EFFECTS OF PINYON JUNIPER REMOVAL ON GREATER SAGE-GROUSE (CENTROCERCUS UROPHASIANUS) HABITAT-USE AND VITAL RATES IN NORTHWESTERN UTAH
2015 ANNUAL REPORT

Cooperators:

Utah Watershed Restoration Initiative (WRI)

Ruby Pipeline and El Paso Corporation

Utah Division of Wildlife Resources

U.S. Bureau of Land Management

Box Elder County Coordinated Resources Management Committee

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

Prepared By:

Charles Sandford and Terry A. Messmer

Utah State University, Logan, Utah.

September 2015

Table of Contents

Tables and Figures

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, Utah 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 all occupied and potential sage-grouse habitats in Box Elder County (Figure 1).

Study Purpose:

This research is being conducted to address some of the knowledge gaps that were identified in the BARM (2007) and Utah Plan (2013). Specifically, this research will investigate whether the conifer removal programs targeting dominant juniper (*Juniperus* spp.) and interspersed pinyon-pine (*Pinus* spp.) areas conducted by the Natural Resources Conservation Service (NRCS), Utah Department of Natural Resources Watershed Restoration Initiative (WRI), the Bureau of Land Management (BLM), and private landowners is an effective way of increasing sage-grouse productivity. We are investigating whether sage-grouse that use areas where conifers have been removed experience higher survival rates (hen survival, nest survival, brood survival, etc.) than

sage-grouse that avoid treatment areas, and use intact sagebrush habitats. The field research was completed by Charles Sandford, an MS level graduate student at Utah State University.

To complete this work, various vital rates will be used as a response to predictors that include habitat type (sagebrush, phase I conifer invasion, phase II conifer invasion, phase III conifer invasion (see Miller 2000 for description of the encroachment phases), and conifer removal), as well as vegetation characteristics of site with sage-grouse use, and random "non-used" sites. 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 conifer removal projects in the Box Elder SGMA.

Objectives:

1. To determine sage-grouse vital rates based on use of juniper removal projects in the area as a means of identifying potential effects of continued habitat improvements in the Box Elder SGMA.

2. To determine the effects of canopy cover on sage-grouse use and non-use, as a means of determining areas of highest priority for juniper removal.

2. To determine the ranked habitat usage of available habitats by conducting pellet counts, as a means of determining the preferred methods of juniper removal for sage-grouse.

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 is part of the Box Elder SGMA as defined in the Utah Plan (2013). 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 and the Wildcat Hills 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, Utah School and Institutional Trust Lands Administration, and U.S. 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 and mahogany

(*Cercocarpus ledifolius*) woodlands and alpine coniferous (*Picea spp.* and *Pseudotsuga menziesii*) forest at higher elevations. Elevation ranges from 4600-9800 ft. (1402-2987 m) above sea level.

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 the 2014 field season we had a dry winter and unusually early spring. This was followed by a dry summer, with sudden and intense rains falling in late July and into August. The 2015 field season was led by a dry, mild winter, early spring, and monsoon-like May where the area caught up to average precipitation.

Methods:

Capture and Marking

Beginning in February of 2014, research teams captured and radio-marked 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 track 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 was 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 were evaluated for habitat use using pellet surveys (Dahlgren et al. 2006). Seven treatment 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 the transect was

recorded for each pellet or pellet group detected. Mule deer 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 sagebrush. New transects were placed in the treatment areas post-treatment to evaluate response of sage-grouse.

Results:

Captures

In 2015, I captured an additional 5 males and 26 females and fitted them with very high frequency (VHF) radio-collars. One female was an adult with a radio-collar with a dead battery who had been captured in 2013. We replaced her collar and continued tracking her. These birds were added to the existing radio-marked population increasing our sample size to 44 VHF radio-marked sage-grouse; 7 males and 37 females. We have also received 7 rump mounted global positioning system (GPS) transmitters of which 4 were deployed in July, and 2 in early September 2015.

At the time this report was completed, we had recorded 14 mortalities; 4 males and 10 females. Several of the radio-collars from the 2014 research season are expected to run out of battery life during August and September 2015. Thus, the fate of these sage-grouse will be unknown, unless we are able to recapture them in the fall/spring. The remaining sample population is 17 birds.

Vital Rates

We are analyzing the vital rates for the 2014/2015 seasons. The following data are estimates based on descriptive statistics, and are subject to change following further analysis.

Of the 37 females, 2 died before nesting season. Of the 35 females that I was able to actively track, 66% (n=23) initiated a nest. The mean clutch size was 6.3 eggs. In 2015, 70% (n=16) of the nests hatched. One hen disappeared – possibly due to a collar that failed while brood-rearing. This bird has been censored from brood success data. Of the remaining hens with broods, 63% (n=10) produced broods. Average brood size was 2.7 chicks per hen at 50 days post-hatch.

Survival Estimates

Due to the expiration of collars' battery life from 2012, 2013, and 2014, calculating survival will be complex. I have not fully estimated survival for birds collared in 2012 and 2013 as of this time. However, survival of sage-grouse collared during the 2015 season from March to September is 71% (n=23). Male survival appears to be 60% (n=3), while female survival appears to be 74% (n=20). I was not able to positively identify the cause of most mortalities.

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 is not available; however this population appears to show similar preferences as other populations in the literature, favoring taller stands of sagebrush for nesting cover and mesic areas within contiguous sagebrush habitat for late brood rearing and summer habitats.

Pellet Surveys

I am currently analyzing pellet count data. Preliminary observations suggest that sage-grouse have moved into the conifer removal areas immediately after treatment. It also appears that the birds may prefer to roost in treatments where available, and return to intact sagebrush stands to forage. Use of conifer cover is extremely 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. I also intend to compile these data to determine if sage-grouse preferred a specific type of conifer removal treatment method.

Plan of Work:

For the remainder of 2015, I will continue to monitor radio-marked birds to determine survival rates and seasonal movements. In particular, I will monitor winter range use patterns. In late 2015, and into 2016 and 2017, we will shift use from VHF telemetry to rump-mounted GPS units in order to better describe spatial and temporal use with more frequent locations. All data collected during the 2014-2015 field seasons will be analyzed for inclusion in an MS thesis. Data from 2012 and 2013 will be included where applicable and appropriate. The thesis will be defended in the spring of 2016.

Acknowledgements:

This project was made possible by the support of landowners throughout the study area in addition to the following agencies and organizations:

Tables and Figures:

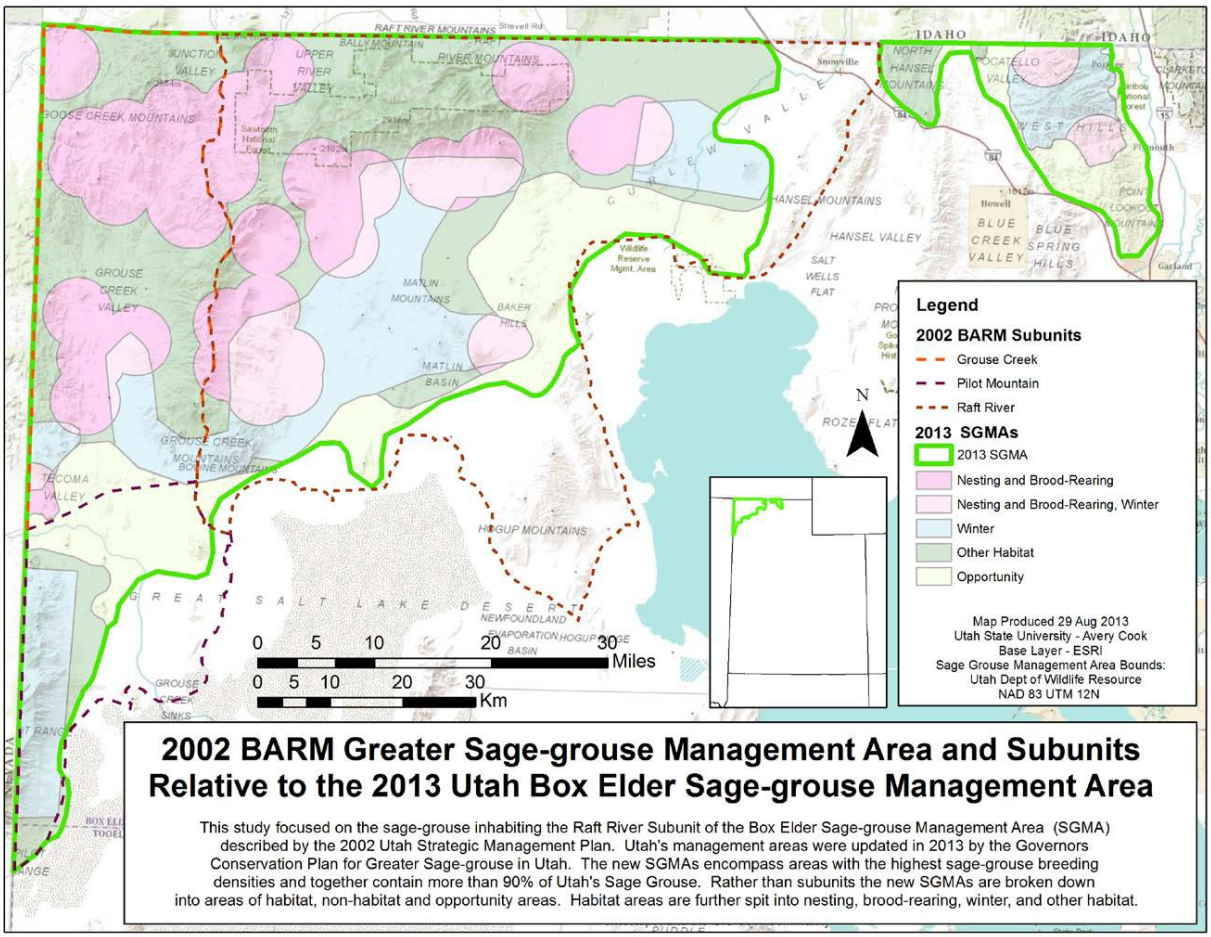
Table 1. Greater Sage-grouse Nest and Brood Success Estimates: Raft River Subunit, West Box Elder County, Utah. 2015.

		Marked Hens	Accessible Marked Hens	Hens Nested	Re-nest Attempts	Mean Clutch Size	Nests Hatched	Successful Broods (4 unknown not included)	Mean Brood Size
2015	Adult	21	21	14 (66%)	1	6.3	11 (79%)	7 (64%)	2.8
	Juvenile	16	16	9 (56%)	0	6.6	6 (66%)	3 (50%)	2.3
	Total	37	35	23 (66%)	1	6.3	17 (74%)	10 (59%)	2.65

Table 2. Greater Sage-grouse Survival Rates Estimate: Raft River Subunit, West Box Elder County, Utah. 2015 BIRDS ONLY.

	Sage-Grouse Radio Marked	Total Mortalities	Percent Mortality
Adult Male	4	2	50.0
Adult Female	16	2	12.5
Juvenile Male	1	0	0
Juvenile Female	10	5	50.0
Total	31	9	29.0

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



Literature Cited:

Beck, J.L., D.L. Mitchell, and B.D. Maxfield. 2003. Changes in the distribution and status of sage-grouse in Utah. Western North American Naturalist 63:203-214.

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

Connelly, J.W., C.A. Hagen, and M.A. Schroeder. 2011. Characteristics and dynamics of greater sage-grouse populations. In *Greater Sage-Grouse: ecology and conservation of a landscape species and its habitats*. Studies in Avian Biology. University of California Press, Berkeley, California. pp. 53–67.

Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Connelly, J.W., K.P. Reese, and M.A. Schroeder. 2003. Monitoring of greater sage-grouse habitats and populations. Station Bulletin 80. University of Idaho College of Natural Resources Experiment Station, Moscow, Idaho.

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

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

Eng, R.L. 1955. A method for obtaining sage grouse age and sex ratios from wings. Journal of Wildlife Management 19:267-272.

Johnson, D.H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61:65-71.

Robel, R.J., J.N. Briggs, A.D. Dayton, and L.C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. Journal of Range Management 23:295-297.

Schroeder, M.A. 1997. Unusually high reproductive effort by sage grouse in a fragmented habitat in north-central Washington. The Condor 99:933-941.

Stevens, Jr., D.L. and A.R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99:262–278.

Stiver, S.J., E.T. Rinkes, and D.E. Naugle. 2010. Sage-grouse habitat assessment framework. Unpublished Report. U.S. Bureau of Land Management, Idaho State Office, Boise, Idaho.

Utah Governors Office. 2013, Conservation Plan for Greater Sage-grouse in Utah. <http://wildlife.utah.gov/uplandgame/sage-grouse/pdf/greater_sage_grouse_plan.pdf>.

Accessed 29 August 2013.

Utah Division of Wildlife Resources. Strategic Management Plan for Sage-Grouse. 2002. Publication 02-20.

Utah Division of Wildlife Resources. Utah Greater Sage-Grouse Management Plan. 2009. Publication 09-17.

Wallestad, R.O. and B.D. Pyrah. 1974. Movement and nesting of sage grouse females in central Montana. Journal of Wildlife Management 38:630-633.

WRCC (Western Regional Climate Center), 2014. ROSETTE, UTAH - Climate Summary. <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ut7408>. Accessed December 19, 2014.