2007 ANNUAL REPORT

PARKER MOUNTAIN
ADAPTIVE RESOURCE MANAGEMENT GROUP (PARM)

Cooperators

Parker Mountain Grazing Association
U. S. Fish and Wildlife Service
U.S.D.A. Farm Services Agency
U.S.D.A. Wildlife Services
Utah Department of Agriculture and Food
Utah Division of Wildlife Resources
Utah State University, Vice President for Research
Utah State University, Vice President for Extension
U. S. Bureau of Land Management
U. S. Forest Service
U.S.D.A. Natural Resource Conservation Service
Utah Agricultural Experiment Station
Utah Department of Natural Resources
Utah Farm Bureau Federation
Utah School and Institutional Trust Lands Administration
Wayne and Piute County Commissions

Prepared by

Michael Guttery, David Dahlgren, Michael Monsen, and Terry Messmer
Quinney Professorship for Wildlife Conflict Management
Jack H. Berryman Institute
Department of Wildland Resources
Utah State University, Logan

Verl Bagley
Utah State University Extension Service
Wayne and Piute County Extension Office

December 2007

Table of Contents

List of Tables

List of Figures

Introduction

Background

The Parker Mountain Resource Area (PRA) is located in south central Utah in Garfield, Piute, and Wayne counties. The PRA encompasses the Awapa Plateau and a northern portion of the Aquarius Plateau. It is bordered on the south by the Escalante and Boulder Mountains, on the east by Rabbit Valley, on the north by the Fish Lake Mountains, and on the west by the escarpment of the Parker Mountains. The PRA encompasses 259,881 acres (105,171 ha) managed by the U.S. Forest Service (USFS), Bureau of Land Management (BLM), Utah School and Institutional Trust Lands Administration (SITLA), and private landowners. The predominant land use in the area is grazing by domestic livestock.

Between 1935 and 1939 greater sage-grouse (*Centrocercus urophasianus*) populations in Wayne County were estimated between 5,200-9,200 birds. In 1969, sage-grouse populations in Wayne County were estimated at 2,982 birds with peak male counts of 497 on leks. Population surveys conducted in 1997 by the Utah Division of Wildlife Resources (DWR) estimated that 644 birds remained in the PRA with peak lek counts of males at 161. Sage-grouse numbers on the area have been monitored since 1967 and although strutting ground counts of displaying cocks have varied greatly over that time, a continual population decline was apparent. The sagebrush (*Artemisia* spp.) habitat of the area has escaped many of the development pressures common throughout the Intermountain West and it continues to be one of the few areas remaining in Utah with relatively large numbers of sage-grouse. Limited information exists concerning current PRA greater sage-grouse microhabitat requirements, which is necessary for implementing habitat improvements designed to benefit the population.

The Parker Mountain Adaptive Resource Management Group (PARM) is a public and private partnership that was formed to restore greater sage-grouse populations and provide multiple benefits for all resource users and wildlife inhabiting the area. The immediate objective of PARM is to restore sage-grouse populations to pre-1969 levels. The partners are in the 4th year of a 10-year adaptive resource management population and habitat monitoring program designed to evaluate the effects of experimental management actions on greater sage-grouse and other wildlife populations. This report summarizes the research activities conducted in 2007 to address the objectives identified below.

Objectives

1. **To develop a population viability model for greater sage-grouse that inhabit the PRA.**
2. **To implement and evaluate management actions on the PRA designed to restore sage-grouse distributions and numbers and benefit other wildlife that inhabit the area.**
3. **To investigate the response of habitat improvements on greater sage-grouse chick and brood survival.**
4. **To coordinate management actions with the Utah Prairie Dog Recovery Team as means assisting in the recovery of the species.**

Sage-grouse Research

Sage-grouse Biology

Sage-grouse lek counts

Lek counts were conducted in April 2007. Lek counts in 2007 were down slightly. A total of 936 males were observed in 2007 on annually counted leks (Figure 1). Previously unknown leks were discovered in 2007. Researchers made a significant search effort and located 12 previously unknown lek sites. The unofficial count (including newly discovered leks) was over 1300 males. This count exceeds the highest number of male sage-grouse ever recorded during lek counts on Parker Mountain. Consistent with the past three years (2004, 2005, and 2006), PARM members assisted census efforts on Parker Mountain in 2007. The teams searched the leks and recorded males displaying on current and historical leks that had been previously dormant. All leks were counted during the same morning.

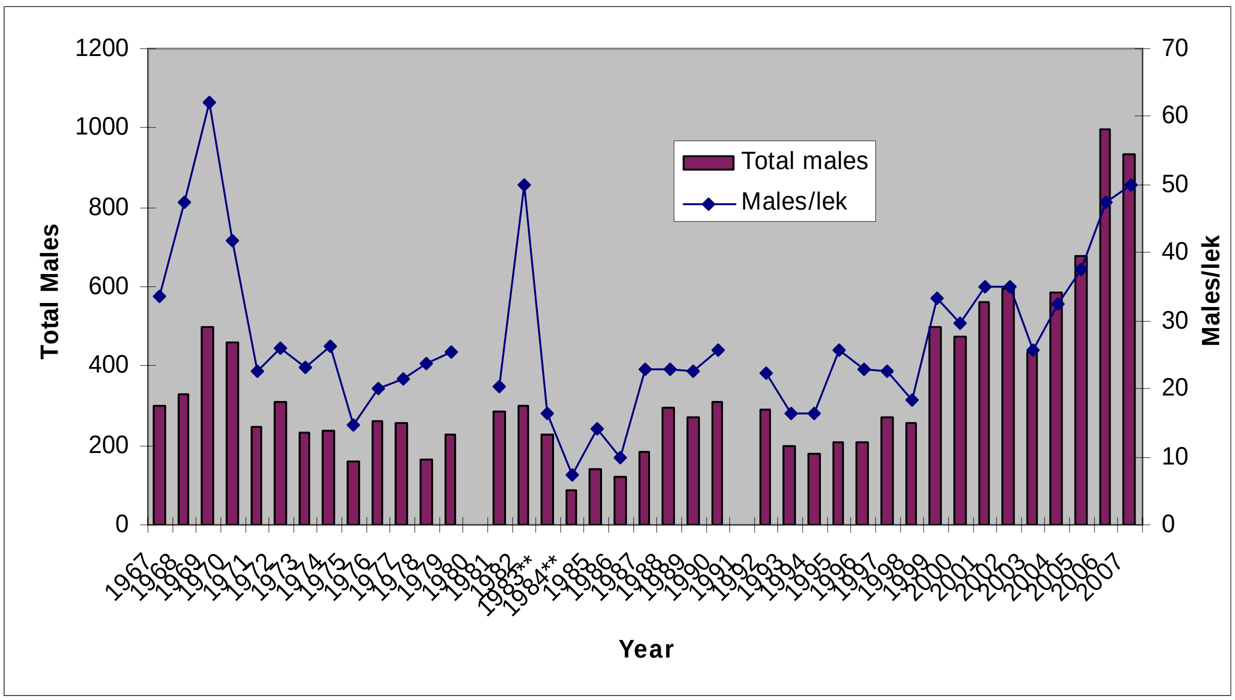


Figure 1. Historic and recent lek counts of the Parker Mountain sage-grouse population

Sage-grouse hen captures

In April 2007 we captured 30 additional hens and equipped them with necklace-style radio transmitters (Geisen et al. 1982). Trapping efforts took place just west of Bull Roost and south of Vance's Corral. Trapping efforts were completed during 3 successive nights (April 6-8). Trapping efforts were conducted by Utah State University personnel with assistance provided by

DWR, USFS, BLM, and others. With these 30 hens plus the 7 remaining hens that were captured in 2006 and 6 remaining hens that were captured in 2005, we had the potential to monitor 43 hens in 2007. Three of these hens were never located.

Monitoring sage-grouse hens

From mid-May to August 2007, we monitored hens to determine their seasonal habitat use patterns, nest and brood success, and chick and adult mortality. We identified and measured the habitats used for nesting and brood-rearing. As in 2005 and 2006, we concentrated our efforts on monitoring nest hens and hens with broods.

Nesting

The radio-collared hens began nesting (incubation, ~28 days) late April and throughout May. During May, 21 of the 40 collared hens (52.5%) had initiated nests. However, nest initiation may have been higher because researchers were not able to start monitoring the hens until early May. Thus, nests that were initiated and lost prior to this time would not be included in this summary. Seven of the 21 nests were depredated (33%). One nest had unusually small eggs, though 1 of the 7 eggs hatched, the chick could not be found within 24 hours of hatching, and was assumed to be non-viable. Thirteen (61.9%) were successful ($\geq$ 1 egg hatched), and 1 nest was abandoned. Clutch size varied between 4-7 eggs/nest.

Brood-rearing

In 2007 we continued monitoring sage-grouse broods using methods in Burkepile et al. (2002). Within 1 day of hatching, the brood hen was approached in the morning or evening when she was most likely brooding. We would flush the hen and gather the 1 to 2 day-old chicks. They were placed in a heated secure enclosure. Each chick was weighed (most weighing ~ 30 grams); a 1.5 gram radio was attached to the backs of all chicks using sutures. We were able to document mortality of marked chicks, overall brood mortality, and document brood hopping. Brood hopping is defined as a chick leaving its mother hen to join the brood of another hen.

Of the 13 successfully hatched broods, we were able to mark and monitor 12. Of the 12 marked broods, 6 (50%) were successful ($\geq$ 1 marked chick survived 50 days after hatch), 2 (17%) broods' fates are unknown as we lost contact with chicks (most likely due to brood hopping). Within 3 (25%) broods we documented brood hopping (Table 1). We documented brood hopping as early as within the first week, with occurrences increasing as the brood got older. We also documented unmarked chicks brood hopping into our monitored broods. Many of our radio marked chicks went "missing," meaning we could not find their signal or document if they died or brood hopped.

Overall, brood success in 2007 was low in comparison with last year. Based on our first three years of this more intensive brood monitoring, Parker Mountain sage-grouse are having good although variable success.

Vegetation data taken at brood sites suggest Parker Mountain brood habitat is lower in forb coverage compared to other study areas. The majority of our 2005, 2006, and 2007 early (< 3 weeks) brood-rearing took place in black sagebrush (*A. nova*)-dominated sites. These sites are typically low in forbs. High arthropod density and diversity may also contribute to increased chick survival. We collected arthropod data along with vegetation data during 2007. We are currently analyzing these data.

Table 1. Brood data for Parker Mountain, 2005-2007.

Year	# of Radioed Broods	# of Radioed Chicks	Average Radioed Chicks per Brood	[a]# Successful Broods	[b]# Unsuccessful Broods	[c]# Broods with Unknown Fate	Average # of Radioed Chicks per Brood that Survived >42 Days	Proportion of Marked Chicks Which Survived out of the Avg. # Radioed in Each Brood
2005	22	90	~5	13 (54%)	1 (5%)	7 (32%)	2.71	0.542
2006	21	60	~3	17 (81%)	1 (5%)	3 (14%)	1.35	0.450
2007	12	55	~4	8 (67%)	1 (8%)	3 (25%)	1.08	0.270
2007*	12*	55*	~4*	6* (50%)	3* (25%)	3* (25%)	0.75*	0.188*

[a]Successful broods were defined as at least one radioed chick surviving past 42 days
[b]Unsuccessful broods were defined as all radioed chicks in the brood died
[c]Each year we had broods where radioed chicks went missing and we could not document whether they died or brood hopped due to telemetry difficulties
[d]This data is needed to clarify the Avg. # of radioed chicks per brood that survived > 42 days, because the values are not comparable without taking into account the # of radioed chicks per brood, which differed between 2005, 2006, and 2007.
[*]Due to other research objectives, surviving chicks were followed for 50+ days for the 2007 field season.

Vegetation Treatments

Parker Lake Experimental Pasture

We again measured vegetation characteristics in the Dixie harrow, Lawson aerator, Tebuthiuron, and control plots in the Parker Lake Pasture (PLP) in 2007. However, rather than measuring vegetation response in early and late brood-rearing periods, we only recorded measurements at the beginning of July. Analysis of previous years' data showed the greatest differences in vegetation occurred year to year and not within years. Vegetation conditions were similar in all treatments in 2007. The treatments continue to exhibit greater vegetation diversity than the untreated or control plots.

Sage-grouse use

Bird dog surveys were conducted mid- to late-July 2007. The entire plot was covered by a dog in ~1.5 hours. Each plot was surveyed twice, as in past years. Grouse were flushed and classified as chick, hen, male, or unknown. Broods were counted as a hen with any number of chicks. If more than one hen flushed with multiple chicks, the number of broods equaled the number of hens.

Like previous years, bird dog surveys indicated differential selection by sage-grouse with all treatments being preferred over control. Specifically, spike treatments were preferred over other treatment types. Broods also preferred treatment areas, especially spike plots. Vegetation, specifically forbs, within spike areas seemed to differ from the other treatment types. This difference is still being analyzed.

In July 2007 each plot in PLP was surveyed for sage-grouse pellets. Each plot was randomly assigned 3 transects, each within one-third of the plot. Transects were walked slowly while researchers recorded number of pellets (including cecal droppings), distance of pellets to centerline (meters), estimated distance of pellet to edge of habitat type (meters), and habitat type where pellet was found. Edge of habitat was determined by a change in dominant shrub species or abrupt change (e.g., edge of a treated area or a road). Roost piles were counted separately, but equal one pellet cluster occurrence within this analysis.

The spike treatment was again preferred above all other treated areas. Bird dog surveys confirm a general increase in bird-use within PLP year to year. We believe the increase in overall sage-grouse numbers combined with favorable precipitation and increased herbaceous cover in all plots (including control) is causing birds to use the control plots more compared to previous years.

Sage-grouse pellets were found in black sagebrush, mountain big sagebrush (*A. tridentate vaseyana*), silver sagebrush (*A. cana*), aspen (*Populus tremuloides*), and treatment areas. Only big sagebrush and treatment areas were used because of the low sample size in silver sagebrush and aspen in PLP. Pellets found in black sagebrush were ignored because grouse use these areas as nocturnal roosting habitat, and not for diurnal foraging and loafing cover. Like past years, most pellets in 2007 were found near edge (< 40 meters) of intact sagebrush or treatment areas.

Please see more comprehensive results from data gathered in Parker Lake Pasture from 2000 to 2004, which are contained in Dahlgren et al. (2006) published in the Wildlife Society Bulletin.

Rabbit exclosures

Herbaceous understory abundance data collected from June to September in 2002 suggested that rabbits may have had an impact on forage production in the treatment area. August seems to be when rabbit herbivory was greatest. In 2007, we used the same techniques to monitor vegetation responses that were used in the previous 3 years. Our preliminary (2002) data suggested that rabbits may have been removing up to 20% of the treatment response in some plots, though that impact has diminished over the last couple of years. We do not know if this is due to a decline in rabbit populations or a different herbivory regime by the rabbit population.

Strategic Sheep Grazing to Improve Sage-grouse Brood-rearing Habitat

This is a new study that began in 2006. The purpose of this study is to evaluate the effects of strategic sheep grazing on vegetative communities believed important to sage-grouse brood. Intensive dormant season sheep grazing should increase the abundance of herbaceous understory plants by reducing competition by sagebrush as well as through pedoturbation and nutrient recycling (sheep urine and feces).

The experimental design consists of 8 sets of paired plots, 1 grazed plot and 1 control. Four sets of paired plots are located in areas having received a once-over Dixie harrow treatment in 2001. The other 4 sets of paired plots are located in sagebrush stands that had not been manipulated. Selection of which plots would be grazed and which would serve as a control was random. Each plot is approximately 3.2 ha.

Pre-treatment Data Collection

Pre-treatment vegetation data was collected during the first 2 weeks of July 2006. Four transects were randomly located within each plot as well as at 10m, 20m, and 30m outside each plot. Vegetation metrics measured included shrub cover and height (line intercept), vertical obstruction (Robel pole), and understory vegetation composition and ground cover (20 x 50 centimeter Daubenmire frame and point intercept).

Immediately after vegetation data collection was completed, arthropods were sampled in and around all plots. Pitfall traps were established near each vegetation transect. Diluted antifreeze was poured into each pitfall trap to euthanize and preserve arthropods falling into the traps. Each pitfall trap was left open for approximately 48 hours.

During late July 2006, pellet counts and bird dog flush counts were conducted in all plots. Sage-grouse pellets were counted and removed from 1-meter radius circular plots located at each end of each vegetation transect in and around each plot. Bird dog flush counts were conducted using dogs experienced at locating sage-grouse on Parker Mountain. Each plot was thoroughly covered by at least 1 dog and 1 handler. All grouse flushed from a plot were counted and their approximate location marked with a GPS.

Just prior to sheep grazing, shrub density was estimated using five 3-m radius circular plots in each control and grazed plot. At the same time, 5 sagebrush plants were randomly chosen and all above ground biomass was harvested. Harvested plants will be dried and weighed as an estimate of sagebrush biomass within each plot. Biomass sampling was repeated immediately after grazing to determine the amount of biomass consumed by sheep.

Sheep Grazing

Beginning in mid-September 2006, 3-strand electric fences were constructed around plots randomly chosen to be grazed. Approximately 1,000 local ewes belonging to Andy Taft were used to graze plots. The sheep were split into 2 herds of approximately 500 head each so that plots could be grazed 2 at a time. The sheep were moved onto the first 2 plots on 17 October. Grazing was conducted at this time to insure that herbaceous plants were dormant and therefore not negatively effected and to allow time for terpene levels in the sagebrush to decline. Grazing typically took between 7and 10 days per plot, depending on the amount and size of the sagebrush in each plot. Grazing was completed on 27 November 2006. Assessments of sheep body condition were conducted prior to grazing and again at the end of the treatment by Kim Chapman, Extension Livestock Specialist, Richfield, Utah. The average pregrazing body condition was determined to be 2.5. After approximately 1.5 months of grazing sagebrush, the average body condition was determined to be between 2.5 and 2.75.

Post-treatment Data Collection

Vegetation, arthropod, and grouse use data were collected during the summer of 2007 in the same manner as the data were collected prior to grazing in 2006. Sagebrush coverage in grazed plots was reduced from approximately 27.3% in July 2006 to approximately 8.6% in 2007. Conversely, sagebrush coverage in ungrazed plots increased from 26.5% in 2006 to 26.9% in 2007. In 2007, both forbs and grasses had less coverage than in 2006 (Figure 5). However, both forbs and grasses had greater coverage in grazed plots than in control plots, despite heavy grazing by cattle and antelope. The general reduction in forbs and grasses is likely due to the lack of winter snow pack and summer precipitation.

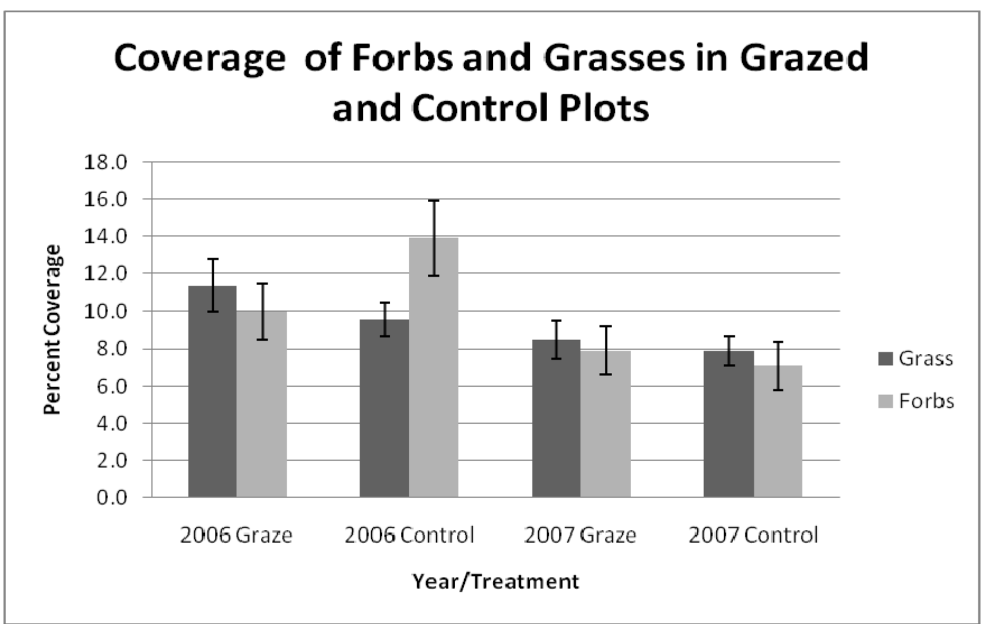


Figure 2. Forb and grass coverage in experimental sheep plots, Parker Mountain 2006 and 2007.

Shrub density was reduced from approximately 25,818 plants per hectare in 2006 to 10,232 in 2007. Density in ungrazed plots did decline from an average of 24,174 plants per hectare in 2006 to 21,638 plants per hectare in 2007.

Grouse use of Sheep Plots

Pellet counts conducted in all plots indicate that in 2007, grouse used grazed plots in the Parker Lake area (area received a twice-over Dixie harrow treatment in 2001) more than any of the other plots. On average, grazed plots contained 5 times as many pellets as did ungrazed plots. Both walking area constrained surveys and bird-dog flush count survey further confirm that grouse used grazed plots more heavily than ungrazed control plots (Figure 6). During 3 area constrained surveys, an average of 5.8 grouse were flushed per grazed plot, compared to an average of 1.9 grouse per ungrazed plot. Bird-dog surveys conducted in 2006 indicate that sage-grouse were using control plots more than grazed plots (bird-dog surveys were conducted prior to applying grazing treatments in 2006). In 2007, no grouse were flushed from control plots. In comparison, an average of 2.6 grouse were flushed per grazed plot.

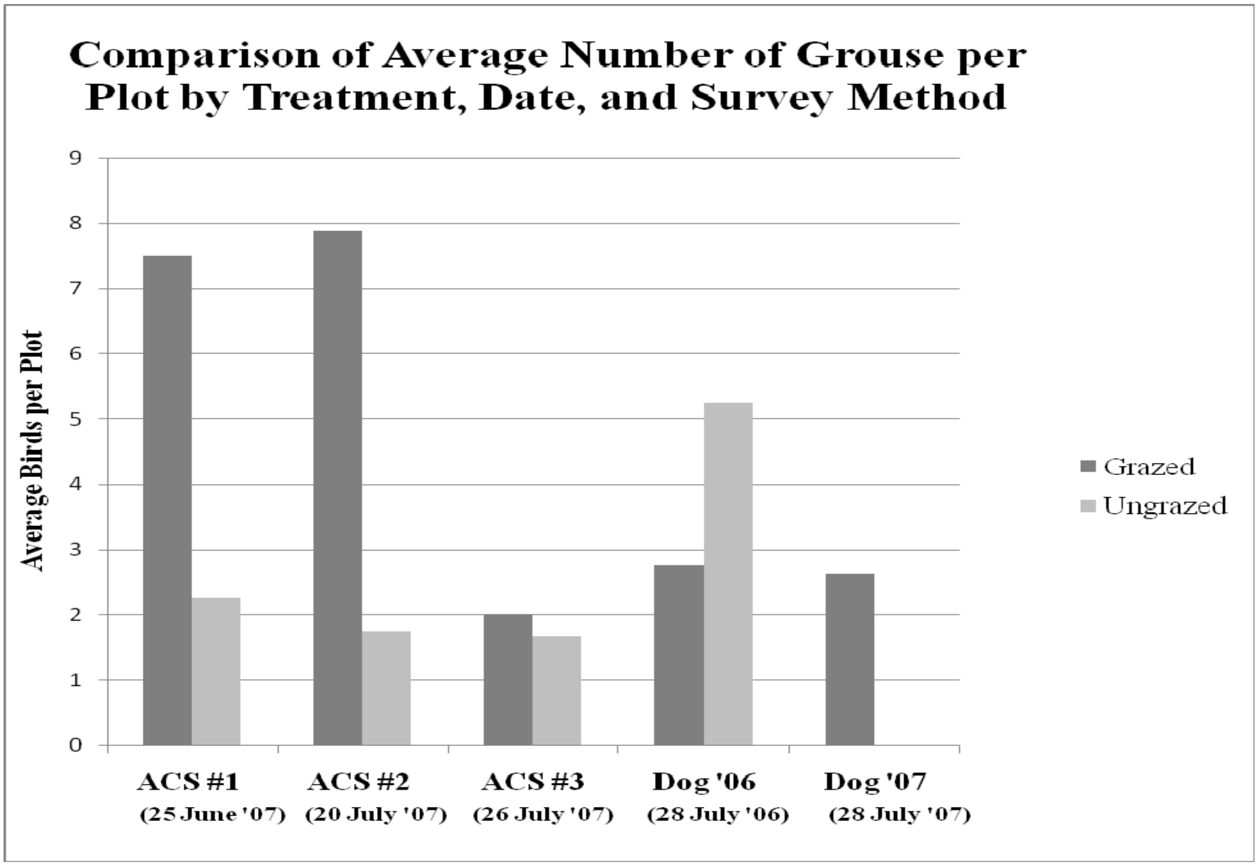


Figure 3. Average number of bird flushed per plot during area constrained surveys (ACS) and bird-dog flush counts.

Sage-grouse nest and brood-site fidelity

A new study aimed at investigating the occurrence of intergenerational nest and brood-site fidelity among female greater sage-grouse began in 2006. The objectives of this study are to determine if female sage-grouse exhibit fidelity to their natal nest-area, the route they traveled as chicks, or to areas with similar vegetative characteristics. These issues will be addressed by following, via radio telemetry, individual birds from the time they are hatched through 1 to 2 years of adult life. Field methods used in data collection are similar to those described above for nesting and brood studies. Of the 4 chicks that were recaptured and fitted with adult collars in 2006, 2 were dead as of the 2007 nesting season. Of the 2 surviving chicks, one was determined to be a male. The final remained bird is believed to be a female but did not nest in 2007. Nine chicks were recaptured and fitted with adult collars in 2007. One of these birds was predated within one week of being recaptured. No actual results concerning site-fidelity are available at this time.

2008 Plan of Work

Telemetry studies will continue in 2008. Hens and chicks will again be captured in the spring and early summer and fitted with radio-transmitters. Telemetry data from 2008 will contribute to the growing data set of sage-grouse reproductive ecology on Parker Mountain. Telemetry data will also be used in the continuing intergenerational site fidelity study that began in 2006. Vegetation measurements, pellet counts, area constrained surveys, bird-dog flush count surveys, shrub density, and shrub biomass data will again be collected as part of the sheep grazing study.

Currently, there are plans to begin a sage-grouse chick diet study in 2008. While chick diets have been investigated in other areas in the past, chicks on Parker Mountain are believed to use atypical habitat during the early brood-rearing period. As part of understanding the influences behind choosing these habitats, we feel it is necessary to know what the chicks are eating during this period. This study will also attempt to develop a new method of evaluating sage-grouse chick diets.

Utah Prairie Dog

Cattle Grazing and Utah Prairie Dog Interactions on Parker Mountain

The Utah prairie dog (*Cynomys parvidens*) is a federally listed species that occurs only in southwestern Utah. The Awapa Plateau in south-central Utah is one of 3 Utah prairie dog recovery areas. The prairie dog population in this area is below recovery goals established in 1991 by the U.S. Fish and Wildlife Service (USFWS). In 2002 the USFWS approved 3 Utah prairie dog mitigation banks on the Awapa Plateau. Little information exists regarding how these mitigation banks should be managed to optimize benefits for the species. Past research has suggested that management actions to reduce shrub canopy cover result in increased grass and forb cover and may benefit Utah prairie dogs.

From 2002-2005, we evaluated the effects of 20-30%, 50-60%, and 80-90% forage (grass) utilization rates, using domestic cattle under a high-intensity/short duration grazing regime, on Utah prairie dog habitat use and foraging behavior on rangeland owned by Utah School and Institutional Trust Lands (SITLA) on Parker Mountain. Parker Mountain is included in the Awapa Plateau recovery area. We wanted to determine if high forage utilization by cattle over short periods could improve Utah prairie dog habitat by reducing shrub cover. Additionally, we wanted to determine what forage utilization rate would be most compatible with the management of prairie dogs.

This work was completed in 2006. Dwayne Elmore, the PhD candidate who worked on the project defended his dissertation and accepted a position as an Assistant Professor and Extension Wildlife Specialist at Oklahoma State University.

We found no evidence that any of the forage utilization levels tested affected Utah prairie dog densities or burrow density. However, Utah prairie dogs spent more time foraging and were less vigilant under high (80-90%) cattle forage utilization. Higher foraging rates by cattle coincided with reduced grass cover in the high utilization pastures. No change in plant composition, particularly shrub cover, was detected for the forage utilization rates implemented during this study.

Our results suggest that implementation of high forage utilization by cattle (80-90%) may negatively effect Utah prairie dogs if it results in increasing predation risks or reduced energy intake. Currently, livestock grazing on the Awapa Plateau (SITLA lands) is managed to achieve a 50-60% forage utilization rate. Our research suggests this forage utilization level is compatible with Utah prairie dogs even through it coincided with peak prairie dog nutritional needs. However, because no reductions in shrub cover were detected even under the highest forage utilization level evaluated, we recommend that mechanical treatments be evaluated for use on the Awapa Plateau to improve Utah prairie dog habitat in areas where shrub cover exceeds recommended guidelines. We recommend that the use of livestock, particularly sheep be implemented and evaluated to maintain treated areas. In summary we did not detect any evidence that current grazing regimes as implemented by SITLA lands on the Awapa Plateau are detrimental to Utah prairie dogs.

Aspen Regeneration

Background

Aspen (*Populus tremuliodes*) has the greatest distribution of any tree species in North America (Bartos 2001). Aspen is a disturbance-dependant species, adapting well to the fire regimes of western landscapes pre-European settlement. Fire suppression and long-term heavy grazing have been implicated as important factors in reducing the amount of aspen dominated lands in the Intermountain West (Bartos and Campbell 1998).

Aspen rely mainly on asexual reproduction produced primarily after a disturbance or dieback of the aspen stand. Regeneration of aspen is dependent on three factors: hormonal stimulation, growth environment, and protection of the resulting suckers (Bartos 2001). Disturbance decreases the flow of auxin; a cytokinin suppressing chemical. Cytokinins stimulate asexual regeneration or suckering of aspen (Bancroft 1989). Asexual reproduction produces many genetically identical replicate ramets (individual trees). A cluster of these ramets is called a clone. Aspen produce many viable seeds for sexual reproduction, but the availability of ideal germinating conditions in the west inhibits germination and survival of seedlings (Bartos 2001). Aspen is an important component of western forests and is considered a key indicator of ecological integrity (White et al. 1997). Aspen stands typically have a higher primary production in their understory compared to other forest types in the Intermountain West (Mueggler 1988). Higher primary production results in a more diverse array of animal species. As such aspen provides many benefits to wildlife. Mule deer (*Odiocoileus hemionus*) and elk (*Cervus elaphus*) feed on young aspen shoots (Gruell and Loope 1974, Krebill 1972, DeByle 1985b). A great diversity of birds feed and nest in aspen (Debyle 1985). Young aspen ramets are also used by livestock as a food source on western rangelands (Shepperd 2000). Aspen stand regeneration can be stunted by herbivory, especially large ungulate herbivory (e.g. deer, elk, and livestock) (Kay and Bartos 2000).

Although some natural regeneration of aspen stands is occurring on Parker Mountain, many stands are not. Stands with little or no regeneration will eventually die out and a net loss in aspen will occur on Parker Mountain. Utah School and Institutional Trust Lands Administration has tried clearcutting aspen stands in the recent past with varying results in regeneration (R. Torgerson, SITLA Biologist; Richfield, Utah, personal communication).

Because deer and elk regularly forage in aspen, and Parker Mountain supports increasing populations of these large ungulates, it is believed they may be impacting regeneration. Additionally, Parker Mountain is also grazed by domestic livestock. However, it is not known what affect livestock are having on stand regeneration.

Many passerine species use aspen stands. Little is known about passerine species abundance in aspen on Parker Mountain. These stands may be important for both reproduction and as migration staging areas of these birds.

Greater sage-grouse regularly using young, regenerating aspen stands during the mid- to late-summer. Use seems higher during summers of extreme drought (L. Bogedahl, UDWR, retired, personal communication). While flushing grouse out of aspen stands, researchers noticed a high forb component in these regenerating stands, probably due to more ameliorated environment provided by the aspen canopy. All age classes of sage-grouse have been found in regenerating aspen stands, though broods seemed to be most abundant (D. Dahlgren, Utah State University, personal communication). Use of aspen stands is probably incidental to sage-grouse biology and not critical, due in part to a lack of raptors, specifically red-tailed hawks (*Buteo jamaicensis*), using aspen for perches (J. Connelly, Idaho Fish and Game, personal communication).

In October 2004 members of the Parker Mountain Adaptive Management Working Group toured several aspen stands to assess regeneration. The group was concerned about the lack of regeneration in many of the older aspen stands. To determine if ungulates were responsible for the lack of regeneration, PARM agreed to implement an experiment to evaluate the effectiveness of 2 exclusion techniques during the first few years of regeneration (Kay and Bartos 2000). The experiment in addition to determine the probable cause for the lack of regeneration would evaluate which technique would be the more cost effective and sustainable. Other questions that will be addressed include: 1) what neo-tropical bird species use the aspen stands on Parker Mountain, 2) the relative use and abundance of these species in aspen stands, and 3) sage grouse use of aspen stands on Parker Mountain.

Methods

In 2005 we manipulated five randomly selected aspen stands and determine vegetation response, wildlife response, and the most effective treatment method. Stand and regeneration density, diameter at breast height (dbh), tree height, canopy cover, herbaceous cover, sage-grouse use, and songbird diversity and abundance will be measured pre- and post-treatment.

The 5 aspen stands chosen for the experiment were located in or near the Chicken and Forshea Spring areas. Linear stands of aspen extending into the sagebrush communities were selected. The smaller strings of aspen are where researchers have recorded sage-grouse using aspen regeneration. Other factors that were considered when selecting stands was canopy cover, lack of recent (the last 20 years) regeneration, and the proximity of a stand to roads (for cutting accessibility).

Five treatments were applied to each of the five stands. Three of the treatments included clearcutting to stimulate regeneration. In each treatment we fenced a 30x30 meter plot. One cut and one uncut plot were fenced using a poly-mesh material. The mesh was attached to a 2x2x8 board which was attached directly to each corner aspen tree using nylon tie downs; metal t-posts or aspen were used in-between the corner trees. A 3-4 inch gap was left at the bottom to allow small animals and grouse entry, but was low enough to exclude large ungulates. An uncut reference plot was not fenced.

One plot was cut in a jack-strawed fashion; the slash and trees were left after cutting so that they created obstacles that would impede potential herbivore access. Another plot was cut, the logs removed and placed around the perimeter of the plot. The remaining plot was clearcut and all logs completely removed. Thus, this plot did not have any type of barrier or exclosure that could inhibit access by a potential herbivore.

The plots were split into two groups, 2 side by side uncut plots, and 3 side by side angled cut plots within each stand (Figure 5). Each group was randomly placed randomly starting in one of the corners of each aspen stand. Each plot within a stand was separated by a 20 meter buffer. We placed wooden stakes on each corner of the treatment plots to outline their perimeter. Within each plot we systematically placed 2 transects. The transects were placed 5 meters from the edge to minimize any edge effect (Ohms 2003). A 1x1 meter square frame was placed on the right side of the transect line starting at 2 meters, then placed every 4 meters ending at 18 meters. The square frame was used to identify the ramets that were measured and the percent ground cover. Brush cover was determined by the point intercept method along the right side of the transect line. Both height and width of the intercept were measured. Canopy cover was determined by using a densitometer at each meter with a determination of yes or no depending whether there is or is not canopy cover at the densitometer's intercept point. Photo points were set up for each stand to be used for a visual representation of the change in the aspen stands.

Wildlife Responses

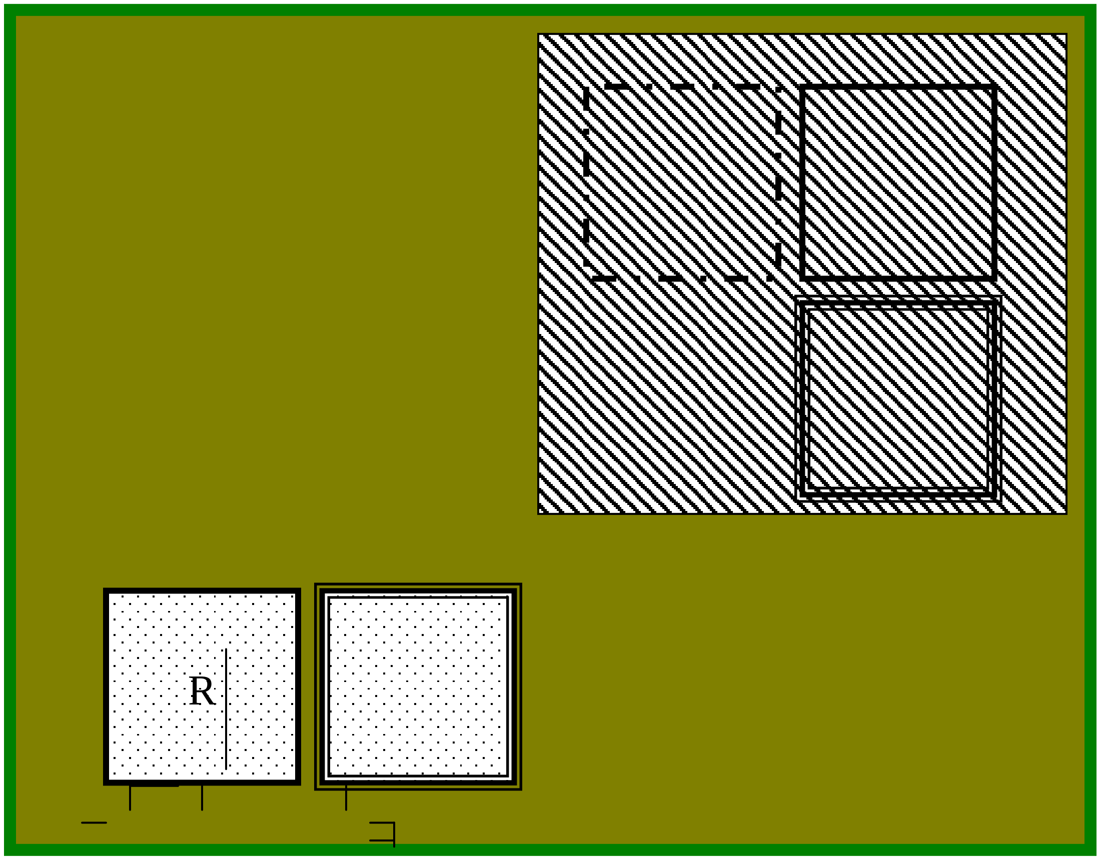
Songbird presence was monitored using point count survey data sheets (Ralph et al. 1993). Including the five stands to be used in the experiment an additional five stands were monitored. The stands monitored were selected based on decadency, little to no regeneration, and proximity to treated stands. To conduct these surveys we identified a center point in the stand surveyed. All birds that were detected within a 50m radius of this center point were recorded.

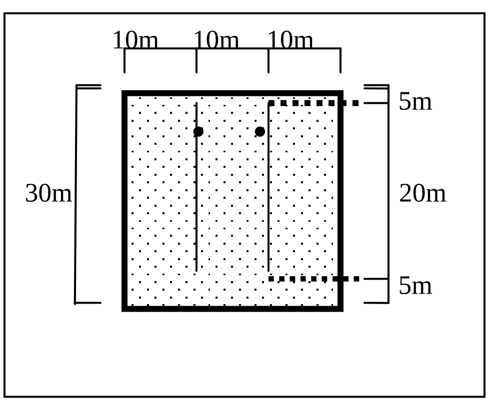
We also conducted random walking surveys of stand to record incidental wildlife observations. We selected 10 days at random out of a 30 day period beginning in mid-July 2006 to conduct the surveys. To conduct a survey, we first walked a 20-30m perimeter around the outside of the treated plots, than walked the immediate perimeter around the edge of the treated plots. We recorded the number and (type) of deer (fawn, doe, or buck), elk (bull, cow, calf) and sage-grouse (male, hen, chick) observed. We also recorded the species and number of rabbits and squirrels, along with the number and age class (cow/calf) of cattle observed. Any other wildlife observed were recorded by number and species (where possible). To be recorded the animal had to be observed in the aspen stand and no more than 20m to the outside of the observer's path. Each day starting point in the stand for the survey was randomly selected. The stands were surveyed on a rotational basis chosen for that day. The stands were surveyed at three time periods throughout the day (morning, afternoon, and evening). The observer walked counterclockwise the first five days, and clockwise the last five days so that each stand was surveyed in both directions.

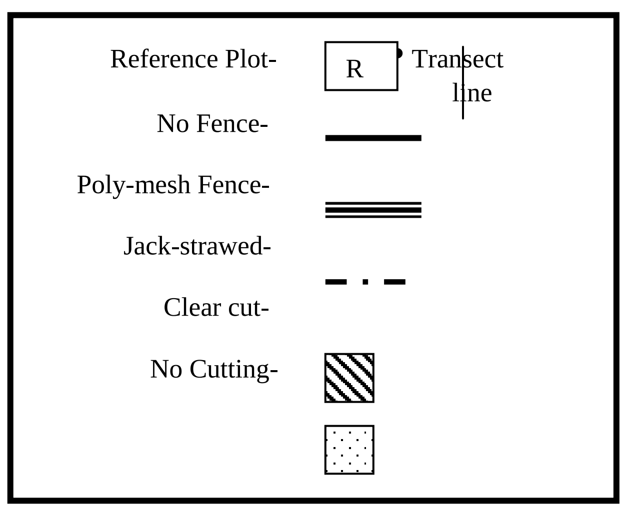
Wildlife response was also recorded using pellet counts. These counts were conducted from a single transect placed within each plot. A randomly selected starting point between one and twenty nine meters was selected. The 30 m tape measure was placed at the top (side where the transect posts are closest to) and we began the count on the right side while facing the plot. A 30m transect line was then placed starting at the random point on the original tape. Starting at the five meter mark on the transect line a rebar post was placed every five meters until twenty five meters is reached. A rope of one meter in length and a loop in one side was placed over the rebar post. The observer than walked a circle around the rebar and identify the type, age, and total number of pellets present within the one meter rope circle.

Figure 4. Experimental Design, Parker Mountain Aspen Regeneration Project, 2005

ASPEN STAND







Birddog surveys, to assess sage-grouse use in general and brood use specifically, were conducted late July to early August beginning in 2006 (Dahlgren et al. 2006). Each plot was surveyed once annually using one dog. The entire plot was covered by a dog in less than 20 minutes. Birddog survey of all plots were conducted in one evening from 1800-2030 hrs. This was done to minimize the risk of double sampling. The survey effort was similar for all plots. In addition to standardized surveys, all incidental sage-grouse observations were recorded throughout the summer. Grouse flushed were classified as chick, hen, male, or unknown. Broods were counted as a hen with any number of chicks. If more than one hen was flushed with multiple chicks, the number of broods equaled the number of hens.

Results

More aspen ramets were produced and survived in the cut fenced plots . Aspen ramets densities were highest in the fenced clear-cut than the jack-strawed or the cut control plots. Ramet height in the first year did not appear to vary due to either fence or cut, whereas in the second year (post-treatment), ramets in the unfenced plots were shorter than in the fenced, particularly in the cut plots compared to the uncut plots. More aspen ramets survived in the cut fenced plots than the unfenced plots.

These observations suggest disturbance in combination with exclusion is needed to maximize ramet production and survival. More ramets were browsed in the cut fenced and cut control plots during August than July suggesting use of the aspen stands by wildlife and livestock is greater later in the summer as the surrounding vegetation senesces. The average cost per surviving ramet was $0.10 for the fenced clear-cut compared to $.04 for the jack-strawed treatment.

Breeding bird richness was greater in the treated stands versus the untreated stands suggesting possible habitat benefits for more species because of the increased edges created by the treatments. Total abundance of breeding birds did was not different between treatment types suggesting there were no negative affects to the current population of breeding birds in the aspen stands. Mule deer (*Odocoilius hemionius*) were the most abundant native large herbivore observed in each stand. Domestic cattle were also documented using the aspen stands. Although elk (*Cervus elaphus*) were never seen using the plots, scat piles were readily evident in all but one of the experimental aspen stands. Small mammals documented included ground squirrels (*Citellus* spp), least chipmunks (*Eutamias minimus*), mountain cottontail rabbits (*Sylvilagus muttalli*), and jack-rabbits (*Lepus* spp). Greater sage-grouse (*Centrocercus urophaisianus*) were documented in all plots except for one. Deer pellets counted were more abundant than cattle, rabbit, and sage-grouse pellets.

Summary and Conclusions

The sage-grouse population on Parker Mountain appears to have natural fluctuation. This year was the highest ever recorded male lek count. Our measurements of sage-grouse use are important monitoring activities. For the third year post-treatment, sage-grouse seem to prefer treated plots over control plots, especially tebuthiuron (spike) plots. The vegetation community and structure will continue to change following treatment. Sage-grouse use patterns within these plots will continue to be assessed.

Nest initiation was comparative to most years. Nest initiation dates for this year were similar to previous years'. Average clutch size was similar to previous years' (six-seven eggs/nest). Nest success was comparatively high. Hen movement was similar to previous years'.

Brood monitoring activities resulted in more clarified information this year. The new technique provided much more detailed information concerning brood-rearing activities and success. Overall brood success was high. There are many factors that influence brood fate such as habitat, insect populations, predation rates, weather patterns, and others. Brood-rearing habitat on Parker Mountain provides all the necessary components according to management guidelines excepting forb cover. Predation, according to the first two years of data, on chicks is relatively low. We saw large movements this year by brood hens that were more sedentary last year. We believe this was a response to little moisture during the nesting and early brood-rearing stages in 2006. One hen moved her < 2 week-old brood over 14 miles in less than 3 days.

Brood hopping may aid in survival for chicks as they grow. In one documented case in 2006, the mother hen died, and the three-week-old chicks joined another brood within two days. We speculate that brood hopping may be prevalent on Parker Mountain due to brood densities in certain areas. The importance of brood hopping is still under investigation, but it may be important to start viewing sage-grouse brood-rearing as a communal activity, rather than a single hen and her chicks.

The response of sagebrush to tebuthiuron treatments has been significant, specifically for more succulent forbs like dandelion. The forb response to tebuthiuron recorded in the Parker Lake pasture is particularly significant. Additionally, forage value of these forbs to sage-grouse broods is critical, especially in dryer years.

Sage-grouse use patterns this year were interesting, with all treatments being preferred over control, specifically tebuthiuron. Along with analyzing vegetation response, documenting sage-grouse use post-treatment will be important to assessing treatment effectiveness. During the third year for Dixie and Lawson post-treatment, and the fourth year for tebuthiuron post-treatment, grouse prefered tebuthiuron treated areas. Timing, precipitation, and other factors may contribute to habitat selection by sage-grouse. Future data will help assess sage-grouse use preferences.

According to previous data rabbit herbivory seemed to impact vegetation response to treatments early. This impact seems to have subsided in recent years. The data collected in Parker Lake Pasture will be important to understanding plant/herbivore interaction, specifically rabbits and herbaceous understory in sagebrush ecosystems.

Prairie dog interactions with cattle grazing have shown some interesting results so far. Utilization levels have been achieved with a high intensity/short duration grazing regime. This regime may be the most productive for Parker Mountain through time. Our research suggests that cattle and the Utah prairie dog can coexist.

The aspen project yielded interesting results. Aspen regeneration and effects of herbivory are important to all Intermountain West forests. The results of this study suggested that the effects of herbivory on aspen regeneration can be mitigated using small plots that are clear-cut and fenced. Neotropical migrant bird richness and sage-grouse use were greater in cut than uncut plots. The smaller cut plots created a forest edge which afforded wildlife increased food availability in proximity to adequate cover.

Evaluating of the Effects of Raven Control

For the last 5 years, USDA Wildlife Services has been conducting raven control on Parker Mountain using DRRC-1339. Our data suggest that over the last several years, nest success and chick survival has increased over previous years when raven control was not conducted. However, without evaluating this treatment, we cannot unequivocally attribute the observed increases to raven control. We are currently discussing how to effect this evaluation. An evaluation proposal is being prepared for presentation to the working group for their consideration.

Literature Cited

Bancroft, B. 1989. Response of aspen suckering to pre-harvest stem treatments: A literature review. Forestry Canada and B.C. Ministry of Forests, Research Branch, Victoria, British Columbia, Canada.

Bartos D. L. and R. B Campbell. 1998a. Decline of quaking aspen in the interior west- examples from Utah. Rangelands 20: 17-24.

Bartos, D. L. 2001. Landscape dynamics of aspen and conifer forests. Pages 5-14 *in* W. D. Shephard, D. Binkley, D. L. Bartos, T. J. Stohlgren, and L.G. Eskew, compilers. Sustaining Aspen in Western Landscapes: Symposium Proceedings, USDA Forest Service Proceedings RMRS- P-18. Ft. Collins, Colorado, USA.

Burkepile, N. A., J. W. Connelly, D. W. Stanley, and K. P. Reese. 2002. Attachment of radiotransmitters to one-day-old sage grouse chicks. Wildlife Society Bulletin 30: 93-96.

Dahlgren, D. K., R. Chi, and T. A. Messmer. 2006. Greater sage-grouse response to sagebrush management in Utah. Wildlife Society Bulletin 34: 975-985.

Dahlgren, D. K. 2006. Greater Sage-grouse Reproductive Ecology and Response to Experimental Management of Mountain Big Sagebrush on Parker Mountain, Utah. Thesis, Utah State University, Logan, Utah, USA.

Debyle, N. V. 1985. Wildlife. Pages 135-152 *in* N. V. Debyle and R. P.Winokur, editors. Aspen: Ecology and management in the western United States. U. S. Department of Agriculture, Forest Service, General Technical Report RM-1 19**.**

Geisen, K. M., T. J. Schoenberg, and C. E. Braun. 1982. Methods for trapping sage-grouse in Colorado. Wildlife Society Bulletin 10: 224-231.

Gruell, G. E., and L. L. Loope. 1974. Relationships among aspen, fire, and ungulate browsing in Jackson Hole, Wyoming. USDA For. Service, Intermountain Region, and USDI National Park Service, Rocky Mountain Region.

Kay, C. E., and D. L Bartos. 2000. Ungulate herbivory on Utah aspen: Assessment of long-term exclosures. Journal of Range Management 53: 145-153

Krebill, R. G. 1972 Mortality of aspen on the Gros Ventre elk winter range. USDA Forest Service Research Paper INT-129. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA.

Mueggler, W. F. 1988. Aspen community types of the intermountain region. USDA Forest Service General Technical Report INT-250. Ogden, Utah, USA.

Ohms, S. R. 2003. Restoration of aspen in different stages of mortality in Southern Utah. Thesis. Utah State University, Logan, Utah, USA.

Ralph, C. J., G. R. Geupel, P. Pyle, T. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring land birds. General Technical Report PSW-GTR-144. Pacific Southwest Research Station, USDA Forest Service, Department of Agriculture, Albany, California, USA.

Shepperd, W. D. 2000**.** Manipulations to Regenerate Aspen Ecosystems. Pages 355-366 *in* W. D. Shephard, D. Binkley, D. L. Bartos, T. J. Stohlgren, and L. G. Eskew, compilers. Sustaining Aspen in western landscapes, Symposium Proceedings, USDA Forest Service RMRS- P-18. Ft. Collins, Colorado, USA.

White, C. A., C. E. Kay, and M. C. Feller. 1997. Aspen communities: A key indicator of ecological integrity in the Rocky Mountains. Presented Sampa III: The Third International Conference of Science and Management of Protected Areas. May 12-16. Calgary, Alberta, Canada.

Appendix A

<u>Summary of Biological Information:</u>

2004's sample size is very low (n=9) and may not be representative of the population at large

I.	Lek Counts	1998	>273 males		
		1999	>350 males, up>25%		
		2000	>350 males, still up but down slightly from 1999		
		2001	>450 males, up ~20% from 2000		
		2002	>550 males, up ~15% from 2001		
		2003	>413 males, down 25% from 2002		
		2004	>541 males, up 32% from 2003		
		2005	>677 males		
		2006	>997 males		
		2007	**>936 males**		
II.	Nest Initiation		Y	A	
		1998	8/19	8/9	(57%)
		1999	6/16	16/17	(67%)
		2000	* 13/26		(50%)
		2001	* 17/25		(68%)
		2002	* 19/26		(79%)
		2003	* 18/19		(95%)
		2004	* 5/9		(56%)
		2005	* 35/55		(65%)
		2006	* 35/43		(81%)
		2007	* 21/40		(53%)

* Denotes combined yearling and adult data

III.	Nest Predation				
		1998	3/16	(19%)	
		1999	10/19	(53%)	
		2000	2/13	(15%)	
		2001	6/17	(35%)	
		2002	5/19	(25%)	
		2003	7/18	(39%)	
		2004	1/5	(20%)	
		2005	8/35	(23%)	2A 2I….Success 66%
		2006	8/35	(23%)	
		2007	**7/21**	**(33%)**	

IV.	Adult Mortality			
		2000	6/21	(28%)
		2001	6/25	(24%)
		2002	9/26	(35%)
		2003	9/25	(36%)
		2004	2/9	(22%)
		2005	5/55	(9%)
		2006	10/50	(20%)
		2007	**4/30**	**(13%)**

V.	Brood Survival (>1 chick survived past 42 days)			
		2005	*13/22	(54%)
		2006	*17/21	(81%)
		2007	*** 6/12**	**(50%)**

*****These numbers don't factor in brood lost due to telemetry difficulties, only known fate