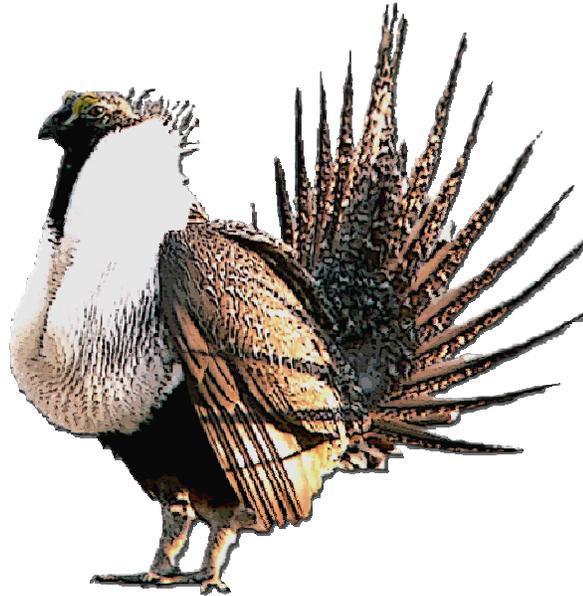


## 2008 ANNUAL REPORT

# GREATER SAGE-GROUSE (*Centrocercus urophasianus*) ECOLOGY IN WESTERN BOX ELDER COUNTY, UTAH



Prepared by

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### Cooperators

Box Elder County Adaptive Resources Management Sage-grouse  
Local Working Group

Utah Division of Wildlife Resources

USDA Natural Resources Conservation Service

US Bureau of Land Management

US Fish and Wildlife Service

Utah Department of Natural Resources

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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 (UDSWR 2002). The species is currently found in 26 counties and inhabits 50% of their historical distribution (Beck et al. 2003). Western Box Elder County supports one of the largest greater sage-grouse populations in the state (UDWR 2002, Beck et al. 2003).

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).

### **Box Elder County Adaptive Resource Management (BARM)**

The Box Elder County Adaptive Resource Management Coalition (BARM) is a public and private partnership that was organized in 2002 to address stakeholder concerns about declining sage-grouse populations. The partnership employs an adaptive resources 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 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. The group believes that baseline information on sage-grouse ecology in Box Elder County is needed to prioritize conservation actions and measure impacts.

Research conducted by Utah State University in south-central Utah suggests that chemical and mechanical manipulations in degraded sage-grouse brood-rearing habitat can successfully restore sagebrush steppe environmental functions, resulting in increased forage production, plant diversity, and grouse use (Dahlgren et al. 2006). The research demonstrated that plant diversity and production in sagebrush habitat types can be increased if sagebrush canopy cover is reduced to 19-20% (Braun et al.1977, Connelly and Braun 1997, Connelly et al. 2000). This work was conducted at elevations above

2600 meters in brood-rearing areas. The size of the treatments were limited to 40.5 ha plots that exhibited 30-70% sagebrush canopy cover.

The results of preliminary research conducted by BARM in cooperation with Utah State University suggests that brood-rearing habitat may also be limiting sage-grouse populations in western Box Elder County (Knerr 2007). To address this, BARM has implemented similar sagebrush treatments on larger plots (120 ha) of private lands on the Grouse Creek Mountain range in western Box Elder County. The project area is < 2000 meters in elevation (Fig. 1).

The need for conducting these types of management experiments at different elevations and scales has been highlighted in both the Utah and WAFWA sage-grouse management guidelines. The results of this research will be used to guide the management activities of the local working group. In addition, this information will be important in assisting the USFWS in making decisions regarding the impacts of conservation efforts when reviewing petitions to list sensitive species.

### **Purpose**

The purpose of this project is to describe the ecology of the greater sage-grouse population in western Box Elder County and evaluate the effect of site-specific sagebrush management treatments conducted on private land to enhance livestock production and sage-grouse habitat. Completion of this project will result in the identification of conservation technologies and strategies that can assist Natural Resources Conservation Service (NRCS) field staff, UDWR biologist, and landowners in the planning and implementation of habitat projects and practices on private lands. These projects also will contribute to range-wide sage-grouse conservation efforts. Specifically, this research will document the effect of larger scale chemical and mechanical treatments on rangeland forage production and greater sage-grouse habitat and habitat-use.

### **Study Objectives**

The objectives of this study are:

- 1) To describe greater sage-grouse ecology in western Box Elder County, including general habitat-use, nesting and brood-rearing habitat, nesting initiation and success, survival, and seasonal movement patterns.
- 2) To delineate winter habitat for the greater sage-grouse population that inhabits Grouse Creek Valley and to evaluate the ecological stability of the wintering habitat.
- 3) To evaluate the effects of two sagebrush treatments [spike (herbicide), and Lawson aerator (mechanical)] on pre-laying sage-grouse hens and brooding sage-grouse within treated areas as it compares to the control treatments.

## Study Area

The study area is located in the Grouse Creek Mountain range in western Box Elder County, Utah (Fig. 1). This area is a sub-management unit of the Box Elder County Adaptive Resources Management area (BARM 2007). The area is bounded by the Idaho border on the north, Nevada border on the west, Grouse Creek Mountains on the east, and Route 30 on the south. There are 37 active leks within the study area, ranging from 1500-2100 m in elevation. Sage-grouse leks have been counted in this area since 1959 (Fig. 2.) The area encompasses approximately 1572 km<sup>2</sup> of public and private lands. Grazing by domestic livestock is the primary use of these lands.

The vegetation in the study area consists mainly of shrub-steppe intermixed with grassy meadows, and woodlands. Common shrubs and trees include big sagebrush (*A. tridentata*), black sagebrush (*A. nova*), rabbitbrush (*Chrysothamnus* spp.), serviceberry (*Amelanchier utahensis*), snowberry (*Symphoricarpos albus*), bitterbrush (*Purshia tridentata*), juniper (*Juniperus osteosperma*), quaking aspen (*Populus tremuloides*), and chokecherry (*Prunus virginiana*). Common grasses include wheatgrasses (*Agropyron* spp.), Kentucky bluegrass (*Poa pratensis*), cheatgrass (*Bromus tectorum*), and great basin wildrye (*Elymus cinereus*). Common forbs include phlox (*Phlox* spp.), astragalus (*Astragalus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), lupine (*Lupinus caudatus*), western yarrow (*Achillea millefolium*), prickly pear (*Opuntia humifusa*), and wild onion (*Allium acuminatum*).

## Methods

### Sage-grouse Ecology

#### *Captures and radio-telemetry*

To collect habitat use and ecology data on greater sage-grouse, we captured up to 40 birds annually and fitted them with radio-transmitters. The birds were captured March - May 2008 on or near leks and late July-August in areas known to be used by sage-grouse. Sage-grouse were located by spotlighting from the back of an ATV and captured with a long-handled net (Giesen et al. 1982). Age (adult or juvenile) was assigned based on primary feather characteristics (Dalke et al. 1963). The birds were then fitted with a Holohil radio-collar. A GPS location was also recorded within 5 m accuracy for each capture site. In 2008, we also captured and radio-marked 15 sage grouse chicks within 48-hours of hatching using similar methods as the adults. The collars were suture type collars with a life of 50-70 days.

Radio-tracking enabled us to monitor seasonal movements, nests initiated, brood survival, adult mortality, chick mortality, and habitat use of greater sage-grouse in the study area. Radio-collared birds were located using Communications Specialists receivers and Telonics 3-element hand-held Yagi antennae, and omni antennae.

Nests were identified and marked at a distance of 50-100 m for future reference. Nests were checked approximately every 3 days from the time they were located until they were predated, abandoned, or successfully hatched. Predated nests were evaluated for potential identification of nest predators from any eggshells, scat, tracks, or hairs. Visual locations were obtained on females with broods every 3 days between May and August of 2008. Visual locations on females without broods were obtained at least bimonthly. Birds were located at least once from fixed-wing aircraft from September to April. Adult mortalities were examined to determine depredating species (Zablan et al. 2003).

The radio-collared hens with broods were monitored every third day using the methods described above. However, the time of the day when the hen was relocated varied so that the hen was located during roosting (midnight), during feeding (sunrise), and while loafing (afternoon). Vegetation measurements were taken at brood sites and random locations in the same habitat type.

### ***Habitat Monitoring***

At each nest site, GPS location (within 5 m), slope, aspect, and clutch size were recorded, along with predation information if necessary. Vegetation measurements were taken in four directions (every 90° starting with a randomly chosen direction). The visual obstruction of the vegetation to and from the nest was measured using a Robel pole (Robel et al. 1970, Connelly et al. 2003). We sampled shrub canopy coverage using a modified line intercept method (Canfield 1941), and the percentage of ground vegetation was measured using 20x50 cm Daubenmire frames (Daubenmire 1959). Percent cover of shrubs was measured with a 15-meter tape. The amount of live shrub canopy intersecting an imaginary vertical plane on the tape was measured. Gaps in the foliage smaller than 5 cm were counted as continuous, gaps 5 cm and larger were not counted. The amount of total shrub intersecting the line was summed and then divided by the length of the line to determine total shrub canopy coverage (Connelly et al. 2003). Use of the line intercept method will allow us direct comparison with data from many other studies because this is a very common method of measuring sagebrush canopy cover (Lyon 2000, Connelly et al. 2003). Daubenmire frames were placed every 2.5 m along the 10 m tape to estimate percentages of grasses, forbs, litter, rock, and bare ground (Daubenmire 1959).

At locations of collared hens with broods, measurements of slope, aspect, and number of visible chicks was recorded, as well as a GPS location (within 5 m). Within 24 hours, the vegetation at each brood location was also measured using the Robel pole and line-intercept method, but with a 10-meter tape. A 20x50 cm Daubenmire frame (Daubenmire 1959) was placed every 2.5 meters along the tape. These measurements were only made if the hen had or was suspected to still have a brood.

### ***Arthropod Sampling***

Arthropods, particularly insects, are an essential element of early brood-rearing habitat (Patterson 1952). Sage-grouse chicks require insects in their diet for survival and normal growth, especially in the first 3 weeks after hatching (Johnson and Boyce 1990). In order

to assess insect abundance in brood foraging habitat, we used pitfall traps (Morrill 1975, Connelly et al. 2003).

Hens with broods were located 3 times each week for 7 weeks after hatching, unless it was determined that chicks were no longer present. Each week one location from each hen with a brood was randomly selected to test insect abundance and diversity. After vegetation measurements were taken, a total of 8 pitfall traps were placed flush with the ground along each of the 4 transects used in the line intercept method (see above). Pitfall traps were placed at 5 and 10 m from the hen location along each transect. Insects were also sampled at the random site chosen for vegetation measurements.

Pitfall traps were filled with a 50/50 solution of water and antifreeze. All traps were opened for 48 hours, at which time all insects were collected. Insects from all traps in a single site were consolidated and refrigerated for preservation. All insects from each location will be separated by class, and each class will then be counted for individuals and measured for volume (E. Evans, Utah State University, personal communication).

## **Sage-grouse Habitat Treatments**

### *Experimental Design*

In 2005, we identified twenty-four 120 ha plots on the Grouse Grazing Association land holdings that exhibited > 40% dense sagebrush canopy. Of these, we randomly selected 18 plots to conduct the experiment. There were 6 replications for each of the three treatments. The three treatments include a control (no treatment), Lawson aerator (mechanical treatment) and tebuthiron herbicide (chemical treatment). To complete the treatments, we worked with the Grouse Creek Grazing Association to prepare and submit a cost-share proposal to NRCS. The proposal was funded and the treatments were initiated in the fall of 2005.

The plots were within 3 km of active leks and within summer brood-rearing habitat. Baseline data for herbaceous cover, plant species composition, shrub canopy cover, shrub densities and forb densities were collected in 2006. The treatment plots were seeded with a mixture provided by the UDWR. Grazing was deferred for 2 growing seasons. Four permanent 10 m transects were established in each treatment replication. Transects were placed in representative areas within each treatment, the direction of the transects were randomly chosen by spinning a logging pin.

The herbaceous cover was collected using the line intercept method. Shrub densities were taken along the same transect by laying a 10 m x 1m belt transect over the top and counting the number of shrubs present within the belt transect. The shrubs were also categorized by age class. Forb density was estimated by counting the number of forbs within each belt transect. Each treatment and control will have two paired sets of exclosures; one that eliminates small mammal use and one that allows small mammal use, but restricts use by large ungulates.

Sage-grouse use data were also collected to document grouse use in the treatments prior to treatment. Sage grouse pellet counts and bird dog flushes were used. Both measures were taken pre and post treatment so that grouse use can be compared for each treatment as well as the relative differences in grouse use between treatments. The pellet counts were conducted along four 100 m transects. We placed 2m<sup>2</sup> hoops on the line at 0, 15, 25, 50 and 100 meters. All of the pellets and cecal droppings were counted and removed from within the hoop. The bird dog flushes were conducted by allowing 1 of 3 bird dogs to cover an entire plot and the numbers of sage-grouse flushed by age class were recorded. The sage-grouse use surveys described above was repeated in 2007 and 2008.

### ***Monitoring***

Greater sage-grouse habitat use patterns were monitored from 2006-2008 on the treatment and control sites. In addition, we monitored vegetation changes to determine the effect of sagebrush treatments on sagebrush-steppe systems.

In 2005, we measured the baseline shrub canopy cover and composition of the understory in each plot. We used a variation of the line intercept method (Canfield 1941) and sampled the big sagebrush areas within each plot. We mapped the big sagebrush and randomly chose five points from which to start a 100 m sampling transect. We recorded a GPS location for each starting point. Then, a 100-meter tape was stretched in a randomly chosen direction. The amount of live shrub canopy intersecting an imaginary vertical plane on the tape was measured. Gaps in the foliage smaller than 5 cm were counted as continuous, gaps 5 cm and larger were not counted. The amount of total shrub intersecting the line was summed and then divided by the length of the line to determine total shrub canopy coverage (Connelly et al. 2003). Shrub height was measured at all locations where line intercepts were taken; the tallest live part of the shrub recorded. The highest point excluded the seed head and was reported as the highest live leaves or branch. In addition, percent cover of forbs, grasses, litter, and bare ground were measured using a 20x50 cm Daubenmire frame. The frame was placed every 10 m along the 100 m transect to estimate percent understory coverage. We believe that by increasing vegetation diversity, chick survivorship will increase as the condition of nesting and brood-rearing habitats improve.

### **Winter Habitat-Use and Diet Selection**

By monitoring radio-collared birds we were able to identify important wintering areas. In 2008, we collected sage grouse pellets from winter use sites for chemical analysis to determine diet selection. We collected 10 random pellet piles at each flock location found in January and February 2008. The pellets were stored in a soft sided cooler until they could be transferred to a freezer. The samples were then homogenized and a 100mg sample was placed into a 20ml vial. A simple methylene chloride extraction was used to extract crude terpenes from the pellet and sagebrush material.

The objectives of the research were:

1. To determine if terpene profiles could be used to differentiate between black and Wyoming sagebrush.
2. To determine if terpene analysis of pellets collected at sage-grouse winter use sites could be used differentiate sagebrush species.
3. To determine greater sage-grouse diet selection by analyzing terpene levels in collected pellets.

### ***Data Analysis***

To describe pre- and post-treatment spring and summer greater sage-grouse habitat use patterns, logistic regression will be used to compare vegetation parameters of use to non-use areas ( $P < 0.05$ ). Logistic regression will be used to evaluate selection of nest sites for vegetation composition and to compare with random sites ( $P < 0.05$ ). Descriptive statistics will be used to describe sage-grouse nesting success, mortality, and survival of broods.

### **Anticipated Benefits**

Completion of this project will provide BARM, the UDWR, and NRCS with information on the role of existing conservation practices and technologies relative to conserving sage-grouse and other sagebrush obligate species in western Box Elder County.

## **Results**

### **Sage-grouse Ecology**

#### ***Captures and Radio-telemetry***

At the beginning of the 2008 breeding season 42 greater sage-grouse hens were monitored. An additional 20 hens were captured and fitted with radio-collars between 15 April and 15 May 2008. We captured and radio-collared 26 chicks from 4 different broods in May-July of 2008. Sage-grouse were captured between the hours of 2300 - 0530 on or in the areas surrounding leks. The captures took place surrounding Dry Canyon Mountain, Meadow Creek, Twin Meadows and Cotton Thomas basin.

#### ***Nesting***

Of the 36 collared females who survived to begin the nesting season, 23 (64%) initiated nests. Nests were initiated under big sagebrush, bitterbrush, and rabbit brush. The vegetation data collected at each nest site is currently being analyzed. Of the 23 nests initiated, 12 were successful (52%). The other nests were predated; it was very difficult to

determine which species may have predated the nests. The average clutch size was 6 chicks.

### ***Brood Survival and Habitat Use***

Nine hens were successful in raising at least 1 chick to 42 days resulting in a brood survival of 83%. The average clutch size at 42 days was 4 chicks. Kimbell Creek, Twin Meadows, and the Cotton Thomas basin were identified as key brood-rearing areas. Vegetation data collected at brood locations in 2007 and 2008 will be compiled and analyzed in spring 2009 to determine if any relationships existed between vegetation composition and brood survival.

### **Sage-grouse Daily Habitat Use**

Sage-grouse summer movements and habitat use data will be analyzed at the end of the 2009 field season, this will be the final year of this phase of the project.

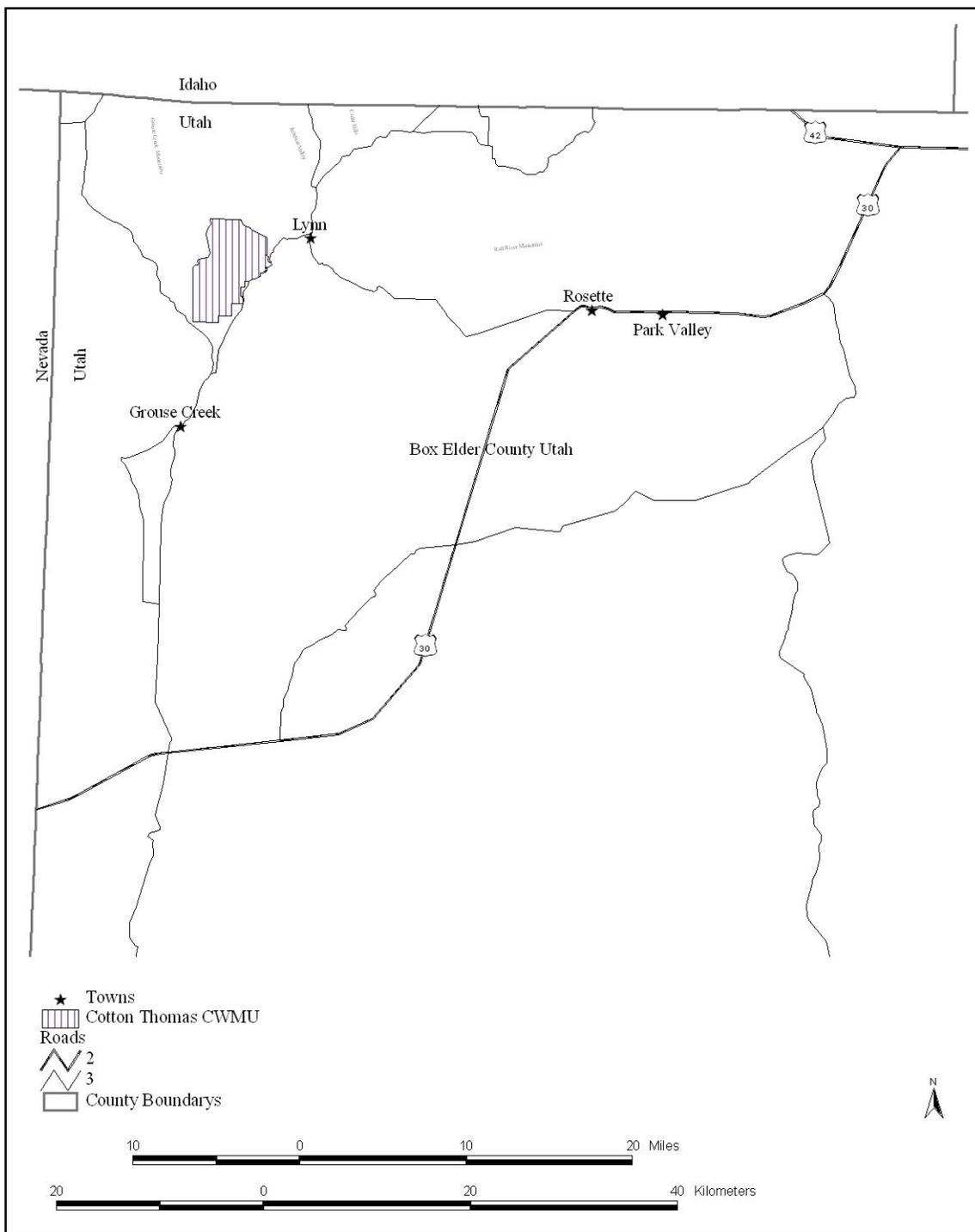
### ***Wintering Sage grouse***

In the winter of 2008 we collected habitat use and pellet data on 19 greater sage-grouse flocks inhabiting sagebrush habitats in western Box Elder County, Utah. To determine habitat use areas, we monitored radio-collared birds.

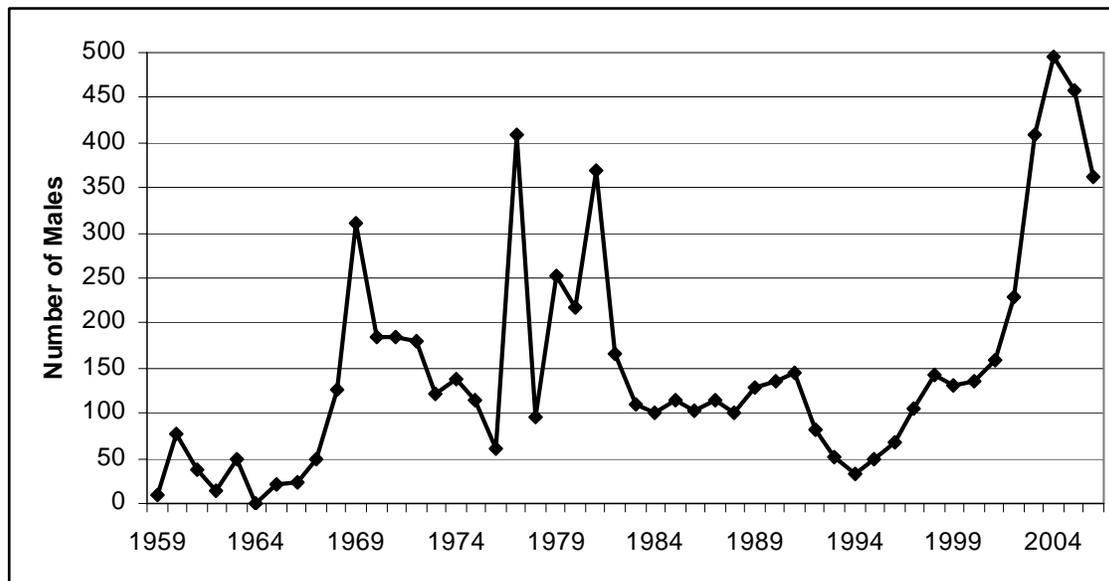
We identified unique terpene profiles for each sagebrush species (black sagebrush and Wyoming sagebrush) (Fig. 3). Thus we were able to determine which species comprised the fecal pellets thus reflecting diet composition (Fig. 4). These results indicated that black sagebrush was consumed more frequently than Wyoming sagebrush during the winter season (Fig. 5). The results also showed that the wintering sage-grouse also selected black sagebrush communities more frequently than Wyoming big sagebrush communities.

## **2009 Plan of Work**

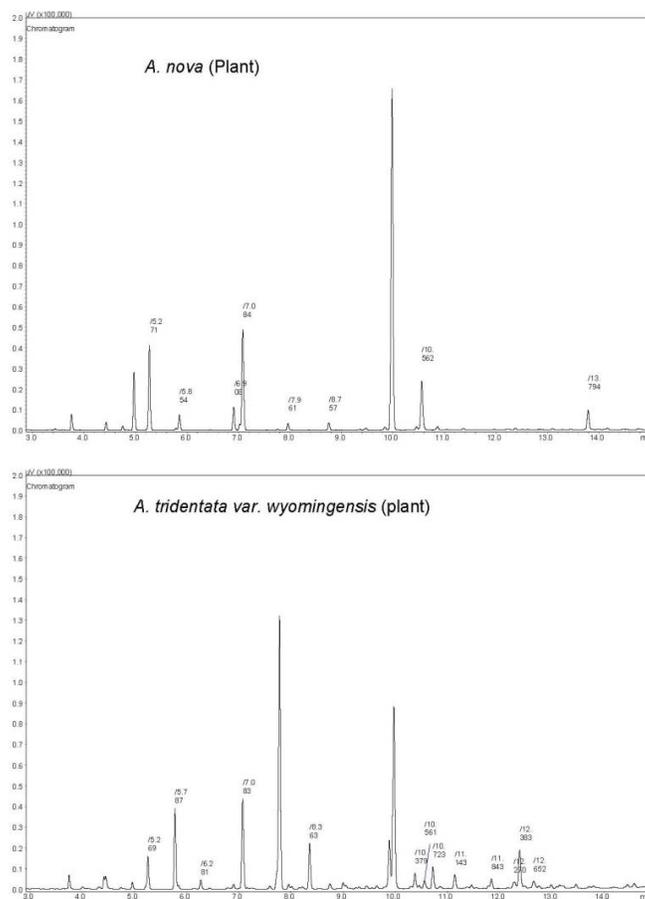
We will continue to monitor greater sage-grouse ecology and habitat use using the methods described above. We will also measure greater sage-grouse use and vegetation responses in the experimental plots. Population data and parameters will be compiled from 2004-2009 and analyzed to determine population trends and stability.



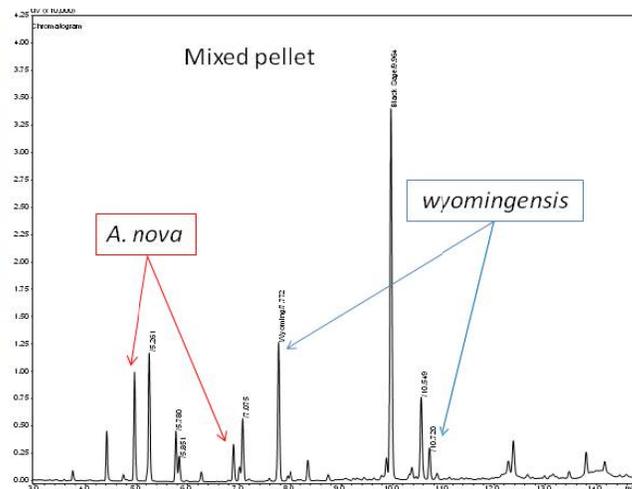
**Fig. 1.** The location of the West Box Elder Study Area, 2005-2008.



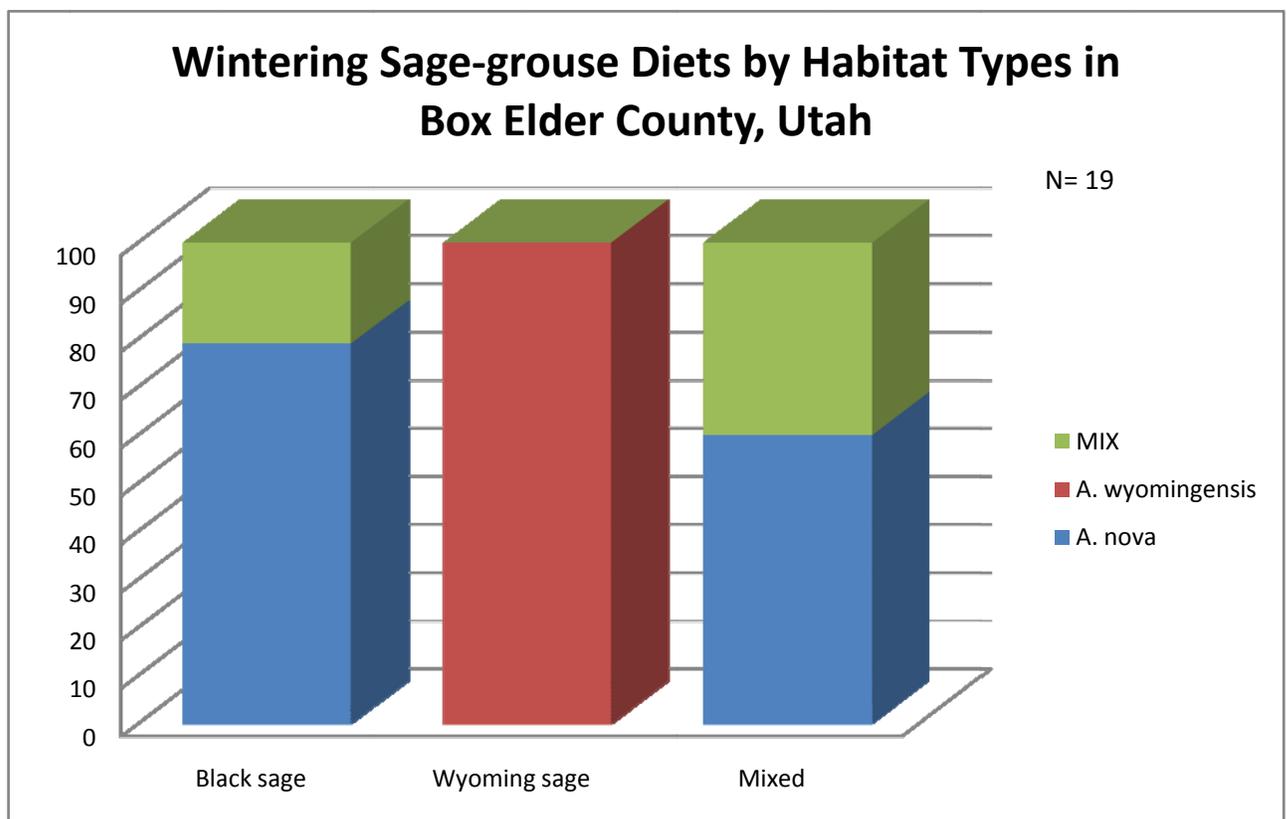
**Fig. 2.** Historical lek count data in the West Box Elder County study area, 1959-2008.



**Fig. 3.** Gas chromatograms of terpene profiles from black sagebrush and Wyoming sagebrush in West Box Elder County, Utah, 2008.



**Fig. 4.** Gas Chromatogram of a mixed sagebrush sage-grouse pellet found in Box Elder County, Utah, 2008.



**Fig. 5.** Diet composition of sage-grouse pellets collected in Box Elder County, Utah, 2008.

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