EFFECTS OF PINYON JUNIPER REMOVAL ON GREATER SAGE-GROUSE (CENTROCERCUS UROPHASIANUS) HABITAT-USE AND VITAL RATES IN NORTHWESTERN UTAH
2014 ANNUAL REPORT (DWR Contract 132573)

WRI Project #2555

Cooperators:

Box Elder County Coordinated Resources Management Committee

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

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January 2015

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Introduction

Populations of greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) have been declining range-wide for the last century (Connelly et al. 2004). The range of sage-grouse has declined from an estimated historical pre-settlement distribution of 1.2 million square km to 668,000 square km as of 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 were estimated to occupy 41% of historic habitats, with the largest populations inhabiting sagebrush areas in 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, 2009). The West Box Elder Adaptive Resource Management Local Working Group (BARM) incorporated the conservation strategies published in the state plan to develop and implement a conservation plan to manage sage-grouse populations and habitats at the regional scale (BARM 2007). The BARM sage-grouse conservation plan identified threats to the species, knowledge gaps, and conservation actions they believed could reverse the decline of sage-grouse.

In April 2013, Governor Gary Herbert signed Utah's Conservation Plan for Greater Sage-Grouse (http://wildlife.utah.gov/uplandgame/sage-grouse/pdf/greater_sage_grouse_plan.pdf). The Utah Plan is a scientific-based strategy that establishes goals and measurable objectives for sage-grouse in Utah, and identifies how Utah will manage their habitat and populations to meet these objectives. The BARM plan conservation strategies were incorporated in the Utah Plan and used to refine the Box Elder Sage-grouse Management Areas (SGMAs). The Box Elder SGMA is one of the 11 described in the Utah Plan. The Box Elder SGMA incorporates occupied and potential sage-grouse habitats in Box Elder County (Figure 1). These plans recognize the diversity of ecological habitats required to sustain this and other landscape species. However, to conserve sage-grouse, better information is needed regarding population or landscape level response to management actions and conservation strategies.

Recent research suggests conifer encroachment has a detrimental effect on sage-grouse populations. Baruch-Mordo et al. (2013) reported sage-grouse leks were extirpated in Oregon when conifer canopy cover exceeded 4% per hectare within 1000m of a lek. Frey et al. (2013) also noted that sage-grouse in southern Utah used agricultural land as much as sagebrush habitat, an indication of insufficient forbs in the sagebrush habitat (Connelly and Doughty 1989). The reduced available forbs could be due to suppressed vegetation communities in conifer areas (Miller 2000, 2005). This would further compound the negative effects of conifer on sage-grouse habitat use. Frey et al. (2013) found that when conifers were removed, sage-grouse selected for mulched and seeded conifer removal sites over previously favored agricultural areas. However, managers still need better information regarding sage-grouse nest initiation rates, nest

and brood success, survival, recruitment, production (i.e., vital rates), and seasonal movement and habitat-use patterns in response to conifer removal projects.

Study Purpose

This research is being conducted to address some of the knowledge gaps that were identified in the BARM (2007) and Utah Plans (2013). Specifically, this research will investigate sage-grouse responses to conifer removal programs conducted under the Natural Resources Conservation Service (NRCS) Sage-grouse Initiative, Utah's Watershed Restoration Initiative (WRI), the Bureau of Land Management (BLM), and private landowners. We are interested in determining the effect of the conifer removal on sage-grouse habitat use and vital rates (adult and juvenile survival, nest and brood success).

Sage-grouse vital rates will be compared relative to habitat-use patterns. The habitats evaluated will include sagebrush, phase I, phase II, and phase III conifer encroachment (Miller 2005), and conifer removal. When completed, this research will provide assistance to land managers, government agencies, and private landowners, to identify areas of highest concern, and expected benefits of juniper removal projects in the Box Elder SGMA.

Objectives

1. To determine if sage-grouse vital rates differ by habitats used and relative to the type of conifer removal projects at both temporal and spatial scales.

2. To determine the effects of changes in percent canopy and herbaceous vegetation cover on sage-grouse vital rates and habitat-use patterns.

2. To identify conifer removal strategies that would benefit sage-grouse and other sagebrush obligate species.

Study Area

This study focuses on the Raft River subunit of the West Box Elder Resource Area located in the north-west corner of Utah (Figure 1). The study area was based on the subunits of the Box Elder Management area outlined in the 2002 state plan, and resides within the Box Elder SGMA defined in the current Utah Plan. 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. The study area encompasses approximately 440,750 ha. Land ownership for the Raft River

subunit is a mix of public and private lands consisting of private, BLM, School and Institutional Trust Lands Administration (SITLA), and US Forest Service.

Vegetation composition and structure in the study area varies with elevation from salt desert scrub at low elevations, through various sagebrush communities, into juniper (*Juniperus* spp.) and mahogany (*Cercocarpus ledifolius*) woodlands and coniferous forest at higher elevations. Elevation ranges from 4600-9800 ft. (1402-2987 m) above sea level.

The primary conifer cover consists of juniper trees. The conifer removal projects in the area thus largely entail removal of juniper using various techniques. Conifer removal projects completed in the study area between 2007 and 2013 included complete mastication (i.e., Fecon Bull Hog, Lebanon, OH), and chaining (Cain 1972).

Climate data for Park Valley, UT, from 1990 to 2013 shows annual precipitation averaged 11.52 in. (29.26 cm) in Park Valley (5000 ft. elevation), with 5.6 inches (14.2 cm) falling as snow between November and April. Temperatures range from a monthly average high of 86° F (30° C) in July to a monthly average low of 15° F (-9.4° C) in December and January (Western Regional Climate Center (WRCC) 2014). Snow does not typically persist through spring at lower elevations but can remain at high elevations over 8000 ft. (2438 m) into late summer. Greater levels of snowfall and colder temperatures exist at higher elevations. During 2014, the study area experienced a dry winter and unusually early spring. This was followed by a dry summer, with sudden and intense rains occurring in late July and into August.

Methods

Sage-grouse Capture and Marking

Beginning in February of 2014, research teams captured and radio-collared sage-grouse using a spotlight and long handled net following protocols described by Connelly et al. (2003). Captured birds were fitted with a numbered leg band and a collar-type VHF radio transmitter, sexed, aged, weighed, and examined to determine general physical condition (Eng 1995). Feathers were collected out of the capture net if they were lost for potential DNA analysis. All captured sage-grouse that were not radio-collared were still equipped with a leg bands. The capture and capture location was recorded (UTM, 12N, NAD 83) and all birds were released on their capture site as quickly after capture as possible. Due to previous research, there were also some sage-grouse with active collars. These birds were monitored as part of this research as well.

Radio Telemetry

Following capture, all radio-collared sage-grouse were located using radio telemetry techniques to determine habitat use patterns, seasonal movements, nest success, brood success, and survival

rates. Marked males were located biweekly from spring to late summer. Marked females were located two times each week during nesting and brood-rearing periods or weekly upon nest or brood failure. We attempted to locate any missing birds using a small fixed-wing aircraft fitted with radio telemetry equipment.

Nest Monitoring

Sage-grouse nest initiations were determined when a hen was recorded using 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 a global positioning system (GPS) record and a discreet physical marker of natural origin to aid researchers in returning to the located nest. Actively nesting females were observed carefully from a distance of 7 to 20 m at least two times weekly until the nest hatched or failed. A successful hatch was determined when egg halves were found intact in or near the nest bowl, and/or the inner membrane of the egg was separated from the shell (Wallestad and Pyrah 1974).

Brood Monitoring

After hatching, females with broods were located twice weekly until they reached at least 50 days of age. Each brood was flushed and the number of chicks was recorded to determine brood success (Schroeder 1997). Due to the tall mixed mountain brush and big sagebrush vegetation communities in which broods were typically found in this study area, these flush counts were conducted in daylight to reduce the risk of missing birds that otherwise may not be visible using a spotlight count method. Radio telemetry was used to locate the adult hen, and the area of her flush was thoroughly searched using an outward spiral pattern until all chicks had flushed.

Vegetation Surveys

Vegetation attributes were measured at sage-grouse use and paired random sites. Use sites included nest locations, brood locations, and general habitat use areas. Random site locations were selected using random directions and distances from brood sites. Each survey was conducted using four transects; each in a cardinal direction. Nest surveys consisted of 15 m transects, and all other surveys consisted of 10 m transects. Along each transect, a 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 m intervals, and four frames were placed at 2.5 m 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

Conifer removal sites of all types (mastication, chaining, pull-and-pile) were evaluated for sage-grouse habitat use using pellet surveys (Dahlgren et al. 2006). Seven treatment areas (4 chaining, 3 pull-and-pile) and 4 pre-treatment (3 mastication and 1 chaining) areas were evaluated by walking four, 600 m transects per treatment area. The number, type (roost, cecal), distance along and distance from the center line of transect was recorded for each pellet or pellet group detected. Mule deer (*Odocoileus hemionus*) pellet groups were also counted simultaneously. Paired transects were also evaluated in adjacent untreated habitat, as well as habitat with juniper cover approximately similar to what was in the area that was treated. Three Before-After-Control Impact (BACI) experiments were also implemented in areas that would be treated between the 2014 and 2015 field seasons. These experiments consisted of transects in the planned treatment area, and native sagebrush. New transects will be placed in the treatment areas post-treatment to evaluate response of sage-grouse.

Preliminary Results

Captures

In 2014, we captured 9 males and 19 females. These birds were included in the existing sample of radio-marked sage-grouse from previous research giving us a sample size 63 radio-marked sage-grouse; 11 males and 53 females. As of January 2015, 4 males and 15 females from the sample population were moralities. All of the signals from the sage-grouse radio-marked during previous research projects from 2012 and 2013 have been lost because of battery failures. Thus the fate of these sage-grouse is unknown. The current sample population consists of 17 radio-marked sage-grouse. This spring we will attempt to radio-mark an additional 33 sage-grouse to increase the sample size to 50. We will attempt to re-capture sage-grouse with failed radio-collars by returning to their previously observed lek of preference and capture area.

Vital Rates

We are currently in the process of analyzing the vital rates for the 2014 season. Thus the following estimates are based on descriptive statistics and subject to change following the 2015 field season.

Of the 53 females radio-collared, 1 died before nesting season, and 10 either moved far out of the study area, or stayed on private property where access was restricted. Of the 42 females that we were able to actively monitor, 95% (n=37) initiated a nest. The mean clutch size was 7 eggs. In 2014, 62% (n=23) of the nests hatched. Three telemetry collars died, and one hen disappeared – possibly related to a failed collar as well during brood-rearing. Failed collars or missing females

have been censored from brood success data. Of the remaining hens with broods, 58% (n=11) produced successful broods. Average brood size was 2.3 chicks per hen at 50 days post-hatch.

Survival Estimates

Because of failed radio-collars from 2012 and 2013, calculating survival is complex. We have not fully estimated survival for birds collared in 2012 and 2013 as of this time. However, survival of sage-grouse collared during the 2014 season from March to December is 61% (n=17). This estimate excludes 2 birds that could not be accounted for as of December 2014. Male survival appears to be 67% (n=6), while female survival appears to be 63% (n=11).

We are currently completing data quality checks on vegetation data and importing into our database for analysis. Currently, summary statistics and analysis of preferred habitat are not available. However, based on personal observations, the radio-marked sage-grouse are demonstrating habitat preferences similar to other studied populations; favoring taller stands of sagebrush for nesting cover and mesic areas within contiguous sagebrush habitat for late brood rearing and summer habitats. There also appears to be recognition of newly opened habitat immediately after juniper removal, although the significance remains unclear until more data can be collected.

Pellet Surveys

We are currently analyzing pellet count data. Preliminary observations suggest that sage-grouse have moved into new conifer removal areas immediately after treatment. It also appears that the birds prefer to roost in treatments where available, and return to intact sagebrush stands to forage. Use of conifer is minimal. Results of the BACI experiments will be unavailable until the completion of the 2015 field season due to the 2 seasons required to collect before and after data. We will compile and analyze these data to identify preferred PJ removal style for maximum sage-grouse response.

Mule deer appear to prefer PJ cover over intact sagebrush, however there has not been a clear observation of deer favoring PJ cover over treatments. During the summer of 2015 I will conduct more pellet transects along the corridors of PJ that were left for mule deer. I will use this data to attempt to discover whether these corridors are being used for their intended purpose.

Plan of Work:

For the remainder of 2014 and through 2015, we will continue to monitor radio-marked birds to determine survival rates and seasonal movements. In particular, we will monitor winter range use patterns. In 2015, we will monitor nesting effort of existing radio-marked birds, capture new hens, and, pending funding, investigate the use of GPS collars on birds to collect movements

with shorter temporal gaps. The use of these collars will help quantify use of habitat types, as well as potential movements through habitat types. All data collected during the 2014-2016 field seasons will be analyzed for inclusion in an MS thesis. Data from 2012 and 2013 will be included where applicable and appropriate.

Because this research studies sage-grouse habitat-use in response to treatment, we will use a Resource Selection Function for analysis of survival based on habitat selection. Resource Selection Functions allow the comparison of used and unused habitat to the ratios of availability of these habitats. Using this analysis, we can investigate whether sage-grouse are favoring one habitat type (sagebrush, phase I, II, III conifer encroachment, or conifer removal), and then investigate if these patterns affect survival.

Tables and Figures:

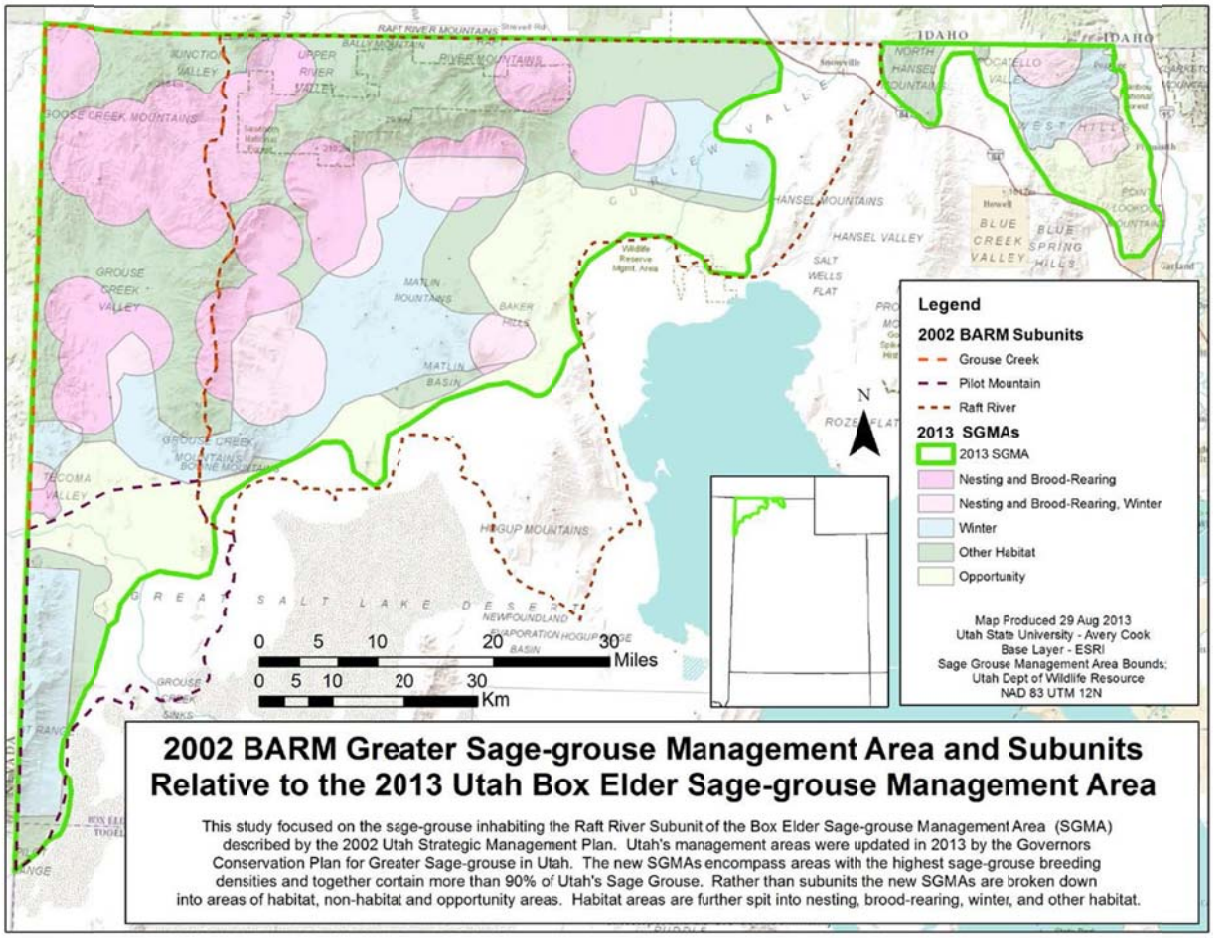
Table 1. Greater Sage-grouse Nest and Brood Success Estimates: Raft River Subunit, West Box Elder County, Utah. 2012-2013

		Marked Hens	Accessible Marked Hens	Hens Nested	Re-nest Attempts	Mean Clutch Size	Nests Hatched	Successful Broods (4 unknown not included)	Mean Brood Size
2014	Adult	44	33	31 (93%)	0	6.9	21 (67%)	9 (53%)	2.5
	Juvenile	9	9	7 (78%)	0	6.3	2 (29%)	2 (100%)	2
	Total	53	42	37 (88%)	0	6.8	27 (73%)	11 (48%)	2.4

Table 2. Greater Sage-grouse Survival Rates Estimate: Raft River Subunit, West Box Elder County, Utah. 2014 BIRDS ONLY.

	Sage-Grouse Radio Marked	Total Mortalities	Percent Mortality
Adult Male	6	3	50
Adult Female	10	6	60
Juvenile Male	3	1	33.3
Juvenile Female	9	2	22.2
Total	28	12	42.9

Figure 1. 2002 BARM Greater Sage-grouse Management Area and Subunits Relative to the 2013 Utah Box Elder Sage-grouse Management Area.



2002 BARM Greater Sage-grouse Management Area and Subunits Relative to the 2013 Utah Box Elder Sage-grouse Management Area

This study focused on the sage-grouse inhabiting the Raft River Subunit of the Box Elder Sage-grouse Management Area (SGMA) described by the 2002 Utah Strategic Management Plan. Utah's management areas were updated in 2013 by the Governors Conservation Plan for Greater Sage-grouse in Utah. The new SGMAs encompass areas with the highest sage-grouse breeding densities and together contain more than 90% of Utah's Sage Grouse. Rather than subunits the new SGMAs are broken down into areas of habitat, non-habitat and opportunity areas. Habitat areas are further split into nesting, brood-rearing, winter, and other habitat.

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