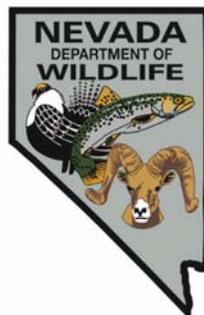


**EFFECTS OF WILDFIRE (1999–2007) ON GREATER SAGE-GROUSE  
(*Centrocercus urophasianus*) AND KEY ECOLOGICAL SAGEBRUSH  
SYSTEMS THAT THEY DEPEND ON IN NEVADA**



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**July 2008**

## EFFECTS OF WILDFIRE (1999–2007) ON GREATER SAGE-GROUSE (*Centrocercus urophasianus*) AND KEY ECOLOGICAL SAGEBRUSH SYSTEMS THAT THEY DEPEND ON IN NEVADA

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### *Effects of Wildfire on Greater Sage-grouse Habitat*

#### **Purpose and Need:**

From the period 1999 through 2007 representing 9 fire seasons, more than 6 million acres of Nevada's rangelands have burned (Table 1). We wanted to estimate, to the greatest extent possible, the actual loss of key sagebrush ecological system types that Greater sage-grouse (*Centrocercus urophasianus*) depend upon in Nevada. We also wanted to estimate the effects that wildfire has had on montane and low to mid elevation sagebrush ecological system types to determine the potential short-term and long-term losses of functional sage-grouse habitats. The importance of establishing a written record of the anticipated effects of these fires for future reference cannot be overvalued. Here, we will explain an approach and the tools utilized to arrive at the figures displayed below.

Year	Number of Incidents	Acres	Acres Per Incident
1999	212	1,621,688	7,649
2000	178	587,020	3,298
2001	215	575,664	2,678
2002	25	27,113	1,085
2003	33	17,612	534
2004	34	33,441	984
2005	106	1,043,180	9,841
2006	218	1,292,747	5,930
2007	126	841,661	6,680
<b>Totals:</b>	<b>1147</b>	<b>6,040,126</b>	<b>5,266</b>

Table 1. Fire history over 9 fire season from 1999-2007 including number of different fires and total number of acres burned.

#### **Methods:**

We used ESRI Arc View 9.2 and available data layers to determine the extent of sagebrush habitat types that were burned during the analysis period. The Southwest Regional GAP Analysis Project (Nature Serve 2003) vegetative overlay was utilized to extract key sagebrush habitat types for sage-grouse. The

following sagebrush ecosystem types were extrapolated from the vegetative overlay:

- 1) Inter-Mountain Basins Big Sagebrush Shrubland (S054);
- 2) Great Basin Xeric Mixed Sagebrush Shrubland (S055);
- 3) Inter-Mountain Basins Montane Sagebrush Steppe (S071);
- 4) Inter-Mountain Basins Big Sagebrush Steppe (S078).

Following this extrapolation, we overlaid the Nevada Department of Wildlife's (NDOW) year around sage-grouse occupied range polygon and the 1999-2007 fire polygons provided by the Bureau of Land Management (BLM). These polygons included lands burned across an array of land ownerships. This helped us determine several factors including the total amount of actual sagebrush habitat, the total number of acres of sagebrush burned, and the total amount of montane sagebrush ecological systems burned in Nevada within the range of Greater sage-grouse. It was very important to separate out the montane sagebrush ecological systems to help determine the amount of low to mid elevation sagebrush habitats burned as these are the most likely to convert to monotypic stands of cheatgrass (*Bromus tectorum*) and other invasive weed species unless aggressive restoration efforts are conducted.

#### Results:

- A total of **21,894,043 acres** of the four selected sagebrush ecological systems exists within the range of Greater Sage-grouse in Nevada (see Table 2 for a breakdown by ecological system).
- **2,561,013 acres** of these sagebrush ecological systems burned during the 9 fire seasons spanning 1999-2007. This figure represents an **11.6% loss** of key sagebrush habitat types that sage-grouse depend on (see Figure 1).
- **1,954,024 acres (76% of the total sagebrush burned) are considered sagebrush ecological systems other than montane.** These are the ecological systems most at risk from invasive annual establishment such as cheatgrass (*Bromus tectorum*) as well as other invasive weed species and will be the most difficult to recover. It is likely that this area will not serve as functional sage-grouse habitat for several decades if not longer.

<b>Sagebrush Ecological System</b>	<b>Soil and Elevation Characteristics</b>	<b>Number of Acres</b>
Intermountain Basins Big Sagebrush Shrubland	Lowland Shrubland, Toeslope/Valley Bottom (1500-2300 m)	12,181,220
Great Basin Xeric Mixed Sagebrush Shrubland	Lowland Shrubland, Ridges and Summits (1000-2600 m)	5,273,694
Inter-Mountain Basins Montane Sagebrush Steppe	Montane, Upper Montane (2,000-3,000 m)	4,130,016
Inter-Mountain Basins Big Sagebrush Steppe	Lowland, Deep Soil, Aridic, Xeromorphic	309,113
Total:		<b>21,894,043</b>

**Table 2. Total amount and characteristics of sagebrush ecological systems within the range of Greater Sage-grouse in Nevada.**

**Discussion and Recommendations:**

Recent literature suggest that the recovery rates of Wyoming big sagebrush communities after fire is very slow and that fire rotations are between 100 – 240 years (Cooper et al. 2007, Baker W.L. 2007). Miller and Eddleman (2001) summarized negative impacts of fire on sage-grouse, including loss of winter and nesting habitat due to the removal of the sagebrush canopy. They indicate there is no evidence to suggest fire will enhance sage-grouse habitat in Wyoming big sagebrush dominated communities.

This exercise and the methodologies used should be expanded to include other western States, in particular Oregon and Idaho, where wildfire has negatively affected sage-grouse populations. Because Southwest Regional GAP analysis does not include Oregon and Idaho, it would be beneficial to conduct this exercise using LANDFIRE (Landscape Fire and Resource Management Tools Project) vegetative layers to be consistent across regional boundaries.

We also recommend using a completed regional analysis as a potential precursor to developing an effective predictive model regarding the likelihood of future wildfires in a given area.

***Effects of Wildfire on Greater Sage-grouse Populations***

**Methods:**

We used ESRI ArcView 9.2 and available data layers to determine the extent of the sage-grouse population affected by wildfire from 1999-2007. Fire polygons were provided by the BLM and overlaid on a sage-grouse year around habitat map developed by NDOW. Then, lek location information from Nevada’s updated lek database (2007) was placed on the map. We selected for fire polygons that

were greater than 1,000 acres in order to more accurately capture fires that would actually impact sizeable amounts of habitats. This figure is strictly arbitrary and additional research needs to be conducted to determine if this is in fact reasonable. We then used these fire polygons to clip out the number of leks that were burned during the 9-year period. We also elected to use buffers of 3.2, 6.4 and 9.6 kilometers when clipping out the number of leks affected because it is very likely that nesting habitat associated with some of those leks was affected as well.

**Results:**

We determined that a total of 307 known lek locations were burned during the 1999-2007 fires seasons. Of these, 131 were classified as active leks. There are a total of 1,981 lek locations (912 classified as active\*) documented in the updated (January 2008) Nevada lek database. These figures translate into 14.4% of the total number of active leks being directly affected by wildfire over a 9 year period. Moving outward from these fire polygons in 3.2 km increments up to 9.6 km, the number of active leks affected could be as high as 551 or 60.4% (Table 3). Figure 2 shows a map of the year around sage-grouse range, all known leks and the fire polygons from 1999 through 2007 and depicts the drastic effects that wildfire has had on sage-grouse in Nevada.

	<b>Distance from Fire Polygon</b>			
	0 km	3.2 km	6.4 km	9.6 km
Total Leks	307	696	944	1,158
Active Leks	131	329	454	551
% of total known active leks	14.4%	36.1%	49.8%	60.4%

**Table 3. Total number of leks, active leks and percentage of active leks affected by wildfire within identified buffer distances.**

\* Active is defined as the observation of 2 or more males on a lek in 2 or more of any of the previous 5 years (Connelly et. al. 2003).

**Recommendations:**

The next step in this analysis process will be to determine lek attendance trends within fire polygons and adjacent to these fires. We will review data from the 131 active leks actually burned (0 km buffer) and select those leks with the greatest amount of data over consecutive years (most likely designated “trend” leks). We will attempt to determine if there are differences in lek attendance in the interior portions of the fire polygons versus the outer perimeter of the fires if enough data exists to make this determination. Additionally, through continued monitoring, we will attempt to determine male attendance trends on leks moving outward from fire polygons in 3.2 km increments up to 9.6 km, barring any additional large fires.

It will be important to attempt to capture as many sage-grouse as possible within and around these fire polygons and radio mark them to help determine how long sage-grouse actually persist in an area post fire and/or whether or not birds attempt to integrate themselves into adjacent populations.

Additionally, as certain areas begin to recover and re-establish an early successional sagebrush habitat (where possible), a monitoring strategy should be developed to determine re-occupation of an area by sage-grouse if it so occurs. The most feasible strategy here would be to develop aerial transects within these fire polygons and sample them intermittently (once every three to five years) until positive detections are made and then follow up observations on the ground.

### **Literature Cited:**

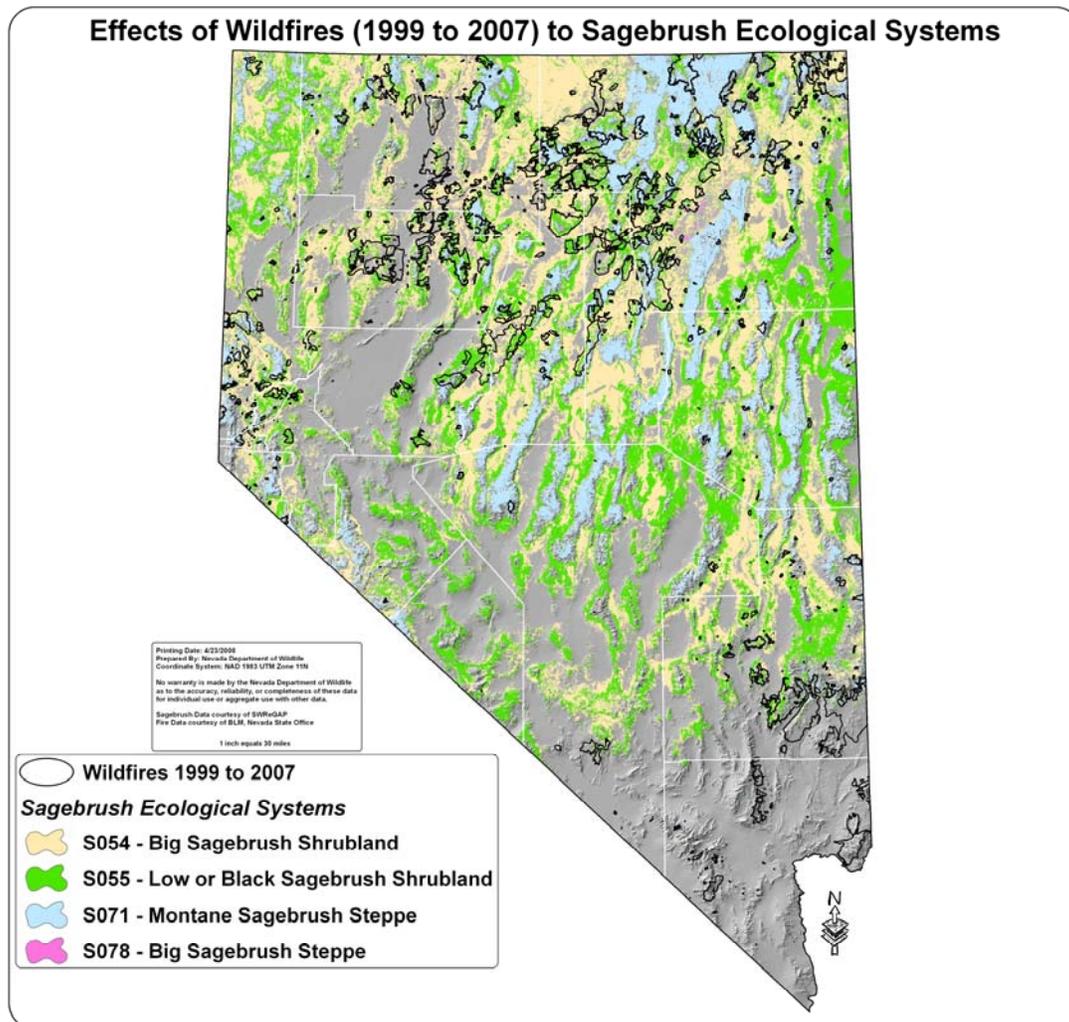
Baker, W.L. 2007. Fire and restoration of sagebrush ecosystems. *Wildlife Society Bulletin* 34(1):177-185.

Connelly, J.W., K.P. Reese and M.A. Schroeder. 2003. Monitoring of Greater Sage-grouse Habitats and Populations. Station Bulletin 80. College of Natural Resources Experiment Station, College of Natural Resources, University of Idaho, Moscow, ID 83844-1142.

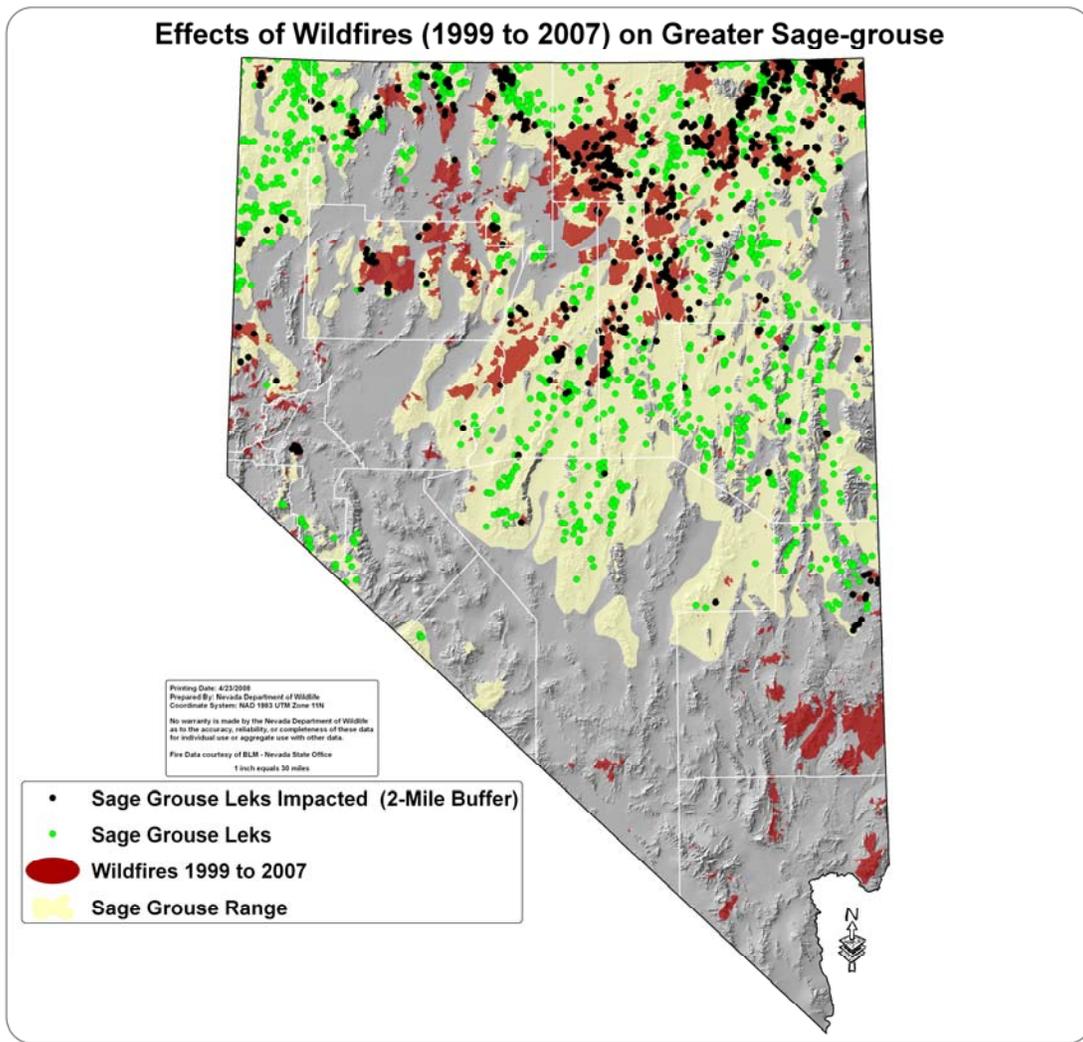
Cooper, Stephen V., Peter Lesica and G.M. Kudray. 2007. Post-fire recovery of Wyoming big sagebrush shrub-steppe in central and southeast Montana. Montana Natural Heritage Program. P.O. Box 201800, Helena, MT. 59620.

Miller, R. F., and L. L. Eddleman. 2001. Spatial and temporal changes of sage grouse habitat in the sagebrush biome. Agricultural Experiment Station Technical Bulletin 151. Oregon State University, Corvallis, USA.

NatureServe. 2003. Landcover Descriptions for the Southwest Regional GAP Analysis Project. Ecological Systems: Copyright 2003 NatureServe.



**Figure 1. Distribution of four selected key sagebrush ecological systems in Nevada and fire polygons from 1999 through 2007.**



**Figure 2. Distribution of sage-grouse leks within the range of Greater sage-grouse in Nevada and the effects of wildfire from 1999 through 2007.**