AVIAN PROGRAM
2014
WILDLIFE RESEARCH SUMMARIES

OCTOBER 2013 – SEPTEMBER 2014

AVIAN RESEARCH PROGRAM

COLORADO DIVISION OF PARKS AND WILDLIFE
Research Center, 317 W. Prospect, Fort Collins, CO 80526

Executive Summary

This Wildlife Research Report contains summaries (<5 pages each) of wildlife research projects conducted by the Avian Research Section of Colorado Parks and Wildlife (CPW) from October 2013 through September 2014. These research projects are long-term projects (2 – 10 years) in various stages of completion, each of which addresses applied questions to benefit the management of various bird species and wildlife habitats in Colorado. More technical and detailed reports of most of these projects can be accessed on the CPW website at http://cpw.state.co.us/learn/Pages/ResearchBirds.aspx or from the project principal investigators listed at the beginning of each summary.

Current research projects in the Section address various aspects of the ecology and management of wildlife populations and the habitats that support them, human-wildlife interactions, and new approaches to field methods in wildlife management. CPW is beginning new research on Columbian sharp-tailed grouse in northwestern Colorado, to understand how these grouse respond to habitat treatments. An initial step in this research is to evaluate the radio transmitters that can be used to track sharp-tailed grouse, to insure the transmitters do not have negative effects on the birds. Because of its high-profile status as a species of concern, CPW has been conducting extensive research on greater sage-grouse; summaries of five different studies are included here. The Avian Research staff includes a plant ecologist and habitat researcher (Dr. Danielle Johnston), who conducts research on managing plant communities and habitats important to birds and other wildlife in Colorado; summaries from three current habitat studies are included in this report. Grassland bird communities are a conservation and research focus, and current CPW research focuses on documenting avian activity and nesting associated with black-tailed and Gunnison prairie dogs; as plague is managed on prairie dog colonies, we will compare the response of avian communities on managed and unmanaged colonies. Finally, CPW has just completed a long-term experimental study on duck hunter success and satisfaction in relation to hunting regulations on State Wildlife Areas in northeastern Colorado.

Also included in this report is a listing of publications, presentations, workshops and participation on various committees and working groups by Avian Research staff from October 2013 through September 2014. Communicating research results and using their subject matter expertise to inform management and policy issues is a priority for CPW scientists.

We are grateful for the numerous collaborations that support these projects and the opportunity to work with and train graduate students and technicians that will serve wildlife management in the future. Research collaborators include the CPW Commission, statewide CPW personnel, Colorado State University, Bureau of Land Management, City of Fort Collins, EnCana Corp, ExxonMobil/XTO Energy, Marathon Oil, WPX Energy, Rocky Mountain Bird Observatory, and the private landowners who have provided access for research projects.

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Colorado Division of Parks and Wildlife
October 2013 – September 2014

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Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Columbian sharp-tailed grouse chick and juvenile radio transmitter evaluation

Period Covered: October 1, 2013 – September 30, 2014

Principal Investigator: Anthony D. Apa, tony.apa@state.co.us

Project Collaborators: Jim Haskins, Brad Petch, Trevor Balzer, Liza Rossi, Jeff Yost, CPW; Brandon Miller, RMBO/NRCS/CPW

The Columbian sharp-tailed grouse (CSTG, *Tympanuchus phasianellus columbianus*) is one of six subspecies of sharp-tailed grouse in North America. CSTG currently occupy 10% of their former range due to habitat loss. Since the initiation of the Conservation Reserve Program (CRP), CSTG have increased in distribution and density. Managers desire to improve habitat conditions on existing or historically enrolled CRP fields. Research techniques to evaluate the population response of CSTG to habitat treatments (via estimates of chick and juvenile demographic parameters) do not exist. Therefore, the objectives of this study are to: 1) evaluate the capture and transmitter attachment technique for day-old CSTG chicks, 2) evaluate the capture and transmitter attachment technique for 30-day-old CSTG chicks, 3) evaluate the capture technique for > 120 day-old CSTG juveniles, and 4) evaluate 2 necklace transmitter attachment designs for female CSTG. The study was conducted near Hayden, Routt County, Colorado (Fig. 1) from April - August 2014.

I captured female CSTG in the spring using walk-in funnel traps, and fit each female with one of two types of 12-g necklace-mounted radio transmitters, to monitor survival and nesting effort. I captured young from broods of successfully-nesting females and radio-marked a sample with 0.65 g (day-old chicks) or 3.9 g (juveniles) transmitter sutured along the dorsal midline between the wings. I monitored survival and movement daily. I conducted summary statistics and Kaplan-Meier function estimates with staggered entry for female and chick survival (Fig, 2-6). I captured 32 female CSTG and monitored survival and productivity from April through August. I documented a 5-month female survival rate of 0.57 which is similar to previous research. Twenty nests exhibited a 47% apparent nest success. Twenty-five chicks and 16 juveniles from seven broods were radio-marked with a mean chick mass of 16.3 g and juvenile mass of 94.3 g. The total average handling time was 31 minutes for chick transmitter attachment. Chick survival to 17 days was 0.49 and juvenile survival was 0.66 from 18 -50 days-of-age. The primary cause of female mortality was predation. Survival estimates for chick and juveniles was consistent with previous research in Alberta and South Dakota with sharp-tailed grouse. The techniques evaluated in this pilot study will be used in future research in Colorado.

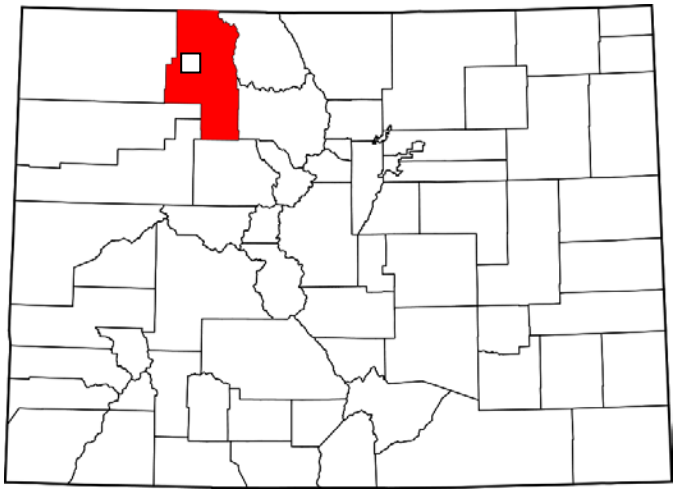


Figure 1. Columbian sharp-tailed grouse study area in Routt County, Colorado, 2013.

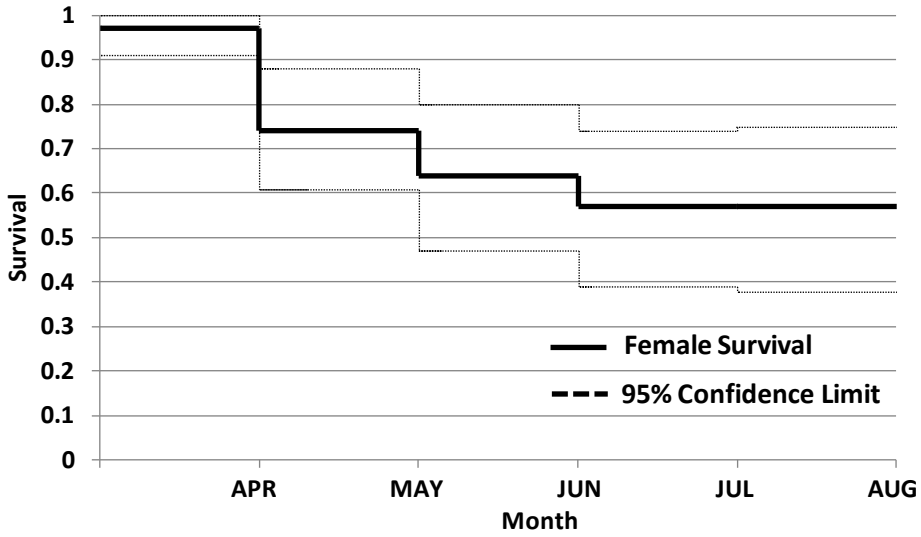


Figure 2. Kaplan-Meier product limit monthly survival with staggered entry of female Columbian sharp-tailed grouse (n = 31) from April - August in Routt County, Colorado, 2014.

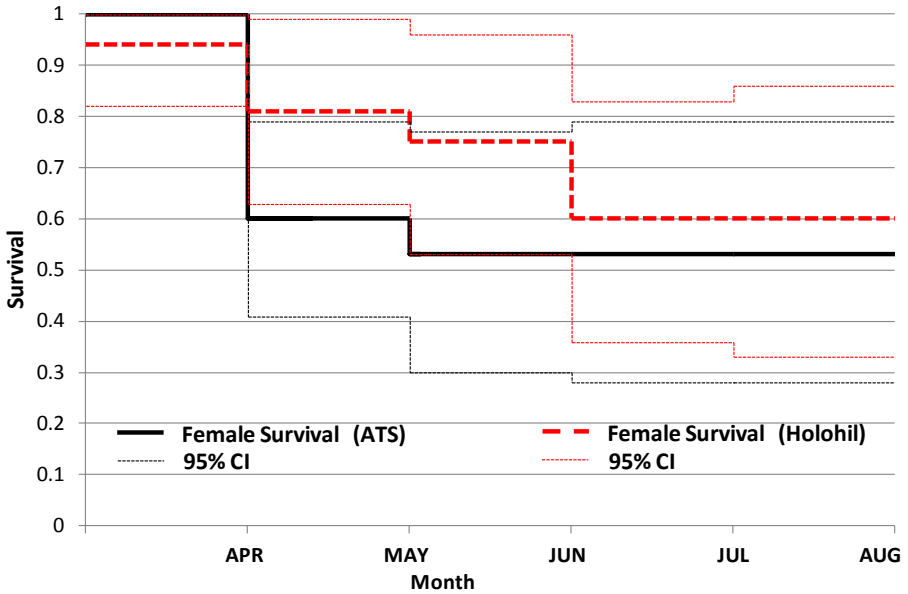


Figure 3. Kaplan-Meier product limit monthly survival with staggered entry of female Columbian sharp-tailed grouse fit with ATS (*n* = 15) and Holohil (*n* = 16) necklace style radio transmitters from April - August in Routt County, Colorado, 2014.

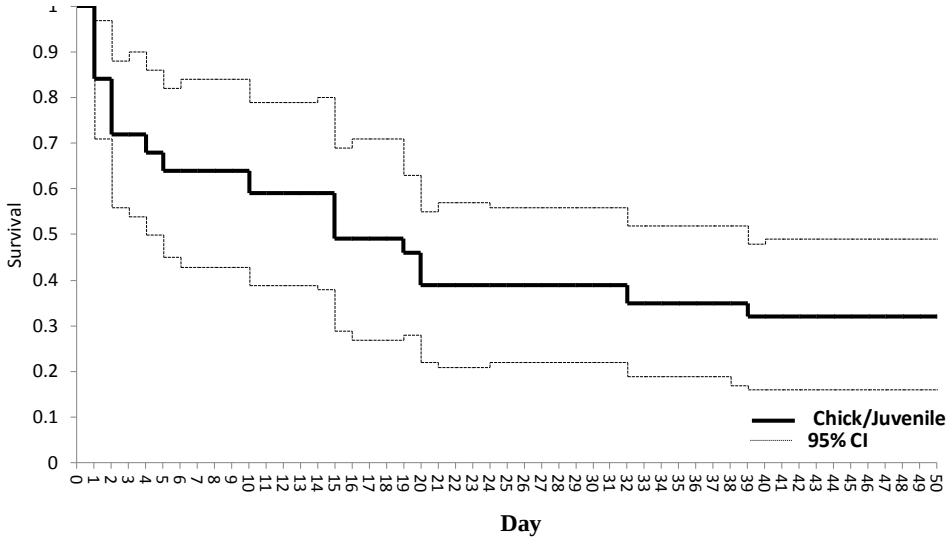


Figure 4. Kaplan-Meier product limit daily survival with staggered entry of chick and juvenile Columbian sharp-tailed grouse chicks (*n* = 31) to 50 days-of-age in Routt County, Colorado, 2014.

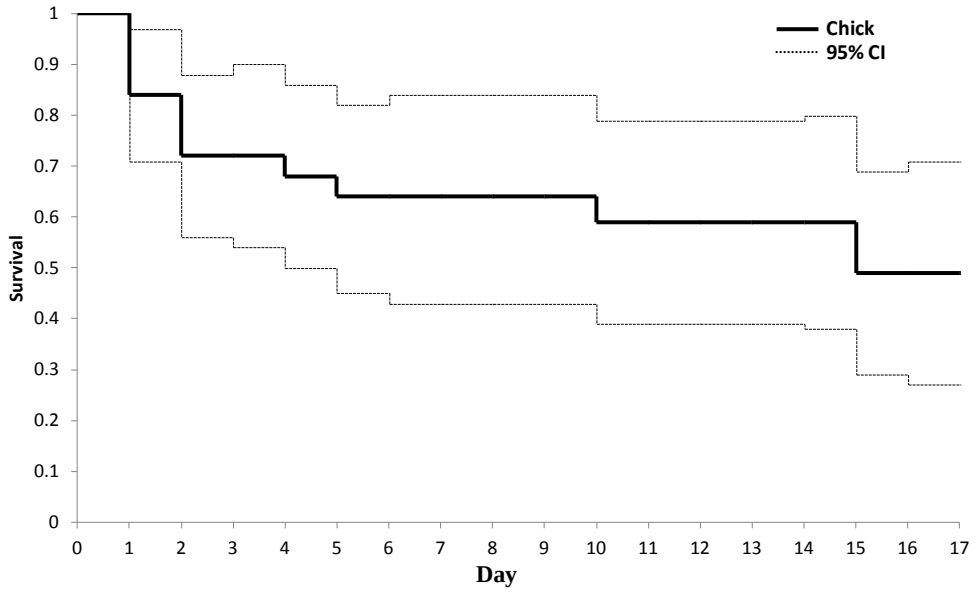


Figure 5. Kaplan-Meier product limit daily survival with staggered entry of Columbian sharp-tailed grouse chicks (*n* = 25) from hatch to 18 days-of-age in Routt County, Colorado, 2014.

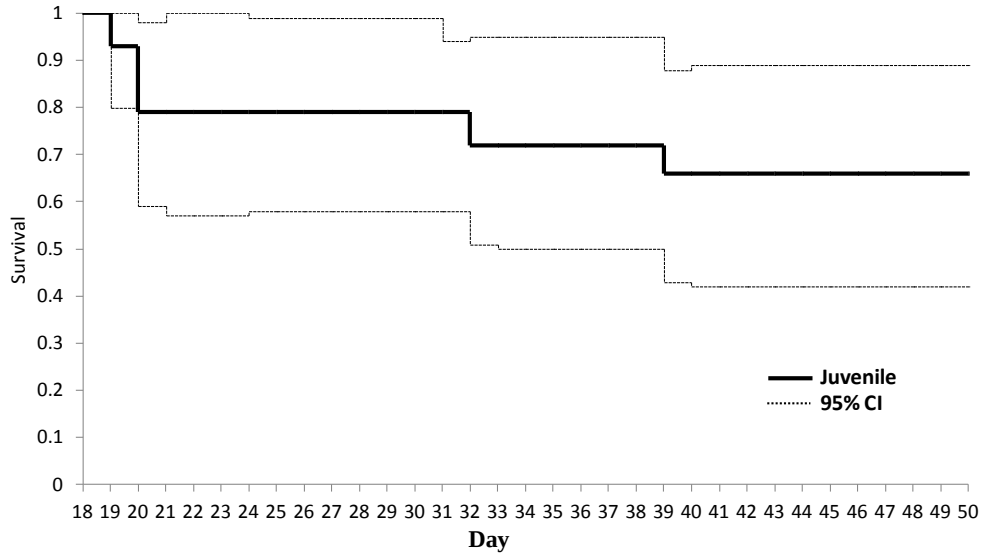


Figure 6. Kaplan-Meier product limit daily survival with staggered entry of juvenile Columbian sharp-tailed grouse chicks (*n* = 16) from 19 - 50 days-of-age in Routt County, Colorado, 2014.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Development of distribution models for management of greater sage-grouse in North Park, Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Mindy B. Rice, mindy.rice@state.co.us

Project Collaborators: Anthony Apa, Liza Rossi

All information in this report is preliminary and subject to further evaluation. Information MAY NOT BE PUBLISHED OR QUOTED without permission of the author. Manipulation of these data beyond that contained in this report is discouraged.

ABSTRACT

Rangewide declines of greater sage-grouse (GRSG, *Centrocercus urophasianus*) and recent energy development within sagebrush habitat has led to concern for conservation of GRSG populations across Colorado, including in North Park (Jackson County), which supports approximately 20% of the state's GRSG. Information on seasonal variations in habitat use by GRSG is needed for effective management. Seasonal selection of vegetation types has been modeled and mapped at the statewide level at a large scale, but investigating smaller scale seasonal habitat selection of GRSG in North Park is a priority, and no GRSG location data from North Park was used to develop the statewide habitat models. Since GRSG habitat use is known to be influenced by both landscape-scale and local-scale factors, data specific to North Park can be used to refine the North Park portion of the statewide models using finer-scale information.

Almost 4,000 locations of 117 radio-marked female GRSG were collected from April 2010-February 2012 in North Park. These locations were used to model breeding, winter, and summer distribution in relation to habitat variables using a logistic regression in Program R. Habitat variables included vegetation types, elevation, the Normalized Difference Vegetation Index (NDVI), distance to water and water density, and distance to sagebrush. To account for oil and gas energy development activity, we used an idex that combined the density of active oil/gas wells and the density of roads leading to wells within 1 km2. We re-ran the best model for each season with the energy development index variable to see if the model improved (reduced AIC) or if development was an informative predictor of GRSG distribution in North Park.

The breeding (Fig. 1) and winter (Fig. 2) habitat selection models were similar, predicting high probability of use in large expanses of sagebrush and little to no probability of use in riparian areas. The summer model (Fig. 3) predicted greater use along the edge of riparian areas and a more disjunct high probability surface.

Overall, oil and gas development features had no effect in the winter or summer seasons, but a significant negative effect during the breeding season. The North Park population has a relatively low level of oil and gas development currently and these prediction surfaces provide managers a useful baseline for seasonal habitat management of GRSG. As the possibility of oil and gas development and other landscape changes occur in North Park, it will become more critical to know how the seasonal habitat selection of GRSG in North Park may change. These seasonal models provide data-driven, defensible distribution maps that managers and biologists can use for identification and exploration when investigating GRSG issues specific to North Park.

Figure 1. Probability of greater sage-grouse presence across North Park during the breeding season.

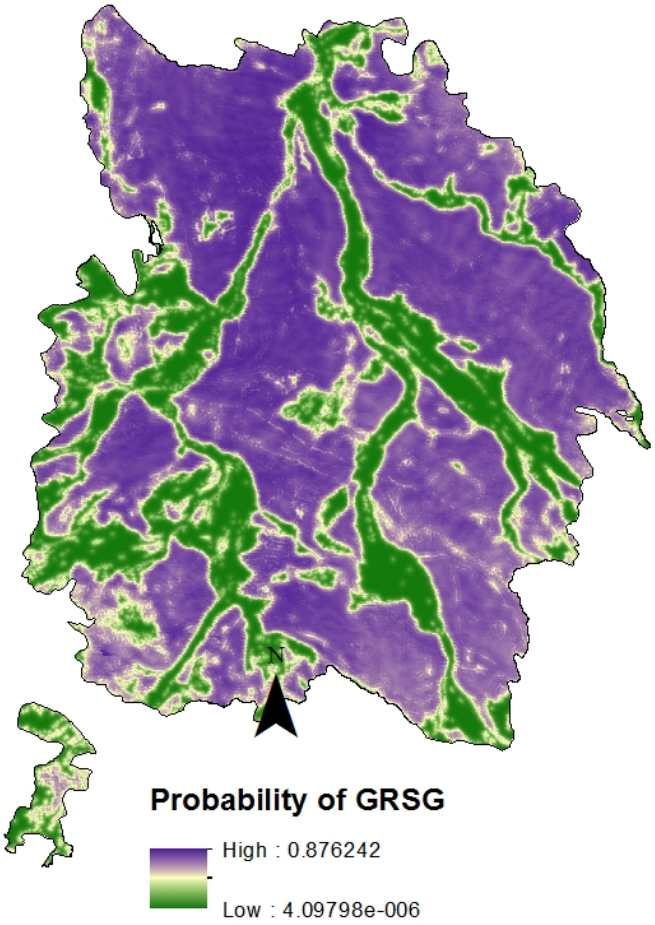


Figure 2. Probability of greater sage-grouse presence across North Park during winter.

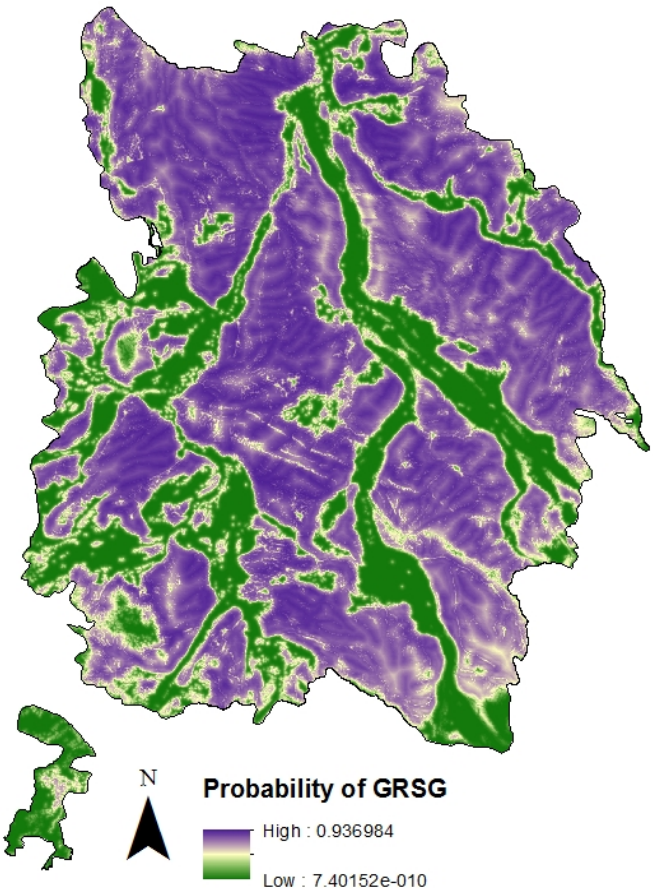
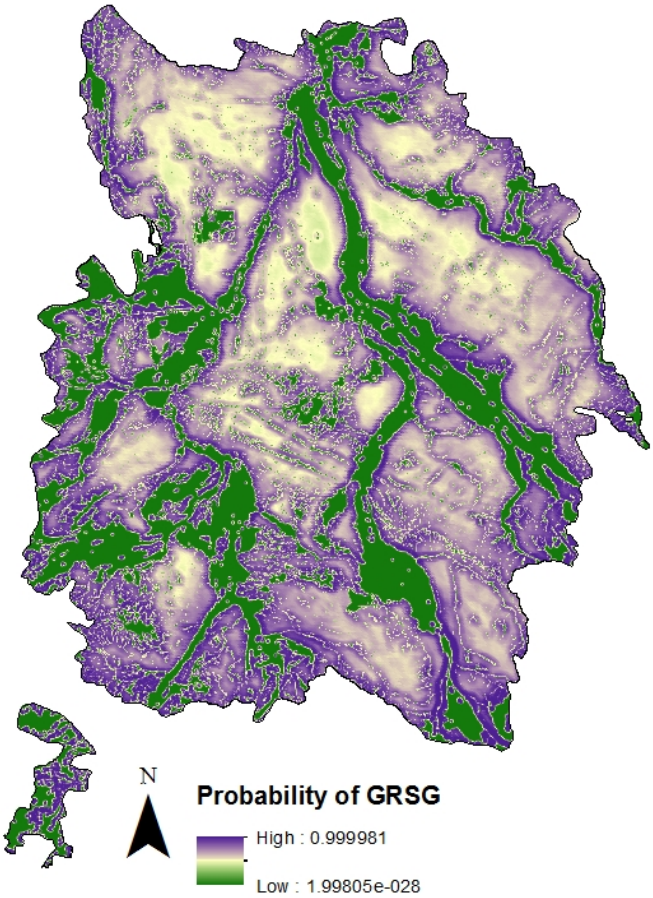


Figure 3. Probability of greater sage-grouse presence across North Park during summer.



Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Using GPS satellite transmitters to estimate survival, detectability on leks, lek attendance, inter-lek movements, and breeding season habitat use of male greater sage-grouse in northwestern Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigator: Brett L. Walker, brett.walker@state.co.us

Project Collaborators: Brian Holmes, Brad Petch, Bill deVergie

ABSTRACT

Implementing effective monitoring and mitigation strategies is crucial for conserving populations of sensitive wildlife species. Concern over the status of greater sage-grouse (*Centrocercus urophasianus*) populations has increased both range-wide and in Colorado due to historical population declines, range contraction, continued loss and degradation of sagebrush habitat, and recent federal listing of the species as warranted but precluded under the Endangered Species Act in 2010. Despite untested assumptions, lek-count data continue to be widely used as an index of abundance by state and federal agencies to monitor sage-grouse populations. Lek locations are also commonly used to identify and protect important sage-grouse habitat. However, the use of lek counts and lek locations to monitor and manage sage-grouse populations remains controversial because it is unknown how closely lek-count data track actual changes in male abundance from year to year, or if lek buffers are effective at reducing disturbance to male sage-grouse and their habitat during the breeding season.

Colorado Parks and Wildlife deployed solar-powered GPS transmitters on male greater sage-grouse (Fig. 1) and conducted double-observer counts and resighting at leks to obtain data on male survival, lek attendance, inter-lek movements, detectability, and diurnal and nocturnal habitat use around leks during the breeding season in and near the Hiawatha Regional Energy Development project area in northwestern Colorado in spring 2011-2014. These data will allow us to evaluate whether current lek-based monitoring methods provide reliable information about sage-grouse population trends and lek buffer sizes effective for conserving greater sage-grouse. We continued monitoring 37 males with GPS transmitters from Sep 2013 - Jun 2014 to obtain an additional year of data on habitat use, lek attendance, and within and between-year inter-lek movements and lek fidelity. Field work is completed and data analysis is continuing.

Figure 1. Attachment, placement, and camouflage of rump-mounted, solar-powered, GPS satellite PTT transmitters for male greater sage-grouse.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Evaluating lek-based monitoring and management strategies for greater sage-grouse in the Parachute-Piceance-Roan population of northwestern Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Brett L. Walker, brett.walker@state.co.us

Project Collaborators: Bill deVergie, Stephanie Duckett, Brian Holmes, Brad Petch, J.T. Romatzke

ABSTRACT

Implementing effective monitoring and mitigation strategies is crucial for conserving populations of sensitive wildlife species. Concern over the status of greater sage-grouse populations has increased range-wide and in Colorado due to population declines, range contraction, loss and degradation of sagebrush habitat, and recent listing of the species as warranted but precluded under the Endangered Species Act. Despite untested assumptions, lek counts are widely used as an index of abundance by state agencies to monitor sage-grouse populations. Lek locations are also commonly used to identify and protect important sage-grouse habitat. However, the use of lek counts and locations to monitor and manage sage-grouse populations remains controversial because it is unknown how closely lek-count data track actual changes in male abundance from year to year or if lek buffers are effective at protecting habitat for male sage-grouse during the breeding season. Colorado Parks and Wildlife is deploying solar-powered GPS satellite transmitters on male greater sage-grouse to obtain data on male survival, lek attendance, inter-lek movements, and diurnal and nocturnal habitat use around leks and conducting double-observer lek counts to estimate detectability of males on leks during the breeding season in the Parachute-Piceance-Roan population in northwestern Colorado. These data will allow us to evaluate whether current lek-based monitoring methods provide reliable information about sage-grouse population trends and whether current lek buffers are effective at protecting breeding males. Fourteen GPS males marked prior to 1 Sept 2013 were monitored for part or all of the 1 September 2013 - 31 August 2014 period. Field crews also captured and deployed GPS transmitters on 21 additional males during the 2014 March-May breeding season. One new potential lek was found by tracking GPS males in 2014, but at least 4 would have been found had field crews not detected them earlier in the breeding season. Field crews conducted 93 standard lek counts at 29 different leks, 28 unreconciled double-observer counts at 14 leks, and 46 paired ground and helicopter counts at 21 leks in spring 2014. We obtained breeding-season location data for a total of 31 GPS males in spring 2014. We plan to capture additional GPS males on Chevron in March-April 2015.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Assessment of greater sage-grouse response to pinyon-juniper removal in the Parachute-Piceance-Roan population of northwestern Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Brett L. Walker, brett.walker@state.co.us

Project Collaborators: Bill deVergie, Brian Holmes, T. Knowles, Brad Petch

All information in this report is preliminary and subject to further evaluation. Information MAY NOT BE PUBLISHED OR QUOTED without permission of the author. Manipulation of these data beyond that contained in this report is discouraged.

ABSTRACT

Greater sage-grouse (*Centrocercus urophasianus*) in the Parachute-Piceance-Roan (PPR) region of western Colorado face at least two major potential stressors: projected habitat loss from energy development and a long-term decline in habitat suitability associated with pinyon-juniper (PJ) encroachment. PJ removal may be a useful mitigation tool to offset potential habitat losses associated with energy development. Although PJ removal is commonly used to improve habitat for greater sage-grouse, no studies to date have quantified the timing or magnitude of how birds respond to treatments. Since 2008, Colorado Parks and Wildlife (CPW) has cooperated with industry and landowner partners to investigate the effectiveness of PJ removal for restoring sage-grouse habitat in the PPR. In fall 2008, I established nine "survey" study plots, arranged in three groups of three, with each group consisting of a sagebrush control plot, an untreated PJ control plot, and a PJ treatment plot (Fig. 1). Treatments were completed on the three treatment plots in 2010 and 2011. Pellet surveys over six summers (2009-2014) indicated that the mean proportion of sample units containing pellets was consistently highest on sagebrush control plots (range 0.197-0.449 across years), consistently lowest on plots with encroaching PJ (range 0.007-0.076), and increased starting 1-2 years after treatment, but response was variable among treatment plots. Twelve transect plots were established in fall 2010 and two more were added in summer 2011. All 14 transect plots were surveyed for pellets in summer from 2011-2014. Transect data indicated low mean pellet densities on the four PJ-Control plots over three years (range across years = 0.00-0.58 pellet piles/km) and on PJ-Treatment plots in the one year prior to treatment (mean = 0.03 pellet piles/km). Estimates of mean pellet density were substantially higher on four Sagebrush-Control transect plots over three years (range across years = 11.10 - 27.14 piles/km) and on one transect plot 4-6 years after treatment (Lower Barnes; range across years = 2.89 - 25.71 piles/km). There has been no increase in mean pellet density on four treated transect plots within three years after PJ removal (range across years = 0.00 - 1.04 pellet piles/km). However, estimates of proportion of sample units with pellets (from survey plots) and of pellet density (from transect plots) also varied substantially among Sagebrush-Control plots within years and among years within plots, which suggests there is substantial baseline variation in pellets present, over and above variation in detection due to observer ability. We completed double-observer sampling on survey plots in 2013 and 2014 to estimate sample unit-level detectability, and we completed distance sampling on transect plots to generate distance-detection curves for transects. We established and conducted pre-treatment surveys on two additional transect plots in summer 2014 (Lower Galloway and Lower Ryan Gulch) in anticipation of treatments by WPX this fall.

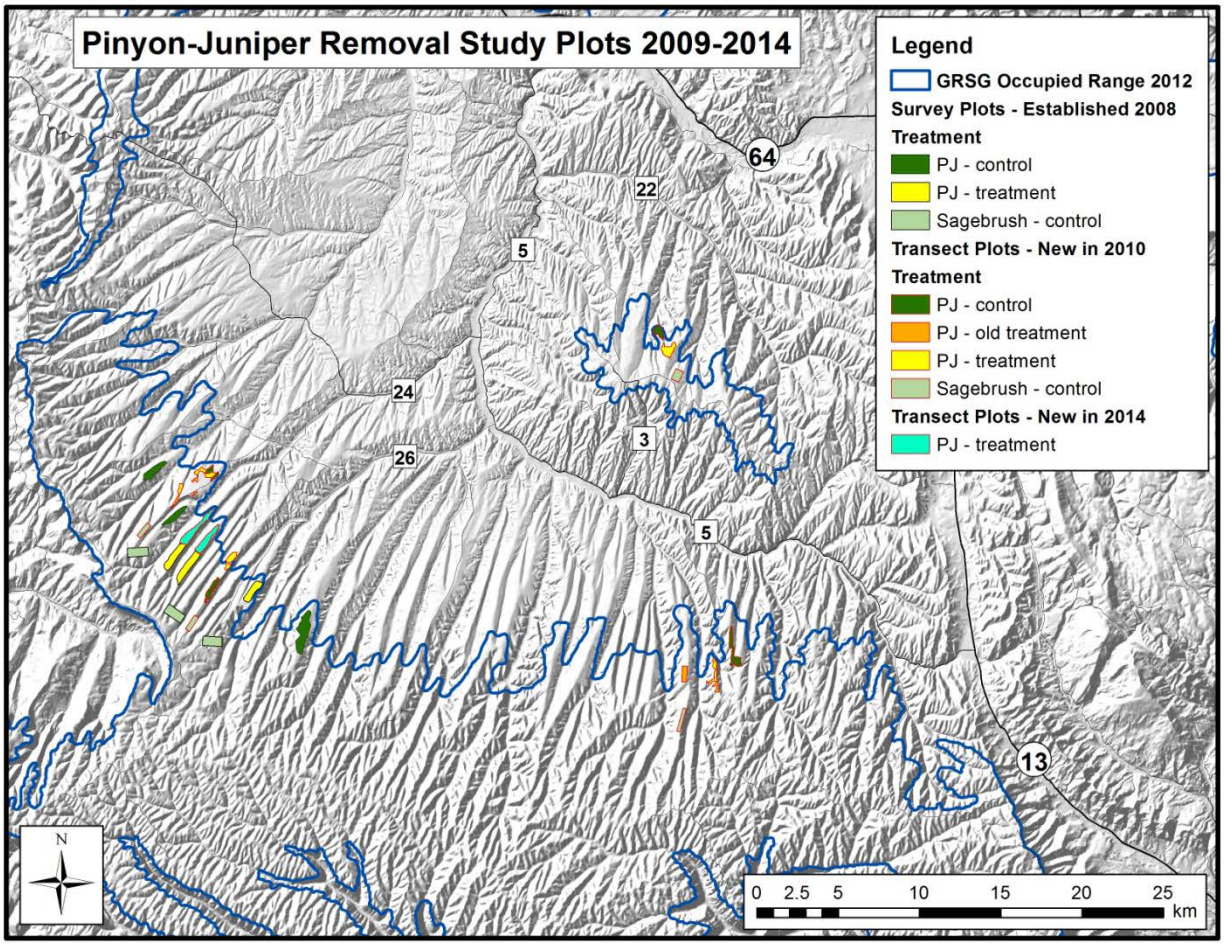


Fig. 1. Map of study plot locations from 2009-2014 for the pinyon-juniper removal experiment and greater sage-grouse occupied range boundary (as of 2012) in the northern portion of the Parachute-Piceance-Roan population of western Colorado, USA.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Evaluation of alternative population monitoring strategies for greater sage-grouse (*Centrocercus urophasianus*) in the Parachute-Piceance-Roan population of northwestern Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Brett L. Walker, brett.walker@state.co.us, Jessica S. Brauch (Colorado State University)

Project Collaborators: Brian Holmes, Brad Petch, Bill deVergie

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ABSTRACT

Robust estimates of population size and population trends provide the scientific basis for managers to make appropriate and defensible recommendations regarding land-use decisions, harvest regulations, and mitigation efforts for wildlife. When linked with environmental variables, robust monitoring programs also allow managers to examine wildlife responses to disease, land-use patterns, habitat treatments, weather, ecological succession, and disturbance. However, many wildlife monitoring programs continue to use untested population indices that may not provide reliable information on population status or trends. For this reason, it is useful to evaluate alternative approaches to population monitoring in terms of estimator precision, cost, practicality, and level of disturbance. Lek counts are the primary index used by state wildlife agencies to monitor changes in greater sage-grouse (*Centrocercus urophasianus*) abundance, but lek counts rely on untested assumptions about lek attendance, detectability, inter-lek movement, sex ratio, and proportion of leks counted. Given the availability of new methodological and statistical approaches to estimate wildlife populations, it is worth comparing the performance of lek counts against other monitoring methods. Dual-frame sampling of leks and non-invasive genetic mark-recapture are promising alternative for monitoring trends in sage-grouse populations. The purpose of this study is to evaluate and compare the reliability and efficiency of dual-frame sampling, genetic mark-recapture, and standard lek counts for estimating population size and trend and to estimate sex ratio in the Parachute-Piceance-Roan population in northwest Colorado. We completed the third and final year of dual-frame sampling in spring 2014, surveying each of 59 list-frame and 104 area-frame cells 3 times. We recorded 28 active leks (7 new) in 24 list-frame cells, 1 new lek in an area-frame cell, and 2 other leks between cells. We marked 4 VHF females and banded 8 juveniles (3 females, 5 males) in fall 2013 (1 Sep-1 Dec 2013). We completed the second and final year of winter pellet sampling for genetic mark-recapture (Nov 2013-Mar 2014). We collected samples in 4 random sampling plots and at 140 additional incidental locations for a total of 1160 pellet and 29 feather samples.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Examining the effectiveness of mechanical treatments as a restoration technique for mule deer habitat

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Danielle Bilyeu Johnston, danielle.bilyeu@state.co.us

Project Collaborators: Bill deVergie, J.C. Rivale; Mark Paschke and Garrett Stephens, Colorado State University; L. Belmonte, Bureau of Land Management

ABSTRACT

The pinyon-juniper (PJ) habitat type has been expanding in the western United States and managers often rely on mechanical methods of thinning or removing pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees in order to improve habitat for big game. Three available thinning methods are ship anchor chaining (CHAIN), roller chopping (ROLLER), and mastication (MAST), which differ in cost, type of woody debris produced, and soil disturbance (Fig. 1). Understory responses and cost-effectiveness of these 3 removal methods were compared beginning in 2011 at two locations in the Magnolia region of the Piceance Basin, Rio Blanco County, Colorado.

The North Magnolia site (n=4 sampling blocks) had higher control plot tree density, lower tree basal area, and higher shrub cover than the South Magnolia site (n=3). Two years post-treatment, the responses of desirable perennials was similar among mechanical treatment types, with all treatments producing 10-15 times higher grass biomass, 2-3 times higher grass cover, and higher shrub biomass (non-significant trend) than control plots (Fig. 2, 3). Responses of annual plants differed by mechanical treatment, with ROLLER producing the greatest response in annuals (both native and exotic), followed by CHAIN, followed by MAST (Fig. 4). This may have been related to the fact that ROLLER produced more bare ground (22%) than CHAIN (14%) or MAST (11%) in the first post-treatment year. Seeding within treatments increased the density of desirable shrubs at South Magnolia, but not North Magnolia. At South Magnolia, seeding was similarly effective in all treatment types, even though for CHAIN and ROLLER, most shrubs were seeded using a seed dribbler mounted to the bulldozers during treatment, while in MAST all seed was broadcast prior to treatment. Bitterbrush (*Purshia tridentata*) was the most common species in seeded plots at South Magnolia. Seeding native annual forbs appeared to be most effective in MAST, possibly due to enhanced germination conditions due to masticated material. Both CHAIN and MAST may be cost-effective treatments, depending on project size, species desired to be seeded, and risk of invasion by non-natives. ROLLER appears to be a less desirable treatment due to high mobilization costs and higher risk of invasion by exotics, including cheatgrass (*Bromus tectorum*). Differences in responses of exotics between North Magnolia and South Magnolia were as great or greater than those due to differences in treatment type, indicating a need for greater understanding of the site conditions which promote invasion by exotics.

Figure 1. Types of machinery used and woody debris produced: Ship anchor chaining (a) and tree skeletons left behind by chaining (b); roller chopper (c) and coarse debris left by roller chopping (d); industrial tractor with masticating head (e) with fine debris left behind by mastication (f).

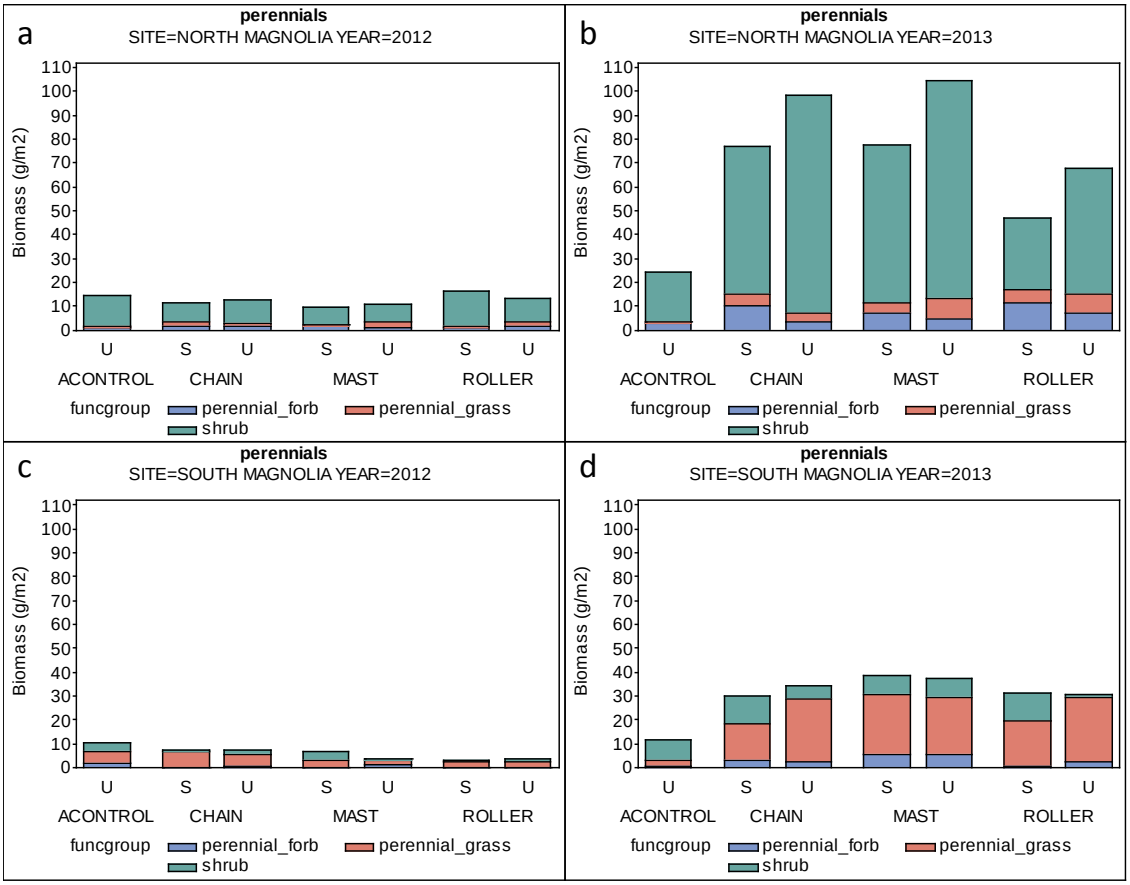

Figure 2. Perennial plant biomass in control (ACONTROL), chained (CHAIN), masticated (MAST) and roller chopped (ROLLER) plots at North Magnolia (a, b) and South Magnolia (c, d) in 2012 (a, c) and 2013 (b, d). Mechanically treated plots were subdivided into seeded (S) and unseeded (U) subplots.

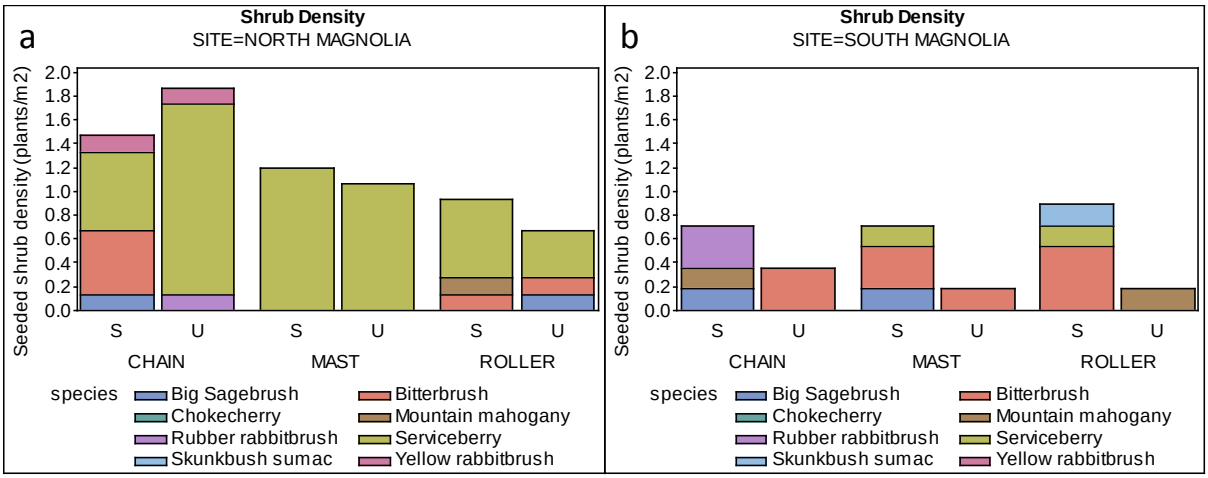

Figure 3. Density of seeded shrubs in seeded (S) and unseeded (U) subplots within 3 mechanical treatment types: chained (CHAIN), masticated (MAST) and roller chopped (ROLLER) at a) North Magnolia and b) South Magnolia.

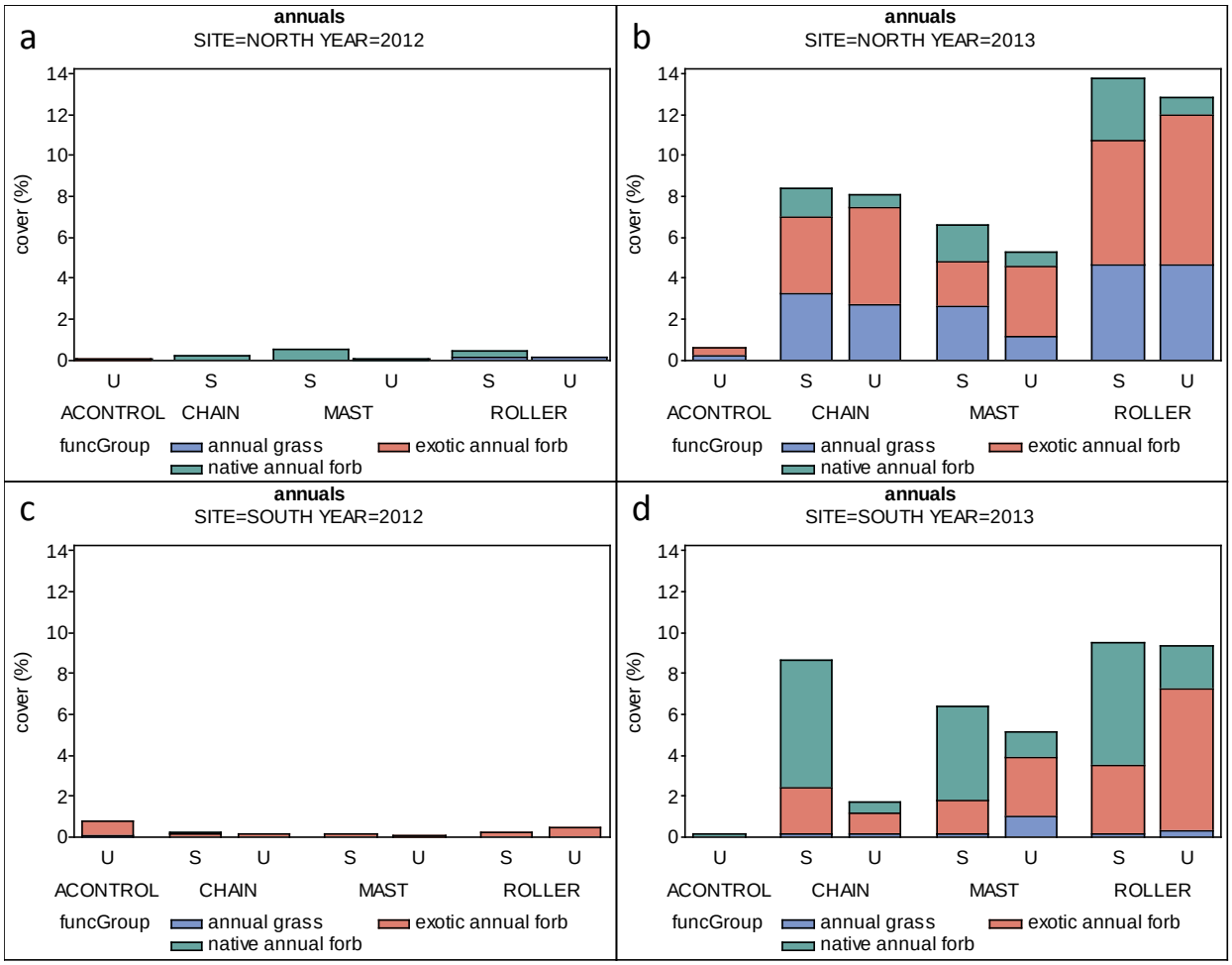

Figure 4. Annual plant cover in control (ACONTROL), chained (CHAIN), masticated (MAST) and roller chopped (ROLLER) plots at North Magnolia (a, b) and South Magnolia (c, d) in 2012 (a, c) and 2013 (b, d). Mechanically treated plots were subdivided into seeded (S) and unseeded (U) subplots.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Rangeland restoration with super-absorbent polymer and potholed surface at Horsethief State Wildlife Area

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Danielle Bilyeu Johnston, danielle.bilyeu@state.co.us

Project Collaborators: Ivan Archer, J.T. Romatzke, Ron Velarde; T. Stroh, Bureau of Land Management

ABSTRACT

Rangeland restoration often fails due to inadequate moisture to support germination, overwhelming competition from non-native annuals, or both. Two techniques which have helped ameliorate these difficulties in a prior CPW study are the use of a roughened, or pothole, surface, and addition of super-absorbent polymer (SAP) to the soil. Both of these techniques have been helpful, when used alone, in restoring well pad disturbances in northwestern Colorado under pressure from the non-native cheatgrass (*Bromus tectorum* L.). In this study, these two techniques are combined in the restoration of previously undisturbed rangeland which is heavily invaded by cheatgrass. The study site is within Horsethief State Wildlife Area near Fruita, Colorado. To prepare the site, scattered sparse greasewood plants were cut with a brush hog and the entire area was sprayed with 70 g ai/ha (4 oz/acre) of imazapic herbicide. A new implement, called a pothole seeder (Fig. 1), was developed in order to make the creation of the potholed surface more efficient. Four polygons, totaling 6.7 acres, were treated with the pothole seeder in November, 2012. Two of these polygons received granulated SAP, which was applied at 300 lbs/ac by mixing the granules with the seed and broadcasting over the potholed surface. A custom-built chain drag trailer was used to cover the seed and polymer. In 2013 and 2014, seedling counts and soil moisture data were collected, and 2013 data were analyzed for this report. In 2013, virtually no cheatgrass was detected in treatment areas, and little established offplot, likely due to unusual weather patterns. SAP crystal density correlated with perennial seedling density in early 2013 (Fig. 2), but by September 2013, most seedlings had died and no correlation with SAP was evident. SAP improved soil moisture in July 2013, the month with lowest average soil moisture (Fig. 3). Visual inspection of treatment plots in 2014 showed that some perennial plants had survived, and treatment areas continued to have lower cheatgrass cover than untreated areas. In 2015 and 2016, cover data will be assessed annually.

Figure 1. The pothole seeder.

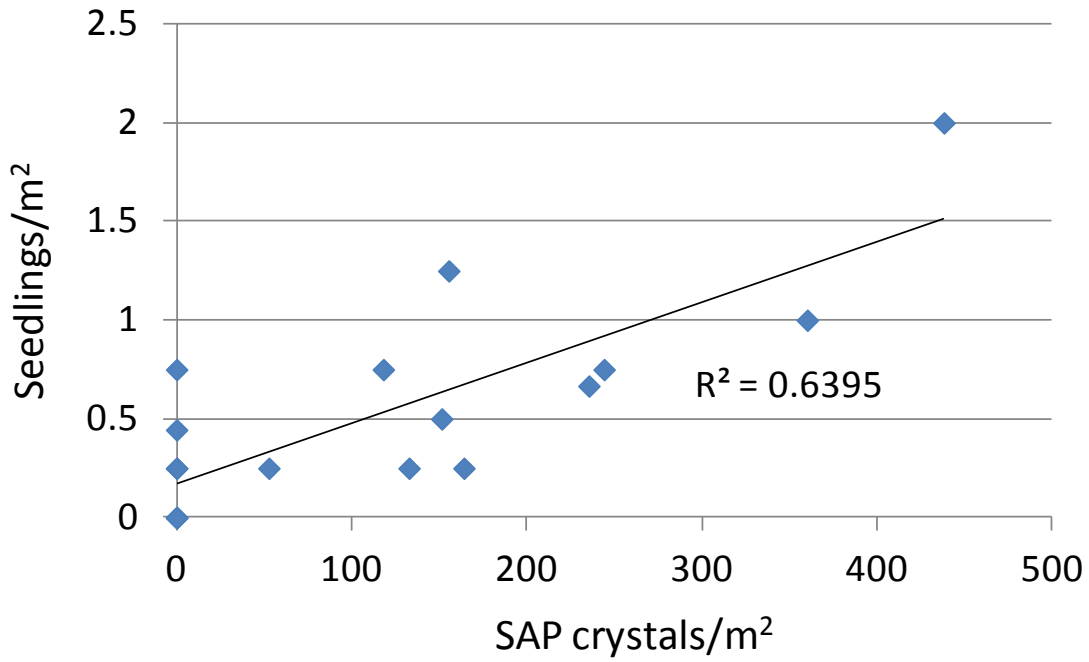

Figure 2. Perennial seedlings counted in June 2013 versus density of SAP crystals evident within holes in May 2013.

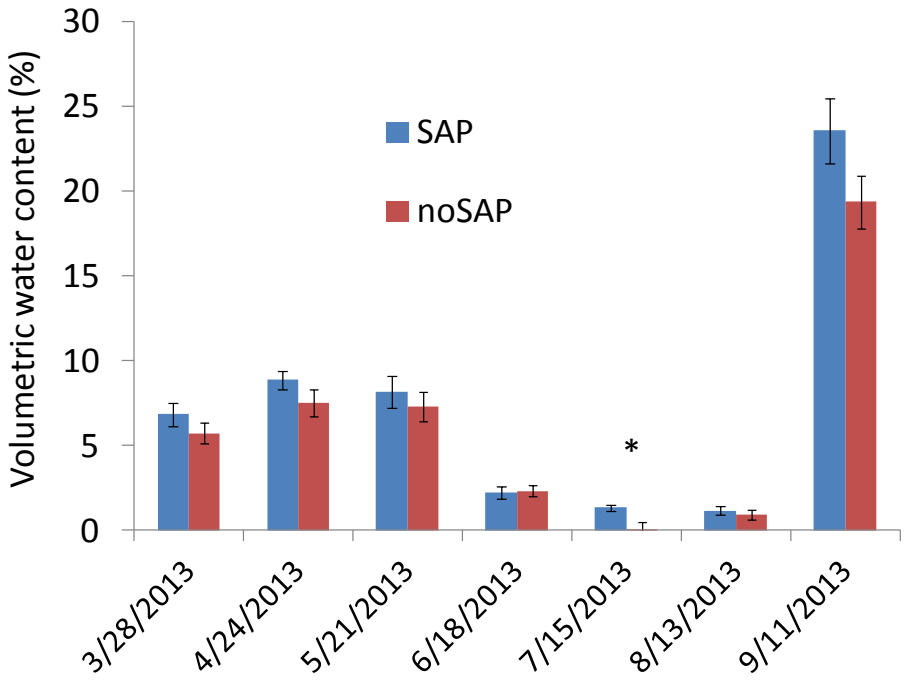

Figure 3. Soil moisture in holes of roughened mound/hole surface, in plots with vs. without super-absorbent polymer (SAP) treatment. *=significant difference at α = 0.05.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Restoring habitat with super-absorbent polymer

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Danielle Bilyeu Johnston, danielle.bilyeu@state.co.us

Project Collaborator: Cynthia Brown and Magda Garbowski, Colorado State University ; Murphy Jacox

All information in this report is preliminary and subject to further evaluation. Information MAY NOT BE PUBLISHED OR QUOTED without permission of the author. Manipulation of these data beyond that contained in this report is discouraged.

ABSTRACT

In the western United States, successful restoration of degraded habitat is often hindered by invasion of exotic species and unfavorable climatic conditions. Cheatgrass (*Bromus tectorum* L.) is an especially aggressive competitor on disturbed lands and poses threats to restoration, including outcompeting desirable species, altering soil nutrient cycles, reducing species diversity, and decreasing the quality of forage and wildlife habitat. In addition, uncertainties of future climate and precipitation changes make planning for and implementing restorations difficult. With their ability to absorb moisture when soils are wet and slowly release it over time, superabsorbent polymers (SAPs) may buffer seeded species against negative impacts of precipitation fluctuations. In a prior CPW study, incorporating SAP into the soil at the time of seeding was found to reduce cheatgrass cover by up to 50%, possibly by shifting the timing of soil moisture availability in a way that favors perennial plants. Because SAPs act on existing soil moisture, their effectiveness is likely to depend on precipitation factors, such as total annual precipitation, seasonal timing, and extent of precipitation events.

In this study, we assess the repeatability of the prior study in two additional locations, locations which have contrasting precipitation patterns: a Colorado front range site (Waverly Ranch), and a Colorado western slope site (Dry Creek Basin State Wildlife Area). We quantify how SAPs influence soil moisture through time at these locations, and how drought, cheatgrass presence, and SAPs interact to influence plant community development. At the Dry Creek Basin site, we also contrast broadcast versus pelleted application methods. In 2013 and 2014, we implemented the experiment by preparing research areas, seeding a native seed mix, and applying drought, SAP, and cheatgrass treatments in a factorial design (Fig. 1). Drought was imposed via construction of rainfall diversion shelters (Fig. 2), and treatments were completed in fall 2013 at Waverly and summer 2014 at Dry Creek. Soil moisture and vegetation responses will be monitored for three growing seasons at each site.

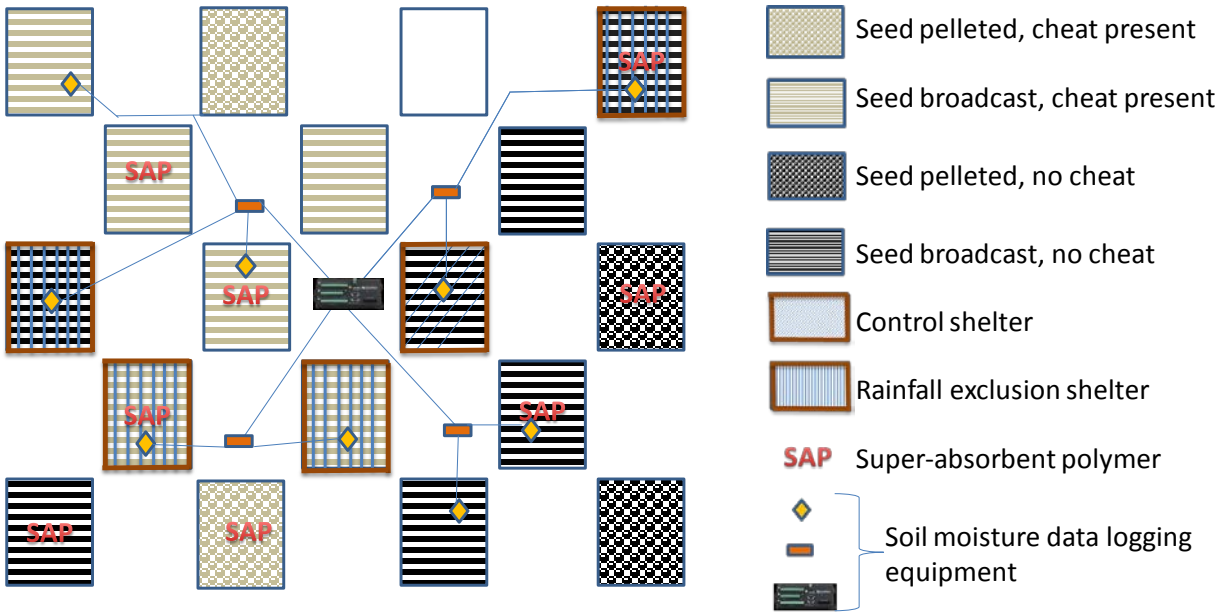

Figure 1. Layout of one of 3 replicate blocks at the Dry Creek Basin site.

Figure 2. One of 3 blocks at the Dry Creek Basin site.

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Avian response to plague management on Colorado prairie dog colonies

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Reesa Yale Conrey, reesa.conrey@state.co.us

Project Collaborators: Dan Tripp, Jim Gammonley; E. Youngberg, Rocky Mountain Bird Observatory

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ABSTRACT

Range-wide declines in prairie dog (*Cynomys* sp.) populations have occurred, and the largest limiting factor in recent decades appears to be the high mortality and colony extirpation associated with plague (Antolin et al. 2002), caused by the bacterium *Yersinia pestis*. Prairie dog colonies support a diverse community of associated species, many of which are not susceptible to plague but may be indirectly affected. In order to conserve prairie dogs and species associated with their colonies, principally the black-footed ferret (*Mustela nigripes*), a plague vaccination program is being developed, which may also benefit a suite of species listed in the Conservation Plan for Grassland Species in Colorado (Colorado Division of Wildlife 2003) and the Colorado Sagebrush Conservation Assessment and Strategy (Boyle and Reeder 2005). In Colorado, CPW researchers led by Dan Tripp are surveying colonies before and after bait distribution and conducting a mark-recapture study of prairie dogs and associated small mammal species. As an extension to this project, we initiated research in 2013 on the effects of plague management on avian species associated with prairie dog colonies.

The 2014 season was the second of three study seasons (Table 1). We collected the first year of post-treatment data and continued investigating whether avian species associations exist for colonies of Gunnison's prairie dogs (*Cynomys gunnisoni*: GUPD); most evidence for associated species comes from black-tailed prairie dogs (*C. ludovicianus*: BTPD). Since fall 2013, plague epizootics have occurred on one GUPD colony and across half the BTPD study area at four treatment sites and five additional colonies. In September and October 2014, black-footed ferrets were released in three BTPD study colonies, one of which was only 0.5 km from the nearest baited site, which experienced a plague epizootic in fall 2013.

In 2014, we detected 95 bird species, with 113 total bird species detected over two seasons, half of which were unique to on- or off-colony sites. We documented 175 plant species in two years, half of which were unique to either BTPD or GUPD sites. Colonies contained a much higher bare ground component with lower vegetation height (heights were similar on- and off-colony in 2013) than off-colony sites, with shortgrasses dominant at BTPD sites and a more even distribution of plant types at GUPD sites. Apparent nest success was 47% in 2014 compared to 53% in 2013, with most of the decrease attributable to hail storms and flooding at BTPD sites. An increase in nest numbers was partly due to increased effort and partly to a huge influx of lark buntings during a wet year. We monitored 68 nests of 11 species in 2013 and 225 nests of 15 species in 2014 (Table 2).

We detected 13 raptor species during counts (Table 3). Burrowing owls, northern harriers, ferruginous hawks, prairie falcons, and rough-legged hawks have been detected only on prairie dog colonies (the latter three, only on BTPD colonies, where no off-colony counts were performed). It is unclear whether golden eagles and American kestrels have a higher level of use on- versus off-GUPD

colonies, as a strong relationship existed in one year but not the other. Our remote camera photos have documented use of vaccine project areas by coyote, badger, fox, and several other carnivores. Overall 4-week carnivore detection rates for May 2013 – April 2014 (naïve occupancy estimates) ranged from 7% for swift fox on BTPD colonies to 54% for coyotes on GUPD colonies. This was the first year of post-treatment data collection on the project, and it will likely take additional years of monitoring to detect potential changes in the avian community caused by plague management, as treated colonies no longer experience extinction events. Thus far, data from vegetation surveys have identified differences between on- and off-colony areas for GUPD sites, but bird data will require further analysis and a third year of data before we draw conclusions regarding the uniqueness of the avian community on GUPD colonies.

Table 1. 2014 sample sizes for BTPD and GUPD sites, on and off prairie dog colonies. We did one point count, three winter raptor counts, and 5 – 9 summer raptor counts per location. We surveyed 1 – 2 vegetation transects per site. Nest search plots were surveyed at least twice. Photos listed above were taken between October 2013 and September 2014, and vegetation species include 2013 and 2014 detections. GUPD cameras were deployed during summer, and BTPD cameras were deployed year-round.

	BTPD on	GUPD on	GUPD off	TOTAL
Point counts	426	108	184	718
Point count bird species	56	45	60	95
Vegetation transects	52	30	29	111
Vegetation species	61	120	123	175
Raptor count locations	9	10	16	35
Raptor count minutes	2760	1800	1860	6420
Nest searching area (acres)	680	300	N/A	980
Nests	167	58	N/A	225
Remote cameras	18	10	N/A	28
Remote camera photos	325063	44849	N/A	369912

Table 5. Nest numbers and fate in vaccine project areas on BTPD and GUPD colonies in 2014.

	# Nests					%
Species	BTPD	GUPD	TOTAL	Known Fate	Successful	Success
Brewer's sparrow	15	33	48	44	26	0.59
burrowing owl	13	0	13	11	8	0.73
common raven	1	0	1	1	1	1.00
ferruginous hawk	1	0	1	1	0	0
green-tailed towhee	0	3	3	3	3	1.00
horned lark	36	1	37	35	14	0.40
lark bunting	69	0	69	67	22	0.33
McCown's longspur	26	0	26	26	10	0.38
mountain plover	2	0	2	2	1	0.50
sage thrasher	0	13	13	13	9	0.69
Swainson's hawk	1	0	1	1	0	0
vesper sparrow	0	8	8	8	7	0.88
western kingbird	1	0	1	1	0	0
western meadowlark	2	0	2	2	1	0.50
TOTAL	167	58	225	215	102	0.47

Table 4. Raptor use of vaccine project areas at BTPD and GUPD sites, on and off prairie dog colonies in 2013 and 2014. Use was quantified as time spent in project areas, and use rate = use minutes/total minutes on BTPD, on GUPD, and off GUPD colonies. Data from 2014 include winter counts (Jan – March).

	2013 Use Rate (%)			2014 Use Rate (%)		
Species	BTPD on	GUPD on	GUPD off	BTPD on	GUPD on	GUPD off
American crow	0	0	0.32	0	0	0
American kestrel	2.37	1.25	2.54	4.94	4.67	2.19
burrowing owl	14.10	0	0	6.94	0	0
common raven	6.47	24.33	44.60	3.50	31.89	16.27
Cooper’s hawk	0	0	0	0	0	0.11
ferruginous hawk	0.19	0	0	0.77	0	0
golden eagle	2.12	4.83	0.16	0.46	2.39	4.60
northern harrier	0.13	0	0	0.46	1.22	0
prairie falcon	0	0	0	0.07	0	0
red-tailed hawk	0.83	3.17	0	1.79	5.83	9.21
rough-legged hawk	0	0	0	0.84	0	0
sharp-shinned hawk	0	0	0	0	0.72	0.91
Swainson's hawk	8.91	0	3.33	1.82	0.67	1.02
turkey vulture	19.49	0.50	0.32	9.74	2.67	5.57
TOTAL minutes	1560	1200	630	2760	1800	1860

Colorado Parks and Wildlife

WILIDLIFE RESEARCH PROJECT SUMMARY

Evaluating relationships between hunting regulations, habitat conditions, and duck hunting quality on State Wildlife Areas in northeastern Colorado

Period Covered: September 1, 2013 – August 31, 2014

Principal Investigators: Jim Gammonley, jim.gammonley@state.co.us, Jon Runge, jon.runge@state.co.us

Project Collaborators: Tom Kroening, Josh Melby, Brian Smith

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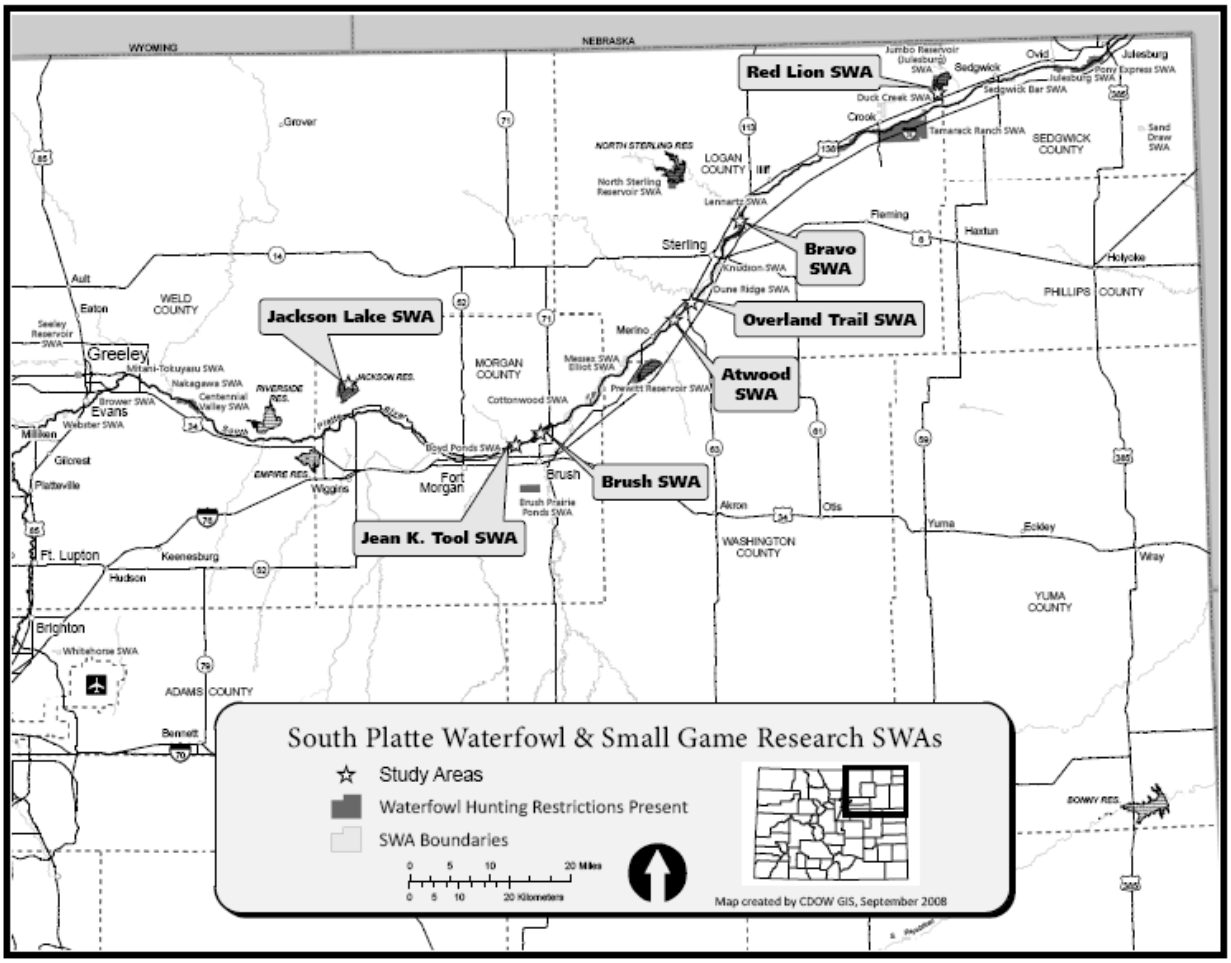
ABSTRACT

The lower South Platte River (SPR) corridor has historically supported the highest numbers of wintering ducks and highest hunter numbers and duck harvest of any region in Colorado. There is concern that harvest pressure has led to reduced numbers of wintering ducks and low harvest success, particularly on State Wildlife Areas (SWAs), which could in turn lead to lower hunter satisfaction and declining hunter recruitment and retention. The goal of this study is to determine the extent to which a set of more restrictive hunting regulations influence duck hunter success, hunter activity, hunter satisfaction, and duck distribution, compared to a set of less restrictive hunting regulations, on selected SWAs along the SPR corridor (Fig. 1). We also examine how the influence of regulations on these responses varies among SWAs with differing habitat conditions.

The 2013-2014 regular duck season was the sixth and final field season of the project. We selected three pairs of SWAs representing different habitat conditions along the SPR corridor, and assigned one SWA in each pair a set of restrictive hunting regulations (hunting access permitted only on weekends, Wednesdays, and legal holidays; reservations required for a limited number of parties; and the property is closed to the public after 2 p.m.), with no restrictive regulations on the other SWA in each pair. We established check stations at each of the SWAs and required all waterfowl and small game hunters to check out during the regular duck season. We interviewed all waterfowl and small game hunters and recorded information on their hunting experience and methods, harvest success, and satisfaction. We also conducted monthly aerial counts of waterfowl along the SPR corridor.

During the 2013-2014 duck season, we obtained information from 980 hunting parties on study SWAs, of which 818 were duck hunting parties. Jackson Lake SWA (unrestricted regulations) had the highest use, with 321 duck hunting parties and 667 duck hunter-days, and Overland Trail SWA (unrestricted regulations) had the lowest use, with 16 duck hunting parties and 30 duck hunter-days. From interview data, season-long harvest success, measured as average ducks bagged per hunter per day, was greater at restricted areas than unrestricted areas of similar size and habitat type: season-long harvest success was twice as high at Atwood SWA than Overland trail SWA, 2.1 times greater at Jean K. Tool/Brush SWAs than Bravo SWA, and 1.5 times greater at Red Lion SWA than Jackson Lake SWA. Hunting parties' satisfaction with hunter crowding levels, habitat conditions, property-specific regulations, and their overall hunt experience averaged slightly satisfied or satisfied on all study SWAs; hunters tended to be dissatisfied or slightly satisfied with duck numbers. Numbers of migrating/wintering ducks in the SPR corridor increased steadily over the course of the season, and large numbers of ducks used open water in large reservoirs. Field work is completed, and analyses and preparation of publications will continue over the coming year.

Figure 1. South Platte River corridor from Greeley to the state line, showing State Wildlife Areas included in the study.



Publications, presentations, workshops and committee involvement by Avian Research staff
October 2013 – September 2014

PUBLICATIONS

Apa, A.D. and L.A. Wiechman. *In Review.* Captive-rearing of Gunnison sage-grouse from egg collection to adulthood to foster proactive conservation and recovery of a conservation-reliant species. Zoo Biology.

Conrey, R. Y., S. K. Skagen, and A. Panjabi. *In review.* Heat and precipitation extremes depress reproductive success in shortgrass prairie birds. Ibis.

Doherty, K. E., D. E. Naugle, J. D. Tack, **B. L. Walker**, J. M. Graham, and J. L. Beck. 2014. Linking conservation actions to demography: grass height explains variation in greater sage-grouse nest survival. Wildlife Biology 20:320-325.

Fedy, B. C., K. E. Doherty, C. L. Aldridge, M. O'Donnell, J. L. Beck, B. Bedrosian, D. L. Gummer, M. J. Holloran, G. D. Johnson, N. W. Kaczor, C. P. Kirol, C. A. Mandich, D. Marshall, G. McKee, C. Olson, A. C. Pratt, C. C. Swanson, and **B. L. Walker**. 2014. Habitat prioritization across large landscapes, multiple seasons, and novel areas: an example using greater sage-grouse in Wyoming. Wildlife Monographs. 190:1-39.

Gammonley, J. H. *Accepted.* Cinnamon teal Anas cyanoptera. *In* L. Wickersham, editor. Colorado Breeding Bird Atlas II. Colorado Bird Atlas Partnership.

Gammonley, J. H., G. S. Boomer, and M. P. Vrtiska. *In review.* Harvest management. *In* B. M. Ballard, J. P. Flekes, and M. G. Brasher, editors. Wintering and migrating waterfowl. Texas A&M University Press.

Johnston D.B. *In press.* Downy Brome (*Bromus tectorum*) control for pipeline restoration. Invasive Plant Science and Management.

Rice, M. B., L. G. Rossi, and **A. D. Apa.** *In review.* Refining scales of analysis for resource selection functions to better manage a greater sage-grouse population in North Park, Colorado. Wildlife Society Bulletin.

Searle, K. R., C. Anderson, C. Bishop, N. T. Hobbs, and **M. B. Rice.** *In press.* Asynchronous vegetation phenology enhances winter body condition of mule deer (*Odocoileus hemionus*) Oecologia.

Thompson, T.R., **A.D. Apa**, K.P. Reese, and K.M. Tadvick. *In press.*Captive-rearing sage grouse for augmentation to surrogate wild broods: evidence for success. Journal of Wildlife Management.

Walker, B. L., **A. D. Apa**, and K. Eichhoff. *In review.* Mapping and prioritizing seasonal habitats for the Parachute-Piceance-Roan greater sage-grouse population in northwestern Colorado. Journal of Wildlife Management.

PRESENTATIONS, WORKSHOPS, AND COMMITTEES

Conrey, R. Y. and D. W. Tripp. April 2014. Prairie birds, prairie dogs, and the Black Death. IGNITE Biodiversity Series (Colorado State University sponsored), Fort Collins, Colorado (oral).

Conrey, R. Y. and D. W. Tripp. March 2014. Avian response to plague management on prairie dog colonies. Honors experimental design class (Nicole Vieira, instructor), CSU, Fort Collins, Colorado (oral).

Conrey, R. Y. Sept 2014. Burrowing Owl. Audubon Society of Greater Denver's HOOTenanny, Littleton, Colorado (poster and activity table).

Conrey, R. Y., D. W. Tripp, E. N. Youngberg, and A. O. Panjabi. Sept 2014. Avian response to plague management on black-tailed and Gunnison's prairie dog colonies. Joint meeting of the American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado (oral).

Gammonley, J. H. Central Flyway Waterfowl Technical Committee meeting, Corpus Christi, TX, December 9-12, 2014.

Gammonley, J. H. Colorado Parks and Wildlife briefing. Ducks Unlimited State Convention, Pueblo, CO, January 11, 2014.

Gammonley, J. H. North American Waterfowl Management Plan Interim Integration Committee meeting, Patuxent, MD, January 14-16, 2014.

Gammonley, J. H. Class lecture: waterfowl management. Fish and Wildlife 375 (Paul Doherty, professor), Colorado State University, January 29, 2014.

Donnelly, P., J. Vest, and **Gammonley, J. H.** Regional conservation planning for migratory birds: an example using Rocky Mountain Population sandhill cranes in the Intermountain West Joint Venture. Colorado Chapter of the Wildlife Society, Fort Collins, CO, February 6, 2014.

Gammonley, J. H. Central Flyway Waterfowl, Webless Migratory Game Bird, and Central Management Unit Dove Technical Committee meetings, Galveston, TX, March 2-7, 2014.

Gammonley, J. H. and J. P. Runge. Evlauating duck hunting regulations on State Wildlife Areas along the South Platte River. South Platte River Blue Ribbon Panel meeting, Brush, CO, March 31, 2014.

Gammonley, J. H. North American Waterfowl Management Plan Interim Integration Committee meeting, Denver, CO, April 29-May 1, 2014.

Gammonley, J. H. Workshop: Central and Mississippi Flyway revisions to adaptive harvest management of mid-continent mallards. Burwell, NE, May 13-15, 2014.

Gammonley, J. H. Central Flyway Waterfowl Technical Committee and Central Flyway Council meeting, Kerrville, TX, July 21-25, 2014.

Gammonley, J. H. (presenter) and J. P. Runge. Assessing duck hunting management along the South Platte River corridor in northeastern Colorado. Parks and Wildlife Commission meeting, Fort Collins, CO, August 8, 2014.

Gammonley, J. H. Workshop: Central and Mississippi Flyway revisions to adaptive harvest management of mid-continent mallards. Kansas City, MO, September 8-10, 2014.

Johnston, D. B. Habitat Research Update. Annual Piceance Basin Research Cooperator's Research Update Meeting. Grand Junction, CO. October 31, 2014.

Rice, M. B. Refining seasonal resource selection models for the management of greater sage-grouse in North Park, Colorado. Joint meeting of the American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado, September, 2014.

Rice, M. B. Workshop: Spatial Ecology in R. Colorado Parks and Wildlife, Grand Junction, CO, May 21-23, 2014.

Walker, B. L. Greater Sage-Grouse Ecology and Research. Colorado Mesa University lecture, April 28, 2014.

Walker, B. L. Evaluating Lek Buffers for Greater Sage-Grouse Conservation in Northwestern Colorado. 29th Sage and Columbian Sharp-tailed Grouse Workshop, Elko, NV, June 19, 2014.

Walker, B. L. Improving Population Monitoring Strategies for Greater Sage-Grouse: Dual Frame Sampling as an Alternative to Traditional Lek Counts. Co-authored presentation. 29th Sage and Columbian Sharp-tailed Grouse Workshop, Elko, NV, June 19, 2014.

Walker, B. L. Parachute-Piceance-Roan Greater Sage-Grouse Research Update. Colorado Parks and Wildlife Area 6 staff meeting. Meeker, CO. October 27, 2014.

Brauch, J. S., and **B. L. Walker.** Evaluation of Population Monitoring Strategies for Greater Sage-Grouse: Genetic Mark-Recapture as an Alternative to Traditional Lek Counts. 2014 Joint Meeting of the American Ornithologist's Union, Cooper Ornithological Society and Canadian Ornithological Society. Estes Park, CO. September 25, 2014.

Walker, B. L. Greater Sage-Grouse Conservation and Management in Oil and Gas Fields of Colorado: How Well Do Lek Buffers Work? 2014 Joint Meeting of the American Ornithologist's Union, Cooper Ornithological Society and Canadian Ornithological Society. Estes Park, CO. September 26, 2014.