2012 Annual Report

Demography, Vital Rates, Habitat-Use, and Seasonal Movements of Greater Sage-Grouse in the Ruby Pipeline HUC 8 Watershed: Phase 1. WRI Project ID: 2119

Cooperators:

Utah Watershed Restoration Initiative

Ruby Pipeline and El Paso Corporation

Utah Division of Wildlife Resources

US Bureau of Land Management

US Forest Service

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

Quinney Professorship for Wildlife Conflict Management

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Introduction

Populations of greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) have been declining range-wide for the last century (Connelly et al. 2004). The range of sage-grouse has declined from a historical pre-settlement distribution of 1.2 million square km to only 668,000 square km as of the year 2000 (Schroeder et al. 2004). These declines have been largely attributed to the deterioration, loss, and fragmentation of the sagebrush (*Artemisia* spp.) habitats upon which they depend (Connelly et al. 2011). In Utah, sage-grouse occupy 41% of historic habitats, and large populations are restricted to Box Elder, Garfield, Rich, Uintah, and Wayne Counties (Beck et al. 2003).

In response to population declines and the potential for the species being designated for protection under the Endangered Species Act, the Utah Division of Wildlife Resources (UDWR) developed a strategic statewide management plan in 2002 (UDWR 2002). The West Box Elder Adaptive Resource Management Local Working Group (BARM) used the state plan to develop and implement a conservation plan to manage sage-grouse populations and habitats at the regional scale (BARM 2007). In 2007, BARM published its sage-grouse conservation plan identifying threats to the species, knowledge gaps, and conservation actions they believed could reverse the decline of sage-grouse.

Study Purpose and Framework

This research was initiated to address the knowledge gaps identified in the BARM conservation plan. Specifically, this research will implement the BLM sage-grouse habitat assessment framework to complete a habitat assessment (landscape, population, and individual habitat-use levels) for the sage-grouse populations inhabiting the Raft River and Pilot Mountain subunits of the UDWR Sage-grouse Box Elder Management Unit (Unit 1) (Johnson 1980, Stiver et al. 2010). The UDWR Management Unit 1 lies within the Sage-grouse Snake River Plain management zone/ Management Zone IV as outlined in Connelly et al. (2004). This assessment will investigate the effect of land ownership patterns, along with historic and contemporary land uses on sage-grouse vital rates and seasonal habitat use.

This research is being conducted collaboratively by two Utah State University masters-level graduate students. The students are using the same group of marked sage-grouse to answer both distinct and shared research questions. Specifically, Avery Cook is researching landscape level effects of human land use, and effects of habitat treatments to determine which habitat treatments are most effective for conserving the species. Avery is also interested in how fragmentation relates to ownership patterns and subsequent land use. Brian Wing is interested in determining how the structure, composition, and nutritional quality of vegetation affect sage-grouse habitat-use, vital rates, and seasonal movements.

To complete this work, vegetation characteristics will be compared between use sites and random sites to determine if the habitat-use patterns of this sage-grouse population reveal a pattern of preference for specific habitat components. This research will contribute to range-wide

or 1st order habitat assessment. Both students will collaboratively answer questions regarding vital rates of the population. Overall, this research will assist land planners and government agencies on local and regional scales to identify land-use and management actions that will contribute to the long-term conservation of the sage-grouse meta-population in this area.

Mutual Objectives

1. To identify and map all leks and lek complexes in study area.
2. To determine the relationship of lek attendance to population estimates by incorporating new methodologies identified by the Utah lek attendance study conducted by USU.
3. To determine and compare sage-grouse vital rates in the Raft River and Pilot Mountain subunits to other areas of Utah and describe their relationship to habitat conditions and corresponding land-uses.
4. To determine sage-grouse use of habitat projects completed in the subunits as a means of documenting responses to habitat improvement projects.
5. To determine the relationship between designated and occupied sage-grouse habitat in the Raft River and Pilot Mountain subunits.
6. To determine if any relationship exists between the nutritional quality of sagebrush plants consumed and sage-grouse fitness in terms of individual productivity.
7. To determine the extent of interstate movements and population exchange pathways with Nevada and Idaho.

Study Area

This study focuses on the Raft River and Pilot Mountain subunits of the West Box Elder Resource Area located in the north-west corner of Utah (Figure 1). Geographically, the core of the study area is bounded by the Raft River Mountains to the north, the Grouse Creek and Pilot Mountains to the west, by the Great Salt Lake to the east, and areas of salt flats to the south. The study area is primarily in the Northern Great Salt Lake Desert HUC 8 watershed (HUC #16020308), but also contains parts of the Curlew Valley HUC 8 watershed (HUC #16020309) on the eastern edge of the study area. Land ownership for the Pilot Mountain and Raft River subunits is a mix of public and private lands consisting of 51% private (676,483 acres), 37% BLM (483,035 acres), 6% SITLA (76,099 acres), and 5% USFS (71,934 acres).

Vegetation structure in the study area varies with elevation from salt desert scrub at low elevations, through various sagebrush communities, and into juniper and mahogany woodlands at higher elevations. Elevation ranges from 4600-9800 ft. above sea level.

From 1990 to 2012, annual precipitation averaged 22.6 in. in Park Valley (5000 ft. elevation), with 5.6 in. of snow falling between November and April. Temperatures range from a monthly average high of 86 F in July to monthly average low of 15 F in December and January (WRCC 2012). Snow does not typically persist at lower elevations but can remain at high elevations into early summer. Greater levels of snow fall and colder temperatures exist at higher elevations, however, climate data is only available for Park Valley proper.

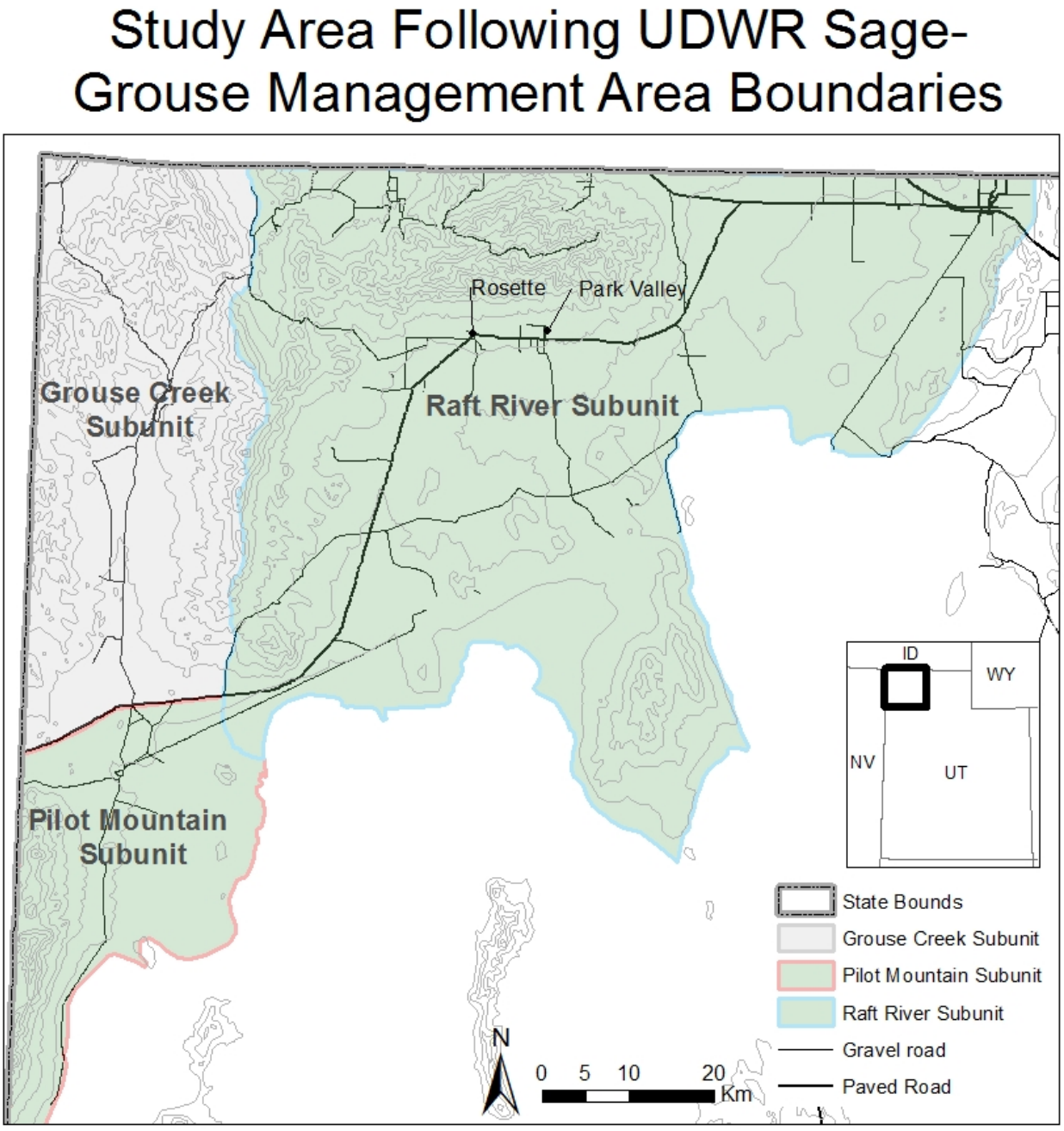


Figure 1. West Box Elder Study Area Including the Raft River and Pilot Mountain Subunits.

Methods

Lek Surveys and Searches

Aerial searches using a Piper Cub fixed-wing aircraft were conducted on clear, calm mornings when winds are < 15 mph) with scattered cloud cover. We contracted with Airmotive Service of

Tremonton, Utah, for aircraft service to complete aerial surveys. Transects were flown at 300-450 ft. above ground level and the pilot and one observer scanned the ground. Surveys began at the east edge of the survey area and worked west to minimize the possibility of the plane flying over leks prior to them being observed. Lek searches were conducted from ½ hour before to one hour after sunrise.

Ground lek surveys were also conducted by driving along roads in suspected or known breeding habitat and stopping every ½ mile to listen for sounds of breeding grouse. Ground searches were conducted from an hour before to an hour after sunrise. Prior to starting the work, landowners in the project area were contacted to explain the purpose of the project and request their assistance in mapping new leks. Permission was obtained from private landowners prior to accessing leks on private land.

Capture and Marking

Beginning in January of 2012, sage-grouse were captured and radio-collared following protocols described by (Connelly et al. 2003). Each bird was fitted with a numbered leg band and a collar-type VHF radio transmitter. Captured birds were sexed and aged (Eng 1955), weighed, examined, had a feather collected for DNA analysis, and capture location recorded (UTM, 12N, NAD 83). Birds were handled with care and released on site.

Radio Telemetry

Following capture, radio-collared sage-grouse were re-located using radio telemetry to determine habitat-use patterns, seasonal movements, nesting and brood success, and survival rates. Marked males were located weekly from spring to late summer. Marked females were located two to three times each week during nesting and one to two times weekly during their brood-rearing period from spring to late summer. From fall to early spring, all marked sage-grouse will be located monthly. Birds that become difficult to track or move into less-accessible locations are re-located using a small fixed-wing aircraft fitted with radio telemetry equipment.

Nest Monitoring

Nesting was determined when a female sage-grouse is found in the same location on two consecutive visits during or following the breeding season. To mitigate nest abandonment, care was taken to not disturb nesting females. Nest locations were marked using global positioning systems (GPS) and a discreet physical marker to aid researchers in re-locating the nest and mitigate predation. Actively nesting females were observed carefully two to three times weekly until the nest hatched or failed. A successful hatch is determined when egg halves are found intact in or near the nest bowl, and the inner membrane of the egg is separated from the shell (Wallestad and Pyrah 1974).

Brood Monitoring

After hatching, females with broods were re-located weekly. Each brood was flushed and counted 50 days after hatching to determine brood success (Schroeder 1997). Due to the tall

vegetation in which broods were typically found this season, these flush counts were conducted in daylight to reduce the risk of missing birds that otherwise may not be visible using the typical spotlight count method. Radio telemetry was used to locate the adult hen, and the area of her flush was thoroughly searched by two observers using an outward spiral pattern until all chicks had flushed.

Vegetation Surveys

Vegetation was measured and compared between sage-grouse use sites and random sites. Use sites included nest locations, brood locations, and general habitat-use locations. Random site locations were selected from 3 broad vegetation strata consisting of sage brush, agriculture, and other. Random vegetation plots were selected from each strata using a generalized random-tessellation stratified sampling design (Stevens 2004). This method of random sample selection produces more regularly spaced samples and a reduction of clumping relative to simple random sampling. Each survey was conducted using four transects; the first directed toward a random bearing and the others at 90 degree increments. Nest surveys consisted of 15 meter transects, and all other surveys consisted of 10 meter transects. Along each transect, the line-intercept method was used to evaluate ground cover density and height of shrub species (Canfield 1941). The height and species composition of forbs and grasses were evaluated along each transect using the Daubenmire frame technique (Daubenmire 1959). Five frames were placed on each nest survey transect at 3 meter intervals, and four frames were placed at 2.5 meter intervals on all other surveys. Nest surveys also included measurements of the nest bush by species, height, length, width, and visual obstruction (Robel 1970).

Pellet Surveys

Treatment sites of interest in the study area will be evaluated for habitat-use using pellet surveys. Length and number of surveys required for a statistically valid result will be calculated using preliminary data from past projects adjacent to the study area (Badger Flat) in a power analysis. Surveys will be conducted by walking transects and recording the number, type (roost, cecal), distance along and distance from the center line of the transect. Transects will also be walked in untreated habitat. Cluster densities and detection probability will be calculated using program DISTANCE, densities will be compared between treated and untreated areas using a z-test.

Results

During the winter and spring, we captured and radio-collared a total of 60 sage-grouse, of which 14 were hens and 46 were males. Of the males, 71.7% (33) were adult and 28.3% (13) were yearlings at the time of capture. Captured hens were 71.4% (10) adult and 28.6% (4) yearlings at the time of capture. An additional 3 males were radio-collared in late summer to replace predated males; of these, two were juveniles and one was an adult. All of the sage-grouse captured in the spring were found on or around active leks within the Raft River subunit; there are no active leks in the Pilot Mountain subunit. Sage-grouse captured in the late summer were located away from leks and found in proximity to previously radio-marked hens.

Through the spring and summer, birds moved extensively within and out of the study area, with a general trend of moving to the north and northeast toward higher elevations and more mesic areas. We did not have any birds move south into the Pilot Mountain subunit. Ten (8 males and 2 hens) of the marked birds moved north and stayed at the top of the Raft River Mountains for the duration of the summer. Birds moving to the Raft Rivers traveled as far as 19 miles from southern leks. There were also extensive movements to the adjacent Grouse Creek subunit. Two hens moved over toward Grouse Creek to nest, being followed by 6 males as the lekking season came to an end. One of the radio-marked males made its way to Cotton Thomas Basin.

This year, we experienced a very early spring and drought through the summer. The early onset of spring caused peak lek attendance by males to shift to earlier-than-expected dates. Female lek attendance may have also shifted forward to late February, before we were able to work full time in Park Valley. However, despite the very dry conditions, the reproductive success was on par with state and range wide averages. Out of 14 hens that were marked with radio collars, 71% (10) initiated nests. Our nest initiation and renesting rate may by lower than the actual rate due to delays in obtaining landowner permission after bird movements. The mean clutch size was 6.5 eggs. Sixty percent (6 of 10) of the nests successfully hatched, with 50% (3) producing successful broods with an average brood size of 2.3 chicks at 50 days (see table 1).

The overall survival rate was 75% with 45 of 60 birds collared in the spring surviving through the end of August 2012. Males had a much higher mortality rate than hens with 14 of the 46 males dying through the spring and summer for a survival rate of 70%. Only one hen of the 14 died, giving the hens a survival rate of 93% over the study period (see table 2). We were not able to positively identify the cause of most mortalities; however, six appeared to be a result of predation, with three likely being consumed by mammalian predators and three likely being consumed by avian predators. There were was one death that may have been caused by a collar being caught and pulled partially over the sage-grouse's head. We were not able to determine the cause of the other eight mortalites due to collars being in inaccessible areas, scavengers reaching the carcass before we were able to, or simply no sign of the bird.

During the spring, we counted leks in association with the Utah Division of Wildlife Resources. Overall lek counts for the Raft River subunit are up from last year with a total of 368 males counted on leks vs 190 in 2011 (see table 3). This may not be a population increase but a result of increased counting effort and the discovery of two new leks. We were not able to fly and search Pilot Mountain in the spring of 2012 because we did not receive FAA clearance until after the lekking season. This area will be flown in 2013.

We are currently completing data quality checks on vegetation data and importing into our database for analysis. Currently, statistics on preferred habitat are not available, however this population appears to show similar preferences, as other populations in the literature, favoring taller sage stands with more cover for nesting and mesic areas within contiguous sagebrush habitat for late brood rearing and summer habitats.

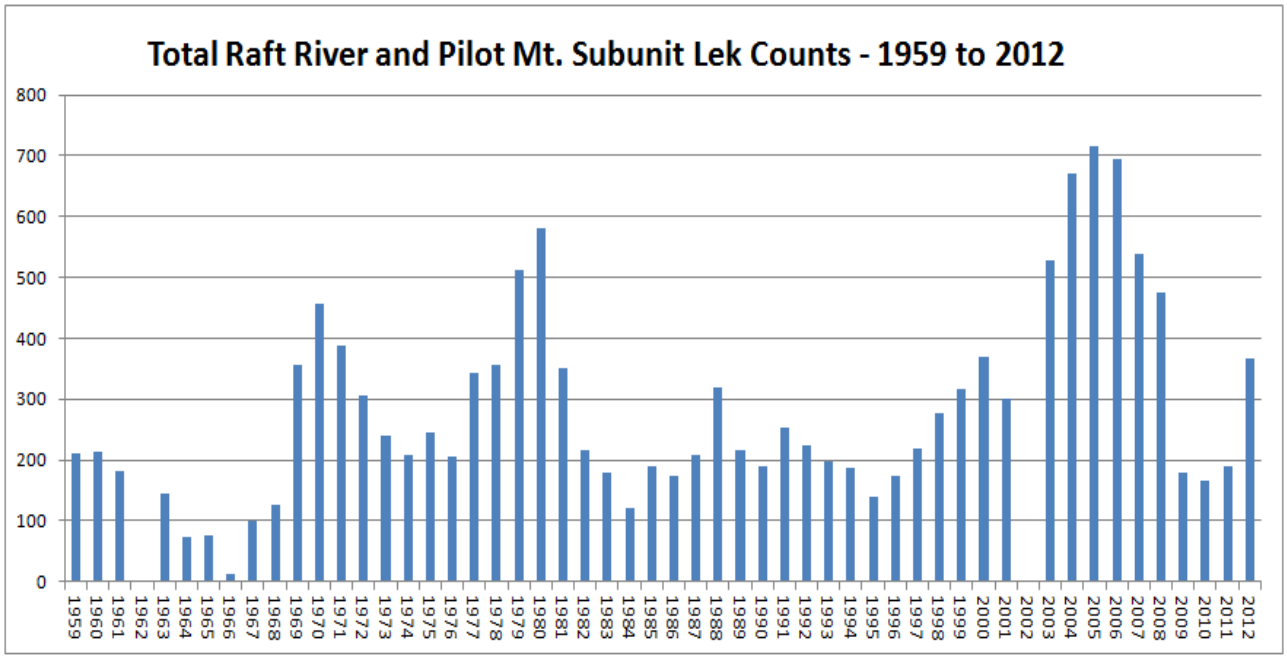
Table 1. Reproductive Vital Rates.

# marked hens	# hens nested	# re-nest attempts	mean clutch size	# nests hatched	# broods successful	mean final brood size
14	10 (71%)	0	6.5	6 (60%)	3 (50%)	2.33

Table 2. Survival (Birds Radio-Marked in Spring 2012)

	Sage-Grouse Radio Marked	Total Mortalities	Mortality Rate (%)
Male	46	14	30.4
Female	14	1	7.1
Total	60	15	25.0

Table 3. Total Lek Counts in the Raft River and Pilot Mountain Subunits 1959-2012.



Future Work Plan

Work on the project will continue through the remainder of the year. We will be spending many nights this fall and winter working on our goal to capture and radio-collar up to 80 female sage-

grouse. We will likely be capturing birds into next spring to reach this goal and also to radio-collar a few males to replace the mortalities of 2012. This fall and winter, we will also be locating each radio-marked bird monthly to monitor their movements until the start of the 2013 field season.

In the spring of 2013, we will again begin collecting data by the same methods of the 2012 season. Data collection of the 2013 season will include nest and brood monitoring, vegetation surveys at use and random sites, as well as weekly monitoring of each bird's movements. In addition, we will also be conducting pellet transect surveys to determine the extent of sage-grouse use within areas of past habitat treatment projects. We will also be collecting vegetation tissue samples from browsed, non-browsed, and random forage plants, which we will submit for lab-testing to determine if sage-grouse in this study area select forage plants with regard to nutritional quality.

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