Greater Sage-grouse Fence Marking Project 2010
Internal BLM Report

Katherine E. Fink and Jessica L. Watkins

Chicago Botanic Garden Conservation and Land Management Interns, Bureau of Land Management, Rock Springs Field Office, Rock Springs, Wyoming
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1. Introduction

The Greater Sage-grouse (*Centrocercus urophasianus*) have anecdotally been documented to collide with rangeland fences resulting in injuries and mortality. Initial efforts by the Wyoming Game and Fish Department and Utah's Hogel Zoo documented significant sage-grouse strikes on several fences northwest of Farson, Wyoming (Christensen 2009). Furthermore, during a pilot study in 2009, the Rock Springs Bureau of Land Management (BLM) Field Office documented on average 4.4 sage-grouse strikes per mile on over 33 miles of fence (Ellis 2009). Both of these studies have adopted a marking technique (Wolfe et al 2009) that utilize vinyl trim siding to increase the visibility of the fence, thereby reducing the likelihood for sage-grouse to strike the fence. Initially, this marking technique has been shown to reduce sage-grouse mortality by 61 percent.

The purpose of the 2010 fence marking study was to analyze the effectiveness of the markers already in place from the 2009 study and determine if high-visibility reflective tape is a cost-effective method to decrease strikes. New fences to be marked were targeted in close proximity to areas of high sage-grouse population and areas of high concern, such as spring lek sites and wintering grounds. This study was also used to identify characteristics associated with rangeland fences that cause increased mortalities and prioritize those fences that need marking or additional markers.

2. Methodology

Data was collected within the Rock Springs Field Office from June 2010 through November 2010. The previously marked 33 miles of fence from 2009 were re-visited with documentation of new strikes and mortalities. All evidence of strikes and mortalities were removed (unless otherwise noted) to avoid confusion for future observation. Fence characteristics at these locations were also documented to see if the fence was modified. Following last year's study, data was collected on foot to ensure accuracy of the data. The location of each strike and mortality was collected using a Trimble Juno series GPS unit. The 2010 data was compiled with the 2009 results and analyzed for other factors that may contribute to sage-grouse mortalities due to rangeland fence collisions.

Previously marked fences had 2-3 white vinyl markers on the top wire along each section of the fence. For the 2010 study, additional markers were placed on fences that were determined to be high priority due to the number of strikes and mortalities documented for this second year of study. Typically, one marker was added to the top wire and two new markers were added on the second wire from the top. This method of marking the fence to maximize

visibility for the sage-grouse was based on a study completed by the Sutton Avian Research Center in Oklahoma (see Figure 1 below).

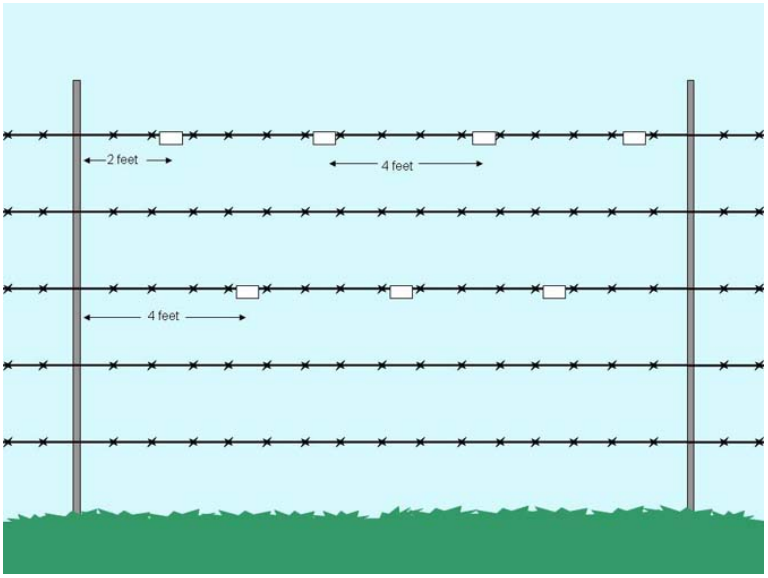

Figure 1. Schematic of fence marker placement suggested by the Sutton Avian Research Center.

Reflective tape was also added to the markers along fences that were still documented with high mortalities in the 2010 study to increase the visibility of the markers in snow cover conditions. These fences were selected based on close proximity (within 1 mile) to sage-grouse wintering grounds. All new fences that were checked and marked were selected based on a 1 mile buffer around spring lek sites and winter sightings of sage-grouse.

Data for this year's fence study was collected in a similar manner as last year's fence marking project, but with the addition of another biologist. All collected strike data was imported into ArcGIS for analysis. Strikes were categorized by species and noted as a "strike" or "mortality". A strike was considered to be any collection of feathers or hair found on or immediately surrounding a fence. If identifiable bones were found a strike was considered a mortality. For the purposes of this study, the majority of analysis was focused on sage-grouse collisions; however, data was also collected for other animal species where collisions were identifiable (Ellis 2009). Information about the location of each fence in relation to known sage-grouse habitat, the physical construction of the fence, and animal strike data from 2009 and 2010 was gathered and analyzed to investigate reasons for fences to have a greater variance in the number of sage-grouse strikes.

3. Results and Discussion

During the 2010 study, a total of 337,506 feet (63.9 miles) of fence within the RSFO was monitored for sage-grouse strikes. 175,706 feet (33.3 miles) with the exception of the 17, 927 feet (3.40 miles) of electric wire fence was marked with white vinyl markers from the 2009 season. This season, 157,742 feet (29.9 miles) of fence in other locations were marked. These fences were selected based on a 1 mile buffer around active lek sites and wintering grounds. Upon analysis of data, high sage-grouse mortalities were found along fences within close proximity to wintering grounds. In the efforts to increase the visibility of fence wires in

snow cover conditions, reflective tape was added to markers on several of the fences previously placed with white markers if they were within 1 mile of a sage-grouse wintering location.

The total cost of fence marking materials from the 2010 study was approximately $5,991.02 not including transportation or labor. The cost of 635 by 12.5 foot long vinyl siding strips totaled $2,991.20 ($4.72 each). This material was able to create 31,750 markers to cover roughly 10,583 sections of fence (based on 15 foot sections) and 30 miles of fence. The cost of the 39 rolls of reflective tape, a tape slitter, and extra blades purchased totaled $2,993.82 ($75.00 per roll). The reflective tape was able to cover 23,400 markers. The reflective tape chosen for this project was a reflexite fluorescent orange colored high-intensity conspicuity tape ordered from Identi-Tape Inc. The tape was chosen based on previous fence collision studies, brightness, and weatherproofing abilities.

In total, there were thirty-seven fences monitored for strikes and mortalities during the 2010 study (Table 1). Information regarding strike species, mortality species, location of strike, and fence characteristics were documented and used for analysis. Twenty-five of the thirty-seven fences monitored this year were marked during the 2009 study (Table 2). Additional markers were added to four of the twenty-five originally marked fences due to the high number of recorded strikes and mortalities found during the 2010 fence check. This year, thirteen new fences were identified as potentially problematic to sage-grouse. The selectivity of these fences was based on a location within 1 mile of an active lek or wintering grounds and the relative winter population size.

Eleven of the twenty-five original fences from 2009, a distance of 85,346 feet (16.2 miles), had recorded sage-grouse strikes, while the other fifteen, a distance of 90, 360 feet (17.1 miles), had zero sage-grouse strikes. In this year's study, there were a total of 73 sage-grouse strikes across all 33 miles of previously marked fence, 58 of which were confirmed mortalities. This is a vast difference from the 2009 study in which there were a total of 147 strikes across the same distance of fence, with 64 confirmed mortalities. This season, data showed an average of 2.2 sage-grouse strikes per mile and 1.7 sage-grouse mortalities per mile. Last season, these numbers were at 4.4 sage-grouse strikes and 1.9 sage-grouse mortalities per mile. This information comparing the 2009 and 2010 strike total data as well as the total fence strikes and the mortality rates by species for the 37 fences monitored in 2010 can be found in the tables below (Table 3 and Table 4).

Table 3. Comparison between the 2009 and 2010 total fence strikes and mortality rates by species or category.

	Total Strikes		**Number of Confirmed Mortalities**		**Minimum Mortality Rate**	
Sage-grouse	147	**73**	64	**58**	44%	**79%**
Big Game	15	**77**	5	**69**	33%	**90%**
Other Bird Species	11	**76**	9	**67**	82%	**88%**

BOLD = 2010 Data Collection

Table 4. Total fence strikes found and mortality rates by species or category during the 2010 study.

	Total Strikes	Number of Confirmed Mortalities	Minimum Mortality Rate
Sage-grouse	235	192	82%
Big Game	126*	120*	95%
Other Bird Species	84	72*	86%

*Strike and mortality data for big game and other bird species was not taken for the first fence checked by the Hogle Zoo.

Twenty-three of the thirty-seven fences in the 2010 fence marking study, a distance of 247,149 feet (46.8 miles) had recorded sage-grouse strikes, while the other fourteen, a distance of 90,357 feet (17.1), had zero sage-grouse strikes. With a total of 235 sage-grouse strikes and 192 mortalities, there was an average of 3.7 sage-grouse strikes and 3.0 sage-grouse mortalities per mile documented for the 2010 study. Considering only sage-grouse fence strikes, there were only six fences whose strike per mile value was above the study average of 3.7 strikes per mile. These six fences were determined to be the most problematic to sage-grouse out of those studied and appear in red on Table 5.

To maintain consistency of data analysis, the five problematic characteristics that were used in Ellis' 2009 study were also used for the 2010 study. These characteristics were considered to be possible reasons for the high number of sage-grouse strikes based on established sage-grouse habitat and life history data. These characteristics include: fences located within 6/10 of a mile from an active lek, within a sage-grouse core area, under 2 miles from a sage-grouse winter location, close proximity to a continuous water supply, and the height of top fence wire being above BLM range fence standards (38 inches maximum height to meet multiple-use needs for combination of cattle, deer, and antelope) (Ellis 2009). Of the six most problematic fences, two fit all five characteristics, three fences fit four characteristics, and only one fit three characteristics. The lesser problematic fences (>3.7 strikes per mile) had greater variation in the number of characteristics they displayed. These ranged from one characteristic out of five to four characteristics out of five (Table 5). Similarly, the 2009 study had a similar trend with variation and the lesser problematic fences. The top two problematic fences, which accounted for 96 of the 235 sage-grouse strikes, had four of the five characteristics and the next two problematic fences displayed all five characteristics (Table 5).

4. Conclusion

During the 2010 fence marking study, it was found that the five characteristics established in the 2009 study lead to greater sage-grouse strikes and mortalities. Although they are not the only factors leading to greater sage-grouse strikes, they are accurate predictions for beginning to understand the actions that need to be taken to resolve the issue. Some additional confounding factors that were observed during the 2010 study included the differences in fence construction and the placement of fences in relation to the terrain of the land. Many of

the sage-grouse strikes were found in flatter terrain and along fences with a top wire above the BLM standard height of 38 inches.

The timing in which the fences are monitored is also important in obtaining accurate data. Fences within close proximity of a spring lek site or wintering ground should be checked late spring or as early as possible. Otherwise, strike evidence is often scavenged and destroyed before the fence has even been checked thus resulting in inaccurate data. For example, the first fence checked in the 2010 study by the Hogle Zoo in mid-April had an astounding 78 strikes and 63.4 sage-grouse strikes per mile which is 60 more strikes and 46.3 strikes per mile more than any of the other fences monitored later in the year.

During this study, fence marking was proven to be effective in reducing the number of mortalities along rangeland fences. There was a decrease of 74 sage-grouse strikes and a difference of only 6 mortalities from the fences that were marked in 2009 to the data collected this year. However, there was a large increase in the number of big game and other bird species (Table 3). These variations in numbers may exist due to the change in people monitoring the fences. A few tips and guideline for bone identification and checking fences has been created to decrease these discrepancies (Appendix A).

The thirty-seven fences monitored during this study are only a fraction of the miles of fence that exist within the Rock Springs Field Office boundary. There is an estimate of 2,130 total miles of fence line within the field office, only 64 of which were monitored and 63.5 marked. This amounts to only 3 percent of the total length of fence used in this study. While it is important to point out that the fences chosen for this project were chosen for their proximity to sage-grouse habitat and do not likely act as a good representation of all fences in the area, the result that an average of 3.7 sage-grouse strikes per mile found is a good indication that this project should be continued in the future. This number is significantly less than the 2009 study given the total length of fence monitored, however, it is still relatively high.

An important factor that was used in the selection of the new fences marked in the 2010 study was winter location population size (currently, the Rock Springs BLM office does not have recent population data for the leks). For example, compare a 1 mile long fence with a sage-grouse wintering population of more than 300 and 98 strikes along the fence to a 1 mile fence with a lek population of only 25 and only 2 strikes. A lot of information can be revealed from a comparative analysis with population size. Sage-grouse lek populations are often much smaller than winter populations. Winter populations can reach up to and over 1,000 sage-grouse. (Chindgren 2007)

On-going and future efforts should be made in identifying the best method of increasing the visibility of the fence wires. Anecdotally, the same fence markers that were used in the Rock Springs BLM fence marking study have been proven effective in many other studies; however, are these markers really the best method? In some instances, depending on the cloud coverage, lighting, and angle in which one is facing the fence, the markers can seem invisible or non-existent from less than forty feet from the fence. On a few fences that Steve Chindgren, an independent researcher, marked with soda pop cans, it was found that the cans

were visible from much farther away in comparison to the reflective vinyl markers. The downfall, however, is that the cans weather much more quickly and are visually obtrusive.

The results of this study highlight the dangers sage-grouse as well as other bird and big game species face when coming into contact with rangeland fences. This is not to say that every fence that exists in these types of habitats is a problem, but that the most problematic fences also tended to be those with the highest number of sage-grouse habitat characteristics. Future actions should be explored regarding fence design, specifications, and fence construction locations as they relate to proximity to known sage grouse core areas (Ellis 2009). An important lesson that should be taken from this study is how much more research still needs to be completed on fence collisions and their association to sage-grouse habitats and population size.

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References
Chindgren, Steve. 2007. It's Just Sage-Brush: The Life History of the Greater Sage-Grouse.

Christiansen, T. 2009. Fence marking to reduce greater sage-grouse (*Centrocercus urophasianus*) collisions and mortality near Farson, Wyoming – Summary of interim results. Wyoming Game and Fish Department.

Wolfe, D.H., M.A. Patten, and S.K. Sherrod. 2009. Reducing grouse collision mortality by marking fences (Oklahoma). *Ecological Restoration*. **27:2**:141-143.

Ellis, K. 2009. Sage-grouse fence marking project 2009. Internal BLM report for the Rock Springs Field Office.