2008 ANNUAL REPORT

PARKER MOUNTAIN
ADAPTIVE RESOURCE MANAGEMENT GROUP (PARM)

Prepared by

Michael Guttery, David Dahlgren, Danny Caudill,
Gretchen Hochnedel, Todd Black, 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

2008 ANNUAL REPORT

PARKER MOUNTAIN ADAPTIVE RESOURCE MANAGEMENT GROUP (PARM)

Cooperators

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

Prepared by

Michael Guttery, David Dahlgren, Danny Caudill,
Gretchen Hochnedel, Todd Black, 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

Table of Contents

Page

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 to be 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 (UDWR) 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 5th 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 2008 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 a means of assisting in the recovery of the species.**

Sage-grouse Research

Sage-grouse Biology

Sage-grouse lek counts

Lek counts were conducted in April 2008. Lek counts in 2008 were down considerably. A total of 616 males were observed in 2008 on annually counted leks (Figure 1). The unofficial count (including leks newly discovered in 2007) was just below 1000 males. The official 2008 count (616) was the lowest observed on Parker Mountain since 2004. The low count in 2008 may be at least in part due to poor chick production and survival in 2007 (Table 1). Consistent with the past four years, PARM members assisted census efforts on Parker Mountain in 2008. 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.

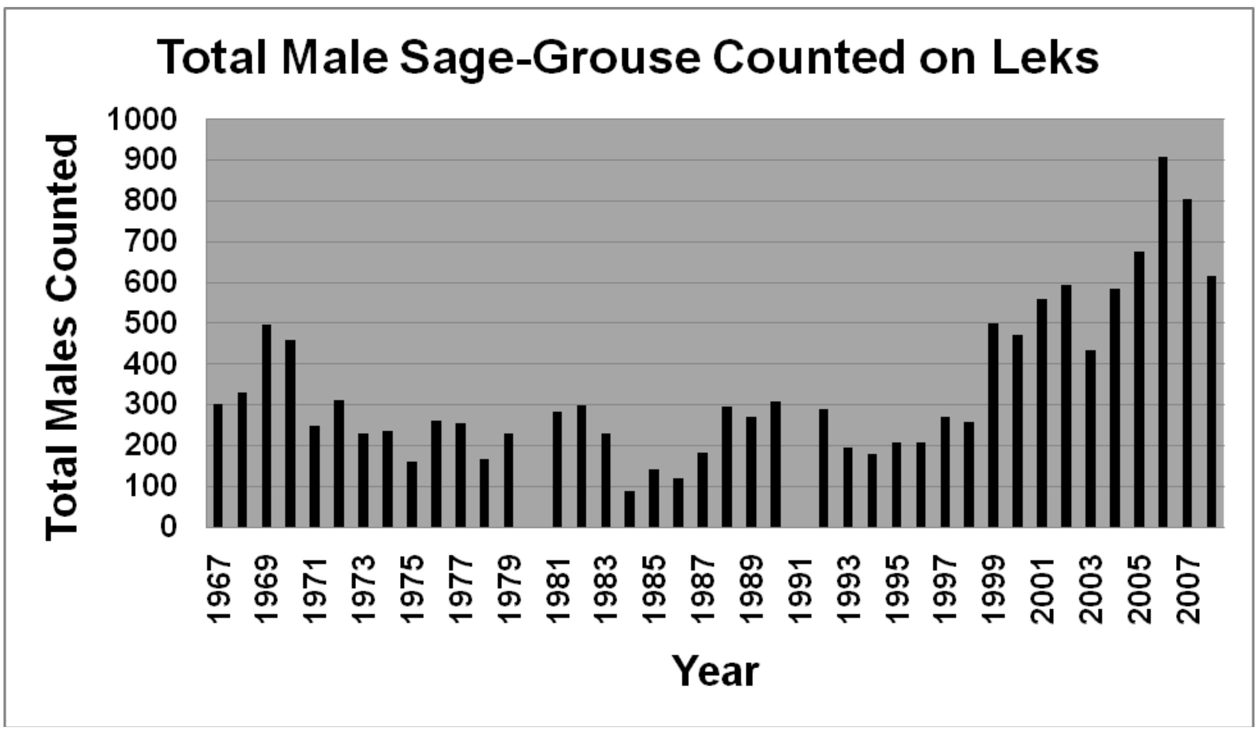

Figure 1. Historic and recent lek counts of the Parker Mountain sage-grouse population

Sage-grouse hen captures

In April 2008 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 in the Bogedahl lek area. Trapping efforts were completed during 2 consecutive nights (April 11-12). Trapping efforts were conducted by Utah State University and UDWR personnel with assistance provided by DWR personnel and other volunteers. With these 30 hens plus the 16 remaining hens that were captured in 2007 and 4 remaining hens that were captured in 2006, we had the potential to monitor 48 hens in 2008.

Monitoring sage-grouse hens

From May to August 2008, 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 previous years, we concentrated our efforts on monitoring nesting hens and hens with broods.

Nesting

The radio-collared hens began nesting (incubation, ~28 days) in late April and throughout May. During May, 23 of the 48 collared hens (48%) 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. Three of the 23 nests were depredated (13%). One of the depredated was monitored for >40 days before the nest was predated, indicating that the eggs were not fertile and thus the depredation did not actually result in a reproductive loss. One hen was found dead near her nest but the eggs were not disturbed. Nineteen (82.6%) were successful (≥ 1 egg hatched). Clutch size varied between 3-8 eggs/nest.

Brood-rearing

In 2008 we continued monitoring sage-grouse broods using the methods detailed in Burkepile et al (2002). Within 5 days of hatching, the brood hens were approached in the morning or evening while brooding the chicks. Hens were flushed and the chicks collected and placed in a secure warm container (usually a small lunch cooler). 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 brood mixing. Brood mixing is defined as a chick leaving its mother hen to join the brood of another hen.

Of the 19 successfully hatched broods, we were able to mark and monitor 11. Of the 11 marked broods, 10 (91%) were successful (≥ 1 marked chick survived 42 days after hatch), 1 (9%) broods' fates was unknown as we lost contact with chicks (possibly due to brood hopping). Within 3 (18%) broods we documented brood hopping (Table 1). We have documented brood hopping as early as within the first week, with occurrences increasing as broods get 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 2008 was excellent in comparison with 2007. Based on our first 4 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, 2007, and 2008 early (< 3 weeks) brood-rearing took place in black sagebrush (*A. nova*)-dominated sites. These sites are typically low in forbs. We are currently conducting more thorough analyses these data.

Table 1. Brood data for Parker Mountain, 2005-2008.

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%)	2 (17%)[e]	2 (17%)	1.08	0.270
2008	11	66	~6	10 (91%)	0 (0%)	1 (9%)	3.45	0.575

[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.
[e]Both unsuccessful broods had only one chick marked

Effect of Brood Mixing and Habitat Use of Greater Sage-grouse Chick Survival

In 2008, analysis was completed on data collected for 89 chicks in 21 broods and 61 chicks in 21 broods in 2005 and 2006 (n = 150), respectively. Only 2.6% of the chicks (n = 3 in 2005, and n = 1 in 2006) were classified as deaths due to handling or radio-marking and all were excluded from survival analyses. Therefore, 146 individual chick survival histories were used to estimate survival to 42 days. Of the 21 radio-marked hens monitored in 2005, 7 had radio-marked broods in 2006 as well. Of the 42 radio-marked broods, 29 had adult hens, 11 had yearling hens, and 2 hens were of unknown age.

Brood-mixing occurred with 21% (31/146) of radio-marked chicks, and within 43% (18/42) of monitored broods. We documented 2 cases of radio-marked brood hen mortality during the brood monitoring period. In each case the radio-marked chicks were assimilated into unmarked broods within 48 hours of the documented hen mortality. In 45% (9/20) of brood-mixing events, multiple radio-marked chicks (2 or 3) left their original broods and joined new broods (unmarked hens) at the same time; one multiple-mixing event was due to brood hen mortality. In 2005 all but 1 (a hen of unknown age) brood-mixing events took place with yearling hens. In 2006 all radio-marked brood hens were adults. Disregarding mixing events due to brood hen mortality, multiple chick mixing took place in 71% (5/7) of yearling hen broods, and in only 20% (2/10) of adult hen broods.

Brood-mixing occurred during weeks 1 to 6 of development, with 70% (14/20) of brood-mixing events taking place within weeks 2 and 3. Additionally, we found indications of chicks from unmarked broods switching into marked broods. We documented presumably older/larger chicks that greatly exceeded the range of chick weights (24-36g) for 1 or 2 day old chicks when capturing broods within 24-48 hours of hatch. Moreover, inadvertent flushing of chicks occurred later in the monitoring period and we occasionally documented a marked increase in the number and/or differentiation in the size (a relative correlate of age) of flushed chicks within a given brood, which we assumed was due to brood-mixing into the marked brood.

Predation accounted for 32% (38/120) of known chick fates. Of the documented chick predations, we attributed predation to avian (n = 8), mammalian (n = 8), and unknown (n = 22) causes. For the mammalian depredated chicks 50% (n = 4) were found underground in long-tailed weasel (*Mustela frenata*) dens. We attributed 6 deaths to exposure.

In 2006 we monitored arthropod abundance at brood sites throughout the early brood-rearing period (day 1-21). We used modeling procedures with chick survival and arthropod abundance data to assess the influence of arthropods during this time. Abundance of all arthropod types, and specifically Orthoptera, Lepidoptera, Coleoptera, and ants, seemed related to chick survival.

Our chick survival (average of 0.50 given our best model) was higher than estimates reported in previous studies. Brood-mixing had the most important influence on chick survival, and may be a strategy to improve chick survival within this population. Our results showed that yearling hens had a higher probability of chicks leaving their broods, which may have provided these chicks with enhanced probabilities of survival. Chicks may be mixing to broods of adult hens, though we did not assess this directly and further research is necessary. In our study, adult hens showed a greater ability than yearling hens to keep chicks within their natal broods. The amount of brood-mixing that occurred in our study indicates that chick survival could be underestimated without radio-marking individuals, and other non-radio-marking methods (e.g., pit tags, leg bands, etc.) may not be sufficient.

Parker Mountain Sage-grouse Population Dynamics (1998-2006)

Data for this research was collected by 3 separate graduate students; Joel Flory (1998-1999), Renee Chi (2000-2002), and David Dahlgren (2003-2006). In the spring of 1998-2006 female sage-grouse were captured on or near leks and radio-collared. During late April (1998-2000) and May (1998-2006) radio-marked hens were monitored to assess nest initiation rates and success, and brood success. Successful radio-marked hens and their broods were monitored regularly (~ every 3 days 1998-2004, and ~ every 2 days 2005-2006). Throughout the study (1998-2006), brood success (or fledgling success) was estimated as the proportion of successfully hatched broods where ≥ 1 chick (marked or unmarked) was observed alive ≥ 42 days following hatch. This research allowed estimation of survival and reproductive vital rates for the Parker Mountain sage-grouse population from 1998-2006.

Survival of yearling and adult hens was monitored throughout the study. Additionally, a small sample of radio-marked hens were harvested and reported during the Fall UDWR sage-grouse hunting season (1998-2006). The UDWR also collected samples of wings (1998-2003 and 2006) for harvested grouse using wing barrels at each exit from the study area. Wings were characterized by age and sex. Greater sage-grouse survival and reproduction were estimated across years and age-classes and used to construct female-based table of vital rates (or life table) for the Parker Mountain sage-grouse population from 1998-2006 (Table 2).

From 1998-2006 180 hens were captured, radio-marked, and monitored totaling 276 annual survival histories (adults n = 136, yearlings n = 140). Nest survival was monitored for 153 nests. Clutch size and infertility was estimated from 125 and 100 nests, respectively. Brood success was determined from 99 broods and the number of chicks fledged per successful brood was calculated from 30 successful radio-marked broods in 2005-2006.

Our analysis of the life table data indicated the growth rate for the Parker Mountain sage-grouse population during the period studied was stable to increasing. Hen survival did not differ by age. Adult hens had higher nest initiation rates than yearling hens. Average effective (considering infertility rates) clutch size (5.85) was in the lower range reported for sage-grouse (6 – 9.5). Infertility rates reduced the effective clutch size. We noted 3 occasions where the entire nest was infertile, and had multiple occasions where 1 or more eggs within a successful nest were infertile. This may be a reflection of low quality prelaying habitat condition, but pre-laying conditions on Parker Mountain need further investigation. Throughout the study, we documented only 1 renesting event, where both nests were found. However, we documented multiple nests with only 3-4 eggs, which may have been renesting attempts.

Nest survival and brood success (or fledgling success) was relatively high throughout the study (Table 2). Fledgling survival (August to March) was similar to reported estimates of 0.64 and 0.86 for Idaho mountain valley and lowland populations.

Comparison of harvested female age distribution to modeled age-distribution indicated that current Utah sage-grouse harvest management is likely selecting for yearling, not adult hens (Figure 2). The UDWR regulates sage-grouse harvest by estimating sage-grouse populations based on male lek counts (personal communication, D. Olsen, UDWR Upland Game Program Coordinator). Only 6 radio-marked hens (3 yearlings and 3 adults) were harvested during this study period (1998-2006). Another 6 hen mortalities were detected shortly (< 1 month) after the regular hunting season, and were possibly hunter wounded mortalities, but there was no certainty because all carcasses were scavenged. Our study was not designed to assess whether harvest was additive or not, and adult hens that are harvested, although below availability, may still be additive to overwinter survival.

We constructed a life matrix (fertility and survival parameters) based on two age classes (yearling and adult female) for the Parker Mountain population. We calculated the growth rate ($\lambda = 1.001$) of this population based on the population matrix. We then used sensitivity, elasticity, and a Life Table Response Experiment (LTRE) to assess the importance of all vital rates for this population. Our results determined that adult female survival was the most important vital rate for this population, followed closely by production (chick and fledgling survival) parameters.

The Parker Mountain sage-grouse population was stable to increasing during this study period. Our population vital rates were relatively high compared to other studies. Surprisingly, hen survival was variable year to year, especially for a relatively long-lived species. Yet, adult hen survival was the most important factor, because of higher reproductive rates for this age class which impacted population growth. Production (chick and fledgling survival) was also extremely important. Fledgling survival estimates for this research was based on yearling and adult hen survival, and more research directly measuring fledgling survival (August to March) is needed. Based on preliminary information, harvest (based on UDWR regulations) that occurred during 1998-2006 likely did not influence overall adult hen survival. However, our modeling results suggested that adult hen mortality/harvest could potentially have large negative impacts to the population. Moreover, our results suggested that harvested wing data was biased toward the yearling female age-class.

In conclusion, management activities that target adult female survival and production parameters would be the most influential for this population. Additionally, more research is needed to assess the specific factors that influence adult and juvenile survival.

Table 2. Female-based life table for the Parker Mountain sage-grouse population, 1998-2006.

Year	HS[c]		NI[d]		ECS[e]	NS[f]		BS[g]	Ch/SB[h]	FS[i]
	Y[a]	A[b]	Y	A		Y	A			
1998	0.56	0.56	0.56	0.81	5.85	0.67	0.78	0.81	0.55	0.68
1999	0.56	0.56	0.56	0.81	5.85	0.38	0.67	0.81	0.55	0.68
2000	0.56	0.56	0.70	0.89	5.85	0.67	0.78	0.59	0.55	0.68
2001	0.56	0.56	0.70	0.89	5.85	0.38	0.67	0.81	0.55	0.68
2002	0.56	0.56	0.70	0.89	5.85	0.38	0.67	0.59	0.55	0.68
2003	0.42	0.42	0.70	0.89	5.85	0.38	0.67	0.81	0.55	0.56
2004	0.78	0.78	0.56	0.81	5.85	0.67	0.78	0.59	0.55	0.85
2005	0.78	0.78	0.56	0.81	5.85	0.38	0.67	0.81	0.55	0.85
2006	0.56	0.56	0.56	0.89	5.85	0.38	0.67	0.95	0.55	0.68
Mean	0.59	0.59	0.62	0.85	5.85	0.48	0.71	0.75	0.55	0.70

a = yearling hen
b = adult hen
c = annual hen survival
d = nest initiation
e = effective clutch size
f = nest survival
g = brood survival
h = proportion of chicks per successful brood that survived ≥ 42days
i = fledgling survival

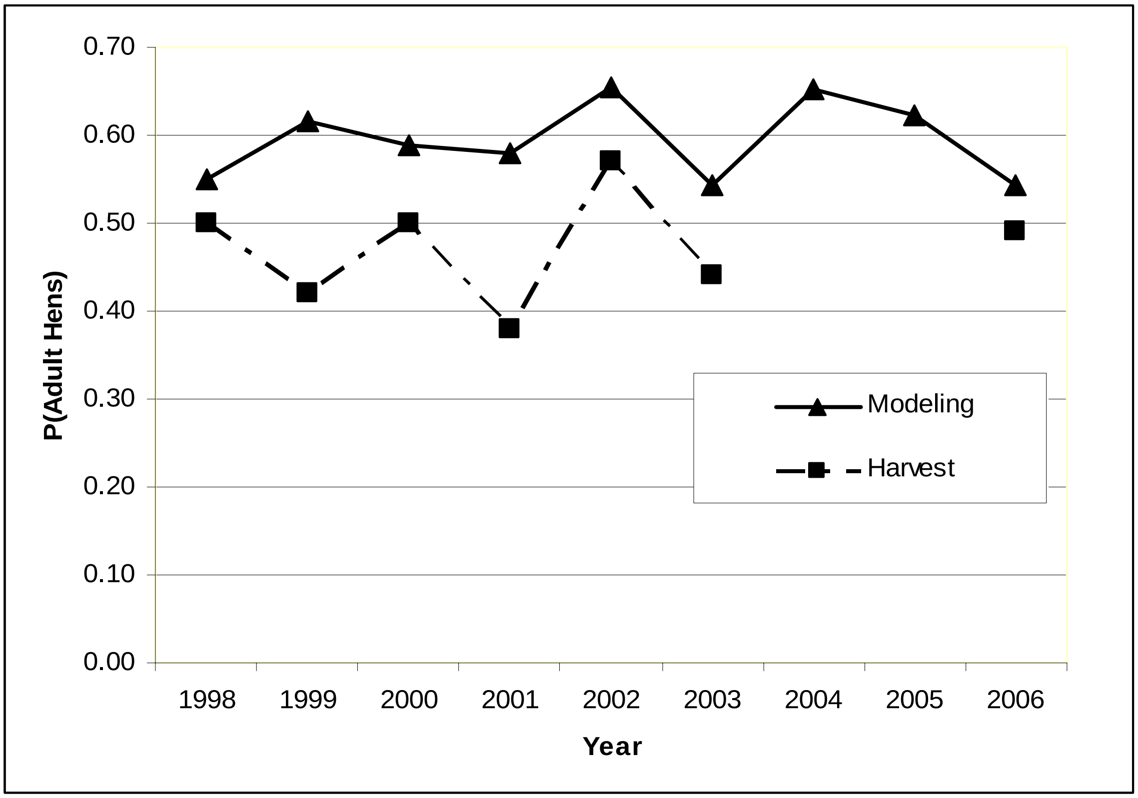

Figure 2. Comparison of harvested (missing 2004-2005 data) and modeled age distributions for adult hen sage-grouse (note: because yearling hen age distribution is proportional to adults, the inverse of this graph is the proportion of yearling hens in harvested and modeled distributions), Parker Mountain, Utah, 1998-2006.

Sage-grouse Response to Habitat Treatments

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

This study began in 2006. The purpose of the study is to evaluate the effects of strategic sheep grazing on vegetative communities believed important to sage-grouse broods. 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 unmanipulated sagebrush stands. 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 summers of 2007 and 2008 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

(Figure 3). By 2008, sagebrush cover in grazed plots had rebounded to 12.9%. Sagebrush coverage in ungrazed plots increased from 26.5% in 2006 to 26.9% in 2007 and continued to increase to 28% in 2008. Shrub density in grazed plots was reduced from approximately 25,818 plants per hectare in 2006 to 10,232 in 2007. Similar to sagebrush coverage, density did increase slightly in 2008. 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. Ungrazed plots also saw a slight increase in shrub density in 2008.

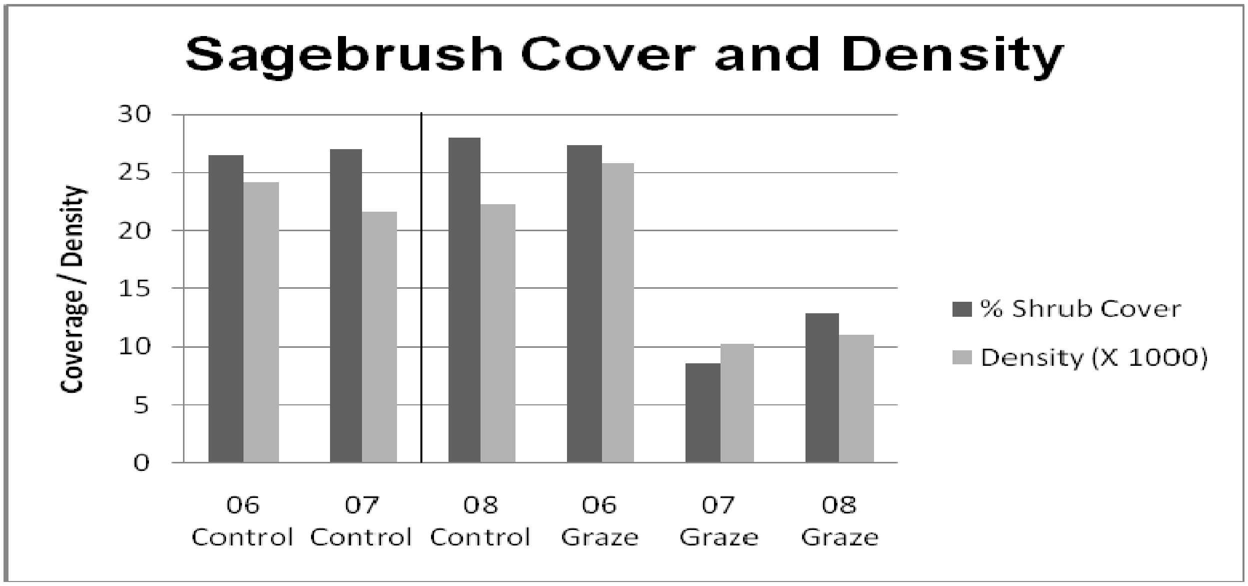

Figure 3. Sagebrush cover and density in experimental sheep plots, Parker Mtn 2006 – 2008.

In 2007, both forbs and grasses had less coverage than in 2006 (Figure 4). 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 in 2007 is likely due to the lack of winter snow pack and summer precipitation. Under the improved precipitation patterns of 2008, forb and grass coverage increased in all plots. It is interesting to note that while coverage of forbs and grass did increase in both grazed and ungrazed plots, forb coverage drastically increased in grazed plots.

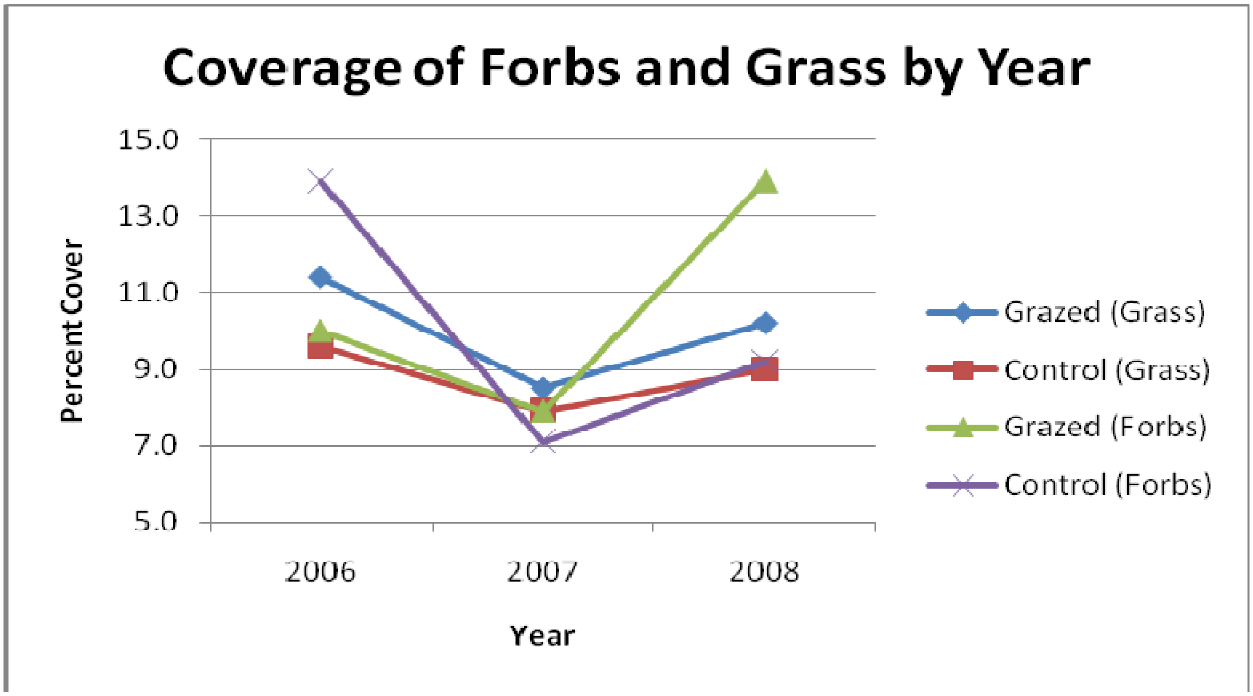

Figure 4. Forb and grass coverage in experimental sheep plots, Parker Mountain 2006 - 2008.

Grouse use of Sheep Plots

Walking area constrained surveys indicated that in 2007, sage-grouse used grazed plots considerably more than ungrazed plots (Figure 5). However, in 2008 the results of the area constrained surveys were mixed and generally showed far less grouse use than in 2007.

Bird-dog surveys conducted in 2006 indicated that sage-grouse were using control plots more than grazed plots (bird-dog surveys were conducted prior to applying grazing treatments in 2006) (Figure 6). Bird-dog flush counts showed considerably higher use of grazed plot in 2007. In 2007, no grouse were flushed from control plots. In comparison, an average of 2.6 grouse were flushed per grazed plot. Unlike the area constrained surveys, the bird-dogs detected approximately twice as many grouse in grazed plots as ungrazed plots in 2008.

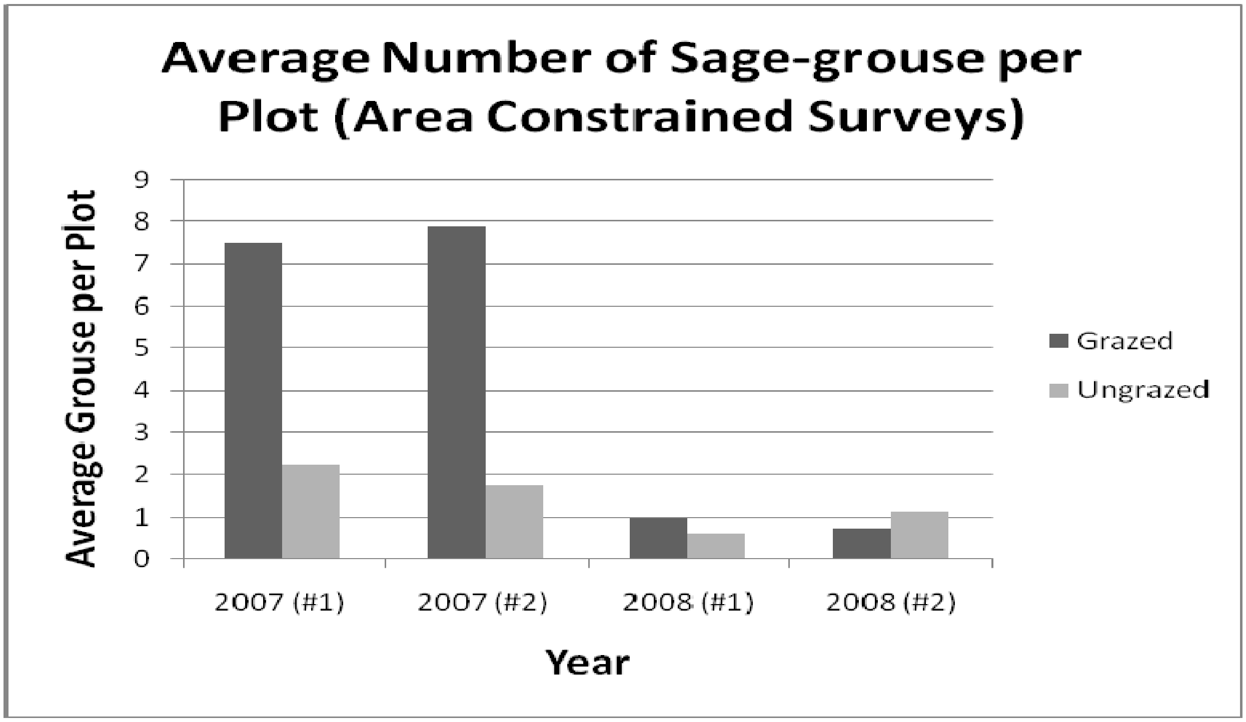

Figure 5. Average number of birds flushed per plot during area constrained surveys, 2007-2008.

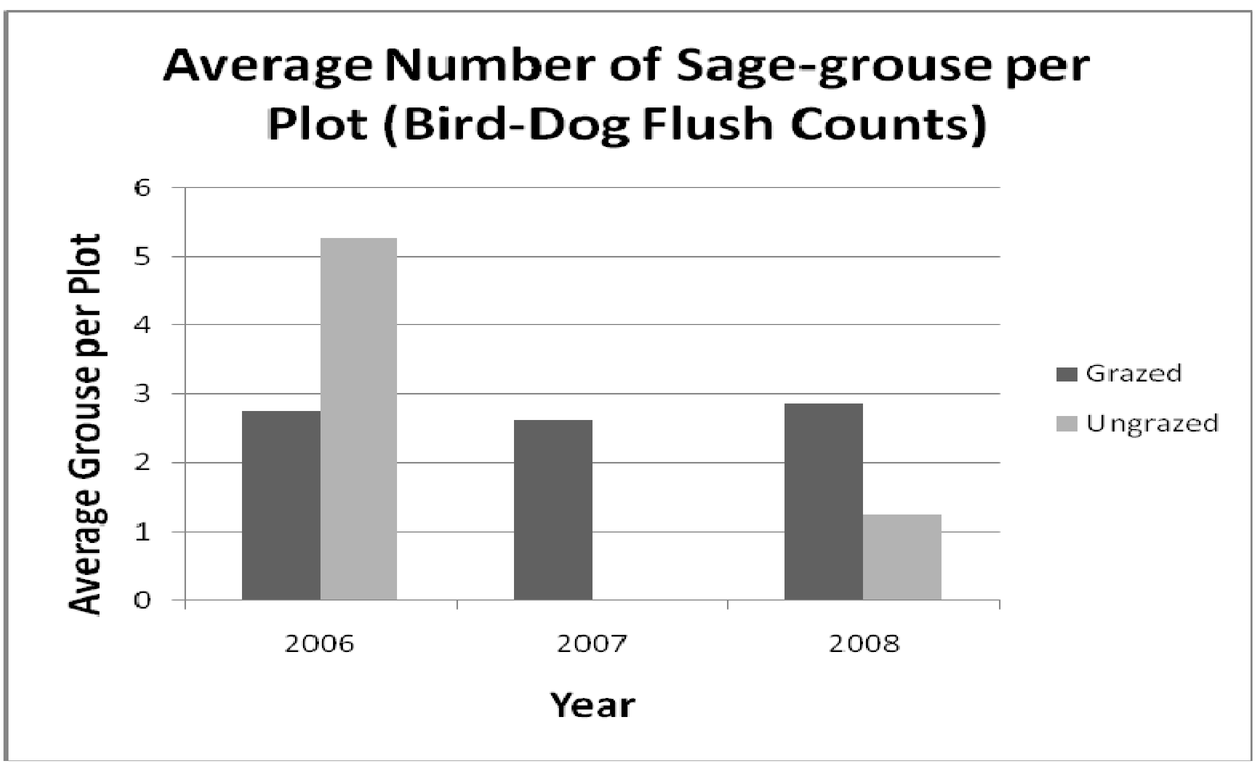

Figure 6. Average number of bird flushed per plot during area constrained surveys (ACS) and bird-dog flush counts.

New Research

In 2008, three additional studies were initiated to address PARM long term conservation objectives. The studies were; 1) Sex Biased Survival of Sage-grouse Chicks, 2) Survival and Habitat Use of Juvenile Greater Sage-grouse Hens, 3) Influence of Sheep Grazing and Chemical Treatments on Utah Prairie Dogs and Their Habitat. Another study, the Evaluation of the Effects of Raven Control has been proposed but not implemented. The first study is being conducted by Michael Guttrey. Projects 1 and 2 are being conducted by Danny Caudill and Gretchen Hochnedel, respectively. Danny and Gretchen are recent graduates of the University of Tennessee and M.S. degree students at Utah State University. They spent this past summer working on Parker Mountain. The work they initiated this fall is summarized below. Project 3 is pending based on PARM approval and funding support.

Sex Biased Survival of Sage-Grouse Chicks

A new study was initiated in 2008 that works in conjunction with the ongoing nest and chick monitoring. The DWR use leks counts to estimate populations. This protocol assumes that for every male counted on a lek; two females exist in the population counted. However, this assumption has not been validated and it is unclear how this female biased sex ratio is expected to develop. One theory holds that in species where one sex is considerably larger than the other, juveniles of the larger sex will suffer higher mortality during scarce years due to an inability to obtain sufficient resources. It has also been suggested that females may be able to bias the sex ratio at birth/hatching based on physiological or environmental factors. Because male sage-grouse are considerably larger than females, they present an interesting opportunity to study sex ratios from both applied and theoretical perspectives.

To appropriately address the questions associated with biased sex ratios, it is necessary to know the sex ratio at hatching as well as the sex of each marked chick. To determine hatching sex ratios, we collected all the eggs from each hatched nest. Egg shells were stored separately to avoid cross-contamination. It should be possible to harvest a DNA sample from the membrane inside the egg shell. To determine the sex of marked chicks, DNA samples were collected from each chick after suturing a radio-transmitter to its back. DNA samples were obtained from chicks by plucking a single flight feather. All DNA samples are being molecular analyzed to determine sex. Using these data in combination with habitat data, we believe will be able to determine sex ratios and explain any biases that may be environmentally related.

Survival and Habitat Use of Juvenile Greater Sage-grouse Hens

The study will primarily take place in south-central Utah on Parker Mountain and the Awapa Plateau within Wayne, Piute, Sevier, and Garfield counties. Greater sage-grouse are hunted in the study area. In 2008 the UDWR issued 370, two bird permits for the Parker Mountain unit. Little is know about greater sage-grouse juvenile survival, winter habitat use, and mortality factors. This study will fill this information void.

Research Objectives

Objective 1. Greater Sage-grouse Juvenile Survival

For the purposes of this study, juvenile survival rates will be determined as the percent of radio-marked birds captured at 100+ days that are alive at the time the breeding season begins (March). As part of this study we will document all mortalities from time of capture to breeding.

Objective 2. Movement and Habitat Use

The late fall and over winter movements of radio-collared birds will be monitored. The attributes of the habitats used by radio-collared birds will be documented to determine habitat selection and if survival rates differ by habitat use.

Methods

Objective 1.

Twenty-eight juvenile sage-grouse were captured between September 6-20, 2008 using night spotlighting techniques. These birds were weighed, sexed, and fitted with necklace radio-collars, and banded. The birds were released on the capture site

Objective 2.

Movements and the location of radio-collared birds were monitored 2-3 times weekly during the fall through late November. This monitoring will be resumed in January –March 2009. Locations of radio-collared birds will be recorded using GPS. Attributes of the winter habitat used by a random subset of radio-collared birds will recorded. Selected individual habitat use will be monitored weekly at different times of the day. Vegetation and environmental parameters measured will include dominant sagebrush species at flush site, number of birds flushed, evidence of use intensity (i.e, number of pellet piles), percent canopy cover by sagebrush species, height above snow, snow depth, temperature, slope and aspect, wind speed will be recorded.

Preliminary Results

Objective 1.

Of the 28 birds captured, 2 died shortly after capture. Of the birds available during the sage-grouse hunt, 5 were confirmed killed by hunters, 2 were killed by predators. As of 1 December 2008, 19 birds were alive.

C. Influence of Sheep Grazing and Chemical Treatments on Utah Prairie Dogs and Their Habitat

The Utah prairie dog (*Cynomys parvidens*) was listed by U.S. Fish and Wildlife Service (USFWS) as endangered species in 1973. The decline of the species was due to pest control campaigns, plague, drought, and habitat loss. Some increases were seen post 1973 leading to the species' reclassification to threatened in 1984. The USFWS have established 3 recovery areas for the species: the West Desert, the Awapa Plateau, and the Paunsagunt Area (USFWS 1991). In 2002 the USFWS approved 3 Utah prairie dog mitigation banks on the Awapa Plateau Recovery Area. The Awapa Plateau located in south-central Utah. The prairie dog population in this area is below recovery goals established in 1991 (USFWS 1991). According to USFWS (1991), habitat loss and poor habitat quality are immediate concerns for the remaining Utah prairie dogs.

In particular shrub height appears to be a limiting factor for prairie dogs because adequate line-of-sight is a primary defense against predation. The height of vegetation must be low enough as to not impair prairie dogs from scanning for predators. Because of this controlled grazing has been suggested as one management strategy that may be compatible with habitat management (Crocker-Bedford 1975). However, 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 results in increased grass and forb cover and may benefit Utah prairie dogs (Chang and Ritchie 2005).

From 2002-2005, Elmore (2006) 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 managed by Utah School and Institutional Trust Lands Administration (SITLA) on Parker Mountain (Elmore 2006). Parker Mountain is included in the Awapa Plateau recovery area. He wanted to determine if high forage utilization by cattle over short periods could improve Utah prairie dog habitat by reducing shrub cover. Additionally, he wanted to determine what forage utilization rate would be most compatible with the management of prairie dogs.

Elmore (2006) 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.

His results suggested 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. This research suggested 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, Elmore (2006) recommended that other treatments (i.e. mechanical and chemical) be evaluated for use on the Awapa Plateau to improve Utah prairie dog habitat in areas where shrub cover exceeded recommended guidelines. He further, recommended that dormant season grazing by domestic sheep grazing be evaluated as an alternative strategy to maintain and enhance mitigation bank habitat.

Justification

Grazing by domestic livestock has been speculated to be a cost-effective management tool compared to mechanical methods such as harrowing or disking. However, consideration must be given to the continued cost of administration of the ESA for the Utah prairie dog, private landowner implications of the ESA, and time and logistical considerations of implementing a landscape level high-intensity/short duration grazing regime. With all of these factors taken into account, dormant season grazing by domestic sheep appears more acceptable to achieve shrub cover guidelines recommended for areas inhabited by the Utah prairie dog.

Additionally, previous chemical treatments using Tebuthiuron (Spike) in black sagebrush (*Artemisia nova*) reduced canopy cover to less than 4% (R. Togerson, SITLA, personal communication). This observation was recorded as part of a research effort to reduce mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) canopy cover to benefit greater sage-grouse (*Centrocercus phasianellus*). The pilot who was contracted to apply the chemical inadvertently treated a stand of black sagebrush located on an adjacent hillside.

Herbicide treatments are not recommended except in very low-statured stands of black sagebrush where residual brush will not obstruct prairie dog vision (< 12 inches). However, herbicide treatment is generally an economical method to increase forage production in sagebrush steppe (Holecheck and Hess 1994).

The South Butte mitigation bank site, where this research is being conducted, exhibits shrub cover above and grass cover below the recommendations for Utah prairie dogs. In the South Butte mitigation bank area, mechanical treatments may not be feasible (i.e., the area is very rocky and may contain archaeological resources). Thus fall grazing by sheep and the use of spike will be evaluated as an option to reduce shrub cover. While these methods may be cheaper, it may take longer to achieve the desired results at these high elevation sites. Additionally, supplements will be necessary to increase shrub consumption by sheep.

Research Objectives and Study Area

1. Determine the effectiveness of high intensity sheep grazing as a management tool for Utah prairie dogs.

2. Determine the effectiveness of a Tebuthiuron (Spike) treatment as a management tool for Utah prairie dogs.

The research is being conducted on the SITLA South Banks Mitigation Bank Site (Figure 7, Elmore 2006). The dominant vegetation on the site mainly consists of black sagebrush along with several species of grasses and forbs. The elevation on the site ranges from 2,200 m-3,000m. The current dominant land use on Parker is cattle grazing, although the area concerned with this research has been excluded from cattle grazing since 2005. The study area currently has numerous active colonies.

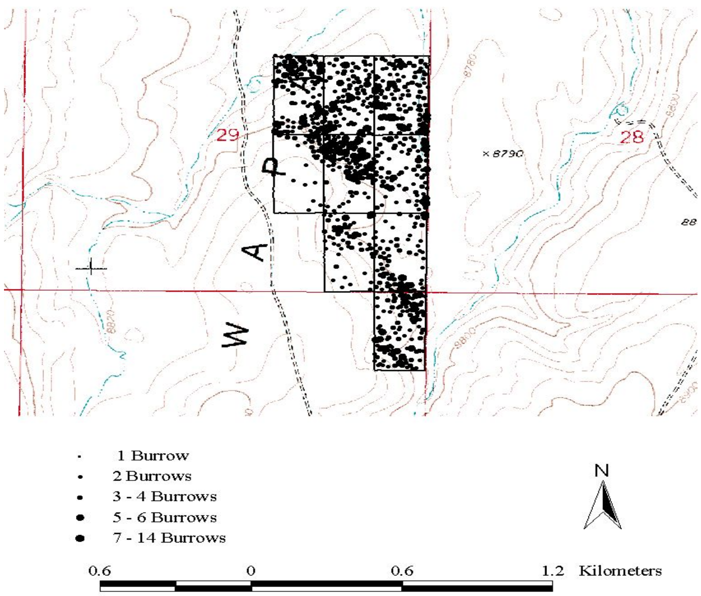

Figure 7. Distribution of prairie dog burrows in experimental treatment pastures on Parker Mountain Utah, 2005 (Elmore 2006).

Methods

Objective 1: Sheep Grazing to Manage Utah Prairie Dog Habitat

We used 15 replicated plots (5 grazed, 5 spike, 5 controls) to initiate this study. The plots were grazed by cattle for a previous study from 2004-2005 (Elmore 2006), but have been excluded from domestic livestock grazing since that time. The 15 plots, located in a drainage, vary somewhat in slope so we stratified the plots and randomly selected assigned the treatments to reflect this topographical variation. Thus each treatment and the control had 3 plots characterized as swales and 2 plots characterized as ridges. Each plot was 10 acres and separated from other plots with fencing. The 5 plots that were grazed were separated with barb wire and 2 stands of electric fencing. The band of sheep used to conduct the grazing were owned by Andy Taft.

One band of sheep consisting of 1,700 sheep grazed each plot for 3 days beginning 11 October 2008. In addition to the forage within the plots, the sheep were fed a corn and alfalfa supplement. The sheep were watered daily from a pond adjacent to the plots.

Objective 2: Tebuthiron (Spike) Treatment to Manage for Utah Prairie Dog Habitat

Tebuthiron (Spike) was applied to 5 randomly selected plots in early November 2008. The spike 0.3% concentration) was applied by an ATV mounted spreader at a rate of 1.5 to 2.0 lbs per acre.

D. 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.

2009 Plan of Work

A. Sage-grouse Studies

Telemetry studies will continue in 2009. Hens and chicks will again be captured in the spring and early summer and fitted with radio-transmitters. Telemetry data from 2009 will contribute to the growing data set of sage-grouse reproductive ecology on Parker Mtn. Telemetry data will also be used in the continuing sex ratio study that began in 2008. 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.

B. Utah Prairie Dog Study

Monitoring Prairie Dog Mounds and Burrows

To determine Utah prairie dog response the treatments, we monitor activity and burrow occupancy in the treatment and control plots for 2 years post-treatment. These locations will be recorded and compared each year based on GPS technology to determine whether prairie dogs are colonizing historic mounds, increasing the amount of current mounds, etc. We are also proposing to monitor prairie dog survival and movement by capturing adults and juveniles. All captured animals will be weighed and tagged. In addition we are proposing to radio-collar up to 5 juveniles in each treatment and control plot to monitor over winter survival. Prior to conducting this work, we will be requesting appropriate permits from the USFWS and the UDWR .

Vegetation Response

In addition to recording prairie dog response, will we record vegetation data in each of the 15 plots. Each plot will have 4 randomly chosen, permanent GPS points which will be the base points. From the base point, a random azimuth will be chosen and 10 meters will be measured off using this azimuth. At both points rebar will be driven to permanently mark the transect (Canfield 1941). The height and width of each shrub intersecting with a 10 m tape stretched the length of the transect will be recorded to determine if treatments are decreasing the vertical structure. A Daubenmire frame will be used to determine % cover at 2.5 m, 5 m, and 7.5 m (Daubenmire 1959). Specifically, the data collected will consist of each grass species and its % cover, each forb species and its % cover, % cover of rock, % cover of bare ground, and % cover of litter. This data will be used to compare composition and % cover within each of the 15 plots post treatment. This will help us determine if treatments affect these factors. Vegetation sampling will take place in May, early June, and late July (Elmore 2006).

Prairie Dog Census

Weekly census information will also be conducted for 2 summers following treatment to determine any changes in prairie dog abundance related to each plot (Elmore 2006). Each plot will be surveyed using UDWR protocols.

Summary and Conclusions

Sage-grouse Research

The sage-grouse population on Parker Mountain appears to have natural fluctuation. This year lek counts were lower than observed in several years. This decline may be the result of poor chick production in 2007. Our measurements of sage-grouse use are important monitoring activities.

Nest initiation was comparable to most years. Nest initiation dates for this year were similar to previous years'. Average clutch size was also similar to past years' (six-seven eggs/nest). Nest success was 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 data obtained thus far, on chicks is relatively low. We saw large movements this year by brood hens that were more sedentary last year.

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.

Compared to measurements taken in 2007, sagebrush cover and density increased slightly in 2008. These increases were anticipated. Coverage of both forbs and grass increased in all plots in 2008. Somewhat surprisingly given the results from 2007, forb coverage in grazed plots increased drastically in 2008. Despite the impressive response by forbs in grazed plots, sage-grouse use of plots was down from 2007.

Literature Cited

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.

Canfield, R. H. 1941. Application of the line intercept method in sampling range vegetation. Journal of Forestry 39:388-394.

Crocker-Bedford, D. 1975. Utah prairie dog habitat evaluation. Proc. Utah Wildlife Tech. Meeting. 7pp.

Cheng, E. and M. E. Ritchie. 2005. Impacts of simulated livestock grazing on Utah prairie dogs (*Cynomys parvidens*) in a low productivity ecosystem. Oecologia 147: 546-555.

Daubenmire, R. F. 1959. A canopy coverage method of vegetational analysis. Northwest Science 33: 43-64.

Elmore, R. D. 2006. Recovery of the Utah Prairie Dog: Public perception and cattle grazing as a management tool. Ph.D. Dissertation. Utah State University, Logan.

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

Holecheck, J. L, and K. Hess. 1994. Brush control considerations: a financial perspective. Rangelands 16: 193-196.

U.S. Fish and Wildlife Service.1991. Utah prairie dog recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. 41pp.

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%)
2008	* 23/48		(48%)

* 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%)	
2008	3/23	(13%)	

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%)
2008	1/23	(4%)

V. Brood Survival (>1 chick survived past 42 days)

2005	*13/22	(54%)

2006	*17/21	(81%)
2007	* 6/12	(50%)
2008	*10/10	(100%)

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