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Rangeland Management Practices Used to Increase Usable Habitat Space: A Case Study with Greater Sage-Grouse

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Key words: Sagebrush, Forb and Grass Response, Shrub Canopy, Spike, Dixie Harrow, Lawson Aerator

Abstract

Greater sage-grouse (*Centrocercus urophasianus*) need forbs, and the associated insects, for chick diet and growth in sagebrush habitat. In some cases, sagebrush cover may limit the abundance of forbs in the understory. Sage-grouse require sagebrush and large-scale shrub treatments are detrimental to sage-grouse populations. We implemented small (40.5 ha) shrub-management treatments of Dixie Harrow, Lawson Aerator, and Tebuthiuron (Spike) in a replicated plot design with control and monitored the response of herbaceous cover and grouse. We found that spike treatments demonstrated the strongest forb response, especially forbs that are known to be consumed by sage-grouse, and greater grouse use. This long-term response of forbs and grouse shows that small-scale shrub management may provide rangeland managers with methods to improving sage-grouse brooding habitat when needed.

Introduction

Greater sage-grouse (*Centrocercus urophasianus*; hereinafter sage-grouse) depend upon sagebrush-dominated rangelands throughout western North America (Connelly et al. 2000). Sage-grouse populations have been experiencing declines due to loss or degradation of sagebrush (*Artemesia* spp.) communities (Braun 1998, Schroeder et al. 2004). Additionally, in some big sagebrush (*A. tridentata*) communities shrub canopy cover has increased and can limit herbaceous understory cover and diversity, which may negatively impact sage-grouse brooding habitat. For brood-rearing habitat, sage-grouse prefer more open shrub canopy cover (~15% cover) with plentiful grasses and forbs, which typically provide arthropods - an important component of chicks' diet - and an indication of high-quality brood-rearing habitat (Connelly et al. 2000).

The scale of habitat management is critical to predicting whether an action would be positive, negative or neutral. Sage-grouse are a landscape species, dependent on large expanses (i.e., thousands of km^2) of sagebrush-dominated rangelands (Connelly et al. 2000). However, more information is needed regarding the appropriate management techniques and scale of management activity within these areas to improve specific seasonal habitats, such as brooding areas, for sage-grouse. Within the context of a large intact sagebrush landscape, small-scale habitat manipulations may provide an effective rangeland management tool for improving herbaceous cover and associated arthropod resources, while not adding large-scale fragmentation that is known to be detrimental to sage-grouse.

Our objectives were to assess the vegetation and sage-grouse response to small-scale sagebrush canopy reduction treatments in mountain big sagebrush communities (*A. t. vaseyana*) in a replicated (i.e., n=4) and controlled design. We predicted that treated areas would exhibit improved brooding habitat conditions and sage-grouse would select for treated areas more than controls.

Methods

Study Area

Our study occurred on Parker Mountain, south-central Utah, USA. Parker Mountain is a 120,000-ha high elevation (~ 2500 – 3000 m) plateau dominated by sagebrush, with Wyoming big sagebrush (*A. t. wyomingensis*) at lower elevation, black sagebrush (*A. nova*) at mid-elevation, and mountain big sagebrush at higher elevation (Dahlgren et al. 2006). The study area has one of the largest and relatively stable populations of sage-grouse in Utah. There is relatively little to no development on Parker Mountain, except for some graded gravel and two-track roads. The study area typically receives 400-500 mm of precipitation annually, primarily in the form of winter snow and late-summer monsoons.

Shrub Removal Treatments

In 2000 and 2001, we implemented small-scale (n = 16, 40.5-ha square plots) shrub canopy reduction treatments with three methods – mechanical treatments of Dixie Harrow and Lawson Aerator, a chemical treatment of Tebuthiuron (i.e., Spike), and control plots (Figure 1). The Dixie harrow is dragged behind a large tractor and has connected pipes with alternating harrows that rip up sagebrush and scarify the bare soil when dragged in two opposing directions (i.e., double harrow treatment). The Lawson aerator is a large drum aerator dragged behind a tractor that crushes larger, woodier sagebrush without impacting the soil. The 40.5-ha plots were square and delineated to contain as much mountain big sagebrush cover as possible, but each plot also contained areas of black sagebrush. Only mountain big sagebrush was treated. Mechanical treatments were completed in a mosaic design to leave some intact big sagebrush adjacent to treated areas (Figure 2). Spiked plots received 0.75 lbs. per ha active ingredient resulting in a mosaic of varying levels of defoliation and kill to the mountain big sagebrush due to varying soil depths and other conditions within the plots.

Vegetation and Grouse Monitoring

From 2001 to 2009, we sampled n = 5 randomly placed permanent 20-m vegetation transects in each plot and measured shrub and herbaceous canopy cover using a variation of the line intercept method (Canfield 1941) and Daubenmire frames (Daubenmire 1959) centered on every meter, respectively. We recorded genus and species, when known, of shrubs, forbs, and grasses. To evaluate sage-grouse use of plots, we used trained pointing dogs to locate, point, and flush grouse using the plots from mid-July to the end of August (Dahlgren et al. 2006). A handler would cast the dog through the plots to search the entire plot. Each plot was sampled at least twice per field season.

Results

Sagebrush canopy cover was relatively high (~ 40%) in our plots pre-treatment (Figure 3). All treatments reduced sagebrush cover and increased grasses and forbs the first couple years post-treatment. However, spiked plots showed the strongest long-term herbaceous response to treatment (Figure 4). When we separated forb species into those known (i.e., reported in the published literature) to be consumed by sage-grouse we found the strongest long-term treatment response. Sage-grouse responded positively to all treatment plots, with more use (grouse flushed per plot) compared to control plots. However, grouse had nearly double the flush rate in spiked plots when conducting pointing dog surveys than the mechanical treatments (Figure 5).

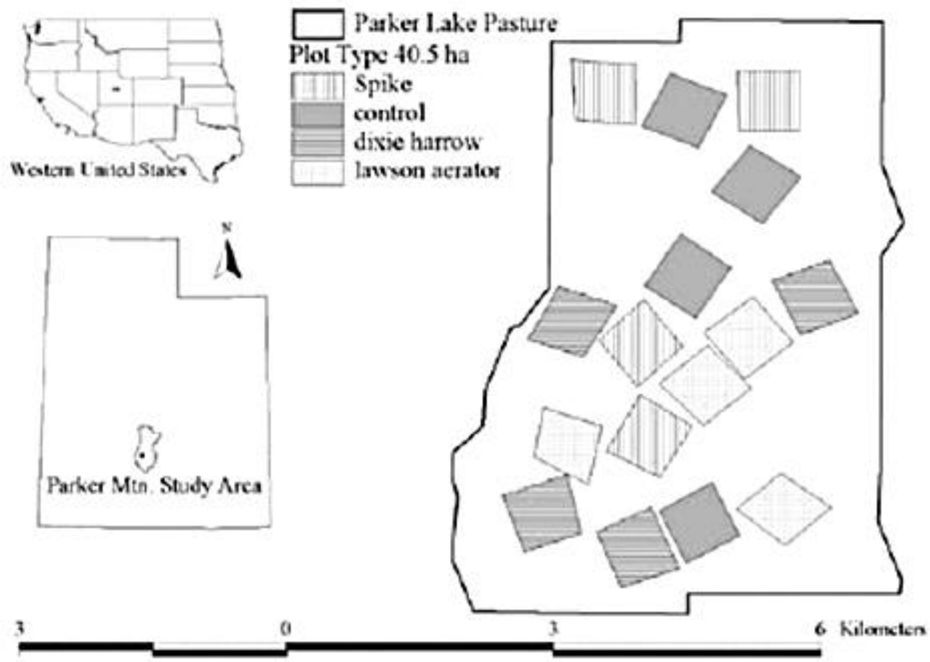

Figure 1. Parker Lake Pasture study design, Parker Mountain, Utah, USA.

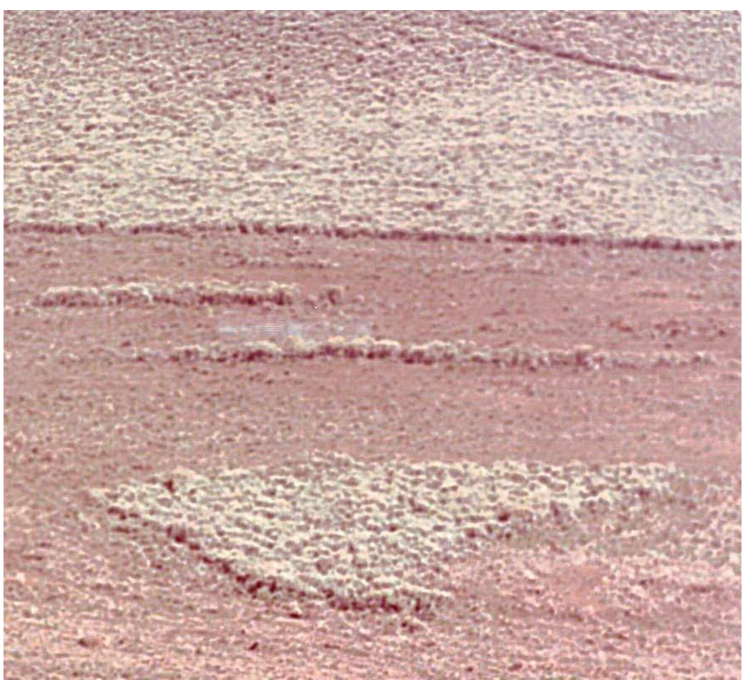

Figure 2. Example of a mosaic design shortly after the Dixie Harrow treatment was implemented, Parker Mountain, Utah, USA, 2002.

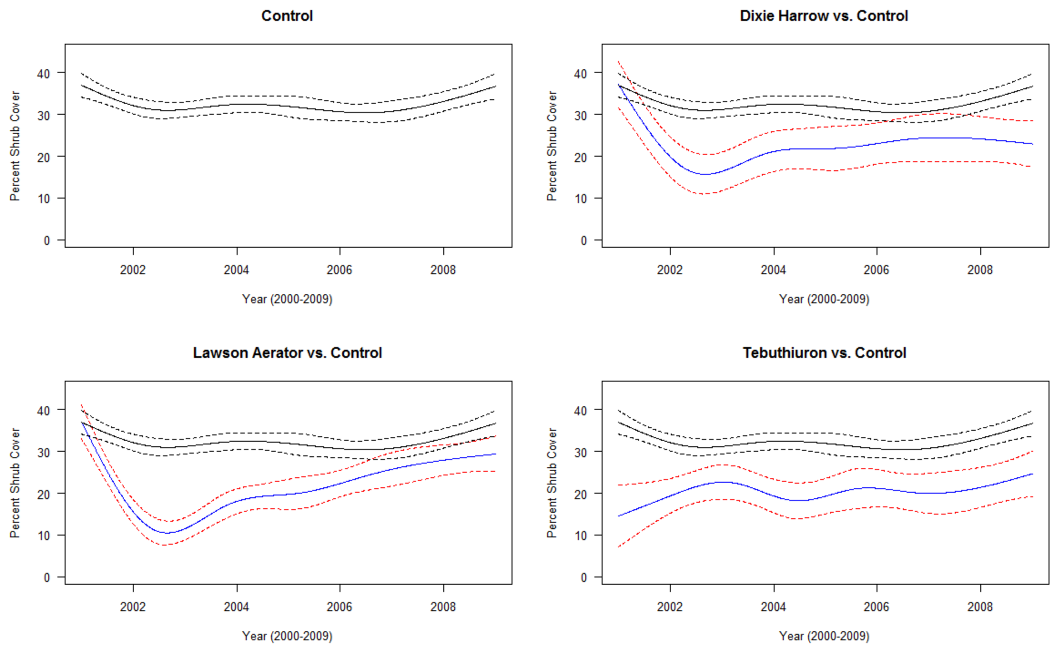

Figure 3. Response of shrub cover to treatments of Tebuthiuron, Dixie Harrow, and Lawson Aerator, mean percent canopy cover and 95% confidence intervals, Parker Mountain, Utah, USA, 2000-2009.

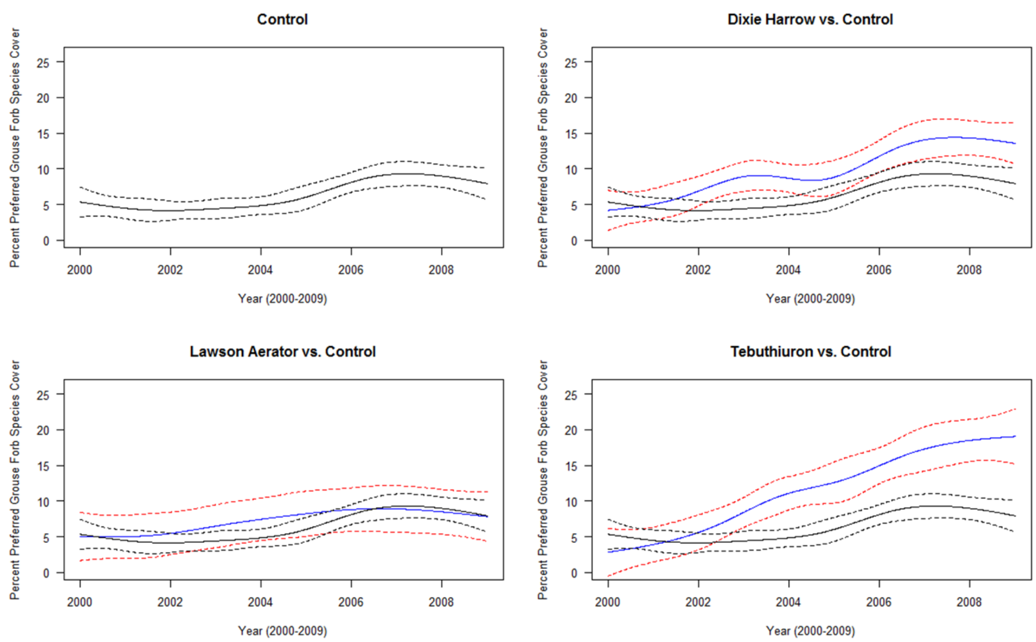

Figure 4. Percent canopy cover of perennial gras and forbs, mean percent canopy cover and 95% confidence intervals, Parker Mountain, Utah, USA, 2000-2009.

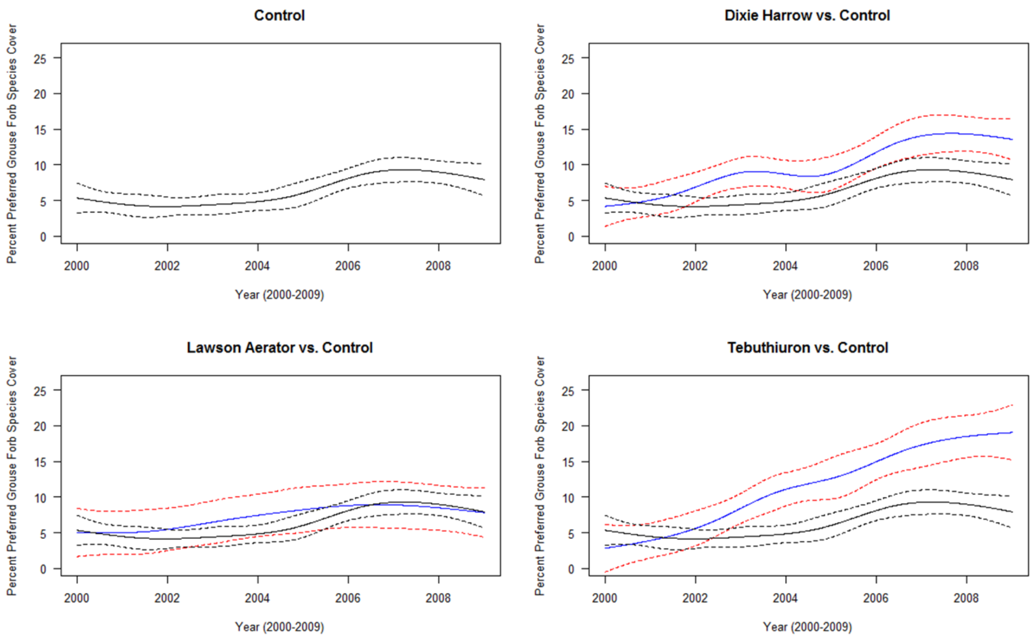

Figure 5. Response of forbs consumed by sage-grouse (in published literature) to sagebrush canopy cover treatments, mean percent canopy cover and 95% confidence intervals, Parker Mountain, Utah, USA, 2000-2009.

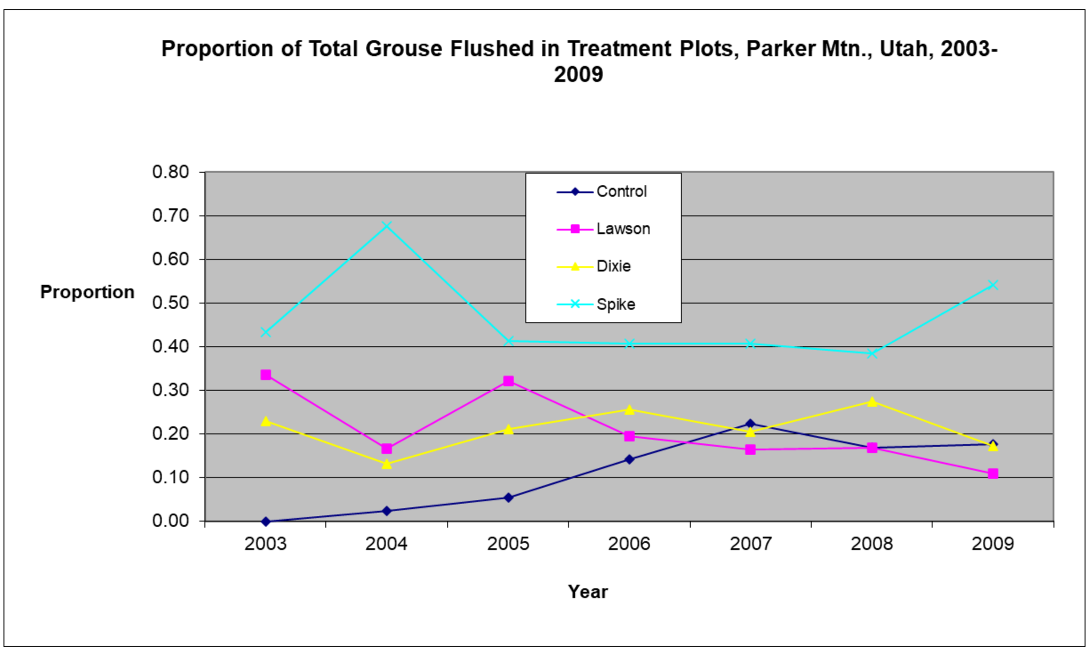

Figure 6. Response of sage-grouse to sagebrush canopy reduction treatments using pointing dog surveys, Parker Mountain, Utah, USA, 2003-2009.

Conclusions and Implications

All treatment types reduced shrub canopy cover and mechanical treatments showed a small herbaceous response for the first few years post-management. Spike treatments demonstrated a long-term increase in herbaceous cover, especially forbs that sage-grouse eat. Sage-grouse use, especially broods, was correlated with the strong forb response in spiked plots. Spike plots also demonstrated a longer recovery period for sagebrush canopy cover, likely associated with the long-term increase in herbaceous cover. The Dixie harrow and Lawson aerator plots initially showed a significant decrease in shrub canopy cover, but they also returned to pre-treatment shrub canopy cover levels within our 10-year study period.

Spatial and temporal scales are critical to consider when planning and implementing sagebrush canopy cover reduction treatments (Connelly et al. 2000). Our small (40.5 ha) treatment areas were placed within a large intact sagebrush landscape. Such prescriptive small-scale rangeland treatments may provide an opportunity for managers to address seasonal habitat needs for sage-grouse, such as forb and grass cover in brood-rearing habitat, and other sagebrush-associated species. Shrub canopy reductions conducted at large scales (100's to 1000's of ha) have been shown to be detrimental to sage-grouse. Sagebrush canopy reductions would not be advisable in sage-grouse habitat that is highly fragmented or within landscapes with limited sagebrush dominated areas (Braun et al. 1977). Additionally, we placed these treatments in high-elevation mountain big sagebrush known to be brooding habitat. Sagebrush canopy cover reduction in nesting or wintering habitat, and/or in lower-elevation Wyoming big sagebrush, have been shown to have only neutral or detrimental impacts to sage-grouse habitat and populations. The recovery time frame of treated sagebrush communities is another important consideration when it comes to how often an area might be treated and predicting potential impacts to sage-grouse.

Our results may seem somewhat counterintuitive. We provide novel findings concerning how, when, and where sagebrush treatments may benefit a sagebrush obligate species to help them meet specific seasonal habitat conditions, such as increased forbs during the brooding period. While sagebrush treatments have become highly discouraged over time as the sage-grouse conservation issue has grown since the mid-1990s, our study offers a way to continue to manage sagebrush rangelands, even potentially increasing forage for livestock and other species, while continuing to conserve and support sage-grouse populations into the future.

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