

# Setting the Record Straight: A Response to “Sage-Grouse at the Crossroads”

By **J. W. Connelly, C. E. Braun, M. A. Schroeder,  
and C. A. Hagen**

*Editor's Note: The Brunner paper was submitted as an opinion paper and should have been labeled as a Viewpoint paper and does not represent the opinion of the Society for Range Management.*

**T**he status of sage-grouse (*Centrocercus* spp.) has been a concern to scientists and conservationists since the early part of the twentieth century<sup>1</sup> and significant range-wide population declines have been documented.<sup>1-3</sup> As a result, extensive research has been conducted on sage-grouse populations, behavior, and habitats<sup>1,4,5</sup> and a large body of literature now exists describing the species' biology and conservation issues. Despite this wealth of available information on sage-grouse populations and habitats, a review article by Brunner<sup>6</sup> was recently published that was replete with ambiguous or misleading information on sage-grouse population biology and habitat.

Schroeder et al.<sup>7</sup> provided a detailed critique of a recent sage-grouse issue paper<sup>8</sup> that contained much misleading information. Unfortunately, their critique was immediately followed by publication of Brunner's<sup>6</sup> article containing even more misinformation than the paper reviewed by Schroeder et al. This second paper contributed to the uncertainty associated with management of sage-grouse and added further confusion to the complex problem of sage-grouse conservation and sagebrush (*Artemisia* spp.) steppe management. Thus, the purpose of our paper is to briefly document the vast amount of information available on sage-grouse

populations and habitat needs, and then examine statements made by Brunner<sup>6</sup> to assess the validity of his report with respect to available information.

## Current Knowledge

At least eight general reviews of sage-grouse population characteristics and sagebrush habitats have been published since 1999 (Table 1). These reports provide comprehensive overviews of sage-grouse ecology, and trends in sage-grouse populations and habitats. They also contain many references, allowing readers to assess the detailed knowledge supporting these reports. Seven of the eight reports were subject to peer review.

## Brunner (2006)

Despite the vast amount of information generally available on sage-grouse (Table 1), Brunner<sup>6</sup> authored a paper entitled “Sage-grouse at the crossroads,” which contained numerous factual errors and many statements that were unsupported by scientific data. To clarify misunderstandings and minimize or eliminate confusion, we organize these statements under population and habitat subheadings and address them accordingly.

## Populations

*The Gunnison sage-grouse was listed under ESA.* In January 2000, a petition was submitted to the US Fish and Wildlife Service (USFWS) requesting Gunnison sage-grouse (*C. minimus*) be listed under the Endangered Species Act. The USFWS made a decision in April 2006 that listing this

---

This article has been peer reviewed.

**Table 1. Extensive reviews of sage-grouse and sagebrush rangeland published since 1999**

Year	Topic	Reference no.	Source
1999	Sage-grouse species account	4	Birds of North America
2000	Sage-grouse management guidelines	12	Wildlife Society Bulletin
2002	Sage-grouse ecology	30	Policy Analysis Center for Western Public Lands
2003	Sagebrush habitats	31	Condor
2004	Sage-grouse ecology/management	5	Rangeland Ecology and Management
2004	Sage-grouse populations/habitat	1	Western Assoc. of Fish and Wildlife Agencies
2005	Sagebrush habitats	27	USDA Forest Service
2005	Sage-grouse habitats	25	USDA Forest Service

species was not warranted (Federal Register 71:199953-199982). From December 2000 (Federal Register 65:82310-82312) to 2006, the Gunnison sage-grouse was officially designated as a “candidate” for federal listing, but was never listed as either threatened or endangered.

*Sage-grouse “strut” in February.* Although sage-grouse can display in late February at lower elevations with mild climates, most breeding activity occurs from mid-March to late April. At higher elevations male lek attendance can persist into late May or early June.<sup>4,9,10</sup>

*White-tailed deer eat sage-grouse eggs.* Elk (*Cervus elaphus*) have been reported eating sage-grouse eggs<sup>11</sup> but we are unaware of any reports of white-tailed deer (*Odocoileus virginianus*) eating sage-grouse eggs. Moreover, given habitat preferences of white-tailed deer, it would be unusual to find this species in sage-grouse breeding habitat.

*Only 50% of sage-grouse survive the first winter—predators and harsh weather account for 45%–48% of these birds.* Sage-grouse only feed on leaves and buds of sagebrush during winter. Despite this reasonably austere diet, winter is normally not a markedly severe time for sage-grouse. In fact, birds usually gain weight during winter and reach their peak weights in early March, at the start of the breeding season.<sup>4</sup> Sage-grouse have high annual survival rates and overwinter survival is also high, often reaching or exceeding 90%.<sup>12–14</sup> However, high winter mortality was recently documented in Montana following severe winter storms.<sup>15</sup>

*The sage-grouse’s natural reluctance to fly indicates that hawks and eagles take a heavy toll.* In addition to low overwinter mortality discussed above, sage-grouse are strong flyers and can attain speeds of at least 78 km · hr<sup>-1</sup> with single flights of 10 km or more.<sup>4</sup> Moreover, sage-grouse populations can occupy annual ranges exceeding 2,700 km<sup>2</sup> and movements between seasonal habitats can range from 8 to 34 km.<sup>1,4,16</sup> Although golden eagles (*Aquila chrysaetos*) and some hawks are common predators of sage-grouse,<sup>4</sup> the relatively high annual survival rates reported for sage-grouse<sup>1,12</sup> certainly do not support the contention that these raptors “take a heavy toll.”

*A comparison of sage-grouse on the Sheldon Antelope Range (where cattle have been outlawed) and adjacent grazed lands show the flocks are healthier on grazed ranges.* M. A. Gregg (US Fish and Wildlife Service, personal communication, 2007) conducted research on and adjacent to Sheldon National Wildlife Refuge and reported that sage-grouse numbers (i.e., lek counts) increased on Sheldon and adjacent grazed Bureau of Land Management lands. During the years of his research (2000–2004), the lek on which he trapped most of the sage-grouse used in his study occurred on Sheldon. Attendance at this lek increased from 87 to 225 males during his study. Further, grazing was not “outlawed” from the Refuge. Grazing permits were purchased at fair market value from willing sellers (M. A. Gregg, personal communication, 2007). Moreover, research at Hart Mountain National Antelope Refuge indicated that sage-grouse productivity increased following removal of livestock grazing.<sup>17</sup>

*The “natural 10-year boom-and-bust cycle” among sage-grouse.* Although evidence exists suggesting sage-grouse populations might be cyclic,<sup>18</sup> there is no published information suggesting this is a “boom and bust” phenomenon similar to that of snowshoe hares (*Lepus americanus*) and ruffed grouse (*Bonasa umbellus*). More importantly, regardless of cyclic patterns in sage-grouse populations, compelling data now exist documenting the long-term declines of both species.<sup>13</sup> From 1965 to 2003, greater sage-grouse (*Centrocercus urophasianus*) declined an average of 2% per year. Rates of change varied among areas within the range of greater sage-grouse but populations have clearly declined over the long term in at least 8 of 10 states for which data were adequate to allow analysis.<sup>1</sup> These declines likely resulted from large-scale habitat loss<sup>1</sup> and possibly low recruitment rates.<sup>2</sup>

#### Habitat

*Hens have the “best success” if they use an area where sagebrush “...is scattered, about 14–20 inches tall.”* Numerous studies show that sage-grouse nest in areas characterized by 15%–25% canopy cover of sagebrush with an average height of 40–80 cm (16–31 inches) and a healthy understory of grasses

and forbs.<sup>12,19</sup> Sagebrush in these stands would not generally be described as “scattered.” A recent study in Wyoming concluded that sage-grouse avoid nesting in sparse stands of sagebrush.<sup>11</sup>

*Recent studies show that predation and cover are not closely linked.* Research in Oregon, Wyoming, and Idaho<sup>20–23</sup> has demonstrated the importance of cover for successful nesting by sage-grouse. We are not aware of any published studies indicating there is no relationship between cover and predation of sage-grouse nests. Several studies have documented the importance of tall grasses to successful nesting attempts.<sup>19–21</sup> Numerous studies have documented sage-grouse vital rates.<sup>14</sup> In general, clutch sizes range from 7 to 9 eggs, and overall nest success is about 50%. High annual survival and generally high nest success rates suggest that predation does not pose much of a problem for this species in areas where cover is adequate.

*Chicks may be trapped in tall, coarse grass and starve.* We can not find any references in the scientific literature supporting this statement. However, the importance of herbaceous cover to nesting sage-grouse has clearly been demonstrated,<sup>12,19,21</sup> and numerous researchers have concluded that sage-grouse nest success is largely influenced by herbaceous understory.<sup>21</sup> Recent work<sup>24</sup> in Alberta indicated that chick loss declined as grass cover increased and that grass heights must exceed 35–40 cm before habitats become risky to chicks.

*Chicks must have relatively bare ground.* This observation has not been substantiated in the literature. Early brood-rearing areas occur relatively close to the nest site, an area that is characterized by a healthy herbaceous understory.<sup>19</sup> Holloran<sup>11</sup> summarized the importance of herbaceous cover in early brood-rearing habitat and noted that broods in Wyoming used areas within or near sagebrush stands averaging 20% canopy cover, and that increased productivity was positively associated with the abundance of insects and herbaceous cover.

*Grouse prefer Lahontan sagebrush during summer.* Summer habitats vary a great deal. Sage-grouse can use meadow areas, riparian zones, or farmland.<sup>12,19</sup> In all cases, however, birds seek areas rich in succulent forbs with stands of sagebrush for escape cover and roosting. The diet of sage-grouse during summer often is comprised largely of forbs and insects. Sagebrush is eaten, but in most areas low sagebrush (*A. arbuscula*), Wyoming sagebrush (*A. t. wyomingensis*), and mountain sagebrush (*A. t. vaseyana*) are consumed.<sup>4</sup> There is little published information on the importance of Lahontan sagebrush to sage-grouse during summer or any other time of year. It is a subspecies of low sagebrush and is likely eaten by sage-grouse where it occurs.

*During the winter sage-grouse eat alkali sagebrush.* Sage-grouse are a sagebrush obligate. Both species of sage-grouse depend on big sagebrush (*A. tridentata*) throughout most of their range, but within the northern and eastern edges of the range of greater sage-grouse (*C. urophasianus*) this species

depends largely on silver sagebrush (*A. cana*). Moreover, both low sagebrush and black sagebrush (*A. nova*) provide important habitat in many areas.<sup>1,12</sup> Numerous studies have documented the importance of big sagebrush and low sagebrush to wintering sage-grouse.<sup>5,12,13,25</sup> Alkali sagebrush (*A. longiloba*) is generally confined to heavy soils derived from alkaline shales and also grows on lighter limey soils.<sup>26</sup> It can be consumed by sage-grouse during winter but there is little information on its overall importance to wintering grouse.<sup>1</sup>

*Cattle manure attracts and breeds insects, and these insects in turn feed sage-grouse; where there are no cattle there are few birds.* We would not argue that cattle manure attracts and breeds insects, but are unaware of any research suggesting that insects associated with manure are important to sage-grouse. For the first 1–2 weeks of life, sage-grouse chicks depend on insects (often ants and beetles) and then switch to forbs. When chicks reach 3–6 weeks of age, the hen begins moving the brood to summer range. Both insects and forbs are quite abundant in sagebrush habitat in good ecological condition. At least 23 species of beetles and 23 species of ants are associated with big sagebrush, indicating the importance of this plant species to insects consumed by sage-grouse.<sup>27</sup> Recent research concluded that annual grazing by livestock in nesting habitat could negatively impact the following years’ nest success.<sup>21</sup> As indicated above, livestock grazing no longer occurs on Sheldon National Wildlife Refuge nor does it occur on Hart Mountain National Antelope Refuge; however, sage-grouse populations at both of these areas are growing at similar rates to those of adjacent grazed pastures (M. A. Gregg, personal communication, 2007; Oregon Department of Fish and Wildlife, unpublished data). There appears to be no published information supporting the assertion that “...where there are no cattle, there are precious few birds.”

*Empirical evidence indicates that sage-grouse follow the cattle as they are rotated between pastures.* This comment also appears to lack support in the scientific literature. The phrase “empirical evidence” suggests an experiment has taken place. If this is the author’s contention, he should have cited the source for this claim. Although positive impacts of cattle grazing on sage-grouse have been identified in the scientific literature,<sup>28</sup> no mention was made of sage-grouse following cattle. The large number of documented negative impacts of livestock grazing in sagebrush shrub steppe appears to neutralize or outweigh any positive effects.<sup>17,28</sup>

*Forbs grow only on disturbed soil.* Although disturbed areas often support stands of exotic forbs and grasses, numerous forbs are native to sagebrush-dominated areas. We can find no evidence supporting this statement (except as it relates to exotic forbs or weeds). Investigators in Idaho concluded that unlike most areas in sagebrush steppe with a long history of grazing, their study area (with much less grazing) supported an abundance of perennial grasses and a high diversity of forbs.<sup>29</sup>

## Conclusions

The Society for Range Management website characterizes the journal *Rangelands* as providing a forum for “scientifically correct” information. We argue that the paper by Brunner<sup>6</sup> contains little scientific information but is replete with opinion and unsubstantiated statements. We see nothing wrong with individuals expressing opinions in natural resource journals, as long as those papers are identified as such. However, the article by Brunner<sup>6</sup> was not identified as opinion. Thus there is a danger that information provided in this article could be viewed as “fact.” The dissemination of scientifically correct data and identification of uncertainty associated with the conservation and management of sage-grouse is very important and could be facilitated by collaborative efforts sponsored jointly by range and wildlife professionals. These efforts should be built on a foundation of good science. We suggest that *Rangelands* demonstrate its commitment to good science by formally withdrawing the paper by Brunner.<sup>6</sup>

## Literature Cited

1. CONNELLY, J. W., S. T. KNICK, M. A. SCHROEDER, and S. J. STIVER. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Cheyenne, WY: Western Association of Fish and Wildlife Agencies. Unpublished Report. 610 p.
2. CONNELLY, J. W., and C. E. BRAUN. 1997. Long-term changes in sage grouse *Centrocercus urophasianus* populations in western North America. *Wildlife Biology* 3:229–234.
3. SCHROEDER, M. A., C. L. ALDRIDGE, A. D. APA, J. R. BOHNE, C. E. BRAUN, S. D. BUNNELL, J. W. CONNELLY, P. A. DEIBERT, S. C. GARDNER, M. A. HILLIARD, G. D. KOBRIGER, S. M. McADAM, C. W. MCCARTHY, J. J. MCCARTHY, D. L. MITCHELL, E. V. RICKERSON, and S. J. STIVER. 2004. Distribution of sage-grouse in North America. *Condor* 106:363–376.
4. SCHROEDER, M. A., J. R. YOUNG, and C. E. BRAUN. 1999. Sage grouse (*Centrocercus urophasianus*). In A. Poole, and F. Gill [EDS.]. *The Birds of North America*, No. 425. Philadelphia, PA: The Birds of North America, Inc. p. 1–28.
5. CRAWFORD, J. A., R. A. OLSON, N. E. WEST, J. C. MOSLEY, M. A. SCHROEDER, T. D. WHITSON, R. F. MILLER, M. A. GREGG, and C. S. BOYD. 2004. Ecology and management of sage-grouse and sage-grouse habitat. *Journal of Range Management* 57:2–10.
6. BRUNNER, J. 2006. Sage-grouse at the crossroads. *Rangelands* 28(3):15–16.
7. SCHROEDER, M. A., J. W. CONNELLY, C. L. WAMBOLT, C. E. BRAUN, C. A. HAGEN, and M. R. FRISINA. 2006. Society for Range Management issue paper: ecology and management of sage-grouse—a reply. *Rangelands* 28:3–7.
8. SOCIETY FOR RANGE MANAGEMENT. 2005. Ecology and management of sage-grouse and sage-grouse habitat. Issue paper created by the Society of Range Management. Wheat Ridge, CO: Society for Range Management. 8 p.
9. ENG, R. L. 1963. Observations of the breeding biology of male sage grouse. *Journal of Wildlife Management* 27:841–846.
10. CONNELLY, J. W., K. P. REESE, and M. A. SCHROEDER. 2003. Monitoring of greater sage-grouse habitats and populations. Moscow, ID: Idaho Forest, University of Idaho College of Natural Resources Experiment Station, Bulletin 80. 50 p.
11. HOLLORAN, M. J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming [dissertation]. Laramie, WY: University of Wyoming. 211 p.
12. CONNELLY, J. W., M. A. SCHROEDER, A. R. SANDS, and C. E. BRAUN. 2000. Guidelines to manage sage grouse populations and their habitats. *Wildlife Society Bulletin* 28:967–985.
13. ROBERTSON, M. D. 1991. Winter ecology of migratory sage grouse and associated effects of prescribed fire in southern Idaho [thesis]. Moscow, ID: University of Idaho. 88 p.
14. WIK, P. A. 2002. Ecology of greater sage-grouse in south-central Owyhee County, Idaho [thesis]. Moscow, ID: University of Idaho. 141 p.
15. MOYNAHAN, B. J., M. S. LINDBERG, and J. W. THOMAS. In press. Factors contributing to process variance in annual survival of female greater sage-grouse in northcentral Montana. *Ecological Applications* 16:1529–1538.
16. CONNELLY, J. W., H. W. BROWERS, and R. J. GATES. 1988. Seasonal movements of sage-grouse in southeastern Idaho. *Journal of Wildlife Management* 52:116–122.
17. COGGINS, K. A. 1998. Relationship between habitat changes and productivity of sage grouse at Hart Mountain National Antelope Refuge, Oregon [thesis]. Corvallis, OR: Oregon State University. 61 p.
18. RICH, T. 1985. Sage grouse population fluctuations: evidence for a 10-year cycle. Boise, ID: Department of Interior Bureau of Land Management Technical Bulletin 85-1. 29 p.
19. HAGEN, C. A., J. W. CONNELLY, and M. A. SCHROEDER. 2007. A meta-analysis of greater sage-grouse *Centrocercus urophasianus* nesting and brood-rearing habitats. *Wildlife Biology* 13(Suppl):42–50.
20. GREGG, M. A., J. A. CRAWFORD, M. S. DRUT, and A. K. DELONG. 1994. Vegetational cover and predation of sage grouse nests in Oregon. *Journal of Wildlife Management* 58:162–166.
21. HOLLORAN, M. J., B. J. HEATH, A. G. LYON, S. J. SLATER, J. L. KUIPERS, and S. H. ANDERSON. 2005. Greater sage-grouse nesting habitat selection and success in Wyoming. *Journal of Wildlife Management* 69:638–649.
22. CONNELLY, J. W., W. L. WAKKINEN, A. D. APA, and K. P. REESE. 1991. Sage-grouse use of nest sites in southeastern Idaho. *Journal of Wildlife Management* 55:521–524.
23. DELONG, A. K., J. A. CRAWFORD, and D. C. DELONG. 1995. Relationship between vegetational structure and predation of artificial sage grouse nests. *Journal of Wildlife Management* 59:88–92.
24. Aldridge, C. L. 2005. Identifying habitats for persistence of Greater Sage-grouse (*Centrocercus urophasianus*) in Alberta, Canada [dissertation]. Edmonton, Alberta, Canada: University of Alberta. 250 p.
25. BRAUN, C. E., J. W. CONNELLY, and M. A. SCHROEDER. 2005. Seasonal habitat requirements for sage-grouse: spring, summer, fall, and winter. In N. L. Shaw, M. Pellant, and S. B. Monson [COMPS.]. Sage-grouse Habitat Restoration Symposium Proceedings. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. RMRS-P-38. p. 38–42.



26. McARTHUR, E. D. 1999. Sagebrush systematics and distribution. *In* P. G. Entwistle, A. M. DeBolt, J. H. Kaltenecker, and K. Steenhof [COMPS.]. Proceedings: Sagebrush Steppe Symposium. Boise, ID: Bureau of Land Management publication Number BLM/ID/PT-001001+1150. p. 9–14.
27. WELCH, B. L. 2005. Big sagebrush: a sea fragmented into lakes, ponds and puddles. Denver, CO: US Department of Agriculture, Forest Service General Technical Report RMRS-GTR-144. 210 p.
28. BECK, J. L., and D. L. MITCHELL. 2000. Influences of livestock grazing on sage grouse habitat. *Wildlife Society Bulletin* 28:993–1002.
29. ANDERSON, J. E., K. T. RUPPEL, J. M. GLENNON, K. E. HOLTE, and R. C. ROPE. 1996. Plant communities, ethnobotany, and flora of the Idaho National Engineering Laboratory. Idaho Falls, ID: Environmental Science and Research Foundation ESRF-005. 111 p.
30. WAMBOLT, C. L., A. J. HARP, B. L. WELCH, N. SHAW, J. W. CONNELLY, K. P. REESE, C. E. BRAUN, D. A. KLEBENOW, E. D. McARTHUR, J. G. THOMPSON, L. A. TORELL, and J. A. TANAKA. 2002. Conservation of greater sage-grouse on public lands in the western U.S.: implications of recovery and management policies. Caldwell, ID: Policy Analysis Center for Western Public Lands. Policy Paper SG-02-02. 41 p.
31. KNICK, S. T., D. S. DOBKIN, J. T. ROTENBERRY, M. A. SCHROEDER, W. M. VANDER HAEGEN, and C. VAN RIPER III. 2003. Teetering on the edge or too late: conservation and research issues for avifauna of sagebrush habitats. *Condor* 105:611–634.

---

*Authors are Principal Wildlife Research Biologist, Idaho Department of Fish and Game, Department of Biological Sciences, Idaho State University, Pocatello, ID 83209, jcsagegrouse@aol.com (Connelly); Director, Grouse, Inc., 5572 North Ventana Vista Road, Tucson, AZ 85750 (Braun); Research Scientist, Washington Department of Fish and Wildlife, PO Box 1077, Bridgeport, WA 98813 (Schroeder); and Sage-Grouse Coordinator, Oregon Department of Fish and Wildlife, 61374 Parrell Road, Bend, OR 97702 (Hagen).*