2008 ANNUAL REPORT

Ecology of the Seep Ridge Greater Sage-grouse Population: Implications for Conservation and Management

Photo courtesy of Leah Smith

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Cooperators

Utah Division of Wildlife Resources

Ute Tribe Fish and Wildlife Department

Bureau of Land Management

Uintah Basin Adaptive Resource Management Local Working Group

Enduring Resources, LLC

Andarko Petroleum Corporation

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The photo on the front cover is a view of Willow Creek from Agency Draw. This photograph depicts typical habitat used by the Seep Ridge sage-grouse population during the summer. Photo by: Leah Smith

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Introduction

Greater sage-grouse (*Centrocercus urophasianus)* are the largest grouse species in North America and are considered sagebrush (*Artemisia* spp.) obligates. Greater sage-grouse (hereafter sage-grouse) were once common in sagebrush habitat throughout the western United States. The range and abundance of sage-grouse populations have declined as sagebrush ecosystems have been reduced (Connelly and Braun 1997, Connelly et al. 2004, Schroeder et al. 2004). Concern about the status of sage-grouse populations has resulted in several petitions to list the species as threatened or endangered under the Endangered Species Act of 1973. In December 2005, the U.S. Fish and Wildlife Service (USFWS) announced a decision that listed the species was unwarranted. A lawsuit file the following year resulted in a federal judge ruling in December 2007 that the USFWS must reconsider its previous decision because of procedural errors. In February 2008, the USFWS announced that greater sage-grouse would receive additional review to determine if listing of the species throughout its range or any portion of its range is warranted.

Uintah Basin Adaptive Resource Management Sage-grouse Local Working Group

The Uintah Basin Adaptive Resource Management (UBARM) sage-grouse local working group (LWG) was organized in 2003 to proactively manage sage-grouse and their habitats in Uintah and Duchesne Counties. The partnership includes representatives of state and federal agencies, non-governmental organizations, private industry, and landowners.

Specific threats affecting greater sage-grouse populations in this area as identified in the UBARM Strategic Management Plan (web site url provided below - http://utahcbcp.org/files/uploads/uintah/ubarmsagrplan.pdf) include: home and cabin development, tall structures such as power lines, oil and gas development, roads, drought and weather, hunting pressure, incompatible fire management practices, incompatible livestock grazing, OHV recreation, invasive/noxious weeds, parasites and disease, predation, vegetation management, and Pinyon (*Pinus edulis*)/Juniper (*Juniperus utahensis*) encroachment.

The LWG also recommended that more information is needed regarding the ecology of the populations inhabiting the UBARM resource area for application to management. Additionally, UBARM is concerned about the effects of increasing energy development on greater sage-grouse populations and habitat. The LWG emphasized the need to quantify the effect of oil and gas development on sage-grouse as well as mitigation strategies that could be implemented to mitigate potential effects.

Greater Sage-grouse and Energy Development

Concern about the potential negative effects of energy development on greater sage-grouse is increasing (Lyon and Anderson 2003, Connelly et al. 2004, Holloran 2005, ALL Consulting 2007). Greater sage-grouse sensitivity to energy development appears

to be related to the disturbance and fragmentation of the sagebrush habitat on which they depend on to complete their life cycle (Braun et al. 2002, Connelly et al. 2004).

Because energy development typically requires a large infrastructure including wells, well pads, holding tanks, and large networks of roads, pipelines, and power lines; the impact of energy development on sage-grouse habitat and populations can be substantial. Negative effects of energy development include: direct mortality (deaths due to traffic and collisions with infrastructure), changes in habitat use (Naugle et al. 2006), reduced breeding success (Lyon and Anderson 2003), and the spread of weeds and predators via roads (Gelbard and Belnap 2003).

Seep Ridge is located approximately 45 miles south of Vernal, Utah. In this area proposed energy development overlap occupied greater sage-grouse habitat. Future development plans for Seep Ridge propose to construct 3,550 natural gas wells in the next 10 years. Currently, little information concerning the survival, reproductive success, or habitat use of this population is known and development may already be affecting the grouse. Additionally, the Seep Ridge population appears to be unique regarding habitat use and gene flow between northeastern populations may be minimal.

Study Purpose

The purpose of this research is to collect baseline data on the survival, reproductive success, and habitat use of the Seep Ridge greater sage-grouse population. We also attempted to examine sage-grouse habitat use patterns in relation to development, and describe sage-grouse genetic diversity in northeastern Utah. Research will provide a basis for understanding how future energy development may affect the Seep Ridge population and measures that may be implemented to mitigate existing and potential threats.

Specific Research Questions Addressed:

Ecological Questions

1. How many sage-grouse are in the Seep Ridge population?
2. Where are active leks located in the Seep Ridge study area?
3. How do the reproductive success, adult mortality rate, causes of adult mortality, and timing of mortality of the Seep Ridge population compare to other populations in Utah?
4. Where are seasonal habitats located and what habitat characteristics do the Seep Ridge sage-grouse prefer to use?
5. How does the arthropod abundance and composition at Seep Ridge brood rearing sites compare to other brood rearing sites in Utah?
6. How do the Seep Ridge sage-grouse use a disturbed landscape?

Genetic Questions

1. How is mitochondrial DNA (mtDNA) genetic diversity distributed among six sage-grouse populations in northeastern Utah?
2. If any new haplotypes are found, how do they fit into the range-wide haplotype phylogeny?

Study Area

The Seep Ridge study area was defined by greater sage-grouse movements. The study area is roughly bounded to the north by White River, to the east by Green River, to the west by Bitter Creek, and to the south by the Book Cliffs (Fig. 1). The eastern portion of the study area consists of rolling hills dominated by Wyoming big sage (*A. tridentata wyomingensis)* and scattered stands of pinyon and Utah juniper). The western portion of the study is dominated by black sage (*A. nova)* and is divided by Willow Creek, a tributary to the Green River. The Willow Creek area consists of previously cultivated alfalfa fields and a deep wash bordered by greasewood (*Sarcobatus vermiculatus)* and salt cedar (*Tamarix ramosissima*).

There are three known active leks in the area. Two leks (Sand Wash Rim and East Bench 16) are located on East Bench and the third lek (Middle Bench Guzzler) is located on Middle Bench. Strutting birds on the Sand Wash Rim lek have been observed since 1983 and the East Bench 16 lek has been active since 2004. Birds strutting on the East Bench 16 lek may have previously strutted on two currently inactive leks: the East Bench lek (active 1983-1994; 2004) and the East Bench NE lek (active 1999-2001) (B. Maxfield, Utah Division of Wildlife, unpublished data). The number of males counted on the East Bench leks have steadily declined throughout the past two decades. The Middle Bench Guzzler lek was discovered 2005 and the location was confirmed in 2007.

Status of Energy Development

Energy development has occurred in the Seep Ridge area since the 1950s, but has begun to intensify recently. Energy development plans in two Bureau of Land Management (BLM) project areas, Greater Natural Buttes and Rock House, coincide with areas currently occupied by Seep Ridge sage-grouse during the breeding season (Fig. 2).

The Greater Natural Buttes Project Area is located in the northern portion of the study area and encompasses 162,911 acres (65,164 ha). Anadarko Petroleum Corporation proposes to construct 3,496 natural gas wells in the project area over a 10 year period (Bureau of Land Management, 2006). Approximately 1,077 natural gas and 20 oil wells are currently present in the area.

The Rock House Project Area is located directly south of the Greater Natural Buttes Project Area and encompasses 34,471 acres (13,788 ha). Currently, the BLM is writing an Environmental Assessment evaluating Enduring Resources LLC plans to construct 55 natural gas wells from 30 well pads in the project area (BLM 2007). The proposal also

includes plans to construct 11.2 miles (918.0 km) of roads and 9.7 miles (14.5 km) of surface gas lines.

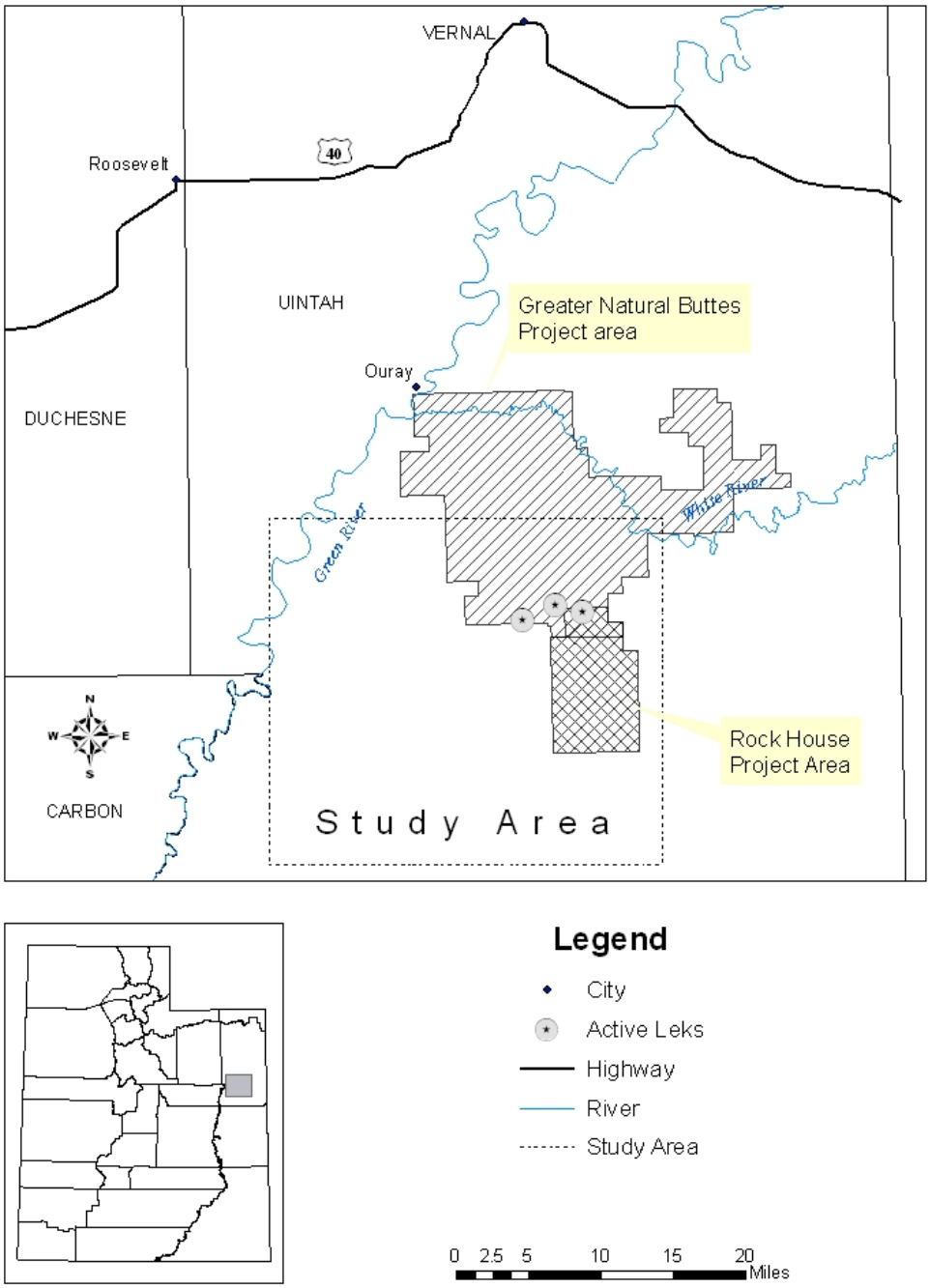

Fig. 1. The Seep Ridge Study Area.

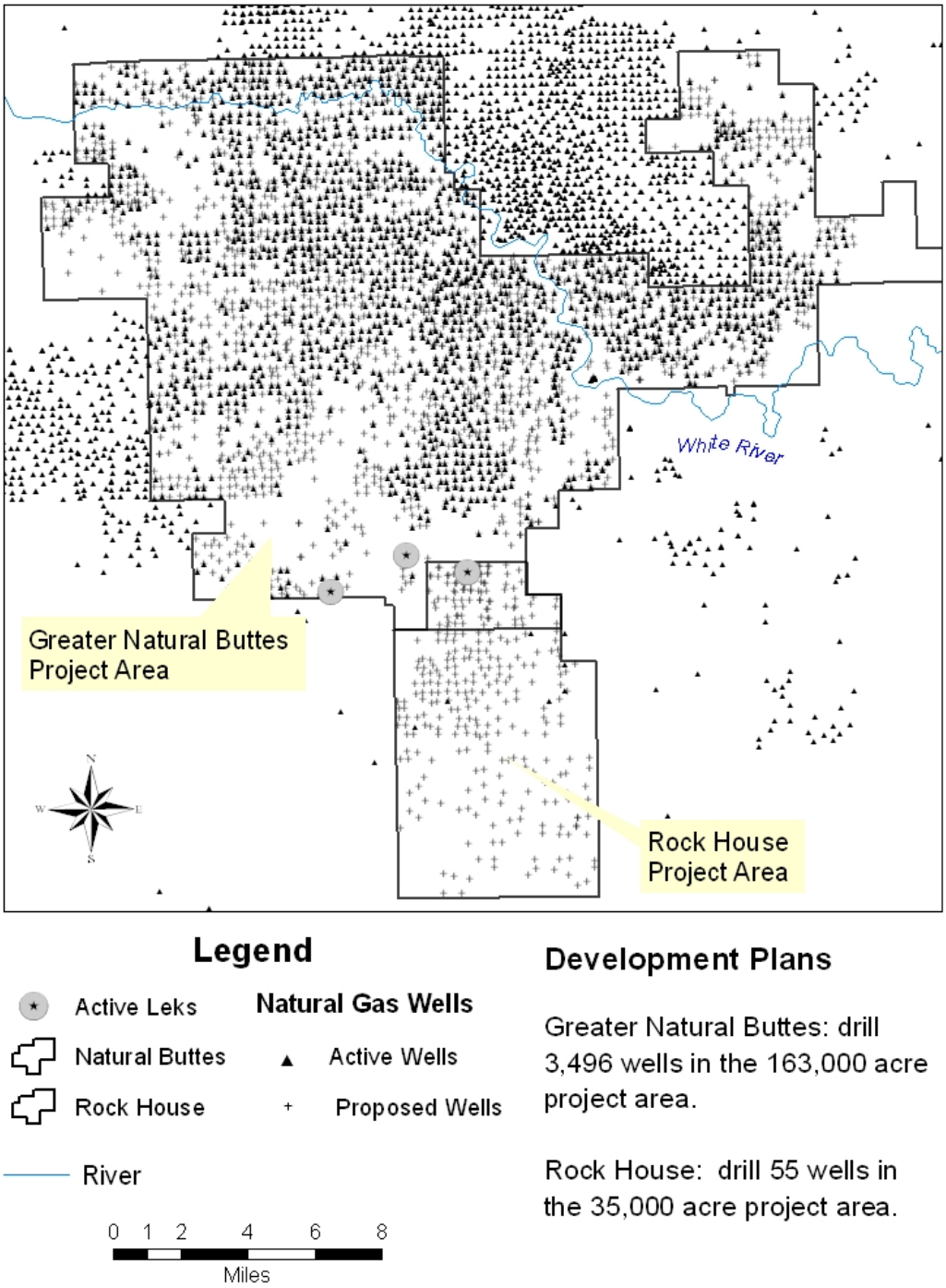

Figure 2. Development plans in relation to leks in the Seep Ridge study area, 2008.

Methods

Sage-grouse Ecology

Lek survey

Attendance of both male and female sage-grouse was recorded at 2 known leks on East Bench and 1 lek on Middle Bench twice a week from February to April. A lek route was established according to range wide protocols (Connelly et al. 2003). Leks were counted in 1.5 hours and counts began 0.5 hours before sunrise. We counted sage-grouse 3 times before moving to the next lek, and recorded the highest number of males and females. Population estimates were calculated according to methods as described by Connelly et al. (2003). Maximum male attendance was assumed to represent 75% of males. Females were assumed to follow a 2:1 ratio to males.

Searches for new leks occurred from March through late April via driving surveys. Driving surveys were completed and the majority of roads within the study area and observers exited the vehicle every kilometer to scan the area with binoculars listen for displaying sage-grouse (Connelly et al. 2003).

Capture and radio-telemetry

Grouse were located via spotlighting roost sites in the study area and were captured with long-handled hoop nets. Each bird was placed in a small sack to minimize stress and fitted with an ATS A4060 necklace-mounted, battery-powered radio-transmitter. We determined the sex and age of each captured bird according to mass and plumage characteristics (Beck et al. 1975).

In 2008, we collected blood samples and additional morphological measurements. We measured the tarsus (middle toe to proximal end of tarsus), exposed culmen length and width (according to Pyle et al. 1987), tail length (ruler inserted between the coverts and retrices), and the lengths of primaries 10 (ruler inserted between P10 and P9), 9 (ruler inserted between P9 and P8) and 1 (ruler inserted between P1 and P2). Blood samples were collected from clipped grouse toenails. Silver nitrate was applied to the toenail if bleeding did not stop after applying pressure with a cotton ball.

All adult and yearling sage-grouse were located at least once a week from April to August. Female sage-grouse on nests, initiating nests, or with broods were located 2 to 3 times a week. At each grouse location we recorded the UTM coordinates, habitat type, identification number of visible wells within 2.5 km, slope, aspect, and weather.

Habitat assessment

We used a variation of the line intercept method to estimate shrub canopy cover at all sage-grouse seasonal habitats (Connelly et al. 2003). At nest sites, a 15-meter tape was stretched out in 4 directions radiating away from the nest. The first transect followed a random bearing and additional transects were located at 90 degree intervals. At all other

grouse use sites, canopy cover measurements occurred along 10-meter tapes aligned in the same manner. All transects were centered as close as possible to the bird's former location.

At each transect, the amount of live shrub canopy directly below the tape was measured. Gaps larger than 5 cm were excluded from canopy cover measurements while gaps less than 5 cm were included in measurements. To estimate canopy cover, the total amount of canopy below the tape was summed, and then divided by the total length of the tape.

Herbaceous cover was measured with a 20X50 cm Daubenmire frame (Daubenmire 1959, Connelly et al. 2003). Daubenmire frame measurements occurred every 2.5 m (8.2 ft) along each line intercept transect. An estimate of the percent cover of both grasses and forb species were recorded. Litter, rock, and bare ground cover were also estimated. We used a Robel Pole to measure visual obstruction into brood sites, nest sites, and control sites (Robel et al. 1970). At nest sites, Robel Pole measurements out of the site were also recorded. Paired control transects were aligned in the same manner and located a random distance (100m , 200m, 300m, 400m) and direction away from each former bird location.

Arthropod sampling

At brood rearing sites, insect abundance was assessed via pit fall traps (Morrill 1975), which collect ants and beetles; insects are believed to be an especially important aspect of chick survival (Holloran and Anderson 2004).

Habitat Use Patterns

Sage-grouse habitat use patterns in the natural gas field were calculated using the minimum distance that individual grouse were located near wells. The minimum distance that individual birds approached wells was calculated in ArcGIS by using the distance between grouse telemetry locations and natural gas wells. Descriptive statistics were calculated for individual birds.

To determine if sage-grouse used habitat near wells less frequently, sage-grouse telemetry locations were categorized as near wells or far from wells. We used these data to determine if sage-grouse use habitat near wells was less frequently that expected. Thiessen polygons, which contain only one point and are defined as perpendicular bisectors between all points, were constructed around wells (Fig. 3). These polygon boundaries represent habitat in the natural gas field that is located as far away from wells as possible. We calculated the distance from each grouse location to the nearest Thiessen line and to the nearest well. These distances were used to categorize locations as near wells or near Thiessen lines, representing habitat located far from wells.

Well location data were obtained from Utah Division of Oil Gas and Mining. All wells with infrastructure in place, even those that are inactive, were included in analysis. To avoid psuedoreplication, flock locations were used in analysis instead of redundant

locations for radio-collared grouse flocking together. A chi-squared analysis was used to determine if sage-grouse habitat use near wells and far from wells differed from availability.

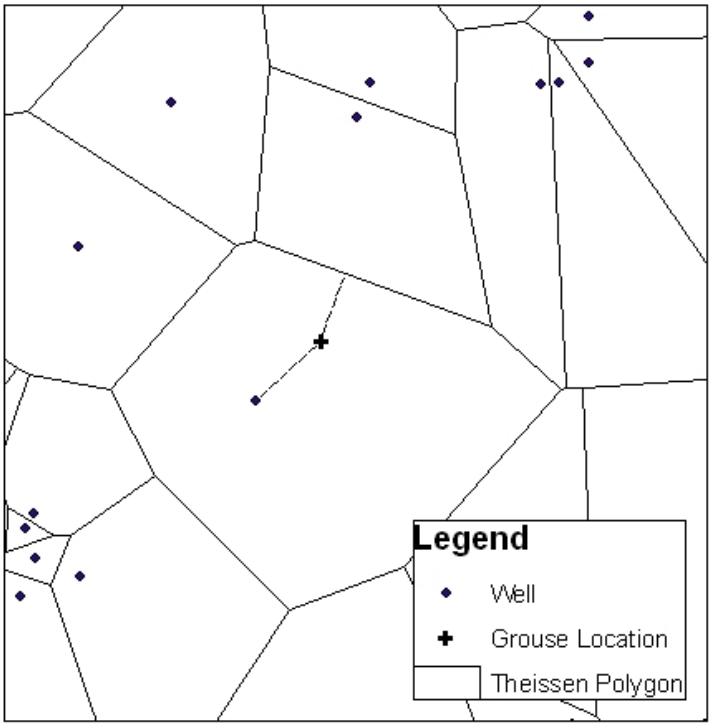

Fig. 3. Thiessen polygons constructed around natural gas wells, 2008.

Genetics

Blood samples were obtained from three sage-grouse populations in northeastern Utah (Fig. 4). Mitochondrial DNA (MtDNA) sequencing and extraction will follow the protocol outlined by Kahn et al. 1999. If new haplotypes are discovered, haplotype phylogeny will be explored with maximum-parsimony analysis (Oyler-McCance et al. 2005). Blue grouse will be used as an outgroup in maximum-parsimony analysis and previously described haplotypes will be included.

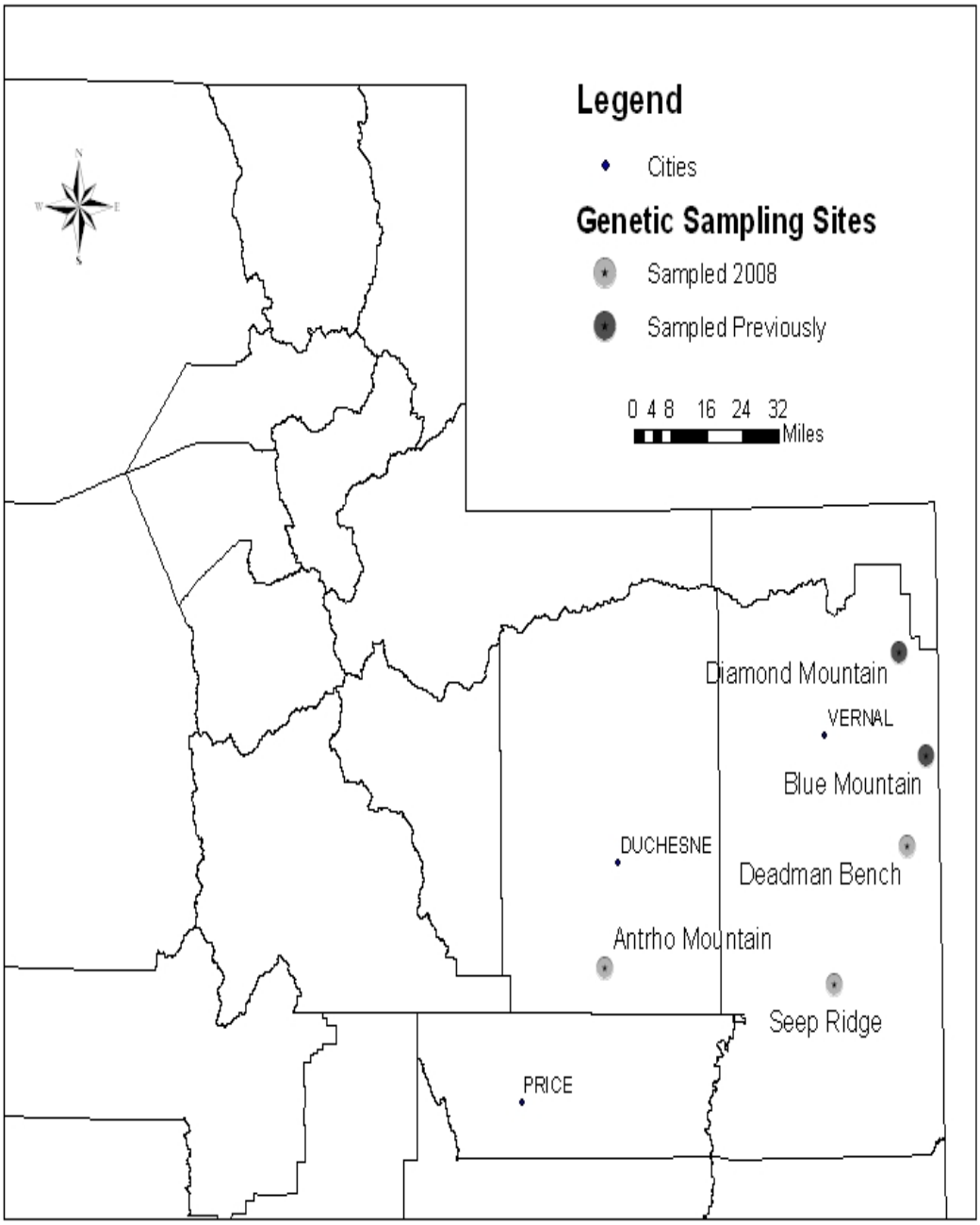

Fig. 4. Map of genetic sampling sites in northeastern Utah**.**

Results

Sage-grouse Ecology

Lek survey

Five known lek sites in the Seep Ridge study area were surveyed. Two leks were active. We counted a maximum of 9 males attending these leks. From this count, we estimate that the population consists of approximately 34 birds. This estimate is substantially lower than last year's population estimate of 120 birds. No new leks were located during driving surveys.

Capture and radio-telemetry

Seven sage-grouse were captured between 18 March and 8 April 2008. Two birds were recaptures from 2007. We collected blood samples and morphological measurements from all sage-grouse before releasing them. We also fitted the newly captured birds with radio-collars. Of the new captures, 3 were males (2 adults, 1 juvenile), and 1 was female (juvenile). We were unable to capture 2 sage-grouse (1 female and 1 male) remaining from the 2007 field season. The average weight of the male sage-grouse was 2650 g. (5.83 lbs.) The female sage-grouse weighed 1400 g (3.1 lbs.). This work was conducted in accordance with UDWR Certificate of Registration Number 3BAND7775 and Utah State University Institutional Animal Care and Use Permit Number 1332.

Nesting

We documented the location of 1 nest in 2008. The successful nest was initiated approximately 21 April and hatched 16 May 2008. All 8 eggs hatched successfully. The nest was located under sagebrush. The following habitat measurements were recorded at the nest: shrub cover 11.9%, forb cover 2.2 %, and grass cover 13.8%. The nest shrub height was 54 cm. (21 in.).

Brood survival and habitat use

The brood used East Bench and Middle Bench for early brood rearing and the land adjacent to Willow Creek for late brood rearing. None of the 8 chicks survived to 50 days. The brood moved to Willow Creek approximately 1 June 2008. The brood was lost approximately15 June 2008 when the chicks were 31 days old

Broodless hen and male habitat use

Male sage-grouse moved from the benches to Willow Creek between 18 June and 2 July 2008. Males used the Willow Creek and Agency Draw areas for summer range habitat.

After capture, one hen traveled 17.6 miles (28.3 km) to join what may be another population of sage-grouse on the Uintah and Ouray Indian Reservation (Fig. 5).

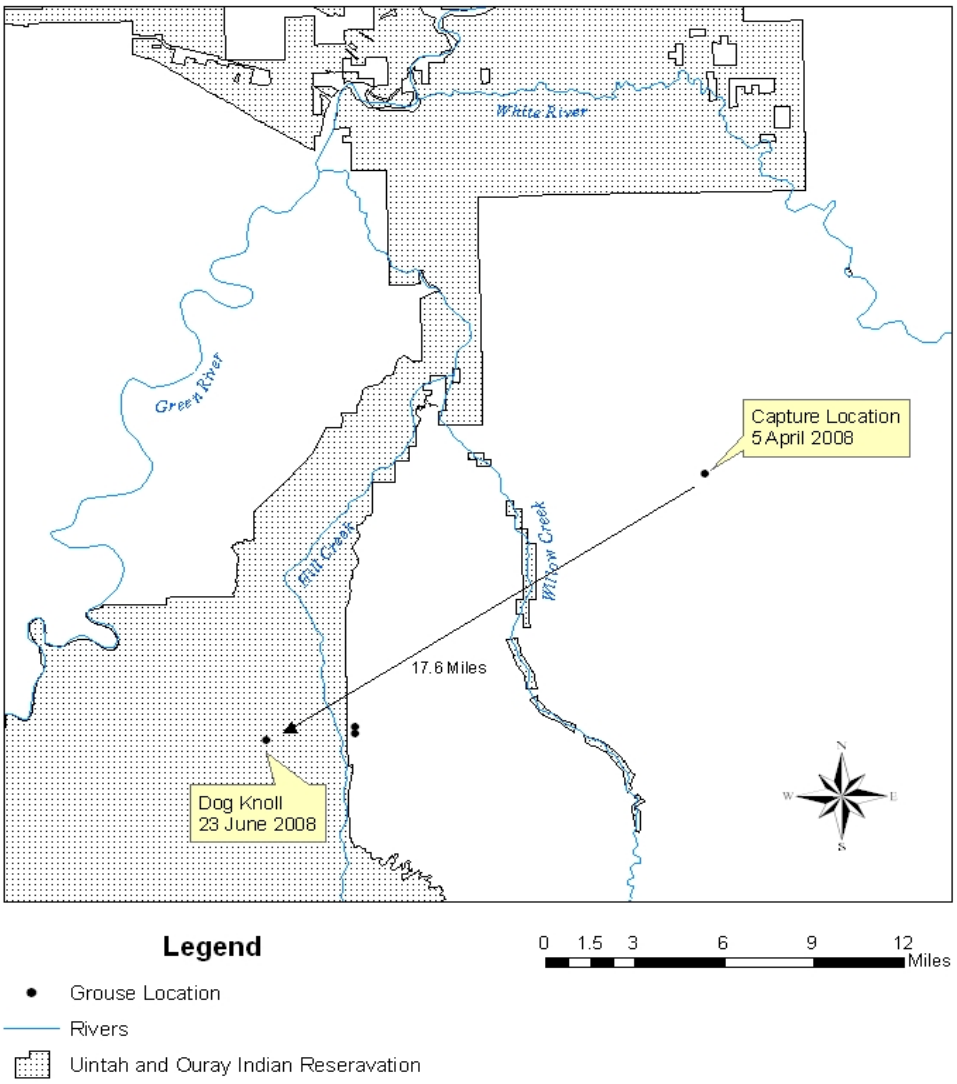

Fig 5**.** Long distance movement of a female greater sage-grouse from the capture site to Dog Knoll, which is located on the Uintah and Ouray Indian Reservation, 2008.

The hen was located on Dog Knoll on 23 June 2008 and remained in the area throughout the summer. This is an interesting discovery because it indicates that the Seep Ridge population is not as isolated as we originally believed.

Male and hen site shrub cover appeared to be temperature dependent. At Willow Creek, adults were found in the shade of the creek banks, cottonwoods, and tall shrubs during the hottest portion of the day. At Agency Draw sites birds were observed in the shade of greasewood, juniper, and rock ledges.

Mortality

One female and five males (66.7%) died between 3 March and 26 September 2008. The cause of the mortalities was difficult to determine. One adult male grouse may have died as a result of injuries sustained during lekking. The bird had a punctured air sac, but was otherwise intact.

Habitat Use Patterns

The average minimum distance observed between sage-grouse and natural gas wells was 271 m (888 ft) (Table 1). The smallest minimum distance observed between a sage-grouse and a well was 62 m (203.4 ft). The largest minimum distance between a grouse and a well was 6,335 m (20,779 ft.). Both the largest and smallest minimum distance observed between a grouse and wells were locations for females without broods.

More sage-grouse were located in habitat categorized as far from wells than in habitat categorized as near wells ($n = 188$, $n = 17$). The data provides strong evidence that sage-grouse use habitat near wells less often than expected ($P < 0.001$).

2009 Work Plan

We plan to continue data analysis, conduct genetic sample sequencing and analysis, and quantify results from arthropod sampling in spring of 2009. Currently, we do not have any plans to capture additional grouse from the Seep Ridge population. We expect to complete all data analyses in spring 2009.

Table 1. Descriptive statistics for Seep Ridge greater sage-grouse habitat use in a natural gas field. The distance (m) to natural gas wells with infrastructure in place is reported for each radio-collared bird, 2008.

Bird ID	Locations	Minimum Distance	Maximum Distance	Average Distance
SR944207	19	62	3283	1674
SR929407	22	127	1184	715
SR959508	14	153	3870	1447
SR968307	48	251	3584	2392
SR931207	20	258	3315	2026
SR937207	17	258	4216	1678
SR951307	24	258	4393	1383
SR924507	14	287	1274	766
SR977307	20	287	3333	2177
SR979407	22	287	3369	1978
SR983308	13	363	3470	2040
SR963108	5	402	2635	918
SR941207	19	524	3101	1599
SR912208	6	796	2427	1446
SR918407	1	1148	1148	1148
SR971308	3	6335	6895	6591
Average	20	271	3156	1599

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