattern with other forestlands and share a common road system, the invasive plant percentages included in or inferred from Donnegan et al. (2008) would be expected to apply or even under-report conditions on BLM lands.[65]

Environmental Consequences

This section addresses the effect of the alternatives on timber production, even though the alternatives themselves do not include the use of herbicides specifically for timber volume production.

Effects Common to All Alternatives

Effects of Herbicide and Non-herbicide Treatment Methods

The effects of invasive plant treatments themselves, whether accomplished with herbicide or non-herbicide methods, are expected to be negligible. Treatments for noxious weeds and other invasive plants are generally focused on specific plants, and collateral damage to crop trees is rare. Aerial application, for example, would not occur west of the Cascades under Alternatives 3 or 4, and would occur only rarely if at all under Alternatives 2 or 5. Equipment used to pull larger plants such as Scotch broom can damage or uproot individual conifers, but individual tree mortality in timber production plantations is common and usually does not noticeably reduce long-term production unless the site is only marginally stocked. The same damage could occur during spot herbicide treatments, and treatments would be designed to avoid damage to non-target plants including conifers. The likelihood of damage from herbicide and non-herbicide weed control treatments would decrease as trees get older.

If there are effects to timber production, they would likely be positive "release" type effects as invasive plants competing with desirable conifers are removed.

64 The "invasive plant" definition used in the Donnegan report is different than used elsewhere in this EIS. Donnegan et al. (2008) considered all species not native to the U.S. and readily recognizable to a trained inventory crew. Thus, it includes some species not considered invasive in this EIS, like foxglove, but misses less common noxious weeds. The overall numbers are probably reasonably comparable with other numbers in this EIS.

65 Donnegan et al. (2008) numbers would be expected to under-report low elevation checkerboard forests and over-report higher elevation more consolidated National Forests because most common invasive weeds favor temperate climates and harvest-related disturbances.

Effects of Invasive Plants

Invasive plants adversely affect reforestation and early growth in forest plantations. Invasive grasses like false brome use early season soil moisture and reduce first year conifer seedling survival. Most invasive plants are early seral species, although large species like Himalayan blackberry and Scotch broom will remain in the stand for decades, impacting growth and complicating cultural work such as young-stand thinning. Pole-size and larger stands typically shade out early seral invasive plants, and those that are left would likely use only a small percentage of site resources. Few if any invasive plants have been reported altering forest soils sufficiently to retard reforestation and growth, at least west of the Cascades. Long-lived seeds such as those from Scotch broom would typically lay dormant under such conditions, and not germinate unless an opening was created or the stand was regenerated again. Scotch broom has been identified as the noxious weed causing the highest productivity losses of any of Oregon's noxious weeds, at $47 million annually (Radke and Davis 2000:19-20).

Invasive plants reduce timber growth as well, but the effect is not as pronounced as it is on adjacent private commercial forestlands where rapid growth is the primary objective. In western Oregon, native plants quickly reestablish in timber harvest sites and contribute to stand diversity, helping stands to meet a variety of management objectives in exchange for some timber volume growth. Invasive plants such as Scotch broom are even more efficient than native plants at populating recently harvested sites and being competitive with desired conifers. This results in decreased growth, but the effects are gradual; current culturing methods are already dealing with some level of invasive plants. Yield predictions are based in part on the performance of existing stands, and quantifying the growth loss from the current or future percentage of invasive plants has not been done for BLM lands.

In addition to some level of growth loss, any area with noxious weeds is more expensive to manage if for no other reason than because mitigation measures must be taken to prevent off-site movement. For example, a requirement can be added to the sale contract that equipment be cleaned before it is moved from one area to another. In general, risks from harvest activities should be mitigated by the BLM's policy of requiring the development of a noxious weed risk assessment that identifies actions to be taken and monitoring to be done whenever analysis of proposed ground disturbing activities determines the activity will have a moderate or high risk of spreading noxious weeds (USDI 1992b).

There are other potential effects that are detrimental to timber production. Some invasive plants such as Portuguese broom invade and grow faster and more competitively than most native species, and additional "release" treatments may be needed to keep the plantations healthy, thereby increasing costs. Some have particularly long-lived seeds that are quick to invade disturbed sites (although the seeds of some native brush species like manzanita are similarly long-lived). Some have allelopathic influences that poison the soil or otherwise slow regeneration and tree seedling growth. Some, such as gorse, create a spiny thicket that foresters cannot work in, and that equipment might inadvertently move to other areas. In addition, some regeneration treatments (and natural small gap dynamics taking place in areas managed for old-growth and natural processes) rely on natural seeding by conifers, and aggressive invasive plants could lower success in these cases, or create a need to do more expensive and potentially more ground-disturbing site preparation. Invasive plants can also limit the growth of native and other non-invasive plant species important to soil nutrients in the long term, such as the nitrogen fixing characteristics of alder, lupines, and ceanothus.

As described in the *Noxious Weeds and Other Invasive Plants* section earlier in this Chapter, the action alternatives are predicted to slow the spread of noxious weeds from a current 12, to 7 and 6 percent annually for Alternatives 3 and 4/5 respectively. These reductions would correspondingly reduce the potential for the adverse effects listed above.

Effects by Alternative

Reference Analysis – No Herbicide Use and Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Continuation of the current (Alternative 2) or even accelerated (Reference Analysis) weed spread rate is predicted to result in one-third or more of BLM lands in Oregon infested with noxious weeds in 15 years. While infestation rates in the forested lands in western Oregon may lag behind this statewide projection to a degree (Denton 2009), problematic weeds such as Scotch Broom, Himalayan blackberry, gorse, yellow starthistle, and others could become ubiquitous in the not-too-distant future at this level of control. Decreased growth, increased costs, and long-term site productivity losses are likely.

With management responsibility for about ten percent of the current State-designated Sudden Oak Death quarantine area in southwestern Oregon, Alternative 2 (No Action) would keep the BLM as the only landowner not using herbicides to control the native host plants. Pathologists predict that the likelihood of eventual control in that area is being compromised by this limitation. If Sudden Oak Death escapes the current quarantine area and becomes widespread, the growth and marketability of certain hardwoods and even Douglas-fir will be negatively affected. See *Pests and Diseases* in this Chapter for more information.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

The additional herbicides available under this alternative would reduce the likelihood of collateral damage to non-target plants including those being grown for timber. The addition of pests and diseases as an allowable control objective would allow the BLM to more aggressively treat its portion of the Sudden Oak Death State quarantine area (or any future area designated by the State as a quarantine area), significantly increasing the likelihood of eventual containment and control of Sudden Oak Death in Oregon.

The reduction in the spread rate for noxious weeds predicted for this alternative from 12 to 7 percent could significantly delay or prevent the adverse effects of noxious weeds on many timber sites.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses and Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Because of its checkerboard ownership, the BLM shares a road system with other landowners. This road system is particularly susceptible to infestation by invasive plants. The current system of spot-spraying noxious weeds and then returning to mow other encroaching vegetation is not only inefficient, it risks missing noxious weeds that can then be spread by the mowing equipment or spread onto the road where it can be spread by other traffic. It is perhaps here as much as anywhere that the additional 25 percent gain in noxious weed control from using herbicides to control non-invasive roadside vegetation would apply, decreasing overall weed spread to six percent and proportionately benefitting the timber resource for BLM (and adjacent non-Federal timberlands).

Paleontological and Cultural Resources

Affected Environment

In the 1960s, passage of the National Historic Preservation Act (1966) and NEPA (1969) lead to increased awareness of the cultural and scientific value of cultural resources and slowed inadvertent loss of those resources on public lands. With requirements to inventory and evaluate cultural properties for eligibility to the National Register of Historic Places, previously undocumented cultural resources were identified often in response to proposed developments or other Federal undertakings. The Archaeological Resources Protection Act of 1979 provided additional protections for cultural resources on public and tribal lands. In 1990, passage of the Native American Graves Protection and Repatriation Act provided protection of American Indian human remains, sacred objects and associated funerary objects on Federal and tribal lands. The Paleontological Resources Protection Act (PRPA) was signed into law as part of the Omnibus Public Lands Management Act of 2009. Federal agencies are required to protect and manage paleontological resources using scientific principles and expertise. In addition, the Federal Land Management and Policy Act (FLPMA) of 1976 authorizes the Federal agency to protect public resources including those with scientific values. These resources include fossilized paleontological specimens on Federal lands. In addition, FLPMA directs the BLM to protect the quality of historical resources and archaeological values.

Paleontological Resources

As a natural heritage resource, fossil localities must be considered in developing land use management decisions. The fossil record in the western U.S. includes almost all of the geologic periods from the Cambrian (500+ million years ago) to the Holocene (about 10,000-12,000 years ago to present). Many of the fossil deposits contain specimens of national and international importance and were first made known to the scientific world from deposits found in the western U.S.

The BLM manages fossils under the general guidance of the PRPA, FLPMA, and NEPA to promote their use in research, education, and recreation. The BLM manages 15.7 million acres of public land in Oregon. Nearly 300 paleontological localities have been identified on BLM administered land in the State. The fossil record extending as early as 100 to 200 million years ago includes some of the richest Paleogene /Neogene (65 million to 1.8 million years ago) plant and animal fossil localities in the world (USDI 1999:45). Exposures of nearly continuous datable geologic sequences offer unique opportunities for scientists to study and understand changing ecology, geologic structure, and mammalian evolution.

Cultural Resources

Cultural resources include archaeological, historic, or architectural sites, structures, or places with historically significant values and uses, and may include locations (sites or places) of traditional cultural or religious importance to specific social or cultural groups. Cultural resources are managed according to their relative importance, to protect historically and culturally significant resources from inadvertent loss, destruction, or impairment, and to encourage and accommodate the appropriate uses of these resources through planning and public participation.

The cultural heritage for public lands administered by the BLM in Oregon extends back 11,000 to 13,000 years before the present. The increased number and variety of known cultural properties through time is attributed in part to preservation and discovery of cultural materials and to population growth including European and Euroamerican exploration and immigration into the Northwest by the early nineteenth century. Cultural sites include geological landmarks with American Indian cultural and historical significance, American Indian activity sites such as campsites, fish traps, shelters, trails, and pictographs, and Euro-American settlement sites including trestles, shipwrecks, buildings, wagon roads, river fords, and mines. Approximately 1.5 million acres of BLM administered lands in Oregon have been inventoried for cultural resources and more than 12,000 sites have been recorded.

Traditional and Cultural Uses (American Indian Interests)

Some Pacific Northwest Indian tribes have reservation lands held in trust status by the Secretary of the Interior. However, of the tribes with interests within the State of Oregon some also have treaty reserved, or Executive Order rights upon unoccupied Federal lands outside the bounds of their respective Indian reservations. These rights include fishing, hunting, gathering, trapping, and the right to graze domestic livestock. There are also tribes without specific off-reservation reserved rights who continue to gather natural resources for traditional or cultural purposes (Table 4-21).

Table 4-21. Federally Recognized American Indian Tribes with Interests in Oregon

Tribe	Off-Reservation Rights
Klamath Tribes	√
Confederated Tribes of the Umatilla Indian Reservation	√
Confederated Tribes of the Warm Springs Reservation of Oregon	√
Nez Perce Tribe	√
Confederated Tribes and Bands of the Yakama Nation	√
Confederated Tribes of the Colville Reservation	√
Shoshone-Bannock Tribes of the Fort Hall Reservation	√
Shoshone-Paiute Tribes of the Duck Valley Reservation	√
Fort McDermitt Paiute and Shoshone Tribes	√
Burns Paiute	
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians of Oregon	
Coquille Indian Tribes	
Cow Creek Band of Umpqua Tribe of Indians	
Confederated Tribes of the Grand Ronde Community of Oregon	
Confederated Tribes of Siletz Indians of Oregon	
Quartz Valley Indian Community (California)	
Fort Bidwell Paiute (California)	

The areas of interest to American Indian tribes with off-reservation rights are the lands ceded to the U.S., often referred to as “ceded lands.” Historically, some of these lands were occupied by a single specific tribe or band, while others were used by several tribes or bands. These ceded lands include most of the Federal lands managed by the BLM within the State of Oregon.

Protecting and maintaining plants, animals, fish, and water quality on these lands is an important responsibility of the Federal Government. As a land management agency, the BLM has a responsibility to ensure that meaningful government-to-government consultation is conducted with Federally recognized tribes to discuss and consider the effect that any proposed management action may have on treaty rights and resources.

Invasive plants interfere with reserved treaty rights of American Indian tribes of the Pacific Northwest. Invasive plants crowd out plants traditionally gathered for food, dress, or ceremonial purposes and can influence wildlife and fish numbers and behavior.

Environmental Consequences

Paleontological and cultural resources are nonrenewable, and any damage or displacement from their natural context is often irreparable and cumulative. Although fossil resources and many cultural resources are often protected from impacts by overlying sediments and deposits, once eroded or otherwise physically exposed, the potential for adverse effects greatly increases. All alternatives include treatment methods that could affect cultural resources through ground disturbance, increased erosion, or thermal alteration. Adverse effects can also result from the herbicide mixes themselves, and from invasive plants. Similarly, tribal traditional and cultural use areas can be adversely affected by activities conducted under each of the alternatives, and from increases in invasive plants. Effects would be most likely to occur if the these resources were not recognized and marked for avoidance by required pre-disturbance surveys during the identification or implementation phases or if the project could not be re-designed to avoid these resources. In those instances, incidental or inadvertent discovery or impacts to sites could occur but measures to document or recover the data from those sites would mitigate those effects to some extent.

In any case, most vegetation treatment options involving ground-disturbing activities would likely disturb only the upper few inches of sediments and in many cases would be confined to roads, trails, or access routes. Treatment methods causing erosion or soil disturbance could cause indirect impacts to these resources but these effects are expected to be minimal. Potential effects would be reduced by pre-disturbance review and inventory of treatment areas to reduce inadvertent or incidental impacts to cultural resources. Consequently, cumulative loss of paleontological, cultural, and tribal use resources on public lands due to the proposed vegetation treatments under any of the alternatives is expected to be negligible.

Effects Common to All Alternatives

Paleontological Resources

The effect of vegetation treatments on fossil material would vary with respect to fossil type, minerals, degree of fossilization, and exposure. Damage to fossil materials would likely result if wheeled equipment used to apply herbicides, or other mechanical methods, or prescribed fire, impacted the site directly, exposed it by causing erosion, or created tracks or other access later traveled by recreational OHVs. The degree of those effects to fossil resources would depend on the attributes of the fossil material, whether the fossil is buried or exposed, and the method of herbicide application. Methods involving the use of off-road vehicles could crush fossil material exposed on the surface or increase erosion in the fossil localities.

With the exception of some fire or mechanical vegetation treatment methods, impacts to fossil resources are unlikely to be substantial. Application of herbicides by wheeled vehicles may crush or displace some fossils exposed at or near the ground surface.

Indirect impacts can result from activities that contribute to erosion of fossil bearing sediments that lead to exposure of fossils and subsequent discovery as well as advance deterioration or loss of the resource. Direct impacts can result from activities that cause ground disturbance or direct harm to the resource. Proposed non-herbicide vegetation treatments including mechanical methods or prescribed fire can produce direct harm through crushing or indirect effects from increased erosion or other soil disturbances to fossil resources. This potential effect could occur on more than 15,000 acres in the next 15 years under all alternatives.

Cultural Resources

The effect of vegetation treatments on cultural resources depends on the treatment method and the herbicides applied. Some herbicide applications can increase soil acidity, which can advance artifact deterioration. Exposure of artifacts or other archaeological resources to herbicides is expected to be minimal; however, herbicides containing alkyl, biphenyl, or other compounds that contain C_{12} and C_{14} could contaminate carbon samples from exposed cultural materials commonly used for dating (Fink and Zietz 1996:473). In addition, the herbicide can affect surfaces of masonry structures, pictographs, or petroglyph panels if not removed soon after exposure.

Cultural resources are distributed unevenly over the landscape. Areas with high probability for sites associated with pre-contact or historic use are generally predictable but locations of specific sites or subsurface cultural resources are generally unknown without an inventory. Numerous cultural resources have been identified but many more remain unknown until either exposed by erosion or identified by inventory and excavation. Cultural resources often occur on or near the ground surface and can be easily impacted or damaged by ground disturbing activities. The more surface disturbance that occurs, the greater the potential for cultural resource site disturbance.

Traditional and Cultural Uses

None of the alternatives would change, restrict, or abrogate treaty reserved or Executive Order rights. However, implementation of one of the action alternatives may affect food or other natural resources on which the tribes depend. Herbicides can harm plants used by American Indians and can affect the health of the people who gather, handle or ingest recently treated plants, fish or other animals contaminated by the herbicides. Since traditionally gathered plants and animals may occur near vegetation treatment areas, drift from herbicide treatments may occur in areas utilized by American Indians.

In some instances, plants traditionally used by American Indians for subsistence, religious or other uses may not be avoided by vegetation treatments. Whether the plants are affected due to the treatment method selected or the objectives of the treatment (i.e., western juniper control) or through incidental contamination from drift, some traditional use plants may be negatively affected. Herbicide residue left on plants, in the water or other food sources could result in health risks through ingestion, contact, or other exposure to the herbicides from the herbicide treatments.

Effects by Alternative

Reference Analysis – No Herbicide Use

There would be no risk of BLM authorized herbicide treatments drifting onto non-target plants of historical importance or of traditional value to American Indian people, and no risk of exposure through contact or ingestion.

Invasive Plants: Noxious weed management without herbicides would, it is estimated, increase the spread rate of noxious weeds and other invasive plants and result in 2.7 million more acres infested with noxious weeds in 15 years than the No Action Alternative (Alternative 2). In addition, because only about 1/3 of the noxious weeds on BLM lands can be effectively controlled with non-herbicide methods, the ability to respond to specific weed problems in traditional tribal use areas is reduced. Weeds and other invasive vegetation would continue to displace native species that are desirable to traditional American Indian activities, and would adversely affect the quality forage and cover for wildlife utilized by tribes (see *Wildlife Resources* section in this Chapter). Gathering areas for cultural plants, first foods and medicinal plants would be adversely impacted. Cultural features, historical and traditional use areas would also be impacted forcing traditional users to seek other, non-traditional areas. The spread of invasive plants from BLM lands to Tribal lands would affect existing uses and Tribal interests.

Noxious weed invasion would increase risks to paleontological and cultural resources through increased erosion, reduced shading, changes in soil pH, and other environmental changes.

<u>Site Disturbance</u>: Under the Reference Analysis, 8800 acres of directed livestock, 3700 acres of prescribed fire for weed control, and 5100 acres of mechanical treatments would be expected, all of which have a higher risk of affecting sites through ground disturbance than most herbicide application methods (Table 4-22). Although fewer acres would be treated for weeds in this strategy than under Alternative 2 (No Action), the number of acres to be treated by directed livestock and mechanical methods (and thus potentially resulting in site disturbance) would increase. While this acreage is only slightly higher overall than under Alternative 2, the number of acres that would be disturbed by the *most* impacting mechanical treatments and directed livestock, would be significantly greater (31 percent and 68 percent respectively) than under Alternative 2.

Table 4-22. Vegetation Treatment Methods Contributing to Ground Disturbance

Method	**Reference Analysis**	**Alt 2** (No Action)	**Alt 3**	**Alt 4** (Proposed Action)		**Alt 5**	
	Invasive	**Invasive**	**Invasive**	**Invasive & wildlife**	**Rights-of-way**	**Invasive & all other**	**Rights-of-way**
Herbicides Applied by OHV[1]	0	5567	10100	11900	0	13533	0
Mechanical Methods	5100	3500	3200	2003[2]	-8460[3]	974[4]	-8460[3]
Fire	3700	5700	12500	12500		12500	
Livestock	8800	2800	2800	2800		2800	
Total acres	**17600**	**17567**	**28600**	**20743**		**21347**	

[1] 33 percent of total herbicides applied
[2] 3200 acres of invasive plant treatment minus 1197 acres of wildlife treatments. Under Alternative 2, these treatments are done mechanically; under Alternative 4, these treatments are done with herbicides
[3] 8460 acres of right-of-way work. Under Alternative 2, these treatments are done mechanically; under Alternative 4, these treatments are done with herbicides
[4] 3200 minus 2226 acres of wildlife treatments. Under Alternative 2, these treatments are done mechanically; under Alternative 4, these treatments are done with herbicides

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

<u>Herbicides</u>: The risk to human health associated with use of glyphosate, picloram, and dicamba is zero for most exposure scenarios, low for consumption of water contaminated with a spill at the maximum rate. Risk is low to moderate for 2,4-D under some scenarios including consumption of water contaminated with a spill. For American Indians gathering traditional resources, exposure to herbicides would be expected to be lowest of any of the alternatives because fewer acres would be treated, however the high number of acres of 2,4-D in this alternative could result in inadvertent contact and risk to these users.

<u>Invasive Plants</u>: Noxious weed treatments under this alternative are predicted to be twice as effective at eliminating weed populations as methods available under the Reference Analysis (see *Noxious Weeds and*

other Invasive Plants section earlier in this Chapter). However, noxious weeds would be expected to continue spreading at their current 12 percent rate and infest approximately 1/3 of all BLM lands in Oregon in 15 years. This continued spread of noxious weeds would proportionately negatively affect traditional gathering areas as native vegetation is displaced by weeds.

Site Disturbance: Adverse effects from non-herbicide treatment methods (directed livestock, mechanical, and prescribed fire) would be reduced when compared to the Reference Analysis. Approximately 2800 acres of directed livestock, 5700 acres of fire treatments, and 3500 acres of mechanical treatments would be expected, all of which have a higher risk of affecting sites through ground disturbance than most herbicide application methods (Table 4-22). In this alternative, 5567 acres of herbicide application by OHV is estimated. Treatments using OHVs pose a risk of disturbance to paleontological resources and cultural resources, but the risk is less than with the above non-herbicide methods.

For paleontological and cultural resources, prescribed fires of low severity would be expected to result in fewer impacts to artifacts or other archaeological resources. Impacts from broadcast seeding would be negligible but disturbances from drill seeding could result in additional adverse effects.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Herbicides: Under this alternative, glyphosate would be applied to fewer acres statewide and 2,4-D, dicamba, and picloram would be used to treat fewer acres east of the Cascades, than under the No Action Alternative (Alternative 2). While herbicide exposure for American Indians utilizing vegetal resources in treatment areas would be expected to increase as more areas are treated with herbicides, most of the herbicides proposed are of lower risk to human health at typical application rates. In addition, the reduction in the acres for use of 2,4-D and exclusion of aerial spraying west of the Cascades would reduce potential health risks in Alternative 3, although aerial spraying would be uncommon in known American Indian plant collection and use areas under any of the alternatives.

Invasive Plants: The additional treatment acres estimated for this alternative and the increased effectiveness of those treatments because of the wider array of herbicides available would be expected to slow weed spread to 7 percent annually and results in 1.9 million fewer acres infested in 15 years. Reducing the spread of noxious weeds could benefit traditional gathering areas as displacement of native vegetation by weeds is slowed. Having herbicides capable of effectively controlling 116 of the 120 State listed noxious weeds in Oregon, as well as other invasive plants, would allow targeting of specific weeds creating specific resource problems, such as those infesting susceptible or important use areas.

Site Disturbance: In this alternative, 10,100 acres would be treated with herbicides by OHV. Approximately 2800 acres of directed livestock, 12,500 acres of fire treatments, and 3200 acres of mechanical treatments would be authorized, all of which have a higher risk of affecting sites through ground disturbance than most herbicide application methods (Table 4-22). A total of 28,600 acres would be treated by methods that may result in impacts to cultural and paleontological resources by ground disturbance, the most acres of any of the alternatives. The number of acres proposed for treatment potentially resulting in disturbance to cultural and paleontological sites is approximately 39 percent higher than under Alternative 2 (No Action).

The number of acres treated by prescribed fire east of the Cascades, and acres of seeding and planting would increase in this alternative. Following prescribed fire treatment, hunting and plant gathering pursuits would be temporarily limited and possibly shifted to other areas during recovery. Fire treatments would be used primarily for invasive plant control where target plants are resistant to fire or are absent or sparse in the treatment area. Therefore, impacts to plants of traditional value or to sites would be limited.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

About two thirds of the increased number of acres treated in this alternative address management objectives for controlling non-invasive vegetation in rights-of-way, recreation sites, and administrative sites. While acres of herbicide treatments would increase in those areas, a corresponding reduction in non-herbicide treatments would result.

Herbicides: Six herbicides (2,4-D, glyphosate, picloram, imazapic, metsulfuron methyl, and triclopyr) would be used for more than 75 percent of herbicide treatments in this alternative.

The risk to human health associated with use of glyphosate, picloram, imazapic, metsulfuron methyl, and triclopyr at typical application rates is low or zero. Risks to human health are low to moderate for 2,4-D under some scenarios, but the herbicide would be reduced to ounces per acre and would be used in tank mixes for approximately 50 percent of the acres projected. Bromacil and diuron would be added by this alternative and have high health risks to humans under most exposure scenerios, but these herbicides would be used for bare-ground treatments adjacent to roads and other developments, not on previously undeveloped areas or areas traditionally used for tribal gathering. The broader mix of herbicides would increase the options for appropriately managing vegetation while minimizing the risk to humans including American Indians gathering traditional resources near the treatment areas.

The increased number of acres treated with herbicides would result in slightly more acres temporarily closed to traditional hunting and plant gathering following herbicide treatments than Alternative 3. Most of the increased acres are for rights-of-way and other developments, but about 5,700 acres are projected for habitat treatments.

Invasive Plants: Although treatments targeting invasive plants are assumed to be the same under this alternative as under Alternative 3, incidental control of invasive plants along roadsides while controlling encroaching non-native vegetation would further reduce the spread of noxious weeds. Weed spread is projected to be reduced to 6 percent, and there would be 300,000 fewer infested acres in 15 years when compared to Alternative 3 (See Table 4-4 and Appendix 7). Despite the short-term effects and/or area closures resulting from herbicide treatments, the long-term objective of reducing the spread of noxious weeds would benefit traditional gathering areas as displacement of native vegetation by weeds is slowed.

Many designated wild and scenic rivers and some Areas of Critical Environmental Concern (ACECs) contain cultural sites and other tribal use areas, and these areas are often crossed by utility lines or pipelines or include roads and railroads where right-of-way vegetation treatments with herbicides could be expanded. The incidental control of noxious weeds by the herbicide use proposed could potentially decrease the spread of noxious weeds and other invasive plants into or within culturally significant areas.

Site Disturbance: Under Alternative 4, 11,900 acres would be treated with herbicides by OHV. Approximately 2800 acres of directed livestock, 12,500 acres of fire treatments, and 2003 acres of mechanical treatments would be expected, all of which have a higher risk of affecting sites through ground disturbance than most herbicide application methods (Table 4-22). A total of 20,743 acres would be treated by methods that may result in impacts to cultural and paleontological resources by ground disturbance, approximately 27 percent lower than Alternative 3, but 15 percent higher than under Alternative 2 (No Action). Herbicide treatments of rights-of-way, recreation sites, and administrative sites would be unlikely to impact cultural and paleontological resources.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Herbicides: In addition to the herbicides identified in Alternative 4 (Proposed Action), two additional herbicides, diquat and diflufenzopyr + dicamba, would be available under Alternative 5, and bromacil, chlorsulfuron, and tebuthiuron would be authorized west of the Cascades. All herbicides could be used for any vegetation management objective except livestock forage and timber production. Most of the increased acreage in this alternative would likely go toward habitat improvements not included in Alternative 4.

This alternative would have the greatest short-term impact on traditional gathering areas, primarily by resulting in the temporary closure of more lands. Along with these closures, opportunities for collection of plant materials would likely be reduced more than under other alternatives. Although only a small portion of the acres treated using herbicides would occur in known culturally significant areas, more acres and areas would be treated under this alternative than the other alternatives.

Diquat, bromacil, and diuron pose the most severe human health risks and would increase risk to American Indian health if herbicides were ingested from plants that were collected in the treatment areas under this alternative. However, diquat would be used as an aquatic herbicide, and bromacil and diuron use would be along roadsides and around other developments, so they should not pose a significant risk.

Invasive Plants: As with Alternative 4 (Proposed Action), weed spread is projected to be reduced to 6 percent, and there would be 300,000 fewer infested acres in 15 years when compared to Alternative 3. Despite the short-term effects and/or area closures resulting from herbicide treatments, the long-term objective of reducing the spread of noxious weeds would benefit traditional gathering areas as displacement of native vegetation by weeds is slowed.

Site Disturbance: In Alternative 5, 13,533 acres would be treated with herbicides by OHVs. Approximately 2800 acres of directed livestock, 12,500 acres of fire treatments, and 974 acres of mechanical treatments would be expected, all of which have a higher risk of affecting sites through ground disturbance than most herbicide application methods (Table 4-22). The acres of vegetation control potentially resulting in disturbance to sites are greater under this alternative (21,347) than the Proposed Action, Alternative 4 (20,743).

Cumulative Effects

Paleontological resources (fossils) are nonrenewable and once damaged or displaced from their natural context, the damage is often irreparable and cumulative. Although about 300 fossil localities have been identified on BLM administered lands in Oregon, the location of fossils is predictable only to a limited extent. The locations of many paleontological resources remain unknown.

Past effects result from natural erosion as well as purposeful and inadvertent damage from public land uses. Scientific research as well as “collectors” have contributed to past destruction, removal and displacement of fossil resources. Prior to the 1970s, inadvertent damage resulting from various land development and management activities occurred. With increased awareness of the scientific value of the resource, and development of regulations requiring inventory and prohibiting unauthorized removal of scientifically important and unique fossil resources, the cumulative loss of paleontological resources has slowed.

Cultural resources including archaeological and historic sites and materials and properties of traditional cultural and religious importance are vulnerable to cumulative effects from a variety of activities. Archaeological sites can be impacted by erosion, construction, looting, excavation, and activities that alter or destroy features or remove artifacts or other cultural materials from their depositional context. Cultural properties including sites of the built environment, and properties of traditional importance, hunting and fishing sites, graves, and religious or ceremonial sites may lose their integrity and cultural significance when they are degraded as a result of natural or human caused disturbance processes or when access to the properties is lost so that the people who value them can no longer access them resulting in the loss of people's connection to those places over time.

Numerous processes including deposition, erosion, re-use and deterioration has affected artifacts and other cultural materials through time. As natural processes destroyed, deformed, or re-deposited cultural materials and as peoples reused found objects or features, the nature of sites and other cultural resources have been affected. As Euro-American settlement advanced into the region, American Indian peoples were displaced and sites were often further altered, damaged, or destroyed. As Euro-American settlements advanced, land disturbances largely from grazing, timber harvest and mineral exploration and extraction resulted in wide scale impact and loss to cultural properties and life ways.

Cumulative impacts to paleontological and cultural resources from vegetation treatments would be least under the No Action Alternative (Alternative 2) and greatest under Alternative 3 due to the number of acres that could be impacted by ground disturbing activities (Table 4-22). The remaining alternatives would be intermediate between these two alternatives. Most vegetation treatment options involving ground-disturbing activities likely would disturb only the upper few inches of sediments and in many cases would be confined to roads, trails, or access routes. Treatment methods causing erosion or soil disturbance could cause indirect impacts to paleontological resources but these effects would be minimal. Potential effects would be reduced by pre-disturbance surveys and inventory of treatment areas to identify fossil resources, and by designing treatments to avoid impacts to paleontological resources. Consequently, cumulative loss of paleontological and cultural resources on public lands due to actions under any of the alternatives is expected to be negligible.

Tribal uses are adversely affected by the spread of noxious weeds and displacement of plants and animals of traditional importance. Ground disturbing activities including resource extraction, grazing, motorized vehicles, and other land disturbing activities increase impact to cultural resources. Proposed vegetation treatments that increase the number of acres to control the spread of noxious weeds and non-invasive vegetation can result in short-term impacts by temporarily limiting access to traditional resources by American Indian tribes but long-term benefits for improved habitats and plant communities can also be realized. The cumulative impacts to cultural resources from the proposed vegetation treatments would be least under the No Action Alternative (Alternative 2) and greatest under Alternative 3 based on the number of acres that could be impacted by ground disturbing activities. The remaining alternatives would be intermediate between these two alternatives. Prescribed fire and mechanical treatment methods would be anticipated to have the greatest short-term impacts to wildlife and habitats. Acres treated using mechanical methods would be the lowest in Alternative 4 (Proposed Action) and Alternative 5. Acres to be treated by prescribed fire would be similar in Alternative 3, 4, and 5, and each would treat more acres east of the Cascades and fewer acres west of the Cascades than Alternative 2.

Alternative 5 would authorize the greatest number of acres of vegetation treatment with short-term impacts resulting from temporary closure of treatment areas and long-term benefits from more effective and efficient weed treatments, and could result in the greatest risk to American Indian health from exposure or ingestion of herbicides. Alternative 2 (No Action) would treat the fewest acres with herbicides, and Alternative 3 would treat the fewest acres with herbicides having a moderate (or high) risk to American Indian health. However, these alternatives would be less effective than Alternative 4 at controlling vegetation and plants of value to American Indian tribes.

Completion of cultural resource reviews, inventories and consultation with American Indian tribes in areas likely to include cultural resources and traditional cultural values prior to vegetation treatments would reduce potential effects to cultural resources under all alternatives. Pre-disturbance site identification methods and avoidance or other protection methods would reduce the chance that significant cultural resources would be impacted and would result in negligible cumulative impacts to cultural resources.

Visual Resources

Affected Environment

The public lands administered by the BLM in Oregon contain many outstanding scenic landscapes. Vast areas of forested land, grassland, shrubland, canyon land, and mountain ranges provide scenic views to recreationists, visitors, adjacent landowners, and those just passing through. Activities occurring on these lands, such as the treatment of invasive plants and other vegetation, have the potential to impact scenic values.

The BLM uses a system called VRM (Visual Resource Management; Manual 8400) to systematically identify and evaluate scenic values to determine the appropriate level of scenery management (USDI 1984b). The BLM Visual Resource Inventory Handbook (Handbook 8410-1; USDI 1986a) sets forth the procedures for inventorying scenic values and establishing VRM objectives, referred to as Management Classes. These ratings are then used during the land use planning process and considered along with other resource objectives to determine final VRM objectives, or classes. BLM policy requires that every acre of BLM land be inventoried and assigned a VRM class ranging from Class I to Class IV. After VRM classes have been established, BLM policy requires all management activities to be designed to meet the assigned class objectives. Class IV allows for the most visual change to the existing landscape, while Class I allows the least. In Oregon, there are approximately 2.7 million acres in VRM Class I and approximately 750,000 acres in VRM Class II. Several Standard Operating Procedures apply to reducing the visual impact of herbicide and other treatments such as designing treatments in Class I and Class II VRM areas so they do not attract attention of the casual viewer (Appendix 2).

In Oregon, it is estimated that 1.2 million acres of BLM administered lands in Oregon are infested with noxious weeds and another 5 million are infested with other invasive plants, increasing at a rate of 12 percent per year (see *Noxious Weeds and other Invasive Plants* section in this Chapter). In these infested areas, the native vegetation has been replaced, dominated, or significantly altered by one or more invasive plants, leaving the areas in an unnatural state that are assumed in this analysis to be visually degraded. The BLM uses guidance found in the Visual Resource Contrast Rating Handbook (Handbook 8431-1; USDI 1986b) to make such determinations of landscape quality and character. The handbook provides an objective and consistent method for describing landscape character, evaluating visual effects of activities, and developing mitigation to meet VRM objectives. The contrast rating process involves describing the landscape in the context of the basic environmental design elements and features that comprise it. The elements of form, line, color, and texture are used when describing and evaluating landscapes. Activities or modifications in a landscape that repeat these elements are considered to be in harmony with their surroundings. Modifications that contrast with their surroundings are considered not in harmony with their surroundings.

Environmental Consequences

The visual effects of vegetation treatments are dependent on a variety of factors including the existing visual condition of the area, the method of treatment used, the time of year the treatment is conducted and the size of the area treated. The use of herbicides have the short-term effect of creating browned and dead vegetation with the long-term effect of reducing the spread of the targeted species and therefore improving the overall health and visual quality of the landscape.

Effects Common to All Alternatives

Effects of Invasive Plants

Based on principles outlined in BLM's Visual Resource Contrast Rating Handbook (USDI 1986b), this EIS makes the assumption that diverse, native-dominated communities are more visually appealing than plant communities that have been overtaken by monocultures of weeds or other undesired species[66]. The weed spread rate analysis in the *Noxious Weeds and Other Invasive Plants* section in this Chapter determined that for every acre of weeds effectively treated (eradicated), 10 fewer acres are infested 15 years from now, providing a corresponding benefit to visual resources.

Effects of Treatments

Conversely, it is also recognized that all methods of invasive plant treatments have the potential to impact visual resources in the short term (1-3 years). The alternatives in this EIS differ in terms of the types and amounts of invasive plant control and, therefore, the visual impacts of these alternatives. In Oregon, there are approximately 2.7 million acres in VRM Class I and approximately 1.1 million acres in VRM Class II. Of these acres, 0.6 million acres are outside of Wilderness and Wilderness Study Areas, Wild and Scenic Rivers, National Monuments, Areas of Critical Environmental Concern, Outstanding Natural Areas, Steens Mountain Cooperative Management and Protection Area, and Research Natural Areas and similarly designated areas where following the underlying direction for the area would automatically achieve the VRM objectives.

Mechanical treatments such as mowing and the use of chainsaws have the short-term visual effect of cut and browned vegetation and stumps. Blading and disking produces the visual effect of tilled and disturbed soil in the short term. The use of these mechanical methods usually occurs on an annual basis and therefore this visual effect is cyclical in nature with no long-term change in the visual quality of the treatment area. The mechanical portion of the non-herbicide treatment acres for each alternative in all VRM classes are listed below. As noted on the table, no attempt has been made to quantify the tens of thousands of acres of native vegetation treatments currently being done by the BLM in Oregon for all resource objectives. However, for Alternatives 4 and 5, herbicide use would replace approximately 9,657 and 10,686 acres of mechanical treatments respectively, so these are shown as negative numbers, or reductions, in the amount of mechanical treatments currently being done (Table 4-23).

Manual methods of treatment such as pulling, digging, and grubbing weeds focus on the removal of only the unwanted vegetation and therefore there is very little short-term visual impact from this activity, although there is the potential for some trampling of non-target vegetation and soil disturbance to occur (see Table 4-23).

Prescribed fire treatments result in a short-term visual effect of a burned-over, charred, and blackened landscape. Prescribed fire as a weed control treatment is normally applied where invasive plants dominate the landscape, and thus few native species would be lost because of the treatment. These treatments are typically followed by reseeding the area with native vegetation, which results in new growth in the next growing season, with the long-term positive effect of creating a native species-dominated vegetation landscape (see Table 4-23).

The use of directed livestock for weed control (such as the use of grazing goats to treat invasive vegetation) results in the visual effect of a grazed area with limited short-term visual impact (see Table 4-23).

66 It is acknowledged that the yellow flowers of Scotch broom, gorse, and other weeds can be visually appealing to many people, and the effects described in this section might also be considered from that standpoint.

Table 4-23. Estimated Annual Treatment Acres by Alternative

	Reference Analysis	**Alt. 2** (No Action)	**Alt. 3**	**Alt. 4** (Proposed Action)	**Alt. 5**
Mechanical					
Invasive Vegetation	5,100	3,500	3,200	3,200	3,200
Native Vegetation	Unknown[1]	Unknown[1]	Unknown[1]	-9,657[2]	-10,686[2]
Manual					
Invasive Vegetation	3,500	2,200	2,200	2,200	2,200
Native Vegetation	Unknown[1]	Unknown[1]	Unknown[1]	-1,908[2]	-2,594[2]
Prescribed Fire					
Invasive Vegetation	3,700	5,700	12,500	12,500	12,500
Directed Livestock					
Invasive Vegetation	8,800	2,800	2,800	2,800	3,000
Bio-control					
Invasive Vegetation	400	300	200	200	200
Herbicide					
Invasive and Native Vegetation	NA	16,700	30,300	45,200	50,000

[1] No attempt was made to calculate the acres of mechanical and manual treatments for general (non-invasive) vegetation management. Vegetation management on BLM lands in Oregon using all methods generally exceeds 100,000 acres annually.
[2] See the *Assumptions and Information About Treatment Acres* section in Chapter 3.

Effects from biological agent releases such as insects, pathogens, or other organisms to feed upon the targeted weed species occur gradually and are thus almost imperceptible as their impact on the invasive plant may occur over an entire growing season or several growing seasons. Over the long term, their removal of the targeted invasive vegetation will result in a more native dominated system that is visually appealing (see Table 4-23).

The visual effects of using herbicides to treat invasive vegetation vary depending on which herbicide is applied and how it is applied (Chapter 3). Where herbicides are applied directly to the invasive plant using a backpack sprayer or wicking method, the short-term (up to several months, depending on the season) visual impact is from browned and dead vegetation mixed with green, native vegetation and therefore the impact is not very dramatic or easily discernable. When non-selective herbicides are applied aerially or with a boom sprayer, the resulting short-term visual effect is one of an open, browned landscape. For invasive weed treatments, such treatments are usually restricted to areas where invasive weeds dominate the landscape and natives are either resistant to the treatment being applied or the treatment is in conjunction with seeding native species or equivalent restoration treatment. In eastern Oregon, there are also opportunities to treat an area after a wildfire to prevent the introduction of such invasive plants as cheatgrass and medusahead. In these situations, the visual quality of the area has already been diminished by the wildfire and the application of the herbicide after such an event does not further degrade the visual character of the area. For example, approximately 11,500 of the 13,600 acre projected herbicide use increase between Alternatives 2 and 3 would be imazapic applied aerially east of the Cascades in areas heavily infested with invasive annual grasses such as cheatgrass and medusahead, and most of these treatments would follow wild or prescribed fire (see Table 4-23).

In addition, 9,300 acres of the additional herbicide acres between Alternative 3 and 4 are non-selective safety and maintenance treatments along rights-of-ways and around other improvements. However, all of these (and a portion of other treatments proposed under Alternative 4 [Proposed Action]) *replace* non-herbicide methods currently taking place. Nearly 80 percent of the expected herbicide increase between Alternatives 3 and 4, and 75 percent of the increase between Alternatives 3 and 5, replace right-of-way, administrative site, recreation site, and habitat improvement projects already being done with non-herbicide methods (see negative numbers under Alternatives 4 and 5 above), and therefore may be neutral or even beneficial to visual resources (see Table 4-23).

The greater the area of vegetation treatment, the greater the visual impact is likely to be. The effects of treatments over a large portion of the landscape are more likely to be observed by people than the effects of small-scale treatments. However, since areas receiving large-scale treatments are most likely to be degraded lands of low to moderate scenic quality, the visual impact from treatment would be minimized and there would likely be an improvement in the scenic quality of the land over the long term.

Color contrasts caused by vegetation removal would be most apparent in areas dominated by green and/or flowering vegetation and by large plants, such as western juniper. The visual impacts would be heightened if the herbicides also prevented the manifestation of seasonal changes in vegetation, such as spring flowers and/or fall color. However, the brown colors associated with vegetation treatments would be least noticeable during the late fall and the winter, when they would blend more naturally with surrounding colors, than in the spring and summer, when the green colors of new growth are more likely to be present. Impacts to visual resources from even the most broad-scale herbicide treatments would begin to disappear within one to two growing seasons in most landscapes. The regrowth of vegetation on the site would eliminate much of the stark appearance of a cleared area. Over the long term, vegetation treatments would be expected to improve visual resources on public lands as natural color and form are maintained and/or restored.

Effects by Alternative

Reference Analysis – No Herbicide Use

Effects of Invasive Plants: Loss of natural color and form are projected to occur on an additional 2.7 million acres infested with noxious weeds in 15 years when compared to the No Action Alternative (Alternative 2; see Table 4-4 in the *Noxious Weeds and Other Invasive Plants* section in this Chapter).

Effects of Treatments: Potential negative effects to the visual resource that would occur under a no-herbicide strategy are associated with the mechanical, manual, prescribed fire, biological control, and directed livestock treatment methods that would be conducted. These non-herbicide methods of treatment are expected to be conducted on more than 20,000 acres annually. Compared to Alternative 2, this is an approximate 50 percent increase in these methods, but a 16,700-acre decrease in the use of herbicides, resulting in an overall increase in short-term negative effects.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Effects of Invasive Plants: Under this alternative, the number of infested acres partially or wholly replacing more visually desirable native plant communities (see *Effects Common to All Alternatives*, above) is projected to reach 5.9 million acres over a 15 year period, or about 1/3 or all BLM lands in Oregon, with an annual rate of spread of 12 percent (Table 4-4).

Effects of Treatments: Potential negative effects that would occur as a result of implementation of the No Action Alternative (Alternative 2) are associated with the mechanical, manual, prescribed fire, biological control, directed livestock, and herbicide treatment methods that would occur under this alternative. Under this alternative, herbicides can only be used to treat noxious weeds, and the annual herbicide treatment levels are projected to be 16,700 acres. The predominant visual effects of treatments are associated with the use of backpack foliar sprayers and hand held sprayers attached to a small tank on an ATV/UTV or truck. Only the noxious weeds in the treatment area would be sprayed, creating a mosaic visual effect with only the noxious weeds in the treatment area turning brown and dying.

The remaining herbicide acres would be treated with aerial applications (7 percent). The visual effect of these treatments involves the browning and die-off of larger swaths of vegetation. These types of broadcast applications occur where a significant portion of the area is already infested and therefore already exhibits a diminished visual quality. In general, herbicide treatments would have short-term negative effects (first year following treatment) and long-term positive effects on visual resources by allowing for the protection and/or return of native vegetation.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Effects of Invasive Plants: Under this alternative, the number of infested acres partially or wholly replacing more visually desirable native plant communities (see *Effects Common to All Alternatives*, above) is projected to be 1.9 million acres less than under the No Action Alternative (Alternative 2) in 15 years, and be spreading 5 percent slower (7 percent versus 12 percent).

Effects of Treatments: Negative visual effects from implementation of Alternative 3 would be associated with the mechanical, manual, prescribed fire, biological control, directed livestock, and herbicide treatment methods that would occur under this alternative. Under this alternative, with the broader array of herbicides available and the ability to treat invasive vegetation and control pests and diseases in addition to noxious weeds, there is an increase in the total acres treated with herbicides when compared to Alternative 2 (30,300 acres compared to 16,700 acres). There is also a 7,000-acre increase in the use of prescribed fire. The mechanical treatments would be slightly less (3,200 acres compared to 3,500 acres) as would be the use of biocontrol methods (200 acres compared to 300). Both Alternatives 2 and 3 estimate the same amount of directed livestock use (2,800 acres).

Under this alternative, the use of currently available herbicides (2,4-D, dicamba, glyphosate, and picloram) would be reduced while other herbicides would be used. It is estimated that approximately 18,800 of the herbicide treatment acres would be treated using directed foliar spray (spot treatments) and cut stump/wick/wipe/hack and squirt methods, while 11,500 would be treated using imazapic aerially following prescribed fires or wildfires. The visual effect on the 18,800 acres would similar to Alternative 2, involving the browning and die-off of the noxious weed, invasive weed, or pest and disease host (e.g., tanoak trees in Curry County) creating a mosaic visual effect. This visual effect would be short-term with the long-term effect of promoting native vegetation and reducing the spread of the targeted species.

In those situations where imazapic is used following wildfires or prescribed fires, either a wildfire has occurred and the visual quality of the area has already been degraded as a result of the wildfire, or the entire area was already degraded by the establishment of invasive grasses and a prescribed fire was conducted. The subsequent application of herbicides will have no additional visual impact other than the long-term benefit of preventing the resurgence of invasive plants and allowing the area to return to a state where native vegetation dominates. This use of imazapic following wild and prescribed fires in eastern Oregon represents 85 percent of the 13,600 acres of increase in herbicide use between Alternative 2 (No Action), and Alternative 3. The actual increase in spot treatments on all other species is projected to be 2,100 net acres.

In general, herbicide treatments would have short-term negative effects (first year following treatment) and long-term positive effects on visual resources by facilitating the return of native vegetation.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Effects of Invasive Plants: Under this alternative, the number of infested acres partially or wholly replacing more visually desirable native plant communities (see *Effects Common to All Alternatives*, above) is projected to be 2.2 million acres less than under the No Action Alternative (Alternative 2) in 15 years, and noxious weed spread would be reduced to an annual rate of 6 percent, or about half the current rate.

Effects of Treatments: The visual effects of Alternative 4 are associated with the mechanical, manual, prescribed fire, biological control, directed livestock, and herbicide treatment methods estimated to occur under this alternative. Under this alternative, with the broader array of herbicides available and the ability to treat invasive vegetation, pests and diseases, vegetation in rights-of-way, administrative sites, recreation sites, and improve habitats as described in Conservation Strategies, the acres treated with herbicides is estimated at 45,200 acres. This is a 28,400-acre increase compared to Alternative 2 (No Action). The visual effects associated with the treatment of noxious weeds and other invasive plants, and pests and diseases, are the same as noted under Alternative 3.

Under this alternative 9,300 acres of rights-of-way, administrative sites, and recreation sites would also be treated using herbicides. In some right-of-way areas, such as under power lines, the application of herbicides will most likely involve the use of a selective herbicide, which will result in a mosaic visual effect that would replace the visual effect of mechanically treating these areas with such things as a mower or chainsaw. Along road edges and around many administrative sites, a broad-spectrum pre-emergent herbicide would be used to remove most vegetation to prevent damage to improvements and limit the risk of wildfire encroaching on communication and other developed sites. In those areas where herbicides would be used in other administrative sites and recreation sites the primary application method would be backpack application of the herbicide to the targeted vegetation such as blackberry bushes, resulting in the visual effect of intermittent browned and dead vegetation in the area in the short term.

Under this alternative, 5,700 acres would also be used for habitat improvement projects identified in Conservation Strategies. For example, this type of herbicide use is proposed for treatment of western juniper and sagebrush to improve habitat conditions for sage grouse in eastern Oregon. Western juniper and sagebrush are currently treated using mechanical methods (chainsaw/mowing) to achieve these habitat objectives. All but 200 acres of these treatments are expected to be east of the Cascades (Table 3-3). The visual effect of these herbicide treatments would depend on the size of the treatment area and the application method selected, but would result in increased browned and dead vegetation in the short-term.

In general, the herbicide treatments proposed under this alternative would have short-term visual effects (first year following treatment) with the long-term visual effect of returning the treated area to one dominated by a diverse array of native vegetation, and preventing (or slowing) a decline in visual quality caused by future infestations.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Effects of Invasive Plants: As with Alternative 4 (Proposed Action), the number of infested acres partially or wholly replacing more visually desirable native plant communities (see *Effects Common to All Alternatives*, above) is projected to be 2.2 million acres less than under the No Action Alternative (Alternative 2) in 15 years, and noxious weed spread would be reduced to an annual rate of 6 percent.

Effects of Treatments: The visual impacts of Alternative 5 are associated with the mechanical, manual, prescribed fire, biological control, directed livestock, and herbicide treatment methods expected to occur under the alternative. This alternative expands upon the use of herbicides proposed in Alternative 4 (Proposed Action) by 4,800 acres to include treating vegetation to meet a wide range of management objectives such as treating native vegetation to promote habitat for elk and whitetailed deer. With the exception of this additional 4,800 acres, all of the visual effects for this alternative would be the same as described for Alternative 4. (Like Alternative 4, the mechanical, manual, prescribed fire, biological control, and directed livestock treatments are the same as those estimated for Alternative 3).

On the 4,800 acres where additional herbicide treatments are estimated to occur, the visual effects would depend on the size of the treatment area and the application method selected, but would result in increased browned and dead vegetation in the short-term with the long-term visual effect of creating a healthy native vegetative community. Some portion of these treatments would be replacing treatments currently being done with non-herbicide methods.

Wilderness and Other Special Areas

Affected Environment

In Oregon, BLM lands include Wilderness and Wilderness Study Areas; National Wild and Scenic Rivers; National Monuments and National Conservation Areas; National Scenic and Historic Trails; Areas of Critical Environmental Concern (ACEC); Research Natural Areas; and Outstanding Natural Areas. Special management applies within these areas, with the intent to preserve, protect, and evaluate these significant components of our national heritage. Most special areas are either designated by an Act of Congress or Presidential Proclamation, or are created under BLM administrative procedures. With the exception of Wilderness Areas and Wilderness Study Areas, there are no specific restrictions on vegetation treatments in these special areas. However, activities that have the potential to degrade the quality, character, and integrity of these lands are prohibited. The unique characteristics of these special areas would be considered during planning for vegetation treatment activities.

Wilderness and Wilderness Study Areas

The BLM manages eight Wilderness Areas in Oregon encompassing over 247,000 acres. The recently enacted Omnibus Public Land Management Act of 2009 added four new wilderness areas on BLM land, including Soda Mountain in the Cascade-Siskiyou National Monument, the Badlands just east of Bend, Oregon, Spring Basin on the John Day River, and a portion of the Lower White River Wilderness on Mt. Hood. Wilderness Areas are designated by Congress as areas "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (Wilderness Act of 1964). Consisting of areas generally 5,000 acres or larger, Wilderness Areas also offer outstanding opportunities for solitude or a primitive and unconfined type of recreation. These areas may also contain ecological, geologic, or other features that have scientific, scenic, or historic value. In Oregon, the BLM also manages 87 Wilderness Study Areas (WSAs) encompassing 2.6 million acres. While Congress considers whether to designate a WSA as permanent wilderness, the BLM manages the area to prevent impairment of its suitability for wilderness designation.

Vegetation treatments used in wilderness and wilderness study areas follow the guidance contained in 43 C.F.R. 6300 (Wilderness Management; Federal Register 2000), and in the Management of Designated Wilderness Areas

Handbook H-8560-1 (USDI 1988b), and the Interim Management Policy for Lands under Wilderness Review Handbook H-8550-1 (USDI 1995a). The guidance for these areas includes the following direction regarding noxious weeds:

- Noxious weeds may be controlled by grubbing or with herbicides when they threaten lands outside wilderness or are spreading within the wilderness, provided the control can be done without serious impacts on wilderness values and treatments are necessary to maintain the natural ecological balance.
- Plant control must be approved for native plants when needed to maintain livestock grazing operations where practiced prior to the designation of wilderness.
- Reseeding may be done by hand or aerial methods to restore natural vegetation.

In addition to designated wilderness and WSAs, BLM maintains inventories of public lands found to possess wilderness characteristics since completion of the original inventories in the late 1970s and early 1980s. To date, those inventory updates have found approximately 26,000 acres in western Oregon and approximately 225,000 acres in eastern Oregon outside of designated wilderness and WSAs that meet the minimum criteria for wilderness character. There are no specific management restrictions associated with these areas, unless a land use plan has specifically allocated these areas for protection of their wilderness character. Regardless, management activities proposed in these areas must be analyzed for impacts to the area's wilderness character, and reasonable mitigation opportunities will be considered.

Wild, Scenic, and Recreational Rivers

National Wild and Scenic Rivers (WSRs) are rivers (or river sections) designated by Congress or the Secretary of the Interior, under the authority of the Wild and Scenic Rivers Act of 1968, to protect and enhance remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values and to preserve the river in its free-flowing condition. The law recognizes three classes of rivers—wild, scenic, and recreational. Wild rivers are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and water unpolluted. Scenic rivers are free of impoundments with shorelines or watersheds largely undeveloped, but accessible in places by roads. Recreational rivers are readily accessible by road or railroad, may have some development along their shoreline, and/or may have undergone some impoundment or diversion in the past. In Oregon, the BLM manages all or portions of 25 rivers totaling more than 800 miles as part of the National WSR System.

National Monuments

National Monuments are established by Act of Congress or by Presidential Proclamation under the authority of the Antiquities Act. National Conservation Areas (NCAs) are designated by Congress. Oregon BLM manages one National Monument (Cascade-Siskiyou National Monument) totaling nearly 54,000 acres in the Medford District. There are no NCAs per se on BLM-administered lands in Oregon, but the Steens Mountain Cooperative Management and Protection Area (428,000 acres) in the Burns District, and the Yaquina Head Outstanding Natural Area in the Salem District (100 acres), fall under the NCA category due to their similar Congressional designation origins.

National Scenic and Historic Trails

Congress, under the National Trails System Act of 1968, designates areas as National Scenic and Historic Trails. National Scenic Trails offer maximum outdoor recreation potential and provide enjoyment of the various qualities (scenic, historical, natural, and cultural) of the areas through which these trails pass. National Historic Trails are extended trails that follow as closely as possible, on Federal land, the original trails or routes of travel with national historic significance. Designation identifies and protects historic routes and their historic remnants and artifacts for public use and enjoyment. A designated trail must meet certain criteria, including having a significant potential for public recreational use or interest based on historical interpretation and appreciation. In Oregon, BLM manages approximately 50 miles of National Scenic and Historic Trails (41 miles of the Pacific Crest National Scenic Trail, 8 miles of the Oregon National Historic Trail, and about ¾-miles of the California National Historic Trail).

Areas of Critical Environmental Concern, Research Natural Areas, and Outstanding Natural Areas

In Oregon there are 207 ACECs totaling 826,138 acres. The BLM uses the ACEC designation to highlight public land areas where special management attention is necessary to protect and prevent irreparable damage to important historic, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes. The ACEC designation may also be used to protect human life and safety from natural hazards. The BLM identifies, evaluates, and designates ACECs through its resource management planning process. Management prescriptions are set forth in approved RMPs and plan amendments. More detailed activity plans for ACECs may be prepared where circumstances warrant.

In Oregon, there are 82 Research Natural Areas (RNAs) encompassing 197,520 acres. RNAs are areas that are permanently protected from resource extraction and other forms of active management. They are a scientifically classified system of naturally occurring ecosystems for the purposes of scientific study and education and for protection of biological diversity. RNAs are managed to maintain the natural features for which they were established and to maintain natural processes.

Outstanding Natural Areas (ONAs) are areas that have unique scenic, scientific, educational, and recreational values. Recreation activities center on those that foster education and interpretation of the ONA's unique resources. In Oregon, there are nine ONAs encompassing 17,885 acres.

Environmental Consequences

Due to the unique nature of wilderness and other special areas, limited vegetation management occurs in these areas. However, the BLM does control invasive and noxious weeds when they threaten lands outside the area or are spreading within the area itself and can be controlled. Any treatments that take place in wilderness and other special areas need to conform to the management prescriptions for that area and any activity that has the potential to degrade the quality, character, and integrity of these protected lands are prohibited. Treatment methods have the potential to directly and indirectly affect wilderness and other special areas such as the potential effects of disturbed soil (from such actions as grubbing), and the potential to affect native, non-target vegetation with the use of herbicides. Although it is permissible in special or emergency cases, mechanical methods of treatment are rarely utilized in wilderness areas due to their potential for disturbance and adherence to the principle of avoiding use of mechanized equipment in wilderness areas.

Effects Common to All Alternatives

In general, herbicide treatments in wilderness and other special areas would have short-term and usually negligible negative effects and long-term positive effects on wilderness and special status area values and surrounding areas. Regulations and planning direction governing wilderness areas and WSAs permit only treatments that improve the natural condition of these and surrounding areas. In Wild and Scenic Rivers, only treatments that protect and enhance the outstanding and remarkable values identified in the legislation establishing each river are permitted. Therefore, long-term effects, if treatments were successful, would be beneficial. The net effect of treatments on wilderness and other special areas would depend on whether the end condition of the treatment site (considering both long-term benefits and short-term impacts) was an improvement in the characteristics of the area. In almost every case (e.g., eradication of a small population of an incipient pest), vegetative communities in the treatment area would quickly recover, and the overall effect would be positive. In rare cases (e.g., repeated access to a site in order to meet off-site control objectives), the impacts of the treatment to the wilderness character or river values of the site could outweigh the potential long-term benefits to the special area. The short-term effects of vegetation treatments in other special areas would typically be less significant than those in wilderness areas and wild sections of WSRs, as human activities and influences are not necessarily incompatible with their unique qualities. However, all treatments would have the potential to alter these unique qualities, as well as to provide long-term benefits by controlling weeds.

With the use of herbicides, there could also be closure effects in these special areas. Access to a site treated with an herbicide is restricted for a few hours or days, depending on the requirements of the herbicide label. During site closures, BLM posts signs noting the exclusion area and the duration of the exclusion. The longer a site is closed, the greater the adverse effect to recreationists in terms of lost use days, particularly at sites that experience a higher volume of visitors.

In addition to the full range of integrated vegetation management techniques such as prevention and early detection common to all alternatives (see *Integrated Vegetation Management* in Chapter 3), the Standard Operating Procedures common to all alternatives help minimize the potential for adverse effects to wilderness and other special areas (Appendix 2).

In areas found to possess wilderness character outside of designated wilderness and WSAs, vegetation treatments could impair their wilderness values to varying degrees depending on the type and purpose of treatments. For areas with wilderness character specifically protected under a land use plan decision, effects to wilderness character would be similar to those effects described above for wilderness and WSAs. In other areas with wilderness character, treatments designed to improve ecological conditions would have impacts similar to protected areas, while some other treatments may more permanently affect wilderness values where treatments are not designed to return the area to a natural appearance. In all cases, site-specific impact analyses would be conducted as actual treatments are proposed, and possible mitigation measures would be considered.

Effects by Alternative

For context, and as a point of reference for assessing the potential effects of each of the alternatives, the approximate annual acres of noxious weeds currently being treated within each of the special area designations by treatment method are shown on Table 4-24. The annual acres of other invasive weeds currently being treated in these areas are shown on Table 4-25.

Table 4-24. Approximate Acres of Noxious Weeds Currently Treated Annually in Special Areas

Method	Wilderness	Wilderness Study Areas	National Monuments	National Conservation Areas	ONAs	RNAs	ACECs	Wild and Scenic Rivers	Total
Herbicides[1]	26	160	600	1400	180	27	74	237	2,704
Manual	12	7	50	2	175	22	34	275	577
Mechanical					130		30	105	265
Biocontrol				10	4	1	10	80	105

[1] Herbicides limited to 2,4-D, dicamba, glyphosate, and picloram

Table 4-25. Approximate Acres of Other (non-noxious) Invasive Vegetation Currently Treated Annually in Special Areas

Method	Wilderness	Wilderness Study Areas	National Monuments	National Conservation Areas	ONAs	RNAs	ACECs	Wild and Scenic Rivers	Total
Manual	10				25	1	21	7	64
Mechanical			5		3			5	13
Biocontrol							5		5

Reference Analysis – No Herbicide Use

The manual, mechanical, and biological treatments that would be conducted without herbicides would have minimal temporary adverse effects (such as soil disturbance from grubbing), and would contribute to controlling the spread of noxious weeds and reducing their effects on the values that the special designations are intended to preserve. The BLM currently treats approximately 950 acres of noxious weeds in special areas using these methods (Table 4-24), without compromising area objectives. Weeds within and adjacent to special areas that can only be effectively treated with herbicides (2/3 of the noxious weeds species, see Appendix 7: Table A7-1) are not likely to be eradicated with these treatments. These species would threaten the special values of these important areas over the long term.

It is projected that this alternative would result in an additional 2.7 million acres of BLM lands infested with noxious weeds in 15 years (see Table 4-4 in the *Noxious Weeds and other Invasive Plants* section in this Chapter) when compared with Alternative 2 (No Action). This additional spread would negatively affect special areas. This adverse effect would occur even if weed treatments were a priority in these areas, because increases in weeds in surrounding areas would increase the likelihood that special areas would become infested in spite of treatments.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Herbicide and non-herbicide treatments would have minimal temporary adverse effects (such as soil disturbance from grubbing), and have the long-term benefit of helping control the spread of noxious weeds and their effects on the values that the special area designations are intended to preserve. The BLM currently treats approximately 950 acres of noxious weeds in special areas using manual, mechanical, and biological methods and approximately 2,700 acres of noxious weeds using herbicides (Table 4-24) without compromising area objectives. These treatments have the long-term benefit of reducing noxious weeds within the special area and preventing them from spreading beyond the special area.

Under Alternative 2, the BLM is limited to the use of four active herbicide ingredients: dicamba, picloram, 2,4-D, and glyphosate. There are 16 noxious weeds not likely to be effectively controlled under this alternative (Appendix 7: Table A7-1).

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

With a broader array of herbicides available under this alternative, the BLM would have the opportunity to substitute more effective and/or selective herbicides for those currently being used in special areas. This would result in a reduction in short-term effects to non-target species in these special areas because treatments would be more effective and thus less likely to need repeating, and the additional herbicides could be more selective and require lower quantities to be effective. This broader array of herbicides would make available herbicides to treat weeds that currently go untreated due to a lack of effective control. As a result, there would likely be an increase in acres of special areas treated under this alternative. There would be short-term effects from the herbicide treatments conducted under this alternative (such as the browning of the targeted vegetation) and a long-term benefit of better reducing the rate of weed spread within these special areas when compared with the No Action Alternative (Alternative 2). The ability to treat pests and diseases in State-identified control areas using herbicides under this Alternative is not anticipated to affect special areas unless future control areas are identified within or adjacent to specially designated areas. In the event this were to occur, the benefits of eradicating or slowing the spread of the pest or disease with an herbicide would be evaluated in the context of the values for which the special area was designated. At this time, the Sudden Oak Death quarantine area in southwest Oregon is the only identified control area in the State and has within it the North Fork Chetco River ACEC. A May 2010 Environmental Assessment for treating Sudden Oak Death in that area with glyphosate, *Applying Glyphosate on Tanoak to Aid in Sudden Oak Death Eradication,* states that, "Glyphosate would be judiciously applied to facilitate the control of SOD in the ACEC. The use of glyphosate would not threaten the resource values for which the area was established."

Under this alternative, the number of acres infested with noxious weeds on BLM lands in Oregon is projected to be 1.9 million acres less than under the No Action Alternative (Alternative 2) in 15 years, and be spreading at a rate of 7 percent (compared to 12 percent for the No Action Alternative). This reduced rate of spread and the ability to utilize herbicides that are more target-specific and require lower doses when compared to the No Action Alternative would result in less short-term disturbance (from both spraying and non-herbicide methods) to non-target species, as well as increased long-term benefits to native vegetative communities in these special areas.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

The effects to wilderness and other special areas associated with the treatment of noxious weeds, invasive weeds, and pests and diseases are the same as noted under Alternative 3 except that treatment along roadsides and other developments would result in an even slower weed spread (6 percent annually, half of current rate and more acres protected) which will benefit all BLM administered lands, including special areas. Under Alternative 4, there is the additional opportunity to use herbicides to treat native and other non-invasive vegetation to achieve goals specified in Conservation Strategies for Federally Listed and other Special Status species and to meet safety and operation objectives in administrative sites, recreation sites, and rights-of-way. Should any of these treatment opportunities present themselves in a specially designated area, the treatment would need to be consistent with, and conform to, the special requirements and management objectives for that area. Therefore, treatments having the potential to negatively affect the unique values of the special area over the long term would be unlikely.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

The effects to wilderness and other special areas under this alternative would be essentially the same as those for Alternative 4 (Proposed Action) except as follows. Alternative 5 expands the opportunity to treat native and other non-invasive vegetation provided under Alternative 4 to include any vegetation management objective except livestock forage or timber production (e.g., treating native vegetation to promote native plant communities, reduce the risk of wildfire, and improve fish and wildlife habitat). Should any of these treatment opportunities present themselves in a specially designated area, the treatment would need to be consistent with, and conform to, the special requirements and management objectives for that area. Therefore, treatments that have the potential to negatively affect the unique values of the special area over the long term would be unlikely.

Recreation/Interpretive Sites

Affected Environment

Public lands in Oregon provide visitors with a wide range of recreational opportunities, including hiking, fishing, camping, horseback riding, hunting, cross-country skiing, boating, hang gliding, OHV driving, mountain biking, birding, viewing scenery, and visiting natural and cultural heritage sites. Recreation settings include evergreen forests, high deserts, lava flows, rugged river canyons, coastal headlands, and whitewater rapids (USDI 2007d). Combining these natural wonders with the multitude of cultural destinations such as historic trails and archaeological sites makes Oregon public lands some of the most diverse and exciting in the United States (USDI 2007d). In Fiscal Year 2007, there were 8,337,627 recreation visits to BLM public lands and waters in Oregon (USDI 2007d).

The presence of noxious weeds, invasive plants, and other undesirable vegetation (such as poison oak) has the potential to negatively affect the recreational experience of visitors to public lands. Native and other non-invasive vegetation also encroaches on roads, campsites, buildings, and other developments creating safety, access, and maintenance issues (see *Administrative Sites, Roads, and Rights-of-Way* section in this Chapter). At the same time, recreational pursuits themselves have the potential to inadvertently introduce these forms of vegetation to public lands. A key component of BLM's integrated vegetation management strategy is raising public awareness of the threats of noxious weeds and other invasive plants and including prevention techniques on such things as maps, brochures, informational kiosks, and interpretive signs at trailheads.

Following is an overview of the primary ways in which BLM classifies the recreation opportunities found on BLM public lands and the types of vegetation treatments associated with those classifications.

Recreation Management Categories

Dispersed Sites

The majority of BLM lands in Oregon are managed to accommodate multiple uses including many forms of dispersed recreation (e.g., horseback riding, hiking, nature viewing, and hunting), with basic access to these lands provided, and general information such as maps and brochures available, to recreationists. Visitors generally have the freedom of recreational choice with minimal regulatory constraints. Vegetation treatments occurring in these areas would be designed to meet the various vegetation objectives outlined in the Resource Management Plan for the area.

Some areas such as Wild and Scenic Rivers, parts of the National Trail System, and Wilderness Areas have restrictions or special emphases that may limit or focus the types of recreation taking place. Vegetation management in these areas is more likely to be directed at the recreation-oriented designation, and require selective vegetation treatments to protect visitors from hazards and/or adverse effects associated with certain plants in order to maintain and protect the special and unique features of the area.

Developed Sites

The other significant components of BLM's recreation program are developed recreation sites, designated trails, and interpretive facilities. In Oregon, there are 30 developed campgrounds, 35 developed picnic areas, 31 developed recreation trails, 8 off-highway-vehicle (OHV) sites with staging and parking areas, 2 hang gliding sites, 47 "Watchable Wildlife" viewing/interpretive sites, 17 "Adventures in the Past" cultural interpretive sites, 2 wild horse viewing sites, and 15 Backcountry Byways totaling 876 miles. The level of development varies widely among these different sites and designated areas, but in general, the vegetative management objectives focus on protecting visitors from hazards and/or adverse effects associated with certain plants and involves the control of noxious weeds and other invasive plants. Removal of undesirable vegetation such as poison oak to protect visitors, maintain the appearance and function of the site, and prevent the degradation of BLM improvements (such as buildings and parking lots) also takes place in developed recreation sites.

Environmental Consequences

Effective treatment of noxious weeds, invasive plants, and undesirable vegetation enhances the recreational experience and opportunities of public land visitors. Noxious weeds crowd out native vegetation, altering the natural landscape and diminishing the visual appeal of such recreational pursuits as hiking and nature viewing. Control of invasive plants in and around recreation sites also reduces the likelihood of their being spread to other sites by recreationists and their equipment.

Effects Common to All Alternatives

Effects of Invasive Plants and other Vegetation

A site that is dominated by noxious weeds would diminish the habitat for native fish and wildlife species which in turn diminishes the opportunities for those who enjoy such pursuits as wildlife viewing, fishing, and hunting. Certain types of vegetation are also injurious to humans such as yellow starthistle (noxious weed) and poison oak (native vegetation). The dominance and spread of noxious weeds such as Himalayan blackberry can also limit recreation access to such things as campgrounds, trails, and rivers. Weedy landscapes would also be aesthetically less pleasing, discouraging recreational use and causing recreationists to go elsewhere.

Native vegetation also encroaches on roads, developed sites, buildings, and other structures creating access, safety, and maintenance issues. Vegetation can destroy pavement, rub on buildings, reduce site-distances on access roads, and eliminate vistas.

Effects of Treatments

Control treatments for invasive and unwanted native vegetation also have an effect on recreation. For example, the noise associated with mechanical methods of treatment may adversely affect the recreational experience of a public land visitor as can closures that occur to allow the activity to take place. With the use of herbicides, there could also be closure effects. Access to a site treated with an herbicide is restricted for a few hours or days, depending on the requirements of the herbicide label. During site closures, BLM posts signs noting the exclusion area and the duration of the exclusion. The longer a site is closed, the greater the adverse effect to recreationists in terms of lost use days, particularly at sites that experience a higher volume of visitors. Dead and browned vegetation from herbicide treatments could also temporarily reduce recreational potential until vegetation recovered. Herbicide treatments could also pose some health risks to recreational users (see *Human Health and Safety* section). Unintended effects of herbicides on non-target plants, animals, and water could also affect recreation activities (e.g., hiking, plant collecting, hunting, and fishing). The risks to non-target species from use of the 18 herbicides are discussed in the *Native and Other Non-Invasive Vegetation, Fish*, and *Wildlife Resources* sections.

Overall, vegetation treatments would have short-term negative effects and long-term positive effects on recreation. Prevention/removal of noxious weeds and other invasive plants would maintain/return public lands to a more "natural" or "desirable" condition, which hikers and nature enthusiasts would likely value over degraded lands. In addition, the increased aesthetic value of protected or restored sites would benefit most recreational users. In some instances, treated sites could become more desirable as destinations for outdoor activities, making them more popular to recreational users. Treatment of sites to protect or restore native vegetation would enhance fish and wildlife habitat, to the benefit of hunters, birdwatchers, and other users of these resources. Effective control of unwanted native and other non-invasive vegetation within developed sites reduces building and road maintenance costs, and improves safety and accessibility.

Effects by Alternative

Noxious weeds and other invasive plants negatively affect all recreationists regardless of the type of recreation they are involved in. As noted above, negative effects range from changes in visual quality, to displacement of native flora and fauna, to actual human injury from nettles and other plant defenses. Noxious weeds are projected to continue to spread on BLM lands in Oregon under all alternatives, but the rate of spread and thus the number of acres infested in the next 15 years varies by alternative (Table 4-4). To the degree the alternatives would change that level of infestation, the negative effects to recreationists would be proportionately affected. The types and amount of vegetative treatments utilized under the different alternatives to address noxious weeds, invasive plants, and unwanted vegetation would affect recreationists and recreational opportunities on public lands.

The following discussion of recreation effects by alternative highlights the degree to which the alternatives:

- affect dispersed recreation occurring on most BLM lands; and
- affect recreation in developed recreation sites.

To provide context for this discussion, Table 4-26 provides the approximate annual acres of vegetation treated within developed recreation sites and hiking trails by treatment method under existing conditions (Alternative 2 – No Action). (Currently, and under Alternative 2, the BLM can only treat officially designated noxious weeds with herbicides, and is limited to the use of four herbicide active ingredients: dicamba, picloram, 2,4-D and glyphosate.)

Table 4-26. Approximate Annual Acres of Vegetation Currently Treated Within Developed Recreation Sites and Hiking Trails by Treatment Method

Method	Watchable Wildlife Viewing	Wild Horse Viewing	Developed Campgrounds	Developed Picnic Areas	Boat Ramps	OHV Staging / Parking Areas	Hang Gliding Sites	Developed Hiking Trails	Total
Acres of Noxious Weed Treatment									
Herbicides[1]		1	207	8	37	30		57	340
Manual	10		360	32	17	19	1	74	513
Mechanical			22	15	13	15	1	30	96
Biocontrol			5			1		1	7
Acres of Invasive Plant Treatment									
Manual			46	23	9	7	1	54	140
Mechanical	100	4	170	21	11	10	1	33	250
Acres of Native and other Non-Invasive Vegetation Treatments									
Manual	4		45	25	9	5	1	58	147
Mechanical	2		218	10	9	6	1	32	278

[1] Herbicides limited to 2,4-D, dicamba, glyphosate, and picloram

Reference Analysis – No Herbicide Use

Dispersed Recreation

Effects of Noxious Weeds and Other Invasive Plants: An additional 2.7 million acres of public lands are projected to be infested with noxious weeds when compared to the No Action Alternative (Alternative 2), and the rate of weed spread is estimated to be 14 percent per year instead of 12 percent, when compared to the No Action Alternative. As the presence of noxious weeds increases in dispersed recreation areas, their recreation potential decreases. Resultant adverse effects would be as described under Effects Common to All Alternatives; weed-caused reductions to fish and wildlife would diminish wildlife viewing, fishing, and hunting; weeds would limit access and cause injuries, and weeds would generally lower the aesthetic value of the recreational experiences – all proportional to the number of acres infested.

Effects of Treatments: The nearly 50 percent increase in mechanical treatments projected, when compared to the No Action Alternative (Alternative 2), would have the effect of such things as noise from the use of chainsaws and potential area closures for public safety during actual work. The effects on dispersed recreation would be short-term in nature. There are no anticipated short-term effects to dispersed recreation from the other forms of treatment available (manual, biocontrol, and livestock). Prescribed fire effects to users (smoke, area closures) would be less than under No Action.

Developed Recreation

Effects of Noxious Weeds and Other Invasive Plants: Without herbicides, noxious weeds would be more likely to infest developed sites than under the No Action Alternative (Alternative 2; Table 4-4). Further, about 2/3 of the noxious weeds in Oregon cannot be effectively controlled with non-herbicide methods (Appendix 7: Table A7-1), so some weeds would not be effectively controlled at all. Either these acres would be treated using another, potentially less effective, form of treatment or these areas would go untreated. The resulting presence and spread of noxious weeds in these areas would diminish the recreation potential of the site over the long-term, and could lead to site closures.

Effects of Treatments - Under the Reference Analysis, most of the 340 acres of noxious weeds currently treated annually in developed sites with herbicides would be attempted with non-herbicide treatments, even if they were known to be less effective. Disturbance impacts and risks to user publics are probably lower with these treatments than with herbicides (in part, because herbicide uses can result in seasonal or area closures), although such a generality would not apply in all cases. The BLM already treats approximately 513 acres of noxious weeds in developed recreation sites using manual methods, approximately 96 acres using mechanical methods, and approximately 7 acres using biological methods (Table 4-26). The BLM also treats up to 100 acres of invasive plants and approximately 400 acres of native and other non-invasive vegetation (including poison oak) in developed sites annually with non-herbicide methods (Table 4-26). The mechanical and manual methods of control would result in short-term effects to recreationists (noise from the use of mechanical equipment and potential access restrictions while the weeds are mowed, cut, or pulled). However, most of these effects are happening currently, and the net effect of increasing non-herbicide treatments and decreasing herbicide treatments would likely be a reduction of adverse effects to user publics. (There are no anticipated short-term effects associated with the use of biological controls to developed recreation.)

For both dispersed and developed recreation, the lack of herbicide use eliminates any potential for accidental exposure to herbicides by recreationists.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Dispersed Recreation

Effects of Noxious Weeds and Other Invasive Plants - Under this alternative, the rate of weed spread would be expected to remain at 12 percent per year and noxious weeds are projected to infest about 1/3 of all BLM lands in

Oregon in 15 years. As discussed under the Reference Analysis, the presence of noxious weeds has the potential to affect recreation in dispersed areas and therefore, the degree to which each alternative reduces the threat of noxious weeds results in a benefit to dispersed recreation activities.

Effects of Treatments - The use of herbicides under this alternative would result in temporary use restrictions that could affect dispersed recreation. These restrictions would typically last 24 hours but could be as long as one to two years to allow desirable vegetation to become established. The use of herbicides also results in dead and browned vegetation that might result in short-term visual impacts that adversely affect the recreational opportunities of a treatment area. The use of herbicides under this alternative could also result in accidental exposure to the herbicide by recreationists (see the *Human Health and Safety* section).

The effects of mechanical, manual, fire, biocontrol, and livestock treatments under this alternative are essentially the same as those described for the Reference Analysis.

<u>Developed Recreation</u>

Effects of Noxious Weeds and Other Invasive Plants - Developed sites would be affected by the current weed spread rate; the potential for weeds to invade developed sites would continue to increase exponentially as surrounding landscapes become infested. However, this alternative provides effective treatment methods for 104 of the 120 State listed noxious weeds, so noxious weed control efforts focused on weeds in developed sites would generally be successful.

Effects of Treatments - Under Alternative 2 (No Action), most noxious weed control in developed recreation sites occurs using manual methods (approximately 513 acres). Approximately 340 acres would be treated using herbicides, 96 acres using mechanical methods and approximately 7 acres would be treated using biocontrols (Table 4-26). The mechanical and manual methods of control would result in short-term effects to recreationists (noise from the use of mechanical equipment and potential access restrictions while the weeds are manually pulled or grubbed). There are no anticipated short-term effects associated with the use of biological controls to developed recreation. The effects of treating noxious weeds with herbicides under this alternative includes temporary closure of the site or trail in accordance with the herbicide label instructions, the presence of browned and dead vegetation after the treatment, and the potential for accidental exposure to the herbicide by recreationists (see the *Human Health and Safety* section for more information).

Under Alternative 2, all treatment of invasive and any other unwanted native vegetation consists of manual and mechanical treatments (Table 4-26). The effects of these treatments would be the same as described for the Reference Analysis.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

<u>Dispersed Recreation</u>

Effects of Noxious Weeds and Other Invasive Plants - Under this alternative, the rate of weed spread would decrease to an estimated 7 percent per year compared to 12 percent under the No Action Alternative (Alternative 2). Under Alternative 3, 1.9 million fewer acres are projected to become infested in 15 years than under the No Action Alternative. As discussed for the Reference Analysis, the presence of noxious weeds has the potential to effect recreation in dispersed areas and therefore, the degree to which each alternative reduces the threat of noxious weeds results in a benefit to dispersed recreation activities. Additional benefits beyond the reduced spread rate include: 1) the broader array of herbicides available allows for the treatment of those noxious weeds that can only be effectively controlled using one of the herbicides available under this alternative and therefore the reduction of those weeds will improve the health and ultimately the recreation potential of those areas; and, 2) invasive (non-noxious) vegetation could be treated using herbicides. Treating some at-risk areas after a wildfire to prevent the establishment of invasive plants such as cheatgrass will help ensure that those areas support native or other non-invasive vegetation as they recover and this in turn will help those areas support recreational opportunities and activities.

Effects of Treatments - The effects to dispersed recreation from all methods of treatment would be essentially the same as described under Alternative 2 except that the additional herbicides (above the four available under the No Action Alternative 2) would often allow the use of an herbicide that is more target specific and generally less toxic to humans, and more effective in lower doses, thereby reducing the impacts of herbicide use on the recreational resource and reducing the chance for accidental exposure to recreationists. In addition, the use of herbicides to treat invasive vegetation would likely result in additional closures and additional acres of browned and dead vegetation, both of which could affect recreation opportunities and experiences.

Developed Recreation

Effects of Noxious Weeds and Other Invasive Plants - The effects of treating noxious weeds in developed recreation sites and trails would likely be very similar to effects listed under Alternative 2 (No Action) with several exceptions. The ability to treat another dozen of the 16 noxious weeds that cannot be effectively treated under the No Action Alternative could help prevent those species from adversely affecting developed recreation sites and trails. As with dispersed recreation under this alternative, the availability of more effective herbicides has the potential to improve treatment effectiveness. However, with a broader array of herbicides available, an herbicide may be used in place of mechanical and manual treatments if it is thought to be a more effective method of treating a noxious weed in the developed recreation site or trail.

Effects of Treatments - As noted under the dispersed recreation discussion, this alternative could result in the use of herbicides to treat invasive vegetation in developed recreation sites and trails. Currently, 140 acres of invasive vegetation are being treated using manual methods and 250 acres are being treated using mechanical methods in developed recreation sites and trails. With the opportunity to use herbicides, some of these acres would likely be treated using herbicides and it is also likely that additional acres, that currently go untreated due to a lack of an effective method, would be treated using herbicides under this alternative. The additional herbicide use would result in short-term recreation effects such as those associated with closures, browned vegetation, and potential for accidental exposure to herbicides. The availability of additional herbicides would reduce the amount needed (per acre), the need for retreatment, and the effects to non-target vegetation. It is anticipated that manual methods of treatment would continue to be the primary form of treatment of noxious weeds in recreation sites, and that the acres treated and the associated effects from both manual and mechanical methods would be very similar to those under Alternative 2 (No Action).

Native and other non-invasive vegetation encroaching on roads and other developments would continue to be treated using manual and mechanical methods. The effects of those treatments would be essentially the same as described for Alternative 2.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

The effects to both developed and dispersed recreation under Alternative 4 are very similar to those found under Alternative 3 with the following exceptions.

Dispersed Recreation

Alternative 4 allows for the use of herbicides to do safety and maintenance treatments of native and other non-invasive vegetation along access roads and around trailhead parking areas, staging areas, and similar developments. This would result in additional short-term closures of these areas, the presence of browned and dead vegetation, and an increased risk of accidental exposure to herbicides all of which potentially detract from the recreation experience and recreation resources. However, the long-term benefit of these additional treatments is an additional 1 percent reduction in the annual rate of noxious weed spread, to 6 percent, and 300,000 fewer acres infested in 15 years on BLM lands in Oregon when compared to Alternative 3. This gain comes in part because these herbicide treatments would incidentally control small, undetected noxious weeds before they are picked up by recreational equipment and clothing and get spread to other areas (see the *Noxious Weed Spread Rate by Alternative* subsection for Alternative 4 in the *Noxious Weeds and Other invasive Plants* section earlier in this Chapter). The maintenance of healthy, native, and diverse vegetative communities that results from this lower rate of weed spread benefits recreation resources over the long-term.

Unlike Alternative 3, Alternative 4 also allows for the treatment of native and other non-invasive vegetation with herbicides in an effort to improve habitat for Special Status species. These types of treatments could benefit dispersed recreation opportunities such as wildlife viewing, hiking, and hunting by promoting more natural conditions for plants and wildlife.

<u>Developed Recreation</u>
The other primary difference in recreation effects when comparing Alternatives 3 and 4 involves the option of treating native and other non-invasive vegetation in developed recreation sites, such as poison oak, using herbicides. These treatments would increase the effects of short-term area closure, the presence of browned and dead vegetation,[67] and the risk of accidental exposure to herbicides. The ability to treat unwanted vegetation would result in short and long-term benefits to recreation sites and trails by improving access, protecting BLM improvements (signs, restrooms, parking lots), and reducing the potential for recreationists to be exposed to injurious native vegetation such as poison oak. With the ability to use herbicides to treat native and other non-invasive vegetation in developed recreation sites there would be a corresponding reduction in the amount of manual and mechanical treatments and therefore the effects from those activities would be reduced.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

The effects to both *<u>developed</u>* and *<u>dispersed recreation</u>* under Alternative 5 would be the same as described for Alternative 4 (Proposed Action) with the following exceptions.

Alternative 5 permits the use of herbicides for general habitat improvement, fuels treatments, and other non-vegetation management objectives other than those specifically for livestock forage or timber production. An additional 4,800 acres of herbicide treatments are expected to occur under this alternative. These types of treatments could have additional short-term negative impacts to dispersed recreationists from site closures, and long-term benefits from improved wildlife viewing, hiking, and hunting from improved conditions for plants and wildlife.

Alternative 5 also allows for the use of a slightly broader array of herbicides when compared to Alternative 4. This would provide the BLM with greater flexibility in the treatment of noxious weeds, invasive plants, and unwanted vegetation and may result in different herbicides being applied in dispersed and developed recreation sites and trails. However, the overall acres of noxious weeds and other invasive plants treated would be about the same as under Alternative 4, so changes in effects to recreationists would be negligible.

67 It is also possible that treatment of native vegetation could involve such things as treating stumps of cut woody vegetation to keep it from sprouting. Without herbicides, the vegetation would be cut anyway, but preventing its resprouting would allow adjacent desirable vegetation to grow.

Administrative Sites, Roads, and Rights-of-Way

Affected Environment

This section addresses vegetation management around administrative sites[68], roads, and rights-of-way (referred to herein as "developments") for the purposes of maintaining and protecting infrastructure developments and providing for their safe and efficient designed use. Developments addressed here include those owned and managed by the BLM, as well as those owned and managed by private individuals, companies, districts, city/county/state governments, and other Federal agencies and occupying BLM lands under permit or other written agreement. They include but are not limited to:

- Linear utility transmission systems and pipelines, including multi-purpose corridors;
- Road or railroad rights-of-way;
- Oil and gas production or gas storage agreement areas and facilities;
- Geothermal, wind, or solar energy production areas and facilities;
- Pumped storage hydro-power production areas and facilities[69];
- Common-material or rock quarry pits and storage areas (primarily to ensure invasive weeds are not spread with the material);
- Federal, State, local or tribal designated fire suppression equipment sites and staging areas including helispots;
- Cell phone, microwave, and other communication sites;
- BLM seed orchards and progeny test sites;
- Public purpose lease areas, including airstrips, schools, parks, etc. ;
- Interagency special management areas (e.g., reservoirs, military training, etc.);
- Watchable Wildlife, Adventures in the Past, Wild Horse Herd Viewing, Outstanding Natural Areas and other BLM designated interpretive sites;
- BLM offices, fire stations, and other facilities;
- Developed campgrounds, picnic areas, trails, overlooks, OHV play staging or parking areas, hang-gliding areas and boat facilities;
- Other administrative and operational sites needed for wildfire suppression, law enforcement, search and rescue, inventory, research, resource monitoring or other authorized administrative uses; and,
- Mines.

Vegetation is currently managed around and/or within these sites to prevent it from growing into, against, or through developments such as buildings, power lines, and roads; to reduce fuels so wildfire will not damage developments such as microwave towers and transformer stations; to reduce fuels so fires starting within the developments do not escape onto surrounding wildlands; to remove vegetation interfering with road sight distances or the safe use of developed recreation sites; and, to facilitate their designed use such culturing activities needed to establish, maintain, and access trees within seed orchards or progeny test sites. In general, this

68 Administrative sites include various developed recreation sites, which are discussed in additional detail in the *Recreation/Interpretive Sites* section in this Chapter.

69 As of July 2010, there are no approved wind, solar, or pumped storage facilities on Oregon BLM lands, but such projects might be developed in the future. A proposed wind energy project is under consideration on the Baker Resource Area.

vegetation management is the responsibility of the development owner, using methods approved by the BLM. Permit holders are usually also responsible for controlling State Category A and T noxious weeds on their permit areas. Except for noxious weed control using one of the four currently approved herbicides, herbicide use is not currently an approved method for vegetation management in or around these sites.

Government Facilities and Roads

- The BLM operates or oversees operation of diverse facilities on public lands.[70] These includeDesignated BLM road systems, rock quarries or pits and bulk material or equipment storage sites;
- Buildings, administrative sites and other government facilities, including leased sites and BLM (sole use) communication facilities, remote weather stations, water wells, etc.;
- Seed orchards and progeny test sites or cottonwood gallery production sites.

Construction and operations disturbance can often introduce noxious weeds and other invasive vegetation to facility sites and roads. However, most vegetation management at facilities focuses on controlling vegetation that can pose a health, safety, or fire hazard, contaminate materials, or interfere with site operations.

Government Roads, Quarries, Rock Pits, Bulk Material, and Equipment Storage Sites: There are approximately 23,000 miles of BLM managed roads in Oregon including mainline, collector and administrative roads and spurs (USDI 2007d). All components are managed to meet transportation system objectives, including maintaining roadside vegetation to minimize wildfire hazards, optimize driver line-of sight for safe operations and provide access to various informational signs or kiosks. In addition, there are non-system roads, ways, and user-created access routes, which are normally not subject to routine annual maintenance. Generally, only noxious weed and other invasive plant management is anticipated for non-system roads.

BLM road systems require substantial quantities of "pit-run" or unprocessed rock material and crushed and graded rock to surface, maintain, and stabilize roads and related structures. BLM also provides nearby owners and State and local governments with common material to minimize overall road system management costs and increase efficiency and safety of travel. In some instances, material is stockpiled or pre-positioned for future use. It is estimated there are 300 rock pits or quarries and an additional 300 material stockpile or other road-system related storage sites. These sites are usually maintained free of most vegetation to enhance site operations and safety and to minimize the production and distribution of invasive weed seeds from the quarry, pit, or storage site to the road system.

Buildings, Administrative Sites, and Other Government Facilities: These include seasonal fire stations, BLM managed airstrips and helipads, corrals, water source developments, sanitary systems, BLM-only communication sites, and remote automated weather stations. Small radio repeater stations are often required to extend the "line of sight" for radio transmissions into remote and rugged terrain. Often these facilities are co-located with other BLM structures or sites managed in common with other low power communication systems owned by Rural Fire Districts, County Sheriffs, Oregon State Police, etc.

Recreation and Public Purpose (R&PP) Leases and Jointly Managed BLM Managed Lands: About 40 parcels totaling over 7,000 acres are under long-term lease or cooperative management agreements to local governments. These include parks, schools, solid waste transfer stations, and highway equipment maintenance or bulk materials storage. They also include airport buffer zones or options for future site expansion that do not require active vegetative management at this time. BLM also jointly manages lands with other Federal agencies, including dams and recreation areas around reservoirs managed with the Corps of Engineers, and training areas and radar sites managed with the Department of Defense. It is possible the Oregon Air National Guard, the Air Force, and some

70 Some BLM roads and other developments not on BLM lands are also included in this discussion.

Oregon County Sheriff's departments have pre-identified road junctions or other suitable locations for medical-evacuation landing sites, especially in areas with frequent search and rescue operations.

Seed Orchards and Progeny Test Sites: The Oregon BLM manages four seed orchards in Clackamas, Lane, Jackson, and Josephine Counties. The seed orchards provide genetically improved Douglas-fir and sugar pine seed and seedlings for reforestation and a variety of land management activities. Additionally, the orchards are involved in cooperative agreements with private timber companies and nurseries to provide seed in return for commensurate payment for operational and management costs. All have current NEPA analysis and management plan/Record of Decisions (USDI 2005a, b, c, 2006a, b) with identified needs and opportunities for the use of up to five herbicides[71] to control unwanted vegetation inside fenced, access-controlled, posted sites. The Forest Service Dorena Genetics Resource Center is also on BLM lands and has an existing NEPA document addressing the use of glyphosate and triclopyr (USDA 1995a). In addition there are hundreds of progeny test sites; the Forest Service manages a seed orchard on BLM lands in Coos County, and the Prineville District manages a cottonwood "gallery" for production of riparian restoration seedling production.

Rights-of-Way

Under FLPMA and the Mineral Leasing Act provisions, the BLM issues right-of-way grants to authorize the construction, operation, and maintenance of a wide range of projects on public lands. These include petroleum and natural gas pipelines, electrical transmission lines, telecommunications lines, energy development and distribution facilities, water facilities, (non-BLM) communication sites, and roads. Rights-of-way are issued for short-term use of public lands or in perpetuity. Right-of-way grants including those to the Oregon Department of Transportation and counties for highways generally include provisions that authorize the holder to manage vegetation within and adjacent to the rights-of-way using methods approved by the BLM. Provisions also require adherence to applicable State and Federal laws and regulations concerning the use of herbicides and other pesticides. Prior to the use of such substances on or near the right-of-way, grantees are required to complete a written plan for approval by the BLM that specifies the type and quantity of material to be used, the pest to be controlled, the method of application, and other information as the BLM may require. All use of such substances on or near the right-of-way shall be in accordance with the approved plan.

The scope and intensity of vegetation management treatments within rights-of-way are operationally specific and highly variable, and various vegetation management methods are used. Currently on *non-BLM managed lands in Oregon,* pre-emergence or post-emergence herbicides can be applied to prevent or control young emerging and existing vegetation. Mechanical methods, such as mowing, are also used *on all ownerships* to eliminate undesirable vegetation. In certain situations, livestock are used to selectively remove undesirable plant species, in a targeted approach. Both invasive and non-invasive vegetation can interfere with right-of-way site access and facility maintenance, interfere with electric power flow, and pose safety problems for workers and other users of the right-of-way. The development and maintenance of rights-of-way has significant impacts on vegetation. Maintenance of most rights-of-way in early seral vegetation exacerbates the potential for invasive plants; the relatively open nature of rights-of-way make them attractive to many recreationists including OHV enthusiasts, horseback riders, and hikers who can spread these plants within and away from the right-of-way.

Permits or memorandums of understanding (MOUs) specify expectations and responsibilities for vegetation management. For example, the Federal government's 2006 MOU with Edison Electric Institute regarding its transmission lines specifies reducing soil erosion and water quality impacts within the right-of-way by using best management practices; reducing the risk to human health, natural resources, and the environment by promoting the use of integrated vegetation management for maintaining vegetation near transmission and distribution lines; manage rights-of-way to maintain habitat and protect Federally Listed species; reduce the introduction and control

71 dicamba, glyphosate, picloram, hexazinone, and triclopyr

the spread of invasive plants or noxious weeds; and, prevent wildfires (Edison Electric Institute et al. 2006). Vegetation management along many power line rights-of-way and other developments is addressed by existing, cooperatively written NEPA documents, and herbicide use proposed in those documents or their decision records is included on Table 3-3 for Alternatives 4 and 5.

Petroleum and Natural Gas Leases, Pipelines, Access and Related Facilities: Natural gas pipeline and associated underground facilities are operated and maintained in accordance with 49 C.F.R. 192, Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards, as required by the Department of Transportation. The only producing natural gas or petroleum field in Oregon is the Mist Field, located in Columbia and Clatsop Counties. This field is also used for seasonal underground storage of off-site-produced natural gas under a Federal gas storage agreement. Portions of major (10 inches or larger diameter) petroleum or natural gas regional transportation pipelines cross BLM managed lands in Oregon, and can require vegetation control on a corridor 50 feet wide. Vegetation along the permanent pipeline right-of-way is periodically maintained by mowing or cutting. Vegetation maintenance is a required periodic use of the Federal lands crossed by the pipeline, and is included in the terms and conditions of the right-of-way grant. Generally, herbicides would not be used except for select treatment of nuisance vegetation or select use within aboveground facilities. No herbicides are used without the consent of the land-managing agency. Vegetation maintenance is conducted every 3-to-5 years, depending on vegetation growth rates. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width, centered over the pipeline may be maintained in an herbaceous state by annual maintenance if required. In addition, access routes and related facilities for monitoring, control, pumping, or compression may entail additional acreage. Generally, these related facilities would be fenced and devoid of any vegetation to reduce operational or fire safety risks. Current vegetation management, exclusive of noxious weed control, is limited to non-herbicide methods.

Geothermal Energy Leases, Energy Generation, and Transmission: There are no *producing* geothermal energy leases on BLM managed lands in Oregon, although there are geothermal leases primarily in Deschutes and Klamath Counties. Geothermal energy conversion to electric power would require on-site development of pipelines, generation and other facilities, electric sub-stations and transmission lines.

Railroads – Railroad rights-of-way cross BLM managed lands primarily in Baker, Deschutes, Douglas, Tillamook, and Union Counties. Rights-of-way also include maintenance access routes and related facilities for system monitoring, control, or material storage (often fenced). Generally, facilities are maintained devoid of any vegetation to reduce operational or fire safety risks.

Electric and Telecommunications Transmission Lines: About 4,000 miles of electric transmission lines cross BLM-managed lands in Oregon. Major transmission systems are considered any line energized to 69 kilovolts or more and are generally designated as utility corridors through BLM's land use planning process. The interstate electric transmission system includes numerous lines that are operated at 230, 360, 500, or 750 kilovolts and require cleared rights-of way 200 feet wide and greater. Vegetation management standards are included in American National Standards Institute (ANSI) Standards A300-2001, Tree Care Operations – Tree, shrub and Other Woody Plant Maintenance – Standard Practices, and the conduct of vegetation control is covered in part by ANSI Z133.1-1994 for Tree Care Operations – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements (Edison Electric Institute et al. 2006). Smaller local lines or distribution lines frequently cross BLM lands and are often associated with public roads and co-located with communication lines. Communication lines include metallic wire and fiber-optic cable telephone lines. Fiber-optic cables may be co-located on high-voltage towers or poles or buried in conduits parallel to power lines, railroads, or road rights-of-way. Transmission system maintenance access routes and related facilities for system monitoring, control, or voltage regulation or distribution sub-stations may entail additional acreage. Generally, these related facilities would be fenced and devoid of any vegetation to reduce operational or fire safety risks.

Communication Sites: There are about one hundred authorized communication sites on BLM managed lands in

Oregon, averaging about two acres per site. Some have vegetation management objectives covering as much as 200 acres to maintain line-of-sight for both radio and microwave technologies. Most sites are located on exposed ridgelines or other high topographic features and may be naturally devoid of deeper soils and taller or faster growing vegetation. Site maintenance access routes and related facilities for system monitoring, control or emergency operation fuel storage may entail additional acreage. Generally, these related facilities would be fenced and devoid of any vegetation to reduce operational or fire safety risks.

Renewable Wind, Solar and Hydro Energy Generation and Transmission Facilities: There are no commercial operating wind or solar energy facilities on BLM lands in Oregon at this time. However, the BLM's national EIS/Record of Decision projected a long-term wind energy lease and development potential of 9,700 acres of BLM managed lands, of which ten percent or approximately 970 acres could be directly affected by access roads, tower sites and related ancillary land uses requiring regular vegetation treatments (USDI 2005e). Oregon's currently untapped solar resources are significant with two-thirds of Oregon receiving as much or more annual radiation than Florida. The Oregon Department of Energy's 2005 Renewable Energy Action Plan notes 100 megawatt-range solar thermal electric facilities may be the preferred option for central solar power generating facilities in the future (ODEQ 2005:27). A University of Oregon Solar Radiation Monitoring Laboratory 2004 Solar Resource GIS Data Base report shows Lake, Harney, and Malheur Counties to have the highest levels of solar radiation in the State (SRML 2004:1). Various other energy proposals have been made, notably pumped storage power generation in Klamath County, and herbicide use may be considered in related future NEPA documents.

Environmental Consequences

Effects by Alternative

West of the Cascades, up to fifty percent of rights-of-way and other developments require annual control of encroaching non-invasive vegetation depending upon the nature of the development and its level of use, with some portions of heavily used system roads getting vegetation treatment at least annually. Total non-invasive (native and other) vegetation control in and around administrative sites, roads, and rights-of-way is estimated to be 10,000 to 15,000 acres per year.[72] East of the Cascades, although gross acres of developments are four to five times what they are west of the Cascades, the need for annual maintenance is much lower, and the annual vegetation control need is also estimated to be 10,000 to 15,000 acres per year.

Reference Analysis – No Herbicide Use; Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only; and, Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Under the Reference Analysis and Alternatives 2 and 3, all management of native and other non-invasive vegetation in and around developments would continue to be conducted using non-herbicide methods. These methods include mowing, flailing, tilling, roller/crushing, hoeing, scraping, pulling, prescribed fire, directed livestock, covering, propane (or other fuel) burning, hot foam or steam, and other methods. Objectives of these treatments include:

- protect developments from damage from plants such as trees growing into wires or rubbing on buildings, and plants growing through pavements;
- reduce flammable vegetation near developments, particularly those in remote areas such as microwave

72 This work is so functionalized and spread across so many development owners that a more precise estimate would be difficult. The estimate is offered here only to provide a rough context for the Alternatives 4 and 5 proposed use of herbicides.

towers, to reduce the risk of damage from wildfire;
- reduce flammable vegetation along roads and around drilling and other work sites to prevent sparks and other ignition sources from starting a wildfire;
- remove vegetation interfering with road sight distances;
- remove vegetation interfering with safe use of developed recreation sites such as poison oak; and,
- to otherwise conduct the management the site is designed for, such as conducting culturing activities needed to establish, maintain, and access trees within seed orchards or progeny test sites.

Where vegetation resprouts, treatments may need to be repeated two or three times per season.

Under Alternative 2, four herbicides would be available for treating noxious weeds only. Only an incidental portion of the above treatments would involve noxious weeds, so the use of herbicides under Alternative 2 would do very little to change the conduct or effectiveness of these treatments. In fact, it is common practice in some areas to treat noxious weeds along roadsides with herbicides, and then return to mow or otherwise treat the remaining vegetation on the same site. Under Alternative 3, more herbicides would be available, but their use would be limited to noxious weeds and other invasive plants. Along roads and around other developments where invasive plants such as cheatgrass create a fuels hazard, some fire protection objectives could be met with herbicides because invasive plants could be controlled with herbicides.

Accomplishing this work without herbicides is usually practical; it has been done at least since 1984. As discussed in other sections of this EIS, however, there are drawbacks when compared to herbicide use. These drawbacks most notably include high cost and the higher likelihood that mowing and crushing equipment would spread invasive plants down the road and from site to site much more so than would spray equipment. In rural areas, however, vegetation management along highways and county roads can be delayed or left undone because of the complexity of having to treat the BLM-portion of the right-of-way with non-herbicide methods. This results in safety issues, and having vegetation and resultant fires come right to the pavement edge where they cause damage.

The additional herbicides under Alternative 3 would substantially improve the ability of rights-of-way permit holders to meet permit requirements to control State listed Category A and T noxious weeds.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses and Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Vegetation Management Objectives

Alternatives 4 and 5 would make herbicides available to meet a portion of the vegetation management objectives in and around developments. The analysis assumes that herbicide use would replace, on a one-to-one basis, acres currently treated with non-herbicide methods (Chapter 3). West of the Cascades, selective herbicides are generally used. For example, except for a couple of feet immediately adjacent to the pavement edge[73], roadside treatments west of the Cascades generally seek to reduce woody vegetation while maintaining roadside grasses and forbs in roadside drainage ditches to prevent erosion. East of the Cascades, one of several persistent pre-emergent herbicides may be used (Table 3-3) because the risk of erosion in the ditches is lower while the risk of a wildfire being started on a roadside is considerably higher, making complete clearing for 10 to 20 feet more desirable. Similarly, herbicides could be used to treat vegetation around wooden power poles on BLM lands, to reduce the risk of wildfire burning down the poles.

73 On both sides of the Cascades, the couple of feet adjacent to pavement may be treated with persistent, bare-ground herbicides to prevent plants from damaging pavement edges.

Under these alternatives, the persistent and relatively non-selective herbicides bromacil, diuron, and tebuthiuron would be available east of the Cascades (and diuron would be available west of the Cascades) to provide longer-term vegetation control around pump stations, communications sites, electricity substations, and other administrative sites to protect them from wildfire. Dry vegetation near developments east of the Cascades can be a fire risk, and a vegetation-free buffer of even a few yards can protect these otherwise unprotected, often isolated, and generally unstaffed sites (see herbicide use summaries under *The 18 Herbicides* section in Chapter 3). Non-herbicide methods that require rock, pavement, or other materials are more expensive and can create disturbances that exacerbate invasive weed problems.

Herbicides would be considered where they have operational advantages over non-herbicide treatments. For example, vegetation under power lines west of the Cascades can be converted to shrubs and forbs by chainsaw cutting trees and following with stump-applied herbicide treatments to keep them from resprouting. Herbicides would also facilitate the removal of low-growing vegetation without the damage to compacted fills and shoulders that could result from blading or other treatments. As noted in the *Noxious Weeds and Other Invasive Plants* section in this Chapter, herbicides are likely to do less site disturbance, reducing the likelihood of infestation by invasive plants. Other potential advantages (and disadvantages) of using herbicides in rights-of-way, administrative sites, and recreation sites are discussed in other resource sections within this Chapter and include:

- Herbicide use would reduce mowing and other potentially more visually disturbing treatments (see *Visual Resources* section).
- Herbicide vegetation control would be less expensive than corresponding non-herbicide treatments (see *Implementation Costs* section). This is particularly true for owners of pipelines, transmission lines, and other linear developments where the owners are already using herbicides on non-BLM portions of the route.
- On many sites, herbicide treatments can be safer for workers than the corresponding use of mechanical equipment like repeated use of chainsaws (see *Human Health and Safety* section).
- Herbicide use on native and other non-invasive vegetation would incidentally kill noxious weeds not identified and controlled by noxious weed control crews, which is particularly important because roads are dispersal corridors for noxious weeds, and access roads under power lines often attract OHV use, which is implicated in noxious weed spread (see *Noxious Weeds and Other Invasive Plants* section).
- Because OHVs use power line and other access roads, herbicide exposure could increase for this user group.
- Herbicide equipment would be less likely to move noxious weed seeds to other sites than other control methods (see *Noxious Weeds and Other Invasive Plants* section). These last two points are projected to incidentally[74] reduce noxious weed infestations by 300,000 acres over 15 years when compared to Alternative 3.
- Herbicides would be less likely to start fires than most mechanical control treatments, particularly chainsaws.
- Herbicides could be used by cooperators to maintain sight-distances on shared maintenance roads in checkerboard lands, allowing safety-related maintenance of entire haul routes in a single treatment and better facilitating cooperators' expected heavy use dates.
- Keep wildfire away from developments (also see *Fire and Fuels*).

The potential for positive and negative effects to soils, wildlife, water, wetlands and riparian areas, human health, public perception (socioeconomic), and native and other non-invasive plants are discussed in those sections. For example, roadsides include ditches and culverts that lead to streams. The potential for roadside sprays to enter those streams is considered in the *Water Resources* section. Similarly, the general application of herbicides to

74 Incidentally, because noxious weed control is not the stated objective of the native vegetation control treatments that would take place under Alternatives 4 and 5.

roadsides is considered by many publics to result in an unknown and unacceptable potential exposure to humans (see *Social and Economic Values* and *Human Health and Safety* sections).

Standard Operating Procedures, site-specific NEPA analysis, licensed applicators, and other restrictions would apply to all herbicide applications. For example, herbicides are usually not applied aerially over power lines because drift could not be adequately controlled while flying that high (although they may be applied by flying under power lines). In addition, stream and Special Status species' buffers suggested in the PEIS Mitigation Measures and finalized at the project level must be adhered to. Herbicide use in and around developments including those occupying BLM lands under permit or other agreement is subject to BLM approval.

Seed Orchards and Progeny Test Sites: Herbicide use at the Horning, Tyrrell, Provolt, and Sprague Seed Orchards was proposed and examined in detail in a 2005 *Integrated Pest Management EIS*, and that use was subsequently approved in December 2005/2006 Records of Decision pending the lifting of the 1984/87 District Court Injunction. Five herbicides[75] are proposed to be used in combination with non-herbicide methods for the control of noxious weeds, woody brush, and other vegetation along fence lines, roads, administrative buildings, buffer areas, competing vegetation around orchard trees, and for site preparation when establishing new seedlings. Herbicides would replace some of the work currently done with non-herbicide methods. For example, manual vegetation control along fence lines at the Tyrrell Seed Orchard is currently scheduled about every three years, and requires about 21 days for a 10-person inmate crew to complete. An herbicide application covering the area would take one person a single day. These alternatives also include the use of glyphosate and triclopyr (as well as future site-evaluated herbicides) at the Forest Service Dorena Genetic Resource Center for noxious weeds, woody brush and vegetation along fence lines, roads and administrative buildings, and competing vegetation around orchard trees. The cottonwood gallery site at Prineville may need incidental herbicide use for vegetation maintenance.

In general, herbicides are not required for vegetation control on the hundreds of first generation progeny sites; measurements are nearly completed and most are being managed as part of the surrounding forestland. However, Salem and Eugene BLM each have a 10-acre second-generation Douglas-fir site planted in 2001, and Coos Bay BLM has two 13-acre Douglas-fir sites planted in 2002. Control of selected brush and weed species on the Salem and Eugene sites may be beneficial for maintenance, but only minimal herbicide use is planned. Herbicides are not expected to be required on the Coos Bay sites. Proposed herbicide use in seed orchards and progeny sites totaling about 100 acres per year is included on Table 3-3, and the potential for adverse effects to water and other resources is addressed in those sections of this EIS.

Social and Economic Values

Affected Environment

Use of resources and recreational visitation on BLM lands generates employment and income in the surrounding communities and counties. Revenues generated from these uses are returned to the counties and Federal treasury, or are used to fund additional activities to accomplish land management objectives. Similarly, resources flowing from BLM lands including water, fish, wildlife, and clean air affect surrounding communities and off-site resources. Additionally, less desirable elements like wildfire and invasive weeds can also affect surrounding communities. Herbicide use and other vegetation treatment methods on BLM lands affect these area resources and opportunities, and thus affect the adjacent communities.

75 dicamba, glyphosate, picloram, hexazinone, and triclopyr

Analysis Area

For this analysis, four economic areas from the U.S. Bureau of Economic Analysis (BEA)[76] are used to divide the State into two broad areas composed of counties that fall on the east and west sides of the Cascade mountain range. Social and economic characteristics of Oregon make this division appropriate. The Interior Columbia Basin Ecosystem Management Project (ICBEMP) used the BEA's economic areas for regional analysis (USDA 1998). These economic areas represent the relevant regional markets for labor, products, and information and are mainly determined by commuting patterns. This delineates local labor markets and serves as a proxy for local markets where businesses in the areas sell their products (Johnson and Kort 2004). Four of these economic areas make up most of Oregon: west of the Cascades the Portland-Vancouver and Eugene-Springfield economic areas, and the Bend-Prineville and Pendleton-Hermiston economic areas are located east of the Cascades. While Curry, Klamath and Malheur counties make up portions of other economic areas, they can reasonably be considered as integrated with adjacent economic areas in Oregon for this analysis. Two analysis areas, one for each side of the cascades, logically combine economic areas, correspond to district boundaries, and separate areas with significantly different ecological settings, issues, and primary resource management objectives. Scoping comments, population density differences, and other factors also make this grouping appropriate from a social perspective.

In the western half of the State, residents are likely to identify and place value in a variety of traditions, cultures, and ways-of-life within both urban and rural areas. Communities in the growing urban centers of the Willamette Valley and SW Oregon value public land for recreational, commodity, and non-commodity uses. Outside of these urban areas agricultural traditions are valued and a part of the culture of many Oregonians. In more rural areas of the Cascade Mountain foothills, the Coast Range and along the coast, timber, and fishing traditions are valued culturally.

In the eastern half of the State, residents also identify and place value in a variety of traditions, cultures, and ways-of-life within the growing urban areas and steadfast rural communities. Along the Columbia Plateau residents identify with farming traditions more than grazing or timber. In the Northeastern portion of the State, residents are outdoor-oriented in work and play which remains a key value in local communities and an amenity that attracts newcomers. Grazing and timber traditions are also a source of cultural identity in this area (JKA 2006). As noted above, pockets of growing urban areas also exist throughout Oregon's east side where residents identify and place value in a variety of cultures. Regardless of whether a community is west or east side or can be classified as urban or rural, Oregonians value natural resources and the outdoors at some level. Whether through traditional industry, recreation, or with a preservation ethic, communities see the landscape as an important part of what it means to be an Oregonian.

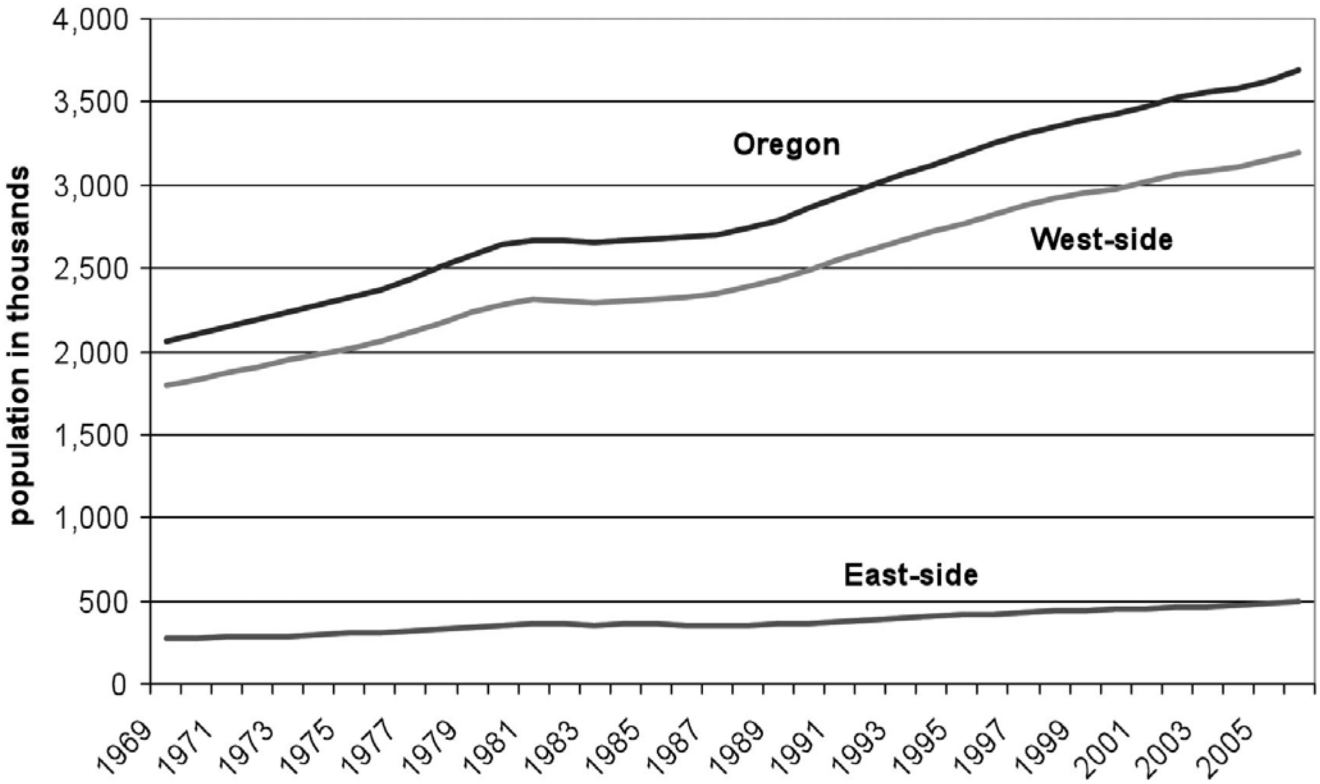
Population and Demographic Change

In 2005, the State of Oregon had a total population of 3,629,959 people with 3,148,960 (85 percent) and 480,999 (15 percent) west and east of the Cascades respectively. Population growth from 1970 to 2005 on both sides of the Cascades was faster than the 45 percent national average. Over this period, the State population grew by 72.4 percent west of the Cascades and 75.7 percent east of the Cascades (Figure 4-8).

Oregon had an overall population density of 38 people per square mile in 2005. Population density within Oregon varies widely, with the lowest county population density at 0.7 people per square mile in Harney County and the highest county population density at 1,560 people per square mile in Multnomah County.

76 The Bureau of Economic Analysis (BEA) is an agency in the United States Department of Commerce that provides important economic statistics including the gross domestic product of the United States. Its stated mission is to "promote a better understanding of the U.S. economy by providing the most timely, relevant, and accurate economic data in an objective and cost-effective manner."

Figure 4-8. Population change for Oregon and counties east and west of the Cascades (Source: US Department of Commerce 2005)



Population density does not indicate if the people living in the area are in more urban or rural areas. The U.S. Census Bureau classifies urban areas and their populations. In the year 2000, populations in counties west of the Cascades were 82 percent urban and 18 percent rural. Of the 82 percent, 65 percent were classified as being inside urban areas while the remaining 17 percent were inside urban clusters (census blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks have an overall density of at least 500 people per square mile), demonstrating a predominantly urban population.

East of the Cascades, populations were 58 percent urban and 42 percent rural. Of the 58 percent classified as urban only 13 percent were actually classified as being inside urban areas while the remaining 45 percent were inside urban clusters, demonstrating the east side contains pockets of urban populations (US Census Bureau 2000a) across a predominantly rural landscape.

Economic Specialization

It is expected that communities that are particularly dependent on a single, resource-dependent industry would be more susceptible to the differences between the alternatives than other communities. In particular, ranching and recreation-dependent communities may be more affected than more diversified communities. Rural county population change, the development of rural recreation, and the development of retirement-destination areas are all related to natural amenities (Knapp and Graves 1989, Clark and Hunter 1992, Treyz et al. 1993, Mueser and Graves 1995, McGranahan 1999, Lewis et al. 2002). Many of the natural amenities in the area are managed by the BLM and thus, may indirectly contribute to specialization in rural areas. For example, elk hunting on BLM lands in the fall provides a significant injection of external dollars in some rural areas of Oregon.

Perceptions, Values, and Concerns

Oregonians' awareness of the threat posed by invasive species to the landscape, and consequently to their values traditions, cultures, and ways-of-life, is increasing. Scoping for this EIS indicated a broad level of support for controlling invasive species on public lands. In 2002, the Oregon Invasive Species Council was created by the State Legislature and began working to raise public awareness of Oregon's invasive species. One of the actions taken by the council was the creation of a hotline to ensure that the public could help in reporting of new exotics and invasive plants. Since its inception, the number of calls has increased each year (Statesman Journal 2007) indicating a potential increase in awareness and community engagement.

The effects of Federal land management actions are likely to be most critical to small, rural communities (USDA 2000a:5). Consequently, *geographically defined communities* are an important and relevant level for social assessment. Not all social scientists agree however, that the geographically based community is always the appropriate level of analysis. FEMAT (USDA et al. 1993:VII-35) makes the point that this view "only refers to physical or political boundaries and not to the relationships among people who reside within such boundaries."

Communities of interest transcend physical or political boundaries and can be used to examine effects to rural communities. Communities of interest bring together stakeholders from different backgrounds to solve problems of common concern (Fischer 2001:4). Brown and Duguid (1991) describe communities of interest as "communities-of-communities." They provide unique opportunities to explore the linkages between people and public land that may transcend the geographically defined community.

The *Environmental Consequences* section identifies scoping-defined groupings based on perceptions, values, and concerns that address both communities of place and communities of interest as they relate to the alternatives.

Environmental Consequences

Invasive plants affect BLM and surrounding lands in a variety of negative ways. Infestations can reduce recreational land values, and the spiny species can cause human health problems (DiTomaso 2000). For example, hunters and bird dogs are reluctant to use land infested with thistles, and weeds diminish the enjoyment of recreationists along trails and near campgrounds. Float boaters similarly have difficulty finding suitable campsites, and fishing along stream banks is often impossible because of the pain inflicted by thistles (Asher and Spurrier 1998). Invasive plants can have a negative effect on observation-based tourism, as the wildlife and wildflowers that people come to enjoy and photograph are crowded out by invasive plants (Westbrooks 1998). Consequently, recreation dependent communities in Oregon may be more susceptible to the effects of invasive weed spread than more economically diversified communities.

Similarly, the *Livestock* section in this Chapter identifies reductions in livestock carrying capacity of thirty-five to ninety percent from weed infestations. Invasive weeds affect the livestock industry by lowering yield and quality of forage, poisoning animals, increasing the costs of managing and producing livestock, and reducing land value (DiTomaso 2000). A 1993 economic study in Grant County showed the annual economic impact to livestock grazing was $326,000 and losses would climb to over $3.96 million [2009 dollars] without increased weed management (Test 1993). In addition to impacts on forage for livestock, invasive plants have impacts on other commodity uses of BLM lands. West of the Cascades, scotch broom partially hampers reforestation efforts and reduces growth rates of surviving trees on some timber harvest units (Asher and Spurrier 1998).

Management of invasive plants affects the goods, services, and uses provided by BLM lands. The analysis of social and economic effects considers market and non-market related values as well as effects to program areas and users of public lands. Direct and indirect effects to programs and BLM users are examined for each alternative in the context of community perceptions, values, and concerns.

Concerns Raised During Oregon Scoping

Many if not most of the comments received during the scoping period for this EIS in July 2008 reflect the *perceptions, values and concerns* of individuals, geographic communities, and communities of interest throughout Oregon. People's feelings and ideas about herbicides are complex. The variety and detail of scoping comments is summarized here into three general categories that are subsequently examined across the range of alternatives. The categories are not intended to label individuals as the comments from single individuals often fell into more than one of these categories.

The Spread of Invasive Plants from Adjacent BLM Lands

Scoping comments described adverse effects from the spread of invasive plants from BLM to adjacent lands. Comments suggested BLM's fragmented ownership pattern and large number of acres (more than 75 percent of some counties east of the Cascades) creates more edge and greater potential for invasive plants spread onto private, residential, urban, agricultural, or other land uses. The inability of BLM to effectively control numerous specific weed species such as medusahead and perennial pepperweed jeopardizes cooperative weed management efforts, as other partners are using herbicides that are more recently available. This was the most frequent comment raised east of the Cascades.

Concerns over the spread of invasive weeds from BLM lands are often founded in the reality of economic losses seen in communities often close to BLM lands. In 1988, a 1,300-acre ranch in Klamath County was abandoned and then auctioned for about ten percent of its original value due to a leafy spurge infestation (Asher and Spurrier 1998). Incomes in ranching dependent communities are also affected by weed spread since weeds decrease the nutritional value and availability of forage in pastures. These effects are compounded by increasing commodity prices, which further decrease profitability. Production losses, fire damage and control costs associated with 21 invasive plants in Oregon were estimated at $120 million per year in 2007 dollars. Potential nursery production losses and control costs if Sudden Oak Death continues to spread in Oregon were estimated at $79 to $304 million per year in 2007 dollars. In addition, the complete removal of invasive plants and revegetation with native species in the city of Portland was estimated at $10 to $31 million per year in 2007 dollars (Cusack and Harte 2008). While total costs attributable to invasive plant spread from BLM lands are not available, these examples give perspective on the extent of potential losses statewide. Costs from noxious weed and other invasive plant spread from BLM lands would be borne by communities and landowners adjacent to BLM.

Herbicide as a Threat to Resource Values and Human Health

Many comments proposed that the potential damage to resource values from treatments does not justify the use of herbicides. Many suggested herbicides threaten non-target native, Federally Listed, and other Special Status species. Some noted effects to other forest products collected for their subsistence, cultural or commercial value such as chanterelle or matsutake mushrooms. Others suggested herbicides would destroy beneficial species which help control invasive plants. Concerns about the persistence of herbicides in soils and their threat to air and water quality were noted. Particular concern was expressed about bioaccumulation and the threat herbicides pose to biodiversity and ecosystem function. Several comments identified threats to resource values off BLM lands from off-site movement of herbicides; agricultural crops and other non-target species were mentioned. Other comments made the case that the use of aerial application and boom broadcast spraying methods increased the likelihood of harm to these resource values. Many of these comments reflect the interests of communities who value non-commodity uses of BLM.

In addition to concerns about adverse ecosystem effects of herbicides, comments reflected concerns about adverse effects on human health. These comments noted the increased human health threat to users of BLM lands, adjacent landowners, herbicide applicators, and BLM personnel who work in the field. Particular comments made the case aerial application and boom broadcast spraying methods were a threat to human health. Other comments noted that children, elderly, and others with special medical conditions have an increased vulnerability to herbicide treatment. Bioaccumulation and cumulative exposure to pesticides and other contaminants from all sources was stated as a concern.

Herbicide as a Benefit to Resource Values

Many comments stated that proper herbicide use could enhance, protect, and maintain resource values. These comments made the case that herbicides can be used to maintain and restore habitats and biodiversity on BLM lands, including in special management areas. Others said herbicide treatments would decrease the threat of noxious weeds and other invasive plants to commodity and human uses such as livestock grazing recreation use. Others stated that additional herbicides, and aerial application methods, are essential to ensure efficient and effective treatment of invasive plants and allow BLM to enhance, protect, and maintain resource values at lower cost.

These and related comments identified a range of commodity and non-commodity resource values important to quality of life that need to be protected. They noted that assigning and understanding the value of non-commodity resources and non-market values was important, since without estimates, these resources may be undervalued and decisions regarding their use may not accurately reflect their true value to society. Non-market values can be particularly difficult to quantify because they include existence, bequest, and option values. Existence values are the amount society is willing to pay to guarantee that an asset simply exists, while option and bequest values are society's willingness to pay to preserve the opportunity for future use and for future generations

In their report to the Oregon Invasive Species Council, Cusack and Harte (2008) note that while there have been many studies on the impacts of invasive species in localized settings, few take into account non-use impacts of invasive species, which might be due to the difficulty in preparing estimates and the controversy over available methods. In the absence of quantitative information for these goods, they are discussed qualitatively where appropriate below. These values are also discussed in other sections of this EIS.

Effects Common to All Alternatives

Invasive weeds on BLM lands and the activities proposed under the alternatives can affect the public in several different ways including:

- Management activities such as those involving timber, vegetation, public access, grazing, recreation, mining, fire, and fuels management are made more expensive by the need to incorporate weed prevention techniques such as equipment cleaning, avoidance, seasonal restrictions, mitigation, and monitoring;
- Physical and aesthetic impediments to land use created by the invasive plants themselves;
- Area or facility closures, or herbicide exposures, related to vegetation treatments themselves;
- Degradation of resources flowing from BLM lands such as water or wildlife;
- The spread of invasive weeds to non-BLM lands; and,
- Infestation-related resource displacement resulting in commodity, non-commodity, and non-market losses.

Conversely, treatments under the action alternatives would variously result in improvements in the condition of BLM resources and would lead to increases in commodity, non-commodity, and non-market values. Non-market values such as improved recreation opportunities, reductions in wildfire risk, more efficient management of rights-of-way, and habitat improvements would benefit the economies of communities, dependent on recreational opportunities and natural amenities.

Economic Losses

Economic losses are not particularly quantifiable for BLM lands with existing information. BLM lands share a statewide problem that no central source exists for compiling invasive plant infestation and treatment information within Oregon, and there is no requirement for county, private, or corporate landowners to report invasive plant information Despite limited reporting on weed locations, maps of the reported distribution of noxious weed species are available on a species-by-species basis online at http://www.weedmapper.org. The 1.2 million acre estimate for noxious weeds was compiled by the nine BLM district weed coordinators based on district maps and records, and from a special report, and includes about 600,000 acres just of medusahead.

Oregon-wide information compiled for the Oregon Department of Agriculture by Radke and Davis (2000) is illustrative of the issues on BLM lands, since BLM manages 25 percent of Oregon and 12.3 percent of its forestlands. Their report includes:

> "A preliminary analysis of the economic impact in personal income of the 12 worst noxious weeds in Oregon estimated the foregone income to Oregon of these weeds to be $67 million annually (Radtke 1999)",

And

> "In Oregon… tansy ragwort, is known to have caused annual losses on the order of $6 million. Economic Containment programs so far have kept tansy ragwort from becoming an economic problem in eastern Oregon. There is a real threat for this noxious weed to expand into rangelands of eastern Oregon. The potential loss to agriculture and supporting industries for such on invasion could be $10 million in total personal income or 400 annual jobs."

Effects by Alternative

The Spread of Invasive Plants from Adjacent BLM Lands

Neighboring private and public lands are adversely affected by the spread of invasive plants from BLM lands. Land values are reduced, forage and other vegetation values are harmed, and weed control costs for neighboring landowners or other administrative agencies (Federal, State, and local governments) are increasing. A reduction in the magnitude of these adverse effects would be directly related to the success of the selected alternative in slowing noxious weed spread and decreasing future infested acres.

Reference Analysis – No Herbicide Use: The spread of invasive plants from BLM lands would be highest under without herbicides, where weed spread would increase to a predicted 14 percent annually, and an estimated 1/2 of BLM lands in Oregon would be infested with noxious weeds in 15 years (Table 4-4). Further, the BLM would be without effective control methods for about 2/3 of the noxious weed in Oregon (Appendix 7: Table A7-1), so eradication of specific weed populations about to spread to new or susceptible areas would often be ineffective.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only: Under Alternative 2, noxious weeds would be expected to continue expanding at the current 12 percent per year, and about 1/3 of the 15.7 million BLM acres in Oregon are projected to become infested in 15 years (Table 4-4). Since treatment acres would remain at current levels, future costs to neighboring private and public lands would continue to escalate along current trends as the scope and size of the problem continued to grow.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases: Under Alternative 3, future costs to neighboring private and public lands would decrease (from the No Action Alternative). Herbicides would be available to treat 97 percent of the noxious weeds, and cooperative control efforts could take place on BLM lands because most of the herbicides already being used by these groups on adjacent lands would be available. The BLM would be perceived as a more equal partner in weed control efforts with the means to use a wider range of herbicides. In addition, some east side and possibly Siskiyou Biome communities would benefit from decreased fire risk associated with additional treatments with imazapic to reduce annual grasses. Wildland fire-related costs in these communities (such as property loss, and lost revenues) could be reduced because of the additional 11 to 13,000 acres of invasive grass treatments east of the Cascades.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses and Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives: Under Alternatives 4 and 5, neighboring private, residential, urban, and other land uses adjacent to BLM lands would benefit from the overall reduction in noxious weeds of 2.2 million acres in 15 years when compared to the No Action Alternative (Table 4-4). Benefits to adjacent landowners would particularly accrue from the roadside herbicide treatments indirectly reducing noxious weeds and other and invasive plants in locations where they are most likely to be spread to their lands.

Herbicide as a Threat to Resource Values and Human Health

Many comments stated invasive plant control did not justify the adverse effects to non-target plants, wildlife, water quality and other resources values from herbicide treatment. Particular concern was expressed about the use of methods such as aerial application and boom broadcast spraying methods. This perception would be least under Alternative 2 (No Action) and to some degree 3, because herbicide use would be limited to the control of invasive plants. A certain segment of the comments expressed concerns that herbicides would unacceptably damage non-target plants and other non-commodity resources and non-market values. Alternative 2 may be more acceptable because of the fewer acres treated with herbicides (Table 3-3), but Alternative 3 would use 35 percent fewer total pounds (Table 3-4) and provide more herbicides to accomplish control objectives while decreasing environmental risk.

A related concern is potential threats to human health from herbicide use and its method of application. In addition to users of BLM lands and resources, comments identified applicators as being among those most likely to be exposed to herbicides. Concerns were not limited to exposure from direct application; concerns have been expressed over the potential for accumulation and cumulative effects, and from contamination of ground and surface waters that are used for consumption. Because concerns about herbicide effects on the environment and human health are primarily tied to the acres of use, concern is likely to remain lower under Alternative 2, the No Action Alternative than under any of the action alternatives.

Under *Alternative 3*, concerns about the use of herbicides would likely intensify because of an 81 percent increase in projected herbicide treatment acres, an increase in the number of herbicides available, and the addition of non-noxious invasive plants to the list of species that could be sprayed. However, while an 81 percent overall increase over the No Action Alternative (Alternative 2) is projected, concerns may be limited because only a 14 percent increase is anticipated west of the Cascades where population densities are the greatest. Increased use west of the Cascades is limited by a slightly lower incidence of invasive plants, a lower incidence of the invasive annual grasses that account for most of the increase east of the Cascades, by the presence of more (and often difficult to detect) watercourses, by topography, and by population densities and public concerns. The 14 percent acreage increase would be considered by a portion of this concern group as worthwhile because it would control additional weed species and Sudden Oak Death, because total pounds of herbicide to be applied would decrease 35 percent, and because there would be no aerial applications permitted west of the Cascades. As with Alternative 2, Standard Operating Procedures and PEIS Mitigation Measures would limit risks to human health and wildland resources.

The *Human Health and Safety* section in this Chapter concludes that the additional herbicides available under Alternative 3, on average and in total, present less risk to human health than the four currently used herbicides. Use of 2,4-D is projected to decrease by 2/3 compared with Alternative 2. Despite the adoption of Standard Operating Procedures and PEIS Mitigation Measures, the decreased risk associated with the additional herbicides, and the 35 percent reduction in pounds applied, perceived risk to human health would remain and likely be greater than under the No Action Alternative (Alternative 2) because 13,600 more acres would be treated.

Under *Alternative 4 (Proposed Action)*, concerns about resource damage and human health risk from the use of herbicides are likely to intensify significantly with the addition of herbicides to annually treat nearly 15,000 acres of *native* and other non-invasive vegetation along rights-of-ways, administrative sites, recreation sites, and certain habitats. Public comments reflected concern that herbicide treatments along roadsides could have unintended consequences on human health and non-target food or water sources. Comments expressed concern that they would be unknowingly exposed by traveling on BLM roads and utilizing roadside resources. They also point out that this work is taking place now simply at higher cost. Aside from using herbicides at all, spraying roadsides is probably the biggest concern with this group. This alternative is rated in the *Human Health and Safety* section in this Chapter as having a slightly higher potential for health risks than Alternative 3. Thus, perceptions of herbicide as a threat to resource values, human health, and quality of life would remain and likely intensify given the availability of additional herbicides and treatment of 14,900 additional acres when compared with Alternative 3 (Table 3-3).

Under *Alternative 5*, concerns about resource damage and human health risks from the use of herbicides would be greater than under Alternative 4 (Proposed Action) because the additional 4,800 acres of projected use is more open-ended in terms of its objective, need, and location. Further, 50,000 total acres of herbicide use annually will simply seem too high for many people in this group, regardless of the objective. It is nearly three times the No Action Alternative (Alternative 2) and nearly four times use levels in recent years. This alternative would also permit aerial applications west of the Cascades, although such use would be rare (something less than one project annually). Finally, this alternative would raise the number of herbicides available to 18, although actual treatment acres for some of the additional herbicides would be low.

It would help those with concerns about Alternative 5 that most of the increased use (when compared to Alternative 4) would be east of the Cascades, and that most would likely be for additional habitat treatments such as the reduction of rabbitbrush and western juniper currently at unnaturally high levels because of years of fire exclusion. These individuals and groups will also be eased by the fact that the 18 herbicides that would be available under this alternative have been analyzed and chosen by the BLM nationally as those with the least risk to humans and the environment and most appropriate for BLM wildland use, from among over a hundred herbicides registered for use in Oregon. These herbicides, and this alternative, are what is currently available to BLM in the other 16 western states. Nevertheless, the potential for adverse effects to human health and wildland resources could be perceived as greater under Alternative 5 than for the other alternatives. The analysis in this EIS judged this alternative to have the greatest overall risk to human health of the alternatives in this EIS, thus the perceptions of herbicide as a threat to resource values and human health would be the greatest under this alternative, with its availability of additional herbicides, additional management objectives, and 4,800 additional acres treated.

Herbicide as a Benefit to Resource Values

Reference Analysis: Many comments stated that proper herbicide use could enhance, protect, and maintain resource values. While effective invasive plant control without herbicide use could be maintained in some areas, the 14 percent noxious weed spread rate and 8.6 million acres infested in 15 years would be perceived as more adverse than the other alternatives by these stakeholders. Those who hold commodity, non-commodity, and non-market values of BLM lands and perceive herbicide use as an effective means to protect these values would be troubled by accelerated decline in resource conditions and biodiversity as a result of increases in the rate of spread. Given the largest costs per acre of treatment (*Implementation Costs* section) and the labor-intensive nature of limited treatment options, individuals and groups interested in reducing costs to protect resource values would likely perceive reduced treatment effectiveness as an inefficient means of controlling invasive plants.

Alternative 2, the No Action Alternative, would be perceived as an improvement over the Reference Analysis. However, many stakeholders would perceive the current spread of noxious weeds and other invasive plants as an adverse effect. Since more effective controls are available to other agencies and landowners in Oregon and even to BLM in the other 16 western states. Those who hold value commodity, non-commodity, and non-market values of BLM lands and perceive herbicide use as an effective means to maintain those values, would see the continued, and to them unnecessary, decline in resource conditions and biodiversity as an inappropriate way to manage the BLM's public resources.

Alternative 3 would be perceived as a substantial improvement to those seeing herbicides as an efficient and effective way to benefit resource values. Additional herbicide treatments of noxious weeds and other invasive plants under this alternative would be perceived as improving ecosystem health, thus improving the quality of market and non-market values. In addition to reducing weed infestation by an estimated 1.9 million acres in 15 years, unquantifiable benefits would accrue from being able to treat weeds as aggressively as adjacent landowners. Important native species and biological diversity within scenic areas, scenic byways, wild and scenic rivers, wilderness areas, and ACECs would be better maintained; recreation and/or educational values of these areas would be enhanced. Given the smaller cost per acre of effective treatment than Alternative 2, individuals and groups interested in reducing costs to protect resource values, would likely perceive this alternative as a more efficient means of controlling invasive plants.

Alternative 4 *(Proposed Action)* would be perceived as providing additional resource benefits with the additional 300,000-acre reduction in weed-infested acres in 15 years and a decrease in the rate of noxious weed spread from 7 to 6 percent. Individuals and groups who associate an improvement in commodity uses with herbicide use would likely perceive little change from herbicide treatment of rights-of-way because the work is taking place now, without herbicides. The increase in treatments for wildlife objectives would also be perceived as beneficial by those interested in commodity, non-commodity, and non-market values.

Alternative 5 would be perceived as contributing additional benefits associated with the annual treatment of approximately 4,800 additional acres, almost all of which would be habitat improvements east of the Cascades. Individuals and groups identified above would associate some additional benefits to their non-commodity and non-market values associated with these habitat improvements.

Cumulative Effects

In addition to localized effects discussed above cumulative effects to social and economic values have accrued and are discussed here. Historically, trade and migration routes from Europe to the New World were the major pathways of invasive species to the Unites States. Changing world markets have made Oregon a more important U.S. port increasing Oregon's susceptibility to invasive species (Statesman Journal 2007). In addition, the economy can be affected by a variety of factors including population growth, changes in interest rates, location of new industries, recession, growth of new sectors, tax policy, State economic policy, etc. which are influenced by regional and world market factors. When compared to these kinds of variables, the projected effect of noxious weeds and other invasive plants on BLM resources in Oregon has a relatively small if any effect on regional economic conditions. However when combined with the spread of noxious weeds and other invasive plants that would occur off BLM lands, effects on the regional economic conditions could occur. The rate of weed spread estimated to occur under Alternative 2 (and under the Reference Analysis) would have cumulative adverse effects on weed suppression costs on and off BLM lands within the State. While the ability to treat existing noxious weeds and other invasive plants will improve as more herbicides are made available, market forces of an ever-changing world economy make cooperative efforts across agencies, community, and cultural boundaries critically important.

Although private landowners and Federal, State, and local governments administering lands adjacent to the BLM will continue invasive plant treatment activities, implementation of Alternative 2 would continue to contribute to increased occurrence of weeds throughout Oregon relative to the action alternatives. The resulting decrease in biological diversity and reduction in economic and social returns would continue to adversely affect all stakeholders. For example, the threat to the agricultural based economy of the region posed by invasive plants would be aggravated by spread from BLM lands, thereby adversely affecting the continuation of agricultural associated lifestyles and customs. Costs incurred by adjacent land ownerships would likely continue to increase because of increased spread from BLM lands.

Environmental Justice

Affected Environment

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. Executive Order 12898 requires Federal agencies to "identify and address the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Thus, the concentrations of low income and minority groups, as well as trends in ethnic and racial composition of Oregon, are relevant to this analysis.

Population and Demographic Change

For the State of Oregon, the percentage of the total population identified as white, African American, and American Indian or Alaska Natives declined between 1990 and 2000. The percentage of Asian, Native Hawaiian, those persons identifying with some other race alone[77], and Hispanics increased over this period (Table 4-28). Within individual counties:

- The percentage of total population identified as white decreased between 1990 and 2000 within all counties in Oregon.
- The largest increases in non-white racial groups were:
    - Malheur County where those identified as African American increased as a percentage of total population by 1.2 percent;

77 Persons identifying with a single other racial group other than white, African American, American Indian or Alaska Native, Native Hawaiian and Other Pacific Islander, and Asian groups.

  - Klamath County American Indians and Alaska Natives increased by 1.7 percent;
  - Multnomah County Asians increased by 2.8 percent, and;
  - Morrow County those identifying with some other race increased by 11.1 percent.
- Individual county percentages higher than the percentage in their respective east and west side analysis areas indicate where higher concentrations of minorities may exist:
  - On the east-side, all counties exceed the analysis area percentage for at least one minority group except Baker, Crook, Deschutes, Gilliam, Wallowa and Wheeler counties, and;
  - West of the Cascades, all counties exceed the analysis area percentage for at least one minority group except Clackamas, Clatsop, and Tillamook counties (Table 4-29).

Race and ethnicity are broken out separately since Hispanics can be of any race. Between 1990 and 2000, the percentage of the total Oregon population of Hispanic origin increased by 4.1 percent (from 3.9 to 8 percent). Population numbers and the percentage of total population increased in all counties except Gilliam and Wallowa. The Hispanic populations of the east side and west side of Oregon increased by 3.9 percent and by 4.1 percent, respectively.

According to the Council on Environmental Quality's Environmental Justice Guidelines for NEPA (CEQ 1997) "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis…..a minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above stated thresholds." The discussion above and Table 4-29 shows the percentage of those identifying with some other race[78] or Hispanics was greater in many Oregon counties than the total percentage on the east or west side. The concentration of minority populations within counties "meaningfully" greater than east and west side populations suggests they likely exist within smaller geographies. Thus, the U.S. Census data suggest minority populations within the analysis area likely meet the CEQ's Environmental Justice criterion.

In addition to race, concentrations of low-income people and trends in the change of the population defined as low income are pertinent to the examination of Environmental Justice considerations. Between 1989 and 1999, the percentage of the Oregon population living below the Federally defined poverty level increased in nine counties, only two of which were west of the Cascades - Washington and Marion counties (Table 4-27). Sherman County (east of the Cascades) saw the largest percentage increase, while Washington County increased most in absolute terms by 12,377 (less than 1 percent change). In 1999 the percentage of the population living below poverty was slightly greater east of the Cascades (13.1 percent) than west of the Cascades (11.4 percent). In addition the percentage of the total population east of the Cascades decreased by a greater degree than west of the Cascades over the period from 1989 and 1999 - decreasing by 1.6 and 0.7 percent, respectively. In 1999, 26 counties had higher percentages of their populations living below the poverty level than the State percentage, 11 west of the Cascades and 15 east of the Cascades (Table 4-27) (US Census Bureau 2000b).

CEQ guidance on identifying low-income populations states "agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or American Indians), where either type of group experiences common conditions of environmental exposure or effect."

Examining both the racial and ethnic composition of poverty (Table 4-30), it is apparent that poverty levels amongst minority populations are greater than among white populations in all Oregon counties. In all counties

Table 4-27. Population Living Below the Poverty Level

	1989	1999	change	change in number of low income		1989	1999	change	change in number of low income
OREGON	12.4%	11.6%	-0.8%	43873	OREGON	12.4%	11.6%	-0.8%	43873
WEST-SIDE					EAST-SIDE				
Benton *	15.5%	14.6%	-1.0%	660	Baker *	14.7%	14.7%	0.0%	218
Clackamas	6.9%	6.6%	-0.4%	2866	Crook	11.1%	11.3%	0.2%	591
Clatsop *	14.4%	13.2%	-1.2%	-102	Deschutes	10.9%	9.3%	-1.6%	2513
Columbia	10.2%	9.1%	-1.2%	97	Gilliam	11.9%	9.1%	-2.8%	-31
Coos *	16.5%	15.0%	-1.4%	-484	Grant *	12.7%	13.7%	1.0%	86
Curry *	12.4%	12.2%	-0.1%	185	Harney *	10.6%	11.8%	1.2%	137
Douglas *	14.9%	13.1%	-1.7%	-829	Hood River *	15.7%	14.2%	-1.4%	235
Jackson *	13.2%	12.5%	-0.7%	3344	Jefferson *	18.6%	14.6%	-4.0%	244
Josephine *	18.3%	15.0%	-3.3%	-68	Klamath *	16.7%	16.8%	0.0%	1021
Lane *	14.5%	14.4%	-0.1%	5585	Lake *	13.9%	16.1%	2.2%	192
Lincoln *	14.4%	13.9%	-0.5%	560	Malheur *	19.3%	18.6%	-0.7%	320
Linn	13.5%	11.4%	-2.1%	-560	Morrow *	15.1%	14.8%	-0.3%	476
Marion *	13.2%	13.5%	0.3%	8466	Sherman *	9.9%	14.6%	4.7%	90
Multnomah *	13.1%	12.7%	-0.5%	6826	Umatilla *	16.5%	12.7%	-3.9%	-895
Polk	13.6%	11.5%	-2.1%	468	Union *	15.8%	13.8%	-2.0%	-346
Tillamook	15.0%	11.4%	-3.6%	-450	Wallowa *	15.8%	14.0%	-1.8%	-76
Washington	6.6%	7.4%	0.8%	12377	Wasco *	13.4%	12.9%	-0.5%	172
Yamhill	11.7%	9.2%	-2.6%	37	Wheeler *	20.9%	15.6%	-5.3%	-52
West-side totals	12.1%	11.4%	-0.7%	38978	East-side totals	14.8%	13.1%	-1.6%	4895

(* County percent of population greater than the State in 1999. Sources: US Census Bureau 2000a, b)

except Clackamas and Curry counties, the percentage of at least one minority group was greater than its respective east and west side aggregated percentage in 1999, indicating concentrations of low income minorities exist throughout the State and likely meet the CEQ's Environmental Justice Criterion for poverty discussed above. In Lane County, the percentage of people living below the poverty level exceeds the State and west side percentages for all minorities and Hispanics (Table 4-30).

Environmental Consequences

According to the description of the affected environment, minority and low income populations, as defined by CEQ, are likely present in Oregon. The presence of minority groups, low income, and American Indian tribes is relevant to the analysis because they may be disproportionately affected by the alternatives. These groups are often at a disproportionate risk compared to the general Oregon population, since they often participate in special uses on BLM lands. These uses include gathering food, cultural material, floral material, and other products either for personal or commercial use. Disproportionate risk to these groups could also result from participation in weed and other vegetation control work with herbicide and non-herbicide methods as part of a contract work crew.

Identification of minority populations and low-income populations primarily requires an analysis of trends and current populations of minorities and people living below the poverty level from U.S. Census data. Effects to resources important to minorities or persons living below the poverty level are one concern. The other is that work crews implementing weed control activities having a higher percentage of minorities and lower income groups could be subject to adverse effects of herbicide and non-herbicide treatments.

The potential for effects to non-target plants and animals that might be used by minority and other groups was determined from those respective resource sections elsewhere in this Chapter. To consider potential effects to work crews, BLM districts provided estimates of the percentage of non-herbicide and herbicide treatments that would be accomplished by contract work crews for the control of noxious weeds and other invasive plants for the Reference Analysis and Alternatives 2 and 3. The rights-of-way and related treatments portion of Alternatives 4 and 5 was assumed to be mostly accomplished by employees of the persons owning the developments on those rights-of-ways. Applicators are likely to be regular employees using equipment, and little to no disproportionate representation is expected.

Effects Common to All Alternatives

Work Crew Exposure

The racial composition of work crews implementing treatment activities are expected to be generally similar to that of the analysis area population, with potential for slightly higher percentages of minorities and lower income groups. Scoping suggested minority laborers who may know little English, may not be able to read product labels, may not have prior awareness of the health risk of using herbicides, may not be in a position to seek redress for being put in illegal or unsafe situations by their employers, and/or may not be able to access workmen's compensation or other health care, may be at greater risk by working on herbicide application crews. Such a situation is conceivable, but should be considerably mitigated by current requirements that all contract crew members be State certified as, at minimum, Trainees. The test for a Trainee permit examines knowledge of applicable laws and safe handling procedures. There is a potential for disproportionate representation of minority and low income groups in work crews implementing herbicide treatments. To some degree, this suggests that all alternatives could pose an adverse risk to these groups. This risk increases with the amount of acres treated with herbicides under each alternative (Table 3-3), and the toxicity of those herbicides to humans. However, there are also risks associated with non-herbicide methods as well. For example, a reduction in chainsaw exposure is one factor favoring the use of herbicides in some rights-of-way.

Invasive Plant Effects

American Indian and other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses on BLM lands may be disproportionately affected by the spread of noxious weeds and other invasive plants. Populations of native plant species used for cultural purposes such as food, medicine, dress, basketry, or ceremonial activities are likely to be reduced because of invasive plant spread. These groups would be forced to seek these resources in other areas, or the resources would become less available. Some invasive plants like blackberries have collectable value, but such species are over-represented and spreading at the expense of native species. Although some culturally significant historic American Indian gathering areas may be relatively higher priority for weed control treatments, most areas would be expected to become infested at the same rate as BLM lands in general. Noxious weeds are projected to infest (be present on) approximately 1/2, 1/3, 1/4, and 2/9 of the BLM lands in Oregon and be spreading at a rate of 14, 12, 7 and 6 percent in 15 years for the Reference Analysis and Alternatives 2, 3 and 4/5 respectively under a current budget trends scenario (Table 4-4).

User Group Exposure

The same user groups that would be adversely affected by the displacement of native species by invasive plants could also be affected by herbicide residues or area closures associated with herbicide use under the various alternatives. Treatment areas would normally be posted on site, depending upon the label and an analysis of the risk, but that would not necessarily prevent all contact or ingestion. Site-specific planning on proposed treatments would include consultation with tribes, and potential mitigation measures to protect and preserve those resources for the people that use them. The BLM may opt to use manual and mechanical treatments in traditional use areas and herbicides outside of those areas.

Effects by Alternative

Reference Analysis – No Herbicide Use

Work Crew Exposure: An estimated 28,600 acres of manual and mechanical treatments would be performed by contract crews. Work crews may experience injury during manual and mechanical treatments, such as chainsaw injuries cutting hardwood trees on steep hillsides under power lines. Exposure to cutting and grubbing tool injuries would be comparable to those experienced by fire crews. There is no potential for human exposure to BLM-applied herbicides.

Invasive Plant Effects: Without herbicides, noxious weeds are projected to infest 8.6 million acres in 15 years, or about 1/2 of all BLM lands in Oregon. Other invasive plants would cover millions of additional acres. Native plants important for cultural uses could potentially be crowded out of some areas forcing American Indian users to seek these resources in other areas or discontinue traditional uses. Populations of culturally important plants could decrease to the point of being insufficient to support traditional use. Visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses may also be impacted. Areas important to these visitors for mushroom gathering, berry picking, greenery or floral materials collection or other activities could be adversely impacted by the spread of invasive plants.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Work Crew Exposure: An estimated 20,600 acres of manual and mechanical treatments would be performed by contract crews, exposing workers to tool and other injuries. In addition, approximately 15,300 acres of noxious weeds would be treated with herbicides by certified or licensed contract crews under this alternative. Of the four herbicides available under this alternative, 2,4-D has low to moderate risk from direct contact under all application methods, and dicamba presents a low risk to applicators from boom spraying at maximum rates.

Invasive Plant Effects: Under Alternative 2 (No Action), noxious weeds are projected to infest 5.9 million acres in 15 years, or about 1/3 of all BLM lands in Oregon. Other invasive plants would cover millions of additional acres. Native plants important for cultural uses could be crowded out of some areas forcing American Indian users to seek these resources in other areas or discontinue traditional uses. Populations of culturally important plants could decrease to the point of being insufficient to support traditional use. Visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses may also be impacted. Areas important to these visitors for mushroom gathering, berry picking, greenery collection or other activities could be adversely impacted by the spread of invasive plants.

User Group Exposure: An estimated 16,700 acres would be treated with herbicides under this alternative. American Indian and visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses could be adversely affected by herbicide exposure, or by inadvertent effects to non-target culturally important plants, or to wildlife species of value to these groups. However, treatment design would attempt to minimize exposure of non-target food and water sources. In addition, Standard Operating Procedures require consultation with tribes to locate any areas of vegetation that are significant to the tribes and that might be affected by herbicide treatments. Despite these measures, the potential for disproportionate or adverse impacts to minority or low-income work crews would still exist.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Work Crew Exposure: An estimated 17,100 acres of manual and mechanical treatments would be performed by contract crews, exposing workers to tool and other injuries. In addition, approximately 27,000 acres of noxious weeds would be treated with herbicides by contract crews under this alternative. Twelve or 13 herbicides would be available on the west and east side respectively, providing project planners with opportunities to select herbicides that are used at lower rates, and present lower risks, than those available under Alternative 2 (No Action). Use of 2,4-D and dicamba would be lower than under Alternative 2, but hexazinone, triclopyr, and chlorsulfuron present a risk (albeit low) under at least one worker exposure scenario at the maximum rate.

Invasive Plant Effects: Under Alternative 3, noxious weeds are projected to infest 4.0 million acres in 15 years, or about 1/4 of all BLM lands in Oregon. Other invasive plants would cover millions of additional acres. Native plants important for cultural uses could potentially be crowded out of some areas forcing American Indian users to seek these resources in other areas or discontinue traditional uses. Populations of culturally important plants could decrease to the point of being insufficient to support traditional use. Visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses may also be impacted. Areas important to these visitors for mushroom gathering, berry picking, greenery collection or other activities could be adversely impacted by the spread of invasive plants.
User Group Exposure: An estimated 30,300 acres would be treated with herbicide under this alternative, an increase of 13,600 acres when compared to the No Action Alternative (Alternative 2). American Indian and visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses could be adversely affected by herbicide exposure, or by inadvertent effects to non-target culturally important plants, or to wildlife species of value to these groups. However, treatment design would attempt to minimize exposure of non-target food and water sources. In addition, Standard Operating Procedures require consultation with tribes to locate any areas of vegetation that are significant to the tribes and that might be affected by herbicide treatments. Despite these measures, the potential for disproportionate or adverse impacts to minority or low-income work crews would still exist.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

Work Crew Exposure: Work crews may experience injury during manual and mechanical treatments, with risks expected to be similar to those described for Alternative 3. Contract treatments are projected to increase less than 5,000 acres from Alternative 3.

Invasive Plant Effects: Under Alternative 4, noxious weeds are projected to infest 3.7 million acres in 15 years, or about 2/9 of all BLM lands in Oregon. Other invasive plants would cover millions of additional acres. Native plants important for cultural uses could potentially be crowded out of some areas forcing American Indian users to seek these resources in other areas or discontinue traditional uses. Populations of culturally important plants could decrease to the point of being insufficient to support traditional use. Visitors from other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses may also be impacted. Areas important to these visitors for mushroom gathering, berry picking, greenery collection or other activities could be adversely impacted by the spread of invasive plants.

User Group Exposure: An estimated 45,200 acres would be treated with herbicides under this alternative, an increase of 14,800 acres from Alternative 3. Approximately 2/3 of the increase would be spraying native and other non-invasive plants along roads, rights-of-ways, and other developments. To the degree some user groups collect products within a few feet of the road edge, as might occur with blackberries for example, exposure would be increased. Under Alternative 4, these plants would be deliberately targeted, increasing the potential to affect plants and other products (which include other forest products such as mushrooms, manzanita, and greenery for wreaths) utilized by under-represented groups.

As with Alternatives 2 and 3, however, treatment design would attempt to minimize exposure of non-target food and water sources. In addition, Standard Operating Procedures require consultation with tribes to locate any areas of vegetation that are significant to the tribes and that might be affected by herbicide treatments. Despite these measures, the potential for disproportionate or adverse impacts to minority or low-income work crews would still exist.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

Work Crew Exposure: Work crews may experience injury during manual and mechanical treatments, with risks expected to be similar to those described for Alternative 3. Contract herbicide treatments could increase as much as 8 to 9,000 acres compared to Alternative 3, but the type of exposure would be similar.

Invasive Plant Effects: Effects from invasive plants would be essentially the same as described for Alternative 4 (Proposed Action).

User Group Exposure: Alternative 5 would increase herbicide treatments on an additional 4,800 acres when compared to Alternative 4 (Proposed Action), with the increase primarily applying to treatment of native plants for habitat improvement and other vegetation treatments not designed for livestock forage or timber production. The risk to plants and other resources used by American Indian and other under-represented groups on a per-acre basis would be higher than under Alternatives 2 and 3, because treatments would target native and other non-invasive plants, which could affect forest products such as mushrooms, manzanita, and greenery for wreaths. Inadvertent treatment of areas not identified as important to other racial, ethnic, or low-income backgrounds participating in subsistence or cultural uses would be highest under this alternative.

However, treatment design would attempt to minimize exposure of non-target food and water sources. Habitat or fuels treatments under this alternative would normally target areas where total vegetation, or a specific species, has become over-abundant. In addition, Standard Operating Procedures require consultation with tribes to locate any areas of vegetation that are significant to the tribes and that might be affected by herbicide treatments. Despite these measures, the potential for disproportionate or adverse impacts to minority or low-income work crews would still exist.

Cumulative Effects

With growing populations of minority (Table 4-28) and low-income populations (Table 4-27) throughout the State, the cumulative effects on Environmental Justice are relevant. As Hispanic, American Indian, and other minority or low-income populations continue to grow, the likelihood of these groups using public lands is likely to increase. Combined with increasing levels of treatment, the possibility increases that effects associated with vegetation treatments would disproportionately affect these minority populations. These combined trends illustrate the importance of site-specific consideration of the potential to affect under-represented groups, and American Indian consultation, conducted during planning for future herbicide treatment projects.

Table 4-28. Racial and Ethnic Change Compared to the Total Population Change in Oregon, by County (1990 to 2000)

	White alone	Black or African American alone	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Some other race alone	Hispanic*
OREGON	-6.4%	0.0%	-0.2%	0.7%	0.0%	2.5%	4.1%
WEST-SIDE COUNTIES							
Benton	-2.9%	0.1%	-0.2%	-1.2%	0.0%	1.0%	2.5%
Clackamas	-5.3%	0.3%	-0.1%	0.8%	0.1%	1.5%	2.5%
Clatsop	-3.9%	0.4%	-0.2%	0.0%	0.0%	0.9%	2.4%
Columbia	-2.5%	0.2%	-0.2%	-0.4%	0.0%	0.2%	0.3%
Coos	-4.1%	0.0%	-0.2%	-0.3%	0.0%	0.7%	0.8%
Curry	-3.1%	0.1%	-0.7%	0.5%	-0.1%	0.6%	1.7%
Douglas	-2.9%	0.0%	-0.2%	0.0%	-0.2%	0.3%	0.6%
Jackson	-4.0%	0.2%	-0.6%	-0.1%	0.1%	1.3%	2.6%
Josephine	-3.2%	0.0%	-0.3%	0.1%	0.0%	0.5%	1.4%
Lane	-4.9%	0.0%	0.0%	0.1%	0.0%	1.2%	2.0%
Lincoln	-5.6%	0.1%	0.2%	0.1%	0.0%	1.5%	3.0%
Linn	-4.0%	0.0%	0.1%	0.1%	0.1%	1.0%	1.8%
Marion	-9.8%	0.0%	-0.2%	0.1%	0.1%	6.4%	9.6%
Multnomah	-8.2%	-0.6%	-0.2%	1.3%	0.1%	3.1%	4.5%
Polk	-3.9%	-0.1%	0.0%	0.1%	0.1%	1.0%	3.3%
Tillamook	-3.0%	-0.2%	-0.8%	0.1%	0.0%	1.3%	3.5%
Washington	-10.0%	0.4%	0.0%	2.8%	0.1%	3.4%	6.5%
Yamhill	-5.2%	0.0%	-0.3%	0.1%	-0.1%	2.8%	4.0%
West-side Totals	-6.5%	-0.1%	-0.2%	0.8%	0.1%	2.5%	4.1%
EASTSIDE COUNTIES							
Baker	-2.4%	0.1%	-0.1%	0.2%	0.1%	0.5%	0.1%
Crook	-4.3%	0.0%	-0.4%	0.2%	0.0%	3.2%	3.1%
Deschutes	-2.8%	0.1%	-0.4%	0.0%	-0.1%	1.1%	1.8%
Gilliam	-2.0%	0.1%	0.5%	-0.4%	0.0%	1.0%	-1.0%
Grant	-1.6%	0.0%	-0.2%	-0.1%	0.0%	0.0%	0.4%
Harney	-4.3%	0.1%	0.1%	0.2%	0.1%	-0.2%	1.4%
Hood River	-11.9%	0.0%	-1.0%	-0.1%	-0.1%	10.5%	9.4%
Jefferson	-5.7%	-0.1%	-4.2%	0.2%	0.0%	6.4%	7.2%
Klamath	-5.3%	-0.2%	0.1%	0.3%	0.1%	1.4%	2.6%
Lake	-4.6%	-0.2%	1.7%	0.2%	-0.5%	0.7%	1.2%
Malheur	-5.7%	1.2%	-0.1%	-1.3%	0.0%	3.0%	5.4%
Morrow	-14.3%	0.1%	0.5%	0.2%	-0.1%	11.1%	13.4%
Sherman	-5.9%	0.6%	1.3%	0.5%	0.0%	0.8%	3.2%
Umatilla	-7.0%	0.4%	-0.1%	0.0%	0.0%	4.6%	7.4%
Union	-2.4%	0.1%	-0.5%	0.1%	0.1%	1.0%	0.8%
Wallowa	-1.2%	0.0%	-0.1%	-0.3%	0.0%	0.1%	-0.8%
Wasco	-6.2%	0.0%	-0.2%	0.3%	-0.3%	3.6%	4.2%
Wheeler	-4.2%	0.1%	0.1%	-0.1%	0.0%	1.7%	2.2%
Eastside Totals	-5.1%	0.1%	-0.4%	0.0%	0.0%	2.9%	3.9%

(*Hispanics or Latinos may be of any race. Sources: US Census Bureau 2000a)

Table 4-29. Racial and Ethnic Share of 2000 Population

	White alone	Black or African American alone	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Some other race alone	Hispanic*
OREGON	86.4%	1.6%	1.3%	2.9%	0.2%	4.3%	8.0%
WEST-SIDE COUNTIES							
Benton	89.0%	1.0%	0.7%	4.3%	0.1%	1.8%	4.6%
Clackamas	91.2%	0.6%	0.6%	2.4%	0.2%	2.3%	5.0%
Clatsop	92.5%	0.7%	0.9%	1.0%	0.2%	1.8%	4.6%
Columbia	94.2%	0.3%	1.3%	0.5%	0.1%	0.9%	2.3%
Coos	91.5%	0.2%	2.6%	0.5%	0.1%	1.2%	3.2%
Curry	93.0%	0.1%	2.4%	0.8%	0.0%	1.0%	3.3%
Douglas	93.7%	0.2%	1.6%	0.6%	0.0%	0.9%	2.8%
Jackson	91.6%	0.4%	1.1%	0.8%	0.2%	2.9%	6.7%
Josephine	93.7%	0.2%	1.3%	0.5%	0.0%	1.3%	4.2%
Lane	90.5%	0.8%	1.1%	1.9%	0.2%	2.0%	4.5%
Lincoln	90.3%	0.2%	2.7%	0.7%	0.3%	1.9%	4.7%
Linn	93.0%	0.2%	1.4%	0.8%	0.2%	1.8%	4.1%
Marion	81.7%	0.9%	1.3%	1.7%	0.3%	10.6%	17.2%
Multnomah	79.0%	5.4%	1.0%	5.6%	0.4%	4.1%	7.5%
Polk	89.3%	0.3%	1.6%	1.2%	0.2%	4.5%	8.8%
Tillamook	94.4%	0.2%	0.5%	0.5%	0.1%	1.7%	5.1%
Washington	82.0%	1.0%	0.7%	6.7%	0.3%	5.9%	11.1%
Yamhill	89.2%	0.7%	1.2%	1.0%	0.1%	5.1%	10.6%
West-side Totals	86.3%	1.7%	1.1%	3.2%	0.2%	4.0%	7.7%
EASTSIDE COUNTIES							
Baker	96.0%	0.3%	0.7%	0.5%	0.1%	0.7%	1.9%
Crook	92.5%	0.0%	1.7%	0.3%	0.0%	4.0%	5.6%
Deschutes	94.8%	0.2%	0.9%	0.5%	0.1%	1.5%	3.8%
Gilliam	96.8%	0.1%	1.0%	0.3%	0.0%	1.0%	1.4%
Grant	95.8%	0.0%	1.3%	0.1%	0.0%	0.9%	2.7%
Harney	90.3%	0.1%	3.6%	0.8%	0.2%	1.0%	4.5%
Hood River	78.7%	0.2%	0.9%	1.4%	0.1%	16.2%	25.1%
Jefferson	68.7%	0.1%	15.3%	0.6%	0.1%	11.9%	17.6%
Klamath	87.2%	0.5%	4.1%	0.7%	0.2%	3.6%	7.8%
Lake	90.5%	0.0%	3.2%	0.7%	0.1%	2.8%	4.9%
Malheur	75.7%	1.4%	0.9%	1.6%	0.1%	17.4%	25.7%
Morrow	75.0%	0.2%	1.7%	0.5%	0.0%	20.2%	24.4%
Sherman	92.5%	0.6%	2.1%	0.7%	0.0%	1.3%	4.7%
Umatilla	82.0%	1.0%	3.2%	0.7%	0.1%	10.9%	16.1%
Union	94.5%	0.5%	0.6%	0.9%	0.6%	1.5%	2.3%
Wallowa	97.8%	0.0%	0.4%	0.0%	0.1%	0.2%	0.7%
Wasco	86.4%	0.4%	3.5%	0.9%	0.1%	5.9%	9.3%
Wheeler	95.2%	0.1%	0.5%	0.0%	0.0%	1.7%	3.4%
East-side Totals	87.1%	0.5%	2.7%	0.7%	0.1%	6.5%	10.5%

(*Hispanics or Latinos may be of any race. Sources: US Census Bureau 2000a)

Table 4-30. Population Living Below the Poverty Level in Oregon, by County, Race, and Ethnicity

	White	Black or African American	American Indian & Alaska Native	Asian	Native Hawaiian & Other pacific Islander	Some Other Race	Hispanic or Latino*
OREGON	10%	24%	22%	12%	18%	27%	25%
WESTSIDE COUNTIES							
Benton	13%	24%	15%	38%	11%	21%	25%
Clackamas	6%	10%	9%	5%	16%	26%	21%
Clatsop	12%	52%	19%	15%	22%	48%	45%
Columbia	8%	15%	17%	11%	15%	35%	26%
Coos	14%	29%	25%	17%	39%	14%	22%
Curry	12%	0%	15%	1%	0%	3%	7%
Douglas	13%	12%	18%	11%	17%	32%	28%
Jackson	12%	24%	20%	18%	10%	29%	26%
Josephine	14%	13%	25%	14%	13%	27%	24%
Lane	13%	26%	24%	31%	26%	28%	27%
Lincoln	13%	16%	30%	12%	21%	35%	29%
Linn	11%	19%	20%	9%	3%	30%	26%
Marion	11%	31%	19%	13%	30%	27%	27%
Multnomah	10%	26%	22%	13%	14%	30%	26%
Polk	10%	31%	22%	14%	4%	27%	29%
Tillamook	11%	77%	13%	16%	0%	32%	39%
Washington	6%	11%	11%	8%	21%	24%	21%
Yamhill	8%	6%	6%	18%	3%	21%	20%
West-Side Totals	10%	24%	19%	13%	18%	27%	25%
EASTSIDE COUNTIES							
Baker	14%	7%	40%	17%	100%	33%	29%
Crook	10%	0%	32%	0%	NA	34%	37%
Deschutes	9%	42%	26%	10%	0%	24%	20%
Gilliam	9%	0%	0%	0%	NA	47%	35%
Grant	13%	NA	27%	0%	0%	44%	24%
Harney	10%	0%	36%	10%	42%	24%	22%
Hood River	12%	0%	14%	9%	0%	28%	34%
Jefferson	10%	0%	32%	0%	0%	19%	22%
Klamath	15%	17%	40%	11%	3%	37%	32%
Lake	15%	NA	28%	0%	25%	32%	30%
Malheur	16%	47%	39%	4%	72%	30%	28%
Morrow	11%	41%	15%	20%	0%	27%	27%
Sherman	14%	0%	20%	21%	NA	73%	39%
Umatilla	10%	33%	21%	6%	29%	25%	23%
Union	13%	24%	21%	16%	35%	18%	24%
Wallowa	14%	NA	15%	0%	100%	0%	33%
Wasco	11%	9%	24%	11%	33%	21%	25%
Wheeler	14%	0%	0%	NA	NA	56%	60%
East-side Totals	11%	27%	30%	9%	22%	27%	27%

(*Hispanics or Latinos may be of any race. NA indicates counties contained no population of that minority.
Sources: US Census Bureau 2000a)

Implementation Costs

This section examines the direct costs of implementing the various alternatives. Examined for each alternative are total direct costs, direct costs per effectively treated acre, and cost savings (where applicable) from substituting one treatment method for another for activities that must be conducted regardless of the alternative selected. BLM funding is finite; funds spent in one place usually means less funding is available to be spent elsewhere. No attempt is made to estimate the cost/benefit of these potential alternative uses for funds.

Costs are arguably not a potential effect on the human environment and thus the section is not necessarily required by NEPA. However, in this case, it furthers NEPA objectives to display the factors that will be used by the decision-maker to select from among the alternatives, and cost-effectiveness is thus identified as a *Purpose* in Chapter 1. BLM planning policy specifies that management actions having a high likelihood of improving resource conditions for relatively small expenditures of time and money should receive relatively higher priority (USDI 2005f:34). This section helps furthers these decision-making objectives.

This section does not assign a dollar value to resources impacted by invasive weeds. It is difficult to assess the monetary value for many of the resource values obtained from public lands. The various degrees of infestation would add complexity to those estimates. However, the various resource sections in this Chapter describe the negative effects in qualitative terms. Invasive weeds increase management costs, decrease resource values and outputs, and exacerbate the effects of natural and human-caused resource disturbances. See *Cumulative Effects* at the end of this section for further information.

Treated Acres and Effectively Treated Acres, by Alternative

Treated Acres

An estimate of the acres of noxious weeds and other invasive plants that would be treated annually with each herbicide and each non-herbicide treatment method, for each alternative, is presented in Table 3-3. Included also are estimated acres of rights-of-way/recreation site/administrative site herbicide treatments, and habitat and other vegetation treatments that would occur with herbicides if herbicides were available for those purposes (Alternatives 4 and/or 5). Table 3-3 acres are a compilation of estimates made by the nine BLM districts in Oregon using a "current budget trends" assumption, and represent an estimated average annual treatment level for the next 10 to 15 years. Table 3-3 acres applicable to this cost analysis are summarized in Table 4-31 below, for reference.

Actual annual treatment levels could vary based on changes in program emphasis or priorities, fluctuations in annual budgets, opportunities for cost savings with partnerships, and the availability of external funding. Since project related actions may be implemented through cooperative agreements, multiple partners may bear these costs. State and local governments, adjacent land owners, Cooperative Weed Management Areas, interest groups, and right-of-way and other permit holders will contribute to or fully fund some vegetation treatments, especially where those parties own, or have interests in, a potentially affected area or development. Although a rough estimate of the percentage of each vegetation treatment category to be accomplished by Federal versus non-Federal work forces is possible (to identify BLM's portion of the work), especially for rights-of-way and related work in Alternatives 4 and 5, such a breakdown is not necessarily relevant to comparing the alternatives, since most costs are ultimately borne by (and benefits accrue to) a general cross section of the public[78]. Therefore,

78 Most rights-of-way treatments, for example, would be done by the State, counties, or utility companies and costs are borne by taxpayers or ratepayers.

the estimated costs and benefits of all herbicide uses on BLM lands that would occur under each alternative are reported together and not allocated between partners (Table 4-31).

Effectively Treated Acres

The *Noxious Weeds and other Invasive Plants* section in this Chapter explains that invasive weed control treatments are not 100 percent effective at controlling invasive weed populations on the first try. Under each alternative, some level of retreatment would be necessary to achieve complete control. A five-acre treatment, for example, would be monitored to detect additional or remaining plants, and some portion of those acres would likely require retreatment. The amount of retreatment necessary is a function of how effective the prior treatment is. For the Reference Analysis, for example, nearly two-thirds of the noxious weeds in Oregon cannot be effectively controlled with non-herbicide methods. Further, non-herbicide methods (particularly mechanical and directed livestock treatments) often disturb soils leading to reinvasion, and plants are more likely to be moved off site. Mechanical treatments of re-sprouting woody species may temporarily reduce the vigor of these species, but not kill the weed.[79]

“Effective” treatments for each alternative are the portion of the treatments that successfully control the invasive weeds on the treated site and thus prevent future weed spread. The percentage of treatments meeting this definition varies by alternative and is estimated to be 30, 60, and 80 percent of the total weed treatments for the Reference Analysis and Alternatives 2 and 3-5 respectively (Table 4-31). It is most appropriate to look at cost per effectively treated acres, because the overarching objective is to control weeds and prevent their spread. The efficacy of herbicide treatments for objectives other than control of invasive plants under Alternatives 4 and 5 is assumed to be effective, since complete plant removal is usually not the objective.

Table 4-31. Estimated Annual Acres of Noxious/Invasive Weed Treatment by Alternative

Method	Reference Analysis	Alt. 2 (No Action)	Alts. 3-5[1]
Invasive with non-herbicide methods	42,100	28,800	28,100
Invasive with herbicide methods	-	16,700	30,300
Total Treated	42,100	45,500	58,400
Percent Effective[2]	30 %	60 %	80 %
Total Treated Effectively	12,630	27,300	46,160[3]

[1] The noxious weed/invasive plant portions of Alternatives 3 through 5 are the same.
[2] From the *Noxious Weeds and other Invasive Plants* section in this chapter.
[3] Does not include 2,350 acres of noxious weeds incidentally killed by right-of-way treatments of native and other non-invasive plants in Alternatives 4 and 5 and not included in invasive weed cost per acre calculations.

Costs by Treatment Method

Direct project-level costs were provided by each of the nine BLM districts for herbicide treatments and for non-herbicide methods. Costs include equipment, materials, wages, and contract costs; they do not include program planning (e.g., NEPA) or overhead. Costs on the east and west sides of the Cascades are averaged separately because there are substantial differences between the two areas in terms of factors that affect costs, like topography, size and density of vegetation, and moisture regime. The acreage-weighted averages of these estimates are shown in Table 4-32. Costs are not discounted since all costs are annual averages in 2008 dollars,

79 Not being able to kill the weed does not mean the treatments are a waste of time. Treatments may prevent seed production or other spread, and thus meet objectives of containing infestations and preventing spread.

and apply equally to all years. Providing a discounted total of all costs over the next 10 or 15 years would not change the relative difference between the alternatives.

Herbicide application costs were averaged even though the cost of the herbicides themselves varies. The potential difference the additional calculations would have made was not judged to be significant to a reasonable comparison of the alternatives.

Table 4-32. Average Direct Cost of Treatment by Treatment Method, per Acre, East and West of the Cascades

Method	Cost per acre	
	W[1]	E
Non-herbicide		
Mechanical	$225	$222
Manual	$345	$90
Prescribed Fire for Weed Control	$340	$48
Directed Livestock	$284	$250
Seeding of Planting	$199	$108
Herbicides: Noxious & Invasive Weeds		
Herbicide Application	$107	$118
Herbicides: Rights-of-Way & Wildlife/Other		
Herbicide Application	$107	$118

[1] West/East of the Cascades

Total Cost and Cost per Effectively Treated Acre by Alternative

The noxious weed and other invasive plant control treatment acres are predicted to increase under alternatives making more herbicides available, e.g., Alternative 3 would treat more acres than Alternative 2 (No Action), and Alternative 2 would treat more acres than the Reference Analysis. Reasons for this increase include: 1) the additional herbicides provide tools to control weeds not presently treated or at least not treated effectively; 2) the additional herbicides make control treatments more efficient and therefore more treatments can be done within existing funding; 3) additional cooperator and permit-holder funding sources become available as it becomes practical to treat more species; and 4) approving herbicides currently used on adjacent non-BLM lands would encourage cooperative weed management across ownerships.

Total costs generally increase as successive alternatives treat more acres. However, the cost per effectively treated acre decreases as the effectiveness of the alternatives increases (Table 4-33). This decrease is wholly related to the increased efficiency of having more control tools available.

Table 4-33. Annual Cost of Noxious Weed/Invasive Plant Treatment per Alternative

Method	Reference Analysis		Alt. 2 (No Action)		Alts. 3-5[1]	
	W	**E**	**W**	**E**	**W**	**E**
Non-Herbicide	$2,371,941	$4,769,567	$1,921,718	$2,741,639	$1,806,178	$3,627,714
Herbicide	$0	$0	$746,200	$1,141,903	$852,800	$2,625,201
Total cost	$7,141,508		$6,551,460		$8,911,892	
Cost per acre effectively treated	$565		$240		$193	

[1] The noxious weed/invasive plant portions of Alternatives 3 through 5 are the same.

Effects by Alternative

Reference Analysis – No Herbicide Use

The annual cost of implementing treatments is greater than Alternative 2 (No Action) (in spite of fewer acres treated), but less than all other alternatives at a total of $7,141,508 in 2008 dollars (Table 4-34). Despite the relatively lower cost of treatment, the cost per acre treated effectively is the higher than any of the alternatives at $565 per acre (Table 4-33).

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

The annual cost of implementing treatments is $6,551,460 in 2008 dollars, the least of all alternatives. Costs of herbicide treatment for invasive plants are less than the cost of herbicide treatments under the action alternatives for both the east and west-sides. However, reduced effectiveness of treatment makes the treatment cost per acre higher than the action alternatives, at $240 per acre (Table 4-33).

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

The annual cost of implementing treatments is more than the Reference Analysis or the No Action Alternative (Alternative 2), at $8,911,892 in 2008 dollars. However, increased effectiveness of treatment makes the treatment cost per acre lower than all other alternatives at $193 (Table 4-33).

Although indirect benefits of each alternative are qualitatively discussed at the end of this section, it should be noted that an effect specific to this alternative would be the ability to control invasive annual grasses, potentially reducing the risk of wildfire adjacent to communities (the wildland urban interface) east of the Cascades.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses and Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

The effects and costs for Alternative 3 apply equally to the noxious weeds and other invasive plant treatment portion of Alternatives 4 and 5 as well. However, Alternative 4 would also make herbicides available for treating *native* and other non-invasive vegetation encroaching on the safety and function of rights-of-way, administrative sites, and recreation sites (9,300 acres), and for certain habitat treatments (5,700 acres). Alternative 5 would include all of the treatments in Alternative 4, and would add about 4,800 more acres of herbicide treatments for habitat improvement and other vegetation management not including those for livestock forage or timber production. Only these additional uses are discussed here.

Rights-of-Way, Administrative Sites, and Recreation Sites: For controlling native and other non-invasive vegetation affecting the safety and function of rights-of-way, administrative sites, and recreation sites, agencies and partners are currently accomplishing needed vegetation control work with non-herbicide methods. The 9,300 acres proposed for herbicide use for these objectives under Alternatives 4 and 5 (Table 3-3) thus represent a corresponding number of acres of non-herbicide treatments already taking place.[80] (The remainder of annual vegetation treatment needs along rights-of-way and other developments would continue to be accomplished with non-herbicide methods.) For cost comparison purposes, 10 percent of the herbicide treatments are assumed to

80 These current rights-of-way and other sites non-herbicide native vegetation treatments are not displayed on Tables 3-3 or 4-31 to avoid confusion with the non-herbicide noxious weed/invasive plant control treatments

replace existing manual treatments, while 90 percent are assumed to replace existing mechanical methods. Using herbicides to meet the annual vegetation control needs on 9,300 acres of rights-of-way, roads, and around other developments would save nearly $1 million per year (Table 4-34).

Table 4-34. Annual Cost for Rights-of-Way/Administrative Sites/Recreation Sites Treatments.

	Alts 1-3 (Non-herbicide)	Alts 4 and 5 (Herbicide)
Treatments for Rights-of-Way/Administrative Sites/Recreation site objectives		
Cost East of the Cascades	$1,566,188	$882,915
Cost West of the Cascades	$449,752	$202,540
Total cost	$2,015,940	$1,085,455
Acres	9,300	9,300
Average Cost per Acre	$217	$117

Habitat and Other Objectives: Of the acres proposed for herbicide use to accomplish habitat improvement objectives under Alternative 4 (5,700 acres), and wildlife and other objectives under Alternative 5 (an additional 4,800 acres), about 35 percent are already being done with non-herbicide methods and 65 percent represents new opportunities because of the availability of herbicides. The 35 percent already being done with non-herbicide methods costs about $217 per acre. Doing these same treatments with herbicides would cost an average of $117 per acre. The availability of herbicides would lead to the accomplishment of nearly three times more acres in part because of the reduced cost, but in part because many needed treatments cannot be accomplished with non-herbicide methods because they would be too labor intensive, difficulties in targeting the correct plant species or age group, or would cause site disturbances that would negate all or part of the treatment objective.

Alternative 4 would make herbicides available to treat any vegetation to achieve habitat goals specified in approved Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, or Conservation Agreements for Federally Listed and other Special Status species. The 5,700 acres of treatments proposed in Alternative 4 to meet this objective would cost $668,800 if accomplished with herbicides. No corresponding non-herbicide cost is calculated because the same acres would not be attempted with non-herbicide methods.

In addition to the habitat treatments described for Alternative 4, Alternative 5 would make herbicides available for the full range of objectives and uses approved nationally in the Record of Decision for the PEIS except projects specifically to improve livestock forage or timber production. Districts indicated most additional treatments under this alternative would be thinning western juniper and sagebrush for habitat improvement, or possibly treating fuels east of the Cascades, although other uses are possible. The additional 4,800 acres projected to be treated to meet these objectives under Alternative 5 would cost $574,700 if accomplished with herbicides. No corresponding non-herbicide cost is calculated because the same acres would not be attempted with non-herbicide methods

Non-Quantified and Cumulative Effects

Management of invasive plants affects the goods, services, and uses provided by BLM land and the costs of managing those lands. Increased operating costs due to invasive plant management may result in direct or indirect transfer of costs to land management programs or users of BLM lands. Noxious weed and other invasive plant management may compete with other important land management needs, resulting in cost tradeoffs; management of timber, vegetation, roads, public access, grazing, recreation, habitat, minerals, and fire may be affected by cost increases or loss of opportunity due to invasive plant management. Invasive plant and other treatments would result in improvements in the condition of BLM resources and would lead to increases in commodity and non-commodity values. Treatments would also increase the quantity and quality of wildlife forage, reduce fire hazard, and reduce other negative effects from noxious weed and other and invasive plant spread. Improved recreation opportunities, reductions in risk of wildfires, improvements of rights-of-way, and habitat improvements would benefit the economies of rural communities, which are often dependent on recreational opportunities and other natural resource-based businesses.

Human Health and Safety

Affected Environment

Background Health Risks

People living in Oregon are exposed to a variety of risks common to the U.S. as a whole, including automobile accidents and other injuries; contaminants in the air, water, soil, and food; smoking, alcohol and various diseases. Risks to workers may differ from those facing the public, depending on the nature of a person's work. Some of these risks may be quantified, but a lack of data allows for only a qualitative description of certain risks. Human Health information was obtained from the Centers for Disease Control and Prevention (CDC), the National Center for Injury Prevention and Control (NCIPC), the National Center for Health Statistics (NCHS), the National Institute for Occupational Safety and Health (NIOSH), and the Bureau of Labor Statistics.

Risks from Diseases

Disease Incidence

Despite the difficulties in establishing correlations between work conditions and disease, only certain illnesses have been linked to occupational hazards. For example, asbestosis and lung cancer among insulation and shipyard workers has been linked to their exposure to asbestos (NTP 2009). Pneumoconiosis among coal miners has been correlated with the inhalation of coal dust. Occupational exposures to some metals, dusts, and trace elements, carbon monoxide, carbon disulfide, halogenated hydrocarbons, nitroglycerin, and nitrates can result in increased incidence of cardiovascular disease. Neurotoxic disorders can arise from exposure to a wide range of chemicals, including some pesticides.[81] Dermatological conditions like contact dermatitis, infection, trauma, cancer, vitiligo, urticaria, and chloracne have a high occurrence in the agricultural, forestry, and fishing industries.

Injury and Disease Mortality

Mortality rates for Oregon compared with national statistics are listed in Table 4-35. The five most common causes of death in the U.S., as well as in Oregon, are heart disease, cancer, cerebrovascular disease (stroke), respiratory disease, and accidents. Oregon has lower than average mortality rates for cancer, heart disease, and injuries and higher incidence for stroke and respiratory disease.

81 Pesticides include insecticides, rodenticides, fungicides, herbicides, and other "pest" control materials.

Risks from Cancer

Cancer Incidence

Nationwide, the chance of developing some form of cancer during one's lifetime is estimated to be about one in three (NCI 2005). There are many causes of cancer development, including genetic, viral, and occupational exposure to carcinogens, environmental contaminants, and substances in food. In the U.S., one-third of all cancers are attributed to tobacco smoking. Work-related cancers are estimated to account for 4 percent to 20 percent of all malignancies. It is difficult to quantify the information because of the long time intervals between exposure and diagnosis, personal behavior patterns, job changes, and exposure to other carcinogens. The NIOSH has reported that approximately 20,000 cancer deaths and 40,000 new cases of cancer each year in the U.S. are attributable to occupational hazards. Millions of U.S. workers are exposed to substances that have tested as carcinogens in animal studies (NIOSH 2009b).

Cancer Mortality

Cancer accounted for 23 percent of all deaths in Oregon in 2003. Nationwide, cancer accounts for approximately 24 percent of all fatalities (NCHS 2007). Generally, males have higher rates of cancer mortality than females, and African Americans have higher rates than Caucasians.

Table 4-35. Leading Causes of Death by Percentage

	Oregon	U.S.
Cancer	23.4	24.3
Heart Disease	22.7	27.2
Cerebrovascular Disease	8.3	5.0
Chronic Lower Respiratory Disease	5.9	5.0
Accidents	4.5	6.1

Oregon numbers are from DHS (2002); U.S. numbers are from NCHS (2007).

Injury Risk from Using Herbicides and Non-Herbicide Treatments

Manual and mechanical treatments can present health hazards to forestry workers. Adverse weather and terrain commonly create unfavorable working conditions and increased hazards. Hazards associated with adverse weather conditions include extreme heat and cold, which can be exacerbated by very dry and very wet conditions. Other hazards include falling objects (especially when cutting trees), tripping or slipping on hazards on the ground, protruding objects such as branches and twigs, poisonous plants and insects, and dangerous wildlife.

Tools and equipment present inherent hazards, such as sharp edges on the tools themselves, and the hazardous nature of fuels and lubricants used in mechanized equipment. Manual and mechanical methods present potential ergonomic hazards related to lifting and carrying equipment, and when pulling vegetation.

Injuries can vary from minor cuts, sprains, bruises, and abrasions to major arterial bleeding, compound bone fractures, serious brain concussions, and death. Workers are subject to heat-related illness or hypothermia when working in extreme weather conditions, and may incur musculo-skeletal injuries related to improper body mechanics.

Equipment operators could be injured from improperly operating the equipment or losing control of equipment on steep or slippery terrain. Operators and nearby workers can also suffer hearing damage. Nearby workers and the public can be struck by flying debris around some machinery.

The potential for hazard exposure (risk of injuries) is exacerbated when workers are fatigued, poorly trained, poorly supervised, or do not follow established safety practices. Appropriate training, together with monitoring and intervention to correct unsafe practices, would minimize risk of worker injury and illness. Compliance with Occupational Safety and Health Administration (OSHA) standards, along with agency, industry, and manufacturers' recommendations reduces the potential exposure and risk of injury to workers. Members of the public are usually not at risk from manual and mechanical methods unless they are too close to machinery that is producing flying debris during treatment.

Statistics on injuries from herbicide application, mechanical treatment, and prescribed fire are sparse. Work-related pilot fatalities in agriculture have a fatality rate of 70 per 100,000, third highest in the United States far exceeding the overall occupational fatality rate of 4 per 100,000. Only timber cutters and fishing industries have higher rates and these workers have fatality rates eight times the average worker rate (CDC 2004, USBLS 2008). Agriculture and forestry activities have among the highest injury rates (USBLS 2008). Use of chainsaws and mowers in mechanical treatments can lead to injuries. Likewise, prescribed fire presents hazards from inhaling particulates. Fatalities have been caused by prescribed fire (NIOSH 2009a).

Use of all terrain vehicles (ATVs) for herbicide application and prescribed fire has also caused injuries and fatalities. In response to this, BLM has conducted research to evaluate the type of vehicle, load size, slope, and to establish policy and training to make ATV application safer (Morin 2008). This research has been used by OSHA, the Consumer Product Safety Commission, and the EPA to promulgate regulations for ATV use.

Injuries from vegetation treatment are related to the percentage of acres treated by method. For instance, under the No Action Alternative (Alternative 2), 2 percent of acres treated are aerial application of herbicide and 32 percent are ground application. Twelve percent of acres treated are manual or mechanical treatment and another 12 percent of acres are treated by prescribed fire. The remaining acres are treated with bio-control, directed livestock, or seeding and planting.

No injuries to herbicide applicators from herbicide exposure have been recorded for at least the past five years on BLM lands in Oregon (Thompson, T. pers. comm.; DOI Accident Database).

Environmental Consequences

Herbicides are formulated to affect plant growth; some mimic plant hormones (auxins), others affect photosynthesis, amino acid, or lipid synthesis, or disrupt plant cell membranes. While they are selective for plants and among plants, they have the potential to affect human health if used improperly. The use of herbicides under a variety of application methods, as proposed in this EIS, involves potential risk or the perception of risk to workers and members of the public living or engaging in activities in or near herbicide treatment areas. Therefore, Risk Assessments were conducted to evaluate potential human health risks that could result from herbicide exposure both during and after treatment of public lands. See Chapter 3 and Tables 3-16 through 3-21 for more explanation of the process and a summary of the risk categories under various exposure scenarios.

Methodology for Assessing Effects

For the PEIS, the BLM completed Risk Assessments to evaluate potential risks to human health from exposure to the following five active ingredients: diflufenzopyr, diquat, fluridone, imazapic, and sulfometuron methyl. Diflufenzopyr was assessed only in formulation with dicamba. The remaining 12 active ingredients addressed in this EIS were evaluated in other Risk Assessments. The BLM relied on Risk Assessments prepared in recent years by the Forest Service to evaluate the risks to human health associated with ten active ingredients (2,4-D, chlorsulfuron, clopyralid, dicamba, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr). For bromacil, diuron, and tebuthiuron, the BLM relied on information provided in an earlier BLM vegetation treatment EIS (USDI 1991), confirmed with a literature search for the PEIS.

The following sections briefly discuss the Risk Assessment methods used by the BLM in the current assessment, the Risk Assessment methods used by Forest Service, and the methods used by BLM in the earlier EISs. More detailed information on the methodology used to evaluate risks is in Appendix 8 and 13, and the Risk Assessments themselves are in Appendix 8.

BLM Human Health Risk Assessment Methodology (2007)

For diflufenzopyr (with dicamba), diquat, fluridone, imazapic, and sulfometuron methyl, the Risk Assessments followed the four-step risk assessment model identified by the National Academy of Sciences (NAS 1983)(See Appendix 13). These steps are: 1) hazard identification; 2) dose response assessment; 3) exposure assessment; and, 4) risk characterization. The outcome of each of these steps is discussed below. The PEIS used herbicide toxicity factors from EPA that included system, neurologic, reproductive, and endocrine disrupting, and other endpoints.

An exposure assessment was conducted to predict the magnitude and frequency of potential human exposure to the herbicides under consideration. Both worker and public (adult and children) exposures were evaluated. Exposures were evaluated for applications using the maximum application rate designated by the herbicide label, and applications using a typical application rate that was defined by BLM.

Workers include those that mix, load, and apply herbicides and operate transport vehicles, recognizing that in some cases workers would perform multiple tasks, increasing his or her exposure. Both routine-use and accidental exposure scenarios were included in the worker evaluation. For the routine-use exposure scenario, the exposure assumptions were derived using information from the Pesticide Handlers Exposure Database, which is a generic database containing empirical dermal and inhalation exposure data for workers mixing, loading, or applying pesticides (EPA 1998). Accidental exposures for workers could occur via spills or direct spray onto a worker.

Two types of public use exposure scenarios are addressed:

- Potential exposure by the public during routine use of public lands to herbicide active ingredient(s) that have drifted outside of the area of application; and,
- Accidental scenarios where the public prematurely enters a sprayed area (a reentry scenario), is sprayed directly, or contacts water bodies that have accidentally been sprayed directly or into which an herbicide active ingredient has been spilled.

Based on consideration of potential public uses of BLM lands, and consistent with the 1991 *Vegetation Treatment on BLM Lands in Thirteen Western States Final EIS* (USDI 1991), receptors (people exposed) evaluated included 1) hiker/hunter; 2) berry picker - child and adult; 3) angler; 4) swimmer - child and adult; 5) nearby resident - child and adult; and 6) American Indian - child and adult. It is assumed that the public could be exposed through one or more of the following exposure pathways: 1) dermal (skin) contact with spray; 2) dermal contact with foliage; 3) dermal contact with water while swimming; 4) ingestion of drinking water or incidental ingestion of water while swimming; 5) ingestion of berries; and, 6) ingestion of fish.

AgDrift, a computer model developed by the EPA, industry, and others was utilized to evaluate the off-site deposition of herbicides (SDTF 2003). The GLEAMS model was used to simulate surface runoff of the three terrestrial herbicides (see Appendix 8).

Forest Service Human Health Risk Assessment Methodology

The Forest Service Risk Assessment methodology (used for 2,4-D, chlorsulfuron, clopyralid, dicamba glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr) was similar to that used by the BLM. In the exposure assessment phase, the Forest Service developed general and accidental exposure scenarios for workers expected to be handling the herbicides and for the public who could be inadvertently exposed to herbicides. General exposure for workers included exposure via directed foliar, broadcast ground, and broadcast aerial applications. Accidental exposure scenarios for workers included immersion or contaminated clothing and spills. Exposure scenarios for the public included: 1) direct spray; 2) dermal exposure from contaminated vegetation; 3) consumption of contaminated water; 4) acute exposure via spills; 5) consumption of contaminated fish; and, 6) consumption of contaminated vegetation.

The risk characterization process then compared the exposure assessment to the dose response assessment to determine a hazard quotient (HQ) for a specific exposure scenario. HQs were calculated by dividing the exposure level determined in the PEIS by the toxicity factor. A higher HQ indicates that the exposure level exceeds the toxicity factor.

BLM Human Health Risk Assessment Methodology (1991) and Toxicology Literature Review

Human health Risk Assessments for bromacil, diuron and tebuthiuron were conducted by the BLM for an earlier vegetation treatment EIS (USDI 1991). Literature reviews and evaluations were conducted for the period between 1991 to 1998 to assess whether toxicity data reported since the 1991 EIS would indicate that a new risk assessment should be conducted (e.g., if the new toxicity data suggested greater risks to humans) (McMullin and Thomas 2000). Bromacil, diuron, and tebuthiuron did not have recent toxicity data suggesting additional risks to humans; therefore, the human health risks of these herbicides are reported using results from the earlier EIS.

Uncertainty in the Risk Assessment Process

The Risk Assessments conducted by the BLM and Forest Service incorporate varying conservative assumptions to compensate for uncertainties in the risk assessment process. Within any of the steps of the human health risk evaluation process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk evaluation process. Regulatory risk evaluation methodology requires that conservative assumptions be made throughout the risk assessment process to ensure that public health is protected. This conservatism, both in estimating exposures and in setting toxicity levels likely led to an exaggeration of the real risks of the vegetation management program to ensure any uncertainty was interpreted on the side of protecting human health.

Effects Common to All Alternatives

Human Health Risks Associated with Herbicides Evaluated in the 2007 BLM PEIS

Tables 3-16 and 3-17 present summaries of the level of risk that workers and the public would face during the application of a given herbicide, for both maximum and typical application rate scenarios. Aggregated Risk Indices (ARIs) (see Chapter 3) are partitioned into no, low, moderate, and high levels of risk for ease of comparison. These designations are strictly for comparison purposes, and do not imply actual risks to people because Standard Operating Procedures, PEIS Mitigation Measures, site-specific mitigation, and actual application and exposure scenarios would lessen exposures from Risk Assessment levels (see Standard Operating Procedures, PEIS Mitigation Measures, Risk, and the Potential for Adverse Effects, Chapter 3).

Diflufenzopyr: For workers, routine use ARIs were calculated for inhalation exposures under both typical and maximum application rate scenarios. No dermal toxicity values are available for diflufenzopyr, which, based on laboratory data, is not expected to be toxic through the dermal route. Routine use ARIs are greater than 1 under both the typical and maximum application rate scenarios, indicating no exceedance of the EPA's LOC (see *Risk Assessments*, Chapter 3). Because the accidental worker scenarios all assume dermal exposure and diflufenzopyr does not have a short-term dermal NOAEL, an accidental scenario ARI was not calculated.

For the public, routine use scenario ARIs are greater than 1 under both the typical and maximum application rate scenarios for the public, indicating no LOC. Under the accidental scenario, it is assumed that the public is exposed directly to maximum herbicide application rates via dermal contact, incidental ingestion of water while swimming, or dietary exposure pathways at the maximum application rate. All accidental scenario ARIs are greater than 1, indicating risks are below the LOC.

These results indicate that exposures to diflufenzopyr are not expected to exceed the EPA's LOC for worker or the public under the scenarios evaluated. Risk to aerial and boat workers were not evaluated because diflufenzopyr is not applied aerially or to aquatic sites. Risk to workers for accidental spill was not evaluated because there is no toxicity factor for oral exposure.

Diquat: PEIS Mitigation Measures (Appendix 2) limit the use of diquat to aquatic treatments, and to typical application rates where feasible. At the typical application rate, diquat presents a low to moderate risk to some workers (all backpack and horseback applicators),[82] and a low risk to child residents. When diquat is applied at the maximum application rate, there is low to moderate[83] risk to workers (except boat applicators) and the public (except swimmers). Diquat poses a high risk to workers and a low to moderate risk to the public under all accidental scenarios. Diquat causes moderate acute dermal effects and reversible eye irritation.

Fluridone: PEIS Mitigation Measures (Appendix 2) limit the use of fluridone to typical application rates, where feasible. Fluridone does not pose a risk to workers or the public when applied at the typical application rate. When fluridone is applied at the maximum application rate, there is low risk to aerial mixer/loaders. For accidental scenarios, fluridone poses a low to high risk to all workers, and a low risk to children and resident publics. Fluridone causes reversible eye irritation.

Imazapic applications do not present risk to the public or workers when applied in routine use situations at either the typical or maximum application rate. Accidental scenarios involving dermal contact with direct spray of vegetation or dietary exposure were not calculated because imazapic has not been shown to have acute dietary or dermal effects in hazard analyses conducted by the EPA (ENSR 2005l). Accidental scenarios involving dermal contact with a sprayed water body or a water body into which herbicide is spilled do not result in risk to swimmers. Risk to workers for accidental spill and to several public scenarios was not evaluated because there is no toxicity factor for oral exposure.

82 Risks to aircraft loaders are also displayed in Chapter 3, but Standard Operating Procedures preclude aerial application of diquat.

83 Diquat shows a high risk to workers for two aerial application scenarios, but Standard Operating Procedures prohibit aerial application.

Sulfometuron methyl applications do not present risk to human health when applied in routine use situations at either the typical or maximum application rate. Accidental scenarios involving dermal contact with direct spray of vegetation or dietary exposure were not calculated because sulfometuron methyl has not been shown to have acute dietary or dermal effects in hazard analyses conducted by the EPA (ENSR 2005l). Accidental scenarios involving dermal contact with a sprayed water body or a water body into which sulfometuron methyl is spilled do not present a risk to swimmers. Risk to workers for accidental spill and most public scenarios were not evaluated because there is no toxicity factor for oral exposure. The EPA has not developed any acute toxicity categories for sulfometuron methyl (EPA 2008b).

Human Health Risks Associated with Herbicides Evaluated in the 2005 Forest Service EIS[84]

Tables 3-18 and 4-19 present summaries of the level of risk that workers and the public would face during the application of a given herbicide, for both maximum and typical application rate scenarios. The Forest Service Risk Assessments presented the risk results as HQs, which were used to designate a risk level as no, low, moderate or high, for ease of comparison.

2,4-D: PEIS Mitigation Measures (Appendix 2) limit the use of 2,4-D to typical application rates, where feasible. At the typical and maximum application rates, workers involved in backpack spray, boom spray, and aerial application face low to moderate risk from 2,4-D exposure. Workers also face moderate risk from wearing contaminated gloves for 1 hour and no risk from exposure to a spill on lower legs for one hour or from exposure to spill on the hands for one hour. Based on upper bound hazard quotients that exceed 1, adverse health outcomes are possible for workers exposed repeatedly over a longer period. The public faces zero risk from most modeled scenarios at the typical and maximum application rates. Consumption of contaminated vegetation (fruit) over a period of several months would have a low risk to the public and a moderate risk to subsistence populations. Other chronic exposures to the public have no risk.

Based on recent studies reviewed by SERA, 2,4-D is toxic to the immune system and developing immune system, especially when used in combination with other herbicides (tank mixes). The mechanism of action of 2,4-D toxicity is cell membrane disruption and cellular metabolic processes. 2,4-D toxicity affects human lymphocytes and nerve tissue. Therefore, interactions are likely to occur when 2,4-D is mixed with other chemicals that affect cell membranes and cell metabolism (SERA 2006).

SERA (2006) suggests that 2,4-D may cause endocrine disruption in male workers applying large amounts of this herbicide; however, the study was inconclusive. Based on currently available toxicity information that demonstrate effects on the thyroid and gonads following exposure to 2,4-D, there are some data supporting its endocrine disruption potential and EPA is studying this further (EPA 2005a). In the Human Health Risk Assessment conducted to support the reregistration of 2,4-D (EPA 2004), the EPA concluded that there is not sufficient evidence that 2,4-D is an endocrine disrupting chemical.

Chlorsulfuron: For both workers and the public, most exposures to chlorsulfuron at the typical or maximum application rate would not pose a risk (SERA 2004a). Ground broadcast applications at the maximum application rate would pose a low risk to workers.

Eye and/or skin irritation are likely to be the only overt effects of mishandling chlorsulfuron. Following industrial hygiene practices during the handling of the chlorsulfuron would eliminate or minimize these effects.

84 The 2,4-D Risk Assessment was updated in 2006.

Clopyralid: There are no risks to the public or workers associated with most of the anticipated typical and accidental exposure scenarios for clopyralid. Irritation and damage to the skin and eyes can result from direct exposure to relatively high levels of clopyralid; this is likely to be the only overt effect as a consequence of mishandling clopyralid (SERA 2004b). Children face low risk from consumption of water contaminated by an accidental spill.

The human health risks of hexachlorobenzene and pentachlorobenzene were also analyzed in the Forest Service Human Health Risk Assessment, as technical grade clopyralid may be contaminated with these chemicals. Hexachlorobenzene was evaluated for potential carcinogenicity. Based on the levels of contamination of technical grade clopyralid with hexachlorobenzene and pentachlorobenzene, and the relative potencies of these compounds compared to clopyralid, this contamination is not significant in terms of potential systemic toxic effects. In addition, the contamination of clopyralid with hexachlorobenzene does not appear to present any substantial cancer risk above the Forest Service cancer risk LOC of 1 in 1 million.

Dicamba applications present low risk to workers during boom spraying. Dicamba may result in reversible eye irritation and severe skin irritation. There is low risk to the public from the consumption of water from a pond contaminated with a spill.

Glyphosate: For both workers and members of the public, there are no risks associated with nearly all exposures to glyphosate at the typical or maximum application rate (SERA 2003a). The Risk Assessment calculated no risk for all but one of the tested scenarios. There is low risk to children in the public associated with accidental exposure to glyphosate consumption of contaminated water after an herbicide spill into a small pond.

Endocrine disruption and glyphosate was studied by SERA in 2002. SERA reported, "Three specific tests on the potential effects of glyphosate on the endocrine system have been conducted and all of these tests reported no effects. The conclusion that glyphosate is not an endocrine disruptor is reinforced by epidemiological studies that have examined relationships between occupational farm exposures to glyphosate formulations and risk of spontaneous miscarriage, fecundity, sperm quality, and serum reproductive hormone concentrations… the approach taken in the Risk Assessment is highly conservative and no recent information has been encountered suggesting that this Risk Assessment is not adequately protective of any reproductive effects that might be associated with glyphosate exposure." However, a recent study by Benachour and Seralini (2008) shows potential endocrine disruption, DNA damage, and toxicity of POEA and possibly alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA, the major glyphosate degradate) in human cell cultures. This is a single study and scientists rely on the weight of evidence of multiple studies, which have not identified these adverse effects. These new findings need to be confirmed by other studies (see also the *Adjuvants* subsection later in this section).

Hexazinone: PEIS Mitigation Measures (Appendix 2) limit the use of hexazinone to typical application rates, where feasible, in addition to not allowing the application of hexazinone with an over-the-shoulder broadcast applicator. At typical and maximum application rates, all worker groups exposed to hexazinone may face risks, with the highest risks predicted for workers using an over-the-shoulder broadcast applicator (SERA 1997). Worker exposure is likely to exceed exposures that would generally be regarded as acceptable, if workers do not follow prudent handling practices that would minimize exposure. Workers exposed to hexazinone via direct and broadcast ground spray and aerial applications at the maximum application rate are at low risk. There would be a low risk associated with accidental exposure to hexazinone mixed for the maximum application rate via contaminated gloves (also low risk at the typical application rate) and via spills on lower legs. The most likely effects include irritation to the eyes, respiratory tract, and skin. Even under the most extreme exposure scenarios, outward toxic effects are not likely to be observed; however, the upper estimates of exposure levels could be associated with subclinical (non-symptomatic) effects and possible reproductive effects. In some accidental exposure scenarios, members of the public may face risks from exposure to hexazinone. At the typical application rate, there is low to moderate risk to the public associated with exposure to hexazinone under the following scenarios: direct spray of the entire body, acute consumption of water contaminated by a spill, and acute consumption of contaminated fish by the public and subsistence populations. For application at the maximum rate, the risks to the public associated with the above scenarios are low to moderate. The following additional scenarios pose a low risk: direct spray of the lower legs, acute and chronic consumption of fruit, and consumption of stream water contaminated by runoff or percolation.

Imazapyr: Most exposures to imazapyr at either the typical or the maximum application rate do not present a risk to either workers or members of the public, suggesting that workers and the public would generally not be at any substantial risk from longer-term exposure to imazapyr even at the upper range of the application rate considered in the Risk Assessment (SERA 2004d). Eye irritation is likely to be the only overt effect as a consequence of mishandling imazapyr. This effect can be minimized or avoided by prudent industrial hygiene practices during the handling of the compound.

Metsulfuron methyl: Typical exposures to metsulfuron methyl at the typical or maximum application rates do not present a risk to workers or the public (SERA 2004e). For workers, there is no risk associated with acute or chronic exposure scenarios, even at the upper ranges of estimated dose. For members of the public, no risks were predicted for any of the exposure scenarios. From a practical perspective, eye and skin irritation are likely to be the only overt effects of mishandling metsulfuron methyl. These effects can be minimized or avoided by prudent industrial hygiene practices during the handling of this compound.

Picloram: Typical exposures to picloram at either the typical or maximum application rates present few risks to workers or the public (SERA 2003b). For workers, no risks were predicted even at the upper ranges of exposure. For members of the public, no risks were predicted except for the consumption of water by a child following an accidental spill of a large amount of picloram into a very small pond, which presents a low risk. From a practical perspective, eye irritation and skin sensitization are likely to be the only overt effects as a consequence of mishandling picloram. Based on the standard assumptions used in this and other Forest Service Risk Assessments, the contamination of picloram with hexachlorobenzene does not appear to present a substantial cancer risk, even at the upper ranges of plausible exposure.

Triclopyr: PEIS Mitigation Measures (Appendix 2) limit the use of triclopyr to typical application rates, where feasible. Workers face low risk from directed and broadcast ground spray and aerial applications at the upper ranges of exposures for both evaluated forms of triclopyr (triclopyr acid and triclopyr BEE), at the maximum application rate (SERA 2003c). At the maximum application rate, workers face low risk from accidental exposure to contaminated gloves (1-hour duration). Thus, for workers who may apply triclopyr repeatedly over a period of several weeks or longer, it is important to ensure that work practices involve reasonably protective procedures to avoid the upper extremes of potential exposure. At higher application rates, measures that limit exposure should be developed on a case-by-case basis depending on the application rate and method. There is low to moderate risk to the public from triclopyr applications under several acute or accidental scenarios: 1) direct spray to the entire body; 2) direct spray to the lower legs; 3) dermal contact with contaminated vegetation; 4) acute consumption of contaminated fruit (maximum application rate only); and 5) acute consumption of pond water contaminated by a spill.

Human Health Risks Associated with Herbicides Evaluated in the 1991 BLM EIS

The human health risks of bromacil, diuron, and tebuthiuron were evaluated in an earlier BLM vegetation treatment EIS. These herbicides were not reevaluated because a literature review and evaluation showed that most toxicity values for these herbicides reported in more recent studies were not substantially lower (i.e., present more risk) than the values used to assess risks to human health in the 1991 EIS (McMullin and Thomas 2000). Tables 3-20 and 3-21 present summaries of the risks to workers and the public associated with these herbicides.

Bromacil: PEIS Mitigation Measures (Appendix 2) limit the use of bromacil to typical application rates, where feasible. According to the 1991 EIS, there would be a risk to workers associated with several exposure scenarios involving typical bromacil application practices. Pilots and aerial mixer-loaders face a risk for systemic, reproductive, and cancer effects from typical and maximum exposures to bromacil. Backpack and hand applicators and ground applicators, mixer-loaders, and applicator/mixer-loaders are also at risk for systemic and reproductive effects from maximum exposures. Risks for systemic, reproductive, and cancer effects to workers and the public are associated with accidental scenarios of spill to skin (concentrate and mixture), direct spray (no cancer risk), consumption of fish from a directly sprayed water body (no cancer risk), consumption of directly sprayed berries (no cancer risk), and drinking from water contaminated by a truck spill or a jettison of mixture (no cancer risk). The cancer slope factor for bromacil used in the Human Health Risk Assessment was the one available from the EPA at the time of the 1991 EIS. However, in its most recent review of bromacil, the EPA did not provide a cancer slope factor (EPA 1996), therefore bromacil is likely not carcinogenic.

<u>Diuron</u>: PEIS Mitigation Measures (Appendix 2) limit the use of diuron to typical application rates, where feasible. According to the 1991 EIS, there are risks to workers and the public associated with both routine and accidental exposures to diuron. Aerial application poses a risk to the public for systemic effects from worst-case exposures (e.g., direct exposure of hikers, berry pickers, anglers, and nearby residents; spray drift to skin; vegetation contact by berry pickers; consumption of contaminated drinking water and fish). Berry pickers also face a risk for systemic effects from worst-case direct exposure and contact with vegetation scenarios. In aerial application scenarios, pilots and mixer-loaders are at risk for systemic and reproductive effects under both typical and worst-case exposures, and fuel-truck operators are at risk for systemic and reproductive effects under worst-case exposures. In addition, backpack and hand applicators and ground applicators, mixer-loaders, and applicator-mixer-loaders are at risk for systemic and reproductive effects for typical (systemic only) and worst-case exposures. There are also risks to workers and the public for systemic and reproductive effects associated with accidental exposures of spill to skin (herbicide concentrate and mixture), direct spray, drinking, or eating fish from a directly sprayed water body, or immediate reentry into a sprayed area by a berry picker. Diuron is a known carcinogen.

<u>Tebuthiuron</u>: PEIS Mitigation Measures (Appendix 2) limit the use of tebuthiuron to typical application rates, where feasible. According to the 1991 EIS, tebuthiuron poses health risks to workers under various application scenarios. Typical and worst-case aerial application exposure to tebuthiuron could result in systemic and reproductive effects to pilots and to mixer-loaders (no systemic risk at typical exposures). Fuel-truck operators could experience systemic effects from worst-case exposure to tebuthiuron during aerial application. Backpack applicators face systemic and reproductive risks from maximum exposures to tebuthiuron. For workers using ground mechanical equipment, there are systemic and reproductive risks to applicators, mixer-loaders, and applicator/mixer-loaders associated with worst-case exposures to tebuthiuron. Hand applicators are at risk from typical (reproductive effects) and worst-case (systemic and reproductive effects) exposures. Several accidental scenarios also pose a risk for systemic and reproductive effects to workers and the public: 1) spill of herbicide mixture to skin; 2) direct spray to person; 3) drinking directly sprayed water (reproductive only); 4) immediate reentry of a berry picker into a sprayed area; 5) consumption of directly sprayed berries; and 6) consumption of water contaminated by a jettison of mixture or by a truck spill.

Potential Endocrine Disrupting Chemicals

According to the World Health Organization (2002), endocrine disrupters have been defined as exogenous substances that alter function(s) of the endocrine system and consequently cause adverse health effects in an intact organism or its progeny, or in (sub) populations. Endocrine disrupters interfere with the functioning of the endocrine system, in at least three possible ways:

- By mimicking the action of a naturally-produced hormone, such as estrogen or testosterone, and thereby setting off similar chemical reactions in the body;
- by blocking the receptors in cells receiving the hormones (hormone receptors), thereby preventing the action of normal hormones; or,
- by affecting the synthesis, transport, metabolism, and excretion of hormones, thus altering the concentrations of natural hormones.

During the toxicity review for the Human Health and Ecological Risk Assessments, no endocrine disrupting effects were noted. However, an extensive literature search revealed that diuron and 2,4-D are listed by the European Commission Directorate-General for the Environment (2003) as Category 2 chemicals, meaning that there is evidence of the potential for the listed chemical to cause endocrine disruption. Diuron only appeared on a single list, so there is some uncertainty within the scientific community about this herbicide's status as an endocrine disruptor.

In the Human Health Risk Assessment conducted to support the reregistration of 2,4-D (EPA 2004c), the EPA concluded that there is not sufficient evidence that 2,4-D is an endocrine disrupting chemical. The EPA did not conduct the Human Health Risk Assessment using endocrine disruption endpoints. Since the current studies that showed evidence of endocrine effects were tested using doses above renal saturation, the EPA recommended formal testing of 2,4-D for endocrine endpoints. However, there is no standard protocol for determination of endocrine effects of chemicals.

Adjuvants

Various sources of toxicity data (Muller 1980, Lewis 1991, Dorn et al. 1997, Wong et al. 1997) suggest that, for herbicides with high application rates, adjuvants have the potential to cause acute, and potentially chronic, adverse effects to aquatic species. Adjuvants and degradates were examined in the PEIS.

The adjuvant POEA was present in the formulations of glyphosate examined in the Risk Assessment but is not present in all formulations. Glyphosate with POEA is potentially toxic to fish (discussed in the *Fish* section), but there is no evidence in the Risk Assessment that humans approach LOCs under any exposure scenario. A recent study by Benachour and Seralini (2008) shows potential endocrine disruption, DNA damage, and toxicity of POEA in human cell cultures. This is a single study and scientists rely on the weight of evidence of multiple studies, which have not identified these adverse effects. As the study itself points out, these new findings need to be confirmed by other studies.

The adjuvant R-11 is a nonylphenol ethoxylate that is acutely toxic to aquatic life (Stark and Walthall 2003) and is suspected to be an endocrine-disrupting chemical (Bakke 2003). The Record of Decision for the PEIS suspended the use of R-11 in herbicide applications.

Human Health Risks by Application Method

Air: Aerial applications of herbicides generally pose a greater risk due to off-site drift than ground applications, as herbicides applied at greater distances from the ground are able to drift farther from the target application area. Therefore, risks to the public recreating or living near an application area would extend out greater distances if the herbicide were applied aerially than if it was applied by a ground application method. The BLM does not apply, sulfometuron methyl, or diflufenzopyr by air. Standard Operating Procedures specify avoiding applying bromacil or diuron aerially, and limiting aerial application of chlorsulfuron and metsulfuron methyl to areas with difficult land access.

Ground applications typically pose a lower risk to off-site humans than aerial applications because they are less likely to be exposed to spray drift. Similarly, spot rather than boom/broadcast applications are less likely to result in health risks to people downwind. However, these spot applications could present an increased risk to the workers charged with applying the herbicide because they are more likely to come into contact with the herbicide (their exposure doses is higher). In particular, workers applying diquat and 2,4-D by backpack and horseback would be at low to moderate risk for health risks from exposure to the herbicide. Ground boom spray applicators of 2,4-D would have low to moderate risk, but those applying diquat at the typical application rate by ATV or truck would not be at risk. In contrast, chlorsulfuron does not pose a risk to workers involved with aerial applications, but does pose a risk to workers conducting ground broadcast applications at the highest application rate. Exposure to hexazinone and triclopyr at the maximum rate has low risk to backpack and ground boom sprayers.

Typical Application Rate

PEIS Mitigation Measures limit the use of the following herbicides to the typical application rate, where feasible.[85] Diquat is not applied to BLM lands aerially, and poses a low risk at typical rates under some worker and public exposure scenarios. 2,4-D applications at the typical application rate would pose a low to moderate risk to plane and helicopter pilots and mixer/loaders, backpack applicator/mixer/loaders, horseback applicators and applicator /mixer /loaders, and consumers of contaminated fruit/vegetation. Bromacil, diuron, hexazinone, triclopyr, and tebuthiuron also pose a risk to the public and workers when applied at the typical application rate. None of the other herbicides pose a risk to people when applied at the typical application rate (Tables 3-16 through 3-21 and Table 4-36).

Maximum Application Rate

At the maximum application rate, more herbicides, in a greater number of exposure scenarios, have greater potential to affect human health. Fluridone, chlorsulfuron, clopyralid, dicamba, glyphosate, picloram, and triclopyr do not pose a risk when applied at the typical application rate, but do pose a risk under one or more exposure scenarios when applied at the maximum application rate. Clopyralid, glyphosate, and picloram pose a low risk under the accidental scenario involving consumption of water from a small pond that has experienced a recent spill of herbicides mixed for the maximum application rate, which is a very unlikely scenario. In addition, a greater number of exposure scenarios have health risks from herbicide applications at the maximum application rate. Diflufenzopyr, imazapic, imazapyr, metsulfuron methyl, and sulfometuron methyl do not pose a risk to any humans when applied at the maximum (or typical) application rate.

Accidental Direct Spray and Spill Scenarios

Accidental direct spray and spill scenarios for many herbicides pose a risk to workers and the public (accidental scenarios for diflufenzopyr, imazapic, and sulfometuron methyl were not evaluated because these herbicides are not considered toxic through short-term dermal exposure). These scenarios are unlikely, and can be minimized by following Standard Operating Procedures. However, these scenarios are included on Table 4-36, Estimated Annual Acres of Treatments with Risk to Human Health.

Human Health Risks

Worker: 2,4-D, bromacil, diquat, diuron, and tebuthiuron pose risks to workers when applied at both typical and maximum application rates. Diuron poses a risk to most workers at the typical application rate. For 2,4-D, diquat, bromacil, and tebuthiuron, people working with aerial applications would be at low to moderate risk for applications at the typical application rate, and most workers would be at risk when applying these herbicides at maximum application rates. 2,4-D, also poses risks to ground applicators, particularly during applications at the maximum application rate. In addition, there are potential cancer risks to mixer/loaders of diuron. Mixer/loaders working with aerial applications of fluridone are at low risk, and those working with bromacil, diuron, and tebuthiuron are at high risk when applying those herbicides at the typical and maximum application rates.

85 Standard Operating Procedures specify typical rate, where feasible, for 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr to reduce the risk to occupational and public receptors (Appendix 2).

Ground broadcast applicators are at risk from applying dicamba or diuron at the typical application rate, and bromacil, chlorsulfuron, and tebuthiuron at the maximum application rate. All workers are at risk from applying hexazinone, tebuthiuron, and triclopyr at the maximum application rate. The rest of the scenarios of potential exposure to workers were not predicted. Workers involved in the aerial application of herbicides appear to be at greater risk than are other workers; however, the application method that creates the most risk to workers appears to depend on the herbicide.

Public: In general, there are lower risks to the public than occupational workers. However, within this category, there is higher risk to children than adults. The public does not appear to be at risk from chlorsulfuron, diflufenzopyr, imazapic, imazapyr, metsulfuron methyl, or sulfometuron methyl applications (accidental scenarios were not evaluated for imazapic and sulfometuron methyl because these herbicides are not toxic through short-term exposure for specific exposure routes). Diquat application at the typical application rate poses a low risk to children. At the maximum application rate, diquat poses a low to moderate risk to the public, except swimmers.[86] Under maximum application rates or accidental exposures, diuron poses a risk to the public under all treatment scenarios. In addition, 2,4-D, bromacil, dicamba, diuron, fluridone, glyphosate, picloram, tebuthiuron, and triclopyr pose a risk to the public under one or more maximum application rate accidental exposure scenarios (e.g., exposure resulting from the spill of an herbicide into a small pond). For most herbicides (except diquat), risk to the public can be minimized or avoided by using the typical application rate, including other proposed mitigation measures, and following Standard Operating Procedures that greatly reduce the likelihood of accidents (see Standard Operating Procedures, PEIS Mitigation Measures, Risk, and the Potential for Adverse Effects, Chapter 3).

Summary of Highest Human Health Risks

Bromacil, diuron, diquat, and tebuthiuron have the highest health risks for workers of the 18 herbicides analyzed. PEIS Mitigation Measures specify avoiding applying bromacil and diuron aerially, and avoiding the maximum rate where feasible. Bromacil, diuron, and tebuthiuron have the highest risks to some of the public. Diuron is a suspected carcinogen (ENSR 2005f). 2,4-D has possible endocrine disruption abilities in workers applying large amounts of 2,4-D and poses moderate risks to workers performing ground-based boom spraying at maximum rates and under some accidental exposure scenarios.

Cumulative Human Health Risks

The human health risks from both herbicide and non-herbicide vegetation treatments are not unlike a host of other occupational risks throughout the west, as this section point out. The pounds of herbicide expected to be applied annually under future decisions implementing the Proposed Action (Alternative 4) (Table 3-4) are less than two-tenths of one percent of the total pounds of pesticides applied in Oregon in 2008 (*Cumulative Impacts* section near the start of Chapter 4). Other cumulative effects are described within this section.

Effects by Alternative

As described in the *Affected Environment* section, there is injury/fatality risks associated with prescribed fire and manual and mechanical vegetation control as well as with herbicides. Aerial spraying is hazardous to pilots, but the hours worked in aerial spraying are far less than hours worked for ground applications per acre.

Because mechanical methods in Oregon often involve timber cutting (the most dangerous occupation in the U.S.), mechanical and fire methods are generally believed to be more hazardous to workers than use of herbicides.

86 Standard Operating Procedures preclude using diquat at maximum rate, or using aerial application.

The criteria used in this section, and in Table 4-36, are: (1) relative risk of injury and disease between herbicide use and non-herbicide vegetation controls (e.g., mechanical and prescribed fire), (2) relative toxicity of herbicides, (3) acres treated, (4) mode of treatment (aerial versus ground application), and (5) population density.

Table 4-36. Estimated Annual Acres of Treatments with Risk to Worker and Public Human Health by Alternative

Herbicide or Method / Risk Category[1]		Reference Analysis	Alt 2 (No Action)	Alt 3	Alt 4 (Proposed Action)	Alt 5
Statewide						
Estimated Annual Acres of Herbicide Treatments by Risk Category	H	0	0	0	2600	3300
	M	0	8500	4000	5400	7500
	L	0	4600	3200	5700	6300
	0	0	9700	25700	34500	37000
Total Non Herbicide Risk Acres		8800	9200	15700	6043	5014
West of the Cascades *(population density: 1 person every 6.7 acres)*						
Bromacil	H	0	0	0	0	100
Diuron	H	0	0	0	100	100
Tebuthiuron	H	0	0	0	0	100
Total High Risk Acres		*0*	*0*	*0*	*100*	*300*
2,4-D	M	0	1800	2100	2300	2300
Total Moderate Risk Acres		*0*	*1800*	*2100*	*2300*	*2300*
Dicamba	L	0	100	200	200	200
Diquat	L	0	0	0	0	100
Triclopyr	L	0	0	1500	2200	2300
Total Low Risk Acres		*0*	*100*	*1700*	*2400*	*2600*
Total 0 Risk (Herbicides) Acres		*0*	*5400*	*5600*	*6700*	*7000*
Mechanical		4100	3300	3000	1248	1206
Fire		600	600	400	400	400
Total Non Herbicide Risk Acres		*4700*	*3900*	*3400*	*1648*	*1606*
East of the Cascades *(population density: 1 person every 95.3 acres)*						
Bromacil	H	0	0	0	900	900
Diuron	H	0	0	0	1300	1300
Tebuthiuron	H	0	0	0	300	800
Total High Risk Acres		*0*	*0*	*0*	*2500*	*3000*
2,4-D	M	0	6700	1900	3100	5200
Total Moderate Risk Acres		*0*	*6700*	*1900*	*3100*	*5200*
Dicamba	L	0	4500	800	1400	1400
Diquat	L	0	0	0	0	100
Triclopyr	L	0	0	700	1900	2200
Total Low Risk Acres		*0*	*4500*	*1500*	*3300*	*3700*
Total 0 Risk (Herbicides) Acres		*0*	*4300*	*20100*	*27800*	*30000*
Mechanical		1000	200	200	-7705	-8692
Fire		3100	5100	12100	12100	12100
Total Non Herbicide Risk Acres		*4100*	*5300*	*12300*	*4395*	*3408*

H = High, M= Moderate, and L=Low

[1] Highest risk category considering all exposure scenarios, typical rate, from Tables 3-16 through 3-21 (highest categories come from accidental exposure scenarios).

Reference Analysis – No Herbicide Use

There would be no human health risk associated with herbicide applications; risk to human health would be entirely from non-herbicide vegetation controls.

On the west side of the Cascades, invasive plants would be treated with mechanical methods and fire on 4,700 acres, which is more than under any of the alternatives. Hence, risk from non-herbicide methods would be higher than under any of the alternatives.

On the east side of the Cascades, acres treated with mechanical and fire account for 4,100 acres. This is less than most alternatives.

Alternative 2 (No Action) – Use 4 Herbicides to Treat Noxious Weeds Only

Under Alternative 2 (No Action), there would be human health risk from the application of 2,4-D and dicamba. 2,4-D poses a moderate risk to workers, and to the public under one accidental exposure scenario, which makes it one of the highest risk herbicides being proposed under any alternative (of the 18 being considered). Dicamba poses a low risk to workers using boom sprays at the maximum application rate and to the public under one accidental spill scenario. The other two herbicides proposed under this alternative are generally in the no risk category except for some low risks under one or more accidental exposure scenarios.

On the west side of the Cascades, 1,800 acres of 2,4-D and 100 acres of dicamba would be applied, which is less than under any other alternative (and hence less risk). Mechanical and fire treatments would happen on 3,900 acres, which is less than the Reference Analysis, but more than under any of the alternative (and hence more risk).

East of the Cascades, 6,700 acres of 2,4-D and 4,500 acres of dicamba would be applied. This is more acres for these two herbicides than under any other alternative. Mechanical and fire treatments would be the second highest of the alternatives (and hence the second highest risk).

Aerial application of herbicides would account for 7 percent of the application, and most or all of this would occur east of the Cascades.

Adverse effects (risk) can extend beyond BLM borders as cooperators attempt to match BLM herbicides on intermixed ownerships or cooperative use roads.

Alternative 3 – Use 12 (W) or 13 (E) Herbicides to Treat Invasive Weeds and Control Pests and Diseases

Under Alternative 3, low risk triclopyr become available.

West of the Cascades, the use of 2,4-D and dicamba would increase slightly, which, along with 1,500 acres of low risk triclopyr, makes this alternative slightly higher risk from herbicides than Alternative 2 (No Action). Aerial application would not be allowed. Acres treated with mechanical and fires would decrease, which would decrease risk from non-herbicide methods.

East of the Cascades, the use of 2,4-D would drop 70 percent and dicamba more than 80 percent with addition of herbicides categorized as no risk. Seven hundred acres of low risk triclopyr becomes available. Imazapic is likely to be applied aerially for 90 percent of the imazapic acres, but imazapic has a risk category of no risk, and would be applied in areas with low population. Aerial methods will be used to apply seven percent of the other herbicides. Risk from herbicides would be lower than under any other alternative. However, mechanical and fire methods are expected to increase significantly, and risks from non-herbicide methods would be higher than under any other alternative.

Alternative 4 (Proposed Action) – Use 13 (W) or 16 (E) Herbicides to Treat Invasive Weeds plus Limited Additional Uses

West of the Cascades, under Alternative 4, diuron, which is assigned a risk category of high, becomes available. The use of 2,4-D would increase slightly, which, along with 100 acres of diuron and 2,200 acres of low risk triclopyr, makes this alternative slightly higher risk from herbicides than Alternative 2 (No Action). Aerial application would not be allowed. Mechanical acres drop slightly, which would slightly decrease risk from non-herbicide methods.

East of the Cascades, the use of 2,4-D would increase when compared to Alternative 3 (but still be half of the Alternative 2 acres), and 2,500 acres of high risk herbicides would be available, which would increase risks (when compared to Alternative 3)(Table 4-36). In addition, the low risk triclopyr acres would increase to 1,900. Imazapic would be applied aerially for 90 percent of the imazapic acres, but imazapic has a risk category of no risk, and would be applied in areas with low population. Aerial methods would be used to apply nearly seven percent of the other herbicides. Under this alternative, rights-of-way, administrative sites, and recreation sites can be sprayed to control native and other non-invasive vegetation, and this could result in less selective treatments than under Alternatives 2 and 3. However, total high and moderate risk herbicides would be be lower than Alternative 2 (No Action). Mechanical methods are expected to decrease significantly, and risks from non-herbicide methods would be lower than under Alternative 2 and 3, and similar to the Reference Analysis.

Alternative 5 – Use 18 Herbicides to Treat Invasive Weeds and Meet Other Vegetation Management Objectives

West of the Cascades, under Alternative 5, the low and high rated diquat, bromacil, and tebuthiuron become available. The use of 2,4-D would increase slightly, which, along with 100 acres of high risk diuron and 2,300 acres of low risk triclopyr, makes this alternative higher risk from herbicides than any of the other alternatives. Aerial application would be allowed, but would be rare. Mechanical acres drop slightly, which would decrease risk from non-herbicide methods slightly.

East of the Cascades, the use of 2,4-D would increase (but still be less than under Alternative 2), and additional low risk triclopyr and high risk tebuthiuron would become available and the herbicide risk from the alternative would be the highest of any of the alternatives. Imazapic would be applied aerially for 90 percent of the imazapic acres, but imazapic has a risk category of no risk, and would be applied in areas with low population. Aerial methods will be used to apply nearly seven percent of the other herbicides. Mechanical methods are expected to continue to decrease, and risks from non-herbicide methods would be lowest under this alternative.

Critical Elements of the Human Environment

Air Quality	Air Quality is addressed in the *Air Quality* section.
American Indian Religious Concerns	American Indian religious concerns are addressed in the *Paleontological and Cultural Resources* section.
Areas of Critical Environmental Concern [ACECs]	Areas of critical environmental concern are addressed in the *Wilderness and Other Special Areas* section.
Cultural Resources	Cultural resources are addressed in the *Paleontological and Cultural Resources* section.
Energy	Executive Order 13212 provides that agencies shall expedite review and…take action to expedite…projects that will increase the production, transmission, or conservation of energy. BLM Instruction Memorandum OR-2002-081 requires NEPA documents to contain information from which the BLM can later complete a Statement of Adverse Energy Impacts. Alternatives 4 and 5 would reduce maintenance costs by making herbicides available to treat native and other non-invasive vegetation within rights-of-ways.
Environmental Justice	Environmental Justice is addressed in the *Environmental Justice* section.
Prime Farmlands or Unique Land Characteristics	The Farmland Protection Policy Act, (7 U.S.C. §4201 et seq.) regulates Federal actions with the potential to convert existing prime and unique farmlands to non-agricultural purposes. None of the action alternatives would convert farmlands. In fact, the alternatives would increase the likelihood of maintaining the productivity of such lands on or near BLM lands.
Floodplains	Executive Order 11988, as amended, requires agencies to determine if a Proposed Action (Alternative 4) will occur in a floodplain and if the action will significantly affect the quality of the human environment. The objective of the law is to avoid adverse impacts associated with occupancy and modification of floodplains and to avoid floodplain development. The action alternatives themselves do not authorize any actions; only add tools for the control of invasive plants. By improving the control of invasive plants, the action alternatives could positively affect floodplains in ways that significantly affect the quality of the human environment. The potential effects of the alternatives on water flows that could affect floodplains are addressed in detail in the *Wetlands and Riparian Areas* and *Water Resources* sections.
Invasive Species	EO 13112 requires the prevention of introduction of invasive species and to provide for their control and to minimize their economic, ecological, and human health impacts. The *Need* to which this EIS responds is, in part, to be able to better meet BLM's noxious weed responsibilities, and Alternatives 3-5 seek to more efficiently reduce the spread of noxious weeds and other invasive plants.
Invasive and Non-native Species	The Lacey Act of 1981, as amended, makes it unlawful to import, export, sell, acquire, or purchase fish, wildlife, or plants. None of the alternatives propose such activities.

Noxious Weeds	The Federal Noxious Weed Act of 1974, as amended, requires carrying out operations or measures to eradicate, suppress, control, or prevent or retard the spread of any noxious weed. Alternative 3 and portions of Alternatives 4 (Proposed Action) and 5 are specifically designed to further the objectives of this Act.
Threatened or Endangered Species	Federally Listed, Proposed, and other Special Status species of plants, fish, and wildlife are addressed in the *Native and Other Non-Invasive Vegetation*, *Fish*, and *Wildlife Resources* sections, and in Appendix 5, and in additional detail in the Biological Assessment of the PEIS, which is incorporated in this EIS. There are several Federally Listed fish, plants, and terrestrial animals within the analysis area that could potentially be affected, usually positively at least in the long term.
Wastes, Hazardous or Solid	The Resource Conservation and Recovery Act of 1976 and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 are laws that regulate hazardous waste that endangers public health or the environment. The alternatives propose the use of herbicides, some of which may not be applied, may become outdated, and may require disposal in Class I dumps. Every effort is made to avoid this action. Empty containers will be triple rinsed and disposed of in approved dumps.
Water Quality, Drinking or Ground	The *Water Resources* section addresses water quality and conformance with State water quality standards.
Wetlands/ Riparian Zones	Executive Order 11990 requires Federal agencies to avoid destruction or modifications of wetlands and to avoid undertaking or providing assistance for new construction located in wetlands. The alternatives themselves only authorize consideration of additional herbicides for the control of noxious weeds and other invasive plants in wetlands and riparian areas. These measures do not destroy, modify, or undertake/assist new construction located in wetlands. The action alternatives could variously benefit wetlands.
Wild and Scenic Rivers	Wild and scenic rivers are discussed in the *Recreation / Interpretive Sites* and the *Wilderness and Other Special Areas* sections.
Wilderness	Wilderness and wilderness study areas are discussed in the *Wilderness and Other Special Areas* section.

Other Environmental Consequences

Consistent with the mandates of FLPMA and other laws and policies, the BLM and/or its cooperators manage vegetation on thousands of acres per year to restore forest and rangeland health; provide sustainable habitat for Special Status and other species of plants and animals; reduce the risk of wildland fire; and, provide for safe use and access to a variety of authorized developments. For these treatments, a full range of non-herbicide treatment methods have been analyzed in existing resource management plan (RMP) or program NEPA documents, and are currently in use to achieve vegetation management objectives. A portion of the vegetation management program is focused on the control on noxious weeds, and the tools used for the noxious weed portion of the program currently include the use of four herbicides. RMP direction directing the control of noxious weeds is compiled for reference in Appendix 6. It is in this context that the alternatives examined in this EIS are presented. The proposal is to increase the number of herbicides available to the nine BLM districts in Oregon for use in their existing vegetation management programs. No additional *types* of work would be added by the action alternatives. Efficiency and quantity of vegetation management may go up because of selection of one of the action alternatives, but those effects would be within the scope of existing plans. No effects from any of the action alternatives, beyond those addressed within this Chapter, are anticipated.

This EIS is programmatic; individual NEPA analysis and decision-making will be made at the district and/or project scale to examine the potential for site-specific adverse effects.

The Council on Environmental Quality regulations require that the discussion of environmental consequences include

> . . . any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented (40 C.F.R. 1502.16).

Adverse Effects Which Cannot Be Avoided

Decisions made following an EIS do not have to avoid adverse effects, but the EIS must identify and disclose any adverse environmental, social, and economic effects. This EIS attempts to describe all identifiable adverse effects caused by the alternatives herein. Adverse effects, which cannot be avoided, include the likely continued spread of some species of noxious weed and other invasive plants at some level. The action alternatives are predicted to slow, but not eliminate, the adverse effects of this spread.[87] For some or possibly all areas, the benefits of the alternatives in terms of preventing infestations of some noxious weeds, or restoring native plant communities infested by them, may be transitory.

There is also a low potential that the herbicide use proposed would contribute to the cumulative effect of herbicides, other pesticides, and other pollutants in some of Oregon's waters. This EIS displays, in Chapter 3, the amount of each herbicide that would be used under the Proposed Action (Alternative 4) in the context of the total amount of those herbicides used statewide. The BLM could conceivably contribute to the amount of any of those herbicides that are found, for example, in the waters of the State. However, because of low application rates, streamside buffer distances and other Standard Operating Procedures and PEIS Mitigation Measures, the percent applied with ground methods, and the presence of environmental factors that will help hold and break down those herbicides, the BLM's contribution to detectable off-site herbicide accumulations should be even lower than its percentage contribution to statewide totals would imply.

Standard Operating Procedures and PEIS Mitigation Measures, as well as potential mitigation measures listed in Chapter 2, should make the likelihood of adverse effects low. In any event, those likelihoods are described in their respective sections. The possible adverse effects include health effects to persons applying herbicides, particularly via spills and other accidents. Although no toxicity accidents have been documented on BLM lands in Oregon in at least five years, they have certainly occurred in other states and could occur in Oregon in the future. Following prescribed procedures however, there is no evidence injury levels would significantly exceed those expected for industrial type work, or exceed those that would occur if the work were to be accomplished with non-herbicide methods.

87 Using "current budget trends" and the spread rates calculated in the *Noxious Weeds and Other Invasive Plants* section. The predicted spread rates could be incorrect, program emphasis may change, biocontrols may reduce the effect of weeds, and other factors outside the scope of this analysis may contribute to changes in weed spread rates in the future.

Relationship Between Short-Term Uses of the Human Environment and Maintenance of Long-term Productivity

The Proposed Action (Alternative 4) is not an extraction or development. The action alternatives would help slow the spread of noxious weeds and other invasive plants, improve habitat, and make native and other non-invasive vegetation control more effective and efficient (and potentially less impacting) than currently-used methods. The *Soil Resources* section in this Chapter concludes that the herbicides proposed would not have permanent effects on the soil. Some of the herbicides are known ground-water contaminants, and PEIS Mitigation Measures are offered to reduce the likelihood of BLM applications polluting water. Half-lives of the herbicides under various conditions, are addressed in the *Soil Resources* and *Water Resources* sections; BLM-applied herbicides will break down at or near the point of application. The *Fish* section indicates BLM applications will not significantly contribute to cumulative downstream effects to fish. No herbicide-related effects to long-term productivity are identified.

Long-term productivity will be affected by noxious weeds, however, either by their displacement of native plant communities or by their allelopathic effects on soil, so native species are displaced. These effects can last for years or decades. The degree to which noxious weeds remain uncontrolled will affect long-term productivity.

Irreversible or Irretrievable Impacts

Irreversible refers to a loss of nonrenewable resources, such as mineral extraction, heritage (cultural) resources, or to those factors which are renewable over long time-spans, such as soil productivity. Irretrievable commitment applies to losses that are temporary, such as loss of forage production in an area being used as a ski run or use of renewable natural resources.

The Proposed Action (Alternative 4) is not an extraction or development. The potential for damage to, or loss of, non-renewable cultural resources is addressed in this EIS. That portion of the analysis concluded that with required pre-project clearances and surveys in likely paleontological and historic areas, the likelihood of damaging sites during herbicide treatments was negligible.

The spread of invasive weeds will likely cause irreversible and irretrievable impacts on many BLM sites in Oregon. Adverse and potentially long-term effects of noxious weed spread are documented in the analysis and include reductions in soil quality and wildlife habitat carrying capacity, reduced livestock and wild horse carrying capacity, and decreased water quality. The action alternatives would reduce, not exacerbate, these effects.

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Glossary

Abiotic: Not involving living organisms.

Absorption: The process by which a chemical or other substance is able to pass through body membranes and enter an organism.

Acetolactate synthase (ALS): A plant enzyme that facilitates the development of amino acids needed for plant growth.

Acetolactate synthase (ALS)-inhibitor: An herbicide that starves plants by reducing ALS. In this EIS, the ALS-inhibitors include three sulfonylureas (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl) and two imidazolinones (imazapic and imazapyr).

Acid soil or acidic soil: A soil material having a pH of less than 7.0.

Active ingredient (a.i.): The ingredient in an herbicide that prevents, destroys, repels, desiccates, or otherwise controls the target plant.

Acute adverse effect level: The level at which a substance can cause adverse effects within a short time of dosing or exposure.

Acute effect: An adverse effect on any living organism in which symptoms develop rapidly and often subside after the exposure stops.

Acute exposure: A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as "acute" is dependent on the life span of the organism.

Acute toxicity: The quality or potential of a substance to cause injury or illness shortly after exposure through a single or short-term exposure.

Adaptive management: A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and if not, facilitating management changes that will best ensure that outcomes are met or reevaluated.

Additive: A substance added to another in relatively small amounts to impart or improve desirable properties or suppress undesirable properties.

Additive effect: A situation in which combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone.

Adjuvant: A chemical that is added to the pesticide formulation to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle.

Administrative site: A reservation of public land for use as a site for a public buildings or other administrative facility. Administrative sites are generally withdrawn from public entry or mining claims and also include any Federal lands that have been dedicated to a specified public purpose. On BLM managed lands in Oregon, administrative sites include, but are not limited to; seasonal fire stations, wild horse corrals, rock quarries and bulk material and equipment storage sites, seed orchards and related progeny test sites, other developed or improved sites for vegetative propagation, BLM managed airstrips and helipads, BLM range improvements and water source developments, sanitary systems, BLM communication sites, remote automated weather stations, etc.

Adsorption: 1) The adhesion of substances to the surface of solids or liquids. 2) The attraction of ions of compounds to the surface of solids or liquids.

Adverse impact: An impact that causes harm or an undesirable result.

Aerobic: Life or processes that require, or are not destroyed by, the presence of oxygen (Also see *anaerobic*).

Affected environment: Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Air pollutant: Any substance in the air that could, if in high enough concentration, harm humans, animals, vegetation, or material. Air pollutants may include almost any natural or artificial matter capable of being airborne in the form of solid particles, liquid droplets, gases, or a combination of these.

Air quality: The composition of air with respect to quantities of pollution therein. Used most frequently in connection with "standards" of maximum acceptable pollutant concentrations.

Algae: Simple plants containing chlorophyll. Many are microscopic, but under conditions favorable for their growth, they can grow in colonies and produce mats and similar nuisance masses.

Alien species: Any species, including its seed, eggs, spores, or other biological material capable of propagating that species that is not native to the ecosystem under consideration. Also referred to as non-natives, or exotics.

Allelopathic or allelopathy: Suppression of growth of a plant by a toxin released from a nearby plant of the same or another species.

Allotment (grazing): Area designated for the use of a certain number and kind of livestock for a prescribed period of time.

Alluvium: General term for clay, silt, sand, or gravel deposited in the bed of a stream during relatively recent geologic time as a result of stream action.

Alternative: In an EIS, one of a number of possible options for responding to the purpose and need for action.

Ambient air: Any unconfined portion of the atmosphere; open air, surrounding air, or "outdoor air."

Amphibian: Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

Amplitude: See *ecological amplitude*.

Anadromous fish: Fish that mature in the sea and swim up freshwater rivers and streams to spawn. Examples include salmon, steelhead, and sea-run cutthroat trout.

Anaerobic: Life or processes, such as the breakdown of organic contaminants by microorganisms, which take place without oxygen.

Analyte: A chemical substance that is the subject of a chemical analysis.

Animal unit (AU): A standardized unit of measurement for range livestock that is equivalent to one cow, one horse, five sheep, five goats, or four reindeer, all over six months of age.

Animal unit month (AUM): The amount of feed or forage required by one animal unit grazing on a pasture for one month.

Anions: Negatively charged ions in solution e.g., hydroxyl or OH–ion.

Annual (plant): A plant whose life cycle is completed in one year or season.

Anthropogenic: Caused or produced by humans.

Antifoaming agent: A type of adjuvant added to a commercial pesticide that prevents the formation of foam.

Aquatic: Growing, living in, frequenting, or taking place in water; used to indicate habitat, vegetation, or wildlife in freshwater.

Aquifer: Rock or rock formations (often sand, gravel, sandstone, or limestone) that contain or carry groundwater and act as water reservoirs.

Area of Critical Environmental Concern (ACEC): An area within public lands that requires special management attention to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; other natural systems or processes; or to protect life or provide safety from natural hazards.

Areal: Of or relating to or involving an area.

Arid: A term applied to regions or climates where lack of moisture severely limits growth and production of vegetation. The limits of precipitation vary considerably according to temperature conditions.

Arthropods: Invertebrates belonging to the largest animal phylum (more than 800,000 species) including crustaceans, insects, centipedes, and arachnids. Characterized by a segmented body, jointed appendages, and an exoskeleton composed of chitin.

Attainment area: A geographic area that is in compliance with the National Ambient Air Quality Standards. An area considered to have air quality as good as or better than the National Ambient Air Quality Standards as defined in the Clean Air Act.

Auxin: A class of substances that in minute amounts regulate or modify the growth of plants, esp. root formation, bud growth, and fruit and leaf drop.

Back Country Byways: Roads designated to complement the National Scenic Byway program, featuring waterfalls, geology, glaciers, and rivers.

Basal application: In pesticides, the placing of an herbicide on stems or trunks of plants just above the soil line.

Base: Substances that (usually) liberate OH anions when dissolved in water and weaken a strong acid.

Bedload: Rocks, pebbles, and other material in regular contact with the streambed but being moved along by it. Includes material moving only part of the time, as well as material rolling, sliding, etc.

Benthic: Of or relating to or happening on the bottom under a body of water.

Bequest Value: The willingness to pay or forgo something of value to ensure resources are available for use by future generations. This value may be expressed at the individual, group, or societal scales.

Best management practices (BMPs): Manual-directed standard operating procedures and other standing direction, particularly when they apply to water.

Binder: A material used to bind together two or more other materials in mixtures.

Bioaccumulation: The process of a plant or animal selectively taking in or storing a persistent substance. Over time, a higher concentration of the substance is found in the organism than in the organism's environment.

Biodegradation: Process of decomposition by microorganisms or other natural environmental factors.

Biodiversity: The variety of life and its processes, including all life forms from one-celled organisms to complex organisms such as insects, plants, birds, reptiles, fish, other animals; and the processes, pathways, and cycles that link such organisms into natural communities.

Biological assessment (BA): A document prepared by or under the direction of a federal agency. A BA addresses Federally Listed, species proposed for listing, and designated and proposed critical habitat that may be present in the action area, and evaluates the potential effects of the action on such species and habitat.

Biological control: The use of non-native agents including invertebrate parasites and predators (usually insects, mites, and nematodes), and plant pathogens to reduce populations of invasive plants.

Biological crust: Thin crust of living organisms on or just below the soil surface; composed of lichens, mosses, algae, fungi, cyanobacteria, and bacteria. Biological crusts are typically found in arid areas.

Boom (herbicide spray): A tubular metal device that conducts an herbicide mixture from a tank to a series of spray nozzles. Usually mounted to a truck, or behind a tractor or all-terrain vehicle.

Brackish: Saline water whose salt concentration is between that of freshwater and seawater (ranging from 0.5 to 30 parts per thousand).

Broadcast application: An application of an herbicide that uniformly covers an entire area.

Bryophytes: Plants of the phylum *Bryophyta*, including mosses, liverworts, and hornworts; characterized by the lack of true roots, stems, and leaves.

Buffer: A solution or liquid whose chemical makeup is such that it minimizes changes in pH when acids or bases are added to it; a space or distance left between the application and a non-target area; a strip of vegetation that is left or managed to reduce the impact that a treatment or action on one area might have on another area.

Bunchgrass: A grass having the characteristic growth habit of forming a round clump; lacking stolons or rhizomes.

Bureau Sensitive: Species designated by the State Director as requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. All Federal candidate species, proposed species, and delisted species in the 5 years following delisting are conserved as Bureau sensitive species, in addition to species designated by the State Director. (see also Sensitive species.)

Burn-down: Quickly stopping a plant's progress towards seed ripening.

California Puff (CALPUFF): CALPUFF is an advanced non-steady-state meteorological and air quality modeling system adopted by the U.S. Environmental Protection Agency as the preferred model for assessing long range transport of pollutants and their impacts involving complex meteorological conditions.

Carcinogen: A chemical capable of causing cancer.

Carnivore: An animal that feeds on other animals, especially the flesh-eating mammals.

Carrier: A non-pesticide substance added to a commercial pesticide formulation to make it easier to handle or apply.

Carrying capacity: The maximum population of a particular species that a particular area can support without hindering future generations' ability to maintain the same population.

Cascades: A mountain range in Oregon. As used in the EIS, the Cascade crest until, at the south end of the state, the crest meets the Klamath County line. Then follow that line west and then south to the state line, so that the entire Klamath Falls Resource Area is considered east of the Cascades, and the entire Medford District is considered west of the Cascades.

Cation: Positively charged ions in a solution.

Cation exchange capacity (CEC): The capacity of soil to hold nutrients for plant use. Specifically, CEC is the amount of negative charges available on clay and humus to hold positively charged ions. Effective cation exchange capacity (ECEC) is reported for acid soils ($pH<5$). Expressed as centimoles of charge per kilogram of soil (cmolc/kg).

Chaining: Woody vegetation control that is accomplished by hooking a large anchor chain between two bulldozers, or one bulldozer and a weight; as the bulldozers move through the vegetation, the vegetation is broken or uprooted. Chaining kills a large percentage of the woody vegetation, and is often followed a year or two later by burning and/or seeding.

Chloracne: An acne-like skin disorder caused by prolonged exposure to chlorinated hydrocarbons.

Cholinesterase: An enzyme found in animals that regulates nerve impulses. Cholinesterase inhibition is associated with a variety of acute symptoms such as nausea, vomiting, blurred vision, stomach cramps, and rapid heart rate, paralysis, convulsions, and death.

Chemical degradation: The breakdown of a chemical substance into simpler components through chemical reactions.

Chronic exposure: Exposures that extend over a long period. Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects.

Chronic toxicity: The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

Cisco: Salmonid fish of the genus *Coregonus* that differs from other members of the genus in having upper and lower jaws of approximately equal length and high gillraker counts.

Class I area: Under the 1977 Clean Air Act amendments, all international parks, parks larger than 6,000 acres, and national wilderness areas larger than 5,000 acres that existed on August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional air pollution that can be added to these areas.

Clay: In soil, particles smaller than .002 mm in diameter.

Climate: The composite or generally prevailing weather conditions of a region throughout the year, averaged over a series of years.

Code of Federal Regulations (CFR): A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

Confidential business information (CBI): Information submitted to EPA by a pesticide registrant to fulfill requirements for pesticide registration that contains trade secrets or commercial or financial information that has been claimed as confidential by its source. EPA has special procedures for handling such information.

Conservation Strategy: See Chapter 2, Alternative 4 or http://www.fs.fed.us/r6/sfpnw/issssp. Recovery Plans or other plans specifically identified as part of recovery or delisting plans, Conservation Strategies, and Conservation Plans are collectively referred to as Conservation Strategies.

Consultation: Exchange of information and interactive discussion; usually refers to consultation mandated by statute or regulation that has prescribed parties, procedures, and timelines (e.g. Consultation under National Environmental Policy Act or Section 7 of the Endangered Species Act, or Consultation with tribes).

Control: Eradicating, suppressing, or reducing vegetation; a population that is not exposed to the potentially toxic agent in toxicology or epidemiology studies.

Cooperator: Leasees, permittees, and others with authorized uses or occupancy on BLM lands.

Council on Environmental Quality (CEQ): An advisory council to the President of the United States established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover: 1) Trees, shrubs, rocks, or other landscape features that allow an animal to partly or fully conceal itself. 2) The area of ground covered by plants of one or more species, usually expressed as a percent of the ground surface.

Criteria pollutants: Air pollutants designated by the U.S. Environmental Protection Agency as potentially harmful and for which ambient air quality standards have been set to protect the public health and welfare. The criteria pollutants are carbon monoxide, sulfur dioxide, particulate matter, nitrogen dioxide, ozone, hydrocarbons, and lead.

Critical habitat: 1) Specific areas within a species' habitat that are critically important to its life functions; an area designated by the FWS under rule-making as being critical to the needs of a federally listed species, and which then carries special protection and consultation requirements.

Cultural resources: Nonrenewable evidence of human occupation or activity as seen in any area, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature, which was important in human history at the national, state, or local level.

Cumulative effect: The effects that results from identified actions when they are added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

DBH: See *diameter at breast height*.

Degradates: Compounds resulting from degradation.

Degradation: Physical or biological breakdown of a complex compound into simpler compounds.

De minimus: Latin for "of minimum importance" or "trifling." Essentially it refers to something or a difference that is so little, small, minuscule, or tiny that it is not worth considering.

Density: The number of individuals per a given unit area.

Detritus: Matter produced by the decay or disintegration of an organic substance.

Diameter at breast height: The diameter of the stem of a tree measured at 4.5 feet above the ground on the uphill side.

Diluent: An inert diluting agent added to a commercial pesticide formulation that decreases the viscosity of the formula.

Dilution: The act of mixing or thinning, and therefore decreasing a certain strength or concentration.

Direct effects: Effects on the environment that are caused by the action and occur at the same time and place.

Directed livestock: The careful application of grazing or browsing prescriptions (i.e., specified grazing intensities, seasons, frequencies, livestock species, and degrees of selectivity) to achieve natural resource objectives. Livestock production is a secondary or nonobjective when using prescribed grazing as a natural resource management tool.

Disseminule: A reproductive plant part, such as a seed, fruit, or spore that is modified for dispersal.

Dispersant: A type of inert ingredient added to an herbicide formulation that reduces the cohesive attraction between like particles.

Dispersion: The act of distributing or separating into lower concentrations or less dense units.

Disturbance: Events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species; also, noise or visual distractions that may displace or otherwise adversely affect wildlife.

Dominant: A group of plants that by their collective size, mass, or number exerts a primary influence onto other ecosystem components; a tree whose canopy is above surrounding trees of the same age.

Dose: The amount of chemical administered or received by an organism, generally at a given point in time.

Dose-response: Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

Draft environmental impact statement (DEIS): The draft statement of the environmental effects of a federal action, which is required under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

Drift: That part of a sprayed herbicide that is moved from the target area by wind while it is still airborne.

EC_{50}: A concentration in air or in water that causes 50% inhibition of growth.

EC_{100}: A concentration in air or water that causes complete inhibition of growth.

Ecological amplitude: The breadth of the biological and environmental requirements of a species such as temperature, moisture, soil types, hosts, and vegetation community characteristics.

Ecosystem: Includes all the organisms of an area, their environment, and the linkages or interactions among them; all parts of an ecosystem are interrelated. The fundamental unit in ecology, containing both organisms and abiotic environments, each influencing the properties of the other.

Effect: Environmental change resulting from a proposed action. Direct effects are caused by the action and occur at the same time and place, while indirect effects are caused by the action but are later in time, further removed in distance, or secondary. Effect and impact are synonymous as used in this document.

Encroaching vegetation: Any plants growing too closely into a roadway and hampering access or visibility (safety) or cracking pavement; growing into power lines or structures and endangering them; growing into campgrounds and preventing use or diminishing enjoyment; and so forth.

Endangered species: Any species listed under the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act (ESA): A law passed in 1973 to conserve species of wildlife and plants determined by the Director of the Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

Endemic species: A species that is naturally unique to a specific locality.

Endocrine: Referring to several glands in higher animals that secrete hormones.

Environment: 1) The physical conditions that exist within an area (e.g., the area that may be affected by a proposed project), including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. 2) The sum of all external conditions that affect an organism to influence its development or existence.

Environmental assessment (EA): A concise public document that serves to document an examination of the potential environmental effects of a proposed project, and from that, examination documents whether to prepare an environmental impact statement or a finding of no significant impact.

Environmental impact statement (EIS): A document required by the National Environmental Policy Act to display the significant environmental effects that may occur as a result of a federally proposed action or action on federal lands, and to document the examination by the responsible federal agency of consideration of a reasonable range of alternatives to achieve the same purpose, in order to help facilitate federal decision-making that minimizes unnecessary adverse environmental effects.

Environmental justice: Equal protection from environmental hazards for individuals, groups, or communities regardless of race, ethnicity, or economic status. This applies to the development, implementation, and enforcement of environmental laws, regulations, and policies, and implies that no population of people should be forced to shoulder a disproportionate share of negative environmental impacts of pollution or environmental hazard due to a lack of political or economic strength.

Ephemeral Streams: Streams that contain running water only sporadically, such as during and following storm events.

Epidemiology study: A study of human population or human populations. In toxicology, a study which examines the relationship of exposures to one or more potentially toxic agents to adverse health effects in human populations.

Eradication: Removal or elimination of a population.

Erosion: The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities.

Essential fish habitat (EFH): Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Estivation: A state of animal dormancy somewhat similar to hibernation that takes place during periods of heat and dryness (summer)

Eutrophication: Excessive nutrients in a lake or other body of water, usually caused by runoff of nutrients (animal waste, fertilizers, sewage) from the land, which causes a dense growth of plant life; the decomposition of the plants depletes the supply of oxygen, leading to the death of animal life.

Evapotranspiration: The process of transferring moisture from the earth to the atmosphere by evaporation of water and transpiration from plants.

Existence Values: The value held by an individual, group, or society associated with the existence of a specific place or resource. This typically includes market and non-market values.

Exotic species: Includes species introduced into an area; non-native species.

Extirpate: The elimination of a species from a particular area.

Extrapolation: The use of a model to make estimates of values of a variable in an unobserved interval from values within an already observed interval.

°F: Degrees Fahrenheit.

Fate: The course of an applied herbicide in an ecosystem or biological system, including metabolism, microbial degradation, leaching, and photodecomposition.

Fauna: The vertebrate and invertebrate animals of the area or region.

Feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Federally Listed: Species listed as threatened or endangered under the Endangered Species Act.

Final Environmental Impact Statement (Final EIS): A revision of the Draft Environmental Impact Statement based on public and agency comments on the draft; the document upon which a Record of Decision is based.

Fire dependent: A plant or ecosystem evolving under periodic perturbations by fire and that consequently depends on periodic fires for normal function.

Fire intolerant: Species of plants that do not grow well with, or die from, the effects of too much fire.

Fire return interval: The average time between fires in a given area.

Fire tolerant: Species of plants that can withstand a certain frequency and intensity of fire.

Fire use: The combination of prescribed fire and wildland fire use for resource benefit to meet resource objectives.

First order dermal absorption: Absorption of a material (herbicide) that occurs over 24 hours.

Fishery: The act, process, occupation, or season of taking an aquatic species.

Flora: Plant life, especially all the plants found in a particular country, region, or time regarded as a group; a systematic set of descriptions of all the plants of a particular place or time.

Fluvial: Of or relating to or happening in a river.

Forage: Vegetation eaten by animals, especially grazing and browsing animals.

Forb: Small broad-leafed plant; broad-leaved herb other than a grass, especially one growing in a field, prairie, or meadow.

Forestland: Land where the potential natural plant community contains 10% or more tree canopy cover.

Formulation: The commercial mixture of an herbicide that includes both the active and inactive (inert) ingredients.

Fragmentation (habitat): The breaking-up of a habitat or cover type into smaller, disconnected parcels.

Fuel (fire): Dry, dead parts of trees, shrubs, and other vegetation that can burn readily.

Fugitive dust: Small dust particles that travel some distance from their point of origin; the road and trail dust equivalent of drift smoke.

Fungi: Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic.

Gravel: In soil, particle sizes between 2 and 64 mm in diameter.

Gross infested area or treatment area: An area of land occupied by one or more invasive plant species; the area of land defined by drawing a line around the general perimeter of the infestation, not the canopy cover of the plants; the gross area of a logical treatment unit. May contain significant parcels of land that are not occupied by the weed.

Groundwater: Subsurface water that is in the zone of saturation; the top surface of the groundwater is the "water table"; source of water for wells, seeps, and springs.

Groundwater Contaminant: Chemical detected in ground waters. Does not necessarily infer levels are toxic or harmful.

Habitat: The natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions; the place where an organism lives.

Half life: The amount of time required for half of a compound to degrade.

Hazardous fuels: Living and dead and decaying vegetation that form a special threat of ignition and resistance to control.

Hazard quotient (HQ): The ratio of the estimated level of exposure to a substance from a specific substance from a specific pesticide application to the reference dose (RfD) for that substance, or to some other index of acceptable exposure or toxicity. An HQ less than or equal to 1 is presumed to indicate an acceptably low level of risk for that specific application. Analogous to BLM risk quotient.

Herbaceous: Non-woody plants that include grasses, grass-like plants, and forbs.

Herbicide: A pesticide used to control, suppress, or kill vegetation, or severely interrupt normal growth processes.

Herbicide resistance: Naturally occurring heritable characteristics that allow individual weeds to survive and reproduce, producing a population, over time, in which the majority of the plants of the weed species have the resistant characteristics.

Herbivore: An animal that feeds on plants.

Herd management areas (HMAs): Areas established for wild and free-roaming horses and burros through the land use planning process. The *Wild Free-roaming Horse and Burro Act* of 1971 requires that wild free-roaming horses and burros be considered for management where they were found at the time Congress passed the Act. The BLM initially identified 264 areas in the western U.S. as herd management areas.

Herptiles, herps, herpetofauna: Reptiles and amphibians.

Historic Trail: See *national historic trails.*

Home range: The area around an animal's established home that is visited during the animal's normal activities.

Hydric soil: A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrologic: The properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrologic cycle (water cycle): The ecological cycle that moves water from the air by precipitation to the earth and returns it to the atmosphere; includes evaporation, run-off, infiltration, percolation, storage, and transpiration.

Hydrolysis (chemical): Decomposition or alteration of a chemical substance by water.

Imidazolinone: A group of herbicides that interfere with interfere with acetolactate synthase, an enzyme needed for plant cell growth.

Impermeable: Cannot be penetrated.

Indigenous: Living or occurring naturally in an area; native, endemic people, flora, or fauna.

Indirect effects: Effects that are caused by an action, but are later in time or farther removed in distance.

Inert ingredient(s): Those ingredients that are added to the commercial product (formulation) and are not herbicidally active. Also called other ingredients.

Infested: An area having one or more of the subject invasive species – either plants or plant pathogens. Infested areas are not necessarily 100 percent infested.

Infested Area: See *gross infested area*.

Infiltration: The movement of water through soil pores and spaces.

Infrastructure: The basic facilities and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, public buildings, campgrounds, and other developments.

Insolation: Solar radiation received at the earth's surface.

Integrated vegetation management (IVM): A long-standing, science-based, decision-making process that identifies and reduces risks from vegetation and vegetation management related strategies. It coordinates the use of vegetation biology, environmental information, and available technology to prevent unacceptable levels of damage by the most economical means, while posing the least possible risk to people, property, resources, and the environment. IVM provides an effective strategy for managing vegetation in all arenas from developed agricultural, residential, and public areas to wild lands. IVM serves as an umbrella to provide an effective, all encompassing, low-risk approach to manage problem vegetation. A sustainable approach to managing vegetation by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.

Interagency special status/sensitive species program (ISSSSP): The BLM and FS shared program to coordinate record keeping and other management of the Bureau Special Status and Forest Service Sensitive species programs. Also, see *special status species*.

Intermittent stream: Any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Interspecific: Occurring between different species.

Interpretive facilities: Developed sites designed primarily to educate and provide safe access for resource observation, such as Adventures in the Past, Watchable Wildlife, wild horse viewing, and geologic interpretation sites.

Introduced species: An alien or exotic (non-native) species that has been intentionally or unintentionally released into an area as a result of human activity.

Invasive plants (or weeds): A non-native aggressive plants with the potential to cause significant damage to native ecosystems and/or cause significant economic losses. *This Oregon EIS definition differs from the PEIS definition by not including species native to the ecosystem under consideration.*

Invertebrate: Small animals that lack a backbone or spinal column, e.g. spiders, insects, and worms.

Irretrievable commitment: A term that applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the potential timber production there is “irretrievably” lost. If the ski area closes, timber production could resume; therefore, the loss of timber production during the time the area is devoted to skiing is irretrievable, but not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

Irreversible commitment: A term that applies to non-renewable resources, such as minerals and archaeological sites. Losses of these resources cannot be reversed. Irreversible effects can also refer to the effects of actions on resources that can be renewed only after a very long period of time, such as the loss of soil productivity.

Issue: A matter of controversy, dispute, or general concern over resource management activities or land uses.

K Factor: In soils, a relative index of susceptibility of bare cultivated soil to particle detachment and transport by rainfall.

K_{oc}: Organic carbon-water partition coefficient.

Label: All printed material attached to or part of the pesticide container, and which contains instructions for the legal application of the pesticide.

Landscape: All the natural features such as grasslands, hills, forest, and water, which distinguish one part of the earth's surface from another part; usually that portion of land that the eye can comprehend in a single view, including all of its natural characteristics.

Large woody debris: Pieces of woody material derived from tree limbs, boles, and roots in various stages of decay, generally having a diameter of at least 3 inches and a length greater than 3 feet; pieces of wood that are of a large enough size to affect stream channel morphology.

LC_{50} (median lethal concentration): A concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

LD_{50} (median lethal dose): The dose of a chemical calculated to cause death in 50% of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

Leaching: The movement of chemicals through the soil by water; may also refer to the movement of herbicides out of leaves, stems, or roots into the air or soil.

Lek: A traditional place where males (esp. sage grouse) assemble during the mating season and engage in competitive displays that attract females.

Lentic: Pertaining to or living in still water.

Level of concern (LOC): The concentration or other estimate of exposure above which there may be effects.

Lichens: Organisms made up of specific algae and fungi, forming identifiable crusts on soil, rocks, tree, bark, and other surfaces. Lichens are primary producers in ecosystems. They contribute living material and nutrients, enrich the soil and increase soil moisture-holding capacity, and serve as food sources for certain animals. Lichens are slow growing and sensitive to chemical and physical disturbances.

Listed species: Formally listed as a threatened or endangered species under the ESA. Designations are made by the FWS or NMFS.

Litter: The uppermost layer of organic debris on the soil surface, which is essentially the freshly fallen or slightly decomposed vegetation material such as stems, leaves, twigs, and fruits.

Long-term: Generally refers to a period longer than 10 years, but it depends upon the context.

Lowest observed adverse effect level (LOAEL): The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

Lymph: A clear fluid containing white blood cells. Lymph circulates throughout the lymphatic system, removing bacteria and certain proteins from body tissue. It also is responsible for transporting fat from the small intestine and supplying mature lymphocytes to the blood.

Lymphatic: Pertaining to lymph, a lymph vessel, or a lymph node.

Macrophyte: A plant, especially a marine or aquatic plant, large enough to be visible to the naked eye.

Malignant: Cancerous.

Marsh: A type of wetland that does not accumulate appreciable peat deposits and is dominated by herbaceous vegetation. Marshes may be either fresh or saltwater, tidal or nontidal.

Mast: Nuts or fruits of trees and shrubs, such as beechnuts, acorns, and berries, which accumulate on the forest floor, providing forage for animals.

Material safety data sheet (MSDS): A compilation of information required under the Occupational Safety and Health Administration Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Maximum application rate: The maximum application rate included on the label of the formulated product. For example, Plateau, the formulated product that has imazapic as its active ingredient, the label states that no more than 12.0 fluid ounces of product are to be applied on a per acre basis. According to the label there are two pounds of imazapic acid equivalent in a gallon of formulated product, so the maximum amount of active ingredient that may be applied is 0.1875 lb. a.i./acre.

Mechanical control: The use of any mechanized approach to control or eliminate invasive plants (i.e. mowing, weed whipping, or cutting with a chainsaw).

Mediterranean climate: A type of climate characterized by hot, dry, sunny summers and a winter rainy season.

Mesic: Of, characterized by, or adapted to a moderately moist habitat.

Metabolism: The sum of the chemical reactions occurring within a cell or a whole organism; includes the energy-releasing breakdown of molecules (catabolism) and the synthesis of new molecules (anabolism).

Microbial degradation: The breakdown of a chemical substance into simpler components by bacteria or other microorganisms.

Micron: The millionth part of a meter. There are 10,000 microns in a centimeter.

Minimize: Apply best available technology, management practices, and scientific knowledge to reduce the magnitude, extent, and/or duration of something.

Mitigation: Actions that would: 1) avoid an impact altogether by not taking a certain action or parts of an action; 2) minimize an impact by limiting the degree or magnitude of the action and its implementation; 3) rectify an impact by repairing, rehabilitating, or restoring the affected environment; 4) reduce or eliminate an impact over time by preserving and maintaining operations during the life of the action; and, 5) compensate for an impact by replacing or providing substitute resources or environments.

Mollusks: Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft unsegmented body usually enclosed in a calcareous shell; representatives found on BLM lands include snails, slugs, and clams.

Monitoring: The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives.

Montane forests: The lower vegetation belt on mountains.

Monument: See *national monument.*

Morbidity: Rate of disease, injury, or illness.

Motility: Capability of motion.

Multiple uses: A combination diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources. These may include recreation, grazing, timber, minerals, watershed, wildlife, and fish, along with natural scenic, scientific, and historical values.

Mutagenic: Capable of inducing mutation or increasing its rate.

National ambient air quality standards (NAAQS): Standards set by the U.S. Environmental Protection Agency for the maximum levels of pollutants that can exist in the outdoor air without unacceptable effects on human health or the public welfare.

National conservation areas: Areas designated by Congress their natural, recreational, cultural, wildlife, aquatic, archeological, paleontological, historical, educational, and/or scientific resources and values, that are managed for the areas long-term conservation, protection, enhancement, and use.

National Environmental Policy Act (NEPA): An act of Congress passed in 1969, declaring a national policy to encourage productive and enjoyable harmony between people and the environment, to promote efforts that will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of people, and to enrich the understanding of the ecological systems and natural resources important to the nation, among other purposes.

National Historic Trails: Trails established to identify and protect historic routes; they follow as closely as possible the original trails or routes of travel of national historic significance.

National Landscape Conservation System (NLCS): A single system that encompasses some of the BLM's premier land designations such as wilderness, wild and scenic rivers, national scenic and historic trails, national monuments, and other designations.

National Monument: An area designated to protect objects of scientific and historic interest by public proclamation of the President under the Antiquities Act of 1906, or by the Congress for historic landmarks, historic and prehistoric structures, or other objects of historic or scientific interest situated upon the public lands; designation also provides for the management of these features and values.

National Recreation Area: An area designated by Congress to assure the conservation and protection of natural, scenic, historic, pastoral, and fish and wildlife values and to provide for the enhancement of recreational values.

National Recreation Trails: Trails established administratively by the Secretary of the Interior to provide for a variety of outdoor recreation uses in or reasonably close to urban areas. They often serve as connecting links between the National Historic Trails and National Scenic Trails.

National Scenic Trails: Trails established by an Act of Congress that are intended to provide for maximum outdoor recreation potential and for the conservation and enjoyment of nationally significant scenic, historical, natural, and cultural qualities of the areas through which these trails pass.

Native species: Species that historically occurred or currently occur in a particular ecosystem and were not introduced.

Naturalized: An exotic species that now behaves like a native in that it maintains itself without further human intervention and is regionally widespread leading many to believe it is native.

Neurotoxins: Materials that affect nerve cells and may produce muscular, emotional, or behavioral abnormalities, impaired or abnormal motion, and other physiologic changes.

Neutral: In pH terms, 7; neither acid nor basic.

Neutral soil: A soil in which the surface horizon is neither acid nor alkaline in reaction; soils with pH 6.5 to 7.5.

Neutralizer: A type of inert ingredient added to an herbicide that modifies the effect of, or counteracts the properties of, something within the herbicide or spray solution.

No action alternative: The most likely condition to exist in the future if current management direction were to continue unchanged.

No observed adverse effect level (NOAEL): The exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect between the exposed and control populations.

No observed effect level (NOEL): Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect between the exposed and control populations.

Non-market values: Values assigned by an individual, group, or society to goods and services that are not usually bought, sold, or traded. Non-market values are typically very difficult to measure.

Non-selective herbicide: An herbicide that is generally toxic to plants without regard to species or group.

Non-target: Any organism that is not the objective of a control treatment.

Noxious weed: A subset of invasive plants that are county, state, or federally listed as injurious to public health, agriculture, recreation, wildlife, or any public or private property

Nutrient cycle: Ecological processes in which nutrients and elements such as carbon, phosphorous, nitrogen, and others, circulate among animals, plants, soils, and air.

O&C lands: Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States. O&C lands are only in Oregon, and most are managed by the BLM.

Objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used to achieve identified goals.

Obligate, as in obligate species: Required; also, exhibited by, all members of a species without exception.

Off-highway vehicle (OHV): Any motorized track or wheeled vehicle designed for cross-country travel over natural terrain.

Omnivore: An animal that eats a combination of meat and vegetation.

Option values: The willingness to pay or forgo something of value to preserve future options. This value may be expressed at the individual, group, or societal scales.

Oregon and California lands: Public lands in Western Oregon that were granted to the Oregon Central Railroad companies (later the Oregon and California Railroad Company) to aid in the construction of railroads, but that were later forfeited and returned to the federal government by revestment of title.

Organic matter: Plant and animal material that is in the process of decomposing.

Paleontological resources: A work of nature consisting of or containing evidence of extinct multicellular beings and includes those works or classes of works of nature designated by the regulations as paleontological resources.

Paleontology: A science dealing with the life of past geological periods as known from fossil remains.

Parent material: The unconsolidated and more or less chemically weathered mineral or organic matter from which the soil has developed by pedogenic processes.

Particulate matter (PM): A complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These tiny particles vary greatly in shape, size, and chemical composition, and can be made up of many different materials such as metals, soot, soil, and dust.

Particulates: Solid particles or liquid droplets suspended or carried in the air.

Pathogen: An agent such as a fungus, virus, or bacterium that causes disease.

Perennial: A plant with a life cycle lasting more than two years; a stream that flows year round.

Periphyton: A complex matrix of algae and heterotrophic microbes attached to submerged substrata in almost all aquatic ecosystems.

Permit: A revocable authorization to use public land for a specified purpose.

Persistence: The length of time a compound, once introduced into the environment, stays there.

Pesticide: Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, and so forth. Any material used in this manner is a pesticide and must be registered as such, even if it has other non-pesticide uses.

Petroglyph: An image recorded on stone, usually by prehistoric peoples, by means of carving, pecking, or otherwise incised on natural rock surfaces.

Pictograph: A symbol that represents an object or a concept by illustration.

pH: A measure of how acidic or alkaline (basic) a solution is on a scale of 0 to 14 with 0 being very acidic, 14 being very alkaline, and 7 being neutral. The abbreviation stands for the potential of hydrogen.

Photodegradation: The photochemical transformation of a molecule into lower molecular weight fragments, usually in an oxidation process. This term is widely used in the destruction (oxidation) of pollutants by ultraviolet-based processes.

Photolysis: Chemical decomposition induced by light or other radiant energy.

Phytotoxicity: The ability of a material such as a pesticide or fertilizer to cause injury to plants.

Piscivore: Animal that feeds on fish.

Plant: Any of various photosynthetic, eukaryotic (meaning an organism with cells having a distinct nucleus), multicellular organisms of the kingdom *Plantae* characteristically producing embryos, containing chloroplasts, having cellulose cell walls, and lacking the power of locomotion. For purposes of this EIS, the term "plant" does not include fungi.

Plant community: A vegetation complex, unique in its combination of plants, which occurs in particular locations under particular influences. A plant community is a reflection of integrated environmental influences on the site, such as soils, temperature, elevation, solar radiation, slope aspect, and precipitation.

Playas: Flat land surfaces underlain by fine sediment or evaporate minerals deposited from a shallow lake on the floor of a topographic depression.

$PM_{2.5}$: Fine particulates that measure 2.5 microns in diameter or less.

PM_{10}: Particulate matter that measures 10 microns in diameter or less.

Porosity: The ratio of the volume of void space in a material (e.g., sedimentary rock or sediments) to the volume of its mass.

Post-emergent (herbicide): Herbicide used to kill weeds after they have germinated and are growing.

Potable water: Water that is considered safe for drinking and cooking.

Potential vegetation type: The combination of species that could occupy the site in the absence of disturbance.

Predator: An animal that exists by preying on other animals.

Pre-emergent (herbicide): A soil applied herbicide used to keep seeds from germinating.

Preferred alternative: The alternative identified in an EIS as best resolving the problems identified in the purpose and need.

Prescribed fire: A wildland fire that burns under specified conditions and in predetermined area, to produce the fire behavior and fire characteristics required to attain resource management objectives.

Prevention: To detect and ameliorate conditions that cause or favor the introduction, establishment, or spread of invasive organisms or conditions.

Prevention of significant deterioration (PSD): A U.S. Environmental Protection Agency program in which state and/or federal permits are required in order to restrict emissions from new or modified sources in places where air quality already meets or exceeds primary and secondary ambient air quality standards.

Primary productivity: The process by which organisms make their own food from inorganic sources. The majority of primary producers are terrestrial plants and microbial life, such as algae. These organisms are known as autotrophs, since they can use inorganic substrates and solar energy to carry out metabolic processes and build cellular material. Primary productivity due to photosynthesis is commonly measured by quantifying oxygen production or CO_2 assimilation.

Productivity: The innate capacity of an environment to support plant and animal life over time. Plant productivity is the rate of plant production within a given period of time.

Productive soil: Soil with the capacity of a soil to produce plant growth, due to the soil's chemical, physical, and biological properties.

Programmatic EIS: An EIS that examines the area-wide effects of a proposal to adopt area-wide direction.

Progeny test site: A test area for evaluating parent seed trees by comparing the growth of their offspring seedlings.

Propagule: A structure such as a cutting, a seed, or a spore, that can produce a plant.

Proper functioning condition: The condition of riparian and wetland areas when adequate vegetation, landform, or large woody debris are present to dissipate stream energy associated with high water flows. This reduces erosion and improves water quality; filters sediment, captures bedload, and aids in floodplain development; improves floodwater retention and groundwater recharge; develops root masses that stabilize streambacks against cutting; develops diverse ponding and channel characteristics to provide habitat and water depth, duration, and temperature necessary for fish production, avian breeding habitat, and other uses; and supports greater biodiversity.

Proposed action: A proposal by a federal agency to authorize, recommend, or implement an action.

Proposed threatened or endangered species: Plant or animal species proposed by the U.S. Fish & Wildlife Service to be biologically appropriate for listing as threatened or endangered and that is published in the Federal Register. It is not a final designation. Proposed species are, at minimum, managed as Bureau Sensitive until a decision is made about federal listing.

Public domain lands: One category of public lands that have never left federal ownership (as opposed say, to the O&C lands); also, lands in federal ownership that were obtained by the government in exchange for public domain lands or for timber on public domain lands.

Public lands: Any land and interest in land owned by the United States that are administered by the Secretary of the Interior through the BLM, without regard to how the United States acquired ownership, except for 1) lands located on the Outer Continental Shelf, and 2) lands held for the benefit of American Indians, Aleuts, and Eskimos. Includes public domain and acquired lands.

Public purpose lease: Public lands leased to State and local governments and to qualified nonprofit organizations for recreation and public purposes such as historic monument sites, campgrounds, schools, firehouses, law enforcement facilities, municipal facilities, landfills, hospitals, parks, and fairgrounds. Authority is under the Recreation and Public Purposes Act, 68 Statute 173; 43 United States Code 869 et. Seq., and administered by the BLM under regulations at 43 CFR Part 2912.

Public scoping: See *scoping*.

Pumped storage hydro-power: A high and low lake system connected by pump/turbines that can generate electricity from falling water during high electrical use periods, and then reverse to pump the water back up using alternative sources of electricity during low electrical use periods, such as at night.

Qualitative: Traits or characteristics that relate to quality and cannot be readily measured with numbers or for which the numbers are unknown and would be difficult to obtain with any precision.

Quantitative: Traits or characteristics that can be measured with numbers.

Radiorespirometric: Of, relating to, or being a study of metabolism by the measurement of carbon dioxide labeled with carbon 14 from the carbohydrate substrate.

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs; not forests.

Raptor: Bird of prey; includes eagles, hawks, falcons, and owls.

Ratepayer: A utility subscriber whose monthly bill goes in part to (and is thus affected by) maintaining the generating and/or distribution system across public lands, be it power or phone lines, pipe lines, cell phone towers, wind mills, etc.

Receptor: An ecological entitysuch as a person, fish, plant, or slug exposed to a stressor such as an herbicide dose.

Record of decision (ROD): A document separate from, but associated with, an EIS, which states the decision, describes why it was selected from among the alternatives, specifies which is environmentally preferable alternative, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

Recovery plan: A plan for the conservation and survival of an endangered or threatened species listed under the Endangered Species Act. The plan's purpose is to improve (recover) the status of the species so it no longer needs Federal Listing.

Recreation Area: See national recreation area.

Recreation Trails: See national recreation trails.

Reducing or reduced soil conditions: Conditions that deplete or remove oxygen and where anaerobic processes dominate.

Reference dose (RfD): An estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to not result in an appreciable risk of deleterious effects during a lifetime. It is derived from the no-observed-adverse-effect-level, the lowest-observed-adverse-effect-level, or a benchmark dose. Uncertainty factors are applied when developing the reference dose so the RfD incorporates additional protection to account for the range of uncertainties in the data used.

Registered herbicide: All herbicides sold or distributed in the United States must be registered by the U.S. Environmental Protection Agency. Registration requires scientific studies showing that the material can be used without posing unreasonable risks to people or the environment.

Research natural areas (RNAs): Parts of a national network of reserved areas under various ownerships, containing important ecological and scientific values and are managed for minimum human disturbance. They are established and managed to protect ecological processes, conserve biological diversity, and provide opportunities for observation for research and education.

Resident fish: Fish that spend their entire life in freshwater (e.g., bull trout) on or near a specific location.

Residue: Herbicide or its metabolites remaining in or on soil, water, plants, animals, or surfaces.

Resilience: The ability of a system to respond to disturbances without long-term adverse effects to the functioning of the system; the ability of a community to respond to externally induced changes such as larger economic forces.

Resource management plan (RMP): A plan for a BLM district or portion of a district that provides for public land use. The Plan must observe the principles of multiple use and sustained yield, use an interdisciplinary approach, give priority to the designation and protection of areas of critical environmental concern, consider present and future uses, consider scarcity of the values involved, and appropriately integrate with other federal plans and pollution control laws.

Restoration: Actions taken to move a degraded ecosystem back toward desired, healthy, and functioning conditions and processes.

Revegetation: Establishing or re-establishing desirable plants where desirable plants are absent or of inadequate density, either by controlling site conditions (including the suppression of unwanted competition) so existing vegetation can reseed and spread, or by direct seeding or transplanting.

Right-of-way (ROW): A permit or an easement that authorizes the use of lands for certain specified purposes, such as the construction of forest access roads, gas pipelines, or power lines.

Rill erosion: An erosion process in which many small channels a few centimeters deep are formed. It occurs mainly on recently denuded soils.

Riparian area: Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

Risk: The likelihood that a given exposure to an item or substance (e.g. herbicide dose) will produce illness or injury.

Risk assessment: The process of gathering data and making assumptions to estimate short- and long-term harmful effects to human health or elements of the environment from particular products or activities. See Appendix 8.

Risk quotient (RQ): The Estimated Environmental Concentration (EEC), as calculated through computer modeling, divided by the LD50 (lethal dose where 50% of test population dies) or LC 50 (lethal concentration for aquatic forms, where 50% of the test population dies). RQs were developed to provide a more realistic scenario of herbicide exposure. Even so, results assume 100 percent exposure and animals confined to the treatment area. For species that are at all mobile, such exposures are unlikely from the applications proposed by the action alternatives. Analogous to Hazard Quotient. An RQ less than or equal to 1 is presumed to indicate an acceptably low level of risk for a specific application.

Risk quotient: The lowest reported acute statistical endpoint (e.g. NOAEL, LOEAL) or Toxicity reference value (TRV) divided by the estimated exposure concentration (ECC). See Chapter 3, *High, Medium, and Low Risk in BLM and FS Risk Assessments*.

Runoff: Overland flow; that part of precipitation, as well as any other flow contributions that does not soak into soil or stay held on the site for evaporation or transpiration, but runs into streams.

Salmonids: Fishes of the family *Salmonidae*, including salmon, trout, chars, whitefish, ciscoes, and grayling.

Sand: In soil, particles .05 to 2 mm in diameter.

Savannah: Areas with canopy cover (generally dominated by oaks) less than 30 percent, and grass dominated understory.

Scenic trails: See national scenic trails.

Sclerophyllous: Hard-leaved evergreen shrubs that are adapted to hot summers.

Scoping: A process at the beginning of a NEPA analysis whereby the public is asked to provide oral or written comments about the scope of the analysis and the range of alternatives, to help ensure the analysis appropriately addresses potential effects on individuals, communities, and the environment.

Sediments: Unweathered geologic materials generally laid down by or within water bodies; the rocks, sand, mud, silt, and clay at the bottom and along the edge of lakes, streams, and oceans.

Sedimentation: The process of forming or depositing sediment; letting solids settle out of wastewater by gravity during treatment.

Seed orchard: A plantation of clones or seedlings from selected trees; isolated to reduce pollination from outside sources; weeded of undesirables; and cultured for early and abundant production of seed.

Selective herbicide: A chemical designed to affect only certain groups or types of plants, leaving other tolerant plants unharmed.

Semi-arid: Moderately dry; region or climate where moisture is normally greater than under arid conditions, but still limits the production of vegetation.

Sensitive species (Bureau Sensitive): Native species designated by the state director as sensitive because they are found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either: 1. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or 2. The species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk (USDI 2008d). See also Bureau Sensitive.

Seral: Pertaining to the sequence of ecological communities successively occupying an area from the initial stage to the climax.

Sheet erosion: The removal of a fairly uniform layer of soil from the land surface by runoff water.

Short-term effects: Effects occurring during or shortly after project implementation and normally ceasing or recovering within hours to weeks, depending upon the resource.

Shrub steppe vegetation: See *Sagebrush Steppe Biome* description near the beginning of Chapter 4.

Significant: The description of an impact that exceeds a certain threshold level. Requires consideration of both context and intensity. The significance of an action must be analyzed in several contexts, such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of effects, which should be weighed along with the likelihood of its occurrence. Determination of significance for effects is a management decision considering multiple factors, and not one made by technical specialists to indicate the quantity of effects are above or below some level.

Silt: In soil, particles between .002 and .05 mm in diameter.

Site-specific: At the site, area, or project level.

Socioeconomic: Pertaining to, or signifying the combination or interaction of social and economic factors.

Soil compaction: The compression of the soil profile from surface pressure, resulting in reduced air space, lower water holding capacity, and decreased plant root penetrability.

Soil horizon: A layer of soil material approximately parallel to the land surface that differs from adjacent genetically related layers in physical, chemical, and biological properties.

Special status species: Federally Listed threatened, endangered, proposed, or candidate species, and species managed as sensitive species by the BLM.

Species: A group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

Spot treatment: An application of an herbicide to a small selected area such as an individual plant, as opposed to a broadcast application.

Stabilizer: A type of inert ingredient added to a commercial pesticide that makes the mixture more stable.

Stand: A group of trees, shrubs, or grasses in a specific area that is sufficiently alike in composition, age, arrangement, and condition so as to be distinguishable from the vegetation in adjoining areas.

Standard operating procedures (SOPs): Procedures that would be followed by the BLM to ensure that risks to human health and the environment from treatment actions were kept to a minimum. See Appendix 2. Since they originate from Manual and other direction, they may appear in resource management and other plans under other titles. SOPs specific to water are usually referred to as best management practices (BMPs).

Step-down: The process of applying broad-scale science findings and land use decisions to site-specific areas using a hierarchical approach of understanding current resource conditions, risks, and opportunities.

Stressor: Any event or situation that precipitates a change.

Subalpine: A terrestrial community that generally is found in higher elevation harsher environments than the montane terrestrial community. Subalpine communities are generally colder than montane and support a unique clustering of plant and wildlife species.

Subchronic toxicity: The ability of the substance to cause effects for more than one year but less than the lifetime of the exposed organism.

Subchronic: The effects observed from doses that are of intermediate duration, usually 90 days.

Subsistence: Customary and traditional uses of wild renewable resources (plants and animals) for food, shelter, fuel, clothing, tools, etc.

Substantive: Possessing substance; having practical importance, value, or effect.

Succession: The change in structure and composition of plant and animal communities over time. Usually used to describe the advancement of a younger, pioneering community to an older differing in species age, composition, and processes, and thus may be reset by fire or other disturbance.

Sulfonylurea: A group of herbicides that interfere with interfere with acetolactate synthase, an enzyme needed for plant cell growth.

Surface water: Water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Surfactant: A material that improves the emulsifying, dispersing, spreading, wetting, droplet size, or other surface-modifying properties of liquids.

Surrogate: A substitute or stand-in.

Synergistic: A type of cumulative effect where total effect is greater than the sum of the effects taken independently.

T Factor: The tolerable amount of soil loss (tons per acre per year) prior to reduced productivity.

Tank mixture: The mixture of two or more compatible herbicides in a spray tank in order to apply them simultaneously.

Target species: A species (in this EIS, a plant species) that is a target or goal of a treatment or control effort.

Teratogenic: Causing structural defects that affect the development of an organism; causing birth defects.

Terrestrial: Of or relating to the earth, soil, or land; inhabiting the earth or land.

Threatened species: A plant or animal species federally listed as *threatened* under the Endangered Species Act, and status defined as likely to become an endangered species throughout all or a significant portion of its range within the foreseeable future.

Threshold: A dose or exposure below which there is no apparent or measurable adverse effect.

Tier: Incorporating by reference the analyses in an EIS or similar document of a broader scope. For example, BLM field offices could prepare environmental assessments for local projects that tier to this EIS.

Tolerable soil loss: The maximum annual amount of soil which can be removed before the long-term natural soil productivity is adversely affected.

Tolerances: EPA limits on the amount of a pesticide permitted in foods or drinking water.

Total suspended particles (TSP): A method of monitoring airborne particulate matter by total weight.

Toxicity: A characteristic of a substance that makes it injurious.

Toxicity reference value (TRV): A quantitative benchmark. For each herbicide, receptor, and route of exposure, the lowest reported acute statistical endpoint was selected as the Acute TRV.

Traditional use areas (Native American plant gathering): Areas where tribes continue to gather plant materials for food, basketry, and other traditional uses. These may or may not be treaty reserved rights and/or areas.

Transpiration: Water loss from plants during photosynthesis.

Treaty resources: Resources for which one or more tribes have treaty rights. An exhaustive list does not exist, because American Indian tribes maintain confidentiality for names of medicines or spiritual plants and other natural resources.

Treaty rights: Tribal rights or interests reserved in treaties, by American Indian tribes for the use and benefit of their members. The uses include such activities as described in the respective treaty document. Only Congress may abolish or modify treaties or treaty rights.

Tribe: Term used to designate any American Indian band, nation, or other organized group or community, which is recognized as eligible for the special programs and services provided by the U.S. to American Indians because of their status as Indians.

Trophic: Of or pertaining to nutrition; concerned in nutritive processes.

Trust land: Any land in collective tribal holding or individual ownership for which the Secretary of the Interior has a continuing responsibility to manage in a manner to benefit the respective tribe or individual. The most common example is forested acres on a reservation. Some Trust lands were set aside as compensation for claims made against the Government; most of which are off-reservation.

Typical rate or typical application rate: One of two application rates considered in many Risk Analyses (the other being Maximum Rate); a rate based upon a general summary of actual applications that have been made of the different formulations of a particular active ingredient on BLM lands. Under some situations, this value may be higher or lower than what is going to be applied for a specific job. The rate of application of any pesticide is based upon several factors, including, but not limited to, the species to be controlled, the environment for which the application is to be made, the timing of the application, and other factors. For example, a typical rate of application for imazapic is about 2.0 fluid ounces of Plateau, which, when taking into the concentration of the formulated product (2.0 pounds acid equivalent/per gallon) equates to 0.0313 lb. a.e./acre. It is known that 2.0 fluid ounces of Plateau will achieve a specific level of control under a specific set of conditions. Rates around 4.0 to 6.0 fluid ounces of imazapic appear to be the more common range for activity, based on the experience of researchers, for downy brome. The rate is based upon what is identified as what is normally considered for application under a normal condition. See *Background for Effects Analysis* in Chapter 3 for table of amounts of a.e./acre.

Uncertainty factor: A multiplier used in risk assessments to compensate for unknown risks due to limitations in the research.

Understory: Plants that grow beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

Upland: The portion of the landscape above the valley floor or stream.

Urticaria: A transient condition of the skin usually caused by an allergic reaction, characterized by pale or reddened irregular, elevated patches and severe itching; hives.

Utility corridor: A linear strip of land identified for the present or future location of utility lines.

Vascular plants: Plants that have specialized tissues that conduct nutrients, water, and sugars along with other specialized parts such as roots, stems, and reproductive structures. Vascular plants include flowering plants, ferns, shrubs, grasses, and trees.

Vertebrate: An animal with a backbone, such as fish, amphibians, reptiles, birds, and mammals.

Visual resources: The visible physical features of a landscape.

Vitiligo: A skin disorder characterized by smooth, white patches on various parts of the body, caused by the loss of the natural pigment.

Volatilization: The conversion of a solid or liquid into a gas or vapor; evaporation of herbicide before they are bound to a plant or ground.

Water quality: The interaction between various parameters that determines the usability or non-usability of water for on-site and downstream uses. Major parameters that affect water quality include temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, discharge, and fecal coliform.

Watershed: The region draining into a river, stream, or body of water.

Weed: A plant considered undesirable and that interferes with management objectives for a given area at a given point in time.

Wetlands: Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include habitats such as swamps, marshes, and bogs.

Wild and scenic rivers: Rivers designated in the National Wild and Scenic Rivers System that are classified in one of three categories (wild, scenic, or recreational), depending on the extent of development and accessibility along each section. In addition to being free flowing, these rivers and their immediate environments must possess at least one outstandingly remarkable value: scenic, recreational, geologic, fish and wildlife, historical, cultural, or other similar values.

Wilderness: Land designated by Congress as a component of the National Wilderness Preservation System. Characteristics qualifying an area for wilderness are: 1) naturalness - lands that are natural and primarily affected by the forces of nature; 2) roadless and having at least 5,000 acres of contiguous public lands; and 3) outstanding opportunities for solitude or primitive and unconfined, non-motorized types of recreation. In addition, areas may contain "supplemental values," consisting of ecological, geological, or other features of scientific, educational, scenic, or historical importance.

Wilderness study area: An area managed so as not to impair its suitability as wilderness, while Congress determines whether to designate it as wilderness.

Wildfire: An unwanted wildland fire.

Wildland fires: Fires occurring on wildlands, regardless of ignition source, damages, or benefits, and including wildfire and prescribed fire.

Wildland urban interface (WUI): An area where structures and other human development intermingle with undeveloped wildlands or vegetative fuels.

Woodland: Areas with oak or other hardwoods occupying greater than 30 percent canopy cover, generally forming only an open canopy with the intervening area being occupied by lower vegetation, commonly grass.

Xeric: Very dry region or climate; tolerating or adapted to dry conditions (e.g. desert).

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References included here are specific to Chapters 1-4. References sections are also included in many of the appendices.

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Leanne Mruzik - *Fuels Management Specialist.* Leanne completed the Technical Fire Management (TFM) program accredited through Colorado State University in 2000. Leanne began her career in fire in 1987, and continued working seasonally with the Forest Service on the Klamath and Shasta-Trinity National Forest in California until 1996. In 1997, Leanne joined the BLM on the Medford District as a fuels management specialist and eventually becoming the fuels program lead for the Butte Falls Resource Area, until being hired into her position at the State Office as the Fuels Management Program Lead for Oregon and Washington in 2008. Leanne has been involved with watershed analysis, environmental analysis, planning and implementation of a complex integrated fuels management program, restoration projects, and community education and outreach projects related to fire and fuels.

Adrienne Pilmanis - *Botanist.* Adrienne has a BS in Biology from the University of Colorado, an MS in Botany from Duke University. She started working in ecology and botany in the early 1990's doing seasonal ecological studies on the Nevada Test Site. She spent several years doing advanced academic research before joining the Oregon State office of BLM as the Regional Data Steward for the Special Status Species Program in 2005, and is now the Botany Lead at the BLM Wyoming State Office. Adrienne's research included spatial analysis of soil and vegetation heterogeneity in disturbed Chihuahuan desert, nitrogen cycling under simulated global change scenarios in Colorado Plateau grasslands, and Holocene vegetation and fire history in northwestern Ontario. .

Jeff Rose - *BLM Eastern Oregon Sagebrush Conservation Coordinator*. Jeff has a MS in Rangeland Resources from Oregon State University. Beginning in 1986, he has served as a Range Conservationist for the Confederated Tribes of Warm Springs, Research Associated for the Eastern Oregon Agricultural Research Center in Burns, OR, and as a Fire Ecologist for the Burns District of the Bureau of Land Management. Jeff has authored or coauthored 15 journal articles relating to ecology and management of western juniper woodlands and sagebrush steppe habitats. In his current position, Jeff works with BLM districts in Oregon to coordinate restoration and conservation activities concentrating on sagebrush and western juniper habitats.

Jeanne M. Standley – *Botanist and Weed Coordinator*. Jeanne has a B.S in Rangeland Resources at Oregon State University. She began her federal career with the Soil Conservation Service in eastern Oregon in 1983. She worked seasonally for the Extension Service in Roseburg as a Forestry technician and as a botanist for the USFS in Glide, OR, and joined the BLM in 1986. Jeanne served as the district weed coordinator and botanist in Roseburg, and as the state program lead for several programs in Alaska including Forestry, Botany, Range, and Weeds, as well as co-leading a team to implement Burned Area Emergency Stabilization and Rehabilitation on 6.4 million acres. She is the weed coordinator with the Coos Bay District, and a member of the EIS core team.

Dale A. Stewart – *Soil Scientist*. Dale obtained a B.S in Forestry and a M.S. in Biological Sciences from Michigan Technological University. He worked for the United States Forest Service on the Fremont National Forest in Oregon and the Ouachita National Forest in western Arkansas. He has worked for the BLM, Coos Bay District since 1986 in forest management as a timber sale administrator and planner, silviculturist, and since 1994, as the district soil scientist. He has been involved in watershed analysis, environmental analysis, and implementation of forest management activities and restoration projects such as road decommissioning, culvert replacements and sediment control

Eric Stone - *Program Analyst, Planning and NEPA*. Eric obtained a B.S. in Forestry from the University of Connecticut and a M.S. in Forest Management from Oregon State University. He is currently employed as a consultant with the Oregon State Office, BLM in Portland Oregon. Before retiring from the BLM, he had held positions as a field forester, natural resource specialist, environmental coordinator, regional planner and program analyst from 1969-2004. He was involved at the State Office level in all land use planning and major activity plans in Oregon/Washington from 1980-2004. He has previously worked in the BLM Salem District and Eastern States and Montana State Offices.

Todd Thompson – Natural Resource Specialist – Restoration *Coordinator and Vegetation Treatments EIS Team Project Manager*. Todd has a B.S. in Wildlife Resources from the University of Idaho in Moscow. He worked for the Idaho Fish & Game as a Wildlife Technician before joining the BLM in Spokane where he was the Border Resource Area Wildlife Biologist and in 1996 became District Fish, Wildlife & Botany Program lead. Before managing the EIS Team, he was primarily involved in partner-based habitat restoration and vegetation management projects including a number of shrub-steppe and riparian/aquatic projects located throughout eastern Washington and northern Idaho.

Carol Thornton – *Hydrologist*. Carol has a B.S. in Geology from the University of Oregon and a M.S. in Hydrology from the University of Nevada Reno. She worked for BLM for two years as a hydrologist and then went to work in 2002 for the Forest Service as a member of TEAMS, an enterprise unit. Her work takes her to projects throughout the west and occasionally to the eastern U.S. NEPA projects include timber sales, salvage sales, and other invasive plant EIS's. Non-NEPA projects have included stream surveys and watershed analysis.

Brian J. Watts - *Fire Ecologist*. Brian has a B.S. in Rangeland Management from Oregon State University. Brian has worked in both Range Management and Fire Management since 1992 with both the United States Forest Service and BLM in Oregon, Idaho, Nevada, and New Mexico. He is currently Fire Ecologist with the Bureau of Land Management on the Vale District in eastern Oregon.

Public Comment Analysis Team

Carolyn Sharp – *Public Comment Coding Lead*. Carolyn has a Masters degree in Urban and Regional Planning from Portland State University and a Bachelors of Science in Environmental Studies from Florida International University. She is the owner of Sharp Communication, LLC, specializing in public involvement, environmental planning, and technical writing. With ten years of experience in environmental planning for local governments, she has four years of experience implementing public outreach strategies and two years of experience analyzing public comments for a large capital infrastructure project undergoing NEPA analysis.

The public comment coding team included BLM botanists **Claire Hibler**, **Robin Taylor-Davenport**, and **Marcia Wineteer**; Denton and Denton Environmental planners **Markus Mead** and **Tiffany Gray** and wildlife biologist **Carroll Albert**; and Mason, Bruce and Girard planners **Jonathon Belmont**, **Kate Parker,** and **Brian Cook** and technical writer **Daniel Trudo**.

Special Acknowledgments

Jerry Asher - Retired BLM special assistant to the State Director for noxious and other invasive weeds. Thanks for the references, leads, review of working papers, and review of the EIS.

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BLM District Weed Coordinators: Dan Tippy, Lynn Silva, Mike Woods, Lesley Richman, Erin McConnell, Molly Boyter, Claire Hibler, Nancy Sawtelle, Susan Carter, Mark Mousseaux, Glen Harkleroad, Brennan Hauk, Jennifer Moffit, Jeff Moss, Caryn Meinicke, and Jeanne Standley

Steering Committee:
Mike Mottice (Deputy State Director to May 2009), Mike Haske (Deputy State Director since May 2009), Miles Brown (Branch Chief, Rangeland Resource, Recreation, and Wilderness), Dave Henderson (District Manager, Vale to December 2009), Don Gonzales (District Manager, Vale since December 2009), Mark Johnson, EIS Steering Committee President (District Manager, Coos Bay)

About 30 **internal reviewers** and the members of the Southeast Oregon Resource Advisory Council and the John Day/Snake Resource Advisory Council for their pre-publication review.

Rochelle Desser, Doug Daoust, Shawna Bautista, Cathy Selby, and other members of the **Forest Service Invasive Plant EIS Team**.

Susan Hale and the members of **the public** who participated in scoping in July 2008.

Distribution List

In June of 2008, the Oregon BLM sent out 17,200 postcards and 2,000 emails notifying individuals and organizations that the Oregon BLM was going to begin preparation of this EIS. The postcards and emails advised how to get on the mailing list and when scoping meetings would be held. Those notified included: State and Federal elected officials; American Indian Tribes and Nations; lessees of BLM land; Soil and Water Conservation Districts and Oregon State University Extension Boards, as well as other interested parties identified by the Oregon Department of Agriculture; and, mailing lists from other planning efforts including the Western Oregon Plan Revisions, the Forest Service's Invasive Plant EIS, the National PEIS, and all Oregon BLM districts' mailing lists of persons having expressed an interest in being kept informed about local BLM planning efforts.

At the same time, approximately 400 press releases were sent to media outlets throughout the State. Newspapers do not have to publish news releases, but articles were published in several papers, including the Oregonian and the Ontario Argus Observer, and the issue received airtime on KEX and KCBY.

In addition, a Notice of Intent was published in the Federal Register on June 23, 2008. The Federal Register notice, news releases, and the postcards all announced the twelve scoping meetings, subsequently held throughout the State in July 2008.

About 1,300 interested parties were on the mailing list to receive the Draft EIS and about 2,000 interested parties are on the mailing list (below) to receive the Final EIS. Per NEPA regulations (40 C.F.R 1502.10), the Draft and the Final EIS includes the names and/or organizations of all parties who are on the mailing lists.

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U.S Senators
Ron Wyden
Jeff Merkley
U.S. Representatives
David Wu
Greg Walden
Earl Blumenauer
Peter DeFazio
Kurt Schrader
Oregon State Senators
Jason Atkinson
Alan Bates
Suzanne Bonamici
Brian Boquist
Ginny Burdick
Margaret Carter
Peter Courtney
Richard Devlin
Jackie Dingfelder
Ted Ferrioli
Larry George
Fred Girod
Mark Hass
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Jefferson Smith
Sherrie Sprenger
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Suzanne VanOrman
Jim Weidner
Gene Whisnant
Matt Wingard
Brad Witt

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Lane County Commissioner Faye Stewart
Lincoln County Commissioners
Stevens County Commissioners
Tillamook County Commissioner Charles Hurliman

Federal Agencies

Environmental Protection Agency
- Region 10

Department of Agriculture

Forest Service
- Region 6
- Bend/Fort Rock Ranger District
- Modoc National Forest
- Ochoco National Forest
- Wallowa-Whitman National Forest
- Winema National Forest
- PNW Research Station

Natural Resource Conservation Service

Department of Commerce

NOAA Fisheries

Department of Defense

US Army Corps of Engineers

Department of Energy

Bonneville Power Administration

Department of the Interior

Bureau of Indian Affairs

Bureau of Land Management
- Washington D.C. (National) Office
- California State Office
- Colorado State Office
- Idaho State Office
- Montana State Office
- Nevada State Office
- Oregon State Office
- Arcata Office
- Baker Office
- Burns Office
- Coos Bay Office
- Eugene Office
- Grants Pass Office
- Klamath Falls Resource Area
- Lakeview Office
- Medford Office
- Prineville Office
- Roseburg Office
- Salem Office
- Tillamook Office
- Vale Office
- Spokane (WA) Office
- Wenatchee (WA) Office
- Lake Havasu (AZ) Office
- Snake Resource Advisory Committee
- Southeast Oregon Resource Advisory Committee

Bureau of Reclamation

Fish and Wildlife Service
- Alaska Regional Office
- Bend Field Office
- Ecological Services Program
- Eagle Creek National Fish Hatchery
- Klamath Basin National Wildlife Refuge

National Park Service
- Whitman Mission National Historic Site

USGS Research

Department of Justice

Bureau of Alcohol, Tobacco, Firearms and Explosives

State, County, and Local Governments

Idaho
Department of Lands
Oregon
Department of Agriculture
- Noxious Weed Control

Department of Environmental Quality
Department of Fish and Wildlife
Department of Forestry
Department of State Lands
- Research Reserve South Slough NERR

Department of Transportation
- District 11E

Parks and Recreation Department
Water Resources Department
Watershed Councils
- Columbia Slough Watershed Council
- Gilliam-East John Day Watershed Council
- Harney County Watershed Council
- Lower Columbia River Watershed Council
- Malheur Watershed Council
- McKenzie River Watershed Council
- Mid John Day & Bridge Creek Watershed Councils
- Mohawk Watershed Partnership
- North Fork John Day Watershed Council
- Owyhee Watershed Council
- Tualatin River Watershed Council

Counties
Association of O & C Counties
Baker County Weed Control
Benton County
Coos County
Curry County
Deschutes County
- Sheriff's Posse

Douglas County Land Dept
Garfield County Noxious Weed Control Board
Gilliam County Road Department
Harney County
- Court
- Weed Board

Hood River County
Jackson County Roads and Parks
Josephine County Parks
Klamath County
- Weed Supervisor
- Planning Department

Lane County
- Public Works
- Council of Governments

Lincoln County Road Dept.
Linn County Road Department
Malheur County Weed Control
Marion County Public Works
Polk County Public Works
Sherman County Assessor
Umatilla County
Wallowa County
Wasco County Weed Department
Yamhill County Sheriff Crabtree
Cities
Canyon City Watermaster Office
Cottage Grove
Hillsboro – Water Department
Medford Water Commission
Oxbow Park
Redmond
Salem Water Resources Section: Public Works Department
Washington
City Of Ilwaco
Washington Department of Fish and Wildlife
- Webster Forest Nursery

WSDOT Southwestern Region
County Weed Boards
- Klickitat County Noxious Weed Control Board
- Lewis County Noxious Weed Control Board
- Pend Oreille County Weed Board
- Snohomish County Noxious Weed Control Board
- Yakima County Noxious Weed Board

American Indian Tribes and Nations

Burns Paiute Tribe
Confederated Tribes of Siletz Indians
Confederated Tribes of the Colville Reservation
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians
Confederated Tribes of the Grand Ronde Community of Oregon
Confederated Tribes of the Umatilla Indian Reservation
Coquille Tribe
Cow Creek Band of Umpqua Tribes of Indians
Fort Bidwell Indian Community
Fort McDermitt Tribe
Klamath Tribes
Latgawa Native American Indian Tribe
Nez Perce Tribe
Siletz Tribe
Warm Springs Reservation
Yakama Tribe

Businesses

ABC Tree Farms
Arrowhead Timber Company
Babylon Computer
Barnes Cattle Company
BASF Corporation
Benton Rock Products
Big Wind Oregon LLC
Boise Cascade Co
Box R Water Analysis Lab
Buckhorn Ranch
C&D Lumber Company
Capital Press
Central Lincoln People's Utility District
Chevron Pipe Line Co
Coast Range Conifers LLC
Comfort Control Heating
Consumers Power Inc.
Coos County Sheep Company
Corbett Water District
Crook Timberlands LLC
Crump Ranch
Curtis Wicks Contracting
Custom Installation
Devil's Canyon Ranch
Douglas Electric Coop
Douglas Timber Operators
Dow AgroSciences
DuPont Crop Protection
Ed Garrett Ranch, Inc
Emigrant Creek Ranch
E.I. DuPont de Nemours and Company
ENSR International
EP Minerals LLC
ERA All State Real Estate
Eugene Water & Electric Board
Ferris Creek Ranch
Ferris Nursery
Flying Buffalo Ranches
Forest Capital Partners
Freres Timber Inc
Georgia Pacific LP
Giustina Land & Timber Co
Giustina Resources
Greyskull Enterprise, LLC
Habitat Creations
Haglund Kelley
Hammond Ranches, Inc
Healy Ranch
HGJ Livestock
High Desert Museum
High Heaven Timberlands
Hollingsworth Tree Farms LLC
Idaho Power
Indian Hill, LLC
Inform Media
Inshallah Ranch Inc.
Jacobs Ranch

James Matteri & Sons
Jerry & Linda Miller Ranch LLC
JKs Rough String Ranch
JWTR LLC
Lane Electric Coop
Loghouse Plants
Lone Rock Timber Management Company
Mackenzie Ranch
M.A. Palmer & Sons Inc
McMinnville Water and Light
MBM Group
McDade Ranch
Miller Ranch
Morgan Woods
Mortimore Corporation
North Unit Irrigation District
Ochoco Valley Ranch
Optasite Towers LLC
Oregon - Idaho Utilities
Oregon End Ranch
Oregon Safe Tree, Inc.
Overland Ranch
Owyhee Grazing Association, LLC
Pacific Analytics
Panhandle Spray Service
Pesticide Research Institute
PFC Properties
Plum Creek Timber Company
Port of Coquille River
Portland General Electric
Pryor Land And Livestock Inc.
Rashford Tree Farm
Raven Research
Resource Management Services
River Run Ranch
Rosboro, LLC
Roseburg Forest Products
Roseburg Resources Company
Roxy Ann Gem and Mineral / Crater Rock Museum
Sainte Partners II, L.P.
Scientific Ecological Services
Seneca Jones Timber Co
Seneca Sawmill Company
Silvies Valley Ranch LLC
Sno-Peak Nobles
Spirit Lake Industrial Park
Starfire Lumber Company
Stimson Lumber Company
Stuntzner Engineering
The Final Edition / Mt. Family Calendar
Timber Products Company
Tree Top Ranches
Tri-Creek Ranch
TtEC
Up the Creek Ranch
URS Corporation
Westfall Ranches
Weyerhaeuser Company
Whitewater Ranch
Wild and Scenic Nursery
William Smith Properties
Willow-Witt Ranch
YJ Ranch

Other Organizations

Cooperative Weed Management Areas
- Diamond Valley CWMA
- Harney County CWMA
- Lake County CWMA
- Tri-County CWMA
- Jordan Valley CWMA

Soil and Water Conservation Districts
- Crook County SWCD
- Douglas SWCD
- East Multnomah SWCD
- Josephine County SWCD
- Marion SWCD
- Polk SWCD
- Sherman County SWCD
- Tualatin SWCD
- Upper Willamette SWCD
- West Multnomah SWCD

American Forest Resource Council
Applegate Fire Plan
Applegate Forestry
Archaeological Society of Central Oregon (ASCO)
Associated Oregon Loggers
Audubon Society of Portland
Back Country Horsemen and Oregon Equestrian Trails
Bark
Blue Mountains Biodiversity Project and League of Wilderness Defenders
Blue Ribbon Coalition
Camp Forest
Canaries Who Sing, Gaia Vision, Coast Range Guardians, Residents of Oregon Against Deadly Spray and Smoke, and Citizens Environmental Protection Alliance
Cape Arago Audubon Socienty
Cascade Geographic Society
Cascadia Wildlands Project
Cascadia's Ecosystem Advocates
Center for Biological Diversity
Central Oregon Shooting Sports Association
Citizens for Florence
Citizens Environmental Protection Alliance
Citizens Interested In Bull Run
Coast Range Guardians
Concerned Citizens for Clean Air
Corkscrew Trail
Crescent Water Association
Deer Creek Valley Natural Resources Conservation Association
Defenders of Wildlife
Deschutes Land Trust
Ecola Creek Awareness Project
Emerald Chapter, Oregon Society of American Foresters
Environment and Human Rights Advisory
Fir Point Bible Conference
Forestland Dwellers
Forestry Action Committee
Greater Greenwater Gateway Committee
Hells Canyon Preservation Council
Hugo Neighborhood Assoc. & Historical Society
Human Downstream
Institute for Applied Ecology
Institute for Culture and Ecology
International Society for the Protection of Mustangs and Burros
Izaak Walton League of America
John Day Basin Trust
Josephine County OSU Extension Office
Kalmiopsis Audubon Society
Kettle Range Conservation Group
Klamath Forest Alliance
Klamath Siskiyou Wildlands Center
Kootenai Environmental Alliance
Lacomb Irrigation District
Lane County Audubon Society
Legacy Lands Project
Lick Creek Road Association
Lincoln County Mycological Society
Lyons Gulch P O A
Mohawk Valley Community Grange
Motorcycle Riders Association
Mt Hood Corridor Community Planning Organization
North American Butterfly Association Eugene/Springfield Chapter
Northcoast Environmental Center
Northwest Coalition for Alternatives to Pesticides
Northwest Environmental Advocates
Northwest Environmental Defense Center
Northwest Weed Management Partnership
OHA Harney County Chapter
Oregon Cattlemen's Association
Oregon Center for Environmental Health
Oregon Council Trout Unlimited
Oregon Environmental Council
Oregon Farm Bureau Federation
Oregon Grotto
Oregon Hunters Association

Oregon Natural Desert Association
Oregon Recreation Coalition
Oregon Society of American Foresters
Oregon State Snowmobile Association
Oregon Toxics Alliance
Oregon Wild
Oregonians for Food and Shelter
Pacific Biodiversity Institute
Pacific Northwest 4 Wheel Drive Association
Pacific Rivers Council
Parsnip Peak Grazing Association
Partnership for the Umpqua Rivers
Pitchfork Rebellion
Plas Newydd
Redmond Oregon Hunters Association
Rocky Mountain Elk Foundation
Rockydale Neighborhood Association
Rogue Snowmobilers
Rogue Group Sierra Club
Rogue Valley Audubon Society
Sagebrush Sea Campaign
Save Our Ecosystems
Selkirk Conservation Alliance
Sierra Club
Siskiyou Project
SOLV
Somerset Hills III HOA
Southeast Oregon Resource Advisory Council
Sunriver Owners Association
The Nature Conservancy
Threatened and Endangered Little Applegate Valley
TraditionalMountaineering.org
Tumalo Irrigation District
Umpqua Valley Audubon Society
Umpqua Watersheds, Inc.
Urban Forager
Wallowa Canyonlands Partnership
Western Watersheds Projects
Wilderness Watch
Wildlife Forever
Willamette Agate and Mineral Society
Willamette Valley Grotto
Williams Community Forest Project
Williams Waterways Project
WOPR & Beyond Coalition

Libraries, Schools, and Universities

Ashland Public Library
Colorado State University Libraries
Corvallis- Benton County Public Library
Dallas Public Library
Douglas County Library System
Eagle Point Public Library
Klamath County Library
Lake County Library
Lewis and Clark College
Lewis and Clark Law School: Boley Law Library
University of Washington: Natural Sciences Library
Oregon State University
  Agricultural Program
  Columbia Basin Agricultural Research Center
  Department of Crop & Soil Science
  Extension Service - Pendleton
  Forest Engineering Department
  Klamath Basin Research and Extension Center
  Library
  Rangeland Ecology and Management
Northwestern University – Environmental Policy and Culture Program
Rogue Community College
Ruch Public Library
South Lane School District 4553
Southern Oregon University
Springfield Public Library
Thomas Creek Library
University of Georgia – Center for Invasive Species and Ecosystem Health
University of Minnesota: Forestry Library
University of Notre Dame
University of Oregon
  Library
  School of Law
USDA National Agricultural Library

Media

Argus Observer (Ontario)
Eugene Weekly
KLCC Radio (Eugene)
News-Register (McMinnville)

Individuals

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Noel Adams
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Leslie Cox
Erika Coyer
Patrick Craig
Sandra and Stephen Cramer
Rebecca Crane
Jed Cravitts
Niko Cremer
Connie Crew
Phyllis Cribby
Sukita Crimmel
Laurel Croft
Dan and Laury Cron
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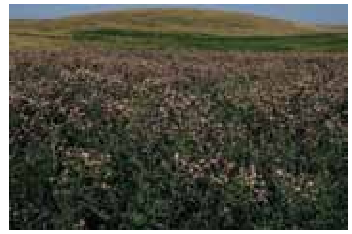
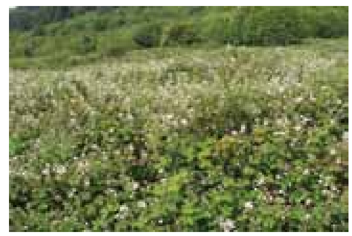
Vegetation Treatments Using Herbicides on BLM Lands in Oregon

Volume 2 - Appendices



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Oregon State Office

July 2010

FES 10-23
BLM/OR/WA/AE-10/077+1792

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Cover: Southeast of Richland, Oregon along the Brownlee Reservoir (Snake River), a rancher views vast stands of medusahead (a noxious weed). The area is mixed BLM/private ownership (photographer: Matt Kniesel).

Because science cannot, in any practical sense, assure safety through any testing regime, pesticide use should be approached cautiously.
(EPA scoping comment, July 28, 2008)

Our present technologies for countering invasive non-native weeds are rudimentary and few: control by biological agents, manual eradication, mechanized removal, fire, and herbicides. All have limitations; all are essential (Jake Sigg, California Native Plant Society 1999)

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Appendices

Changes Between Draft and Final EIS

The following changes were made to the Appendices between the draft and final EIS. Minor corrections, explanations, and edits are not included in this list.

Changes were made in:

- Appendix 3 - Monitoring, to better describe existing monitoring under the Northwest Forest Plan, PACFISH/INFISH, and the National Invasive Species Monitoring Systems, and to add information about State monitoring efforts;
- Appendix 5 – Endangered, Threatened, and other Special Status Species, to update it for expanded bull trout critical habitat, the listing of Pacific Eulachon, 12-month findings for petitions to list the greater sage grouse, and to add the Conservation Measures from the PEIS Consultation and Conferencing;
- Appendix 8 – Risk Assessments, to add newer risk assessments for hexazinone and clopyralid; and,
- Appendix 9 – Additional Information About the 18 Herbicides, to add individual information summary pages for each of the 18 herbicides, to add a list of BLM's currently approved adjuvants, and to clarify how the *Alternative where recommended herbicide available* determinations on Table A9-2 were made.

In addition, the following Appendices were added:

- Appendix 10 – Response to Public Comments on the September 2009 Draft EIS;
- Appendix 11 – Comment Letters from Federal, State, and local Government Agencies on the 2009 Draft EIS;
- Appendix 12 – 2,4-D provides additional information about 2,4-D, and specifically documents additional considerations of 2,4-D as a management tool; and,
- Appendix 13 – EPA Pesticide Registration and BLM/FS Risk Assessment Process describes the process and information considered during herbicide registration, and during the Agencies' Risk Assessment process. This Appendix includes additional information about incomplete and unavailable information about inerts and adjuvants to supplement the discussions in Chapter 3 and in the Incomplete and Unavailable information section early in Chapter 4.

Appendix 1 – The PEIS

This appendix consists of the *Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS) published in June 2007. The Oregon EIS is tiered to this 2007 analysis, and the PEIS is incorporated in its entirety into the Oregon EIS as Appendix 1. The PEIS is available at http://www.blm.gov/wo/st/en/prog/more/veg_eis.html. A CD or hard copy version can be obtained by emailing, writing, or calling the BLM at the contact points included in the front of this EIS.

The PEIS consists of three volumes and a separately published Biological Assessment. The volumes and sections within each are arranged on the website as follows:

Final Vegetation Treatments Using Herbicides Programmatic Environmental Impact Statement

Programmatic EIS Vol. 1

a. Dear Reader Letter
b. Title Page - Abstract
c. Executive Summary
d. Table of Contents
e. Chapters 1 - 8
    i. Chapter 1 - Proposed Action and Purpose and Need
    ii. Chapter 2 - Alternatives
    iii. Chapter 3 – Affected Environment
    iv. Chapter 4 – Environmental Consequences
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g. List of Acronyms

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Appendix 2 - Standard Operating Procedures and Mitigation Measures from the PEIS

Introduction

The following Standard Operating Procedures and Mitigation Measures have been adopted from the Record of Decision for the PEIS. Minor edits have been made to some Standard Operating Procedures and Mitigation Measures to clarify intent.

Standard Operating Procedures (identified below with SOP) have been identified to reduce adverse effects to environmental and human resources from vegetation treatment activities based on guidance in BLM manuals and handbooks, regulations, and standard BLM and industry practices.[1] The list is not all encompassing, but is designed to give an overview of practices that would be considered when designing and implementing a vegetation treatment project on public lands (PER:2-29)[2]. Effects described in the EIS are predicated on application of the Standard Operating Procedures, that a site-specific determination is made that their application is unnecessary to achieve their intended purpose or protection, or that if the parent handbook or policy direction evolves, the new direction would continue to provide the appropriate environmental protections.

For example, the Standard Operating Procedure to "complete vegetation treatments seasonally before pollinator foraging plants bloom" would not be applied to treatments not likely to have a significant effect on pollinators.

PEIS Mitigation Measures (identified below with MM) were identified for all potential adverse effects identified in the PEIS. They are included in, and adopted by, the Record of Decision for the PEIS. Like the SOPs, application of the mitigation measures is assumed in this EIS. However, for PEIS Mitigation Measures, site-specific analysis and/or the use of Individual Risk Assessments Tools (see Chapter 3), or evolution of the PEIS Mitigation Measures into handbook direction at the national level, would be permitted to identify alternative ways to achieve the expected protections (PEIS:4-4).

Although not displayed here, Standard Operating Procedures for non-herbicide treatments (from regulation, BLM policy, and BLM Handbook direction) also apply (PER:2-31 to 44).

Standard Operating Procedures and Mitigation Measures for Applying Herbicides

Guidance Documents

BLM Handbook H-9011-1 (*Chemical Pest Control*); and manuals 1112 (*Safety*), 9011 (*Chemical Pest Control*), 9012 (*Expenditure of Rangeland Insect Pest Control Funds*), 9015 (*Integrated Weed Management)*, and 9220 (*Integrated Pest Management*).

1 Manual-directed standard operating procedures and other standing direction may be referred to as best management practices in resource management and other plans, particularly when they apply to water.

2 The PER includes Standard Operating Procedures for the full range of vegetation treatment methods. Only those applicable to herbicide application are included in this appendix.

General

- Prepare an operational and spill contingency plan in advance of treatment. *(SOP)*
- Conduct a pretreatment survey before applying herbicides. *(SOP)*
- Select the herbicide that is least damaging to the environment while providing the desired results. *(SOP)*
- Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, other ingredients, and tank mixtures. *(SOP)*
- Apply the least amount of herbicide needed to achieve the desired result. *(SOP)*
- Follow herbicide product label for use and storage. *(SOP)*
- Have licensed or certified applicators or State-licensed "trainees" apply herbicides, or they can be applied by BLM employees under the direct supervision of a BLM-certified applicator. *(SOP)*
- Use only USEPA-approved herbicides and follow product label directions and "advisory" statements. *(SOP)*
- Review, understand, and conform to the "Environmental Hazards" section on the herbicide product label. This section warns of known herbicide risks to the environment and provides practical ways to avoid harm to organisms or to the environment. *(SOP)*
- Consider surrounding land use before assigning aerial spraying as a treatment method and avoid aerial spraying near agricultural or densely populated areas. *(SOP)*
- Minimize the size of application area, when feasible. *(SOP)*
- Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents/ landowners. *(SOP)*
- Post treated areas and specify reentry or rest times, if appropriate. *(SOP)*
- Notify adjacent landowners prior to treatment, if appropriate. *(SOP)*
- Keep a copy of Material Safety Data Sheets (MSDSs) at work sites. MSDSs are available for review at http://www.cdms.net/. *(SOP)*
- Keep records of each application, including the active ingredient, formulation, application rate, date, time, and location. *(SOP)*
- Avoid accidental direct spray and spill conditions to minimize risks to resources. *(SOP)*
- Avoid aerial spraying during periods of adverse weather conditions (snow or rain imminent, fog, or air turbulence). *(SOP)*
- Make helicopter applications at a target airspeed of 40 to 50 miles per hour (mph), and at about 30 to 45 feet above ground. *(SOP)*
- Take precautions to minimize drift by not applying herbicides when winds exceed >10 mph (>6 mph for aerial applications), or a serious rainfall event is imminent. *(SOP)*
- Use drift control agents and low volatile formulations. *(SOP)*
- Conduct pre-treatment surveys for sensitive habitat and Special Status species within or adjacent to proposed treatment areas. *(SOP)*
- Consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation. *(SOP)*
- Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species. *(SOP)*
- Turn off application equipment at the completion of spray runs and during turns to start another spray run. *(SOP)*
- Refer to the herbicide product label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide. *(SOP)*
- Clean OHVs to remove plant material. *(SOP)*

The BLM has suspended the use of the adjuvant R-11.

Air Quality
See Manual 7000 (*Soil, Water, and Air Management*)

- Consider the effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks. *(SOP)*
- Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (>6 mph for aerial applications) or rainfall is imminent. *(SOP)*
- Use drift reduction agents, as appropriate, to reduce the drift hazard. *(SOP)*
- Select proper application equipment (e.g., spray equipment that produces 200- to 800-micron diameter droplets [spray droplets of 100 microns and less are most prone to drift]). *(SOP)*
- Select proper application methods (e.g., set maximum spray heights, use appropriate buffer distances between spray sites and non-target resources). *(SOP)*

Soil
See Manual 7000 (*Soil, Water, and Air Management*)

- Minimize treatments in areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected. *(SOP)*
- Minimize use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility. *(SOP)*
- Do not apply granular herbicides on slopes of more than 15% where there is the possibility of runoff carrying the granules into non-target areas. *(SOP)*

Water Resources
See Manual 7000 (*Soil, Water, and Air Management*)

- Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs. *(SOP)*
- Select herbicide products to minimize impacts to water. This is especially important for application scenarios that involve risk from active ingredients in a particular herbicide, as predicted by risk assessments. *(SOP)*
- Use local historical weather data to choose the month of treatment. (*SOP*)
- Considering the phenology of target aquatic species, schedule treatments based on the condition of the water body and existing water quality conditions. *(SOP)*
- Plan to treat between weather fronts (calms) and at appropriate time of day to avoid high winds that increase water movements, and to avoid potential stormwater runoff and water turbidity. *(SOP)*
- Review hydrogeologic maps of proposed treatment areas. Note depths to groundwater and areas of shallow groundwater and areas of surface water and groundwater interaction. Minimize treating areas with high risk for groundwater contamination. *(SOP)*
- Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body. *(SOP)*
- Do not rinse spray tanks in or near water bodies. (*SOP*)
- Do not broadcast pellets where there is danger of contaminating water supplies. *(SOP)*
- Minimize the potential effects to surface water quality and quantity by stabilizing terrestrial areas as quickly as possible following treatment. *(SOP)*
- Establish appropriate (herbicide-specific) buffer zones for species/populations (Tables A2-1 and A2-2). (*MM*)
- Areas with potential for groundwater for domestic or municipal use shall be evaluated through the appropriate, validated model(s) to estimate vulnerability to potential groundwater contamination, and appropriate mitigation measures shall be developed if such an area requires the application of herbicides and cannot otherwise be treated with non-herbicide methods. (*MM*)
- Use appropriate herbicide-free buffer zones for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths from water of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications. *(SOP)*

- Maintain buffers between treatment areas and water bodies. Buffer widths should be developed based on herbicide and site-specific conditions to minimize impacts to water bodies. *(SOP)*

Wetlands and Riparian Areas

- Use a selective herbicide and a wick or backpack sprayer. *(SOP)*
- Use appropriate herbicide-free buffer zones for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths from water of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications. *(SOP)*
- See mitigation for Water Resources and Vegetation. (*MM*)

Vegetation
See Handbook H-4410-1 (*National Range Handbook*), and manuals 5000 (*Forest Management*) and 9015 (*Integrated Weed Management*)

- Refer to the herbicide label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide. *(SOP)*
- Use native or sterile plants for revegetation and restoration projects to compete with invasive plants until desired vegetation establishes. *(SOP)*
- Use weed-free feed for horses and pack animals. Use weed-free straw and mulch for revegetation and other activities. *(SOP)*
- Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. Consider adjustments in the existing grazing permit, to maintain desirable vegetation on the treatment site. *(SOP)*
- Minimize the use of terrestrial herbicides (especially bromacil, diuron, and sulfometuron methyl) in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. (*MM*)
- Establish appropriate (herbicide-specific) buffer zones (Tables A2-1 and 2) around downstream water bodies, habitats, and species/populations of interest. Consult the ecological risk assessments (ERAs) prepared for the PEIS for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios. (*MM*)
- Limit the aerial application of chlorsulfuron and metsulfuron methyl to areas with difficult land access, where no other means of application are possible. (*MM*)
- Do not apply sulfometuron methyl aerially. (*MM*)
- When necessary to protect Special Status plant species, implement all conservation measures for plants presented in the *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment* (see Appendix 5). (*MM*)

Pollinators

- Complete vegetation treatments seasonally before pollinator foraging plants bloom. *(SOP)*
- Time vegetation treatments to take place when foraging pollinators are least active both seasonally and daily. *(SOP)*
- Design vegetation treatment projects so that nectar and pollen sources for important pollinators and resources are treated in patches rather than in one single treatment. *(SOP)*
- Minimize herbicide application rates. Use typical rather than maximum rates where there are important pollinator resources. *(SOP)*
- Maintain herbicide free buffer zones around patches of important pollinator nectar and pollen sources. *(SOP)*
- Maintain herbicide free buffer zones around patches of important pollinator nesting habitat and hibernacula. *(SOP)*
- Make special note of pollinators that have single host plant species, and minimize herbicide spraying on those plants and in their habitats. *(SOP)*

Fish and Other Aquatic Organisms

See manuals 6500 (*Wildlife and Fisheries Management*) and 6780 (*Habitat Management Plans*)

- Use appropriate buffer zones based on label and risk assessment guidance. *(SOP)*
- Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used, and use spot rather than broadcast or aerial treatments. *(SOP)*
- Use appropriate application equipment/method near water bodies if the potential for off-site drift exists. *(SOP)*
- For treatment of aquatic vegetation, 1) treat only that portion of the aquatic system necessary to meet vegetation management objectives, 2) use the appropriate application method to minimize the potential for injury to desirable vegetation and aquatic organisms, and 3) follow water use restrictions presented on the herbicide label. *(SOP)*
- Limit the use of diquat in water bodies that have native fish and aquatic resources. (*MM*)
- Limit the use of terrestrial herbicides (especially diuron) in watersheds with characteristics suitable for potential surface runoff that have fish-bearing streams during periods when fish are in life stages most sensitive to the herbicide(s) used. (*MM*)
- To protect Special Status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment* (see Appendix 5). (*MM*)
- Establish appropriate herbicide-specific buffer zones for water bodies, habitats, or fish or other aquatic species of interest (Tables A2-3 and A2-4, and recommendations in individual ERAs). (*MM*)
- Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams. (*MM*)
- At the local level, consider effects to Special Status fish and other aquatic organisms when designing treatment programs. (*MM*)

Wildlife

See manuals 6500 (*Wildlife and Fisheries Management*) and 6780 (*Habitat Management Plans*)

- Use herbicides of low toxicity to wildlife, where feasible. *(SOP)*
- Use spot applications or low-boom broadcast operations where possible to limit the probability of contaminating non-target food and water sources, especially non-target vegetation over areas larger than the treatment area. *(SOP)*
- Use timing restrictions (e.g., do not treat during critical wildlife breeding or staging periods) to minimize impacts to wildlife. *(SOP)*
- To minimize risks to terrestrial wildlife, do not exceed the typical application rate for applications of dicamba, diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr, where feasible. (*MM*)
- Minimize the size of application areas, where practical, when applying 2,4-D, bromacil, diuron, and Overdrive® to limit impacts to wildlife, particularly through contamination of food items. (*MM*)
- Where practical, limit glyphosate and hexazinone to spot applications in grazing land and wildlife habitat areas to avoid contamination of wildlife food items. (*MM*)
- Do not use the adjuvant R-11 (*MM*)
- Either avoid using glyphosate formulations containing POEA, or seek to use formulations with the least amount of POEA, to reduce risks to amphibians. (*MM*)
- Do not apply bromacil or diuron in rangelands, and use appropriate buffer zones (Tables A2-1 and 2) to limit contamination of off-site vegetation, which may serve as forage for wildlife. (*MM*)
- Do not aerially apply diquat directly to wetlands or riparian areas. (*MM*)
- To protect Special Status wildlife species, implement conservation measures for terrestrial animals presented in the *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment* (See Appendix 5) (*MM*)

Threatened, Endangered, and Sensitive Species
See Manual 6840 (*Special Status Species*)

- Provide clearances for Special Status species before treating an area as required by Special Status Species Program policy. Consider effects to Special Status species when designing herbicide treatment programs. *(SOP)*
- Use a selective herbicide and a wick or backpack sprayer to minimize risks to Special Status plants. *(SOP)*
- Avoid treating vegetation during time-sensitive periods (e.g., nesting and migration, sensitive life stages) for Special Status species in area to be treated. *(SOP)*

Livestock
See Handbook H-4120-1 (*Grazing Management*)

- Whenever possible and whenever needed, schedule treatments when livestock are not present in the treatment area. Design treatments to take advantage of normal livestock grazing rest periods, when possible. *(SOP)*
- As directed by the herbicide product label, remove livestock from treatment sites prior to herbicide application, where applicable. *(SOP)*
- Use herbicides of low toxicity to livestock, where feasible. *(SOP)*
- Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non-target food and water sources. *(SOP)*
- Avoid use of diquat in riparian pasture while pasture is being used by livestock. *(SOP)*
- Notify permittees of the herbicide treatment project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. *(SOP)*
- Notify permittees of livestock grazing, feeding, or slaughter restrictions, if necessary. *(SOP)*
- Provide alternative forage sites for livestock, if possible. *(SOP)*
- Minimize potential risks to livestock by applying diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr at the typical application rate where feasible. (*MM*)
- Do not apply 2,4-D, bromacil, dicamba, diuron, Overdrive®, picloram, or triclopyr across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Where feasible, limit glyphosate and hexazinone to spot applications in rangeland. (*MM*)
- Do not apply bromacil or diuron in rangelands, and use appropriate buffer zones (Tables A2-1 and 2) to limit contamination of off-site vegetation, which may serve as forage for wildlife. (*MM*)

Wild Horses and Burros

- Minimize using herbicides in areas grazed by wild horses and burros. *(SOP)*
- Use herbicides of low toxicity to wild horses and burros, where feasible. *(SOP)*
- Remove wild horses and burros from identified treatment areas prior to herbicide application, in accordance with herbicide product label directions for livestock. *(SOP)*
- Take into account the different types of application equipment and methods, where possible, to reduce the probability of contaminating non-target food and water sources. *(SOP)*
- Minimize potential risks to wild horses and burros by applying diuron, glyphosate, hexazinone, tebuthiuron, and triclopyr at the typical application rate, where feasible, in areas associated with wild horse and burro use. (*MM*)
- Consider the size of the application area when making applications of 2,4-D, bromacil, dicamba, diuron, Overdrive®, picloram, and triclopyr in order to reduce potential impacts to wild horses and burros. (*MM*)
- Apply herbicide label grazing restrictions for livestock to herbicide treatment areas that support populations of wild horses and burros. (*MM*)
- Where practical, limit glyphosate and hexazinone to spot applications in rangeland. (*MM*)
- Do not apply bromacil or diuron in grazing lands within herd management areas (HMAs), and use appropriate buffer zones identified in Tables A2-1 and 2 to limit contamination of vegetation in off-site foraging areas. (*MM*)

- Do not apply 2,4-D, bromacil, or diuron in HMAs during the peak foaling season (March through June, and especially in May and June), and do not exceed the typical application rate of Overdrive® or hexazinone in HMAs during the peak foaling season in areas where foaling is known to take place. (*MM*)

Cultural Resources and Paleontological Resources

See handbooks H-8120-1 (*Guidelines for Conducting Tribal Consultation*) and H- 8270-1 (*General Procedural Guidance for Paleontological Resource Management*), and manuals 8100 (*The Foundations for Managing Cultural Resources*), 8120 (*Tribal Consultation Under Cultural Resource Authorities*),and 8270 (*Paleontological Resource Management*). See also: *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act.*

- Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act* and State protocols or 36 Code of Federal Regulations Part 800, including necessary consultations with State Historic Preservation Officers and interested tribes. *(SOP)*
- Follow BLM Handbook H-8270-1 (*General Procedural Guidance for Paleontological Resource Management*) to determine known Condition I and Condition 2 paleontological areas, or collect information through inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. *(SOP)*
- Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected by herbicide treatments; work with tribes to minimize impacts to these resources. *(SOP)*
- Follow guidance under Human Health and Safety in the PEIS in areas that may be visited by Native peoples after treatments. *(SOP)*
- Do not exceed the typical application rate when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr in known traditional use areas. (*MM*)
- Avoid applying bromacil or tebuthiuron aerially in known traditional use areas. (*MM*)
- Limit diquat applications to areas away from high residential and traditional use areas to reduce risks to Native Americans. (*MM*)

Visual Resources

See handbooks H-8410-1 (*Visual Resource Inventory*) and H-8431-1 (*Visual Resource Contrast Rating*), and manual 8400 (*Visual Resource Management*)

- Minimize the use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned vegetation. *(SOP)*
- Consider the surrounding land use before assigning aerial spraying as an application method. *(SOP)*
- Minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; minimize treatment in areas where herbicide runoff is likely; establish appropriate buffer widths between treatment areas and residences) to contain visual changes to the intended treatment area. *(SOP)*
- If the area is a Class I or II visual resource, ensure that the change to the characteristic landscape is low and does not attract attention (Class I), or if seen, does not attract the attention of the casual viewer (Class II). *(SOP)*
- Lessen visual impacts by: 1) designing projects to blend in with topographic forms; 2) leaving some low-growing trees or planting some low-growing tree seedlings adjacent to the treatment area to screen short-term effects; and 3) revegetating the site following treatment. *(SOP)*
- When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape character conditions to meet established Visual Resource Management (VRM) objectives. *(SOP)*

Wilderness and Other Special Areas

See handbooks H-8550-1 (*Management of Wilderness Study Areas (WSAs)*), and H-8560-1 (*Management of Designated Wilderness Study Areas*), and Manual 8351 (*Wild and Scenic Rivers*)

- Encourage backcountry pack and saddle stock users to feed their livestock only weed-free feed for several days before entering a wilderness area, and to bring only weed-free hay and straw onto BLM lands. *(SOP)*
- Encourage stock users to tie and/or hold stock in such a way as to minimize soil disturbance and loss of native vegetation. *(SOP)*
- Revegetate disturbed sites with native species if there is no reasonable expectation of natural regeneration. *(SOP)*
- Provide educational materials at trailheads and other wilderness entry points to educate the public on the need to prevent the spread of weeds. *(SOP)*
- Use the "minimum tool" to treat noxious weeds and other invasive plants, relying primarily on the use of ground-based tools, including backpack pumps, hand sprayers, and pumps mounted on pack and saddle stock. *(SOP)*
- Use herbicides only when they are the minimum treatment method necessary to control weeds that are spreading within the wilderness or threaten lands outside the wilderness. *(SOP)*
- Give preference to herbicides that have the least impact on non-target species and the wilderness environment. *(SOP)*
- Implement herbicide treatments during periods of low human use, where feasible. *(SOP)*
- Address wilderness and special areas in management plans. *(SOP)*
- Control of weed infestations shall be carried out in a manner compatible with the intent of Wild and Scenic River management objectives. *(SOP)*
- Mitigation measures that may apply to wilderness and other special area resources are associated with human and ecological health and recreation (see mitigation measures for Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety). (*MM*)

Recreation

See Handbook H-1601-1 (*Land Use Planning Handbook, Appendix C*)

- Schedule treatments to avoid peak recreational use times, while taking into account the optimum management period for the targeted species. *(SOP)*
- Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas. *(SOP)*
- Adhere to entry restrictions identified on the herbicide product label for public and worker access. *(SOP)*
- Post signs noting exclusion areas and the duration of exclusion, if necessary. *(SOP)*
- Mitigation measures that may apply to recreational resources are associated with human and ecological health (see mitigation measures for Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, and Human Health and Safety). (*MM*)

Social and Economic Values

- Consider surrounding land use before selecting aerial spraying as a treatment method, and avoid aerial spraying near agricultural or densely-populated areas. *(SOP)*
- Post treated areas and specify reentry or rest times, if appropriate. *(SOP)*
- Notify grazing permittees of livestock feeding restrictions in treated areas, if necessary, as per herbicide product label instructions. *(SOP)*
- Notify the public of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. *(SOP)*
- Control public access until potential treatment hazards no longer exist, per herbicide product label instructions. *(SOP)*
- Observe restricted entry intervals specified by the herbicide product label. *(SOP)*

- Notify local emergency personnel of proposed treatments. *(SOP)*
- Use spot applications or low-boom broadcast applications where possible to limit the probability of contaminating non-target food and water sources. *(SOP)*
- Consult with Native American tribes to locate any areas of vegetation that are of significance to the tribes and Native groups and that might be affected by herbicide treatments. *(SOP)*
- To the degree possible within the law, hire local contractors and workers to assist with herbicide application projects and purchase materials and supplies for herbicide treatment projects (including the herbicides) through local suppliers. *(SOP)*
- To minimize fears based on lack of information, provide public educational information on the need for vegetation treatments and the use of herbicides in an integrated vegetation management program for projects proposing local use of herbicides. *(SOP)*

Rights-of-way

- Coordinate vegetation treatment activities where joint or multiple use of a ROW exists. *(SOP)*
- Notify other public land users within or adjacent to the ROW proposed for treatment. *(SOP)*
- Use only herbicides that are approved for use in ROW areas. *(SOP)*

Human Health and Safety

- Establish a buffer between treatment areas and human residences based on guidance given in the HHRA, with a minimum buffer of ¼ mile for aerial applications and 100 feet for ground applications, unless a written waiver is granted. *(SOP)*
- Use protective equipment as directed by the herbicide product label. *(SOP)*
- Post treated areas with appropriate signs at common public access areas. *(SOP)*
- Observe restricted entry intervals specified by the herbicide product label. *(SOP)*
- Provide public notification in newspapers or other media where the potential exists for public exposure. *(SOP)*
- Store herbicides in secure, herbicide-approved storage. (*SOP*)
- Have a copy of MSDSs at work site. *(SOP)*
- Notify local emergency personnel of proposed treatments. *(SOP)*
- Contain and clean up spills and request help as needed. *(SOP)*
- Secure containers during transport. *(SOP)*
- Follow label directions for use and storage. *(SOP)*
- Dispose of unwanted herbicides promptly and correctly. *(SOP)*
- Use the typical application rate, where feasible, when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr to reduce risk to workers and the public. (*MM*)
- Avoid applying bromacil and diuron aerially. Do not apply sulfometuron methyl aerially. (*MM*)
- Limit application of chlorsulfuron via ground broadcast applications at the maximum application rate. (*MM*)
- Limit diquat application to ATV, truck spraying, and boat applications to reduce risks to workers; limit diquat applications to areas away from high residential and subsistence use to reduce risks to the public. (*MM*)
- Evaluate diuron applications on a site-by-site basis to avoid risks to humans. There appear to be few scenarios where diuron can be applied without risk to workers. (*MM*)
- Do not apply hexazinone with an over-the-shoulder broadcast applicator (backpack sprayer). (*MM*)

TABLE A2-1. Buffer Distances to Minimize Risk to Vegetation from Off-Site Drift of BLM-Evaluated Herbicides

Application Scenario	BROM[1]	CHLR[1]	DIQT[1]	DIUR[1]	FLUR[1]	IMAZ[1]	OVER[1]	SULF[1]	TEBU[1]
Buffer Distance (feet) from Non-target Aquatic Plants									
Typical Application Rate									
Aerial	NA	0	NE	NA	NE	0	NA	1,300	NE
Low Boom[2]	100	0	NE	900	NE	0	100	900	0
High Boom[2]	900	0	NE	1,000	NE	0	900	900	0
Maximum Application Rate									
Aerial	NA	300	NE	NA	NE	300	NA	1,500	NE
Low Boom[2]	900	0	NE	1,000	NE	0	900	900	0
High Boom[2]	900	0	NE	1,000	NE	0	900	900	0
Buffer Distance (feet) from Non-target Terrestrial Plants									
Typical Application Rate									
Aerial	NA	1,350	1,200	NA	NE	0	NA	0	NE
Low Boom[2]	950	900	100	0	NE	0	0	0	0
High Boom[2]	950	900	900	100	NE	0	100	0	0
Maximum Application Rate									
Aerial	NA	1,350	1,200	NA	NE	900	NA	0	NE
Low Boom[2]	1,000	1,000	900	200	NE	0	100	0	50
High Boom[2]	1,000	1,000	900	500	NE	0	100	0	50
Buffer Distance (feet) from Threatened, Endangered, and Sensitive Plants									
Typical Application Rate									
Aerial	NA	1,400	1,200	NA	NE	0	NA	1,500	NE
Low Boom[2]	1,200	1,000	900	1,000	NE	0	100	1,100	0
High Boom[2]	1,200	1,000	900	1,000	NE	0	900	1,000	50
Maximum Application Rate									
Aerial	NA	1,400	1,200	NA	NE	900	NA	1,500	NE
Low Boom[2]	1,200	1,050	1,000	1,000	NE	0	900	1,100	100
High Boom[2]	1,200	1,000	1,000	1,000	NE	0	900	1,000	500

[1] BROM = Bromacil; CHLR = Chlorsulfuron; DIQT = Diquat; DIUR = Diuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = Diflufenzopyr + Dicamba (Overdrive); SULF = Sulfometuron methyl; and TEBU = Tebuthiuron.
[2] High boom is 50 inches above ground and low boom is 20 inches above ground.
NE = Not evaluated and NA = not applicable.
Buffer distances are the smallest modeled distance at which no risk was predicted. In some cases, buffer distances were extrapolated if the largest distance modeled still resulted in risk, or interpolated if greater precision was required.

Table A2-2. Buffer Distances to Minimize Risk to Vegetation from Off-Site Drift of Forest Service-Evaluated Herbicides

Application Scenario	2,4-D	Dicamba	Clopyralid	Glyphosate	Hexazinone	Imazapyr	Metsulfuron Methyl	Picloram	Triclopyr
Buffer Distance (feet) from Susceptible Plants[1]									
Typical Application Rate									
Aerial	NE	>900	900	300	300	900	900	>900	500
Low Boom	NE	300	900	50	NE	900	900	>900	300
Maximum Application Rate									
Aerial	NE	>900	1,000	300	900	>900	>900	>900	>900
Low Boom	NE	900	1,000	300	NE	>900	>900	>900	>900
Buffer Distance (feet) from Tolerant Terrestrial Plants									
Typical Application Rate									
Aerial	NE	0	0	25	NE	100	50	25	NE
Low Boom	NE	0	0	25	0	25	25	25	NE
Maximum Application Rate									
Aerial	NE	0	25	50	NE	300	100	50	NE
Low Boom	NE	0	25	25	100	50	25	25	NE

NE = Not evaluated.
Buffer distances are the smallest modeled distance at which no risk was predicted. In some cases, buffer distances were extrapolated if the largest distance modeled still resulted in risk, or interpolated if greater precision was required.
[1] Mitigation measures for Bureau Sensitive or Federally Listed species use these buffer distances

Table A2-3. Buffer Distances to Minimize Risk to Non-Special Status Fish and Aquatic Invertebrates from Off-Site Drift of BLM-Evaluated Herbicides from Broadcast and Aerial Treatments

Application Scenario	BROM[1]	CHLR	DIQT	DIUR	FLUR	IMAZ	OVER	SULF	TEBU
Minimum Buffer Distance (feet) from Fish and Aquatic Invertebrates									
Typical Application Rate									
Aerial	NA	0	NA	NA	NA	0	NA	0	NA
Low boom	0	0	NA	0	NA	0	0	0	0
High boom	0	0	NA	0	NA	0	0	0	0
Maximum Application Rate									
Aerial	NA	0	NA	NA	NA	0	NA	0	NA
Low boom	0	0	NA	100	NA	0	0	0	0
High boom	0	0	NA	100	NA	0	0	0	0

[1] BROM = Bromacil; CHLR = Chlorsulfuron; DIQT = Diquat; DIUR = Diuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = Diflufenzopyr + Dicamba (Overdrive); SULFM = Sulfometuron methyl; and TEBU = Tebuthiuron.
NA = Not applicable.
Boom height = The Tier I ground application model allows selection of a low (20 inches) or a high (50 inches) boom height.

Table A2-4. Buffer Distances to Minimize Risk to Special Status Fish and Aquatic Organisms from Off-Site Drift of BLM-Evaluated Herbicides from Broadcast and Aerial Treatments

Application Scenario	BROM[1]	CHLR	DIQT	DIUR	FLUR	IMAZ	OVER	SULF	TEBU
Minimum Buffer Distance (feet) from Fish and Aquatic Invertebrates									
Typical Application Rate									
Aerial	NA	0	NA	NA	NA	0	NA	0	NA
Low boom	0	0	NA	0	NA	0	0	0	0
High boom	0	0	NA	100	NA	0	0	0	0
Maximum Application Rate									
Aerial	NA	0	NA	NA	NA	0	NA	0	NA
Low boom	0	0	NA	100	NA	0	0	0	0
High boom	0	0	NA	900	NA	0	0	0	0

[1] BROM = Bromacil; CHLR = Chlorsulfuron; DIQT = Diquat; DIUR = Diuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = Diflufenzopyr + Dicamba (Overdrive); SULFM = Sulfometuron methyl; and TEBU = Tebuthiuron.
NA = Not applicable.
Boom height = The Tier I ground application model allows selection of a low (20 inches) or a high (50 inches) boom height.

Appendix 3 – Monitoring

Introduction

Monitoring is the orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. Two types of monitoring are addressed here. One type is implementation monitoring, which answers the question, "Did we do what we said we would do?" The second type is effectiveness monitoring, which answers the question, "Were treatment and restoration projects effective?" Implementation monitoring is usually done at the land use planning level or through annual work plan accomplishment reporting. Effectiveness monitoring is usually done at the local project implementation level.

Consistent with the FLPMA's broad mandates for resource management, and focused most specifically by each district's Resource Management Plan, vegetation management and related monitoring is already being done on BLM lands in Oregon to meet a variety of objectives. These objectives include fuels reduction, range improvements, wildlife habitat improvement, watershed restoration, invasive plant control, and timber harvest. *Implementation* monitoring of these treatments is usually done at the plan level through annual work plan accomplishment reporting, and by a variety of formal or semi-formal post-project reviews done by staff, district management teams, or next-level reviews. *Effectiveness* monitoring takes place both formally and informally within two to three years. Examples include seedling survival exams and follow-up monitoring of invasive plant populations. *Evaluations* of the appropriateness and effectiveness of the overall Resource Management Plan direction are done periodically, usually every five years, to determine if Resource Management Plan direction is meeting overall goals.

Herbicides are one of the tools currently being used to meet the noxious weed control objectives identified in the Resource Management Plans. Herbicides are currently being applied to more than 12,000 acres annually, mostly as spot spraying of individual weeds. Herbicides can be uniquely hazardous and adverse effects can be difficult to observe directly, so specialized controls and monitoring requirements are applied. Management objectives for herbicide use include protection of the public, environmental safety, and efficient control of target vegetation. Existing monitoring would apply to the selected alternative and continue to provide the primary controls for assuring treatments adhere to established standards for herbicide use. Existing monitoring is described (in part) below, as it is being applied not only across Oregon but in other states as well.

Part I - Existing Monitoring

Policy Requirements

Monitoring ensures that vegetation management is an adaptive process that continually builds upon past successes and learns from past mistakes. The adaptive management framework employed by the State Office includes developing stated management objectives to guide decisions about what actions to take and identifying explicit assumptions about expected outcomes that are then compared against actual outcomes. This framework acknowledges uncertainty about how natural resources systems function and how they would respond to management actions, and it makes use of management intervention and monitoring to improve subsequent decision-making (USDI 2008). The regulations of 43 C.F.R 1610.4-9 require that land use plans establish intervals and standards for monitoring and evaluating land management actions. Within BLM district Resource Management Plans, integrated vegetation management objectives and actions are outlined and the effectiveness of those actions are evaluated as part of the overall effectiveness monitoring of the Resource Management Plans. The 1601 Land Use Planning Manual requires that monitoring and evaluation of Resource Management Plans take place at prescribed intervals (typically every five years) and in accordance with standards identified in those plans.

BLM Manual Section 9011, Chemical Pest Control, institutes implementation monitoring requirements for pesticide applications as part of an integrated vegetation management strategy. Manual Section 9011 requires that a Pesticide Use Proposal be prepared for each chemical application. This Pesticide Use Proposal must be reviewed and approved by the BLM State Office prior to the pesticide application. Once the application of the pesticide is completed, a Pesticide Application Record is completed. This record documents the pesticide application that occurred and is then kept on file for ten years. These records are used by the BLM to track pesticide use, which is reported to the EPA annually.

Numerous other BLM Manuals and Handbooks describe applicable monitoring policy and practices, including:

- ***BLM Technical Reference 1730-1 Measuring and Monitoring Plant Populations (1998).*** Provides technical guidance on how to develop and implement effective monitoring plans for vegetation and use monitoring in adaptive management.
- ***Manual Section 9011 Chemical Pest Control (1992).*** Establishes requirements for monitoring pesticide applications.
- ***Manual Section 9014 Use of Biological Control Agents of Pests on Public Lands (1990).*** Establishes requirements to monitor success or failure in survival, control, and spread of biological agents.
- ***Manual Section BLM Manual 9015, Integrated Weed Management.*** Outlines the BLM's integrated weed management policy and within that sets out requirements related to monitoring in those areas where management actions have a potential to introduce or spread noxious weeds or when the action is taking place in an area where known noxious weeds already exist.
- ***Guidelines for Coordinated Management of Noxious Weeds (1990).*** Provides guidance on establishing monitoring plans for noxious weeds and their control.
- ***NEPA Handbook H-1790-1 Chapter VI – Monitoring (1988).*** All actions and mitigation measures, including monitoring and enforcement programs, adopted in a decision document are legally enforceable commitments. The purposes of monitoring in a NEPA context are to 1) ensure compliance with decisions, 2) measure effectiveness of decisions, and 3) evaluate validity of decisions.
- ***Manual Section 1734 Monitoring and Inventory Coordination (1983).*** Provides the BLM with technical guidance on how to develop and implement effective monitoring plans for vegetation.

Other technical references for inventory, monitoring, and assessment of the cross section of BLM-managed resources are found at http://www.blm.gov/nstc/library/techref.htm.

Implementation Monitoring

Implementation monitoring answers the question, "Did we do what we said we would do?"

During preparation of implementation plans, treatment objectives, standards, and guidelines are stated in measurable terms, where feasible, so that treatment outcomes can be measured, evaluated, and used to guide future treatment actions. This approach ensures that vegetation treatment processes are effective, adaptive, and based on prior experience (Record of Decision for the PEIS:2-6).

According to BLM Manual Section 9011 and noted above, implementation monitoring specified in the local Resource Management Plans, project-specific NEPA documents, and/or the Biological Assessment or Opinions associated with the project may be accomplished by reviewing the Pesticide Application Records (PAR) completed at the time of treatment and comparing them with the Pesticide Use Proposal, Standard Operating Procedures, and specific mitigation measures prescribed in the project NEPA decision. The PAR documents the actual rate, date, time, and location of herbicide application. It also documents the species treated and climatic characteristics such as wind speed and air temperature. The Pesticide Application Record, which must be completed within 24 hours of the application, documents the actual rate of application and that all the PUP and NEPA Standard Operating Procedures and mitigation measures were taken into account. Review of the PARs can determine whether actual application was consistent with plans and requirements documented in the site-specific NEPA decision or Pesticide Use Proposal. Pesticide Application Records are used to develop annual state summaries of herbicide use for the BLM (Record of Decision for the PEIS:App. D). Pesticide Application Records are used for site-specific implementation monitoring. For example, the time of application recorded in the PAR can be compared with the prescribed mitigations to determine whether the application was made at the correct time, or if mitigation for sensitive wildlife concerns identified were observed during treatment.

Invasive plant implementation monitoring for non-herbicide treatments is accomplished through site revisits performed during the growing season of the target species to determine if treatments were implemented correctly and decide the best time for follow-up treatments (Record of Decision for the PEIS:App. D).

Adaptive management strategies require implementation monitoring to determine whether the plan was followed and obtained the expected results. Monitoring also ensures that vegetation treatment Standard Operating Procedures and mitigation measures are adopted and implemented appropriately and determined to be effective (Record of Decision for the PEIS:2-6).

Effectiveness Monitoring

Effectiveness monitoring answers the question, "Were treatment and restoration projects effective?" The BLM 9011 Handbook provides technical guidance on post-treatment evaluations for pesticide applications. Effectiveness monitoring can be formal or informal and typically compares vegetation characteristics of a site before and after treatment. Effectiveness monitoring typically occurs within two years of treatment, and results in recommendations for additional monitoring and weed or other vegetation management actions.

A purpose of effectiveness monitoring is to demonstrate the effects of pest control and the cost effectiveness of various treatment methods or combination of methods (USDI 1992c:Chapter 2. IV. A. Post-Treatment Evaluation Procedures). However, the objective of weed control is not just to kill weeds, but to protect, maintain, and enhance native plant communities and the ecosystems that depend on them.

Thorough effectiveness monitoring determines if the actions taken had the intended outcome or effect. Monitoring of invasive plant treatment effectiveness (regardless of the treatment method) can range from site visits to compare the targeted population size against pre-treatment inventory data, to comparing pre-treatment and post-treatment photo points, to more elaborate transect work, depending on the species and site-specific variables. The goals of monitoring should be to answer questions such as the following:

- What changes in the distribution, amount, and proportion of invasive plant infestations have resulted due to treatments?
- Has infestation size been reduced at the project level or larger scale (such as a watershed)?
- Which treatment methods, separate or in combination, are most successful for a particular species? (Record of Decision for the PEIS:App D)

A long-term adaptive management approach is based on changing conditions. The invasive plant infestation conditions need to be monitored in order to know when it is appropriate for action to be taken, and whether that action is effective. If treatment was not effective, the decision maker would review the strategy (USDA 2005:2-15)

Water quality monitoring is conducted at the discretion of the district. Typically water quality monitoring would be conducted to check the effectiveness of buffer strips and administrative controls on protecting water quality and aquatic environments (USDI 1992:Chapter 2. IV. B). BLM's Chemical Pest Control Handbook notes that the need for and type of monitoring are dictated by the nature of the critical components of the environment in the treatment area. Thus, a toxic chemical proposed for use in a sensitive area, such as near a residential area, or domestic water supply must be monitored intensively. Chemical residues in air, vegetation, soil, and water may need to be determined. A less toxic chemical used on other areas may require only limited stream monitoring to ensure that significant quantities of the chemical do not enter the stream. An innocuous chemical used on a small remote area may require no monitoring (USDI 1992).

There might also be a need to determine if the Conservation Measures were effective at reducing potential effects to Federally Listed species and/or designated critical habitat.

Monitoring Biological Control Agent Releases

BLM Manual Section 9014 requires that a Biological Control Agent Release Proposal be prepared when a district is considering the use of a biological control agent as part of an integrated vegetation management strategy. The Proposal is reviewed and approved by the BLM State Office. Upon completion of the biological control release, a Biological Control Agent Release Record is prepared and the State Office maintains a permanent record of all releases and locations. In addition to this implementation monitoring, Manual Section 9014 also requires that BLM conduct effectiveness monitoring of the release, and document the success or failure in terms of species survival, control, and spread. All biological control agents must be approved by the State Department of Agriculture.

Monitoring BLM Management Activities for Weed Spread

BLM Manual 9015, Integrated Weed Management outlines the BLM's integrated weed management policy and within that, sets out requirements related to monitoring in those areas where BLM management actions have a potential to introduce or spread noxious weeds or when the action is taking place in an area where known noxious weeds already exist. If, through a risk assessment process, it is determined that a proposed management activity (such as a timber sale or road construction) has a moderate or high risk for establishing noxious weeds, BLM is required to prescribe follow-up monitoring as well as identify project actions that need to be taken in order to reduce or prevent the spread of noxious weeds.

Northwest Forest Plan Aquatic and Riparian Effectiveness Monitoring Program (AREMP)

The purpose of AREMP is to assess the status and trend of watershed attributes to determine if the Forest Service and BLM's Northwest Forest Plan Aquatic Conservation Strategy[1] is achieving its goals of maintaining and restoring watersheds. Monitoring determines watershed condition every five years for every 6th-field watershed (with > 25% federal ownership along the stream length) based on upslope and riparian data derived from GIS layers and satellite imagery. In-channel attributes are also measured each year in a subset of

1 The Northwest Forest Plan Aquatic Conservation Strategy is a common set of watershed management standards and guidelines added to BLM district and National Forest Land and Resource Management Plans within the range of the northern spotted owl in 1994. A joint-agency common monitoring strategy is used.

watersheds to supplement the watershed condition assessments and validate the models used to assess stream condition. Watershed condition assessments are done using decision-support models. AREMP also tracks changes in watershed condition over time, and reports on the Forest Plan's effectiveness across the region. Although the program was not designed to monitoring pesticides or track invasive plants, invasive plants are recorded when found.

The program's 2008 Annual Technical Report noted AREMP staff "participated in the second year of a pilot regional survey effort to locate aquatic invasive species on federal lands. Protocols developed by Oregon State University Sea Grant College Program personnel were used to survey for 11 aquatic plants and animals identified as primary threats to northwest watersheds. Among the key species included were; …yellow flag iris, knotweed, hydrilla, Chinese mitten crabs, and four species of nonnative crayfish. Included also were fifteen species of secondary concern" (USDA, USDI 2008).

PACFISH/INFISH Biological Opinion (PIBO) Effectiveness Monitoring Program

Similar to the AREMP, the goal of the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO) is to determine whether the aquatic conservation strategies within PACFISH and INFISH, or revised land management plans, are effective in maintaining or restoring the structure and function of riparian and aquatic systems. This affects Oregon BLM streams with anadromous fish and bull trout outside of the Northwest Forest Plan area. Like AREMP, the program is not designed to monitor pesticides. PIBO monitoring does establish transects on each stream reach and are records vegetation down to species. This data could be used to track the spread or occurrence of invasive plants if we choose to query them.

National Invasive Species Information Management System (NISIMS)

In 2007, the BLM began field-testing a new data management system for documentation, mapping, treating, and monitoring of invasive species. When fully operational, the system will provide tools for data collection and the generation of BLM-wide analysis and statistics for invasive species infestations and treatments. The objective of this project is to develop a BLM-wide invasive species geodatabase that is web-enabled.

The deployment of a BLM-wide database supports the BLM strategies of the delivery of information directly to the program specialists/decision makers; establish accountability, responsibility, and standardized, comprehensive management of BLM information.

Primary functions of the system are:

- Track invasive species infestation areas and treatments of infestation areas.
- Generate yearly reports and other reports as required by various constituents of the weed program.
- Provide standardized data for analysis of invasive species infestations/inventories.
- Provide bi-directional synchronization between system and field collection devices.
- Serve tabular and spatial BLM-wide invasive species data and analysis to internal and external customers. Geospatial components facilitate weed control effectiveness monitoring.
- Provide capability to share corporate data set with other national applications.
- Provide components that could be utilized in the development of other national datasets.

Part II – Potential Monitoring

Introduction

In addition to existing monitoring, the selection of one of the action alternatives could create a changed circumstance or condition (e.g. a concern over a potential environmental effect) that would suggest a need for additional monitoring. Those circumstances might include the use of different herbicides with different ecological risks, more acres being treated, more acres being treated in proximity to people or sensitive environmental resources, more use of broadcast spraying with its potential for drift, or simply increasing the use of "new" herbicides as weed specialists become more familiar with their advantages. This section describes changes that might suggest additional, EIS-specific monitoring and describes some options as to what form that monitoring might take. These descriptions should be viewed the same as Potential Mitigation, they do not apply unless the decision maker specifically selects them in the Record of Decision. Potential monitoring could also be adopted during site-specific NEPA.

Implementation Monitoring

Monitoring for Concerns Identified in the EIS - For each of the first five years of EIS implementation, a subset of the year's herbicide application projects could be identified using parameters identified in the EIS as having the potential for adverse effects. A list of what constitutes qualifying parameters may be compiled after the Final EIS is issued. For example, parameters might include aerial spray within a certain distance of population centers or Federally Listed species, treatments exceeding some number of acres with herbicides having a high risk of environmental damage to non-target species (other than non-special status plants), treatments where PEIS Mitigation Measure buffers around sensitive species were reduced by more than 50 percent, aquatic treatments, riparian treatments for streams with Federally Listed fish, use of known ground-water contaminants on the west side, projects that required formal consultation, sprays within riparian management zones, broadcast sprays of over 100 contiguous acres, roadside boom sprays on native plants, use of diuron, bromacil, tebuthiuron, or 2,4-D at higher than 50% of the typical rate for over 100 net acres in any one thousand acre area, and so forth.

From this "higher risk" subset, a representative sample (at least three) of State Office randomly selected projects could be identified. Both the east and west side would be represented by at least one selection assuming there are projects that qualify. For selected projects, the full set of planning and reporting documents would be reviewed, as well as field implementation records, monitoring, applicator licenses, adherence to Standard Operating Procedures and appropriate mitigations measures, and all other project requirements. A questionnaire listing these review elements would be prepared by the State Office. The review could be conducted by a team that includes, at minimum, at least one non-BLM person from a Resource Advisory Committee, County Weed Board, County Board of Supervisors, or Oregon Department of Agriculture Invasive Plant or Pesticide Enforcement Division, and; a line officer, District Weed Coordinator, or State Office Restoration Program lead from a different district or the State Office.

Implementation Monitoring on the Avoidance and Mitigation of Adverse Impacts to Non-target Resources - The above project monitoring would not preclude the need to identify specific, or narrow, concerns with specific herbicides regarding certain parameters. Pre-emergent herbicides with long soil half-lives may suggest soil monitoring. Water monitoring should be conducted, particularly where there are Federally Listed fish species, when there is a possibility herbicides toxic to fish could drift onto, or be washed into, streams. This type of monitoring is already described in the BLM's Chemical Pest Control Handbook (USDI 1992), in Chapter 1. I. E, Chemical Residue Monitoring, for when toxic materials are introduced near sensitive areas such as residences or domestic water supplies. Suggested monitoring points include air, vegetation, soil, and water. Although this represents existing monitoring, it is included here to suggest using the EIS analysis to help identify monitoring points.

Effectiveness Monitoring

Five-year Examination of Weed Spread - The action alternatives are expected to have a significant effect on, but not stop, noxious weed spread on BLM lands in Oregon. Assuming an action alternative is selected and a more complete set of tools are available for weed control and are being utilized; a more careful estimate of noxious weed spread rate should be made to determine if a change in the control strategy is warranted. Setting up a statewide series of randomly selected (but unmarked) plots soon, and then rechecking them in five years or other selected interval, could provide a statistically valid estimate of weed spread rate. This effort might be done cooperatively with other agencies.

Restoration Monitoring – The action alternatives would make imazapic available, and districts estimate its primary use would follow wildfire or prescribed burns in, or threatened by, medusahead or other invasive annual grasses. Imazapic was desired because it would leave more native forbs than glyphosate. Because large applications will be expensive and may not occur annually at least on any one district, a detailed examination of the first two or three large-scale uses could help ensure this new tool achieves maximum effectiveness while protecting non-target vegetation and other resources.

State of Oregon Information Sharing

The Oregon Department of Environmental Quality has requested that the BLM coordinate with them when sending data electronically for potential entry into the Oregon Department of Environmental Quality's Laboratory Analytical Storage and retrieval Database (LASAR). In addition, the Oregon Department of Environmental Quality has requested copies of any monitoring reports of herbicide effectiveness and impacts on water quality and ecological conditions.

Similarly, the state of Oregon encourages the BLM to share any water quality effectiveness monitoring data collected in support of this EIS with the State of Oregon's Water Quality Pesticide Management Team (WQMPT). The multi-agency WQMPT acts to review and respond to pesticide detections in Oregon's ground and surface water in support of Oregon's Pesticide Management Plan for Water Quality Protection (see http://egov.oregon.gov/ODA/PEST/docs/pdf/wqpmtPMP.pdf).

References

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Appendix 4 – Protocol for Identifying, Evaluating, and Using New Herbicides

The Oregon EIS evaluates a proposal and alternatives that would make up to 18 herbicides available to the BLM districts in Oregon for use in their existing noxious weed, invasive plants, and other vegetation management programs (except for projects specifically designed to improve livestock forage or timber production). These herbicides were analyzed in the 2007 PEIS and approved for use in the 17 western states by the 2007 Record of Decision. This EIS does not propose or assume the use of any herbicides other than these 18. Should other herbicide active ingredients be desired for use in the future, Appendix A of the 2007 Record of Decision for the PEIS entitled, *Protocol for Identifying, Evaluating, and Using New Herbicides* outlines a protocol that is to be followed. This protocol applies to BLM nationally; individual State BLM offices do not implement the process independently. However, the BLM in Oregon may help identify future herbicide active ingredients needed, and propose them to the National Office under this protocol.

The PEIS protocol (summarized below) addresses the identification and approval of new herbicide products and technologies, requires that there be a determination of the need for the herbicide, involves a formal request for use of the herbicide be made to the BLM National Office, requires that the herbicide active ingredient have completed EPA Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) registration and be labeled for use on the site type proposed, and requires National Environmental Policy Act (NEPA) compliance. The BLM National Office would take the lead on conducting the NEPA analysis for new herbicide active ingredients.

Summary of 2007 Record of Decision Appendix A – Protocol for Identifying, Evaluating, and Using New Herbicides

The BLM may become aware of new herbicide active ingredients, products, and technologies that are developed and marketed in the future, and may consider application of these products or technologies to vegetation treatment projects.

Identification and Approval of New Herbicide Products and Technologies

The means by which the BLM could learn of new products and their applications include, but are not limited to, professional networking, technical research and publications, and vendor marketing.

Networking

The BLM participation in professional networks is an important method for learning or staying current about the technical, regulatory, efficacy, and environmental aspects of herbicide products in the development phase and those currently on the market. These networks include other state and Federal agencies such as the U.S. EPA and Oregon Department of Agriculture, as well as county weed districts, university extension services, the Weed

Science Society of America, and numerous others. For the most part, networking occurs at the local level, with BLM professional staff and managers working with local representatives of the organizations mentioned above. BLM State Office weed coordinators and vegetation management professionals often represent the BLM at annual meetings and workshops.

Occasionally, members of the public who are interested in various approaches to vegetation treatment send relevant information to the BLM. As with vegetation treatment methods identified through other avenues, if the BLM determines that the approach may have some utility for meeting its needs, a product demonstration or additional information may be requested.

Research and Demonstration

Demonstration areas for current and emerging technologies play an important role in facilitating research and evaluating efficacy of treatment applications. Current BLM practice allows for limited and controlled use of new herbicides on demonstration plots up to 5 acres in size, with a maximum of 15 acres per field office. Approval to adopt a new herbicide for research and demonstration use is provided by the BLM National Office after an initial evaluation of FIFRA registration materials and risk assessments. If research and demonstration results appear favorable, the BLM then considers the herbicide for further human health and ecological risk assessments, and those results are evaluated through the NEPA process.

Technical Research and Publications, and Vendor Marketing

The BLM also obtains information on vegetation management and herbicide treatments from professional journals associated with vegetation management societies and associations, working though a wide variety of publication compilation services. The general public and non-governmental organizations also provide the BLM with information through the NEPA process and other participatory processes. For example, scoping comments received for this EIS suggested that aminopyralid (e.g. Milestone®) should be the next herbicide adopted for use by the BLM. Also, vendors of invasive plant control technologies, including agrochemical company representatives, contact the BLM to introduce new active ingredients and new formulations, and to provide updates on existing products.

Determining the Need for New Herbicides

In order for the BLM to consider and approve a new active ingredient or formulation, the BLM must first consider whether there is a need for an available product. Factors that would be considered when assessing the need for adopting an available product include, but are not limited to: spectrum of application, efficacy, factors that could limit efficacy, extent or scope of use, cost, availability, availability of substitute or alternative products or technologies, expected effectiveness compared to any currently used methods, previous use reports at other sites and their outcomes, results from research and demonstration use, training and personnel requirements, and any other relevant factors including hazards and risks. Once a need is determined, the BLM would then integrate the approval process with its annual budget cycle. In general, the approval/budget process should take approximately two fiscal years to complete once a need for an available product is identified.

The determination for the need is a primarily a "bottom up" process that would typically start with a BLM field or state office collecting information regarding the need. To assess the potential for site-specific effectiveness, the BLM field office manager will investigate its use through professional networks, technical publications, and research reports, such as those described in the previous section. Requests are forwarded to the BLM National Office with annual statewide pesticide use reports. Proposed herbicide active ingredients must already have a completed FIFRA registration in place, and be labeled for use on the site proposed (e.g. rangeland, pasture, non-cropland, aquatic habitat). The BLM will not consider any active ingredients in its review and approval process, including research and demonstration, if it does not have a completed FIFRA registration. The BLM will comply with label directions and with state registration requirements. Thus, if current state requirements do not allow the application of an herbicide being considered for use by the BLM, the BLM will not apply that herbicide in that state.

Weed specialists and others in the BLM National Office will determine whether the new active ingredient being proposed will benefit the BLM and whether the cost of analysis is likely to be justified. If approved, funds will be requested in the following fiscal year's budget process to conduct a risk assessment.

Assessment of Hazards and Risks

FIFRA registration already requires product performance data relating to each product's effectiveness. This requirement was designed "to ensure that pesticide products will control the pests listed on the label and that unnecessary pesticide exposure to the environment will not occur as a result of the use of ineffective products" (40 C.F.R. 158.202[i]). Therefore, any new pesticide registered under FIFRA is expected to be generally effective for the labeled uses.

For an herbicide to be considered for use on public lands, the EPA-reviewed toxicological, environmental fate, and ecotoxicity data submitted by the pesticide manufacturer to support its registration application will be available for review. These data could then be used to conduct an assessment of the potential human health and ecological risks from the herbicide's use, including, but not limited to, the following components:

- Identification of potential use patterns, including target plants, formulation, application methods, locations to be treated, application rate, and anticipated frequency of use;
- Review of herbicide hazards relevant to the human health risk assessment, including systemic and reproductive effects, skin and eye irritation, allergic hypersensitivity, carcinogenicity, dermal absorption, eurotoxicity, immunotoxicity, and endocrine disruption;
- Estimation of exposure to workers applying the herbicide or reentering a treated area;
- Environmental fate and transport, including drift, leaching to groundwater, and runoff to surface streams and ponds;
- Estimation of exposure to members of the public;
- Review of available ecotoxicity data, including hazards to mammals, birds, reptiles, amphibians, fish, and aquatic invertebrates;
- Estimation of exposure to terrestrial and aquatic wildlife species; and,
- Characterization of risk to human health and wildlife.

If the available toxicity or ecotoxicity data were inconclusive, or if substantial disagreement occurs among the results of technical studies that could affect the potential risk conclusions for the herbicide, the BLM will conduct a formal peer review of the available scientific information to develop a consensus about the endpoint(s) in question. The peer review process is based largely on EPA's peer review process (EPA 2000).

If review of the registration information supports use, the next step is to confirm or redesign the human health and ecological risk assessment protocols and complete the assessment(s). The risk assessment protocols used by the BLM must reflect the best science available and ensure current standards for environmental review are utilized while the risk assessments are conducted.

NEPA Documentation

The potential use of new herbicide active ingredients will require compliance with NEPA. That requirement might be met all or in part by tiering to an existing document, supplementing an existing document, and/or incorporating or adopting another analysis as appropriate under NEPA. If existing NEPA documentation is determined to be inadequate, a new NEPA document will be prepared.

In any event, the process for complying with NEPA for proposals to use new herbicide active ingredients on BLM lands differs from the standard NEPA screening process for other Federal actions. For example, neither the USDI, nor the BLM have categorical exclusions[1] that address the use of herbicides; therefore, this step does not apply. The BLM, through this and previous EISs, has already determined that approval of herbicides for future use on public lands is a controversial Federal action significantly affecting the human environment. It is therefore inappropriate to use an Environmental Assessment and Finding of No Significant Impact for such approval. This is not to say a particular project involving the use of herbicides could not be assessed with an Environmental Assessment level analysis, properly tiered to a land use plan EIS or other NEPA document, such as this Programmatic EIS. This determination of significance only applies to the approval of a new active ingredient for use by BLM overall. Site-specific impacts for any project using herbicides will be assessed at a level appropriate for the project, using the standards for "significantly" found under 40 C.F.R. 1508.27.

Initially, the BLM expects to use the PEIS as its basis for conducting future risk assessments and approvals. Following the guidance under 40 C.F.R. 1502.9 (4) *Environmental Impact Statement, Draft, Final and Supplemental Statements*, the BLM will conduct risk assessments on new active ingredients and build on the analysis contained in the PEIS through the issuance of a Supplemental Environmental Impact Statement (SEIS). A final decision on whether an active ingredient is approved would be recorded in a Record of Decision. SEISs would be utilized for approvals of new active ingredients until such time as the need for a new programmatic EIS was warranted and such a document was prepared. For cost efficiency, BLM would likely assess several active ingredients together in one SEIS.

Special Status Species

As part of any NEPA analysis of new herbicides, the BLM would consult with the FWS and NMFS as required under Section 7 of the Endangered Species Act. As part of this process, the BLM would prepare a consultation package that could include a description of the program; species listed as threatened or endangered, species proposed for listing, and critical habitats that could be affected by the program, and; a Biological Assessment that evaluates the likely impacts to listed species, species proposed for listing, and critical habitats from the proposed vegetation treatment program. The BLM will also provide guidance on actions that will be taken by the BLM to avoid adversely impacting species or destroying critical habitat.

References

ENSR. 2004. Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol. Report Prepared for the Bureau of Land Management, Reno, Nevada. Westford, Massachusetts.

1 Categorical exclusions are "a category of [federal] actions that does not individually or cumulatively have a significant effect on the human environment…for which, therefore, neither an Environmental Assessment (EA) nor an EIS is required" (40 C.F.R. 1508.4).

ENSR. 2005. Human Health Risk Assessment Final Report. Report Prepared for the Bureau of Land Management, Reno, Nevada. Westford, Massachusetts.

U.S. Department of the Interior Bureau of Land Management (USDI BLM). 1988. National Environmental Policy Act Handbook. Bureau of Land Management Handbook H-1790-1 Washington, D.C.

U.S. Environmental Protection Agency (USEPA). 2000. Peer Review Handbook 2nd Edition. Washington, D.C. Available at: http://www.epa.gov/osp/spc/prhandbk.pdf.

Appendix 5 – Federally Listed and other Special Status Species

This appendix addresses species Federally Listed or proposed as threatened or endangered, and Bureau Sensitive species (collectively referred to as Special Status Species), and proposed or designated critical habitat. Since this EIS is programmatic, tiered to the PEIS, and all of its action alternatives are wholly consistent with the selected alternative in the Record of Decision for the PEIS, the Biological Assessment for the PEIS[1] is incorporated by reference in accordance with 50 CFR 402.12 (g). That statute says:

> If a proposed action requiring the preparation of a biological assessment is identical, or very similar, to a previous action for which a biological assessment was prepared, the Federal agency may fulfill the biological assessment requirement for the proposed action by incorporating by reference the earlier biological assessment, plus any supporting data from other documents that are pertinent to the consultation, into a written certification that:
>
> (1) The proposed action involves similar impacts to the same species in the same geographic area;
>
> (2) No new species have been listed or proposed or no new critical habitat designated or proposed for the action area; and
>
> (3) The biological assessment has been supplemented with any relevant changes in information.

This Appendix serves as that supplement. Updated information is provided for bull trout Critical Habitat, Pacific Eulachon, and greater sage grouse. Oregon-specific information about the effects of the alternatives is presented in Chapter 4.

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1 The PEIS is the Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement, June 2007. The Biological Assessment is available on the PEIS website at http://www.blm.gov/wo/st/en/prog/more/veg_eis.html

Summary of the Action Alternatives

The selected alternative in the Record of Decision for the PEIS and to which the PEIS Biological Opinion applied, would make 18 herbicides available to the BLM in the 17 western states for use in their vegetation management program. The action alternatives in the Oregon EIS are subsets of that alternative, using fewer herbicides and/or restricting their use to particular plants or management objectives as described below.

As with the PEIS, an estimate has been made of the acres to be sprayed with each herbicide (Table 3-3 in Chapter 3). This estimate is for analysis purposes, and the estimated acres are not part of the alternative descriptions themselves. The estimates are comparable to the estimates made for the PEIS.

An important overriding assumption of the Biological Assessment (BA) is that each site-specific action that could occur under the Proposed Action will be analyzed as required by NEPA and the Endangered Species Act, and that there will be compliance with all Federal laws during implementation of the project. Since this EIS is programmatic in nature, it does not authorize a specific commitment of resources. Therefore, any proposed site-specific activity will require a site-specific NEPA analysis and consultation, if necessary, between the local BLM field office and the Services.

The Action Alternatives

Alternative 3 would add 8 and 9 herbicides on the west and east side of the Cascades respectively, to the 4 herbicides already being used on BLM lands in Oregon for noxious weeds. They could be used on noxious weeds and other invasive plants, and on native plants as needed to control plant pests and diseases in State-identified control areas.

Alternative 4, the proposed action, would add 9 herbicides west of the Cascades, and 12 herbicides east of the Cascades, to the four already in use, and to expand their use from noxious weeds to all invasive plants, the control of pests and diseases, the control of native vegetation in rights-of-way, administrative sites, and recreation sites, and to improve wildlife habitat where specified in interagency Recovery/Delisting Plans or Conservation Strategies.

Alternative 5 would add 14 herbicides to the 4 already being used, and permit them to be used to achieve any management objective except livestock forage or timber production. Except for the inability to use herbicides for livestock forage or timber production, this alternative corresponds to the selected alternative from the PEIS.

The complete description of these alternatives, as well as the No Action Alternative (Alternative 2) and the Reference Analysis, which would cease the use of herbicides completely, is in Chapter 2.

Summary of Applicable Standard Operating Procedures and PEIS Mitigation Measures

Standard Operating Procedures were identified in the PEIS and adopted by the Record of Decision for the PEIS. They are included in this EIS, Appendix 2, with minor edits for clarity. Standard Operating Procedures reduce adverse effects to environmental and human resources from vegetation treatment activities, and are based on guidance in BLM manuals and handbooks, regulations, and standard agency and industry practices. The list is not all encompassing, but is designed to give an overview of practices that would be considered when designing and implementing a vegetation treatment project on public lands (PER:2-29). Effects described in the EIS are predicated on application of the Standard Operating Procedures or that a site-specific determination is made that their application is unnecessary to achieve their intended purpose or protection. As with the corresponding protective measures listed in the Biological Opinion, BLM field offices would tailor these national Standard Operating Procedures based on local conditions and the habitat needs of the particular threatened and endangered species that could be affected by the treatments (PEIS Biological Opinion [Record of Decision for the PEIS:Appendix C-22]).

Mitigation Measures were identified for all potential adverse effects identified in the PEIS, and they were adopted by the Record of Decision for the PEIS. They are included in this EIS with minor edits for clarity, in Appendix 2 with the Standard Operating Procedures. Like the Standard Operating Procedures, application of the mitigation measures is assumed in the analysis. However, for PEIS mitigation measures, site-specific analysis, the use of Individual Risk Assessment Tools, or the evolution of these measures into similar handbook direction is permitted to identify alternative ways to achieve the expected protections.

Consultation

For the PEIS, the BLM consulted with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) as required under Section 7 of the Endangered Species Act (PEIS:Chapter 5 and Appendix G). The BLM prepared a formal initiation package that included: 1) a description of the program, listed threatened and endangered species, species proposed for listing, and critical habitats that may be affected by the program; and, 2) a Biological Assessment for Vegetation Treatments on Bureau of Land Management Lands in 17 Western States (BA). That BA evaluated the likely impacts to listed species, species proposed for listing, and critical habitats from the proposed use of herbicides and other treatment methods in its vegetation treatment program, and also identified management practices to minimize impacts to these species and habitats.

The FWS issued a Letter of Concurrence on September 1, 2006, which concurred that the proposed action as described in the PEIS and Biological Assessment, with all PEIS Mitigation Measures and Standard Operating Procedures and the Biological Assessment's Conservation Measures, would not likely adversely affect any threatened or endangered species under the jurisdiction of the FWS. In addition, the FWS recognized that any future site-specific[2] actions carried out under the PEIS would undergo additional consultation as appropriate.

The Biological Opinion issued by the NMFS on June 26, 2007 concluded that the proposed action as described in the PEIS and Biological Assessment, in addition to Biological Assessment-identified Conservation Measures for Aquatic Species (referred to in the Biological Opinion as Protective Measures), was not likely to jeopardize the continued existence of endangered and threatened salmon and trout, threatened green sturgeon, and threatened southern resident killer whales. Since the PEIS does not authorize any site-specific actions, subsequent Section 7 review on proposed site-specific vegetation treatments will be required. There is no incidental take[3] identified or exempted by the Biological Opinion for the PEIS. If take is anticipated for site-specific treatments, then the amount or extent of take will be identified during consultation for those treatments.

Like the PEIS, this programmatic EIS does not authorize site-specific actions or amend RMPs. In addition, the three action alternatives in this EIS are subsets of the selected alternative in the PEIS. Therefore this EIS is incorporating the PEIS Biological Assessment by reference (50 CFR 402.12(g)). A discussion of the Federally Listed (and proposed) species in Oregon, proposed and designated critical habitat, and a list of the Bureau Sensitive species in Oregon are included in this appendix. Informal consultation with the FWS (50 CFR

2 Site, area, or project-specific level

3 "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

402.13), and formal consultation with NMFS (50 CFR 402.14), are expected to confirm and apply the PEIS consultation results to this EIS. Specific treatment projects that tier to this EIS will be subject to site–specific consultation as appropriate.

Biological Assessment Conservation Measures

The BLM will incorporate mitigation and conservation measures identified in the Ecological Risk Assessments and Biological Assessment, and from analysis of exposure levels based on modeling, to eliminate or reduce risks to Threatened, Endangered and Proposed species. It is possible that conservation measures would be less restrictive than those listed in subsequent sections of this appendix if local site conditions were evaluated using the Ecological Risk Assessments when developing project-level conservation measures. Conservation measures specifically listed in the Biological Assessment for the PEIS are included in this appendix for all of the species to which they apply.

Endangered and Threatened Species in Oregon

Birds

Endangered

California Brown Pelican
The primary reference for this section is: USFWS. No Date. Brown Pelican, (*Pelicanus occidentalis*). Available at: http://species.fws.gov.

The brown pelican (*Pelicanus occidentalis*), also called the American brown pelican or common pelican, inhabits the Atlantic, Pacific, and Gulf coasts of North and South America. On the Atlantic Coast, pelicans can be found from Virginia south to the mouth of the Amazon River in Brazil; on the Pacific, they range from central California to south-central Chile and the Galapagos Islands; and on the Gulf of Mexico, they are found in Alabama, Louisiana, and Texas. Brown pelicans are rarely seen either inland or far out at sea.

Pelicans are primarily fish eaters, and require up to 4 pounds of fish a day. Their diet consists mainly of "rough" fish, species considered unimportant commercially. Examples of rough fish species are menhaden, herring, sheepshead, pigfish, mullet, grass minnows, topminnows, and silversides. Brown pelicans have also been known to eat some crustaceans, usually prawns. Brown pelicans have extremely keen eyesight. As they fly over the ocean, sometimes at heights of 60 to 70 feet, they can spot a school of small fish, or even a single fish. Diving steeply into the water, they may submerge completely or only partly, depending on the height of the dive, and come up with a mouthful of fish. Air sacs beneath the pelican's skin cushion the impact and help it surface.

Pelicans are social and gregarious. Males and females, juveniles and adults, congregate in large flocks for much of the year. The only breeding area in the western U.S. is in Channel Islands National Park in California. Pelicans nest in large colonies on the ground, in bushes, or in the tops of trees. On the ground, a nest may be a shallow depression lined with a few feathers and a rim of soil built up 4 to 10 inches above ground, or it may be a large mound of soil and debris with a cavity in the top. A treetop nest is built of reeds, grass, and straw heaped on a mound of sticks interwoven with the supporting tree branches. In most of the pelican's U.S. nesting range, peak egg-laying occurs in March and April. Two or three chalky white eggs hatch in approximately 1 month. Like many birds, newly hatched pelicans are blind, featherless, and completely dependent upon their parents. Average age at first flight is 75 days.

The brown pelican was Federally Listed as endangered on June 2, 1970. Critical habitat has not been designated. On February 4, 1985, brown pelican populations on the Atlantic Coast of the U.S. (including all of Florida and Alabama), had recovered to the point that the species could be removed from the Endangered Species List in that part of its range. The U.S. Gulf Coast population, which is still considered endangered, was recently estimated at nearly 6,000 breeding pairs. The brown pelican is also endangered in the Pacific Coast portion of its range, and in Central and South America. The southern California population of brown pelicans today is estimated at 4,500 to 5,000 breeding pairs. Brown pelicans have few natural enemies. Although ground nests are sometimes destroyed by hurricanes, flooding, or other natural disasters, the biggest threat to pelican survival comes from human activities. Pelican populations have been heavily affected by past hunting to protect commercial fishery resources, as well as the use of DDT and other pesticides. Current threats to the species include human development along the coast, abandoned fishing lines and tackle, and potential future oil spills.

Conservation Measures for the California Brown Pelican

Although treatment activities are unlikely to negatively affect the brown pelican or its habitat, extra steps could be taken by the BLM to ensure that herbicide treatments conducted in brown pelican wintering habitat did not result in negative effects to the species:

- If feasible, conduct vegetation treatments in brown pelican wintering habitat outside the period when pelicans are likely to be present.
- If herbicide treatments in brown pelican habitats must be conducted during the wintering period:
- Do not use 2,4-D in pelican wintering habitat.
- Prior to conducting herbicide treatments on pelican wintering habitat, survey the area for pelicans. Wait for pelicans to leave the area before spraying.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in pelican wintering habitats.
- If broadcast spraying imazapyr or metsulfuron methyl in pelican wintering habitats, use the typical rather than the maximum application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in brown pelican wintering habitat, utilize the typical, rather than the maximum, application rate.

Threatened

Marbled Murrelet

The primary references for this section are: USFWS. 1992j. Determination of Threatened Status for the Washington, Oregon, and California Population of the Marbled Murrelet. Federal Register 57(191):45328-45337; and National Audubon Society. 2002a. Marbled murrelet (*Brachyramphus marmoratus*). Available at: http://audubon2.org/webapp/watchlist/. References cited in this section are internal to the above-referenced USFWS document. A complete list of these references is available from the USFWS Portland Field Office, Portland, Oregon.

The North American subspecies of marbled murrelet (*Brachyramphus marmoratus marmoratus*) is a small seabird found on the Pacific Coast of North America. Marbled murrelets are generally found in nearshore waters (within about 3 miles of shore) near their nesting sites. They nest in a narrow range along the Pacific, from the Aleutian Islands of Alaska south through British Columbia, Washington, and Oregon, to central California. The species generally occupies nesting areas on a year-round basis, although in certain places in Alaska and British Columbia, birds move to more protected waters during the winter. This species can also be found wintering south of its breeding range, along the coast of southern California to extreme northwestern Baja California. The states of California, Oregon, and Washington encompass roughly one-third of the geographic area occupied by this subspecies, comprising an important portion of its range. The amount of nesting habitat has undergone a tremendous decline since the late 1800s (most of which has taken place during the last 30 to 40 years), especially in the coastal areas of all three states. Therefore, the marbled murrelet is listed only in these three states, which together constitute a distinct population segment of the eastern Pacific subspecies.

Marbled murrelets feed primarily on fish and invertebrates in nearshore marine waters. During the summer, major food items include Pacific sand lance, northern anchovy, Pacific herring, and other small schooling fish, while during the winter, krill, amphipods, and herring are major prey items. Marbled murrelets usually forage alone, or in pairs, and are active in search of food both day and night. Although the majority of birds are found within or adjacent to the marine environment, there have been detections of marbled murrelets on rivers and inland lakes (Carter and Sealy 1986). Marbled murrelets spend the majority of their lives on the ocean, and come inland to nest, although they visit some inland stands during all months of the year. There are records of marbled murrelets up to 50 miles inland in Washington (Hamer and Cummins 1991), 35 miles inland in Oregon (Nelson 1990), 22 miles inland in northern California (Carter and Erickson 1988, Paton and Ralph 1990), and 11 miles inland in central California (Paton and Ralph 1990). However, the majority of detections were recorded closer to the coast. Marbled murrelets are semi-colonial in their nesting habits, and simultaneous detections of more than one bird are frequently made at inland sites. Nesting birds are often aggregated, with separate nests located close together.

Marbled murrelets do not reach sexual maturity until their second year, and adults have a variable reproductive rate (i.e., not all adults may nest every year). They produce one egg per nest, which the female lays on the limb of an old-growth conifer tree. Nesting occurs over an extended period from mid-April to late September (Carter and Sealy 1987). Incubation lasts about 30 days, and fledging takes another 28 days (Simons 1980; Hirsch et al. 1981). Both sexes incubate the egg in alternating 24-hour shifts (Simons 1980; Singer et al. 1991). Flights from ocean feeding areas to inland nest sites occur most often at dusk and dawn (Hamer and Cummins 1991). The adults feed the chick at least once per day, carrying one fish at a time (Carter and Sealy 1987; Hamer and Cummins 1991; Nelson 1992; Singer et al. 1992). Before leaving the nest, the young molt into a distinctive juvenile plumage. Fledglings appear to fly directly from the nest to the sea, rather than exploring the forest environment first (Hamer and Cummins 1991).

In California, Oregon, and Washington, marbled murrelets use older forest stands near the coastline for nesting. These forests are generally characterized by large trees (32 inches diameter at breast height or larger), a multi-storied stand, and a moderate to high canopy closure. In certain parts of the range, marbled murrelets are also known to use mature forests with an old-growth component. In order to provide suitable nest platforms, trees must have large branches or deformities (Binford et al. 1975; Carter and Sealy 1987; Hamer and Cummins 1990, 1991; Singer et al. 1991, 1992). Marbled murrelets tend to nest in the oldest trees in the stand. Observations of nests indicate that they tend to be located high above ground, usually with good overhead protection, in locations that allow easy access to the exterior of the forest. In Oregon and Washington, nests are located in stands dominated by Douglas-fir, and in California they are located in old-growth redwood stands.

In California, the species is restricted to old-growth redwood forests in Del Norte, Humboldt, San Mateo, and Santa Cruz Counties (Paton and Ralph 1988). In northwest Washington, marbled murrelets are mostly found at old-growth/mature sites (Hamer and Cummins 1990), and in Oregon, they occupy stands dominated by larger trees more often than those dominated by smaller trees (Nelson 1990). Large geographic gaps in offshore marbled murrelet numbers occur between central and northern California (a distance of 300 miles), and between Tillamook County, Oregon, and the Olympic Peninsula (a distance of about 120 miles), where nearly all older forest has been removed near the coast.

The marbled murrelet was Federally Listed as threatened in California, Oregon, and Washington on October 1, 1992. On May 24, 1996, 32 critical habitat units in Washington, Oregon, and California, encompassing approximately 3,887,800 acres of land, were designated for the species. Critical habitat areas focused on two primary constituent elements: individual trees with potential nesting platforms, and forested areas within 0.5 miles of these trees with a canopy height of at least one-half the site-potential tree height. The principal factor affecting the marbled murrelet in the three-state area, and the main cause of population decline has been the loss of older forests and associated nest sites. Older forests have declined throughout the range of the marbled murrelet as a result of commercial timber harvest, with additional losses from natural causes such as fire and wind throw. Most suitable nesting habitat on private lands within the range of the subspecies in Washington, Oregon, and California has been eliminated by timber harvest (Green 1985; Norse 1988; Thomas et al. 1990). Remaining tracts of potentially suitable habitat on private lands throughout the range are subject to continuing timber harvest operations. Mortality associated with oil spills and gill-net fisheries (in Washington) are lesser threats. It has been estimated that marbled murrelets are experiencing an annual population decline throughout their range as great as 4 to 7% per year. Surveys from Vancouver Island conducted 10 years apart suggest that populations there may have decreased by 40%. Populations in the northern Gulf of Alaska, meanwhile, may have declined by 50 to 73% over a 17- to 20-year period of time.

Western Snowy Plover

The primary reference for this section is: USFWS. 1993n. Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover. Federal Register 58(42):12864-12874. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Sacramento Field Office, Sacramento, California.

There are two distinct populations of western snowy plover (*Charadrius alexandrinus nivosus*), only one of which is a Federally Listed. The Pacific coast population of the western snowy plover, which is genetically isolated from interior-breeding western snowy plovers, is defined as those individuals that nest adjacent to or near tidal waters, including all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. It is the Pacific coast population that is addressed in this document.

In the U.S., three breeding areas currently exist in southern Washington, and nesting birds have been recorded in nine locations in Oregon (USFWS 2001). In California, eight geographic areas support over three-quarters of the breeding population in that state: San Francisco Bay, Monterey Bay, Morro Bay, the Callendar-Mussel Rock Dunes area, the Point Sal to Point Conception area, the Oxnard lowland, Santa Rosa Island, and San Nicolas Island (Page et al. 1991).

The coastal population of the western snowy plover consists of both resident and migratory birds. Some birds winter in the same areas used for breeding, while other birds migrate either north or south to wintering areas (Warriner et al. 1986), the majority of which are south of Bodega Bay, California. Pacific coast western snowy plovers breed primarily on coastal beaches from southern Washington to Mexico. It is estimated that, at most, about 2,000 snowy plovers breed along the U.S. Pacific Coast (Page et al. 1995). Nest sites occur in flat, open areas with sandy or saline substrates, usually in areas where vegetation and driftwood are sparse or absent (Widrig 1980; Wilson 1980; Stenzel et al. 1981). Nesting habitat is unstable and ephemeral as a result of unconsolidated soil characteristics influenced by high winds, storms, wave action, and colonization by plants. Other, less common nesting habitats include salt pans, coastal dredged spoil disposal sites, dry salt ponds, and salt pond levees. Sand spits, dune-backed beaches, unvegetated beach stands, open areas around estuaries, and beaches at river mouths are the preferred habitats for nesting (Wilson 1980; Stenzel et al. 1981). Snowy plovers forage on invertebrates in the wet sand and among surf-cast kelp within the intertidal zone; in dry, sandy areas above the high tide; on salt pans; at spoil sites; and along the edges of salt marshes and salt ponds.

Snowy plovers breed in loose colonies that range in size from 2 to 318 adults. Based on concentrations of breeding birds along the coast, it is believed that the center of the plovers' coastal distribution lies close to the southern boundary of California (Page and Stenzel 1981). The breeding season of coastal western snowy plovers extends from mid-March through mid-September. The majority of snowy plovers are site-faithful, returning to the same breeding site each year, and often nesting in exactly the same locations. Nest initiation and egg laying occurs from mid-March through mid-July (Wilson 1980; Warriner et al. 1986). Typically, the clutch size is three eggs, and incubation averages 27 days, with both sexes incubating the eggs (Warriner et al. 1986).

The Pacific coast population of the snowy plover was Federally Listed as threatened on March 5, 1993. On December 7, 1999, the USFWS designated 28 areas along the coast of California, Oregon, and Washington (totaling approximately 18,000 acres and 180 miles of coastline) as critical habitat for this population segment.

Declines in snowy plover populations have been attributed to poor reproductive success resulting from human disturbance, predation, and inclement weather, combined with habitat loss resulting from urban development and the encroachment of introduced European beachgrass. These factors continue to threaten existing coastal populations of this species.

Conservation Measures for the Western Snowy Plover

The following conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect TEP species. Survey for western snowy plovers, piping plovers, and interior least terns (and their nests) in suitable areas on proposed treatment areas, prior to developing treatment plans.

- Do not treat vegetation in nesting areas during the breeding season (as determined by a qualified biologist).
- Do not allow human (or domestic animal) disturbance within ¼ mile of nest sites during the nesting period.
- Ensure that nest sites are at least 1 mile from downwind smoke effects during the nesting period.
- Conduct beachgrass treatments during the plant's flowering stage, during periods of active growth.
- Closely follow all application instructions and use restrictions on herbicide labels; in wetland habitats use only those herbicides that are approved for use in wetlands.
- Do not use 2,4-D in western snowy plover, piping plover, or interior least tern habitats; do not broadcast spray 2,4-D within ¼ mile of western snowy plover, piping plover, or interior least tern habitat.
- Where feasible, avoid use of the following herbicides in western snowy plover and piping plover habitat: clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr; in interior least tern habitat avoid the use of clopyralid, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, diquat, diuron, glyphosate, hexazinone, picloram, or triclopyr in western snowy plover or piping plover habitat; do not broadcast spray these herbicides in areas adjacent to western snowy plover or piping plover habitat under conditions when spray drift onto the habitat is likely.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in interior least tern habitat; do not broadcast spray these herbicides in areas adjacent least tern habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying imazapyr or metsulfuron methyl in or adjacent to western snowy plover, piping plover, or interior least tern habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in western snowy plover, piping plover, or interior least tern habitat, utilize the typical, rather than the maximum, application rate.

Additional, project-specific conservation measures would be developed at the local level, as appropriate.

<u>Northern Spotted Owl</u>
The primary reference for this section is: USFWS. 1990g. Determination of Threatened Status for the Northern Spotted Owl. Federal Register 55(123):26114-26194. References cited in this section are internal to the above-referenced document. A complete list of references is available from the USFWS, Fish and Wildlife Enhancement, Portland, Oregon.

The northern spotted owl (*Strix occidentalis caurina*) is one of three subspecies of the spotted owl, a nocturnal bird of forest habitats. The current range of the northern spotted owl is from southwestern British Columbia, through western Washington, western Oregon, and northern California south to San Francisco Bay. Throughout this present range, individuals are not evenly distributed. The majority of individuals are found in the Cascade Mountains of Oregon and the Klamath Mountains in southwestern Oregon and northwestern California (USDA 1989; Gould 1989). Evidently, northern spotted owls reach their highest population densities and may have their best reproductive success in suitable habitat in this part of their range (USDI 1987, 1989; Franklin and Gutierrez 1988; Miller and Meslow 1988; Franklin et al. 1989; Robertson 1989).

The northern spotted owl is known from most of the major types of coniferous forests in the Pacific Northwest (Gould 1974, 1975, 1979; Forsman et al. 1977, 1984; Garcia 1979; Marcot and Gardetto 1980; Solis 1983; Sisco and Gutierrez 1984; Gutierrez et al. 1984; Forsman and Meslow 1985). In California, northern spotted owls most commonly use the Douglas-fir and mixed conifer forest types (Marcot and Gardetto 1980, Soils 1983, Gutierrez 1985). In Washington's coastal forests, the spotted owl is found in forests dominated by Douglas-fir and western hemlock. At higher elevations in western Washington, Pacific silver fir is commonly used by owls, whereas on the east side of the Cascades, Douglas-fir and grand fir are used (Postovit 1977). Extensive studies of spotted owls during the last 20 years have shown the species to be strongly associated with late-successional forests throughout much of its range.

Northern spotted owls have been observed over a wide range of elevations, although they seem to avoid higher elevation, subalpine forests (USDA 1986). The age of forests is not as important a factor in determining habitat suitability as are vegetational and structural components. Suitable owl habitat has moderate to high canopy closure (60 to 80%); a multi-layered, multi-species canopy dominated by large (> 30 inches diameter at breast height) overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, dwarf-mistletoe infections, and other evidence of decadence); numerous large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas et al. 1990). Usually, the features characteristic of owl habitat are most commonly associated with old-growth forests or mixed stands of old-growth and mature trees, which do not assimilate these attributes until 150 to 200 years of age.

Although a secretive and mostly nocturnal bird, the northern spotted owl is relatively unafraid of human beings (Bent 1938; Forsman et al. 1984; USDA 1986). The adult spotted owl maintains a territory year-round; however, individuals may shift their home ranges between the breeding and nonbreeding season. Northern spotted owls are perch-and-dive predators; over 50% of their prey items are arboreal or semi-arboreal species. They subsist on a variety of mammals, birds, reptiles, and insects, with small mammals (e.g., flying squirrels, red tree voles, and dusky-footed woodrats) making up the bulk of the food items throughout the range of the species (Solis and Gutierrez 1982; Forsman et al. 1984; Barrows 1985).

Monogamous and long-lived, northern spotted owls tend to mate for life. However, specific northern spotted owl pairs usually do not nest every year, nor are nesting pairs successful every year. Nesting behavior begins in February to March, with nesting occurring from March to June. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). The number of eggs in a clutch ranges from one to four, with two eggs being most common. Fledging occurs from mid-May to late June, with parental care continuing into September. Females are capable of breeding in their second year, but it is likely that most do not breed until their third year (Barrows 1985; Miller and Meslow 1985b; Franklin et al. 1986). Males do most of the foraging during incubation, and assist with foraging during the fledging period.

The northern spotted owl was Federally Listed as a threatened species on June 26, 1990. On January 15, 1992, critical habitat was designated for the subspecies in 190 areas, encompassing a total of nearly 6.9 million acres of land. Throughout its range, the northern spotted owl is threatened by the loss and modification of suitable habitat as a result of timber harvesting. These threats are exacerbated by risks of catastrophic events such as fire, volcanic eruption, and wind storms. The population of the northern spotted owl is estimated at approximately 3,800 pairs and 1,000 individuals (National Audubon Society 2002).

Conservation Measures for the Northern Spotted Owl

The following programmatic-level conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect the marbled murrelet, northern spotted owl, or Mexican spotted owl.

- Survey for marbled murrelets, northern spotted owls, and Mexican spotted owls (and their nests) on suitable proposed treatment areas, prior to developing treatment plans.
- Delineate a 100-acre buffer around nests prior to mechanical treatments or prescribed burns.
- Do not allow human disturbance within ¼ mile of nest sites during the nesting period (as determined by a local biologist).
- Ensure that nest sites are at least 1 mile from downwind smoke effects during the nesting period.
- Protect and retain the structural components of known or suspected nest sites during treatments; evaluate each nest site prior to treatment and protect it in the most appropriate manner.
- Maintain sufficient dead and down material during treatments to support spotted owl prey species (minimums would depend on forest types, and should be determined by a wildlife biologist).
- Do not conduct treatments that alter forest structure in old-growth stands.
- Do not use 2,4-D in marbled murrelet, northern spotted owl, or Mexican spotted owl habitats; do not broadcast spray 2,4-D within ¼ mile of marbled murrelet, northern spotted owl, or Mexican spotted owl habitat.
- Where feasible, avoid use of the following herbicides in northern spotted owl and Mexican spotted owl habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Where feasible, avoid use of the following herbicides in marbled murrelet habitat: clopyralid, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in marbled murrelet, northern spotted owl, or Mexican spotted owl habitat; do not broadcast spray these herbicides in areas adjacent to marbled murrelet, northern spotted owl, or Mexican spotted owl habitat under conditions when spray drift onto the habitat is likely.
- Do not broadcast spray diuron in Mexican or northern spotted owl habitat; do not broadcast spray these herbicides in areas adjacent to Mexican or northern spotted owl habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying imazapyr or metsulfuron methyl in or adjacent to marbled murrelet, northern spotted owl, or Mexican spotted owl habitat, apply at the typical, rather than the maximum, application rate.
- If broadcast spraying bromacil or diquat in or adjacent to Mexican or northern spotted owl habitat, apply at the typical, rather than the maximum, application rate.

- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in marbled murrelet, northern spotted owl, or Mexican spotted owl habitat, utilize the typical, rather than the maximum, application rate.
- Follow all instructions and Standard Operating Procedures to avoid spill and direct spray scenarios into aquatic habitats, particularly marine habitats where murrelets forage for prey.

Additional conservation measures would be developed, as necessary, at the project level to fine-tune protection of these species.

Other

Greater Sage Grouse

The primary references for this section are: Federal Register/Vol. 75, No. 55/Tuesday, March 23, 2010/13910-140014/ Proposed Rules, available at http://www.regulations.gov; Hagen, C. A. 2005. Greater sage-grouse conservation assessment and strategy for Oregon: a plan to maintain and enhance populations and habitat. Oregon Department of Fish and Wildlife, Salem, USA; and, Instruction Memo OR-2007-073, July 25, 2007, Sage-Grouse Guidelines.

On March 23, 2010 the Fish and Wildlife Service (Service) announced three 12-month findings on petitions to list three entities of the greater sage grouse (*Centrocerus urophasinus*) as threatened or endangered under the Endangered Species Act of 1973, as amended. The Service found that listing the greater sage grouse (rangewide) is warranted, but precluded by higher priority listing actions and will develop a proposed rule to list the greater sage-grouse as priorities allow (1). Therefore the greater sage-grouse remains a Bureau Sensitive species in Oregon and no ESA consultation is required. Oregon BLM districts will continue to implement the conservation guidance provided in *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon A Plan to Maintain and Enhance Populations and Habitat* as per Oregon Instruction Memo OR-2007-073.

Fish

Endangered

Modoc Sucker

The Modoc sucker (*Catostomus microps*) is known from only a few widely separated tributary systems to the upper Pit River in northeastern California—the Rush-Ash Creek system and the Washington-Turner-Hulbert system (Moyle 1976, Ford 1977). This species occurs primarily in sections of stream with low or intermittent flow, or pools of the meadowlands (Moyle and Mariochi 1975, Moyle 1976, Ford 1977). In general, sites where Modoc suckers have been found are characterized by the following: low flows (intermittent in some); largely shallow pools; muddy bottoms; partial shade trees, shrubs, boulders, or undercut banks; abundant cover from riparian vegetation and undercut banks; and moderately clear water (Moyle and Mariochi 1975). Water temperatures (summer and fall) in Modoc sucker habitat range from 46 F (fall) to 74 F (summer; Ford 1977). Modoc suckers are omnivorous, feeding on detritus, diatoms, filamentous algae, chironomid larvae, crustaceans, and aquatic insect larvae. Adult suckers usually remain on the bottom or close to it (Martin 1972).

Spawning usually occurs from mid-April to the last week in May or the first week in June (Boccone and Mills 1979). Spawning occurs over coarse fine gravel in the lower end of pools with abundant cover. Water temperatures range from 56 to 61 F. There is some evidence from Johnson and Washington Creeks of upstream migration by Modoc suckers to small intermittent tributaries, such as Higgins and Rice flats, during spawning season. Also, a possible spawning migration of Modoc suckers has been observed from Moon (Lake) Reservoir upstream into Cedar Creek.

The Modoc sucker was Federally Listed as endangered on June 11, 1985. Critical habitat has been designated in Modoc County, California. Designated habitat includes intermittent and permanent water and adjacent land areas that provide vegetation for cover and protection from soil erosion of all or portions of: Turner Creek, Hulbert Creek, Cedar Creek, Washington Creek, Coffee Mill Gulch, Johnson Creek, Higgins and Rice flats, and Rush Creek, Modoc County, California. The Modoc sucker is endangered because of its very restricted distribution combined with destruction of habitat. A major portion of the Rush Creek Modoc sucker habitat is on privately-owned land used for grazing sheep and cattle, which trample streambanks, thereby causing destruction of habitat through increased erosion of streambanks, removal of aquatic and riparian vegetation needed as cover, and siltation (Moyle 1976; Cooper et al. 1978; Mills 1980; Cooper 1983; Chesney 1985). Destruction of natural barriers to the Sacramento sucker by flooding areas for the creation of pastures, and by channelization, has resulted in losses through hybridization and backcrossing in several of the Modoc sucker streams (Ford 1977; Cooper et al. 1978; Mills 1980; Cooper 1983; Chesney 1985). Diversions of water for irrigation reduce the number and sizes of pools available to the Modoc suckers (Ford 1977). In addition, introductions of brown trout have added to the predation pressure on the Modoc sucker (Cooper et al. 1978; Mills 1980; Cooper 1983). Destruction of habitat by overgrazing and limited distribution of pure populations of the Modoc sucker still threaten the species (Ford 1977, Chesney 1985).

Lost River and Shortnose Suckers

The primary reference for this section is: USFWS. 1993l. Lost River (*Deltistes luxatus*) and Shortnose (*Chasmistes brevirostris*) Sucker Recovery Plan. Portland, Oregon. References cited in this section are internal to the above-referenced document. They are included in the Bibliography.

The Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostris*) are large, long-lived suckers endemic to the upper Klamath Basin of Oregon and California. Historical records indicate that the two species were once widespread and abundant within their range. The present distribution of the Lost River sucker includes Upper Klamath Lake and its tributaries, Clear Lake Reservoir and its tributaries, Tule Lake and the Lost River up to Anderson-Rose Dam, and the Klamath River downstream to Copco Reservoir (Beak Consultants Incorporated 1987; Buettner and Scoppettone 1990, 1991). The present distribution of the shortnose sucker includes Upper Klamath Lake and its tributaries, Klamath River downstream to Iron Gate Reservoir, Clear Lake Reservoir and its tributaries, Gerber Reservoir and its tributaries, the Lost River, and Tule Lake.

Lost River and shortnose suckers are omnivores that feed primarily on zooplankton and insects. Both species generally spawn in rivers or streams and then return to the lake (Buettner and Scoppettone 1990). However, both species have separate populations that spawn near springs in upper Klamath Lake (Klamath Tribe 1993). Larval suckers usually spend relatively little time in tributary streams before they migrate back to the lake. Migration from spawning sites can begin in May or June. During the day, larvae typically move to shallow (depths of less than 20 inches) shoreline areas in the river, over substrates of sand, mud, and concrete (Buettner and Scoppettone 1990). Larvae are generally found in close proximity to rooted aquatic vegetation, and appear to avoid areas devoid of vegetation (Coleman and McGie 1988). It is believed that the suckers once used the extensive marsh system of the lower river as nursery habitat. Much of this habitat has been replaced by gently sloping, sandy, unvegetated shorelines. Adult Lost River and shortnose suckers usually spend relatively little time in tributary streams and migrate back to the lake after spawning. Adults appear to prefer areas with relatively low densities of algae and good water quality in terms of pH and dissolved oxygen, such as areas of the lake near inflows from streams or springs.

The Lost River and shortnose sucker were Federally Listed as endangered on July 18, 1988. The designation of critical habitat for both species was proposed in 1994, but has not occurred. The limited distribution of both sucker species, combined with the level of agricultural development and associated water and land use threats within the drainage, make these fishes susceptible to past and present habitat loss and degradation throughout their distribution. Cumulative impacts of land management on public and private lands has led to the endangered status of the Lost River sucker and shortnose sucker, and continues to hinder their recovery. Inputs of sediment and nutrients, and changes in timing and duration of stream flow as a result of road building have altered lake habitats. Habitat has also been lost through construction of dams, diversion of water from streams, reclamation of wetlands, and other changes.

Borax Lake Chub

The permanent habitat of the Borax Lake chub (*Gila boraxobius*) is a 10.2-acre thermal lake located in the Borax Lake Basin of Oregon. This lake, which is shallow and fed by hot and cool springs, is perched about 30 feet above the desert floor in a "pedestal" of deposited salts. The saline lake bottom is inhospitable to rooted plants, although some of the precipitated minerals are finely divided and silt-like. Irrigation channels have been dug from the lake to supply water for hay fields, and the chub may also be found in these channels. The chub is found in Lower Borax Lake, an artificial pond, when it has water in it. This habitat is highly alkaline, with murky water and little vegetation. If enough overflow water is received, marshes and temporary pools may also provide habitat for the chub. All of the Borax Lake chub's known habitats in southeastern Oregon comprise approximately 640 acres.

The Borax Lake chub is an opportunistic omnivore (Hudson et al. 2000). Spawning can occur year-round, but primarily occurs in the spring. Substantial spawning activity and larval chubs have been observed during autumn, following the cessation of unusually hot spring inflows during the preceding months.

The Borax Lake chub was Federally Listed as endangered on October 5, 1982. Critical habitat has been designated in Harney County, Oregon, and includes all 640 acres of habitat in Township 37 South, Range 33 East, including Borax Lake, marsh areas to the south and southwest, Lower Borax Lake, and hot springs north of Borax Lake. Because the lake depends upon several subterranean springs for its water supply, lowering the rim of the lake or tapping and diverting the springs could have severe effects upon the species. Borax Lake is in a known geothermal resource area, and both diversion and geothermal exploration appear to constitute a threat to the species.

Steelhead

Along the west coast, steelhead trout (*Oncorhynchus mykiss*) are distributed across about 15 degrees of latitude from the U.S. Canada border south to the mouth of Malibu Creek, California. In some years, steelhead may be found as far south as the Santa Margarita River in San Diego County. There are 10 listed steelhead ESUs, 8 of which are found in the project area: Central California Coast, Upper Columbia River, Snake River Basin, Lower Columbia River, California Central Valley, Upper Willamette, Middle Columbia River, and Northern California.

Steelhead have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations. Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of activity. In any given river basin there may be one or more peaks of migration activity; some rivers may have multiple runs, and fish are divided into either winter, spring, summer, or fall run steelhead. North American steelhead commonly spend 2 years in the ocean before entering fresh water to spawn. Summer steelhead enter fresh water up to a year prior to spawning. Steelhead may spawn more than once. In some cases, the separation between anadromous steelhead and rainbow or redband trout is obscured.

Upper Columbia River

The Upper Columbia River ESU was Federally Listed as endangered on August 18, 1997. This ESU occurs in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border. Wells Hatchery stock steelhead are also part of the listed ESU. NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 1,262 stream miles and 7 square miles of lake habitat has been designated as critical habitat. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 9,545 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon—Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco; and Washington—Benton, Chelan, Clark, Cowlitz, Douglas, Franklin, Gilliam, Grant, Kittitas, Klickitat, Okanogan, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. Critical habitat is found in the following counties: Oregon—Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Umatilla, and Wasco; and Washington—Adams, Benton, Chelan, Clark, Cowlitz, Douglas, Franklin, Grant, Kittitas, Klickitat, Okanogan, Skamania, Wahkiakum, Walla Walla, and Yakima. BLM-administered lands are found in all counties with critical habitat except Wahkiakum.

<u>Snake River</u>

The Snake River ESU of steelhead was Federally Listed as threatened on August 18, 1997. This ESU occurs in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 8,049 stream miles and 4 square miles of lake habitat has been designated as critical habitat. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 29,282 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Idaho—Adams, Blaine, Boise, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, and Valley; Oregon—Baker, Clatsop, Columbia, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, and Wasco; and Washington—Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Gilliam, Klickitat, Skamania, Wahkiakum, Walla Walla, and Whitman. Critical habitat is found in the following counties: Idaho—Adams, Blaine, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, and Valley; Oregon—Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, and Wasco; and Washington—Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Skamania, Wahkiakum, Walla Walla, and Whitman. BLM-administered lands are found in all counties with critical habitat except Wahkiakum.

<u>Lower Columbia River</u>

The Lower Columbia River ESU was Federally Listed as threatened on March 19, 1988. This ESU occurs in streams and tributaries to the Columbia River between the Cowlitz and Wind rivers, Washington (inclusive) and the Willamette and Hood rivers, Oregon (inclusive). Excluded are steelhead in the upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon rivers in Washington. NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 2,324 stream miles and 27 square miles of lake habitat has been designated as critical habitat. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 5,017 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon—Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, and Washington; and Washington—Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum. Critical habitat is found in the following counties: Oregon—Clackamas, Clatsop, Columbia, Hood River, Marion, and Multnomah; and Washington—Clark, Cowlitz, Klickitat, Lewis, Skamania, and Wahkiakum. BLM-administered lands are found in all counties with critical habitat except Wahkiakum.

<u>Upper Willamette</u>

The Upper Willamette ESU of steelhead was Federally Listed as threatened on March 25, 1999. This ESU includes all naturally-spawned populations of winter-run steelhead in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River, inclusive. NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 1,276 stream miles and 2 square miles of lake habitat has been designated as critical habitat. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,872 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon—Benton, Clackamas, Clatsop, Columbia, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; and Washington—Clark, Cowlitz, Pacific, and Wahkiakum. Critical habitat is found in the following counties: Oregon—Benton, Clackamas, Clatsop, Columbia, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; and Washington—Clark, Cowlitz, and Wahkiakum. BLM-administered lands are found in all counties with critical habitat except Wahkiakum.

Middle Columbia River

The Middle Columbia River ESU was Federally Listed as threatened on March 25, 1999. This ESU occurs in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington. Excluded are steelhead from the Snake River Basin. NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 5,815 stream miles has been designated as critical habitat. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 26,739 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon—Clatsop, Columbia, Crook, Gilliam, Grant, Harney, Hood River, Jefferson, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco, and Wheeler; and Washington—Benton, Clark, Columbia, Cowlitz, Franklin, Kittitas, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. Critical habitat is found in the following counties: Oregon—Clatsop, Columbia, Crook, Gilliam, Grant, Hood River, Jefferson, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco, and Wheeler; and Washington—Benton, Clark, Columbia, Cowlitz, Franklin, Kittitas, Klickitat, Skamania, Wahkiakum, Walla Walla, and Yakima. BLM-administered lands are found in all counties with critical habitat except Wahkiakum.

Chinook Salmon

Chinook salmon (*Oncorhynchus tshawtscha*) are found from the Bering Strait south to Southern California. Historically, they ranged as far south as the Ventura River in California. There are 17 ESUs of chinook salmon along the west coast of the United States, which range from southern California to the Canadian border and east to the Rocky Mountains. In the project area, there are eight listed ESUs: Sacramento Winter-run; Snake River Fall-run; Snake River Spring/Summer-run; Lower Columbia River; Upper Willamette River; Upper Columbia River Spring-run; Central Valley Spring-run; and California Coastal.

Chinook salmon are the largest of any salmon, with adults often exceeding 40 pounds. Like coho salmon, they are anadromous and spawn only once before dying. Chinook salmon stocks exhibit considerable variability in size and age of maturation, at least some of which is genetically determined. The relationship between size and length of migration may also reflect the earlier timing of river entry and the cessation of feeding for salmon stocks that migrate to the upper reaches of river systems. Body size, which is correlated with age, may be an important factor in migration and the successful construction of redds (spawning beds).

There are different seasonal runs of chinook salmon, which correspond to the timing of migration from ocean to freshwater. These runs have been identified on the basis of when adults enter freshwater to begin their spawning migration. However, distinct runs also differ in the degree of maturation at the time of river entry, the thermal regime and flow characteristics of their spawning site, and their actual time of spawning.

Adult female chinook prepare spawning beds in stream areas with suitable gravel composition, water depth, and velocity. The female then lays eggs, which she guards for a brief period before dying. Eggs hatch between 90 and

150 days after deposition, depending on water temperatures. The following spring, young salmon fry emerge, and may spend from 3 months to 2 years in freshwater before migrating to estuarine areas as smolts, and then into the ocean to feed and mature. Chinook salmon remain at sea for 1 to 6 years, with the exception of a small number of yearling males that mature in freshwater, or return after 2 to 3 months in salt water.

There are two distinct races of chinook salmon: stream-type and ocean-type. Stream-type chinook have a longer freshwater residency and perform extensive offshore migrations before returning to their natal streams in the spring and summer months. Ocean-type chinook, which are commonly found in coastal streams, typically migrate to sea within the first 3 months of emergence, but may spend up to a year in fresh water prior to emigration. They also spend their ocean life in coastal waters, utilizing estuaries and coastal areas more extensively for juvenile rearing.

Snake River Fall Run

The Snake River Fall-run ESU was Federally Listed as a threatened species on April 22, 1992. This ESU includes all natural populations occurring in the mainstem Snake River and any of the following subbasins: Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River.

Critical habitat (designated on December 28, 1993) includes all river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams) in the Columbia River, from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side). Critical habitat also includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake rivers. On the Snake River, all reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam are included. Also included are the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; and the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,679 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho—Adams, Benewah, Clearwater, Idaho, Latah, Lewis, Nez Perce, and Shoshone Valley; Oregon—Baker, Union, and Wallowa; and Washington—Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman. Counties with critical habitat are: Idaho—Adams, Clearwater, Idaho, Latah, Lemhi, Lewis, and Nez Perce; Oregon—Baker, Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, Wallowa, and Wasco; and Washington—Adams, Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Lincoln, Pacific, Skamania, Spokane, Wahkiakum, Walla Walla, and Whitman. BLM-administered lands are found in all counties with critical habitat except Wahkiakum County.

Snake River Spring/Summer Run

The Snake River Spring/Summer-run ESU was Federally Listed as a threatened species on April 22, 1992. Included in this ESU are all natural populations occurring in the mainstem Snake River and in the subbasins of the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River.

Critical habitat (designated on December 28, 1993) is similar to that for the Snake Fall-run ESU, except that stretches of the Palouse River, Clearwater River, and the North Fork Clearwater are not included. There are a total of 22,390 square miles of major river basins containing spawning and rearing habitat for this ESU in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho—Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and Valley; Oregon—Baker, Umatilla, Union, and Wallowa; and Washington—Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman. Counties with critical habitat are: Idaho—Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and

Valley; Oregon—Baker, Clatsop, Columbia, Gillium, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, and Wasco; and Washington—Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, and Whitman. BLM-administered lands are found in all counties with critical habitat except Wahkiakum County.

Lower Columbia River

The Lower Columbia River ESU was Federally Listed as threatened on March 24, 1999. Included in this ESU are all naturally-spawned populations occurring in the Columbia River and its tributaries, from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River This ESU also includes populations in the Willamette River to Willamette Falls, Oregon, exclusive of spring-run chinook salmon in the Clackamas River.

On August 15, 2005, NMFS filed the final critical habitat designation for this species in Clackamas, Clatsop, Columbia, Hood River, Multnomah, Wasco counties in Oregon; and Clark, Cowlitz, Klickitat, Lewis, Pacific, Pierce, Skamania, Wahkiakum, and Yakima counties in Washington. Major river basins that contain spawning and rearing habitat for this ESU comprise approximately 6,338 square miles in Oregon and Washington. There are approximately 1,311 stream miles and 33 square miles of lake habitat within this ESU that is designated as critical habitat. The following counties lie partially or wholly within these basins, or contain migration habitat for the ESU: Oregon—Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco, and Washington; and Washington—Clark, Cowlitz, Klickitat, Lewis, Pacific, Pierce, Skamania, Wahkiakum, and Yakima. Critical habitat is found in the following counties: Oregon—Clackamas, Clatsop, Columbia, Hood River, and Multnomah; and Washington—Clark, Cowlitz, Klickitat, Lewis, Pacific, Skamania, and Wahkiakum. BLM-administered lands are found in all counties with critical habitat except Pierce and Wahkiakum counties.

Upper Willamette River

The Upper Willamette River chinook salmon ESU was Federally Listed as threatened on March 24, 1999. This ESU includes all naturally-spawned populations occurring in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon.

NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 1,472 stream miles and 18 square mile of lake habitat has been designated as critical habitat in this ESU. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 8,575 square miles. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon—Benton, Clackamas, Clatsop, Columbia, Douglas, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; and Washington—Clark, Cowlitz, Pacific, and Wahkiakum. Critical habitat has been designated in the following counties: Oregon—Benton, Clackamas, Clatsop, Columbia, Lane, Linn, Marion, Multnomah, Polk, and Yamhill; and Washington—Clark, Cowlitz, and Wahkiakum. BLM-administered lands are found in all counties with critical habitat except Wahkiakum County.

Upper Columbia River Spring Run

The Upper Columbia River Spring-run ESU was Federally Listed as threatened on March 24, 1999. Included in this ESU are all naturally-spawned populations occurring in all accessible river reaches in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Chinook salmon (and their progeny) from the following hatchery stocks are considered part of the listed ESU: Chiwawa River (spring run); Methow River (spring run); Twisp River (spring run); Chewuch River (spring run); White River (spring run); and Nason Creek (spring run).

NMFS filed final critical habitat designation for this species on August 15, 2005. Approximately 974 stream miles and 4 square miles of lake habitat has been designated as critical habitat in this ESU. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 7,003 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration corridors for the species): Oregon—Clatsop, Columbia, Hood River, Gilliam, Morrow, Multnomah, Sherman, Umatilla, and Wasco; and Washington—Benton, Chelan, Clark, Cowlitiz, Douglas, Franklin, Grant, Klickitat, Kittitas, Okanogan, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. Critical habitat for this ESU is found in the following counties: Oregon—Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco; and Washington—Benton, Chelan, Clark, Cowlitiz, Douglas, Franklin, Grant, Kittitas, Klickitat, Okanogan, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. BLM-administered lands are found in all counties with critical habitat except Wahkiakum County.

Threatened

Warner Sucker

The primary reference for this section is: USFWS. 1998l. Recovery Plan for the Native Fishes of the Warner Basin and Alkali Subbasin. Portland, Oregon. References cited in this section are internal to the above-referenced document. They are included in the Bibliography.

The Warner sucker (*Catostomus warnerensis*) is endemic to the Warner Basin of southeastern Oregon. The probable historic range of this species includes the main Warner Lakes (Pelican, Crump, and Hart), and other accessible standing or flowing water in the Warner Valley, as well as the low-to-moderate gradient reaches of the tributaries that drain into the valley. Studies conducted between 1977 and 1991 indicate that when adequate water is present, Warner suckers may inhabit all the lakes, sloughs, and potholes in the Warner Valley. Stream resident populations are found in Honey Creek, Snyder Creek, Twentymile Creek, and Twelvemile Creek.

There are two phenotypic variations, or morphs of the Warner sucker, which correspond to the two generally continuous aquatic habitat types provided by the Warner Basin. Stream morphs occur in the temporally stable stream environments, and lake morphs occur in the temporally less stable lake environments. Individual fish can opportunistically change from one morph to another based on the types of habitat that are available. The exact nature of the relationship between lake and stream morphs is not well studied, and remains poorly understood.

The feeding habitats of the Warner sucker depend to a large degree on habitat and life history stage, with adult suckers becoming more generalized than juveniles and young-of-year. Larvae have terminal mouths and short digestive tracts, enabling them to feed selectively in midwater or at the surface. Invertebrates, particularly planktonic crustaceans, make up most of their diet. As the suckers grow, they develop subterminal mouths and longer digestive tracts, and gradually become benthic feeders, eating diatoms, filamentous algae, and detritus. Adult stream morph suckers forage nocturnally over a wide variety of substrates, such as boulders, gravel, and silt. Adult lake morph suckers are thought to have a similar diet, though they feed over predominantly muddy substrates (Tait and Mulkey 1993a, b).

Spawning usually occurs in April and May in streams, although variations in water temperature and stream flows may result in either earlier or later spawning. Temperature and flow cues appear to trigger spawning, with most taking place at 57 to 68 °F when stream flows are relatively high. Suckers spawn in sand or gravel beds in slow pools (White et al. 1990, 1991; Kennedy and North 1993). In years when access to stream spawning areas is limited by low flow or by physical in-stream blockages, suckers may attempt to spawn on gravel beds along the lake shorelines.

Larvae are found in shallow backwater pools or on stream margins where there is no current, often among or near macrophytes. Young-of-year are often found over still, deep water from midwater to the surface, but also move into faster flowing water near the heads of pools (Coombs et al. 1979). Juveniles (1 to 2 years old) are usually found at the bottom of deep pools or in other habitats that are relatively cool or permanent, such as near springs. In general, adults use stretches of streams where the gradient is sufficiently low to allow the formation of long (167 feet or longer) pools. These pools tend to have undercut banks, large beds of aquatic macrophytes, root wads or boulders, a surface to bottom temperature differential of at least 36 °F, a maximum depth greater than 5 feet, and overhanging vegetation.

The Warner sucker was Federally Listed as threatened on September 27, 1985, with critical habitat designated at the time of listing. Critical habitat for this species includes the following areas: 1) Twentymile Creek from the confluence of Twelvemile and Twentymile Creeks upstream for about 4 miles; 2) Twentymile Creek starting about 9 miles upstream of the confluence of Twelvemile and Twentymile Creeks and extending downstream for about 18 miles; 3) Spillway Canal north of Hart Lake and continuing about 2 miles downstream; 4) Snyder Creek from the confluence of Snyder and Honey Creeks upstream for about 3 miles; and 5) Honey Creek from the confluence of Hart Lake upstream 16 miles.

The Warner sucker is threatened by human-induced stream channel and watershed degradation; irrigation diversion practices that block its spawning migration routes and reduce stream flows below the points of diversion; and predation by and competition with non-native game fish such as crappie, bullhead catfish, and bass that were previously stocked in Warner Basin lakes.

Hutton Tui Chub

The following information, taken from Moyle (1976), refers to tui chubs in general. Tui chubs occur in a wide variety of habitats, most commonly in the weedy shallows of lakes and quiet waters in sluggish rivers. They do well in a wide variety of water conditions from warm to cold, and clear to eutrophic. In the fall, they seek out deeper water and may spend winters in a semi-dormant state on the bottom of lakes. Tui chubs are opportunistic omnivores concentrating on invertebrates associated with bottom or aquatic plants (i.e., clams, insect larvae, insects, crayfish), as well as algae and plant material.

Tui chub usually spawn from late April to late June; eggs adhere to plants or the bottom and hatch in 9 days. In large deep lakes, they tend to form large schools in shallow water frequently associated with beds of aquatic vegetation. In shallow lakes, with heavy aquatic growth, schooling is less noticeable. Tui chubs tend to disperse amongst the vegetation, presumably as protection from predators. They also appear to be able to adapt to the severe long- and short-term climatic fluctuations characteristic of the interior basins where they are most common. The minnow family in general has been successful because they have a well-developed sense of hearing, release a fear scent when injured (a warning signal to others), have a broad diet, and exhibit high fecundity. Despite these advantages, many native minnows are declining in numbers as their environment deteriorates beyond their ability to cope with the changes or they are displaced by more aggressive introduced species.

The Hutton tui chub (*Gila bicolor* ssp.) is endemic to Hutton Spring and a nearby unnamed spring in Lake County, south-central Oregon (NatureServe Explorer 2001). These springs are located in a grassy rangeland bordered to the north and west by shrubby rangeland and to the east and south by the lake bed of pluvial Alkali Lake.

The Hutton tui chub was Federally Listed as threatened on March 28, 1985. Critical habitat has not been designated. The current isolation of the Hutton tui chub was caused by the desiccation of pluvial Alkali Lake (Snyder 1908a, Hubbs and Miller 1942). Present status is in part a result of past access by cattle to the springs in which the Hutton tui chub occurs (Franzreb 1985). Threats include pumping of water from the springs, which occurred in the past but is no longer occurring (Bond 1974, Franzreb 1985), and contamination of groundwater by dispersal of chemicals from a nearby herbicide-manufacturing residue disposal site (Franzreb 1985). Modification of the springs by heavy equipment (causing siltation, erosion, vegetation cover loss, water diversion and drawdown) has also had detrimental effects on the chub population.

Lahontan Cutthroat Trout

The primary reference for this section is: Hudson, B., J. Augsburger, M. Hillis, and P. Boehne. 2000. Draft Biological Assessment for the Interior Columbia River Basin Ecosystem Management Project Final Environmental Impact Statement. USDI BLM and USDA Forest Service. Boise, Idaho. References cited in this section are internal to the above-referenced document. Full citations have been included in the Bibliography.

The Lahontan cutthroat trout (*Oncorhyncus clarki henshawi*) in the only trout native to the Lahontan subbasin of the American Great Basin, west-central Nevada. Historically, the subspecies was found in the Carson, Humboldt, Truckee, and Walker rivers, and in their tributary lakes and streams. Since the late 19th century, fluvial (stream) and lacustrine (lake) populations of the Lahontan cutthroat trout have been reduced to approximately 10.7% and 0.4% of their original habitat, respectively.

Lahontan cutthroat trout occupy a great variety of habitats, from large rivers and lakes to small tributary streams. They are unusually tolerant of both high temperatures (> 81 °F) and large daily fluctuations in temperature (up to 68 °F). In addition, they are tolerant of high alkalinity (>3,000 ppm) and dissolved solids (>10,000 ppm). However, they are intolerant of competition or predation by non-native salmonids (LaRivers 1962, Trotter 1987, Behnke 1992).

Lahontan cutthroat trout are obligate but opportunistic stream spawners. Typically, they spawn from April through July, depending on water temperature and flow characteristics, though autumn spawning runs have also been reported for some populations. Fish may spawn more than once, although post-spawning mortality rates of 60 to 90% have been reported. Lake residents migrate into streams to spawn, typically on well-washed gravels in riffles. Adults court, pair, and deposit and fertilize eggs in a spawning bed dug by the female, which may then be defended for some period of time.

The Lahontan cutthroat trout was Federally Listed as threatened on July 16, 1975. Critical habitat has not been designated. The observed major decline in this species has been attributed to habitat loss, introgression with introduced rainbow trout, and competition with other introduced species of trout, such as brown and brook trout. Habitat loss and the negative impacts of non-native fishes continue to be the primary threats to the Lahontan cutthroat trout (Coffin and Cowan 1995, Gerstrung 1998).

Coho Salmon

Historically, coho salmon (*Oncorhyncus kisutch*) were distributed throughout the North Pacific Ocean, from Central California to Point Hope, Alaska, through the Aleutian Islands, and from the Anadyr River, Russia south to Hokkaido, Japan. The species probably once inhabited most coastal streams in Washington, Oregon, and northern California. Some populations, now considered extinct, are believed to have migrated hundreds of miles inland to spawn in tributaries of the upper Columbia River in Washington and the Snake River in Idaho. There are six distinct ESUs of coho salmon along the West Coast of the United States, three of which are listed and occur in the project area: Central California, Southern Oregon/Northern California Coast, and Oregon Coast.

Coho salmon are anadromous; adults migrate from a marine environment into the freshwater streams and rivers of the birth. The species spawns only once, and then dies. Coho spend approximately the first half of their life cycle rearing in streams and small freshwater tributaries. The remainder of their life cycle is spent foraging in estuarine and marine waters of the Pacific Ocean, prior to returning to their stream of origin to spawn and die. Most fish return to spawn at 3 years old, although some precocious males may do so at 2 years of age.

Southern Oregon/Northern California Coasts

The Southern Oregon/Northern California Coasts ESU was Federally Listed as threatened on May 6, 1997. This ESU includes all naturally spawned populations occurring in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California. Critical habitat (designated on May 5, 1999) includes all accessible reaches within this range, with the exception of areas above specific dams or above longstanding, naturally impassable barriers. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 18,090 square miles in California and Oregon. Counties that lie partially or wholly within watersheds inhabited by this ESU include Del Norte, Glenn, Humboldt, Lake, Mendocino, Siskiyou, and Trinity counties in California, and Coos, Curry, Douglas, Jackson, Josephine, and Klamath counties in Oregon. Counties with critical habitat are Del Norte, Glenn, Humboldt, Lake, Mendocino, Siskiyou, and Trinity counties in California, and Curry, Douglas, Jackson, Josephine, and Klamath counties in Oregon; BLM-administered lands are also found in these counties.

Lower Columbia River

The Lower Columbia River ESU was Federally Listed as threatened on June 28, 2005. This ESU includes all naturally spawned populations occurring in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia River up to and including the Big White Salmon and Hood Rivers. This ESU also includes the Willamette River to Willamette Falls, Oregon, as well as 25 artificial propagation programs. Critical habitat for this ESU is currently under development, and has not yet been proposed for designation.

Foskett Speckled Dace

The Foskett speckled dace (*Rhinichthys osculus* ssp.) is endemic to Foskett Spring in south-central Oregon, a small spring system in the Coleman Basin on the west side of Warner Valley. Habitat is a small springhole and overflow rivulets that occur in what appears to be mixed rangeland at the edge of an alkali playa. The wet areas at the spring, along the course of the rivulets, and at the sump on the edge of the playa supports grasses and some aquatic vegetation, including cattails. The main population is in the springhole, which is about 6 feet in diameter and mostly 6 to 12 inches deep. Individuals also live in tiny outflow rivulets that are at times only a few inches wide and deep. Some are found in cattle tracks into which water seeps continuously (Bond 1974). Cover utilized includes overhanging bank edges, grass, exposed grass roots, and filamentous algae. Water in the spring is clear, and the current is slow. The bottom is primarily mud. The dace has also been introduced into Dace Spring, an excavated area at a spring source located on public land about 1 mile south of Foskett Spring. This artificial habitat is muddy and well-vegetated (Armantrout 1985). Although individuals have been collected from shallow water habitats associated with filamentous algae, exposed grass roots, and emergent aquatic vegetation, this habitat is not believed to be optimal. Based on conditions under which other speckled dace live, it is likely that deeper water with moderate vegetative cover would be better habitat.

The Foskett speckled dace appears to feed primarily on invertebrates. Extensive migration is not known, but larval and early juvenile dace have been observed only in the marsh at the edge of the lake bed (Hayes 1980), so there is either a migration of adults downstream to spawn, or a migration of the hatched larvae from the spring hole or rivulets to the marsh (a distance of about 6 to 12 feet). Reproduction apparently occurs in the second year of age, and spawning is believed to occur between late May and early July (Hayes 1980).

The Foskett speckled dace was Federally Listed as threatened on March 28, 1985. Critical habitat has not been designated. The subspecies apparently became isolated in Foskett Spring about 9,000 to 10,000 years ago, when Lake Warner went dry (Hubbs and Miller 1948a). Its main natural habitat has been overrun by vegetation or heavily trampled by cattle. Future perceived threats are essentially the same as the past reasons for decline, although the dace population seems to have stabilized to a point compatible with present use of the area by cattle. A spring to which the dace was transplanted by the BLM is fenced to exclude cattle (Armantrout and Bond 1981), and the main threat at this site is the encroachment of vegetation (cattails and possible rushes), and the resulting decrease in dissolved oxygen. Pumping of groundwater or channelization (via heavy equipment, such as a backhoe) at either site could impact the habitat as well (USFWS 1985i). Both springs that contain the dace are in a known geothermal area, so there is also a potential future threat of energy development.

Bull Trout

The primary references for this section are: USFWS. 1999h. Determination of Threatened Status for Bull Trout in the Coterminous United States Final Rule. Federal Register 64(210):58909-58933; Federal Register/Vol. 75, No. 9/Thursday, January 14, 2010/2270-2431/Proposed Rules; and, USFWS Biological Opinion and Letter of Concurrence USDA Forest Service, USDI Bureau of Land Management and the Coquille Indian Tribe for Programmatic Aquatic Habitat Restoration Activities in Oregon and Washington That Affect ESA-listed Fish, Wildlife, and Plant Species and their Critical Habitats, June 14, 2007. References cited in this section are internal to these documents.

Bull trout (*Salvelinus confluentus*) are native to the Pacific Northwest and western Canada. They historically occurred in major river drainages in the Pacific Northwest, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada, north to the headwaters of the Yukon River in Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, the range of the bull trout includes the Puget Sound, and various coastal rivers of Washington, British Columbia, Canada, and southeast Alaska (Bond 1992, Leary and Allendorf 1997). Bull trout are relatively dispersed throughout tributaries of the Columbia River Basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River Basin of south-central Oregon. East of the Continental Divide, they are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, Brewin and Brewin 1997).

Bull trout exhibit both resident and migratory life-history strategies through much of their current range (Rieman and McIntyre 1993). Resident bull trout complete their life cycles in the tributary streams in which they spawn and rear. Migratory bull trout spawn in tributary streams, and juvenile fish rear from 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, saltwater (anadromous), to mature (Fraley and Shepard 1989, Goetz 1989). Anadromy is the least studied life-history stage in bull trout, and some biologists believe the existence of true anadromy in bull trout is still uncertain (McPhail and Baxter 1996). Resident and migratory forms may be found together, and bull trout may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993).

Compared to other salmonids, bull trout have more specific habitat requirements (Rieman and McIntyre 1993) that appear to influence their distribution and abundance. Critical parameters include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (Oliver 1979; Pratt 1984, 1992; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watersheds must have specific physical characteristics to provide the necessary habitat requirements for bull trout spawning and rearing, although these characteristics are not necessarily ubiquitous throughout watersheds in which bull trout occur. Because bull trout exhibit a patchy distribution, even in undisturbed habitats (Rieman and McIntyre 1993), fish would not likely occupy all available habitats simultaneously (Rieman et al. 1997).

Bull trout are typically associated with the colder streams in a river system, although fish can occur throughout larger river systems (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997). All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979, Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Maintaining bull trout populations requires stream channel and flow stability (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns.

Preferred spawning habitat generally consists of low gradient stream reaches, which are often found in high gradient streams that have loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 41 to 48 °F in late summer to early fall (Goetz 1989). The size and age of maturity for bull trout is variable depending upon life-history strategy. Growth of resident fish is generally slower than that of migratory fish; resident fish tend to be smaller at maturity and less fecund (productive; Fraley and Shepard 1989, Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years, and can live 12 or more years. Biologists report repeat and alternate year spawning, although repeat spawning frequency and post-spawning mortality are not well known (Leathe and Graham 1982, Fraley and Shepard 1989, Pratt 1992, Rieman and McIntyre 1996). Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout may begin spawning migrations as early as April, and move upstream as far as 155 miles to spawning grounds in some areas of their range (Fraley and Shepard 1989, Swanberg 1997). Depending on the water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and juveniles remain in the substrate after hatching. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile bull trout prey on terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish (Wyman 1975, Rieman and Lukens 1979 *cited in* Rieman and McIntyre 1993, Boag 1987, Goetz 1989, Donald and Alger 1993). Adult migratory bull trout are primarily piscivorous, known to feed on various trout and salmon species, whitefish, yellow perch and sculpin (Fraley and Shepard 1989, Donald and Alger 1993).

The bull trout was Federally Listed as threatened throughout its entire range in the coterminous United States on November 1, 1999. On October 6, 2004, approximately 1,748 miles of streams and 61,235 acres of lakes and reservoirs in Oregon, Washington, and Idaho were designated as critical habitat for the Klamath River and Columbia River populations of bull trout. However, the USFWS is currently re-evaluating this designation. The decline of bull trout is primarily attributable to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of non-native species.

On January 14, 2010 the USFWS issued a proposed rule to revise the designation of critical habitat for the bull trout with a final decision to be submitted to the Federal Register by September 30, 2010. This proposed revision identifies additional streams, rivers, lakes, reservoirs, and near shore areas as critical habitat in Oregon, Idaho, Washington, Montana, and Nevada. In addition to implementing SOPs and mitigation measures identified in this EIS, and in the absence of additional site-specific analysis or consultation, the BLM in Oregon will continue to follow applicable project design criteria as identified in the USFWS Biological Opinion and Letter of Concurrence for the Programmatic Aquatic Habitat Restoration Activities in Oregon and Washington That Affect ESA-listed Fish, Wildlife, and Plant Species and their Critical Habitats. The BLM is Conferencing with the Service on this proposed rule as per section 7(a)4 of the Act with documentation to be provided as part of the Service's letter of concurrence for the proposed action.

Pacific Eulachon

The primary references for this section area: Federal Register/Vol. 75, No. 52/Thursday, March 18, 2010/13012-13024; and, NMFS Endangered Species Act – Section 7 Programmatic Consultation Biological Opinon and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation, June 27, 2008.

On March 18, 2010 the National Marine Fisheries Service (NMFS) issued a final determination to list the southern Distinct Population Segment (DPS) of the Pacific eulachon (*Thaleichthys pacificus*) as a threatened species under the Endangered Species Act of 1973, as amended (6). NMFS intends to consider protective regulations and critical habitat for this DPS in separate rule making to occur at a later date. In the absence of finer scale distribution maps, it is assumed that the eulachon occurs in Oregon within the Salem District (eg. Sandy River) and may also occur on the Eugene and Coos Bay Districts. The most significant threat to eulachon identified by NMFS are changes in ocean conditions due to climate change followed by a moderate threat associated with climate-induced change to freshwater habitats (6). Since there are no anticipated contributions to climate change which would result from implementing any of the alternatives analyzed in the Oregon EIS (FEIS 162), there are not likely to be any adverse affects to eulachon or their ocean and freshwater habitats. In addition to Conservation Measures identified in the NMFS PEIS Biological Opinion for anadromous fish, and in the absence of additional site-specific analysis or consultation, Oregon will continue to follow applicable project design criteria as identified in the NMFS *Endangered Species Act-Section 7 Programmatic Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation* (7). ESA Consultation is ongoing with NMFS and any applicable direction concerning the eulachon will be addressed in the forthcoming biological opinion.

Conservation Measures for Aquatic Animals

Many local BLM offices already have management plans in place that ensure the protection of these species, and have completed formal or informal consultations on similar treatment activities. These consultations have identified protection zones alongside aquatic habitats that support these species. The conservation measures discussed below are probable steps required of the BLM to ensure that vegetation treatments would minimize impacts to TEP species. These conservation measures are intended as broad guidance at the programmatic level; further analysis of treatment programs and species habitats at the local level is required to better reduce potential impacts from proposed vegetation treatments. Completion of consultation at the local level will fine-tune conservation measures associated with treatment activities and ensure consistency of the treatments with ESA requirements.

The aquatic TEP species considered in this programmatic BA occur in varied habitats, over a large geographic area. The conservation measures guidance presented below is intended to apply broadly to aquatic species and habitats over the entire region covered by this BA, based on the common features found in nearly all aquatic and riparian habitats. Some species with alternate or unusual habitat requirements may require additional conservation measures to ensure a Not Likely to Adversely Affect determination at the local level. Such additional conservation measure are outside the scope of this BA, and will be completed at the local level.

Some local BLM plans have delineated protected riparian areas, or portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines (USDA Forest Service 1995). These protected riparian areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by 1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams; 2) providing root strength for channel stability; 3) shading the stream; and 4) protecting water quality. Examples of protected riparian areas are the BLM's Riparian Reserves of the Pacific Northwest and the Interior Columbia Basin, as described in the Aquatic Conservation Strategy (USDA Forest Service and USDI BLM 1994). The term "riparian areas," as used in the conservation measures guidance below, refers to riparian protected areas, wherever such designations apply. However, since not all local BLM plans have made such designations, "riparian areas," when the above-mentioned use is not applicable, generally refers to: 1) for streams, the stream channel and the extent of the 100-year floodplain; and 2) for wetlands, ponds, and lakes, and other aquatic habitats, the area extending to the edges of the riparian vegetation, provided it is no less than the minimum buffer distance for a given site established by local BLM biologists.

Conservation Measures for Site Access and Fueling/Equipment Maintenance

For treatments occurring in watersheds with TEP species or designated or undesignated critical habitat (i.e., unoccupied habitat critical to species recovery):

- Where feasible, access work site only on existing roads, and limit all travel on roads when damage to the road surface will result or is occurring.
- Where TEP aquatic species occur, consider ground-disturbing activities on a case by case basis, and implement Standard Operating Procedures to ensure minimal erosion or impact to the aquatic habitat.
- Within riparian areas, do not use vehicle equipment off of established roads.
- Outside of riparian areas, allow driving off of established roads only on slopes of 20% or less.
- Except in emergencies, land helicopters outside of riparian areas.
- Within 150 feet of wetlands or riparian areas, do not fuel/refuel equipment, store fuel, or perform equipment maintenance (locate all fueling and fuel storage areas, as well as service landings outside of protected riparian areas).
- Prior to helicopter fueling operations prepare a transportation, storage, and emergency spill plan and obtain the appropriate approvals; for other heavy equipment fueling operations use a slip-tank not greater than 250 gallons; Prepare spill containment and cleanup provisions for maintenance operations.
- Do not conduct biomass removal (harvest) activities that will alter the timing, magnitude, duration, and spatial distribution of peak, high, and low flows outside the range of natural variability.

Conservation Measures Related to Revegetation Treatments

- Outside riparian areas, avoid hydro-mulching within buffer zones established at the local level. This precaution will limit adding sediments and nutrients and increasing water turbidity.
- Within riparian areas, engage in consultation at the local level to ensure that revegetation activities incorporate knowledge of site-specific conditions and project design.

Conservation Measures Related to Herbicide Treatments

The complexity of this action within riparian areas requires local consultation, which will be based on herbicide risk assessments.

Possible Conservation Measures:

- Maintain equipment used for transportation, storage, or application of chemicals in a leak proof condition.
- Do not store or mix herbicides, or conduct post-application cleaning within riparian areas.
- Ensure that trained personnel monitor weather conditions at spray times during application.
- Strictly enforce all herbicide labels.
- Do not broadcast spray within 100 feet of open water when wind velocity exceeds 5 mph.
- Do not broadcast spray when wind velocity exceeds 10 mph.

- Do not spray if precipitation is occurring or is imminent (within 24 hours).
- Do not spray if air turbulence is sufficient to affect the normal spray pattern.
- Do not broadcast spray herbicides in riparian areas that provide habitat for TEP aquatic species. Appropriate buffer distances should be determined at the local level to ensure that overhanging vegetation that provides habitat for TEP species is not removed from the site. Buffer distances provided as conservation measures in the assessment of effects to plants (Chapter 4 of this BA) and fish and aquatic invertebrates should be consulted as guidance (Table A2-3). (Note: the Forest Service did not determine appropriate buffer distances for TEP fish and aquatic invertebrates when evaluating herbicides in Forest Service ERAs; buffer distances were only determined for non-TEP species.)
- Do not use diquat, fluridone, terrestrial formulations of glyphosate, or triclopyr BEE, to treat aquatic vegetation in habitats where aquatic TEP species occur or may potentially occur.
- Avoid using glyphosate formulations that include R-11 in the future, and either avoid using any formulations with POEA, or seek to use the formulation with the lowest amount of POEA available, to reduce risks to aquatic organisms.
- Follow all instructions and Standard Operating Procedures to avoid spill and direct spray scenarios into aquatic habitats. Special care should be followed when transporting and applying 2,4-D, bromacil, clopyralid, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray diuron, glyphosate, picloram, or triclopyr BEE in upland habitats adjacent to aquatic habitats that support (or may potentially support) aquatic TEP species under conditions that would likely result in off-site drift.
- In watersheds that support TEP species or their habitat, do not apply bromacil, diuron, tebuthiuron, or triclopyr BEE in upland habitats within ½ mile upslope of aquatic habitats that support aquatic TEP species under conditions that would likely result in surface runoff.

Numerous conservation measures were developed from information provided in ERAs. The measures listed below would apply to TEP fish and other aquatic species at the programmatic level in all 17 western states. However, local BLM field offices could use interactive spreadsheets and other information contained in the ERAs to develop more site-specific conservation measures and management plans based on local conditions (soil type, rainfall, vegetation type, and herbicide treatment method). It is possible that conservation measures would be less restrictive than those listed below if local site conditions were evaluated using the ERAs when developing project-level conservation measures.

Conservation Measures Related to Non-herbicide Treatments

<u>*Conservation Measures Related to Prescribed Fire*</u>

Within riparian areas, in watersheds with TEP species or their habitats:
- Conduct prescribed burning only when long-term maintenance of the riparian area is the primary objective, and where low intensity fires can be maintained.
- Do not construct black lines, except by non-mechanized methods.
- Utilize/create only the following firelines: natural barriers; hand-built lines parallel to the stream channel and outside of buffer zones established at the local level; or hand built lines perpendicular to the stream channel with waterbars and the same distance requirement.
- Do not ignite fires using aerial methods.
- In forested riparian areas, keep fires to low severity levels to ensure that excessive vegetation removal does not occur.
- Do not camp, unless allowed by local consultation.

- Have a fisheries biologist determine whether pumping activity can occur in streams with TEP species.
- During water drafting/pumping, maintain a continuous surface flow of the stream that does not alter original wetted stream width.
- Do not alter dams or channels in order to pump in streams occupied by TEP species.
- Do not allow helicopter dipping from waters occupied by TEP species, except in lakes outside of the spawning period.
- Consult with a local fisheries biologist prior to helicopter dipping in order to avoid entrainment and harassment of TEP species.

Conservation Measures Related to Mechanical Treatments

Note: these measures apply only to treatments occurring in watersheds that support TEP species or in unoccupied habitat critical to species recovery (including but not limited to critical habitat, as designated by USFWS).

Outside riparian areas in watersheds with TEP species or designated or undesignated critical habitat (i.e., unoccupied habitat critical to species recovery):

- Conduct soil-disturbing treatments only on slopes of 20% or less, where feasible.
- Do not conduct log hauling activities on native surface roads prone to erosion, where feasible.

Within riparian areas in these watersheds, more protective measures will be required to avoid negatively affecting TEP species or their habitat:

- Do not use vehicles or heavy equipment, except when crossing at established crossings.
- Do not remove large woody debris or snags during mechanical treatment activities.
- Do not conduct ground disturbing activities (e.g., disking, drilling, chaining, and plowing).
- Ensure that all mowing follows guidance to avoid negative effects to streambanks and riparian vegetation and major effects to streamside shade.
- Do not use equipment in perennial channels or in intermittent channels with water, except at crossings that already exist.
- Leave suitable quantities (to be determined at the local level) of excess vegetation and slash on site.
- Do not apply fertilizers or seed mixtures that contain chemicals by aerial methods.
- Do not apply fertilizer within 25 feet of streams and supersaturated soils; apply fertilizer following labeling instructions.
- Do not apply fertilizer in desert habitats.
- Do not completely remove trees and shrubs.

Conservation Measures Related to Biological Control Treatments using Livestock

For treatments occurring in watersheds that support TEP species or in critical habitat:

- Where terrain permits, locate stock handling facilities, camp facilities, and improvements at least 300 feet from lakes, streams, and springs.
- Educate stock handlers about at-risk fish species and how to minimize negative effects to the species and their associated habitat.
- Employ appropriate dispersion techniques to range management, including judicial placement of saltblocks, troughs, and fencing, to prevent damage to riparian areas but increase weed control.
- Equip each watering trough with a float valve.

Within riparian areas of these watersheds, more protective measures are required.

- Do not conduct weed treatments involving domestic animals, except where it is determined that these treatments will not damage the riparian system, or will provide long-term benefits to riparian and adjacent aquatic habitats.
- Do not locate troughs, storage tanks, or guzzlers near streams with TEP species, unless their placement will enhance weed-control effectiveness without damaging the riparian system.

Local BLM offices should design conservation measures for treatment plans using the above conservation measures as guidance, but altering it as needed based on local conditions and the habitat needs of the particular TEP aquatic species that could be affected by the treatments. Locally-focused conservation measures would be necessary to reduce or avoid potential impacts such that a Not Likely to Adversely Affect determination would be reached during the local-level NEPA process. BLM offices that are responsible for the protection of Northwest salmonids are directed to the guidance document: Criteria for At-Risk Salmonids: National Fire Plan Activities, Version 2.1 (National Fire Plan Technical Team 2002), which contains detailed instructions for developing suitable conservation measures for these TEP species in conjunction with vegetation treatment programs, and from which many of the above-listed conservation measures were taken.

Invertebrates

Endangered

Fender's Blue Butterfly

The primary reference for this section is: USFWS. 2000i. Endangered Status for *Erigeron decumbens* var. *decumbens* (Willamette Daisy) and *Plebejus icarioides fenderi* (Fender's Blue Butterfly) and Threatened Status for *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's Lupine). Federal Register 65(16):3875-3890.

The Fender's blue butterfly (*Plebejus icarioides fenderi*) is endemic to upland prairies of the Willamette Valley in Oregon. Although the precise historic distribution of this subspecies is unknown, recent surveys have indicated that the insect is confined to the Willamette Valley and currently occupies 32 sites in Yamhill, Polk, Benton, and Lane counties (Hammond and Wilson 1993, Schultz 1996). One population is found in wet, hairgrass-type prairie, while the remaining sites are found on drier upland prairies characterized by fescue. Fender's blue butterflies occupy sites located almost exclusively on the western side of the valley, within 21 miles of the Willamette River.

The primary habitat requirement for the fender's blue is its host plant, Kincaid's lupine, which is the larval food source. Of the 32 sites where Fender's blue butterfly occurs, Kincaid's lupine co-occurs as a larval host plant at 27. Spurred lupine and sickle keeled lupine may be secondary food plants used by the insect (Hammond and Wilson 1993).

It is thought that the life cycle of Fender's blue is similar those of related subspecies (Hammond and Wilson 1993, Mattoni 1997, Pratt 1997). Adult butterflies lay their eggs on the host plant, which serves as a food source for the caterpillars during May and June. Newly hatched larvae feed for a short time, reaching their second developmental stage in the early summer, at which point they enter an extended diapause (maintaining a state of suspended activity). Diapausing larvae remain in the leaf litter at or near the base of the host plant through the fall and winter, and may become active again in March or April of the following year. Some larvae may be able to extend diapause for more than one season depending upon the individual and environmental conditions (Mattoni 1997). Once diapause is broken, the larvae feed and grow through three to four additional developmental stages, enter their pupal stage, and then emerge as adult butterflies in April and May. A Fender's blue butterfly may complete its life cycle in 1 year.

References cited in this section are internal to the above referenced document. A complete list of these references is available from the USFWS Oregon State Office, Portland, Oregon.

The Fender's blue was Federally Listed as endangered on January 25, 2000. The designation of critical habitat for this species was deemed prudent, but has been deferred. The primary threats are habitat loss from agriculture and urban development, the invasion of non-native plant species into prairie habitat, and the small size of the remaining populations. Herbicide use and collecting are also factors that can impact this subspecies.

Threatened

Vernal Pool Fairy Shrimp

The primary reference for this section is: USFWS. 1994e. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. Final Rule. Federal Register 59(180):48136-48153. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Sacramento Field Office, Sacramento, California.

The Conservancy fairy shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*B. longiantenna*), vernal pool fairy shrimp (*B. lynchi*), and vernal pool tadpole shrimp (*Lepidurus packardi*) are aquatic crustaceans that are endemic to vernal pools in California. The vernal pools in which these species occur are found in the Central Valley, the Coast Range, and a limited number of sites in the Transverse Range and Santa Rosa Plateau. All four species are sporadic in their distribution, often inhabiting only one or a few pools in vernal pool complexes that are quite widespread (Eng 1990, King 1992, Simovich 1992; Brusca 1992). None are known to occur in riverine waters, marine waters, or other permanent bodies of water.

The three fairy shrimp and the vernal pool tadpole shrimp are ecologically dependent on seasonal fluctuations in their habitat, such as absence or presence of water during specific times of the year, duration of inundation, and other environmental factors that include specific salinity, conductivity, dissolved solids, and pH levels. The Conservancy fairy shrimp inhabits vernal pools with highly turbid waters. It is known from six disjunct populations, occurring in large pools with low conductivity, total dissolved solids, and alkalinity (Barclay and Knight 1984; Eng et al. 1990). The Conservancy fairy shrimp is usually collected at cool temperatures and appears to be relatively long-lived (Patton 1984; Simovich et al. 1992). This species has been observed from November to early April.

The longhorn fairy shrimp inhabits clear to turbid, grass-bottomed vernal pools in grasslands, and clear-water pools in sandstone depressions. The water in grassland pools inhabited by this species has very low conductivity, total dissolved solids, and alkalinity (Eng et al. 1990). This species is only known from four disjunct populations along the eastern margin of the central coast range. All vernal pools inhabited by this species are filled by winter and spring rains, and may remain inundated until June. The longhorn fairy shrimp has been observed from late December until late April.

The vernal pool fairy shrimp, although it has a relatively wide range, primarily occurs in vernal pools with clear to tea-colored water, most commonly in grass- or mud-bottomed swales, or in basalt flow depression pools in unplowed grasslands. However, one population occurs in sandstone rock outcrops, and another population occurs in alkaline vernal pools. The water in pools inhabited by this species has low total dissolved solids, conductivity, alkalinity, and chloride (Collie and Lathrop 1976). Vernal pool fairy shrimp have been collected from early December to early May.

The vernal pool fairy shrimp has a sporadic distribution within vernal pool complexes (Patton 1984; County of Sacramento 1990; Jones and Stokes 1992, 1993; Stromberg 1993; Sugnet and Associates 1993b), wherein the majority of pools in a given complex are not inhabited by the species. The species is typically found at low population densities (Simovich et al. 1992), and only rarely does it co-occur with other fairy shrimp species. Although the vernal pool fairy shrimp can mature quickly, allowing populations to persist in shorter-lived pools, it also persists later into the spring where pools are longer lasting.

The vernal pool tadpole shrimp inhabits vernal pools containing clear to highly turbid water, and ranging in size from 54 square feet to 89 acres. Pools have low conductivity, alkalinity, and total dissolved solids (Barclay and Knight 1984; Eng et al. 1990). These pools are located most commonly in grass-bottomed swales of grasslands in old alluvial soils underlain by hardpan, or in mud-bottomed pools containing highly turbid water. The vernal pool tadpole shrimp is known from 18 populations in the Central Valley, and from a single pool complex located on the San Francisco Bay National Wildlife Refuge in the city of Fremont, Alameda County, California.

The life history of the vernal pool tadpole shrimp is linked to the phenology of the vernal pool habitat. After winter rainwater fills the pools, the populations are re-established from eggs that have been dormant in the dry pool sediments (Ahl 1991, Lanway 1974). Eggs hatch shortly after inundation, with sexually reproductive adults appearing in about 3 to 4 weeks after hatching (Ahl 1991). A female surviving to large size may lay up to six clutches of eggs, which are sticky, and readily adhere to plant matter and sediment particles (Simovich et al. 1992). A portion of the eggs hatch immediately, and the rest become dormant and remain in the soil to hatch during later rainy seasons (Ahl 1991). The vernal pool tadpole shrimp matures slowly and is a long-lived species (Alexander 1976, Ahl 1991). Adults are often present and reproductive until the pools dry up in the spring (Ahl 1991, Simovich 1992).

Nearly all fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus (Pennak 1989). The females carry eggs in an oval or elongate ventral brood sac. The eggs are either dropped to the pool bottom or remain in the brood sac until the female dies and sinks. The "resting" or "summer" eggs are capable of withstanding heat, cold, and prolonged desiccation. When the pools refill in the same or subsequent seasons some, but not all, of the eggs may hatch. The egg bank in the soil may be comprised of the eggs from several years of breeding (Donald 1983). The eggs hatch when the vernal pools fill with rainwater. The early stages of the fairy shrimp develop rapidly into adults. These non-dormant populations often disappear early in the season long before the vernal pools dry up. Tadpole shrimp are primarily benthic animals that swim with their legs down. They climb or scramble over objects, as well as plow along in bottom sediments, and their diet consists of organic detritus and living organisms, such as fairy shrimp and other invertebrates (Fryer 1987, Pennak 1989). Female tadpole shrimp deposit their eggs on vegetation and other objects on the bottom. Vernal pool tadpole shrimp populations pass the dry summer months as dormant eggs in pool sediments. Some of the eggs hatch as the vernal pools are filled with rainwater in the fall and winter of subsequent seasons.

The Conservancy fairy shrimp, longhorn fairy shrimp, and vernal pool tadpole shrimp were listed as endangered on September 19, 1994. The vernal pool fairy shrimp was listed as threatened on the same date. On August 6, 2003, the USFWS designated approximately 1,184,513 acres of vernal pool habitat as critical habitat for these and other vernal pool species. Urban, water, flood control, highway, and utility projects, as well as conversion to agricultural use, have eliminated vernal pools in southern California (Riverside and San Diego counties), the Central Valley, and the San Francisco Bay area (Jones and Stokes Associates 1987). Factors that threaten these species include changes in hydrologic patterns, overgrazing, OHV use, and any human activities that alter the watershed of the vernal pools. For some species, continued development could destroy existing habitat.

See *Conservation Measures for Aquatic Animals* in the Fish section of this appendix for Vernal Pool Fairy Shrimp Conservation Measures.

Oregon Silverspot Butterfly
The primary reference for this section is: USFWS. 2001h. Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*) Revised Recovery Plan. Portland, Oregon. References cited in this section are internal to the above-referenced document. Full citations have been included in the Bibliography.

The Oregon silverspot butterfly (*Speyeria zerene hippolyta*) occurs at disjunct sites near the Pacific coast, from Del Norte County, California, north to Long Beach Peninsula, Washington. The subspecies occupies three types of grassland habitat: marine terrace and coastal "salt spray" meadows, stabilized dunes, and montane grasslands. The first two habitats are strongly influenced by proximity to the ocean, with mild temperatures, high rainfall, and persistent fog. Of the two, the dune habitat tends to have lower relief, highly porous soils, and less exposure to winds. Conditions at the montane sites include colder temperatures, frequent cloud cover, substantial snow accumulations, less coastal fog, and no salt spray.

Oregon silverspot butterfly populations currently (as of 2001) are known to occur at only six sites. One is in Del Norte County (Lake Earl), two are in Lane County (Rock Creek-Big Creek and Bray Point), and two are in Tillamook County (Cascade Head and Mount Hebo). The population at a sixth site in Clatsop County (Clatsop Plains) has declined in recent surveys, with only one Oregon silverspot butterfly documented in 1998 (VanBuskirk 1993, 1998).

Each type of habitat must provide the Oregon silverspot with host plants, nectar sources, and other suitable environmental conditions. Caterpillars feed primarily on early blue violets. Stands of violets that are large enough to provide enough food for larval butterflies on the Oregon coast occur only in relatively open and low-growing grasslands, where violets may be an abundant component of the plant community (Hammond and McCorkle 1984). Apart from early blue violets, Oregon silverspot caterpillars are also known to feed on a few other violet species, such as yellow stream violets and Aleutian violets. Nectar plants most frequently used by Oregon silverspot butterflies are members of the aster family, including the following native species: Canada goldenrod, dune goldenrod, California aster, pearly everlasting, dune thistle, and yarrow. They are also known to nectar on two common introduced species: tansy ragwort and false dandelion. The flowering seasons of these species overlap, providing an array of nectar choices for adult butterflies throughout the flight season.

The Oregon silverspot butterfly goes through six larval instars and a pupal stage before metamorphosing into an adult. Newly hatched first-instar larvae immediately enter diapause after eating the lining of the eggshell. They remain in diapause until host plants send up new growth in spring, and feed until pupation in the summer. Very little is known about the biology of the caterpillar or pupae. Adult emergence starts in July and extends into September, with many males appearing several weeks before females appear. Mating usually takes place in relatively sheltered areas. Adults will often move long distances for nectar or to escape windy and foggy conditions.

The Oregon silverspot butterfly was Federally Listed as threatened on July 2, 1980, and critical habitat was designated at the same time. Lands included in the critical habitat designation are those that were known to be occupied by the butterfly at the time: portions of Section 15 and the south half of Section 10 that are west of a line parallel to and about 1,500 feet west of the eastern section boundaries of Sections 10 and 15, Township 16 South, Range 12 West, Lane County, Oregon. Invasion by exotic species, natural succession, fire suppression, and land development have resulted in the loss and modification of the species' habitat. Land use practices have altered disturbance regimes needed to maintain existing habitats and create new habitats for species expansion. Other threats to the subspecies include OHVs, grazing, erosion, road kill, and pesticides. The Oregon silverspot butterfly is also sought by collectors.

Conservation Measures for Butterflies

Many local BLM offices already have management plans in place that ensure the protection of these species during activities on public lands. The following conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect TEP species.
Each local BLM office is required to draw up management plans related to treatment activities that identify any TEP butterfly or moth species or their critical habitat that are present in the proposed treatment areas, as well as the measures that will be taken to protect these species.
Management plans should, at a minimum, follow this general guidance:

- Use an integrated pest management approach when designing programs for managing pest outbreaks.
- Survey treatment areas for TEP butterflies/moths and their host/nectar plants (suitable habitat) at the appropriate times of year.
- Minimize the disturbance area with a pre-treatment survey to determine the best access routes. Areas with butterfly/moth host plants and/or nectar plants should be avoided.
- Minimize mechanical treatments and OHV activities on sites that support host and/or nectar plants.
- Carry out vegetation removal in small areas, creating openings of 5 acres or less in size.
- Avoid burning all of a species' habitat in any 1 year. Limit area burned in butterfly/moth habitat in such a manner that the unburned units are of sufficient size to provide a refuge for the population until the burned unit is suitable for recolonization. Burn only a small portion of the habitat at any one time, and stagger timing so that there is a minimum 2-year recovery period before an adjacent parcel is burned.
- Where feasible, mow or wet around patches of larval host plants within the burn unit to reduce impacts to larvae.
- In TEP butterfly/moth habitat, burn while butterflies and/or moths of concern are in the larval stage, when the organisms would receive some thermal protection.
- Wash equipment before it is brought into the treatment area.
- Use a seed mix that contains host and/or nectar plant seeds for road/site reclamation.
- To protect host and nectar plants from herbicide treatments, follow recommended buffer zones and other conservation measures for TEP plants species when conducting herbicide treatments in areas where populations of host and nectar plants occur.
- Do not broadcast spray herbicides in habitats occupied by TEP butterflies or moths; do not broadcast spray herbicides in areas adjacent to TEP butterfly/moth habitat under conditions when spray drift onto the habitat is likely.
- Do not use 2,4-D in TEP butterfly/moth habitat.
- When conducting herbicide treatments in or near habitat used by TEP butterflies or moths, avoid use of the following herbicides, where feasible: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, picloram, tebuthiuron, and triclopyr.
- If conducting manual spot applications of diquat, diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr to vegetation in TEP butterfly or moth habitat, utilize the typical, rather than the maximum, application rate.

Mammals

Endangered

Gray Wolf

The primary reference for this section is: USFWS. 2000p. Proposal to Reclassify and Remove the Gray Wolf From the List of Endangered and Threatened Wildlife in Portions of the Coterminous United States; Proposal To Establish Three Special Regulations for Threatened Gray Wolves; Proposed Rule. Federal Register Volume

65(135):43449-43496. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Region 3 Office, Fort Snelling, Minnesota.

Gray wolves (*Canis lupus*) are the largest wild members of the dog family. The species historically occurred across most of North America, Europe, and Asia. In North America, wolves occurred from the northern reaches of Alaska, Canada, and Greenland to the central mountains and the high interior plateau of southern Mexico. The only areas of the contiguous U.S. that apparently lacked gray wolves are much of California and the Gulf and Atlantic coastal plain south of Virginia. In addition, wolves were generally absent from the extremely arid deserts and the mountaintops of the western United States (Goldman 1944, Hall 1959, Mech 1974). The cultural attitudes of European settlers, coupled with perceived and real conflicts between wolves and human activities along the frontier, led to widespread persecution of wolves. Poisons, trapping, and shooting—spurred by federal, state, and local government bounties—resulted in extirpation of the species from more than 95% of its range in the 48 coterminous states.

Wolves are predators of large animals. Wild prey species in North America include white-tailed deer, mule deer, moose, elk, woodland caribou, barren ground caribou, bison, muskox, bighorn sheep, Dall sheep, mountain goat, beaver, and snowshoe hare, with small mammals, birds and large invertebrates sometimes being taken (Mech 1974, Stebler 1944, Wisconsin Department of Natural Resources 1999a). Wolves may also feed on domestic animals (Paul 1999). Wolves are social animals, normally living in packs of 2 to 10 members. Packs are primarily family groups consisting of a breeding pair, their pups from the current year, offspring from the previous year, and occasionally an unrelated wolf. Packs occupy, and defend from other packs and individual wolves, a territory of 20 to 214 square miles (though typically larger in the Rocky Mountains). Normally, only the top-ranking male and female in each pack breed and produce pups. Litters are born from early April into May; they can range from 1 to 11 pups, but generally contain 4 to 6 pups (USFWS 1992a, Michigan Department of Natural Resources 1997). Yearling wolves frequently disperse from their natal packs, although some remain with their pack. Dispersers may become nomadic and cover large areas as lone animals, or they may locate suitable unoccupied habitat and a member of the opposite sex and begin their own territorial pack. Dispersal movements of over 500 miles have been documented (Fritts 1983).

As many as 24 distinct subspecies of gray wolf have been recognized, and federal listings were originally at the subspecies level. On March 9, 1978, the gray wolf was relisted as endangered throughout the conterminous 48 States and Mexico. In Minnesota, however, the gray wolf was reclassified to threatened. In addition, critical habitat was designated in Isle Royale National Park, Michigan, and Minnesota. On November 22, 1994, areas in Idaho, Montana, and Wyoming were designated as nonessential experimental populations in order to initiate gray wolf reintroduction projects in central Idaho and the Greater Yellowstone area. On January 12, 1998, a nonessential experimental population was established for the Mexican gray wolf in portions of Arizona, New Mexico, and Texas.

On July 13, 2000, the USFWS proposed the establishment of four distinct population segments (DPSs) for the gray wolf in the United States and Mexico. Under this proposal, gray wolves in the Western Great Lakes DPS (North Dakota, South Dakota, Minnesota, Wisconsin, and Michigan), the Western DPS (Washington, Oregon, Idaho, Montana, Wyoming, Utah, Colorado, and parts of Arizona and New Mexico), and the Northeastern DPS (New York, Vermont, New Hampshire, and Maine) would be reclassified from endangered to threatened, except where already classified as an experimental population or as threatened. Gray wolves in the Southwestern (Mexican) DPS (portions of Arizona and New Mexico) would retain their endangered status. All three existing gray wolf experimental population designations would be retained. In all other areas of the 48 conterminous states, gray wolves would be removed from the protections of the ESA. Gray wolf populations in all DPSs, except the Southwestern DPS, have shown steady increases from the late 1970s to the present. As of the 1998/1999 census, there were a total of 22 gray wolves in the Southwestern DPS. Gray wolves are still threatened by direct human-caused mortality, and potentially by habitat loss.

Conservation Measures for the Gray Wolf

Although the proposed vegetation treatments would not be likely to have negative effects on wolves or their habitat, the following programmatic-level conservation measures are recommended to ensure protection of the species. Additional or more specific guidance would also be provided at the project level, as appropriate.

- Avoid human disturbance and/or associated activities within 1 mile of a den site during the breeding period (as determined by a qualified biologist).
- Avoid human disturbance and/or associated activities within 1 mile of a rendezvous site during the breeding period (as determined by a qualified biologist).
- Do not use 2,4-D in areas where gray wolves are known to occur; do not broadcast spray within ¼ mile of areas where gray wolves are known to occur.
- Where feasible, avoid use of the following herbicides in gray wolf habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, diuron, glyphosate, hexazinone, picloram, or triclopyr in gray wolf habitat; do not broadcast spray these herbicides in areas adjacent to gray wolf habitat under conditions when spray drift onto the habitat is likely.
    - If broadcast spraying bromacil, diquat, imazapyr, or metsulfuron methyl in or near gray wolf habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in gray wolf habitat, utilize the typical, rather than the maximum, application rate.

<u>Columbian White-tailed Deer</u>

The primary reference for this section is: USFWS. 2002m. Supplemental Proposed Rule to Remove the Douglas County Population of Columbian White-tailed Deer From the Federal List of Endangered and Threatened Wildlife. Federal Register 67(120):42217-42229. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS, Oregon Fish and Wildlife Office, Portland, Oregon.

The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) is the westernmost representative of 30 subspecies of white-tailed deer in North and Central America. The subspecies was formerly distributed throughout the bottomlands and prairie woodlands of the lower Columbia, Willamette, and Umpqua River basins in Oregon and southern Washington (Bailey 1936, Verts and Carraway 1998). It is believed that this deer was locally common, particularly in riparian areas along major rivers (Gavin 1978). With the arrival and settlement of pioneers in the fertile river valleys, the decline in Columbian white-tailed deer numbers was rapid (Gavin 1978). By 1940, a population of 500 to 700 animals along the lower Columbia River in Oregon and Washington, and a disjunct population of 200 to 300 in Douglas County survived (Crews 1939, Gavin 1984, Verts and Carraway 1998).

Columbian white-tailed deer in Douglas County are most often associated with riparian habitats, though the deer also uses a variety of lower elevation habitat types (e.g., grassland, grass shrub, oak savanna, oak-hardwood woodland, oak-hardwood savanna shrub, oak-hardwood conifer, conifer, and urban/suburban yards; Ricca 1999). Open areas are used for feeding between dusk and dawn. The Columbia River population occurs in wet bottomlands and dense forest swamps where there is little elevational relief, and which receive a large amount of precipitation. The diet of Columbian white-tailed deer consists of forbs, shrubs, grasses, and a variety of other foods, such as lichens, mosses, ferns, seeds, and nuts (Whitney 2001).

Like other types of deer, Columbian white-tailed deer breed in the winter, primarily in November and December. Most fawns are born between mid-May and mid-June. Columbian white-tailed deer first breed as yearlings (18 months), and young females typically give birth to a single fawn. After 2 years of age, twins are more common.

The Columbian white-tailed deer was Federally Listed as endangered on March 11, 1967. Protection under the Endangered Species Act has resulted in acquisition, protection, and improvement of habitat, which has allowed the two populations to increase in size. A recovery plan was developed for the two populations of Columbian white-tailed deer in 1983. Many of the tasks identified in the Recovery Plan have been implemented. In 1972, the Julia Butler Hansen Refuge for the Columbian White-tailed Deer was established in Wahkiakum County, Washington.

In Douglas County, the Bureau of Land Management acquired a large parcel of habitat, known as the North Bank Habitat Management Area (NBHMA), through a land exchange specifically to benefit the Columbian white-tailed deer. This parcel alone provides over 6,000 acres of good habitat for the deer. The USFWS has coordinated with the BLM and the Oregon Department of Fish and Wildlife at the NBHMA to accomplish recovery of the Columbian white-tailed deer. The acquisition and management of the NBHMA was instrumental in the delisting of the Douglas County subpopulation in 2003 (http://www.fws.gov/oregonfwo/species/data/columbianwhitetaileddeer/).

Numbers of white-tailed deer have more than doubled since the species was first listed. The Douglas County subpopulation is now estimated at over 5,000 animals, and the Columbia River subpopulation is estimated at approximately 1,000 animals. This species is primarily threatened by a lack of suitable habitat. Logging has degraded forest habitat in some areas. In addition, periodic flooding of the Columbia River, and residential development along the North Umpqua River are also threats to the subspecies.

Conservation Measures for the Columbian white-tailed deer
The projected short-term negative effects of vegetation treatments on the Columbian white-tailed deer could be avoided by implementing the following programmatic-level conservation measures.

- Prior to treatments, survey for evidence of white-tailed deer use of areas in which treatments are proposed to occur.
- Address the protection of Columbian white-tailed deer in local management plans developed in association with treatment programs.
- In areas that are likely to support Columbian white-tailed deer, protect riparian areas from degradation by avoiding them altogether, or utilizing Standard Operating Procedures. Consult Chapter 5 for appropriate conservation measures to be used in protected riparian areas.
- In habitats used by deer, conduct treatments that use domestic animals during the plant growing season, and remove the animals after clearing has been achieved.
- Do not use domestic animals to control weeds in woodland habitats utilized by Columbian white-tailed deer.
- In areas where Columbian white-tailed deer occur, or may possibly occur, avoid the use of fences to keep domestic animals out of sensitive habitats or to otherwise restrict their movement (fence accidents are associated with deer mortality).
- Avoid burning in deer habitats during the fawning season.
- Closely follow all application instructions and use restrictions on herbicide labels; in riparian habitats use only those herbicides that are approved for use in riparian areas.
- Avoid broadcast spray treatments in areas where Columbian white-tailed deer are known to forage.
- Do not use 2,4-D in Columbian white-tailed deer habitats; do not broadcast spray 2,4-D within ¼ mile of Columbian white-tailed deer habitat.
- Where feasible, avoid use of the following herbicides in Columbian white-tailed deer habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, Overdrive®, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, Overdrive®, picloram, or triclopyr in Columbian white-tailed deer habitat; do not broadcast spray these herbicides in areas adjacent to Columbian white-tailed deer habitat under conditions when spray drift onto the habitat is likely.

- If broadcast spraying imazapyr, metsulfuron methyl, or tebuthiuron in or near Columbian white-tailed deer habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, imazapyr, metsulfuron methyl, tebuthiuron, or triclopyr to vegetation in Columbian white-tailed deer habitat, utilize the typical, rather than the maximum, application rate.

In addition, site-specific and project specific conservation measures would need to be developed by local BLM offices to ensure complete protection of the Columbian white-tailed deer.

Threatened

Canada Lynx
The primary reference for this section is: USFWS. 2000m. Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule. Federal Register 65(58):16051-16086. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Montana Field Office, Helena, Montana.

Lynx occur in moist coniferous forests that provide a prey base of snowshoe hare (Quinn and Parker 1987; Koehler 1990; Koehler and Brittell 1990; Mowat et al. 1999). In the contiguous United States, the Canada lynx (*Lynx canadensis*) historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern United States region from Maine southwest to New York (McCord and Cardoza 1982, Quinn and Parker 1987). This distribution associated with the southern boreal forest, comprising of subalpine coniferous forest in the West and primarily mixed coniferous/deciduous forest in the East (Aubry et al. 1999). In Canada and Alaska, however, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982; Quinn and Parker 1987; Agee 1999; McKelvey et al. 1999b). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al. 1999b).

The lynx population in the contiguous U.S. is considered by the USFWS to be part of a larger metapopulation whose core is located in the northern boreal forest of central Canada (Buskirk et al. 1999b; McKelvey et al. 1999a, 1999b). The boreal forest extends south into the contiguous United States along the Cascade and Rocky Mountain ranges in the West, the western Great Lakes Region, and along the Appalachian Mountain Range of the northeastern United States. At its southern margins, the boreal forest becomes naturally fragmented into patches of varying size as it transitions into other vegetation types. These southern boreal forest habitat patches are small relative to the extensive northern boreal forest of Canada and Alaska, which constitutes the majority of the lynx range. Many of these southern boreal forest habitat patches within the contiguous U.S. are able to support resident populations of lynx and snowshoe hare. It is likely that some of the habitat patches act as sources of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 1999a). Other habitat patches act as “sinks” where lynx mortality is greater than recruitment and lynx are lost from the overall population. The ability of naturally dynamic habitat to support lynx populations may change as the habitat undergoes natural succession following natural or manmade disturbances (i.e., fire, clearcutting). In addition, fluctuations in the prey populations may cause some habitat patches to change from being sinks to sources and vice versa.

It is believed that historic and current lynx densities in the contiguous U.S. are naturally low relative to lynx densities in the northern boreal forest. At present, in the western states, resident populations currently exist only in Montana and Washington, and populations that are no longer self-sustaining occur in Oregon, Idaho, Wyoming, Utah, and Colorado. Because the lynx is a secretive animal, there are no reliable population estimates for this species. However, sightings of lynx throughout the U.S. have continued to decrease over the years.

Lynx are highly specialized predators whose primary prey is the snowshoe hare, a species that has evolved to survive in areas that receive deep snow (Bittner and Rongstad 1982). Snowshoe hares use forests with dense understories that provide forage, cover to escape from predators, and protection during extreme weather (Wolfe et al. 1982; Monthey 1986; Hodges 1999a, 1999b). Generally, earlier successional forest stages have greater understory structure than do mature forests and therefore support higher hare densities (Hodges 1999a, 1999b). However, mature forests can also provide snowshoe hare habitat as openings develop in the canopy of mature forests when trees succumb to disease, fire, wind, ice, or insects, and the understory grows (Buskirk et al. 1999b). Lynx concentrate their hunting activities in areas where hare activity is relatively high (Koehler et al. 1979; Parker 1981; Ward and Krebs 1985; Major 1989; Murray et al. 1994; O'Donoghue et al. 1997, 1998a). Lynx also prey opportunistically on other small mammals and birds, particularly when hare populations decline (Nellis et al. 1972; O'Donoghue 1997, 1998a). Red squirrels are an important alternate prey (Apps 1999; Aubry et al. 1999). However, a shift to alternate food sources may not compensate for the decrease in hares consumed (Koehler and Aubry 1994). In northern regions, when hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, which causes the numbers of breeding lynx to level off or decrease (Nellis et al. 1972; Brand et al. 1976; Slough and Mowat 1996; O'Donoghue et al. 1997).

The breeding period for Canada lynx is late winter to early spring, with adult females producing one litter every 1 to 2 years. The gestation period typically lasts from 62 to 74 days, and the litter size is 3 to 4 kittens, on average. Females may reach reproductive maturity by as early as 1 year (Brainerd 1985).

Lynx use large woody debris, such as downed logs and windfalls, to provide denning sites with security and thermal cover for kittens (McCord and Cardoza 1982, Koehler 1990, Koehler and Brittell 1990, Squires and Laurion 1999, Organ 1999). For lynx den sites, the age of the forest stand does not seem as important as the amount of downed, woody debris available (Mowat et al. 1999). The size of lynx home ranges varies by the animal's gender, abundance of prey, season, and the density of lynx populations (Hatler 1988; Koehler 1990; Poole 1994; Slough and Mowat 1996; Aubry et al. 1999; Mowat et al. 1999). Documented home ranges vary from 3 to 300 square miles (Saunders 1963; Brand et al. 1976; Mech 1980; Parker et al. 1983; Koehler and Aubry 1994; Apps 1999; Mowat et al. 1999; Squires and Laurion 1999).

The population of the Canada lynx occurring in the contiguous U.S. was Federally Listed as threatened on March 24, 2000. The designation of critical habitat for the species was deemed prudent, but has not yet occurred. According to the USFWS, the primary factor affecting lynx in the contiguous U.S. is the lack of guidance for conservation of lynx in federal land management plans. People change forests through timber harvest, fire suppression, and conversion of forest lands to agriculture. Forest fragmentation may eventually become severe enough to isolate habitat into small patches, thereby reducing the viability of lynx populations, which are dependent on larger areas of forest habitat (Litvaitis and Harrison 1989). In addition, human alteration of forests may facilitate competition by creating habitats that are more suitable to potential lynx competitors (McCord and Cardoza 1982, Quinn and Parker 1987, Buskirk et al. 1999a). Finally, lynx movements may be negatively influenced by high traffic volume on roads that bisect suitable lynx habitat, such as in the Southern Rockies and in some parts of the Northern Rockies/ Cascades Region.

Vascular Plants

Endangered

McDonald's Rock-cress

McDonald's rock-cress (*Arabis mcdonaldiana*) appears to be restricted to serpentine soils in northern California and immediately adjacent southwestern Oregon. The species occurs at Red Mountain, a dome of red colored rock forming an island of peculiar vegetation protruding through the carpet of mixed evergreen forest indigenous to the Coast Ranges of northern California. The majority of rock-cress populations occupy conspicuously open habitats, scree slopes, rocky ridges, and barren rocky outcrops devoid of competing vegetation and exposed to full sun. This species appears to show long-term stability in open rocky habitats devoid of competition from other plant species. The densest populations occur in areas of north and east exposures or in sheltered saddles, which probably have the most persistent accumulations of snow. Rock-cress roots penetrate rock crevices, and areas of substantial sheet erosion appear to be poor areas of establishment. Temporarily successful at this site, McDonald's rock-cress is likely a transitional member of this rapidly changing chaparral community (Baad 1985).

The vegetation covering the crest of Red Mountain is notably sparse, consisting of an open forest of sugar pine, ponderosa pine, Jeffrey pine, and incense-cedar. An understory of chaparral species forms a patchy mosaic of dense cover alternating with extensive park-like expanses of open forest. Frequent herbaceous associates include Red Mountain buckwheat and Red Mountain stonecrop (Baad 1985). McDonald's rock-cress is found at elevations of 3,200 to 4,100 feet.

McDonald's rock-cress is a perennial herb whose aboveground parts remain alive year-round (Rollins 1941, 1973; Baad 1985). Germination commences with fall rains. Flowering occurs from April through June, and fruiting occurs from July through August, with dispersal from August through mid-September (Baad 1985). A number of insect visitors appear to be potential pollinators of rock-cress, including Syrphid flies, solitary bees, and bumblebees. Individual plants produce a variable number of fruits, which split open in August.

McDonald's rock-cress was Federally Listed as endangered on September 28, 1978. Critical habitat has not been designated. Although approximately two-thirds of the plants occur on public land, all populations are potentially endangered by plans to mine exploitable nickel and chromium deposits occurring within this area. A large-scale surface mining operation immediately adjacent to the total distribution of the species represents a serious threat to the survival of McDonald's rock-cress.

<u>Marsh Sandwort</u>

The primary reference for this species is: USFWS. 1998k. Recovery Plan for Marsh Sandwort (*Arenaria paludicola*) and Gambel's Watercress (*Rorippa gambelii*). Portland, Oregon. References cited in this section are internal to the above-referenced document. Full citations have been included in the Bibliography.

The Marsh sandwort (*Arenaria paludicola*) was historically found in scattered locations near the Pacific coast in southern and central California and Washington. The species occurs in freshwater marshes at elevations from sea level to 1,480 feet. Soils in these habitats are saturated, acidic bog soils that are predominantly sandy and have a high organic content. Presently, there are only two known populations of this species in the United States, both in San Luis Obispo County, California: one of fewer than 10 individuals in Black Lake Canyon, and one of more than 85 individuals at Oso Flaco Lake. The Marsh sandwort has been listed by the Washington Natural Heritage Program as "possibly extirpated" in Washington State. Nonetheless, it is thought that suitable habitat for the species remains in Washington State, and that populations could exist there now or in the future. As this species occurs on the BLM's Washington/Oregon special status species list, but not on the California list, it is unlikely that this species presently occurs on public lands.

Because there are so few individuals of the Marsh sandwort remaining, studying the life history of this species has been difficult. Although plants have been observed flowering and fruiting minimally, and a viable seed bank has been identified, information about the species' pollinators, seed germination and dispersal, and seedling recruitment is lacking.

The Marsh sandwort was Federally Listed as endangered on August 3, 1993. Critical habitat has not been designated. Threats to the species include encroaching vegetation (both native and non-native) associated with lowered water tables, agricultural and residential development, and OHV use. In addition, the very low number of individuals in the remaining populations puts this species at a great risk of extinction as a result of random, naturally occurring events.

<u>*Applegate's Milk-vetch*</u>
The primary reference for this section is: Hudson, B., J. Augsburger, M. Hillis, and P. Boehne. 2000. Draft Biological Assessment for the Interior Columbia River Basin Ecosystem Management Project Final Environmental Impact Statement. BLM and Forest Service. Boise, Idaho. Other references used are cited in the text and included in the Bibliography.

Applegate's milk-vetch (*Astragalus applegatei*) is a narrow endemic, known only from the Lower Klamath Basin near the city of Klamath Falls in southern Oregon. It is restricted to flat-lying, seasonally moist, strongly alkaline soils (USFWS 1997g). Although it is currently replete with introduced grasses and other weeds, the species' habitat was historically characterized by sparse, native bunchgrasses and patches of bare soil. Currently, there are two known populations of the species, which occur over a total area of less than 10 acres, and which form a total metapopulation of fewer than 20,000 individuals. Of the two populations, one is on land leased by The Nature Conservancy and one is on state land. There are no populations on federal lands.

Applegate's milk-vetch appears to be dependent on the seasonal flooding that occurs at sites where it is found, which may limit the dominance of other species and create favorable openings for the establishment of new plants. Applegate's milk vetch hosts an unknown species of beetle larvae, and is pollinated by ground-nesting beetles.

Applegate's milk-vetch was federally-listed as endangered on July 28, 1993. Critical habitat has not been designated. The primary threats to this species include invasion of habitat by exotic species such as quackgrass and cheatgrass, urban development, and road construction. Low population numbers, loss of habitat, wildlife grazing (rabbits), and management controls that alter natural wildfire and flooding regimes all pose serious threats to this species.

<u>*Willamette Valley Daisy*</u>
The primary reference for this section is: USFWS. 1997f. Endangered Status for *Erigeron decumbens* var. *decumbens* (Willamette Daisy) and Fender's Blue Butterfly (*Plebejus icarioides fenderi*) and Threatened Status for *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's Lupine). Federal Register 65(16):3875-3890. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Oregon State Office, Portland, Oregon.

The Willamette Valley daisy(*Erigeron decumbens* var. *decumbens*) is restricted primarily to the Willamette Valley of Oregon. The valley is an alluvial floodplain that is 130 miles long and 20 to 40 miles wide, with an overall northward gradient (Orr et al. 1992). The valley is narrow and flat at its southern end, widening and becoming hilly near its northern end at the confluence of the Willamette and Columbia rivers. The alluvial soils of the Willamette Valley and southern Washington host a mosaic of grassland, woodland, and forest communities. The Willamette Valley daisyoccupies native grassland habitats within the Willamette Valley. The vast majority of Willamette Valley grasslands require natural or human-induced disturbance for their maintenance (Franklin and Dryness 1973), and would likely be forested if left undisturbed (Johannessen et al. 1971).

The Kalapooya Indians cleared and burned lands in the Willamette Valley used for hunting and food gathering. Accounts by early explorers suggest a pattern of annual burning by the Kalapooya Indian tribe resulted in the maintenance of extensive wet and dry prairie grasslands (Johannessen et al. 1971). Although much of the woody vegetation was prevented from becoming established on the grasslands by this treatment, the random survival of young fire-resistant species such as Oregon white oak, accounted for the widely-spaced trees on the margins of the valley (Habeck 1961). After 1848, burning decreased sharply through the efforts of settlers to suppress large-scale fires. Consequently, the open, park-like nature of the valley floor was lost, replaced by agricultural fields, dense oak and fir forests, and scrublands following logging.

The primary habitat for the Willamette Valley daisy is native wetland prairie. This habitat is characterized by the seasonally wet tufted hairgrass community that occurs in low, flat regions of the Willamette Valley where flooding creates anaerobic and strongly reducing soil conditions. This wet prairie community includes rushes and California oatgrass as co-dominant native species, as well as the introduced species tall fescue, Japanese brome, and sweet vernal grass.

The Willamette Valley daisy is a perennial herb, 0.6 to 2.4 inches tall, with erect to sometimes prostrate stems at the base. As with many species in the Aster family, the Willamette Valley daisy produces large quantities of wind-dispersed seeds. Flowering typically occurs in June and July with pollination carried out by flies and bees. Seeds are released in July and August. Although the seeds are wind-dispersed, the short stature of this species likely prevents the long-distance travel of many of these seeds. The Willamette Valley daisy is capable of vegetative spreading and is commonly found in large clumps scattered throughout a site (Clark et al. 1993).

The Willamette Valley daisy was Federally Listed as endangered on January 25, 2000. At the time of listing, the USFWS indicated that designation of critical habitat was prudent, but that it would be deferred until resources became available to do so. The Willamette Valley daisy likely once occurred over a large distribution throughout the historic native prairie. However, native prairie vegetation in the Willamette Valley was decimated by the rapid expansion of agriculture from the 1850s to the present. In addition, fire suppression allowed shrub and tree species to overtake grasslands, while agricultural practices hastened the decline of native prairie species through habitat loss and increased grazing (Johannessen et al. 1971; Franklin and Dyrness 1973). Currently, the species is threatened by commercial and/or residential development, agriculture, silvicultural practices, road improvement, collection, herbicide use, and naturally occurring demographic and random environmental events.

Gentner's Fritillary

The primary reference for this section is: BLM. 2008. Biological Assessment FY 2009-2013 Programmatic Assessment For Activities that May Affect the Listed Endangered Plant Species Gentner's Fritillary, Cook's Lomatium, McDonald's Rockcress, and Large-flowered Wooly Meadowfoam. USFWS concurred with this assessment on 9/25/08. References cited in this section are internal to the above-referenced document.

Gentner's fritillary (*Fritillaria gentneri*), a perennial herb of the lily family, is restricted to southwestern Oregon and northern California where it is known from scattered localities in the Rogue and Klamath River basins in Josephine, Jackson and Siskiyou counties. The species is known from a wide variety of habitats and soil types across its range. The recovery plan (USDI 2003) identifies over 25 soil types and about 16 different plant communities that this species can occupy. Elevations of known occurrences range from 600 feet near the Rogue River to nearly 5,000 feet near Soda Mountain and can occur on nearly all aspects. Gentner's fritillary is most often found in forest ecotones or transitional areas, especially along ridgelines or aspect changes. No estimates of suitable habitat have been done because of the wide range of habitats in which it has been found. There are 194 known occurrences on all ownerships; 146 sites (75%) occur on federal lands, 16 sites (8%) occur on State, County or City owned public lands and 32 sites (16%) on private lands (Medford BLM, 2008; USDI FWS 2002; USDI FWS, 2003).

Gentner's fritillary is found in four general habitat types: ecotones between (and inclusions within) forested sites and more open habitat (oak woodlands/grasslands/chaparral);open canopied woodlands and mixed evergreen forests of madrone and Douglas-fir; permanent openings and edges of openings in forest and woodlands; riparian zone edges with canopy gaps and or deciduous tree canopies.

The primary means of reproduction of Gentner's fritillary is asexual. Small plants arise from near the base of larger flowering plants, presumably from underground bulblets coming off the parent bulb. The flowering season for this species is April-June. Few plants set fruit containing viable seed and most occurrences of this species contain few flowering plants. Plants may remain dormant for several years without producing above-ground stems and flowers. Hummingbirds (McFarlane 1980), and andrinid and halictid bees (Donham 2002) are the likely pollinators. About 3,000 flowering plants are documented on federal lands, and it is estimated that about 140,000 vegetative plants exist, although since the amount of genetic diversity within patches is very low, the number of distinct genotypes may be fewer than a few hundred. Three populations on private lands are believed to be extirpated.

Gentner's fritillary was Federally Listed as endangered on December 10, 1999. Critical habitat has not been designated. The species is threatened by residential development, agricultural activities, browsing by deer and livestock, logging, road and trail improvement, OHV use, collection for gardens, and problems associated with small population size. The recovery plan calls for intensive augmentation of populations with nursery-grown plants.

<u>*Western Lily*</u>
The primary reference for this section is: USFWS. 1998e. Recovery Plan for the Endangered Western Lily (*Lilium occidentale*). Portland, Oregon.

The western lily (*Lilium occidentale*) occurs in early successional bogs or coastal scrub on poorly drained soils, usually those underlain by a hard, poorly permeable layer. Currently, the species occurs in widely scattered locations near the Pacific Ocean. Populations occur along a 200-mile stretch of the Pacific Coast, from near Coos Bay in Oregon, south to Humboldt Bay in California. The plants grow at low elevations, from almost sea level to about 300 feet, and from ocean-facing bluffs to about 4 miles inland. Common plant associates include the shrubs salal, western wax myrtle, western spiraea, huckleberry, blackberry, black twinberry, and glandular Labrador tea. Common tree associates include shore pine, Sitka spruce, red alder, Port Orford cedar, and willow. Common herbaceous associates include Pacific reed-grass, slough sedge, bunchberry, staff gentian, bracken fern, peat moss, and western tofieldia.

The western lily appears to require a habitat that maintains a delicate balance between having some shrubbery and having too much. Vegetation less than 3 feet tall can be beneficial to the lily by sheltering juvenile plants from browsing by large mammals, and by providing shelter from the heat in July and August. This protection is most critical during spring and early summer, because seedlings appear to tolerate dieback of aboveground parts later in the growing season. Dense, tall shrub growth reduces reproduction and survivorship, and closure of the forest canopy will eventually eliminate a population entirely.

The western lily is an herbaceous perennial that grows from an unbranched, scaly, bulblike rhizome. The species reproduces primarily by seed, but asexual reproduction is possible from detached bulb scales growing into new plants. Shoots emerge primarily in March and April, although they can emerge as early as January in some locations. Flowers bloom in May to July. Rhizomes may produce one or more flowering shoots per year, each typically with one to three, but up to 25, pendant flowers. Flowers often emerge above the surrounding shrubs, where they are available to pollinators such as hummingbirds. Capsular fruits become erect and may produce over 100 seeds when mature. Seeds are dispersed primarily by wind and gravity, generally within a radius of about 13 feet. Each year the aboveground portion of the plants die back and individuals overwinter underground as rhizomes/bulbs.

The western lily was Federally Listed as endangered on August 17, 1994. Critical habitat has not been designated. The species is known or assumed to be extirpated in at least nine historical sites, as a result of forest succession, cranberry farm development, livestock grazing, deer and mammal herbivory, highway construction, and other development. These factors continue to threaten the western lily, with development taking a primary role. Populations of the western lily appear to have been maintained in the past by occasional fires, at least at some sites in Oregon, and by grazing. Among the most serious threats to this species is loss of habitat as a result of ecological succession facilitated by aggressive fire suppression.

Large-flowered Woolly Meadowfoam

The primary reference for this species is: USFWS. 2002c. Determination of Endangered Status for *Lomatium cookii* (Cook's Lomatium) and *Limnanthes floccosa* ssp. *grandiflora* (Large-flowered Woolly Meadowfoam) from Southern Oregon. Federal Register 67(216):68003-68015.

References cited in this section are internal to the above-referenced document. A complete list of these references is available from the State Supervisor, USFWS, Oregon Fish and Wildlife Office, Portland, Oregon.

Large-flowered woolly meadowfoam (*Limnanthes floccosa* ssp. *grandiflora*), like Cook's Lomatium discussed in the previous species account, occurs in vernal pool habitats in a small area of Jackson County, southwestern Oregon. The species is known to occur at about 15 sites in Jackson County (M. Jones, USDI BLM 2002; Oregon Natural Heritage Information Center Database 2002).

The large-flowered woolly meadowfoam occurs within the Agate Desert, a landform that was described in the previous species account. This landform is characterized by shallow soils, a relative lack of trees, sparse prairie vegetation, and agates commonly found on the soil surface (Oregon Natural Heritage Program 1997). Vernal pools in the Agate Desert vary in size from 3 to 100 feet across, and attain a maximum depth of about 12 inches. Common associated native species in these vernal pools include popcorn flower, a rush, navarretia, common woolly meadowfoam, and annual hairgrass.

The large-flowered woolly meadowfoam is a delicate annual of the meadowfoam family that is covered with short, fuzzy hairs. Like Cook's Lomatium, plants are adapted to grow, flower, and set seed during the short time that water is available in the spring, finishing their life cycle before the dry hot summers. Each year, plant populations exhibit some natural variation in numbers, related primarily to temperature and rainfall conditions for that year.

The large-flowered woolly meadowfoam was Federally Listed as endangered on November 7, 2002. Designation of critical habitat has been deferred. The primary threat to the large-flowered woolly meadowfoam is the destruction of vernal pool habitat by industrial and residential development, including road and powerline construction and maintenance. Agricultural conversion, certain grazing practices, and OHV use also contribute to population declines and local extirpations. Recent evidence also indicates that non-native annual grasses, particularly medusahead, are a greater problem than previously believed, as discussed in the species account for Cook's Lomatium.

Bradshaw's Desertparsley

The primary reference for this section is: USFWS. 1993g. *Lomatium bradshawii* (Bradshaw's desertparsley) Recovery Plan. Portland, Oregon. References cited in this section are internal to the above-referenced document. They are included in the Bibliography.

Bradshaw's desertparsley , or Bradshaw's desert-parsley (*Lomatium bradshawii*) is endemic to the central and southern portions of the Willamette Valley, in western Oregon. It is known from Marion, Linn, Benton, and Lane counties. The majority of the sites and plants occur in and adjacent to the Eugene metropolitan area, with the greatest concentration found in West Eugene. Bradshaw's desertparsley occurs in two very distinct habitats. The rarest are the shallow, stream-covered basalt areas found in Marion and Linn counties neat the Santiam River. At these sites, the plants occur in areas with almost no soil, usually in vernal wetlands or along stream channels. The majority of the species' populations occur on seasonally saturated or flooded prairies, which are common by creeks and small rivers in the southern Willamette Valley. They occur in areas with deep, pluvial clays, usually in a matrix with alluvial silts. The slowly permeable clay layer results in a perched water table in winter and spring, so soils are generally saturated to the surface or slightly inundated during the wet season. This relic wetland prairie has been described as the tufted hairgrass valley prairie, which ranges from fairly wet areas with high sedge and rush cover, to drier bunchgrass prairie. In the wet areas, Bradshaw's desertparsley occurs on the edges of tufted-hairgrass or sedge bunches, in patches of bare or open soil. In the drier areas, it is found in low areas, such as small depressions, trails, or seasonal channels, also with open, exposed soils.

Bradshaw's desertparsley reproduces entirely by seeds, which are produced on umbels. Flowers are visited by numerous pollinators, and require insects for pollination. The species blooms fairly early in the spring, usually in April or early May. In the Willamette Valley, these are often wet, rainy weeks, when large bees and butterflies are largely absent. The very general nature of the insect pollinators probably buffers the species from population swings of any one pollinator (Kaye 1992). A typical population of Bradshaw's desertparsley is composed of many more vegetative plants than reproductive plants. In general, populations that have experienced prescribed fire have a higher probability of survival.

Bradshaw's desertparsley was Federally Listed as endangered on September 30, 1988. Critical habitat has not been designated. The species' habitat is presently being destroyed or modified by a number of factors: invasion of prairie vegetation by trees and shrubs; changes in flooding patterns and water movement (which may be critical to seedling establishment); urban development; and agricultural or rural development. In addition, disease caused by a fungal parasite, and insect predation of plants and fruit may threaten smaller populations. Finally, natural factors such as inbreeding or limited pollinator availability may reduce fecundity, and therefore reproductive capacity of the species.

<u>*Cook's Lomatium*</u>
The primary reference for this species is: USFWS. 2002c. Determination of Endangered Status for *Lomatium cookii* (Cook's Lomatium) and *Limnanthes floccosa* ssp. *grandiflora* (Large-flowered Woolly Meadowfoam) from Southern Oregon. Federal Register 67(216):68003-68015. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the State Supervisor, USFWS, Oregon Fish and Wildlife Office, Portland, Oregon.

Cook's Lomatium (*Lomatium cookii*) occurs in vernal pool habitats in a small area of Jackson County, southwestern Oregon. It is also known to occur in seasonally wet habitats at a few sites in Josephine County, the adjacent county to the west. Cook's Lomatium is known to occur at about 15 sites in Jackson County and at about 21 sites in Josephine County (M. Jones, USDI BLM 2002; Oregon Natural Heritage Information Center Database 2002).

Cook's Lomatium occurs within a 32-square-mile landform in southwestern Oregon known as the Agate Desert in Jackson County. This landform is characterized by shallow soils, a relative lack of trees, sparse prairie vegetation, and agates commonly found on the soil surface (Oregon Natural Heritage Program 1997). Vernal pools in the Agate Desert vary in size from 3 to 100 feet across, and attain a maximum depth of about 12 inches (Oregon Natural Heritage Program 1997). Common associated native species in these vernal pools include popcorn flower, a rush, navarretia, common woolly meadowfoam, and annual hairgrass.

Cook's desert parsley also occurs in another area of about 4 square miles in adjacent Josephine County. This area, referred to as French Flat, is located within the Illinois Valley near the Siskiyou Mountains. In this area, Cook's desert parsley grows in wet meadow areas underlain with floodplain bench deposits that contain sufficient clay to form a clay pan at 24 to 35 inches below the soil surface (U.S. Department of Agriculture 1983). The clay pan creates seasonally wet areas similar to the vernal pools of the Agate Desert, but mostly lacking in mound-swale topography. Common associated species include California oatgrass, popcorn flower, horkelia, mariposa lily, and trout lily. The surrounding forest contains ponderosa pine and Jeffrey pine.

Cook's Lomatium is a perennial forb in the carrot family that grows from a slender, twisted taproot. The species is adapted to grow, flower, and set seed during the short time that water is available in the spring, finishing its life cycle before the dry hot summers.

Cook's Lomatium was Federally Listed as endangered on November 7, 2002. Designation of critical habitat for this species has been deferred. The primary threat to Cook's Lomatium is the destruction of vernal pool habitat by industrial and residential development, including road and powerline construction and maintenance. Agricultural conversion, certain grazing practices, and OHV use also contribute to population declines and local extirpations. Recent evidence also indicates that non-native annual grasses, particularly medusahead, are a greater problem than previously believed. Unlike native perennial bunchgrasses that originally occupied the area, annual grasses die back each year, creating a buildup of thatch from the dead leaves that interferes with the seed germination of native species. Current observations indicate that, without control of annual grasses through mowing, grazing, or prescribed burns, populations tend to decrease over time, and could be extirpated within a relatively short time frame as a result of competition with non-native grasses (Borgias 2002). Additionally, Cook's Lomatium sites in Josephine County are threatened by habitat alteration associated with gold mining and woody species encroachment resulting from fire suppression.

Critical habitat designation for the listed Cook's Lomatium and *Limnanthes floccosa* spp. *grandiflora* is out in draft (June 2006), and a recent settlement agreement says it will be done by July 2010.

<u>Rough Popcorn flower</u>

The primary reference for this species is: USFWS. 2000f. Endangered Status for the Plant *Plagiobothrys hirtus* (Rough Popcorn flower). Federal Register 65(16):3866-3875. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Oregon State Office, Portland, Oregon.

The rough popcorn flower (*Plagiobothrys hirtus*) is endemic to seasonal wetlands (e.g., wet swales and meadows) of the interior valley of the Umpqua River in southwestern Oregon (Amsberry and Meinke 1997b). The plant grows at elevations ranging from 98 to 886 feet, in open microsites within interior valley grasslands. Common associates include one-sided sedge, meadow barley, tufted hairgrass, American slough grass, great camas, water foxtail, baltic rush, wild mint, Willamette downingia, and bentgrass (Gamon and Kagan 1985).

The rough popcorn flower is an annual herb on drier sites or a perennial herb on wetter sites (Amsberry and Meinke 1997a). It grows in scattered groups and reproduces largely by insect-aided cross-pollination and partially by self-pollination. The taxon is considered dependent on seasonal flooding and/or fire to maintain open habitat and to limit competition with invasive non-native plant species, such as Himalayan blackberry, teasel, Canada thistle and pennyroyal and native Oregon ash (Gamon and Kagan 1985, Almasi and Borgias 1996).

Approximately 20 occurrences of this species are known, all of which are located in Douglas County, in the vicinity of Wilbur, Sutherlin and Yoncalla, Oregon. Fifteen populations naturally occurring and two are reintroduced. Of the naturally occurring populations, only 5 are legally protected. Two are on Oregon Department of Transportation land and 3 are on private land managed by The Nature Conservancy. The remaining populations are on private, commercial, residential and agricultural land. There is an estimated 7,000 individuals, with patch sizes ranging from 1 to 3,000 individuals. However, since *Plagiobothrys hirtus* ssp. *hirtus* can spread vegetatively, it is difficult to estimate the total number of genetic individuals. Total occupied habitat is only about 45 acres (USFWS 2000).

In cooperation with the Bureau of Land Management (BLM - Roseburg District) and USFWS, ODA created three new populations on the North Bank Habitat Management Area, a 6,000 acre ranch currently managed by the BLM for multi-species habitat conservation. Planted in 1998, these populations continue to thrive, and make a significant contribution to the recovery of this species. ODA continues to monitor these created populations and cooperate with BLM to ensure their long term viability (ODA 2008).

The rough popcorn flower was Federally Listed as endangered on January 25, 2000. Critical habitat has not yet been designated for this species. Draining of wetlands for urban and agricultural uses and road and reservoir construction, however, has altered the original hydrology of the valley to such an extent that the total area of suitable habitat for the species has been substantially reduced. In addition to the ongoing threat of direct loss of habitat from conversion to urban and agricultural uses, hydrological alterations, and fire suppression, other threats to the species include spring and summer livestock grazing, roadside mowing, spraying, competition with non-native vegetation, and landscaping (Gamon and Kagan 1985, Kagan 1995).

Malheur Wire-lettuce

The primary reference for this section is: Hudson, B., J. Augsburger, M. Hillis, and P. Boehne. 2000. Draft Biological Assessment for the Interior Columbia River Basin Ecosystem Management Project Final Environmental Impact Statement. BLM and Forest Service. Boise, Idaho.

Malheur wire-lettuce (*Stephanomeria malheurensis*) is an annual plant that is found at only one 70-acre location near Malheur National Wildlife Refuge in Harney County, Oregon. This population is found within the high desert environment typical of the northern portion of the Great Basin, on top of a dry, broad hill. The substrate at this location is an azonal soil derived from the volcanic tuff layered with thin crusts of limestone. By contrast, the surrounding soils are derived from basalt. The top of the hill is about 500 feet above the surrounding flats, which consist of sagebrush-rabbitbrush desert. The immediate site itself is dominated by big sagebrush, common or gray rabbitbrush, and cheatgrass. Malheur wire-lettuce appears to be one of the few species that is able to survive on and around the otherwise barren harvester ant hills at the site. The area has been fenced to protect the population.

Because the species is an annual, the numbers of plants vary greatly from year to year, and depend largely on the amount of precipitation received prior to and during the spring growing season. Seeds germinate in the fall after a late summer / early fall rain.

The Malhuer wire-lettuce was Federally Listed as endangered on November 10, 1982, and critical habitat was designated to include the 160-acre Scientific Study Area on public land administered by the BLM, located 27 miles south of Burns in Harney County, Oregon. Because of its extremely restricted range and low numbers, this species is vulnerable to even small land disturbances in and around its habitat. Potential future zeolite mining in the area also endangers the continued existence of this species. Other threats to this species that have been identified include competition with cheatgrass, grazing by native herbivores, and possible foraging by beetle larvae.

Threatened

Golden Paintbrush

The primary references for this section are the listing notice (Final Rule) in the June 11, 1997 Federal Register, Vol.62, No. 112, 31740-31748, and Recovery Plan, August 23, 2000, in Portland OR.

Golden paintbrush (*Castilleja levisecta*) inhabits gravelly prairies at low elevations, west of the Cascades from Vancouver Island south through the Puget Trough of Washington. Historically, golden paintbrush was found as far north as British Columbia, and as far south as the Willamette Valley of Oregon. Golden paintbrush is believed to have been extirpated from Oregon although remnants of its Willamette Valley habitat still exists and botanists continue to search for this species. Many populations have been destroyed by the conversion of native prairie habitat to agricultural, residential, and commercial uses. The decline of golden paintbrush is also correlated with fire suppression. Fire disturbance is an integral component of the prairie ecosystem, maintaining grassland by preventing the successional encroachment of woody shrubs and trees. As a direct consequence of these land-use changes, golden paintbrush has not been seen in Oregon for over 40 years. It is found in openings damp in the winter but not from standing water, and it is typically associated with Idaho or red fescue, meadow checkerbloom, camas, cinquefoil, peacock larkspur, Hall's aster, and hairgrass.

Golden paintbrush is a multi-stemmed perennial with covered with soft, somewhat sticky hairs. Flower bracts are about the same width as the upper leaves and are a brilliant golden to yellow color. Plants emerge in early March and flower from April to early September. Bumblebees are most frequently observed foraging on the flowers, and are suspected of being a primary pollinator. Seed production is rather prolific, and cold stratification is required for germination. Like many species within the family Scrophulariaceae, and particularly within the genus Castilleja, golden paintbrush is considered to be a facultative root parasite.

Golden paintbrush was federally-listed as threatened on June 11, 1997. Critical habitat has not been designated. Threats to the extant populations include loss of suitable habitat, the invasion of grassland habitat by native and non-native species, herbivory, trampling, fire suppression, and collecting by humans. The few remaining populations of golden paintbrush in the Pacific Northwest region are isolated, fragmented, and most are quite small. As such, they are vulnerable to extirpation from random, stochastic events, and are individually and collectively critical for the long term survival of this species. USFWS. 1997.

<u>Water Howellia</u>

The primary reference for this section is: Hudson, B., J. Augsburger, M. Hillis, and P. Boehne. 2000. Draft Biological Assessment for the Interior Columbia River Basin Ecosystem Management Project Final Environmental Impact Statement. BLM and Forest Service. Boise, Idaho.

Water howellia (*Howellia aquatilis*) is an annual aquatic plant with a scattered distribution in the Pacific Northwest. The species is known to be extant in Idaho, Montana, and Washington, but is also historically known from California and Oregon. Sites in California and Oregon have not been recently relocated, despite intensive field surveys in both states. Within its current range, water howellia is known from a total of 110 occurrences. There are two main centers of distribution within this range: one in the Swan River Valley in Montana, and one in the vicinity of Spokane, Washington. Populations of water howellia in these centers range from one to 1,000 plants, and occur mostly on publicly-owned land, and at elevations of 400 to 2,320 feet. Two occurrences are known in northern Idaho, in private ownership, and two others are found in western Washington. The total known occupied habitat for this species is less than 100 acres.

Water howellia is restricted to small pothole ponds or the quiet water of shallow, abandoned river oxbows. These wetland habitats typically occur in a matrix of dense forest vegetation, and all known sites have at least some deciduous tree cover around a portion of the pond. Ponderosa pine forests typically surround the ponds, and red-osier dogwood is usually present around the perimeters. The bottom surfaces of the wetlands consist of firm, consolidated clay and organic sediments. These wetlands are generally filled by snowmelt runoff and spring rains, but then dry out to varying degrees by late summer or early fall, depending on annual patterns of temperature and precipitation. The ponds are typically shallow, averaging 1 to 2 feet in depth during the middle of summer.

The bloom period of water howellia varies by geographic location, but typically occurs in May and June. The drying of the wetland habitat in late summer is critical to the species' life cycle; the seeds will only germinate if they are exposed to the atmosphere. After the seedlings appear, usually in October, they overwinter under the snowpack. In late spring and early summer, the plants resume growth in the water that accumulates in the ponds. This ecological relationship has a profound influence on the size of occurrences from year to year; the summer climate determines the degree of pond drying, and thus the amount of seed germination in the fall. During years when seed germination is reduced, few plants are present the following summer.

Water howellia was listed as threatened on July 14, 1994, but critical habitat was not designated. The highly specialized ecological adaptations of the species make it vulnerable to both short- and long-term natural environmental changes, such as succession or climate change. Land management activities and habitat destruction have also affected this species. Development, construction of dams, livestock grazing and trampling, timber harvesting, and road building are some of the human activities that alter the habitat of this species. Competition with introduced plant species, such as reed canarygrass and purple loosestrife, is also a threat.

<u>*Kincaid's Lupine*</u>

The primary references for this section is: USFWS. 1997f. Endangered Status for *Erigeron decumbens* var. *decumbens* (Willamette Daisy) and Fender's Blue Butterfly (*Plebejus icarioides fenderi*) and Threatened Status for *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's Lupine). Federal Register 65(16):3875-3890 and the Management Plan for Kincaid's Lupine (*Lupinus sulphureus* ssp. *kincaidii*) in Douglas County, Oregon by BLM, USDA FS, USFWS. 2008. References cited in this section are internal to the above-referenced documents. A complete list of these references is available from the USFWS Oregon State Office, Portland, Oregon.

In 2008, Kincaid's lupine was known from 76 occurrences, totaling approximately 1,150 acres (465 ha) in size, scattered across six counties (Yamhill, Polk, Benton, Lane, and Douglas Counties in Oregon and Lewis County, Washington) (USFWS 2005). In the Willamette Valley, Kincaid's lupine is typically found in native upland prairie with red fescue and/or Idaho fescues, the dominant species, and Tolmie's mariposa, Hooker's catchfly, broadpetal strawberry, rose checker-mallow, and lomatium species serving as herbaceous indicator species (Hammond and Wilson 1993). The primary habitat for Kincaid's lupine in Douglas County is open woodland and meadow edges, often near roadsides, associated with Pacific madrone *(Arbutus menziesii*), incense cedar *(Calocedrus decurrens*), and Douglas-fir *(Pseudotsuga menziesii*) trees with a relatively open canopy cover. Most of the Douglas County populations appear to tolerate more shaded habitat conditions than the Willamette Valley populations with canopy cover of 50 to 80 percent (Barnes 2004). However, canopy covers between zero and 50 percent occur at the Callahan Meadows and Callahan Ridge sites. Elevations are generally below 460 meters (1,500 feet) and soils are typically shallow and rocky over bedrock, or sometimes deep and very well drained (Chappell and Kagan 2001).

Kincaid's lupine populations in Douglas County, represent the furthest southern extent of the current range. These populations are highly disjunct and isolated from the Willamette Valley populations with approximately 54 miles (87 km) separating Oregon's south Willamette Valley populations from the Douglas County populations. In Douglas County, Kincaid's lupine occurs at 14 sites ranging in size from 0.21 to 3.55 acres. Of these, nine sites occur on public lands. The Douglas County populations may be adapted to tolerate more extreme habitat and/or other environmental conditions. (BLM, USDA FS, USFWS. 2008. Management Plan for Kincaid's Lupine (*Lupinus sulphureus* ssp. *kincaidii*) in Douglas County, Oregon.) In addition to its Oregon occurrences, this species is known from two small sites in Lewis County, southern Washington, 40 miles north of the Willamette Valley.

Kincaid's lupine is a long-lived perennial species, with a maximum reported age of 25 years (Wilson 1993). Individual plants are capable of spreading by rhizomes, producing clumps of plants exceeding 66 feet in diameter

(Hammond 1994). The long rhizomes do not produce adventitious roots (secondary roots growing from stem tissue) and apparently do not separate from the parent clump, and the clumps may be short-lived, regularly dying back to the crown (Kuykendall and Kaye 1993a). Kincaid's lupine is pollinated by solitary bees and flies (Hammond 1994). Seed set and seed production are low, with few (but variable) numbers of flowers producing fruit from year to year, and each fruit containing an average of 0.3 to 1.8 seeds (Liston et al. 1994). Seeds are dispersed from fruits that open explosively upon drying. Kincaid's lupine is the host plant of the federally endangered Fender's blue butterfly.

Kincaid's lupine was Federally Listed as threatened on January 25, 2000. Critical habitat was designated in 2007 for Willamette Valley populations, and a management plan for the species in Douglas County was developed in lieu of critical habitat in 2008. Kincaid's lupine likely once occurred over a large distribution throughout the historic native prairie. However, native prairie vegetation in the Willamette and Umpqua Valleys. Fire was the primary mode of disturbance which kept grassland habitats open and free from encroaching trees and shrubs; the settlement of the Willamette and Umpqua Valleys by Euro-Americans resulted in the conversion of grasslands to urban and agriculture uses, and severely restricted the frequency of fires (Chappell and Kagan 2001). Currently, Kincaid's lupine is threatened by commercial and/or residential development, agriculture, silvicultural practices, road improvement, collection, herbicide use, and naturally occurring demographic and random environmental events. Populations of *Lupinus sulphureus* ssp. *kincaidii* occur on public lands or lands that are managed by a conservation organization at William L. Finley National Wildlife Refuge and Baskett Slough National Wildlife Refuge, Fern Ridge Reservoir, Bureau of Land Management units in Lane and Douglas Counties, the Umpqua National Forest, Willow Creek Preserve, and at the McDonald State Forest. All of these parcels have some level of management for native prairie habitat values.

McFarlane's Four-o'clock

The primary reference for this section is: USFWS. 1996c. Reclassification of *Mirabilis Macfarlanei* (MacFarlane's Four-o'clock) from Endangered to Threatened Status. Federal Register 61(52):10693-10697. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Snake River Basin Office, Boise, Idaho.

MacFarlane's four-o'clock (*Mirabilis macfarlanei*) is found on talus slopes in canyonland corridors where the climate is regionally warm and dry, and where precipitation occurs mostly during the period from winter to spring. It can be found in three disjunct areas in Oregon and Idaho that are associated with the Snake, Salmon, and Imnaha rivers. The species occurs as scattered plants on open, steep (50%) slopes of sandy soils, which generally have a west to southeast aspect. Talus rock underlies the soil in which the plants are rooted. Although a variety of soils support this plant throughout its range, the more common sandy soils are quite susceptible to displacement by wind and water erosion.

The plant community in which MacFarlane's four-o'clock occurs is a transition zone between bluebunch wheatgrass-Sandberg bluegrass and smooth sumac-bluebunch wheatgrass, consisting of bluebunch wheatgrass, cheatgrass, sand dropseed, scorpion weed, desert parsley, hackberry, smooth sumac, yarrow, and rabbit bush (Daubenmire 1970, Franklin and Dyrness 1973).

One geographic unit of MacFarlane's four-o'clock includes approximately 25 acres along 6 miles of Hells Canyon on the banks and canyonland slopes above the Snake River in Idaho County, Idaho, and Wallowa County, Oregon. The second geographic unit includes approximately 68 acres along 18 miles of banks and canyonland slopes above the Salmon River in Idaho County, Idaho. The third geographic unit includes about 70 acres of habitat along 3 miles of canyonland slopes over the Imnaha River in Wallowa County, Oregon.

MacFarlane's four-o'clock is a perennial plant with a stout, deep-seated taproot. Flowering occurs from early May to early June, and peaks in mid-May.

MacFarlane's four-o'clock was Federally Listed as endangered on October 26, 1979. After additional populations were discovered, the plant was reclassified as threatened on March 15, 1996. Critical habitat has not been designated. Threats to the species include lack of plant recruitment in some areas, insect predation, invasions of non-native plants (often as a result of grazing practices), and the small size of some populations.

Nelson's Checker-mallow

The primary reference for this section is: USFWS. 1998j. Recovery Plan for the Threatened Nelson's Checker-mallow (*Sidalcea nelsoniana*). Portland, Oregon. References cited in this section are internal to the above-referenced document. They are included in the Bibliography.

Nelson's checker-mallow (*Sidalcea nelsoniana*) occurs as scattered populations in two distinct ecological regions: the northern Coast Range and the Willamette Valley of Oregon (includes two outlying populations in the Puget Trough of Washington). The species is not restricted to a single habitat type. Rather, it occupies a broad range of soils that vary in texture, drainage, and disturbance regimes (CH2M Hill 1986b). Plants appear to favor primary drainages, or those that receive mostly ground flow of stormwater runoff, rather than drainages fed by stream sources.

Although occasionally occurring in the understory of woodlands or among woody shrubs, populations of Nelson's checker-mallow in the Willamette Valley usually occupy open habitats that support early successional species (i.e., plants that colonize openings and then disappear as trees shade them out). These habitats are frequently represented by margins of sloughs, ditches, and streams, roadsides, fence rows, drainage swales, native prairie remnants, and fallow fields. Most sites have been densely colonized by invasive weeds, especially introduced forage grasses. Commonly associated plant species include: tall fescue, rose, common rush, Canada thistle, common St. Johnswort, blackberry, sedge, timothy, velvet grass, yarrow, vetch, western spiraea, bird's-foot trefoil, ox-eye daisy, colonial bent-grass, meadow foxtail, reed canarygrass, Douglas' hawthorn, wild carrot, large-leaved avens, geranium, and Oregon ash (Oregon Department of Agriculture 1995).

Populations of Nelson's checker-mallow in the Coast Range generally occur in open, wet-to-dry meadows, intermittent stream channels, and along the margins of coniferous forests. These areas typically support larger components of native vegetation than the Willamette Valley sites. Commonly associated plant species include tansy ragwort, spear-head senecio, strawberry, velvet grass, timothy, rush, sedge, and yarrow.

Nelson's checker-mallow is an herbaceous perennial plant species in the mallow family. In the Willamette Valley, flowering begins as early as mid-May, and continues through August to early September, depending on the moisture and climatic conditions of each site. Coast Range populations experience a shorter growing season and generally flower later and go dormant earlier. Seeds are deposited locally at or near the base of the parent plant, and may be shed immediately or persist into winter within the dry flower parts that remain attached to the dead stems. Seed dissemination could conceivably be accomplished through ingestion by deer and elk, particularly in the Coast Range. Aboveground portions of the plant die back in the fall, usually followed by some degree of re-greening at the base. It is not uncommon for some plants to continue producing flowers into the fall and early winter. Sexual reproduction appears to be accomplished entirely by insect pollinators.

Nelson's checker-mallow was Federally Listed as threatened on February 12, 1993. Critical habitat has not been designated. Prior to European settlement, Nelson's checker-mallow habitats were likely maintained and kept free of overgrowth and woody vegetation by natural wildfires, fires set by Native Americans (Johannessen et al. 1971; Franklin and Dyrness 1973; Boyd 1986), and sporadic flooding. The landscape and processes such as flooding and fire have been dramatically altered since the onset of European settlement. Today, no natural prairie remains in the Willamette Valley without evidence of livestock grazing, agriculture, and fire suppression (Moir and Mika 1972). Urbanization and conversion of the native prairies into intensively managed croplands and pastures have eliminated and fragmented grasslands to the extent that Nelson's checker-mallow is now restricted to sparsely distributed patches within narrow highway and country road ROW, undeveloped tracts, ditches, fence rows, abandoned fields, parks, and wildlife refuges. Populations in the Willamette Valley are threatened by roadside maintenance, herbicide application and mowing, soil cultivation, ditching, and other habitat modifications.

Land threats are less extreme in the Coast Range, where the meadows occupied by Nelson's checker-mallow are isolated from agricultural and urban development. Potential threats to these populations include a planned water impoundment project, herbicide application associated with timber harvest, and motorcyclists. Other threats to the species as a whole are competition with invasive plant species, the encroachment of trees and shrubs, limited seed production, and the species' small population size and fragmentation.

<u>*Spalding's Catchfly*</u>

The primary reference for this section is: USFWS. 2001c. Final Rule to List *Silene spaldingii* (Spalding's catchfly) as Threatened. Federal Register 66(196):51598-51606. References cited in this section are internal to the above-referenced document. A complete list of these references is available from the USFWS Snake River Basin Office, Boise, Idaho.

Spalding's catchfly (*Silene spaldingii*) is primarily restricted to mesic grasslands that make up the Palouse region in southeastern Washington, northwestern Montana, adjacent portions of Idaho and Oregon, and British Columbia. Palouse prairie is considered a subset of the Pacific Northwest bunchgrass habitat type (Tisdale 1986). Spalding's catchfly is also found in canyon grassland habitat, which is another division of the Pacific Northwest bunchgrass habitat type. Canyon grasslands are dominated by the same bunchgrass species as the Palouse prairie, but the two habitat types differ in their overall plant species composition (Hill 2000, Yuncevich 2000). In addition, canyon grasslands occur in steep, highly dissected canyon systems, whereas Palouse grasslands generally occur on gently rolling plateaus. The steep slopes in canyon grasslands result in pronounced habitat diversity (Yuncevich 2000). This steepness has also prevented the conversion of canyon grasslands to other uses, such as agriculture.

Spalding's catchfly is typically associated with grasslands dominated by native perennial bunchgrasses such as Idaho fescue or rough fescue. Other associated species include bluebunch wheatgrass, prairie Junegrass, snowberry, Nootka rose, yarrow, prairie smoke avens, sticky purple geranium, and arrowleaf balsamroot (Lichthardt 1997, Montana Natural Heritage Program 1998). Scattered individuals of ponderosa pine may also be found in or adjacent to Spalding's catchfly habitat. Sites on which Spalding's catchfly occurs range from approximately 1,500 feet to 5,100 feet in elevation (Oregon Natural Heritage Program 1998, Washington Natural Heritage Program 1998).

At the time of listing in 2001, this species was known from a total of 52 populations in the United States and British Columbia, 51 of which were in the United States (7 in Idaho, 7 in Oregon, 9 in Montana, and 28 in Washington). The range of individuals in each population ranges from one to several thousand. Much of the remaining habitat occupied by Spalding's catchfly is fragmented, with clusters of populations geographically isolated from one another.

Spalding's catchfly is a long-lived perennial herb that ranges from 8 to 24 inches in height (Lichthardt 1997). The species does not possess rhizomes or other means of vegetative reproduction, and reproduces by seed only (Lesica 1992). Plants are typically pollinated by bumblebees, which appear to be critical to population viability (Lesica 1993).

Spalding's catchfly was Federally Listed as threatened on October 10, 2001. At the time of listing, designation of critical habitat was deemed prudent, but was deferred until resources become available. Large-scale ecological changes in the Palouse region over the past century, including agricultural conversion, changes in fire frequency, and alterations of hydrology, have resulted in the decline of Spalding's catchfly. More than 98% of the original Palouse prairie habitat has been lost or modified be agricultural conversion, grazing, invasions of non-native plant species, altered fire regimes, and urbanization (Noss et al. 1995). In addition, the less accessible canyon grasslands have been disturbed by livestock grazing and the invasion of non-native plant species. Threats to this species include habitat destruction and fragmentation resulting from agriculture and urban development, grazing and trampling by domestic livestock and native herbivores, herbicide treatment, and competition from non-native plant species.

Howell's Spectacular Thelypody

The primary reference for this section is: USFWS. 1999c. Threatened Status for the Plant *Thelypodium howellii* ssp. *spectabilis* (Howell's Spectacular Thelypody). Federal Register 64(101):28393-28403. References cited in this section are internal to the above-referenced document. They are included in the Bibliography.

Howell's spectacular thelypody (*Thelypodium howellii* var. *spectabilis*) occurs in moist, alkaline meadow habitats at approximately 3,000 feet to 3,500 feet elevation in northeastern Oregon. The plant is currently known from 11 sites (five populations) ranging in size from 0.03 to 41 acres in the Baker-Powder River Valley in Baker and Union counties. The total occupied habitat for this species is approximately 100 acres, and its range lies entirely within a 13-mile radius of Haines, Oregon. Howell's spectacular thelypody usually grows in valley bottoms around woody shrubs that dominate the habitat on the knolls, and along the edge of wet meadow habitat between the knolls. Associated species include greasewood, alkali saltgrass, giant wild rye, alkali cordgrass, and alkali bluegrass (Kagan 1986). Soils are pluvial-deposited alkaline clays mixed with recent alluvial silts, and are moderately well-drained.

Howell's spectacular thelypody is an herbaceous biennial that reaches a height of approximately 2 feet, with branches arising from near the base of the stem. Flowers are purple and borne on short stalks, and fruits are long, slender pods (Greenleaf 1980, Kagan 1986). The taxon may be dependent on periodic flooding, since it appears to rapidly colonize areas adjacent to streams that have flooded (Kagan 1986). In addition, this taxon does not compete well with encroaching weedy vegetation such as teasel (Davis and Youtie 1995).

Howell's spectacular thelypody was listed as threatened on May 26, 1999. Critical habitat has not been designated. Factors that threaten this taxon include habitat destruction and fragmentation caused by agricultural and urban development, grazing by domestic livestock, competition from non-native vegetation, and alteration of wetland hydrology.

Conservation Measures for Vascular Plants

As dictated in BLM Manual 6840 (Special Status Species Management), local BLM offices are required to develop and implement management plans and programs that will conserve listed species and their habitats. In addition, NEPA documentation related to treatment activities (i.e., projects) will be prepared that identify any TEP plant species or their critical habitat that are present in the proposed treatment areas, and that list the measures that will be taken to protect them.

Many local BLM offices already have management plans in place that ensure the protection of these plant species during activities on public land. However, a discussion of these existing plans is outside the scope of this programmatic BA. The following general guidance applies to all management plans developed at the local level.

Required steps include the following:

- A survey of all proposed action areas within potential habitat by a botanically qualified biologist, botanist, or ecologist to determine the presence/absence of the species.
- Establishment of site-specific no activity buffers by a qualified botanist, biologist, or ecologist in areas of occupied habitat within the proposed project area. To protect occupied habitat, treatment activities would not occur within these buffers.
- Collection of baseline information on the existing condition of TEP plant species and their habitats in the proposed project area.
- Establishment of pre-treatment monitoring programs to track the size and vigor of TEP populations and the state of their habitats. These monitoring programs would help in anticipating the future effects of vegetation treatments on TEP plant species.
- Assessment of the need for site revegetation post treatment to minimize the opportunity for noxious weed invasion and establishment.

At a minimum, the following must be included in all management plans:

- Given the high risk for damage to TEP plants and their habitat from burning, mechanical treatments, and use of domestic animals to contain weeds, none of these treatment methods should be utilized within 330 feet of sensitive plant populations UNLESS the treatments are specifically designed to maintain or improve the existing population.
- Off-highway use of motorized vehicles associated with treatments should be avoided in suitable or occupied habitat.
- Biological control agents (except for domestic animals) that affect target plants in the same genus as TEP species must not be used to control target species occurring within the dispersal distance of the agent.
- Prior to use of biological control agents that affect target plants in the same family as TEP species, the specificity of the agent with respect to factors such as physiology and morphology should be evaluated, and a determination as to risks to the TEP species made.
- Post-treatment monitoring should be conducted to determine the effectiveness of the project.

In addition, the following guidance must be considered in all management plans in which herbicide treatments are proposed to minimize or avoid risks to TEP species. The exact conservation measures to be included in management plans would depend on the herbicide that would be used, the desired mode of application, and the conditions of the site. Given the potential for off-site drift and surface runoff, populations of TEP species on lands not administered by the BLM would need to be considered if they are located near proposed herbicide treatment sites.

- Herbicide treatments should not be conducted in areas where TEP plant species may be subject to direct spray by herbicides during treatments.
- Applicators should review, understand, and conform to the "Environmental Hazards" section on herbicide labels (this section warns of known pesticide risks and provides practical ways to avoid harm to organisms or the environment).
- To avoid negative effects to TEP plant species from off-site drift, surface runoff, and/or wind erosion, suitable buffer zones should be established between treatment sites and populations (confirmed or suspected) of TEP plant species, and site-specific precautions should be taken (refer to the guidance provided below).
- Follow all instructions and Standard Operating Procedures to avoid spill and direct spray scenarios into aquatic habitats that support TEP plant species.
- Follow all BLM operating procedures for avoiding herbicide treatments during climatic conditions that would increase the likelihood of spray drift or surface runoff.

The following conservation measures refer to sites where broadcast spraying of herbicides, either by ground or aerial methods, is desired. Manual spot treatment of undesirable vegetation can occur within the listed buffer zones if it is determined by local biologists that this method of herbicide application would not pose risks to TEP plant species in the vicinity. Additional precautions during spot treatments of vegetation within habitats where TEP plant species occur should be considered while planning local treatment programs, and should be included as conservation measures in local-level NEPA documentation.

The buffer distances provided below are conservative estimates, based on the information provided by ERAs, and are designed to provide protection to TEP plants. Some ERAs used regression analysis to predict the smallest buffer distance to ensure no risks to TEP plants. In most cases, where regression analyses were not performed, suggested buffers extend out to the first modeled distance from the application site for which no risks were predicted. In some instances the jump between modeled distances was quite large (e.g., 100 feet to 900 feet). Regression analyses could be completed at the local level using the interactive spreadsheets developed for the ERAs, using information in ERAs and for local site conditions (e.g., soil type, annual precipitation, vegetation type, and treatment method), to calculate more precise, and possibly smaller buffers for some herbicides.

2,4-D

- Because the risks associated with this herbicide were not assessed, do not spray within ½ mile of terrestrial plant species or aquatic habitats where TEP aquatic plant species occur.
- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- Assess local site conditions when evaluating the risks from surface water runoff to TEP plants located within ½ mile downgradient from the treatment area.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Bromacil

- Do not apply within 1,200 feet of terrestrial TEP plant species.
- If using a low boom at the typical application rate, do not apply within 100 feet of an aquatic habitat in which TEP plant species occur.
- If using a low boom at the maximum application rate or a high boom, do not apply within 900 feet of an aquatic habitat in which TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Chlorsulfuron

- Do not apply by ground methods within 1,200 feet of terrestrial TEP species.
- Do not apply by aerial methods within 1,500 feet of terrestrial TEP species.
- Do not apply by ground methods within 25 feet of aquatic habitats where TEP plant species occur.
- Do not apply by aerial methods at the maximum application rate within 300 feet of aquatic habitats where TEP plant species occur.
- Do not apply by aerial methods at the typical application rate within 100 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Clopyralid

- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 900 of terrestrial TEP species.
- Do not apply by ground methods at the typical application rate within ½ mile of terrestrial TEP species.

- Do not apply by aerial methods within ½ mile of terrestrial TEP species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Dicamba

- If using a low boom at the typical application rate, do not apply within 1,050 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate, do not apply within 1,050 feet of terrestrial TEP plant species.
- If using a high boom, do not apply within 1,050 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Diflufenzopyr

- If using a low boom at the typical application rate, do not apply within 100 feet of terrestrial TEP plant species.
- If using a high boom, or a low boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.
- If using a high boom, do not apply within 500 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Diquat

- Do not use in aquatic habitats where TEP aquatic plant species occur.
- Do not apply by ground methods within 1,000 feet of terrestrial TEP species at the maximum application rate.
- Do not apply by ground methods within 900 feet of terrestrial TEP species at the typical application rate.
- Do not apply by aerial methods within 1,200 feet of terrestrial TEP species.

Diuron

- Do not apply within 1,100 feet of terrestrial TEP species.
- If using a low boom at the typical application rate, do not apply within 900 feet of aquatic habitats where TEP aquatic plant species occur.
- If using a high boom, or a low boom at the maximum application rate, do not apply within 1,1000 feet of aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Fluridone

- Since effects on terrestrial TEP plant species are unknown, do not apply within ½ mile of terrestrial TEP species.

Glyphosate

- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species.
- Do not apply by ground methods at the typical application rate within 50 feet of terrestrial TEP plant species.
- Do not apply by ground methods at the maximum application rate within 300 feet of terrestrial TEP plant species.
- Do not apply by aerial methods within 300 feet of terrestrial TEP plant species.

Hexazinone

- Since the risks associated with using a high boom or an aerial application are unknown, only apply this herbicide by ground methods using a low boom within ½ mile of terrestrial TEP plant species and aquatic habitats that support aquatic TEP species.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species or aquatic habitats that support aquatic TEP plant species.
- Do not apply by ground methods at the maximum application rate within 900 feet of terrestrial TEP plant species or aquatic habitats that support aquatic TEP plant species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Imazapic

- Do not apply by ground methods within 25 feet of terrestrial TEP species or aquatic habitats where TEP plant species occur.
- Do not apply by helicopter at the typical application rate within 25 feet of terrestrial TEP plant species.
- Do not apply by helicopter at the maximum application rate, or by plane at the typical application rate, within 300 feet of terrestrial TEP plant species.
- Do not apply by plane at the maximum application rate within 900 feet of terrestrial TEP species.
- Do not apply by aerial methods at the maximum application rate within 300 feet of aquatic TEP species.
- Do not apply by aerial methods at the typical application rate within 100 feet of aquatic TEP species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Imazapyr

- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply at the typical application rate, by ground or aerial methods, within 900 feet of terrestrial TEP plant species or aquatic habitats in which aquatic TEP species occur.
- Do not apply at the maximum application rate, by ground or aerial methods, within ½ mile of terrestrial TEP plant species or aquatic habitats in which aquatic TEP species occur.
- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Metsulfuron Methyl

- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply at the typical application rate, by ground or aerial methods, within 900 feet of terrestrial TEP plant species or aquatic habitats in which aquatic TEP species occur.
- Do not apply at the maximum application rate, by ground or aerial methods, within ½ mile of terrestrial TEP plant species or aquatic habitats in which aquatic TEP species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Diflufenzopyr + Dicamba

- If using a low boom at the typical application rate, do not apply within 100 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.
- If using a high boom, do not apply within 900 feet of terrestrial TEP plant species.

- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Picloram
- Do not apply by ground or aerial methods, at any application rate, within ½ mile of terrestrial TEP plant species.
- Assess local site conditions when evaluating the risks from surface water runoff to TEP plants located within ½ mile downgradient from the treatment area.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Sulfometuron Methyl
- Do not apply by ground or aerial methods within 1,500 feet of terrestrial TEP species.
- Do not apply by ground methods within 900 feet of aquatic habitats where TEP plant species occur, or by aerial methods within 1,500 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Tebuthiuron
- If using a low boom at the typical application rate, do not apply within 25 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate or a high boom at the typical application rate, do not apply within 50 feet of terrestrial TEP plant species.
- If using a high boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Triclopyr Acid
- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species.
- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications at the maximum application rate of this herbicide within ½ mile of aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species.
- Do not apply by aerial methods at the typical application rate within 500 feet of terrestrial TEP plant species.
- Do not apply by ground or aerial methods at the maximum application rate within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- If applying to aquatic habitats in which aquatic TEP plant species occur, do not exceed the targeted water concentration on the product label.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Triclopyr BEE
- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.

- Do not apply by aerial methods at the typical application rate within 500 feet of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground or aerial methods at the maximum application rate within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

The information provided in Table 4-4 provides a general guideline as to the types of habitats in which treatments (particularly fire) may be utilized to improve growing conditions for TEP plant species. However, at the local level, the BLM must make a further determination as to the suitability of vegetation treatments for the populations of TEP species that are managed by local offices. The following information should be considered: the timing of the treatment in relation to the phenology of the TEP plant species; the intensity of the treatment; the duration of the treatment; and the tolerance of the TEP species to the particular type of treatment to be used. When information about species tolerance is unavailable or is inconclusive, local offices must assume a negative effect to plant populations, and protect those populations from direct exposure to the treatment in question.

Treatment plans must also address the presence of and expected impacts on noxious weeds on the project site. These plans must be coordinated with BLM weed experts and/or appropriate county weed supervisors to minimize the spread of weeds. In order to prevent the spread of noxious weeds and other unwanted vegetation in occupied or suitable habitat, the following precautions should be taken:

- Cleared areas that are prone to downy brome or other noxious weed invasions should be seeded with an appropriate seed mixture to reduce the probability of noxious weeds or other undesirable plants becoming established on the site.
- Where seeding is warranted, bare sites should be seeded as soon as appropriate after treatment, and at a time of year when it is likely to be successful.
- In suitable habitat for TEP species, non-native species should not be used for revegetation.
- Certified noxious weed seed free seed must be used in suitable habitat, and preference should be given to seeding appropriate plant species when rehabilitation is appropriate.
- Straw and hay bales used for erosion control in suitable habitat must be certified weed- and seed-free.
- Vehicles and heavy equipment used during treatment activities should be washed prior to arriving at a new location to avoid the transfer of noxious weeds.

When BAs are drafted at the local level for treatment programs, additional conservation measures may be added to this list. Where BLM plans that consider the effects of vegetation treatments on TEP plant species already exist, these plans should be consulted, and incorporated (e.g., any guidance or conservation measures they provide) into local level BAs for vegetation treatments.

Table A5-1. State Director's Special Status Species List – Federally Threatened, Endangered, or Proposed, Oregon January 2008

Scientific Name	Common Name	Listed	Critical Habitat	Recovery Plan
Birds				
Endangered				
Pelecanus occidentalis californicus	California brown pelican	1970	None	Final 1983
Threatened				
Brachyramphus marmoratus	Marbled murrelet	1992	Designated 1996	Final 1997
Charadrius alexandrinus nivosus	Western snowy plover *(Pacific Coastal population)*	1993	Designated 2005	Final 2007
Strix occidentalis caurina	Northern spotted owl	1990	Designated 1992	Draft 2007
Fish				
Endangered				
Catostomus microps	Modoc sucker	1985	Designated 1985	None
Chasmistes brevirostris	Shortnose sucker	1988	Proposed 1994	Final 1993
Deltistes luxatus	Lost river sucker	1988	Proposed 1994	Final 1993
Gila boraxobius	Borax lake chub	1980	Final 1982	Final 1987
Oncorhynchus mykiss	Steelhead *(Upper Columbia River)*	1997	Designated 2005	Final 2007
Oncorhynchus tshawytscha	Chinook salmon *(Upper Columbia River Spring run)*	1999	Designated 2005	Final 2007
Threatened				
Catostomus warnerensis	Warner sucker	1985	Designated 1985	Final 1998
Gila bicolor ssp.	Hutton tui chub	1985	None	Final 1998
Oncorhynchus clarki henshawi	Lahontan cutthroat trout	1970	None	Final 1995
Oncorhynchus kisutch	Coho salmon *(Lower Columbia River)*	2005	None	None
	(Northern CA / Southern Oregon Coast)	1997	Designated 1999	None
Oncorhynchus mykiss	Steelhead *(Lower Columbia River)*	1998	Designated 2005	None
	(Middle Columbia River)	1999	Designated 2005	None
	(Upper Willamette River)	1999	Designated 2005	None
	(Snake River Basin)	1997	Designated 2005	None
Oncorhynchus tshawytscha	Chinook salmon *(Lower Columbia River)*	1999	Designated 2005	None
	(Upper Willamette River)	1999	Designated 2005	None
	(Snake River – Fall/Spring/Summer runs)	1992	Designated 1993	None
Rhinichthys osculus ssp.	Foskett speckled dace	1985	None	Final 1998
Salvelinus confluentus	Bull trout *(Columbia River)*	1998	Final 2005	Draft 2002
	(Klamath River)	1998	Final 2005	Draft 2002
	(Coastal / Puget Sound)	1999	Final 2005	Draft 2004

Table A5-1. State Director's Special Status Species List – Federally Threatened, Endangered, or Proposed, Oregon January 2008 (continued)

Invertebrates				
Endangered				
Plebejus icarioides fenderi	Fender's blue butterfly	2000	Proposed 2005	None
Threatened				
Branchinecta lynchi	Vernal pool fairy shrimp	1994	Designated 2003	Final 2005
Speyeria zerene hippolyta	Oregon silverspot butterfly	1980	Designated 1980	Final 2001
Mammals				
Endangered				
Canis lupus	Gray wolf	2003	None in OR or WA	Final 1987
Odocoileus virginianus leucurus	Columbian white-tailed deer *(Columbia River population)*	1967	None	Final 1983
Threatened				
Lynx canadensis	Canada lynx	2000	Designated 2006	None
Vascular Plants				
Endangered				
Arabis macdonaldiana	Macdonald's rock-cress	1978	None	Final 1984
Arenaria paludicola	Marsh sandwort	1993	None	Final 1998
Astragalus applegatei	Applegate's milk-vetch	1993	None	Final 1998
Erigeron decumbens var. *decumbens*	Willamette valley daisy	2000	Proposed 2005	None
Fritillaria gentneri	Gentner's fritillary	1999	None	Final 2003
Lilium occidentale	Western lily	1994	None	Final 1998
Limnanthes floccosa ssp. *grandiflora*	Large-flowered wooly meadowfoam	2002	None	Draft 2006
Lomatium bradshawii	Bradshaw's desertparsley	1988	None	Final 1993
Lomatium cookii	Cook's lomatium	2002	None	Draft 2006
Plagiobothrys hirtus	Rough popcorn flower	2001	None	Final 2003
Stephanomeria malheurensis	Malheur wire-lettuce	1982	Final 1982	Final 1991
Threatened				
Castilleja levisecta	Golden paintbrush	1997	None	Final 2000
Howellia aquatilis	Water howellia	1994	None	Draft 1996
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine	2000	Designated 2006	None
Mirabilis macfarlanei	Macfarlane's four o'clock	1979	None	Final 2000
Sidalcea nelsoniana	Nelson's checkermallow	1993	None	Final 1998
Silene spaldingii	Spalding's catchfly	2001	None	Final 2007
Thelypodium howellii ssp. *spectabilis*	Howell's spectacular thelypody	1999	None	Final 2002

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM

Scientific name	***Common name***
Amphibians	
Aneides flavipunctatus	Black salamander
Ascaphus montanus	Inland tailed frog
Batrachoseps attenuatus	California slender salamander
Batrachoseps wrightorum	Oregon slender salamander
Bufo woodhousii	Woodhouse's toad
Dicamptodon copei	Cope's giant salamander
Plethodon larselli	Larch mountain salamander
Plethodon stormi	Siskiyou mountains salamander
Rana boylii	Foothill yellow-legged frog
Rana luteiventris	Columbia spotted frog (Great Basin population)
Rana pipiens	Northern leopard frog
Rana pretiosa	Oregon spotted frog
Birds	
Agelaius tricolor	Tricolored blackbird
Ammodramus savannarum	Grasshopper sparrow
Bartramia longicauda	Upland sandpiper
Branta canadensis occidentalis	Dusky canada goose
Branta hutchinsii leucopareia	Aleutian canada goose
Bucephala albeola	Bufflehead
Centrocercus urophasianus	Greater sage-grouse
Charadrius alexandrinus nivosus	Western snowy plover (outside Pacific Coastal population)
Coccyzus americanus	Yellow-billed cuckoo
Coturnicops noveboracensis	Yellow rail
Cygnus buccinator	Trumpeter swan
Cypseloides niger	Black swift
Dolichonyx oryzivorus	Bobolink
Egretta thula	Snowy egret
Elanus leucurus	White-tailed kite
Eremophila alpestris strigata	Streaked horned lark
Falco peregrinus anatum	American peregrine falcon
Fratercula cirrhata	Tufted puffin
Haliaeetus leucocephalus	Bald eagle
Histrionicus histrionicus	Harlequin duck
Larus pipixcan	Franklin's gull
Leucosticte atrata	Black rosy finch
Melanerpes lewis	Lewis' woodpecker
Pelecanus erythrorhynchos	American white pelican
Picoides albolarvatus	White-headed woodpecker
Podiceps auritus	Horned grebe
Podiceps grisegena	Red-necked grebe
Pooecetes gramineus affinis	Oregon vesper sparrow
Progne subis	Purple martin
Seiurus noveboracensis	Northern waterthrush
Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Fish	
Catostomus tahoensis	Tahoe sucker
Cottus pitensis	Pit sculpin
Gila alvordensis	Alvord chub
Gila bicolor eurysoma	Sheldon tui chub
Gila bicolor oregonensis	Oregon lakes tui chub
Gila bicolor ssp.	Summer basin tui chub
Gila bicolor ssp.	Catlow tui chub
Gila bicolor thalassina	Goose lake tui chub
Lampetra minima	Miller lake lamprey
Lampetra tridentata ssp.	Goose lake lamprey
Lavinia symmetricus mitrulus	Pit roach
Oncorhynchus clarki lewisi	Westslope cutthroat trout
Oncorhynchus clarkii	Coastal cutthroat trout (Columbia River / SW Washington)
Oncorhynchus keta	Chum salmon (Pacific Coast)
Oncorhynchus kisutch	Coho Salmon (Oregon Coast)
Oncorhynchus mykiss	Steelhead (Klamath Mountains Province)
Oncorhynchus mykiss	Steelhead (Oregon Coast)
Oncorhynchus mykiss	Inland redband trout
Oncorhynchus tshawytscha	Chinook salmon (Southern Oregon / N. California Coast)
Oregonichthys kalawatseti	Umpqua chub
Rhinichthys cataractae ssp.	Millicoma dace
Richardsonius egregius	Lahontan redside shiner
Mammals	
Antrozous pallidus	Pallid bat
Arborimus longicaudus	Oregon red tree vole (NW Oregon, North of Hwy. 20)
Brachylagus idahoensis	Pygmy rabbit (outside Columbia Basin population)
Corynorhinus townsendii	Townsend's big-eared bat
Enhydra lutris	Sea otter
Euderma maculatum	Spotted bat
Gulo gulo luteus	California wolverine
Martes pennanti	Fisher
Myotis thysanodes	Fringed myotis
Odocoileus virginianus leucurus	Columbian white-tailed deer (Douglas County population)
Spermophilus washingtoni	Washington ground squirrel
Vulpes macrotis	Kit fox
Invertebrates	
Algamorda newcombiana	Newcomb's littorine snail
Allomyia scotti	Scott's apatanian caddisfly
Boloria bellona	Meadow fritillary

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Boloria selene	Silver-bordered fritillary
Bombus franklini	Franklin's bumblebee
Callophrys johnsoni	Johnson's hairstreak
Callophrys polios maritima	Hoary elfin
Chloealtis aspasma	Siskiyou short-horned grasshopper
Cicindela hirticollis siuslawensis	Siuslaw sand tiger beetle
Colligyrus sp. nov. 1	Columbia duskysnail
Cryptomastix devia	Puget oregonian
Cryptomastix populi	Hells canyon land snail
Deroceras hesperium	Evening fieldslug
Euphydryas editha taylori	Taylor's checkerspot
Fluminicola insolitus	Donner und blitzen pebblesnail
Fluminicola sp. nov. 11	Nerite pebblesnail
Fluminicola sp. nov. 3	Klamath rim pebblesnail
Gliabates oregonius	Salamander slug
Gonidea angulata	Western ridged mussel
Helisoma newberryi newberryi	Great basin ramshorn
Helminthoglypta hertleini	Oregon shoulderband
Hemphillia glandulosa	Warty jumping-slug
Hesperarion mariae	Tillamook westernslug
Juga hemphilli dallesensis	Dalles juga
Juga hemphilli hemphilli	Barren juga
Juga hemphilli maupinensis	Purple-lipped juga
Lanx klamathensis	Scale lanx
Lanx subrotunda	Rotund lanx
Lygus oregonae	Oregon plant bug
Micracanthia fennica	Harney hot spring shore bug
Monadenia chaceana	Chase sideband
Monadenia fidelis beryllica	Green sideband
Monadenia fidelis celeuthia	Travelling sideband
Monadenia fidelis ssp. nov.	Deschutes sideband
Monadenia fidelis ssp. nov.	Modoc rim sideband
Ochlodes yuma	Yuma skipper
Oreohelix variabilis sp. nov.	Deschutes mountainsnail
Pisidium ultramontanum	Montane peaclam
Plebejus saepiolus littoralis	Insular blue butterfly
Polites mardon	Mardon skipper
Pomatiopsis binneyi	Robust walker
Pomatiopsis californica	Pacific walker
Pristiloma arcticum crateris	Crater lake tightcoil
Pristiloma pilsbryi	Crowned tightcoil
Prophysaon vanattae pardalis	Spotted tail-dropper
Pterostichus rothi	Roth's blind ground beetle
Pyrgulopsis intermedia	Crooked creek springsnail
Pyrgulopsis robusta	Jackson lake springsnail
Rhyacophila chandleri	A caddisfly
Rhyacophila haddocki	Haddock's rhyacophilan caddisfly
Saldula villosa	Hairy shore bug
Speyeria coronis coronis	Coronis fritillary
Vespericola sierranus	Siskiyou hesperian

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Reptiles	
Actinemys marmorata marmorata	Northwestern pond turtle
Chrysemys picta	Painted turtle
Vascular plants	
Abronia turbinata	Trans montane abronia
Abronia umbellata ssp. *breviflora*	Pink sand-verbena
Achnatherum hendersonii	Henderson's ricegrass
Achnatherum speciosum	Desert needlegrass
Achnatherum wallowaensis	Wallowa ricegrass
Adiantum jordanii	California maiden-hair
Agastache cusickii	Cusick's giant-hyssop
Agoseris elata	Tall agoseris
Agrostis howellii	Howell's bentgrass
Allenrolfea occidentalis	Iodine bush
Allium geyeri var. *geyeri*	Geyer's onion
Amsinckia carinata	Malheur valley fiddleneck
Anemone oregana var. *felix*	Bog anemone
Arabis koehleri var. *koehleri*	Koehler's rockcress
Arabis sparsiflora var. *atrorubens*	Sickle-pod rockcress
Arctostaphylos hispidula	Hairy manzanita
Argemone munita	Prickly-poppy
Arnica viscosa	Shasta arnica
Artemisia arbuscula ssp. *longicaulis*	Lahontan sagebrush
Artemisia campestris ssp. *borealis* var. *wormskioldii*	Northern wormwood
Artemisia papposa	Owyhee sagebrush
Artemisia pycnocephala	Coastal sagewort
Asplenium septentrionale	Grass-fern
Asplenium trichomanes-ramosum	Green spleenwort
Astragalus californicus	California milk-vetch
Astragalus calycosus	King's rattleweed
Astragalus collinus var. *laurentii*	Laurence's milk-vetch
Astragalus cusickii var. *sterilis*	Sterile milk-vetch
Astragalus diaphanus var. *diurnus*	South fork john day milk-vetch
Astragalus gambelianus	Gambel milk-vetch
Astragalus geyeri var. *geyeri*	Geyer's milk-vetch
Astragalus mulfordiae	Mulford's milk-vetch
Astragalus peckii	Peck's milk-vetch
Astragalus platytropis	Broad-keeled milk-vetch
Astragalus tegetarioides	Bastard kentrophyta
Astragalus tyghensis	Tygh valley milk-vetch
Bensoniella oregana	Bensonia
Botrychium ascendens	Upward-lobed moonwort
Botrychium campestre	Prairie moonwort
Botrychium crenulatum	Crenulate moonwort
Botrychium lineare	Slender moonwort
Botrychium lunaria	Moonwort
Botrychium minganense	Gray moonwort
Botrychium montanum	Mountain grape-fern

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Botrychium paradoxum	Twin-spiked moonwart
Botrychium pedunculosum	Stalked moonwort
Botrychium pumicola	Pumice grape-fern
Brodiaea terrestris	Dwarf brodiaea
Bupleurum americanum	Bupleurum
Calamagrostis breweri	Brewer's reedgrass
Callitriche marginata	Winged water-starwort
Calochortus coxii	Crinite mariposa-lily
Calochortus greenei	Greene's mariposa-lily
Calochortus howellii	Howell's mariposa-lily
Calochortus indecorus	Sexton mt. Mariposa-lily
Calochortus longebarbatus var. *peckii*	Peck's mariposa-lily
Calochortus macrocarpus var. *maculosus*	Green-band mariposa-lily
Calochortus monophyllus	One-leaved mariposa-lily
Calochortus nitidus	Broad-fruit mariposa-lily
Calochortus persistens	Siskiyou mariposa-lily
Calochortus umpquaensis	Umpqua mariposa-lily
Calyptridium roseum	Rosy pussypaws
Camassia howellii	Howell's camas
Camissonia graciliflora	Slender-flowered evening-primrose
Camissonia pygmaea	Dwarf evening-primrose
Cardamine pattersonii	Saddle mountain bittercress
Carex abrupta	Abrupt-beaked sedge
Carex atrosquama	Blackened sedge
Carex brevicaulis	Short stemmed sedge
Carex capillaris	Hairlike sedge
Carex capitata	Capitate sedge
Carex comosa	Bristly sedge
Carex constanceana	Constances's sedge
Carex cordillerana	Cordilleran sedge
Carex crawfordii	Crawford's sedge
Carex diandra	Lesser panicled sedge
Carex dioica var. *gynocrates*	Yellow bog sedge
Carex gynodynama	Hairy sedge
Carex idahoa	Idaho sedge
Carex klamathensis sp. nov.	A sedge
Carex lasiocarpa var. *americana*	Slender sedge
Carex livida	Pale sedge
Carex macrochaeta	Large-awn sedge
Carex media	Intermediate sedge
Carex nardina	Spikenard sedge
Carex nervina	Sierra nerved sedge
Carex pelocarpa	New sedge
Carex pyrenaica ssp. *micropoda*	Pyrenaean sedge
Carex retrorsa	Retrorse sedge
Carex scabriuscula	Siskiyou sedge
Carex scirpoidea var. *stenochlaena*	Alaskan single-spiked sedge
Carex serratodens	Saw-tooth sedge
Carex subnigricans	Dark alpine sedge

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Carex vernacula	Native sedge
Castilleja chlorotica	Green-tinged paintbrush
Castilleja fraterna	Fraternal paintbrush
Castilleja mendocinensis	Mendocino coast indian paintbrush
Castilleja rubida	Purple alpine paintbrush
Castilleja thompsonii	Thompson's paintbrush
Caulanthus crassicaulis var. *glaber*	Smooth wild cabbage
Caulanthus major var. *gevadensis*	Slender wild cabbage
Chaenactis xantiana	Desert chaenactis
Chaetadelpha wheeleri	Wheeler's skeleton-weed
Cheilanthes covillei	Coville's lip-fern
Cheilanthes feei	Fee's lip-fern
Cheilanthes intertexta	Coastal lipfern
Chlorogalum angustifolium	Narrow-leaved amole
Cicendia quadrangularis	Timwort
Cimicifuga elata var. *elata*	Tall bugbane
Collomia mazama	Mt. Mazama collomia
Coptis trifolia	Three-leaf goldthread
Cordylanthus maritimus ssp. *palustris*	Point reyes bird's beak
Corydalis aquae-gelidae	Cold-water corydalis
Cryptantha leiocarpa	Seaside cryptantha
Cryptantha milo-bakeri	Milo baker's cryptantha
Cryptogramma stelleri	Steller's rockbrake
Cupressus bakeri	Baker's cypress
Cymopterus acaulis var. *greeleyorum*	Greeley's cymopterus
Cymopterus longipes ssp. *ibapensis*	Ibapah wavewing
Cymopterus nivalis	Snowline spring-parsley
Cymopterus purpurascens	Purple cymopterus
Cyperus acuminatus	Short-pointed cyperus
Cyperus lupulinus ssp. *lupulinus*	A cyperus
Cypripedium fasciculatum	Clustered lady's-slipper
Delphinium bicolor	Flathead larkspur
Delphinium leucophaeum	White rock larkspur
Delphinium nudicaule	Red larkspur
Delphinium nuttallii	Nutall's larkspur
Delphinium pavonaceum	Peacock larkspur
Dicentra pauciflora	Few-flowered bleedingheart
Dodecatheon austrofrigidum	Frigid shootingstar
Dodecatheon pulchellum var. *shoshonense*	Darkthroat shootingstar
Draba howellii	Howell's whitlow-grass
Elatine brachysperma	Short seeded waterwort
Eleocharis bolanderi	Bolander's spikerush
Epilobium oreganum	Oregon willow-herb
Ericameria arborescens	Golden fleece
Erigeron cervinus	Siskiyou daisy
Erigeron disparipilus	White cushion erigeron
Erigeron engelmannii var. *davisii*	Engelmann's daisy
Erigeron howellii	Howell's daisy
Erigeron latus	Broad fleabane

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Erigeron oreganus	Oregon daisy
Eriogonum brachyanthum	Short-flowered eriogonum
Eriogonum chrysops	Golden buckwheat
Eriogonum crosbyae	Crosby's buckwheat
Eriogonum cusickii	Cusick's buckwheat
Eriogonum hookeri	Hooker's wild buckwheat
Eriogonum lobbii	Lobb's buckwheat
Eriogonum prociduum	Prostrate buckwheat
Eriogonum salicornioides	Playa buckwheat
Eriogonum umbellatum var. *glaberrimum*	Green buckwheat
Eriophorum chamissonis	Russet cotton-grass
Erythronium elegans	Coast range fawn-lily
Erythronium howellii	Howell's adder's-tongue
Eschscholzia caespitosa	Gold poppy
Eucephalus gormanii	Gorman's aster
Eucephalus vialis	Wayside aster
Filipendula occidentalis	Queen-of-the-forest
Fritillaria camschatcensis	Black lily
Galium serpenticum ssp. *warnerense*	Warner mt. Bedstraw
Gentiana newberryi	Newberry's gentian
Gentiana plurisetosa	Elegant gentian
Gentiana prostrata	Moss gentian
Gentiana setigera	Waldo gentian
Gentianella tenella ssp. *tenella*	Slender gentian
Geum rossii var. *turbinatum*	Slender-stemmed avens
Gilia millefoliata	Seaside gilia
Gratiola heterosepala	Boggs lake hedge-hyssop
Hackelia bella	Beautiful stickseed
Hackelia cronquistii	Cronquist's stickseed
Hackelia ophiobia	Three forks stickseed
Hastingsia bracteosa var. *atropurpurea*	Purple-flowered rush-lily
Hastingsia bracteosa var. *bracteosa*	Large-flowered rush-lily
Heliotropium curassavicum	Salt heliotrope
Hieracium horridum	Shaggy hawkweed
Horkelia congesta ssp. *congesta*	Shaggy horkelia
Horkelia tridentata ssp. *tridentata*	Three-toothed horkelia
Hydrocotyle verticillata	Whorled marsh-pennywort
Hymenoxys lemmonii	Cooper's goldflower
Iliamna latibracteata	California globe-mallow
Iris tenax var. *gormanii*	Gorman's iris
Ivesia rhypara var. *shypara*	Grimy ivesia
Ivesia rhypara var. *shellyi*	Shelly's ivesia
Ivesia shockleyi	Shockley's ivesia
Juncus triglumis var. *albescens*	Three-flowered rush
Kalmiopsis fragrans	Fragrant kalmiopsis
Keckiella lemmonii	Bush beardtongue
Kobresia bellardii	Bellard's kobresia
Kobresia simpliciuscula	Simple kobresia
Lasthenia ornduffii	Large-flowered goldfields

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Lathyrus holochlorus	Thin-leaved peavine
Lepidium davisii	Davis' peppergrass
Lewisia columbiana var. *columbiana*	Columbia lewisia
Lewisia leana	Lee's lewisia
Limnanthes floccosa ssp. *bellingeriana*	Bellinger's meadow-foam
Limnanthes floccosa ssp. *pumila*	Dwarf meadow-foam
Limnanthes gracilis var. *gracilis*	Slender meadow-foam
Limonium californicum	Western marsh-rosemary
Lipocarpha aristulata	Aristulate lipocarpha
Listera borealis	Northern twayblade
Lobelia dortmanna	Water lobelia
Lomatium engelmannii	Englemann's desert-parsley
Lomatium erythrocarpum	Red-fruited lomatium
Lomatium foeniculaceum ssp. *fimbriatum*	Fringed desert-parsley
Lomatium ochocense	Ochoco lomatium
Lomatium ravenii	Raven's lomatium
Lomatium suksdorfii	Suksdorf's desert parsley
Lomatium watsonii	Watson's desert parsley
Lotus stipularis	Stipuled trefoil
Luina serpentina	Colonial luina
Lupinus lepidus var. *cusickii*	Cusick's lupine
Lupinus nevadensis	Nevada lupine
Lupinus tracyi	Tracy's lupine
Lycopodiella inundata	Bog club-moss
Lycopodium complanatum	Ground cedar
Malacothrix sonchoides	Lyrate malacothrix
Meconella oregana	White fairypoppy
Mentzelia congesta	United blazingstar
Mentzelia mollis	Smooth mentzelia
Mentzelia packardiae	Packard's mentzelia
Microseris bigelovii	Coast microseris
Microseris howellii	Howell's microseris
Mimulus bolanderi	Bolander's monkeyflower
Mimulus congdonii	Congdon's monkeyflower
Mimulus evanescens	Disappearing monkeyflower
Mimulus hymenophyllus	Membrane-leaved monkeyflower
Mimulus latidens	Broad-toothed monkeyflower
Mimulus tricolor	Three-colored monkey-flower
Muhlenbergia minutissima	Annual dropseed
Navarretia leucocephala ssp. *leucocephala*	White-flowered navarretia
Nemacladus capillaries	Slender nemacladus
Oenothera wolfii	Wolf's evening-primrose
Ophioglossum pusillum	Adder's-tongue
Oxytropis sericea var. *sericea*	White locoweed
Pellaea andromedifolia	Coffee fern
Pellaea bridgesii	Bridges' cliff-brake
Pellaea mucronata ssp. *mucronata*	Bird's-foot fern
Penstemon barrettiae	Barrett's penstemon
Penstemon glaucinus	Blue-leaved penstemon

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Penstemon peckii	Peck's penstemon
Perideridia erythrorhiza	Red-rooted yampah
Phacelia argentea	Silvery phacelia
Phacelia gymnoclada	Naked-stemmed phacelia
Phacelia inundata	Playa phacelia
Phacelia leonis	Siskiyou phacelia
Phacelia lutea var. *mackenzieorum*	Mackenzie's phacelia
Phacelia minutissima	Dwarf phacelia
Phlox hendersonii	Henderson's phlox
Phlox multiflora	Many-flowered phlox
Physaria chambersii	Chambers' twinpod
Pilularia americana	American pillwort
Plagiobothrys austiniae	Austin's plagiobothrys
Plagiobothrys figuratus ssp. *corallicarpus*	Coral seeded allocarya
Plagiobothrys greenei	Greene's popcorn flower
Plagiobothrys lamprocarpus	Shiny-fruited popcorn flower
Plagiobothrys salsus	Desert allocarya
Platanthera obtusata	Small northern bog-orchid
Pleuropogon oregonus	Oregon semaphoregrass
Poa rhizomata	Timber bluegrass
Poa unilateralis	San francisco bluegrass
Pogogyne floribunda	Profuse-flowereed mesa mint
Polystichum californicum	California sword-fern
Potamogeton diversifolius	Rafinesque's pondweed
Pyrrocoma racemosa var. *racemosa*	Racemose pyrrocoma
Pyrrocoma radiata	Snake river goldenweed
Rafinesquia californica	California chicory
Ranunculus austrooreganus	Southern oregon buttercup
Ranunculus triternatus	Dalles mt. Buttercup
Rhamnus ilicifolia	Redberry
Rhynchospora alba	White beakrush
Ribes divaricatum var. *pubiflorum*	Straggly gooseberry
Romanzoffia thompsonii	Thompson's mistmaiden
Rorippa columbiae	Columbia cress
Rotala ramosior	Lowland toothcup
Rubus bartonianus	Bartonberry
Salix farriae	Farr's willow
Salix wolfii	Wolf's willow
Saxifraga adscendens ssp. *oregonensis*	Wedge-leaf saxifrage
Saxifragopsis fragarioides	Joint-leaved saxifrage
Scheuchzeria palustris var. *americana*	Scheuchzeria
Schoenoplectus subterminalis	Water clubrush
Scirpus pendulus	Drooping bulrush
Sedum moranii	Rogue river stonecrop
Senecio ertterae	Ertter's senecio
Sericocarpus rigidus	White-topped aster
Sesuvium verrucosum	Verrucose sea-purslane
Sidalcea hickmanii ssp. nov.	Hickman's checkerbloom
Sidalcea hirtipes	Bristly-stemmed sidalcea

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Sidalcea malviflora ssp. *patula*	Coast checker bloom
Silene hookeri ssp. *bolanderi*	Bolander's catchfly
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass
Sisyrinchium sarmentosum	Pale blue-eyed grass
Solanum parishii	Parish's horse-nettle
Sophora leachiana	Western sophora
Stanleya confertiflora	Biennial stanleya
Stellaria humifusa	Creeping chickweed
Streptanthus glandulosus	Common jewel flower
Streptanthus howellii	Howell's streptanthus
Streptopus streptopoides	Kruhsea
Suksdorfia violacea	Violet suksdorfia
Sullivantia oregana	Oregon sullivantia
Symphoricarpos longiflorus	Long-flowered snowberry
Talinum spinescens	Spinescent fameflower
Thalictrum alpinum	Alpine meadowrue
Thelypodium brachycarpum	Short-podded thelypody
Thelypodium eucosmum	Arrow-leaf thelypody
Townsendia montana	Mountain townsendia
Townsendia parryi	Parry's townsendia
Trifolium douglasii	Douglas' clover
Trifolium leibergii	Leiberg's clover
Trifolium owyheense	Owyhee clover
Trillium kurabayashii	Siskiyou trillium
Trollius laxus var. *albiflorus*	American globeflower
Utricularia gibba	Humped bladderwort
Utricularia minor	Lesser bladderwort
Utricularia ochroleuca	Northern bladderwort
Viola primulifolia ssp. *occidentalis*	Western bog violet
Wolffia borealis	Dotted water-meal
Wolffia columbiana	Columbia water-meal
Zigadenus fontanus	Small-flowered death camas
Bryophytes	
Andreaea schofieldiana	Moss
Barbilophozia lycopodioides	Liverwort
Bryum calobryoides	Moss
Calypogeia sphagnicola	Liverwort
Campylopus schmidii	Moss
Chiloscyphus gemmiparus	Liverwort
Codriophorus depressus	Moss
Cryptomitrium tenerum	Liverwort
Diplophyllum plicatum	Liverwort
Encalypta brevicollis	Moss
Encalypta brevipes	Moss
Encalypta intermedia	Moss
Entosthodon fascicularis	Moss
Ephemerum crassinervium	Moss
Gymnomitrion concinnatum	Liverwort
Helodium blandowii	Moss

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Herbertus aduncus	Liverwort
Iwatsukiella leucotricha	Moss
Jungermannia polaris	Liverwort
Kurzia makinoana	Liverwort
Limbella fryei	Moss
Lophozia laxa	Liverwort
Meesia uliginosa	Moss
Metzgeria violacea	Liverwort
Orthodontium pellucens	Moss
Peltolepis quadrata	Liverwort
Polytrichum sphaerothecium	Moss
Porella bolanderi	Liverwort
Pseudocalliergon trifarium	Moss
Ptilidium pulcherrimum	Liverwort
Rhizomnium nudum	Moss
Rhytidium rugosum	Moss
Schistidium cinclidodonteum	Moss
Schistostega pennata	Moss
Splachnum ampullaceum	Moss
Tayloria serrata	Moss
Tetraphis geniculata	Moss
Tetraplodon mnioides	Moss
Tomentypnum nitens	Moss
Tortula mucronifolia	Moss
Trematodon boasii	Moss
Tritomaria exsectiformis	Liverwort
Fungi	
Albatrellus avellaneus	
Alpova alexsmithii	
Arcangeliella camphorata	
Boletus pulcherrimus	
Bridgeoporus nobilissimus	
Chamonixia caespitosa	
Choiromyces venosus	
Cortinarius barlowensis	
Cudonia monticola	
Cystangium idahoensis	
Dermocybe humboldtensis	
Destuntzia rubra	
Gastroboletus imbellus	
Gastroboletus vividus	
Gomphus kauffmanii	
Gymnomyces fragrans	
Gymnomyces nondistincta	
Helvella crassitunicata	
Leucogaster citrinus	
Mythicomyces corneipes	
Octaviania macrospora	
Otidea smithii	

Table A5-2. State Director's Special Status Species List – Bureau Sensitive, January 2008, Oregon BLM (cont.)

Phaeocollybia californica	
Phaeocollybia dissiliens	
Phaeocollybia gregaria	
Phaeocollybia olivacea	
Phaeocollybia oregonensis	
Phaeocollybia pseudofestiva	
Phaeocollybia scatesiae	
Phaeocollybia sipei	
Phaeocollybia spadicea	
Pseudorhizina californica	
Ramaria amyloidea	
Ramaria gelatiniaurantia	
Ramaria largentii	
Ramaria rubella var. *blanda*	
Ramaria spinulosa var. diminutiva	
Rhizopogon chamaleontinus	
Rhizopogon ellipsosporus	
Rhizopogon exiguus	
Rhizopogon inquinatus	
Sowerbyella rhenana	
Stagnicola perplexa	
Thaxterogaster pavelekii	
Lichens	
Bryoria pseudocapillaris	
Bryoria spiralifera	
Bryoria subcana	
Calicium adspersum	
Chaenotheca subroscida	
Dermatocarpon meiophyllizum	
Erioderma sorediatum	
Heterodermia leucomela	
Heterodermia sitchensis	
Hypogymnia duplicata	
Hypotrachyna revoluta	
Leioderma sorediatum	
Leptogium burnetiae	
Leptogium cyanescens	
Lobaria linita	
Microcalicium arenarium	
Niebla cephalota	
Pannaria rubiginosa	
Pilophorus nigricaulis	
Pseudocyphellaria mallota	
Ramalina pollinaria	
Stereocaulon spathuliferum	
Teloschistes flavicans	
Texosporium sancti-jacobi	
Tholurna dissimilis	
Usnea nidulans	

Appendix 6 – Summary of Existing District Resource Management Plan Direction for Noxious Weeds

The public lands within the nine BLM Districts in Oregon are covered by 18 Resource Management Plans (RMPs) and accompanying environmental impact statements (Figure A6-1). The RMPs contain direction for allocated uses, protection for resource values, and objectives for vegetation management. All of the RMPs acknowledge the problem of noxious weeds and contain objectives for their control. However, like other objectives identified in RMPs, they are not prescriptive with regards to control methods, tools, seasons, or other treatment parameters. Following are the sections within each of the 18 RMPs that address noxious weeds and their treatment.

Acronyms specific to this Appendix
(Acronyms for the entire EIS be found in Volume I, page i of this EIS)

ACS	Aquatic Conservation Strategy
AMR	Appropriate Management Response
CMPA	Cooperative Management and Protection Area
CSNM	Cascade Siskiyou National Monument
DEA	Diversity Emphasis Area
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
KFRA	Klamath Falls Resource Area
PNC	Potential Natural Communities
PRIA	Public Rangelands Improvement Act
RA	Resource Area
ROD	Record of Decision
SMA	Special Management Area
T&E	Threatened & Endangered
USFWS	U.S. Fish and Wildlife Service

References cited in this Appendix are internal to the RMP that the reference is cited in.

Salem Resource Management Plan, Salem District, 1995, Page 64

Noxious Weeds

Objectives

Contain and/or reduce noxious weed infestations on BLM-administered lands using an integrated pest management approach. Some noxious weeds expected to be subject to control are tansy ragwort, Canadian thistle, scotch broom, and knapweed.

Avoid introducing or spreading noxious weed infestations in any areas.

Land Use Allocations
No allocations are made for noxious weeds in the planning process.

Management Actions/Direction

Late-Successional Reserves

Evaluate impacts of nonnative plants (weeds) growing in Late-Successional Reserves.

Develop plans and recommendations for eliminating or controlling nonnative plants (weeds) which adversely effect Late-Successional Reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within reserves.

All Land Use Allocations

Continue to survey BLM-administered lands for noxious weed infestations, report infestations to the Oregon Department of Agriculture, and work with them to reduce infestations.

Use control methods which do not retard or prevent attainment of Aquatic Conservation Strategy objectives.

Apply integrated pest management methods (e.g., chemical, mechanical, manual and/or biological) in accordance with BLM's multistate environmental impact statement for noxious weed control and the related record of decision.

Eugene Resource Management Plan, Eugene District, 1995, Page 102

Noxious Weeds

Objectives

Contain and/or reduce noxious weed infestations on BLM administered land using an integrated pest management approach. Some noxious weeds expected to be subject to control are:

Common Name	Scientific Name
meadow knapweed	*Centaurea jacea x nigra*
tansy ragwort	*Senecio jacobaeae*
Canada thistle	*Cirsium arvense*
St.-Johns-wort	*Hypericum perforatum*
Scotch broom	*Cytisus scoparius*
French broom	*Cytisus monspessulanus*
gorse	*Ulex europaeus*
diffuse knapweed	*Centaurea diffusa*
spotted knapweed	*Centaurea maculosa*
purple loosestrite	*Lythrum salicaria*
puncture vine	*Tribulus terrestris*
bull thistle	*Cirsium vulgare*
distaff thistle	*Carthamus lanatu*s

Avoid introducing or spreading noxious weed infestations in any areas.

Land Use Allocations

No allocations are made for noxious weeds in the planning process.

Management Actions/Direction

Implement an integrated noxious weed control program. Develop a Prevention Plan and identification of Weed Free Areas. Site-specific plans will be prepared for 5-year periods. Control methods or combinations of methods proposed are dependent upon size, location, species, and type of weed infestation.

Evaluate impacts of nonnative plants (weeds) growing in all land use allocations.

Develop plans and recommendations for eliminating or controlling nonnative plants (weeds) that adversely affect Late-Successional Reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within reserves.

Continue to survey BLM administered land for noxious weed infestations, report infestations to the Oregon Department of Agriculture (ODA) and work with ODA to reduce infestations.

Use control methods that do not retard or prevent attainment of Aquatic Conservation Strategy objectives.
Apply integrated pest management methods (chemical, mechanical, manual and/or biological) in accordance with BLM's multistate Environmental Impact Statement, Northwest Area Noxious Weed Control Program, 1985, as supplemented in 1987, and the related ROD.

Roseburg Resource Management Plan, Roseburg District, 1995, Page 74

Noxious Weeds

Objectives

Contain and/or reduce noxious weed infestations on BLM-administered land using an integrated pest management approach.

Avoid introducing or spreading noxious weed infestations in any areas.

Land Use Allocations

No allocations are made for noxious weeds in the planning process.

Management Actions/Direction

Late-Successional Reserves

Evaluate impacts of nonnative plants (weeds) growing in Late-Successional Reserves.

Develop plans and recommendations for eliminating or controlling nonnative plants (weeds) which adversely affect Late-Successional Reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within reserves.

All Land Use Allocations

Continue to survey BLM-administered land for noxious weed infestations, report infestations to the Oregon Department of Agriculture, and work with the department to control infestations.

Use control methods which do not retard or prevent attainment of Aquatic Conservation Strategy Objectives. Apply integrated pest management methods (e.g., chemical, mechanical, manual, and biological) in accordance with BLM's 1985 Northwest Area Noxious Weed Control Program Environmental Impact Statement, 1987 Supplement and respective Records of Decision.

Medford Resource Management Plan, Medford District, 1995, Page 92

Noxious Weeds

Objectives

Contain and/or reduce noxious weed infestations on BLM-administered land using an integrated pest management approach. Some noxious weeds expected to be subject to control are:

Common Name	Scientific Name
Rush skeleton weed	*Chondrilla juncea*
Tansy ragwort	*Senecio jacobaea*
Yellow star thistle	*Centaurea solstitialis*
Scotch broom	*Cytisus scoparius*
Puncturevine	*Tribulus terrestiris*
Canada thistle	*Cirsium arvense*
Leafy spurge	*Euphorbia esula*
Diffuse knapweed	*Centaurea diffusa*
Purple loosestrife	*Lythrum salicaria*

Avoid introducing or spreading noxious weed infestations in any areas. Reduce infestations where possible.

Land Use Allocations

None

Management Actions/Direction

Late-Successional Reserves

Evaluate impacts of nonnative plants (weeds) growing in late-successional reserves.

Develop plans and recommendations for eliminating or controlling nonnative plants (weeds) which adversely affect late-successional reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within late-successional reserves.

All Land Use Allocations

Continue to survey BLM-administered land for noxious weed infestations, report infestations to the Oregon Department of Agriculture (the department), and work with the department to reduce infestations.

Use control methods that do not retard or prevent attainment of Aquatic Conservation Strategy and riparian reserve objectives.

Apply integrated pest management methods (e.g., chemical, mechanical, manual and/or biological) in accordance with BLM's multistate environmental impact statement, Northwest Area Noxious Weed Control Program, 1986, as supplemented in 1987, and the related ROD.

Place priority on elimination or reduction of noxious weeds occurring within special areas.

Coos Bay Resource Management Plan, Coos Bay District, 1995, Page 72

Noxious Weeds

Objectives

Contain and/or reduce noxious weed infestations on BLM-administered land using an integrated pest management approach and avoid introducing or spreading noxious weed infestations in any areas. Some noxious weeds expected to be subject to control are:

Common Name	Scientific Name
Purple loosestrife	*Lythrum salicaria*
Gorse	*Ulex europaeus*
Scotch broom	*Cytisus scoparius*
French broom	*Genista monospessulana*
Yellow starthistle	*Centaurea solstitalis*
Tansy ragwort	*Senecio jacobaea*
Maltgrass	*Nardus stricta*
Thistles	*Cirsium* spp.

Land Use Allocations

No allocations are made for noxious weeds in the planning process.

Management Actions/Direction - Late-Successional Reserves

Evaluate impacts of non-native plants (weeds) growing in Late-Successional Reserves.

Develop plans and recommendations for eliminating or controlling non-native plants (weeds) that adversely affect Late-Successional Reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within reserves.

Management Actions/Direction - All Land Use Allocations

Continue to survey BLM-administered land for noxious weed infestations, report infestations to the Oregon Department of Agriculture, and coordinate with them to reduce infestations.

Use control methods that do not retard or prevent attainment of Aquatic Conservation Strategy Objectives.

Apply integrated pest management methods (e.g., chemical, mechanical, manual, and/or biological) in accordance with BLM's multi-state environmental impact statement, Northwest Area Noxious Weed Control Program, as supplemented, and the related ROD.

Klamath Falls Resource Management Plan, Lakeview District, 1995, Page 73

Noxious Weeds

Objectives
Avoid introducing or spreading noxious weed infestations in any areas.

Contain and/or reduce noxious weed infestations on BLM-administered land using an integrated pest management approach. Some noxious weeds expected to be subject to control are listed in Table 18.

Land Use Allocations

No allocations are made for noxious weeds in the planning process.

Management Actions/Direction

All Land Use Allocations

Continue to survey BLM-administered land for noxious weed infestations, report infestations to the Oregon Department of Agriculture, and work with the Department of Agriculture to reduce infestations.

Use control methods which do not retard or prevent attainment of Aquatic Conservation Strategy Objectives. Apply integrated pest management methods (for example, chemical, mechanical, manual, and/or biological) in accordance with the BLM's multi-state environmental impact statement, Northwest Area Noxious Weed Control Program, 1985, as supplemented in 1987, and the related Record of Decision, and as described in the Noxious Weed Strategy for Oregon/Washington (July 1994). Local direction for the planning area is from an integrated weed control plan and environmental assessment decision record of July 1993.

Design management actions to minimize the potential for noxious weed invasion and/or dominance of the affected area.

Late-Successional/District Designated Reserves
Evaluate impacts of non-native plants (weeds) growing in Late-Successional/District Designated Reserves.

Develop plans and recommendations for eliminating or controlling non-native plants (weeds) which adversely affect Late-Successional/District Designated Reserve objectives. Include an analysis of effects of implementing such programs on other species or habitats within reserves.

Cascade Siskiyou National Monument Record of Decision and Resource Management Plan, Medford District, August 2008, Pages 28, 31, 33, 45, 48, 49, 50, 56, 58, 67, 81, 83 and Appendix F

Page 28
Noxious Weeds/Invasive Plants
Noxious weeds and other non-native species are also a management concern. Canada thistle, yellow starthistle, and medusahead are the most common noxious weeds in the OGEA. Bulbous bluegrass, a non-native species, has established a strong foothold in all plant communities throughout the monument. Knapweeds show potential for spreading within the OGEA, but have so far been restricted to a few roadside populations that have been treated with herbicides.

Page 31
2) Protect or enhance existing habitat for species associated with late-successional forests.
- Reduce the threat of high-severity wildland fire or other major disturbance events (stand replacement) to areas currently functioning as late-successional habitat.
- Reduce mortality rates of large trees, especially pines, in mid- and late-successional stands with high tree densities.
- Maintain intact, healthy old-growth structure in forests. Focus treatments on stands where previous interventions or events have adversely impacted stand structure.
- Reintroduce fire to the landscape through the careful use of prescribed fire.
- Reduce the presence and spread of noxious weeds and undesirable non-native species.

Page 33
Noxious Weed Treatments
Noxious weed treatments are an important component of OGEA management. The tools that can be used to treat noxious weeds are described in Appendix F.

Page 45
Noxious Weeds/Invasive Plants
One of the primary management concerns in the DEA is the proliferation of weeds across the landscape (Map 15). Spatial analysis in GIS indicates that weeds are associated with roads, sites of acute disturbance (past timber harvest, power line corridors, pastures and other tilled areas), and areas of high livestock utilization. Disturbance associated with management activities may favor noxious weed invasion; therefore, limiting disturbance appears critical to controlling weeds. Some of the major ecological problems associated with grass/shrub/woodlands involve annual grasses, and noxious weeds like yellow starthistle and Canada thistle.

Page 48
1) Control the spread of noxious weeds and other invasive grasses.
- Maintain healthy herbaceous plant communities as a barrier to weed invasions.
- Improve conditions of stands that have a mixture of weeds and remnant native herbaceous species.
- Eradicate and restore small isolated weed patches to native herbaceous plant domination.
- Survey and treat primary travel corridors that serve as vectors for weed spread.
- Isolate and treat large extensive weed areas.
- Develop a long-term restoration plan for weedy areas greater than one acre.

Page 49

4) Protect monument resources from fires originating on adjacent private lands. Reduce the risk of wildland fires spreading to residential properties in the wildland-urban interface.

- Manage DEA lands in the WUI in a way that complements the management of adjacent lands in the OGEA.
- Where possible, reinforce fire hazard reduction activities on private lands by reducing fire hazard on adjoining monument lands.

The control of noxious weeds and the improvement of riparian habitats are management objectives that extend beyond the boundaries of the DEA. Although these objectives are of particular concern in the DEA, this section references rather than repeats the monument's landscape-wide noxious weed strategy (Appendix F) and the Riparian Areas and Aquatic Resources section of this chapter.

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Weed Abatement

DEA-1 The comprehensive strategy for treating noxious weeds across the monument described in Appendix F is adopted. The treatments described in this strategy will not be limited by the pilot studies described below. Noxious weed treatments can include manual weeding, biological control, herbicides, prescribed fire or prescribed grazing. Focal areas identified for immediate treatments are identified in the weed strategy. Noxious weeds will be treated aggressively, contingent on funding. Current funding has allowed a mixture of hand-pulling and herbicide treatments on approximately 1,000 to 2,000 acres each year for the past several years. The only herbicide currently used in the monument is RODEO® (glyphosate).

Page 56

Noxious Weeds/Invasive Plants

Noxious weeds and other invasive species are present in riparian areas and can displace the native vegetation used by aquatic and terrestrial wildlife. Some aquatic noxious weeds, such as purple loosestrife, are present in the region and could infest the monument's riparian ecosystems in the near future.

Page 58

2) Maintain and improve wetland and riparian plant communities and structure (ACS Objective 8).

- Promote herbaceous and woody-plant development.
- Protect existing late-successional structure in riparian areas.
- Promote the development of late-successional structure where appropriate.
- Reduce the presence and spread of noxious weeds and other non-native species.
- Restore floodplain plant communities and add large wood to floodplains.
- Where possible, improve, reconstruct or decommission constructed water sources to allow recovery of the former native plant communities.

Page 67

Noxious Weeds

The spread of noxious weeds is a problem throughout the monument, particularly in the Diversity Emphasis Area (DEA). Livestock are one vector associated with the spread of noxious weeds: livestock disturbance may increase site receptiveness to noxious weed invasions; and livestock movement through areas may also contribute to weed spread. To what extent do livestock, as compared to other historic or current disturbance factors, contribute to the introduction and/or spread of noxious weeds and undesirable non-native species in the monument?

Page 81

Disturbance associated with road construction and subsequent travel over roads provides corridors for the spread of noxious weeds and other invasive species. An analysis of the spatial relationship of individual weed populations relative to disturbance factors throughout the monument indicate that higher than expected counts of weed populations occur within 100 meters (328 feet) of roads. Most of the recorded weed populations within the monument are found in close proximity to roads (Map 15).

Page 83

Road Closures

Seasonal, temporary, and long-term road closures will be used to reduce the open road density in order to protect monument resources. Gates and road barriers regulate vehicle access in order to reduce maintenance costs, road damage, soil erosion, water quality degradation, the spread of noxious weeds, wildland fire risk, and wildlife disturbance. Road closures restrict unauthorized motorized access while allowing access for administrative purposes, ROW grants, reciprocal agreements, fire suppression, or other authorized uses. Roads that are closed but not decommissioned may be maintained. Seasonal closure of roads with natural surfaces may prevent damage during the wet season. Roads may also be closed on a seasonal basis to provide various species with protection from motorized traffic during the breeding season or other sensitive times.

APPENDIX F- STRATEGY FOR CONTROLLING THE SPREAD OF NOXIOUS WEEDS AND OTHER INVASIVE GRASSES IN THE CASCADE-SISKIYOU NATIONAL MONUMENT

WEED ABATEMENT MANAGEMENT STRATEGY

This appendix describes the strategy and objectives for weed management and provides a framework to control the spread of noxious weeds and other invasive grasses in the monument. Although this strategy is specific to the Cascade-Siskiyou National Monument (CSNM), it incorporates decisions and guidance provided in the following documents:

- The Decision Record, signed June 5, 1998, for the *Integrated Weed Management Plan* with the associated FONSI and Medford District Integrated Weed Management Plan.
- Instruction Memo OR 91-302 *Approved Herbicides for Noxious Weed Control* states: “A copy of this memorandum should be made a permanent part of your reference copy of the Record of Decision for the Northwest Area Noxious Weed Control Program., BLM offices in Oregon and Washington are authorized to use these herbicides for noxious weed control in accordance with BLM Manual H-9011-1.”
- The Supplemental Record of Decision, signed May 5, 1987 for the Northwest Area Noxious Weed Control Program and the associated Final Environmental Impact Statement (March 1987).

The primary goal of monument management is to maintain, protect, and restore habitat and ecological processes critical to richness and abundance of the objects of biological interest for which the monument was proclaimed. The proliferation of weeds across the landscape is an obstacle to this goal, and is a management concern throughout the monument, especially in the Diversity Emphasis Area. Current objectives for weed management have been developed and are described below. Additional weed abatement objectives could be developed through research and pilot studies following the adaptive management strategy in Chapter 3 of this RMP.

Spatial analysis in GIS indicates that weeds are associated with roads, sites of acute disturbance (past timber harvest, pastures and other tilled areas), and areas of high livestock utilization. Some of the major ecological problems associated with grass/shrub/woodlands involve annual grasses, yellow starthistle, and Canada thistle displacing the native bunchgrasses found in the monument. Limiting disturbance, therefore, is critical to controlling weeds; reduction of soil surface disturbance and increased shading of the soil can help favor the growth of native bunchgrasses over noxious weeds and other invasive grasses.

The literature supports the following formulation of a general management strategy incorporating aspects of vegetation management and weed control:

Maintain healthy herbaceous plant communities as a barrier to weed invasions.
- Limit ground-disturbing activities.
- Collect and maintain sources of native grass and forb seed for emergency restoration.
- Sow with native seed where natural or ground-disturbing management activities take place.

Improve condition of stands that have a mixture of weeds and remnant native herbaceous species.
- Apply manual or spot herbicide treatments.
- Utilize prescribed burning where appropriate.
- Restore native species by seeding and/or planting.
- Utilize different grazing strategies to reduce disturbance.

Eradicate and restore small isolated weed patches to native herbaceous plant domination.
- Apply manual or spot herbicide treatment.
- Protect sensitive resources (e.g., wetlands, riparian, and rare plants). If herbicide treatments occur in riparian areas, use appropriate herbicides labeled for use in these communities.
- Seed areas with native grass and forbs.

Survey and treat primary travel corridors that serve as vectors for weed spread.
- Inventory roads and power line corridors.
- Apply manual or spot herbicide treatments in a systematic manner.
- Work with power companies, the county, and adjacent land owners to reduce periodic disturbance and treat weeds on adjacent non-federal land.
- Re-vegetate treated areas with native grass and forbs.

Isolate and treat large extensive weed areas.
- Minimize soil disturbance and activities that could spread weeds, especially during the wet season.
- Manually or spot spray large patches working from the "outside" in toward the center of the infestation.
- Seed or plant treated locations with native vegetation.

Implement a long-term restoration/management plan for extensive weedy areas (>1 acre)
- Work with local groups and land owners on noxious weed education and management.
- Identify high-priority treatment areas.
- Avoid disturbance in large patches.
- Monitor efficacy of treatment(s).
- Apply adaptive management strategy.

POTENTIAL MANAGEMENT TOOLS

Education and cooperative partnerships with adjacent landowners and local groups

Educating private land owners within the greater monument boundary on weed issues and treatment strategies is paramount to succeeding in controlling and eradicating weeds in the monument. Partnerships and cost-sharing projects, moreover, are an efficient way to treat larger landscape areas. Working with adjacent land owners, including companies under BLM-permitted activities (e.g., power companies), to prevent the spread of weeds across ownership boundaries, and addressing noxious weeds in all land management activities is critical to success for the landscape as a whole. Identification booklets, preventive strategies, and recommended treatment methods could be a valuable tool for educating and developing partnerships with the monument public.

Weed inventories
The use of surveys and inventories contribute to the understanding of the pattern and distribution of weeds within the monument, informing ongoing creation of adaptive strategies to control and eliminate such weeds from the monument. Surveys identify new species and patches becoming established, such that they become a treatment priority before they spread. Focused inventories along identified primary travel corridors and areas of primary concern will help target specific weed populations for containment and eradication.

Weed prevention and treatments
Weed prevention is an important tool to stop the introduction and spread of weeds. Prevention activities can reduce the spread and introduction of weeds. These activities include the use of "weed-free" hay, mulch, and seed for restoration activities; routinely washing the under-carriage of equipment and vehicles; and keeping vehicles and livestock out of heavily infested areas (i.e., reduce disturbance). All available means to effectively and efficiently prevent and treat weeds could be used in the monument, including manual weeding, hot foam treatments, cultural control, biological control, herbicides, prescribed fire, or grazing. Various treatments are discussed below in more detail.

Manual weeding can effectively remove target species over small- to medium-sized areas. Extensive manual weeding can also cause severe damage to micro-topography and microphytic crust through trampling, potentially leading to soil surface instability.

Hot foam treatment is a manual method that utilizes hot steam with foam (formulated from sugar extracts from corn and coconut). This treatment is used along roadways and other accessible areas to treat weeds. The steam and foam is delivered through a hose with a wand. The foam holds the temperature of the steam for several minutes, killing the unwanted vegetation.

The hot foam method is used on individual weed plants, usually in the rosette stage. The hot steam (212 degrees) can kill individual special status plants if treated, but pre-disturbance surveys for special status plants will identify plants to be protected.

Cultural treatments*,* such as disking or plowing, consist of entire plant removal from a specific site, but do have some negative side effects. For example, these treatments require precise timing to control the desired species; the acute ground disturbance resulting from these treatments can destroy the remnant native vegetation and promote additional weed invasion; and these treatments are difficult to apply in rough or rocky terrain, and will not occur in the monument with perhaps the exception of road-beds during decommissioning. Mowing or clipping removes the above-ground parts of all plants which is harmless to native bunchgrasses. Mowing can result in light to moderate damage to the soil surface, depending on the technique used. Mowing and manual seed head clipping can be effective in reducing a single year seed crop, although it does not kill the plants. However, some weeds, like starthistle or knapweeds, adapt quickly and will flower closer to the ground following mowing. Mowing may require multiple applications and can lead to soil surface instability. Mowing is not likely to be used in the monument except perhaps along road edges.

Bio-control involves the use of insects to control noxious weeds. Insect releases for starthistle in the monument are ongoing. This method is only effective in certain locations. Currently, there are no effective bio-controls available for other weeds like Canada thistle, Dyer's woad, cheatgrass or medusahead. As new bio-controls are developed in the future, these could be incorporated into the monument's weed strategy.

Spot spraying with herbicides can target specific plants in specific areas. Herbicide application is the most cost-effective weed treatment over large areas and has a low level of soil disturbance. Within the monument, only spot spraying or individual plant wicking or wiping with approved chemicals will be used so as to reduce secondary harm to other life forms. In riparian areas, only chemicals approved for such areas will be used in weed treatment.

Prescribed fire can be used to reduce cheatgrass, medusahead, and starthistle when the timing and intensity of the application is carefully controlled. Prescribed fire also reduces litter build-up and rejuvenates bunchgrasses over large areas. While prescribed fire can result in mortality for some woody plant species and lichens, it can also serve to rejuvenate others.

Livestock grazing prescribed at the right time and intensity may allow removal of specific plants and weeds. When applied correctly, prescribed grazing may reduce litter and rejuvenate bunchgrasses over large areas. Changing the grazing system (e.g., rest-rotation) can serve to allow recovery of the native plant community in heavily utilized areas in combination with other treatment methods. Controlled grazing by goats could also be used to control starthistle. Insufficient livestock control, however, can result in degradation of adjacent biological resources from over-utilization (e.g., in wetlands, springs, and riparian areas). Livestock are also vector for weed spread.

Vegetative restoration
Native seed application is best used several years following weed control treatments, or in areas of acute ground disturbance to prevent weeds from becoming established. Local, adapted native sources of grass and forb species have been established. Planting native shrubs and trees, especially along treated riparian areas will help restore and maintain healthy plant communities that are resistant to weed invasion. Sowing or planting appropriate native plants following under-story burning can re-establish the native plant community and facilitate succession.

Monitoring
Implementation and validation monitoring of treated areas is critical to the adaptive management process. Multiple years are often involved in successful containment and eradication. Successful weed treatments could involve different or multiple treatment methods, depending on the local site conditions, the species of targeted weeds, and infestation levels.

A thorough literature review on control measures for noxious weeds can be found in the CSNM Draft Resource Management plan, Appendix GG, pages 396-411.

PRIORITY TREATMENT AREAS
The following list of focus areas is intended to provide a relative prioritization of areas in which to survey and treat noxious weeds. These focus areas are of major concern and include the primary travel corridors that can function to spread weeds. In general, these are the areas that contain higher densities of weed populations; containment and eventual eradication is the objective. The methods for containment and eradication can vary, depending on site-specific issues, but, in general, working from the outside into the center of the infestations is the model for manual or herbicide treatments.

Given the annual fluctuations in operational funds to treat weeds, not all areas will be treated annually. New areas may be added over time as new populations are discovered; as monitoring shows successful treatment, areas will be dropped. The focus areas outlined below are a starting point for controlling noxious weeds in the monument and are not intended to be an exhaustive list. Numerous small populations occur that are also important to treat before they spread. Knapweeds, for example, are new to the monument. Because they are forming new starts, they are a high priority for eradication while populations are small.

Infestations in areas utilized by livestock are also high on the list of treatment priorities so as to prevent further weed spread and to improve the range condition. Some of these infested areas targeted for weed treatment are around seeps, springs, and stock ponds. In some areas, pasture rotation or even rest for several years from grazing could be beneficial for recovery while they are treated.
The focus areas are listed by local name, township, range, and section and/or BLM road segments. Weed infestations in adjacent areas on private lands may also be of concern, but are not listed. When possible, partnerships with adjacent land owners will be formed to treat weeds within the sub-watershed across ownerships.

Focus areas (not in priority order):
- Soda Mountain area (T40S, R3E, sections 21, 27, 28)
- Box O ranch area (T40S, R4E, sections 21, 22, 27, 28)
- Parsnip Lakes (T40S, 3E, section 10)
- Agate Flat, T41S, R4E, sections 6 and 7
- Hobart Lake (T40S, 3e, section 16)
- Eastern Schoheim road (Camp Creek) T41S, R3E, Sections 11, 12 including road 41-2E-10.1
- Scotch Creek RNA (T41S, R3E, section 8,9)
- Jenny Creek (below the Box O to the California Border)
- Mariposa Lily Botanical Area (T41S, R 2E, Sections 8, 9)
- Buck Rock (T40S, 2E, section 11) and roads 39-2E-34 and 40-2E-1
- Chinquapin area (T39S, R3E, sections 23, 26, 35)

As important as actual infested acres are, linear features that serve as vectors for spread also require attention. The major roadways coming into the monument and the large PacifiCorp power line corridor that bisect the monument are areas that receive some level of periodic disturbance from vehicles, maintenance, and animals. Weeds are spreading along these areas, mostly by seed on vehicles, equipment, and animals, including livestock. Wind and water also serve as vectors. The periodic disturbance in these areas provides available habitat for weed species to become established and then spread to adjacent areas outside the corridors. In some areas, grazing is confined to accessible areas along the roads. These linear features need to be continually surveyed and monitored, and as infestations are detected, treatment will prevent further weed spread.

Primary travel routes
- PacifiCorp power line and associated access road: (T40S, R3E, section 16, 17, 21, 27, 35;
- T41S, R3E, sections 1, 12; T41S, R4E, sections 6, 7, 8);
- Tyler Creek Road (BLM road 40-3E-5);
- Upper Jenny Creek and Roads 39-4E-6, -7.5, -8);
- Keene Creek/Lincoln creek/Rancore Pass roads (40-3E-12-12.1);
- Soda Mountain Road (39-3E-32.3);
- Lower Keene creek road (40-3E-12.2, 40-3E-7).

MITIGATING MEASURES

RODEO® (glyphosate) would be used as the primary herbicide in efforts to control noxious weeds listed by Oregon Department of Agriculture in the monument. Manual and biological treatments may also occur in conjunction with the control efforts. Treatment operations would generally occur between March 15th and October 31st.

The following mitigating measures apply to noxious weed treatments in the monument:
- **Human buffer** – None of the products may be applied within 500 feet of any residence or other place of human occupation unless the occupant or resident gives their consent in writing.

- **Cropland buffer** – Commercial products will not be applied within 100 feet of any cropland.
- **25-foot water buffer** – Commercial products applied by ground vehicles equipped with boom sprayers will not be applied within 25 feet of any water, flowing/moist (i.e., not dry) streams, springs, and wetlands (saturated ground).
- **10-foot water buffer –** Spot treatments with vehicle-mounted handguns or with backpack sprayers will not be applied to within 10 feet of water. To add an extra measure of security, a ten-foot buffer "no spray" buffer will be respected along all flowing/moist (i.e., not dry) streams, springs, and wetlands. This will eliminate the potential for any drift entering waters (Hatterman-Valenti et al. 1995). Ground application within 10 feet of any flowing/moist waters will only be done by hand-wicking, wiping, or painting.
- **Spraying Prohibitions** – Spraying operations will be prohibited when wind velocity exceeds 5 mph; when temperatures exceed 80 degrees; when air turbulence would affect spray pattern; or in the event of any other kind of adverse weather conditions that could cause the glyphosate to impact non-target plants. These requirements would eliminate the potential for spray drift entering the stream channels.
- **Dry season application –** The herbicide treatment would occur only during months with little rain. These months will almost always be June - September; however, during some years, May can be hot and dry and weeds will ripen and begin to set seed early. Moreover, every few years, April can be almost rainless with weeks of temperatures in the high 70s. In such situations, glyphosate may be applied during April or May.
- **Weather Monitoring** – During application, weather conditions will be monitored periodically by trained personnel at spray sites. Weather will be monitored frequently during the first days of a prolonged project, especially projects within Riparian Reserves. Additional weather monitoring will occur whenever a weather change may affect safe placement of the herbicide on the target area. The intent is to ensure that weather conditions are within the parameters of this document and/or other regulatory restrictions.
- **Communication** – Prior to beginning treatment each year, the District Weed Specialist and/or Resource Area staff will provide the Resource Area Fisheries Biologists with the following information:
    - Locations to be treated
    - Riparian Reserves and approximate acres to be treated
    - Application method
    - Herbicide to be used
    - Approximate date of treatment
- **"No rain" rule –** Glyphosate would never be applied when weather reports predict precipitation within 24 hours of application, before or after. This ensures that glyphosate would not be washed off by precipitation into small rivulets, or enter ground water. From a practical perspective, glyphosate would not be as effective if sprayed when rain could wash it off.
- **Mixing and Loading Restrictions** – Herbicides will be mixed and loaded into tanks at least 100 feet from any stream channel or surface water or at a location where an accidental spill would not flow into or contaminate a stream or body of water.
- **Tank Washing and Disposal** – Spray tanks will not be washed or rinsed within 100 feet of any waters. All chemical containers will be disposed of at sites approved by the Oregon State Department of Environmental Quality.
- **Application Concentrations** – RODEO® and ACCORD® will be applied at or below concentrations allowable on the labels.
- **Quality Control** – Regular testing on field calibration and calculation will take place to prevent gross application errors. A licensed/certified herbicide applicator will oversee all spray projects. Dye or a similar method will be used to ensure that chemical application occurs only in target areas. (See "Monitoring" below.)
- **Spill Safety** – The BLM contract inspector will review the BLM spill response procedures outlined in the BLM manual 9011-1 with each applicator before commencing herbicide application operations. All hand-operated application equipment must be leak- and spill-proof.

- **Parsimony Rule** – Only the minimum area necessary for the control of noxious weeds will be treated
- **Monitoring –** Spray cards, dye, or other type of indicator to monitor chemical drift will be used at the water's edge on a small sample (no less than five sites) of riparian treatment areas. These indicators will provide visual verification that the application methods are minimizing risk to listed fish species.

Upper Klamath Basin and Wood River Wetland Resource Management Plan, Lakeview District, 1996, Page 18

Noxious Weed Management

Objective: Manage noxious weed species to facilitate restoration and maintenance of desirable plant communities and healthy ecosystems; prevent introduction, reproduction, and spread of noxious weeds into and within the property; and manage existing populations of noxious weeds to levels that minimize the negative impacts of noxious weed invasions.

Federal agencies are directed to control noxious weeds on federal lands by the Carlson-Foley Act (Public Law (PL) 90-583) and the Federal Noxious Weed Act of 1974 (PL 93-629). Noxious weed management on the Wood River property will be part of an integrated noxious weed management program as described in the Integrated Weed Control Plan and Environmental Assessment (EA) for the Klamath Falls Resource Area (OR-014-93-09). An appropriate combination of manual, mechanical, chemical, and biological methods, and water level manipulation will be used to control noxious weed species. Seasonal timing will be considered in any control program. Herbicide use will be in accordance with the program design features outlined in the KFRA Integrated Weed Control Plan and EA.

All chemical and some mechanical treatments for noxious weeds will be accomplished through a contract with Klamath County or other appropriate contractors, if populations of these species are identified for control. Appropriate herbicides will be used for treatment of noxious weeds in or adjacent to wetlands. Biological control organisms are supplied and/or distributed by the Oregon Department of Agriculture (ODA) through a memorandum of understanding between ODA and the BLM's Oregon State Office.

Lakeview Resource Management Plan, Lakeview District, 2003, Page 37

Noxious Weeds and Competing Undesirable Vegetation Management Goal—Control the introduction and proliferation of noxious weeds and competing undesirable plant species, and reduce the extent and density of established populations to acceptable levels.

Rationale

FLPMA and PRIA direct BLM to ". . . manage public lands according to the principles of multiple-use and sustained yield . . ." and ". . . manage the public lands to prevent unnecessary degradation . . . so they become as productive as feasible." The introduction and spread of noxious weeds and undesirable plants within the planning area contributes to the loss of rangeland productivity, increased soil erosion, reduced species and structural diversity, loss of wildlife habitat, and in some instances may pose a threat to human health and welfare. The "Carlson-Foley Act" (Public Law 90-583) and the "Federal Noxious Weed Act" (Public Law 93-629) direct weed control on public land. Protection of natural resource values depends on educating people about the negative impacts of weeds and what actions agencies and individuals can take to prevent weeds from becoming established.

Management Direction

Noxious weed prevention and control will continue to be a priority. Weeds will be controlled in an integrated weed management program that includes prevention education and cultural, physical, biological, and chemical treatments. Preventative measures such as public education and livestock and wildlife management will be employed to maintain or enhance desirable vegetation cover and reduce the distribution and introduction of noxious weed seed and plant parts. Mechanical and manual control methods and burning treatments will physically remove noxious weeds and unwanted vegetation; biological controls will introduce and cultivate agents such as insects and pathogens that naturally limit the spread of noxious weeds; and chemical treatments using approved herbicides will be applied where mechanical and/or biological controls are not feasible. Integrated weed management will be implemented in cooperation with the State of Oregon, Lake County, private interests, and neighboring counties and Federal jurisdictions.

Existing weed management plans for two specific geographic areas, the "Warner Basin Weed Management Area Plan" (USDI-BLM 1999g) and the "Abert Rim Weed Management Area Plan" (USDI-BLM 1995e), will continue to be implemented. A Greater Abert Weed Management Area will be proposed which will include the existing Abert Rim Weed Management Area and the rest of the Lake Abert Subbasin. The plan will be developed in consultation and cooperation with private landowners, ODFW, USFWS, U.S. Forest Service (USFS), Tribal governments, and other stakeholders in the Lake Abert Basin. The plan will be patterned after the "Warner Basin Weed Management Area Plan."

The weed control program is designed to address the dynamic nature of noxious weeds such as increasing numbers of species, different plant physiology for the various species, changing conditions of infestations, and changing technologies. Selection of the appropriate control method will be based on such factors as the growth characteristics of the target species, size of the infestation, location of the infestation, accessibility of equipment, potential impacts to nontarget species, use of the area by people, effectiveness of the treatment on target species, and cost. Depending on the plant's characteristics, these methods may be used individually or in combination and may be utilized over several years. Due to the length of seed viability, annual germination of seed from previous years, and the characteristics of certain plants, treatments could occur annually for a period of 10 or more years. Because weed infestations vary annually due to new introductions, spread of existing infestations, and the results of prior year treatments, site-specific reviews of known locations will be conducted annually prior to initiating weed treatment activities.

Approved weed control methods, including mechanical, biological, and chemical treatments as identified in "Vegetation Treatment on BLM Lands in Thirteen Western States FEIS and ROD" (USDI-BLM 1991b), "Supplement to the Northwest Area Noxious Weed Control Program FEIS and ROD" (USDI-BLM 1987a), and the "Integrated Noxious Weed Control Program Environmental Assessment" (USDA-BLM 1994d) will continue to be applied. Emphasis is on detection of new invaders and inventory and control in proven hot spots such as roads, rights-of-way, waterholes, and recreation sites, but with an expanded program to inventory areas that are less disturbed, remote, or previously uninventoried. Weed sites will be restored to desirable species. Control efforts will be expanded to include any new sites detected. Education and outreachHerbicide treatment: Herbicides that may be used are those approved in the "Vegetation Treatment on BLM Lands in Thirteen Western States EIS" (USDI-BLM 1991b), or any that are approved through an amendment or other agency approval process (see Appendix G of the "Proposed RMP/ EIS"(USDI-BLM 2003) for the current list of approved chemicals). Application will take place only in accordance with the manufacturer's label and by qualified/certified applicators.

Methods of application include wiping or wicking, backpack spraying, spraying from a vehicle with a hand gun or boom, aerial spraying, or other approved methods. WSAs: Noxious weeds occurring in WSA's will be treated with methods that are in accordance with the provisions of the wilderness IMP (USDI-BLM 1995b).

Monitoring

Management Goal**.** Evaluation of treatments will continue in cooperation with the State of Oregon, Lake County, and private interests as well as, neighboring counties and Federal jurisdictions. Inventories to identify new introductions, distribution, and density of noxious weed populations will be carried out on an annual basis in cooperation with these entities. Known noxious weed sites which are identified for treatment will be visited each year and evaluated for effectiveness of control. Known sites not identified for treatment will be visited on a rotational basis over 3years. All known sites visited will be located with a global positioning system unit, photographed, measured, and a determination of the need for future treatment will be made.

Inventories for new noxious weeds will be conducted each year on a 3-year rotation through the resource area. All burned areas (natural and prescribed) will be surveyed for noxious weeds for 3 years following the burn. Any newly discovered sites will be located with a global positioning system unit, photographed, measured, and a determination of the need for future treatment will be made. Ecological trends due to changes in vegetation composition over time, in areas dominated by competing undesirable plant species, will be measured through periodic rangeland health assessments following procedures outlined in "Interpreting Indicators of Rangeland Health" (Shaver et al. 2000). Efforts will be expanded to include areas outside of Lake County in an effort to "head-off" species that may spread into the resource area.

Appendix D, Best Management Practices, Page A-6
Noxious Weed Management

1) All contractors and land-use operators moving surface-disturbing equipment in or out of weed-infested areas should clean their equipment before and after use on public land.

2) Control weeds annually in areas frequently disturbed such as gravel pits, recreation sites, road sides, livestock concentration areas.

3) Consider livestock quarantine, removal, or timing limitations in weed-infested areas.

4) All seed, hay, straw, mulch, or other vegetation material transported and used on public land weed-free zones for site stability, rehabilitation, or project facilitation should be certified by a qualified Federal, state or county officer as free of noxious weeds and noxious weed seed. All baled feed, pelletized feed, and grain transported into weed-free zones and used to feed livestock should also be certified as free of noxious weed seed.

5) It is recommended that all vehicles, including offroad and all-terrain, traveling in or out of weed-infested areas should clean their equipment before and after use on public land.

Appendix F, Watershed and Water Quality, Page A-160-161
Noxious Weeds and Competing Undesirable Vegetation Management Goal:

Control the introduction and proliferation of noxious weeds and competing undesirable plant species and reduce the extent and density of established populations to acceptable limits.

Three Rivers Resource Management Plan, Burns District, 1992, Page 2-53

Vegetation Program Objective and Rationale

V 1: Maintain, restore or enhance the diversity of plant communities and plant species in abundances and distributions, which prevent the loss of specific native plant community types or indigenous plant species within the RA. Rationale: FLPMA mandates that public lands be managed in a manner that will protect the quality of the ecological resources among others. The BLM is committed to maintaining and enhancing the vegetation of the RA in terms of diversity and abundance of species and diversity of plant communities. Such diversity is necessary to sustain the variety of uses that BLM managed lands receive.

Allocation/Management Action

V1.6:Apply approved weed control methods including manual, biological and chemical control methods as identified in the Weed Control EIS and Burns District Weed Control EA in an integrated pest management program to prevent the invasion of noxious weeds into areas presently free of such weeds and to improve the ecological status of sites which have been invaded by weeds. Weed control activities will be prioritized and funded based on the following criteria, as identified in Burns District's Weed Control EA:

Priority I: Potential New Invaders - Emphasizes education and awareness;
Priority II: Eradication of New Invaders-Emphasizes eradication, priority funding;
Priority III: Established Infestations - Emphasizes containment and control.

Procedures to Implement/Monitoring Needs

1. Inventory.
2. Prioritize infestations.
3. Apply manual or biological control procedures if appropriate.
4. Where chemical control is required, evaluate site for impacts, complete and submit pesticide use proposal (PUP) to Oregon State Office for approval.

Monitoring Needs:

- Monitoring to determine effectiveness of applied treatments will be done at least annually for the 5 years following treatment.
- NEPA documents compliance monitoring, if appropriate.

Andrews Management Unit Resource Management Plan, Record of Decision, Burns District, 2005, Page 31

Noxious Weeds

Goal - Control the introduction and proliferation of noxious weeds and reduce the extent and density of established populations to acceptable levels.

<u>*Objective 1*</u>**.** Treat noxious weeds and inventory for new infestations using the most effective means available, as outlined in the Burns District's Integrated Management Program EA/Decision Record.

*Objective 2***.** Create public awareness on how to utilize public land without inadvertently spreading noxious weeds.
*Objective 3***.** Maintain partnerships with local groups and government agencies to combine efforts in the control and prevention of noxious weed infestations.

Rationale

The FLPMA and PRIA direct the BLM to "…manage public lands according to the principles of multiple-use and sustained yield…" and to "…manage the public lands to prevent unnecessary degradation...so they become as productive as feasible." The introduction and spread of noxious weeds and undesirable plants within the AMU contributes to the loss of rangeland productivity, increased soil erosion, reduced species and structural diversity, loss of wildlife habitat, and in some instances may pose a threat to human health and welfare. The Carlson-Foley Act (Public Law [PL] 90-583), the Federal Noxious Weed Act (PL 93-629), and the Burns District's Integrated Management Program EA direct noxious weed inventory and control on public land in the AMU. In the future, additional weed management direction will come from the new National Vegetation Management EIS, which is currently being developed. Protection of natural resource values depends on educating people about negative impacts of weeds, and actions, which agencies and individuals can take to prevent introduction, establishment, and spread of invasive species.

The Burns District Noxious Weed Management Program addresses the dynamic nature of noxious weeds such as the increasing number of species, changing conditions of infestations, and changing technologies. Currently, 18 noxious weed species are known to occur within the AMU, infesting 1,457 acres. Selection of appropriate control methods is based on such factors as growth characteristics of the target species, size and location of infestation, accessibility/feasibility of equipment, potential impacts to nontarget species, human use of the area, effectiveness of the treatment on target species, and cost. In addition, all BLM-authorized activities are evaluated for potential to spread or cause new infestations. If necessary, effects from proposed activities shall be mitigated so weed establishment is minimal.

Depending on plant characteristics, control methods may be used individually or in combination and may be utilized over several years. Control treatments may include cultural, mechanical, chemical, or biological methods. Due to the length of seed viability, annual germination of seed from previous years, and characteristics of certain plants, treatment could occur annually for a period of ten or more years. Since weed infestations vary annually due to new introductions, spread of existing infestations, and results of prior treatments, annual site-specific reviews of known locations will be conducted prior to initiating weed treatment activities.

Herbicides that may be used are those approved in the Vegetation Treatment on BLM Lands in Thirteen Western States EIS (1991b), or any that are approved through an amendment or other agency approval process. Application will take place only in accordance with the manufacturer's label and by qualified/certified applicators. Methods of application include wiping or wicking, backpack spraying, spraying from a vehicle with a handgun or boom, aerial spraying, or other approved methods.

Noxious weeds occurring in special management areas, including areas with T&E species/habitat, will be treated with methods to protect resource values and in accordance with provisions of the Burns District's Integrated Management Program EA directing weed management.

Management Direction

Noxious weed prevention and control will continue to be a priority. Weeds will be controlled in an integrated weed management program, which includes prevention, education, and cultural, physical, biological, and chemical treatments. Preventive measures such as public education and livestock and wildlife management will be employed to maintain or promote desirable vegetation cover and reduce distribution and introduction of noxious weed seed and plant parts. Mechanical and manual control methods and burning treatments will physically remove noxious weeds and unwanted or invasive vegetation; biological controls will introduce and cultivate factors such as insects and pathogens that naturally limit the spread of noxious weeds; and chemical treatments using approved herbicides will be applied where mechanical or biological controls are not feasible. Periodic inventories will detect new infestations. Monitoring the extent of known infestations is key to controlling or eradicating noxious weeds.

Integrated management will be implemented for control of noxious weeds. Control on disturbed areas such as roads, ROWs, waterholes, and recreational sites will be emphasized. Priority is given to land with high quality natural resource values. Emphasis is on prevention, restoration, research, and expanded efforts to inventory and detect new infestations.

Public education concerning noxious weeds will be expanded to include areas outside Harney County.

The Harney County Weed Management partnership will continue.

Monitoring

Noxious weed infestations are a serious threat to all vegetative communities. Monitoring is focused on identification of new infestations, spread of existing infestations, and effectiveness of treatment activities. Monitoring for new infestations is accomplished through inventories, most commonly in areas previously disturbed by fire or other disturbance-causing activities, and also in areas with high resource values where early detection is critical to maintain those values. Spread of existing infestations and treatment effectiveness are often monitored simultaneously using stem counts, various estimation techniques, and calculations using calibrated herbicide application equipment.

See the Vegetation Monitoring Section for additional monitoring information.

Steens Mountain Cooperative Management and Protection Area Resource Management Plan, Record of Decision, Burns District, 2005, Page 32

Noxious Weeds

Goal - Control the introduction and proliferation of noxious weeds and reduce the extent and density of established populations to acceptable levels.

Objective 1. Treat noxious weeds and inventory for new infestations using the most effective means available, as outlined in the Burns District's Integrated Management Program EA/Decision Record.
Objective 2. Create public awareness on how to utilize public lands without inadvertently spreading noxious weeds.
Objective 3. Maintain partnerships with local groups and government agencies to combine efforts in the control and prevention of noxious weed infestations.

Rationale

The FLPMA and PRIA direct the BLM to "…manage public lands according to the principles of multiple-use and sustained yield…" and to "…manage the public lands to prevent unnecessary degradation ...so they become as productive as feasible." Introduction and spread of noxious weeds and undesirable plants within the CMPA contributes to loss of rangeland productivity, increased soil erosion, reduced species and structural diversity, loss of wildlife habitat, and in some instances may pose a threat to human health and welfare. The Carlson-Foley Act (Public Law [PL] 90-583), the Federal Noxious Weed Act (PL 93-629), and the Burns District Integrated Management Program EA direct noxious weed inventory and control on public lands in the CMPA. In the future, additional weed management direction will come from the new National Vegetation Management EIS, which is currently being developed. Protection of natural resource values depends on educating people about negative effects of weeds, and actions which agencies and individuals can take to prevent introduction, establishment, and spread of invasive species.

Burns District Noxious Weed Management Program addresses the dynamic nature of noxious weeds such as increasing number of species, changing conditions of infestations, and changing technologies. There are currently 17 noxious weed species known to occur within the CMPA, infesting 336 acres. Selection of appropriate control methods is based on such factors as growth characteristics of target species, size and location of infestation, accessibility/feasibility of equipment, potential impacts to nontarget species, human use of the area, effectiveness of treatment on target species, and cost. In addition, all BLM-authorized activities are evaluated for potential to spread or cause new infestations. If necessary, effects from proposed activities shall be mitigated so weed establishment is minimal.

Depending on plant characteristics, control methods may be used individually or in combination and may be utilized over several years. Control treatments may include cultural, mechanical, chemical, or biological methods. Due to length of seed viability, annual germination of seed from previous years, and characteristics of certain plants, treatment could occur annually for a period of ten or more years. Since weed infestations vary annually due to new introductions, spread of existing infestations, and results of prior treatments, annual site-specific reviews of known locations will be conducted prior to initiating weed treatment activities.

Herbicides that may be used are those approved in "Vegetation Treatment on BLM Lands in Thirteen Western States EIS" (1991b), or any approved through an amendment or other agency approval process. Application will take place only in accordance with the manufacturer's label and by qualified/certified applicators. Methods of application include wiping or wicking, backpack spraying, spraying from a vehicle with a handgun or boom, aerial spraying, or other approved methods.

Noxious weeds occurring in special management areas, including areas with T&E species/habitat, will be treated with methods to protect resource values and in accordance with provisions of Burns District Integrated Management Program EA directing weed management.

Management Direction

Noxious weed prevention and control will continue to be a priority. Weeds will be controlled in an integrated weed management program, which includes prevention, education, and cultural, physical, biological, and chemical treatments. Preventive measures such as public education and livestock and wildlife management will be employed to maintain or promote desirable vegetation cover and reduce distribution and introduction of noxious weed seed and plant parts. Mechanical and manual control methods and burning treatments will physically remove noxious weeds and unwanted or invasive vegetation. Biological controls will introduce and cultivate factors such as insects and pathogens that naturally limit spread of noxious weeds, and chemical treatments using approved herbicides will be applied where mechanical or biological controls are not feasible. Periodic inventories will detect new infestations. Monitoring the extent of known infestations is key to controlling or eradicating noxious weeds.

Integrated management will be implemented for control of noxious weeds. Control on disturbed areas such as roads, ROWs, waterholes, and recreational sites will be emphasized. Priority will be given to lands with high quality natural resource values. Emphasis is on prevention, restoration, research, and expanded efforts to inventory and detect new infestations.

Public education concerning noxious weeds will be expanded to include areas outside Harney County.

The Harney County Weed Management partnership will continue.

Monitoring

Noxious weed infestations are a serious threat to all vegetative communities. Monitoring is focused on identification of new infestations, spread of existing infestations, and effectiveness of treatment activities. Monitoring for new infestations is accomplished through inventories, most commonly in areas previously disturbed by fire or other disturbance causing activities, and also in areas with high resource values where early detection is critical to maintain those values. Spread of existing infestations and treatment effectiveness are often monitored simultaneously using stem counts, various estimation techniques, and calculations using calibrated herbicide application equipment.

See Vegetation Monitoring Section for additional monitoring.

Baker Resource Management Plan, Vale District, 1989, Page 50

(The Baker RMP is scheduled for revision in 2010.)

Noxious Weed Control

Infestations of noxious weeds are known to occur on some public lands in the planning area (refer to Figures 2 and 3). The most common noxious weeds are diffuse, spotted and Russian knapweed, yellow starthistle, Canadian thistle, and yellow leafy spurge. Control methods will be proposed and subject to site specific environmental analyses consistent with the Record of Decision on BLM's Northwest Area Noxious Weed Control Program EIS and EIS Supplement. Control methods will not be considered unless the weeds are confined to public lands or control efforts are coordinated with owners of adjoining infested non-public lands. Proper grazing management will be emphasized after control to minimize possible reinfestation. Coordination and cooperation with county weed control officers will continue on a regular basis.

Southeastern Oregon Resource Management Plan, Vale District, 2002

Record of Decision, Page 10
Forest and Woodland Management

Land suitable for timber production will be managed on a sustained yield basis. All forestland and western juniper and quaking aspen woodlands will be managed to protect long-term productivity, biological diversity, and watershed values.

The BLM will work with county, state, and Federal agencies to monitor the locations and spread of noxious weeds. Noxious weed control will be conducted in accordance with the integrated weed management guidelines and design features identified in the "Northwest Area Noxious Weed Control Program EIS" (USDI-BLM 1985).

Control of noxious weeds will occur in SMA's, if needed, but may include certain restrictions to reduce potential impacts on specific values. The BLM will assess land prior to acquisition to determine whether or not noxious weeds are present.

Record of Decision, Page 25

Rangeland vegetation includes a mosaic of multiple-aged shrubs, forbs, and native and desirable nonnative perennial grasses. Shrub overstories are present in a variety of spatial arrangements and scales across the landscape level, including some large contiguous blocks, islands, and corridors. Shrub overstories are present in predominantly mature, late structural status. Plant communities not meeting DRFC's show upward trends in condition and structural diversity. Desirable plants continue to improve in health and vigor. New infestations of noxious weeds are not common across the landscape, and existing large infestations are declining. Populations and habitat of rare plant species are stable or continue to improve in vigor and distribution.

Record of Decision Page 38 - 40
Rangeland Vegetation

Objective 1: Restore, protect, and enhance the diversity and distribution of desirable vegetation communities including perennial native and desirable introduced plant species. Provide for their continued existence and normal function in nutrient, water, and energy cycles.

<u>Rationale</u>: With passage of FLPMA and the "Public Rangelands Improvement Act" (PRIA) of 1978, objectives and priorities for the management of public land vegetation resources were more clearly defined. Guidance contained in 43 CFR 4180 of the regulations directs public land management toward the maintenance or restoration of the physical function and biological health of rangeland ecosystems. Standards of Rangeland Health and Guidelines for Livestock Grazing Management (S&G's) for public land administered by the BLM in Oregon and Washington were approved by the Secretary of the Interior on August 12, 1997 (USDI-BLM 1997). This objective will maintain and improve the condition and trend in plant communities that provide wildlife habitat, recreation, forage, scientific, scenic, ecological, and water and soil conservation benefits for consumptive and nonconsumptive uses. The long-term goal of vegetation management across the landscape is to maintain or improve rangeland condition to DRFC's which meet management objectives, not specifically late-potential natural communities (PNC's) ecological status.

Management actions authorized or implemented by BLM will influence future vegetation composition. These actions may include season, intensity, and duration of livestock grazing within diverse vegetation communities (Appendix R); the influence of fire and associated suppression actions; emergency fire rehabilitation and the reintroduction of grazing following fire; the use of natural and management-created firebreaks to protect early seral communities from frequent fire intervals; rehabilitation and reclamation actions following soil-disturbing activities; management of noxious weeds; OHV use; wild horse management; recreational use; and mining.

Vegetation management has been based on existing inventories delineating the ecological status of vegetation communities. Management objectives have been to improve early and middle seral stage vegetation communities to attain late seral or PNC within the limits of ecological site potential. Additionally, those vegetation communities in late seral stage or PNC have been managed to improve or maintain those desirable conditions. The basis for defining ecological status and potential is site descriptions that provide a summary of expected species composition and variability within climax vegetation communities, as well as anticipated responses with management. The delineation of ecological sites is based on soils and climatic conditions.

Management objectives within previous land use plans to attain late-PNC seral communities were based on the increased productivity of late-PNC seral communities relative to low seral communities, their greater ability to stabilize watersheds, and their improved role in water, nutrient, and energy cycling. Vegetation communities in late-PNC seral stage express a mosaic of species composition and structure consistent with site potential and, as such, reflect a range of possible plant communities that should meet the objectives defining desired future conditions within this land use plan.

Monitoring: Over the life of this plan, vegetation communities will be monitored to determine progress toward attaining DRFC's. Monitoring to determine success in meeting vegetation management objectives will include periodic measurements of plant composition, vigor, and productivity as well as measurement of the amount and distribution of plant cover and litter which protects the soil surface from raindrop impact, detains overland flow, protects the surface from wind erosion, and retards soil moisture loss through evaporation. Additional data, to determine the effectiveness of established tools in meeting objectives, may include herbaceous or woody utilization, actual use, and climatic parameters.

Management Actions: Upland native rangeland communities will be managed to attain a trend toward DRFC's based on management objectives and site potential. Management actions will maintain the condition of those native communities where vegetation composition and structure will be consistent with desired conditions and natural values. Nonnative seedings in poor or fair condition will be managed to restore production and vigor, as well as to improve structural and species diversity consistent with other management objectives. Nonnative seedings in good or excellent condition will be managed to maintain seeding health, improve structural and species diversity, and ensure continued forage production. Upland shrub cover across the landscape will be maintained at moderate to heavy levels of potential for wildlife cover values (see Appendix F, Table F-1) and structural diversity in most native vegetation communities where potential exists and in nonnative seedings as consistent with other resource management objectives. The frequency, distribution, and ecological integrity of native stands of mountain shrubs will be restored and maintained where site potential will support these species.

Management actions will be implemented to rehabilitate and/or vegetate plant communities that do not meet DRFC's due to dominance by annual, weedy or woody species. Vegetation manipulation projects will be implemented primarily to direct trend toward desired conditions, improve structural and species diversity, and protect soil, water, and vegetation resources. Emphasis will be placed on the use of prescribed and wildland fire to regulate woody species dominance and direct vegetation composition toward desired conditions. Appropriate Management Response (AMR) will be implemented on wildland fires to meet vegetation management and other objectives. Following wildland fire, priority will be placed on the rehabilitation of rangeland vegetation communities held at risk due to dominance by annual and woody species. Seedings will be implemented with appropriate mixes of adapted perennial species. Species mixes will be determined on a site-specific basis dependent on the probability of successful establishment, risks associated with seeding failure, and other management considerations. Preference will be toward the use of native species, though nonnative species may be used when better adapted to out-compete established annual species. Use of competitive native species or desirable nonnative species will be emphasized in seedings within sites moderately and highly susceptible to degradation. Treatment configuration will emphasize the maintenance of natural values as consistent with other resource management objectives.

Areas burned by wildland fire, including those subsequently rehabilitated, will be rested from grazing for one full year and through a second growing season at a minimum, or until monitoring data or professional judgment indicate that health and vigor of desired vegetation has recovered to levels adequate to support and protect upland function. Appropriate grazing use of healthy perennial vegetation communities, or areas dominated by annual species, prior to the two growing season limit may be allowed on a case-by-case basis, as consistent with objectives for improving or maintaining rangeland health and other objectives. Annual rangeland vegetation communities at risk from frequent fires will be protected through the establishment of appropriate firebreaks (such as greenstripping) using both desirable native and nonnative species. An emphasis will be placed on the establishment of effective firebreaks using seed mixes and project configurations consistent with resource management objectives and goals to maintain natural values.

Record of Decision, Page 40-41

Objective 3: Control the introduction and proliferation of noxious weed species and reduce the extent and density of established weed species to within acceptable limits.

Rationale: FLPMA and PRIA direct BLM to "manage public lands according to the principles of multiple use and sustained yield" and "manage the public lands to prevent unnecessary degradation . . . so they become as productive as feasible." "The Carlson-Foley Act" (Public Law 90-583) and the "Federal Noxious Weed Act" (Public Law 93-629) direct weed control on public land. The introduction and spread of noxious weeds within the planning area cause a decline in rangeland condition, expose soils to accelerated rates of erosion, reduce productivity, reduce dominance of individual species and communities of native plants, and reduce economic returns to individuals and society.

Monitoring: In cooperation with the State of Oregon, Malheur County, adjoining counties, and private landowners, inventories to identify the distribution and density of identified noxious weeds will continue. Inventories will be repeated as necessary in subsequent years following control actions to identify effectiveness.

Management Actions: The distribution and density of noxious weeds will be reduced through the application of approved control methods in an integrated program in cooperation with the State of Oregon, Malheur County, Harney County, and other adjoining counties, adjoining private landowners, and other affected agencies and interests (see Map SS-1). Control methods will include preventive management to maintain competitive vegetation cover and reduce the distribution and introduction of noxious weed seed; manual and mechanical methods to physically remove noxious weeds; biological methods to introduce and cultivate factors that naturally limit the spread of noxious weeds; cultural practices; and application of chemicals. Target species will include those identified by county, state and BLM weed priority lists.

Record of Decision, Appendix O, Page O-7

Noxious Weed Management

1) All contractors and land-use operators moving surface-disturbing equipment in or out of weed infested areas should clean their equipment before and after use on public land.

2) Control weeds annually in areas frequently disturbed such as gravel pits, recreation sites, road sides, livestock concentration areas.

3) Consider livestock quarantine, removal, or timing limitations in weed infested areas.

4) All seed, hay, straw, mulch, or other vegetation material transported and used on public land weed-free zones for site stability, rehabilitation or project facilitation should be certified by a qualified Federal, State, or county officer as free of noxious weeds and noxious weed seed. All baled feed, pelletized feed and grain transported into weed-free zones and used to feed livestock should also be certified as free of noxious weed seed.

5) It is recommended that all vehicles, including off-road and all-terrain, traveling in or out of weed infested areas should clean their equipment before and after use on public land.

For additional controls on noxious weed management please refer to the "Northwest Area Noxious Weed Control Program" (1987), its associated "Supplemental Environmental Impact Statement" and the "Vale District Fire-Year Noxious Weed Control Program Environment Assessment" (1987) with extensions.

John Day Resource Management Plan, 1995, as amended in 2001 through the John Day River Management Plan, Two Rivers, John Day and Baker Resource Management Plan Amendments, Page 154

Noxious Weeds

'Noxious' is a legal classification rather than an ecological term. Plants that can exert substantial negative environmental or economic impact can be designated as noxious by various government agencies. The single greatest threat to the native rangeland biodiversity and recovery of less than healthy rangelands and watersheds is the rapidly expanding invasion of noxious weeds (Asher 1993). Both forestland and rangeland are being invaded by noxious weeds at an accelerated rate. Noxious weed encroachment reduces the potential of forest and rangeland to support grazing timber production,wildlife use, and viewing by displacing native plant species and reducing natural biological diversity; degrading soil integrity, nutrient cycling, and energy flow; and interfering with site-recovery that allow a site to recover following disturbance (Quigley and Arbelbide 1997).

The weeds of most concern in the John Day basin are diffuse, spotted and Russian knapweeds; Dalmatian toadflax; yellow starthistle; Scotch thistle; purple loosestrife; rush skeletonweed; leafy spurge; poison hemlock; and medusahead rye. Weeds of special concern are those beginning to occupy very small niches with just a few plants along the high water line, and small patches on islands (mainly diffuse knapweed and Dalmatian toadflax) that could spread very rapidly. Also, small infestations of Russian knapweed and dalmatian toadflax are becoming more prevalent on the upper, sheltered alluvial flats. This is especially noteworthy for riparian areas below the confluence of Thirtymile Canyon at RM 84. In the Clarno area, medusahead rye is prevalent in the burned areas on the west side of the river, north and south of Highway 219. It is also prevalent in the Murderer's Creek drainage, a tributary of the South Fork of the John Day River. Diffuse knapweed is found along the road right-of-way, south of Clarno. Russian knapweed is prevalent in the Clarno and Bridge Creek areas, and has been found in numerous small patches on alluvial flats. Dalmatian toadflax has also been observed on these flats and up slope areas, particularly below Thirtymile Canyon. The thistles (Scotch, bull and Canada) and poison hemlock commonly occur at the small tributaries near and in riparian areas. Yellow starthistle has been found in several locations in the Clarno area and is especially prevalent in the upper Bridge Creek area near Mitchell. It is also prevalent around the Columbia River near Biggs and the Horn Butte ACEC, an area north and east of the John Day/Columbia River confluence. Leafy spurge is found in Grant County in the upper watersheds (Fox Valley and Cottonwood Creek) of the North Fork of the John Day. Four sites were found and treated in 1995, and 18 sites were found and treated between Monument and Spray in 1996. A very serious threat is noted in the recent increase of perennial pepperweed in the Bridge Creek drainage. Federal and state laws require certain actions be directed at managing noxious weeds. In large part, the 'invasion of alien plants into natural areas' and the crowding 'out of native flora and fauna has been stealthy and silent, and thus, largely ignored' (Cheater 1992).

Two Rivers Resource Management Plan District, Prineville District, 1986, Page 31

Noxious Weed Control

Infestations of noxious weeds are known to occur on some public lands in the planning area. The most common noxious weeds are diffuse, spotted and Russian knapweed, yellow star thistle, tion toadflax, and poison hemlock. Control methods will be proposed consistant with the Record of Decision on Northwest Area Noxious Weed Control Program EIS. Control methods will then be subjected to site specific environmental analyses tiered to that EIS. Control will be considered on public iands where efforts are coordinated with owners of adjoining infested, non public lands. Proper grazing management will be emphasized after control to minimize possible reinfestation. Coordination and cooperation with county weed control officers will continue on a regular basis.

Brothers/LaPine Resource Management Plan, Record of Decision, Prineville District, 1989, Page 126

Noxious Weed Control

Infestations of noxious weeds are known to occur on some public lands in the planning area. Control methods including grazing management as well as chemical/mechanical, thermal and biological methods will be proposed and subject to site-specific environmental analysis. Control methods will not be considered unless weeds are confined to public lands or control efforts are coordinated with owners of adjoining lands. Proper grazing management will be emphasized to minimize new invasions of weeds and after control to minimize possible reinfestation.

A multi-state BLM environmental impact statement on noxious weed control has been completed for Oregon, Washington, Idaho, Montana and Wyoming. A district-wide environmental assessment has also been completed by the Prineville BLM to assess specific noxious weed control sites throughout the district. Copies of these documents and the related State Director decisions for Oregon and Washington are available for public review at the Prineville District Office during normal working hours.

Upper Deschutes Record of Decision and Resource Management Plan, Prineville District, 2005, Page 37

Noxious Weeds

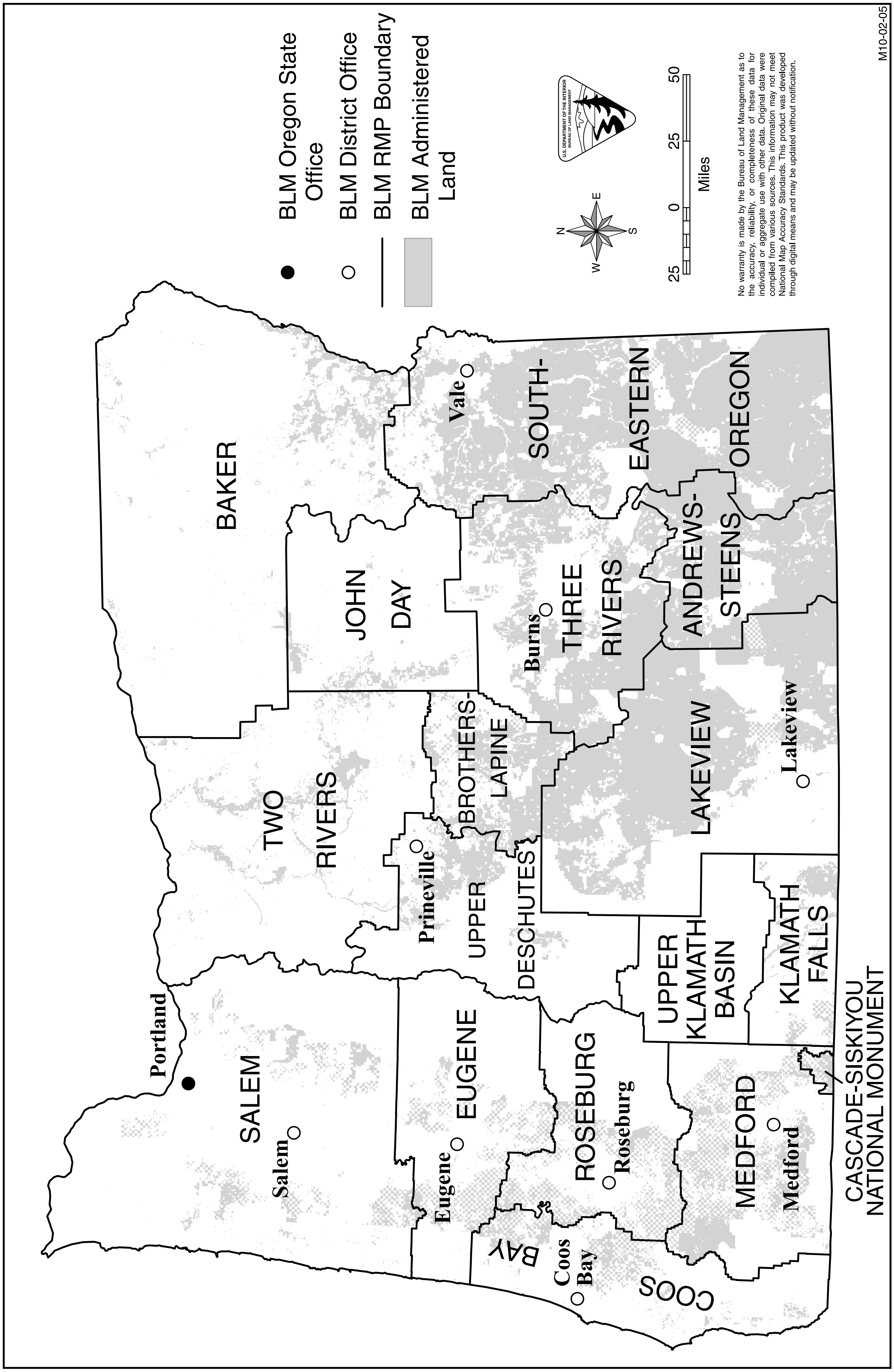
Objective V – 2: Maintain noxious weed-free plant communities or restore plant communities with noxious weed infestations through the use of broad-scale integrated weed management strategies. During planning for vegetation management and other ground disturbing activities, consider opportunities to manage undesirable non-native or invasive species.

<u>Rationale</u>:
The rapid expansion of noxious and other invasive species in portions of the planning area is one of the greatest threats to the integrity of native plant communities. Noxious weeds reduce the value of native plant communities in several ways.

Guidelines:

1. All land management activities and projects will assess the risk of introducing or spreading weeds. Integrated weed management strategies will be incorporated into the planning, design, implementation, monitoring, and follow-up actions of all ground-disturbing projects and activity plans.
2. Integrated weed management strategies will incorporate some or all of these objectives: detection, inventory, prevention, containment, control, and eradication of noxious weeds. Strategies may also target other undesirable plant communities as appropriate and practicable.
3. A balanced ecosystem approach for management of undesirable vegetation may include one or more of the following techniques: cultural, manual, mechanical, prescribed fire, competitive seeding, biological, and chemical.
4. When possible, grazing management practices will be designed to help control noxious weeds and other undesirable plants (such as cheatgrass, medusahead and thistles).
5. Opportunities will be sought to form partnerships with other public agencies and adjacent landowners to develop regionally effective and cost-efficient weed management strategies.
6. All treatments will be in accordance with policy and guidelines in the following current or subsequent programmatic vegetation management plans: (1) "Vegetation treatment on BLM administered lands in thirteen western States" (USDI-BLM, 1991) and (2) "Prineville District Integrated Weed Management Environmental Assessment (USDI-BLM 1994)."
7. Where possible, weed management within the planning area will be prioritized as follows:
    a. Prevent new infestations by limiting weed seed dispersal, minimizing soil disturbance, and properly managing desirable vegetation.
    b. Detect and eradicate new invaders.
    c. Target roadways, watercourses, campgrounds, utility corridors and other high disturbance areas for a prevention and containment program.
    d. Emphasize control of large-scale infestations (limiting the spread of noxious weeds and reducing the infestation level).
    e. Focus initial efforts on small, manageable units with a component of desirable native plants (or desirable non-native plants), and then focus on the remaining infestation. Start from the outside and work toward the center of the infestation.
8. In high risk areas, prevention measures will include provisions in all land management activities, projects and agreements to inspect or certify that vehicles, equipment, livestock, supplies, and materials entering, using, or transporting across public lands are free of noxious weed seed or other reproductive parts of noxious weeds. Precautions will include ensuring use of weed-free hay/feed for livestock and weed-free seed in seeding projects.
9. Consider limiting season of use for ground disturbing activities to prevent the spread of weeds during and immediately after the flowering and seed production period.
10. Consider potential for spread of cheatgrass and other undesirable plants that could occur with disturbance by land uses or vegetation treatments, particularly within the lower elevation pumice sand community types.

Figure A6-1. Resource Management Plan Areas



Appendix 7 – Additional Information about Noxious Weeds and Other Invasive Plants

Table of Contents

Oregon State Noxious Weed List

Table A7-1. Oregon State Noxious Weed List: Abundance and Alternative Where Effective Control Becomes Available - June 2010. This list includes most of the noxious weeds actively managed by the BLM in Oregon, but additional plants may be designated on Federal or County lists.

Alternative where effective control is available[1]	Common Name	Noxious State List[4]	Abundance Category[2]	Number of OR counties where weed			Weeds targeted for biocontrol agents
				is abundant	has limited distribution	is not known to occur	
RA[3]	Starthistle, Iberian	A	A	0	1	36	
RA[3]	Thistle, Taurian or bull cottonthistle	A	A	0	1	36	
RA[3]	Thistle, Plumeless	A	A	0	2	35	
RA[3]	Thistle, Wooly distaff	A	A	0	3	34	
RA[3]	Yellow floating heart	A	A	0	3	34	
RA[3]	Starthistle, Purple	A	A	0	1	26	
RA[3]	Thistle, Smooth distaff	A	N	0	0	37	
RA[3]	Policemans helmet	B	A	0	6	31	
RA[3]	Dyers woad	B	A	0	9	28	
RA[3]	Velvetleaf	B	A	0	11	26	
RA[3]	Thistle, Scotch	B	A	15	4	18	
RA[3]	Teasel, cutleaf	B	B	0	2	35	
RA[3]	Broom, Portugese	B	B	1	1	35	
RA[3]	Halogeton	B	B	1	2	33	
RA[3]	Cocklebur, spiny	B	B	1	10	26	
RA[3]	Thistle, Slender flowered	B	B	5	6	26	√
RA[3]	Buffalobur	B	B	0	15	22	
RA[3]	Spanish heath	B	C	3	3	31	
RA[3]	Broom, French	B	C	2	5	30	√
RA[3]	Ragweed	B	C	3	7	27	
RA[3]	Thistle, Italian	B	C	3	6	27	
RA[3]	Jubata grass (Purple Pampas grass)	B	C	2	9	26	
RA[3]	Mediterranean sage	B	C	2	9	26	
RA[3]	Thistle, Musk	B	C	4	10	23	√
RA[3]	Spurge laurel	B	C	3	12	22	
RA[3]	Thistle, Milk	B	C	11	5	21	√
RA[3]	Houndstongue	B	C	9	10	18	
RA[3]	Puncturevine	B	C	18	9	10	√
RA[3]	English Ivy	B	D	19	0	18	
RA[3]	Tansy ragwort	B	D	21	11	5	√
RA[3]	Knapweed, Diffuse	B	D	12	21	4	√
RA[3]	Thistle, Bull	B	D	37	0	0	√
RA[3]	Starthistle, Yellow	B	E	12	14	11	√
RA[3]	Broom, Scotch	B	E	21	10	6	√
RA[3]	Flowering rush	B	E	37	0	0	
RA[3]	Geranium, Herb Robert	B	N				
RA[3]	Geranium, Shiny leaf	B	N				
2	Camel thorn	A	A	0	0	37	
2	African rue	A	A	0	1	36	
2	Cordgrass, saltmeadow	A	A	0	1	36	
2	Goatgrass, Barbed	A	A	0	1	36	
2	Hawkweed, Mouse-eared	A	A	0	1	36	

Alternative where effective control is available[1]	Common Name	Noxious State List[4]	Abundance Category[2]	Number of OR counties where weed			Weeds targeted for biocontrol agents
				is abundant	has limited distribution	is not known to occur	
2	Matgrass	A	A	0	1	36	
2	Spurge, Myrtle	A	A	0	1	36	
2	Yellowtuft – murale	A	A	1	0	36	
2	Yellowtuft – corsicum	A	A	1	0	36	
2	Cordgrass, smooth	A	A	0	2	35	
2	Kudzu	A	A	0	2	35	
2	Paterson's curse	A	A	0	2	35	
2	Knapweed, Squarrose	A	A	0	3	34	
2	Hawkweed, Meadow	A	A	0	7	30	
2	Hawkweed, Orange	A	A	0	8	29	
2	Giant Hogweed	A	A	0	11	26	
2	Skeletonleaf bursage	A	C	5	6	26	
2	Cordgrass, common	A	N	0	0	37	
2	Cordgrass, dense flower	A	N	0	0	37	
2	European Water chestnut	A	N	0	0	37	
2	Goatgrass, Ovate	A	N	0	0	37	
2	Hawkweed, King-devil	A	N	0	0	37	
2	Hawkweed, Yellow	A	N	0	0	37	
2	Purple Nutsedge	A	N	0	0	37	
2	Silverleaf Nightshade	A	N	0	0	37	
2	Syrian bean-caper	A	N	0	0	37	
2	Goatsrue	A	N				
2	White Bryonia	A	N				
2	Oblong spurge	A	N	0	1	36	
2	Common reed	A	N				
2	Biddy-biddy	B	A	0	3	34	
2	Common cruprina	B	A	0	3	34	
2	Parrot's feather	B	A	0	3	34	
2	Lesser celadine or fig buttercup	B	A	0	4	33	
2	Broom, Spanish	B	A	0	5	32	
2	Common bugloss	B	A	0	5	32	
2	Spurge, Leafy	B	A	0	9	28	√
2	Garlic mustard	B	B	1	5	31	
2	Knotweed, Himalayan	B	B	1	7	29	
2	Johnsongrass	B	B	1	20	16	
2	Yellow Flag Iris	B	B	9	14	14	
2	Knotweed, Japanese	B	B	13	16	8	
2	Knotweed, Giant	B	B	13	17	7	
2	Purple loosestrife	B	B	17	16	4	√
2	False brome	B	C	4	7	26	
2	Gorse	B	C	4	7	26	√
2	Goatgrass, Jointed	B	C	7	5	25	
2	Butterfly bush	B	C	2	11	24	
2	Old man's beard	B	C	5	9	23	
2	Sulfur cinquefoil	B	C	5	10	22	
2	Whitetop,Hairy	B	C	4	12	21	
2	Knapweed, Russian	B	C	7	11	19	√
2	whitetop, Lens-podded	B	C	7	11	19	

Alternative where effective control is available[1]	Common Name	Noxious State List[4]	Abundance Category[2]	Number of OR counties where weed is abundant	has limited distribution	is not known to occur	Weeds targeted for biocontrol agents
2	Toadflax, Yellow	B	C	1	18	18	√
2	Rush skeletonweed	B	C	7	12	18	√
2	Whitetop, (Hoary cress)	B	C	7	13	17	
2	Kochia	B	C	18	2	17	
2	Knapweed, Meadow	B	C	14	9	14	√
2	Toadflax, Dalmation	B	C	9	16	12	√
2	Knapweed, spotted	B	C	8	27	2	√
2	Swainsonpea	B	C				
2	Poison hemlock	B	D	37	0	0	
2	St. Johnswort	B	D	37	0	0	√
2	Blackberry, Himalayan	B	E	20	16	1	
2	Quackgrass	B	E	35	2	0	
2	Thistle, Canada	B	E	37	0	0	√
2	Field bindweed	B	N	37	0	0	√
3	Coltsfoot	A	N	0	0	37	
3	Hydrilla	A	N	0	0	37	
3	Texas blueweed	A	N	0	0	37	
3	Creeping yellow cress	B	A	0	4	33	
3	Spikeweed	B	A	0	6	31	
3	Saltcedar	B	B	1	10	26	√
3	Brazilian or S American waterweed	B	B	7	12	18	
3	Yellow nutsedge	B	B	16	6	15	
3	Perennial peavine	B	C	3	2	32	
3	Watermilfoil, Eurasian	B	C	2	20	15	
3	Perennial pepperweed	B	D	9	10	18	
3	Medusahead rye	B	D	24	9	4	
5	Horsetail, Giant	B	C	14	3	20	
None	Japanese dodder	A	N				
None	Small broomrape	B	A	0	7	30	
None	Dodder	B	C	13	12	12	

RA = Reference Analysis

[1] Determined based on herbicides recommended by PNW Weed Management Handbook, internet sources or comparison of similar species. Other herbicides may be effective. Some of the herbicides may be effective only under certain conditions. It is based on individual species response to a particular treatment and without regard to infestation size, non-target species, access, slope, follow-up treatments, cost or other key factors in determining which treatment method is suitable for a particular infestation or site. Non-herbicide methods of treatment can be used to control species under the Reference Analysis when those treatments are feasible. Alternative 2 indicates that at least one of the currently available herbicides could be used to obtain some degree of control on these species. Alternatives 3, 4 or 5 indicates that of the treatments currently available none are effective. Information in this column, including identification of what species can be controlled with non-herbicide methods under the Reference Analysis, is derived from the information in Table A9-2 and the herbicides available under the different alternatives.

[2] Abundance Categories indicate number of acres statewide:

N= Not known A < 1000 B=1,000-10,000 C=10,000-100,000 D= 100,000-1,000,000 E>1,000,000

[3] Reference Analysis. Effective on small or new infestations – Manual/mechanical methods kill plants. Not feasible on larger or more established infestations.

[4] "A" designated weeds are weeds of known economic importance which occurs in the state in small enough infestations to make eradication or containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent. Infestations are subject to eradication or intensive control when and where found.

"B" Designated Weeds are those of economic importance and regionally abundant, but which may have limited distribution in some counties. Control efforts are generally limited to intensive control at the state, county or regional level as determined on a site specific, case-by-case basis. Where implementation of a fully integrated statewide management plan is not feasible, biological control (when available) is the primary control method.

"T" Designated Weeds are priority noxious weeds designated by the Oregon State Weed Board as a target for which the ODA will develop and implement a statewide management plan. "T" designated noxious weeds are species selected from either the "A" or "B" list.

Common and Scientific Plant Names

Table A7-2. Common and Scientific Plant Names of Plants Potentially Requiring Management

Common Name	Scientific Name	Duration[1]	Growth Form	Family	Vegetation Type
African rue	*Peganum harmala*	P	forb	Zygophyllaceae	Noxious Weed
Alder	*Alnus*	P	shrub, tree	Betulaceae	Native Plant
Annual fescues	*Vulpia*	A	graminoid	Poaceae	Invasive Plant
Babysbreath	*Gypsophila paniculata*	P	forb	Caryophyllaceae	Invasive Plant
Bear's breeches	*Acanthus mollis*	P	forb	Acanthaceae	Invasive Plant
Biddy-biddy	*Acaena novae-zelandica*	P	shrub	Rosaceae	Noxious Weed
Big leaf maple	*Acer macrophyllum*	P	tree	Aceraceae	Native Plant
Big sagebrush	*Artemesia tridentata*	P	shrub	Asteraceae	Native Plant
Bird cherry	*Prunus avium*	P	tree	Rosaceae	Invasive Plant
Birdfoot trefoil	*Lotus corniculatus*	P	forb	Fabaceae	Invasive Plant
Black henbane	*Hyoscyamus niger*	A, B	forb	Solanaceae	Invasive Plant
Black locust	*Robinia pseudoacacia*	P	tree	Fabaceae	Invasive Plant
Blackberry, Evergreen	*Rubus laciniatus*	P	vine	Rosaceae	Invasive Plant
Blackberry, Himalayan	*Rubus armeniacus*	P	shrub	Rosaceae	Noxious Weed
Blackberry, Himalayan	*Rubus discolor*	P	shrub	Rosaceae	Noxious Weed
Blackgrass	*Alopecurus myosuroides*	A	graminoid	Poaceae	Invasive Plant
Blackthorn	*Prunus spinosa*	P	tree	Rosaceae	Invasive Plant
Bouncing bet	*Saponaria officinalis*	P	forb	Caryophyllaceae	Invasive Plant
Brazilian or S American waterweed	*Egeria densa*	P	aquatic forb	Hydrocharitaceae	Noxious Weed
Bristly dog's-tail	*Cynosurus echinatus*	A	graminoid	Poaceae	Invasive Plant
Broom, French	*Genista monspessulana*	P	shrub	Fabaceae	Noxious Weed
Broom, Portugese	*Cytisus striatus*	P	shrub	Fabaceae	Noxious Weed
Broom, Scotch	*Cytisus scoparius*	P	shrub	Fabaceae	Noxious Weed
Broom, Spanish	*Spartium junceum*	P	shrub	Fabaceae	Noxious Weed
Buffalobur	*Solanum rostratum*	A	forb	Solanaceae	Noxious Weed
Bur buttercup	*Ceratocephala testiculata*	A	forb	Ranunculaceae	Invasive Plant
Burdock, common	*Arctium minus*	B	forb	Asteraceae	Invasive Plant
Burnweed	*Erectites minima*	A, P	forb	Asteraceae	Invasive Plant
Butterfly bush	*Buddleja davidii*	P	shrub	Buddlejaceae	Noxious Weed
Camel thorn	*Alhagi maurorum*	P	shrub	Fabaceae	Noxious Weed
Cereal rye	*Secale cereal*	A	graminoid	Poaceae	Invasive Plant
Cheatgrass	*Bromus tectorum*	A	graminoid	Poaceae	Invasive Plant
Chicory	*Cichorium intybus*	B,P	forb	Asteraceae	Invasive Plant
Climbing nightshade	*Solanum dulcamara*	P	forb	Solanaceae	Invasive Plant
Clover spp	*Trifolium*	P	forb	Fabaceae	Invasive Plant
Cocklebur, rough	*Xanthium strumarium*	A	forb	Asteraceae	Invasive Plant
Cocklebur, spiny	*Xanthium spinosum*	A	forb	Asteraceae	Noxious Weed
Coltsfoot	*Tussilago farfara*	P	forb	Asteraceae	Noxious Weed
Common bugloss	*Anchusa officinalis*	P	forb	Boraginaceae	Noxious Weed
Common cruprina	*Crupina vulgaris*	A	forb	Asteraceae	Noxious Weed
Common knotweed	*Polygonum aviculare*	A,P	forb	Polygonaceae	Invasive Plant
Common reed	*Phragmites australis*	P	Graminoid	Poaceae	Noxious Weed
Common mullein	*Verbascum thapsus*	B	forb	Scrophulariaceae	Invasive Plant

Common Name	Scientific Name	Duration[1]	Growth Form	Family	Vegetation Type
Common Pear	*Pyrus communis*	P	tree	Rosaceae	Invasive Plant
Common velvet-grass	*Holcus lanatus*	P	graminoid	Poaceae	Invasive Plant
Conifers	various	P	tree	Pinaceae	Native Plant
Cordgrass, common	*Spartina anglica*	P	graminoid	Poaceae	Noxious Weed
Cordgrass, dense flower	*Spartina densiflora*	P	graminoid	Poaceae	Noxious Weed
Cordgrass, saltmeadow	*Spartina patens*	P	graminoid	Poaceae	Noxious Weed
Cordgrass, smooth	*Spartina alternifolia*	P	graminoid	Poaceae	Noxious Weed
Creeping buttercup	*Ranunculus repens*	P	forb	Ranunculaceae	Invasive Plant
Creeping yellow cress	*Rorippa sylvestris*	P	forb	Brassicaceae	Noxious Weed
Crested dog's-tail grass	*Cynosurus cristatus*	P	graminoid	Poaceae	Invasive Plant
Dandelion	*Taraxacum officinale*	P	forb	Asteraceae	Invasive Plant
Dense silkybent	*Apera interrupta*	A	graminoid	Poaceae	Invasive Plant
Dodder	*Cuscuta* spp.	A,B,P	forb	Cuscutaceae	Noxious Weed
Dyers woad	*Isatis tinctoria*	B, P	forb	Brassicaceae	Noxious Weed
Elecampane inula	*Inula helenium*	P	forb	Asteraceae	Invasive Plant
Elodea	*Elodea*	P	aquatic forb	Hydrocharitaceae	Invasive Plant
English holly	*Ilex aquifolium*	P	tree	Aquifoliaceae	Invasive Plant
English Ivy	*Hedera helix*	P	vine	Araliaceae	Noxious Weed
European beach grass	*Ammophila arenaria*	P	graminoid	Poaceae	Invasive Plant
European centaury	*Centaurium erythraea*	A, B	forb	Gentianaceae	Invasive Plant
European Water chestnut	*Trapa natans*	P	aquatic	Trapaceae	Noxious Weed
Evergreen huckleberry	*Vaccinium ovatum*	P	shrub	Ericaceae	Native Plant
Feverfew	*Tanacetum parthenium*	P	forb	Asteraceae	Invasive Plant
Field bindweed	*Convolvulus arvensis*	P	forb	Convolvulaceae	Noxious Weed
Field mustard	*Brassica rapa*	A,B	forb	Brassicaceae	Invasive Plant
Field sowthistle	*Sonchus arvensis*	P	forb	Asteraceae	Invasive Plant
False brome	*Brachypodium sylvaticum*	P	graminoid	Poaceae	Noxious Weed
Flowering rush	*Butomus umbellatus*	P	Forb	Butomaceae	Noxious Weed
Garden cornflower or bachelor buttons	*Centaurea cyanus*	A	forb	Asteraceae	Invasive Plant
Garden vetch	*Vicia sativa ssp. nigra*	A	vine	Fabaceae	Invasive Plant
Garlic mustard	*Alliaria petiolata*	A, B	forb	Brassicaceae	Noxious Weed
Geranium, Herb Robert	*Geranium robertianum*	A, B	Forb	Geraniaceae	Noxious Weed
Gerranium, Shinyleaf	*Geranium lucidum*	A, B	Forb	Geraniaceae	Noxious Weed
Giant Hogweed	*Heracleum mantegazzianum*	P	forb	Apiaceae	Noxious Weed
Goatgrass, Barbed	*Aegilops triuncialis*	A	graminoid	Poaceae	Noxious Weed
Goatgrass, Bulbed	*Aegilops ventricosa*	A	graminoid	Poaceae	Invasive Plant
Goatgrass, Jointed	*Aegilops cylindrica*	A	graminoid	Poaceae	Noxious Weed
Goatgrass, Ovate	*Aegilops ovata*	A	graminoid	Poaceae	Noxious Weed
Goatgrass, Tausch's	*Aegilops tauschii*	A	graminoid	Poaceae	Invasive Plant
Goatsrue	*Galea officinalis*	P	forb, subshrub	Fabaceae	Noxious Weed
Gorse	*Ulex europaeus*	P	shrub	Fabaceae	Noxious Weed
Grasses		A,P	graminoid	Poaceae	Native Plant
Grasses, escaped	Various	NA	graminoid	Poaceae	Invasive Plant
Halogeton	*Halogeton glomeratus*	A	forb	Chenopodiaceae	Noxious Weed
Harding grass	*Phalaris aquatica*	P	graminoid	Poaceae	Invasive Plant
Hawkweed, common	*Hieracium lachenallii*	P	forb	Asteraceae	Invasive Plant
Hawkweed, King-devil	*Hieracium piloselloides*	P	forb	Asteraceae	Noxious Weed

Common Name	**Scientific Name**	**Duration**[1]	**Growth Form**	**Family**	**Vegetation Type**
Hawkweed, Meadow	*Hieracium caespitosum*	P	forb	Asteraceae	Noxious Weed
Hawkweed, Mouse-eared	*Hieracium pilosella*	P	forb	Asteraceae	Noxious Weed
Hawkweed, Orange	*Hieracium aurantiacum*	P	forb	Asteraceae	Noxious Weed
Hawkweed, Yellow	*Hieracium fendleri*	P	forb	Asteraceae	Invasive Plant
Hawkweed, Yellow	*Hieracium floribundum*	P	forb	Asteraceae	Noxious Weed
Hawthorn, Oneseed	*Crataegus monogyna*	P	tree	Rosaceae	Invasive Plant
Hawthorn, Smooth	*Crataegus laevigata*	P	tree, shrub	Rosaceae	Invasive Plant
Hazel	*Corylus cornuta*	P	shrub	Betulaceae	Native Plant
Herb Robert	*Geranium robertianum*	A, B	forb	Geraniaceae	Invasive Plant
Horehound	*Marrubium vulgare*	P	forb	Lamiaceae	Invasive Plant
Horsetail, Giant	*Equisetum telmateia*	P	forb	Equisetaceae	Noxious Weed
Houndstongue	*Cynoglossum officinale*	B	forb	Boraginaceae	Noxious Weed
Hydrilla	*Hydrilla verticillata*	P	aquatic forb	Hydrocharitaceae	Noxious Weed
Italian ryegrass	*Lolium perenne ssp. multiflorum*	A,P	graminoid	Poaceae	Invasive Plant
Japanese dodder	*Cascuta japonica*	A	vine	Cuscutacea	Noxious Weed
Johnsongrass	*Sorghum halepense*	P	graminoid	Poaceae	Noxious Weed
Jubata grass (Purple Pampas grass)	*Cortaderia jubata*	P	graminoid	Poaceae	Noxious Weed
Knapweed, Diffuse	*Centaurea diffusa*	A, B, P	forb	Asteraceae	Noxious Weed
Knapweed, Meadow	*Centaurea debeauxii*	P	forb	Asteraceae	Noxious Weed
Knapweed, Russian	*Acroptilon repens*	P	forb	Asteraceae	Noxious Weed
Knapweed, spotted	*Centaurea stoebe*	B, P	forb	Asteraceae	Noxious Weed
Knapweed, Squarrose	*Centaurea triumfetti*	P	forb	Asteraceae	Noxious Weed
Knotweed, Bohemian	*Polygonum bohemicum*	P	forb	Polygonaceae	Invasive Plant
Knotweed, Giant	*Polygonum sachalinense*	P	forb	Polygonaceae	Noxious Weed
Knotweed, Himalayan	*Polygonum polystachyum*	P	forb	Polygonaceae	Noxious Weed
Knotweed, Japanese	*Polygonum cuspidatum*	P	forb	Polygonaceae	Noxious Weed
Kochia	*Kochia scoparia*	A	forb	Chenopodiaceae	Noxious Weed
Kudzu	*Pueraria montana* var *lobata*	P	vine	Fabaceae	Noxious Weed
Lepyrodiclis	*Lepyrodiclis holosteoides*	A	forb	Caryophyllaceae	Invasive Plant
Lesser celadine or fig buttercup	*Ranunculus ficaria*	P	forb	Ranunculaceae	Noxious Weed
Lesser hawkbit	*Leontodon taraxacoides*	A, B, P	forb	Asteraceae	Invasive Plant
Madrone	*Arbutus menziesii*	P	tree	Ericaceae	Native Plant
Marestail	*Conyza canadensis*	A, B	forb	Asteraceae	Invasive Plant
Matgrass	*Nardus stricta*	P	graminoid	Poaceae	Noxious Weed
Mediterranean sage	*Salvia aethiopis*	B	forb	Lamiaceae	Noxious Weed
Medusahead rye	*Taeniatherum caput-medusae*	A	graminoid	Poaceae	Noxious Weed
Mutiflora rose	*Rosa multiflora*	P	shrub	Rosaceae	Invasive Plant
Narrowleaf plantain	*Plantago lanceolata*	A,B,P	forb	Plantaginaceae	Invasive Plant
North Africa grass	*Ventenata dubia*	A	graminoid	Poaceae	Invasive Plant
Oblong spurge	*Euphorbia oblongata*	P	forb	Euphorbiaceae	Noxious Weed
Ocean spray	*Holodiscus discolor*	P	shrub	Rosaceae	Native Plant
Old man's beard	*Clematis vitalba*	P	vine	Ranunculaceae	Noxious Weed
Orchardgrass	*Dactylis glomerata*	P	graminoid	Poaceae	Invasive Plant
Oxeye daisy	*Leucanthemum vulgare*	P	forb	Asteraceae	Invasive Plant

Common Name	Scientific Name	Duration[1]	Growth Form	Family	Vegetation Type
Pacific Rhododendron	*Rhododendron macrophyllum*	P	shrub	Ericaceae	Native Plant
Pampas grass	*Cortaderia selloana*	P	graminoid	Poaceae	Invasive Plant
Parrot's feather	*Myriophyllum aquaticum*	P	aquatic forb	Haloragaceae	Noxious Weed
Paterson's curse	*Echium vulgare*	A, B, P	forb	Boraginaceae	Invasive Plant
Paterson's curse	*Echium plantagineum*	A,B	forb	Boraginaceae	Noxious Weed
Pennyroyal	*Mentha pulegium*	P	forb	Lamiaceae	Invasive Plant
Perennial peavine	*Lathyrus latifolius*	P	forb	Fabaceae	Noxious Weed
Perennial pepperweed	*Lepidium latifolium*	P	forb	Brassicaceae	Noxious Weed
Perennial ryegrass	*Lolium perenne* ssp. *perenne*	P	graminoid	Poaceae	Invasive Plant
Periwinkle	*Vinca major*	P	vine,forb	Apocynaceae	Invasive Plant
Poison hemlock	*Conium maculatum*	B	forb	Apiaceae	Noxious Weed
Poison ivy	*Toxicodendron rhydbergii*	P	shrub	Anacardiaceae	Native Plant
Poison Oak	*Toxicodendron diveralobum*	P	shrub, vine	Anacardiaceae	Native Plant
Policemans helmet	*Impatiens glandulifera*	A	forb	Balsaminaceae	Noxious Weed
Poverty brome	*Bromus sterilis*	A	graminoid	Poaceae	Invasive Plant
Prickly lettuce	*Lactuca serriola*	A,B	forb	Asteraceae	Invasive Plant
Prickly sowthistle	*Sonchus asper*	A	forb	Asteraceae	Invasive Plant
Puncturevine	*Tribulus terrestris*	A	forb	Zygophyllaceae	Noxious Weed
Purple foxglove	*Digitalis purpurea*	B	forb	Scrophulariaceae	Invasive Plant
Purple loosestrife	*Lythrum salicaria*	P	forb	Lythraceae	Noxious Weed
Purple Nutsedge	*Cyperus rotundus*	P	graminoid	Cyperaceae	Noxious Weed
Quackgrass	*Elymus repens*	P	graminoid	Poaceae	Noxious Weed
Rabbitbrush	*Ericameria* spp	P	shrub	Asteraceae	Native Plant
Ragweed	*Ambrosia artemisiifolia*	A	forb	Asteraceae	Noxious Weed
Red brome	*Bromus rubens*	A	graminoid	Poaceae	Invasive Plant
Reed canarygrass	*Phalaris arundinacea*	P	graminoid	Poaceae	Invasive Plant
Ripgut brome	*Bromus rigidus*	A,P	graminoid	Poaceae	Invasive Plant
Rush skeletonweed	*Chondrilla juncea*	P	forb	Asteraceae	Noxious Weed
Russian olive	*Elaeagnus angustifolia*	P	tree	Elaeagnaceae	Invasive Plant
Salmonberry	*Rubus spectablis*	P	shrub	Rosaceae	Native Plant
Saltcedar (tamarisk)	*Tamarix ramosissima*	P	tree	Tamaricaceae	Noxious Weed
Shining geranium	*Geranium lucidum*	A,B	forb	Geraniaceae	Invasive Plant
Silverleaf Nightshade	*Solanum elaegnifolium*	P	forb	Solanaceae	Noxious Weed
Skeletonleaf bursage	*Ambrosia tomentosa*	P	forb	Asteraceae	Noxious Weed
Slender oat	*Avena barbata*	A	graminoid	Poaceae	Invasive Plant
Small broomrape	*Orobanche minor*	A	forb	Orobanchaceae	Noxious Weed
Smalleaf periwinkle	*Vinca minor*	P	vine,forb	Apocynaceae	Invasive Plant
Soft brome	*Bromus hordeaceus* ssp. *hordeaceus*	A	graminoid	Poaceae	Invasive Plant
Spanish heath	*Erica lusitanica*	P	Shrub	Ericaceae	Noxious Weed
Spikeweed	*Hemizonia pungens*	A	forb	Asteraceae	Noxious Weed
Spotted Cat's ear	*Hypocheris radicata*	P	forb	Asteraceae	Invasive Plant
Spotted henbit	*Lamium maculatum*	P	forb	Lamiaceae	Invasive Plant
Spreading hedge-parsley	*Torilis arvensis*	A	forb	Apiaceae	Invasive Plant
Spurge laurel	*Daphne laureola*	P	shrub	Thymelaeaceae	Noxious Weed
Spurge, Leafy	*Euphorbia esula*	P	forb	Euphorbiaceae	Noxious Weed
Spurge, Myrtle	*Euphorbia myrsinites*	P	forb	Euphorbiaceae	Noxious Weed

Common Name	Scientific Name	Duration[1]	Growth Form	Family	Vegetation Type
St. Johnswort	*Hypericum perforatum*	P	forb	Hypericaceae	Noxious Weed
Starthistle, Iberian	*Centaurea iberica*	P	forb	Asteraceae	Noxious Weed
Starthistle, Malta	*Centaurea melitensis*	A, B	forb	Asteraceae	Invasive Plant
Starthistle, Purple	*Centaurea calcitrapa*	A, B, P	forb	Asteraceae	Noxious Weed
Starthistle, Yellow	*Centaurea solstitialis*	A, B	forb	Asteraceae	Noxious Weed
Sulfur cinquefoil	*Potentilla recta*	P	forb	Ranunculaceae	Noxious Weed
Swainsonpea	*Sphaerophysa salsula*	P	forb	Fabaceae	Noxious Weed
Sweet fennel	*Foeniculum vulgare*	B,P	forb	Apiaceae	Invasive Plant
Sweetclover, white	*Melilotus alba*	A, B, P	forb	Fabaceae	Invasive Plant
Sweetclover, yellow	*Melilotus oficinalis*	A, B, P	forb	Fabaceae	Invasive Plant
Syrian bean-caper	*Zygophyllum fabago*	P	forb	Zygophyllaceae	Noxious Weed
Tall fescue	*Schedonorus phoenix*	P	graminoid	Poaceae	Invasive Plant
Tanoak	*Lithocarpos densiflora*	P	tree	Fagaceae	Native Plant
Tansy ragwort	*Senecio jacobaea*	B, P	forb	Asteraceae	Noxious Weed
Tansy, Common	*Tanacetum vulgare*	P	forb	Asteraceae	Invasive Plant
Teasel, common	*Dipsacus fullonum*	B	forb	Dipsacaceae	Invasive Plant
Teasel, cutleaf	*Dipsacus laciniatus*	B	forb	Dipsacaceae	Noxious Weed
Texas blueweed	*Helianthus ciliaris*	P	forb	Asteraceae	Noxious Weed
Thimble berry	*Rubus parviflorus*	P	shrub	Rosaceae	Native Plant
Thistle, Bull	*Cirsium vulgare*	B, P	forb	Asteraceae	Noxious Weed
Thistle, Canada	*Cirsium arvense*	P	forb	Asteraceae	Noxious Weed
Thistle, Italian	*Carduus pycnocephalus*	A, B	forb	Asteraceae	Noxious Weed
Thistle, Milk	*Silybum marianum*	A, B	forb	Asteraceae	Noxious Weed
Thistle, Musk	*Carduus nutans*	B, P	forb	Asteraceae	Noxious Weed
Thistle, Plumeless	*Carduus acanthoides*	B	forb	Asteraceae	Noxious Weed
Thistle, Russian	*Salsola kali*	A	forb	Chenopodiaceae	Invasive Plant
Thistle, Scotch	*Onopordum acanthium*	B	forb	Asteraceae	Noxious Weed
Thistle, Slender flowered	*Carduus tenuiflorus*	P, A	forb	Asteraceae	Noxious Weed
Thistle, Smooth distaff	*Carthamus baeticus*	A	forb	Asteraceae	Noxious Weed
Thistle, Taurian or bull cottonthistle	*Onopordum tauricum*	B	forb	Asteraceae	Noxious Weed
Thistle, wavyleaf	*Cirsium undulatum*	B,P	forb	Asteraceae	Invasive Plant
Thistle, Whitestem distaff	*Carthamus leucocaulos*	A	forb	Asteraceae	Invasive Plant
Thistle, Wooly distaff	*Carthamus lanatus*	A	forb	Asteraceae	Noxious Weed
Toadflax, Dalmation	*Linaria dalmatica*	P	forb	Scrophulariaceae	Noxious Weed
Toadflax, Yellow	*Linaria vulgaris*	P	forb	Scrophulariaceae	Noxious Weed
Tree-of-heaven	*Ailanthus altissima*	P	tree	Simaroubaceae	Invasive Plant
Tumbleweed or Prickly Russian thistle	*Salsola tragus*	A	forb	Chenopodiaceae	Invasive Plant
Velvetleaf	*Abutilon theophrasti*	A	forb	Malvaceae	Noxious Weed
Vine maple	*Acer circinatum*	P	shrub	Aceraceae	Native Plant
Watermilfoil, Eurasian	*Myriophyllum spicatum*	P	aquatic forb	Haloragaceae	Noxious Weed
Western juniper	*Juniperus occidentalis*	P	tree	Cupressaceae	Native Plant
Western water hemlock	*Cicuta douglasii*	P	forb	Apiaceae	Native Plant
White Bryonia	*Byonia alba*	P	vine	Cucurbitaceae	Noxious Weed
Whitetop, (Hoary cress)	*Cardaria draba*	P	forb	Brassicaceae	Noxious Weed
Whitetop, Lens-podded	*Cardaria chalapensis*	P	shrub	Brassicaceae	Noxious Weed
Whitetop,Hairy	*Cardaria pubescens*	P	forb	Brassicaceae	Noxious Weed

Common Name	Scientific Name	Duration[1]	Growth Form	Family	Vegetation Type
Wild carrot	*Daucus carota*	B	forb	Apiaceae	Invasive Plant
Wild oat	*Avena fatua*	A	graminoid	Poaceae	Invasive Plant
Wild proso millet	*Panicum miliaceum*	A	graminoid	Poaceae	Invasive Plant
Wild safflower	*Carthamus oxyacantha*	A	forb	Asteraceae	Invasive Plant
Willow	*Salix*	P	shrub, tree	Salicaceae	Native Plant
Yellow Flag Iris	*Iris pseudacorus*	P	forb	Iridaceae	Noxious Weed
Yellow floating heart	*Nymphoides peltata*	P	aquatic forb	Menyanthaceae	Noxious Weed
Yellow glandweed	*Parentucellia viscosa*	A	forb	Scrophulariaceae	Invasive Plant
Yellow nutsedge	*Cyperus esculentus*	P	graminoid	Cyperaceae	Noxious Weed
Yellowtuft	*Alyssum murale*	A	Forb	Brassicaceae	Noxious Weed
Yellowtuft	*Alyssum corsicum*	A	Forb	Brassicaceae	Noxious Weed

[1] A = Annual B = Biennial P = Perennial

Noxious Weed Spread Rate References and Calculations

Source of Current Noxious Weed Spread Rate Estimate of 12 Percent.

The *Noxious Weed and Other Invasive Plants* section in Chapter 4 notes that the current 1.2 million acres of noxious weeds on BLM lands in Oregon is spreading at an estimated rate of 12 percent annually, or currently 144,000 acres per year. This estimate has been made after examining the following sources:

- The PEIS notes "a recent estimate of weed spread on all western federal lands is 10% to 15% annually (Asher and Dewey 2005 as cited in PEIS:3-27). Asher has indicated this estimate does not include cheatgrass (*Bromus tectorum*), and was made primarily by doing an acreage-weighted average of the common noxious weeds for which species-specific spread rates had been published (Asher, J. pers. comm.).[1]
- The 1998 BLM's *National Strategy for Invasive Plant Management, Pulling Together,* says "experts estimate that invasive plants already infest well over 100 million acres and continue to increase by 8 to 20 percent annually" (USDI 1998).
- The 1999 Forest Service *Stemming the Invasive Tide: Forest Service Strategy for Noxious and Nonnative Invasive Plant Management* reports "on Federal lands in the Western United States, it is estimated that weeds occur on more than 17 million acres" (USDA 1999). Asher has calculated a 2,300 acres per day spread rate for BLM lands, and separately calculated a 2,300 acre per day spread rate for all other federal lands (Asher, J. pers. comm. and variously published). Applying the 4,600-acre per day sum of these estimates to the 17 million acres reported infested (above) results in an annual spread rate of 10.0 percent. However, the 17 million may include cheatgrass, which is not in J. Asher's rate of spread estimate. If so, the actual percentage would be higher than 10.0 percent.

1 For example, the *Spartina alterniflora* infestation in Willapa Bay grew from 300 acres to 8,500 acres in the 19 years from 1984 to 2003 (19.5 percent) (see WA DNR 2008). Duncan and Clark (2005) report 950,000 acres of yellow starthistle in Oregon with a spread rate of 17 percent; perennial pepperweed spread at an average annual rate of 11 percent in Utah and 18 percent in Montana; dalmation toadflax has spread from introduction in 1908 to 32 states in 2002 at an annual rate of 11 percent; cheatgrass 14 percent; musk thistle 12-22 percent, diffuse knapweed 8-14 percent; and so forth.

- There are 1.2 million acres of noxious weeds on BLM lands in Oregon (combined district estimates 2007). An average compounded rate of spread necessary to reach 1.2 million acres is calculable if a starting date is known or assumed. It is known "weed invasions began a few centuries ago but primarily in the mid-1800s when weeds began arriving from other countries…." (Asher and Spurrier 1998), and even in the 1800s "about one hundred exotics per decade were establishing in the five northwest states" (Rice 1999). If we assume spread didn't become significant until 20 years after the 1849 gold rush, a 140 year compounded average spread rate of 8.7 percent would account for today's 1.2 million acres.
- The Forest Service Region 6 (Oregon and Washington) 2005 Invasive Plant EIS notes "Invasive plant populations increase in acreage at an estimated rate of 8-12 percent per year on Forest Service System land [nationwide] (USDA 1999[b])" cited in USDA 2005:3-2. "Using this range, if one estimates spread at 10 percent per year…." (USDA 2005).
- "From, 1985 to 1996, invasive plants quadrupled to 17 million acres on western federal lands (Asher 1998, Westbrooks 1998)" as cited in USDA 2005:3-2. To quadruple in 11 years requires a compound rate of 15.75 percent per year.

The Forest Service and even the BLM west of the Cascades probably has a lower spread rate than the BLM in Oregon as a whole (in the area of 10 percent). The primary agent of noxious weed spread is disturbance, and that is likely more prevalent on the open flat BLM lands east of the Cascades. Additionally, the generally higher, steeper, more vegetated landscape on the National Forests would be outside of the ecological amplitude of many Mediterranean species invading BLM lands; access to OHVs is more restricted both legally and geographically; and certain windborne species don't travel well on steeper more vegetated areas. Using the high end of the Forest Service's 8-12 percent range, and taking the other figures at face value, a reasonable estimate of the current annual spread rate of noxious weeds on BLM lands in Oregon is 12 percent. Because Oregon has been controlling noxious weeds aggressively under the same direction since 1987, this rate is assumed to correspond, or in part be the product of, the current direction or No Action Alternative 2. The acres that would result from an annual increase of noxious weed acres (from the current 1.2 million) at a 12 percent rate for the next 15 years is shown on the right-most column on Tables A7-4, 5, and 6 below.

The BLM Western Oregon Plan Revision (WOPR) FEIS (USDI 2008) identifies 61 noxious weeds and an additional 69 invasive plants in the WOPR planning area (p. 3-274), and predicts the increase in timber harvest activities under all of the action alternatives would increase the risk of spreading invasive plants (p. 4-628). The increased risk is not quantified using the same parameters as discussed here, so a direct comparison is not possible, but it does not appear that the described increase would equal a whole percentage point.

Scoping for the Vegetation Treatments EIS revealed a concern that roadside hazard tree and other salvage tree removal can result in a soil-disturbing piece of equipment traversing several miles of forest roads per day and potentially spreading any encountered noxious weeds over that larger area. This possibility is a part of the increased risk noted above. To some degree, such a risk should be mitigated by the BLM's policy of requiring the development of a Noxious Weed Risk Assessment that identifies actions to be taken and monitoring to be done whenever analysis of proposed ground disturbing activities determines the activity will have a moderate or high risk of spreading noxious weeds (BLM Manual 9015; USDI 1992).

Effective Treatments by Alternative

The treatment efficiency percentages and effectively treated acres by alternative shown on Table A7-3 below are from Table 4-3 and associated discussion in the *Noxious Weeds and Other Invasive Plants* section of Chapter 4. Gross treatment acres are from FEIS Table 3-3. This information is relevant to the calculations of weed spread rate in the following sections.

Table A7-3. Annual Acres of Effective Noxious Weed Control by Alternative

Alternative	Gross Treatment Acres	Efficiency Percentage	Tent. Effectively Treated Acres	25% ROW Treat Benefit	Total Effectively Treated Acres
Reference Analysis	42,100	.30	12,630	n/a	12,630
2	45,500	.60	27,300	n/a	27,300
3	57,700	.80	46,160	n/a	46,160
4	57,700	.80	46,160	2,350	48,510
5	57,700	.80	46,169	2,350	48,510

Alternative 3 Spread Rate

The increase in effective treatments under Alternative 3 when compared to No Action Alternative 2 is 18,860 acres (from Table A7-3). The reduction in the current 144,000 acre annual increase in noxious weeds the first year would be no more than this 18,860 acres. However, because treatments are targeted at populations in the introduction phase of the infestation, these treatments would prevent 10 times those acres (188,600 acres) over the next 15 year time period. For example, 100 acres of effective control treatments in 1980 are assumed to reduce noxious plants by 1000 acres by 1995. Because that gain comes from controlling acres early in the Invasion Lag Curve (Figure 4-2), the 188,600 acres of weeds prevented is spread along the same curve in the following percentages per year: 10, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 10, 10, 10, 10 = 100%. Only 10 percent of the gain is achieved the first year, another 5 percent the next year, and so forth until the entire gain is achieved by the 15th year. Another 18,860 acres is treated the next year, and the gains are additive. Thus in year two, the reduction in infested acres is the 18,860 acres treated that year, and the 9,430 acres credit from the previous year's treatment. In decade 3, it's 18,860+9,430+9,430=37,7200, and so forth. These gains continue to add up, until after 15 years, the 18,860 acres annual treatment are decreasing weed infestation acres by 188,600 acres per year. At that point, there are 1.86 million fewer acres infested than under Alternative 2, and the annual spread rate is slowed to 7 percent (Table A7-4).

Table A7-4. Weed Spread of 12% Reduced by 10 Times 18,860 Acres of Effective Annual Control (Difference Between Alts 2 and 3), Distributed Over 15 Decades at 10, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 10, 10, 10 and 10% ea Decade

Alternative 3							Alternative 2
Year	Begin Acreage	12 % Growth		Effective Control	End Acreage	% increase from prev.	12% annual increase
1	1,200,000	1.12	1,344,000	18,860	1,325,140		1,200,000
2	1,325,140	1.12	1,484,157	28,290	1,455,867	9.87%	1,344,000
3	1,455,867	1.12	1,630,571	37,720	1,592,851	9.41%	1,505,280
4	1,592,851	1.12	1,783,993	47,150	1,736,843	9.04%	1,685,913
5	1,736,843	1.12	1,945,264	56,580	1,888,684	8.74%	1,888,223
6	1,888,684	1.12	2,115,326	66,010	2,049,316	8.50%	2,114,810
7	2,049,316	1.12	2,295,234	75,440	2,219,794	8.32%	2,368,587
8	2,219,794	1.12	2,486,169	84,870	2,401,299	8.18%	2,652,818
9	2,401,299	1.12	2,689,455	94,300	2,595,155	8.07%	2,971,156
10	2,595,155	1.12	2,906,574	103,730	2,802,844	8.00%	3,327,694
11	2,802,844	1.12	3,139,185	113,160	3,026,025	7.96%	3,728,018
12	3,026,025	1.12	3,389,148	132,020	3,257,128	7.64%	4,174,260
13	3,257,128	1.12	3,647,984	150,880	3,497,104	7.37%	4,675,171
14	3,497,104	1.12	3,916,756	169,740	3,747,016	7.15%	5,236,192
15	3,747,016	1.12	4,196,658	188,600	4,008,058	6.97%	5,864,535

Reference Analysis Spread Rate

The decrease in effective treatments under the Reference Analysis when compared to No Action Alternative 2 is 14,670 acres. Implementation of the Reference Analysis would, it is predicted, increase the current 144,000 acre annual by 14,670 acres. This reduction in effective treatment acres is shown as a negative number under effective control (Table A7-5). The weed spread rate under the Reference Analysis increases to 14 percent immediately and stays there through the 15-year period. An additional 2.7 million acres would become infested when compared to Alternative 2.

Table A7-5. Weed Spread of 12% Increased by 10 Times the 14,670 Acres Less Effective Annual Control (Difference Between Alt 2 and the Reference Analysis, Shown as a Negative Number), Distributed over 15 Decades at 10, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 10, 10, 10 and 10% ea Decade

Reference Analysis							**Alternative 2**
Year	Begin Acreage	12 % Growth		Effective Control	End Acreage	% increase from prev.	12% annual increase
1	1,200,000	1.12	1,344,000	-14,670	1,358,670		1,200,000
2	1,358,670	1.12	1,521,710	-22,005	1,543,715	13.62%	1,344,000
3	1,543,715	1.12	1,728,961	-29,340	1,758,301	13.90%	1,505,280
4	1,758,301	1.12	1,969,297	-36,675	2,005,972	14.09%	1,685,913
5	2,005,972	1.12	2,246,689	-44,010	2,290,699	14.19%	1,888,223
6	2,290,699	1.12	2,565,583	-51,345	2,616,928	14.24%	2,114,810
7	2,616,928	1.12	2,930,959	-58,680	2,989,639	14.24%	2,368,587
8	2,989,639	1.12	3,348,396	-66,015	3,414,411	14.21%	2,652,818
9	3,414,411	1.12	3,824,140	-73,350	3,897,490	14.15%	2,971,156
10	3,897,490	1.12	4,365,189	-80,685	4,445,874	14.07%	3,327,694
11	4,445,874	1.12	4,979,379	-88,020	5,067,399	13.98%	3,728,018
12	5,067,399	1.12	5,675,487	-102,690	5,778,177	14.03%	4,174,260
13	5,778,177	1.12	6,471,558	-117,360	6,588,918	14.03%	4,675,171
14	6,588,918	1.12	7,379,588	-132,030	7,511,618	14.00%	5,236,192
15	7,511,618	1.12	8,413,013	-146,700	8,559,713	**13.95%**	5,864,535

Alternatives 4 and 5 Spread Rate

The increase in effective treatments under Alternative 4 when compared to No Action Alternative 2 is 21,210 acres. Applying the calculations and assumptions described above, the rate of noxious weed spread by year 15 is reduced to 6 percent (compared to 7 percent in Alternative 3 and 2.2 million fewer acres are infested (Table A7-6).

Table A7-6. Weed Spread of 12% Reduced by 10 Times 21,210 Acres of Effective Annual Control (Difference Between Alts 2 and 4), Distributed Over 15 Decades at 10, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 10, 10, 10 and 10% ea Decade

Alternatives 4 and 5							**Alternative 2**
Year	Begin Acreage	12 % Growth		Effective Control	End Acreage	% increase from prev.	12% annual increase
1	1,200,000	1.12	1,344,000	21,210	1,322,790		1,200,000
2	1,322,790	1.12	1,481,525	31,815	1,449,710	9.59%	1,344,000
3	1,449,710	1.12	1,623,675	42,420	1,581,255	9.07%	1,505,280
4	1,581,255	1.12	1,771,006	53,025	1,717,981	8.65%	1,685,913
5	1,717,981	1.12	1,924,138	63,630	1,860,508	8.30%	1,888,223
6	1,860,508	1.12	2,083,769	74,235	2,009,534	8.01%	2,114,810
7	2,009,534	1.12	2,250,678	84,840	2,165,838	7.78%	2,368,587
8	2,165,838	1.12	2,425,739	95,445	2,330,294	7.59%	2,652,818
9	2,330,294	1.12	2,609,929	106,050	2,503,879	7.45%	2,971,156
10	2,503,879	1.12	2,804,345	116,655	2,687,690	7.34%	3,327,694
11	2,687,690	1.12	3,010,212	127,260	2,882,952	7.27%	3,728,018
12	2,882,952	1.12	3,228,907	148,470	3,080,437	6.85%	4,174,260
13	3,080,437	1.12	3,450,089	169,680	3,280,409	6.49%	4,675,171
14	3,280,409	1.12	3,674,058	190,890	3,483,168	6.18%	5,236,192
15	3,483,168	1.12	3,901,148	212,100	3,689,048	**5.91%**	5,864,535

Additional Information about the Ecological Damage Caused by Invasive Plants

Invasive plants are non-native plants likely to cause economic or environmental harm or harm to human health (Executive Order 13112). They typically have biological traits that allow them to colonize new areas and successfully compete with native plants, and they are away from natural enemies or competitors that may have restricted growth in their native lands. Biological traits making them successful typically include one or more of the following characteristics: deep tap root systems and very little surface foliage, allowing them to grow later in the summer than most native rangeland plants; earlier growth and reproduction than most natives; long-lived seeds; adaptations for spreading long and short distances; production of many seeds from on plant; long lifespan; ability to delay flowering; ability to reproduce vegetatively; tolerance for a wide range of physical conditions; rapid growth; self pollination; ability to compete intensively for nutrients; thorns, poisons, or lack of palatability that keep them from being browsed; and production of toxic compounds that negatively affect neighboring plants (PEIS:3-26).

Many invasive plants also have characteristics that cause long-term physical damage to soils. The limited foliage and non-fibrous root do little to protect soil from rain-splash and overland flow; annual grasses cure early resulting in frequent high-intensity wildfires damaging soils and exposing them to wind and rain; they change nutrient recycling permitting important nutrients to be lost from the site; and many poison soils with their roots or shed leaves. Invasive plants impact water quality by increasing erosion, changing nutrient cycling, decreasing stream flows, making streams less habitable by fish and reducing water available for people. Invasive plants can also change the seral progression of a site to the extent that forestland loses the ability to produce trees. Invasive plants create monocultures and otherwise displace native plant communities. As native plants are displaced, animals that depend on them lose forage, nesting sites, hiding cover and other essentials necessary for their survival. Invasive plants create fire safety issues as highly flammable cheatgrass encroaches on the wildland-urban interface. The coastal town of Bandon was destroyed and 11 citizens killed in 1936 by a fire propagated by gorse, a highly flammable invasive plant (Simberloff 1996).

Invasive plants change ecosystems. Invasive plants compete with native plants for resources, thereby becoming dominant. More importantly they can outcompete plants that are food supplies for animals in the ecosystem. This may result in animals depending on nonnative plants for food or, if they are specialists, losing their food source entirely. Invasive plants normally lack predators and may more easily outcompete natives with their natural predators. Invasive plants are a problem because they alter the invaded ecosystem and species composition (Woods 1997) to such an extent that they threaten native flora and fauna. Invasive species capitalize on many techniques in order to invade ecosystems. There are three ways that biological invasions alter ecosystems according to D'Antonio and Vitousek (1992).

Invasive exotic plants alter rates of resource supply, trophic level relationships, and the disturbance regime. A highly disturbed ecosystem is susceptible to invasion (Hobbs and Huenneke 1992).

Selected citations from 2005 Region 6 Forest Service Invasive Plant EIS (USDA 2005:3-1 to 3-68)

- Spotted knapweed is an aggressive competitor and produces an allelopathic compound (pg.3-8).
- Yellow starthistle forms solid stands that dramatically reduce forage for livestock and wildlife. This species causes a fatal neurological disorder when ingested by horses called chewing disease (pg. 3-9).
- Soil erosion more than doubled in knapweed dominated areas compared to uninfested areas (pg 3-28).
- Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles and mammals (pg 3-49)

- Known effects of invasive plants to wildlife: embedded seeds leading to injury or death, scratches leading to infection, ingestion of plant parts leading to poisoning, cascading effect of direct or indirect mortality on other species (pg 3-49).

Trammel and Butler (1995) found that deer, elk, and bison avoided sites infested with leafy spurge. Tamarisk stands have fewer and less diverse populations of mammals, reptiles, and amphibians (Jakle and Gatz 1985, Olson 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles, and mammals (Kiviat 1996, Lor 1999, Rawinski 1982, Thompson et al. 1987, Weihe and Neely 1997, Weiher et al. 1996)

The rapid growth of many invasive plants allows them to out-compete native vegetation. This competitive advantage results in the loss of functional riparian communities, loss of rooting strength and protection against erosion, decreasing slope stability and increasing sediment introduction to streams, and impacts on water quality (Donaldson 1997).

Some invasive plants (such as knapweed) contain chemical compounds that make the plant unpalabtable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen, or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999).

Native plants with cultural significance, such as camas and bitterroot, are declining in number across the western landscape. This decrease is of great concern to many tribes, as traditional gathering areas have experienced a decline in productivity due to anthropogenic influences of the past century and the proliferation of invasive plant species - especially spotted knapweed and sulfur cinquefoil (Bonnicksen et al. 1998).

Numerous studies demonstrate reduced numbers and/or diversity in birds, reptiles, small mammals, and insects in stands of non-native plant species (Huenneke 1996). For example, kangaroo rat and ground squirrel populations were severely reduced or totally eliminated on sites infested with Russian knapweed in a study in Wyoming (Johnson et al. 1994).

Studies in Montana show that spotted knapweed invasions reduced available winter forage for elk between fifty and ninety percent (Duncan 1997).

Research shows that the total number of insects, total insect biomass and taxonomic richness of invertebrates associated with giant reed are significantly lower than that associated with native vegetation (Herrera 1997).

Giant reed uses about three times as much water as the native plants, introduces an unnatural fire cycle into the ecosystem, and it easily replaces entire plant communities (Iverson 1993, Reiger and Kreager 1989).

Knapweeds are the best regional (Pacific Northwest) symptom of desertification, the loss of the productive potential of the land (Roche 1988).

The severe level of deterioration in four desertification classes is described in part as follows: "Undesirable forbs and shrubs have replaced desirable grasses or have spread to such an extent that they dominate the flora" (Dregne 1977).

Aggressive foreign plants spread quickly into natural areas, monopolize resources, and push out native flora and fauna - including endangered species (Cheater 1992).

The simplest effect of some invasions is the displacement of native plant species, by simple crowding, by competition for resources, or by other mechanisms. Many invasive plants form broad-leaved rosettes or in some other way shade out neighbors (Huenneke 1996).

The impact of purple loosestrife on native vegetation has been disastrous, with more than 50 percent of the biomass of some wetland communities displaced. Monospecific blocks of this weed have maintained themselves for at least twenty years (Thompson et al. 1987).

In the absence of predators, immune systems or other biological control mechanisms adapted to counteract these species, populations of some exotics have exploded (Monnig 1992).

Infections in the eyes, mouth, and throat commonly occur in cattle and sheep feeding where medusahead is present (Bovey 1961, Hilken 1980).

Annual economic impacts of leafy spurge infestations on grazing and wildlands in Montana, North Dakota, South Dakota, and Wyoming are approximately $129,000,000 (Leitch 1994).

The reduction in wildlife-associated recreation expenditures due to current leafy spurge infestations on wildlands in North Dakota is estimated to be $2,900,000 (Wallace et al. 1992).

In Montana, knapweed infestations result in an estimated direct annual impact of $14,000,000 with total secondary impacts of about $42,000,000 per year which could support over 500 jobs in the state's economy (Hirsch and Leitch 1997).

Scotch broom has been identified as the noxious weeds causing the highest productivity losses of any of Oregon's noxious weeds, at $47 million annually (Radke and Davis 2000:19-20).

Many studies and repeated landowner experiences show that weeds commonly reduce livestock carrying capacity from thirty-five percent to ninety percent (Hilken 1980, Bucher 1984).

Runoff and sediment yield were fifty-six percent and 192 percent higher, respectively, for spotted knapweed than for bunch grass vegetation types (Lacey et al. 1989).

Salt cedar, a deep rooted shrub or small tree, uses an excessive amount of water. A mature salt cedar consumes as much as 800 liters of water per day -- 10 to 20 times the amount used by native species it tends to replace (Cooperrider 1995).

Tamarisk (also known as salt cedar) has been able to out compete willow and other riparian plants in many locations, greatly diminishing the quantity and quality of riparian habitat for migrant songbirds and vegetation dependent birds, like the endangered Yuma clapper rail at the Salton Sea and elsewhere (Dudley 1995).

Tamarisk dominated riparian areas have depauperate faunas, even in the native range of tamarisk (Lovich 1996).

A study by DeLoach (1991) in the Lower Colorado Valley showed that for the entire year, salt cedar had only fifty-nine percent of the mean density of birds as the cottonwood-willow, screwbean and western honey mesquite communities. During the winter, saltcedar had only thirty-nine percent of the density of birds as other vegetative communities. The leaf litter of salt cedar increases soil salinity so that large areas are unfit for native vegetation and the wildlife that depend on that vegetation.

Spotted knapweed has been found to reduce grass production from 60-90 percent (Harris and Cranston 1979, Bedunah and Carpenter 1989, Wright and Kelsey 1997) decreasing carrying capacity for livestock and lowering the quality of winter range habitat for wildlife (Rice et.al. 1997).

Spotted knapweed produces a chemical, called catechin, that causes native vegetation to die (Kahn 2003).

In some parts of Theodore Roosevelt National Park, leafy spruge diminished bison forage by 83 percent and deer and elk forage by 70 percent (Stalling 1998).

Each wildlife species has specific habitat requirements for feeding and cover – which are different for different animals. Therefore, instead of monocultures of weeds (or plant communities being pushed toward monocultures by weeds) the native vegetation must be diverse to support the full wildlife community (Asher 2000).

Lesser yellow legs and other shorebirds use shallow water areas in wetlands. They prefer habitats that are open, with low-profile vegetation and low plant cover, like flooded mud flats. Such areas are quickly invaded by reed canarygrass, which makes them unsuitable habitat for shorebirds. Foraging habitat for the 25 species of shorebirds, that use the Turnbull National Wildlife Refuge, in Washington, when migrating, has been substantially reduced by the weed (Rule 2004).

Shallow, flooded, seasonal wetlands are important habitat for the migration, pairing and brood rearing of many of the duck species, especially mallards, cinnamon and blue-winged teal, and green-winged teal, on the Turnbull Wildlife Refuge. Once invaded by reed canarygrass these areas have less diverse and less abundant food resources. The dense thatch layer that develops also restricts access to these food resources (Rule 2004).

Aspen-dominated riparian communities on the Turnbull Wildlife Refuge refuge are the most important Habitat for 65 species of land birds. Reed canarygrass invades the understory of many of these stands. This reduces structural and floral diversity by impeding the growth of native understory shrubs and forbs. It also impedes the regeneration of aspen. The result is a significant decline in habitat diversity, which may lead to as much as a 50-percent decrease in bird species diversity (Rule 2004).

The impact of purple loosestrife on native vegetation has been disastrous, with more than 50 percent of the biomass of some wetland communities displaced. Monospecific blocks of this weed have maintained themselves for at least twenty years (Thompson et al. 1987).

In its native habitat, purple loosestrife only comprises one to four percent of the native vegetation, but in North America densities of up to 80,000 stalks per acre have been recorded (Strefer 1996).

Purple loosestrife out competes native plant species and reduces biodiversity (Nyvall 1995).

Endangered, threatened, and rare birds completely avoided invasive Phragmites while utilizing neighboring short grass wetlands (Benoit and Askins 1997).

One study showed that when chukar partridge were given free access to all the medusahead caryopses (seed) they would eat, along with other dietary requirements, they suffered dramatic losses in body weight (Savage et al. 1969).

Research concerning chukar partridge habitat use and availability in the severely infested lower Salmon River Canyon of Idaho, revealed that chukars selected against (avoided) habitats with higher yellow starthistle ground cover (Lindbloom 1998).

The impact of (weed) invasions can be permanent when economic and environmental factors limit the ability of a managing agency to restore the ecosystem to a healthy state (NAS 2002)

Loss of wildlife habitat function would be irretrievable (PEIS:2-32).

In one research area in Colorado, dalmation toadflax recently increased 1,200 percent over a six year period (Beck 2009)

Weeds are spreading rapidly, and in some cases exponentially, in every cluster and sixty-six percent of the BLM/FS lands are susceptible to knapweeds and yellow starthistle (Quigley and Arbelbide 1997).

Like human populations, weeds typically increase exponentially beginning slowly, then doubling and redoubling (Kummerow 1992).

There were only minor populations of spotted knapweed in Montana in 1920. Today, there are about five million acres with another 29 million acres of highly susceptible land in that state alone (Duncan 1997).

Weed spread

Yellow starthistle was first reported near San Francisco and Seattle in the mid-1800's. Today it infests over 12 million acres in California and many millions of acres in Oregon, Washington, and Idaho.

In 1993, Jackson county in southern Oregon, and Umatilla county in north east Oregon both reported explosions of yellow starthistle with over 100,000 acres in Jackson county and 200,000 acres in Umatilla county. Now, both counties report that the populations have at least doubled.

In 1970, there was about thirty-two acres of leafy spurge in the Theodore Roosevelt National Park in North Dakota. The use of herbicides was not allowed and now leafy spurge dominates over 4,400 acres of the park (Andrascik 1997).

From just a few plants in western Idaho in 1954, rush skeletonweed now infests over four million acres as it continues to "leapfrog" to the east, now out beyond Shoshone, Idaho, and to the west into the Hells Canyon National Recreation Area in Oregon and Idaho.

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Appendix 8 –
Human Health and Ecological Risk Assessments

Risk Assessments

One of the *Purposes* identified in Chapter 1 of the Final EIS is: *6. Prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public, to desirable flora and fauna, and to soil, air, and water.* To help address this *Purpose*, the EIS relies on BLM and/or Forest Service-prepared Human Health and Ecological Risk Assessments for the 18 herbicides analyzed in this EIS. The Risk Assessments are used to quantitatively evaluate the probability (i.e. risk) that herbicide use in wildland settings might pose harm to humans or other species in the environment. As such, they address many of the risks that would be faced by humans, plants, and animals, including special status species, from the use of the herbicides. The level of detail in the Risk Assessments for wildland use exceeds that normally found in EPA's registration examination.

Risk is defined as the likelihood that an effect (injury, disease, death, or environmental damage) may result from a specific set of circumstances. It can be expressed in quantitative or qualitative terms. While all human activities carry some degree of risk, some risks are known with a relatively high degree of accuracy because data have been collected on the historical occurrence of related problems (e.g. lung cancer caused by smoking, auto accidents caused by alcohol impairment, and fatalities resulting from airplane travel). For several reasons, risks associated with exposure to herbicides cannot be so readily determined. The Risk Assessments help evaluate the risks resulting from these situations.

Risks to non-target species associated with herbicide use are often approximated via the use of surrogate species, as toxicological data does not exist for most native non-target species. Survival, growth, reproduction, and other important sub-lethal processes of both terrestrial and aquatic non-target species were considered. Assessments considered acute and chronic toxicity data. Exposures of receptors[1] to direct spray, surface runoff, wind erosion, and accidental spills were analyzed.

Most of the Human Health and Ecological Risk Assessments were developed by the BLM for the 2007 PEIS, or by the Forest Service for the 2005 *Pacific Northwest Region Invasive Plant Program EIS* (see Table A8-1). Three Human Health Risk Assessments used in this EIS (bromacil, diuron, and tebuthiuron) were used in BLM's 1991 *Vegetation Treatment on BLM Lands in Thirteen Western States EIS* and more recent literature has been examined to ensure these Risk Assessments remain current. The Risk Assessments, for herbicides analyzed, total over 6,000 pages. The various sections of each Risk Assessment can be accessed on the web as described below, or obtained on compact disk by calling, emailing, or writing to the BLM at the contact points listed on the title page of this EIS.

The Risk Assessments, related separate analyses, and the EIS include analysis of inerts and degradates for which information is available and not constrained by confidential business information (CBI) restrictions. Preparing a risk assessment for every conceivable combination of herbicide, tank mix, surfactant, adjuvant, and other possible mixture is not feasible, as the BLM cannot prepare hundreds of risk assessments, and the cost would be exorbitant. To the degree a toxic substance is known to pose a significant human or ecological risk, the BLM has

1 An ecological entity such as a human, fish, plant, or slug.

undertaken analysis to assess its impacts through risk assessments. Additional information about uncertainty in risk assessments is included in Appendix 13.

When evaluating risks from the use of herbicides proposed in a NEPA planning document, reliance on EPA's pesticide registration process as the sole demonstration of safety is insufficient. The U.S. Forest Service and Bureau of Land Management were involved in court cases in the early 1980's that specifically addressed this question (principally Save Our Ecosystems v. Clark, 747 F.2d 1240, 1248 (9th Cir. 1984) and Southern Oregon Citizens v. Clark, 720 F. 2d 1475, 1480 (9th Cir. 1983)). These court decisions and others affirmed that although the BLM can use EPA toxicology data, it is still required to do an independent assessment of the safety of pesticides rather than relying on Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) registration alone. This Court also found that FIFRA does not require the same examination of impacts that the BLM is required to undertake under NEPA. Further, risk assessments consider data collected from both published scientific literature and data submitted to EPA to support FIFRA product registration, whereas EPA utilizes the latter data only. The EPA also considers many wildland pesticide uses to be minor. Thus, the project-specific application rates, spectrum of target and non-target organisms, and specialized exposure scenarios evaluated by the BLM are frequently not evaluated by EPA in its generalized registration assessments.

The Risk Assessments are the source for much of the individual herbicide information presented in each of the effects sections in the EIS, including the high-moderate-low risk ratings shown in tables at the end of Chapter 3 and referenced in Chapter 4. Individual Risk Assessment Tools (IRATs) are being, developed for each herbicide to assist field managers in translating risks to project design parameters. The use of these tools is explained in Chapter 3, *Use of Individual Risk Assessment Tools During Implementation*.

The component parts of the various Risk Assessments, and their origins, are shown on Table A8-1. Each part is available on the web via http://www.blm.gov/or/plans/vegtreatmentseis/riskassessments/index.php. At this address, each of the "X"s in the table are clickable links that access the respective section. The additional Risk Assessment information shown on Table A8-2 can be accessed at the above website as well.

Table A8-1. Risk Assessments

<table>
<tr><th rowspan="4">Herbicide</th><th colspan="7">Ecological Risk Assessments (ERA)</th><th colspan="8">Human Health Risk Assessments (HHRA)</th></tr>
<tr><th colspan="6">2007 BLM PEIS[1]</th><th colspan="2" rowspan="3">2005 FS EIS[2] Ecological & Human Health (and worksheet)</th><th colspan="6">2007 BLM PEIS[1]</th><th rowspan="3">1991 BLM EIS[3]</th></tr>
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<tr><td>Diflufenzopyr</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td colspan="2"></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>Picloram</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">x (x)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sulfometuron methyl</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td colspan="2"></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
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</table>

1. 2007 PEIS: Risk Assessments developed for the 2007 *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement*.
2. 2005 FS EIS: Risk Assessments developed for the 2005 *Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement*. These Risk Assessments are both human health and ecological. For chlorsulfuron and dicamba, the BLM has a more recent ERA and HHRA (respectively), so only the remaining part of the FS Risk Assessment was used
3. 1991 BLM EIS: Human Health Risk Assessments adopted with the 1991*Vegetation Treatments on BLM Lands Record of Decision*, and originally developed for the Forest Service's 1988 *Managing Competing and Unwanted Vegetation Final Environmental Impact Statement*. as part of a HHRA that covers 16 herbicides.
4. 2007 BLM PEIS Ecological Risk Assessment Appendices are as follows:
   A. Relevant Data B. ERA Worksheets C. Listed Species D. CBI Information E. Tank Mix Risk Quotients
5. 2007 BLM PEIS Human Health Risk Assessment Appendices are as follows:
   A. Herbicide Labels B. Spreadsheets C. AgDrift Modeling D. Gleams Modeling E. Public Uncertainty Analysis
6. The 2,4-D Risk Assessment was replaced in 2006.

Table A8-2: Additional Risk Assessment Information

2007 BLM PEIS ERA	2005 FS EIS ERA and HHRA	2007 BLM PEIS HHRA
Ecological Risk Assessment Protocol Appendix A: AgDrift Modeling Appendix B: Gleams Modeling	Preparation of Environmental Documentation and Risk Assessments Nonylphenol Polyethoxylate-based (NPE) Surfactants	Appendix B – Spreadsheets Occupational – All Public – General

Appendix 9 – Additional Information About the 18 Herbicides

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Herbicide Formulations Approved for BLM Lands

Table A9-1 shows herbicide trade names that could be approved (depending on the alternative selected) for use on BLM lands in Oregon in 2010. These herbicides are approved for use by the EPA, approved for use in Oregon, and approved for use on BLM lands. This list is subject to change annually; it is just informational. Label restrictions apply.

Table A9-1. Herbicide Formulations Approved for Use on BLM Lands Nationally as of November 2009 (This list is subject to change annually.)

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Bromacil	Bromacil 80DF	Alligare, LLC	81927-4
Bromacil	Hyvar X	DuPont	352-287
Bromacil	Hyvar XL	DuPont	352-346
Bromacil + Diuron	Bromacil/Diuron 40/40	Alligare, LLC	81927-3
Bromacil + Diuron	DiBro 2+2	Nufarm Americas Inc.	228-227
Bromacil + Diuron	DiBro 4+2	Nufarm Americas Inc.	228-386
Bromacil + Diuron	DiBro 4+4	Nufarm Americas Inc.	228-235
Bromacil + Diuron	Krovar I DF	DuPont	352-505
Bromacil + Diuron	Weed Blast 4G	SSI Maxim	34913-19
Bromacil + Diuron	Weed Blast Res. Weed Cont.	Loveland Products Inc.	34704-576
Chlorsulfuron	Chlorsulfuron E-Pro 75 WDG	Nufarm Americas Inc.	79676-72
Chlorsulfuron	NuFarm Chlorsulf Pro 75 WDG	Nufarm Americas Inc.	228-672
Chlorsulfuron	Telar DF	DuPont	352-522
Chlorsulfuron	Telar XP	DuPont	352-654
Clopyralid	CleanSlate	Nufarm Americas Inc.	228-491
Clopyralid	Clopyralid 3	Alligare, LLC	42750-94-81927
Clopyralid	Cody Herbicide	Alligare, LLC	81927-28
Clopyralid	Pyramid R&P	Albaugh, Inc.	42750-94
Clopyralid	Reclaim	Dow AgroSciences	62719-83

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Clopyralid	Spur	Albaugh, Inc.	42750-89
Clopyralid	Stinger	Dow AgroSciences	62719-73
Clopyralid	Transline	Dow AgroSciences	62719-259
Clopyralid + 2,4-D	Commando	Albaugh, Inc.	42750-92
Clopyralid + 2,4-D	Curtail	Dow AgroSciences	62719-48
Clopyralid + 2,4-D	Cutback	Nufarm Americas Inc.	71368-72
2,4-D	2,4-D 4# Amine Weed Killer	UAP-Platte Chem. Co.	34704-120
2,4-D	2,4-D Amine	Helena Chem. Co.	5905-72
2,4-D	2,4-D Amine	Setre (Helena)	5905-72
2,4-D	2,4-D Amine 4	Albaugh, Inc./Agri Star	42750-19
2,4-D	2,4-D LV 4	Albaugh, Inc./Agri Star	42750-15
2,4-D	2,4-D LV 6	Albaugh, Inc./Agri Star	42750-20
2,4-D	2,4-D LV 6 Ester	Nufarm Americas Inc.	228-95
2,4-D	2,4-D LV4	Setre (Helena)	5905-90
2,4-D	2,4-D LV6	Helena Chem. Co.	4275-20-5905
2,4-D	2,4-D LV6	Setre (Helena)	5905-93
2,4-D	Agrisolution 2,4-D Amine 4	Agriliance, L.L.C.	1381-103
2,4-D	Agrisolution 2,4-D Amine 4	Winfield Solutions, LLC	1381-103
2,4-D	Agrisolution 2,4-D LV4	Agriliance, L.L.C.	1381-102
2,4-D	Agrisolution 2,4-D LV4	Winfield Solutions, LLC	1381-102
2,4-D	Agrisolution 2,4-D LV6	Agriliance, L.L.C.	1381-101
2,4-D	Agrisolution 2,4-D LV6	Winflied Solutions, LLC	1381-101
2,4-D	Amine 4	Wilbur-Ellis Co.	2935-512
2,4-D	Amine 4CA 2,4-D Weed Killer	Loveland Products Inc.	34704-5
2,4-D	Aqua-Kleen	Nufarm Americas Inc.	71368-4
2,4-D	Aqua-Kleen	Nufarm Americas Inc.	228-378
2,4-D	Barrage HF	Helena	5905-529
2,4-D	Barrage LV Ester	Setre (Helena)	5905-504
2,4-D	Clean Amine	Loveland Products Inc.	34704-120
2,4-D	Clean Crop Amine 4	UAP-Platte Chem. Co.	34704-5 CA
2,4-D	Clean Crop Low Vol 6 Ester	UAP-Platte Chem. Co.	34704-125
2,4-D	Clean Crop LV-4 ES	UAP-Platte Chem. Co.	34704-124
2,4-D	Cornbelt 4 lb. Amine	Van Diest Supply Co.	11773-2
2,4-D	Cornbelt 4# LoVol Ester	Van Diest Supply Co.	11773-3
2,4-D	Cornbelt 6# LoVol Ester	Van Diest Supply Co.	11773-4
2,4-D	D-638	Albaugh, Inc./Agri Star	42750-36
2,4-D	Esteron 99C	Nufarm Americas Inc.	62719-9-71368
2,4-D	Five Star	Albaugh, Inc./Agri Star	42750-49
2,4-D	Formula 40	Nufarm Americas Inc.	228-357
2,4-D	HardBall	Helena	5905-549
2,4-D	Hi-Dep	PBI Gordon Corp.	2217-703

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
2,4-D	Lo Vol-4	Wilbur-Ellis Co.	228-139-2935
2,4-D	Lo Vol-6 Ester	Wilbur-Ellis Co.	228-95-2935
2,4-D	Low Vol 4 Ester Weed Killer	Loveland Products Inc.	34704-124
2,4-D	Low Vol 6 Ester Weed Killer	Loveland Products Inc.	34704-125
2,4-D	LV-6 Ester Weed Killer	Loveland Products Inc.	34704-6
2,4-D	Opti-Amine	Helena Chem. Co.	5905-501
2,4-D	Platoon	Nufarm Americas Inc.	228-145
2,4-D	Saber	Loveland Products Inc.	34704-803
2,4-D	Saber CA	Loveland Products Inc.	34704-803
2,4-D	Salvo	Loveland Products Inc.	34704-609
2,4-D	Salvo LV Ester	UAP-Platte Chem. Co.	34704-609
2,4-D	Savage DF	Loveland Products Inc.	34704-606
2,4-D	Savage DF	UAP-Platte Chem. Co.	34704-606
2,4-D	Solve 2,4-D	Albaugh, Inc./Agri Star	42750-22
2,4-D	Unison	Helena	5905-542
2,4-D	Weedar 64	Nufarm Americas Inc.	71368-1
2,4-D	Weedone LV-4	Nufarm Americas Inc.	228-139-71368
2,4-D	Weedone LV-4 Solventless	Nufarm Americas Inc.	71368-14
2,4-D	Weedone LV-6	Nufarm Americas Inc.	71368-11
2,4-D	WEEDstroy AM-40	Nufarm Americas Inc.	228-145
Dicamba	Banvel	Arysta LifeScience N.A. Corp.	66330-276
Dicamba	Banvel	Micro Flo Company	51036-289
Dicamba	Clarity	BASF Ag. Products	7969-137
Dicamba	Cruise Control	Alligare, LLC	42750-40-81927
Dicamba	Diablo	Nufarm Americas Inc.	228-379
Dicamba	Dicamba DMA	Albaugh, Inc./Agri Star	42750-40
Dicamba	Rifle	Loveland Products Inc.	34704-861
Dicamba	Sterling Blue	Winfield Solutions, LLC	7969-137-1381
Dicamba	Vanquish	Syngenta	100-884
Dicamba	Vanquish Herbicide	Nufarm Americas Inc.	228-397
Dicamba	Vision	Albaugh, Inc.	42750-98
Dicamba + 2,4-D	Brash	Winfield Solutions, LLC	1381-202
Dicamba + 2,4-D	KambaMaster	Nufarm Americas Inc.	71368-34
Dicamba + 2,4-D	Outlaw	Albaugh, Inc./Agri Star	42750-68
Dicamba + 2,4-D	Range Star	Albaugh, Inc./Agri Star	42750-55
Dicamba + 2,4-D	Rifle-D	Loveland Products Inc.	34704-869
Dicamba + 2,4-D	Veteran 720	Nufarm Americas Inc.	228-295
Dicamba + 2,4-D	Weedmaster	BASF Ag. Products	7969-133
Dicamba + Diflufenzopyr	Distinct	BASF Ag. Products	7969-150
Dicamba + Diflufenzopyr	Overdrive	BASF Ag. Products	7969-150
Diquat	Diquat E-Pro 2L	Nufarm Americas Inc.	79676-75

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Diquat	Nufarm Diquat 2L Herbicide	Nufarm Americas Inc.	228-675
Diquat	NuFarm Diquat Pro 2L Herbicide	Nufarm Americas Inc.	228-675
Diquat	Reward	Syngenta Crop Prot., Inc.	100-1091
Diuron	Direx 4L	DuPont	352-678
Diuron	Direx 4L	Griffin Company	1812-257
Diuron	Direx 80DF	Griffin Company	1812-362
Diuron	Diuron 4L	Loveland Products Inc.	34704-854
Diuron	Diuron 4L	Makteshim Agan of N.A.	66222-54
Diuron	Diuron 80 WDG	Loveland Products Inc.	34704-648
Diuron	Diuron 80DF	Agriliance, L.L.C.	9779-318
Diuron	Diuron 80DF	Alligare, LLC	81927-12
Diuron	Diuron 80DF	Winfield Solutions, LLC	9779-318
Diuron	Diuron 80WDG	UAP-Platte Chem. Co.	34704-648
Diuron	Diuron-DF	Wilbur-Ellis	00352-00-508-02935
Diuron	Karmex DF	DuPont	352-692
Diuron	Karmex IWC	DuPont	352-692
Diuron	Karmex XP	DuPont	352-692
Diuron	Vegetation Man. Diuron 80 DF	Vegetation Man., LLC	66222-51-74477
Fluridone	Avast!	SePRO	67690-30
Fluridone	Sonar AS	SePRO	67690-4
Fluridone	Sonar Precision Release	SePRO	67690-12
Fluridone	Sonar Q	SePRO	67690-3
Fluridone	Sonar SRP	SePRO	67690-3
Glyphosate	Accord Concentrate	Dow AgroSciences	62719-324
Glyphosate	Accord SP	Dow AgroSciences	62719-322
Glyphosate	Accord XRT	Dow AgroSciences	62719-517
Glyphosate	Accord XRT II	Dow AgroSciences	62719-556
Glyphosate	Aqua Neat	Nufarm Americas Inc.	228-365
Glyphosate	Aqua Star	Albaugh, Inc./Agri Star	42750-59
Glyphosate	Aquamaster	Monsanto	524-343
Glyphosate	AquaPro Aquatic Herbicide	SePRO Corporation	62719-324-67690
Glyphosate	Buccaneer	Tenkoz	55467-10
Glyphosate	Buccaneer Plus	Tenkoz	55467-9
Glyphosate	ClearOut 41	Chem. Prod. Tech., LLC	70829-2
Glyphosate	ClearOut 41 Plus	Chem. Prod. Tech., LLC	70829-3
Glyphosate	Cornerstone	Winfield Solutions, LLC	1381-191
Glyphosate	Cornerstone Plus	Winfield Solutions, LLC	1381-192
Glyphosate	Credit Xtreme	Nufarm Americas Inc.	71368-81
Glyphosate	Forest Star	Albaugh, Inc./Agri Star	42570-61
Glyphosate	Foresters	Nufarm Americas Inc.	228-381
Glyphosate	Gly Star Original	Albaugh, Inc./Agri Star	42750-60

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Glyphosate	Gly Star Plus	Albaugh, Inc./Agri Star	42750-61
Glyphosate	Gly Star Pro	Albaugh, Inc./Agri Star	42750-61
Glyphosate	Glyfos	Cheminova	4787-31
Glyphosate	Glyfos Aquatic	Cheminova	4787-34
Glyphosate	Glyfos PRO	Cheminova	67760-57
Glyphosate	GlyphoMate 41	PBI Gordon Corp.	2217-847
Glyphosate	Glyphosate 4	Vegetation Man., LLC	73220-6-74477
Glyphosate	Glyphosate 4 PLUS	Alligare, LLC	81927-9
Glyphosate	Glyphosate 5.4	Alligare, LLC	81927-8
Glyphosate	Glypro	Dow AgroSciences	62719-324
Glyphosate	Glypro Plus	Dow AgroSciences	62719-322
Glyphosate	Honcho	Monsanto	524-445
Glyphosate	Honcho Plus	Monsanto	524-454
Glyphosate	Mirage	Loveland Products Inc.	34704-889
Glyphosate	Mirage Herbicide	UAP-Platte Chem. Co.	524-445-34704
Glyphosate	Mirage Plus	Loveland Products Inc.	34704-890
Glyphosate	Mirage Plus Herbicide	UAP-Platte Chem. Co.	524-454-34704
Glyphosate	Rascal	Winfield Solutions, LLC	1381-191
Glyphosate	Rascal Plus	Winfield Solutions, LLC	1381-192
Glyphosate	Rattler	Setre (Helena)	524-445-5905
Glyphosate	Razor	Nufarm Americas Inc.	228-366
Glyphosate	Razor Pro	Nufarm Americas Inc.	228-366
Glyphosate	Rodeo	Dow AgroSciences	62719-324
Glyphosate	Roundup Original	Monsanto	524-445
Glyphosate	Roundup Original II	Monsanto	524-454
Glyphosate	Roundup Original II CA	Monsanto	524-475
Glyphosate	Roundup PRO	Monsanto	524-475
Glyphosate	Roundup PRO Concentrate	Monsanto	524-529
Glyphosate	Roundup PRO Dry	Monsanto	524-505
Glyphosate	Roundup PROMAX	Monsanto	524-579
Glyphosate + 2,4-D	Campaign	Monsanto	524-351
Glyphosate + 2,4-D	Landmaster BW	Albaugh, Inc./Agri Star	42570-62
Glyphosate + 2,4-D	Landmaster BW	Monsanto	524-351
Glyphosate + Dicamba	Fallowmaster	Monsanto	524-507
Glyphosate + Dicamba	GlyKamba	Nufarm Americas Inc.	71368-30
Hexazinone	Pronone 10G	Pro-Serve	33560-21
Hexazinone	Pronone 25G	Pro-Serve	33560-45
Hexazinone	Pronone MG	Pro-Serve	33560-21
Hexazinone	Velpar DF	DuPont	352-581
Hexazinone	Velpar L	DuPont	352-392
Hexazinone	Velpar ULW	DuPont	352-450

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Hexazinone + Sulfometuron methyl	Oustar	DuPont Crop Protection	352-603
Hexazinone + Sulfometuron methyl	Westar	DuPont Crop Protection	352-626
Imazapic	Imazapic E 2 SL	Etigra, LLC	79676-65
Imazapic	Panoramic 2SL	Alligare, LLC	66222-141-81927
Imazapic	Plateau	BASF	241-365
Imazapic + Glyphosate	Journey	BASF	241-417
Imazapyr	Arsenal	BASF	241-346
Imazapyr	Arsenal Applicators Conc.	BASF	241-299
Imazapyr	Arsenal PowerLine	BASF	241-431
Imazapyr	Arsenal Railroad Herbicide	BASF	241-273
Imazapyr	Chopper	BASF	241-296
Imazapyr	Ecomazapyr 2 SL	Vegetation Man., LLC	74477-6
Imazapyr	Ecomazapyr 2SL	Alligare, LLC	81927-22
Imazapyr	Habitat	BASF	241-426
Imazapyr	Imazapyr 2 SL	Vegetation Man., LLC	74477-4
Imazapyr	Imazapyr 2SL	Alligare, LLC	81927-23
Imazapyr	Imazapyr 4 SL	Vegetation Man., LLC	74477-5
Imazapyr	Imazapyr 4SL	Alligare, LLC	81927-24
Imazapyr	Imazapyr E-Pro 2 - VM & Aquatic Herbicide	Etigra, LLC	81959-8
Imazapyr	Imazapyr E-Pro 2E - Site Prep & Basal	Etigra, LLC	81959-7
Imazapyr	Imazapyr E-Pro 4 - Forestry	Etigra, LLC	81959-9
Imazapyr	Polaris	Nufarm Americas Inc.	228-534
Imazapyr	Polaris AC	Nufarm Americas Inc.	241-299-228
Imazapyr	Polaris AC	Nufarm Americas Inc.	228-480
Imazapyr	Polaris AQ	Nufarm Americas Inc.	241-426-228
Imazapyr	Polaris Herbicide	Nufarm Americas Inc.	241-346-228
Imazapyr	Polaris RR	Nufarm Americas Inc.	241-273-228
Imazapyr	Polaris SP	Nufarm Americas Inc.	228-534
Imazapyr	Polaris SP	Nufarm Americas Inc.	241-296-228
Imazapyr	SSI Maxim Arsenal 0.5G	SSI Maxim Co., Inc.	34913-23
Imazapyr	Stalker	BASF	241-398
Imazapyr + Diuron	Imazuron E-Pro	Etigra, LLC	79676-54
Imazapyr + Diuron	Mojave 70 EG	Alligare, LLC	74477-9-81927
Imazapyr + Diuron	Sahara DG	BASF	241-372
Imazapyr + Diuron	SSI Maxim Topsite 2.5G	SSI Maxim Co., Inc.	34913-22
Imazapyr + Metsulfuron methyl	Lineage Clearstand	DuPont	352-766
Imazapyr + Sulfometuron methyl + Metsulfuron methyl	Lineage HWC	DuPont	352-765
Imazapyr + Sulfometuron methyl + Metsulfuron methyl	Lineage Prep	DuPont	352-767

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Metsulfuron methyl	Escort DF	DuPont	352-439
Metsulfuron methyl	Escort XP	DuPont	352-439
Metsulfuron methyl	Metsulfuron Methyl DF	Vegetation Man., L.L.C.	74477-2
Metsulfuron methyl	MSM 60	Alligare, LLC	81927-7
Metsulfuron methyl	MSM E-AG 60 EG Herbicide	Etigra, LLC	81959-14
Metsulfuron methyl	MSM E-Pro 60 EG Herbicide	Etigra, LLC	81959-14
Metsulfuron methyl	Patriot	Nufarm Americas Inc.	228-391
Metsulfuron methyl	PureStand	Nufarm Americas Inc.	71368-38
Metsulfuron methyl + Chlorsulfuron	Cimarron Extra	DuPont	352-669
Metsulfuron methyl + Chlorsulfuron	Cimarron Plus	DuPont	352-670
Metsulfuron methyl + Dicamba + 2,4-D	Cimarron MAX	DuPont	352-615
Picloram	Grazon PC	Dow AgroSciences	62719-181
Picloram	OutPost 22K	Dow AgroSciences	62719-6
Picloram	Picloram 22K	Alligare, LLC	42750-79-81927
Picloram	Picloram 22K	Alligare, LLC	81927-18
Picloram	Picloram K	Alligare, LLC	42750-81-81927
Picloram	Picloram K	Alligare, LLC	81927-17
Picloram	Tordon 22K	Dow AgroSciences	62719-6
Picloram	Tordon K	Dow AgroSciences	62719-17
Picloram	Triumph 22K	Albaugh, Inc.	42750-79
Picloram	Triumph K	Albaugh, Inc.	42750-81
Picloram	Trooper 22K	Nufarm Americas Inc.	228-535
Picloram + 2,4-D	Grazon P+D	Dow AgroSciences	62719-182
Picloram + 2,4-D	GunSlinger	Albaugh, Inc.	42750-80
Picloram + 2,4-D	HiredHand P+D	Dow AgroSciences	62719-182
Picloram + 2,4-D	Pathway	Dow AgroSciences	62719-31
Picloram + 2,4-D	Picloram + D	Alligare, LLC	42750-80-81927
Picloram + 2,4-D	Picloram + D	Alligare, LLC	81927-16
Picloram + 2,4-D	Tordon 101 R Forestry	Dow AgroSciences	62719-31
Picloram + 2,4-D	Tordon 101M	Dow AgroSciences	62719-5
Picloram + 2,4-D	Tordon RTU	Dow AgroSciences	62719-31
Picloram + 2,4-D	Trooper 101	Nufarm Americas Inc.	228-561
Picloram + 2,4-D	Trooper P + D	Nufarm Americas Inc.	228-530
Picloram + 2,4-D + Dicamba	Trooper Extra	Nufarm Americas Inc.	228-586
Sulfometuron methyl	Oust DF	DuPont	352-401
Sulfometuron methyl	Oust XP	DuPont	352-601
Sulfometuron methyl	SFM 75	Alligare, LLC	81927-26
Sulfometuron methyl	SFM 75	Vegetation Man., L.L.C.	72167-11-74477
Sulfometuron methyl	SFM E-Pro 75EG	Etigra, LLC	79676-16

Active Ingredient	Trade Name	Manufacturer	EPA Reg. Number
Sulfometuron methyl	Spyder	Nufarm Americas Inc.	228-408
Sulfometuron methyl + Chlorsulfuron	Landmark XP	DuPont	352-645
Sulfometuron methyl + Metsulfuron methyl	Oust Extra	DuPont	352-622
Tebuthiuron	Spike 20P	Dow AgroSciences	62719-121
Tebuthiuron	Spike 80DF	Dow AgroSciences	62719-107
Tebuthiuron	SpraKil S-5 Granules	SSI Maxim Co., Inc.	34913-10
Tebuthiuron + Diuron	SpraKil SK-13 Granular	SSI Maxim Co., Inc.	34913-15
Tebuthiuron + Diuron	SpraKil SK-26 Granular	SSI Maxim Co., Inc.	34913-16
Triclopyr	Ecotriclopyr 3 SL	Vegetation Man., LLC	72167-49-74477
Triclopyr	Element 3A	Dow AgroSciences	62719-37
Triclopyr	Element 4	Dow AgroSciences	62719-40
Triclopyr	Forestry Garlon XRT	Dow AgroSciences	62719-553
Triclopyr	Garlon 3A	Dow AgroSciences	62719-37
Triclopyr	Garlon 4	Dow AgroSciences	62719-40
Triclopyr	Garlon 4 Ultra	Dow AgroSciences	62719-527
Triclopyr	Pathfinder II	Dow AgroSciences	62719-176
Triclopyr	Relegate	Nufarm Americas Inc.	228-521
Triclopyr	Remedy	Dow AgroSciences	62719-70
Triclopyr	Remedy Ultra	Dow AgroSciences	62719-552
Triclopyr	Renovate 3	SePRO Corporation	62719-37-67690
Triclopyr	Renovate OTF	SePRO Corporation	67690-42
Triclopyr	Tahoe 3A	Nufarm Americas Inc.	228-384
Triclopyr	Tahoe 3A	Nufarm Americas Inc.	228-518
Triclopyr	Tahoe 3A	Nufarm Americas Inc.	228-520
Triclopyr	Tahoe 4E	Nufarm Americas Inc.	228-385
Triclopyr	Tahoe 4E Herbicide	Nufarm Americas Inc.	228-517
Triclopyr	Triclopry 4	Alligare, LLC	81927-11
Triclopyr	Triclopyr 3	Alligare, LLC	81927-13
Triclopyr	Triclopyr 3 SL	Vegetation Man., LLC	72167-53-74477
Triclopyr	Triclopyr 4EC	Alligare, LLC	72167-53-74477
Triclopyr + 2,4-D	Candor	Nufarm Americas Inc.	228-565
Triclopyr + 2,4-D	Crossbow	Dow AgroSciences	62719-260
Triclopyr + 2,4-D	Everett	Alligare, LLC	81927-29
Triclopyr + Clopyralid	Brazen	Nufarm Americas Inc.	228-564
Triclopyr + Clopyralid	Prescott Herbicide	Alligare, LLC	81927-30
Triclopyr + Clopyralid	Redeem R&P	Dow AgroSciences	62719-337

Target Species and Recommended Herbicide Controls

Table A9-2 shows which herbicides are recommended for what species. The information pertains primarily to established or larger infestations; small infestations of noxious or invasive weeds of many species may be effectively controlled with non-herbicide methods such as hand pulling or digging. Recommended herbicides are necessary for effective/cost effective control of difficult-to-control species. Public comments about additional invasive species and treatment recommendations were used to update the information in this table between the Draft EIS and the Final EIS.

Table A9-2. Target Species and Recommended Herbicide Controls

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
Noxious Weeds																				
No	2	African rue										√	√		√	√				
No	2	Biddy-biddy					√													√
No	2	Blackberry, Himalayan	√[3]									√			√	√	√			√
No	3	Brazilian or S American waterweed							√		√									
Yes[5]	2	Broom, French	√[3]			√						√			√		√[3]			√
Yes[5]	2	Broom, Portugese	√[3]			√						√			√		√[3]			√
Yes[5]	2	Broom, Scotch	√[3]			√						√			√		√[3]			√
No	2	Broom, Spanish	√[3]			√						√			√		√[3]			√
Yes	2	Buffalobur				√						√					√			
No	2	Butterfly bush										√			√					
No	2	Camel thorn				√									√		√			√
Yes	2	Cocklebur, spiny	√	√		√	√					√								
No	3	Coltsfoot				√														
No	2	Common bugloss	√		√									√		√	√			
Yes[6]	2	Common cruprina	√[3]			√	√[3]										√			√
No	2	Common reed										√								
No	2	Cordgrass, common										√			√					
No	2	Cordgrass, dense flower										√			√					
No	2	Cordgrass, saltmeadow										√			√					
No	2	Cordgrass, smooth										√			√					
No	3	Creeping yellow cress													√					
No	None	Dodder																		
Yes	2	Dyers woad	√		√		√									√				
Yes[5]	2	English Ivy										√								√
Yes[6]	2	European Water chestnut	√																	
No	2	Field bindweed	√				√									√				
No	2	False brome										√								

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
Yes[5]	3	Flowering rush													√					
Yes[6]	2	Garlic mustard										√								
Yes	2	Geranium, Herb Robert								√		√								
Yes[5]	2	Geranium, Shiny leaf								√		√								√
No	2	Giant Hogweed										√		√						
Yes[7]	2	Goatgrass, Barbed										√		√				√		
Yes[7]	2	Goatgrass, Jointed										√[2]		√				√		
Yes[7]	2	Goatgrass, Ovate										√		√				√		
Yes[7]	2	Goatsrue	√			√	√													
No	2	Gorse	√[3]				√					√				√	√[3]			√
Yes	2	Halogeton	√											√		√			√	
No	2	Hawkweed, King-devil	√[3]			√	√[3]										√			√[3]
No	2	Hawkweed, Meadow	√[3]			√	√[3]										√			√
No	2	Hawkweed, Mouse-eared	√[3]			√	√[3]										√			√[3]
No	2	Hawkweed, Orange	√[3]			√	√[3]										√			√
No	2	Hawkweed, Yellow	√[3]			√	√[3]										√			√
No	5	Horsetail, Giant			√															
Yes[5]	2	Houndstongue	√		√											√	√[2]			
No	3	Hydrilla							√		√									
No	None	Japanese dodder																		
No	2	Johnsongrass		√								√[2]		√	√			√		
Yes[5]	2	Jubata grass (Purple Pampas grass)										√			√					
Yes	2	Knapweed, Diffuse	√[2]														√[2]			√
Yes[9]	2	Knapweed, Meadow	√			√		√[3]				√		√			√[2]			√
No	2	Knapweed, Russian				√											√			√
No	2	Knapweed, spotted	√			√											√[2]			
No	2	Knapweed, Squarrose				√		√[3]				√		√			√			√
No	2	Knotweed, Giant				√	√					√			√					√
No	2	Knotweed, Himalayan				√	√					√			√					√
No	2	Knotweed, Japanese				√	√					√			√					√
No	2	Kochia	√[2]				√							√		√				
No	2	Kudzu				√						√								
No	2	Lesser celadine or fig buttercup										√								
No	2	Matgrass										√			√					
Yes[5]	2	Mediterranean sage	√			√											√			
No	3	Medusahead rye												√			√			
No	2	Oblong spurge	√		√		√					√		√			√			
No	2	Old man's beard										√								√
No	2	Parrot's feather	√						√											

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
No	2	Paterson's curse	√		√									√		√	√			
No	3	Perennial peavine				√														
No	3	Perennial pepperweed	√[3]		√									√		√				
No	2	Poison hemlock	√				√					√				√	√			
Yes	2	Policemans helmet	√									√								√
Yes[5]	2	Puncturevine	√		√												√			
No	2	Purple loosestrife										√			√	√				√
No	2	Purple Nutsedge										√		√						
No	2	Quackgrass		√[3]						√[3]		√			√					
Yes	2	Ragweed	√[3]			√						√			√					
No	2	Rush skeletonweed	√			√	√										√[2]			
No	3	Saltcedar													√					√
No	2	Silverleaf Nightshade				√						√			√		√			
No	2	Skeletonleaf bursage	√[3]			√[3]						√								
No	None	Small broomrape																		
Yes	2	Spanish heath	√[3]														√[3]			√
No	3	Spikeweed				√														
Yes	3	Spurge laurel													√					
No	2	Spurge, Leafy			√									√			√			
No	2	Spurge, Myrtle	√		√		√							√			√			
No	2	St. Johnswort	√													√	√			
Yes[5]	2	Starthistle, Iberian	√[3]			√[3]	√										√			√
Yes[5]	2	Starthistle, Purple	√[3]			√[3]	√										√[3]			√
Yes	2	Starthistle, Yellow				√											√[2]			√
No	2	Sulfur cinquefoil	√				√[2]					√				√	√[2]			
No	2	Swainsonpea	√			√														
No	2	Syrian bean-caper	√	√[3]	√					√[3]				√						
Yes	2	Tansy ragwort	√				√									√	√			√
Yes	2	Teasel, cutleaf			√	√	√[3]	√[3]						√		√				√
No	3	Texas blueweed				√														
Yes[5]	2	Thistle, Bull	√[2]		√	√	√[2,3]	√[3]								√				√
No	2	Thistle, Canada			√	√											√[2]			√
Yes	2	Thistle, Italian	√			√	√										√			
Yes	2	Thistle, Milk	√		√	√	√[3]	√[3]				√				√				√
Yes	2	Thistle, Musk	√[2]			√		√[3]				√[2]					√			√
Yes	2	Thistle, Plumeless	√		√	√	√[3]	√[3]				√[2]				√	√			√
Yes	2	Thistle, Scotch	√[3]		√	√	√[3]									√	√			√
Yes	2	Thistle, Slender flowered	√			√	√										√			
Yes	2	Thistle, Smooth distaff				√											√			
Yes[5]	2	Thistle, Taurian or bull cottonthistle	√			√	√													

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
Yes[5]	2	Thistle, Wooly distaff				√											√			
No	2	Toadflax, Dalmation	√		√		√										√			
No	2	Toadflax, Yellow			√												√			
Yes	2	Velvetleaf	√									√[2]					√			
No	3	Watermilfoil, Eurasian							√		√									
No	2	White Bryonia	√[3]				√					√					√			√[3]
No	2	Whitetop, (Hoary cress)	√		√		√					√		√	√	√				
No	2	whitetop, Lens-podded	√		√									√	√	√				
No	2	Whitetop,Hairy	√		√									√	√	√				
No	2	Yellow Flag Iris	√									√		√	√	√				
Yes	2	Yellow floating heart							√			√								
No	3	Yellow nutsedge												√						
No	2	Yellowtuft (2 sp)	√		√		√					√		√	√	√				
Invasive Plants																				
No	3	Annual fescues										√		√	√					
No	3	Babysbreath	√				√													
No	4	Bare ground		√						√									√	
No	3	Bear's breeches										√								
Yes	3	Bird cherry										√			√					
No	3	Birdfoot trefoil				√														
No	3	Black henbane				√	√					√				√	√			
No	3	Black locust				√						√			√					√
No	3	Blackberry, Evergreen	√[3]									√				√	√			√
No	3	Blackgrass										√			√					
No	3	Blackthorn													√					
No	5	Bouncing bet					√									√[3]		√[3]		
No	3	Bristly dog's-tail										√			√					
Yes	3	Bur buttercup	√				√					√			√			√		
Yes	3	Burdock, common	√[2]			√[3]	√[2]					√					√[2]			√[3]
Yes	3	Burnweed				√														
No	3	Cereal rye										√		√	√					
No	3	Cheatgrass												√	√					
No	3	Chicory	√			√	√[2]					√					√[2]			
No	3	Climbing nightshade				√														
No	3	Clover spp				√														
Yes	3	Cocklebur, rough				√						√								
No	3	Common knotweed				√						√			√					
Yes	3	Common or Wooly mullein			√		√					√		√			√[2]			
No	3	Common Pear										√			√					√
No	3	Common velvet-grass										√			√					

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
No	3	Creeping buttercup	√																	
No	3	Crested dog’s-tail grass										√			√					
No	3	Dandelion				√														
No	3	Dense silkybent										√			√					
No	3	Elecampane inula				√														
No	3	Elodea							√		√									
No	3	English holly													√					√
NA	3	escaped ornamental grasses										√			√					
No	3	European beach grass										√			√					
Yes	3	European centaury	√				√													
No	3	False indigo	√				√										√			
No	3	Feverfew			√	√	√									√	√			
Yes	3	Field mustard	√		√													√		
No	3	Field sowthistle	√			√											√			
Yes	3	Garden cornflower or bachelor buttons	√			√		√[3]				√		√			√			√
No	3	Garden vetch	√			√						√								√
Yes	3	Goatgrass, Bulbed										√		√				√		
Yes	3	Goatgrass, Tausch’s										√		√	√					
No	3	Harding grass										√			√					
No	3	Hawkweed, common	√			√	√										√			√
No	3	Hawkweed, Yellow	√			√	√										√			√
No	3	Hawthorn, Oneseed													√					
No	3	Hawthorn, Smooth													√					
Yes	3	Herb Robert										√								
No	3	Horehound	√	√[3]						√[3]										√
No	3	Italian ryegrass										√		√		√				
No	3	Knotweed, Bohemian				√	√					√			√					
Yes[5]	None	Lepyrodiclis																		
Yes	3	Lesser hawkbit				√														
No	3	Marestail				√														
No	3	Mutiflora rose	√[3]									√					√[3]			√
Yes	3	narrowleaf plantain	√				√					√								
No	3	North Africa grass										√		√	√					
No	3	Orchardgrass										√			√					
No	3	Oxeye daisy				√	√								√		√[2]			
Yes	3	Pampas grass, Uruguayan										√			√					
No	3	Paterson’s curse	√		√									√		√	√			
No	3	Pennyroyal										√								
No	3	Perennial ryegrass										√			√					

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
No	3	Periwinkle										√								√
No	3	Poverty brome										√			√					
Yes	3	Prickly lettuce				√														
No	3	Prickly sowthistle	√			√											√			
Yes	3	Purple foxglove	√		√		√							√			√			
No	3	Red brome										√			√					
No	3	Reed canarygrass										√						√		
No	3	Ripgut brome										√			√					
No	3	Russian olive										√			√					
No	3	Shining geranium										√			√					√
No	3	slender oat										√			√					
No	3	smalleaf periwinkle										√								√
No	3	soft brome										√			√					
No	3	Spotted Cat's ear				√														
No	3	spotted henbit										√				√				
No	3	Spreading hedge-parsley			√							√		√						√
Yes	3	Starthistle, Malta				√	√[3]	√[3]									√			√
No	3	sweet fennel	√														√			
Yes	3	sweetclover, white				√														
Yes	3	sweetclover, yellow				√														
No	3	tall fescue										√		√						
No	3	Tansy, Common			√	√	√					√[2]				√	√[2]			
Yes	3	Teasel, common	√		√	√	√[3]	√[3]						√		√				√
Yes	3	Thistle, Russian	√											√		√				
No	3	Thistle, wavyleaf	√		√	√	√[3]	√[3]				√				√				√
Yes	3	Thistle, Whitestem distaff				√											√			
No	3	Tree-of-heaven	√[3]				√[3]					√			√	√	√			√
Yes	3	Tumbleweed or Prickly Russian thistle	√				√					√		√		√	√			
No	3	Wild carrot			√											√				
Yes	3	Wild oat										√			√					
No	2	Wild proso millet										√		√	√					
Yes	3	Wild safflower				√											√			
No	2	Yellow archangel																		√
No	3	Yellow glandweed	√		√		√							√			√			
Native and Other Non-Invasive Vegetation[8]																				
No	4	Alder													√		√			√
No	4	Big leaf maple													√					√
Yes	4	Big sagebrush	√			√									√				√	
Yes	4	Conifers													√	√	√			
No	4	Evergreen huckleberry																		

Non-herbicide methods effective[8]	Alternative where recommended herbicide available[1]	Common Name	2,4-D	Bromacil	Chlorsulfuron	Clopyralid	Dicamba	Diflufenzopyr+	Diquat	Diuron	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Tebuthiuron	Triclopyr
No	4	Grasses										√	√		√			√		
No	4	Hazel										√[2]			√					√[2]
No	4	Madrone	√									√			√		√			
No	4	Ocean spray													√					
No	4	Pacific Rhododendron																		
No	4	Poison ivy	√[3]									√			√					√[3]
No	4	Poison Oak	√[3]									√			√		√			√[3]
Yes	4	Rabbitbrush	√												√		√			
No	4	salmonberry										√			√	√		√		
No	3[4]	Tanoak										√			√	√	√			√
No	4	Thimble berry										√			√	√				
No	4	Vine maple										√			√		√			√
Yes	4	Western juniper													√					
No	4	Western water hemlock	√																	
No	4	Willow	√			√									√	√	√			√

[1] Based on the experience of District Weed Specialists and various references, primarily the Pacific Northwest Weed Management Handbook (OSU 2009), the Weed Control Methods Handbook (Tu et al. 2001), Weeds of California and other Western States (DiTomaso and Healy. 2007), Biology and Management of Noxious Rangeland Weeds (Sheley and Petroff 1999), The Nature Conservancy Element Stewardship Abstracts (TNC 2009). Other herbicides may be effective. Some of the herbicides may be effective only under certain conditions.

[2] Excellent control, recommended from multiple sources.

[3] Used in combination with another herbicide (tank mix)

[4] To control Sudden Oak Death, allowed under Alternative 3.

[5] Effective on small or new infestations (manual/mechanical methods kill plants) but not feasible on larger or more established infestations.

[6] Infestations require repeat visits for effective control –Manual/mechanical kill most plants, sprouts and germinating seeds require additional treatment. For larger infestations, herbicide use is recommended.

[7] Some cropping systems and fallow are effective. These techniques are not likely to be compatible with wildland management.

[8] Native and other non-invasive vegetation is included on this table because a) it is important to know what native and other non-invasive species might be collaterally damaged by particular herbicides, and b) Alternatives 4 and 5 permit the use of herbicides for the control of native and other non-invasive species under certain circumstances.

[9] The Institute of Applied Ecology found that hand pulling was the only non-herbicide control effective on meadow knapweed, although it was expensive.

References:

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The Nature Conservancy. 2009. The Nature Conservancy Element Stewardship Abstracts. Available at http://www.imapinvasives.org/GIST/ESA/index.html

Tu, M., C. Hurd, and J. M. Randall. 2001. Weed Control Methods Handbook: Tools & Techniques for Natural Areas. The Nature Conservancy, http://www.invasive.org/gist/handbook.html. June 2001.

Adjuvants Approved for Use on BLM Lands Nationally

Table A9-3. Adjuvants Approved for Use on BLM Lands Nationally as of November 2009
(This list is subject to change annually.)

Adjuvant Type	Trade Name	Manufacturer
Surfactants		
Non-ionic	Actamaster Soluble Spray Adj.	Loveland Products Inc.
Non-ionic	Actamaster Spray Adjuvant	Loveland Products Inc.
Non-ionic	Activator 90	Loveland Products Inc.
Non-ionic	Agripharm 90	Walco International
Non-ionic	Agrisolutions Preference	Agriliance, LLC.
Non-ionic	Agrisolutions Preference	Winfield Solutions, LLC
Non-ionic	Aqufact	Aqumix, Inc.
Non-ionic	Baron	Crown (Estes Incorporated)
Non-ionic	Brewer 90-10	Brewer International
Non-ionic	Cornbelt Premier 90	Van Diest Supply Co.
Non-ionic	Induce	Setre (Helena)
Non-ionic	LI-700	Loveland Products Inc.
Non-ionic	N.I.S. 80	Estes Incorporated
Non-ionic	Optima	Helena
Non-ionic	R-900	Wilbur-Ellis
Non-ionic	Red River 90	Red River Specialties, Inc.
Non-ionic	Spec 90/10	Helena
Non-ionic	Spray Activator 85	Van Diest Supply Co.
Non-ionic	Spreader 90	Loveland Products Inc.
Non-ionic	Super Spread 7000	Wilbur-Ellis
Non-ionic	Super Spread 90	Wilbur-Ellis
Non-ionic	UAP Surfactant 80/20	Loveland Products Inc.
Non-ionic	X-77	Loveland Products Inc.
Spreader/Sticker	Agri-Trend Spreader	Agri-Trend
Spreader/Sticker	Attach	Loveland Products Inc.
Spreader/Sticker	Bind-It	Estes Incorporated
Spreader/Sticker	Bond	Loveland Products Inc.
Spreader/Sticker	Cohere	Helena

Adjuvant Type	Trade Name	Manufacturer
Spreader/Sticker	CWC 90	CWC Chemical, Inc.
Spreader/Sticker	Insist 90	Wilbur-Ellis
Spreader/Sticker	Lastick	Setre (Helena)
Spreader/Sticker	Nu-Film-IR	Miller Chem. & Fert. Corp.
Spreader/Sticker	R-56	Wilbur-Ellis
Spreader/Sticker	Surf-King PLUS	Crown (Estes Incorporated)
Spreader/Sticker	Tactic	Loveland Products Inc.
Spreader/Sticker	TopFilm	Biosorb, Inc.
Silicone-based	Aero Dyne-Amic	Helena
Silicone-based	Bind-It MAX	Estes Incorporated
Silicone-based	Dyne-Amic	Helena
Silicone-based	Freeway	Loveland Products Inc.
Silicone-based	Kinetic	Setre (Helena)
Silicone-based	Phase	Loveland Products Inc.
Silicone-based	Phase II	Loveland Products Inc.
Silicone-based	SilEnergy	Brewer International
Silicone-based	Silnet 200	Brewer International
Silicone-based	Silwet L-77	Loveland Products Inc.
Silicone-based	Sun Spreader	Red River Specialties, Inc.
Silicone-based	Sylgard 309	Wilbur-Ellis
Silicone-based	Syl-Tac	Wilbur-Ellis
Silicone-based	Thoroughbred	Estes Incorporated
Oil-based		
Crop Oil Concentrate	Agri-Dex	Helena
Crop Oil Concentrate	Brewer 83-17	Brewer International
Crop Oil Concentrate	Crop Oil Concentrate	Helena
Crop Oil Concentrate	Crop Oil Concentrate	Loveland Products Inc.
Crop Oil Concentrate	Herbimax	Loveland Products Inc.
Crop Oil Concentrate	Majestic	Crown (Estes Incorporated)
Crop Oil Concentrate	Mor-Act	Wilbur-Ellis
Crop Oil Concentrate	R.O.C. Rigo Oil Conc.	Wilbur-Ellis
Crop Oil Concentrate	Red River Forestry Oil	Red River Specialties, Inc.
Methylated Seed Oil	Hasten	Wilbur-Ellis
Methylated Seed Oil	Methylated Spray Oil Conc.	Helena
Methylated Seed Oil	MSO Concentrate	Loveland Products Inc.
Methylated Seed Oil	Red River Supreme	Red River Specialties, Inc.
Methylated Seed Oil	Sun Wet	Brewer International
Methylated Seed Oil	Sunburn	Red River Specialties, Inc.
Methylated Seed Oil	SunEnergy	Brewer International
Methylated Seed Oil	Sunset	Red River Specialties, Inc.
Methylated Seed Oil	Super Spread MSO	Wilbur-Ellis
Methylated Seed Oil + Organosilicone	Inergy	Crown (Estes Incorporated)
Vegetable Oil	Amigo	Loveland Products Inc.
Vegetable Oil	Competitor	Wilbur-Ellis
Vegetable Oil	Noble	Estes Incorporated
Fertilizer-based		
Nitrogen-based	Bronc	Wilbur-Ellis
Nitrogen-based	Bronc Max	Wilbur-Ellis
Nitrogen-based	Bronc Max EDT	Wilbur-Ellis
Nitrogen-based	Bronc Plus Dry EDT	Wilbur-Ellis

Adjuvant Type	Trade Name	Manufacturer
Nitrogen-based	Bronc Total	Wilbur-Ellis
Nitrogen-based	Cayuse Plus	Wilbur-Ellis
Nitrogen-based	Dispatch	Loveland Products Inc.
Nitrogen-based	Dispatch 111	Loveland Products Inc.
Nitrogen-based	Dispatch 2N	Loveland Products Inc.
Nitrogen-based	Dispatch AMS	Loveland Products Inc.
Nitrogen-based	Flame	Loveland Products Inc.
Nitrogen-based	Quest	Setre (Helena)
Special Purpose or Utility		
Buffering Agent	Buffers P.S.	Helena
Buffering Agent	Oblique	Red River Specialties, Inc.
Buffering Agent	Spray-Aide	Miller Chem. & Fert. Corp.
Buffering Agent	Tri-Fol	Wilbur-Ellis
Colorants	BullsEye	Milliken Chemical
Colorants	Hi-Light	Becker-Underwood
Colorants	Hi-Light WSP	Becker-Underwood
Colorants	Marker Dye	Loveland Products Inc.
Colorants	Signal	Precision
Compatibility/ Suspension Agent	Blendex VHC	Setre (Helena)
Compatibility/ Suspension Agent	E Z MIX	Loveland Products Inc.
Compatibility/ Suspension Agent	Support	Loveland Products Inc.
Deposition Aid	Agripharm Drift Control	Walco International
Deposition Aid	Bivert	Wilbur-Ellis
Deposition Aid	Compadre	Loveland Products Inc.
Deposition Aid	Coverage G-20	Wilbur-Ellis
Deposition Aid	CWC Sharpshooter	CWC Chemical, Inc.
Deposition Aid	Cygnet Plus	Brewer International
Deposition Aid	EDT Concentrate	Wilbur-Ellis
Deposition Aid	Intac Plus	Loveland Products Inc.
Deposition Aid	Liberate	Loveland Products Inc.
Deposition Aid	Mist-Control	Miller Chem. & Fert. Corp.
Deposition Aid	Pointblank	Helena
Deposition Aid	Poly Control 2	Brewer International
Deposition Aid	ProMate Impel	Helena
Deposition Aid	Reign	Loveland Products Inc.
Deposition Aid	Secure Ultra	Red River Specialties, Inc.
Deposition Aid	Sta Put	Setre (Helena)
Deposition Aid	Strike Zone DF	Helena
Deposition Aid	Weather Gard	Loveland Products Inc.
Defoaming Agent	Cornbelt Defoamer	Van Diest Supply Co
Defoaming Agent	Defoamer	Brewer International
Defoaming Agent	Fighter-F 10	Loveland Products Inc.
Defoaming Agent	Fighter-F Dry	Loveland Products Inc.
Defoaming Agent	Foam Buster	Setre (Helena)
Defoaming Agent	Foam Fighter	Miller Chem. & Fert. Corp.
Defoaming Agent	No Foam	Wilbur-Ellis
Diluent/Deposition Agent	Hy-Grade EC	CWC Chemical, Inc
Diluent/Deposition Agent	Hy-Grade I	CWC Chemical, Inc
Diluent/Deposition Agent	Improved JLB Oil Plus	Brewer International
Diluent/Deposition Agent	JLB Oil Plus	Brewer International

Adjuvant Type	Trade Name	Manufacturer
Diluent/Deposition Agent	Red River Basal Oil	Red River Specialties, Inc.
Foam Marker	Align	Helena
Foam Marker	R-160	Wilbur-Ellis
Invert Emulsion Agent	Redi-vert II	Wilbur-Ellis
Tank Cleaner	All Clear	Loveland Products Inc.
Tank Cleaner	Cornbelt Tank-Aid	Van Diest Supply Co.
Tank Cleaner	Kutter	Wilbur-Ellis
Tank Cleaner	Neutral-Clean	Wilbur-Ellis
Tank Cleaner	Tank and Equipment Cleaner	Loveland Products Inc.
Tank Cleaner	Wipe Out	Helena
Water Conditioning	Blendmaster	Loveland Products Inc.
Water Conditioning	Choice	Loveland Products Inc.
Water Conditioning	Choice Weather Master	Loveland Products Inc.
Water Conditioning	Choice Xtra	Loveland Products Inc.
Water Conditioning	Cut-Rate	Wilbur-Ellis
Water Conditioning	Rush	Crown (Estes Incorporated)

Individual Herbicide Summaries

The following information about each of the 18 herbicides has been compiled for reference from information within the EIS. More information, including comparisons with other herbicides, can be found at the following locations:

- Examples of product names used on BLM lands can be found in this Appendix (Appendix 9);
- Species that an herbicide is effective on is contained in Appendix 7;
- Estimated Annual Treatment Acres is from Table 3-3 (Chapter 3);
- Selected Risk Categories includes data from Table 3-12 through 3-21 (Chapter 3), which summarizes the Risk Assessment information in (uncirculated) Appendix 8. H (High), M (Moderate), L (Low), and 0 (no risk) risk categories are defined in the Chapter 3 tables;
- Leaching, persistence and half-life information can be found in:
    - Table 3-1 (*The 18 Herbicides* section in Chapter 3)
    - Table 4-14 (*Soil Resources* section in Chapter 4)
    - Table 4-17 (*Water Resources* section in Chapter 4)
    - Table 4-20 (*Wetlands and Riparian Areas* section);
- PEIS Mitigation Measures and Standard Operating Procedures can be found in Appendix 2; and,
- All other information can be found in the *The 18 Herbicides* section in Chapter 3.

2,4-D

2,4-D is a post emergent foliar applied herbicide that is selective to broadleaf plants.

Species that it is effective on: 2,4-D is effective on about half of the Oregon-listed noxious weeds (see Table A9-2).

Examples of Product Names used on BLM lands: Many (see Table A9-1).
Commercial formulations with other active ingredients: Many. Commercial formulations currently available to the BLM include mixtures with clopyralid, dicamba, glyphosate, metsulfuron methyl, picloram, and triclopyr.

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds			
Alternative 2 (No Action) total	**6,700**	**1,800**	**8,500**
Invasive Plants and Pests and Diseases			
Alternative 3 total	**1,900**	**2,100**	**4,000**
ROWs, Admin, Recreation Sites	700	200	900
Habitat Improvement	600	100	700
Alternative 4 (Proposed Action) total	**3,100**	**2,300**	**5,400**
Additional allowed under Alt 5	2,100	100	2,200
Alternative 5 total	**5,200**	**2,300**	**7,500**

Annual Application Rates
(lbs/acre)
Typical: 1
Maximum: 1.9
(*PEIS Mitigation Measures limit 2,4-D to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? 2,4-D is effective on a wide range of broadleaf weeds while protecting most grasses. While having additional herbicides available can allow for more target specific control, having one herbicide that controls a vast range of vegetation could reduce operator error that can occur while mixing and applying herbicides. The Oregon BLM has used 2,4-D without incident to human health for 23 years. In addition, adding a small amount of 2,4-D to a tank mix can improve the effectiveness of the other herbicides and reduce the likelihood of weed resistance. Additional information about 2,4-D can be found in Appendix 12. 2,4-D is available under the No Action Alternative (Alternative 2); use of 2,4-D drops statewide under all of the action alternatives.

Registered for use:

Rangeland	Forestland	Riparian & Aquatic
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	H	0	0	L	L	M	L	M	0
Maximum	H	0	0	M	L	M	M	M	0

	Small mammal			**Bird**		**Fish**	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	L	0	L	0	M	0
Maximum	L	L	0	L	0	M	0

Leaching, Persistence, and Half-life

K_{oc}	Solubility	SPISP II Rating – Leaching Potential: PLP Leaching	SPISP II Rating – Leaching Potential: PSRP Solution Runoff	SPISP II Rating – Leaching Potential: PARP Adsorbed Particle Runoff	Persistence: Water	Persistence: Soils	Half life in soils (days): Aerobic	Half life in soils (days): Anaerobic
20-100	33,900	Intermediate	Intermediate	Low	Moderate	Low	10	333

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide

- Minimize the size of application areas, where practical, when applying 2,4-D to limit impacts to wildlife, particularly through contamination of food items. (*MM*)
- Do not apply 2,4-D across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications of 2,4-D in order to reduce potential impacts to wild horses and burros. (*MM*)
- Do not apply 2,4-D in HMAs during the peak foaling season (March through June, and especially in May and June). (*MM*)
- Do not exceed the typical application rate when applying 2,4-D in known traditional use areas. (*MM*)
- Use the typical application rate, where feasible, when applying 2,4-D to reduce risk to workers and the public. (*MM*)

Bromacil

Bromacil is pre and post emergent soil applied herbicide that is not selective.

Species that it is effective on: spiny Cocklebur, Johnsongrass, Quackgrass, Syrian bean-caper, Horehound. *Used for bare ground*

Examples of Product Names used on BLM lands: Hyvar X and Hyvar XL
Commercial formulations with other active ingredients: Bromacil + Diuron is sold as Kroval I DF, Weed Blast Res., Weed Cont., DiBro 2+2, DiBro 4+2, and Weed Blast 4G

Species that it is effective on: spiny Cocklebur, Johnsongrass, Quackgrass, Syrian bean-caper, Horehound. *Used for bare ground*

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds			
Alternative 2 (No Action) total	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases			
Alternative 3 total	**NA**	**NA**	**NA**
ROWs, Admin, Recreation Sites	700	**NA**	700
Habitat Improvement	0		0
Alternative 4 (Proposed Action) total	**900**		**900**
Additional allowed under Alt 5	0	100	100
Alternative 5 total	**900**	**100**	**1,000**

Annual Application Rates
(lbs/acre)
Typical: 4
Maximum: 12
(*PEIS Mitigation Measures limit bromacil to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? Bromacil, like diuron, is a non-selective herbicide that kills all vegetation. The primary use for bromacil would be in communications sites such as cell phone, radio, television tower sites, electrical substations, or similar facilities where complete vegetation control is desired to reduce fire risk and maintenance costs.

Registered for use:

~~Rangeland~~	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	H	M	0	NE	NE	S, R, C	0	0	NE
Maximum	H	M	0	H	NE	NE	S, R	0	NE

	Small mammal			**Bird**		**Fish**	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	L	L	0	L	M	NE

Leaching, Persistence, and Half-life

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
32	700	High	High	Intermediate	Moderate	Moderate / High	60-240	144-198

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Minimize the use of bromacil in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. (*MM*)
- Minimize the size of application areas, where practical, when applying bromacil to limit impacts to wildlife, particularly through contamination of food items. (*MM*)
- Do not apply bromacil in rangelands, and use appropriate buffer zones (Tables A2-1 and 2) to limit contamination of off-site vegetation, which may serve as forage for wildlife. (*MM*)
- Do not apply bromacil across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Do not apply bromacil in rangelands, and use appropriate buffer zones (Tables A2-1 and 2) to limit contamination of off-site vegetation, which may serve as forage for wildlife. (*MM*)
- Consider the size of the application area when making applications of bromacil in order to reduce potential impacts to wild horses and burros. (*MM*)
- Do not apply bromacil in grazing lands within herd management areas (HMAs), and use appropriate buffer zones identified in Tables A2-1 and 2 to limit contamination of vegetation in off-site foraging areas. (*MM*)
- Do not apply bromacil in HMAs during the peak foaling season (March through June, and especially in May and June) (*MM*)
- Do not exceed the typical application rate when applying bromacil in known traditional use areas. (*MM*)
- Avoid applying bromacil or tebuthiuron aerially in known traditional use areas. (*MM*)
- Use the typical application rate, where feasible, when applying bromacil to reduce risk to workers and the public. (*MM*)
- Avoid applying bromacil aerially. (*MM*)

Chlorsulfuron

Chlorsulfuron is a pre and early post emergent soil and foliar applied herbicide that is selective to broadleaf plants. It is effective on Common bugloss, Dyers woad, Giant Horsetail, Houndstongue, Oblong spurge, Paterson's curse, Perennial pepperweed, Puncturevine, Leafy Spurge, Myrtle Spurge, Syrian bean-caper, cutleaf Teasel, Bull Thistle, Canada Thistle, Milk Thistle, Plumeless Thistle, Scotch Thistle, Dalmation Toadflax, Yellow Toadflax, Whitetop (Hoary cress), Lens-podded whitetop, Hairy Whitetop, Common or Wooly mullein, Feverfew, Field mustard, Paterson's curse, Purple foxglove, Spreading hedge-parsley, Common Tansy, common Teasel, Thistle, wavyleaf, Wild carrot, and Yellow glandweed

Examples of Product Names used on BLM lands: Telar DF and Telar XP.
Commercial formulations with other active ingredients: Metsulfuron methyl + Chlorsulfuron is sold as Cimarron Extra and Cimarron Plus; Sulfometuron methyl + Chlorsulfuron is sold as Landmark XP.

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	**NA**	**NA**	**NA**
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**3,300**	**NA**	**3,300**
Alternative 3 total			
ROWs, Admin, Recreation Sites	900	**NA**	900
Habitat Improvement	0		0
Alternative 4 (Proposed Action) total	**4,100**		**4,100**
Additional allowed under Alt 5	0	100	100
Alternative 5 total	**4,100**	**100**	**4,200**

Annual Application Rates
(lbs/acre)
Typical: 0.047
Maximum: 0.141

Why is the Oregon BLM considering the use of this herbicide?
Chlorsulfuron is an ALS-inhibitor that is effective against grasses and broadleaf plants such as whitetop, perennial pepperweed, Mediterranean sage, and thistles. It is often mixed with 2,4-D to reduce the likelihood of developing plant resistance and to produces more immediately visible results. It can also be used on toadflax and knapweeds.

Registered for use:

Rangeland	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	H	M	0	NE	NE	0	0	0	0
Maximum	H	M	0	H	NE	0	L	0	0

	Small mammal			**Bird**		**Fish**	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	0	0	0	0	NE

Leaching, Persistence, and Half-life

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
40	7,000	High	High	Intermediate	Moderate	Moderate	40	109-263

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Limit the aerial application of chlorsulfuron to areas with difficult land access, where no other means of application are possible. (*MM*)
- Limit application of chlorsulfuron via ground broadcast applications at the maximum application rate. (*MM*)

Clopyralid

Clopyralid is a post emergent foliar applied herbicide that is selective to broadleaf plants.

Species that it is effective on: Many (see Table A9-2).

Examples of Product Names used on BLM lands: Spur, Pyramid R&P, Clopyralid 3, Stinger, and Transline.
Commercial formulations with other active ingredients: Clopyralid + 2,4-D is sold as Curtail and Commando. Triclopyr + Clopyralid is sold as Redeem R&P.

Species that it is effective on: Many.

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	**NA**	**NA**	**NA**
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**1,400**	**300**	**1,700**
Alternative 3 total			
ROWs, Admin, Recreation Sites	700	0	700
Habitat Improvement	0	100	100
Alternative 4 (Proposed Action) total	**2,000**	**300**	**2,300**
Additional allowed under Alt 5	0	0	0
Alternative 5 total	**2,000**	**300**	**2,300**

Annual Application Rates
(lbs/acre)
Typical: 0.35
Maximum: 0.5

Why is the Oregon BLM considering the use of this herbicide? Clopyralid would target many of the same species as picloram, but is more selective. It is effective on knapweeds and Canada thistle, while minimizing risk to surrounding desirable brush, grass, and trees.

Registered for use:

Rangeland	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes	Worker			Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	0	0	0	H	0	0	0	0	0
Maximum	L	0	0	H	0	0	0	0	0

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	L	0	L	0	M	0
Maximum	0	L	0	L	0	M	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
2	1,000	High	Intermediate	Low	Moderate	Moderate	40	>1,000

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide: *None*

Dicamba

Dicamba is a pre and post emergent foliar applied herbicide that is selective to broadleaf and woody plants (see Table A9-2).

Examples of Product Names used on BLM lands: Dicamba DMA, Vision, Banvel, Clarity, Rifle, Banvel, Diablo, and Vanquish
Commercial formulations with other active ingredients: Dicamba + 2,4-D is sold as Outlaw, Range Star, Weedmaster, Rifle-D, KambaMaster, and Veteran 720

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**4,500**	**100**	**4,600**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**800**	**200**	**1,000**
ROWs, Admin, Recreation Sites	600	100	700
Habitat Improvement	100	0	100
Alternative 4 (Proposed Action) total	**1,400**	**200**	**1,600**
Additional allowed under Alt 5	100	0	100
Alternative 5 total	**1,400**	**200**	**1,600**

Annual Application Rates
(lbs/acre)
Typical: 0.25
Maximum: 2
(*PEIS Mitigation Measures limit 2,4-D to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide?
Dicamba has been used extensively on thistles and perennial pepperweed; in combination with 2,4-D on mustards and knapweeds; and, in combination with picloram for rush skeletonweed. Use would drop under the action alternatives, and chlorsulfuron and metsulfuron methyl would be used for many of these treatments. However, dicamba provides good burn-down right up to seed set, which extends the treatment window.

Registered for use:

Rangeland	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	H	0	0	NE	NE	0	0	0	0
Maximum	H	0	0	NE	NE	0	L	L	0

	Small mammal			**Bird**		**Fish**	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	L	0	0	0
Maximum	0	L	0	M	0	0	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
2	400,000	High	Intermediate	Low	Moderate	Low	14	>1,000

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- To minimize risks to terrestrial wildlife, do not exceed the typical application rate for applications of dicamba where feasible. (*MM*)
- Do not apply dicamba across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications of dicamba in order to reduce potential impacts to wild horses and burros. (*MM*)

Diflufenzopyr + dicamba

Diflufenzopyr + Dicamba is a post emergent soil applied herbicide that is selective to broadleaf plants

Species that it is effective on: Meadow Knapweed, Squarrose Knapweed, cutleaf Teasel, Bull Thistle, Milk Thistle, Musk Thistle, Plumeless Thistle, Garden cornflower or bachelor buttons, Malta Starthistle, common Teasel, and wavyleaf Thistle,

Examples of Product Names used on BLM lands: Overdrive, Distinct

Species that it is effective on: Meadow Knapweed, Squarrose Knapweed, cutleaf Teasel, Bull Thistle, Milk Thistle, Musk Thistle, Plumeless Thistle, Garden cornflower or bachelor buttons, Malta Starthistle, common Teasel, and wavyleaf Thistle,

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	**NA**	**NA**	**NA**
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**NA**	**NA**	**NA**
Alternative 3 total			
ROWs, Admin, Recreation Sites	NA	NA	NA
Habitat Improvement	NA	NA	NA
Alternative 4 (Proposed Action) total	**NA**	**NA**	**NA**
Additional allowed under Alt 5	NA	NA	NA
Alternative 5 total	**100**	**100**	**200**

Annual Application Rates
(lbs/acre)
Typical: 0.2625
Maximum: 0.4375 on oil, gas, and mineral sites. Maximum rate on rangeland: 0.35

Why is the Oregon BLM considering the use of this herbicide? Diflufenzopyr + Dicamba is included only in Alternative 5. It would be used for many of the same species as dicamba. It can be used in a mixture with picloram, triclopyr, and clopyralid, allowing for a reduced rate of these chemicals.

Registered for use:

Rangeland	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	M	0	0	NE	NE	NE			
Maximum	H	0	0	M	NE				

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	0	0	0	0	NE

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Minimize the size of application areas, where practical, when applying to limit impacts to wildlife, particularly through contamination of food items. (*MM*)
- Do not apply across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications in order to reduce potential impacts to wild horses and burros. (*MM*)
- Do not exceed the typical application rate in HMAs during the peak foaling season in areas where foaling is known to take place. (*MM*)

Diquat

Diquat is a post-emergent aquatic non-selective herbicide. It is effective on Brazilian or South American waterweed, Hydrilla, Parrot's feather, Eurasian Watermilfoil, Yellow floating heart, and Elodea

Examples of Product Names used on BLM lands (*see Table A9-1*): Reward

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**NA**	**NA**	**NA**
ROWs, Admin, Recreation Sites Habitat Improvement **Alternative 4 (Proposed Action) total**	**NA**	**NA**	**NA**
Additional allowed under Alt 5 **Alternative 5 total**	**100**	**100**	**200**

Annual Application Rates
(lbs/acre)
Typical: 1
Maximum: 4
(*PEIS Mitigation Measures limit diquat to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? Diquat is an aquatic herbicide that is included only in Alternative 5. Of the 18 herbicides analyzed in the PEIS, this is the only herbicide that can control giant salvinia, which has not been found in Oregon.

Areas where BLM could use:

~~Rangeland~~	~~Forestland~~	Riparian & Aquatic
~~Oil, Gas, & Minerals~~	~~Right-of-way~~	~~Recreation & Cultural~~

Selected Risk Categories:

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	H	L	NE	NE	NE	NE	L	L	NE
Maximum	H	M	NE	H	NE	NE	M	L	NE

	Small mammal			**Bird**		**Fish**	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	L	0	L	NE	NE
Maximum	0	L	M	L	H	H	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils (days)	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
1,000,000	718,000	Very Low	Low	High	High	High	1,000	>1,000

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide (see Appendix 2):

- Limit the use of diquat in water bodies that have native fish and aquatic resources. (*MM*)
- Do not aerially apply diquat directly to wetlands or riparian areas . (*MM*)
- Avoid use of diquat in riparian pasture while pasture is being used by livestock. *(SOP)*
- Do not exceed the typical application rate when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr in known traditional use areas. (*MM*)
- Limit diquat applications to areas away from high residential and traditional use areas to reduce risks to Native Americans. (*MM*)
- Use the typical application rate, where feasible, when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr to reduce risk to workers and the public. (*MM*)
- Limit diquat application to ATV, truck spraying, and boat applications to reduce risks to workers; limit diquat applications to areas away from high residential and subsistence use to reduce risks to the public. (*MM*)

Diuron

Diuron is a pre-emergent herbicide applied to the soil.

Species that it is effective on: Herb Robert Geranium, Shiny leaf Geranium, Quackgrass, Syrian bean-caper, Horehound. *Used for bare ground*

Examples of Product Names used on BLM lands: Karmex DF, Karmex XP, Karmex IWC, Direx 4L, Direx 80DF, Diuron 4L, Diuron 80 DF, Diuron 80 WDG

Commercial formulations with other active ingredients:
Tebuthiuron + Diuron sold as SpraKil SK-13 Granular and SpraKil SK-26 Granular
Imazapyr + Diuron sold as Mojave 70 EG, Sahara DG, Imazuron E-Pro, and SSI Maxim Topsite 2.5G
Bromacil + Diuron sold as Kroval I DF, Weed Blast Res. Weed Cont, DiBro 2+2, DiBro 4+2, and Weed Blast 4G

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	**NA**	**NA**	**NA**
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**NA**	**NA**	**NA**
Alternative 3 total			
ROWs, Admin, Recreation Sites	1200	100	1200
Habitat Improvement	0	0	0
Alternative 4 (Proposed Action) total	**1200**	**100**	**1300**
Additional allowed under Alt 5	0	0	0
Alternative 5 total	**1200**	**100**	**1300**

Annual Application Rates
(lbs/acre)
Typical: 6
Maximum: 20
(*PEIS Mitigation Measures limit diuron to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? The primary use for diuron would be in communications sites such as cell phone, radio, television tower sites, electrical substations, or similar facilities where no vegetation is desired. A bare ground herbicide would permit treatments of these sites every 2-3 years (see the Administrative Sites, Roads, and Rights-of-Way section in Chapter 4). It also has use as a site-preparation tool for nursery beds.

Registered for use:

~~Rangeland~~	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	M	0	0	NE	NE	S, R	S	S, R, C	NE
Maximum	H	L	0	H	NE		S, R		

	Small mammal			**Bird**		**Fish**	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	M	0	0	NE	NE
Maximum	0	L	H	L	M	H	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
480	42	Intermediate	High	Intermediate	Moderate	Moderate	90	5-100

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- To minimize risks to workers and the public, terrestrial wildlife, wild horses, burros, and livestock, do not exceed the typical application rate for applications of diuron where feasible. (*MM*)
- Avoid applying diuron aerially. (*MM*)
- Minimize the use of diuron in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. (*MM*)
- Limit the use of diuron in watersheds with characteristics suitable for potential surface runoff that have fish-bearing streams during periods when fish are in life stages most sensitive to the herbicide(s) used. (*MM*)
- Minimize the size of application areas, where practical, when applying diuron to limit impacts to wildlife, particularly through contamination of food items. (*MM*)
- Do not apply diuron in rangelands and use appropriate buffer zones (Tables A2-1 and 2) to limit contamination of off-site vegetation, which may serve as forage for wildlife. (*MM*)
- Do not apply diuron across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications of diuron in order to reduce potential impacts to wild horses and burros. (*MM*)
- Do not apply diuron in grazing lands within herd management areas (HMAs), and use appropriate buffer zones identified in Tables A2-1 and 2 to limit contamination of vegetation in off-site foraging areas. (*MM*)
- Do not apply diuron in HMAs during the peak foaling season (March through June, and especially in May and June) (*MM*)
- Evaluate diuron applications on a site-by-site basis to avoid risks to humans. There appear to be few scenarios where diuron can be applied without risk to workers. (*MM*)

Fluridone

Fluridone is a post emergent aquatic herbicide that is effective on submersed plants.

Species that it is effective on: South American waterweed, Elodea, Hydrilla, and Watermilfoil

Examples of Product Names used on BLM lands: Avast!, Sonar AS, Sonar Precision Release, and Sonar Q, and Sonar SRP

Species that it is effective on: South American waterweed, Elodea, Hydrilla, and Watermilfoil

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	NA	NA	NA
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**100**	**200**	**300**
Alternative 3 total			
ROWs, Admin, Recreation Sites	0	0	0
Habitat Improvement	0	0	0
Alternative 4 (Proposed Action) total	**100**	**200**	**300**
Additional allowed under Alt 5	0	0	0
Alternative 5 total	**100**	**200**	**300**

Annual Application Rates
(lbs/acre)
Typical: 0.15
Maximum: 1.3
(*PEIS Mitigation Measures limit fluridone to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? Fluridone is an aquatic herbicide that requires prolonged plant contact, so it can only be used on aquatic plants in still water. It would be used primarily on Brazilian waterweed, elodea, hydrilla, and watermilfoil.

Registered for use:

~~Rangeland~~	~~Forestland~~	Riparian & Aquatic
~~Oil, Gas, & Minerals~~	~~Right-of-way~~	~~Recreation & Cultural~~

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	NE	NE	NE	NE	NE	NE	0	0	NE
Maximum	NE	NE	NE	L	NE	NE	0	0	NE

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	0	0	0	M	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential: PLP Leaching	SPISP II Rating – Leaching Potential: PSRP Solution Runoff	SPISP II Rating – Leaching Potential: PARP Adsorbed Particle Runoff	Persistence: Water	Persistence: Soils	Half life in soils: Aerobic	Half life in soils: Anaerobic
1000	10	Low	Intermediate	Intermediate	Low	Low	21	4-270

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Do not exceed the typical application rate when applying fluridone in known traditional use areas. (*MM*)
- Use the typical application rate, where feasible, when applying fluridone to reduce risk to workers and the public. (*MM*)

Glyphosate

Glyphosate is a post emergent soil or foliar applied herbicide that is non-selective. It is effective on about two thirds of the State-listed noxious weeds (see Table A9-2).

Examples of Product Names used on BLM lands: Many (see Table A9-1).
Commercial formulations with other active ingredients: Glyphosate is sold in combination with 2,4-D Dicamba and Imazapic.

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**700**	**5,200**	**5,900**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**400**	**2,300**	**2,700**
ROWs, Admin, Recreation Sites	1,000	300	1,300
Habitat Improvement	100	200	300
Alternative 4 (Proposed Action) total	**1,300**	**2,700**	**4,000**
Additional allowed under Alt 5	100	100	200
Alternative 5 total	**1,300**	**2,700**	**4,000**

Annual Application Rates
(lbs/acre)
Typical: 2
Maximum: 7
(*PEIS Mitigation Measures limit 2,4-D to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? In addition to being used on broadleaf weeds and woody species, glyphosate has been used to treat medusahead in eastern Oregon. However, it is a non-selective herbicide and can harm desirable plants, so use has been limited to areas where this is an acceptable treatment. Glyphosate could be used on administrative sites, rights-of-way, and recreation sites under the Proposed Action (Alternative 4). Glyphosate and 2,4-D have been the only two aquatic herbicides available to the BLM for the past 23 years, and use would decrease as more aquatic herbicides became available.

Registered for use:

Rangeland	Forestland	Riparian & Aquatic
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	L	0	0	M	0	0	0	0	0
Maximum	M	0	0	M	0	0	0	L	0

	Small mammal			Bird		Fish	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	L	0	H	0
Maximum	0	L	0	L	0	H	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
24,000	900,000	Very Low	High	High	Moderate	Moderate	47	12-70

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Minimize potential risks to terrestrial wildlife, livestock, wild horses, and burros by applying glyphosate at the typical application rate where feasible. (*MM*)
- Where practical, limit glyphosate to spot applications in grazing land and wildlife habitat areas to avoid contamination of wildlife food items. (*MM*)
- Either avoid using glyphosate formulations containing POEA, or seek to use formulations with the least amount of POEA, to reduce risks to amphibians. (*MM*)
- Where feasible, limit glyphosate to spot applications in rangeland. (*MM*)

Hexazinone

Hexazinone is a pre and post emergent soil and foliar applied herbicide that is effective on grasses, broadleaf, and woody plants. It is effective on African rue and grasses.

Examples of Product Names used on BLM lands: Velpar ULW, Velpar L, and Velpar DF
Commercial formulations with other active ingredients: Hexazinone + Sulfometuron methyl is sold as Westar

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds			
Alternative 2 (No Action) total	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases			
Alternative 3 total	**100**	**100**	**200**
ROWs, Admin, Recreation Sites	100	200	300
Habitat Improvement	0	100	100
Alternative 4 (Proposed Action) total	**100**	**200**	**300**
Additional allowed under Alt 5	0	100	100
Alternative 5 total	**100**	**200**	**300**

Annual Application Rates
(lbs/acre)
Typical: 2
Maximum: 4
(*PEIS Mitigation Measures limit hexazinone to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? Hexazinone would be primarily used in administrative sites, utility and road rights-of-way, and along the deer exclosure fence lines at the seed orchards where vegetation must be removed to facilitate maintenance. It could also be used on African rue, a bushy invasive perennial that is toxic to people and livestock.

Registered for use:

Rangeland	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	M	0	0	H	M	0	0	0	0
Maximum	M	0	0	H	M	0	L		

	Small mammal			Bird		Fish	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	L	0	0	0
Maximum	L	0	0	L	0	L	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
54	33,000	High	High	Intermediate	High	Moderate to High	90	30-180

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- To minimize risks, do not exceed the typical application rate for applications of hexazinone where feasible. (*MM*)
- Do not exceed the typical application rate of hexazinone in HMAs during the peak foaling season in areas where foaling is known to take place. (*MM*)
- Do not exceed the typical application rate when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr in known traditional use areas. (*MM*)
- Where practical, limit hexazinone to spot applications in grazing land and wildlife habitat areas to avoid contamination of wildlife food items. (*MM*)
- Where feasible, limit glyphosate and hexazinone to spot applications in rangeland. (*MM*)
- Do not apply hexazinone with an over-the-shoulder broadcast applicator (backpack sprayer). (*MM*)

Imazapic

Imazapic is a pre and post emergent soil applied herbicide that is selective to some broadleaf plants and grasses.

Species that it is effective on: Common bugloss, Giant Hogweed, Barbed Goatgrass, Jointed Goatgrass, Ovate Goatgrass, Halogeton, Johnsongrass, Meadow Knapweed, Squarrose Knapweed, Kochia, Medusahead rye, Oblong spurge, Paterson's curse, Purple Nutsedge, Spurge, Leafy, Spurge, Myrtle Syrian bean-caper, cutleaf Teasel, Whitetop (Hoary cress), Lens-podded whitetop, Hairy Whitetop, Wild proso millet, Yellow Flag Iris, Yellow nutsedge, Annual fescues, Cereal rye, Cheatgrass, Common or Wooly mullein, Garden cornflower or bachelor buttons, Bulbed Goatgrass, Tausch's Goatgrass, Italian ryegrass, North Africa grass, Paterson's curse, Purple foxglove, Spreading hedge-parsley, tall fescue, Common Teasel, Russian Thistle, Tumbleweed or Prickly Russian thistle, and Yellow glandweed

Examples of Product Names used on BLM lands: Plateau and Panoramic 2SL
Commercial formulations with other active ingredients: Imazapic + Glyphosate is sold as Journey

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds			
Alternative 2 (No Action) total	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases			
Alternative 3 total	**11,000**	**500**	**11,500**
ROWs, Admin, Recreation Sites	400	100	500
Habitat Improvement	2,300	100	2,400
Alternative 4 (Proposed Action) total	**13,500**	**500**	**14,000**
Additional allowed under Alt 5	2,100	100	2,200
Alternative 5 total	**15,500**	**500**	**16,000**

Annual Application Rates
(lbs/acre)
Typical: 0.0313
Maximum: 0.1875

Why is the Oregon BLM considering the use of this herbicide? Imazapic, an ALS-inhibitor, is especially effective against the invasive annual grasses such as cheatgrass and medusahead, which infest more than 5 million acres in eastern Oregon. At low rates, it is selective for these grasses, leaving the perennial herbaceous species critical for restoration. The BLM does not currently have an effective method of treating these fire-prone invasive annual grasses.

Registered for use:

Rangeland	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	L	0	0	NE	NE	NE	0	NE	NE
Maximum	M	0	0	H	NE	NE	0	NE	NE

	Small mammal			**Bird**		**Fish**	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	0	0	0	0	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils (days)	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
137	2,200	High	High	Intermediate	High	Moderate	120-140	>1,000

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide: *None.*

Imazapyr

Imazapyr is a pre and post emergent soil and foliar applied herbicide that is non-selective. It is effective on many species (see Table A9-2).

Examples of Product Names used on BLM lands (*see Table A9-1*): Arsenal, Arsenal Applicators Conc., Arsenal PowerLine, Arsenal Railroad Herbicide, Chopper, Ecomazapyr 2 SL, Habitat, Imazapyr 2 SL, Imazapyr 4 SL, Imazapyr E-Pro 2 - VM & Aquatic Herbicide, Imazapyr E-Pro 2E - Site Prep & Basal, Imazapyr E-Pro 4 – Forestry, Polaris, Polaris AC, Polaris AQ, Polaris Herbicide, Polaris RR, Polaris SP, SSI Maxim Arsenal 0.5G, and Stalker

Commercial formulations with other active ingredients:

Imazapyr + Diuron is sold as Imazuron E-Pro, Mojave 70 EG, Sahara DG, and SSI Maxim Topsite 2.5G

Imazapyr + Metsulfuron methyl is sold as Lineage Clearstand and Lineage HWC

Imazapyr + Sulfometuron methyl + Metsulfuron methyl is sold as Lineage Prep

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	NA	NA	NA
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	**300**	**1,200**	**1,500**
Alternative 3 total			
ROWs, Admin, Recreation Sites	100	500	600
Habitat Improvement	600	100	700
Alternative 4 (Proposed Action) total	**1,000**	**1,600**	**2,600**
Additional allowed under Alt 5	100	100	200
Alternative 5 total	**1,100**	**1,600**	**2,700**

Annual Application Rates
(lbs/acre)
Typical: 0.45
Maximum: 1.25

Why is the Oregon BLM considering the use of this herbicide? Imazapyr is an ALS-inhibitor that is effective against brushy and woody species such as saltcedar and Russian olive. It would also be used on tanoak to control sudden oak death. At high doses, it is an effective bare ground herbicide that could be used in areas other bare ground herbicides are not registered for. It is used to treat African rue, Japanese knotweed, and leafy spurge.

Registered for use:

Rangeland	Forestland	Riparian & Aquatic
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	M	0	0	H	0	0	0	0	0
Maximum	M	0	0	H	0				

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	0	0
Maximum	0	0	0	L	0	L	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
100	>11,000	High	High	Intermediate	Moderate	Moderate to High	25-141	>500

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide: *None*

Metsulfuron methyl

Metsulfuron methyl is a post emigrant soil or foliar applied herbicide that is selective to broadleaf or woody plants. It is effective on African rue, Himalayan Blackberry, Common bugloss, Dyers woad, Field bindweed, Gorse, Halogeton, Houndstongue, Kochia, Paterson's curse, Poison hemlock, Purple loosestrife, St. Johnswort, Sulfur cinquefoil, Tansy ragwort, cutleaf Teasel, Bull Thistle, Milk Thistle, Plumeless Thistle, Thistle, Scotch, Whitetop,(Hoary cress), Lens-podded whitetop, Hairy Whitetop, Yellow Flag Iris, Black henbane, Evergreen Blackberry, Bouncing bet, Feverfew, Italian ryegrass, Paterson's curse, spotted henbit, Common Tansy, common Teasel, Russian Thistle, wavyleaf Thistle, Tree-of-heaven, Tumbleweed or Prickly Russian, thistle, Wild carrot, Conifers, Salmonberry, Tanoak, Thimble berry, Willow

Examples of Product Names used on BLM lands (*see Table A9-1*): Escort DF, Escort XP, Metsulfuron Methyl DF, MSM 60, MSM E-AG 60 EG Herbicide, MSM E-Pro 60 EG Herbicide, Patriot, and PureStand
Commercial formulations with other active ingredients:
Sulfometuron methyl + Metsulfuron methyl is sold as Oust Extra
Metsulfuron methyl + Chlorsulfuron is sold as Cimarron Extra and Cimarron Plus
Metsulfuron methyl + Dicamba + 2,4-D is sold as Cimarron MAX
Imazapyr + Metsulfuron methyl is sold as Lineage Clearstand
Imazapyr + Sulfometuron methyl + Metsulfuron methyl is sold as Lineage HWC and Lineage Prep

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds			
Alternative 2 (No Action) total	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases			
Alternative 3 total	**2000**	**500**	**2500**
ROWs, Admin, Recreation Sites	400	100	500
Habitat Improvement	100	0	100
Alternative 4 (Proposed Action) total	**2300**	**600**	**2900**
Additional allowed under Alt 5	100	0	100
Alternative 5 total	**2300**	**600**	**2900**

Annual Application Rates
(lbs/acre)
Typical: 0.03
Maximum: 0.15

Why is the Oregon BLM considering the use of this herbicide? Metsulfuron methyl has similar targets and effects as chlorsulfuron, but can cause more harm to desired meadow grasses. It could be used on perennial pepperweed, whitetop and other mustards, and blackberries. It can also be used to control conifer trees under power lines.

Registered for use:

Rangeland	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories

	Terrestrial Vegetation			Macrophytes		Worker		Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	L	0	0	H	0	0	0	0	-
Maximum	M	0	0	H	0				

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	0	0
Maximum	0	0	0	0	0	0	0

Leaching, Persistence, and Half-life

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
35	9,500	High	High	Intermediate	Moderate	Low	30	338

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide (see Appendix 2):

- Limit the aerial application of metsulfuron methyl to areas with difficult land access, where no other means of application are possible. (*MM*)

Picloram

Picloram is a pre and post emergent foliar applied herbicde that is selective to broadleaf and Woody plants. It is effective on many species (see Table A9-2).

Examples of Product Names used on BLM lands: Grazon PC, OutPost 22K, Picloram 22K, Picloram K, Tordon 22K, Tordon K, Triumph 22K, Triumph K, Trooper 22K
Commercial formulations with other active ingredients:
Picloram + 2,4-D is sold as Grazon P+D, GunSlinger, HiredHand P+D, Pathway, Picloram + D, Tordon 101 R Forestry, Tordon 101M, Tordon RTU, Trooper 101, and Trooper P + D
Picloram + 2,4-D + Dicamba is sold as Trooper Extra

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**3,600**	**200**	**3,800**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**1,100**	**400**	**1,500**
ROWs, Admin, Recreation Sites	200	100	300
Habitat Improvement	1,300	0	1,300
Alternative 4 (Proposed Action) total	**2,500**	**500**	**3,000**
Additional allowed under Alt 5	100	0	100
Alternative 5 total	**2,500**	**500**	**3,000**

Annual Application Rates
(lbs/acre)
Typical: 0.35
Maximum: 1

Why is the Oregon BLM considering the use of this herbicide? Picloram has been used on rush skeletonweed, knapweeds, toadflax, and thistles, and provides good residual control. Use would decrease under any of the action alternatives, and clopyralid, which is more selective, would likely be used instead. However, it is also effective on western juniper and could be used to improve sage grouse habitat.

Registered for use:

Rangeland	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

<table>
<tr><th rowspan="3"></th><th colspan="3">Terrestrial Vegetation</th><th colspan="2">Macrophytes</th><th colspan="2">Worker</th><th colspan="2">Public</th></tr>
<tr><td rowspan="2">Direct Spray</td><td rowspan="2">Off-site Drift Low boom</td><td rowspan="2">Surface Runoff</td><td rowspan="2">Accidental Spill</td><td rowspan="2">Chronic Exposure</td><td rowspan="2">Wearing soiled gloves</td><td rowspan="2">General Exposure Boom spray</td><td colspan="2">Consumption of Contaminated Water</td></tr>
<tr><td>Acute / Accidental</td><td>Chronic / Long-term</td></tr>
<tr><td>Typical</td><td>L</td><td>0</td><td>0</td><td>0</td><td>0</td><td rowspan="2">0</td><td rowspan="2">0</td><td>0</td><td rowspan="2">0</td></tr>
<tr><td>Maximum</td><td>M</td><td>0</td><td>0</td><td>0</td><td>0</td><td>L</td></tr>
</table>

<table>
<tr><th rowspan="3"></th><th colspan="3">Small mammal</th><th colspan="2">Bird</th><th colspan="2">Fish</th></tr>
<tr><td rowspan="2">Direct Spray</td><td colspan="2">Consumption of Contaminated vegetation</td><td colspan="2">Consumption of Contaminated vegetation</td><td rowspan="2">Accidental spill</td><td rowspan="2">Chronic exposure</td></tr>
<tr><td>Acute / Accidental</td><td>Chronic / Long-term</td><td>Acute / Accidental</td><td>Chronic / Long-term</td></tr>
<tr><td>Typical</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>L</td><td>0</td></tr>
<tr><td>Maximum</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>L</td><td>0</td></tr>
</table>

Leaching, Persistence, and Half-life:

<table>
<tr><th rowspan="2">K_{oc}</th><th rowspan="2">Solubility</th><th colspan="3">SPISP II Rating – Leaching Potential</th><th colspan="2">Persistence</th><th colspan="2">Half life in soils</th></tr>
<tr><td>PLP Leaching</td><td>PSRP Solution Runoff</td><td>PARP Adsorbed Particle Runoff</td><td>Water</td><td>Soils</td><td>Aerobic</td><td>Anaerobic</td></tr>
<tr><td>16</td><td>200,000</td><td>High</td><td>High</td><td>Intermediate</td><td>Moderate</td><td>Moderate/ High</td><td>20-300</td><td>>500</td></tr>
</table>

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Do not apply picloram across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications of picloram in order to reduce potential impacts to wild horses and burros. (*MM*)

Sulfometuron methyl

Sulfometuron methyl is a pre and post emergent soil or foliar applied herbicide that is not selective. It is effective on Bouncing bet, Bur buttercup, Field mustard, Barbed Goatgrass, Bulbed Goatgrass, Jointed Goatgrass, Ovate Goatgrass, Grasses, Johnsongrass, Reed canarygrass, and salmonberry

Examples of Product Names used on BLM lands: Oust DF, Oust XP, SFM 75, SFM E-Pro 75EG, and Spyder
Commercial formulations with other active ingredients:
Sulfometuron methyl + Chlorsulfuron sold as Landmark XP
Sulfometuron methyl + Metsulfuron methyl sold as Oust Extra
Hexazinone + Sulfometuron methyl sold as Oustar and Westar
Imazapyr + Sulfometuron methyl + Metsulfuron methyl sold as Lineage HWC an d Lineage Prep

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**400**	**100**	**500**
ROWs, Admin, Recreation Sites	500	0	500
Habitat Improvement	100	100	200
Alternative 4 (Proposed Action) total	**900**	**100**	**1,000**
Additional allowed under Alt 5	100	100	200
Alternative 5 total	**900**	**200**	**1,100**

Annual Application Rates
(lbs/acre)
Typical: 0.14
Maximum: 0.38

Why is the Oregon BLM considering the use of this herbicide? Like imazapic, sulfometuron methyl (an ALS-inhibitor) is effective against cheatgrass and medusahead. It has a shorter half-life than imazapic, which speeds restoration efforts. However, sulfometuron methyl is not applied aerially, and is not registered for use in rangeland, and a current EPA proposal would limit its use in drier areas (see Chapter 1). This would limit its use on grasses to invasive grasses occurring in woodlands and forest openings. In addition, sulfometuron methyl is effective on mustards and can harm desirable forb species. In high doses, it would be used on road rights-of-way as a bare ground herbicide.

Registered for use:

~~Rangeland~~	Forestland	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			Macrophytes		Worker		Public	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Consumption of Contaminated Water: Acute / Accidental	Consumption of Contaminated Water: Chronic / Long-term
Typical	0	0	0	NE	NE	NE	0	NE	NE
Maximum	L	0	0	H	NE				

	Small mammal			Bird		Fish	
	Direct Spray	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Consumption of Contaminated vegetation: Acute / Accidental	Consumption of Contaminated vegetation: Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	0	0	0	0	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
78	70	Intermediate	High	Low	Low	Low	20	60

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- Do not apply sulfometuron methyl aerially. (*MM*)
- Minimize the use of sulfometuron methyl in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. (*MM*)

Tebuthiuron

Tebuthiuron is a pre and post emergent soil applied herbicide that is selective to broadleaf and woody plants

Species that it is effective on: Halogeton and sagebrush

Examples of Product Names used on BLM lands: Spike 20P, Spike 80DF, and SpraKil S-5 Granules
Commercial formulations with other active ingredients: Tebuthiuron + Diuron is sold as SpraKil SK-13 Granular and SpraKil SK-26 Granular

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds	NA	NA	NA
Alternative 2 (No Action) total			
Invasive Plants and Pests and Diseases	NA	NA	NA
Alternative 3 total			
ROWs, Admin, Recreation Sites	100	NA	100
Habitat Improvement	300		300
Alternative 4 (Proposed Action) total	**300**		**300**
Additional allowed under Alt 5	500	100	600
Alternative 5 total	**800**	**100**	**900**

Annual Application Rates
(lbs/acre)
Typical: 0.5
Maximum: 4
(*PEIS Mitigation Measures limit tebuthiuron to typical application rates where feasible*)

Why is the Oregon BLM considering the use of this herbicide? Tebuthiuron would primarily be used at low rates to thin sagebrush to improve habitat for sage grouse and other species. It could also be used at high rates as a bare ground herbicide.

Registered for use:

Rangeland	~~Forestland~~	~~Riparian & Aquatic~~
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation			**Macrophytes**		**Worker**		**Public**	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	M	0	0	NE	NE	NE	0	R	NE
Maximum	H	0	0	H	NE	SR	SR		

	Small mammal			**Bird**		**Fish**	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	0	0	0	0	0	NE	NE
Maximum	0	0	L	0	0	L	NE

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
80	2,500	High	High	Intermediate	High	High	360	unknown

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- To minimize risks to the public and workers, terrestrial wildlife, livestock, wild horses, and burros, do not exceed the typical application rate, where feasible. (*MM*)
- Do not exceed the typical application rate when applying in known traditional use areas. (*MM*)
- Avoid applying tebuthiuron aerially in known traditional use areas. (*MM*)

Triclopyr

Triclopyr is a post emergent foliar applied herbicide that is selective to broadleaf and woody plants. It is effective on many species (see Table A9-2).

<u>Examples of Product Names used on BLM lands:</u> Triclopyr 4EC, Element 3A, Element 4, Forestry Garlon XRT, Garlon 3A, Garlon 4, Garlon 4 Ultra, Remedy Ultra, Pathfinder II, Tahoe 3A, Tahoe 3A, Tahoe 4E, Renovate 3, Renovate OTF, Ecotriclopyr 3 SL, and Triclopyr 3 SL
<u>Commercial formulations with other active ingredients:</u> Triclopyr + 2,4-D is sold as Crossbow; Triclopyr + Clopyralid is sold as Redeem R&P

Estimated Annual Treatment Acres	East of the Cascades	West of the Cascades	Total
Noxious Weeds **Alternative 2 (No Action) total**	**NA**	**NA**	**NA**
Invasive Plants and Pests and Diseases **Alternative 3 total**	**700**	**1,500**	**2,200**
ROWs, Admin, Recreation Sites	600	800	1,400
Habitat Improvement	700	100	800
Alternative 4 (Proposed Action) total	**1,900**	**2,200**	**4,100**
Additional allowed under Alt 5	300	100	400
Alternative 5 total	**2,200**	**2,300**	**4,500**

<u>Annual Application Rates</u>
(lbs/acre)
Typical: 1
Maximum: 10
(*PEIS Mitigation Measures limit triclopyr to typical application rates where feasible*)

<u>Why is the Oregon BLM considering the use of this herbicide?</u> Triclopyr is effective on woody plants, and would be used on saltcedar, Russian olive, blackberries, brooms, and other shrubs. It is the preferred treatment for purple loosestrife, and could be used to control woody species in recreation sites.

Registered for use:

Rangeland	Forestland	Riparian & Aquatic
Oil, Gas, & Minerals	Right-of-way	Recreation & Cultural

Selected Risk Categories:

	Terrestrial Vegetation (Susceptible)			**Macrophytes (Susceptible)**		**Worker**		**Public**	
								Consumption of Contaminated Water	
	Direct Spray	Off-site Drift Low boom	Surface Runoff	Accidental Spill	Chronic Exposure	Wearing soiled gloves	General Exposure Boom spray	Acute / Accidental	Chronic / Long-term
Typical	H	L	M	H	0	0	0	0	0
Maximum	H	M	H	H	L	L	L	L	0

	Small mammal			**Bird**		**Fish**	
		Consumption of Contaminated vegetation		Consumption of Contaminated vegetation			
	Direct Spray	Acute / Accidental	Chronic / Long-term	Acute / Accidental	Chronic / Long-term	Accidental spill	Chronic exposure
Typical	L	0	0	L	L	NE	0
Maximum	M	0	0	M	M	NE	0

Leaching, Persistence, and Half-life:

K_{oc}	Solubility	SPISP II Rating – Leaching Potential			Persistence		Half life in soils	
		PLP Leaching	PSRP Solution Runoff	PARP Adsorbed Particle Runoff	Water	Soils	Aerobic	Anaerobic
20 (salt) 780 (ester)	435	High	High	Intermediate	Moderate	Moderate	46	<1

PEIS Mitigation Measures and Standard Operating Procedures specific to this herbicide:

- To minimize risks to workers and the public, terrestrial wildlife, livestock, wild horses, and burros do not exceed the typical application rate, where feasible, for applications of triclopyr. (*MM*)
- Do not apply triclopyr across large application areas, where feasible, to limit impacts to livestock, particularly through contamination of food items. (*MM*)
- Consider the size of the application area when making applications of triclopyr in order to reduce potential impacts to wild horses and burros. (*MM*)

Appendix 10 - Response to Public Comments on the September 2009 Draft EIS

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Response to Public Comments on the September 2009 Draft EIS

Introduction

The public comment period for the *Vegetation Treatments using Herbicides on BLM Lands in Oregon Draft Environmental Impact Statement* (Draft EIS) began on October 2 and ran through December 1, 2009. Agencies, officials, and the public were invited to comment of the Draft EIS. During the 60-day public comment period, 803 communications were received in the form of letters, postcards, and emails (collectively referred to as letters). The BLM continued to accept and process letters received between December 2 and the completion of public comment analysis on January 6, 2010. During this time, the BLM processed an additional 240 letters.

Letters were received from a variety of interests including individuals, organizations (including watershed councils), businesses, and Federal, State, and local (including soil and water conservation districts) government agencies. Letters were received from 10 of the 50 states, as well as from India, but the majority of letters originated from Oregon. The letters are part of the public record on the EIS and are available for public inspection. Individuals or organizations who submitted comment letters (including form letters) have been added to the EIS distribution list, and will receive, unless otherwise requested, a CD-ROM containing the Final EIS.

All of the letters received between October 2, 2009 and January 6, 2010 were processed by a public comment coding team who identified over 500 substantive comments and passed them along to the EIS resource specialist for consideration and response. Resource specialists created comment statements, responses, and made resultant corrections or additions to the Final EIS. Comment statements are summary statements that identify and describe specific concerns with the analysis or the alternatives considered. Unique concerns generated their own comment statement and similar concerns voiced in multiple letters were grouped into one comment statement (40 C.F.R. 1503.4(b)). Letters were not treated as votes; all letters were treated equally and were not given weight by the number received, organizational affiliation, or other status of the respondents. All substantive comments have responses presented in this appendix, and many resulted in improvements to the analysis presented in the Final EIS. We very much appreciate the public's review and participation.

Six letters were received between January 7 and April 1, 2010. Four of these were duplicative form letters, but the remaining two letters were reviewed by the BLM. Issues identified by the authors of these letter were not included in this appendix, though several points were incorporated into the Final EIS and some of the other points had been made by previous respondents.

Organization of this Appendix

This appendix contains the comment statements and responses, organized to follow the order of the Final EIS. The comments and responses are intended to be explanatory in nature; if there are any inadvertent contradictions between this Appendix and the text in the Final EIS, the Final EIS prevails.

Letters received from Federal, State, and local governments are responded to in this Appendix, and displayed in their entirety in Appendix 11.

Summary

1. Comment: The *Summary* should include costs and benefits, or refer the reader to specific pages in the Environmental Impact Statement (EIS) where these are discussed.

Response: The Final EIS *Summary* now includes page references to the EIS for items discussed. However, there are elements of the analysis that may not be in the *Summary.* CEQ regulations at C.F.R. 1502.12 state, "Each environmental impact statement shall contain a summary which adequately and accurately summarizes the statement. The summary shall stress the major conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives). The summary will normally not exceed 15 pages."

2. Comment: There are value-laden sentences heavily biased toward the Proposed Action (Alternative 4). Using the term "some" risk trivializes both the scope and severity of potential risks while the conclusion that slowing noxious weed spread "more than compensates for the risks incurred" is totally unsubstantiated.

Response: The statement regarding "more than compensates for the risks incurred" in the *Summary* has been edited to clarify that it only applies to resource values, not to the potential for worker and public health effects. Otherwise, the statement summarizes the general conclusions in the individual resource sections in Chapter 4 that, across the range of alternatives, the spread of invasive weeds will be more likely to degrade resource values than the herbicides proposed for use.

3. Comment: The *Summary* does not indicate how long the various herbicides remain toxic in the environment.

Response: Half-lives vary depending upon whether the herbicide is exposed to sunlight, in the soil, or in water, and whether conditions are aerobic or anaerobic. In addition, degradates can be variously toxic. These subjects are addressed in the *Water Resources* and *Soil Resources* sections in Chapter 4, and do not lend themselves to easy compilation in the *Summary*. The term "toxic" is a relative term that does not represent a single point, since different herbicides can have potential effects to different portions of the environment (e.g. fish, non-target plants, or human health).

4. Comment: The *Summary* does not indicate how the health effects of herbicide use have been factored into the analysis of the cost-effectiveness of herbicide use.

Response: The EIS includes, and the *Summary* summarizes, the potential risks from both herbicides and invasive plants to human health and the environment. These discussions, particularly the effects of invasive plants on the environment, are often qualitative; the financial value of a healthy ecosystem is difficult to quantify, and no numerical comparison of environmental risk versus benefit is possible. Individual Risk Assessment Tools currently being prepared by the BLM National office for each herbicide will help site-specific plans evaluate any human and environmental health risks associated with proposed and alternative treatments. No human health effects are factored into a cost-effectiveness equation because no increase in health care or other health costs are associated with herbicide use described by the alternatives.

5. Comment: The *Summary* discussion of herbicide use along rights-of-way and recreation sites dwells on the positive without mentioning that the additional herbicides would negatively affect soil, air, water, native plants, wildlife, and humans.

Response: The *Summary* does not include such a discussion because the EIS analysis indicated that the proposed uses, with implementation of Standard Operating Procedures and PEIS Mitigation Measures, presented very little risk to the environment. However, the *Summary* has been combined with the rest of the EIS, and a reference to the *Comparison of the Effects of the Alternatives* section in Chapter 2 has been added to the *What are the Effects of the Alternatives* section in the *Summary*.

Chapter 1 – Purpose and Need

6. Comment: The *Need* and *Purposes* are so narrowly construed as to preclude consideration of the various impacts of individual herbicides, application methods, or treatment objectives as a factor in decision-making.

Response: The *Need* narrowly focuses on herbicides because other elements of weed prevention and control are currently available and being implemented to the maximum extent practicable. Twenty-five years of being limited to four herbicides, and those being only available for noxious weed control, has assured development and heavy reliance on prevention, early detection, and control using non-herbicide methods.

Regarding consideration of the individual herbicides, the alternatives are structured to display different mixes of herbicides and treatment objectives. The objectives of Alternative 3 are all included in Alternative 4 (the Proposed Action) and Alternative 5, but Alternatives 4 and 5 each add additional treatment objectives and additional herbicides. In addition, Alternative 5 permits aerial application west of the Cascades, while Alternatives 3 and 4 do not. A discussion of the potential for each herbicide to have adverse effects on each resource is included in most of the resource sections; a 2,4-D discussion has been added as Appendix 12 and additional information about the specific uses of each herbicide has been added to Chapter 3 to supplement information already included on the "Herbicide Information" table at the start of Chapter 3, Table A9-2, and elsewhere. This information will allow the decision-maker to consider individual herbicides, treatments, and region of the State, with respect to environmental risk. The *Decision to be Made* section in Chapter 1 notes the decision-maker can add or delete individual herbicides from the selected alternative in the Record of Decision.

The only area where the analysis does not describe the effects of dropping individual herbicides is in the calculation of weed spread. Table A9-2 provides information about which herbicides control which target plant, and several of the potential target plants are susceptible to only one of the available herbicides. Beyond this, the implications of dropping a single herbicide are discussed more qualitatively. The EIS did not attempt to identify the high-priority control species and then analyze the implications of excluding individual herbicides from Alternative 3 because: a) priorities will likely change over the 15-year life of the EIS; b) there is no complete inventory of all invasive plant populations, so priorities and emphasis might change with additional information; c) the needs and priorities of the Oregon Department of Agriculture, cooperators, and adjacent landowners will vary by geographic area and time; and, d) with the possible exception of 2,4-D (see Appendix 12), the estimate of future noxious weed spread rate under Alternative 3 is too gross to reveal the implications of eliminating individual herbicides. A discussion of this analysis weakness in this area has been added to the *Incomplete and Unavailable Information* section early in Chapter 4.

Within the constraints of the existing data, the BLM considered having additional alternatives between Alternative 2 (the No Action Alternative) and Alternative 3, to examine the implications of removing specific herbicides from Alternative 3. The BLM determined there would be little discernable detectable difference between such alternatives (not already made clear by the individual herbicide discussions), in part because Standard Operating Procedures, PEIS Mitigation Measures, site-specific planning, and other measures minimize the likelihood of adverse effects to resources regardless of the alternative, and in part because resultant differences in weed spread could not be reasonably estimated.

7. Comment: The *Need* and *Purposes* seem to be narrowly construed to allow for, and promote the increased use of, herbicides, rather than to effectively prevent and control the spread of invasive plants, which is more in the public interest.

Response: Chapters 1 and 2 have both been edited to clarify that the alternatives are all set in the context of the existing vegetation management program, where the prevention and early detection of noxious weeds and other invasive plants has, and will continue to have, primary emphasis. Those elements of the program are common to all alternatives, and are already authorized or assumed in existing Land and Resource Management Plans (Appendix 6) and district weed management Environmental Assessment documents.

Increases in the acres treated with herbicides under the action alternatives are predicted in part because the four herbicides currently available (and acres treated with non-herbicide methods) are not effectively controlling the spread of invasive plants.

8. Comment: The scope of the EIS is too broad; herbicide use beyond noxious weed control requires greater analysis and public input. The EIS proposes that additional herbicides would be used to, "treat any vegetation to meet safety and operation objectives in administrative sites" [including schools and parks], and to "…treat any vegetation as needed to control pests and diseases," and to, "…treat any vegetation to achieve habitat goals specified in approved Recovery Plans…" The BLM must specifically state what is covered and what is not. The scope is wide open and would allow all types of actions outside of the main intent to control high priority plants. A program of this magnitude requires a detailed analysis of environmental impacts that cannot be deferred until a later time.

Response: The EIS is not a vegetation management plan; the need to manage vegetation is well established in Land and Resource Management Plans and other plans, law, policy, existing district Environmental Assessments, and by State and National policy. The EIS also does not analyze projects. The acres in the analysis are simply annual estimates of the types of projects that would be identified and analyzed at the district level. The EIS is primarily a cumulative effects analysis of a proposal to, consistent with the PEIS selected alternative, permit the use of additional herbicides as one tool to meet existing vegetation management objectives.

Herbicide uses proposed in Alternative 3 are similar to Alternative 2 (No Action), adding relatively minor herbicide use for non-noxious invasive plants and pest and disease control to an otherwise existing program. Alternative 3 would reduce (when compared to Alternative 2) the total pounds of herbicides that would be applied and would reduce the number of acres treated annually with herbicides having a moderate public and worker health risk category (the EIS does not propose to add any herbicides in the high risk category). This portion of the analysis addresses the use of *different* herbicides in a portion of the vegetation management program that is already using herbicides. The scope of the analysis, therefore, is limited to an examination of herbicides and related effects. The potential for these herbicides to slow the spread of invasive weeds, and the environmental advantages of that slowing, are also considered.

The comment suggests that adding herbicides for rights-of-ways and other uses in Alternative 4 (Proposed Action) and Alternative 5 are a whole new program area for herbicides and warrants a more detailed analysis and program justification than presented in the EIS. The EIS suggests, however, that the uses proposed in Alternatives 4 and 5 are not so different from those suggested by Alternative 3. The BLM is already managing vegetation in these areas, and BLM cooperators are already using herbicides to meet their safety and maintenance responsibilities on adjacent lands. Most of the estimated herbicide treatment acres would replace, acre for acre, vegetation treatments that are already taking place using mowers and other non-herbicide methods. (The remainder, at least under Alternative 4 (the Proposed Action), would be for Conservation Strategy-specified, but currently undone, habitat improvements for Special Status species[1].) Herbicides would only be used for a small percentage of these currently ongoing vegetation treatments. Each of these Alternative 4 (the Proposed Action) and 5 objectives would be subject to their own site-specific Environmental Assessment or EIS analysis; district weed control Environmental Assessments would only address invasive plant control. Since this EIS examines the cumulative effects of herbicide use on BLM lands in Oregon, it is correct that it should also cover the future estimated level of these additional uses. The *Need* and *Purposes* recognize, at the programmatic scale, the BLM's obligation to manage vegetation. The alternatives correctly propose making additional tools available. The information available about risks, as well as the Standard Operating Procedures and PEIS Mitigation Measures, all comport to these additional uses. The analysis considers the nature of these uses from an herbicide effects standpoint. The resultant estimated level of use is adequate for the examination of cumulative effects, but it is not a commitment or approval for specific projects.

It should be noted that the analysis carefully separates the invasive plant control objective from the administrative sites and habitat improvement objectives, taking care not to justify one with the other (although the likelihood of some incidental invasive plant control from native vegetation roadside herbicide treatments is identified). The conclusions in most resource sections that invasive plants will cause more adverse effects than the proposed herbicides, for example, applies only to the invasive plant control portion of the proposal. Any decision to adopt the additional administrative areas and habitat improvement treatments would need to be based upon EIS-described risks and benefits specifically related to those objectives.

The *Comparison of the Effects of the Alternatives* section in Chapter 2 has been edited to more clearly separate and display the effects of invasive plant control versus the effects of the administrative sites and habitat improvement objectives added in Alternatives 4 and 5. The Record of Decision will also address these two aspects of the decision separately.

9. Comment: The 1.2 and 5 million acre figure for current noxious weed and invasive plant infestations seems purposefully alarmist when it is admitted in the small print footnotes that an undisclosed number of these acres may only contain a few invasive plants per acre.

Response: The sentence states, "About 1.2 million of the 15.7 million acres of BLM lands in Oregon are currently infested <u>at some level</u> with noxious weeds…" (emphasis added), and then footnotes that "some level" ranges from monocultures to a few plants per acre. Given that most invasive plants spread exponentially once they have become established, the BLM is rightfully concerned that there are noxious weeds on 1.2 million acres. While some of these acres may never become fully occupied, in part because biological controls help limit population densities of some weeds, native species and other environmental values are compromised. Other areas have become monocultures, with most or all native plants totally excluded. The five million acre figure was derived from satellite imagery, and on those acres, invasive annual grasses are dominant. A map of these acres east of the Cascades is included in the *Fire and Fuels* section in Chapter 4.

There is no estimate of net acres occupied with noxious weeds on BLM lands. One study of 21 noxious weeds in Oregon estimated that 32 million infested acres represented 6.5 million net acres or about 20 percent (Radke and Davis 2000)(see *Noxious Weeds and Other Invasive Plants* in Chapter 4). Assuming that ratio applied to BLM lands and all noxious weeds, the current 12 percent annual noxious weed spread rate would result in 1.2 million net acres, and 6 million infested acres, in about 15 years.

1 The Special Status Species Program includes species listed as Threatened or Endangered, proposed for listing, as well as Bureau Sensitive species

10. Comment: The *Purposes* do not present compelling needs for herbicide use. *Purpose* 3 fails to acknowledge natural cycles of western juniper expansion; *Purposes* 3 and 4 suggest herbicides can cure problems caused by livestock grazing, off-highway vehicles (OHVs), roading, and other invasive plant pathways; *Purpose* 5 suggests the BLM should adversely impact the environment because their neighbors are doing it; regarding *Purpose* 6, having more herbicides will not reduce wildlife effects unless the more toxic herbicides are dropped; and so forth.

Response: The *Purpose* statements are not required to present a compelling need. The statements are broad management objectives or issues that the *Need* and scoping comments identified as desirable, and thus are extensions or clarifications of the *Need*. The general discussions under each *Purpose*, however, are suppositions for how the alternatives might help. Whether or not the alternatives *actually* help meet the *Purposes* and whether adverse effects result from the process, are the subject of the analysis in Chapter 4. Thus, the truth, significance, and importance of the discussion under each *Purpose* is to be confirmed or rejected by the subsequent analysis in the remainder of the document. The decision-maker will determine which alternative best meets the *Need* and *Purposes* by examining the analysis described in Chapters 2 and 4.

11. Comment: Regarding *Purpose* 2, there is no compelling need to spray native vegetation with herbicides. Spraying along roads and within recreation sites will expose my family to herbicides.

Response: The *Purposes* represent issues or subdivisions of the *Need* for analysis purposes. The analysis in Chapter 4 (and summarized in Chapter 2) will be used by the decision-maker to determine the degree to which this and other *Purposes* are met, including *Purpose* 6, "prevent herbicide control treatments from having unacceptable adverse effects to applicators and the public,…" Reasons for using herbicides in these areas include: control of invasive plants too small to be detected by invasive plant control crews; control of native plants injurious or fatal to recreation site users like poison oak and water hemlock; cost savings of about $1 million per year that could be transferred to other maintenance budgets or returned to utility subscribers; fire protection around communication sites, transmission poles, and other improvements; reduced worker injury from non-herbicide methods – particularly those from chainsaw use on steep slopes under power lines; and, reduced site-disturbance. The *Human Health and Safety* section shows that herbicide applications following label and Standard Operating Procedure requirements will present an extremely low risk to public travel, recreation, and even consuming sprayed forest products like berries and mushrooms. Sprayed areas would be signed for hours to days as required by the herbicide label and Standard Operating Procedures. The decision-maker will weigh these and other points to determine whether the benefits support selection of this portion of the Proposed Action (Alternative 4).

12. Comment: What is the target species for the habitat improvement suggested by *Purpose* 3 and permitted in Alternatives 4 and 5? Many birds and amphibians are particularly susceptible to herbicides, and many animals depend upon plants to survive.

Response: Habitat improvement treatments under Alternative 4 (the Proposed Action) would be those directly accomplishing needs identified in Conservation Strategies or plans identified in Endangered Species Act recovery or delisting plans. For example, imazapic might be used to control medusahead invading the North Bank Habitat Management Area, an important habitat area near Roseburg at the core of the southern population of the recently delisted Columbian white-tailed deer. Maintenance of habitat in this area is identified in the *Post-Delisting Monitoring Plan for the Douglas County Distinct Population Segment of the Columbian White-tailed Deer* (USDI 2006d) as critical to continued recovery of the white-tailed deer. Any herbicide use would be subject to site-specific analysis that would help identify the potential for harm to other species in the area. Many of the proposed habitat improvement treatments under Alternative 5 would benefit sage grouse, and would be subject to site-specific analyses.

Proposed Action

13. Comment: The massive escalation in herbicide-affected acreage, and the sudden inclusion of up to 14 additional herbicides, means that the past policies of the BLM have failed. It is evident that the BLM is trying to remedy its past failure by sudden remedial measures.

Response: The number and acreage of invasive plants in Oregon continues to increase in all land use allocations. In general, this increase is driven by increased human mobility, international trade, increased recreational use of wildlands, and many other factors. The BLM in Oregon has been restricted to using only four herbicides since a 1984/87 court injunction. An increase in the number of herbicides, needed for some time and now proposed by this EIS, is made possible in part by the recent completion of herbicide Risk Assessments. Additionally, several of the proposed herbicides have been developed since the BLM's last (USDI 1989) EIS addressing herbicide use in Oregon.

Of the predicted 13,600-acre increase in herbicide treatments of invasive plants under the action alternatives (when compared to the No Action Alternative), 11,500 acres would be with imazapic. Almost all of this would go to controlling medusahead east of the Cascades, an invasive annual grass not well controlled by the four herbicides currently available and therefore spreading relatively unrestrained. Treatment of the remaining 2,100 additional acres generally represents opportunities for controlling invasive plants not reasonably controllable with the four herbicides currently available, or by non-herbicide methods. Examples include perennial pepperweed and saltcedar. With this acreage increase, total pounds of herbicides used for invasive plants would decrease 35 percent when compared to the No Action Alternative.

Additional herbicide acres are proposed for administrative sites and habitat improvement under Alternatives 4 and 5, but these are not related to invasive weed spread.

Alternatives to the Proposed Action

14. Comment: The EIS only fully considered alternatives that would lessen protections for BLM forests and watersheds. These would fail to meet BLM's obligations to protect Federally Listed species and provide for recovery, protect clean water, provide for recreation, and protect clean water and wildlife habitat.

Response: None of the alternatives would "lessen protections" for BLM forests and watersheds. Alternative 3 would lessen the total pounds of herbicides applied per year when compared to Alternative 2 (No Action). Alternatives 3 and 4 would decrease the average pounds per acre applied, and decrease the acres treated with high and moderate-risk herbicides, when compared to Alternative 2. The analysis relies on a large body of evidence and experience when it determines that invasive plants are adversely affecting virtually all resource values. An increase in the number of herbicides available would increase the likelihood that local managers would be able to select an herbicide that would control problem weeds while also protecting non-target resources. The analysis indicates water, fish, wildlife, and other resource values are at little risk from the herbicides, herbicide use levels, and applications examined in the EIS. The EIS, and subsequent site-specific projects, are subject to Endangered Species Act consultation.

15. Comment: There needs to be an alternative focused on prevention, particularly in view of the need to avoid adding to the anthropogenic causes of climate change.

Response: Prevention is already the BLM's first priority for invasive weed control (see *Integrated Vegetation Management* in Chapter 3). The EIS analysis does not support the position that an increase in the number of herbicides available for use would change the BLM's contribution to climate change. The *Air Quality* section in Chapter 4, for example, found the Proposed Action (Alternative 4) would result in the lowest levels of particulate matter of any alternative. Total pounds of herbicide used specifically for invasive plant control would decrease under the action alternatives when compared to Alternative 2 (No Action), and the additional herbicide use proposed for administrative sites, recreation sites, and rights-of-way would simply replace treatments currently done with non-herbicide methods. The *Implications of the Alternatives on Climate Change* section in Chapter 4 indicates plant community changes could have both positive and negative effects on climate change.

16. Comment: Effective cultural, mechanical and biological treatments should be considered in all situations and utilized when they are likely to be as effective as chemical treatments. The alternative should limit herbicide use to rare cases in small areas where absolutely no other alternative exists, or as a last resort when other options have proven to be inadequate, ineffective, or inefficient.

Response: Existing policy may not be significantly different from that suggested in the comment. The BLM's Integrated Vegetation Management policies, described in Chapter 3, require BLM to accomplish pest management through cost-effective means that pose the least risk to humans, natural and cultural resources, and to the environment. Additional information describing the BLM's treatment method selection process has been added to this section. The process strikes a balance between providing adequate tools for managing vegetation and protecting the environment, while assuring protection of the environment from those tools themselves. Non-herbicide treatment methods are not always gentler on the environment and human health.

17. Comment: If the "additional, generally newer, herbicides are more target-specific, can be used in lower doses, and are generally less likely to adversely affect non-target plants and animals than the four herbicides currently in use," why is there no alternative that would drop the current four in favor of the new ones?

Response: The statement is a general one, and use of the currently available four herbicides would decrease even under Alternative 4, where total acres and treatment objectives are substantially increased. However, because most of the newer herbicides are more target-specific, an alternative completely without the current four herbicides would effectively control fewer of the noxious weeds than the No Action Alternative (see Table A9-2).

18. Comment: Weeds are spreading at an estimated 144,000 acres per year, but the Proposed Action (Alternative 4) would only treat 58,400 acres annually (all methods). The EIS should include an alternative that treats more than 144,000 acres per year.

Response: The EIS does not fully examine the size of the Oregon BLM invasive plant control program, but considers options within current budget trend constraint. Within that budget constraint, the *Need* indicates additional or more effective tools are necessary. The only additional efficiencies known beyond those already available to the BLM in Oregon is the availability of additional herbicides. The treatment acres estimated for each alternative are estimated only for effects purposes, are limited by the current budget trends assumption, and are not goals in themselves.

An examination of the size of the overall invasive plant control program is beyond the scope of this analysis. Such an examination would need to consider the specific effects and practicality of control for specific weeds or groups of weeds. Several noxious weeds, such as Himalayan blackberry, occupy more than one million acres statewide (all ownerships). Well-established, widespread weeds are often treated in specific locations such as in critical habitats, or in newly infested areas, but remaining areas are generally treated with biological controls or not at all. While biological controls seldom eliminate a weed, they can reduce their dominance and allow restoration of some portion of normal ecosystem function. These acres are not reflected in the estimated annual treatment acres under each alternative; biological control numbers on Table 3-3 are "releases." See *Noxious Weeds and Other Invasive Plants* in Chapter 4 for additional information.

Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon

19. Comment: The National Marine Fisheries Service is examining the effects of 37 pesticides, including 2,4-D, diuron, and triclopyr BEE, on protected salmon and steelhead. The BLM states that they will stop using these chemicals when and if the Environmental Protection Agency (EPA) and/or National Marine Fisheries Service find them to be harmful. Rather than using these chemicals until they are found to be lethal or detrimental to the environment or human health, the BLM should stop using them until they have been found to be safe for fish and humans.

Response: The National Marine Fisheries Service is completing Endangered Species Act consultation on 37 pesticides the EPA determined "may affect" anadromous fish. As part of that consultation, the National Marine Fisheries Service would determine if protective measures for these fish are needed and what they would be. Their review is not expected to address other elements of the environment, nor human health. The alternatives include Standard Operating Procedures and PEIS Mitigation Measures that limit risks to non-target species (Appendix 2), and even stricter Conservation Measures near water containing Threatened, Endangered, and Proposed species (see Appendix 5). The BLM would also follow whatever protection measures result from the EPA/National Marine Fisheries Service consultation. These protection measures could include banning some or all of these pesticides, but it would be premature to assume that they would.

20. Comment: In the Northwest Coalition for Alternatives to Pesticides / National Marine Fisheries Service Settlement Agreement to Examine 37 Pesticides, the EIS states that the proposed use of 2,4-D, triclopyr BEE, and diuron is not likely to substantially contribute to anadromous fish effects. The BLM should not make this assumption before the studies are completed, and the BLM should not use any herbicides until studies are complete.

Response: The BLM has done extensive analysis to study the effects of all of the proposed herbicides, and has adopted Standard Operating Procedures and PEIS Mitigation Measures to limit effects to non-target species. These include maintaining buffer distances from bodies of water, using spot treatments, and minimizing use near fish-bearing water bodies. The BLM estimated uses would be less than 1% of the 2,4-D in the State, less than 2% of the diuron, and less than 4% of the triclopyr (*Cumulative Impacts,* Chapter 4), the analysis documented in the *Fish* section in Chapter 4 indicates the BLM is unlikely to substantially contribute to anadromous fish effects.

21. Comment: As described near the beginning of Chapter 4 in the Draft EIS, the Natural Resources Defense Council has petitioned the EPA to revoke all food and water residue tolerances and cancel all registrations for 2,4-D. The BLM should suspend any consideration of 2,4-D until the EPA has completed its review and issued final guidance on its permissible uses.

Response: The description mentioned in the comment has been moved to the end of Chapter 1, to a new section called *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon.* It is the BLM's understanding that the EPA is currently seeking comments on the Natural Resources Defense Council petition, not conducting a 2,4-D "review." The BLM is following current EPA guidance on permissible uses. The EPA completed a Reregistration Eligibility Decision of 2,4-D in 2005, and the Forest Service completed a new Risk Assessment for 2,4-D in 2006.

22. Comment: As a result of a lawsuit filed against the EPA by the Washington Toxics Coalition in 2002, a Federal judge ordered (in 2004) that “buffer zones” be placed around salmon bearing streams for the application of several pesticides including 2,4-D, diuron, and triclopyr BEE. The buffers include a 20 yard no application zone adjacent to salmon bearing waters when specific pesticides are being applied by ground methods and a 100-yard buffer during aerial applications to protect Threatened and Endangered salmon species. The stream buffers of 10, 25, and 100 feet for hand, broadcast, and aerial spray should be revised for 2,4-D, diuron, and triclopyr BEE to meet that Federal Court order.

Response: A subsection addressing this issue has been added to the *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1. The court order stems from a finding that the EPA had not completed consultation with the National Marine Fisheries Service on registration labels permitting pesticide applications near certain salmon-bearing streams. Since the original issue was consultation, the order setting larger stream buffers contains an exception for agency programs subject to National Marine Fisheries Service consultation. Because the BLM consulted with the National Marine Fisheries Service on the PEIS, is consulting on this EIS, and will consult again on site-specific projects, the herbicide use proposed in this EIS fully meets the provisions of this exception.

23. Comment: Directed by the State legislature, the Oregon Department of Environmental Quality has developed a comprehensive list of toxic pollutants related to surface waters in an attempt to protect human health and the environment. The BLM’s proposed use of herbicides runs counter to Oregon Department of Environmental Quality’s and the State Legislature’s intent to reduce such herbicide use.

Response: The Oregon Department of Environmental Quality’s list of toxic pollutants includes 118 water pollutants, including mercury, DDT, and PCBs. The list does not include any of the 18 herbicides analyzed in this EIS.

24. Comment: The Draft EIS does not discuss the draft Oregon Department of Environmental Quality Priority Toxics Focus List that indentifies diuron, glyphosate, and 2,4-D as toxics warranting analysis for reduction.

Response: A subsection discussing this issue has been added to the *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1. The draft list identifies State of Oregon program priorities for these three herbicides. All three will be analyzed for their effects to land quality as a household hazardous waste, and to water quality because they are Pesticides of Interest (see the *Water Resources* section in Chapter 4 for more information) and are on the Willamette Toxics Monitoring Program Analyte List. In addition, diuron is on the Drinking Water Source Monitoring Program Contaminant List.

The Proposed Action (Alternative 4) would reduce the use of 2,4-D and glyphosate when compared to the No Action Alterative (Alternative 2). Standard Operating Procedures and PEIS Mitigation Measures do not allow the use of diuron anywhere near water. If these herbicides were identified as toxics needing further reduction, the BLM would follow any applicable, resulting regulations for these herbicides.

25. Comment: The EPA has only just begun reviewing herbicides for endocrine disruption, so the EPA and BLM don’t really know which herbicides are endocrine disruptors..

Response: Presented with evidence that some materials could be endocrine disruptors, Congress instructed the EPA to initiate an endocrine disruptor screening program to screen pesticide chemicals and environmental contaminants for their potential to affect the endocrine systems of humans and wildlife. The EPA has identified an initial list of 67 “Tier 1” pesticides for screening, but have announced that “nothing in the approach for generating the initial list provides a basis to infer that any of the chemicals selected interfere with or are suspected to interfere with the endocrine systems of humans or other species" (EPA 2010). A discussion of this screening has been added to Chapter 1. The BLM conducted its own review of endocrine disrupting potential for the 18 herbicides addressed in this EIS (see *Potential Endocrine Disrupting Chemicals* in the *Human Health and Safety* section in Chapter 4). None of the herbicides have any mention in the literature of having endocrine disruption effects with the exception of diuron and 2,4-D, and evidence is inconclusive for these two herbicides.

Chapter 2 – The Alternatives

26. Comment: The alternatives are weighted in favor of herbicide use and are hence unfairly stacked.

Response: The BLM has a need to manage, protect, and restore vegetation. Some of this need arises from the variety of uses that take place on BLM lands, and some arises from the intrusion of invasive plants, and wildfire. The BLM is already managing vegetation in a variety of ways to meet this need, and a full range of management tools is available, authorized, and being used - with the exception of herbicides. Since all of the districts' Land and Resource Management Plans already consider and prescribe noxious weed and other vegetation management, the EIS was designed primarily to examine the cumulative effects (statewide) of making additional herbicides available as additional tools available for use on BLM lands in Oregon to meet existing management priorities.

27. Comment: The Draft EIS pretends to offer five alternatives but admits Alternatives 1 and 2 are only for comparison. In reality, the range of alternatives represented by Alternatives 3 through 5 is too narrow. There should be an alternative that eliminates the most toxic herbicides.

Response: The Draft EIS noted that only Alternatives 3, 4, and 5 would meet the *Need*. Nevertheless, the inclusion of a non-herbicide reference analysis as "Alternative 1" was confusing. The Final EIS keeps the analysis, but clearly labels it as a "Reference Analysis." It is included to help provide a baseline from which herbicide and weed spread effects can be measured or described. The other alternatives retain their Alternatives 2, 3, 4, and 5 Draft EIS designations to avoid confusion between alternatives in the Draft and Final EIS. The No Action Alternative (Alternative 2) is required by National Environmental Policy Act (NEPA) regulations.

This EIS tiers to, and incorporates the analysis in, the 2007 PEIS, which examined several other alternatives. In this EIS, an action alternative that allowed for fewer than 11 herbicides was not developed because the Standard Operating Procedures, PEIS Mitigation Measures, site-specific planning, and other requirements address concerns about the toxicity of individual herbicides proposed in Alternative 3. A shorter list of herbicides available would be less likely to meet the need for action, but would not result in less harmful herbicide exposure. However, the decision-maker could decide to remove one or more herbicide active ingredients in the final decision as explained in the *Decision to be Made* section in Chapter 1.

28. Comment: In the description of Alternatives in Chapter 2 of the Draft EIS, the no herbicides alternative is discounted with no analysis or explanation.

Response: Since every element of Alternative 1 is currently available to, and being used by, the BLM in Oregon now as part of the current direction, and since the discussion of the *Need* indicates the current direction is not adequate, Alternative 1 by definition does not meet the *Need*. For this reason, it was incorrect to include it as an Action Alternative in the Draft EIS. However, since the analysis of this alternative did provide a valuable benchmark from which to measure the effects of using herbicides, even at current levels, it has been retained in the Final EIS as a "Reference Analysis." Preliminary analysis indicates if this remained an "alternative" and was selected, it would have a negative effect on the accomplishment of the *Need* and most, if not all, of the eight *Purposes*, when compared with the No Action Alternative (Alternative 2).

29. Comment: The potential success of a no herbicide alternative was underestimated because it did not consider the potential for American Reinvestment and Recovery Act (ARRA) funds to provide weed control jobs.

Response: The EIS used a current budget trends assumption. The BLM requested and received economic stimulus funds for weed control. However, it would be hard to quantify how this temporary funding increase might disproportionately affect a no herbicides alternative (the Reference Analysis in the Final EIS) because all alternatives include non-herbicide treatments. Since the weed control need exceeds the potential funding and workforce, it is likely stimulus moneys would have been used for all kinds of treatments, not as a substitute for herbicides. Stimulus funds are not long-term; recent federal budget predictions indicate BLM funding will be declining for the next three years.

30. Comment: The EIS does not acknowledge that the “no herbicides” policy used by the Eugene District, rather than failing to manage weeds, has put forth a concerted effort to employ nontoxic weed control methods already proven effective. The creation of green jobs is supposedly a high priority for the government, and manual removal of weeds is an ideal opportunity to employ rural residents in economically struggling communities.

Response: On the Eugene District, the use of both manual and mechanical control methods has been a cost effective way to get invasive plant control work done mainly because of the Secure Rural Schools Act funding, which has provided inmate and youth workforces. This funding source is not expected to continue. With a decrease of funding, treatments will need to be cost-effective. Manual and mechanical control has been successful primarily on small populations of target species and where multiple years of treatment have finally exhausted plant resources. Both mechanical and manual control work are expected to continue in selected areas on target species. Certain species or certain sizes of infestations, however, cannot be effectively controlled without the use of herbicides. The current practice of cutting or mowing these areas annually to reduce seed production, never actually eradicates the weeds. Because of that, the BLM in the Eugene area has not been able to increase control efforts beyond a set of selected sites, thus limiting the progress made on invasive plant eradication on a landscape scale. In addition, restoration efforts for critically Endangered and Threatened plant species and other susceptible habitats that are currently being invaded cannot be effectively recovered without herbicide treatments. Infestations of new species will require a rapid response and effective treatment, which manual and mechanical treatments may not provide.

31. Comment: What is the current policy for herbicide use on BLM lands in Oregon? Is it permissible to spray any “native vegetation,” or only vegetation that has been declared a noxious weed?

Response: With a minor exception for glyphosate use to control Sudden Oak Death in 2009-2010, and European beach grass control in Curry County 2009-2011, only 2,4-D, dicamba, picloram, and glyphosate may be used, and these may only be applied to county, State, or Federally Listed noxious weeds. Oregon State’s June 2010 list of 120 noxious weeds is shown on Table A7-1 in Appendix 7. The current policy is represented by Alternative 2 (No Action) in the EIS.

32. Comment: The EIS does not make it clear if spraying of regeneration harvest units would be allowed under any alternative, and if aerial spraying of regeneration harvests is allowed under the No Action Alternative (Alternative 2) and Alternative 5.

Response: Spraying within harvest units would be allowed, but not because they are harvest units. The herbicide uses that would be permitted under each alternative including the No Action Alternative (Alternative 2) are described in *The Alternatives* section in Chapter 2. The alternatives exclude herbicide use "specifically for livestock forage or timber production." However, noxious weed control could occur in harvest units under Alternative 2 (No Action), and invasive weed control could occur in harvest units under any of the action alternatives, either to control a new infestation or as part of a broader attempt to control an invasive plant population in a geographic area. Aerial application could be used west of the Cascades in Alternatives 2 (as it is now) and 5, but its use would be rare. These treatments would not target native plants, even if they were competing with planted trees. The first two paragraphs in the *Timber* section in Chapter 4 provides additional detail.

33. Comment: Applying six different herbicides in lakes and streams is too many.

Response: As noted in Chapter 1, Purpose 6, having more herbicides available generally increases the opportunity to control the target species while minimizing the effects to non-target plants and other organisms. Having additional herbicides registered for aquatic use available increases the likelihood of having an herbicide available that will meet specific control objectives while minimizing environmental risk. The aquatic herbicide diquat is not included in the Proposed Action (Alternative 4). Normally only one of these herbicides would be used at any given time or place. Aquatic applications normally involve considerable need and interagency planning.

34. Comment: The Draft EIS states in Chapter 1 that it "does not propose the use of herbicides specifically for commodity production such as projects to improve timber growth or livestock forage." This statement is not reflected in the rest of the EIS. Throughout the EIS, the BLM describes how vegetation affects commodities and economics, and bases the need to remove weeds on commodity production. For instance, the EIS describes how ranching and logging on lands adjacent to BLM will commercially benefit by the BLM using herbicides; how herbicides will be used to control Sudden Oak Death because the BLM needs to protect the local nursery industry, and how herbicides are needed to protect tree-plantations from undesirable weeds that "slow regeneration and tree seedling growth." There is an entire section on the environmental consequences on timber production.

In fact, everything from roadside spraying to facilitate log truck passage, to maintenance of utility rights-of-way, to cheatgrass spraying to increase cattle grazing, is aimed at greater commercial production and higher economic return. The BLM misspoke when claiming commodity production has nothing to do with their proposal to use additional herbicides.

Response: The term "commodity production" was broader than the EIS intended, and this term has been replaced with "specifically for livestock forage or timber production" to better describe the limits intended in the analysis. Herbicide use specifically for livestock forage or timber production is not included under any of the alternatives. As noted in the comment, however, herbicide uses proposed in the EIS would have economic benefits.

35. Comment: Aerial spraying west of the Cascades should be an option in all alternatives. In many cases, helicopters are actually more of a necessity west of the Cascades because of the steep terrain. Limiting vegetation treatments to ground methods on steep terrain presents both safety issues for individual ground applicators and unnecessarily high costs. Western Oregon has many remote areas away from people, population centers, and water, and the risk to humans or any resource is low to negligible. These areas would qualify for treatment with helicopters and their use should be considered on a case-by-case basis.

Helicopter application technology has advanced in the past few years allowing applications to be done with safety and precision. The use of shape files with a Satloc® navigation system and half-boom applications along streams and property lines are several recent and well-used techniques. A National Spray Drift Task Team has concluded, "With good drift management practices, drift can be practically reduced to zero."

Because helicopters can be more productive, treatments that are more effective would be realized when small "windows" of treatment opportunities exist due to weather, weed development, or other factors. Effective weed treatments would therefore reduce the need for re-treatments and reduce the overall use of herbicides. For most herbicides, including 2,4-D, potential exposure to applicators is less when applied by helicopter. Eliminating aerial application from Alternatives 3 and 4 (the Proposed Action) needlessly constrains attainment of the *Purposes* and *Need*.

Response: Aerial application is proposed to remain a tool east of the Cascades under all alternatives, and west of the Cascades in Alternatives 2 and 5. Aerial application is excluded from Alternatives 3 and 4 west of the Cascades in part because of a lack of need, and formalizing that point in the EIS simplifies the analysis and more clearly defines (for the public and the resource effects descriptions in the EIS) the range of treatments that could be expected. No districts west of the Cascades are currently using aerial methods for the control of noxious weeds, even though aerial methods are permitted under the No Action Alternative (Alternative 2). Potential needs for aerial applications under Alternatives 3 and 4 (the Proposed Action) were considered. These included the possibility of treating large expanses of invasive annual grasses in oak savannah types in the southern part of the State or in the North Bank Habitat Management Area near Roseburg; treating Portuguese broom within its relatively small infested area near Roseburg; and, treating transmission corridors, particularly those with pipelines or other improvements permitting relatively low application height. The likelihood these treatments would be proposed, and that their objectives could not be reasonably met using non-aerial methods, was small compared with the benefits of simply excluding these treatments from Alternatives 3 and 4.

36. Comment: The BLM does not currently do aerial application of the four herbicides currently used. Therefore, Alternative 2 should also prohibit aerial spraying to be a true No Action Alternative.

Response: There is currently no prohibition against aerial herbicide applications in Alternative 2. Chapter 3 *Treatment Methods* shows about seven percent of the herbicides currently used by the BLM in Oregon against noxious weeds are applied aerially, all east of the Cascades. No aerial applications have been done west of the Cascades in recent memory, but the spread of noxious weeds such as medusahead rye in oak savannah habitats could conceivably lead to such proposals. Alternatives 3 and 4 (the Proposed Action) exclude aerial application west of the Cascades.

37. Comment: Alternative 4 (the Proposed Action) should not include 2,4-D, given this herbicide's potential for adverse health effects in humans, fish, birds, invertebrates, and wildlife in general.

Response: Concerns with 2,4-D were raised during scoping and again during the public comment period on the Draft EIS. At each of these steps, the BLM has carefully considered its risks, available mitigation measures, and its potential role in meeting the *Need* to decide whether to continue to keep it in one or more of the action alternatives. A summary of information reviewed after the public comment period on the Draft EIS is included in Appendix 12. In short, reasons for keeping it in the action alternatives in the Final EIS include:

1) The districts have considerable experience with this herbicide and its effects on target and non-target vegetation, and have been using it without incident since 1987;
2) the total statewide use under the Proposed Action is projected to decrease by one-third when compared to the No Action Alternative (Alternative 2);
3) approximately half of the 2,4-D acres would be treated with ounces per acre as a part of tank mixes (although it is acknowledged the Risk Assessment does not find that this necessarily reduces risks), and;
4) 2,4-D remains an effective, selective herbicide that is often the best choice for many situations and is thus crucial for meeting the *Need*.

Site-specific herbicide selection would continue to be guided by BLM policy that requires weed control "through cost-effective means that pose the least risk to humans, natural and cultural resources, and the environment" (USDI 2007e).

For any herbicide or use, the decision-maker may modify the selected alternative to remove an herbicide or modify its use, if the environmental effects of such a change are reasonably clear. A discussion of this possibility has been added to the *Decision to be Made* section in Chapter 1. Additional information about the uses and need for each specific herbicide has been added to Appendix 9.

38. Comment: 2,4-D should not be used on public lands because it can vaporize and cause effects miles from the application site, particularly to ultra-susceptible crops like wine grapes.

Response: The *Native and Other Non-Invasive Vegetation* section in Chapter 4 has been edited to note that grapes can be ultra-susceptible to 2,4-D and can be damaged for a considerable distance downwind of application sites. This sensitivity is also mentioned on 2,4-D product labels, and would be a consideration in site-specific analysis. All of the action alternatives would result in a decrease in the use of 2,4-D when compared with the No Action Alternative (Alternative 2). Alternatives 3 and 4 (the Proposed Action) would not permit aerial applications west of the Cascades. When herbicides are used Standard Operating Procedures (Appendix 2) help protect adjacent crops by requiring the use of drift prevention measures such as: no spraying when wind is above 10 miles per hour or precipitation is imminent; use of large herbicide droplets and drift reduction agents where appropriate; use of low volatile formulations; use of low pressure equipment; use of herbicide free buffer strips where appropriate; and notification of adjacent landowners.

39. Comment: It appears Alternative 4 (the Proposed Action) would expand BLM's authority to spray all vegetation including at schools on leased BLM lands, campgrounds, and picnic areas.

Response: Yes, the Proposed Action would permit the BLM to use herbicides to meet safety and maintenance objectives along roads and around other developments including campgrounds. It would also allow holders of rights-of-way, permits, and public purpose leases (such as schools, fire stations, airports, transfer stations, and other municipal or non-profit group-owned improvements) to use herbicides to meet safety and maintenance objectives around their improvements. The BLM would not require owners of these improvements to use herbicides; Alternatives 4 and 5 would simply permit their use.

40. Comment: Alternative 4's (the Proposed Action) "recreation sites" are poorly defined. Would undesignated OHV trails be sprayed? Would BLM roads be sprayed even though there is no public access?

Response: Invasive plants might be sprayed anywhere on BLM lands under Alternatives 3 through 5, the same as noxious weeds are currently treated under the No Action Alternative (Alternative 2). Under Alternative 4 (the Proposed Action) and Alternative 5, native and other non-invasive vegetation on designated and undesignated OHV trails would not be sprayed; they are not included or inferred by the list of administrative sites, recreation sites, and rights-of-way listed for Alternative 4 (the Proposed Action) in Chapter 2. Regarding BLM roads without public access, the *Administrative Sites, Recreations Sites, and Rights-of-Way* section in Chapter 4 notes that generally only noxious weed and other invasive plant management is anticipated for non-system roads, even under Alternative 4 (the Proposed Action) and Alternative 5.

41. Comment: It is unclear if Alternative 4 (the Proposed Action) includes the ability to preventatively remove host species of the invasive pathogen Sudden Oak Death (*Phythophthora ramorum*) outside of infested sites.

Response: Alternatives 4 and 5 are additive; each includes all treatments and herbicides included in the next lower alternative. The three action alternatives would permit and anticipate herbicide treatments of native species serving as pest hosts in State-designated control areas. This includes the preventative removal of host species of Sudden Oak Death surrounding infestations. The EIS does not address specific projects however; a site-specific Environmental Assessment or EIS would be part of the site-specific decision-making regarding treatment methods.

42. Comment: Alternative 5's lack of specificity as to how and where herbicides would be used "for a fairly unspecified group of projects" (*Summary of the Major Effects of Each Alternative* in Chapter 2) is both unacceptable and probably illegal.

Response: The EIS primarily examines, at the programmatic scale, the cumulative human health and environmental effects of using additional herbicides on BLM lands in Oregon. To conduct this analysis, the BLM asked vegetation management personnel on the nine districts in Oregon to estimate, for each of the alternatives, annual herbicide use levels, treatment types, and general treatment locations for the next 15 years. Alternative 5 would permit herbicide uses for all vegetation management needs except livestock forage production and timber production. Additional uses permitted by Alternative 5 are estimated (in the EIS) to be mostly habitat improvement projects east of the Cascades, mostly involving imazapic or 2,4-D. The effects described in the EIS are based on those estimates. The BLM would periodically examine actual use to determine if the analysis in the EIS is still adequate.

The EIS does not set weed treatment priorities or approve projects. Specific treatment needs and resource protection priorities are identified in district Land and Resource Management Plans, district weed management Environmental Assessments, and other site-specific plans. Prior to any specific herbicide treatment, site-specific analyses would be conducted, with the opportunity for public comment. These site-specific analyses would identify the potential effects of specific herbicide treatments. Deferring site-specific analysis of actual herbicide treatment proposals is consistent with NEPA, since without the ability to identify, among other things, the specific location of an undetermined treatment, it is impossible to identify what the potential site-specific effects of such a project might be. Nothing in NEPA, FLPMA, or the Land and Resource Management Plans requires the BLM to propose an actual herbicide activity plan or site-specific proposals at this time; site-specific vegetation management proposals that include an herbicide component will be developed at a later date based on the alternative selected from this EIS. The acreage and herbicide application figures used for analysis purposes in this EIS were gross estimates only, made for the purposes of describing potential statewide risks and effects.

The *Summary of the Major Effects of Each Alternative* section no longer appears in Chapter 2; it has been replaced with Table 2-5, Comparison of the Effects of the Alternatives. The *Summary of the Major Effects of Each Alternative* still appears in the *Summary* however.

43. Comment: In the table "Selected Parameters for Each Alternative…," why are there no differences in the number of acres of herbicide versus non-herbicide control between Alternatives 3 through 5? Why is there no alternative examining various levels of non-herbicide control?

Response: Alternatives 3 through 5 all would permit the use of herbicides to control invasive plants. Thus, the invasive plant portion of these three alternatives is essentially the same. Alternative 4 (the Proposed Action) and Alternative 5 would *also* permit the use of herbicides for objectives outside of invasive plant control. Those additional treatment acres are shown on the same table, but on the line titled Native Plant Herbicide Annual Treatment Acres.

An examination of various levels of non-herbicide treatments is outside the scope of the analysis because such treatments are already available and being used by policy to the extent practicable. The EIS includes a no herbicide Reference Analysis ("Alternative 1" in the Draft EIS) to provide a benchmark of the implications of using no herbicides.

Alternatives Eliminated From Detailed Study

44. Comment: In order to find the most ecologically effective alternative, the BLM should fully develop and analyze all of the alternatives eliminated from detailed study, except the use of household chemicals (we know what saltlicks do to soils).

Response: The reasons for the rejection of each of these alternatives are explained for each in Chapter 2. Most are outside the scope of this analysis because the treatments they include are already permitted and being used; are legally required to be accomplished some other way; or were already analyzed in the PEIS to which this EIS tiers and which is incorporated as Appendix 1.

45. Comment: In the *Alternatives Eliminated from Detailed Study* section of Chapter 2, the EIS justifies keeping ALS-inhibiting herbicides in part by explaining they are needed for effective control of perennial pepperweed, hoary cress, and to a lesser extent, saltcedar. Just how big of a problem are these three species? What do they affect, and how seriously. What is their current extent in Oregon? What non-chemical measures can be used to control them?

Response: According to Table A7-1, these are all State-listed Category B noxious weeds, which are by definition invasive, likely to cause significant environmental or economic harm. Perennial pepperweed occupies more than 100,000 acres in the State (all ownerships), occurs in about half of Oregon counties, and is abundant in a quarter of them. The *Wetlands and Riparian Areas* section says the Warner Wetlands near Hart Mountain in Lake County, for example, is critical to nesting waterfowl and other wildlife, and is infested with perennial pepperweed. It is BLM's biggest cooperative weed control project with Oregon Department of Agriculture. Annual nesting success of ducks in this wetland has been positively correlated with the success of perennial pepperweed control. Saltcedar and perennial pepperweed are known to extract salts from deep in the soil and deposit it on the surface making the site unsuitable for native plants. Saltcedar is in the 1,000 to 10,000 acre abundance category, and is found in 11 Oregon counties, 1 abundantly. It is an efficient riparian area competitor east of the Cascades, displacing native plants and adversely affecting all riparian functions including. The *Water Resources* section says a mature saltcedar consumes as much as 800 liters of water per day, 10 to 20 times the amount used by native species it tends to replace (Cooperrider 1995). Hoary cress is in the 10,000 to 100,000 acre abundance category, and similarly overruns riparian habitats. None of these three noxious weeds can be effectively controlled without herbicides.

All of the above information is drawn from tables in Appendix 7 or 9, and from examples included in the EIS for effects comparison purposes. The EIS does not set weed treatment priorities or approve projects. Specific treatment needs and resource protection priorities are identified in district's Resource Management Plans, and in district weed management Environmental Assessments and other site-specific plans.

46. Comment: The EIS needs to evaluate the impact of eliminating or reducing the root causes of noxious weed infestations in order to prevent new infestations. Grazing, mining, logging, and vehicle use all contribute to the spread of weeds and the BLM needs to consider whether noxious weeds and other invasive plants can be better controlled by increasing the use of herbicides or decreasing these root causes.

Response: A wide variety of management activities including grazing, timber harvest, mining, and public recreation are mandated by the FLPMA, the O&C Act, and other policy and direction. These activities do contribute to the spread of weeds, and it is the role of each district's Land and Resource Management Plan to identify an appropriate mix of uses and practices consistent with land capability, long-term productivity, and ecosystem health. The potential for an activity to contribute to resource degradation (such as the spread of noxious weeds and other invasive plants) is one consideration in determining appropriate uses. An alternative proposing to reduce various management activities implicated in weed spread, and the reasons for its elimination, is included in the *Alternatives Eliminated From Detailed Study* section of Chapter 2. Such proposals are outside the scope of this EIS because a reconsideration of the mix of land uses is the specific purview of the land management planning process described in the FLPMA.

47. Comment: Using herbicides to control weeds spread by livestock grazing and timber harvest only benefits ranchers and loggers, at the expense of the public and the environment. The EIS should consider an alternative that addresses grazing, timber harvest, road construction, OHV use, prescribed fire, and other management activities implicated in the spread of invasive weeds. Decrease or modify these activities and weed spread will decline.

Response: Livestock grazing, timber harvest, OHV use, camping, hiking, wildfire control, boating, and all other activities on or near BLM lands variously contribute to the spread of invasive weeds. However, as noted in the *Background* section in Chapter 1, the FLPMA and O&C Act both specify that the BLM will provide for various land uses and outputs, and accommodate various developments for the public good. It is the role of various levels of planning, beginning with each district's Land and Resource Management Plan, to identify the appropriate mix of uses consistent with land capability, long-term productivity and ecosystem health, and compatibility with other uses. The potential for an activity to contribute to resource degradation (such as the spread of noxious weeds and other invasive plants) is one consideration in determining appropriate uses. Activity plans tiered to the Land and Resource Management Plan (such as allotment management plans) similarly consider implications on noxious weed spread. At the project scale, BLM policy requires that when a proposed management activity (such as a timber sale or road construction) has a moderate or high risk for establishing noxious weeds, BLM must prescribe follow-up monitoring as well as identify project actions that need to be taken in order to reduce or prevent the spread of noxious weeds (USDI 1992b).

The *Reduce Management Activities Implicated in Weed Spread* alternative in the *Alternatives Eliminated From Detailed Study* section of Chapter 2 addresses this issue.

48. Comment: Studies indicate that vinegar herbicides can perform as well or better than chemical herbicides (Cornell University 2008).

Response: Risk assessments are necessary to support BLM use of herbicides, even for common items like vinegar (see the *Risk Assessments* section in Chapter 3). So far, there in not enough evidence that vinegar would provide effective target species control while protecting ecosystem values. Thus, the BLM has not completed a risk assessment for vinegar used as an herbicide.

49. Comment: The EIS should include an alternative that minimizes the use of herbicides and increases the use of volunteers, inmates, and other crews using hand tools, herds of goats, and so forth. People could adopt an acre, road, or developed site and remove noxious weeds. These may be more expensive, but not when human and environmental health is considered. The jobs would benefit the economy. Without a rigorous look at these alternatives, the EIS does not satisfy NEPA.

Response: The BLM already uses volunteers and other groups to the extent they are available. However, it has been difficult to recruit volunteers for difficult jobs or remote locations. Other crews (inmates, contract crews) are used, but complete reliance involves logistical considerations that can increase costs and personnel needs over other methods. The State of Oregon added noxious weed control to its Adopt-A-Highway program in 2009. Having groups adopt popular recreation sites might be a good place to start with BLM. This kind of experimentation is already encouraged by BLM policies, and could be done using volunteer agreements. The BLM's current invasive plant control program already makes use of non-herbicide methods to the extent practical, and nothing in the Proposed Action (Alternative 4) suggests decreasing these efforts. As stated in Chapter 1, the *Need* is for more effective control measures, meaning a greater suite of herbicides available and an increase in the acres treated with herbicides annually. Issues related to herbicide use are addressed in part through Standard Operating Procedures, PEIS Mitigation Measures, and site-specific analysis.

50. Comment: The EIS should include an alternative that uses the same budget costs to create manual labor jobs.

Response: The *Implementation Costs* section in Chapter 4 shows that the Reference Analysis for no herbicide use would cost $600,000 more than the No Action Alternative (Alternative 2), while treating 3,400 fewer acres per year. The *Noxious Weeds and Other Invasive Plants* section in Chapter 4 estimates such an approach would be about half as effective at controlling treated noxious weed infestations as Alternative 2. (Increased cost estimates for Alternative 3 come in part from cooperator and other project funds that would become available if the program were more effective at controlling weeds.)

51. Comment: It is disingenuous to reject the *Increase Funding to Pay for Additional Non-Herbicide Control Treatments* Alternative because of "adverse environmental effects" associated with non-herbicide methods, or because it would require asking for more funding.

Response: The discussion under this alternative has been rewritten to explain that since the weed control need exceeds funding, expecting and using increased funding to pay for the current level of activity at an increased cost would be inappropriate. The *Need* seeks to improve the effectiveness of the current program. A current budget trends assumption for all alternatives permits a realistic comparison of their relative effectiveness at accomplishing the *Need*. Future budget increases, if any, could be applied to the selected alternatives to further reduce the spread of weeds.

52. Comment: Given that other apparently less toxic and persistent herbicides are now available for use, the BLM should include an alternative that prohibits the use of the most toxic, persistent, mobile, and non-selective herbicides, including 2,4-D, picloram, dicamba, glyphosate with POEA surfactant, triclopyr BEE, bromacil, diuron, hexazinone, and tebuthiuron. Just as the Forest Service Region 6 has dropped the use of 2,4-D and dicamba and is not even considering use of the very toxic diquat, diuron, bromacil, and tebuthiuron, so too can the BLM drop the planned use of the most toxic herbicides listed above, in addition to picloram. Based on an examination of Table A9-2, such an alternative would control most of the invasive weeds. Some of the others have commercial value (like St. John's wort), so permits could be issued for complete collection.

Response: In general, the availability of a broader range of herbicides permits selection of the one that would best accomplish the control objective while minimizing site-specific adverse effects. In addition, having more than one herbicide to control a plant helps avoid having weed populations develop resistance. Exclusion of the "most toxic" herbicides is relative; the BLM already excludes use of more than 80 other herbicides registered for use in Oregon, often *because* they are more toxic. A discussion of the uses and considerations for each herbicide has been added to the EIS in Appendix 9, and additional information about 2,4-D had been added in Appendix 12.

Regarding the Forest Service herbicides, bromacil, diuron, and tebuthiuron are included in Alternative 4 to meet developed site management or habitat improvement objectives outside of the scope of the Forest Service analysis. 2,4-D and dicamba are retained because they control many species and provide a good burn-down right up to seed-set, important qualities when a small weed control staff is covering districts larger than a million acres. Glyphosate with POEA and triclopyr BEE are more toxic to fish and certain other organisms than glyphosate without POEA or triclopyr. The risk categories shown in the EIS are for the more toxic formulations, which would not be used near water.

Collection and sale of noxious weeds is illegal in Oregon, so proposing to control those with medicinal value by colleting would not a be a valid control strategy.

53. Comment: The EIS should consider the approach described in the Restoring Native Ecosystems Alternative, which focuses on prevention and restoration. The alternative is displayed in Appendix I of the PEIS. Important parts of the alternative were deemed outside the scope and excluded from consideration in the PEIS, but it should be included in the Oregon EIS. The native ecosystems alternative meets the purpose and need better than any of the other alternatives because it avoids the causal actions that would perpetuate the 12 percent annual increase in invasive species.

Response: The Restoring Native Ecosystems Alternative displayed in PEIS Appendix I was reviewed for its applicability to the Oregon EIS *Need* and *Purposes*, in its entirety, and in parts. The 2002 policy analysis conducted by the BLM's Technology Center in Denver, Colorado (also in Appendix I) was reviewed as well, as was PEIS Alternative E, which presented some elements of the proposal. The policy analysis findings appear to be wholly applicable to the Oregon EIS; elements of the proposed alternative are either similar to existing policy, contrary to legal direction, or outside the scope of this analysis. The reasons for not selecting Alternative E at the west-wide level apply to Oregon. The Oregon EIS action alternatives fit completely within the selected PEIS Alternative in order to comply with National direction.

54. Comment: The EIS should include examination of the Natural Selection Alternative presented during scoping and previously presented to the South Deer Landscape Management Project on the Medford District. Preventative and passive vegetation management as prescribed in the Natural Selection Alternative are proactive treatments for controlling invasive species, restoring native vegetation, and reducing fire fuel density on public land. The EIS should not avoid analyzing these techniques simply because they do not meet a traditional definition of vegetation "treatments." The analysis needs to examine the Natural Selection Alternative's contribution to all ecosystem values, services, products, and uses including purification of air and water, nutrient cycling, pollination, herbs and medicinal, recreation and tourism, healthy working environment, chemical drift, cumulative effects, the eminent and lethal threat to salmon and aquatic systems, carbon sequestration, and use of fossil fuels, just to name a few.

Response: The Natural Selection Alternative, as presented by the Deer Creek Valley Natural Resource Conservation Association, was analyzed in the South Deer Landscape Management Project Environmental Analysis on the Medford District (USDI 2005g). The alternative presents itself as emphasizing natural succession and maintenance of fully stocked natural stands. Management disturbances are minimized; timber harvest comes from trees about to be naturally shaded out; and the use of prescribed natural fire is minimized. Invasions of non-native species are preempted by canopy coverage, minimal soil disturbance, and minimal prescribed or wild fire. Weed control is accomplished with physical removal, manual application of least toxic effective chemicals, and weed prevention protocols and eradication, in accordance with the Medford District's Integrated Weed Management plan and programmatic EIS. Grazing, recreation, and other potential disturbances do not appear to be specifically addressed.

The Natural Selection Alternative proposal is a land management alternative more appropriately considered in the FLPMA-required land and resource management planning process, or in project specific landscape management plans such as South Deer, and as such is outside the scope of this EIS and not responsive to its *Purpose* and *Need*. The invasive plant control portion of the Natural Selection Alternative is not significantly different from the Integrated Vegetation Management approach already used by the BLM and a part of the action alternatives, as evidenced by the Natural Selection Alternative's stated reliance on/consistency with the Medford District's Integrated Weed Management Plan. The Natural Selection Alternative emphasis on prevention is also consistent with existing BLM direction applicable to all of the action alternatives. The suggestions for how to accomplish that are outside the scope of the EIS because the EIS is not examining the full range of existing prevention and treatment options.

55. Comment: Instead of structuring the EIS to develop a range of alternatives centered around the need to intensively alter and treat still relatively intact native vegetation and spray weeds everywhere, the BLM should consider a range of alternatives that focus on restoring cheatgrass-infested lands and protecting native vegetation as much as possible. Expansion of cheatgrass pushes communities across thresholds from which natural recovery is difficult - if even possible.

Response: The BLM's vegetation management program includes restoring cheatgrass-infested lands and protecting native vegetation. Much of the acreage increase between No Action (Alternative 2) and Alternative 3 would be the use of a new herbicide, imazapic, that would effectively control cheatgrass and medusahead to facilitate restoration of the sage-forb communities on the east side of Oregon.

56. Comment: The alternatives should allow the use of herbicides for the full range of multiple uses including timber and livestock forage production. The O&C Act requires timber production. BLM policy ensures only appropriate uses would go forward. Limiting herbicides to non-commodity objectives is a waste of public resources and an abrogation of management responsibilities.

Response: The BLM has chosen to limit the scope of the Proposed Action (Alternative 4) in order to simplify the analysis. This does not preclude the BLM from proposing and analyzing additional herbicide uses in the future.

Comparison of the Effects of the Alternatives

57. Comment: The *Additional Effects by Resource* subsection in chapter 2 is heavily biased toward herbicide use, sometimes with no mention of impacts of increased herbicide use with very toxic herbicides.

Response: The summary resource effects paragraphs in the Draft EIS have been replaced with an effects comparison table in the Final EIS to contrast, rather than summarize, the effects of the alternatives. Then to help ensure this section accurately reflects the analysis in Chapter 4, the comparison table has been reviewed and edited by the Chapter 4 resource specialists with instructions to include significant effects and inform the decision-maker about the important points revealed by their analysis. However, the section focuses on herbicide use because the alternatives are about adding herbicides. The analysis is clear that with the Standard Operating Procedures and PEIS Mitigation Measures, human and environmental risks are low or minimized, and there are substantial environmental benefits to their use. Reporting on this important analysis conclusion is not a "bias." The potential for toxic herbicide effects is discussed in the resource effects sections in Chapter 4 and displayed on the effects comparison tables in Chapter 2.

58. Comment: The *Visual Resource* section's statement in Chapter 2 that "long-term benefits of protecting native plant communities would outweigh any short-term adverse effects of herbicide treatments" seems to be an unsubstantiated ideological mantra used to override any legitimate objections from the public.

Response: This statement in Chapter 2 was an oversimplification of the effects reported in more detail in the *Visual Resources* section in Chapter 4. Invasive weed monocultures are assumed less visually desirable than more diverse native vegetation. The visual effect of using herbicides to treat vegetation varies depending on which herbicide is applied and how it is applied. When herbicides are applied directly to an invasive plant using a backpack sprayer or wicking method, the short-term visual impact is browned and dead vegetation mixed with green native vegetation. When non-selective herbicides are applied aerially or with a boom sprayer, the resulting short-term visual effect is one of an open, browned landscape. Long-term benefits of protecting native plant communities would outweigh any short-term visual adverse effect of herbicide treatments.

59. Comment: There seems to be an automatic assumption in the *Comparison of the Effects of the Alternatives* section that non-herbicide control is always more expensive regardless of plant type, the availability of volunteer crews, etc, because the analysis ignores the hidden costs of herbicides to water quality, fisheries, edible plants, cultural native plants, human health, and so forth.

Response: The necessarily undetailed summary comparison sections in Chapter 2 reflect the conclusions of the more detailed resource sections in Chapter 4. The Chapter 4 *Implementation Costs* section compares the implementation costs of the various alternatives, and does not attempt an overall cost/benefit analysis. Regarding natural resource values, the resource specialists preparing the individual resource sections of the EIS compared the degradation expected from invasive plants with the risks of using herbicides, and generally concluded the risks from herbicides was low, while the risks from invasive plants was substantially higher. While both sides of this comparison include qualitative judgments, various estimates of the economic impact of invasive plants, and the quantitative risk calculations made in the Risk Assessments and reflected on the "Risk Categories" tables at the end of Chapter 3, tend to support this conclusion.

60. Comment: The *Comparison of the Effects of the Alternatives* section concludes that herbicide risks would be "negligible." What does negligible mean in the real world? What context and severity of impacts would occur to what values and which species? This term fails the accurate science and disclosure test of quantification and qualification.

Response: The supporting context, severity, and quantification are in the more detailed sections in Chapter 4. Those sections report on the potential for herbicides to cause various adverse effects, but also note that implementation of the Standard Operating Procedures and PEIS Mitigation Measures would, by design[2] and when coupled with site-specific analysis and project design, reduce risk to the point where significant adverse effects at the programmatic scale would be unlikely. This conclusion is consistent with the BLM's experience with herbicides over the past 25 years.

A section on the relationship between the *Standard Operating Procedures, PEIS Mitigation Measures, and the Potential for Adverse Effects* is presented at the end of Chapter 3. This section summarizes the finding from the resource discussions in Chapter 4, that these measures "should make the potential for adverse effects negligible, de minimus, or at worst, "minimized"."

Potential Mitigation

61. Comment: Identified mitigation measures should be mandatory unless other means are fully justified as meeting the mitigation need, not just rejected because of cost or presumed less effectiveness. Otherwise, the public and decision-maker cannot assume essential protection from serious impacts, since the EIS relies on mitigation as foundational to Risk Assessment conclusions.

2 Adverse effects identified in the 2007 PEIS, to which the Oregon EIS tiers, resulted in the preparation of corresponding mitigation measures. The 2007 PEIS Record of Decision adopted ALL of these mitigation measures. Thus, by definition, the potential for adverse effects when viewed at the west-wide programmatic scale should be minimized when PEIS Mitigation Measures are implemented.

Response: Risk Assessments are analytical examinations of the potential for adverse effects given modeled and described exposures and doses. There is no assumption in the Risk Assessments about Standard Operating Procedures or PEIS Mitigation Measures. Standard Operating Procedures and PEIS Mitigation Measures are the BLM's way of insuring that the adverse risks identified in the Risk Assessments are avoided.

The analysis of effects in the EIS assumes application of all Standard Operating Procedures and PEIS Mitigation Measures, listed in Appendix 2, (unless, as the comment suggests, site-specific analysis indicates their objectives can be met some other way.) The Standard Operating Procedures reflect various BLM policies. The PEIS Mitigation Measures were selected by the 2007 PEIS Record of Decision and apply to all herbicide use on BLM lands in the 17 western states, and are a part of all alternatives in the Oregon EIS.

Potential Mitigation measures in Chapter 2 of the Oregon EIS are in addition to the PEIS Mitigation Measures. NEPA requires identification of mitigation measures, if possible and within limits, for all adverse effects identified in the analysis. The Oregon EIS analysis identifies the potential for adverse effects (in spite of the application of all Standard Operating Procedures and PEIS Mitigation Measures), and thus identifies Oregon-specific potential mitigation measures (Chapter 2). This is no surprise; programmatic or site-specific analysis below the west-wide scale of the PEIS would be expected to identify more site-specific adverse effects. To the degree that any of the EIS-identified potential mitigation measures are necessary to avoid contributing to listing or meeting any other legal requirements, they would be adopted. Potential mitigation measures based on other adverse effects, however, will be examined by the decision-maker to determine if the described adverse effects, and the degree to which they would mitigate an identified adverse effect, is significant enough to justify the investment and/or constrain the proposal. Upon consideration of potential mitigation measures, there is no substantive requirement to mitigate all adverse effects (40 C.F.R. 1505.2).

62. Comment: The NEPA requirement that in the Record of Decision, the decision-maker must state whether all practicable means to avoid or minimize environmental harm from the selected alternative have been adopted, and if not, state why not, implies the need to seriously consider and analyze in detail a variety of less harmful alternatives including most of those suggested by the public and not analyzed in detail. This NEPA requirement does not seem to have been met by the EIS.

Response: NEPA does not require that proposed actions or decisions have no significant adverse effects. Similarly, the requirement to identify whether or not adverse effects can be mitigated does not infer the EIS must include alternatives that are outside the scope or would not meet the *Need* simply to avoid such effects. The EIS includes a range of alternatives that would meet the *Need*. The EIS also addresses (in Chapter 2 and/or in this section) all public proposals for additional alternatives with a potential to meet the *Need*, as well as public-suggested mitigation measures.

63. Comment: The BLM should take an active role in having a forb component in native seed mixtures to accurately reflect the plant communities on BLM lands.

Response: The BLM has an existing policy to use native seed in restoration (USDI 1992a; USDI 2008a). Non-native seed may be used following NEPA analysis that documents the need for other than native seed primarily to protect the soil resource and future site potential. Restoration is already an element of Integrated Vegetation Management and other vegetation management direction, and reconsideration of, or a change in, BLM native seed policies and direction is outside the scope of this EIS.

64. Comment: How are 100 and 200-foot buffers determined for wells and springs? Are these adequate? There should be no herbicide spraying in or near hydrological-connected ditches and roads (wet or dry). Mitigations should also prohibit herbicide sprays near water and restrict herbicide use in dry riparian buffers to the winter hibernation or aestivation period to more fully protect amphibians and susceptible mollusks – or (preferable) use non-herbicide control methods. Not using herbicides on native plants would help reduce risk to ungulates and other wildlife. Herbicide impacts to Federally Listed and other Special Status species should be completely avoided. Maximum application rates should be prohibited.

Response: Most of the points suggested by this comment are already required by the Standard Operating Procedures, PEIS Mitigation Measures, or other laws and policies. Since most of the potential for adverse effects was identified in the PEIS, few additional potential adverse effects are identified in the Oregon EIS. Some of the measures suggested by the comment are not PEIS Mitigation Measures, but no adverse effect has been identified that would indicate their being needed. Determination of spring and well minimum buffers is based on the potential for drift, the potential for herbicides to be carried to water intakes by rain events, and the potential for adverse human health effects. Most existing treatments are spot sprays or daubs with little potential for long-distance drift.

65. Comment: Herbicides should not be broadcast sprayed in riparian areas.

Response: Standard Operating Procedures for Wetlands and Riparian Areas specify the use of wick or backpack sprayer.

66. Comment: Herbicides should not be sprayed on amphibian habitat.

Response: Such a prohibition would effectively eliminate many treatment projects in riparian/wetland habitats. In addition to site-specific planning that would consider important amphibian habitat, Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) require avoidance of POEA-containing glyphosate; avoidance of critical wildlife breeding or staging periods; the use of water buffer zones for herbicides not labeled for aquatic use; and others. The analysis in the *Wildlife Resources* section in Chapter 4 indicates some of the herbicides are toxic to amphibians, some are not, and some are unknown. The analysis also points out that the two aquatic herbicides currently available to the BLM in Oregon (2,4-D and glyphosate) are toxic to amphibians, while some of those that would be added by Alternative 3 are not. Amphibians included in the Special Status Species Program or Survey and Manage would be specifically considered during site-specific analysis to meet the requirements of those programs.

67. Comment: As moths and butterflies are among the larger group of pollinators, the EIS should specify the following:

1. Maintain herbicide free buffer zones around patches of important pollinator nectar and pollen sources.
2. Maintain herbicide free buffer zones around patches of important pollinator nesting habitat (called host plants for Lepidoptera) and hibernacula (pupa and cocoons).
3. Make special note of pollinators that have single host plant species and minimize herbicide spraying on those plants and in their habitats.

Response: These recommendations are already within the Standard Operating Procedures for pollinators listed in Appendix 2. The effects analysis in this EIS assumes Standard Operating Procedures would be followed or that a site-specific determination is made that they are unnecessary to achieve the intended protection or objective.

68. Comment: Some herbicides are highly persistent and should not be used. For example, in areas with edible and medicinal plants and fungus, the theoretical "safe time" to enter the area and use these plants may be one-to-three years after application, or longer with repeated applications, making prevention of adverse human health effects by posting unlikely.

Response: Some of the more persistent herbicides (diuron, bromacil) included in the analysis are soil-applied and would not result in human exposures for people gathering food and medicinal plants. Herbicides on vegetation, exposed to moisture and sunlight, break down far more quickly. Site posting requirements are specified accordingly. The potential for herbicides to adversely affect persons actively engaged in food collection is examined in the Risk Assessments and discussed in the *Human Health and Safety* section in Chapter 4.

69. Comment: The alternatives need to include guidelines that protect edible wild mushrooms and medicinal plants. This particularly applies to Alternative 4 (the Proposed Action) and Alternative 5's proposal for broadcast treatments of native plants along roadsides and other areas.

Response: The Risk Assessments summarized at the end of Chapter 3 and discussed in the *Human Health and Safety* section in Chapter 4 indicate the amount of these herbicides likely reaching, then being ingested or contacted by, collectors and end users of mushrooms and other forest products presents a very low risk of harm. Both of these products are recognized as valuable wildland resources and products. Standard Operating Procedures and required signing would reduce direct user exposure. Herbicide treatments potentially affecting these two products would be subject to site-specific analysis. That analysis should recognize and consider the potential for herbicide applications to affect both populations of, and users of, mushrooms and other forest products.

Chapter 3 – Background and Assumptions for Effects Analysis

The 18 Herbicides

70. Comment: The EIS did not include an analysis of the inert ingredients. The BLM needs to fully disclose the active and so-called inert ingredients of all of the approved herbicides, and fully describe their ecological and health effects, both individually and in combination. Inert ingredients can be toxic to target and non-target species and they can persist in soil and water. Inert ingredients - especially in combination with other pesticides - can be more toxic to humans and fish than the listed ingredients.

We acknowledge that the BLM attributes the analysis deficiency to current law that permits pesticide makers to hide the identity of the inert ingredients by claiming trade secrets. However, without revealing this information, the BLM does not comply with NEPA requirements to disclose effects.

Response: The BLM recognizes that certain inert ingredients can be toxic to target and non-target species. It is the manufacturer's intention that they enhance toxicity or exposure to target species. BLM evaluated inert compounds to assess affect on non-target species. Many inert compounds are naturally occurring substances. Some, such as nontoxic mineral compounds, do persist in soil. The BLM and Forest Service evaluated inert ingredients and two surfactants, POEA and R-11, are specifically addressed in Appendix D of the PEIS. R-11 is no longer used by the BLM, and POEA in glyphosate is reflected in the risk category for glyphosate shown in Chapter 3 and discussed in the various resource effects sections in Chapter 4. The *Adjuvants, Impurities, and Other Ingredients* section in Chapter 3 has been expanded to better describe the BLM analysis of inerts. Potential effects are discussed in the *Fish, Wildlife Resources*, and *Human Health and Safety* sections in Chapter 4. Additional information about uncertainty related to these materials in included in Appendix 13.

Pesticide manufacturers usually disclose their inert ingredients only to the EPA and the BLM. The BLM is prohibited by law from disclosing the actual inert ingredients because they are considered proprietary. In response to petitions asking the EPA to require that these ingredients be identified on the labels of products that include them in their formulations, the EPA has initiated rulemaking to increase public availability of the identities of the inert ingredients in pesticide products. A 60-day public comment period began December 23, 2009, and was extended an additional 60 days. The EPA has not yet reported on the results. Any new information about herbicide toxicity will be incorporated into subsequent site-specific analyses. A description of this rule-making effort is included in Chapter 1.

71. Comment: The EIS needs to identify toxic active ingredients, adjuvants, and exact formulas and analyze impacts of formulas and tank mixes.

Response: Active ingredients were identified for all herbicides. Common names are typically used in discussing herbicides rather than chemical formulas, as they are long, technical, and generally not understood except by organic chemists. Formulas are available at many locations; see for instance the Herbicide Handbook (Vencill et al. 2002). EPA licensing and Risk Assessments are conducted with the herbicides as formulated, so any risks are included in the risk categories. For example, the EIS points out that adverse effects to fish attributed to glyphosate may be more attributable to the surfactant POEA rather than the active ingredient itself. The BLM evaluated inert ingredients, degradates, adjuvants and tank (combined) mixes in the Risk Assessments, and results are described in Chapter 3 and in the *Fish, Wildlife Resources*, and *Human Health and Safety* sections in Chapter 4. A detailed discussion of uncertainty in the Risk Assessments (relative to those materials) is included in Appendix 13. The Risk Assessments considered repeated use within the same areas; maximum label rates are per year. An additional description of the analysis of these materials done by the BLM has been added to Chapter 3.

72. Comment: In the *Fish* section of the EIS, the BLM is assuming that inert ingredients would not represent a substantial part of the herbicide product. This may or may not be true, and should not be assumed to be.

Response: The comment mischaracterizes the statement in the *Fish* section in Chapter 4. The *Fish* section states that *toxic* inerts would not represent a substantial part of the herbicide product (emphasis added). The EPA ranks inerts based on their toxicity, and few of the herbicide products that would be used on BLM lands have toxic inerts. More information about inerts and toxicity can be found in Chapter 3. A list of herbicide products that could be approved for use on BLM lands is shown in Appendix 9. This list includes products screened by the BLM for the absence of toxic inerts and adjuvants identified by the EPA, Risk Assessments, and additional available information. The BLM's list of approved products changes annually as new information is acquired.

73. Comment: The statement that differences in the number of herbicides available east and west of the Cascades is based on differences in native vegetation types and invasive plant occurrence is contrary to earlier statements about population density and public acceptance.

Response: Differences in population density and public acceptance did not influence the selection of herbicides for the various alternatives. The incorrect text in the *Comparison of the Effects of the Alternatives* section in Chapter 2 has been deleted. The differences in herbicides east and west of the Cascades are based on differences in vegetation and weed spread, registered uses, objectives, and environmental conditions such as fire risk or the prevalence of watercourses. For example, a persistent, soil-applied herbicide could be used along roadsides east of the Cascades to remove fire-prone dry grasses, while the same herbicide would not be used west of the Cascades because the risk of roadside grass fires is low, bare ground in roadside ditches would erode, and roadside-applied persistent herbicides might end up in nearby streams.

The *Differences in the Number of Herbicides Proposed East and West of the Cascades* section in Chapter 3 has been edited to better reflect these reasons.

74. Comment: There needs to be a process for making new herbicides available for use by the BLM in Oregon as more effective, less persistent herbicides become available. For example, aminopyralid should be added to the herbicides included in Alternative 4 (the Proposed Action).

Response: The process for adding additional herbicides is prescribed by the BLM national office. The process is described in Appendix 4, and it includes the preparation of Ecological and Human Health Risk Assessments followed by NEPA analysis. Such analysis is expensive, and is undertaken only after a significant need is identified. Aminopyralid is being considered for this process. The BLM does not rely on the EPA registration alone to determine if an herbicide is appropriate for use on wildlands. The process is slow, but helps minimize the potential for adverse public or ecosystem effects.

This issue is addressed further in the *Alternatives Eliminated From Detailed Study* section in Chapter 2, under an alternative named *Consider the Use of Different Herbicides Other than the 18 Being Considered*.

75. Comment: The Proposed Action (Alternative 4) would increase the use of 2,4-D and diuron, both of which have been shown to have adverse effects to human health.

Response: The Proposed Action (Alternative 4) proposes to increase the number of herbicides available so that herbicides that are more effective on certain plants or in certain areas can be used. Hence, the Proposed Action would actually decrease the use of 2,4-D statewide by one-third. Potential effects to human health are described in the *Human Health and Safety* section in Chapter 4, and 2,4-D information is summarized in Appendix 12. Diuron is one of the new herbicides that would become available under the Proposed Action. Diuron is a non-selective herbicide that would be used to kill all vegetation in areas such as along pavement edges or around communication towers, electrical substations, and other non-public use areas where vegetation would degrade pavement, harm structures, or spread fire. Most use would be east of the Cascades; use of diuron is estimated at 100 acres annually west of the Cascades. Summaries about each herbicide, including explanations of what each herbicide would be used for, have been added to the Final EIS in Appendix 9. Potential health effects are addressed in the *Human Health and Safety* section in Chapter 4.

76. Comment: Diuron is long-lived, contaminates water, is harmful to fish, has harmful effects on people, and is a risk to all susceptible wildlife. Why would it be considered for use west of the Cascades?

Response: Diuron's persistence and non-selectivity make it useful for complete vegetation control within seldom-visited enclosed communication sites to reduce maintenance costs and prevent wildfire damage. It is also useful within a foot or two of pavement edges to prevent plants from encroaching on and damaging road edges. It would not normally be used within the roadside ditches west of the Cascades because the ditches connect to streams, because grass or other low vegetation is often desirable to stabilize drainage structures, and for other environmental reasons cited in the comment. Because of the concerns noted, use is estimated at 100 acres per year west of the Cascades and would occur only where unacceptable adverse environmental effects could be avoided. A potential mitigation measure has been added to Chapter 2, requiring consideration of the roadside ditch connection in all project analyses for roadside treatments.

Although the Draft EIS described how administrative sites and roads would benefit from Alternative 4 (the Proposed Action), benefits were generally not attributed to specific herbicides. Additional information about the specific uses and risks has been added to the EIS for each herbicide in Chapter 3. In addition, the *Administrative*

Sites, Roads, and Rights-of-Way section in Chapter 4 now specifically describes the benefits of the persistent herbicides (diuron, bromacil, tebuthiuron) added by Alternative 4.

Assumptions and Information about Treatment Acres

77. Comment: The EIS does not have an alternative that would deal with any sort of integrated weed management nor does it provide a protocol for determining the best or most appropriate treatments. The BLM should have a process for examining other methods before it resorts to herbicides.

Response: All of these suggestions are requirements of the BLM's Integrated Vegetation Management policy (USDI 2008a, USDI 2007e, and others). The alternatives propose to add additional herbicides to the BLM's existing noxious weed and other vegetation management programs. Other elements of Integrated Vegetation Management and BLM policies for determining the best or most appropriate treatments are already in place and apply to all alternatives. Prevention, followed by early detection and rapid response, would remain the BLM's highest priority weed control strategies, for example. The description of Integrated Vegetation Management in Chapter 3 is intended to set the context for the alternatives. The introduction to the *Need* in Chapter 1, and the *Introduction* in Chapter 2, both state that the alternatives would only add additional herbicides to the existing Integrated Vegetation Management program. The *Integrated Vegetation Management* section in Chapter 3 has been supplemented with a discussion of how, following BLM policies, vegetation treatment methods are selected.

78. Comment: The EIS defers reconsideration of ground-disturbing management activities by, in part, saying planning of management activities must consider and mitigate their role in noxious weed spread. Since weeds are spreading at 12 percent in part because of management activities, there is little evidence the policy is being followed.

Response: The discussion under the *Reduce Ground-Disturbing Activities* alternative in Chapter 2 has been rewritten to place the emphasis where it belongs, that being that reconsideration of other management activities is more correctly the purview of the resource management planning process required by the FLPMA and outside the scope of this analysis.

Risk and other discussions throughout the EIS analysis assume compliance with existing BLM policies. For the preparation of project NEPA documents, it is customary for districts and field offices to maintain a policy checklist. Such lists would be expected to include the policy of considering and mitigating each projects role in noxious weed spread. In consideration of this comment, however, three random timber sale Environmental Assessments were selected from each of the Coos Bay and Roseburg District websites. The control of noxious weeds was displayed prominently in each, and the control of noxious weeds was a specific project objective in one. Based on these points, various EIS references to this BLM policy do not appear to be overstated.

79. Comment: The EIS should explain how the risks associated with ground disturbing activities proposed by BLM are documented and implemented.

Response: All NEPA planning processes for ground disturbing projects and projects that have the potential to alter plant communities must include a noxious weed risk assessment when it is determined that a proposed action may introduce or spread noxious weeds. If the risk assessment determines there is a moderate to high risk of spreading noxious weeds, then actions must be taken to reduce or prevent the spread of noxious weeds. Example actions include modifying the project to include seeding the disturbed area with native species, controlling existing infestations of noxious weeds prior to project implementation and incorporating prevention measures into the project design or as contract stipulations. Results of the risk assessment are filed in the appropriate NEPA project file (USDI 1992b). This policy in mentioned in the *Integrated Vegetation Management* section in Chapter 3 of the EIS, and explained in more detail in Appendix 3, in the *Existing Monitoring* section.

80. Comment: Given that certain BLM vegetation management projects are treated as categorical exclusions and not analyzed under environmental impact statements, the EIS should address invasive plant concerns for categorical exclusion projects. Management activities proposed as categorical exclusion projects should be assessed in light of their effects upon invasive plant prevention.

Response: The potential for a vegetation management project to spread invasive plants is a consideration in deciding whether a categorical exclusion is appropriate. However, the use of a categorical exclusion would not nullify the policy requirement to conduct a noxious weed risk assessment and include mitigation, a control strategy, and monitoring if the risk of spreading noxious weeds is moderate or high.

81. Comment: The EIS is flawed because it is based on the projected spread of invasive plants without addressing prevention. Education should be a key component of weed prevention and the EIS should address specific plans for outreach for public participation in weed prevention and eradication efforts.

Response: The Integrated Vegetation Management discussion in Chapter 3 notes that prevention, including education, remain the BLM's highest priority strategy for weed control. This and other elements of Integrated Vegetation Management are in place, are common to all alternatives, and take precedence over herbicide use.

82. Comment: The EIS needs to clearly describe the decision-making process and risk considerations for selecting between herbicide and non-herbicide methods at the site-specific scale.

Response: Department of the Interior integrated pest management policy states that "Bureaus will accomplish pest management through cost-effective means that pose the least risk to humans, natural and cultural resources, and the environment" and requires bureaus to "[e]stablish site management objectives and then choose the lowest risk, most effective approach that is feasible for each pest management project" (USDI 2007e). A list of parameters that affect how vegetation treatment methods are selected has been added to *Integrated Vegetation Management* section of Chapter 3. These parameters include potential impacts to humans, fish, and wildlife; opportunities to conserve native vegetation; and, proximity of the treatment area to susceptible areas, such as wetlands, streams, or habitat for species of concern.

83. Comment: To avoid loss of habitat and food for wildlife, the BLM should be extremely careful not to harm beneficial plants and trees.

Response: In treating invasive vegetation with both herbicide and non-herbicide methods, the BLM tries to avoid harm to non-target species. Invasive weeds, herbicides, and non-herbicide methods to remove plants all have the potential to harm beneficial plants and trees. Integrated Vegetation Management, Standard Operating Procedures, and PEIS Mitigation Measures all serve to help avoid damage to non-target species. Descriptions of these can be found in Chapter 3 and Appendix 2. When working with invasive plants, it is usually beneficial to minimize disturbance to adjacent native plants 1) so they can help restore the treatment area, and 2) so invasive plants do not invade disturbed sites.

84. Comment: The EIS does not adequately disclose and consider the fact that using herbicides is less effective than other alternatives because it kills not only the target plant but also often kills the non-target plant, which reduces the cover of desired native vegetation and creates more opportunities for weedy plants to invade treated areas. Hand pulling and carefully targeting just the invasive plants leaves more of the native plants in place to reoccupy the site and prevent future establishment of weeds.

Response: Herbicide use would be done in the context of Integrated Vegetation Management, where the best tool (or tools) for the job would be selected. Typically, invasive species would be targeted, retaining native plants to reoccupy the site regardless of the treatment method used. In many instances, carefully targeting the invasive plant with herbicides (using spot treatments) is far more effective than hand pulling. Some species break apart and spread when pulled, some infestations are too large to be effectively controlled by hand, and many times hand pulling has to be repeated many times in order to be effective, which can cause trampling of nearby vegetation and disturb wildlife. The soil disturbance associated with many non-herbicide methods is more conducive to reinfestation than spot herbicide treatments. When necessary, planting and reseeding would be done in areas where monocultures of invasive weeds have reduced the likelihood of natural revegetation with native species. More than 80% of the estimated herbicide use under the Proposed Action (Alternative 4) would be with herbicides that are selective to specific types of plants (e.g. grasses, broadleaf, etc). Additionally, Standard Operating Procedures and PEIS Mitigation Measures help prevent or minimize damage to non-native plants.

85. Comment: Opportunities should be explored to provide washing stations to prevent the spread of weeds by vehicles.

Response: Washing stations have been considered, as have discounts at local existing washing facilities. Signing at OHV staging areas and boat landings warn of the dangers of invasive weeds and direct users to existing facilities. Liability, cost, vandalism, water contamination, and other issues affect consideration of washing stations. Consideration of washing stations, however, is an existing element of Integrated Vegetation Management, and a reconsideration or change of emphasis regarding this issue is outside the scope of this EIS.

86. Comment: Restoration and monitoring plans must be drafted and funds allotted at the same time as control measures are implemented.

Response: There are restoration and monitoring requirements that apply to each invasive plant control treatment. Many of those specifically addressing herbicide use are described in the *Integrated Vegetation Management* section in Chapter 3, or in Appendix 3. General project implementation monitoring is also conducted to ensure consistency with NEPA and Land and Resource Management Plan decisions.

87. Comment: No apparent scientific methodology was applied to come up with the estimates of annual herbicide use; they appear to be over-exaggerations.

Response: The estimates of annual herbicide use were developed by the district vegetation managers with knowledge of the existing district needs and management direction. District weed coordinators with many years of experience coordinating, and planning the current Integrated Vegetation Management program related to noxious weeds helped prepare these estimates. Estimates are based in part on past use, which is reported annually by the district and state offices to the National office and the EPA. However, the EIS is clear that these numbers are estimates for cumulative effects analysis purposes only, and are not decisions to manage vegetation. Actual herbicide use could vary based on many factors including new and/or previously unknown infestations of weeds. Site-specific analysis would be used to determine and confirm the need to treat vegetation, and examine site-specific effects. If actual herbicide use is less than these estimates, then the EIS-described herbicide risks would be reduced.

88. Comment: The "Estimated Annual Acres Treated in Rights-of-Way, Administrative Sites, and Recreation Sites" table in Chapter 3 shows such a wide range of acres that may be treated that the information is meaningless. It makes it impossible to estimate the potential impacts.

Response: In the Draft EIS, the estimated annual acreages of treatments shown in a table in Chapter 3 and used throughout the document for Alternatives 4 and 5 were partially based on weighted averages of ranges shown in this table. For the Final EIS, district experts were asked to re-estimate the acreages based on the herbicide, rather than use the multiple herbicides by project type approach that was used in the Draft EIS. This provided a more meaningful estimate of the acreages to be displayed in the Final EIS. However, the weighted averages used in the Draft EIS and the estimated acres used in the Final EIS are similar.

89. Comment: The BLM should follow the Forest Service in prohibiting maximum application rates.

Response: The 2005 Region 6 Forest Service Record of Decision does not prohibit the use of maximum application rates shown in the Forest Service EIS (USDA 2005:4-2) and adopted by its Record of Decision. The Forest Service typical and maximum rates are similar to those being considered in this EIS.

90. Comment: The EIS should recognize that herbicides have to be used repeatedly because one application will not be effective. Noxious weeds are hard to destroy, so herbicides will have to be used repeatedly because one application will not be enough to be effective. Most herbicide use requires multiple applications each year for three to five years.

Response: Noxious weeds are often hard to destroy, and for those situations needing herbicides, it is best to find the right herbicide for the control objectives. The four currently available herbicides are not very effective on some weeds (e.g. whitetop), but have been used multiple times to suppress these weeds to prevent flowering and thus slow weed spread. The additional herbicides proposed in Alternative 3 would greatly increase the likelihood that the right herbicide would be available, so one application could kill plants that would otherwise need years of pulling or other treatments. If one area is treated more than once in a year, it is usually to find missed areas or plants. In such cases, maximum and typical *annual* rates would still apply. That is, an herbicide would not be applied more, within that entire year, than then permitted by the maximum annual rates shown on Table 3-1 in Chapter 3. For invasive weed populations treated in consecutive years, the amount of herbicide used should decrease as control objectives are met. Weed treatments are frequently evaluated for effectiveness (see Appendix 3), and the BLM would not want to treat vegetation, year after year, with a method that was ineffective.

91. Comment: The BLM should make a specific measurable commitment to reducing or eliminating its reliance on herbicides over time.

Response: Nothing in the noxious weed spread calculations, or in advances in alternative control methods, indicates that the need for herbicides will significantly decline in the 15-year planning horizon considered in this EIS. New weed infestations will continue to be discovered, and resource values will continue to benefit from their effective control. However, the herbicide application acres in the EIS are only estimates for analysis purposes. They are neither minimums nor maximums, and no treatments are authorized by this EIS. If there were a reduced need for herbicides in the future, it would be reflected in site-specific decisions.

92. Comment: The EIS should restrict herbicide use to a last resort, and acknowledge the research done by Rinella et al (2009) which indicates herbicide use can exacerbate invasive weed problems.

Response: Rinella et al. (2009) documents the 16th year examination of native forb species responses when an herbicide, in this case enough picloram to remain soil active for some months, was applied once to a grass/forb area infested with leafy spurge in an effort to improve livestock forage on a ranch in Montana. Both the forbs and the invasive leafy spurge were substantially reduced by the spray (but not the grass), and reinvasion of leafy spurge subsequently occupied those sites, locally extirpating some of the forb species. The paper acknowledges the initial reduction in forb species was to blame, and contrasts the study with a similar one where the forb component was retained, and post-treatment reinvasions did not reduce the forb community.

The results of this study do not contradict the analysis in this EIS. The studied herbicide application scenario, however, has little resemblance to those described in this EIS. For example, the *Wildlife Resources* section in Chapter 4 states "few broad-scale treatments of native vegetation are anticipated to be conducted under any of the alternatives unless they are specifically designed to benefit wildlife habitat (Chapter 3, *Assumptions about Herbicide Treatments*). Invasive plant treatments are generally directed only at noxious weeds and other invasive plants either by treating only the invasive plant or by using a selective herbicide. The objective of those treatments is to remove weeds and restore native (or other non-invasive) vegetation. Treatments are designed to reduce damage to native vegetation and reduce unnecessary site disturbance that favors reinvasion by the invasive plants." As noted in the quote, there is similar language in the *Assumptions about Application Methods* section in Chapter 3. One broad-scale herbicide use estimated to occur in the EIS under Alternative 3 is imazapic applications on areas infested by medusahead rye, or recently burned areas likely to become heavily infested with this invasive annual grass. Current medusahead treatments using glyphosate can kill desirable forbs, but imazapic at low rates is selective for annual grasses. Imazapic would be available for medusahead control under the action alternatives, and is desired specifically to decrease the likelihood of having the adverse effects of using glyphosate described in Rinella et al. (2009).

The treatment described in the article involved a one-time treatment to improve livestock forage. No such treatments are envisioned from this EIS. Invasive plant treatments are usually targeted just at the invasive plants, and require monitoring within two years. The *Noxious Weeds and Other Invasive Plant* section in Chapter 4 describes noxious weed treatments under Alternatives 3-5 as being about 80 percent effective, meaning a return to the site is usually necessary to spot treat missed and newly emerging plants. Weed control staff are aware that a lack of follow-up will often result in failure to achieve control.

93. Comment: The adverse impacts of methods and scale of herbicide applications are not addressed.

Response: Chapter 3 (*Background and Assumptions for Effects Analysis*) provides an explanation as to the methods and scale of herbicide applications; Chapter 4 (*Affected Environment and Environmental Consequences*) shows the impacts (adverse and beneficial) of the herbicide applications described in Chapter 3.

94. Comment: The EIS fails to adequately consider the detrimental impacts of aerial spraying thousands of acres of clear-cut forests.

Response: The EIS does not propose or imply that thousands of acres of clear-cut forests would be sprayed with herbicides. All alternatives exclude the use of herbicides for timber production; most herbicide use after timber harvest would be to keep invasive plants from spreading or gaining a foothold. Aerial spraying would not be allowed west of the Cascades under Alternatives 3 and 4 (the Proposed Action) and would occur rarely (if at all) under Alternative 2 (the No Action Alternative) and Alternative 5. Aerial spraying would occur more often east of the Cascades, but BLM's dry forests east of the Cascades are managed to promote forest stand health. Timber volume production is not an objective, and treatments are generally thinning (and not clear-cuts). Aerial application of herbicides east of the Cascades would be used primarily to control monocultures of invasive weeds like yellow starthistle and medusahead or where ground access is difficult.

95. Comment: The authority to apply herbicides aerially as described in the EIS is excessively broad. Aerial application of herbicides should be subject to NEPA analysis on a project-by-project basis.

Response: As noted in Chapter 3, about seven percent of the noxious weed herbicide treatments currently being conducted by the BLM in Oregon are done with planes (two percent) or helicopters (five percent). These applications follow project-level site-specific analysis. Any future applications conducted pursuant to this EIS would be similarly subject to NEPA analysis at the site-specific scale. The aerial applications levels described in Chapter 3 are the assumptions under which the EIS's cumulative effects analysis is based, and are not decisions to conduct projects. Alternatives 3 and 4 (the Proposed Action) would not allow aerial herbicide application west of the Cascades.

96. Comment: The BLM should be cautious about dousing post-wildfire landscapes with imazapic as proposed. What would be the effects to other plants and wildlife re-colonizing the areas or surviving the fire?

Response: The BLM exercises the caution suggested in the comment; the brief statement about expected imazapic use the *Comparison of the Effects of the Alternatives* section in Chapter 2 does not include a discussion of all the caution and considerations that would go into site-specific planning for such use. Chapter 3 states that imazapic is selective for "some broadleaf and grasses." It would be used primarily to control monocultures of invasive annual grasses such as cheatgrass and medusahead while retaining native forbs to help with restoration, and some would be used to prevent invasive grass reinvasion after major fires prior to seeding. The *Native and Other Non-Invasive Vegetatio*n section notes the estimated 11,000 acres annually of imazapic east of the Cascades would be used to control monocultures of invasive annual grasses, and that imazapic has a low-to-moderate risk of harming non-target plants. These treatments would result in a corresponding 5,000-acre increase in native seeding because the invasive grasses could be controlled. Both the *Fish* and *Wildlife Resources* sections note that imazapic is one of the lowest risk herbicides to these two resources of any of the herbicides proposed for use. In any event, the potential for damage to remaining native vegetation critical to habitat and restoration, or to on-site fauna, would be reconsidered at the site-specific scale.

The statement about using imazapic to prevent grass reinvasion and prepare restoration sites, while true, was incorrectly included in the *Fire and Fuels* section of the *Comparison of the Effects of the Alternatives* section in Chapter 2 of the Draft EIS; restoration has not been identified in the EIS as a "fire and fuels" objective. This point has been moved to the *Native and Other Non-Invasive Vegetation* subsection in this same section of Chapter 2.

Risk Assessments

97. Comment: There is not enough research on potential damage to fish and wildlife.

Response: The EPA requires pre-market multiple toxicity, persistence, and environmental fate tests prior to registration. The toxicity tests include mammals, fish, plants, and other taxa. Prior to registration, in an effort to evaluate risk to fish and wildlife, the EPA also examines ecological risks to fish and wildlife including Threatened and Endangered species. The Forest Service and the BLM have conducted additional Risk Assessments of the herbicides analyzed in this EIS, to examine the available literature relating to fish and wildlife toxicity. The resource effects sections in Chapter 4 further cite relevant literature published since development of the Risk Assessments. Herbicides are heavily studied. There is enough information available for the decision-maker to understand the potential for significant environmental effects at the programmatic scale. Additional analysis will occur when site-specific projects are proposed.

An overview of the EPA and Risk Assessment processes, including a discussion of the types of information they each consider, has been added to the Final EIS as Appendix 13.

98. Comment: In some cases, herbicides may seem less toxic because they are newer and we know less about them.

Response: Much has been learned about the effects of pesticides and other chemicals in our environment in the past few decades, and more is known about groups of herbicides, adjuvants, and other materials. The development of newer herbicides has been informed by studies on older herbicides. Use of chemicals in society is regulated by various entities; pesticides are regulated by the EPA. The EPA requires toxicity, persistence, and environmental fate tests prior to registration. The EPA has registered each of the herbicides for specific uses identified in the EIS. Herbicide labels are required by the EPA to contain a section on health hazard information for workers and users. The BLM and Forest Service have also completed Risk Assessments for the herbicides in this EIS that examine plausible exposure scenarios specific to wildland uses. The Risk Assessments acknowledge and quantify risks. These identified risks are the reason for the Standard Operating Procedures and PEIS Mitigation Measures (see *Standard Operating Procedures, PEIS Mitigation Measures, and the Potential for Adverse Effects* at the end of Chapter 3), and serve as the basis for the effects (risk) discussions in Chapter 4.

99. Comment: The alternatives should include all EPA-tested and approved herbicides.

Response: As noted in the *Risk Assessments* section in Chapter 3, the United States Court of Appeals for the Ninth Circuit has found the EPA registration procedures to be inadequate to meet the wildland applications hard look requirements of NEPA. Risk Assessments build upon the EPA registration information by adding information from the scientific literature, and considering applications in wildland settings that appeared to be "minor" in the EPA registration process. Risk assessments are not completed for other herbicides because the cost is high compared to need, or preliminary indications are that the BLM would not want to use them. The BLM nationally maintains a list of Risk Assessments it considers to adequately cover wildland use, and periodically conducts literature searches to check the accuracy of less recent Risk Assessments. The BLM also maintains a list of approved adjuvants, selected based on absence of known toxicity (see Table A9-3 in Appendix 9). From these two sources, the BLM maintains a list of specific products known to contain only approved herbicides and adjuvants. The list of approved herbicides and formulations is updated annually. Those approved in 2009 are shown in Appendix 9, Table A9-2. There are over 80 additional herbicides registered for use in Oregon that the BLM has not approved for use on BLM lands. Use of other herbicides is limited to experimental uses. The process for adding herbicides to the BLM National list is described in Appendix 4.

100. Comment: The EIS failed to consider the impact of pesticides even if labels are followed. Labels often do not consider the latest scientific findings, such as new information on impacts to amphibians and long-term impacts to human health.

Response: The EPA updates label requirements regularly as new information is compiled. The BLM did not rely solely on herbicide label information for the Risk Assessments. Risk Assessments include the EPA registration data for toxicity studies, fate and transport studies, chemical physical properties and other information. Literature searches were also conducted. The herbicides discussed in the EIS include only those having been subject to acceptable Risk Assessments and approved by the BLM nationally. It should be noted that Standard Operating Procedures and PEIS Mitigation Measures are applied after, and in response to, risks identified for Risk Assessment scenarios. Thus, actual risk from BLM use envisioned in this analysis is typically very low.

101. Comment: Despite a considerable body of data on acute exposure effects from the proposed list of herbicides, it is important to recognize that the chronic and sublethal risks are not yet well characterized. The historical record of pesticide toxicology reveals many cases of serious and unexpected adverse effects associated with pesticides that were not predictable from standard acute toxicity tests. Because of these unknown risks, we encourage use of non-chemical alternatives with known risks wherever feasible.

Response: Besides acute toxicity testing, the EPA does require extensive chronic toxicity testing. Information about the types of data used during the EPA's registration process has been added to the Final EIS in Appendix 13. Chronic and sub-lethal effects are discussed in the Risk Assessments, and risk categories summarized on the "Risk Categories" tables at the end of Chapter 3, and discussed in the resource sections in Chapter 4, include risk categories for chronic exposure.

102. Comment: The EIS fails to analyze short-term effects on plants and wildlife during and directly following the application of herbicides. Since long-term effects are the focus of BLM's analysis, it is unclear how many plants and animals will be killed or harmed during applications, and how that immediate contact might contaminate future generations. Given that many plants and animals might perish, the cumulative effect could be devastating.

Response: Risk Assessments examine plausible individual acute and chronic exposure scenarios, and resultant identified risks have been the basis for development of Standard Operating Procedures and PEIS Mitigation Measures, which minimize risk. Then, assuming the Standard Operating Procedures and PEIS Mitigation Measures are applied, and considering the generally limited scope of BLM herbicide uses, the potential for adverse effects to individual resources are addressed within Chapter 4. Many of those sections identify little or no risk in both the short and long-term, even at the very site-specific scale. The *Fish, Wildlife Resources*, and particularly the *Native and Other Non-Invasive Vegetation* section, however, identify risks to certain individuals from certain herbicides. For example, glyphosate with POEA is identified as toxic to directly sprayed amphibians away from riparian areas. (Glyphosate with POEA would not normally be used within riparian areas.) Most of the herbicides are toxic to non-target plants if they are sprayed. These resource sections point out, however, that these adverse effects would be at the scale of the individual organism, and no long-term effect from herbicides is anticipated at the population scale. For Special Status species, those species' assumed sensitivity and the requirement for pre-project clearances reduces the likelihood of adverse effects even at the scale of the individual organism.

Many of the resource sections in Chapter 4 *do* identify a likely long-term adverse effect from the continued spread of noxious weeds and other invasive plants.

103. Comment: The safety of most of these chemicals has not been determined using modern analytical methods in double blind tests. Most of the safety literature has been developed by those most in a position to profit. The government has no business releasing these agents for widespread use when their effects are so poorly known.

Response: The EPA requires extensive toxicological testing in multiple plant and animal species prior to registration using modern analytical methods. A certain portion of the testing is funded by the manufacturer, but it is conducted in independent laboratories using scientific methods approved by the EPA. The BLM does not rely only on this testing however; Risk Assessments are prepared, further examining the available literature to determine the implications of using the pesticides in wildland settings. Overviews of the EPA registration and reregistration processes, and of the BLM and Forest Service's Human Health and Ecological Risk Assessment processes, have been added as Appendix 13.

104. Comment: How many hazardous chemicals have been tested in situations where winds blow cattle-trampled and de-stabilized herbicide-encrusted soils into waters or onto migratory birds eggs or into pygmy rabbit burrows as well as on the vegetation that pygmy rabbits eat?

Response: The Risk Assessments test maximum plausible exposure scenarios. Exposure to lesser quantities by less direct methods would simply have less effect (lower risk); testing these specific scenarios is not needed to understand risks. Dust transport of herbicides on soils into water was specifically addressed in the *Water Resources* section in Chapter 4. Most of the herbicides considered in the EIS are applied to foliage, not soil, so the scenarios described in the comment would be limited.

Toxicity testing is performed on concentrated active ingredients. In the environment, herbicides are transformed by hydrolysis, photolysis, sorption, and biodegradation to less normally less toxic compounds and various degradates, each at lower concentration. The Ecological Risk Assessment scenarios addressed consumption of contaminated vegetation, and the *Soils Resources* section addressed effects on soil organisms. Many herbicides are rapidly degraded in soils, waters, and plant surfaces (see *Soil Resources* and *Native and Other Non-Invasive Vegetation* sections).

105. Comment: A full analysis of the adverse effects of all herbicides and their associated chemicals, including where multiple chemicals may be used, must be conducted under real-world degraded wild lands situations. Increased weather extremes under climate change scenarios must be incorporated into these Risk Assessments.

Response: Risk Assessments are performed using herbicide application type and rate information, exposure pathways including fate and transport models of migration through soil, water, and air, and multiple human and non-target species' categories, to estimate risk as comprehensively as possible. The reason many wild lands are degraded is because of invasive species; there is no reason to believe that the risk models would not be applicable to degraded wild lands. Nor is there reason to believe climate change would affect herbicide exposures.

106. Comment: 1) BLM exposure scenarios were not as inclusive for the public as Forest Service exposure scenarios. 2) Failure to include water and food consumption could understate risk. 3) The exact methodology for assigning risk categories is not transparent.

Response: 1 and 2) The BLM exposure scenarios were equally or more inclusive than Forest Service scenarios and included exposure to berry pickers, anglers, swimmers, ingestion of water, berries, and fish (see *Human Health Risk Assessment Methodology* in the *Human Health and Safety* section in Chapter 4). 3) The risk category methodology is almost identical between the two Federal Agencies. Appendix 13 has been added to the Final EIS to make information about the BLM and Forest Service Risk Assessment processes more available.

107. Comment: The EIS does not clearly explain what the term "moderate toxicity" means.

Response: As discussed in the *High, Moderate, and Low Risk in BLM and Forest Service Risk Assessments* section of Chapter 3, the Risk Assessments for each herbicide evaluated in this EIS established a Risk Quotient (RQ) for each herbicide evaluated by BLM and a HQ (hazard quotient) for herbicides evaluated by the Forest Service. The EPA identifies a Level of Concern (LOC) for herbicides, which is the dose of the herbicide above which effects would be expected. In absence of information indicating otherwise, the LOC is generally 1/10 of the Lowest Observed Adverse Effect Level (LOAEL); or, the lowest dose level where there was a statistically significant increase in frequency or severity of lethal or sublethal adverse effects to the test organism. The RQ is calculated by dividing the Estimated Exposure Concentration (ECC) by the Toxicity Reference Value (TRV). The ECC is the dose that an organism would be exposed to under the test scenario (a cow eating only sprayed grass for a day, for example) and the TRV is the toxicity of the herbicide - usually the No Observed Adverse Effect Level (NOAEL) or the LOAEL. When the RQ is equal to 10 to 100 times the most conservative LOC for an herbicide (generally equal to the LOAEL to 10 times the LOAEL), BLM determined it to be a "moderate risk."

108. Comment: How do risk categories translate in real term effects? Are RfDs (Reference Dose) and TIs Toxicity Index) or TRVs (Toxicity Reference Value) expressed in comparable units of measurement and do the calculations of dividing EECs (Estimated Exposure Concentration) by TRVs really express the hazard? It seems that low or moderate risk categories could result in mortality or severe effects to the most vulnerable species.

Response: Computed environmental exposure concentrations were divided by toxicity reference values to derive risk quotients. Values greater than 1.0 indicate a level of risk that increases with the numerical value, but the relationship between dose and response may not always be linear. Because of this uncertainty and because of the thousands of exposure scenarios evaluated, a category system was used. The category schemes described in the *Risk Assessments* section of Chapter 3 reflect the severity of risk.

The RfDs and TRVs use the same units of measurement (e.g. mg/kg body weight/day). The calculations are used by toxicologists to express the hazard.

Regarding the "real term effects," the *High, Moderate, and Low Risk in BLM and Forest Service Risk Assessments* section in Chapter 3 attempts to put the risk categories in useable terms. The lower range for the L, or low, risk category is theoretically the level at which an effect began to be discernable in testing or modeling. The minimum identified effect may have been skin or eye irritation, leaf damage, and so forth. The lower range is not usually the level at which effects were actually notices, because uncertainty factors are added to address hypersensitive individuals, or accommodate uncertainties in the measurements, such as inferring effects to one species based on actual tests on other species. Uncertainty factors are typically multiples of 10, so the assumed Lowest Observable Effects dose could have been inflated 10, 100, or even 1,000 times for uncertainties. Thus, exposure of the average individual to the dose identified as having an effect probably would not have an effect. Nevertheless, the L or low category indicates risks start at that point. The moderate risk category indicates risk starts at doses one-tenth those of the low categories; high is one-hundredth of the testing scenario dose. Testing scenarios are severe (e.g. soaking the test animal), so Standard Operating Procedures and PEIS Mitigation Measures such as buffers, wind speed limits, and so forth, as well as required safety equipment, limit exposure to substantially less than tested doses. For herbicides with moderate and high risk categories for a particular species, special cautions are implemented. For example, buffers for Special Status plant species are set at the shortest tested distance where no effect was discernable or predicted. Some are as large as 1,500 feet for some herbicides (Table A2-1). The low, moderate, or high human health risk categories shown on the "Risk Categories" tables at the end of Chapter 3 are more conservative than the EPA risk categories (Caution, Warning, or Danger/Poison) used on herbicide labels.

109. Comment: The increase in application and addition of new herbicides pose significant risks to the environment. In particular, the Proposed Action (Alternative 4) increases the risk of contamination of Oregon's water, further threatens already imperiled species, and may endanger the health of local residents and those who use public lands.

Response: Nothing in the analysis indicates the current or proposed use of herbicides would pose a significant risk to the environment; the analysis seems to indicate not. The risk categories for each herbicide are based on scenarios plausible before the application of the Standard Operating Procedures and PEIS Mitigation Measures. Using the risk categories from the Risk Assessments and summarized on tables at the end of Chapter 3, and the estimated herbicide treatment acres for each alternative shown on Table 3-3, the Comparison of the Effects of the Alternatives table in Chapter 2 (Table 2-5) shows that the Proposed Action (Alternative 4) would treat fewer acres with moderate or high-risk herbicides than the No Action Alternative (Alternative 2), even though total acres treated with herbicides would nearly triple. The Proposed Action would use additional herbicides that have generally been chosen because they are less toxic than the four currently allowed on BLM lands. The risks to different organism groups are not related– e.g. an herbicide that is moderately toxic to birds may have no toxicity to fish. However, the *Human Health and Safety* section shows that herbicides that have a moderate risk to humans (the EIS does not propose using any herbicides that have a high risk to humans) are used on an estimated 1,200 less acres annually under Alternative 4 (the Proposed Action) than under Alternative 2 (the No Action Alternative). All wildlife risk decreases between Alternative 2 and 3; herbicides that have moderate or high risk decrease between an estimated 800 acres annually (insects) to 8,900 acres (birds). Risks from herbicides between Alternatives 3 and 4 go up as risks from non-herbicide methods go down. Alternative 4 (the Proposed Action) would allow herbicide treatments in rights-of-way, administrative sites, and recreation sites; methods currently used are usually mechanical (mowing and chainsaws) which have their own set of risks.

In addition, a larger number of available herbicides allows the most appropriate herbicide to be used. For example: one herbicide might be more effective at killing a weed and has less risk to non-target plants than another herbicide, but the first herbicide poses more risk to fish. If the herbicide application does not occur near a body of water, then risk to fish – an important consideration – might be completely irrelevant.

110. Comment: The EIS fails to adequately consider the harm from drift.

Response: Various drift scenarios are addressed on the "Risk Categories" tables at the end of Chapter 3, and considered and discussed under applicable herbicides in the various resource sections throughout Chapter 4. The discussions of drift in the *Water Resources* section includes a table of drift distances by droplet size; the AgDrift model is discussed in the *Fish* section; and Appendix 2 includes tables of buffer distances to avoid drift damage to Special Status species. In addition to drift, post-application off-site movement is addressed. Because most of the risks discussed in the EIS result from drift (as most non-target species would not be directly sprayed), addressing drift is an important component of the EIS.

111. Comment: In 2001, the EPA changed the legal definition of pesticide 'drift' to 'the movement of liquid droplets.' Previously, the definition included the movement of vapor. Vaporization occurs when the pesticides/herbicides interact with the sun. It is a known fact that pesticides/herbicides drift much farther when vaporized than they do as liquid droplets. The current EIS refers to drift of droplets but never once mentions the more far-reaching drift by vaporization. Elimination of vapor as a drift exposure to adjacent lands appears to be a loophole to not be responsible for herbicide pollution.

Response: Herbicide labels include restrictions against "drift," so the EPA defines what that term means when it is on a label. In 2001, the EPA proposed to define drift as:

> Spray or dust drift is the physical movement of pesticide droplets or particles through the air at the time of pesticide application or soon thereafter from the target site to any non- or off-target site. Spray drift shall not include movement of pesticides to non- or off-target sites caused by erosion, migration, volatility, or windblown soil particles that occurs after application or application of fumigants unless specifically addressed on the product label with respect to drift control requirements (EPA 2001).

The 2001 EPA notice also said the EPA's "drift" focus is "within relatively short distances (up to 1/2 mile)", that "under certain circumstances lower levels of pesticides may drift considerably farther", and that "pesticide vapor and the off-target movement of pesticides by other means…can nevertheless present substantial risks to humans and the environment. The EPA generally addresses these routes of exposure and associated risk at the individual pesticide level through its regulatory programs." In short, the definition applies to an application term, but in no way presumes to set geographic limits on the area of potential effect. A discussion of the EPA action has been added to Chapter 1.

The BLM and Forest Service Risk Assessments consider the effects of herbicide contact, and do not distinguish whether that contact is from liquid, droplets, vapor, on blowing dust, in waters, or from other mechanisms in or out of the EPA's drift definition. A background discussion about drift has been added to the *Risk Assessments* section in Chapter 3.

Herbicides have very low vapor pressures. One study showed that with more volatile insecticides, little or no vapor drift was detected 9-27 meters downwind for insecticides with vapor pressures less than $1x10^{-4}$ mm Hg (Woodward et al. 1997). All of the herbicides covered by the EIS have very low vapor pressures (maximum is $4x10^{-6}$ mm Hg and they range to as low as $5.5x10^{-16}$ mm Hg; Vencill et al. 2002).

112. Comment: The AgDrift model may be inadequate for forest and range settings, which are more complex than agricultural fields.

Response: For the past 25 years, the Forest Service has evaluated AgDrift and their similar version (AgDisp) to develop accurate, validated models that predict the behavior of pesticides applied by aerial application above forests. An extensive field study and model validation effort confirmed the predictive capability of the computational engine that drives the near-wake solution scheme in both AgDisp and AgDrift (Thistle 2005). The range settings would not differ significantly from those used for agriculture, because topography and application heights would be similar.

113. Comment: Even if the BLM aerially applies herbicides in compliance with the labels, it runs the risk of acting in a negligent manner by failing to designate a sufficiently large buffer zone around navigable waters. Considering the high density of adjacent waters to some of the area where aerial application is proposed, the probability of herbicide drift entering navigable waters increases significantly under the BLM's Proposed Action (Alternative 4).

Response: A subsection addressing drift has been added to the *Risk Assessments* section of Chapter 3. Identification of water bodies during site-specific planning, constantly improving drift reduction agents, and improving technology regarding spray equipment including instant, pinpoint navigational equipment on aircraft, continues to reduce the likelihood of aerially applied herbicides reaching water bodies. The Proposed Action (Alternative 4) does not include aerial applications west of the Cascades in part because of numerous, sometimes hard to detect even from the ground, water bodies there. Standard Operating Procedure-prescribed buffers often exceed label requirements, and Special Status species' buffers can exceed a thousand feet (Table A2-1 in Appendix 2). "Drift" is a primary exposure scenario addressed in the risk categories and discussed in the resource sections in Chapter 4, so any risk is well considered and displayed for consideration by the decision-maker and during subsequent site-specific analysis. This EIS does not propose projects. There is no basis for the claim that buffers would be too small or that subsequent treatments would be negligent.

Most of the projected increase in aerially applied herbicides under the Proposed Action (Alternative 4) is for imazapic east of the Cascades. The "Risk Categories" tables at the end of Chapter 3 show imazapic to have no risk to the public or any element of the environment except plants, at every examined scenario including spills into water bodies.

114. Comment: The BLM's inability to prepare a Risk Assessment for all combinations of herbicide mixes, and for all adjuvants and inerts, suggests the need for a precautionary approach, including the avoidance of the more toxic herbicides and prohibiting boom sprays.

Response: Uncertainty factors used to set apparent No Observable Effect Levels, and the doses assumed by the Risk Assessments when setting risk categories, are precautionary in nature. Additionally, the BLM uses buffers and other Standard Operating Procedures and PEIS Mitigation Measures that often exceed label requirements. When using tank mixes, risks are considered additive, not proportionate to the amount of each herbicide in the mix (as a precaution against unforeseen synergistic effects). Special Status species' risk categories were based, generally, on an assumption they are ten times more susceptible than non-Special Status species. These and other factors are part of the precautionary approach used with BLM herbicide applications.

115. Comment: Synergistic effects of multiple herbicides and tank mixes have not been adequately analyzed. In addition, what is meant by the statement, "BLM generally does not tank mix diquat, fluridone, and tebuthiuron?"

Response: BLM assessed commonly used tank mixes in the Ecological Risk Assessments by adding, not proportioning, risk quotients for each component in part to allow for unforeseen synergistic effects. Like results for separate active ingredients, results varied from no risk to elevated risk to wildlife, and aquatic and terrestrial plants. PEIS Mitigation Measures apply to components in tank mixes as well as single active ingredients. Numerous tank mixes are addressed in the Risk Assessments and results suggest some synergistic effects occur with some mixes, but that the risk increase is too small to change the risk categories.

Tank Mix Risk Quotient Risk Assessment appendices (Appendix 8) were not prepared for diquat, fluridone, and tebuthiuron because the BLM generally does not use these in tank mixes.

116. Comment: 2,4-D: 1) is persistent in streams, rivers, and wells; 2) residue has been found by the CDC in 25% of Americans; 3) is found in 60% of air samples; and, 4) involved in many incidents.

Response: According to the EPA's 2005 Reregistration Eligibility Decision Document: 1) The degradation of 2,4-D was rapid (half-life= 6.2 days) in aerobic mineral soils. The half-life of 2,4-D in aerobic aquatic environments was 15 days. Monitoring data considered in the EPA's assessment were the USGS National Water Quality Assessment Program (NAWQA) groundwater and surface water database, USGS/EPA reservoir monitoring database, National Drinking Water Contaminant Occurrence Database (NCOD), and EPA's Storage and Retrieval environmental data system (STORET). Review of these databases was conducted to provide peak and median concentrations. Additionally, the quality of data was evaluated for targeting pesticide use areas, detection limits, and analytical recoveries. The monitoring data indicate that 2,4-D is detected in groundwater and surface water. In addition, 2,4-D is detected in finished drinking water. Maximum concentrations of 2,4-D in surface source water and ambient groundwater are 58 ug/L and 14.8 ug/L, respectively. The median 2,4-D concentration of 1.18 ug/L was derived from finished water samples in the NCOD database. The highest time weighted annual mean (TWAM) concentration was 1.45 ug/L from the NAWQA database containing non-targeted data reflecting pesticide concentrations in flowing water as opposed to more stationary bodies of water such as ponds, lakes, and reservoirs. 2) BLM could find no published information on this part of the comment. 3) BLM could find no find no published information on this part of the comment. 4) Drift is a concern for all herbicide spray formulations. Label instructions and PEIS Mitigation Measures are intended to minimize drift. Typical application rates showed no risk to terrestrial plants and most aquatic plants. Appendix 13 provides additional information specifically about 2,4-D.

117. Comment: The EIS does not reveal that 2,4-D is linked with bladder cancer and testicular problems in dogs.

Response: The EPA Reregistration Eligibility Decision document for 2,4-D does not mention any types of cancers or testicular effects in canines (EPA 2005a). The Reregistration Eligibility Decision process is described in Appendix 13. Health Canada's 2,4-D reregistration announcement addressed the cancer question as follows:

> Based on re-examination of the data, various scientists and workgroups have concluded that there is no relationship between 2,4-D use and canine malignant lymphoma (CML). Although a 1991 article by the National Cancer Institute (NCI) indicated a link between dogs with CML and dog-owners that applied 2,4-D to their lawn, a 1991-1992 independent panel concluded that the NCI study design was severely flawed and, in fact, did not show an association between CML and 2,4-D use. In 1999, scientists at Michigan State University re-examined the NCI data and also concluded that there was no relationship between 2,4-D use and CML (Health Canada 2009).

118. Comment: According to the Journal of Pesticide Reform, glyphosate: 1) is carcinogenic to humans causing non-Hodgkin's lymphoma, miscarriages, causes reduction of male reproductive capacity; 2) affects plants that birds use; 3) affects fish immune systems, causes genetic damage to amphibians; 4) is persistent into the fall harvest season; and, 5) has been found in streams in King County (JPR 2004).

Response: 1) The BLM has reviewed Hardell (1999), which was cited in this journal article; the authors do not show glyphosate causes Non-Hodgkin's lymphoma (NHL), nor was the sample size sufficient to report a significant association. Recent work by De Roos et al. (2005) with a larger sample size and improved epidemiologic techniques failed to show any link with NHL, all cancers or cancers by target organ, with the exception of a "suggested" association with multiple myeloma (although sample size is again small). Neither the EPA, nor the consensus of the scientific community conclude glyphosate is carcinogenic and the EPA Reregistration Eligibility Decision for Glyphosate (EPA 1993) does not mention any form of cancer or male reproductive effect. The glyphosate Risk Assessment discusses the referenced miscarriages documents and finds a) that the 95 percent confidence interval included 1.0 (no effect), and b) that the apparent effect evaporated when the data was correlated with the known maternal age risk factor.

2) Any herbicide will affect plants for which it is designed to kill, including plants that birds use for forage; however, much of the Proposed Action (Alternative 4) is targeted at invasive plants that would not be essential to native bird species.

3) Glyphosate formulations with adjuvant POEA have been found toxic to fish and amphibians, however glyphosate minus POEA is of much lower toxicity. BLM will restrict use of POEA near aquatic habitats as a PEIS Mitigation Measure.

4) Glyphosate is moderately persistent in soil and has low potential to leach to groundwater (see the *Soil Resources* and *Water Resources* sections in Chapter 4). The citation's "into the fall harvest season" indicates the study is from agriculture use, which is far different from the uses proposed by the BLM.

5) It is not surprising glyphosate would be found in urban streams in and around Seattle; glyphosate is widely used and readily available at home and garden centers.

119. Comment: A Human Health Risk Assessment should have been completed for Overdrive (diflufenzopyr + dicamba).

Response: Human Health Risk Assessments were done for both diflufenzopyr and for dicamba (dicamba is proposed specifically to be used in combination with diflufenzopyr). The combination of these herbicides in a tank mix or commercial product would result in an additive impact to human health (hazard index), depending on the concentration and application rate of each ingredient, thus a specific Human Health Risk Assessment for the combination is not necessary. The mixture of the two ingredients changes the risk to vegetation compared to each used separately, thus an Ecological Risk Assessment was prepared for the combination.

120. Comment: The EPA did not accept staff recommendations that picloram registration not be continued. In addition, according to the Journal of Pesticide Reform of Spring, 1998: 1) picloram causes damage to internal organs and is contaminated with hexachlorobenzene, which causes cancer of internal organs; 2) picloram is toxic to fish, persistent, and mobile in soil; and, 3) runoff has damaged crops (JPR 1998)

Response: The BLM cannot address internal EPA (deliberative) communications. Picloram is still registered by the EPA. 1) Picloram is rated by the EPA as being only slightly toxic to humans via ingestion. Picloram is contaminated with <100 ppm hexachlorobenzene (HCB). The EPA's 1995 Reregistration Eligibility Decision Fact Sheet for picloram rated the carcinogenic risk from the trace contaminant HCB in picloram to the general public as being negligible and the risk for workers mixing picloram as "not-unacceptable," (see detail in the *Human Health and Safety* section in Chapter 4). 2) Picloram is moderately persistent and mobile in soil (see the *Soil Resources* section in Chapter 4). The Risk Assessments show it is highly toxic to susceptible fish under a spill scenario, and low to non-toxic under all other scenarios ("Risk Categories" tables at the end of Chapter 3). 3) Any herbicide runoff has potential to damage non-target vegetation. Standard Operating Procedures for application and PEIS Mitigation Measures (including buffer distances) are intended to prevent such occurrences. The risks described here are acknowledged in the Risk Assessment and reflected in the risk categories and use recommendations.

121. Comment: According to the Risk Assessments, sulfometuron methyl causes various health effects, has been found in surface waters, persists in soils, drift has caused crop damage, and it causes cancer and developmental toxicity.

Response: Sulfometuron methyl was identified in the EIS as having moderate potential for leaching, is moderately persistent in soil, and is rarely found in surface water (see the "Herbicide Information" table near the beginning of Chapter 3 and the *Soil Resources* and *Water Resources* sections in Chapter 4). The EPA Reregistration Eligibility Decision document for Sulfometuron Methyl found no credible information that sulfometuron methyl causes cancer or developmental toxicity (EPA 2008b). The Risk Assessment says "The EPA (2003b) states that the carcinogenicity of sulfometuron methyl is not yet evaluated. However, no carcinogenic effects have been detected in either rats or mice exposed to sulfometuron methyl (EPA 1990 as cited in Extoxnet 1996b). Therefore, it is reasonable to assume that sulfometuron methyl would not be classified as a likely carcinogen" (ENSR 2005j). A crop damage incident is described in the EIS. Standard Operating Procedures and PEIS Mitigation Measures preclude similar (aerial) applications.

122. Comment: The Human Health Risk Assessments used for bromacil, diuron, and tebuthiuron were completed in 1991. Information that is more current is available, and should have been considered in the EIS.

Response: As noted in the *Risk Assessments* section in Chapter 3, these Human Health Risk Assessments were used in BLM's 1991 Vegetation Treatment on BLM Lands in Thirteen Western States EIS, and literature that is more recent has been examined to ensure that these Risk Assessments remain current. Additional new information is published all the time; however, no new information has been found thus far that changes the findings in these 1991 Risk Assessments. The BLM completed Risk Assessments for all herbicides where literature searches indicated new findings.

Methodology for Assessing Effects

123. Comment: In general, in the EIS, the risks of non-herbicide control are over-stated and the risks of herbicide use are downplayed. The EIS discusses the threat of invasive plants to various resources, but fails to give equal attention to the numerous threats posed by herbicides to water quality, soils, wildlife, air quality, humans, recreation, Wilderness, Special Status species, etc.

Response: The primary focus of the analysis in Chapter 4 and the Risk Assessments regards the use of herbicides and their potential to affect on the resources listed in the comment. PEIS Mitigation Measures and Standard Operating Procedures limit many of the risks. Non-herbicide methods are also addressed because it is easy to forget that substitute non-herbicide methods are not benign. The effects of non-herbicide methods are poorly quantified, however, so it is difficult to see how they are "over-stated." Non-herbicide methods also have standard operating procedures and mitigation measures, but they (like herbicides), would still have some risk. Chapter 3 explains the assumptions that the resource specialists worked from. Chapter 4 explains the environmental consequences of the alternatives (including the effects of herbicides, non-herbicide methods, and untreated invasive plants). Appendix 2 includes the PEIS Mitigation Measures and Standard Operating Procedures common to all alternatives in this EIS for the use of herbicides. Appendix 8 has detailed Risk Assessments for each proposed herbicide. All of the assumptions and discussion of the relative risks are presented in detail.

124. Comment: The use of herbicides trades one harm for another. While the EIS correctly states invasive plants are upsetting the natural balance, it also acknowledges that human activities have been to blame. Now humans propose to introduce herbicides, affecting the balance in ways that may surpass the effects of invasive species. The BLM should take a conservative approach until further research conclusively demonstrates that the introduction of new herbicides is safe and will not have unintended consequences.

Response: EPA registration, Risk Assessments, and the EIS have taken a hard look at the potential for the proposed herbicides to do environmental harm, and information in these documents reasonably demonstrates that the herbicides are unlikely to have significant unintended adverse effects when used as proposed. Standard Operating Procedures and PEIS Mitigation Measures are designed to virtually eliminate the potential for significant adverse effects, and the effects discussions in the resource sections in Chapter 4 assume their application. However, as noted near the start of Chapter 4, resource management is uncertain and always will be. Not using herbicides is also a management decision with implications (see Reference Analysis). The BLM uses herbicides conservatively, following site-specific analysis and appropriate Endangered Species Act consultation.

Chapter 4 – Affected Environment and Environmental Consequences

Incomplete and Unavailable Information

125. Comment: Despite stating the CEQ requirements for how to proceed with an EIS with incomplete or unavailable information, the EIS section on this does not appear to supply the information required by CEQ points 3 (a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment), or 4 (the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community).

Response: The *Incomplete and Unavailable Information* section in Chapter 4 explains how the Risk Assessments deal with each of these points. Resultant conservative risk categories are carried into the specific resource effects and the *Human Health and Safety* sections in Chapter 4. Adjuvants and inerts are also discussed in the Risk Assessments, and recommendations for avoiding adverse effects are presented. The Final EIS, in Chapter 3 and in the *Fish* section in Chapter 4, includes additional information about adjuvants and inerts.

126. Comment: The EIS fails to address synergistic effects of multiple herbicides.

Response: The EIS acknowledges that there is a high degree of uncertainty surrounding potential effects from multiple complex mixtures and multiple exposures (*Incomplete and Unavailable Information* early in Chapter 4). To address concerns over herbicide use the BLM and Forest Service have supplemented the EPA herbicide registration information with over 6,000 Pages of Environmental and Human Health Risk Assessments (Appendix 8). These assessments address the potential for synergistic effects. Where applicable, those risks have been noted. For example, the increased potency of 2,4-D tank mixes is addressed. The EIS notes that tank mix risk quotients are added, not proportioned, in part to account for the potential for synergistic effects.

127. Comment: The EIS failed to adequately consider the impact of mistakes on water quality, wildlife, and human health. Mistakes will happen and herbicides will be applied in places and at times that are not allowed. The EIS should not assume that herbicides would always be used according to the label. Humans are fallible.

Some people who may apply herbicides on BLM lands may not be able to read and understand what is written on the labels. The analysis needs to conduct a Risk Assessment that accounts for the high likelihood of chemical accidents and misuse.

Response: The *Risk Assessments* section in Chapter 3 notes that risk categories were developed for exposures to direct spray, surface runoff, wind erosion, and accidental spills through the Risk Assessment process. A summary of these risk categories are displayed on the "Risk Categories" tables at the end of Chapter 3, and are used in the various resource sections in Chapter 4. The *Incomplete and Unavailable Information* section notes "Risk Assessments test or model a range of plausible scenarios including spills and direct applications on non-target organisms, but exposure beyond those modeled is possible," and goes on to describe a recent example. The *Accidental Spill or Misapplication* section describes various spill scenarios, as well as the acknowledgement that misapplications will occur, a likelihood potentially increased when new herbicides are being used for the first time. Reducing such incidents is one objective of some of the existing and potential implementation monitoring described in Appendix 3. There is no evidence of a human health incident having occurred with a BLM herbicide application in Oregon in the past 25 years.

The potential impacts of spills are specifically addressed in the *Native and Other Non-Invasive Vegetation* section both generally and for specific herbicides; in the *Water Resources* section where it is specifically addressed in both the *Direct Application* and *Leaching* sections; in the *Wetlands and Riparian Areas* section both generally and for most of the herbicides specifically; in the *Fish* section generally and under a specific heading of *Water Contamination from Accidental Spills,* under most of the specific herbicide discussions, and under the discussion of each alternative; variously in the *Wildlife Resources* section; in the *Environmental Justice* section; and, in the *Human Health and Safety* section. Impacts from misapplications are the same as those for spills (at a much smaller scale) or for collateral damage, addressed in all sections.

Accidental applications at the wrong sites, or with the wrong materials, would usually adversely affect the treated plants and, potentially, susceptible species that were to be avoided. Other effects would generally be as assessed in the analysis since applications would still be at rates specified on the label. Applicators must have state licenses, and part of the written test for that license requires reading labels. In cases where direct supervision fails, post-project monitoring can find errors. Districts generally already select a certain percentage of implemented projects for on-the-ground review, to insure agreements made during the planning (NEPA) process were implemented as intended. Appendix 3 in this EIS suggests, under *Potential Monitoring*, that some minimum number of high-profile herbicide projects be selected on each district annually for similar post-project monitoring by a group that includes weed control and herbicide experts.

The comment does not suggest why the analysis is not adequate, or identify what additional information would make it so.

Cumulative Impacts

128. Comment: The *Cumulative Impacts* section fails to discuss the cumulative impacts of the herbicides that the BLM wants to use at a statewide scale.

Response: This EIS is a programmatic EIS discussing - at the statewide scale - the effects of the BLM's use of herbicides to various resources, including human health, native vegetation, and wildlife. Since the entire programmatic analysis is essentially a cumulative effects analysis, miscellaneous information applicable to more than one section was presented early in Chapter 4 to help provide context to individual sections, particularly as some of those sections refer to those actions. Some of the ongoing actions described in the Draft EIS in the *Cumulative Impacts* section, however, are not impacts. These have been moved to the *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* section in Chapter 1.

129. Comment: In the *Cumulative Impacts* section, the Draft EIS states that the Oregon Department of Agriculture's Pesticide Usage Reporting System 2008 report did not include households. This is not true.

Response: The Oregon Department of Agriculture required businesses to report their pesticide use, but did not require households to do the same. However, the 2008 report does include a household component. The Gilmore Research Group conducted a Household Pesticide Use Survey in 2008, which asked about 2,000 households in Oregon to track their pesticide use. Response and reporting consistency were so poor that the Oregon Department of Agriculture did not extrapolate that information out to make any conclusions about other households in the State. This has been clarified and further described in the *Cumulative Impacts* section early in Chapter 4.

130. Comment: The Draft EIS does not disclose the cumulative impacts of their past spray actions.

Response: A section addressing past spray actions has been added to the *Cumulative Impacts* section early in Chapter 4.

Being limited to four herbicides has contributed to the spread of invasive plants because of restrictions and/or limitations on the plants that can be controlled by these herbicides, and the places that they can be used. Limiting the number of herbicides can also contribute to some invasive plants becoming resistant to certain herbicides. These issues are discussed in the *Noxious Weeds and Other Invasive Plants* section.

131. Comment: Private timber companies are aerially spraying the lands that surround and are intermixed with the O&C lands. The BLM is proposing to use herbicides on these checkerboard lands, and thus will double the amount of herbicides that are already being sprayed over neighboring children, houses, food, and animals. The EIS needs to consider the cumulative impacts of spraying additional herbicides in the same area where private industrial timber companies are already spraying thousands of acres.

Response: Timber companies that are using herbicides to grow timber would be using herbicides in a different manner, and in greater quantities, than proposed by the BLM. The BLM currently uses herbicides on noxious weeds on O&C lands. While the number of herbicides available under the Proposed Action (Alternative 4) would increase, and the types of vegetation that could be sprayed would change, the estimated annual pounds of herbicides applied west of the Cascades, and the acres sprayed with herbicides rated in the EIS as having a moderate or high risk to the environment or human health, would decrease under the Proposed Action (Tables 3-4 and 2-6). The number of acres sprayed under Alternative 4 (the Proposed Action) would increase, but application methods are primarily methods that target distinct vegetation, and PEIS Mitigation Measures and Standard Operating Procedures would limit impacts to non-target species. (Aerial spray would not be permitted on BLM lands west of the Cascades under Alternative 4.) Therefore, cumulative effects from the Proposed Action on O&C lands would be expected to differ little from the No Action Alternative (Alternative 2). It is unknown how much herbicide is used on the private portion of checkerboard lands, but the BLM's contribution to Oregon State totals is shown in the *Cumulative Impacts* section. A public comment letter from industry suggested that better invasive plant control on BLM lands, whether because of increased availability of herbicides or incidentally during rights-of-way maintenance, would likely reduce the invasive plant treatments required on industry lands. A subsection addressing this potential effect has been added to the *Cumulative Impacts* section.

132. Comment: The EIS should note that better control of invasive plants would reduce the need for neighboring landowners to use herbicides on their lands.

Response: Although the Draft EIS noted many times that adjacent non-BLM land resources would benefit from better control of BLM weeds, the implication that cross-boundary resources might benefit from a reduced overall need to treat non-BLM lands was only touched on in the Draft EIS at one point. In the *Native and Other Non-Invasive Vegetation* section, the Draft EIS noted "Other native ecosystems on BLM lands may also suffer when invasive plants spread from BLM lands. Adjacent landowners may control these weeds with less environmentally friendly methods or products. Collateral damage may occur near property lines, and landscape-scale values such as watershed or wildlife values may be degraded by these well intended treatments, particularly west of the Cascades where the checkerboard ownership often means the BLM manages no more than 50 percent of any watershed."

A subsection addressing this topic has also been added to the *Cumulative Impacts* section early in Chapter 4.

133. Comment: It is generally believed that rangeland degradation exacerbates populations of grasshoppers and Mormon crickets, so as more areas of BLM lands become overrun with cheatgrass, more acres will be sprayed with insecticides Moreover, in the past two years, there has been a large increase in lands sprayed for West Nile virus. The Draft EIS does not evaluate this co-occurrence, or overlap, of lands likely to be sprayed for weeds and with insecticides.

Response: Most insecticide treatments on BLM lands in Oregon are likely to be spatially or temporally separated from most herbicide treatments proposed in this EIS, so virtually few organisms except, conceivably, plants, would be expected to have active doses of both materials at the same time. Any overlaps of concern should be identified in site-specific analyses; ongoing invasive plant treatments would be a consideration during insecticide spray planning, in part, because of the widespread use of noxious weed biological controls. Of 157,000 acres of Oregon grasshoppers sprayed statewide by the Animal and Plant Health Inspection Service and/or the Oregon Department of Agriculture in 2009, about 34,000 acres were on BLM lands. No BLM acres were sprayed for Mormon cricket (Brown 2009).

Cumulative adverse effects to humans or other elements of the environment are most likely when two pesticides share a common mechanism of toxicity. That is, they both affect an organism the same way. Cumulative effects assessments conducted by the EPA typically *begin* by grouping pesticides by mechanism of toxicity (EPA 2002). Because insecticides and herbicides work so differently, even a concurrent application would be unlikely to result in significant additive environmental effects when both products are applied within label limits. Synergism is not impossible however; the 2,4-D Risk Assessment reports that 2,4-D induced cytochrome P450 (a natural animal enzyme that processes toxins) in the southern armyworm (*Spodoptera eridania*) and caused synergistic effects on insecticide toxicity (Kao et al. 1995). In addition, exposure to 2,4-D caused decreased carbaryl and permethrin insecticide toxicity. This discussion has been added to the *Cumulative Impacts* section.

134. Comment: The EIS did not adequately consider the proposed increase in the number of proposed wind and geothermal energy sites, transmission lines, and gas pipelines that will result in large-scale disturbance, which will allow for significant inroads to be made by invasive species, which will prompt the BLM to douse public lands with herbicides.

Response: The EIS took into account new energy projects in the State. District experts were asked to estimate herbicide use for the next 10-20 years, and were specifically asked to consider current and future developments under each administrative site, recreation site, and right-of-way category listed under Alternative 4 in Chapter 2. These include geothermal facilities, wind energy facilities, utility distribution, and pipelines.

New permits require mitigation measures and restoration plans for disturbed sites. The analysis for such projects follows BLM policy described in Chapter 3 and Appendix 3, that proposals with a moderate or high risk for establishing noxious weeds require follow-up monitoring as well as identification of project actions that need to be taken in order to reduce or prevent the spread of noxious weeds.

135. Comment: The EIS must assess the levels and degree of desertification that have occurred across the Oregon EIS area. This is necessary to understand the likelihood of soil erosion, accelerated runoff, and other forms of drift, and to understand the amounts of chemicals likely to be applied over time. This is necessary to understand the capability and suitability of these lands for livestock grazing, the productivity and carrying capacity of these lands for grazing, the current or likely future extent of cheatgrass and other hazardous fuels problems linked to desertification and livestock or other degradation, the need for treatments, and the type of treatments that may best be applied, the risks associated with treatments, and the likely effectiveness or success of any treatments undertaken under the EIS. The effects of alternatives, their ability to meet any objectives, and the ability of actions under the EIS to maintain, enhance, or restore habitats and populations of Special Status and other important species and native plant communities depend on the current environmental conditions of the lands where they would be applied.

Response: As noted in Chapter 1, the underlying need to which the alternatives respond is for more effective vegetation control measures to better meet the BLM's existing noxious weed and other vegetation management responsibilities. Actual use of new herbicides made available by the selection of one of the action alternatives would be for meeting objectives identified in existing Land and Resource Management Plans, Conservation Strategies, Facilities Maintenance Plans, health and safety responsibilities, or other plans and direction. Differences in activity levels between alternatives in this EIS are estimates to help quantify the potential for adverse effects using herbicides (and to put them in context with other effects), and are not decisions to conduct vegetation management activities. The selected alternative would not authorize any activities.

An understanding of the capability of lands for grazing, or a detailed study of the implications of cheatgrass on fire danger or habitat decline, thus, is outside the scope of this analysis and unnecessary for an understanding of cumulative adverse effects of the proposed level of herbicide use and the alternatives. The descriptions of the biomes early in Chapter 4, and the *Affected Environment* sections in the specific resource sections (also in Chapter 4), are adequate to support the analysis of the differences between the alternatives. This is a programmatic EIS; the degree to which herbicides might adversely affect described resources are themselves cumulative impacts. Further, the activities expected to be conducted with any new herbicides are nearly all aimed at improving vegetation conditions and/or restoring native ecosystems, and thus are not expected to significantly contribute to adverse effects that may be resulting from other activities on BLM and adjacent lands. Exceptions to this generalization include water quality, air quality, and fish effects. The potential for herbicides to affect these resources is cumulative to other factors degrading these resources. Such cumulative effects are described in those specific sections.

136. Comment: The EIS does not adequately examine the direct, indirect, synergistic, and cumulative effects of the use of herbicides in the context of ecological problems associated with continued disturbances such as livestock grazing. There is an inadequate assessment of the current environmental setting, including the degree of severity of desertification and degradation of watersheds; disturbance across land ownership boundaries; fuels treatments; chronic livestock and grazing management impacts; and baseline information on wildlife species (including many Special Status and other declining species) focused on habitat loss and fragmentation of habitats and populations across native vegetation communities targeted by the EIS for large-scale treatment. There is no analysis of the Fundamentals of Rangeland Health (FRH) assessments or current Ecological Site Inventory (ESI) that is necessary to provide a baseline of current land condition and thus understanding of risk of weed expansion/dominance and amount of herbicide use that may be occurring. ESI and other information are necessary to understand the current ecological condition and health of the lands, and the adverse effects of livestock grazing disturbance on them. Unless the environmental setting in which the herbicide use and continued land use disturbances such as grazing and vegetation treatments would occur are fully revealed and assessed based on sound ecological and Best Available Science, the BLM cannot develop a reasonable range of alternatives, nor apply adequate analysis of impacts of the Proposed Action (Alternative 4) or alternatives.

Response: As noted in Chapter 1, the underlying need to which the alternatives respond is for more effective vegetation control measures to better meet the BLM's *existing* noxious weed and other vegetation management responsibilities. The alternatives in the EIS are not weed or vegetation management plans, which is a much broader topic. Actual use of new herbicides made available by the selection of one of the action alternatives would be for meeting objectives identified in existing Land and Resource Management Plans, Conservation Strategies, Facilities Maintenance Plans, health and safety responsibilities, grazing allotment management plans, or other plans and direction. Differences in activity levels between alternatives are district estimates, made to help quantify the potential for adverse and positive effects using herbicides (and to put them in context with other effects). These estimates are not decisions to conduct vegetation management activities. Site-specific conditions and applicable management direction would be considered at the project scale before actual treatments are authorized.

The inventories and assessments referenced in the comment contributed to the descriptions of the biomes early in Chapter 4, and to the *Affected Environment* subsections in several of the specific resource sections, also in Chapter 4. Those descriptions are adequate to support the analysis of the environmental effects of the alternatives, and the alternatives are set in the context of existing vegetation-related management and activities. The potential effects of grazing on climate change or desertification, or even on weed spread, are outside the scope of this EIS and more correctly left to Land and Resource Management Planning and allotment and grazing management plans.

Environmental Setting

137. Comment: There appears to be no information in the Oregon EIS on the current ecological conditions of the affected lands with respect to cheatgrass, or mapping and analysis of areas of Oregon public lands that are vulnerable to cheatgrass and other weed spread with continued livestock grazing disturbance, etc. The EIS fails to provide criteria and alternatives that would "manage" and "treat" areas with small amounts of cheatgrass or that are at great risk of its expansion by removing grazing or other intensive disturbances.

Response: Cheatgrass and other annual grasses are identified in the *Noxious Weeds and Other Invasive Plants* section in Chapter 4 as an issue on approximately five million acres. These grasses are described as a threat to native ecosystems by displacing native plant communities, displacing wildlife habitat communities for species such as sage grouse, and increasing fire incidence, which affects sagebrush communities and can create a fire hazard in the wildland-urban interface. This information provides a context and basis for the estimates of annual herbicide use under each alternative, and helps set the context for the analysis of effects. However, estimated treatment acres are for analysis of effects at the programmatic scale, and do not represent plans or commitments of resources.

A complete discussion of the management of cheatgrass, or an examination of land uses and their effects on the spread of cheatgrass and other invasive plants, is outside the scope of this analysis. The alternatives simply examine the effects of adding additional herbicides to the BLM's existing vegetation management programs in Oregon, with an emphasis on examining the environmental and human health risks at the programmatic scale. The resource descriptions in the *Biomes*, *Noxious Weeds and Other Invasive Plants*, and various other resource sections in Chapter 4 is sufficient to understand the differences in effects between the programmatic alternatives, three of which include imazapic and other selective herbicides effective on annual grasses. Consideration of various land uses, their sustainability, and their effects on other ecosystem components is more correctly left to the Land and Resource Management Planning process required and defined by the FLPMA.

Site-specific decisions to alter grazing or change other management practices to avoid spreading small populations of invasive plants are always an option; stopping weed populations while they are small is a management priority. These and other Integrated Vegetation Management actions would remain available under all alternatives.

Noxious Weeds and Other Invasive Plants

138. Comment: Missing from the EIS is an unbiased examination of the ultimate causes of the asserted epidemic of invasive species or the full-range of options to deal with that problem.

Response: A discussion of the spread of invasive plants is included in the *Noxious Weeds and Other Invasive Plants* section, particularly under the subheading *Mechanisms of Invasion*. The full range of available control treatments is discussed, for background purposes, in Chapter 3 under *Assumptions and Information about Treatment Acres*. A consideration of the weed spread implications of various resource management practices, and the adoption of noxious weed control as a management emphasis, is included in the Land and Resource Management Plan for each BLM district (see Appendix 6). Reconsideration of management plan decisions is outside the scope of this EIS; the EIS proposes simply to make additional herbicides available to the BLM's existing vegetation management programs.

139. Comment: Weeds spread geometrically and logarithmically, not linearly. The longer the delay to treat weeds, the higher the costs to resources, as well as operation and maintenance costs.

Response: The Invasion Lag Curve in the *Noxious Weeds and Other Invasive Plants* section shows a geometric relationship for individual weed infestations. Costs are higher (or impractical) if weeds spread before control is attempted. Thus, as the *Noxious Weeds and Other Invasive Plants* section in Chapter 4 points out, control efforts are generally focused on new weeds, new populations, and edges of larger populations. However, the noxious weeds in Oregon are now at various positions on the Lag Curve. The twelve percent weed spread rate estimate described in this section averages all of the noxious weeds on BLM lands in Oregon, and all populations, and provides a representation of the problem and how the Alternatives could make a difference in the long-term (15 years).

140. Comment: There is no basis offered for the conclusion that two-thirds of the noxious weeds cannot be controlled with non-herbicide methods. Table A7-1 lists them, but there is no explanation for the basis. In addition, Table A7-1 makes it clear that Alternative 4 (the Proposed Action) and Alternative 5 are not necessary.

Response: The Alternatives 2 through 5 species that cannot be effectively controlled with non-herbicide methods listed on Table A7-1 are those receiving a "no" in the "Non-herbicide methods effective" column on Table A9-2, but there was little documentation on either table in the Draft EIS indicating the basis for those decisions. They are based on the experience of district weed coordinators and various references, primarily the Pacific Northwest Weed Management Handbook (OSU 2009); the Weed Control Methods Handbook (Tu et al. 2001), Weeds of California and other Western States (DiTomaso and Healy 2007); Biology and Management of Noxious Rangeland Weeds (Sheley and Petroff 1999); and The Nature Conservancy Element Stewardship Abstracts (TNC 2009). A footnote has been added to Tables A7-1 and A9-2 to this effect.

Alternatives 4 and 5 add additional herbicides and objectives for controlling native vegetation to meet maintenance and safety objectives around developments, to conduct certain habitat improvement projects, and (in the case of Alternative 5) meet other objectives. The noxious weed list on Table A7-1 has little bearing on these Alternative 4 (the Proposed Action) and Alternative 5 objectives.

141. Comment: Many of the "weeds" you propose to target have medicinal values and are of great value.

Response: In the discussion of non-native plants early in the *Noxious Weeds and Other Invasive Plants* section, "medicinal" has been added to the list of reasons why plants may have been moved into Oregon. There is no doubt many of the State listed noxious weeds and other invasive plants continue to have value at some level; that is the reason many of these plants were introduced into Oregon in the first place. Noxious weeds, however, are those that are too successful, have departed from their limited intended purpose, or were successful but management objectives have changed. Invasive plant control efforts could make some medicinally important plants more difficult to find at the local scale. BLM control efforts are not likely, however, to make medicinally important plants unavailable to those who need them. However, State law makes it illegal to own or sell State-listed noxious weeds, so the BLM refrains from issuing collection permits for them, regardless of their "value" or intended uses.

142. Comment: The EIS fails to consider a reasonable degree of tolerance. With invasive plants having become dominant across so much of the landscape, and the economy in decline, it is preposterous to presume an ability to gain control over the invasive situation. Eradication is not a sane strategy, and, generally, we have more important battles to wager than the one on invasives plants. Invasive weed control must be carefully targeted to protect the most threatened native organisms at least cost.

Response: Most of this comment reflects BLM's current weed control strategies. The BLM coordinates weed control efforts with the Oregon Department of Agriculture, as well as with local weed control districts and neighboring landowners and managers. None of these landowners or agencies have the resources to remove all invasive plants. Therefore the State has classified their 120 listed noxious weeds into two categories based on priority for control, with that priority being influenced heavily by how widely spread a weed already is. "A" list weeds are those of known economic importance which occurs in small enough infestations to make eradication or containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent. Management direction for these is normally eradication or intensive control when and where found. Remaining weeds are on the "B" list (at least locally common). Species from either list may also be assigned to a "T" list (special management plan needed). The assignments for each weed, and the description of the three categories, are shown on Table A7-1. BLM treatments may not follow the State priorities exactly because of local resource protection issues. Protecting a Special Status species' habitat or uninfested watershed, for example, may be a priority regardless of how well established the weed is elsewhere in the State or what list it is on. With noxious weeds spreading on BLM lands at an estimated 144,000 acres per year, some degree of tolerance is required. Biological controls are being used (when available and after Oregon Department of Agriculture approval) to reduce the impact of many of the most widespread weeds.

143. Comment: The EIS missed an opportunity to conduct a real analysis of the risks of weed spread and the futility of treatments, if livestock grazing continues at or near current levels.

Response: As noted in this appendix under *Alternatives Eliminated From Detailed Study*, a reconsideration of grazing capacity is outside the scope of this EIS and is more correctly left to planning implementing the FLPMA, Taylor Grazing Act, and other direction.

144. Comment: The invasive plant "problem" is an invention of the herbicide industry in order to sell more herbicides.

Response: Economic and ecological effects have been documented by numerous experts. Independent estimates of financial losses exceed $100 million for single species within single states (e.g. Radke and Davis 2000; the

Global Invasive Species Information Network; and others). Global impacts from invasive species including invasive plants have been estimated to be five percent of the world's gross national product (Simpson 2004). The International Union for the Conservation of Nature notes that a significant proportion of species now considered extinct were driven to extinction by invasive species (IUCN 2008). The United States Invasive Species Council has a budget of $1.2 billion and is chaired by the Secretaries of Commerce, Interior, and Agriculture (NISC 2006). The Council estimates invasive species (including plants) cost the U.S. Economy over $100 billion per year, and they are the second biggest cause (after habitat loss) for species becoming Federally Listed as Threatened or Endangered. There are also several Federal and State laws requiring the BLM to actively prevent and suppress noxious weeds (see *Background* section in Chapter 1).

145. Comment: The EIS should consider the information in the book *Invasion Biology: Critique of a Pseudoscience*, by David Theodoropoulos (2003).

Response: Information from the book *Invasion Biology: Critique of a Pseudoscience* was considered in the development of this EIS. The book states that not all non-native species are bad; species move from place to place and have historically done so; native ecosystems are not inherently weak and prone to invasion; and, non-native species are not inherently competitively inherently superior to the natives. Analysis in this EIS does not contradict these points. However, the book also refutes science that shows that invasion is a major threat to Endangered species; evidence that economic costs of invasions are in the hundreds of billions of dollars; and, asserts there are connections between invasion biology and the pesticide industry. These assertions are contrary to the majority of invasive plant research examined in the creation of this EIS and/or are beyond the scope of this analysis.

Native and Other Non-Invasive Vegetation

146. Comment: Please explain why desirable non-native plants are considered "native vegetation."

Response: This definition of native vegetation has been removed, and the phrase "native and other non-invasive vegetation" has been used in the text where such a distinction is needed. Lumping desirable non-native plants with native plants was intended to be shorthand for a class of vegetation that might only be treated with herbicides in Alternative 4 (the Proposed Action) and Alternative 5, but the combination not only caused confusion, but also conflicted with referenced policy to use only "native species" in restoration treatments.

147. Comment: The EIS views the expansion of native western juniper as a problem, when it is really just a natural and expected result of climate change, livestock grazing, and altered fire regimes. The BLM should not expect to change the course of western juniper expansion until these other factors are reversed. Western juniper can live to be 1600 years old, and provides important wildlife habitat (e.g. ash-throated flycatcher, black-throated gray warbler, roosting cavities for bats, and nesting for raptors) and forest watershed function. Control of western juniper is resulting in hotter, drier sites more prone to weed invasion.

Response: Western juniper is an important source of shelter and food for a variety of animal species. It is a native species in Oregon and performs important ecological functions. However, for a variety of reasons (including a reduction of fire frequency), there has been a several fold expansion of western juniper. This expansion adversely affects other native shrubs, forbs, bunchgrasses and habitats of the sagebrush steppe, and threatens the Eastern Forest Biome ponderosa pine forests at lower elevations. Western juniper invasion results in reduced shrub abundance and reduced ground water, and contributes to loss of riparian plant species (Bedell et al. 1993). The BLM is currently controlling some western juniper by using chaining, mowing, prescribed fire, and cutting and burning. If herbicides were available, they would be used primarily where western juniper a few feet high can be controlled with spot treatments.

However, decisions about how much western juniper to control and where, are outside of the scope of this EIS. The EIS attempts to describe why and how herbicides would be used under Alternative 4 (the Proposed Action) and 5 only so that likely herbicide uses can be understood in a multi-resource analysis context, and a reasonable cumulative effects analysis of the use of herbicides can be prepared. District personnel familiar with local land management plans and existing vegetation management priorities made the estimates. A complete discussion of the reasons for vegetation management including the control of certain western juniper in certain areas is outside the scope of this analysis and would be duplicative of district-level management plans, Conservation Strategies, and other analyses.

148. Comment: There is inadequate analysis of herbicide impact to Federally Listed and other Special Status plants growing on roadsides.

Response: Proposed roadside herbicide use would require a site-specific analysis that includes a review by the area botanist, wildlife biologist, and fish biologist per BLM's Special Status Species Program policy as discussed in the subsection *Endangered, Threatened and other Special Status Plant Species* in Chapter 4. Where these species are known or their habitat is suspected, the resource specialists would conduct surveys and/or prescribe appropriate mitigation measures to avoid impact to Special Status species. The wording in the EIS has been edited to indicate these surveys and resultant protection measures would likely eliminate most of the risks to these species.

149. Comment: The EIS suggests habitat improvement under Alternative 4 (the Proposed Action) and Alternative 5 could have risk to non-target plants. The EIS does not discuss whether inadvertent spraying of Special Status species, contamination of their food or prey, and accidental spills would harm these species. Simply listing these species in an appendix is not adequate.

Response: Potential effects to Special Status wildlife or fish species, and to the soils and waters within their habitats, are addressed in those respective sections in Chapter 4. Those discussions reference the "Risk Categories" tables at the end of Chapter 3, which include risk categories for sensitive/susceptible species. The potential to adversely affect the Federally Listed or other Special Status species for which each Conservation Strategy is written would also be considered in the site-specific analysis for the project. These analyses would normally be done on a site-by-site basis; habitat improvement projects would not be included in each district's weed management Environmental Assessment. Conservation Measures for Federally Listed species, Standard Operating Procedures, PEIS Mitigation Measures, and BLM policies for Special Status species would substantially reduce the likelihood that treatments would directly affect these species.

The EIS statement that habitat improvement treatments "could have risk to non-target plants [although] applications would be specifically designed to improve overall habitat conditions" is in reference to non-Special Status native plants making up the habitat for Special Status fish or wildlife. Some collateral damage might be acceptable in the interest of long-term habitat improvement. However, if the Special Status species in question were a plant, herbicides would likely not be used nearby if any damage were anticipated

150. Comment: The EIS should address whether or not plants affected by herbicides could grow back mutated, and whether this would harm wildlife.

Response: Herbicide effects on plants vary based on the type of herbicide. In general, plants affected by herbicides will exhibit symptoms of abnormal growth or dieback of tissues. Symptoms appear hours to weeks following exposure and include wilt, yellowing, loss of pigment, dieback, twisted leaves or stems and malformed leaves. Herbicide injury may also result in reduced flowering and seed production. There is no reason to believe future generations would be mutated, or if they were, that such mutations would affect wildlife.

151. Comment: The EIS should explain how many non-target species would be eliminated by herbicide use.

Response: No non-target species would be eliminated by herbicide use. While some individuals may be harmed, the impact to a particular species would not threaten its continued existence. On all herbicide treatments, site-specific analysis would consider various local factors and apply Standard Operating Procedures and PEIS Mitigation Measures that would minimize impact to non-targets. Special Status species would get additional protections.

152. Comment: The EIS should more thoroughly consider the special concerns of the Sulfonylurea (SU) herbicides. These herbicides are capable of interfering with reproduction of plants even at exposure levels that show no damage to plants. A rare or susceptible native annual plant may be unintentionally damaged if is unable to properly reproduce due to exposure to a SU. A lawsuit resulted from a BLM application of sulfometuron methyl in Idaho over damage to nearby crops

Response: The sulfonylureas (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl) and the similarly acting imidazolinones (imazapic and imazapyr) work by inhibiting the plant enzyme acetolactate synthase (ALS). An alternative eliminating the use of these five ALS inhibiting herbicides was suggested during scoping and was eliminated from detailed study (Chapter 2). The PEIS analyzed the special concerns associated with ALS inhibitors and considered an alternative without them. They have been retained in the alternatives in part because they are potentially less harmful to plants, animals, and humans than other herbicide active ingredients proposed, and some of the most problematic weeds are best controlled with them. ALS-specific Standard Operating Procedures were designed to prevent adverse effects from these herbicides outside the area of application. Additional information about the potential for these herbicides to affect non-target plants, including Special Status species, has been added to Chapter 4 in the Final EIS.

The sulfometuron methyl crop damage incident is discussed under *Spills* in the *Cumulative Impacts* section in Chapter 4. Standard Operating Procedures now preclude BLM application of this herbicide aerially. In November 2008, the EPA announced that its sulfometuron methyl Reregistration Eligibility Decision was available for review and comment. In the Reregistration Eligibility Decision, the EPA proposes to prohibit application of sulfometuron methyl in counties with an annual rainfall of less than 10 inches and the use on powdery dry soil or light sandy soil when it is predicted that there is less than a 60 percent chance of rainfall within 48 hours. A final decision from the EPA has not been issued. Information about this EPA action is included in the Final EIS near the end of Chapter 1.

153. Comment: The EIS should address the potential for herbicides to drift onto adjacent organic farmlands.

Response: Although the various resource sections in Chapter 4 are intended to discuss effects of BLM actions across ownership boundaries, and site-specific analyses would consider potential effects to adjacent lands, the Draft EIS did not specifically identify adjacent and/or ultra- susceptible plants on adjacent private lands. A discussion of this risk has been added to the *Native and Other Non-Invasive Vegetation* section in Chapter 4. In addition to site-specific analysis and ensuring herbicide labels are followed, existing Standard Operating Procedures help protect adjacent land uses by requiring the use of drift prevention measures such as no spraying when wind is above 10 miles per hour or precipitation is imminent; use of large herbicide droplets and drift reduction agents where appropriate; use of low volatile formulations; use of low pressure equipment; use of herbicide free buffer strips where appropriate; and notification of adjacent landowners. When aerial application is considered, spraying near agricultural lands is limited; application can only occur when wind speed is below 6 mph; application is avoided during periods of adverse weather conditions (snow or rain imminent, fog or air turbulence); and, height and speed of application are limited by type of aircraft.

154. Comment: The EIS should consider the effects of herbicides to wild edible mushrooms (e.g. chanterelles, matsutakes, and porcinis) as a commercial resource and not just in the *Environmental Justice* section.

Response: The *Native and Other Non-Invasive Vegetation* section in Chapter 4 reports on the findings from the few studies found pertaining to herbicide impact on fungi. In laboratory tests at herbicide levels much higher than would occur in actual use, growth of fungi was inhibited. In studies using rates similar to amounts used in vegetation treatments, fungi seem relatively unaffected by herbicides (Busse et al. 2003, Houston et al. 1998). No studies were found regarding these specific ectomychorrhizal species. The risk of herbicide contamination of wild edible mushrooms of the forest is expected to be limited because most herbicide applications would be directed treatments on invasive plant infestations, and in rights-of–ways, rather than within healthy forests where these conifer root-dependent species are found.

155. Comment: The EIS needs to recognize some plants on the target list might also be collected for human use as medicinal plants.

Response: The Risk Assessments evaluated human subsistence populations (Native American) who gather and use large amounts of range and forest products and generally found no risk (see "Risk Categories" tables at the end of Chapter 3). When herbicides are used, the site of spraying would be posted to inform the public that an herbicide has been used in the area. If medicinal plants are noxious weeds (see Table A7-1), Oregon law does not permit their sale, purchase, propagation, or transport. The BLM does not issue permits for the collection of noxious weeds such as milk thistle and St. John's wort, even if they have medicinal uses.

156. Comment: The EIS says herbicides are designed to kill plants, so they will kill non-target plants if they contact them. The EIS should discuss the effects to rare plants and fungi from the increased use of glyphosate and imazapyr to treat Sudden Oak Death in Curry County.

Response: The addition of herbicides to existing treatments is not expected to have additional impact on rare plant populations. Glyphosate would be used to target individual tanoak trees by direct application to the cambium of tanoak or backpack spray to re-sprouting foliage. The risk for offsite movement of this herbicide from these treatments is very low. Risk from imazapic would be higher but would also be mitigated by Standard Operating Procedures, PEIS Mitigation Measures, and (for Federally Listed species) Conservation Measures. Chapter 4 discusses the risks of these herbicides to non-target plants. Currently there are no Special Status or Survey and Manage plants known in the Sudden Oak Death control area. Additionally, proposals for herbicide use are subject to site-specific analysis. At that time, pre-project clearances would determine the presence of Special Status species and their habitat. When Special Status species are present, mitigation measures are added to conserve and or recover Federally Listed species, or to reduce or eliminate threats to proposed or Bureau Sensitive species.

157. Comment: Although the EIS emphasizes targeting noxious weeds, the door is left open for any type of use the BLM feels is convenient or necessary.

Response: All of the action alternatives would target invasive plants, a slightly larger category of non-natives than State listed noxious weeds. They would also target native vegetation as needed to control pests and diseases in State-identified control areas (the Sudden Oak Death control area being the only current example). Alternative 4 (the Proposed Action) would also target native vegetation in very specific areas for very specific objectives – safety and maintenance treatments around developments and for achieving habitat goals specified in Conservation Strategies for Federally Listed and other Special Status species. Alternative 5 would indeed permit the use of herbicides for any vegetation management except livestock forage and timber production. In all these cases, however, the estimated acres included in the analysis are an important indicator of what the BLM might "feel is convenient or necessary." For example, 5,000 acres per year have been estimated for Alternative 5 objectives. All but 200 acres of this is east of the Cascades, and most would be for additional habitat improvement projects. In addition, fuels treatment would be allowed under Alternative 5 but "is unlikely to occur" (*Fire and Fuels*, Chapter 4). There are 250 acres per year estimated for Sudden Oak Death control, 9,300 estimated for rights-of-way, administrative sites, and recreation sites (much of which would be used by permit holders and cooperators), and 5,700 estimated for habitat improvement under Alternative 4 (the Proposed Action). While these are estimates for analysis, not absolute caps, they nevertheless are de facto reasonable representations of the level and type of treatments intended by the provisions of each alternative.

158. Comment: The effects of herbicide use on rights-of-way and administrative sites have not been adequately addressed. What native plants and wildlife would be hurt, and to what extent?

Response: Currently mowing, cutting, and chipping are the primary methods of control of vegetation encroaching on roads, utility corridors, and administrative sites. Some of these treatments could be replaced with herbicides. Any native plants occurring within the normal clearing limits of those sites might be damaged or killed. On utility corridors, vegetation may be removed or managed at a height that does not interfere with power or pipelines. Typically, tall trees would be removed and grasses, forbs, and shrubs would be encouraged. Trees that resprout after cutting like alder and maple would be the primary target for herbicides. On some administrative sites or rights-of-way, all vegetation is removed, especially if it represents an unacceptable fire hazard. The risks of collateral damage to off-site plants are addressed in the *Native and Other Non-Invasive Vegetation* section, and risks that herbicides on plants would be ingested by wildlife are discussed in the *Wildlife Resources* section.

159. Comment: The EIS does not explain what native vegetation would be targeted for "habitat improvement." What native species would benefit? Is this just a disguise for livestock forage increases?

Response: Habitat improvements under Alternative 4 (the Proposed Action) could treat any native or non-native vegetation to achieve habitat goals specified in (usually interagency) Conservation Strategies for Federally Listed or other Special Status species. An example might be sagebrush thinning to improve habitat for sage grouse, if called for in an established Conservation Strategy document. Under Alternative 5, "habitat improvement" is a broader term that could include habitat for fish, wildlife, and plants. An example might be reducing western juniper to improve water availability for native plants such as aspen, wildlife such as mule deer, and aquatic species. Identification of specific vegetation to be controlled or favored would depend upon the objectives of the particular project, and be subject to site-specific analysis. All of the alternatives in this EIS exclude herbicide use specifically for livestock forage production.

Pests and Diseases (Sudden Oak Death)

160. Comment: The *Comparison of Effects By Alternative* section of Chapter 2 states, "There are essentially no negative environmental [effects] associated with the 250 acres per year of herbicide applications expected to occur under Alternatives 3-5 for Sudden Oak Death." Maybe this statement reflects some kind of unstated weighting of impacts, but this is not appropriate NEPA analysis. Both the beneficial and adverse impacts must be fully disclosed and weighted in the open daylight of public discourse.

Response: This summary statement was indeed too encompassing. It would be more correct to say that the use of herbicides to control pest and disease spread represents less than one percent of the total herbicide use proposed under the action alternatives, and no significant adverse impacts specifically attributable to Sudden Oak Death related herbicide applications are discernable in this programmatic EIS. The text was removed from Chapter 2 when the *Comparison of the Effects of the Alternatives* section was changed to be a comparison table.

The statement did not intend to suggest there might not be adverse effects requiring mitigation, or conceivably an EIS, at the project-specific scale. This EIS focuses on cumulative effects of herbicide application statewide and does not authorize any treatments. Use of herbicides on BLM lands to help control Sudden Oak Death would be examined in a project-specific Environmental Assessment or EIS.

161. Comment: The initial control area for Sudden Oak Death was 9 square miles in 2001, and 160 square miles in 2008. The EIS indicates that if the infestation continues to spread, these [250 acres of tanoak treatments per year] would be expected to increase. The EIS does not establish a threshold to trigger reconsideration of the scale, methods, or species to be treated as the spatial scale and intensity of Sudden Oak Death treatments expands.

Response: The EIS estimates the herbicide use that would result from adoption of one of the alternatives, and examines the cumulative effect of that use at the programmatic scale. The acres are estimates for analysis purposes, and no treatments would be authorized by the Record of Decision. When actual treatments exceed or differ from those analyzed in programmatic NEPA documents in potentially significant ways, the BLM examines the adequacy of existing NEPA analysis. The examination primarily considers the likelihood of having a significant level of effects not identified and considered in the original Record of Decision. A doubling of the acres treated for Sudden Oak Death, but not exceeding the total glyphosate use west of the Cascades examined is the EIS (for example), could still fall within the programmatic effects analyzed in this EIS. Actual treatment decisions would be made with site-specific analyses that would tier, in whole or in part, to this EIS. Those site-specific analyses themselves would consider the continued applicability of the EIS analysis. Finally, actual Sudden Oak Death control is examined with site-specific analysis. If Sudden Oak Death control work expands significantly, a separate EIS examining all Sudden Oak Death control activities by Federal Agencies might be needed, even if herbicide use remains within the estimates of this EIS. In either case, a decision to use herbicides on oaks or other species would be looked at in one of those analyses. This EIS does not examine the Sudden Oak Death control program, but only examines the cumulative effects of the herbicide portion of that and other vegetation management programs.

162. Comment: If the Sudden Oak Death outbreak remains small, it probably can and should be dealt with using non-chemical methods. If the Sudden Oak Death outbreak greatly expands, then the effects of large-scale "scorched-earth" vegetation treatments may become very significant especially if it is accomplished with chemicals. The *Pests and Diseases* section of the EIS says, "If the infestation continues to spread, these [treatment] acres would be expected to increase." There is a point at which the treatment of the disease may be worse than the disease itself. The EIS does not establish adequate safeguards or thresholds to trigger reconsideration of the scale and methods of treatment as the spatial scale and intensity of Sudden Oak Death treatments expand.

Response: The effects of managing Sudden Oak Death without the use of herbicides on BLM lands are described under Alternative 2 (No Action) and the Reference Analysis; the infestation continues to spread and the suboptimal tanoak control on BLM lands is believed to be contributing to that spread. Regarding a maximum level of treatments, effects in the EIS are based on estimates of average annual acres to be treated. These are not guaranteed minimums or maximums; the acres are only estimates for analysis purposes. If future use significantly exceeds estimates at the programmatic scale, a review of NEPA adequacy would determine if the EIS still applies. Since Sudden Oak Death control would be subject to site-specific analysis, the adequacy question relative to this EIS might be limited to the continued adequacy of the EIS analysis for cumulative effects. Increases in Sudden Oak Death treatments alone would not necessarily violate the analysis assumptions.

163. Comment: The EIS says it is not precisely known how much more effective herbicides are when compared to non-herbicide treatments to corral Sudden Oak Death-hosting tanoak, with the opinion of pathologists being that non-herbicide methods are 15 to 30 percent less effective. While we are concerned about the loss of oaks, increasing herbicide use for this purpose is not safe or proven to be effective.

Response: The estimated 250 acres per year herbicide use on tanoaks to control Sudden Oak Death on BLM lands within the State-identified Sudden Oak Death control area is included in the herbicide use estimates for Alternatives 3 through 5. No specific adverse effect attributable to this specific use was identified at the programmatic scale. Herbicide applications on National Forest System lands within the control area are currently made with aquatic-formula glyphosate in compliance with existing Fish and Wildlife Service Biological Opinion (USDI 2008b). The potential for adverse effects from glyphosate control of tanoaks to control Sudden Oak Death was examined at the project scale in an Environmental Assessment completed by the Coos Bay BLM District in May, 2010. No significant effects were identified.

Regarding the effectiveness of treatments, the EIS stated "…it is not precisely known how much more effective; data are currently being gathered and is expected to be available in 2009. The opinion of pathologists is that the approach currently used by BLM without herbicide use is 15 to 30 percent less effective than the herbicide approach" (*Pests and Diseases* section). The promised 2009 data is now available and has been incorporated into the Final EIS. Pathologists established 119 plots (2008-2009) around the stumps of the known-infected tanoak trees that had been cut, and examined all host vegetation remaining on the sites. Six percent of the 106 plots on private lands had infected tanoak re-sprouts (post-treatment) using herbicide in some form (injected, stump-top application or sprout spray). Thirty-eight percent of 13 plots on BLM lands where herbicide was not used had infected tanoak re-sprouts (post-treatment). While the small non-herbicide sample size reduces the statistical strength of the apparent trend, the data nevertheless supports the pathologist's earlier impressions that herbicide use reduces the number of infected sprouts post treatment, thus reducing the potential for continued spread of the disease.

However, as with other treatments described in this EIS, the selection of treatment methods is outside the scope of this EIS. The 250-acre per year estimate included in this EIS is for cumulative effects analysis purposes only, and does not represent a commitment to a particular treatment method. Treatment decisions would be made following site-specific analysis.

164. Comment: It is not clear in the discussion of Sudden Oak Death that aquatic-labeled glyphosate would be used to protect fish, or that stream buffers would apply. Why not use imazapyr since it is less toxic to fish?

Response: The EIS section discussing Sudden Oak Death indicates glyphosate and/or imazapyr might be used. As with other herbicide use by the BLM in Oregon, the Standard Operating Procedures and PEIS Mitigation Measures would apply. These include requirements for stream buffers, and the use of glyphosate with low or no POEA near streams. Certain formulations of glyphosate and imazapyr are labeled for riparian and aquatic use. A final decision about if, how, and which herbicide to apply is subject to site-specific analysis. Aquatic-labeled glyphosate is being used on adjacent National Forest System lands, in accordance with a Biological Opinion (USDI 2008b) from the Fish and Wildlife Service.

Climate Trends, Projections, and Implications

165. Comment: The EIS claims manual methods of weed control are not desirable because those methods use fossil fuels, but never admits that herbicides are made from fossil fuels, and their application uses fossil fuels, equating to likely far greater fossil fuel use than manual methods.

Response: This discussion, from Chapter 1, simply notes non-herbicide methods also have adverse effects, and includes the use of fossil fuels as one of those. No comparative analysis is made here or elsewhere in Chapter 1. The emissions estimates in the *Air Quality* section *do* indicate that exhaust from control treatments would be much higher for non-herbicide treatments than for herbicide treatments. Exhaust is created by mechanical (not manual) equipment. Mechanical control methods typically require more trips to the site (lower production rates) and use more fossil-fuel burning equipment than herbicide treatments. Some fossil fuels would be used in the manufacture of herbicides (as they would be refining fossil fuels for use in mechanical equipment) and for some packaging. Some, but not all, herbicide formulations may have their origin in fossil fuels. However, the quantity of herbicides applied at typical rates ranges from two pounds (glyphosate) to less than one ounce (several) per acre (see the "Estimated Annual Pounds of Herbicide..." table in Chapter 3). The active ingredients in powder or concentrate form are typically mixed with several gallons of water to make the spray mix; the BLM no longer permits the use of petroleum products as carriers. Thus, there is no reason to believe that spraying a roadside, for example, would use any more fossil fuel than mowing the same road.

166. Comment: The *Comparison of the Effects of the Alternatives* section in Chapter 2 refers only to climate change-related *increases* in temperature and/or CO_2. The EIS does not recognize that future climate change-related increases in temperature and changes in precipitation are actually very region and sub-region specific and may not favor invasive plants west of the Cascades. Changes are also speculative east of the Cascades.

Response: Although CO_2 levels are predicted to increase from historic levels, temperature and rainfall changes resulting from global climate change could be either up or down as suggested in the coment, depending upon location. The *Comparison of the Effects of the Alternatives* section has been changed to say that CO_2 increases will likely favor invasive plants, and that disturbances to native plant communities exacerbated by significant shifts in temperature or rainfall would likely be exploited by invasive plants.

It is certainly possible that a warming wetting trend west of the Cascades will not benefit invasive plants as visibly, or to the same degree, as climate changes in other areas of the State. However, there are invasive plants in Oregon from all over the world. Any change in environmental conditions would result in some vegetation shift, and that can be expected to be exploited by invasive plants.

167. Comment: The EIS should also include a discussion of the interactions between climate change (changes in fire regimes, increased CO_2 concentrations, changes in precipitation and temperature regimes, changes in the frequencies of droughts, heat waves and cold snaps, and so forth) and other natural and anthropogenic disturbances (logging, OHV use, grazing, planned and unplanned fires, and so forth) that may increase the frequency and extent of soil disturbance, thereby exacerbating invasive plant problems.

Response: In large part, the science needed for this type of discussion is not available. How climate change may interact with anthropogenic disturbances and management activities has not been studied or simulated. Several studies have examined the potential impacts of different forest management scenarios on carbon storage, but these studies have only taken place under the current climate, not taking into account how changing climate may also alter site capability. A small number of studies have examined how increasing atmospheric CO_2 concentrations may affect certain invasive plants (see *Implications of Climate Change on Invasive Plants* in Chapter 4) but none of those studies has examined subsequent interactions between plant response to increased CO_2 concentrations and livestock grazing. Several climate change projections have included a projected increase in fire size, intensity and severity, and an increase in insect outbreaks in forests but none have included a projection of disturbance regime changes in rangeland ecosystems nor have such projections included a discussion on expected interactions with other natural or anthropogenic disturbances.

168. Comment: The EIS should discuss carbon storage.

Response: The effects of the alternatives on climate change and carbon storage has been added to the *Climate Trends, Projections, and Implications* section in Chapter 4.

Soil Resources

169. Comment: Treating administrative sites and rights-of-way acres with herbicides (instead of mechanical means) is more toxic to soil organisms or disruptive to nutrient cycling. These impacts cannot be compared to erosion and compaction from non-herbicide methods. Erosion and compaction effects can be better understood, and more easily mitigated and restored.

Response: Some herbicides could reduce, but not eliminate, soil microorganisms and nutrient cycling processes. The expected recovery for these reductions in populations comes in several (1-3) growing seasons as native or seeded vegetation returns to the site.

The acres in administration sites, rights-of-way and recreation areas not treated with herbicides would continue to be treated through mechanical or manual means. Using mechanical equipment repeatedly in rights-of-ways, administrative sites, and recreation sites generally does not denude the sites enough to allow erosion. When soil is lost from such sites, the potential to restore the soil organisms and cycling processes will take much longer to return, as soil (weathered rock and organic components) will need to be replaced in order to provide a medium for populations of organisms to live and process nutrients. Compaction reduces soil air space, infiltration of water and also reduces or changes the type of populations of organisms. Compaction occurs under the wheeled track portion of the treated area. This compaction can be repeated every year or several times a year in some instances. While this compaction could be restored with an aerator, they are not often utilized, as the equipment for these types of environments is not readily available or is more destructive to the surface and increases the potential for erosion. Compaction and erosion also create surface disturbances and change soil properties, favoring reinvasion by invasive plants. These in turn adversely affect soil chemistry and stability when compared to soils populated with native plants. A major benefit of using herbicides is that they can often avoid or minimize reinvasions associated with surface disturbances (see Reference Analysis in the *Soils Resources* section in Chapter 4, and others).

170. Comment: The EIS should explain which invasive plants would be targeted with a prescribed fire treatment. For the follow-up restoration, when treating by seeding, range drills should not be used in areas of intact biological crusts.

Response: As described in the *Fire and Fuels, Air Quality,* and other sections in Chapter 4, prescribed fire would be used primarily east of the Cascades, in a three-step treatment regimen for preventing or controlling invasive annual grasses. A determination regarding the most appropriate seeding method would be made during site-specific analysis that would consider the existence and sensitivity of soil crusts.

171. Comment: A detailed analysis of the effects on killing or weakening biological crusts (microbiotic crusts) should be included in the EIS. Biological crusts are increasingly recognized as providing natural benefits in reducing climate change processes.

Response: The *Soil Resources* section describes biological crusts and outlines the major components of biological crusts and where these crusts are expected to be located on BLM managed lands. This section has been expanded to note that the application of herbicides could be considered a disturbance event that could result in decreased soil organism diversity, nutrient cycling, soil stability, and organic matter. Individual components of the crusts can be reduced by herbicide applications, causing the crusts to lose some ability to function as a soil protection and a nutrient cycling mechanism.

A section on the potential impact of the alternatives on the carbon storage capacity of biological soil crusts has been added to the *Climate Change* section as well.

172. Comment: In the *Additional Information about the Fate and Effects of Herbicides* subsection, changing the wording to note that chlorsulfuron is "more stable" in neutral soils is suggested. This would be more correct, as well as more consistent with the information on tables in the *Soil Resources* section, than the current wording indicating it "is relatively stable" in neutral soils.

Response: The wording regarding chlorsulfuron in the *Soil Resources* section has been changed to state that it is more stable in neutral soils.

173. Comment: The EIS should include the following information relative to clopyralid in the EIS: Clopyralid has an inability to bind with soils; therefore, it can be highly mobile and a contamination threat to water and non-target plants. It is considered persistent in soil, water, and plants. When applied to cold dry soils or waterlogged soils the residues may persist for years. This herbicide may leach to 180 cm in 20 days and move to streams when placed directly on soil. Direct application to soil may also prevent germinating plants from emerging from the soil. Clopyralid can also present problems for organic farmers as the herbicide can be transferred to other non-target crop plants through compost, plant residues, soil residue, runoff, or leaching.

Response: In the *Soil Resources* section, the characteristics of clopyralid are addressed. Clopyralid is disclosed in the EIS as being unstable in soil and is considered moderately persistent based on its half-life. It will leach under favorable conditions such as in wet, sandy soils like Inceptisols or Andisols as it does not bind to soil tightly. However, biodegradation is rapid in soil and thus the potential for leaching or runoff is low. Clopyralid can persist in plants and, therefore, can be introduced into the soil when plants die and kill other plants. This chemical is not expected to be applied to cold dry soils, as the method of application is to be foliar, it is not approved for wetland or riparian areas, and thus no applications would be expected on waterlogged soils. According to the study by Elliott et al. (1998), the leaching to 180 cm occurred on worst-case experimental conditions (application to a harvested, cultivated field followed by irrigation). These conditions or any such conditions that resemble this level of disturbance would not be encountered during the application of clopyralid on BLM lands. Movement of plant material, soil residue, or compost is not expected under any alternative and thus contamination of secondary crops would not occur. The potential for leaching and runoff are low due to the rapid biodegradation of the active chemicals.

174. Comment: The EIS should address what organisms 3, 4-DCA (diuron's breakdown product) affects, and to what extent.

Response: The effects described for diuron are attributable to the 3,4-DCA. More specifically, according to one study in a Risk Assessment report of the substance 3, 4-dichloroaniline, bacteria, fungi, and red wiggler worms were affected by the application of this chemical to soil (EINECS 2006). Growth inhibition and rate of anaerobic nitrate respiration were reduced for the bacteria and fungi. Reductions of 80 to 40 percent depending on the organism and concentration of the chemical were noted.

A radiorespirometric[3] technique was used to examine the effect of 100 ppm diuron and 3, 4-DCA on respiration of fresh sandy loam soil. *Pseudomonas putida* (a soil bacterium) was inoculated to the sterilized soil and incubated for 18 hours at 25ºC. The results show that diuron had no inhibitory effect on *P. putida* or soil microbial activity. For 3,4-DCA, an inhibition of about 50% could be found. A growth test in vitro showed no inhibition by 3,4-DCA, leading the authors to conclude an influence of physical properties of the soil were the cause for the reduction by 3,4-DCA.

In a second study (also reported in EINECS 2006), nitrification was inhibited with a lag phase of 1, 2, and 17 days by the application of 2.5, 5, and 25 mg/kg of soil of 3,4-DCA, but the eventual appearance of nitrate was almost identical with that of the control. For worms, no effects on mortality and body weight of adults and the number of offspring were observed for the test concentrations of 1 to 100 mg/kg dry weight soil for fresh (2 hrs after application) and aged (5 weeks after chemical application) soil variants. The highest test concentration of 320 mg/kg provided significant effects on mortality and body weight of adults in the freshly contaminated soil, and no offspring were found. In aged soil, some reduction in offspring numbers has been observed at 320 mg/kg dry weight soil only. These findings indicate that the bioavailability of the test substance decreased in the 5 week aged soil.

According to the European Food Safety Authority's Conclusion on the Peer Review of Diuron (EFSA 2005) for bees, non-target arthropods, and soil micro- and macro-organisms including earthworms, the risk is considered low for the representative uses with regard to diuron and metabolites. The above paragraphs are consistent with the information summarized for diuron. This last summary paragraph has been added to the *Soils Resources* text in Chapter 4.

175. Comment: The *Additional Information about the Fate and Effects of Herbicides* subsection states that diuron is a highly persistent herbicide. To be consistent with tables in the *Soil Resources* section, this should be changed to moderately persistent.

Response: The wording regarding diuron in the *Soil Resources* section has been changed to state that diuron is moderately persistent.

176. Comment: The EIS should describe what other soil organisms and other life might be affected by dicamba's breakdown product 3,6-dichlorosalicylic acid in addition to earthworms, and describe its persistence time in soil.

Response: As noted in the EIS, dicamba breaks down in soil to very simple substances like carbon dioxide and water. The soil bacterium *Pseudomonas maltophilia* (strain DI-6) converts dicamba to 3,6-dichlorosalicylic acid (3,6-DCSA), which is adsorbed to soil much more strongly than is dicamba and lacks herbicidal activity. Very little information is available on the toxicity of these breakdown intermediates. According to Smith (1974), the degradation product 3,6-dichlorosalicylic acid built up during the three weeks of degradation of dicamba and was followed by a slow loss that was complete within nine weeks.

177. Comment: The non-persistent rating in tables in the *Soil Resources* section conflicts with the text that states that fluridone may last up to a year on dry soils and is moderately persistent.

Response: Fluridone is an aquatic herbicide for the control of vascular aquatic plants and not proposed for treatments outside lakes, ponds, canals and reservoirs (see the *Water Resources* section). However, information

3 Respirometric: of, relating to, or being a study of metabolism by the measurement of carbon dioxide labeled with carbon 14 from the carbohydrate substrate.

for this herbicide exists for application on soil. In field studies using different soil types, less than10 percent of the originally applied fluridone was found after 220 days in Miller clay, and 20 percent was found remaining after 385 days in Lufkin fine sandy loam soil. In laboratory studies, fluridone persistence in non-sterilized soils after 210 days was 62, 44, 10, and 5% in Lufkin fine sandy loam, Miller clay, Hidalgo sandy clay loam, and Brennan fine sandy loam, respectively (Banks 1979).

The wording in the *Soil Resources* section has been clarified to say fluridone would be used in an aquatic environment. The persistence rating has been footnoted to show it applies to aquatic applications. Fluridone would not be applied to a dry soil environment for weed control on BLM lands in Oregon.

178. Comment: The EIS should explain how, for imazapyr, it can know that "the potential for longer-term effects on soil organisms exists but little is known if the effects would be positive or not."

Response: The *Soil Resources* section notes that studies have reported that imazapyr may be actively exuded from the roots of legumes (such as mesquite). This exudate and the ability of imazapyr to move via intertwined root grafts may therefore adversely affect the surrounding desirable vegetation (SERA 2004d, Tu et al. 2001). SERA (2004d) also describes the lack of known effects to soil microorganisms. Based on the persistence time of the herbicide in soil and the ability of it to be taken up by other vegetation, there may be the potential for soil organisms to be affected, either positively or negatively. In the Forest Service Final EIS Appendix U (USDA 2005), the chemicals are individually assessed for effects and the following statements reflect the knowledge of imazapyr. No other literature searches have yielded new or contradictory information.

- There are no studies on the effects of imazapyr on soil invertebrates, and incomplete information on the effects on soil microorganisms.
- One study indicates cellulose decomposition, a function of soil microorganisms, can be decreased by soil concentrations higher than concentrations expected from [BLM] applications.
- There is no basis for asserting adverse effects to soil microorganisms.
- Imazapyr degrades in soil, with a half-life of 25 to 180 days.
- Degradation rates are highly dependent on microbial action.
- Anaerobic conditions slow degradation.
- Adsorption increases with time as soil dries and is reversible.
- Field studies indicate that imazapyr remains in the top 20 inches of soil and do not indicate any potential for imazapyr to move with surface water.
- In forest field studies, imazapyr did not runoff and there was no evidence of lateral movement.
- Modeling results indicate imazapyr runoff is highest in clay and loam soils with peaks after the first rainfall.
- Imazapyr percolation is highest in sandy soils

This or corresponding relevant information has been included in the discussion of imazapyr in the *Soil Resources* section, and the sentence cited in the comment has been changed to show there are no studies on the effects of imazapyr on soil invertebrates, and there is incomplete information on the effects on soil microorganisms.

179. Comment: The conclusion of no effects to soil quality from herbicide use is contradictory given the stated picloram effects to soil organisms and persistence.

Response: The statement for soil quality degradation has been revised to show that of the four potential herbicides available for use in Alternative 2 (No Action), 2,4-D, dicamba, and glyphosate would not reduce soil quality when used to control noxious weeds under this alternative. Picloram effects may reduce soil organisms for up to a year.

180. Comment: The discussion of sulfometuron methyl in the *Soil Resources* section says that sulfometuron methyl is broken down through hydrolysis and biodegradation and moves readily through coarse textured soils. This is true for laboratory studies but field studies show it to be immobile under field conditions. The EIS should be edited to state that the mobility and persistence of sulfometuron methyl in soil is low.

Response: Field studies by Trubey et al. (1998) determined the persistence of sulfometuron methyl in soils is low. The degradation and mobility of sulfometuron methyl and potential degradates in the Trubey et al. field studies were evaluated under actual field conditions in the United States following application of Oust® herbicide to bare ground at the maximum-labeled rate. Sulfometuron methyl degraded rapidly at the four test sites; calculated half-life values ranged from 12 to 25 days. Sulfometuron methyl and its degradates were immobile under field conditions.

Information from the Extoxnet Pesticide Information Profile cites that the information on the rapid disappearance of sulfometuron methyl and the slight potential to move through soils indicates that the compound does not pose a threat to groundwater (Extoxnet 1996c).

Based on this supporting and new information, the mention of coarse textured soils and mobility within them has been supplemented in the *Soil Resources* section to note that the half-life of sulfometuron methyl is short, and that it has been found to move readily through coarse textured soils such as sand and sandy loams under laboratory conditions but that in field studies it has been demonstrated to be immobile and does not pose a threat to groundwater.

181. Comment: How toxic is triclopyr acid and how long does it persist in soils?

Response: As noted in the *Soil Resources* section, triclopyr is manufactured in two forms: a triethyamine salt (TEA) and a butoxyethyl ester (BEE). Both forms degrade readily in sunlight to the parent compound, triclopyr acid, which is also photodegradable. No information is available for toxicity of the degraded form, triclopyr acid, in soil. The *Soil Resources* section has been expanded to include the following information regarding its half-life: A study of photolysis found the half-life of triclopyr acid on soil under midsummer sun was two hours (McCall and Gavit 1986). Photodegradation can be particularly important in water. Johnson et al. (1995) found triclopyr acid dissolved in water had a half-life due to photolysis of one to 12 hours. They also found that sunlight plays a role in the rate of microbial metabolism of triclopyr, as microbial metabolism slowed when soil was deprived of light. The average half-life of triclopyr acid in soil is 30 days (Tu et al. 2001).

Water Resources

182. Comment: The *Summary* does not mention the potential for contamination of ground or well water.

Response: Although not in the Draft EIS *Summary*, known groundwater contaminates (those herbicides detected in groundwater regardless of the amount) were identified in the *Water Resources* section of the EIS in Chapter 4, and were listed in the short summary of Water Resources information in the *Additional Effects by Resource* section in Chapter 2. In the Final EIS, the *Summary* has been combined with the Final EIS so a complete effects analysis is within one document. The *Additional Effects by Resource* section in Chapter 2 has been replaced with a *Comparison of the Effects of the Alternatives* table, which continues to include a list of known groundwater contaminates.

183. Comment: The Clean Water Act declares a National goal that the "discharge of pollutants into the navigable waters be eliminated." The Act defines pollutants as "chemical waste" and "biological materials," which includes herbicides.

Response: Standard Operating Procedures, PEIS Mitigation Measures, and other measures are designed to keep non-aquatic BLM herbicides from getting into waters. For aquatic herbicides used to control invasive plants in and near water, site-specific analysis would demonstrate that benefits outweigh the risks before projects are authorized. For these cases, the EPA (in 2006) defined label-specified herbicide applications as not constituting a discharge of a pollutant under the Clean Water Act. The EPA's decision was subsequently overturned by the United States Court of Appeals for the Sixth Circuit, but the EPA was given until April 11, 2011 to prepare a general National Pollutant Discharge Elimination System (NPDES) permit for label-applied herbicides into or near water. The general permit, once issued, would have the effect of certifying compliance with the National goal. The BLM would comply with the provisions of the general permit, but the permit would not necessarily result in any changes to the applications described in the EIS.

184. Comment: More than 2,000 miles of BLM streams in Oregon are already listed on the Clean Water Act's 303(d) list as impaired for water quality, and 1,711 of those miles are impaired for temperature violations. The BLM has not adequately examined the effect of herbicide use on temperature-impaired streams.

Response: Both the *Fish* and *Water Resources* sections describe how invasive plants generally provide less stream shading and are less effective at providing bank stability than native, site appropriate, vegetation. In addition, total maximum daily loads (of sediments) are identified for each 303(d)-listed stream, and these include identification of "system potential vegetation" as the target (native) vegetation to meet water temperature standards. Slowing the spread of invasive species and removing invasive species from the riparian areas along streams, allows for the improvement of riparian vegetation important for stream shading and the maintenance of bank stability, both helpful in meeting temperature and other Clean Water Act objectives. Treatments along rights-of-way might have little effect on stream temperatures because of required buffers, and because acres proposed for herbicide use are already being managed using mowers and other non-herbicide methods. In any case, treatments would be analyzed in site-specific analysis that would consider potential effects to specific listed streams.

185. Comment: Oregon Department of Environmental Quality recommends that BLM establish direct communication with the Public Water System (PWS) operators or community liaisons downstream of the BLM treatment areas. Oregon Department of Environmental Quality generally recommends 100 or 200 feet buffers within 500 to 1,000 feet of a PWS intake and that BLM's management in municipal watersheds and aquifers management should support the overall goal of providing the highest quality water possible downstream at intakes and wells.

Response: These Oregon Department of Environmental Quality recommendations have been included in the *Water Resources* section in Chapter 4.

186. Comment: The EIS is defective because it fails to disclose the increasing frequency of pesticide detections over time for watersheds affected by the EIS. For example, the EIS fails to disclose that the [Reference Analysis][4] (no herbicides) would result in the least number of pesticide detections in streams, whereas, Alternative 5 could have up to 18 additional pesticide detections.

Response: The EIS variously reports actual levels of herbicides currently found in water bodies and groundwater, or the percentage of samples in which herbicides were detected, most notably in the *Water Resources* and the revised *Cumulative Impacts* sections early in Chapter 4. The *Water Resources* section goes on to discuss specific

4 This was "Alternative 1" in the Draft EIS and in the public comment. The title "Reference Analysis" is used in this Appendix to conform to the rest of the Final EIS.

herbicides in State waters, routes of delivery, and fate. That same section concludes that the Reference Analysis "would not have the potential to contaminate water with herbicides," while Alternative 5 says "the higher number of acres treated would add to the risk of herbicides impacting water quality …" The potential effects described in the comment are fully disclosed.

187. Comment: The EIS is defective because it fails to provide baseline conditions of potentially affected streams (existing detections of pesticides).

Response: The EIS variously notes the results of State, the EPA, and other herbicide-related water monitoring efforts. Recent monitoring results for the Willamette Basin have been added to the *Water Resources* section. This section also describes incidences and sample results for surface and groundwater. The EIS is programmatic however; no site-specific treatments are proposed, so no specific streams are directly affected by the Record of Decision. Water quality monitoring could occur on a subset of herbicide application projects, particularly where there are Federally Listed fish or where the project is considered higher risk (see Appendix 3). Monitoring is described in the BLM's Chemical Pest Control Handbook (USDI 1992c). The handbook says no set criteria for when to monitor are prescribed, but that a toxic chemical proposed for use in a susceptible areas such as near a residential area, or domestic water supply, must be monitored. Where water quality monitoring occurs, a baseline sample is collected before application of herbicides.

188. Comment: In 2008, the Oregon Department of Environmental Quality initiated a long-term program to monitor surface waters for toxic pollutants. Monitoring objectives were to collect data on pollutants known to present a substantial threat to human health or aquatic life and to gather information about the occurrence of chemicals of emerging concern in the Willamette River Basin. Water samples and fish were collected from mainstem and tributary locations throughout the basin and analyzed for a wide range of organic pollutants and metals. Herbicides were the class of pesticides most commonly found in water samples. Of the herbicides addressed in this EIS, diuron was found in many samples collected at locations throughout the basin.

Response: A discussion of this Oregon Department of Environmental Quality water monitoring has been added to the *Water Resources* section. Diuron was the 13th most commonly used herbicide in the State of Oregon in 2008. Diuron was found at low concentrations, less than 1 microgram per liter, which is 10 to 100 times less than the EPA benchmark for fish and invertebrates. There is no numeric water quality criteria established for diuron at this time (ODEQ 2008).

BLM would use diuron only under Alternative 4 (the Proposed Action) and Alternative 5. The estimated use west of the Cascades would be approximately 100 acres per year (800 acres for the whole State), a small fraction of the total acres treated in Oregon (see the *Cumulative Impacts* section early in Chapter 4). Standard Operating Procedures and PEIS Mitigation Measures include minimum buffers for use of upland labeled herbicides near water, based on application method (Appendix 2). In addition, for project level analysis, Standard Operating Procedures include the guidance to develop further refined buffer widths based on herbicide properties and site-specific conditions, to minimize impacts to water qualities. Buffers limit the transport of herbicide from upland treatments to water (*Water Resources,* Berg 2004, Dent and Robben 2000, Rashin and Graber 1993).

189. Comment: The Oregon Department of Forestry (ODF) encourages the BLM to share any water quality effectiveness monitoring data collected in support of this EIS with the State of Oregon's Water Quality Pesticide Management Team (WQPMT). Initiated and led by the Oregon Department of Agriculture, the inter-agency WQPMT acts to review and respond to pesticide detections in Oregon's ground and surface water as described in the Pesticide Management Plan for Water Quality Protection. As a Team member, the ODF is keenly interested in expanding the knowledge base regarding pesticides use and water quality on forestlands.

Response: Appendix 3 (Monitoring), has been revised to show that the BLM would share effectiveness monitoring data with the Oregon Department of Forestry's Water Quality Pesticide Management Team.

190. Comment: BLM should consider the EPA list of Pesticides of Interest and Oregon's Pesticides of Concern as well as other water protection methods when developing and implementing projects under NEPA.

Response: A subsection addressing Pesticides of Interest and Pesticides of Concern has been added to the *Water Resources* section in Chapter 4.

191. Comment: Many of the herbicides addressed by the EIS were detected in surface or groundwater in the 1992-95 USGS National Ambient Water Quality Assessment (NAWQA) studies in the Willamette Basin. These include 2,4-D, bromacil, dicamba, diuron, glyphosate, and triclopyr (Wentz et al. 1998). These data suggest that standard application practices may result in measurable concentrations of these compounds in surface waters near application areas, sometimes above water quality standards. These results emphasize the need to limit use of chemical herbicide controls whenever feasible.

Response: A discussion of the NAWQA study was added to the *Water Resources* section in Chapter 4.

The herbicides listed in the comment are all commonly used by agriculture, where herbicides are applied at regular intervals to large acreages following label requirements. Of the 18 herbicides addressed in this EIS, the 1992-95 data showed diuron in 53 percent of surface water samples, sometimes in levels exceeding drinking water standards. The BLM manages 25 percent of the land in Oregon but would use less than one percent of the herbicide under any alternative. Standard Operating Procedure-required buffers lessen the risk of herbicides entering water when compared to label requirements. Standard Operating Procedures also require that additional buffer widths be developed based on herbicide-specific and site-specific conditions, to minimize impacts to water quality. The *Water Resources* section includes information about the effectiveness of buffers at limiting the transport of herbicide from upland treatments to water (Berg 2004, Dent and Robben 2000, Rashin and Graber 1993). Diuron use west of the Cascades is estimated at 100 acres per year. The herbicide-specific information added to the Final EIS in Appendix 9 indicates diuron would be used for nursery-bed site preparation, and weed control around cell phone, radio, and television towers and electrical substations well away from water. Given the relatively small amount of herbicide used and the buffers required, it is unlikely that herbicides used by BLM would add measurably to the herbicide levels in surface waters.

192. Comment: While no National Pollutant Discharge Elimination System (NPDES) permit is required by Oregon Department of Environmental Quality at this time, a general NPDES permit for pesticide applications will be required starting in April 2011. The NPDES general permit will include conditions that must be followed by the applicant.

Response: The EPA has until April 2011 to prepare a general NPDES permit for label-applied herbicides into or near water. Such a permit is required by the Clean Water Act for the discharge of "pollutants." The general permit would not necessarily result in any restrictions other than those already required by EPA-approved labels. The BLM would meet all regulatory requirements and obtain required permits as needed, before project implementation.

193. Comment: There are hundreds of domestic water supplies on or adjacent to BLM checkerboard lands, many predating BLM permitting requirements, which are unknown to the BLM. Several of the proposed new herbicide applications could introduce toxic chemicals to people's drinking water. The EIS does not appear to consider this. The USGS report "Pesticides in the Nation's Streams and Ground Water, 1992-2001" confirmed that commonly used pesticides (including herbicides) show in domestic water supplies.

Response: To protect human health and safety a minimum buffer of ¼ mi for aerial application and 100 feet for ground applications would be used between treatment areas and human residences, unless a written waiver is granted (Appendix 2). Where water sources are on BLM or away from the residence, an additional mitigation measure to protect wells and springs used for domestic water supplies has been suggested by the analysis in this EIS (see *Potential Mitigation* in Chapter 2). Analyses for most herbicide use west of the Cascades also consider that almost all streams are in community source water protection areas. Buffers limit the transport of herbicide from upland treatments to water (*Water Resources*, Berg 2004, Dent and Robben 2000, Rashin and Graber 1993). Domestic water intakes on BLM lands would be considered if their location were known through required land use permitting processes. Intakes cannot be buffered if their location is unknown. However, the application of normal water buffers could be expected to minimize herbicides getting into nearby water bodies. The *Water Resources* section describes the incidence of herbicides in ground and other waters, and notes that the EPA has set tolerances for several of the herbicides addressed in this EIS. Herbicide use proposed with this EIS could, but is unlikely to, contribute to herbicides within domestic water supplies.

The referenced USGS report focused on agriculture and urban areas. The report indicates detections occurred most frequently in shallow ground water beneath agricultural and urban areas, where more than 50 percent of wells contained one or more pesticide compounds. About one-third of the deeper wells sampled, which tap major aquifers used for water supply, contained one or more pesticides or degradates. The findings show that streams are most vulnerable to pesticide contamination, but ground water also merits careful monitoring—especially in agricultural and urban areas. Shallow ground water in some of these areas is used for drinking water and ground-water contamination is difficult to reverse once it occurs (USGS 2008).

194. Comment: Herbicides should not be used in the Mt. Hood watershed. Instead, a CCC[5]-type group could be created to assist local efforts in eradicating invasive plants.

Response: It is not clear what area is referenced by "Mt. Hood watershed," but analysis of proposed herbicide use within source water areas for communities would normally involve the potentially affected water district. In any application, potential effects to domestic uses are taken into account. The difficulties of relying on government-employed work-crews range from the costs of transport, supervision, and housing to non-herbicide methods simply not working for many types of invasive plants. As described in Chapter 1, non-herbicide vegetation management methods are already available and being used to the extent practicable.

195. Comment: The EIS cites Austin et al. (1991) in saying glyphosate may stimulate algal growth at low concentrations, contributing to eutrophication of waterways, yet the effects of the proposed use of glyphosate on eutrophication and resultant cynobacterial blooms has not been analyzed on a site-specific or cumulative level.

Response: Austin et al. (1991) cultured periphyton[6] on glass plates suspended in artificial "stream-troughs" which were supplied with flowing water pumped from natural streams in British Columbia. The stream water was low in phosphorus and flowed out of an oligotrophic lake. Glyphosate was added to give nominal concentrations in the troughs of between 0.001 and 0.3 mg/liter. A further series of treatments added nutrients to troughs. The herbicide was not toxic to the periphyton. A transitory decrease in growth was followed by a stimulation of biomass in the glyphosate-treated troughs. Similar effects were seen with added nutrient. The authors considered the effect to be the result of algae using glyphosate as a phosphate source (WHO 1994).

5 Civilian Conservation Corps (CCC) was a public work relief program for unemployed men, providing vocational training through the performance of useful work related to conservation and development of natural resources in the United States from 1933 to 1942.

6 Periphyton is a complex matrix of algae and heterotrophic microbes attached to submerged substrata in almost all aquatic ecosystems

The EIS has been edited to note that the study has more implications in streams flowing through agricultural and urban areas where glyphosate is shown to be relatively common, although additional phosphates from those same areas might mask the effect. The amount of glyphosate expected to reach streams from BLM terrestrial applications would be expected to have no noticeable effect on eutrophication. Aquatic formulations could conceivably affect waterborne algae, and this possibility is noted in the analysis. Studies by the Washington Department of Ecology showed that out of five treatments, three had no detection of herbicide within one hour of treatment, and the two treatments with herbicide detected 1 hour later also had low levels 24 hours after treatment (see *Water Resources* section). However, the spread of riparian or submerged invasive plants is a much higher risk for eutropication than glyphosate. Glyphosate is generally used on small patches of plants, and where herbicide-killed aquatic vegetation is a concern, the plants are removed from the water after treatment.

196. Comment: The *Water Resources* section states that sulfometuron methyl degrades quickly by hydrolysis in acidic water but is stable in neutral water, and that biodegradation and photolyosis are major loss pathways in aquatic systems where hydrolysis rates are generally slow. A more accurate statement would be "Biodegradation is a major loss pathway in aquatic systems, where hydrolysis rates are generally slow."

Response: The statement has been changed to read as suggested.

197. Comment: The EIS does not adequately acknowledge and address the fact that the way BLM's road drainage system has been engineered, roadsides are really an extension of the stream network. Therefore, anything that BLM sprays along roadways has a high chance of polluting streams. This is a powerful argument in favor of alternative treatment methods.

Response: The *Water Resources* section in Chapter 4 addresses this issue with "Roads often parallel streams or have stream crossings. Roads can act as extensions of stream networks with roadside ditches having low but measurable herbicide concentrations months after treatment (Wood 2001). Since vehicles are a major invasive weed vector, a high percentage of invasive weed treatments are along roadsides. Herbicides used in these areas could reach streams even when buffers to the actual stream are applied. Standard Operating Procedures such as stream buffers reduce potential impacts to water quality from herbicide applications but do not specifically address ditches." Some of this same wording is included in the *Special Status Fish* section. Appendix 2 includes a PEIS Mitigation Measure to "Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams." The *Potential Mitigation* section in Chapter 2 of the EIS now includes a requirement that "site-specific analysis for road-side treatments should specifically consider that drainage structures lead to streams and that normal buffer distances, herbicide selection, and treatment method selection may need to be changed accordingly, particularly where those ditches are connected to streams with Federally Listed or other Special Status species."

The concern expressed in this comment is one reason bromacil and tebuthiuron are absent, and diuron nearly so, west of the Cascades under Alternative 4 (the Proposed Action).

198. Comment: The EIS gives a misleading impression that streams are particularly adversely affected by western juniper expansion and would especially improve if we apply chemical treatments to western juniper. The EIS lacks a clear bigger picture of all the things that degrade streams and the many more effective means of improving stream conditions by, for instance, removing or reducing roads, livestock, OHVs, logging, and mining.

Response: There are many factors and management actions that can either degrade or improve riparian areas or stream function and water quality. Discussion of most of these factors or changes in their management is outside the scope of this analysis.

The EIS provides a cumulative effects analysis for a proposal (and alternatives) to increase the number of herbicides, and their uses, on BLM lands in Oregon. The treatment acres are estimates for analysis purposes, and are provided in enough detail to provide background for effects analysis. The EIS does not propose to make decisions about western juniper removal. That said, district herbicide use estimates are based on known or likely vegetation management needs. The analysis sets the context and basis for one likely future use by describing that western juniper expansion has led to to decreasing stream flow (*Effects of Invasive Plants on Water Resources*). The use of herbicides to control western juniper expansion could occur under Alternative 4 (the Proposed Action) and Alternative 5. Localized improvements in stream flows and riparian vegetation would be expected with restoration activities that include western juniper removal. Reducing western juniper cover has been shown to increase understory vegetation and infiltration and reduce erosion (Miller et al. 2005, Pierson et al. 2007, Peterson and Stringham 2008). Removal of western juniper has been the focus of several projects in the Prineville area to increase stream flows (*Wetlands and Riparian Areas*).

199. Comment: The EIS should explain how [the Reference Analysis] can lead to a decrease in water quality, compared with the alternatives, or why "invasive plants have the potential to adversely affect water resources more than herbicides."

Response: There are five reasons described in the *Water Resources* section that support the conclusion that the Reference Analysis could lead to localized impairments in water quality compared to the alternatives.

1) Some non-herbicide methods of removing plants disturb more ground than the use of herbicides. While mowing leaves groundcover in place, pulling or digging plants such as Himalayan blackberry or English ivy can disturb more soil, leaving more area vulnerable to erosion and runoff. The Reference Analysis would use directed livestock on 8,800 acres annually, a threefold increase from the No Action Alternative (Alternative 2). Livestock can also affect water quality by trampling banks, increasing sediment and contributing fecal coliform.
2) Noxious weeds are predicted to spread faster under the Reference Analysis, and many invasive plants provide poor erosion control compared to native plants. Japanese knotweed is an example of an invasive plant providing poor erosion control compared to native plants. Knotweeds spread rapidly downstream and out-compete native vegetation.
3) Large patches of certain plants cannot be treated effectively without herbicides. Although there are potentially successful mechanical or manual control options for small patches of knotweed, landscape-level projects and large sites would almost certainly require integrating herbicide use into a control strategy (Sol 2004).
4) Many aquatic species lead to decreased oxygen in the water and herbicides are an important method of control. For example, Eurasian watermilfoil accelerates eutrophication and lowers amounts of oxygen in the water (also described in the *Fish* section).
5) Invasive plants exclude native plants, typically reducing shade and detritus needed by stream organisms.

Comparing these weed effects against the comparatively small potential for the proposed herbicide treatments to adversely affect water quality, leads to the conclusion questioned in the comment.

200. Comment: The EIS fails to address the cumulative impact of herbicide on oceanic phytoplankton. There are already dead zones in the ocean off the coast of Oregon and at the mouth of the Mississippi.

Response: The low oxygen conditions (hypoxia) found in some summers off the Oregon coast has been linked to changes in surface winds. During normal years, cold water rich in nutrients but low in oxygen upwells from the deep ocean off Oregon, mixes with oxygen-rich water near the surface, causes some phytoplankton growth, and provides the basis for a thriving fishery and healthy marine food chain. During dead zone periods, some of the normal processes (including wind and current conditions) can change. This allows huge masses of plant growth to die, decay and in the process consume even more of the available oxygen near the sea floor, causing hypoxic conditions for marine life. This is a different process than in the Gulf of Mexico where agriculture runoff high in fertilizers is implicated in the Gulf dead zone.

Regarding BLM activity affecting ocean phytoplankton, BLM manages 25 percent of the land in Oregon while proposing to use less than 1 percent of the herbicides. Use of Standard Operating Procedures and PEIS Mitigation Measures, site-specific mitigations decided at the project level, and the generally limited uses proposed, would provide protection for water. Given the relatively small amount of herbicide used and the buffers required, it is unlikely that herbicides used by BLM would add measurably to the herbicide levels in the ocean off the Oregon coast.

Wetlands and Riparian Areas

201. Comment: The EIS fails to explain how using or drifting herbicides into riparian areas would meet the Land and Resource Management Plan's Aquatic Conservation Strategy (ACS) objectives west of the Cascades. Herbicides that harm aquatic species including native aquatic plants, and native plants within the riparian areas such as those in campgrounds, would not meet the ACS.

Response: The Aquatic Conservation Strategy is a requirement of the Northwest Forest Plan and affects districts west of the Cascades and a portion of the Klamath Falls Resource Area, although similar requirements have been made a part of some plans east of the Cascades as well. The important phrases in the ACS standards and guidelines are "meet Aquatic Conservation Strategy objectives," "does not retard or prevent attainment of Aquatic Conservation Strategy objectives," and "attain Aquatic Conservation Strategy objectives." These phrases, coupled with the phrase "maintain and restore" within each of the nine Aquatic Conservation Strategy objectives, define the context for agency review and implementation of management activities. Complying with the Aquatic Conservation Strategy objectives means that an agency must manage the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions. The standards and guidelines focus on "meeting" and "not preventing attainment" of Aquatic Conservation Strategy objectives. Management actions that do not maintain the existing condition or lead to improved conditions in the long term would not "meet" the intent of the Aquatic Conservation Strategy and thus, should not be implemented (USDA, USDI 1994b:B-9-10). Of the nine ACS objectives listed in the standards and guidelines, those most pertinent to herbicide use are probably:

2) …. network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.
3) Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
4) Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
5) Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.
8) Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
9) Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Slowing the spread of invasive plant and protecting native ecosystems, particularly within the riparian areas and in water, would contribute to most of these objectives. The question, then, is whether treatments (including those for native plants along rights-of-way or in developed sites), would lead to degradation.

Potential negative effects from getting herbicides in water are avoided through the use of Standard Operating Procedures and PEIS Mitigation Measures that include the PEIS Biological Opinion (NMFS 2007) Protection Measures, as well as through other site-specific design features and practices. Stream buffers are one effective method of keeping herbicides out of water. Most of the herbicide applications proposed in the EIS are directed, not broadcast, sprays. Aerial applications are excluded from Alternatives 3 and 4 (the Proposed Action) west of the Cascades, in part to avoid drift into undetected waters.

Application of aquatic herbicides to control aquatic invasive plants would be done only where the overall impact on present and future water body conditions would be positive, where collateral mortality of native plants or the effect of the killed plants on water quality are neutral or better when considered in context with the effects of the invasive plants themselves.

However, findings of ACS consistency are made during project-level planning and are based on project design, Watershed Analysis specific to the watershed in which treatments are proposed, and other site-specific factors.

202. Comment: The problem of aquatic invasive plants appears to be very limited in Oregon. This suggests that manual and mechanical control would be feasible, and does not require 2,4 D, diquat, and glyphosate herbicide treatment.

Response: Riparian and wetland invasive plants have not been inventoried intensively. Acres shown on Table A7-1 are small because aquatic habitats are limited. Elodea, parrot's feather, Bohemian knotweed, Japanese knotweed, yellow flag iris, and purple loosestrife have been treated by the BLM in the past. Other weeds getting treatment in riparian areas for restoration projects in the recent years are Himalayan blackberry, saltcedar, Russian olive, perennial pepperweed, and butterfly bush. Any State listed noxious weed in a wetland or riparian area can inhibit habitat functions that only these areas can provide. On the east side of the Cascades in particular, the East Side Riparian Biome description explains that these areas provide benefits that greatly outweigh the acres they cover, so basing treatment on acres alone would lead to improper treatment priorities. Manual and mechanical means are often more disturbing to wet areas than an herbicide application by hand. Manually removing weeds from water can be impractical, since not all material can be collected.

All three herbicides listed above are labeled for use in the wetland or riparian environment and are thus appropriate for treating undesirable vegetation in these areas. Treatments are generally in conjunction with other landowners (private or as part of a watershed council project) so entire stream systems are treated. Methods that would miss some plants would reduce the treatment effectiveness for all sections, since streams could quickly transport seeds and other vegetative material to other areas.

Fish

203. Comment: What is the basis for the Chapter 2 *Comparison of the Effects of the Alternatives* statement that benefits to fish from Alternatives 2 through 5 would outweigh the impacts from toxic herbicide use? There is no clear cost/benefit analysis in the EIS to justify this repeated assumption.

Response: The *Comparison of the Effects of the Alternative* section in Chapter 2 of the Draft EIS summarized the key conclusions from the more detailed resource sections in Chapter 4. The Chapter 4 resource sections indicate that the amount and types of herbicide uses proposed by the BLM, using required site-specific analyses, Standard Operating Procedures and PEIS Mitigation Measures, and Endangered Species Act consultation, are expected to result in little to no adverse effects to fish. On the other hand, invasive plants displace native plant communities and expose watersheds and stream banks to erosion, increase runoff temperatures, reduce stream shading and native food sources, and have other adverse effects to fish. Any significant reduction or slowing of invasive plants is thus predicted to benefit fish, and this benefit is predicted to be well beyond the potential for adverse herbicide effects arising from the uses proposed under the alternatives. While both sides of this comparison include qualitative judgments, various estimates of the economic impact of invasive plants, and the quantitative risk calculations made in the Risk Assessments and reflected on the "Risk Categories" tables in Chapter 3, tend to support this conclusion.

204. Comment: There is no quantified or clear analysis supporting the assumption under Alternative 4 (the Proposed Action) that the benefits of invasive plant control would outweigh herbicide risks to fish.

Response: The risks to fish from herbicides are well studied and quantified, but only to the degree exposure is known. At the scale of this EIS, the BLM cannot conclude with certainty that herbicides could not potentially reach fish-bearing streams and cause adverse effects. However, site-specific analysis and application of Standard Operating Procedure-required buffers and other measures minimize the likelihood of exposures, and reduce the actual risk to fish to extremely low levels. The presence of certain herbicides in some of the State's rivers, for example, does not indicate that BLM applications are implicated, or that BLM applications would contribute measurably or at all. BLM herbicide use under the Proposed Action would be less than one percent of the pesticides used in Oregon (Table 4-1). Required buffers, typical rates, spot treatments, and other measures mean that BLM contributions to adverse fish effects in Oregon would be orders of magnitude lower than even the one percent that might be inferred from these numbers.

The spread of invasive plants, however, is predictable and observable. Effects of this spread on stream shading, food sources, and stream-bank stability are known and discussed under Invasive Plant Effects in the *Fish* section. Although the actual spread reduction that would be accomplished under each alternative is a calculated estimate, rendering a portion of the conclusion qualitative rather than quantitative, the Alternative 4 (the Proposed Action) conclusion that the weed spread reduction would be more beneficial than the risk from herbicides is well founded and clear.

205. Comment: A recent study (Baldwin et al. 2009) examined the effects of exposure to sub-lethal amounts of various pesticides (including herbicides) on salmon. Major efforts are currently underway to restore Pacific salmon habitats in an effort to recover depressed populations. However, not much research has been done to determine the importance of pollution as a limiting factor of Federally Listed species. Pesticide exposure lasting only four days can change the freshwater growth and, by extension, the subsequent survival of sub yearling salmon.

Response: The study by Baldwin et al. (2009) used a modeling approach to link short-term, sub-lethal exposures of organophosphate and carbamate insecticides to chinook salmon. They did not consider herbicides. Because insecticides and herbicides work so differently it is difficult to compare the sub-lethal effects to fish between the two pesticides. However, the analysis shows that some of the herbicides analyzed in this EIS could harm fish if they were exposed. The amount of herbicides expected to reach water are expected to be very low under the alternatives in this EIS, and site-specific treatment design and required Endangered Species Act consultation would attempt to prevent adverse effects to Federally Listed species, including sub-lethal effects. At the scale of this EIS, the BLM cannot conclude with certainty that herbicides could not potentially reach fish-bearing streams and cause adverse effects. Herbicide use at the local or project scale, conducted under the Standard Operating Procedures and PEIS Mitigation Measures, and following site-specific analysis and appropriate consultation, is unlikely to contribute substantially to downstream effects.

206. Comment: The EIS fails to consider the synergistic effects to salmon from herbicides proposed to be applied by the BLM and those pesticides already present in the streams from other users.

Response: There is no sound way to estimate background levels of contaminants in the environment and incorporate that information into a quantitative Risk Assessment. It is impractical and beyond the scope of this EIS to evaluate the potential effect of all possible pesticide contaminants in all surface water bodies of Oregon.

The BLM has done extensive analysis to study the effects of all of the proposed herbicides, and has adopted Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) to prevent or limit translocation to surface waters and effects to non-target species. These include using appropriate herbicide-free buffer zones for herbicides not labeled for aquatic use based on Risk Assessment guidance, with minimum widths from water of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications. Additional herbicide-specific buffer zones may be established for water bodies, habitats, and fish or other aquatic species of interest based on Endangered Species Act consultation requirements and site-specific analysis.

A discussion of *Synergistic Toxicity of Mixtures in the Aquatic Environment* has been added to the *Fish* section in Chapter 4.

207. Comment: New information since the PEIS Biological Opinion (NMFS 2007) indicates mixtures of pesticides that have been commonly reported in salmon habitats may pose a more important challenge for species' recovery than previously anticipated (Laetz et al. 2009:348). Although Laetz et al. (2009) did not test the herbicides proposed for use by the BLM, the fact remains that pesticides found to be not lethal singly may become lethal when mixed (Laetz et al. 2009:348) and with toxicity that greatly exceeds what would be expected from merely additive effects (i.e. synergistic effects).

Response: At the scale of this EIS, the BLM cannot conclude with certainty that herbicides could not potentially reach fish-bearing streams and cause adverse effects. However, the amount of herbicides expected to reach water is expected to be very low under the alternatives in this EIS, and site-specific treatment design would attempt to prevent adverse effects to aquatic species, including synergistic effects.

Laetz et al. (2009) studied the synergistic effects of multiple insecticides on fish. Cumulative adverse effects to humans or other elements of the environment are most likely when two pesticides share a common mechanism of toxicity. That is, they both affect an organism the same way. Cumulative effects assessments conducted by the EPA typically *begin* by grouping pesticides by mechanism of toxicity (EPA 2002). Because insecticides and herbicides work so differently, even a concurrent application would be unlikely to result in significant environmental effects when both products are applied within label limits. As a group, insecticides are far more likely to adversely affect fish than herbicides, because insects and fish share most biological processes.

The potential for synergistic effects to fish was examined in the Risk Assessments (Appendix 8). The information reported by Laetz et al. (2009) has been incorporated into the *Fish* section.

208. Comment: The PEIS Biological Opinion (NMFS 2007) cannot be used for herbicide proposals/decisions in the EIS because of new scientific information about unexpected synergistic (lethal) effects to Coho salmon from pesticide combinations.

Response: The analysis provided in this programmatic EIS adequately addresses the potential impacts to Federally Listed species and critical habitat when considered as a supplement to the Biological Assessment completed for the PEIS as described in Appendix 5. Appendix 5 of the EIS provides information concerning

Federally Listed species known to occur in Oregon and is provided as a supplement to the Biological Assessment which is incorporated by reference in accordance with 50 C.F.R. 402.12 (g). The EIS is programmatic by design and does not identify or authorize site-specific vegetation treatments or amend Land and Resource Management Plans. As a programmatic analysis, the EIS contains the appropriate level of Endangered Species Act analysis at the scale for which it was intended. To minimize potential impacts to Federally Listed species and critical habitat, all Standard Operating Procedures and PEIS Mitigation Measures indentified in Appendix 2 of the EIS, as well as the protective measures in the PEIS Biological Opinion (NMFS 2007) are applicable unless otherwise modified by subsequent site-specific analysis and Endangered Species Act consultation. The EIS states that site-specific analysis, as well as Endangered Species Act consultation, must be completed prior to any project approval for vegetation treatments with herbicides. It is at the site-specific level that potential impacts to specific Federally Listed species are best analyzed and the most effective Conservation Measures are developed.

The local Biological Assessment and supporting documentation must include relevant reports, including EISs, Environmental Assessments, Biological Assessments, or other analyses prepared on the proposal and other relevant studies or other information available on the action, the affected Federally Listed species, or critical habitat. In other words, new scientific information about unexpected synergistic effects to Coho salmon from pesticide combinations would be used to develop the site-specific Biological Assessment.

There does not appear to be any significant new information indicating the PEIS consultation conclusions are flawed. Recent studies showing synergism of two insecticides, with resultant effects on salmonids, are neither unexpected nor necessarily relevant. The Risk Assessment examined the potential for synergistic effects of herbicides, and no new information indicates the Risk Assessment conclusions are wrong or inadequate.

209. Comment: The discussion of herbicides in the *Fish* section states that diuron has a low to moderate tendency to bioaccumulate. Based on research done on fathead minnows by Call et al. (1987), that statement should be changed to "diuron has a low tendency to bioaccumulate."

Response: Carp (*Cyprinus carpio*) exposed for 6 weeks to diuron had experimental bioconcentration factor (BCF) values from two trials ranging from 3.4 to 4.9 (0.5 mg/l exposure) and <3 to 74 (0.05 mg/l exposure)[7] (Chemicals Evaluation Research Institute 2000). According to (Franke et al. 1994), these BCF values suggest the potential for bioconcentration in aquatic organisms is low-to-moderate. Based on these references the original language has been retained, but a statement has been added that diuron has a low tendency to bioaccumulate in fathead minnows.

Wildlife Resources

210. Comment: BLM fails to address the inherent complexity and complex interspersion of vegetation across the landscape, and instead claims that "treatments" are necessary to create more of a mosaic, or for greater diversity.

Response: The *Wildlife Resources* section reports on literature that suggests mosaics of habitat, rather than large monocultures, benefit many species. Some wildlife in some areas will benefit from the creation of mosaics; the examples in the EIS are mostly the facilitation of habitat improvement projects already identified in sage grouse Conservation Strategies. Conversely, some wildlife could be adversely affected by large-scale habitat improvement; hence, a potential mitigation measure is included in Chapter 2 suggesting such treatments mimic natural disturbance mosaics. However, the EIS does not attempt to fully describe or justify vegetation treatment

7 Bioconcentration factor is the concentration of a particular chemical in a tissue per concentration of chemical in water.

prescriptions. Actual habitat improvement and other vegetation treatment needs are identified in the districts' Land and Resource Management Plan, species management plans, and other planning documents. Treatment acres used in the EIS are simply program estimates made by the districts based on knowledge of existing plans and site-specific needs. These estimates provide a basis for the statewide herbicide cumulative effects analysis, and are not a commitment to conduct projects.

211. Comment: Landscape-level fragmentation, cheatgrass presence, livestock facilities, and other information about degraded sage grouse habitat (USGS 2009) should be considered in the cumulative impact analysis of herbicide use where there is potential for native vegetation (required by sagebrush-associated species) to be killed.

Response: Both the *Sage Grouse Conservation Assessment* (Connelly et al. 2004) and *Ecology and Conservation of Greater Sage-Grouse: A Landscape Species and Its Habitats* (USGS 2009) were reviewed and considered in preparation of the EIS and would be considered again when actual treatments are proposed. Invasive plant treatments in infested sage grouse habitats would normally be spot treatments or would be a part of restoration projects carefully designed to benefit sage grouse. Standard Operating Procedures and PEIS Mitigation Measures included in Appendix 2 would help prevent the treatment of vegetation needed by wildlife species during an herbicide application. Hence, the BLM does not anticipate any significant adverse cumulative impacts to native wildlife from the treatment of noxious weeds and other invasive plants. However, invasive weed and habitat-improvement treatment estimates in the EIS are for herbicide cumulative effects analysis, and actual vegetation treatment decisions would follow local direction and be subject to site-specific analysis.

According to Connelly et al. (2004), use of herbicides on private land was historically used to improve forage for livestock grazing and this was often done at the expense of native species. This EIS does not propose the use of herbicides for livestock forage production. The Proposed Action (Alternative 4) is designed in part to protect native ecosystems and the flora and fauna that depend on them; provide sustainable habitats for wildlife, fish, and native plants; and prevent herbicide control treatments from having unacceptable adverse effects to desirable flora and fauna.

The EIS found that the differences between the alternatives regarding noxious weed spread are more detrimental than the risks from herbicides proposed under those alternatives.

212. Comment: The EIS needs to explain the anticipated effects of herbicide use on fragmented sagebrush habitats and sagebrush dependent species such as the sage grouse, pygmy rabbits, Brewer's sparrow, sage sparrow, and sage thrasher.

Response: Sagebrush habitats and the species that depend on them have been negatively impacted by the spread of noxious weeds and other invasive plants. A significant portion of the Proposed Action (Alternative 4) endeavors to reduce the rate of invasive plant spread and help reduce further degradation of imperiled habitats such as those associated with sagebrush steppe ecosystems. No treatment is entirely risk free, but the herbicides proposed in this EIS were chosen to have minimal toxic impacts to native plant and wildlife species. Prior to any specific herbicide treatment, site-specific analyses would be conducted; the action alternatives in this EIS would add several herbicides to the choices available, so the best combination of mechanical and herbicide treatments for the wildlife and plants in their area would be used. In many cases, herbicide treatments would provide a means to restore habitat for these species that is not available with currently approved herbicides and mechanical treatments. Habitat improvement projects permitted under Alternative 4 (the Proposed Action) and Alternative 5 could specifically improve or protect sage grouse and other wildlife habitats. Standard Operating Procedures, PEIS Mitigation Measures, and Conservation Measures for Special Status species (identified in Appendix 2 of this EIS) would help to reduce or avoid adverse treatment effects.

213. Comment: Shrubland and grassland birds such as Brewer's sparrow, sage sparrow, and sage thrasher are declining faster than any other group of species in North America (Saab and Rich 1997, Paige and Ritter 1999, Dobkin and Sauder 2004) and may be important predictors of ecological collapse.

Response: Although these bird species are not Special Status species, they are Fish and Wildlife Service Birds of Conservation Concern. As such, they are evaluated in project planning (USDI 2008c, 2009x). The references cited in the comment are consistent with the *Habitat Change Resulting from Invasive Plants* subsection in the *Wildlife Resources* section, which states that exotic invasive species are contributing to habitat declines. Effects on Brewer's sparrow from invasive grasses adversely affecting sagebrush habitats, for example, are specifically mentioned. Restoration of healthy sagebrush communities for native plants and animals (including the rare birds mentioned in the comment) is one of purposes of the EIS. The Proposed Action (Alternative 4) incorporates Standard Operating Procedures and PEIS Mitigation Measures to allow restoration to occur while minimizing adverse effects to native wildlife species. Additional information on the Brewer's sparrow, sage sparrow, and sage thrasher has been incorporated into the *Wildlife Resources* section.

214. Comment: Juniper birds are of high conservation concern, yet western juniper habitats are among the most consistently under-represented habitat types in biological and ecological survey efforts.

Response: The BLM seeks to maintain native species and habitats in a sustainable way. Any rare birds dependent upon western juniper habitats would be focal species where those habitats are rare (such as in the agriculturally dominated landscapes where western juniper were once more common). However, western juniper treatment projects would most likely occur in areas where western juniper has expanded into sagebrush communities, and are affecting native wildlife in those communities. Western juniper would not be treated where they have not become out of balance with historic and sustainable communities. The western juniper control referenced in the EIS is an estimate made by the districts based on local vegetation management issues and priorities. The EIS does not propose or approve actual projects; decisions to control western juniper would be made following site-specific analysis.

215. Comment: The EIS fails to adequately display the effects of increased herbicide use on birds. The EIS should address the potential impacts to birds using the Partners in Flight Assessment factors, which include population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (Rich et al. 2005).

Response: BLM is a partner in the Partner in Flight program, and reference to the BLM's participation in this program has been added to the *Wildlife Resources* section. The factors listed in the comment would be considered when identifying potential impacts at the project level. Impacts related to breeding and specific population trends vary depending on the ecosystem affected, species' occurrence, pre-project habitat condition, the objective of the treatment proposed, and the timing, dosage, and application method of the treatment, all of which cannot be accurately identified or analyzed in a statewide, programmatic EIS. The EIS predicts the potential effects under proposed dosages and scenarios, and identifies Standard Operating Procedures and PEIS Mitigation Measures designed to reduce impacts to the extent possible at this programmatic scale. These analyses would identify the potential effects of specific herbicide treatments to the wildlife species and habitats within a defined project area. Site-specific analysis would utilize the factors identified by Partners in Flight and many other wildlife and resource parameters in their analysis of applicable effects of a specific project in order to choose the most effective treatment to meet the objective while having the least impact to wildlife and other resource values.

216. Comment: Direct exposure and indirect ingestion of chemicals by birds and grazing or insectivorous mammals through food or water have caused skin and eye irritation, respiratory distress, organ malfunction, suppressed immune response, reproductive problems and behavioral changes leading to reduced vigor or survival.

Response: The *Wildlife Resources* section discloses that the use of chemicals can have deleterious effects to wildlife, and no chemical treatment is entirely risk free. Direct effects to wildlife from herbicides would depend on the dose (how much herbicide), exposure (whether direct contact or ingestion of contaminated food or water), and the toxicity or LOAEL of that level of dosage (if any). The Ecological Risk Assessments (Appendix 8) that form the basis of the *Wildlife Resources* effects discussion determine the possibility of having the effects noted in the comment at plausible exposure scenarios. The resultant risk levels for plausible scenarios are shown on the "Risk Categories" tables at the end of Chapter 3 and are considered in the *Wildlife Resources* effects discussions. Many of the adverse effects reported in the literature are from dosages hundreds of times higher than plausible BLM spray scenario exposures.

217. Comment: A literature review (including Bernanke and Kohler (2008)) suggests a link between endocrine disrupting chemicals and the reproductive system of birds and other vertebrates. The EIS should include and address this research.

Response: The potential for any of the herbicides included in this EIS to be endocrine disrupters is discussed in the *Effects Common to All Alternatives* section within the *Wildlife Resources* section, and in the *Human Health and Safety* section. The EPA reports that endocrine disruption effects can include abnormal thyroid, decreased fertility, decreased hatching success and demasculinization, and feminization of birds. The EPA is in the process of evaluating all pesticides for these potential effects, but to date, there is no confirmation that any of the herbicides proposed in the EIS are known endocrine disruptors of wildlife in field situations. Many papers, including Bernanke and Kohler (2008) summarize the effects of several different chemicals (including PCBs, DDT/DDE, and organochlorines) into an EDC (endocrine disrupting chemical) group. PCB's, DDT/DDE insecticides and organochlorines all have documented adverse effects to wildlife, but are not proposed for use by this EIS. The herbicides proposed in this EIS were chosen to have minimal adverse impacts to non-target species.

218. Comment: Although Roundup is not registered for aquatic uses and studies of its effects on amphibians indicate it is toxic to them, scientists have found that it may wind up in small wetlands anyway due to inadvertent spraying during its application. Studies found that even at concentrations one-third of the maximum concentrations expected in nature, Roundup still killed up to 71 percent of tadpoles raised in outdoor tanks.

Response: Herbicide formulations like Roundup® that are not registered for aquatic use would not be applied by the BLM near water. The surfactant POEA (a surfactant in most Roundup formulations) is associated with risk to aquatic organisms and amphibians and thus would also not be used near water. Standard Operating Procedures prescribe minimum buffers between water and treatments with non-aquatic herbicides to lessen the risk of herbicides entering water. These also require that additional buffer widths be developed based on herbicide-specific and site-specific conditions to minimize impacts to water quality. Buffers limit the transport of herbicide from upland treatments to water (*Water Resources*, Berg 2004, Dent and Robben 2000, Rashin and Graber 1993). The Standard Operating Procedures and PEIS Mitigation Measures are designed to minimize the risk of inadvertent overspray and the site-specific potential for inadvertent overspray would be evaluated and addressed in project level analysis.

219. Comment: The EIS does not adequately address the potential effects of herbicide use on amphibians, reptiles, and mollusks. Although the EIS mentions that some herbicides have low toxicity to mollusks, no further analysis is provided. Recent research suggests that triclopyr and hexazinone have adverse effects to amphibians (Relyea et al (2005), Bernanke and Kohler (2008)), and that diuron inhibits ovulation in frogs (Orton et al 2009). Research by Relyea (2005) suggests adverse effects of the herbicide glyphosate on amphibians.

Response: The *Effects Common to all Alternatives* subsection of the *Wildlife Resources* section discusses potential impacts to amphibians, reptiles, and mollusks. Relyea (2005) and Relyea et al (2005) both describe effects of glyphosate formulations that include the surfactant POEA on amphibians and laboratory communities of aquatic organisms. The surfactant POEA is identified in both papers as adverse to amphibians.

Bernanke and Kohler (2008) summarize the effects of several pesticides (including insecticides and herbicides not proposed for use on BLM lands). Two herbicides being proposed for use are mentioned in their summary: triclopyr and hexazinone, which were evaluated by Berrill et al (1994). The study by Berrill et al. (1994) evaluated dose levels likely to occur in commercial forestry applications, a much different application than proposed by BLM. Even in the studied application, Berrill et al. (1994:658) noted that field level dosages of hexazinone were unlikely to affect invertebrates, resident animals, tadpoles, and embryos. Laboratory studies reported in Orton (2009) suggest some minor changes to testosterone levels in frogs due to diuron, but it was not clear that such effects rose to a level that caused adverse effects to the animals. No estrogenic effects were noted.

Local project planners would evaluate habitat for rare species and incorporate appropriate buffers around wetlands and ponds. Appendix 2 details Standard Operating Procedures and PEIS Mitigation Measures specifically designed to reduce the chance of wildlife exposures. These include avoiding the use of glyphosate with POEA to avoid risks to amphibians.

220. Comment: The spraying of roadsides, rights-of-way, campgrounds, and around BLM offices and buildings would deprive butterflies of much of their current territory, as those are places where sun-loving native plants often grow.

Response: Rights-of-ways and other developed areas require safety and maintenance treatments specific to their objectives, and wildlife habitat may be a secondary objective. It is assumed that in these areas, vegetation is currently being maintained primarily with mechanical methods, such as mowing (see Chapter 3). However, prior to any specific herbicide treatment, site-specific analyses would be conducted that would include wildlife surveys and other efforts to identify particularly important wildlife habitat. Such information can be used to design mitigation measures, make a treatment method selection, and design habitat restoration projects to protect, conserve, or develop alternate habitat for potentially impacted species if appropriate. It is BLM policy to maintain natural conditions that support sustainable populations of native wildlife, particularly rare species.

221. Comment: The EIS lacks specificity in describing the actual effects of herbicides on wildlife.

Response: The effects of herbicide use on wildlife discussed in the *Wildlife Resource* section are summaries of the detailed BLM and Forest Service Risk Assessments. These Risk Assessments are based both on models and surrogate species, as well as on wildlife (the EPA does not require the testing of herbicides on wildlife, and allows the use of surrogate species for Risk Assessments). The EIS also evaluated recent literature on the effects of herbicides on wildlife that have been published since the Risk Assessments were completed. The Risk Assessments are discussed in Chapter 3 and are included in Appendix 8.

Effects are summarized in terms of expected dose (Risk quotient, or RQ; or Hazard Quotient, or HQ) of the herbicide and whether that exposure level exceeds the level of concern (LOC) for each wildlife group tested. BLM's evaluated herbicide risk categories summarize the High, Moderate, or Low chance that the RQ would exceed the LOC for the scenario and exposure method discussed. The risks vary by application scenario, the animals tested, whether typical or maximum dosage is applied, and many other factors. The actual nature of the adverse effects varies; the LOC is based on the first observable adverse effect. This is often eye irritation; the LOC does not usually mean mortality. Actual field risks are likely to be less than analyzed in the Risk Assessments because of the low likelihood that native wildlife would actually be in contact with the herbicide or with food/water sprayed by herbicide, at the modeled doses, or would be exposed to such a level that adverse effects might occur. Most herbicide treatments would be highly focused to treat invasive species and to reduce chances of non-target species being affected.

The *Wildlife Resources* section also describes the potential effects to wildlife food, behavior, and interspecific reactions that may occur from the treatment methods. Effects to wildlife would vary widely by species, timing, treatment method and treatment herbicide, extent and other factors that cannot be evaluated at a programmatic level. The EIS predicts the potential effects under proposed dosages and scenarios, and identifies Standard Operating Procedures and PEIS Mitigation Measures (Appendix 2) designed to reduce impacts to the extent possible at this programmatic scale. Prior to any specific herbicide treatment, site-specific analyses would be conducted, and these analyses would identify the potential effects of specific herbicide treatments to the wildlife species and habitats within a defined project area. These site-specific analyses would allow for the incorporation of such things as buffers, seasonal restrictions, partial treatments of occupied habitat, and other appropriate application methods to reduce potential risks to wildlife. Until actual projects are proposed, it is impossible to say what site-specific effects would be.

Livestock

222. Comment: The Draft EIS states in Chapter 1 that it "does not propose the use of herbicides specifically for commodity production such as projects to improve … livestock forage." This statement is not reflected in the rest of the rest of the EIS. For instance, the EIS describes how ranching on lands adjacent to BLM would commercially benefit by the BLM using herbicides.

Response: The word "commodity" in the description of the Alternatives in Chapter 2 has been replaced with "specifically for livestock forage or timber production," to remove confusion about other economic effects. Noxious weeds adversely affect commodity and non-commodity resource values statewide. These effects are one reason weeds are listed as "noxious" by the State. The *Livestock* section, therefore, displays the effects of the various alternatives on livestock use, the same as the *Recreation* section, *Fish* section, and so forth. Examination of the effects of the alternatives on resource values such as livestock use is a requirement of NEPA, and does not infer herbicides would be proposed specifically to improve livestock forage production. This point is discussed in more detail in the first two paragraphs of the *Livestock* section.

223. Comment: There is no summary of acres of disturbance by livestock, or of range improvement projects such as pipelines, troughs, livestock facility roads, and fences that are or may become infested and serve as weed conduits.

Response: The *Noxious Weeds and Other Invasive Plants* section notes that numerous vectors and events contribute to invasive weed spread including grazing and its appurtenant developments. However, an examination of the factors contributing to weed spread is outside the scope of the EIS; they are mentioned only to support a better understanding of the effects of the alternatives. Grazing is authorized by the FLPMA, Public Rangeland Improvement Act, O& C Act, and the Taylor Grazing Act, and a reconsideration of grazing or its effect on the spread of invasive plants is beyond the scope of this analysis. The potential for grazing and related activities to spread weeds is analyzed during district planning processes and in the analyses for site-specific ground disturbing projects such as fences and pipelines, forage enhancements, and other projects that have the potential to alter plant communities. These analyses must include an assessment of the risk of introducing noxious weeds and other invasive plants.

224. Comment: The EIS needs to recognize livestock grazing exacerbates any climate change-related vegetation shifts that may be occurring, particularly in areas facing increased heat and aridity due to climate change.

Response: A consideration of grazing, or any possible interaction between grazing and climate change, is outside the scope of this EIS.

225. Comment: The EIS should address the effects of intensified grazing as livestock are shifted away from sprayed areas. The EIS should mandate livestock removal from treated areas.

Response: Livestock exclusion times are short, most treatment areas under this EIS would be small, and livestock are already frequently moved to accommodate range conditions. Required herbicide exclusions are not likely to result in adverse grazing effects to alternative grazing sites. Site-specific planning for larger control or restoration projects such as those involving imazapic over thousands of acres would include consideration of the effects on alternate grazing sites.

Wild Horses and Burros

226. Comment: The discussion of wild horses and burros in the *Comparison of the Effects of the Alternatives* section in Chapter 2 does not acknowledge greater risk to grazing animals from herbicides.

Response: The referenced section in the EIS noted that risks to wild horses and burros from herbicides are similar to those for livestock, where herbicide risks were discussed. Additional detail can be found in the corresponding sections in Chapter 4. The *Comparison of the Effects of the Alternatives* section in Chapter 2 has been reformatted and rewritten, and the *Livestock* and *Wild Horses and Burros* sections have been combined.

Fire and Fuels

227. Comment: Fire suppression has increased unwanted vegetation that the BLM now proposes to kill with herbicides, instead of considering the reintroduction of a more natural fire regime. For instance, the EIS notes in Chapter 1, *Purpose* 3, that fire suppression has resulted in a many fold increase in the number of western juniper east of the Cascades when compared with historic levels, and that herbicides could facilitate restoration of habitats for nesting sage grouse and other species.

Response: As identified in the EIS, herbicides would be used as part of an integrated vegetation management approach. The Proposed Action (Alternative 4) would constrain western juniper or sagebrush treatments to objectives specified in Conservation Strategies. The use of prescribed burning would be used to meet multiple hazardous fuels reduction objectives across Oregon as part of the State fuels program. A full examination of the use of fire for ecosystem restoration or fuels reduction is outside the scope of this EIS. Herbicides would be one tool for habitat manipulation and invasive grass fuels treatments; implementation decisions would be the result of site-specific analysis.

228. Comment: A recent study by Dodson and Fielder (2006) and a recent master's thesis by Dodson (2004) indicate a synergistic relationship between fuels treatment, fire, and increased invasion of exotic and undesirable species, with the greatest increases occurring with thinning followed by prescribed burning, versus no treatment at all. Current fuels treatments in sagebrush habitats often encourage cheatgrass invasion.

Response: The BLM recognizes that hazardous fuels treatments, like any other site-disturbing management activity, can contribute to the introduction and spread of noxious weeds and other invasive plants. However, as noted in the *Fire and Fuels* section, wildfire suppression activities can also introduce or spread invasive plants, so thinning and burning are fuels reduction tools that may be used. Decisions about if and how to conduct these and other activities include consideration of their potential to spread noxious weeds. Their reconsideration is outside the scope of this analysis; these are ongoing programs already covered in part by Integrated Vegetation

Management policies designed to prevent and control weed spread. For example, a management activity with a moderate or high risk of spreading noxious weeds is required to have a noxious weed risk assessment that identifies actions to be taken to reduce or prevent the spread of noxious weeds.

229. Comment: The EIS does not clearly identify vegetation to be targeted for hazardous fuels treatment using herbicides and appears only to identify old growth and mature native sagebrush steppe vegetation.

Response: In the Sagebrush Steppe biome, herbicides would be used for the treatment of invasive annual grasses, such as medusahead and cheatgrass, which have altered the historic fire regime. In these areas, as described in the *Fire and Fuels* section, herbicides would be used to help achieve fuels reduction goals in a number of different ways:

- As a standalone treatment or in combination with other vegetation treatments to change the vegetation structure and composition to reduce fire behavior characteristics (rate of spread, fire line intensities) and facilitate suppression actions;
- As a follow up or maintenance treatment to mechanical or prescribed fire treatments or post wildfire rehabilitation treatments, to either further reduce the fuels hazard or to help control new or existing invasions. (The EIS has been edited to help clarify the use of herbicides in conjunction with non-herbicide hazardous fuels reduction treatments.); and,
- To create strategically placed breaks in vegetation (fuel) continuity adjacent to wildland urban interface (WUI) communities or where treatment of the entire affected area would be either impractical or too expensive.

However, these are general estimates for programmatic analysis purposes, not a commitment to conduct treatments. An evaluation of treatment need and a determination of the most appropriate tools for meeting that need are the subject of site-specific analysis. Such treatments are normally implemented based upon vegetation management priorities set in Land and Resource Management Plans or other plans and policies. An examination of the applicability of any particular tool for meeting any particular vegetation management objective is outside the scope of this EIS.

230. Comment: The EIS is not clear how the BLM's existing fuels control program of brushing, controlled burns, thinning, and other activities would be affected by herbicide use.

Response: A noted in the *Fire and Fuels* section, only Alternative 5 would permit herbicides to be used to control *native* plants contributing to high fuel loading. An example might be a treatment to desiccate vegetation so a subsequent prescribed burn can be conducted more safely and under less intense burning conditions. The analysis states that such treatments would be rare in Oregon; fuels issues in the State do not normally lend themselves to those types of treatment.

Alternatives 3 through 5, however, would permit the use of herbicides on noxious weeds and invasive annual grasses currently invading susceptible sagebrush habitats and increasing the risk of hot fast wildfires in some unban interface areas. Herbicides, such as imazapic, could be used alone or in combination with prescribed fire to reduce these fuels in the wildland-urban interface, or to create protection zones through important sagebrush steppe habitats. These herbicide treatments would be in the range of one to five percent of the total fuels treatments done by the BLM in Oregon annually. Herbicides would also be used to prevent reinvasion of some wildfire areas with invasive annual grasses. These uses are described in detail in the *Fire and Fuels* section in Chapter 4.

Timber

231. Comment: The Draft EIS states in Chapter 1 that it "does not propose the use of herbicides specifically for commodity production such as projects to improve timber growth…" This statement is not reflected in the rest of the rest of the EIS. For instance, the EIS describes how logging on lands adjacent to BLM would commercially benefit by the BLM using herbicides.

Response: The word "commodity" has been replaced with "specifically for livestock forage or timber production," to remove confusion about other economic effects. That said, noxious weeds adversely affect commodity and non-commodity resource values statewide. These effects are one reason weeds are listed as "noxious" by the State. The *Timber* section, therefore, displays the effects of the various alternatives on timber production, the same as for the *Recreation* section, *Fish* section, and so forth. Examination of the effects of the alternatives on resource values, such as timber production, is a requirement of NEPA, and does not infer herbicides would be proposed specifically for timber production. This point is discussed in more detail in the first two paragraphs of the *Timber* section.

Paleontological and Cultural Resources

232. Comment: Herbicides should not be applied in areas of American Indian traditional use and subsistence activities.

Response: The Standard Operating Procedures implemented for weed treatment include provisions for reducing risks to traditional use areas from herbicide treatments. Included in the Standard Operating Procedures is a provision for consulting and working with tribes to minimize impacts from herbicide treatments to areas of vegetation considered significant by the tribes. Implementation of the Standard Operating Procedures with cultural resource review, and inventory and consultation with American Indian tribes in areas likely to include cultural resources and traditional cultural values prior to vegetation treatments, would reduce potential adverse effects to native plants species and wildlife utilized in traditional American Indian activities. Treatments potentially affecting the public would also be signed per Standard Operating Procedures and label requirements.

Traditional use and subsistence activities are adversely affected by the spread of invasive plants and displacement of plants and animals of traditional importance. Because only about 1/3 of the noxious weeds on BLM lands can be effectively controlled with non-herbicide methods, the ability to respond to specific weed problems in traditional tribal use areas would be reduced. Without the ability to use herbicides, weeds and other invasive vegetation would continue to displace native species desirable to traditional American Indian activities and would adversely affect the quality of forage and cover for wildlife utilized by tribes.

Visual Resources

233. Comment: It seems implausible that people would prefer the appearance of vegetation that has been treated with herbicides to the appearance of vegetation that has been mowed as stated in the *Summary of the Major Effects of Each Alternative* section in the *Summary*.

Response: The language in the *Summary of the Major Effects of Each Alternative* in the *Summary* (and similar language in Chapter 2) did not accurately reflect the discussion of visual effects found in Chapter 4, and the verbiage related to the visual effects of mowing and herbicide use has been removed. The *Visual Resources* section notes that mowing has the short-term visual effect of cut and browned vegetation and that the visual effect of using herbicides to treat vegetation varies depending on which herbicide is applied and how it is applied. When herbicides are applied directly to the invasive plant using a backpack sprayer or wicking method, the short-term visual impact is browned and dead vegetation mixed with green native vegetation. When non-selective herbicides are applied aerially or with a boom sprayer, the resulting short-term visual effect is one of an open, browned landscape. If herbicides are used in areas in place of mowing (such as along roadsides) the short-term visual effect would be a swath of browned and dead vegetation.

Wilderness and Other Special Areas

234. Comment: The EIS proposes to increase the use of herbicides in such areas as Wilderness Areas, National Monuments, and Wild and Scenic Rivers and does not adequately estimate the number of people likely to be exposed to the herbicides or the effects of this exposure on the visitors to these areas.

Response: With a greater variety of herbicides available to treat noxious weeds and other invasive plants under Alternatives 3, 4 and 5, the EIS assumes there would be increased use of herbicides across all BLM administered lands including Wilderness Areas, National Monuments, and Wild and Scenic Rivers. With increased use of herbicides, there is an increased likelihood of human exposure. This programmatic EIS does not identify where specific herbicide treatments would take place, therefore, it does not attempt to quantify the likelihood of visitor exposure to herbicides. The Risk Assessments, summarized on the "Risk Categories" tables at the end of Chapter 3, include recreational users such as hiker/hunters, anglers, berry pickers, swimmers, and subsistence users of plant materials. The categories for most of the herbicides likely to be used within special areas indicate no risk for these activities. Whether or not an herbicide might pose a risk to one of these user groups would be a site-specific consideration in the selection of which herbicide to use and the timing of the application. Prior to any specific herbicide treatment, site-specific analyses would be conducted that would include public notification and opportunity for public comment and involvement.

In order to help protect public land visitors from herbicide exposure, access to treatment sites is restricted for a short time. During these closures, the BLM posts signs noting the exclusion area and the duration of the exclusion. Wording explaining this closure procedure has been added to the *Wilderness and Other Special Areas* section.

235. Comment: The Western Rivers Conservancy is in the process of purchasing Wildwood Park and associated properties along the Wild and Scenic Salmon River near Welches, Oregon. The purpose is to resell to the BLM to protect the Salmon River Watershed. Use of herbicides in this area would appear to be in conflict with the watershed protection efforts being done in the Salmon River watershed, and would likely not be supported by the local community.

Response: Herbicide treatment within Wild and Scenic River corridors are only permitted if they are conducted in an effort to protect and enhance the outstandingly remarkable values identified in the legislation establishing the river designation. If those values involve public access developments, herbicides might be used for their maintenance. The analysis in the *Water Resources* and *Fish* sections of the EIS indicates proposed herbicide uses are not likely to compromise water and watershed protection objectives including those in Wild and Scenic Rivers. Watershed values would be best protected by controlling invasive plants. Permitting invasive plants to displace native ecosystems within donated Wild and Scenic River corridors would be poor land stewardship. An example of herbicide treatments getting wide public support is the ongoing interagency effort to control Japanese knotweed along the Clackamas and Sandy Rivers (CRBC 2008). Prior to any specific herbicide treatment, site-specific analyses would be conducted that would include public notification and opportunity for public comment and involvement.

Recreation/Interpretive Sites

236. Comment: BLM should require, not simply encourage, weed-free feed for grazing and recreational pack animals on BLM administered lands, and should provide strong inspection and enforcement measures to ensure the requirement is followed.

Response: BLM's Integrated Vegetation Management policy emphasizes the prevention of noxious weeds and other invasive plants and identifies a variety of prevention measures including requiring weed-free seed and mulch in restoration and other re-vegetation projects, and promoting the use of weed-free hay for grazing and recreational pack animals. The BLM in Oregon encourages the use of weed-free hay for grazing and recreational pack animals, because in general, enforcement of stronger measures is not feasible in Oregon at this time. BLM National policy on weed free forage encourages BLM state offices to work cooperatively with state and local agencies to implement a weed free forage plan. The Oregon Department of Agriculture has developed a pilot weed-free forage certification program. This is a voluntary pilot program with the intent of certifying weed forage as a part of overall weed prevention effort. In 2003, Wallowa County adopted the North American Weed Management Association certification standards and now has certified hay and straw products available. The BLM in Oregon will continue to work towards weed free forage as it becomes available, and will implement BLM National policy as it evolves. However, consideration of this policy is ongoing and outside the scope of this EIS. Its disposition would not affect the analysis of the alternatives because it would not materially affect the *Need*, and because a reexamination of all of the BLM policies that might change the noxious weed spread rate is outside the scope of this analysis. There is currently no statewide certification program in Oregon for weed-free hay. If weed-free hay is not available, enforcement is unlikely.

237. Comment: Posting of signs for at least two weeks following an herbicide application in a recreation area may not be sufficient due to herbicide persistence (e.g. picloram).

Response: The *Recreation/Interpretive Sites* section erroneously stated that signs would be posted for at least two weeks following an herbicide treatment in a recreation area. The language in this section has been edited to accurately reflect the procedure BLM follows when applying herbicides in recreation areas or other public access areas. The label requirement of the herbicide being used determines how long an area would be closed to visitor use following an herbicide treatment. Access to a site treated with an herbicide is usually restricted for a few hours or days, depending on the requirements on the herbicide label. During these closures, the BLM posts signs noting the exclusion area and the duration of the exclusion. An herbicide with no demonstrated risk to human health may have a very short exclusion time.

Administrative Sites, Roads, and Rights-of-Way

238. Comment: The EIS has correctly identified rights-of-way as a primary vector for the spread of noxious weeds. Control of roadside vegetation would not only greatly reduce the spread of these plants, it would provide the additional benefit of improving sight distance and subsequently the safety of its road systems.

Response: The *Administrative Sites, Roads, and Rights-of-Way* section includes sight distance as one of the safety and maintenance objectives for vegetation treatments along roadsides. This objective could be met in part by using herbicides under Alternative 4 (the Proposed Action) and Alternative 5. Such use could be particularly advantageous in checkerboard lands where private timber companies share road ownership and maintenance responsibilities. Under Alternatives 4 and 5, herbicide availability could allow shared owners to accomplish safety-related maintenance of entire haul routes in a single treatment. The EIS has been edited to note this benefit.

239. Comment: Invasive weed concerns should be a priority during transportation planning on BLM lands. All motorized travel should be limited to designated routes, cross-country motorized use should be prohibited, and all unnecessary roads should be closed.

Response: Invasive weeds are one element considered during transportation planning on BLM lands, both at the plan and project scale. Transportation planning is beyond the scope of this EIS.

240. Comment: Public funds should not be used to pay for maintenance and protection of private and corporate infrastructure such as under power line rights-of-way.

Response: The EIS notes that in general, vegetation management around developments is the responsibility of the development owner, using methods approved by the BLM. Except for noxious weed control using one of the four currently approved herbicides, herbicide use is not currently approved for vegetation management in or around these sites. Information has been added to this section pointing out that invasive plant control on developed sites is also (usually) a permit-required responsibility of the development owner. Any of the action alternatives would provide more tools so development owners could better meet this permit requirement.

241. Comment: The National Park Service routinely uses herbicides to control noxious and non-native weeds on public lands, but is careful to not begin spraying in areas that do not truly need spraying. Aren't there other cost effective ways to limit weed growth on roadways and in campgrounds? Rather than expose the public, wildlife, and native flora, aren't there less intrusive ways to control unwanted weeds in these public area? Mowing, flame treatments, public education, public weed pulls, and even spot spraying of the worst weeds to control spread are sometime more effective, less expensive, and less harmful/toxic to the watershed and to the humans and wildlife that utilize these areas.

Response: BLM practices are similar to those described in the comment. Like the National Park Service, BLM is guided by Department of the Interior policy. That policy calls for accomplishment of pest management through cost-effective means that pose the least risk to humans, natural and cultural resources, and the environment, and requires bureaus to establish site management objectives and then choose the lowest risk, most effective approach that is feasible for each pest management project (Chapter 3, USDI 2007e). The BLM also has no wish to unnecessarily close recreation sites, or to post herbicide warning signs that discourage public use. These considerations help guide local decision-makers to use non-herbicide methods in such sites wherever feasible. Popular recreation sites are also the locations most likely to enlist volunteers to help remove infestations. Finally, because high public use areas are highly susceptible to invasive weeds, BLM personnel attempt to watch these areas so they can treat new infestations when they are small and might more easily be removed with non-herbicide methods. The vast majority of invasive weed (and native plant) control treatments within developed recreation sites are done with non-herbicide methods.

In some instances, herbicides are the most appropriate treatment method in developed sites. Many invasive plants cannot be reasonably controlled with non-herbicide methods; BLM dispersed sites are potentially more likely to become infested with invasive plants because of a broader array of seed-carrying recreational equipment use the area, including horses and OHVs.

Along roadways, most herbicide treatments of invasive plants are spot treatments posing little risk to the traveling public. A high percentage of the invasive plant treatments are along roadways because roads serve as weed spread corridors. The Reference Analysis shows that relying exclusively on non-herbicide methods in some areas would cost nearly three times more than under the Proposed Action (Alternative 4) when calculated on an effectively treated acre basis (*Implementation Costs* section in Chapter 4). Assuming fixed budgets, this would translate to two-thirds fewer weeds controlled.

242. Comment: Lane County is also concerned about the pollution from herbicides and does not conduct roadside spraying. In addition, in April 2009, the Board of Commissioners adopted a resolution inviting the Oregon Department of Transportation (ODOT) to form a partnership with the County to ensure implementation of an effective plan to prevent roadside spraying on State roads in the County. The resolution states the board "finds that persistent long-term herbicide exposure is now recognized as hazardous." The Board relied on a) a U.S. Geological Survey study on the prevalence in water quality samples of herbicides commonly used on roads and rights-of-way, b) the likelihood of the herbicides sprayed entering the water during and after rains, and c) scientific evidence that even small amounts of herbicides can damage aquatic life. The BLM now proposes to do something counter to the Board's resolution that "persistent long-term herbicide exposure is now recognized as hazardous" and the intent of the County to reduce herbicide use.

Response: The BLM believes the Board's position is more accurately interpreted as follows: The resolution (#09-4-8-16) indicates that Lane County has adopted a Roadside Vegetation and Last Resort Policy in which the Board has offered to collaborate with ODOT and share resources to assist in pesticide use reduction. The Board resolved as a matter of pesticide-use reduction that persistent herbicide exposure is now recognized as hazardous and recommends a reconsideration of routine and "residual" herbicides sprays as a roadside maintenance practice. The Board also resolved, in December of 2009, to support ODOTs Last Resort Herbicide Spray Pilot Project for Highway 36.

The EIS does not dispute that "persistent long-term herbicide exposure" would likely be hazardous. The uses proposed in the EIS would not result in persistent nor long-term herbicide exposures. Herbicides proposed for roadside use west of the Cascades would almost all be applied to foliage, where they would be absorbed and metabolized. Soil-applied herbicides used east of the Cascades are not particularly subject to leaching and washing to streams because of the dry conditions and lower steam densities. The EIS agrees that "residual" (persistent) herbicides used in roadside drainage ditches can find their way into streams where they can harm fish (see *Water Resources* and *Fish* sections). This is why the projected acres of bromacil, tebuthiuron, and diuron are so low west of the Cascades (100 acres per year under the Proposed Action, Alternative 4), and why there is a proposed mitigation measure requiring project planners to consider that roadside ditches connect directly to streams and conventional buffers would not apply. BLM policy regarding the selection of treatment methods prevents herbicide applications from being considered "routine." Although the BLM does not refer to its decision process as a last resort policy, it requires a hard look. The EIS does not dispute the cited research. For example, it is true that small amounts of certain herbicides can damage aquatic life, and that herbicides are found in Oregon's streams. BLM's Standard Operating Procedures and PEIS Mitigation Measures, application measures, and site-specific planning are designed to minimize or eliminate negative effects from herbicide treatments.

243. Comment: The *Administrative Sites, Roads, and Rights-of-Way* section might benefit from examples that are more specific. For instance, Idaho Power uses a diuron/tebuthiuron herbicide to treat vegetation around wooden power poles on BLM lands in Idaho, to reduce the risk of wildfire burning down the poles. Such treatments could be undertaken on BLM lands east of the Cascades under Alternative 4 (the Proposed Action) and Alternative 5.

Response: This example has been added to the *Administrative Sites, Roads, and Rights-of-Way* section.

244. Comment: Saving money, noted in the *Implementation Costs* section for roadside spraying, is not an acceptable reason to further expose the public to chemicals while they are enjoying and recreating on public lands.

Response: As indicated in the *Social and Economic Values* section, there is a part of the population that does not consider cost savings to be a legitimate reason for potentially increasing public herbicide exposure. That position is described in the EIS and would be considered by the decision-maker in formulating the Record of Decision.

That said, it is equally appropriate to display implementation costs in order to inform the decision-maker of the potential for cost savings. BLM toxicologists also detail in the EIS that treatments constitute a negligible effect on human health risks, even if the public is exposed, which is highly unlikely. The analysis indicates that under Alternative 4 (the Proposed Action) and Alternative 5, current road and rights-of-way maintenance budgets would see cost savings of approximately $1 million which would then be available to meet other types of maintenance and improvement needs, or be available to reduce utility customer's costs.

Social and Economic Values

245. Comment: The EIS states there is "higher public acceptance" of herbicide risks east of the Cascades. Whom did you query on this? The Oregon State Extension Service and the County Soil and Water districts, who work almost exclusively with ranchers? Were fish and wildlife biologists from the Oregon Department of Fish and Wildlife and the Forest Service included? Were the Warm Springs, Paiute, and Umatilla Tribes included? Were the environmental communities such as The Nature Conservancy consulted? Were the Native Plant Society and various birding groups east of the Cascades encouraged to comment? We can hardly fathom that people concerned with native plants and insects, recovery of aquatic habitat and fish populations, bird numbers and habitat, etc. east of the Cascades are by nature more receptive to intensive toxic herbicide use than those west of the Cascades.

Response: All of the groups named in the comment are included on the EIS mailing list, most submitted comments, and most comments were supportive of Alternative 3 or Alternative 4 (the Proposed Action). The Oregon Department of Fish and Wildlife submitted a comment letter in favor of Alternative 4 (the Proposed Action). Oregon Department of Environmental Quality "realizes that herbicides will be needed in certain situations to control invasive species." The Nature Conservancy "supports efforts by the BLM to treat noxious weeds and non-native invasive plants that negatively impact biodiversity, natural communities, rare and endangered species, plant communities and habitats, and ecosystem processes. We support BLM using an expanded list of herbicides for vegetation treatments on public lands…" Oregon State Extension and County Soil and Water districts are highly concerned with the long-term sustainability of all county resources including soil and water, as well as with the quality of life for county residents, and many wrote in support of the proposed herbicide increase during scoping and during the public comment period for the Draft EIS. This support tended to come more from east of the Cascades where, for a variety of reasons, public awareness of the scope and effects of invasive plants is higher than west of the Cascades. BLM lands make up a higher percentage of lands east of the Cascades, and the flat, open terrain means invasive weeds are more visible. Scoping meetings east of the Cascades were attended by at least five county supervisors, all of whom were supportive of increasing the number of herbicides available to the BLM for invasive plant control. Tribes received personal contacts as well as specific scoping letters; those responding said they would save comments for site-specific proposals; one noted the need to protect ethnobotany resources in the West Eugene Wetlands. The Forest Service provided internal review comments and other information for the BLM analysis. The EPA gave the Draft EIS its highest grade, "lack of objection," meaning they did not identify any potential environmental impacts requiring changes to the proposal.

The BLM and all of its resource specialists involved with preparation of the EIS are preeminently concerned with the resources and habitats mentioned in the comment. However, nearly every resource section in Chapter 4 concludes that while there is some increased risk to resources because of using herbicides, the effects of invasive plants are far worse.

More herbicide use may be proposed for east of the Cascades in part because 85 percent of the BLM lands in Oregon are east of the Cascades (Table 4-2). Although it is probably also true in a larger sense, the "higher social acceptance" comment was made only in reference to the likely public acceptability of a 4,000 to 5,000 acre per year increase in wildlife habitat improvement projects using herbicides that would occur east of the Cascades under Alternative 5 (when compared to Alternative 4, the Proposed Action), two-thirds of which would be new opportunities that would not happen with non-herbicide methods.

246. Comment: The EIS does not explain the basis for the conclusion in the *Comparison of the Effects of the Alternatives* section in Chapter 2, that on both sides of the Cascades, people believe that invasive plants are more harmful than herbicide use.

Response: While a breadth of perceptions exist on the effects of herbicide use and continued invasive plant spread, many voiced concerns for the threat to resource values from invasive species. These concerns do not overshadow concerns expressed regarding the threat to resource values from herbicide use, and thus the statement may have over generalized the degree of social consensus. The statement does not occur in the reformatted *Comparison of the Effects of the Alternatives* section in Chapter 2.

247. Comment: The *Summary* statement that states that social acceptance of the Reference Analysis is likely to be low, ignores public concerns about the use of herbicides.

Response: This phrase appeared in the *Summary* as well as in Chapter 2 in the *Summary of the Major Effects of Each Alternative*, and was followed by "Although some scoping comments expressed a desire for no herbicide use, most communities are concerned with the resource damage caused by invasive plants and are aware of the higher costs and lower practicality of non-herbicide control methods." The statement has been modified to better state the conclusions in Chapter 4.

248. Comment: The *Social and Economic Values* section states "there is a *perception* of unguarded exposure and the possibility of direct contact or ingestion …" The EIS needs to state there is a *real* threat and not just a perception.

Response: Threats are described in this section as they relate to perceptions instead of actual threats since perceptions vary between individuals, groups, or communities. Thus, while actual threats to specific resources or to human health are discussed in other sections of the EIS, the *Social and Economic Values* section uses perceptions as an indicator since individuals, groups, or communities are of interest.

249. Comment: The EIS should consider the effects on tourism from invasive plants spread. Specifically, effects on wildlife habitat could decrease opportunities for wildlife viewing in certain areas.

Response: That point was addressed in the EIS. The first paragraph of the *Environmental Consequences* subsection of the *Social and Economic Values* section explains, "Invasive plants can have a negative effect on observation-based tourism, as the wildlife and wildflowers that people come to enjoy and photograph are crowded out by invasive plants (Westbrooks 1998). Consequently, recreation dependent communities in Oregon may be more susceptible to the effects of invasive weed spread than more economically diversified communities."

250. Comment: The EIS should consider that the effects of controlling the spread of noxious weeds include a reduced need for control on lands adjacent to BLM.

Response: In the subsection *The Spread of Invasive Plants from Adjacent BLM Lands,* under *Effects by Alternative,* this benefit is discussed. Specific points include "future costs to neighboring private and public lands would decrease" (Alternative 3); "wildland fire-related costs in these communities…could be reduced…" (Alternative 3); and "benefits to adjacent landowners would particularly accrue from the roadside herbicide treatments indirectly reducing noxious weeds and other invasive plants in locations where they are most likely to be spread to their lands" (Alternative 4). A subsection discussing the possibility that herbicide use on BLM lands could result in an overall reduction of herbicide use on adjacent non-BLM lands has been added to the *Cumulative Impacts* section near the beginning of Chapter 4.

251. Comment: The *Social and Economic Values* section should acknowledge the widespread public concern over the use of herbicides in its *Cumulative Effects* subsection.

Response: Language under the *Cumulative Impacts* heading early in Chapter 4 explains that "because this is a statewide programmatic document covering the estimated level of future herbicide use in Oregon, …this entire analysis is itself a cumulative effects analysis." Thus, the *Cumulative Effects* subsection in the *Social and Economic Values* section does not summarize, but adds to, the "cumulative" effects already discussed in the rest of the section.

Environmental Justice

252. Comment: Consider including ranchers in the analysis of *Environmental Justice* and acknowledge that ranchers are poor and their income is affected by increasing commodity prices. In addition, acknowledge that weeds decrease farm income when forage resources are affected.

Response: The Environmental Justice Principles in BLM's Land Use Planning Handbook requires the BLM to "determine if its proposed actions will adversely and disproportionately impact minority populations, low-income communities, and Tribes and consider aggregate, cumulative, and synergistic effects, including results of actions taken by other parties" (USDI 2005f). Per this definition, ranchers are not a defined environmental justice population. However, the handbook encourages consideration of "all potential social and economic effects, positive and negative, on any distinct group." Consequently, the EIS describes loss incurred from the spread of invasive plants in the second paragraph of the *Environmental Consequences* section of the *Social and Economic Values* section stating:

> "Similarly, the *Livestock* section in this Chapter identifies reductions in livestock carrying capacity of thirty-five to ninety percent from weed infestations. Invasive weeds affect the livestock industry by lowering yield and quality of forage, poisoning animals, increasing the costs of managing and producing livestock, and reducing land value (DiTomaso 2000). A 1993 economic study in Grant County showed the annual economic impact to livestock grazing was $326,000 and losses would climb to over $3.96 million [2009 dollars] without increased weed management (Test 1993)."

Losses to ranch values are also included under the subsection on *Concerns Raised During Oregon Scoping* in the *Social and Economic Values* section. In order to provide additional detail suggested by this comment, the text of the EIS has been augmented with the example given in a public comment letter. The text under the section on *Concerns Raised During Oregon Scoping* now includes the sentence:

"Incomes in ranching dependent communities are also affected by weed spread since weeds decrease the nutritional value and availability of forage in pastures. These effects are compounded by increasing commodity prices which further decrease profitability."

253. Comment: Please clarify the sentence "While the percentage of the population living below poverty was slightly greater east of the Cascades, its percentage of total population decreased by a greater degree than west of the Cascades."

Response: The sentence has been changed to "In 1999 the percentage of the population living below poverty was slightly greater east of the Cascades (13.1 percent) than west of the Cascades (11.4 percent). In addition, the percentage of the total population east of the Cascades decreased by a greater degree than west of the Cascades over the period from 1989 and 1999 - decreasing by 1.6 and 0.7 percent, respectively."

254. Comment: The EIS should consider effects to wild mushrooms as a commercial resource and not only in an environmental justice context.

Response: The EIS describes the concern for loss from herbicide use in the *Herbicide as a Threat to Resource Values and Human Health* subsection of the *Social and Economic Values* section, stating: "Many comments proposed that the potential damage to resource values from treatments does not justify the use of herbicides. Many suggested herbicides threaten non-target native, rare, Federally Listed and other Special Status species."

However, concern on potential effects to the commercial value of other forest products was not specifically mentioned in the Draft EIS. Consequently, the text under the *Social and Economic Values* section now goes on to include: "Some noted effects to other forest products collected for their subsistence, cultural or commercial value such as chanterelle or matsutake mushrooms."

Specificity on commercial value of these specific resources is not added to the analysis of the alternatives, as they are included in the *Effects by Alternative* section on *Herbicide as a Threat to Resource Values and Human Health* section in Chapter 3. The topic is also addressed under *Native and Other Non-Invasive Vegetation* section in Chapter 4, and will be considered during site-specific analysis.

255. Comment: The EIS fails to consider the effects of general herbicide use on those who collect native species and "other forest products" such as mushrooms, manzanita, medicinal plants, and greenery for wreaths.

Response: There is a potential for herbicides to contact mushrooms and other forest products. Some native special forest products species could be targeted under Alternative 4 (the Proposed Action) and Alternative 5. The potential for exposure to people who collect or use these products is discussed in the *Environmental Justice* and *Human Health and Safety* sections.

Under the *Environmental Justice* section of Alternative 4 (the Proposed Action), the EIS notes "under Alternative 4, [native species within a few feet of the road edge] would be deliberately targeted, increasing the potential to affect plants and other products (which include other forest products such as mushrooms, manzanita, and greenery for wreaths) utilized by under-represented groups." Corresponding language under Alternative 5 has also been similarly edited.

The *Environmental Justice* section under all the alternatives also notes that site-specific analysis prior to treatments, and Standard Operating Procedures that reduce drift, would help minimize exposure of non-target food and water sources. The Risk Assessments evaluated people who gather and use large amounts of range and forest products and generally found no risk (see "Risk Categories" tables at the end of Chapter 3). Standard Operating Procedures require consultation with tribes to locate any areas of vegetation that are significant to the tribes and that might be affected by herbicide treatments. In addition, when herbicides are used, the application site would be signed to inform the public what herbicides had been used in the area and what precautions to take. To the degree any risk remains, the document notes under all action alternatives that the potential for disproportionate or adverse impacts to minority or low-income groups would still exist.

Regarding the collection of forest products that are classified as noxious weeds, Oregon law does not permit the sale, purchase, propagation, or transport of noxious weeds. Therefore, the BLM does not issue permits for collection of noxious weeds even when they have medicinal uses such as milk thistle and St. John's wort.

256. Comment: The *Environmental Justice* section indicates minorities, American Indians, and low-income people will be disproportionately affected by herbicides. Why are these people sacrificed? Why is there no alternative or provision to better protect these groups?

Response: The comment assumes "risk" equals "effects," which is not the case. The entire analysis is about variations in risk, while in reality Standard Operating Procedures and PEIS Mitigation Measures, and the nature of the proposed treatments, make risk negligible. No actual human health incidents are predicted, and adverse wildlife and other effects would be extremely limited, short-term, and localized.

American Indian tribes were specifically contacted during scoping for this EIS. Those responding indicated support of the Proposed Action (Alternative 4) because improved invasive plant control would help protect traditional uses valuable to the tribes. Tribes are also directly involved with site-specific planning through government-to-government consultation in order to minimize adverse effects and identify safety concerns with regard to traditional gathering areas. Hispanics were identified as potentially adversely affected because language differences could lead to poorer understanding of label and other instructions. State-licensing requirements, however, are aimed at reducing this particular effect. Lower income people and minorities are simply more likely to be gathering food including mushrooms; thus, the analysis identifies them as potentially more exposed. The Risk Assessments, however, examined this potential exposure and found risks to be very low (see *Human Health and Safety* section), and identification of these groups as potentially more exposed does not infer that their exposure would change that. Executive Order 12898 simply requires agencies to identify and address disproportionately high and adverse human health or environmental effects of its decisions on minority and low income populations. This section of the EIS examines that potential.

Implementation Costs

257. Comment: The EIS should consider the effect on employment from mechanical and herbicide treatments that includes potential effects from unemployment. In addition, it should consider updating 2005 data with most recent available information considering effects from the economic downturn.

Response: The programmatic scale of this analysis makes assumption of site-specific project planning speculative; thus, information on anticipated treatments is not available and employment impact estimation is not feasible. Site-specific analysis prior to treatment would include employment effects if public scoping reveals a community concern related to employment impacts. In regards to the need for more current information beyond 2005, the EIS used 2009 cost information and other sources more recent than 2005 for all data except population growth and density, where 2005 is the most recent available data. While additional slight changes in population density and growth over the period from 1970 to the present could have occurred - demographics are discussed in the EIS at a broad regional scale and not affected by the EIS at this scale. Thus, some change in population or demography could occur at the site-specific level, but as stated above, the programmatic nature of this document makes the assumption of site-specific effects infeasible.

258. Comment: The herbicide application cost estimates should have included the cost of monitoring surface water effects from herbicide treatments.

Response: Districts provided their experienced project-level costs, so these costs included existing monitoring.

259. Comment: The EIS should display costs and benefits, showing the true costs of invasive plants (in terms of resources and income losses). It should also show the cost/benefit of treating an infestation early, in order to more clearly support increased budget requests.

Response: Non-market components of wildland resources affected by invasive species are notoriously difficult to quantify, and information about invasive species' economic effects is unavailable specific to BLM lands. These factors make estimates at this scale of analysis speculative; effects might be more discernable at the site and weed-specific scale. BLM-specific data is simply insufficient for any such display to be meaningful. Regardless, the EIS considered much of the identified literature regarding economic losses statewide and for specific sites. Where these losses are relevant, they have been cited in the *Social and Economic Values* section, the *Noxious Weeds and Other Invasive Plants* section, or elsewhere. In addition, despite our inability to quantify non-market values, such values are discussed qualitatively in the *Social and Economic Values* section and in other sections of the EIS. In general, these serve only as examples, and the portion of such numbers that are applicable to BLM lands can only be estimated.

That said, there is little doubt that invasive plants are having a significant economic impact on resource values on BLM lands in Oregon. Effects, and resultant weed control emphasis, *is* a part of district land management plans. The idea that cost information would justify early treatment seems to be well supported by laws and policy at all levels. As the available number of herbicides increase, the cost information presented in Chapter 4 demonstrates the effectiveness of increased treatment on the rate of spread and resulting cost decreases. In effect, this shows cost savings of early treatment.

260. Comment: The EIS should consider that loss to non-commodity resources and non-market values (such as the cost to human health, native plants, water quality, fish, soils, Federally Listed species, grazing mammals, scavengers, neotropical songbirds, amphibian, etc) are not compensated by monetary savings to Federal Agencies from using herbicides.

Response: In the *Environmental Consequences* portion of the *Social and Economic Values* section the document notes that *Concerns Raised During Public Scoping* included "understanding the value of non-commodity resources and non-market values was important, since without estimates, these resources may be undervalued and decisions regarding their use may not accurately reflect their true value to society." The document then notes that while there have been many studies on the impacts of invasive species in localized settings, few take into account non-market impacts of invasive species, which "might be due to the difficulty in preparing estimates and the controversy over available methods" [Cusack and Harte 2008]. In the absence of quantitative information for these goods, they are discussed qualitatively where indicated below."

Under the subsection Herbicide *as a Threat to Resource Values and Human Health* in the section *Effects by Alternative*, the document now notes, "comments expressed concerns that herbicides would unacceptably damage non-target plants and other non-commodity resources and non-market values" to include those values of concern stated in the public comment. The same paragraph of this section then addresses effects by alternative, stating, "Alternative 2 may be more acceptable because of the fewer acres treated with herbicides, but Alternative 3 would use 35 percent fewer total pounds … and provides more herbicides to accomplish control objectives while decreasing environmental risk." In addition, any risks to these values are discussed implicitly in the specific resource sections of this EIS.

While losses to non-commodity and non-market values from herbicide use could occur as recognized above, the document also notes in the *Environmental Consequences* portion of the *Social and Economic Values* section, under *Effects Common to All Alternatives* that "treatments under the action alternatives would variously result in improvements in the condition of BLM resources and would lead to increases in commodity, non-commodity, and non-market values."

261. Comment: The EIS should consider the merits of manual removal beyond just cost. It should consider the environmental and health costs of using herbicides. Studies showing the impacts of pesticides on human health have been published by the Oregon Environmental Council (see, e.g., *The Price of Pollution: Cost Estimates of Environmentally-Related Disease in Oregon,* OEC 2008).

Response: Treatment effects from manual and other non-herbicide methods are described in most of the resource sections in Chapter 4.

The *Social and Economic Values* section acknowledges concerns related to human health in the subsection titled *Herbicide as a Threat to Resource Values and Human Health* and examines human health concerns by alternative. While the Oregon Environmental Council study provides an estimate of the cost associated with environmentally attributable disease and disability in Oregon it is not specific to pesticides and does not provide cost estimates specific to pesticide related illness. Hence, use of this information would thus overstate the cost of pesticide related illness in Oregon. In addition, the paper states "the purpose of this study is to estimate how much money is spent in Oregon annually to pay for environmentally attributable diseases, which are largely preventable" and is thus limited to just cost estimates represented by monetary transactions.

The EIS acknowledges that the cost of pesticide related disease is important and does not limit the discussion to just quantifiable costs of pesticide related illness and disease treatment. In the *Environmental Consequences* subsection of the *Social and Economic Values* section, the document notes that *Concerns Raised during Public Scoping* included "concerns about adverse effects on human health. These comments noted the increased human health threat to users of BLM lands, adjacent landowners, herbicide applicators, and BLM personnel who work in the field." Rather than a quantitative assessment using the incurred cost of disease, the EIS qualitatively recognizes the risks to human health may be greater under some alternatives than others based on levels of treatment.

In this manner, the analysis of cost effectiveness is not a cost-benefit analysis and thus does not claim to cover pesticide related costs associated with illness or resource damage. These costs are discussed qualitatively in the *Social and Economic Values* section (where noted above). This qualitative assessment of non-market transactions is valuable and appropriate given limitations discussed in the EIS, "Understanding the value of non-commodity resources and non-market values was important, since without estimates, these resources may be undervalued and decisions regarding their use may not accurately reflect their true value to society." The EIS then notes the difficulty in preparing estimates of non-market values due to controversy over available methods (Cusack and Harte 2008).

Human Health and Safety

262. Comment: The EIS needs to explain that pesticides cause birth defects and miscarriages.

Response: The herbicides proposed for use in the EIS, used in the manner described, would not cause birth defects of miscarriages. This conclusion is based on the Human Health Risk Assessments and the body of scientific evidence that are the basis for the EIS analysis.

263. Comment: BLM did not analyze effects to recreational users and the young and elderly.

Response: The Risk Assessments, summarized in the "Risk Categories" tables at the end of Chapter 3, include recreational users such as hiker/hunters, angler, berry pickers, swimmers, and subsistence users of plant materials. Both children and adults were also evaluated. In addition, the reference doses used for the acceptable dose contain uncertainty factors for extrapolating to humans including susceptible sub-populations like subsistence users.

264. Comment: The EIS does not discuss that violations of the Rehabilitation Act of 1973 would occur when the BLM disparately harms disabled people by forcing people to endure non-consensual herbicide exposures when they are on BLM lands, or near enough to them to receive drift or vapors, runoff into surface waters, or ground water contamination, or contact via other means of transport. If people suffer from disabilities that render them unable to detoxify the chemicals that BLM proposes to use, they will be disparately harmed by the BLM's massive spray program.

Response: BLM herbicide treatments would not be a violation of the Rehabilitation Act. Under Section 504 of the Rehabilitation Act of 1973, as amended (29 USC 794), no person can be denied participation in a Federal program that is available to all other people solely because of his or her disability. The purpose of this is specifically to allow all people access to services and benefits of a program; it does not protect the public from programs (such as the Integrated Vegetation Management program) potentially denying people access to something else (public lands). In addition, agencies are not required to take any action to facilitate such participation if such action would result in a fundamental alteration in the nature of a program or activity (7 C.F.R. 15(e) 103) (for example, Wilderness does not have to be wheelchair accessible). It should also be noted that no court has found chemical sensitivities to be a disability.

However, herbicide use under the Proposed Action (Alternative 4) would be scattered and infrequent, and not comparable to industrial uses on farms or timberlands. Standard Operating Procedures and PEIS Mitigation Measures require signing and/or other notification when herbicides are applied, and require buffer distances around residences to limit risks to people. In addition, the calculation of human health risk categories used in the EIS included uncertainty factors for extrapolating to humans including susceptible sub-populations.

265. Comment: Private homeowners suffer from negative health conditions because of the BLM and private timber companies' herbicide use.

Response: The Pesticide Analytical Response Center (PARC), a division of the Oregon Department of Agriculture, prepares an annual report to the State Legislature, detailing all suspected or confirmed cases of pesticide poisoning. Physicians are required by State law to report suspected or confirmed pesticide poisoning, and all cases are followed up on. PARC investigated 89 reports in their 2006-2007 report, 84 reports in their 2005-2006 reports, and 213 reports in their 2001 reports (PARC did not receive funding to produce annual reports between 2002-2004, nor have they produced their 2008 or 2009 reports yet). Out of these 386 reports, 28 were herbicide specific. The majority of the reports were occupational incidents, and employers were cited by OSHA for lack of training and lack of safety measures. There were a few reports of drift, where herbicide application (on agricultural lands) blew onto nearby lands and killed non-target plants. There were some reports from homeowners who misapplied herbicides, and some reports of accidental consumption. However, there was only one report of homeowners being affected by long-term herbicide exposure because they live near forested land where herbicides were being applied.

That report occurred in 2001; four residents in Polk County reported human illness and ill horses (cancer and blindness) after long-term exposure to clopyralid, sulfometuron methyl, and 2,4-D used on agricultural and forestry lands. PARC found insufficient information to pursue the case. It should be noted that the lands in question were not BLM lands. The BLM is not proposing to use herbicides for commodity production, and hence application is target specific and not likely to drift to non-target species (including humans).

People who suspect that they have been poisoned by any pesticide should report the incident to their doctor (and/or the Pesticide Analytical Response Center) as soon as possible.

266. Comment: All of the potential public exposures are non-consensual. Unlawful testing of herbicides on humans is in violation of the labels and of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 12 (unlawful testing on humans).

Response: The herbicides addressed in this EIS have been tested and registered for the proposed uses. While analysis of any application contributes information to future adaptive management decisions, the proposed applications are not tests. The FIFRA Section 12 refers to testing of the pesticide for registration, not to application under labeled uses.

267. Comment: The proposed roadside spraying forces the public to endure non-consensual exposures and violates their right to safety at home and during travel.

Response: The proposed herbicides are registered for roadside use, and Risk Assessments indicate those uses are highly unlikely to affect road users. Standard Operating Procedures and PEIS Mitigation Measures further limit exposures.

The BLM is aware of no health issues to the public or workers originating from BLM herbicide applications in Oregon during the past 25 years. Recognizing that current BLM herbicide use is far less than one percent of such use in the State, the BLM chose to examine a larger sample and reviewed the annual Oregon Department of Agriculture Pesticide Analytical Response Center's pesticide incident reports for three different years. The Oregon Department of Agriculture is required to investigate all reported injuries to people or property, as well as reported violations of pesticide application rules. Further, doctors are required to report to the Oregon Department of Agriculture every incident where a patient alleges pesticide poisoning, or the doctor suspects it. Therefore, the Oregon Department of Agriculture reports should represent a good summary of verified herbicide injuries. The Oregon wide reports generally contain two to four herbicide-related illnesses statewide per year (no deaths were found) (PARC 2001, 2006, 2007). These included illnesses from home use, from untrained operators without required safety equipment, and from applications during wind conditions well beyond those permitted by BLM Standard Operating Procedures. Although there were not enough injuries to indicate a statistical trend, it appeared injuries are most likely to occur to incidental operators. Few of the injuries were to trained agricultural or forestry workers or to landowners adjacent to these types of uses. The intent of this examination was to determine if herbicides were inherently risky and if the BLM Standard Operating Procedures were barely keeping us from harm, or if these are reasonable industrial and home-use tools that might be compared to using ladders or radial arm saws, and good work practices would reasonably eliminate most risk. The latter seems most true.

268. Comment: Native plants along roads and other areas can be treated under Alternative 4 (the Proposed Action) and Alternative 5. Herbicides could be applied to forest products such as mushrooms, manzanita, and greenery for wreaths, and species like milk thistle and pennyroyal that are used as medicinal herbs. How does the analysis address effects to those who gather and use these forest products?

Response: The Risk Assessments evaluated human subsistence use (Native American) of those who gather and use large amounts of range and forest products exposed to direct sprays or drift, and generally found no risk (see "Risk Categories" tables at the end of Chapter 3). When an herbicide is used, the potential for exposure would be reduced by posting the spray site to inform the public of herbicide use.

269. Comment: The *Human Health and Safety* section states that the EPA has not developed toxicity categories for sulfometuron methyl. However, they are provided in the Reregistration Eligibility Decision in 2008 (all endpoints are either IV or III)

Response: Toxicity categories III and IV are not endpoints used in Risk Assessment per se. They are simply label categories of the level of caution or danger associated with acute effects associated with handling the herbicide. The Risk Assessments use actual acute and chronic toxicity data for dermal and oral exposure. Sulfometuron methyl does not have any oral toxicity data, but the dermal data were used.

270. Comment: A recent article in Scientific American had an article on Roundup titled: *Weed-Whacking Herbicide Proves Deadly to Human Cells*. The summary says:

> Used in yards, farms and parks throughout world, Roundup has long been a top-selling weed killer. But now researchers have found that one of Roundup's inert ingredients can kill human cells, particularly embryonic, placental and umbilical cord cells... Glyphosate, Roundup's active ingredient, is the most widely used herbicide in the United States. About 100 million pounds are applied to U.S. farms and lawns every year, according to the EPA. Until now, most health studies have focused on the safety of glyphosate, rather than the mixture of ingredients found in Roundup. However, in the new study, scientists found that Roundup's inert ingredients amplified the toxic effect on human cells - even at concentrations much more diluted than those used on farms and lawns. One specific inert ingredient, polyethoxylated tallowamine, or POEA, was more deadly to human embryonic, placental and umbilical cord cells than the herbicide itself -- a finding the researchers call "astonishing." "This clearly confirms that the [inert ingredients] in Roundup formulations are not inert," wrote the study authors from France's University of Caen. "Moreover, the proprietary mixtures available on the market could cause cell damage and even death [at the] residual levels" found on Roundup-treated crops, as soybeans, alfalfa and corn, or lawns and gardens. The research team suspects that Roundup might cause pregnancy problems by interfering with hormone production, possibly leading to abnormal fetal development, low birth weights, or miscarriages.

Response: POEA was specifically evaluated for the PEIS (Appendix D) and found to be toxic for aquatic life, but non-toxic to humans. The Benachour and Seralini (2008) study referenced in Scientific American was published in the Journal of Chemical Research in Toxicology, and shows potential endocrine disruption, DNA damage, and toxicity of glyphosate with and without POEA in human cell cultures. This is a new finding (since the PEIS) based on laboratory tests with cells, and needs to be confirmed by other studies and possible dose implications considered. The Final EIS has been changed to report these findings.

271. Comment: The BLM should not be using 2,4-D because of health risks including the presence of deadly dioxins in about 60 percent of 2,4-D formulations.

Response: The EPA's 2005 Reregistration Eligibility Decision for 2,4-D has concluded 2,4-D is not associated with lymphoma or any cancer, that the dioxins present are of no toxicological concern, and reports that the dioxin/furan contaminant concentration was always low in 2,4-D in the 1980s and the industry has since further reduced these contaminants. Using 1987 data, the EPA found cancer and non-cancer effects from these contaminants to be of no toxicological concern. Additional studies requested by the EPA based on the 2005 Reregistration Eligibility Decision document, are nearing completion (EPA 2005a).

272. Comment: 2,4-D is persistent and has high, not moderate, risks to public and applicators.

Response: The EIS evaluation of the risk is based on the 2006 Forest Service Risk Assessment, which the PEIS analysis did not use. The new Risk Assessment actually reduced risks shown in the EIS when compared to the PEIS. (In addition, errors on Draft EIS Risk Category Tables for 2,4-D have been corrected.) Risks for typical or central exposures average from none to low with moderate risks for only 2 of 21 categories. Risks for maximum exposures average low to moderate with 5 moderate risk categories for 21 categories. According to the EPA's

2005 Reregistration Eligibility Decision document, the degradation of 2,4-D was rapid (half-life= 6.2 days) in aerobic mineral soils. The half-life of 2,4-D in aerobic aquatic environments was 15 days (EPA 2005a). These findings demonstrate that 2,4-D is not persistent.

273. Comment: California is listing 2,4-D as a developmental toxicant.

Response: California listed 2,4-D as a developmental toxicant under Proposition 65 several years ago, based on indicators described in the EPA's 2005 2,4-D Reregistration Eligibility Decision document. The Risk Assessment prepared by the EPA as part of that process, and the Forest Service Risk Assessment, both indicate the cited information is inconclusive. The EPA has requested registrants to provide additional information about these apparent effects. The indicators, and the uncertainty associated with them, are discussed under 2,4-D in the *Human Health and Safety* section. Listing by California's Office of Environmental Health Hazard Assessment does not represent a toxicity interpretation by an authoritative source, only that they believed the evidence met Proposition 65's criteria for listing.

274. Comment: The EIS should consider various draft EPA documents on dioxin and restrict 2,4-D containing the dioxins 2,4,7,8 TCDD and 1,2,4,7,8,PCDD.

Response: It is not clear what draft documents are referred to nor would it be scientifically defensible to take action based on draft EPA documents. The EPA's 2005 Reregistration Eligibility Decision for 2,4-D concluded 2,4-D is not associated with lymphoma or any cancer, and reports that the dioxin/furan contaminant concentration was always low in 2,4-D in the 1980s and the industry has since further reduced these contaminants. Using 1987 data, the EPA found cancer and non-cancer effects from these contaminants to be of no toxicological concern (EPA 2005a). The EPA has not restricted its use nor required any identification of dioxin constituents. The EPA continues to require testing to ensure dioxin contamination continues to decline.

275. Comment: The statement in the *Human Health and Safety* section that eye and skin irritation are the only overt effects of mishandling chlorsulfuron should be deleted. Chlorsulfuron is in toxicity category IV (labeled with "Caution") for skin and eye effects (only slight effects were seen in the studies).

Response: The text properly states that eye and skin irritation are the only overt effects of mishandling of chlorsulfuron because the Risk Assessment did not find any other risks.

276. Comment: Clopyralid can cause severe eye damage, including permanent loss of vision if splashed into the eyes by, for example, a worker accident.

Response: The potential for clopyralid to cause eye irritation and damage is described in the *Human Health and Safety* section of the EIS, under *Human Health Risks Associated with Herbicides Evaluated in the 2005 Forest Service EIS.* That section notes "irritation and damage to the skin and eyes can result from direct exposure to relatively high levels of clopyralid…..as a consequence of mishandling clopyralid (SERA 2004b)." "Severe" effects are not quantified, but study results included in the Risk Assessment show slight to marked conjunctival[8] redness, diffuse to marked corneal opacity, and slight to marked chemosis[9], sometimes lasting longer than 21 days in rabbits treated with high doses. The Risk Assessment does not suggest permanent loss of vision.

8 Conjunctiva: A delicate mucous membrane that covers the internal part of the eyelid and is attached to the cornea.

9 Chemosis: Swelling of eye whites; an inflammatory collection of fluid under the membrane covering the white of the eye so that it swells. It indicates conjunctivitis, often of allergic origin.

277. Comment: Glyphosate has been demonstrated to cause genetic damage in lab tests with human cells and tested animals. Farmers see increased risk of non-Hodgkin's lymphoma. Glyphosate contamination has been demonstrated in all six of King County urban streams tested. The USGS Hydrology Program survey of Midwest Streams (2002) found over one-third of stream samples contained glyphosate, while two-thirds contained primary breakdown products.

Response: No references were provided for the genetic damage portion of this comment. Glyphosate does not cause mutations (EPA 1993). Regarding non-Hodgkin's lymphoma, the glyphosate Risk Assessment (Appendix 8) discusses the available evidence and concludes:

> "Given the marginal mutagenic activity of glyphosate and the failure of several chronic feeding studies to demonstrate a dose-response relationship for carcinogenicity and the limitations in the available epidemiology study, the Group E classification given by the U.S. EPA/OPP (1993a, 3-18 2002) appears to be reasonable. As with any compound that has been studied for a long period and tested in a large number of different systems, some equivocal evidence of carcinogenic potential is apparent and may remain a cause of concern, at least in terms of risk perception (e.g., Cox 2002). While these concerns are understandable, there is no compelling basis for challenging the position taken by the U.S. EPA and no quantitative risk assessment for cancer is conducted as part of the current analysis" (SERA 2003a).

Regarding King County urban streams, it would not be surprising to find glyphosate in urban streams, given the apparent quantities sold in home and garden stores. The USGS publication *Pesticides Detected in Urban Streams in Kings County, Washington 1998-2003* (USGS 2004) identifies lawn and shrub care as the potential source. Wildland use by Federal Agencies following Standard Operating Procedures and PEIS Mitigation Measures is not comparable. USGS has detected glyphosate in Midwest streams but at levels more than 100 times lower than the allowable drinking water standards. The USGS study contributes information that would help guide the future use of glyphosate, but these specific results are not a health concern per se. Glyphosate is the world's best selling herbicide, used in more than 90 countries on 150 crops as well as along roadsides and other locations (USGS 2002). The USGS findings do not indicate BLM uses are inherently dangerous.

278. Comment: The BLM should not be using diuron because it is carcinogenic.

Response: Diuron has been characterized as a "known/likely" human carcinogen; however, risk assessments by EPA shows a lifetime risk estimate of 1.68 cases per million exposed (EPA 2003b). The EPA considers this a low risk.

279. Comment: The *Human Health and Safety* section states that diuron is a "suspected carcinogen, and possible endocrine disruptor." Both of these endpoints have been recently assessed by the EPA. The EPA's 2003 Reregistration Eligibility Decision document for diuron states, "At this time, neither the available submitted studies on diuron or the literature show any indication of endocrine disruption effects" (EPA 2003b). In the Reregistration Eligibility Decision, diuron was classified as a known/likely carcinogen. We suggest the EIS be changed to reflect the EPA's assessment.

Response: The diuron sentence has been changed as suggested.

280. Comment: One of the stated *Purposes* for increasing the number of herbicides is the benefit of the use of "newer, less toxic herbicides" (Chapter 1). However, in all of the action alternatives, the use of at least one of the four older, more toxic herbicides already in use would increase ("Risks to Worker and Public Health" table in the *Human Health and Safety* section). Under the Proposed Action (Alternative 4) the use of herbicides "would more than double the use of moderate risk herbicides (when compared to Alternative 3)." Alternative 3 is designated as having "higher risk" than the No Action Alternative (Alternative 2). In would seem that the action alternatives do not, in fact, meet the stated purpose of "minimizing the effects to non-target plants and other species" and lead "to lower human and ecosystem risk" as suggested in *Purpose* number 6.

Response: The statewide acres treated totals for all four of the currently used herbicides would go down under *all* of the action alternatives, even though total estimated acres treated (with all herbicides) would triple under Alternative 5 ("Estimated Annual Treatment Acres…" table in Chapter 3). The "Risk to Workers and Public Health" table in the *Human Health and Safety* section displays *only* those herbicides registering at least one moderate or low human health risk category (as opposed to zero), and not counting accidental exposure scenarios. Since 2,4-D is the only moderate risk herbicide in Alternative 2 (No Action) and Alternative 3 (the legitimate comparison since any increases between Alternatives 3 and 4 (the Proposed Action) come from the addition of other treatment objectives), there is projected to be a slight increase annually west of the Cascades (shown in the top half of the referenced table), and a 4,800 acre decrease annually east of the Cascades, for a 4,500 acre reduction statewide. Low risk herbicides would be added by Alternative 3, but those 2,400 acres do not negate the gain.

For Alternative 4 (the Proposed Action), the addition of soil active herbicides for use around certain rights-of-way and developments doubles the moderate risk acres when compared with Alternative 3, but the total acres of moderate risk herbicides are still 1,200 acres below those of Alternative 2 (No Action). Even with its expanded objectives, the acres of moderate risk herbicides are lower under the Proposed Action (Alternative 4) than under the No Action Alternative (Alternative 2). With respect to human health, it would appear that the objectives of *Purpose* 6 would be furthered by the Proposed Action.

Third, these numbers only address human health risk. Changes in ecosystem risks are best extrapolated from the individual resource sections in Chapter 4. Thus, in the *Comparison of the Effects of the Alternatives* section in Chapter 2, the Final EIS includes a numerical summary of the acres by risk categories by resource. These numbers are only indicators, because several parameters were rated for each resource. However, they indicate a reduction in overall ecosystem risk between the No Action Alternative (Alternative 2) and Alternative 3.

Other Environmental Consequences

281. Comment: The section on the *Relationship Between Short-Term Uses of the Human Environment and Maintenance of Long-term Productivity* is inadequate because it does not address the potential long-term effects of herbicides.

Response: The potential for long-term effects is addressed in the discussion of half-lives of the herbicides under various conditions in the *Soil Quality* and *Water Resources* sections. BLM applications are not expected to significantly contribute to cumulative downstream effects to fish. BLM-applied herbicides will break down at or near the point of application. The analysis indicates there would be no herbicide-related effects to long-term productivity. These conclusions, inferred or stated by the environmental effects discussions in the pertinent resource sections in this chapter, have been added to this section in the Final EIS.

282. Comment: The section on *Irreversible or Irretrievable Impacts* does not include a discussion of the irretrievable health problems for workers of the public; potential irreversible contamination of waterways, soils, or change to ecological diversity, or loss of vulnerable species such as amphibians.

Response: The potential for such effects is addressed in their respective sections in this chapter. The analysis indicates no such permanent effects are likely under BLM treatment scenarios.

References

283. Comment: An up-to-date search of scientific literature should be undertaken to better inform the BLM in their use of pesticides. There is a lack of references addressing certain issues in the otherwise extensive references section.

Response: The comment does not suggest specific missing references, or name the issues lacking references. To help inform the BLM of the risks associated with their proposed herbicide use, this EIS relies on BLM or Forest Service-prepared Human Health and Ecological Risk Assessments for each of the 18 herbicides. These Risk Assessments are included in this EIS as Appendix 8, and each Risk Assessment itself includes a very extensive references section. The references section at the end of Chapter 4 is also very extensive but generally only includes references that made it into the main body of the EIS. The summaries of the herbicide risk that occur in Chapter 4 are necessarily brief, and often cite the Risk Assessment as the reference rather than the primary source. Pertinent new information published since compilation of the Risk Assessments is included in Chapter 4 and its references section. Additional references have been added based on public comments and resultant new information added between the Draft and Final EISs.

Distribution List

284. Comment: The BLM failed to notify the public of this planning process. Local community leaders and parties that had no vested economic interest in removing invasive weeds or using herbicides should have been informed.

Response: In June of 2008, the Oregon BLM sent out 17,200 postcards and 2,000 emails notifying individuals and organizations that the Oregon BLM was going to begin preparation of an EIS. The postcards and emails advised recipients how to get on the mailing list and when scoping meetings would be held. Those notified included: State and Federal elected officials; American Indian Tribes and Nations; lessees of BLM land; Soil and Water Conservation Districts and Oregon State University Extension Boards, as well as other interested parties identified by the Oregon Department of Agriculture; and, mailing lists from other planning efforts including the BLM Western Oregon Plan Revisions, the Forest Service Pacific Northwest Region Invasive plant program: Preventing and Managing Invasive Plants (2005), the PEIS, and all Oregon BLM districts' mailing lists of persons having expressed an interest in being kept informed about local BLM planning efforts.

Approximately 400 press releases were sent to media outlets throughout the State. Newspapers do not have to publish news releases, but articles were published in several papers, including the Oregonian and the Ontario Argus Observer, and the issue received airtime on KEX and KCBY.

In addition, a Notice of Intent was published in the Federal Register on June 23, 2008. The Federal Register notice, news releases, and the postcards all announced the twelve scoping meetings, subsequently held throughout the State in July 2008.

About 1,300 interested parties were on the mailing list to receive the Draft EIS and about 2,000 interested parties are on the mailing list to receive the Final EIS. Per NEPA regulations, a distribution list is included in both the Draft and the Final EIS, which includes the names and/or organizations of all parties who are on the mailing list. An introduction paragraph has been added to the start of the distribution list to clarify how the distribution list was compiled.

285. Comment: Do form letters count as multiple responses?

Response: The Dear Reader letter in the Draft EIS states that the purpose of the public comment period is to ensure that the appropriate range of reasonable alternatives is presented, that the analysis of effects is complete, appropriately presenting and interpreting the available published information. Comments on the Draft EIS should be as specific as possible and should address the adequacy of the Draft EIS and the merits of the alternatives discussed (40 C.F.R. 1503.3). Comments meeting this standard were identified as "substantive" comments. One letter might have several substantive comments, and another may have none. Receiving the same substantive comment several times has no additional effect on the Final EIS; the deficiency is corrected one time, and no tally or "vote" is otherwise kept. All letters were treated equally and were not given weight by number received, organizational affiliation, or other status of the respondents.

Letters sent during the public comment period process were read by a public comment coding team who found the substantive comments and compiled them into comment statements. All of these comment statements are included in this Appendix, all have written responses, and many resulted in changes to the Final EIS.

Comments received are part of the public record on the Draft EIS and are available for public inspection. Individuals or organizations that submitted comment letters (including form letters) have been added to the distribution list, and would receive or be notified about the Final EIS and the Record of Decision.

Appendix 2 – Standard Operating Procedures and Mitigation Measures from the PEIS

286. Comment: The EIS never mentions or discusses buffer zones.

Response: Non-spray "buffer" zones are mentioned more than 50 times in the body of the EIS, with particular emphasis in the *Water Resources* section. Buffer zones are also specified or emphasized in 20 of the Standard Operating Procedures and PEIS Mitigation Measures in Appendix 2, variously requiring non-spray buffers up to 1500 feet. Four tables in Appendix 2 are titled "Buffer Distances to Minimize Risk to…." As with other Standard Operating Procedures and PEIS Mitigation Measures, effects discussions in Chapter 4 are predicated on the application of these required no-spray buffers.

287. Comment: Loopholes, such as language like "where practicable" and "for the most part" in Appendix 2 (Standard Operating Procedures and PEIS Mitigation Measures) would allow the BLM to avoid using these protective measures. Thus, assurance of few or no effects is weak.

Response: Neither of these phrases appears in Appendix 2. "Where feasible" appears, and denotes a requirement to seek an alternative way of meeting the objective (including reconsideration of whether the control is necessary) and infers that the extra risk of the higher dose be a part of the analysis. However, pending that analysis, the action may be selected. The entire section also has language that would allow departures if the adverse effects they seek to avoid are unlikely to occur. This is one reason measures are duplicated in two or more sections, so users can understand (and achieve) all of the objectives of specific measures. BLM field offices would tailor these Standard Operating Procedures and PEIS Mitigation Measures based on local conditions and site-specific analysis. Such "tailoring" would normally be described in the site-specific analysis documents that would be subject to public involvement and comment.

Appendix 3 – Monitoring

288. Comment: Appendix 3 (Monitoring) should include additional information on Oregon BLM's vision of an adaptive management framework.

Response: The Oregon and Washington BLM State Office follows the Bureau's Adaptive Management Implementation Policy (USDI 2008d). Guidance for implementation of this policy is contained in the US Department of the Interior's Adaptive Management Technical Guide (USDI 2009). The adaptive management framework employed by the State Office includes developing stated management objectives to guide decisions about what actions to take and identifying explicit assumptions about expected outcomes that are then compared against actual outcomes. This framework acknowledges uncertainty about how natural resources systems function and how they would respond to management actions, and it makes use of management intervention and monitoring to improve subsequent decision-making. This information has been added to Appendix 3 as suggested.

289. Comment: Appendix 3 states that Pesticide Application Records are kept for 10 years. What are the implications of that for long term monitoring? Appendix 7 and the *Noxious Weeds and Other Invasive Plants* section both discuss weed spread in the next 15 years; how will Pesticide Application Records kept for only 10 years be sufficient to facilitate meaningful measurement of the control strategy in the Record of Decision?

Response: Pesticide Application Records are retained in project files for a minimum of 10 years as per Bureau Manual 9011 (USDI 1992c). Even if Pesticide Application Records are not kept, district summary records typically include weed treatment information from previous decades. With the deployment of the BLM's National Invasive Species Information Management System (NISIMS) in 2010, Pesticide Application Records would be entered electronically and maintained indefinitely, which would better facilitate long-term data retention. This point has been clarified in Appendix 3.

The 15 year projected weed spread discussed in Appendix 7 and the *Noxious Weeds and Other Invasive Plants* section is a statewide estimate (based on available literature) for analysis purposes, and Appendix 3 does not suggest those should be used as a basis for any sort of monitoring. Potential and existing monitoring indentified in Appendix 3 is generally at a smaller scale than statewide. The 15-year weed spread rate is to show an indication of the size of the problem; individual species, populations, and ecosystems would have varying rates of weed spread, and varying responses to the alternatives.

290. Comment: The EPA recommends monitoring include a description of how BLM's data retention guidelines will facilitate long-term effectiveness monitoring.

Response: Appendix 3 in the Draft EIS failed to describe the BLM's new National Invasive Species Information Management System (NISIMS), which would help address this monitoring need. A description of the system and of the components that would facilitate effectiveness monitoring has been added to Appendix 3 in the Final EIS.

291. Comment: The EPA recommends that Part II of Appendix 3, *Potential Monitoring* be incorporated into all action alternatives in order to help avoid adverse environmental impacts from herbicide use. The EPA also recommends the proposal be amended to explicitly identify minimum site-specific requirements of monitoring. These requirements should provide guidance on how site-specific project planning and NEPA analysis would consider the costs and benefits of monitoring impacts on air, vegetation, soil, and water. Descriptions such as "water quality monitoring would be conducted at discretion of the district" and "there might also be a need to determine if the standards and protection measures were effective at reducing potential effects to Federally Listed species and/or designated critical habitat" do not sufficiently disclose how districts will develop and implement adequate effectiveness monitoring for environmental and human health concerns.

Response: The Appendix has been edited to better describe existing BLM policy direction directing that monitoring should be dictated by the nature of the critical components of the environment in the treatment area. The action alternatives do not propose a new program; they propose to add additional herbicides to an existing BLM program that has been conducted without a significant incident for decades, and operates under BLM-wide guidance developed from BLM's experience with herbicides. This monitoring ideas presented in this section of Appendix 3 could apply to any or all of the action alternatives; the decision-maker would determine which monitoring to adopt, based on concerns raised in the analysis or concerns the decision-maker may have about the selected alternative. Adoption of all monitoring in this section is probably not feasible or necessary. The Standard Operating Procedures and PEIS Mitigation Measures are designed to reduce treatment risks to acceptable levels. Departures from these measures might be a reason to add project-specific implementation monitoring.

292. Comment: The "Five-year Examination of Weed Spread" should be incorporated into the action alternatives because it - or something similar - would provide a mechanism to measure the effectiveness of the chosen control strategy relative to EIS weed spread projections. Coordinating large-scale evaluations with relevant State and Federal Agencies and publishing the results would greatly increase their relevance.

Response: This monitoring is not automatically included in the action alternatives because it would be complicated, and its ability to accomplish the stated objectives unclear or expensive to fine-tune. If selected by the decision-maker, the BLM and relevant cooperators would need to determine its design and what objectives it could achieve. One problem is that the current 12 percent spread rate is an estimate, and BLM actions under the action alternatives are, according to the analysis presented in Appendix 7, will reduce the current rate over the next 10 to 15 years. It is not clear a significant change in weed spread rate would be discernable in five years.

This is not to suggest these issues are insurmountable, but that like other potential monitoring, a decision would have to consider whether the likelihood of meaningful monitoring results would justify the deferral of funds from direct weed control efforts.

293. Comment: *Monitoring Specific Concerns Identified in the EIS* should be incorporated into all action alternatives because it would help to ensure that adverse impacts on non-target resources have been effectively avoided or mitigated. Please also consider a more operational title for this effectiveness monitoring proposal, e.g., "Effectiveness Monitoring on the Avoidance and Mitigation of Adverse Impacts to Non-target Resources."

Response: A new title for this potential monitoring item, similar to that suggested by this comment, has been incorporated into Appendix 3. This monitoring is not automatically adopted because the decision-maker needs to determine if there are any significant concerns remaining after one of the alternatives and potential mitigation are selected. PEIS Mitigation Measures were designed to eliminate all significant effects at the west-wide analysis level, and the Oregon EIS may not have identified adverse effects deemed by the decision-maker to need, or significantly benefit from, monitoring.

294. Comment: The EPA recommends Appendix 3 explicitly identify different potential monitoring as either implementation or effectiveness monitoring. For example, "Monitoring for Concerns Identified in the EIS" might be more broadly understood as statewide implementation monitoring. The EIS describes two major effectiveness monitoring proposals – "Five-year Examination of Weed Spread" and "Monitoring Specific Concerns Identified in the EIS."

Response: The potential monitoring listed in Part II of Appendix 3 has been categorized into new *Implementation* and *Effectiveness* monitoring sections, as suggested.

295. Comment: The Oregon Department of Environmental Quality requests that the BLM coordinate with them when sending data electronically for potential entry into Oregon Department of Environmental Quality's Laboratory Analytical Storage and Retrieval Database (LASAR). In addition, the Oregon Department of Environmental Quality requests copies of any monitoring reports of herbicide effectiveness and impacts on water quality and ecological conditions are shared with Oregon's Water Quality Pesticide Management Team (WQPMT).

Response: These requests have been forwarded to the BLM State Office restoration coordinator. A discussion of the request to coordinate LASAR entries with Oregon Department of Environmental Quality has been added to Appendix 3 in the *Potential Monitoring* section. The request to share any water quality effectiveness monitoring data collected in support of this EIS with Oregon's WQPMT is also described in Appendix 3. The multi-agency WQPMT acts to review and respond to pesticide detections in Oregon's ground and surface water.

Appendix 5 – Federally Listed and other Special Status Species

296. Comment: The Endangered Species Act analysis in the EIS is insufficient and does not adequately address potential impacts to Federally Listed species and Critical Habitat.

Response: The Endangered Species Act analysis provided in this programmatic EIS adequately addresses the potential impacts to Federally Listed species and Critical Habitat when considered as a supplement to the Biological Assessment completed for the PEIS, as described in Appendix 5. Appendix 5 of the EIS provides information concerning Federally Listed species known to occur in Oregon, and is provided as a supplement to the Biological Assessment which is incorporated by reference in accordance with 50 CFR 402.12 (g). The EIS is programmatic by design and does not identify or authorize site-specific vegetation treatments or amend Land and Resource Management Plans, and as a programmatic analysis, it contains the appropriate level of Endangered Species Act analysis at the scale for which it was intended. To minimize potential impacts to Federally Listed species and critical habitat, all Standard Operating Procedures and PEIS Mitigation Measures indentified in Appendix 2, as well as the Protective Measures in the PEIS Biological Opinion (NMFS 2007) and the Conservation Measures listed in the Biological Assessment are applicable unless otherwise modified by subsequent site-specific analysis and Endangered Species Act consultation. The EIS states that site-specific analysis, as well as Endangered Species Act consultation, must be completed prior to any project approval for vegetation treatment with herbicides. It is at the site-specific level that potential impacts to specific Federally Listed species are best analyzed and the most effective Conservation Measures are developed.

297. Comment: The entire Biological Assessment from the PEIS should have been provided as part of the EIS for easier reference.

Response: The Biological Assessment for the PEIS includes information on almost 300 species, of which only a small subset occur in Oregon and are therefore not affected by the Proposed Action (Alternative 4). Some parts of the PEIS Biological Assessment covered non-herbicide treatments addressed in the PER, but outside of the scope of this EIS. The relevant information concerning those species that do occur in Oregon is provided in Appendix

5 of the EIS. At over 530 pages, printing the entire Biological Assessment for distribution was not practical. The Biological Assessment is available on the EIS website, and has been included on CD versions of the Final EIS.

298. Comment: The EIS does not adequately address the effects that 2,4-D, diuron, and triclopyr BEE may have on Federally Listed fish species. The EPA found that current labeled uses of these three herbicides are likely to adversely affect Oregon's Threatened and Endangered salmon and steelhead. The BLM should not propose their use until the National Marine Fisheries Service completes final Biological Opinions for these herbicides.

Response: Near the end of Chapter 1, the EIS notes that 37 pesticides including three of the herbicides included in the Proposed Action (Alternative 4) in this EIS are part of a July 2008 settlement agreement reached in Northwest Coalition for Alternatives to Pesticides et al. v. National Marine Fisheries Service, which requires National Marine Fisheries Service to complete consultation on the registration of these pesticides. That settlement agreement stems from a 2002 decision by the District Court for the Western District of Washington finding that the EPA had not consulted with National Marine Fisheries Service regarding the potential affects to Federally Listed salmon for 55 pesticides. That consultation has not been completed.

In January 2004, in response to the EPA consultations having not been completed, the same court ordered buffer zones be applied to salmon supporting waters, noting pesticide application buffer zones are a common, simple, and effective strategy for avoiding jeopardy for Threatened and Endangered salmonids. The court, however, exempted applications by Federal Agencies for which National Marine Fisheries Service consultation had been conducted, perhaps because such uses already meet one of the "termination events" applicable to the court-ordered buffer requirements, that is, the issuance of a National Marine Fisheries Service Biological Opinion. As noted in the EIS, the BLM would conform to any future EPA label restrictions resulting from the EPA and National Marine Fisheries Service consultation on these pesticides, but there is certainly nothing to indicate the BLM's use should be stopped pending completion of that consultation, or indeed that BLM's uses do not already meet the resolution sought in the original case.

That said, the potential effects that herbicides, including; 2,4-D, diuron and triclopyr BEE, pose to Federally Listed fish species are addressed in the EIS and Biological Assessment and are consistent with the results of NEPA analysis and Endangered Species Act consultation conducted for the PEIS. To further minimize the potential effects to Federally Listed fish species, the PEIS Biological Opinion (NMFS 2007) contains Protective Measures to be followed in addition to the Standard Operating Procedures identified in Appendix 2 of the EIS. The EIS states that site-specific analysis, as well as Endangered Species Act consultation, as appropriate, must be completed prior to any project approval for vegetation treatment.

299. Comment: The BLM cannot assure compliance with the Endangered Species Act if approving herbicides with undisclosed ingredients that are likely harmful to Federally Listed species such as Coho salmon.

Response: Additional information about inert ingredients and adjuvants has been added to the Final EIS. The additional information documents BLM and Forest Service reviews of confidential business information and other information that indicates a very low likelihood that any undisclosed ingredients would have toxic effects on any resource beyond those already described in the Risk Assessments for the herbicides themselves. A list of herbicide products approved for use by the BLM at the National level is included in Appendix 9. Many inerts have been found to have high toxicity levels, and inclusion of one or more of those toxic inerts would preclude the formulation from being approved by the BLM for use.

300. Comment: The list of Endangered, Threatened and Bureau Sensitive species provided in the EIS is not complete based on information contained in *Butterflies and Moths of Pacific Northwest Forests and Woodlands: Rare, Endangered, and Management-Sensitive Species* (USDA 2007x).

Response: The EIS list is complete. Tables A5-1 and A5-2 of the EIS accurately reflect the current list of butterflies in the BLM's Special Status Species Program, which includes Threatened, Endangered, proposed, and Bureau Sensitive species. It appears that the referenced text is using the term "management-sensitive," which is not a category of species considered by the BLM.

Appendix 8 – Human Health and Ecological Risk Assessments

301. Comment: Appendix 8 states that the courts have found that the Federal Insecticide, Fungicide and Rodenticide Act does not require the same examination of the impacts that the BLM is required to undertake under NEPA. What courts?

Response: The United States Court of Appeals for the Ninth Circuit found this in their 1983/84 rulings. This point has been clarified in the text.

Appendix 9 – Additional Information About the 18 Herbicides

302. Comment: Appendix 9 lists a number of important native species and the herbicides that would target them. It is not clear when herbicides would be used to target these species.

Response: Herbicides could be used under Alternative 3 on native plants only to control the spread of pests and diseases in State-identified control areas, such as the one for Sudden Oak Death in Curry County. Herbicides could be sprayed on native species under Alternative 4 (the Proposed Action), to accomplish safety and maintenance objectives in administrative sites, rights-of-way, and recreation sites, or to achieve habitat goals specified in Conservation Strategies for Federally Listed or other Special Status species. Herbicides could be used on any undesired vegetation under Alternative 5, provided that the objective was not to grow timber or livestock forage.

Native species were also included in Appendix 9 because it is important to know what desired species might be harmed if the species were to be exposed to one of the proposed herbicides. An explanation of this has been added to Appendix 9.

303. Comment: The Oregon Institute of Applied Ecology in Corvallis Oregon has helped conduct research on biology, management, and recovery of native plant species; studied and performed habitat management and restoration; and, conducted research on effective control techniques for invasive weeds. Our studies indicate herbicides are needed as follows:

1) The only non-herbicide method that is effective in removing meadow knapweed is hand-grubbing which is relatively expensive. Herbicides have been effectively used to control this species.
2) After eight years of studying various control techniques for false-brome, we found that herbicides could successfully be used to control this invasive species, while avoiding negative impacts to native species, including the Threatened Kincaid's lupine, Nelson's checkermallow, and the Endangered Fender's blue butterfly. Although manual techniques can be used to control false-brome in small areas, those areas are re-invaded within a year or two and manual techniques are not cost effective on large infestations.

3) Each year, rare native prairie habitat is lost to invasive species since the current control methods are not effective at killing priority invasive species such as Canada thistle, Himalayan blackberry, annual grasses, and reed canarygrass. Judicious use of herbicides would restore these areas.
4) In a five-year study of restoration methods in Willamette Valley upland prairies, a combination of burning and treatment with both a broad-spectrum and grass-specific herbicide was the most successful restoration method. When timed correctly, this treatment had minimal effects on established native species, but caused a significant decline in the cover of non-native species. In contrast, treatments without herbicides were ineffective in reducing the cover of non-native species or increasing the cover of native species.

Response: The control of invasive plants to restore native plant communities is a primary purpose for BLM's proposal to increase the number of herbicides available for use. Native plant communities contain the primary resources that comprise wildlife habitat and forage. The herbicides being proposed were selected for their efficiency in controlling weeds and the ability to use them in a manner that prevents or minimizes impact to non-target species. Table A9-2 lists the recommended herbicides for various species. It also lists the alternative where effective control becomes available. The information in this table applies to established infestations that are more difficult and costly to control than new or small infestations. Many species may be effectively controlled with non-herbicide methods such as hand pulling or digging; however, on a larger scale, these treatments are not practical. For example, the Oregon Institute of Applied Ecology noted that hand pulling was effective on Meadow knapweed. While this is true, hand pulling may be too expensive to be feasible on larger infestations. Therefore, there is no conflict in the findings of the Oregon Institute of Applied Ecology and the information summarized in Table A9-2.

304. Comment: Numerous field studies done by The Nature Conservancy, the Institute for Applied Ecology, and a wide variety of local organizations have shown that the only cost/time/resource-effective method for managing Garlic mustard, false brome, Knotweed, False Indigo and yellow archangel is through the use of herbicide treatments.

Response: Treatment recommendations for these species have been added to Appendix 9.

Miscellaneous

305. Comment: Tables should clearly identify the No Action (Alternative 2) and the Proposed Action (Alternative 4) in the headers, so as not to confuse or mislead the reader.

Response: This issue has been corrected in the Final EIS.

306. Comment: The EIS format is confusing. For example, *Affected Environment and Environmental Consequences* have been combined for no apparent benefit; *Comparison of Alternatives* should be in the *Environmental Consequences* chapter; subjects are hard to find without footers or being placed alphabetically; *Incomplete and Unavailable Information* should be in Chapter 3; *Conflicts with Other Plans* should be in Chapter 1; and *Cumulative Impacts* should be at the end of the *Environmental Consequences* chapter.

Response: Although the CEQ regulations at 40 CFR 1502.15 and 16 address the requirements of the *Affected Environment* and *Environmental Consequences* separately, they do not require they be separated in the analysis. In this case, we believe the reader is better served to have the description of the resource presented immediately prior to addressing the effects of the alternative on that resource. This approach has been used by other EISs, notably the Northwest Forest Plan (USDA, USDI 1994a) and its subsequent amendments. It was also used in the 2004 EIS for amending National Forest and BLM District Plans for the management of Port-Orford-cedar (USDA, USDI 2004). This approach prevents needing to summarize the affected environment section before starting the environmental consequences section.

The BLM discovered during preparation that the narrow focus of the analysis required a significant discussion of setting and assumptions; hence, Chapter 3 is long and detailed. Nothing in Chapter 3 is effects per se, but assumptions for the effects analysis. Thus, *Incomplete and Unavailable Information* and other sections correctly addressing affected environment and/or environmental consequences have been left in Chapter 4.

The *Comparison of Alternatives* section has been rewritten and left in Chapter 2. This is consistent with 40 CFR 1502.14, *Alternatives Including the Proposed Action*. This regulation states, "This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (Sec. 1502.15) and the Environmental Consequences (Sec. 1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public." The separation is elucidated in CEQs Forty Most Asked Questions, question number 7, *Difference Between Sections of EIS on Alternatives and Environmental Consequences* (CEQ 1981). The discussion builds on the regulation with:

> In order to avoid duplication between these two sections, most of the "alternatives" section should be devoted to describing and comparing the alternatives. Discussion of the environmental impacts of these alternatives should be limited to a concise descriptive summary of such impacts in a comparative form, including charts or tables, thus sharply defining the issues and providing a clear basis for choice among options (Section 1502.14). The "environmental consequences" section should be devoted largely to a scientific analysis of the direct and indirect environmental effects of the proposed action and of each of the alternatives. It forms the analytic basis for the concise comparison in the "alternatives" section.

The Chapter 2 *Comparison of the Effects of the Alternatives* section in the Final EIS has been converted mostly to table form to better contrast the differences between the alternatives, as suggested by the CEQ direction.

The resource sections in Chapter 4 are sequenced to match the PEIS upon which they are tiered. Consideration was given to alphabetizing, but the titles are not necessarily intuitive enough for an alphabetical arrangement to be very helpful. However, a) the EIS chapters are now separated by colored card stock; b) a table of contents has been added to the start of each chapter immediately following the colored chapter separators; and c) resource section headers now include the name of the section.

The *Conflicts with Other Plans* has been moved to Chapter 1 as suggested.

Finally, since the entire programmatic analysis is essentially a cumulative effects analysis, miscellaneous information applicable to more than one section were presented early in Chapter 4 to help provide context to individual sections, particularly as some of those sections refer to those actions. Some of the ongoing actions described in the Draft EIS in the *Cumulative Impacts* section, however, are not impacts. These have been moved to the end of Chapter 1.

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Appendix 11 - Comment Letters from Federal, State, and Local Government Agencies on the 2009 Draft EIS

This appendix contains comment letters from Federal, State, and local government agencies. The Environmental Protection Agency (EPA) has a legal obligation under Section 309 of the Clean Air Act to review and comment on environmental impact statements. Their letter reviewing the Draft EIS appears at the beginning of this appendix.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

December 4, 2009

Vegetation Treatments EIS Team
P.O. Box 2965
Portland, Oregon 97208-2965

RE: U.S. Environmental Protection Agency (EPA) review and comments for the Vegetation Treatments Using Herbicides on Bureau of Land Management (BLM) Lands in Oregon Draft Environmental Impact Statement (DEIS). EPA Project Number: 08-045-BLM

Dear Vegetation Treatments EIS Team:

This review was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Under our policies and procedures, we evaluate the environmental impact of the proposed action and the adequacy of the impact statement. We have assigned a Lack of Objections (LO) rating to the DEIS. A copy of our rating system is attached.

We agree that invasive plants and noxious weeds are a serious environmental problem. Invasive plants threaten native plant communities and change fire behavior. They reduce water quality, soil productivity, wilderness characteristics, recreation values, and habitat and forage for wildlife and livestock. To limit these adverse impacts we strongly support the principles of Integrated Pest Management (IPM). IPM includes many tools - one of which is herbicides - and we support increasing the BLM's ability to select the most effective methods with the least amount of risk to non-target resources.

Due to persistent uncertainties associated with the safety and effectiveness of herbicide use and in the interest of encouraging a cautious approach we have focused our review on monitoring and adaptive management. This focus reflects EPA's July 30, 2007 comments on Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Final Programmatic EIS (PEIS). Namely, "EPA would expect regional and site specific NEPA documents to include information ensuring adequate monitoring and description of evaluation methods to determine if application rates are effective, buffers are sufficient, drift is minimized and specific goals and endpoints are being met."

In our enclosed comments we recommend that Part II of Appendix 3, "Potential Monitoring" be incorporated into all action alternatives. We also recommend that this "Potential Monitoring" be further developed and (i) establish minimum effectiveness monitoring requirements for site specific project planning, (ii) include additional information on the Oregon BLM's State Office vision of an adaptive management framework, and, (iii) describe how data retention guidelines will facilitate long term effectiveness monitoring.

EPA supports BLM's efforts to restore native plant communities and related ecosystems and we look forward to collaborating further on future phases of this project. In the interim, if you have any questions or concerns about these comments please contact Erik Peterson of my staff at (206) 553-6382 or by electronic mail at peterson.erik@epa.gov.

Sincerely,

Teresa Kubo, Acting Manager
Environmental Review and Sediment Management Unit

Enclosures:
EPA Region 10 Detailed Comments for the Vegetation Treatments Using Herbicides on BLM Lands in Oregon DEIS.
EPA Rating System for Draft Environmental Impact Statements

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EPA REGION 10 DETAILED COMMENTS FOR THE VEGETATION TREATMENTS USING HERBICIDES ON BLM LANDS IN OREGON DEIS

Monitoring and Adaptive Management

To help bolster and define your monitoring plans we recommend you consider the following suggestions for incorporation into your FEIS and Record of Decision.

Potential Monitoring

For clarification, we recommend that the FEIS explicitly identify different Potential Monitoring as either implementation or effectiveness monitoring. For example, "Monitoring for Concerns Identified in the EIS" might be more broadly understood as State-wide implementation monitoring. The DEIS describes two major effectiveness monitoring proposals - "Five-year Examination of Weed Spread" and "Monitoring Specific Concerns Identified in the EIS". We recommend that all of these Potential Monitoring proposals be further developed and incorporated into the action alternatives.

The "Five-year Examination of Weed Spread" should be incorporated into the action alternatives because it – or something similar - would provide a mechanism to measure the effectiveness of the chosen control strategy relative to EIS projections (e.g., Table 2-3). We believe coordinating large scale evaluations with relevant State and Federal agencies and publishing the results would greatly increase their relevance.

"Monitoring Specific Concerns Identified in the EIS" should be incorporated into all action alternatives because it would help to ensure that adverse impacts on non-target resources have been effectively avoided or mitigated. Please also consider a more operational title for this effectiveness monitoring proposal, e.g., "Effectiveness Monitoring on the Avoidance and Mitigation of Adverse Impacts to Non-target Resources".

In addition to incorporating Potential Monitoring on the avoidance of adverse environmental impacts from herbicide use we recommend the proposal be amended to explicitly identify minimum site specific requirements. These requirements should provide guidance on how site specific project planning and NEPA analyses will consider the costs and benefits of monitoring impacts on air, vegetation, soil and water. We do not believe descriptions such as, "Water quality monitoring, would be conducted at the discretion of the district." and "There might also be a need to determine if the standards and protection measures were effective at reducing potential effects to Federally Listed species and/or designated critical habitat." sufficiently disclose how districts will develop and implement adequate effectiveness monitoring for environmental and human health concerns (p.422).

Adaptive Management Framework

The DEIS has numerous references to monitoring and adaptive management. Appendix 3, for example, references BLM Manual Sections 9011, 9014, and 9015; and, BLM Technical Reference 1730-1 etc. Appendix 3 also states, "Adaptive management strategies require implementation monitoring to determine whether we followed the plan and obtained the expected results"; and, "If treatment was not effective, the decision maker would review the strategy (USDA 2005:2-15)". Appendix 6 adds to the DEIS's disclosure of BLM monitoring

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and adaptive management policies by quoting relevant sections of various District level Resource Management Plans.

These references are helpful, yet we remain unsure what the minimum adaptive management requirements for site specific planning would be.

Recommendations:

We recommend that the FEIS dedicate a sub-section of Appendix 3 to a systematic description of the conceptual and legal framework which will guide site specific adaptive management planning. If appropriate, please define the stages of adaptive management (planning, implementation, monitoring and evaluation) and list the relevant authorities for each of these stages. Clearly defining a framework and disclosing sidebars for site specific adaptive management planning may strengthen state wide strategic planning by ensuring a minimum level of comparable information.

Long Term Monitoring

According to the DEIS, Pesticide Application Records (PAR) are kept for 10 years (p. 420). We are interested in this time period's potential implications for long-term monitoring. For example, Table 2-3 provides projections for weed spread to 15 years; how will PARs kept for only 10 years be sufficient to facilitate a meaningful measurement of the control strategy identified in the ROD?

Recommendation:

Please include additional information on long term monitoring in the FEIS – including a definition of what constitutes "long-term" for the BLM. Data retention guidelines, whether for PARs or other monitoring documentation, should be designed to facilitate long-term analysis.

HARNEY COUNTY WEED CONTROL
450 N. Buena Vista Ave. ~ Burns, Oregon 97720
541-573-8385 Office ~ 541-573-8387 Fax

November 1, 2009

Vegetation Treatments EIS team
PO Box 2965
Portland, OR 97208-2965

To whom it may Concern:

The Harney County Weed Board has received and reviewed the Draft Environmental Impact Statement of September 2009. The board would like to comment in support of the document and the management opportunities that the acceptance of this document will afford the BLM of Oregon.

Since 1987, BLM managed lands in Oregon have been mismanaged when it comes to invasive species, habitat improvement though herbicides, and safety on right of ways. The cost to the State of Oregon, local Governments, Tax Payers, and the Federal Government has been astronomical. Here locally we have been waiting for over 20 years for this document to be put together so we could move forward with protecting our private and public lands, improving habitats, and making our public roadways safer.

It is very important to the landowners in Harney County that this document continues to move forward and become active. Without this document the 9th Circuit Court injunction cannot be lifted, causing private landowners, as well as federally managed lands, to continue to lose value with irreparable damage to wildlife habitat and native rangelands as the cost of restoring the acres that are being lost to invasive species in this area is crippling to any landowner or agency.

Sincerely,

Shane Otley, Chair
Harney County Weed Board
450 N. Buena Vista, Ave #10
Burns, OR 97720
541-573-8385

HARNEY COUNTY COURT

Office of Dan Nichols, Commissioner
450 North Buena Vista, Burns, Oregon 97720
Phone: 541-493-2440 Fax: 541-493-2440
E-mail: dannichols@wildblue.net
Websites: www.co.harney.or.us ♦ www.harneycounty.org

November 29,2009

To Whom It May Concern,

After review and consideration of the Draft EIS for Vegetative Treatments it is the consensus of the Harney County Court to support Alternative 5 as the preferred alternative. After 23 years of losing the battle with invasive weeds because of the restrictive and inadequate availability of effective herbicides it is clear that the broadest base of herbicides should be incorporated into the EIS.

The EIS summary estimates that Alternative 5 would only increase herbicide use by 10% over Alternative 4. The summary also correctly points out that more than 90% of that increase would be in Eastern Oregon where environmental risk is lower, advantages more apparent and public acceptance of herbicide use is higher. The extremely limited use of herbicides for the past 20 years has allowed for major infestations of medusahead, knapweeds and thistles in Eastern Oregon. Alternative 5 would allow for the use of diflufenzopyr – dicamba combination for the treatment of knapweeds and thistle species. Their control is of significant importance to the overall health and sustainability of Eastern Oregon rangelands.

Developing an EIS that would exclude the potential for the treatment of the total array of noxious weeds and invasive plants on BLM lands would once again leave the BLM restricted in its management opportunities to the detriment of the public lands. The initial cost of effective, comprehensive treatment is much more practical than attempted restoration or potential loss of valuable resources. Please, do not build a notable restriction into this necessary EIS document.

The Harney County Court requests that you strongly consider Alternative 5 as the Preferred Alternative that would allow for the comprehensive management of all noxious and invasive weeds on BLM lands.

Thank you for moving forward to resolve an issue of paramount importance to the health and sustainability of BLM managed lands.

Sincerely,

Dan Nichols

Dan Nichols
Commissioner, Harney County Court

DN;sj

Appendix 12 - 2,4-D

Introduction

Because of public concern over the use of 2,4-D, the BLM has focused particular attention on whether or not to continue to include 2,4-D in one or more of the action alternatives. Following the July 2008 scoping period, while the EIS team was seeking herbicide use estimates from the nine BLM districts in Oregon, districts were specifically asked to identify what their program would look like without 2,4-D. The Steering Committee considered this and other preliminary information and decided to include 2,4-D in the action alternatives in the Draft EIS. Again in January of 2010 in response to the Draft EIS analysis and over 800 public comments specifically mentioning concerns with 2,4-D, the districts and others were again asked about the implications of managing invasive plants and other vegetation without 2,4-D. The Steering Committee examined the responses along with the other available information about 2,4-D and decided to retain it within the action alternatives in the Final EIS. This appendix includes much of the information considered by the Steering Committee in 2010 (updated to Final EIS language), in the hopes that it will facilitate public and decision-maker understanding of the risks and the value associated with this product.

2,4-D is a widely used, selective, broad-leaf herbicide first registered for use in 1944, and extensively studied since that time. It is inexpensive, effective on a broad range of noxious weeds and other plants either alone and in tank mixes, one with which BLM and other applicators are well familiar, and non-carcinogenic. BLM Weed Coordinators, permit and rights-of-way holders, and cooperators all report serious implications to their programs if its use on BLM lands is discontinued.

However, its association with Agent Orange, with timber spraying in the 1980s, and potential human and environmental risks when compared with some of the other herbicides being proposed, continue to raise public controversy. Of the 1050 public letters received on the DEIS, 821 (including form letters) specifically mentioned 2,4-D as something they opposed. A few writers were opposed to 2,4-D in spite of being in favor of the remainder of the Proposed Action.

Uses and Importance

District Query 2008

Scoping comments in 2008 led the BLM to consider removing 2,4-D during formulation of the alternatives in late 2008. The districts reported heavy reliance on 2,4-D, particularly in tank mixes to reduce the quantity of other herbicides needed, and to make other herbicides more effective. It was noted that BLM permit/rights-of-way holders and cooperators also rely on 2,4-D when spraying on BLM lands. Wind farms, solar, and transmission corridors are increasing rapidly, contributing to a continuing need for such reliance.

District Query 2010

In January 2010, the districts were asked again if there were reasonable substitutes for 2,4-D, and specifically, would removing 2,4-D reduce the BLM's ability to meet *Purpose* 6, to *cooperatively control invasive plants so they do not infest or re-infest adjacent non-BLM lands*. Districts were encouraged to contact cooperators and ask specifically what the loss of 2,4-D would mean to cross-boundary control efforts. The districts were also asked why 2,4-D use was not projected to decrease on the west side between Alternatives 2 and 3, when eight more herbicides become available but only invasive weeds are added to the control objectives. (East side projections dropped 72 percent.) District and Oregon State Office (OSO) staff responses included the following:

Effectiveness

- 2,4-D increases the effectiveness of other herbicides thereby reducing the pounds of herbicide applied per acre, reducing the need for multiple applications, reducing cost, and reducing weed population resistance development.
- The development of weed resistance to 2,4-D has been minor.
- 2,4-D provides a burn-down that effectively stops the plants' progress towards seed ripening, even at advance phenological stages, that cannot be duplicated with other herbicides. This extends the control window so crews can reach multiple control locations.
- 2,4-D in tank mixes similarly extends the spray season for many weeds (e.g. knapweed).
- ALS-inhibitor herbicides are more likely to result in herbicide resistance than 2,4-D.
- One of the few effective treatments for rush skeletonweed is 2,4-D early in the season, followed by picloram in the late season. 2,4-D and sulfometuron methyl is effective on difficult-to-control whitetop and perennial pepperweed.
- Aquatic formulations of 2,4-D can be used in riparian areas and are less damaging to other vegetation than the use of glyphosate.
- 2,4-D is selective for woody vegetation that encroaches on roads, but does not kill grass important to maintaining road cut and ditch stability.

Cooperator Implications

- Oregon Department of Agriculture and Oregon Department of Transportation use 2,4-D as a component of 85 percent of their roadside noxious weed spraying. Heavier reliance on glyphosate could lead to weed resistance.
- The lower cost of 2,4-D when compared to other herbicides makes it commonly used by BLM cooperators.
- 2,4-D is commonly used by BLM cooperators such as Counties and timber companies due in part because it was one of only four herbicides available for use on BLM lands and there was a desire to develop compatible weed control strategies and applications.

<u>Target Species:</u> 2,4-D is one recommended herbicide for 91 of the 230 invasive and native target plants listed on Table A9-2 in Appendix 9, and is the only herbicide available under the proposed action for the control of three of the invasive plant species (see 2,4-D entries in Attachment 1). However, dropping 2,4-D because other herbicides would control most target plants means decreasing the options for site-specific selection of the most effective, least impacting herbicide. For example, loss of 2,4-D and restrictions on picloram use (it is persistent and leachable) mean only one other herbicide is available for diffuse and spotted knapweeds, Mediterranean sage, puncturevine, St. Johnswort, Swainsonpea, velvetleaf, European centaury, sowthistles, and rabbit brush – which could lead to herbicide resistance. 2,4-D is effective on Scotch and Portuguese brooms and gorse at low rates. (Triclopyr is effective on brooms as well, but it has various risks for wildlife.) West side districts reported needing it as a tank mix component for most of their spraying.

The "newer, more target-specific" herbicides are an advantage for specific target weeds located where avoiding collateral damage is necessary, but those herbicides have few general uses and thus are not used for most weed control. Time, equipment costs, and worker health risks are all reduced when one, multiple-species herbicide mix can be used on many different target plants.

Acres and Trends

Estimated use by alternative shows 2,4-D dropping statewide:

	Alt 2	Alt 3	Alt 4	Alt5
West side	1800	2100	2300	2300
East side	6700	1900	3100	5200
Total	8500	4000	5400	7500

West side use is projected to increase across all alternatives

While the additional uses added by Alternatives 4 and 5 would increase herbicide use when compared to Alternative 3, the reason for the west side increase between Alternatives 2 and 3 is that, because of the nature of the weeds on the west side, 2,4-D is a part of almost all tank mixes. Perhaps the pounds of 2,4-D will go down, but the 2008 query to the districts was not specific enough to reflect that.

Worker and Public Health

2,4-D enjoys widespread home and commercial use. It is the second-most commonly used herbicide in Oregon, and the BLM use would be .73% (less than 1%) of the 2,4-D used commercially in the State. The districts have used 2,4-D for more than 25 years without incident. It has been registered for use for over 60 years, and been the subject of extensive study. It was reregistered in 2005 with no uses dropped and two more added. Label changes in 2007 removed most grazing restrictions and tightened mixing instructions to reduce worker exposures. The EPA has set food and water tolerances; tolerance for drinking water is 70 ppb. It is not carcinogenic and is only remotely implicated in development abnormalities at extremely high doses. (These implications are currently being retested.) 2,4-D has a half-life in the body of 12 hours, does not metabolize or transform, is excreted unchanged, and does not accumulate.

The label rate for 2,4-D is 4 lbs/ac, and until recently, many BLM uses were at that rate. The current (PEIS) BLM maximum rate is 1.9 lbs, with a PEIS Mitigation Measure limiting applications to typical rate (1.0 lbs/ac, or 1/4 of label rates) where feasible, to reduce risk to workers and the public. Average application rates on BLM lands have been 1.66, 1.50, and 1.05 lbs/ac for 2006, 2007, and 2008 respectively, and they are still trending down in response to the new (lower) PEIS rates. Tank mixes normally include about 1/2 lb of 2/4-d per acre, but tank mixes raise additional health risks identified in the risk assessment (see Attachment 2). The risk ratings for maximum rate are based on the 4.0 pound label rate.

Although the BLM in Oregon has not had an incident with 2,4-D in 25 years, BLM use is less than one percent of state use. Therefore, the BLM queried three years of statewide Oregon Department of Agriculture pesticide incident reports and found relatively minor incidents at the rate of 3 or 4 a year, mostly home users drifting it onto neighbor's plants. BLM uses SOPs and PEIS Mitigation Measures, certification, training, good equipment, and other standards to reduce the likelihood of incidents.

The Final EIS analysis and associated 2006 2,4-D Risk Assessment shows moderate risk to workers and the public under two accidental exposure scenarios (Attachment 3, EIS Tables 3-18 and 19). It is responsible for about 67 percent of the treatment acres posing a *moderate or high* risks to workers and public resulting from the proposed action, not counting spill scenarios (Table 4-36). The persistent soil-applied bromacil, diuron, and tebuthiuron herbicides are the only ones higher. (Attachment 2 contains the 2,4-D-related human health and safety excerpts from the Final EIS.)

The Risk Assessment Executive Summary recommends 2,4-D be used only as a last resort. The Forest Service decided not to include 2,4-D in their 2005 selected alternative for invasive plant control in Oregon and Washington, at least at the programmatic scale (see Attachment 4 for further discussion).

The Northwest Coalition for Alternatives to Pesticides (NCAP) has petitioned the EPA to drop 2,4-D registration and all food and water tolerances (see *Non-BLM Actions Potentially Affecting the Use of Herbicides on BLM Lands in Oregon* near the end of Chapter 1). EPA initiated a public comment period on the petition, and the Industry Task Forest II on 2,4-D Research Data submitted illustrative comments (project record; available upon request). The Industry Task Force is made up of several herbicide manufacturers for the purpose of funding (not directing) any registration research requested by the EPA or the Canadian Pest Management Regulatory Agency.

Environmental Effects

The risk table ratings for wildlife, fish, and aquatic species are included in Attachment 5, along with the 2,4-D discussion extracted from each of the various resource sections in the EIS. 2,4-D poses some of the higher risk scenarios in the EIS but that is relative, and the analysis indicates Standard Operating Procedures and PEIS Mitigation Measures (like buffers, wind limitations, etc.) would virtually negate adverse effects, at least at the community and population level.

2,4-D is bound tightly to organic matter, and breaks down quickly in wildland settings. It has a half-life of 10 days; the shortest of the 18 herbicides addressed in the EIS. It is one of the herbicides found in the Columbia River, and can be moderately toxic to fish. All resource sections including *Water Quality* indicated that slowing noxious weed spread would more than make up for any risks from the proposed herbicide use.

2,4-D is important enough to noxious weed control that if it is dropped, the estimated weed spread-rate projections for the alternatives would need to be increased. Alts 3, and 4 are projected to reduce the spread of noxious weeds on BLM from the current 12% annually to 7% and 6% respectively. Not having 2,4-D would raise those rates at least to 8% and 7%. This would be consistent with the Forest Service 2005 analysis.

DEIS Public Comments

The BLM received 1050 public comment letters on the Vegetation Treatments Using Herbicides on BLM Lands in Oregon DEIS, with 821 of these specifically mentioning 2,4-D

From the letters mentioning 2,4-D, 18 unique substantive comments statements were created. These and their responses are in Appendix 10, numbers 19-22, 24, 35, 37, 38, 52, 75, 116-117, 191, 271-274, and 298. The Proposed Action would reduce the use of 2,4-D about 50 percent when compared to the No Action Alternative.

Attachment 1 - 2,4-D Vegetation Control

(Source: Table A9-2)

Common Name	2,4-D	Clopyralid	Dicamba	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Triclopyr	Chlorsulfuron	Diflufenzopyr+	Diquat	Diuron	Tebuthiuron	Bromacil
Vegetation that can only be controlled with 2,4-D																		
Creeping buttercup	√																	
European Water chestnut	√																	
Western water hemlock	√																	
Vegetation that can only be controlled with 2,4-D under Alts 2-4																		
Parrot's feather	√														√			
Vegetation that is especially well controlled with 2,4-D and another herbicide																		
Burdock, common	√[2]	√[3]	√[2]		√					√[2]		√[3]						
Knapweed, Diffuse	√[2]									√[2]		√						
Thistle, Bull	√[2]	√	√[2,3]						√			√	√	√[3]				
Thistle, Musk	√[2]	√			√[2]					√		√		√[3]				
Vegetation that is especially well controlled with 2,4-D, and not with any other herbicide																		
Kochia	√[2]		√				√		√									
Vegetation where 2,4-D is one of many tools that can be used for control																		
Babysbreath	√		√															
Big sagebrush	√	√						√									√	
Bur buttercup	√		√		√			√			√							
Chicory	√	√	√[2]		√					√[2]								
Cocklebur, spiny	√	√	√		√													√
Common bugloss	√						√		√	√			√					
Dyers woad	√		√						√				√					
European centaury	√		√															
Field bindweed	√		√						√									
Field mustard	√										√		√					
Field sowthistle	√	√								√								
Garden cornflower or bachelor buttons	√	√			√		√			√		√		√[3]				
Garden vetch	√	√			√							√						
Goatsrue	√	√	√															
Halogeton	√						√		√								√	
Hawkweed, common	√	√	√							√		√						
Hawkweed, Yellow	√	√	√							√		√						
Horehound	√											√				√[3]		√[3]
Hounds-tongue	√								√	√[2]			√					
Knapweed, Meadow	√	√			√		√			√[2]		√		√[3]				

Common Name	2,4-D	Clopyralid	Dicamba	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Triclopyr	Chlorsulfuron	Diflufenzopyr+	Diquat	Diuron	Tebuthiuron	Bromacil
Knapweed, spotted	√	√								√[2]								
Madrone	√				√			√		√								
Mediterranean sage	√	√								√								
narrowleaf plantain	√		√		√													
Oblong spurge	√		√		√		√			√			√					
Paterson’s curse	√						√		√	√			√					
Paterson’s curse	√						√		√	√			√					
Poison hemlock	√		√		√				√	√								
Policemans helmet	√				√							√						
Prickly sowthistle	√	√								√								
Puncturevine	√									√			√					
Purple foxglove	√		√				√			√			√					
Rabbitbrush	√							√		√								
Rush skeletonweed	√	√	√							√[2]								
Spurge, Myrtle	√		√				√			√			√					
St. Johnswort	√								√	√								
Sulfur cinquefoil	√		√[2]		√				√	√[2]								
Swainsonpea	√	√																
sweet fennel	√									√								
Syrian bean-caper	√						√						√			√[3]		√[3]
Tansy ragwort	√		√						√	√		√						
Teasel, common	√	√	√[3]				√		√			√	√	√[3]				
Thistle, Italian	√	√	√							√								
Thistle, Milk	√	√	√[3]		√				√			√	√	√[3]				
Thistle, Plumeless	√	√	√[3]		√[2]				√	√		√	√	√[3]				
Thistle, Russian	√						√		√									
Thistle, Slender flowered	√	√	√							√								
Thistle, Taurian or bull cottonthistle	√	√	√															
Thistle, wavyleaf	√	√	√[3]		√				√			√	√	√[3]				
Toadflax, Dalmation	√		√							√			√					
Tumbleweed or Prickly Russian thistle	√		√		√		√		√	√								
Velvetleaf	√				√[2]					√								
Whitetop, (Hoary cress)	√		√		√		√	√	√				√					
whitetop, Lens-podded	√						√	√	√				√					
Whitetop, Hairy	√						√	√	√				√					

Common Name	2,4-D	Clopyralid	Dicamba	Fluridone	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron	Triclopyr	Chlorsulfuron	Diflufenzopyr+	Diquat	Diuron	Tebuthiuron	Bromacil
Willow	√	√						√	√	√		√						
Yellow Flag Iris	√				√		√	√	√									
Yellow glandweed	√		√				√			√			√					
Vegetation where 2,4-D would be used as part of a tank mix																		
Blackberry, Evergreen	√[3]				√				√	√		√						
Blackberry, Himalayan	√[3]				√			√	√	√		√						
Broom, French	√[3]	√			√			√		√[3]		√						
Broom, Portugese	√[3]	√			√			√		√[3]		√						
Broom, Scotch	√[3]	√			√			√		√[3]		√						
Broom, Spanish	√[3]	√			√			√		√[3]		√						
Common cruprina	√[3]	√	√[3]							√		√						
Gorse	√[3]		√		√				√	√[3]		√						
Hawkweed, King-devil	√[3]	√	√[3]							√		√[3]						
Hawkweed, Meadow	√[3]	√	√[3]							√		√						
Hawkweed, Mouse-eared	√[3]	√	√[3]							√		√[3]						
Hawkweed, Orange	√[3]	√	√[3]							√		√						
Hawkweed, Yellow	√[3]	√	√[3]							√		√						
Mutiflora rose	√[3]				√					√[3]		√						
Poison ivy	√[3]				√			√				√[3]						
Poison Oak	√[3]				√			√		√		√[3]						
Ragweed	√[3]	√			√			√										
Skeletonleaf bursage	√[3]	√[3]			√													
Spanish heath	√[3]									√[3]		√						
Starthistle, Iberian	√[3]	√[3]	√							√		√						
Starthistle, Purple	√[3]	√[3]	√							√[3]		√						
Thistle, Scotch	√[3]	√	√[3]						√	√		√	√					
Tree-of-heaven	√[3]		√[3]		√			√	√	√		√						
White Bryonia	√[3]		√		√					√		√[3]						

[2] Excellent control, recommended from multiple sources.
[3] Used in combination with another herbicide (tank mix)
Based on the experience of District Weed Specialists and various references, primarily the Pacific Northwest Weed Management Handbook (Oregon State University 2008 and 2009), the Weed Control Methods Handbook (Tu et al. 2001), DiTomaso, Joseph M., Evelyn A.Healy. Weeds of California and other Western States (DiTomaso et al. 2007), Biology and Management of Noxious Rangeland Weeds (Shelly and Petroff 1999), The Nature Conservancy Element Stewardship Abstracts (http://www.imapinvasives.org/GIST/ESA/index.html updated 2009)

Attachment 2 - Worker and Public Health

Selected Citations from the Final EIS

Risk Assessment (Final EIS Appendix 8) – Risk ratings used in the Final EIS are based on a Forest Service Risk Assessment completed in 2006 (new since the PEIS, see Appendix 8). The Overview in the *Executive Summary* of the 2,4-D Risk Assessment includes the following:

> Potential exposures to 2,4-D are developed based on the anticipated use patterns and a number of relatively standard exposure scenarios used in most Forest Service risk assessments. Estimates of risk are presented in terms of a hazard quotient. A hazard quotient is simply the quotient of an estimate of exposure divided by the appropriate toxicity value. Concern for the development of adverse effects increases as the value of the as hazard quotient increases. For 2,4-D, substantial concern is evident for workers, members of the general public, as well as several groups of organisms covered in the ecological risk assessment.
>
> For many pesticides, including 2,4-D, accidental exposure scenarios, some of which are extremely conservative and perhaps implausible, lead to risk quotients that exceed the level of concern. 2,4-D is, however, somewhat atypical because many non-accidental exposure scenarios – i.e., exposures that are plausible under normal conditions of use – also exceed the level of concern and often by a very substantial margin.
>
> Unless steps are taken to mitigate risks, workers involved in the application of 2,4-D and members of the general public who consume vegetation contaminated with 2,4-D could be exposed to 2,4-D levels greater than those which are generally regarded as acceptable. In some cases, the exceedances are substantial. Similarly, adverse effects in the normal use of 2,4-D salts or esters could occur in groups of non-target organisms including terrestrial and aquatic plants, mammals, and possibly birds. Adverse effects on aquatic animals are not likely with formulations of 2,4-D salts except for accidental and extreme exposures at the upper ranges of application rates. The ester formulations of 2,4-D are much more toxic to aquatic animals and adverse effects are plausible in sensitive species and sometimes in relatively tolerant species. The results of this risk assessment suggest that consideration should be given to alternate herbicides and that the use of 2,4-D should be limited to situations where other herbicides are ineffective or to situations in which the risks posed by 2,4-D can be mitigated. *[There is a potential mitigation measure to that effect in Chapter 2.]*

The Risk Assessment also suggests that reduced application rates in tank mixes do not necessarily reduce, and in fact may increase, the potential for human health risks. Risk Assessment section 3.1.1 says:

> "Based on recent studies published in the open literature, 2,4-D is toxic to the immune system and developing immune system, especially when used in combination with other herbicides. The mechanism of action of 2,4-D toxicity is disruption of the cell membrane and cellular metabolic processes. The molecular basis for 2,4-D toxicity to human lymphocytes and nerve tissue is likely the induction of programmed cellular death known as apoptosis" (p. 3-2).

The Risk Assessment later expands on this risk saying:

> "That 2,4-D can induce programmed cell death (apoptosis), as discussed in section 3.1.2, suggests a potential for additive, synergistic, or inhibitory effects on other apoptic agents, depending upon the nature of the agent and it's mechanism for induction of the apoptic cascade of events. As discussed in Section

> 3.1.2 (Mechanism of Action) 2,4-D disrupts the cell at a fundamental level; therefore, interactions are likely to occur between 2,4-D and any of the many other chemicals that affect cell membranes and cell metabolism" (p. 3-48).

In 2003, the Forest Practices Branch, British Columbia Ministry of Forests published *Toxicology and Potential Health Risk of Chemicals that May Be Encountered by Workers Using Forest Vegetation Management Options, Part III: Risk to Workers Using 2,4-D Formulations* (Author Frank N. Dost), from which the Abstract reads:

> 2,4-D is possibly the most extensively researched of all pesticides, and the data have been examined by an unusual number of advisory committees and work groups.
>
> 2,4-D is slowly absorbed from the skin, and is rapidly excreted unchanged by the kidneys. It is not stored in the body. Mutagenic activity of 2,4-D is negligible or absent, nor is there evidence of carcinogenicity in animal assays. It does not cause significant reproductive effects except at doses high enough to cause general intoxication. Its ability to cause birth defects is very limited.
>
> The large number of epidemiology studies seeking evidence of a relation between phenoxy herbicides and human cancer has been inconsistent and conflicting. Review panels, including that convened by United States Environmental Protection Agency (USEPA) in April 1993 have consistently concluded that the evidence is at best weakly suggestive and does not warrant change in regulatory policy.
>
> A number of cases of human intoxication from either careless handling or suicide attempts have been reported in the medical literature, almost all in the fifties and sixties. The pattern of effects has been inconsistent but a few individuals have experienced neurologic problems in the extremities.
>
> There is extensive data on exposure of forest workers to 2,4-D, showing that careless work habits increase exposure. The primary concern is skin and eye irritation from certain formulations. Simple protective clothing and work discipline reduce exposure to very low levels.

2,4-D excerpts from the *Human Health and Safety* section of the Final EIS include:

> *2,4-D*: PEIS Mitigation Measures (Appendix 2) limit the use of 2,4-D to typical application rates, where feasible. At the typical and maximum application rates, workers involved in backpack spray, boom spray, and aerial application face low to moderate risk from 2,4-D exposure. Workers also face moderate risk from wearing contaminated gloves for 1 hour and no risk from exposure to a spill on lower legs for one hour or from exposure to spill on the hands for one hour. Based on upper bound hazard quotients that exceed 1, adverse health outcomes are possible for workers exposed repeatedly over a longer period. The public faces zero risk from most modeled scenarios at the typical and maximum application rates. Consumption of contaminated vegetation (fruit) over a period of several months would have a low risk to the public and a moderate risk to subsistence populations. Other chronic exposures to the public have no risk.
>
> Based on recent studies reviewed by SERA, 2,4-D is toxic to the immune system and developing immune system, especially when used in combination with other herbicides (tank mixes). The mechanism of action of 2,4-D toxicity is cell membrane disruption and cellular metabolic processes. 2,4-D toxicity affects human lymphocytes and nerve tissue. Therefore, interactions are likely to occur when 2,4-D is mixed with other chemicals that affect cell membranes and cell metabolism (SERA 2006).
>
> SERA (2006) suggests that 2,4-D may cause endocrine disruption in male workers applying large amounts of this herbicide; however, the study was inconclusive. Based on currently available toxicity information that demonstrate effects on the thyroid and gonads following exposure to 2,4-D, there are

some data supporting its endocrine disruption potential and EPA is studying this further (EPA 2005a). In the Human Health Risk Assessment conducted to support the reregistration of 2,4-D (EPA 2004), the EPA concluded that there is not sufficient evidence that 2,4-D is an endocrine disrupting chemical.

Human Health Risks by Application Method

Ground applications … spot rather than boom/broadcast applications are less likely to result in health risks to people downwind. However, these spot applications could present an increased risk [compared to aerial application] to the workers charged with applying the herbicide because they are more likely to come into contact with the herbicide (their exposure doses is higher). In particular, workers applying … 2,4-D by backpack and horseback would be at low to moderate risk for health risks from exposure to the herbicide. Ground boom spray applicators of 2,4-D would have low to moderate risk...

Typical Application Rate

PEIS Mitigation Measures limit the use of [2,4-D] to the typical application rate, where feasible. 2,4-D applications at the typical application rate would pose a low to moderate risk to plane and helicopter pilots and mixer/loaders, backpack applicator/mixer/loaders, horseback applicators and applicator /mixer / loaders, and consumers of contaminated fruit/vegetation.

Accidental Direct Spray and Spill Scenarios

Accidental direct spray and spill scenarios for many herbicides pose a risk to workers and the public (accidental scenarios for diflufenzopyr, imazapic, and sulfometuron methyl were not evaluated because these herbicides are not considered toxic through short-term dermal exposure). These scenarios are unlikely, and can be minimized by following Standard Operating Procedures. However, these scenarios are included on Table 4-36, Estimated Annual Acres of Treatments with Risk to Human Health.

Human Health Risks

Worker: 2,4-D, …. pose risks to workers when applied at both typical and maximum application rates. For 2,4-D, … people working with aerial applications would be at low to moderate risk for applications at the typical application rate, and most workers would be at risk when applying these herbicides at maximum application rates. 2,4-D, also poses risks to ground applicators, particularly during applications at the maximum application rate.

Public: In general, there are lower risks to the public than occupational workers. However, within this category, there is higher risk to children than adults. 2,4-D….pose[s] a risk to the public under one or more maximum application rate accidental exposure scenarios (e.g., exposure resulting from the spill of an herbicide into a small pond). [R]isk to the public can be minimized or avoided by using the typical application rate, including other proposed mitigation measures, and following Standard Operating Procedures that greatly reduce the likelihood of accidents.

Summary of Highest Human Health Risks

… 2,4-D has possible endocrine disruption abilities in workers applying large amounts of 2,4-D and poses moderate risks to workers performing ground-based boom spraying at maximum rates and under some accidental exposure scenarios.

Attachment 3 – Forest Service Risk Tables

FS-Evaluated Herbicide Risk Categories for Workers (Source: Table 3-18)

Treatment Method	Risk Categories	
	2,4-D[1]	
	Typ[2]	Max[4]
General Exposures		
Directed foliar and spot treatments (backpack)	L[3]	M
Broadcast ground spray (boom spray)	L	M
Aerial applications (pilots and mixer/loaders)	L	M
Accidental/Incidental Exposures		
Immersion of hands	0	0
Wearing contaminated gloves	M	M
Spill on hands	0	0
Spill on lower legs	0	0

[1] Where different formulations exist, risks reported are the most conservative.

[2] Typ = Typical application rate; and Max = Maximum application rate.

[3] Risk categories: 0 = No risk (majority of HQs < 1); L = Low risk (majority of HQs >1 but < 10); M = Moderate risk (majority of HQs > 10 but < 100); H = High risk (majority of HQs > 100); and NE = Not evaluated. Risk categories are based on typical and upper HQ estimates. To determine risk for lower or central HQ estimates, see the individual herbicide risk assessments (SERA 2005b). Risk categories are based on comparison to the HQ of 1 for typical and maximum application rates.

[4] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre. PEIS Mitigation Measures limit 2,4-D to typical application rates where feasible.

FS-Evaluated Herbicide Risk Categories for the Public (Source: Table 3-19)

Treatment Method	Hazard Quotient	
	2,4-D[1]	
	Typ[2]	Max[4]
Acute/Accidental Exposures		
Direct spray - child, entire body	0[3]	L
Direct spray - woman, lower legs	0	0
Dermal - contaminated vegetation, woman	0	0
Consumption of contaminated fruit	0	L
Consumption of contaminated water - pond, spill	M	M
Consumption of contaminated water - stream, ambient	0	0
Consumption of contaminated fish - general public	0	L
Consumption of contaminated fish - subsistence populations	L	L
Chronic/Longer-term Exposures		
Consumption of contaminated fruit	0	L
Consumption of contaminated water	0	0
Consumption of contaminated fish - general public	0	0
Consumption of contaminated fish - subsistence populations	0	0

Attachment 4 – 2005 Forest Service Decision

2,4-D was included in the Forest Service's proposed action in 2005. They de-selected it six months later in their Record of Decision. Their EIS analysis indicates its loss compromises their weed control ability and projections.

Record of Decision-stated reasons for de-selection of 2,4-D were fairly brief: At the regional scale, there were no invasive plants identified that could not be treated with another of their selected herbicides. (They specifically left the door open for site-specific proposals however.) Also 2,4-D (and dicamba) were inherently more risky than the ten herbicides approved for use – being in higher risk categories for humans, large mammals, and birds (FS ROD:25). Finally, the FS analysis indicated 2,4-D and dicamba gave no advantage in terms of avoiding herbicide resistance.

The decision recognized that higher prices for replacement herbicides would reduce acres treated in the neighborhood of 25 percent. (The BLM cannot link this rationale to this EIS. Early in the EIS process, the BLM did a cost per acre comparison of the 18 herbicides in this EIS and decided the herbicide costs were close enough on a per acre basis that there was no reason to track them separately in the EIS cost analysis.)

Effects to cooperators are not mentioned in the Forest Service's Record of Decision. The Forest Service objective is to totally remove invasive weeds, so the decision officially just slows accomplishment of that because it increases cost. Effects to adjacent landowners are not discussed in the Record of Decision, nor would they be the same issue as they are on BLM lands. It may be that BLM lands are crossed by more permitted road and utility rights-of-way, and there are more checkerboard ownership and other adjacent private lands. These would imply that weed and vegetation control by cooperators is more applicable to the BLM than to the Forest Service.

Short-Term Implications for National Forests and, Potentially, the BLM

The Forest Service 2,4-D decision means National Forests have been reduced to (variously) three herbicides since 2005, until they can complete and implement their step-down Forest NEPA documents.

BLM units have expressed a concern that a similar thing could happen to the BLM; if the BLM Record of Decision chooses to drop 2,4-D in favor of other herbicides, and then part of the decision is enjoined, districts could be reduced to three herbicides indefinitely.

Attachment 5 - Environmental Effects

Selected Citations from the Final EIS

Risk Ratings for Wildlife, Fish, and Aquatic Species (Source: Table 3-15)

	2,4-D	
Application Scenario	**Typ[5]**	**Max[1]**
Acute/Accidental Exposures		
Direct spray, small mammal, 1st order absorption	0[6]	L
Direct spray, small animal, 100% absorption	L	M
Direct spray, bee, 100% absorption	L	L
Consumption of contaminated fruit, small mammal	L	L
Consumption of contaminated grass, large mammal	M	M
Consumption of contaminated grass, large bird	L	L
Consumption of contaminated water, small mammal, spill	L	L
Consumption of contaminated water, small mammal, stream	0	0
Consumption of contaminated insects, small mammal	M	H
Consumption of contaminated insects, small bird	L	M
Consumption of contaminated small mammal, predatory mammal	M	M
Consumption of contaminated small mammal, predatory bird	0	0
Consumption of contaminated fish, predatory bird, spill	0	0
Fish (susceptible species) – accidental spill	H	H
Fish (tolerant species) – accidental spill	M	M
Fish (susceptible species) – acute exposure, peak EEC	M	M
Fish (tolerant species) – acute exposure, peak EEC	0	0
Aquatic Invertebrates – accidental spill	L	M
Aquatic Invertebrates – acute exposure, peak EEC	0	0
Chronic Exposures		
Consumption of contaminated vegetation, small mammal, on- site	0	0
Consumption of contaminated vegetation, small mammal, off- site	0	0
Consumption of contaminated vegetation, large mammal, on- site	L	L
Consumption of contaminated vegetation, large mammal, off -site	0	0
Consumption of contaminated vegetation, large bird, on-site	0	0
Consumption of contaminated vegetation, large bird, off-site	0	0
Consumption of contaminated water, small mammal	0	0
Consumption of contaminated fish, predatory bird	0	0
Fish – chronic exposure	0	0
Aquatic invertebrates – chronic exposure	0	0

Shading denotes herbicides that are limited by PEIS Mitigation Measures to typical application rates where feasible.

[1] The 2,4-D Risk Assessment used a maximum rate of 4 lbs/acre. However, at the National level, BLM is limited to 1.9 lbs/acre.

[5] Typ = typical application rate; and Max = maximum application rate.

[6] Risk categories: 0 = No risk (HQ < LOC); L = Low risk (HQ = 1 to 10 x LOC); M = Moderate risk (HQ = 10 to 100 x LOC); H = High risk (HQ > 100 LOC); and NE = Not evaluated. Risk categories are based on upper estimates of hazard quotients and the BLM LOCs of 0.1 for acute scenarios and 1.0 for chronic scenarios. The reader should consult the text of this section of the individual Forest Service Risk Assessments to evaluate risks at central estimates of hazard quotients.

Fish susceptible species include coldwater fish, such as trout, salmon, and Federally Listed species. Fish tolerant species include warm water fish, such as fathead minnows.

2,4-D Summaries From Resource Effects Sections in Chapter 4, Final EIS

Native and Other Non-Invasive Vegetation - *2,4-D* (salts and esters) is a selective herbicide that kills broadleaf plants, but not grasses. It has a long history of use and is relatively inexpensive. Direct spraying of non-target plant species is the highest potential for damage due to 2,4-D application. Drift could damage non-target species close to the application site (much less than 100 feet) although some species such as grapes are more susceptible. One study determined that 2,4-D could affect three species of ectomycorrhizal fungi in laboratory experiments (Estok et al. 1989).

Soils - *2,4-D* has a very short half-life that averages 10 days in moist soil. Its fate is dependent on soil acidity or alkalinity (pH). A soil pH of 7.0 is neutral. Acid soils measure between 1 and 7 on the pH scale whereas alkaline soils measure between 7 and 14. 2,4-D on a Spodosols would resist to degradation, but on a Mollisols, it would readily degrade in a warm and moist environment. 2,4-D is readily broken into simpler components in alkaline soils but the break-down is slower in acidic soils. Temperature affects degradation as well, with slower break-down in cold or dry soils or where microbial organisms are not present. Warm, moist soils previously treated with 2,4-D have been shown to dissipate the herbicide more rapidly due to the presence of bacteria that degrade it (Oh and Tuovinen 1991, Smith and Aubin 1994, Shaw and Burns 1998, all cited in Tu et al. 2001). Furthermore, most studies of the effects of 2,4-D on microorganisms concluded that the quantity of 2,4-D reaching the soil from typical applications would probably not have a serious negative effect on most soil microorganisms (Bovey 2001).

Water Resources - *2,4-D*: Some salt forms of 2,4-D are registered for use in aquatic systems. 2,4-D is a known groundwater contaminant[1] although potential for leaching into groundwater is moderate by its being bound to organic matter and its short half-life. Concentrations of up to 61 mg/L have been reported immediately following direct application to water. Concentrations as low as 0.22 mg/L can damage susceptible plants (Que Hee and Sutherland 1981 cited in Tu et al. 2001).

In terrestrial applications, most formulations of 2,4-D do not bind tightly with soils, and therefore have a moderate potential to leach into the soil column and to move off site in surface or subsurface water flows (Johnson et al. 1995 cited in Tu et al. 2001). In a study on groundwater in small shallow aquifers in Canadian prairies, 2,4-D was detected in 7 percent of 27 samples (Wood and Anthony 1997).

[According to EPAs 2005 Reregistration Eligibility Decision document, the EPA Office of Water has established a Maximum Contaminant Level (MCL) of 0.07 ppm for 2,4-D in drinking water.]

Wetlands and Riparian Areas - *2,4-D*: The principle hazard is unintended spraying or drift to non-target plants; spot treatments applied according to the labeled rate do not substantially affect native aquatic vegetation or significantly change species' diversity (USDA 2005a, WA Dept of Ecology c). Kuhlmann et al. (1995) found no biodegradation of 2,4-D under anaerobic (sulfate reducing) conditions in a laboratory experiment of sediments and groundwater. In aerobic riparian soils that have a high content of organic material, an active microbial community, high pH values, and high temperatures, toxic effects are limited because of rapid degradation of 2,4-D. 2,4-D may inhibit shoot and/or root growth of macrophytes in aquatic systems (Roshon et al. 1999).

Fish - *2,4-D* has formulations that are registered for use on aquatic vegetation, including water hyacinth and Eurasian watermilfoil, and as a tank mix partner to control purple loosestrife. The toxicity of 2,4-D to fish is relatively low (Norris et al. 1991). Risk is greater under scenarios of direct application to water bodies or

1 Has been detected in groundwater. Does not necessarily mean levels have exceeded any established health standard or allowance.

accidental direct spills. The ester forms of 2,4-D (including the BEEs found in Aqua-Kleen) are approximately 200 to 1,000 times more toxic to fish than the amine forms, when toxicity is measured by acute (24- to 48-hour) LC-50 values. While these esters are chemically stable, they are short-lived in natural water because of biological degradation. At the typical application rate, 2,4-D poses a low risk to fish, while at the maximum application rate, 2,4-D poses a moderate risk to fish under scenarios of accidental direct spray or spill to a stream and pond. Routine (non-spill) acute and chronic exposure scenarios do not pose a risk to fish.

Wildlife Resources - *2,4-D* is a possible endocrine disrupter (see *Endocrine Disrupters*) and is one of the more toxic herbicides for wildlife of the foliar-use herbicides considered in this EIS. The ester form is more toxic to wildlife than the salt form. Ingestion of treated vegetation is a concern for mammals, particularly since 2,4-D can increase palatability of treated plants (USDA 2006b) for up to a month following treatment (Farm Service Genetics 2008). Mammals are more susceptible to toxic effects from 2,4-D, and the sub-lethal effects to pregnant mammals were noted at acute rates below LD_{50}. Birds are less susceptible to 2,4-D than mammals, and the greatest risk is ingestion of contaminated insects or plants. The salt form is practically non-toxic to amphibians, but the ester form is highly toxic. It can be neurotoxic to amphibians; although not all amphibians respond the same (e.g., toads were more susceptible than leopard frogs). There is little information on reptile toxicity, although one study noted no sexual development abnormalities. It presents low risk to honeybees (Table 3-15), but little information is available for other terrestrial invertebrates. Parasitic wasps may be affected, which could result in changes to community structure by favoring damaging insects controlled by parasitic wasps.

Livestock and Wild Horses and Burros - *2,4-D* presents a low to moderate acute risk to livestock under several of the direct spray, ingestion, and spill scenarios, and a moderate chronic risk for large mammals for consumption of on-site contaminated vegetation under both typical and maximum rate (SERA 2006). The Risk Assessment suggests that because large livestock eating large quantities of grass and other vegetation are at risk from routine exposure to 2,4-D and because 2,4-D is considered for use in rangeland, it should not be applied over large application areas where livestock would only consume contaminated food. According to label directions for one formulation, dairy animals should be kept out of areas treated with 2,4-D for 7 days. Grass for hay should not be harvested for 30 days after treatment. Meat animals should be removed from treated areas 3 days prior to slaughter. Similar restrictions may be in place for other formulations.

Industry Task Force

The chairman of the Industry Task Force II on 2,4-D Research Data responded to our request for 2,4-D information from cooperators, taking issue with most of the negative effects (risks) described in the DEIS. He also said relabeling in 2007 removed all grazing restrictions except mowing hay. (The Industry Task Force is made up of several herbicide manufacturers for the purpose of funding (not directing) any registration research requested by the EPA or the Canadian Pest Management Regulatory Agency.) [The letter was coded and specific EIS citations were checked and corrected where appropriate.]

Appendix 13 - EPA Pesticide Registration and Reregistration and BLM/FS Risk Assessment Processes

This appendix contains an overview of the EPA pesticide registration process, reregistration eligibility decisions (REDs), and overviews of the BLM and Forest Service Ecological and Human Health Risk Assessments conducted to support effects analysis under the NEPA process. The information is provided to help clarify the parameters and intensity of safety analyses conducted for all herbicides before they can be used on federal lands.

This appendix also includes the *Uncertainty Analysis in Risk Assessments* from Appendix C in the PEIS.

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Data Requirements for EPA Pesticide Registration

The primary reference for this section is: Environmental Protection Agency. 2007. Data Requirements for EPA Pesticide Registration. Available at http://www.epa.gov/pesticides/regulating/data_requirements.htm. References cited in this section are internal to the above-referenced document.

In 2007, the Agency revised the data requirements that pertain to conventional pesticides. The following information is current as of October 26, 2007.

Before manufacturers can sell pesticides in the United States, EPA must evaluate the pesticides thoroughly to ensure that they meet federal safety standards to protect human health and the environment. EPA grants a "registration" or license that permits a pesticide's distribution, sale, and use only after the company meets the scientific and regulatory requirements. These data requirements apply to anyone or any company that registers pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) or seeks a tolerance or tolerance exemption for a pesticide under the Federal Food, Drug, and Cosmetic Act (FFDCA).

In evaluating a pesticide registration application, EPA assesses a wide variety of potential human health and environmental effects associated with use of the product. Potential registrants must generate scientific data necessary to address concerns pertaining to the identity, composition, potential adverse effects, and environmental fate of each pesticide. The data allow EPA to evaluate whether a pesticide has the potential to cause harmful effects on certain nontarget organisms and endangered species that include:

- Humans
- Wildlife
- Plants
- Surface water or ground water

EPA recommends the pesticide registrant provide data from tests conducted according to published EPA test guidelines.

Types of Studies Required

The following sections describe the reasons for each type of test and the kind of information EPA obtains from the results of each test.

Product Performance

Requirements to develop data on product performance provide a mechanism to ensure that pesticide products will control the pests listed on the label and that unnecessary pesticide exposure to the environment will not occur as a result of the use of ineffective products. Specific performance standards are used to validate the efficacy data in the public health areas, including disinfectants used to control microorganisms infectious to humans in any area of the inanimate environment and those pesticides used to control vertebrates (such as rodents, birds, bats, and skunks) and invertebrates (ticks, mosquitoes, etc.) that may directly or indirectly transmit diseases to humans.

Data from Studies that Determine Hazard to Humans and Domestic Animals

Data required to assess hazards to humans and domestic animals are derived from a variety of acute, subchronic, and chronic toxicity tests, and tests to assess mutagenicity and pesticide metabolism.

Acute Studies

Determination of acute oral, dermal, and inhalation toxicity is usually the initial step in the assessment and evaluation of the toxic characteristics of a pesticide. These data provide information on health hazards likely to arise soon after, and as a result of, short-term exposure. Data from acute studies serve as a basis for classification and precautionary labeling. For example, acute toxicity data are used to calculate farm worker reentry intervals and to develop precautionary label statements pertaining to protective clothing requirements for applicators. They also:

- provide information used in establishing the appropriate dose levels in subchronic and other studies;
- provide initial information on the mode of toxic action(s) of a substance;
- determine the need for child-resistant packaging; and
- determine the need to restrict use of the pesticide to trained applicators or in other ways to minimize human and environmental hazards.

Information derived from primary eye and primary dermal irritation studies serves to identify possible hazards from exposure of the eyes, associated mucous membranes, and skin.

Subchronic Studies

Subchronic tests provide information on health hazards that may arise from repeated exposures over a limited period of time. They provide information on target organs and accumulation potential. The resulting data are also useful in selecting dose levels for chronic studies and for establishing safety criteria for human exposure. These tests are not capable of detecting those effects that have a long latency period for expression (e.g., carcinogenicity).

Chronic Studies

Chronic toxicity (usually conducted by feeding the test substance to the test species) studies are intended to determine the effects of a substance in a mammalian species following prolonged and repeated exposure. Under the conditions of this test, effects that have a long latency period or are cumulative should be detected. The purpose of long-term carcinogenicity studies is to observe test animals over most of their life span for the development of neoplastic lesions during or after exposure to various doses of a test substance by an appropriate route of administration.

Data from Studies that Determine Hazard to Non-target Organisms

The information required to assess hazards to nontarget organisms are derived from tests to determine pesticidal effects on birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include short-term acute, subacute, reproduction, simulated field, and full field studies arranged in a hierarchical or tier system that progresses from the basic laboratory tests to the applied field tests. The results of each tier of tests must be evaluated to determine the potential of the pesticide to cause harmful effects and to determine whether further testing is required. A purpose common to all data requirements is to help determine the need for (and appropriate wording for) precautionary label statements to minimize the potential harm to nontarget organisms.

Acute and Subacute Studies

The short-term acute and subacute laboratory studies provide basic toxicity information that serves as a starting point for the hazard assessment. These data are used to:

- establish acute toxicity levels of the active ingredient to the test organisms;
- compare toxicity information with measured or estimated pesticide residues in the environment in order to assess potential effects on fish, wildlife, plants, and other nontarget organisms; and
- indicate whether further laboratory and/or field studies are needed.

Chronic and Field Studies

Additional studies (i.e., avian, fish, and invertebrate reproduction; life cycle studies; and plant field studies) may be required when basic data and environmental conditions suggest possible problems. Data from these studies are used to:

- estimate the potential for chronic effects, taking into account the measured or estimated residues in the environment; and
- determine if additional field or laboratory data are necessary to further evaluate hazards.

Simulated field and/or field data are used to examine acute and chronic adverse effects on captive or monitored fish and wildlife populations under natural or near-natural environments. Such studies are required only when predictions as to possible adverse effects in less extensive studies cannot be made, or when the potential for harmful effects is high.

Post-Application Exposure Studies

Data required to assess hazard to farm employees resulting from reentry into areas treated with pesticides are derived from studies on toxicity, residue dissipation, and human exposure. Monitoring data generated during exposure studies are used to determine how much pesticide people may be exposed to after application and to establish how long workers must wait before reentering a treated area.

Applicator/User Exposure Studies

EPA requires applicator/user exposure data for all pesticides to evaluate the potential risks to people applying the pesticide, i.e., those who may be exposed to higher concentrations of the pesticide through handling, including mixing or applying.

Pesticide Spray Drift Evaluation

Data required to evaluate pesticide spray drift are derived from studies on the range of droplet sizes and spray drift field evaluations. These data contribute to development of the overall exposure estimate. Along with data on toxicity for humans, fish, and wildlife, or plants, data on spray drift are used to assess the potential exposure of these organisms to pesticides. A purpose common to all these tests is to provide data to help determine the need (and appropriate wording) for precautionary labeling to minimize the potential harm to nontarget organisms.

Environmental Fate

EPA uses the data generated by environmental fate studies to:

- assess the presence of widely distributed and persistent pesticides in the environment that may result in loss of usable land, surface water, ground water, and wildlife resources;
- assess the potential environmental exposure of other nontarget organisms, such as fish, wildlife, and plants, to pesticides; and
- help estimate expected environmental concentrations of pesticides in specific habitats where threatened or endangered species or other wildlife populations at risk are found.

Residue Chemistry

EPA uses residue chemistry data to estimate the exposure of the general population to pesticide residues in food and for setting and enforcing tolerances for pesticide residues in food or feed. The Agency can estimate the amount and nature of residues likely to be present in food or animal feed because of a proposed pesticide usage by evaluating information on:

- the chemical identity and composition of the pesticide product;
- the amounts, frequency, and time of pesticide application; and
- test results on the amount of residues remaining on or in the treated food or feed.

EPA Reregistration Eligibility Decision (RED) Documents

The primary reference for this section is: Environmental Protection Agency. 2008. Pesticide Reregistration Facts. Available at http://www.epa.gov/pesticides/reregistration/reregistration_facts.htm. References cited in this section are internal to the above-referenced document.

The 1988 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorized EPA to conduct a comprehensive pesticide reregistration program - a complete review of the human health and environmental effects of pesticides first registered before November 1, 1984, to make decisions about these pesticides' future use. The goal of the reregistration program is to mitigate risks associated with the use of older pesticides while preserving their benefits. Pesticides that meet today's scientific and regulatory standards may be declared "eligible" for reregistration. The results of EPA's reviews are summarized in Reregistration Eligibility Decision (RED) documents.

Risk Reduction through REDs

The reregistration program is bringing about improvements in pesticide safety. Most REDs include at least some of the following risk reduction requirements:

- Voluntary cancellation;
- Some uses not eligible or not yet eligible;
- Limit amount, frequency or timing of applications;
- Other application restrictions;
- "Restricted Use Pesticide" classification;

- Personal Protective Equipment (PPE);
- Restricted Entry Intervals (REIs);
- User safety requirements and recommendations;
- Improved use directions and precautions;
- Special or tamper-resistant packaging;
- Engineering or production controls;
- Ground or surface water safeguards;
- Spray drift labeling;
- Ecological safeguards;
- Special programs to better protect young children.

Product Reregistration

After EPA has issued a RED and declared a pesticide eligible for reregistration, individual end-use products that contain the pesticide active ingredient still must be reregistered. Through this concluding part of the process, known as "product reregistration," the Agency makes sure that the risk reduction measures called for in REDs are reflected on individual pesticide product labels. In some cases, the Agency uses Memoranda of Agreement or other measures to include risk reduction measures on pesticide labels sooner, before product reregistration is completed. EPA plans to complete the last product reregistration decisions by 2014, several years after the last REDs are signed.

Registration Review

Even before the reregistration program was completed, EPA began implementing registration review starting in early 2007. This new program ensures that, as the ability to assess risk evolves and as policies and practices change, all registered pesticides will continue to meet the statutory standard of no unreasonable adverse effects.

BLM Ecological Risk Assessments

The primary reference for this section is: ENSR. 2004. Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol. Pages 2-1 & 2-2. Prepared for the BLM. Westford Massachusetts. Available at http://www.blm.gov/or/plans/vegtreatmentseis/riskassessments/. References cited in this section are internal to the above-referenced document.

For the PEIS, ecological risk assessments (ERAs) were produced for ten herbicides: bromacil, chlorsulfuron, dicamba, diflufenzopyr, diquat, diuron, fluridone, imazapic, sulfometuron methyl, and tebuthiuron (see Appendix 8). The ERAs for each of the herbicides were produced as separate documents. While the risk assessments have been tailored to address the potential usage of each particular herbicide, they follow the same essential format and methodology, which is described below. Each ERA includes the following sections:

- Introduction – covers general concepts and document overview.
- BLM Herbicide Program Description – describes BLM-specific uses of the product, statistics of use to date, and incident reports compiled by the USEPA.
- Herbicide Toxicology, Environmental Fate, and Physical-Chemical Properties – discusses the review of toxicity literature and its results, environmental fate of the herbicide, and specific physical-chemical properties used in the ERA.

- Ecological Risk Assessment – evaluates potential risk to ecological receptors resulting from exposure to the herbicide in a number of different scenarios (discussed in more detail in this section).
- Sensitivity Analysis – discusses the sensitivity of predicted exposure concentrations to variation in environmental processes and the models used to represent them. This analysis is provided in order to verify that most predicted concentrations are overestimates, and to identify situations where the general assumptions of the models might be relaxed or should be made more stringent.
- Rare, Threatened, and Endangered (RTE) Species – discusses potential direct and indirect impacts to RTE species, including consideration of taxa for which ecotoxicological data are not available.
- Uncertainty in the Ecological Risk Assessment – describes data gaps, assumptions, and uncertainties of the risk assessment.
- Summary – summarizes the overall implications of the risk assessment.
- References – presents references considered in the document.

The following appendices are also included in each ERA:
- Summary of Available and Relevant Toxicity Data/Ecological Risk Assessment Literature Review
- Ecological Risk Assessment Worksheets
- Species Listed Under the Endangered Species Act for 17 BLM States
- Review of Confidential Business Information Memo
- Summary of Tank Mix Risk Quotients

Transport via surface runoff and wind-blown dust, and the resulting exposure concentrations, are not included in the ERAs for the aquatic herbicides (diquat and fluridone). Therefore, exposure scenarios and appendices relating to GLEAMS and CALPUFF are not included in the risk assessment documents for these herbicides.
The overall goal of the ERAs is to facilitate risk management decisions for the PEIS and support development of the Biological Assessment (BA) for the PEIS. An additional goal of this process is to provide risk managers with a tool that presents a range of generic risk estimates that vary as a function of site conditions. The tool to accomplish this primarily consists of the Excel spreadsheets (presented in the ERA Worksheets) that may be used to calculate exposure concentrations and evaluate potential risks provided in the risk assessment. For further site-specific evaluation of a particular herbicide, BLM land managers can modify specific variables in the worksheets.

The general approach and analytical methods for conducting the ERAs were based on U.S. Environmental Protection Agency's (USEPA) *Guidelines for Ecological Risk Assessment* (hereafter referred to as the "Guidelines" [USEPA 1998]). The ERA is a structured evaluation of all currently available scientific data (exposure chemistry, fate and transport, toxicity, etc.) that leads to quantitative estimates of risk from environmental stressors to non-human organisms and ecosystems. The current Guidelines for conducting ERAs include three primary phases: problem formulation, analysis, and risk characterization.

BLM Human Health Risk Assessments (HHRA)

The primary reference for this section is: ENSR. 2004. Vegetation Treatments Programmatic EIS Human Health Risk Assessment Protocol. Pages ES1-ES3. Prepared for the BLM. Westford Massachusetts. Available at http://www.blm.gov/style/medialib/blm/wo/Planning_and_Renewable_Resources/veis.Par.82009.File.dat/Risk%20Assessment%20(November%202005).pdf. References cited in this section are internal to the above-referenced document.

For the PEIS, the BLM convened an inter-agency work group from May through October of 2002 to reach consensus on updated risk assessment methods to ensure that the risk assessment methodology is scientifically defensible, is consistent with currently available guidance where appropriate, and meets the needs of the BLM vegetation treatment program.

For the HHRA methods discussion, the inter-agency work group consisted of representatives from the BLM, USEPA, and ENSR International, the contractor who prepared the HHRA for the BLM. The resultant HHRA complies with USEPA guidance for conducting risk assessments for pesticides including, but not limited to, the following documents:

- The Role of Use-related Information in Pesticide Risk Assessment and Risk Management (USEPA 2000a)
- Guidance for Performing Aggregate Exposure and Risk Assessments (USEPA 1999a)
- Exposure Factors Handbook (EFH; USEPA 1997a)

In 1983, the National Research Council of the National Academy of Sciences (NAS 1983) recommended a basic approach for risk assessments that are conducted by or for groups within the federal government. NAS (1983) recommended a four step process: hazard identification, exposure assessment, dose-response assessment, and risk characterization. For risks to be quantified, a hazard must be identified, exposures must be quantitatively estimated, and a dose-response relationship must be expressed quantitatively. A description of the four st.

Hazard Identification

The Hazard Identification section provides information on the herbicide active ingredient (a.i.) characteristics and usage, and toxicity profiles. The toxicity profiles include information on acute, subchronic, and chronic toxicity studies, reproductive and developmental toxicity studies, results of cancer bioassays, mutagenesis, and metabolism. The USEPA's acute toxicity categories are I, II, III, and IV representing severe, moderate, slight, and very slight toxicity. The criteria considered are oral, inhalation, and dermal acute toxicity, eye irritation, skin irritation, and dermal sensitization. For most of the criteria, the herbicide a.i. evaluated in this HHRA are in toxicity categories III and IV. Dicamba is in toxicity category III for acute oral and acute dermal effects, in toxicity category IV for acute inhalation effects, and in toxicity category II for primary eye and primary skin effects. Diquat is in toxicity category II for acute dermal and eye irritation, and fluridone is in toxicity category II for eye irritation. The USEPA has not developed acute toxicity categories for sulfometuron methyl. None of the six herbicide a.i. are designated as potential carcinogens by the USEPA.

Dose-response Assessment

For pesticide risk assessments, noncarcinogenic effects are evaluated differently depending on whether the exposure is dietary or non-dietary. Dietary exposures are evaluated by dividing site-specific herbicide a.i. intakes by a Population Adjusted Dose (PAD). The results are expressed as %PADs. The %PAD approach was used to evaluate public receptor ingestion of drinking water, berries, and fish. Non-dietary exposures are evaluated by dividing a No Observable Adverse Effects Level (NOAEL) by the site-specific intake to calculate a Margin of Exposure (MOE). The MOEs are typically compared to a target MOE of 100, unless specified otherwise. NOAELs are available for a variety of exposure durations and exposure routes. The NOAEL approach is used to evaluate the occupational receptors and the public receptors for the following scenarios: dermal contact with spray, dermal contact with foliage, dermal contact with water while swimming, and incidental ingestion of water while swimming.

For each of the six herbicide a.i. evaluated in this HHRA, the USEPA has developed NOAELs for a majority but not all of exposure durations and exposure routes.

Exposure Assessment

The exposure assessment involves identifying receptors and exposure scenarios and quantifying exposures. To understand how humans may be exposed to herbicide a.i. as a result of the BLM vegetation treatment program, it is necessary to understand herbicide use within the BLM. Within the BLM vegetation treatment program, public lands are classified into various land programs (rangeland, public domain forestland, energy and minerals sites, rights-of-way, recreation and cultural sites, and aquatic sites). Within each program, aerial-, ground-, or boat-based applications may be used. Various application vehicles can be used for each application type, and for each vehicle, there are different application methods. Similarly, there are different BLM job descriptions associated with each application method. It is assumed that occupational receptors may be incidentally exposed to the herbicide a.i. through dermal contact and inhalation exposure routes. In addition, an accidental spill scenario was evaluated for the occupational receptors, assuming a direct spill of herbicide a.i. on the skin.

Members of the public may also be incidentally exposed to herbicide a.i. used on public lands. Such receptors include hikers, hunters, berry pickers, swimmers, anglers, area residents, and Native Americans using natural resources on public lands. Although there are many different exposure scenarios and receptors that could be evaluated, these receptors cover a range of potential exposures that could occur under worst case conditions on BLM lands. It is assumed that these receptors could be exposed through one or more of the following exposure pathways:

- Dermal contact with spray
- Dermal contact with foliage
- Dermal contact with water while swimming
- Ingestion of drinking water or incidental ingestion of water while swimming
- Ingestion of berries
- Ingestion of fish

Although all public receptor exposures to herbicide a.i. used on public lands are considered to be accidental, public receptor exposures are evaluated under two scenarios. Routine-use exposures are assumed to occur when public receptors come into contact with environmental media that have been impacted by spray drift. Accidental exposures are assumed to occur when public receptors come into contact with environmental media that have been subject to direct spray or spills. Under the direct spray scenarios, it is assumed that a receptor enters a foliated area or a pond (for the aquatic herbicide a.i.) that has recently been treated, even though the area is posted with warning signs. The direct spray pathway for terrestrial herbicide a.i. onto ponds assumes that the herbicide a.i. are accidentally sprayed on the pond.

To quantify exposures, it is necessary to estimate the herbicide a.i. concentrations to which receptors could be exposed. For the occupational receptors, routine exposures were calculated using unit exposure (UE) values developed by USEPA combined with the herbicide a.i. application rates (ARs) and the acres treated (AT) per day. Accidental exposures were calculated using the undiluted herbicide a.i. concentrations for liquid formulations and application-ready concentrations for solid formulations, and assuming a certain amount of spill and absorption through the skin.

For the public receptors, routine exposures from spray drift were calculated using exposure point concentrations (EPCs) developed using computer models. The AgDrift model was used to estimate deposition of herbicide a.i. drift onto the receptor, foliage, berries, and pond. The GLEAMS model was used to calculate herbicide a.i. concentrations in the pond resulting from runoff (short-, intermediate-, and long-term exposure durations). For the terrestrial herbicide a.i., pond concentrations calculated in AgDrift were added to the highest pond concentrations calculated in GLEAMS. Accidental exposures were calculated assuming direct spray of the herbicide a.i. at the maximum ARs onto the receptor, foliage, berries, and pond. In addition, an accidental spill scenario was evaluated for the pond assuming that the entire contents of a truck or helicopter could spill into the pond.

Risk Characterization

The risk characterization section provides quantitative risk estimates for each of the herbicide a.i. for the various receptors and exposure scenarios. USEPA's Office of Pesticide Programs (OPP) has developed an Aggregate Risk Index (ARI) approach that combines risks calculated using the %PAD and MOE methods. As with the MOE, potential risk increases as the ARI decreases. The ARI is compared against a target value of 1. Values greater than 1 do not exceed the USEPA's level of concern.

Diquat results in ARIs less than 1 for a majority of the occupational receptors and public receptors, indicating a level of concern. Fluridone results in ARIs less than 1 for several of the occupational and public receptors under the maximum AR scenarios. Dicamba, diquat, and fluridone result in ARIs less than one for the occupational accidental spill scenario (spill to worker skin). The other three herbicide a.i. (diflufenzopyr, imazapic, and sulfometuron methyl) do not result in ARIs below 1 for any scenario, indicating no level of concern with use of these three herbicide a.i.

Forest Service Human Health and Environmental Risk Assessments

The primary reference for this section is: Syracuse Environmental Research Associates, Inc. (SERA). 2007. Preparation of Environemnatl Documentation and Risk Assessments. Pages 1-2 to 1-13. Prepared for the U.S. Department of Agriculture Forest Service. Arlington, Virginia. Fayetteville, New York. Available at http://www.fs.fed.us/foresthealth/pesticide/pdfs/PrepEnvirmentalDoc_01-07.pdf. References cited in this section are internal to the above-referenced document.

The Forest Service Risk Assessments contain both human health and environmental risk assessments sections. Each section follows the four-step process recommended the National Research Council of the National Academy of Sciences (NRC 1983) and used in the BLM Human Health Risk Assessments. For risks to be quantified, a hazard must be identified, exposures must be quantitatively estimated, and a dose-response relationship must be expressed quantitatively. Each of these four basic steps are summarized as follows:

Hazard Identification

Hazard identification is the process of identifying what, if any, effects a compound is likely to have on an exposed population. Hazard identification is the first and most critical step in any risk assessment. Unless some plausible biological effect can be demonstrated, the nature of the subsequent dose-response assessment and risk characterization is extremely limited. Both the human health and ecological risk assessments are prepared using *in vivo* and *in vitro* data from experimental animal studies. Additional sources of information like epidemiology studies, case reports, and clinical investigations are used to prepare human health risk assessment. Studies on various model nontarget test species (e.g., ducks, quail, fish, aquatic invertebrates, plants, and terrestrial invertebrates) are commonly available to strengthen an ecological risk assessment. In addition, available field studies on nontarget species are used in ecological risk assessments in much the same way epidemiology studies are used in human health risk assessments. The hazard identification is based on a review of the toxicological and pharmacokinetics data and is arranged to focus on the dose-response and dose-severity relationships. Of these two relationships, the dose-severity relationship is generally more relevant for non-carcinogenic effects in humans and nontarget species. The severity scale used to conduct the risk assessment typically employs four levels of severity, which are defined in Table 1-1.

Table 1-1: Severity definitions used in human health risk assessment (HHRA) and ecological risk assessment (ERA)

Acronym		
HHRA	**ERA**	**Definition**
NOEL	**NOEC**	*No-observed-effect level (concentration)*: No biologically or statistically significant effects attributable to treatment.
NOAEL	**NOAEC**	*No-observed-adverse-effect level (concentration)*: Effects that are attributable to treatment but do not appear to impair the organism's ability to function and clearly do not lead to such an impairment.
LOEL	**LOEC**	*Lowest-observed-effect level (concentration)*: The lowest exposure level associated with an adverse effect.
AEL		*Adverse-effect level*: Signs of toxicity that must be detected by invasive methods, external monitoring devices, or prolonged systematic observations. Symptoms that are not accompanied by grossly observable signs of toxicity.
FEL		*Frank-effect level*: Gross and immediately observable signs of toxicity.

The terminology used in human health and ecological risk assessments is somewhat different, but the concepts are virtually identical. In human health risk assessment, severity is typically defined by the consequences of different levels of exposure. These include the no-observed-effect level (NOEL), no-observed-adverse-effect level (NOAEL), adverse-effect level (AEL), and frank-effect level (FEL). An additional term, lowest-observedadverse-effect level (LOAEL) is sometimes used to designate the lowest AEL. This scale, with minor differences in nomenclature, is used by many government agencies to classify the toxicological effects observed in experimental or epidemiology studies. In the ecotoxicology literature, the term NOEC—no observed effect concentration—is sometimes used rather than the term NOEL. As indicated in Table 1-1, these terms as well as their variations are synonymous. The hazard identification process involves making judgments about which effects are most relevant to the assessment of human health or nontarget species. During this process, studies may be eliminated from consideration because they are inherently flawed, or because they are grossly inconsistent with the preponderance of other studies.

Although hazard identification results in a qualitative determination, quantitative methods are usually required as in most other assessments of causality. For instance, the process of hazard identification often hinges on a statistical assessment of exposure-response or dose-response relationships. Furthermore, hazard identification must also consider fundamental and qualitative differences among species. Depending on the chemical of concern, hazard identification also may include the use of quantitative or qualitative structure activity relationships or differences in pharmacokinetics.

Exposure Assessment

The exposure scenarios considered in a risk assessment involving pesticide exposure are determined by the application method and the chemical and toxicological properties of the compound. Depending on the properties of the chemical and the application method, the risk assessment may consider acute, subchronic, or chronic durations of oral, dermal, inhalation or combined exposure to the pesticide.

Human Health

Exposure scenarios are developed for workers and members of the general public. For each group, two types of exposure scenarios are generally taken into consideration: *general exposure* and *accidental/incidental exposure*. The term *general exposure* refers to human exposure resulting from the normal use of the chemical. For workers, general exposure involves the handling and application of the compound. These general exposure scenarios can be interpreted relatively easily and objectively. The exposure estimates are calculated from the amount of the chemical handled/day and the exposure rates for the worker group. Although each of the specific exposure assessments for workers involves degrees of uncertainty, the exposure estimates are objective in that they are based on empirical relationships of absorbed dose to pesticide use. For the general public the general exposure scenarios are somewhat more arbitrary and may be less plausible. For each pesticide, at least three general exposure scenarios are considered, including walking through a contaminated area shortly after treatment, the consumption of ambient water from a contaminated watershed, and the consumption of contaminated vegetation. These three scenarios are consistently used because one of them usually leads to the highest estimates of exposure. Additional scenarios discussed below may be considered for each of the individual compounds as warranted by the available data and the nature of the program activities.

Some, if not all, of these general exposure scenarios for the general public may seem implausible or at least extremely conservative. For example, in many cases compounds are applied in relatively remote areas and so it is not likely that members of the general public would be exposed to plants shortly after treatment. Similarly, the estimates of longer-term consumption of contaminated water are based on estimated application rates (lbs a.i./acre) and monitoring studies that can be used to relate levels in ambient water to treatment rates in a watershed; however, in most pesticide applications, substantial portions of a watershed are not likely to be treated. Finally, the exposure scenarios based on longer-term consumption of contaminated vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (e.g., backpack applications). Even in the case of boom spray operations, the spray is directed at target vegetation and the possibility of inadvertent contamination of cultivated or edible vegetation would be low. In addition, for herbicides and other phytotoxic compounds, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed.

All of the factors discussed above concerning general exposure scenarios for the general public have merit and must be considered in the interpretation of the risk characterization (Section 3.4). Thus, the *typical* hazard to the general public may often be negligible because significant levels of exposure are not likely. For the general public, the general exposures may be regarded as *extreme* in that they are based on very conservative exposure assessments and/or very implausible events. Nonetheless, these general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public, and to provide estimates regarding the likelihood and nature of effects after human exposure to pesticides.

Accidental/incidental exposure scenarios describe specific examples of gross over-exposure associated with mischance or mishandling of a chemical. All of these exposure scenarios are arbitrary in that the nature and duration of the exposure is fixed. For example, the worker exposure scenario involving immersion of the hands is based on a 1-minute period of exposure but could just as easily be based on an exposure period of 5 seconds or 5 minutes. Similarly, the consequences of wearing contaminated gloves could be evaluated at 4 hours rather than at 1 hour.

These scenarios are intended to provide an indication of relative hazard among different pesticides and different events in a manner that facilitates conversion or extrapolation to other exposure conditions.

Like the general exposure scenarios, the accidental exposures for the general public may be regarded as more extreme than those for workers. Three scenarios are included in each exposure assessment. They include direct spray, the consumption of contaminated water shortly after a spill, and the consumption of contaminated vegetation shortly after treatment. The direct spray scenario is clearly extreme. It assumes that a naked child is sprayed directly with a pesticide as it is being applied and that no steps are taken to remove the pesticide from the child for 1 hour. There are no reports of such incidents in the literature, and the likelihood of such an incident occurring appears to be remote. Nonetheless, this scenario and others like it are useful not only as a uniform comparison among pesticides but also as a simplifying step in the risk assessment. If the *'naked child'* scenario indicates no basis for concern, other dermal spray scenarios will not suggest a potential hazard and need not be explored. If there is a potential hazard, other more plausible exposure scenarios may need to be considered. The other two accidental scenarios are similarly intended to serve as uniform comparisons among chemicals as well as a means of evaluating the need to explore additional exposure scenarios.

In all cases, the level of exposure is directly proportional to the exposure parameters. The exposure associated with wearing gloves for 4 hours is 4 times the exposure associated with wearing contaminated gloves for 1 hour. Similarly, the general exposure scenarios for workers are based on an 8-hour work day. If a 4-hour application period were used, the hazard indices would be reduced by a factor of two. As another example, general exposure scenarios for both workers and the general public are linearly related to the application rate. Consequently, if the application rate were to double or vary by some other factor, the estimated exposure would double or vary by the same factor. Thus, the specific exposure parameters used in the risk assessment are selected to allow for relatively simple extrapolation to greater or lesser degrees of exposure.

Additional variability is taken into consideration by estimating exposure doses or absorbed doses for individuals of different age groups (i.e., adults, young children, toddlers, and infants). Children may behave in ways that increase their exposure to applied pesticides (e.g., long periods of outdoor play, pica, or imprudent consumption of contaminated media or materials). In addition, anatomical and physiological factors, such as body surface area, and breathing rates and consumption rates for food and water, are not linearly related to body weight and age. Consequently, the models used to estimate the exposure dose (e.g., mg/kg body weight/day) based on chemical concentrations in environmental media (e.g., ppm in air, water, or food) indicate that children, compared with individuals of different age groups, are generally exposed to the highest doses of chemicals for a given environmental concentration.

Ecological Effects

The exposure assessments for ecological effects are conceptually similar to those conducted in the human health risk assessment, and for many terrestrial organisms the exposure assessments are parallel to those used in the human health risk assessment. Similarly, exposures of aquatic species are typically based on the same estimates of concentrations of the chemical in water that are used in the human health risk assessment. Terrestrial animals might be exposed to any applied pesticide from direct spray, the ingestion of contaminated media (vegetation, prey species, or water), grooming activities, or indirect contact with contaminated vegetation. Estimates of oral exposure are expressed in the same units as the available toxicity data. As in the human health risk assessment, these units are usually expressed as mg of agent per kg of body weight and abbreviated as mg/kg body weight. For dermal exposure, the units of measure usually are expressed in mg of agent per cm2 of surface area of the organism and abbreviated as mg/cm2. In estimating dose, however, a distinction is made between the exposure dose and the absorbed dose. The *exposure dose* is the amount of material on the organism (i.e., the product of the residue level in mg/cm2 and the amount of surface area exposed), which can be expressed either as mg/organism or mg/kg body weight. The *absorbed dose* is the proportion of the exposure dose that is actually taken in or absorbed by the animal. For the exposure assessments discussed below, general allometric relationships are used to model exposure (e.g., Boxenbaum and D'Souza 1990). These relationships dictate that for a fixed level of exposure (e.g., concentrations of a chemical in food or water), small animals will receive a higher dose, in terms of mg/kg body weight, than large animals will receive. Based on allometric relationships, it would be possible to model exposure in a very large number of nontarget terrestrial animals. This approach has been used in some past USDA assessments. This approach is no longer used because highly species-specific exposure assessments are of little use in the absence of species-specific dose-response assessments. Thus, if the pesticidespecific information indicates that large mammals may be more sensitive than smaller mammals (i.e., in contrast to the more general relationship noted above), both large and small mammals are modeled separately. Similarly, if the available information suggests that the compound under review may be more toxic to birds than to mammals, separate exposure assessments are conducted for both birds (large and small) and mammals. The basic philosophy behind this approach is that the exposure assessment should not be more complicated than the dose-response assessment.

Generic estimates of exposure are always given for a small mammal. A body weight of 20 g is used for a small mammal, which approximates the body weight of small mammals like mice, voles, shrews, and bats. Other body weights, food consumption, and caloric requirements for mammals and birds are taken from U.S. EPA (1993). The computational details for each exposure assessment presented in this section are provided in standard worksheets (see Appendix 3). Depending on the available toxicity data and the uses of the chemical under review, exposure assessments may be made for larger mammals, birds, various terrestrial invertebrates, and terrestrial plants. The specific scenarios most often considered are detailed in Section 4.2.

Dose-Response Assessment

The purpose of the dose-response assessment is to describe the degree or severity of risk as a function of dose. In classical toxicology, doseresponse assessments are usually expressed as linear or non-linear equations, such as probit analysis and the multistage model, respectively. Using these methods, the prevalence or magnitude of a response can be estimated for any dose level. In regulatory toxicology, this approach is the exception rather than the rule.

Most dose-response assessments in regulatory toxicology, as discussed below, result in point estimates. Although some methods in regulatory toxicology use dose-response models, the regulatory value used is a point estimate. For example, U.S. EPA cancer risk assessments usually employ a form of the multistage model or some other linear dose-response relationship that provide measures of variability or error. The estimate used in setting exposure criteria, however, is typically a point estimate that is a single value rather than a range of values. The results of other commonly used dose-response assessments, such as RfDs, and RfCs, are point estimates of doses that are not believed to be associated with any adverse effect and that are not directly related to a dose-response model.

The practice of relying on point estimates in regulatory toxicology is grounded in the history of this discipline (Dourson and Stara 1983). From its inception, the focus of regulatory toxicology has been the development of criteria (i.e., levels of exposure that are defined as *safe)*. Consequently, the methods used in regulatory toxicology are conservative.

Consistent with the recommendation of NRC (1983) that various groups within the federal government adopt common risk assessment methodologies, standard dose-response assessments are generally based on reference values, like RfDs, derived by other government agencies. This approach avoids a duplication of effort, capitalizes on the expertise of other organizations, and decreases the size, complexity, and cost of risk assessments.

In cases for which these standard approaches yield evidence of potential risk, other statistical methods such as categorical regression may be used to characterize the likelihood and severity of the risk. Categorical regression analysis is used as a tool to supplement RfDs and analogous values. The method defines a relationship between responses that can be categorized according to exposure dose and duration (factors that may influence the response), and estimates the probability that a group of animals subjected to a given exposure will be classified into a particular category (Dourson et al. 1997, Durkin et al. 1992, Guth et al. 1997). Categorical regression as well as other methods (quantitative and semi-quantitative) are discussed further in Section 3.3.5.

In most respects, dose-response assessments for ecological effects are conceptually similar to the methods employed in the human health risk assessments, with one major exception. Human health risk assessments focus on protecting the individual. This is why uncertainty factors (sometimes very large) are used to derive RfD values and why cancer risk is estimated using very conservative assumptions. In ecological risk assessment, the focus is on a population or community rather than an individual. Thus, the use of uncertainty factors is less common and the general methods for dose-response assessment are less conservative.

For terrestrial mammals, the dose-response assessment generally is based on the same data used to derive the RfD in the human health risk assessment: an NOAEL from a chronic exposure study. The data on other terrestrial animals, both birds and invertebrates, are often not as detailed as the available information on experimental mammals. Fewer toxicological endpoints are examined, and, at least for vertebrates, lifetime or chronic studies are seldom available.

For some terrestrial plants as well as some aquatic species, sensitive life-stage studies are often available. Such studies include egg-and-fry studies in fish, life-cycle toxicity studies in *Daphnia magna*, and seed germination and growth studies in plants, all of which are required by the U.S. EPA for the registration of herbicides. The studies are obtained and assessed following the same criteria applied to studies for the human health risk assessment. The principal difference is that NOEL, NOEC, or LD or LC values are used directly rather than RfD values that involve the application of uncertainty factors.

Nonetheless, dose-response assessments for some nontarget species considered in a risk assessment can be complicated (Section 4.3). As in the human health dose-response assessment, the nature of the available data as well as the potential risk may dictate the use of relatively complex dose-response analyses.

Risk Characterization

Conceptually, risk characterization is simply the process of comparing the exposure assessment to the dose-response assessment. In this process, risk is characterized quantitatively either as a ratio or as an incidence of response or a defined risk level – i.e., a risk of 5%.

Because the risk characterization flows directly from the exposure and dose-response assessments, the complexity and clarity of the risk characterization will be dependent on complexity and clarity of both the exposure and dose-response assessments. In most cases, risk will be quantitatively characterized as a ratio: a level of exposure divided by some defined effect level. In the human health risk assessment, the defined effect level is almost always the reference dose (RfD), and the ratio of the exposure to the reference dose is referred to as the hazard quotient (HQ). In the ecological risk assessments, the defined effect level is may be an NOEC or a risk level. The risk level, in turn, may be a lethal dose (e.g., LD50 or some other response level such as an LD25) or a dose causing some risk of a non-lethal effect (e.g., an ED50 or ED25). For aquatic organisms and for some terrestrial organisms for which exposure is characterized by a concentration rather than a dose, the defined risk levels may be expressed as a lethal concentration (LC50 or some other response level) or a sublethal concentration that leads to some effect (e.g., an EC50). In general, the Forest Service prefers to use NOAEL or NOEC values in risk characterizations. If NOAEL or NOEC values are not available, a sublethal effective dose at some response rate (e.g., EDX or ECX where *X* is some level of response) is generally preferred over a lethal response rate (e.g., LDX or LCX). While these ratios are sometimes referred to as HQs, more suitable terms are risk quotients (RQs).

If sufficient data are available and if the simple HQs or RQs suggest some level of concern, doseresponse or dose-severity relationships may be used to characterize risk. Dose-response relationships most often involve explicit dose-response functions that lead to an explicit estimate of risk (e.g., a response rate of 13.2% for some effect or an 8% decrease in some biological function). Dose-severity relationships are typically less quantitative and lead to some assessment of what effects might be observed in a population at various levels of exposure. A fuller discussion of the quotient methods (HQs and RQs) as well as the dose-response and doseseverity relationships are given in Section 3.4 (Human Health Effects) and Section 4.4 (Ecological Effects).

Elaborations

Probabilistic Risk Assessment

Variability and *uncertainty* may be dominant factors in any risk assessment, and these factors should be expressed. Within the context of a risk assessment, the terms *variability* and *uncertainty* signify different conditions. In general, *variability* and *uncertainty* can be distinguished from each other depending on the state of knowledge or information. *Variability* reflects the knowledge of how things may change. By acquiring more knowledge or information, better estimates of variability may be obtained but the *variability* itself will not decrease – i.e., it is inherent in the population or system being considered. Differences in human body weights are a good example of variability. Uncertainty reflects a lack of knowledge and uncertainty can be reduced by acquiring information. For example, while the toxicity of herbicides has been tested in the honey bee, very little information is available on the toxicity of most herbicides to other nontarget terrestrial insects. This leads to uncertainty (in terms of how representative the honey bee is for other insects) but this uncertainty can be reduced by conducting experiments on the toxicity of the herbicide to other insects.

Variability may take several forms. For this risk assessment, three types of variability are distinguished: *statistical*, *situational*, and *arbitrary*. *Statistical variability* reflects apparently random patterns in data. For example, various types of estimates used in this risk assessment involve relationships of certain physical properties to certain biological properties. In such cases, best or maximum likelihood estimates can be calculated, as well as upper and lower confidence intervals that reflect the statistical variability in the relationships. *Situational variability* describes variations depending on known circumstances. For example, the application rate or the applied concentration of an herbicide will vary according to local conditions and goals. As discussed in the following section, the limits on this variability are known and there is some information to indicate what the variations are. In other words, *situational variability* is not random. *Arbitrary variability*, as the name implies, represents an attempt to describe changes that cannot be characterized statistically or by a given set of conditions that cannot be well defined. This type of variability dominates some spill scenarios involving either a spill of a chemical on to the surface of the skin or a spill of a chemical into water. In either case, exposure depends on the amount of chemical spilled and the area of skin or volume of water that is contaminated.

In order to quantitatively address both variability and uncertainty, risk assessment methods generically referred to as ***probabilistic risk assessment*** have been and continue to be developed. The general approach for probabilistic risk assessment, particularly with respect to ecological species, has been articulated by Ecological Committee on FIFRA Risk Assessment Methods (ECOFRAM 1999). The basic approach given in ECOFRAM (1999) involves a tiered risk assessment process:

> Tier 1: Very conservative screening methods involving worse case assumptions in terms of both exposure and dose-response. Risk is typically expressed as a point estimate such as an HQ or RQ.
>
> Tier 2: Typically elaborates or refines the exposure assessment to include more realistic estimates of exposures and may elaborate the dose-response assessment to include the use of full dose-response curves. Risk may be expressed in terms of probabilities rather than point estimates.
>
> Tier 3: An extension of a Tier 2 approach that may involve the inclusion of data on additional species (e.g., species sensitivity distributions) and more sophisticated exposure models.
>
> Tier 4: Is the most complex risk assessment and may involve experimental or monitoring programs designed to definitively characterize either exposure and toxicity and the use of all available data including microcosm, mesocosm, and field studies.

As implied by the term *Tier*, probabilistic risk assessments under the general ECOFRAM model are designed to be conducted in stages going from the most conservative or worst-case approach (Tier 1) to less extreme and presumably more realistic assessments. Because this staged approach typically results in progressively lessened perceptions of risk, probabilistic risk assessments have been criticized as simply mechanisms to make risk disappear by mathematical manipulations. This criticism is addressed in ECOFRAM (1999) and is largely unfounded. While any risk assessment, probabilistic or otherwise, can be manipulated to distort risk (either upward or downward), the proper application of probabilistic risk assessment typically results not in conflicting risk characterizations at the different tiers but rather in more fully elaborated and refined risk assessments.

The nomenclature of probabilistic risk assessments, particularly as embodied in ECOFRAM (1999) is somewhat different from that of NAS (1983) but the concepts are essentially the same. The first stage of a probabilistic risk assessment is typically referred to as the *Problem Formulation*. This is similar to the *Hazard Identification* as defined by NAS (1983) but focuses on identifying which organisms are likely to be at greatest risk. The other stages of the risk assessment process defined by ECOFRAM (1999) are exposure characterization, effects characterization, and risk characterization and correspond closely to more general definitions given by NAS (1983) for the exposure assessment, dose-response assessment, and risk characterization.

In the higher tiered risk assessments, the probabilistic approach is based on more sophisticated methods of handling data and expressing both variability and uncertainty. A central feature of many higher tiered probabilistic risk assessments is Monte Carlo Analysis. *Monte Carlo Analysis* is a general term for any simulation that uses probability distributions rather than point estimates to represent and approximate the variability in a system model. The method was originally developed in the 1940's, shortly after the development of computers, to make probabilistic approximations to the solutions of mathematical equations or models that could not be solved analytically (U.S. EPA/Risk Assessment Forum, 1997).

Monte Carlo Analyses can be relatively simple or very complicated depending on the simplicity or complexity of the model. As a simple example, take a situation in which we knew that a population of individuals will be exposed each day to up to 200 mg of a chemical. In this population, the smallest individual will have a body weight of about 52 kg. Thus, the maximum daily dose is about 3.8 mg/kg body weight. In addition, we knew that the RfD for the general population is 3.5 mg/kg. Taking a standard ratio approach using point estimates (Section 1.2.1.4), the hazard quotient would be about 1.1, somewhat above the level of concern. This would be a standard point-estimate worst-case approach and the risk assessment would conclude that some unspecified number of individuals could be subject to exposures that would not be generally considered acceptable.

Suppose, however, that the average body weight was 70 kg and the body weights in the population evidenced a normal distribution with a standard deviation of 10 kg. In addition, suppose that we knew that not all individuals would be exposed to the same amount of the chemical but that the amount could vary from 50 mg/day to 200 mg/day. Lastly, while the RfD was 3.5 mg/kg/day, we also knew that some individuals could be more sensitive and might respond with an adverse effect at a dose above 2 mg/kg/day, but that other individuals would not respond adversely until the dose reached 10 mg/kg/day. This sort of variability could be modeled in a Monte Carlo Analysis with the following assumptions:

Parameter	Distribution
Body weight	Normal distribution with a mean of 70 kg and a standard deviation of 10 kg
Exposure	Uniform distribution with a range of 50 mg/day to 200 mg/day.
RfD	Triangular with a mode of 3.5 mg/kg/day, a lower limit of 2 mg/kg/day and an upper limit of 10 g/kg/day

An illustration of the results of a Monte Carlo Analysis of this simple model is given in Figure 1-2. Under the conditions of the simulation, the hazard quotient would be greater than unity (the level of concern for this scenario) for about 5% of the population. Note that the use of a Monte Carlo simulation does not necessarily change the conclusions risk assessment. In the above example, the simulation is consistent with the worst-case point estimate approach: some people will be at risk. The Monte Carlo simulation, however, does incorporate more information into the assessment and allows the risk assessor to better characterize the consequences – i.e., about 5% of the individuals may be exposed to more of the agent than would be generally considered acceptable.

Most practical Monte Carlo simulations are much more complicated and may involve quantitative considerations of differences in sensitivity among different species (e.g., Posthuma et al. 2002) as well as very complex applications of environmental fate models (e.g., Randall et al. 2003). Also, although elementary Monte Carlo Analyses can be conducted in commonly available software programs like EXCEL, most Monte Carlo analyses require relatively specialized software. The above example was conducted using an EXCEL add-in called Crystal Ball (Decisioneering 2004) that is commonly used in probabilistic risk assessments conducted by or for the U.S. EPA's Office of Pesticides, Environmental Fate and Effects Division. Other packages capable of more sophisticated modeling include acslXtreme (AEgis Technologies Group 2004), ModelMaker (Cherwell Scientific 2000), and Mathematica (Wolfram Research 2004).

Extreme Value Risk Assessment

The USDA Forest Service has not adopted probabilistic risk assessment methods. Historically, the Forest Service has developed different scenarios that have been referred to as typical and worst-case (e.g., USDA/FS 1989a,b,c). With the advent of the SERA risk assessments, a somewhat different approach was taken in which almost no values used in a risk estimate are presented as a single number. Instead, most numbers used in calculating risk values are expressed as a central estimate and a range, which is sometimes very large. The central estimate would generally correspond to the *typical* value and the upper value in the range (or more specifically the upper or lower bound that leads to the highest estimate of risk) would generally correspond to what used to be called the *"worst-case"* value. The other end of the range (the upper or lower bound that leads to the lowest estimate of risk) might be termed the *"best case"* value. The best case assessment is made simply because an unacceptable level of risk from a *best case* would lead to the clear conclusion that the use of the agent under any circumstances would likely result in some adverse effect.

As with a probabilistic risk assessment, an attempt is often made to apply the extreme value approach both to the exposure assessment as well as to the dose-response assessment. Applications of the exposure assessment are relatively simple and may involve various assumptions concerning animal weight, food consumption, water consumption, rainfall and so forth. Many of the specific assumptions are detailed in Section 3.2 (Human Health) and Section 4.2 (Ecological Effects). In terms of the dose-response assessment, the extreme value approach most often involves the identification of both tolerant and sensitive species, typically in the ecological risk assessment (Section 4.3). In the human health risk assessment (Section 3.3), different RfD values may be derived for sensitive subgroups – e.g., children or women of childbearing age.

The extreme value approach has some but not all of the benefits of probabilistic risk assessment. For example, it can and often does indicate that a particular use of an agent might not cause any adverse effects under some circumstances but could cause adverse effects under other circumstances. To the extent that the circumstances are clearly defined, this may serve as a guide to using the agent in a manner that will minimize the potential for adverse effects. While probabilistic risk assessments may be used by the Forest Service at some point in the future, probabilistic risk assessments generally take longer to conduct (because of the tiered nature of the risk assessment process) and involve the commitment of greater resources.

Uncertainty Analysis in Risk Assessments

The primary reference for this section is: USDI Bureau of Land Management. 2007. Vegetation Treatments using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS). Appendix C, PEIS C-78 to C-86. Available at http://www.blm.gov/wo/st/en/prog/more/veg_eis.html. References cited in this section are internal to the above-referenced document.

For any ERA, a thorough description of uncertainties is a key component that serves to identify possible weaknesses in the analysis and to elucidate what impact such weaknesses might have on the final risk conclusions. The uncertainties of this risk assessment are discussed below (also see Table 7-1 in the herbicide ERAs [ENSR 2005a-j]).

Toxicity Data Availability

The majority of the available toxicity data was obtained from studies conducted as part of the USEPA pesticide registration process. There are a number of uncertainties related to the use of this limited data set in the risk assessment. In general, it would be preferable to base any ecological risk analysis on reliable field studies that clearly identify and quantify the amount of potential risk from particular exposure concentrations of the chemical of concern. However, in most risk assessments it is more common to extrapolate the results obtained in the laboratory to the receptors found in the field. It should be noted, however, that laboratory studies often overestimate risk relative to field studies (Fairbrother and Kapustka 1996).

Species for which toxicity data are available may not necessarily be the most sensitive species to a particular herbicide. These species have been selected as laboratory test organisms because they are generally sensitive to stressors and can also be maintained under laboratory conditions. Toxicity values for the most appropriate sensitive surrogate species for each receptor were selected by qualified toxicologists based on a thorough review of the available toxicity data; however, there is a possibility that some non-tested receptors in a given receptor group would be more sensitive.

Furthermore, the surrogate species used in the registration testing are not an exact match to the wildlife receptors included in the ERA. For example, avian data are only available for two primarily herbivorous birds: the mallard duck and the bobwhite quail. However, TRVs based on these receptors were also used to evaluate risk to insectivorous and piscivorous birds. Species with alternative feeding habits may be more or less sensitive to the herbicide than those species tested in the laboratory (see Tables C-3 and C-4 for a list of surrogate species and their receptor groups).

In general, the most sensitive available endpoint for the appropriate surrogate test species was used to derive TRVs. This approach is conservative as there may be a wide range of data and effects for different species. For example, the EC_{50}s available for aquatic invertebrates exposed to bromacil ranged from 65 mg a.i./L to >1,000 mg a.i./L. Accordingly, 65 mg a.i./L was selected as the aquatic invertebrate TRV, even though the majority of results were well above this value. In general, this selection criterion for TRVs has the potential to overestimate risk within the ERA.

In addition, several of the toxicity tests conducted during the registration process did not use herbicide formulations with 100% a.i. The assumption has been made that any toxicity observed in the tests is due to the herbicide a.i.; however, it is possible that the additional ingredients in the different formulations also had an effect. For purposes of TRV derivation and the ERA, it was assumed that all toxicity data applies to the a.i. itself and not the particular product formulation tested. This may result in an overestimate of risk to certain receptors and species guilds.

Degradates, Inert Ingredients, Adjuvants, and Tank Mixtures

In a detailed herbicide risk assessment, it is preferable to estimate risks not just from the a.i. of an herbicide, but also from the cumulative risks of degradates, inert ingredients (inerts), and adjuvants. Other pesticides may also factor into the risk estimates, as herbicides can be tank mixed to expand the level of control and to accomplish multiple identified tasks (the BLM usually only tank mixes herbicides with other herbicides). However, using currently available models (e.g., GLEAMS), it is only practical to make deterministic risk calculations (i.e., exposure modeling, effects assessment, and RQ derivations) for a single a.i.

In addition, information on inerts, adjuvants, and degradates is often limited by the availability of, and access to, reliable toxicity data for these constituents. The sections below present a qualitative evaluation of the potential risks from degradates, inert ingredients, adjuvants, and tank mixtures.

Degradates

The potential toxicity of degradates should be considered when selecting an herbicide. However, it is beyond the scope of this risk assessment to evaluate all of the possible degradates of the various herbicide formulations of the 10 herbicides. Degradates may be more or less mobile and more or less toxic in the environment than their source herbicides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent herbicides and degradates makes prediction of potential impacts challenging. For example, a less toxic, but more mobile bioaccumulative, or persistent degradate may have a greater adverse impact due to residual concentrations in the environment. A recent study indicated that 70% of degradates had either similar or reduced toxicity to fish, daphnids, and algae than the parent pesticide. However, 4.2% of the degradates were more than an order of magnitude more toxic than the parent pesticide, with a few instances of acute toxicity values below 1 mg/L (Sinclair and Boxall 2003). No evaluations of impacts to terrestrial species were conducted in the study. The lack of data on the toxicity of degradates of the specific herbicides represents a source of uncertainty in the risk assessment.

Inerts

Pesticide products contain both active and inert ingredients. The terms “active ingredient” (a.i.) and “inert ingredient” have been defined by federal law—the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)—since 1947. An a.i. is one that prevents, destroys, repels, or mitigates the effects of a pest, or is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. By law, the a.i. must be identified by name on the label, together with its percentage by weight. An inert ingredient is simply any ingredient in the product that is not intended to affect a target pest. For example, isopropyl alcohol may be an a.i. and antimicrobial pesticide in some products; however, in other products, it is used as a solvent and may be considered an inert ingredient. The law does not require inert ingredients to be identified by name and percentage on the label, but the total percentage of such ingredients must be declared. Because neither the federal law nor the regulations define the term “inert” on the basis of toxicity, hazard or risk to humans, non-target species, or the environment, it should not be assumed that all inert ingredients are non-toxic.

The USEPA has a listing of regulated inert ingredients at http://www.epa.gov/opprd001/inerts/index.html. This listing divides inert ingredients into four lists. The number of inert ingredients found in the nine herbicides evaluated in the ERAs for each category is shown below (nine inerts were not found on the USEPA lists):

List 1 - Inert Ingredients of Toxicological Concern: None.
List 2 - Potentially Toxic Inert Ingredients: None.
List 3 - Inerts of Unknown Toxicity: 12.
List 4 - Inerts of Minimal Toxicity. List 4 is subdivided into List 4A (minimal risk inert ingredients) and List 4B (inerts that have sufficient data to substantiate that they can be used safely in pesticide products): Over 50.

Toxicity information was also searched in the following sources:

- TOMES (a proprietary toxicological database including USEPA's IRIS, the Hazardous Substance Data Bank, and the Registry of Toxic Effects of Chemical Substances (RTEC).
- USEPA's ECOTOX database which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).
- Material Safety Data Sheets from suppliers.
- Other sources, such as the Farm Chemicals Handbook.
- Other cited literature sources.

Relatively little toxicity information was found. A few acute studies on aquatic or terrestrial species were reported. No chronic data, no cumulative effects data, and almost no indirect effects data (food chain species) were found for the inerts in the 10 herbicides.

A number of the List 4 compounds (Inerts of Minimal Toxicity) are naturally-occurring earthen materials (e.g., clay materials or simple salts) that would produce no toxicity at applied concentrations. However, some of the inerts, particularly the List 3 compounds and unlisted compounds, may have moderate to high potential toxicity to aquatic species based on information in Material Safety Data Sheets or on published data.
As a tool to evaluate List 3 and unlisted inerts in the ecological risk assessment, the exposure concentration of the inert compound was calculated and compared to toxicity information. As described in more detail in Appendix D of the ERAs, the GLEAMS model was set up to simulate the effects of a generalized inert compound in the base-case watershed (annual precipitation rate of 50 inches per year, application area of 10 acres, slope of 0.05, surface roughness of 0.015, erodibility of 0.401 tons per acre, and vegetation type of weeds) with a sand soil type. The chemical characteristics of the generalized inert compound were set at either extremely high or low values to describe it as either a very mobile or stable compound. The application rate of the inert/adjuvant compound was fixed at 1 lb a.i./acre. Under these conditions, the maximum predicted ratio of inert concentration to herbicide application rate was 0.69 mg/L per lb a.i./acre (3 day maximum in the pond), and in every case (acute and chronic, pond and stream scenarios) the inert concentrations exceeded herbicide a.i. concentrations.

In general, higher application rates resulted in higher exposure concentrations of surfactant inerts, exceeding 1 mg/L for the maximum pond scenario. This suggests that inerts associated with the application of herbicides may contribute to acute toxicity to aquatic organisms if they reach the aquatic environment. However, due to the lack of specific inert toxicity data, this may be an overestimate of the potential toxicity. It is assumed that toxic inerts would not represent a substantial percentage of the herbicide and that minimal impacts to the environment would result from these inert ingredients.

Adjuvants and Tank Mixtures

Evaluating the potential additional/cumulative risks from mixtures and adjuvants of pesticides is substantially more difficult than evaluating the inerts in the herbicide composition. While many herbicides are present in the natural environment along with other pesticides and toxic chemicals, it is extremely difficult to estimate the potential cumulative risks of such mixtures. The composition of such mixtures is highly site-specific, and thus nearly impossible to address at the programmatic level of the EIS.

Herbicide label information indicates whether a particular herbicide can be tank mixed with other pesticides. Adjuvants (e.g., surfactants, crop oil concentrates, fertilizers) may also be added to the spray mixture to improve the herbicide efficacy when mixed and applied to according to the label. Without product specific toxicity data, it is impossible to quantify the potential impacts of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific evidence allowed a determination of whether the joint action of the mixture was additive, synergistic, or antagonistic. Such evidence is not likely to exist unless the mode of action is common among the chemicals and receptors.

Adjuvants

Adjuvants generally function to enhance or prolong the activity of an a.i. For terrestrial herbicides, adjuvants aid in proper wetting of foliage and absorption of the a.i. into plant tissue. Adjuvant is a broad term that includes surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration guidelines as pesticides; the USEPA does not register or approve the labeling of spray adjuvants. Individual herbicide labels contain lists with "label-approved" adjuvants for use with a particular herbicide under specific conditions.

Following the same procedure used to address inerts in Appendix D of the ERAs, the GLEAMS model was used to estimate the potential portion of an adjuvant that might reach an adjacent waterbody via surface runoff. In addition, sources (Muller 1980; Lewis 1991; Dorn et al. 1997; Wong et al. 1997) generally suggest that the acute toxicity of surfactants and anti-foam agents to aquatic life ranges from 1 to 10 mg/L, and that chronic toxicity ranges as low as 0.1 mg/L. This evaluation indicates that, for herbicides with high application rates, adjuvants have the potential to cause acute, and potentially chronic, risk to aquatic species. However, more specific modeling and toxicity data would be necessary to define the level of uncertainty. Selection of adjuvants is under the control of BLM land managers, and it is recommended that land managers follow all label instructions and abide by any warnings. In general, adjuvants compose a relatively small portion of the volume of herbicide applied; however, selection of adjuvants with limited toxicity and low volumes is recommended to reduce the potential for the adjuvant to influence the toxicity of the herbicide.

Tank Mixtures

The use of tank mixtures of labeled herbicides, along with the addition of an adjuvant (when stated on the label), may be an efficient use of equipment and personnel; however, knowledge of both products and their interactions is necessary to avoid unintended negative effects. In general, herbicide interactions can be classified as additive, synergistic, or antagonistic:

- Additive effects occur when mixing two herbicides produces the same response as the combined effects of each herbicide applied alone. The products neither hurt nor enhance each other.
- Synergistic responses occur when two herbicides provide a greater response than the added effects of each herbicide applied separately.
- Antagonistic responses occur when two herbicides applied together produce less control than if you applied each herbicide separately.

While a quantitative evaluation of all of these mixtures is beyond the scope of this ERA, a qualitative evaluation may be made if the assumption is made that the products in the tank mix will act in an additive manner. The predicted RQs for two active ingredients can be summed for each individual exposure scenario to see if the combined impacts result in additional RQs elevated above the corresponding LOCs.

The RQs for any two herbicides in a tank mix were combined to simulate a tank mix in Appendix E of each ERA (diquat, fluridone, and tebuthiuron are not generally tank mixed by the BLM and were not included in this analysis). The application rates within the tank mix are not necessarily the same as each individual a.i. applied alone. See Table 7-2 in each ERA (ENSR 2005a-j) for a comparison of the percent of RQs exceeding LOCs for each of the 10 herbicide active ingredients applied alone and in a tank mix.

These comparisons indicate that tank mixes for bromacil (with sulfometuron methyl) and imazapic with diflufenzopyr do not result in more RQs above the associated LOCs for birds, mammals, fish, and invertebrates (and aquatic plants for imazapic), than were predicted for bromacil, imazapic, or diflufenzopyr alone. Additional elevated RQs are predicted for both aquatic and RTE terrestrial plants when tank mixes of bromacil with sulfometuron methyl, and imazapic with diflufenzopyr, are applied (aquatic plant risk is not elevated versus imazapic applied alone). This suggests that in some cases plant species may be particularly sensitive to the tank mix. However, when chlorsulfuron and diuron are tank mixed, all receptors are at higher risk than with application of chlorsulfuron alone (risks are not higher than with the application of diuron alone), and most receptors are also at higher risk when sulfometuron methyl is applied with bromacil versus sulfometuron methyl alone.

The comparison of the RQs from herbicide a.i. and tank mixes of these herbicides indicate that results are specific to each tank mix. Aquatic plants and RTE terrestrial plants may be at greater risk from the tank mixed application than from the a.i. alone. However, in some cases all receptors are at greater risk and precautions (e.g., increased buffer zones, decreased application rates) should be taken to reduce risk. There is some uncertainty in this evaluation because herbicides in tank mixes may not interact in an additive manner; this may overestimate risk if the interaction is antagonistic, or it may underestimate risk if the interaction is synergistic. In addition, other products may also be included in tank mixes and may contribute to the potential risk.

Selection of tank mixes, like adjuvants, is under the control of BLM land managers. To reduce uncertainties and potential negative impacts, it is required that land managers follow all label instructions and abide by any warnings. Labels for both tank mixed products should be thoroughly reviewed and mixtures with the least potential for negative effects should be selected. This is especially relevant when a mixture is applied in a manner that may have increased potential for risk. Use of a tank mix under these conditions increases the level of uncertainty in risk to the environment (PEIS C-78 to C-86).

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