2008 ANNUAL REPORT

The effects of prescribed fire on greater sage-grouse (*Centrocercus urophasianus*) on Anthro Mountain, Duchesne County, Utah

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Cooperators

Uinta Basin Adaptive Resources Management Sage-grouse
Local Working Group

Utah Division of Wildlife Resources

Utah State University Extension

U.S. Forest Service

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The front cover is a photo taken of "Lizzy" during the summer birddog survey. Lizzy has located a greater sage-grouse brood on Alkali ridge at the edge of one of the burns.
Photo courtesy of Eric Thacker

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Introduction

Historically, greater sage-grouse (*Centrocercus urophasianus*) were believed to be one of the most abundant and widely distributed indigenous upland game birds in the western United States (Dalke et al. 1963). Sage-grouse were once found in 12 states and 3 Canadian provinces (Connelly et al. 2004, Schroeder et al. 2004). The Utah Division of Wildlife Resources (UDWR) reported that sage-grouse once occupied all 29 counties in Utah (UDWR 2002). The species is currently found in 26 counties and inhabits 50% of their historical distribution (Beck et al. 2003). Sage-grouse numbers have declined on Anthro Mountain over the last five decades, but Anthro still maintains a small population of sage-grouse (UDWR 2002).

Due to continued downward population trends, several organizations have petitioned the U.S. Fish and Wildlife Service (USFWS) to list greater sage-grouse for protection under the Endangered Species Act of 1973 (Connelly et al. 2004). In 1996, the Western Association of Fish and Wildlife Agencies (WAFWA) recommended the formation of local working groups in each state that the birds occupy (Connelly et al. 2004). One of the main goals of these working groups is to research and address local area conservation issues regarding sage-grouse and their required habitat. By 2004, a total of 44 groups had been organized (Connelly et al. 2004).

Uinta Basin Adaptive Resource Management (UBARM)

The Uinta Basin Adaptive Resource Management Coalition (UBARM) is a public and private partnership that was organized in 2003 to address stakeholder concerns about declining sage-grouse populations. The partnership employs an adaptive resource management approach designed to address local stakeholder concerns while working toward achieve the goal of providing multiple resource benefits (Bergerud 1988). These benefits include conservation of greater sage-grouse populations and local community economic sustainability.

The partnership is chaired by local landowners and administered by Utah State University Extension's (USUEXT) Community-Based Conservation Program (CBCP). The working group proposes to implement a 10-year adaptive resource management plan that blends greater sage-grouse conservation and regional socio-economic sustainability with restoration of sagebrush (*Artemisia* spp.) communities. Improvement of sage-grouse brooding habitat was identified by the UBARM local working group (LWG) as a priority. Strategy 3.2 of the LWG action plan states that the group will work with public land agencies to improve existing brooding habitat. Additionally the group wanted these habitat improvements to be monitored to assess their effectiveness. The UBARM sage-grouse conservation plan can be viewed on the web at http://utahcbcp.org/files/uploads/uintah/ubarmsagrplan.pdf.

In cooperation with the Ashley National forest the UDWR and USU EXT the project was initiated in the summer of 2006. This research will evaluate the effects of prescribed fire on sage-grouse brooding habitat.

Prescribed Fire as a Sage-Grouse Management Tool

The role of fire in managing sagebrush for greater sage-grouse has received increased scrutiny as populations decline. Wildfires have been cited as a major factor in these declines in more arid areas of the species range because sagebrush and other native species are being replaced by invasive annual grasses (Connelly and Braun 1997, Connelly et al. 2000a, Connelly et al. 2000b). Additionally, because of the expansion of invasive species such as cheatgrass (*Bromus tectorum*), the frequency and intensity of wildfires in sagebrush steppe ecosystems has increased (Baker 2006). This increase in fire return intervals has lead to a loss of habitat as sagebrush cover and desirable forb understories are replaced by invasive annuals.

Crawford (2004), however, stated that fire in sagebrush steppe systems has been over generalized and that fire in these systems is spatially complex. There are several factors that make the response of fire in sagebrush steppe systems difficult to compare. Factors such as sagebrush species, fuel loads, ecological condition prior to burning, ambient weather conditions, fire temperature, fire speed, and season of burn, all of which may lead to different outcomes (Miller and Eddleman 2000). These factors then confound the comparisons of the effects of the fire (Byrne 2002, Knick et al. 2005). This makes it increasingly difficult to evaluate the use of prescribed burning for improvement of Sage-grouse habitat.

Knick et al. (2005) compiled a synthesis on the role of fire in structuring sagebrush habitats and bird communities. He summarized studies that investigated the effects of fire on sage-grouse. Of the 5 studies that dealt with mountain big sagebrush (*A. tridentata vaseyana*) only 2 reported a positive relationship between fire, sage-grouse, and the abundance of forbs (Martin 1990, Pyle and Crawford 1996). While 3 of the studies reported a neutral relationship or were inconclusive on forbs and insect abundance (Pyle and Crawford 1996, Nelle et al. 2000). Even though there are some discrepancies in the effects of fire in sagebrush communities there are some clear principles that stand out. Using prescribed fire in breeding habitats has a negative impact on breeding sage-grouse. Connelly et al. (2000b) reported an 80% decline in the breeding population and a decrease in the numbers of active leks. Hulet (1983) also reported an increase in lek abandonment.

It is also important to note that both of these studies took place in an areas dominated by Wyoming big sagebrush (*A. t. wyomingensis)*. Bryne (2002) and Nelle et al. (2000) both reported that fire had a negative impact on nesting activities regardless of community type. Knick et al. (2005) reported of the six studies dealing with brooding sage-grouse one showed a negative correlation (Bryne 2002), two reported a positive response (Martin 1990, Pyle and Crawford 1996) while 3 of the papers were inconclusive (Nelle et

al. 2000, Fischer et al 1996, Fischer et al 1997). One of the problems is the overall productivity of the sites is not comparable therefore it makes it difficult to compare the results of these studies.

However, there is one important distinction that needs to be made in reference to brood rearing habitats. None of the studies discussed here have separated their brooding habitat into early or late brooding habitat. Connelly et al. (2000b) suggests that there is in fact two different habitat types early and late brooding. This clarification may help to bring some consensus to the question of whether fire can be used to positively manage sage-grouse habitats.

Typically early brooding occurs close to the nests, meaning that most of the early brooding areas occur within nesting habitat (Connelly et al. 2000a). Nelle et al. (2000) and Bryne (2002) both suggested that fire had negative impacts on nesting sage-grouse therefore using fire in early brooding habitat may negatively affect nesting habitat. In light of this distinction outlined by Connelly et al. (2000) the use of prescribed fire needs to be evaluated in high elevation (>2000m) late brooding habitats. The purpose of this study is to evaluate the effects of small scale prescribed fire on vegetation and document sage-grouse response to vegetation changes caused by prescribed fire in a mountain big sagebrush community in northeastern Utah.

Purpose

The purpose of this study is to evaluate the effects of small scale prescribed fire on vegetation and document sage-grouse response to vegetation changes caused by prescribed fire in a mountain big sagebrush community in northeastern Utah
The results of this project will result in gleaning information as to the effectiveness of prescribed fire in improving late season brooding habitats. The information gleaned from this study will aid the United States Forest Service (USFS), Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS) field staff, UDWR biologist, and landowners in the planning and implementation of habitat projects and practices on public and private lands. These projects also will contribute to range-wide sage-grouse conversation efforts. Specifically, this research will document the effect of small scale prescribed fire on greater sage-grouse habitat and habitat-use.

Study Objective

The primary objective of this study is:

1) To evaluate the effects of small scale prescribed fire on vegetation and document sage-grouse response to vegetation changes caused by prescribed fire in a mountain big sagebrush community on Anthro Mountain.

Study Area

The Anthro Mountain study area is within the U.S. Forest Service (USFS) Ashley National Forest in northeastern Utah (Fig. 1). The study area is located approximately 29 km south of Duchesne, Utah. The area is a high elevation mountain big sagebrush site with pockets of quaking aspen (*Populus tremuloides*) and douglas-fir (*Pseudotsuga menziesii*) on the north facing exposures and some two needle pinyon pine (*Pinus edulis*) at the lower elevations. Black sagebrush (*A. nova*) can be found on the tops of rocky ridges scattered across the mountain. The elevation of the study area ranges from 2500 m to 2900 m. The historical land use is grazing by domestic livestock. Water is not well distributed across the mountain so it has limited grazing in some areas.

In the 1950's approximately 80% of the arable land on the mountain was disked and seeded to smooth brome (*Bromus inermis*), much of the area is covered by smooth brome and mountain big sagebrush (Christensen 2006). The smooth brome has become naturalized in these areas as the other components of the native community have returned. The areas that have not been seeded to smooth brome are dominated by blue bunch wheatgrass (*Pseudoregeneria spicata*), and an array of native forbs including vetches (*Astragulus spp.*) and *penstimons* (*Penstimon spp.*). Shrub species include snowberry (*Symphoricarpos occidentalis*) and wild rose (*Rosa woodsii*).

The climate of Anthro Mountain is typical of most aspen-mountain big sagebrush communities. The annual precipitation is 49cm, the area is typified by heavy snow in the winter and a monsoonal precipitation patterns in July and August, which produce frequent thunderstorms. The mean annual daily maximum temperature is 13°C and a mean annual daily minimum temperature of 1.7°C.

Methods

The prescribed burn study included 10 study plots. These plots were selected by the USFS district ecologists, in the summer of 2006. The plots were selected from mountain big sagebrush communities with shrub canopy cover that exceeded 20% and shrub height that exceeded 61 cm. Plots were selected on relatively level ground where slope did not exceed 15%. Plots were established on the main ridges (5 ridges approximately 9.7 km miles apart) of Anthro Mountain to obtain spatial distribution. Paired Plots were established at least 402 m from each other and were paired based on relative nearness one to another. Control and treatment plots were then selected from the pairs. Treatment plots were selected based upon the ability of trained personnel to control or contain the fire within the area of the plot. The target size for the burns will be ~ 16-32 hectares. The burns were completed in the fall of 2007. The burns were conducted in such a manner to yield a mosaic burn pattern. Sage-grouse use and vegetation response data will be taken for at least 3 years following the burn. Two years of pre-treatment data were collected (2006 and 2007).

Sage-grouse Response and Ecology

Sage-grouse use of the treatment plots was determined using telemetry, pellet density, and bird dog flush counts. Pretreatment flush counts were conducted in the study plots by allowing 1 of 4 bird dogs to cover the entire treatment area and the total number of grouse, sex and age class will be recorded (Dalhgren 2006). Bird dog data were collected in the summer of 2006 and 2007 prior to the plots being burned.
Pellet density was used to estimate grouse use of burn and control plots. Four 100 m transects were placed in each study plot. Transects were systematically placed in areas that would likely burn during the prescribed burns. Permanent quadrats were placed at 10 m intervals, there are 10 quadrats on each transect. A 2 meter hoop is centered at each 10m interval on the line and all sage-grouse fecal pellet piles are counted and removed. A pellet pile was defined as a group of more than 2 pellets in an area approximately the size of an adult hand. Transects will be read in mid August each year to determine the pellet density during the current years breeding season.

Vegetation Response

Vegetation data has been collected by the USFS as part of their long term monitoring program on Anthro Mountain. The data has been collected by Allen Huber and Sheryl Goodrich, USFS. Five 33.5 m permanent belt-line transects were established at the treatment and control study sites. Canopy cover of shrub species was determined from 152 m of line intercept. Measurements were made on the canopy intersecting the tape. Gaps in the shrub canopy of 15 cm or greater were omitted from canopy cover measurements. Measurements were recorded by shrub species (USDA Forest Service 2005).

Foliar cover and ground cover data were collected using the point intercept method (Elzinga et al. 1998). For foliar cover, 300 points were sampled along belt-line transects 1, 3, and 5 at .3 m intervals. Data was recorded by plant species. Plant height was also measured for each foliar cover hit. Ground cover was measured using 500 points along the five belt-lines at .3 m intervals. Ground cover consisted of the basal area of live vegetation, plant litter in contact with the soil surface, and rock with a 2 cm or greater diameter. Standing plant litter (except the basal area), bare soil, and rock or pavement less than 2 cm diameter were not included as ground cover (USDA Forest Service 2005).

Arthropod Abundance

At each vegetation site arthropods were collected, using pitfall traps (Morrill 1975). The traps were placed at 2 m intervals along two 10 m transects at random directions from the vegetation point. The pitfalls were placed flush with the ground and left for 48 hours (Southwood and Henderson 2000, Connelly et al. 2003). Arthropods collected were sorted to one of 5 categories: Hymenoptera, Orthoptera, Coleoptera, Lepidoptera, and other. Gregg (2006) identified these orders of arthropods as being important to sage-grouse chicks.

Results

Sage-grouse Response

In 2006 preliminary vegetation and sage-grouse use data were collected to establish a baseline. In 2006 pellet transects were conducted to determine the level of grouse use prior to treatment. In 2006 the unburned (control) plots 3.0 % of the quadrats were occupied (in order for a quadrat to be occupied it must have more than 1 pellet within the quadrat). In 2008 following the prescribed burns, the unburned plots 7.0% of the quadrats were occupied. In the burned treatment plots in 2006, 1.5% of the quadrats were occupied. In 2008 following the prescribed fires 2% of the quadrats were occupied.

% of Pellet Quadrats Occupied		
	Treatment type	
Year	Control	Burn
2006	3	1.5
2008	7	2

The bird dog surveys were also conducted in 2006 and 2008. In 2006, one bird was flushed from the unburned plots and 7 birds were flushed within the burned plots. In the 2008 following implementation of the prescribed fire there were 0 birds flushed out of the control plots and 5 birds flushed out of the burned plots.

Birddog flush counts Total bird flushed		
	Control	Burn
2006	1	7
2008	0	5

During this time period, the number of males counted on leks on Anthro Mountain decreased, thus suggesting a populations decline. In 2006, 44 males were counted on the four known leks. In 2008, only 16 males were counted on the same four leks (Fig. 2). These declines would influence the number using the landscape and therefore may be confounding or masking any results we may see with sage-grouse use of the treatment plots. Pellet counts and bird dog surveys will be conducted in 2009.

Vegetation Response

Data regarding the vegetation response is currently being analyzed. Vegetation data will also be collected in 2009.

Arthropod Abundance

Arthropod abundance data were collected in 2007 and 2008. These data are being analyzed. Arthropod data will be collected again in 2009.

2009 Plan of Work

We will continue to monitor greater sage-grouse ecology and habitat use using the methods described above. We will also measure greater sage-grouse use and vegetation responses in the experimental plots.

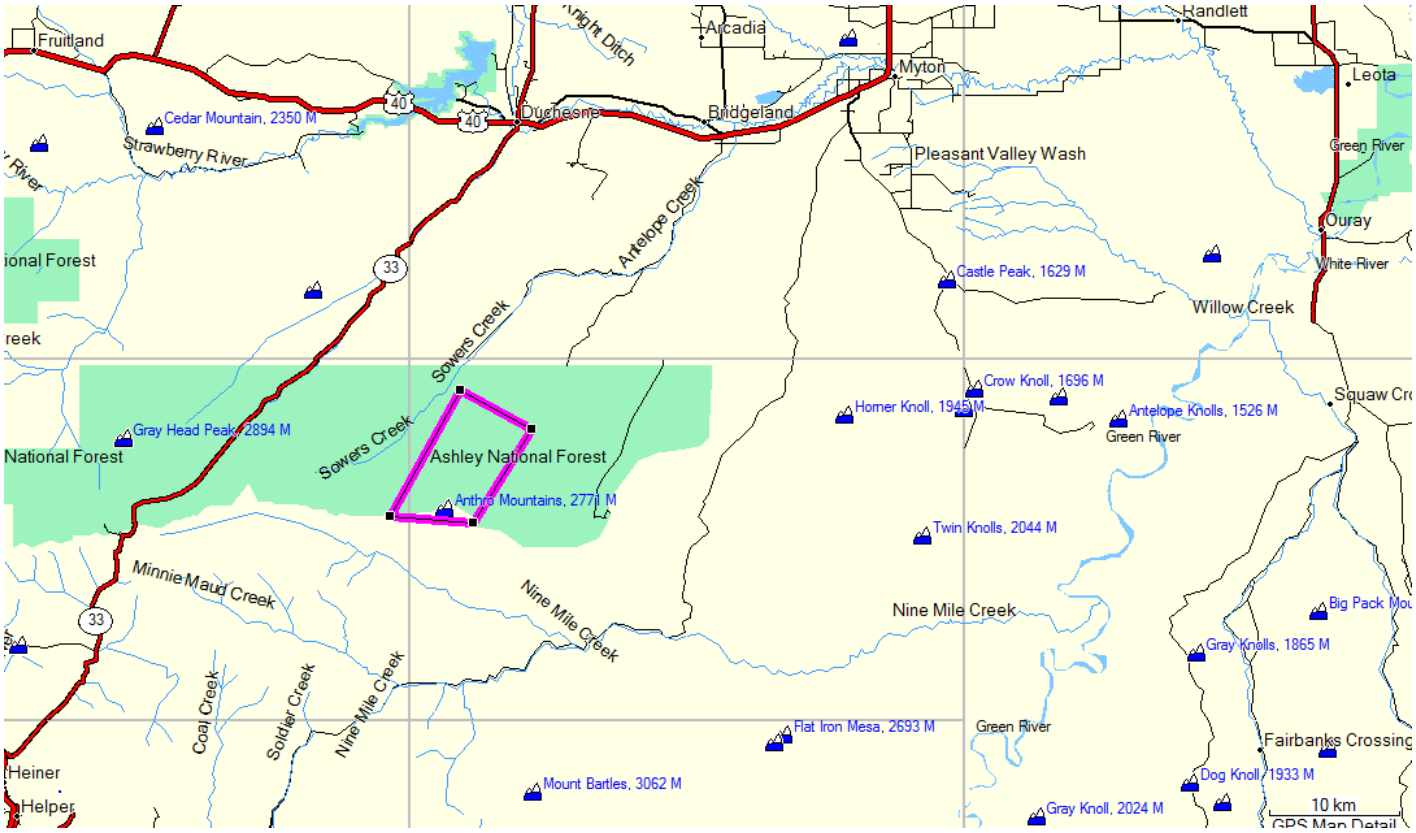

Fig. 1. The Anthro Mountain Prescribed Fire Study Site, Ashley National Forest, Duchesne County, Utah.

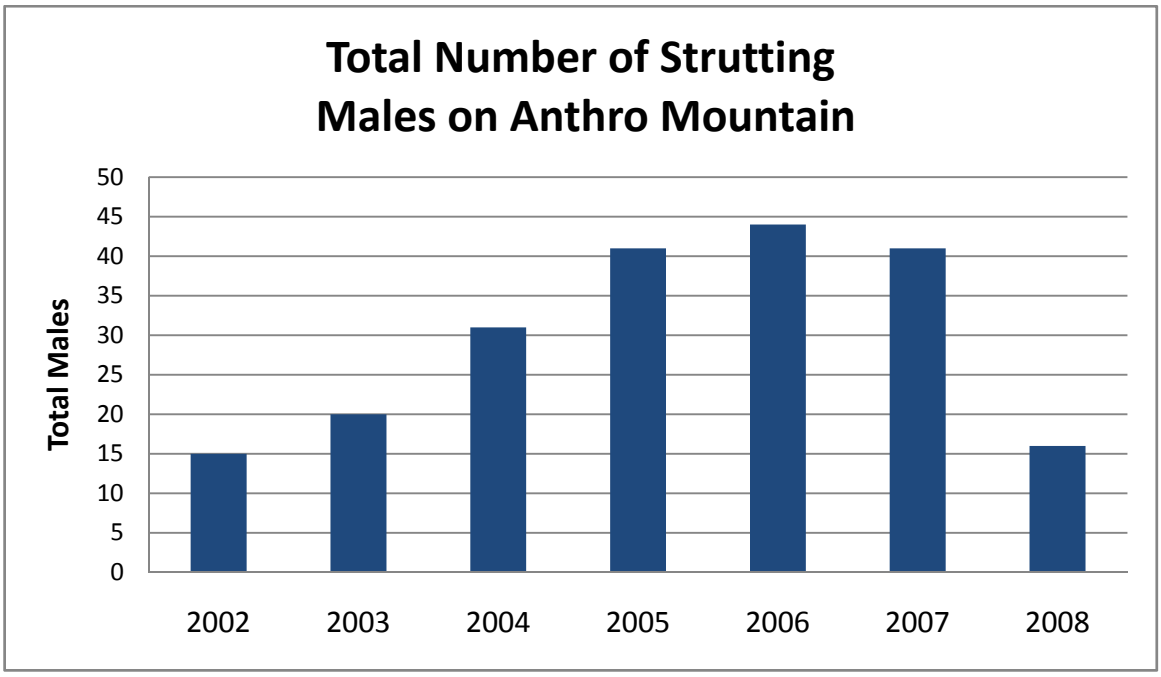

Fig. 2. Lek counts from 2002 to 2008

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