

Potential disturbances in relation to greater sage-grouse lek persistence in the Big Horn Basin

Jennifer Hess
Graduate student

Jeffrey Beck
Assistant Professor
Department of Renewable Resources

Greater sage-grouse (*Centrocercus urophasianus*) is a species of concern across the West. Populations have been declining throughout its range in response to habitat loss and fragmentation.

These disturbances to sagebrush (*Artemisia* spp.) communities are largely related to wildfires, agricultural development, urbanization, invasion of exotic species, and intensive burning programs. The quality of sage-grouse nesting and early brood rearing habitats have the greatest impact on sage-grouse populations by influencing nest success and juvenile survival.

The route to my research started when I began working with the University of Montana with greater sage-grouse in northeastern Wyoming's Powder River Basin in 2003. I immediately fell in love with the Big Horn Mountains, which are home to blue and ruffed grouse, and I also became fascinated with sage-grouse, which occupy the sagebrush-covered lowlands. I was introduced to rocket-fired nets and spotlighting during the capture seasons. I had left a job in Minnesota working

with wolves, deer, and lynx – I thought trapping deer in Minnesota was exciting, but then I was in charge of rocket-net crews and found out how adrenaline really worked! Just imagine waiting at a lek (a sage-grouse breeding area) with a rocket-net set ready to fire. The grouse start appearing at about 4:30 a.m. You begin seeing more and more birds as they start moving toward the net. Before you know it, you're given a signal to fire. The rockets fire, the net shoots, birds are jumping, and you start running from your vehicle carrying blankets to lay over the captured birds to calm them down. You then start removing grouse from the net and begin the processing (weighing birds, applying radio collars, and collecting feather samples).

I began looking for a master's project, and I contacted Assistant Professor Jeff Beck in the College of Agriculture's Department of Renewable Resources. Beck had been funded to initiate a project to evaluate sage-grouse habitat enhancement treatments in the Big Horn Basin in north-central Wyoming (Figure 1, page 50). After initiating my master's fieldwork to evaluate these treatments, we began brainstorming how various sagebrush treatments that have been implemented to enhance sagebrush might possibly affect lek attendance in the Big Horn Basin. Even though these treatments are meant



to improve grouse habitats, could the treatments themselves be affecting the attendance of male sage-grouse on leks during the breeding season?

My project, started in May 2008, focuses on looking at Bureau of Land Management (BLM) treatments (prescribed fire and mechanical mowing) on sagebrush in relation to sage-grouse habitat in the Big Horn Basin. Finding out how habitat management is working and what portions of the management needs improvement is essential in effectively promoting future populations of grouse, among other species.

Impacts of Disturbances on Lek Persistence

Many studies have shown sage-grouse avoid agricultural developments. Attendance of males at breeding grounds has also been shown to decline in relation to increased expansion of cultivated fields. Hens with chicks tend to avoid areas close to cultivated cropland or urbanized developments.

Road development is normally associated with human activity, fragmenting sagebrush communities and sage-grouse habitats. Increased human activity can lead to higher frequencies of wildfire, which can lead to large habitat losses for sage-grouse. Roads have been found to accelerate the dispersal of exotic plant species, thereby lowering production of native plant species selected by sage-grouse for food and cover.

The BLM, working with the Wyoming Game and Fish Department (WGFD), private landowners, and others, is using fire in the Big Horn Basin to improve habitat for sage-grouse and other wildlife. These fires are in old, decadent stands of sagebrush and areas with juniper. Although fires may increase grass or forb production, big

sagebrush (*A. tridentata*) recovery to preburn status is long (25-100 years). Burning may also increase the establishment of invasive plant species such as cheatgrass (*Bromus tectorum*). Cheatgrass competes with native grasses for soil and water following fire and depletes it faster than areas without cheatgrass. Fire frequency increases with cheatgrass invasion and causes substantial competition with native shrub-steppe species. Although short-term improvements of forb and grass production following fire in mountain big sagebrush (*A. t. vaseyana*) have been documented, this outcome has limited temporal benefit for sage-grouse inhabiting these communities. Consequently, burning Wyoming big sagebrush (*A. t. wyomingensis*) can be detrimental to sagebrush obligate species such as sage-grouse (Baker 2006 and Beck et al. accepted). Wyoming and mountain big sagebrush are both found throughout the Big Horn Basin.

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Photo 1. Greater sage-grouse lek with males displaying and females examining potential mates.

Photo by Andy Lindstrand



Figure 1. Map of the Big Horn Basin region in north-central Wyoming. Map modified from Wyoming Geographic Information Science Center.

Mechanical treatments, such as mowing, are seen as possible alternatives for sagebrush enhancement techniques to lower dense stands of sagebrush and allow for other native plants to establish and flourish. The effects of mowing may be less detrimental than prescribed fire, because mowing does not kill all sagebrush plants and allows for quicker recovery than prescribed fire.

Breeding Grounds are ‘Leks’

Sage-grouse breed on areas called “leks,” which are open, flat areas that have low sagebrush cover (Photo 1); for instance, prairie dog (*Cynomys* spp) colonies are commonly selected by grouse for lekking grounds. These open areas make it possible for grouse attending leks to easily observe one another and to detect predators. Males display and compete for female attention during the spring of each year on these lekking grounds. Females arrive, choose a dominant male and eventually mate. Enumerating the numbers of males on leks is the most common way to monitor trends in sage-grouse populations.

By comparing lek occupancy to long-term changes in the landscape, one can effectively identify patterns in lek persistence.

Detecting the disappearance of active leks is an efficient way to determine large declines in populations. There are 286 known leks in the Big Horn Basin, which allows for thorough investigation of what is potentially influencing lek attendance. By evaluating sagebrush community disturbances at a landscape scale, we can assess how these variables may impact lek persistence. Our project does not examine lek counts due to the likelihood of high observer error inherent in the probability of detection when surveying leks. We examined, however, leks that are occupied or unoccupied in the Big Horn Basin.

By using WGFD descriptions, we categorized leks in the Big Horn Basin as either occupied or unoccupied (Figure 2). Unoccupied means males are no longer attending the lek. We summarized the area of each disturbance factor: agricultural development, road development, wildfire, and treatment (prescribed burn or

mowed) around each lek (5-kilometer buffer) in the basin. Our 5-kilometer buffer shows the typical distance a nesting female travels from her breeding ground to her nesting site. We also summarized the area of sagebrush cover around each lek. These summarizations provided us data to identify habitat characteristics that may be leading to the decline in occupied leks in the Big Horn Basin.

After thorough investigation and removal of leks with missing data, we retained 177 (62 percent of total leks in the basin) to examine. The criteria we used to identify leks unsuitable for our analysis include (1) leks where only one survey was conducted for a decade, (2) leks with missing data extending beyond one decade, and (3) leks where only one survey was conducted in a decade, which resulted in designating the lek unoccupied. Of the 177, we identified 146 occupied leks (82 percent) and 31 unoccupied leks (18 percent).

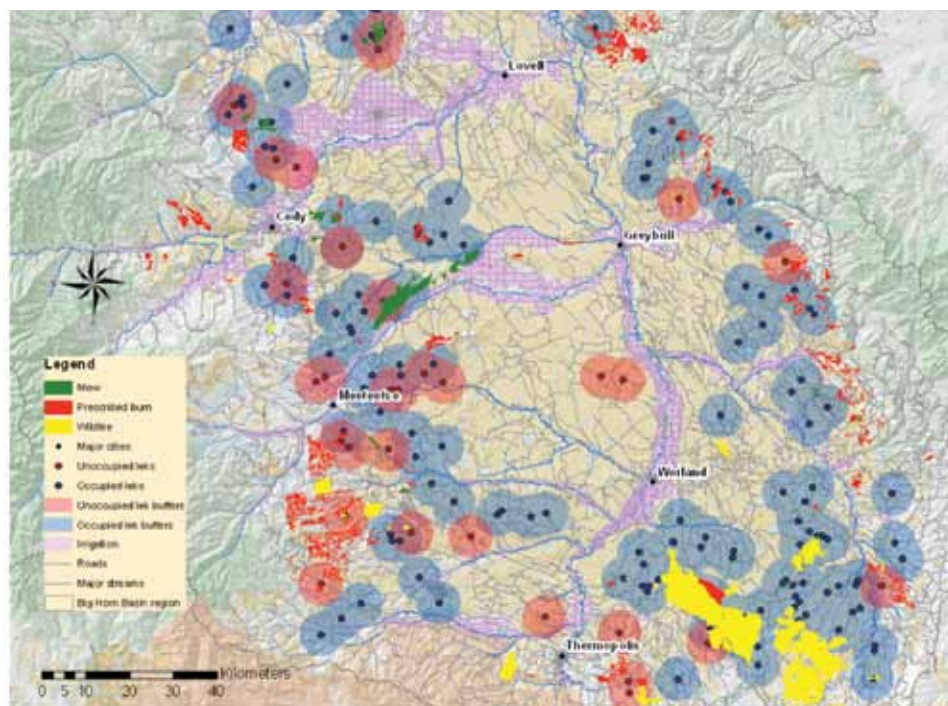


Figure 2. Map of Big Horn Basin, Wyoming, showing 177 leks (31 unoccupied and 146 occupied) with treatments, wildfires, roads, and agricultural development. Layers obtained from Cody Bureau of Land Management Field Office and Wyoming Geographic Information Science Center. Map created by Jennifer Hess.



Male sage-grouse displaying on a lek.

Road Development Impact

Our study indicated road development has had the most influence on lek occupancy in the Big Horn Basin (Figure 3). We are not certain whether newly developed or existing roads have had the greatest influence on lek persistence. A detailed time scale of disturbance is needed to understand when and where the greatest disturbances have occurred. We also intend to create models that consider other factors of disturbance such as energy and housing developments.

The western region of the Big Horn Basin – areas around Cody, Meeteetse, and Thermopolis – has been affected by oil development since the 1920s. This region is also where lek abandonment has increased, according to the WGF D lek database. We would like to examine whether this disturbance has led to an increase in anthropogenic disturbances leading to a decline in occupied leks in the Big Horn Basin.

More work will be completed in the following year as additional coverages are acquired to match our temporal scales of interest. Updated sagebrush coverage layers through Geographic

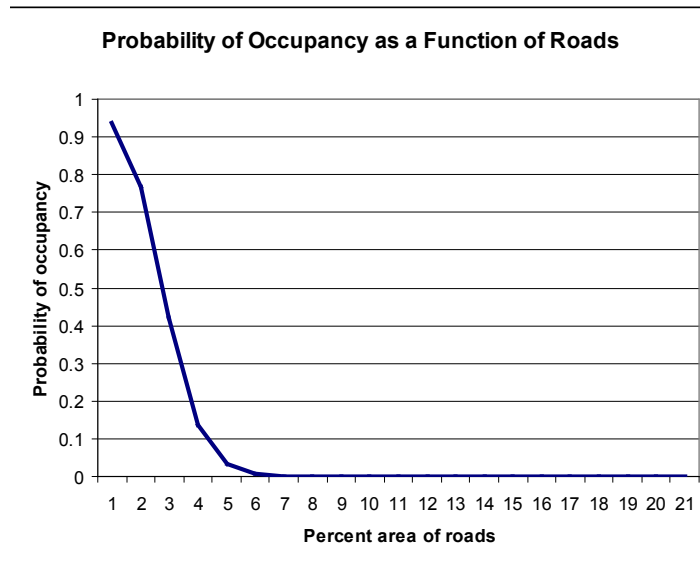


Figure 3. The probability of lek occupancy as a function of roads in the Big Horn Basin, Wyoming, during the last 26 years (1980-2006).

Information Systems will be available this year through the Wyoming Geographic Information Science Center. Oil and gas well information will be acquired through the Wyoming Oil and Gas Conservation Commission Web site (<http://wogcc.state.wy.us>). With further investigation, we intend to pinpoint major influences concerning road development over time as well as more closely examine the rate in which leks are abandoned.

Our model can be used to identify leks in the Big Horn Basin that have

been persistently used by breeding sage-grouse. We can also use these results to help managers decide what areas of the region should not be altered in relation to suitable lekking grounds for sage-grouse. *zm*

To contact:

Jennifer Hess can be reached at (612) 710-8801 or jhess5@uwyo.edu.

Jeffrey Beck can be reached at (307) 766-6683 or jlbeck@uwyo.edu.