ASSESSING LAND USE PRACTICES ON THE ECOLOGICAL CHARACTERISTICS OF SAGEBRUSH ECOSYSTEMS: MULTIPLE MIGRATORY BIRD RESPONSES

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Assessing Land Use Practices on the Ecological Characteristics of Sagebrush Ecosystems: Multiple Migratory Bird Responses

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SUMMARY OF PROGRESS

This research study is designed to evaluate responses of migratory birds to rest-rotation grazing management in sagebrush system. Rest-rotation grazing management is likely to enhance important components of sagebrush, shrubland, and grassland habitat for a wide range of species, but little work has been done to evaluate impacts of prescribed rest-rotation grazing on birds. The scale and magnitude of benefits for avian species remains unclear. In 2012, we initiated a research project building off of the existing US Department of Agriculture - Natural Resource Conservation Service's Sage-Grouse Initiative infrastructure in eastern Montana to evaluate the impact of conservation managed rest-rotational grazing on migratory birds. Our results from the first year of this study indicate the highest presence of Brewer's Sparrow (*Spizella breweri*), Vesper Sparrow (*Pooecetes gramineus*), Western Meadowlark (*Sturnella neglecta*), and McCown's Longspur (*Rhynchophanes mccownii*) in our study area in 'traditional grazing' (non-conservation managed) systems. Here we describe our preliminary findings and our planned work to support our 2013 field season, including data analyses to evaluate our research design, as well as planning for the expansion of our study area into conservation managed rest-rotational grazing lands for the 2013 field season.

BACKGROUND

Livestock grazing is the most widespread land use practice of sagebrush ecosystems (Knick et al. 2010). Due to our ability to manipulate the process, domestic livestock grazing has been suggested to be a suitable land management tool that can facilitate desired habitat conditions (Fuhlendorf and Engle 2001). Additionally, using domestic livestock grazing to achieve sage-brush conservation objectives and outcomes provides land managers with opportunities to reduce conflicts between sagebrush conservation and livestock production goals. In the face of increasing global challenges, particularly increase human consumption of natural resources and uncertainty of impacts on climate change, it is urgent to couple modern land use practices and response of ecological characteristics in sagebrush ecosystems.

Migratory birds can serve as an initial barometer of sagebrush ecosystem integrity and the impacts of grazing management designed to positively benefit avian communities. Migratory birds are among the few groups of organisms in which community reassembly (e.g., Lemoine et al. 2007, Zuckerberg et al. 2009) and adaptation of species to climate change and conservation actions have been documented (Schaefer et al. 2008). Additionally, sagebrush-associated migratory birds respond quickly to habitat changes by shifting their distributions and adapting their reproductive performance.

The aim of our study is to describe species richness, diversity, and composition between conservation managed rest-rotation grazing treatments and traditional grazing in multiple migratory sagebrush-obligate bird species. The 2012 data collection effort was considered a pilot study, as efforts were generally intended to explore general species composition, field logistics, and methodologies. As a result, biological conclusions from the 2012 data are very general in nature and not intended to be indicative of the entire study area.

PILOT STUDY

To address our long-term objective of sagebrush-associated migratory birds response to conservation managed rest-rotation grazing management, we initiated a pilot study in summer 2012 to 1) determine species presence in the study area, 2) evaluate sampling frame, 3) evaluate two bird survey methods, and 4) describe species abundance. Our 2012 field data collection occurred near Roundup, Montana on lands managed by Bureau of Land Management that serve as our 'traditional grazing' (non-conservation managed) area.

Survey Methods

We selected a sample plot size of 500 x 500 m based on the observed territory size of one of our potential species that we believe has the largest breeding territory, the Loggerhead Shrike (*Lanius ludovicianus*) (Brooks 1988). Sample plots were selected based on physiographic and topographic information from Geographic Information System (GIS) layers. We randomly selected evenly distributed sampling plots throughout the study area. We surveyed a total of 40 sample plots but included additional 15 plots in our plot selection in case of unforeseeable logistical issues (e.g., leasee denied assess). We confirmed GIS information for each sampling plot by field observation prior to conducting bird surveys.

We employed two bird survey methods that incorporate detection probability and are based on removal methods: point counts and dependent double observer (also referred to as walking transects). In addition to the bird surveys, we collected general vegetation classification (e.g., percentage sagebrush, grassland, riparian, and other) information for each plot after the dependent double observer survey.

Studies have used distance from the center of the point count to a bird as means to calculate detection probability. However, estimates obtained using distance sampling may be biased if assumptions are not met. Two important assumptions of distance sampling – namely that (1) all individuals at the center of the point are detected with probability equal to 1, and (2) individuals do not move in response to the observer before being detected. Both assumptions can be difficult to assure in field conditions even if birds are given an accumulation period to an observers presence prior to data collection (Rosenstock et al. 2002). Our point count sampling approach is based on removal models in which detection probability is estimated from time intervals during the sampling (Farnsworth et al. 2002). Point counts consisted of a single person conducting a total of four 10-minute point counts equal distributed within each sampling plot. We used a 3-min acclimation period prior to starting the surveys. All birds detected (visual and auditory) with a 100 m radius from the center of the point was recorded at 1-minute intervals.

Our dependent double observer survey method is another observation-based method using 'double observers' (Nichols et al. 2000), but is grounded in mark-recapture estimation methodology. By using two observers, an encounter history can be constructed for each individual (or individual species) with which mark-recapture estimators can be used. Dependent double observer methods have been employed with both point counts (Kissling and Garton 2006) and transect sampling (Tipton et al. 2009). We chose to use transects because the ability to perform the technique is more difficult with point counts (Tipton pers. Comm). Additionally, our habitat is less dense than forested systems; thus, observations of birds are reliable at greater distances, allowing for large coverage of our study area. The dependent double observer transect approach required a two-person survey team with one person designated as the 'primary' observer and the other person as the 'secondary' observer. Following Nichols et al. (2000), while walking the survey 'transect' single file within the 500 x 500 m sampling plot, the primary observer identified all birds observed and heard and communicated each individual detection, including species, detection type, and approximate location, to the secondary observer who recorded the information. In addition, the secondary observer recorded any detections not noted by the primary observer. The roles of primary and secondary observer within a survey team were alternated on consecutive dependent double observer surveys.

2012 Field Surveys

Field surveys using the two methods described above were conducted between May 23 and June 29, 2012. Two field personnel conducted bird surveys for this entire duration, with assistance from two additional field personnel for 10 and 20 days in early June. All surveys were conducted between sunrise (~0530 Mountain Standard Time [MST]) and 1100 MST. Surveys were not conducted on days of high wind or inclement weather.

We started the 2012 field surveys for each sampling plot by employing one survey method on a given day, then the following day the other method (e.g., walking transects on Monday, point counts on Tuesday). All 40 sampling plots were surveyed in this manner. Based on time constraints, we re-surveyed 38 sampling plots using walking transects on a second sampling occasion for a total of 118 bird surveys per plot (Table 1).

2012 Data Analysis

We conducted a preliminary analysis to estimate sampling plot detection probabilities and a derived abundance estimates for each of the top four species detected with each survey method. For both survey methods, we used the Huggins closed-captures model (Huggins 1989, 1991) in program MARK (White and Burnham 1999) setting the probability of recapture (c) to zero to simulate a removal model.

RESULTS

During the 2012 field surveys we had a total of 5,324 detections of 48 species (Table A-1, Appendix A). Vesper sparrow (*Pooecetes gramineus*) was the most common species observed. Brewer's sparrow (*Spizella breweri*), western meadowlark (*Sturnella neglecta*) and McCown's longspur (*Rhynchophanes mccownii*) were commonly observed amongst the two bird survey methods (Table A-1, Appendix A).

Overall, more birds were detected using the walking transect survey method than the point count survey (Table 2 and 3); however, we anticipated this pattern given our counts are based on plots and are not extrapolated to our study area. In addition, results varied by species. For example, horned lark (*Eremophila alpestris*) were observed at a higher frequency using walking transect than point counts, whereas, lark bunting (*Calamospiza melanocorys*) were observed at a higher frequency point counts than walking transects (Table A-1, Appendix A).

For each of the four commonly observed species, the probability of detection was higher using the walking transect survey method than the point count survey (Table 3). During the walking transect, birds were often flushed off of nests increasing our ability to detect them in our plot. In contrast, the observer conducting the point count was stationary, so detections were most likely from foraging birds (birds flying through the point count area) or nesting birds in close proximity to the location of the observer (responding to the observers presence).

FUTURE WORK

Our field effort in 2012 produced valuable information about sagebrush-associated bird species presence within our study area. This information will help us further evaluate our sampling protocols and advance the progress of this study. It will guide follow up research of the breeding ecology (e.g., behavior, breeding phenology, solitary versus colony nesting, etc.) of individual species, which will help us meet our objectives to understand and measure species richness.

We are currently evaluating our study design and logistics for the 2013 field season. We feel our 500 x 500 m sampling frame is appropriate if we continue using the walking transect method. However, for point counts, a circular sampling frame is likely more appropriate when making broad-scale inferences of our research findings. We will conduct additional statistical analyses to further evaluate our future bird survey methods which will assist in determining our sampling frame.

Our data collection in 2013 will expand to include additional area and may include additional survey methods. In 2013 we will include the conservation managed rest-rotation grazing treatment areas, as well as continue surveys in areas with 'traditional grazing'. In addition, we are exploring the possibility of collecting data to evaluate the breeding response of sagebrush-associated migratory birds to grazing. Migratory songbirds are suggested to respond quickly to habitat changes by adjusting reproductive performance. Clutch size and success rates of eggs and nestlings are components of fecundity; a vital rate suggested to impact population viability of many songbird populations.

Table 1. The number of sampling plots surveyed for sagebrush associated bird species using two bird field survey methods; walking transects and point counts, on Bureau of Land Management lands near Roundup, Montana, in May and June 2012.

Sampling Occasion	Date	Survey Method: Walking Transects	Survey Method: Point Counts	Total
1	May 24 – June 18	40	40	80
2	June 19 – June 29	38		38
Total		**78**	**40**	**118**

Table 2. The most common species detected during dependent double observer transect surveys and point count surveys on Bureau of Land Management lands near Roundup, Montana, in May and June 2012.

Common Name	Scientific Name	Total Observations: Walking Transects	Total Observations: Point Counts
vesper sparrow	*Pooecetes gramineus*	1085	410
Brewer's sparrow	*Spizella breweri*	577	235
western meadowlark	*Sturnella neglecta*	384	376
McCown's longspur	*Rhynchophanes mccownii*	276	198
lark bunting	*Calamospiza melanocorys*	179	201
horned lark	*Eremophila alpestris*	338	133

Table 3. Detection probability and estimates abundances for the top four most commonly identified species using the dependent double observer transect surveys and point count surveys on Bureau of Land Management lands near Roundup, Montana, in May and June 2012. Standard errors are shown in parentheses.

Common Name	Detection Probability		Estimated Abundance**	
	Walking Transects	Point Counts	Walking Transects	Point Counts
vesper sparrow	0.85 (0.013)	0.54 (0.035)	1,108 (6.50)	373 (11.23)
Brewer's sparrow	0.87 (0.017)	0.38 (0.060)	568 (3.91)	236 (22.76)
western meadowlark	0.87 (0.021)	0.59 (0.034)	390 (3.34)	332 (7.71)
McCown's longspur	0.91 (0.019)	0.52 (0.052)	278 (1.72)	179 (8.32)

**Abundance estimates for each species are reported as the estimated number of individuals present in each plot a species was observed using. The dependent double observer transect surveys covered a total of 975 hectares; and point count surveys covered a total of 490 hectares.

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Appendix A

Table A-1. The species detected during dependent double observer transect surveys and point count surveys on Bureau of Land Management lands near Roundup, Montana, in May and June 2012.

Common Name	Scientific Name	Total Observations	
		Walking Transects	Point Counts
red-winged blackbird	*Agelaius phoeniceus*	30	32
grasshopper sparrow	*Ammodramus savannarum*	72	41
blue-winged teal	*Anas discors*	2	0
mallard	*Anas platyrhynchos*	5	2
short-eared owl	*Asio flammeus*	7	2
upland sandpiper	*Bartramia longicauda*	3	1
Canada goose	*Branta canadensis*	0	0
ferruginous hawk	*Buteo regalis*	2	0
Swainson's hawk	*Buteo swainsoni*	1	0
lark bunting	*Calamospiza melanocorys*	179	201
chestnut-collared longspur	*Calcarius ornatus*	63	22
turkey vulture	*Cathartes aura*	0	1
greater sage-grouse	*Centrocercus urophasianus*	1	1
killdeer	*Charadrius vociferus*	16	8
lark sparrow	*Chondestes grammacus*	9	5
common nighthawk	*Chordeiles minor*	2	0
northern harrier	*Circus cyaneus*	8	7
red-shafted flicker	*Colaptes auratus*	11	4
rock pigeon	*Columba livia*	19	2
common raven	*Corvus corax*	6	1
horned lark	*Eremophila alpestris*	338	133
Brewer's blackbird	*Euphagus cyanocephalus*	122	44
American kestrel	*Falco sparvarius*	4	1
barn swallow	*Hirundo rustica*	13	7

Common Name	Scientific Name	Total Observations	
		Walking Transects	Point Counts
loggerhead shrike	*Lanius ludovicianus*	1	0
marbled godwit	*Limosa fedoa*	5	1
brown-headed cowbird	*Molothrus ater*	72	18
long-billed curlew	*Numenius americanus*	16	13
sage thrasher	*Oreoscoptes montanus*	5	7
savannah sparrow	*Passerculus sandwichensis*	2	2
cliff swallow	*Petrochelidon pyrrhonota*	21	23
ring-necked pheasant	*Phasianus colchicus*	3	13
black-billed magpie	*Pica hudsonia*	3	1
pine grossbeak	*Pinicola enucleator*	4	0
vesper sparrow	*Pooecetes gramineus*	1085	410
McCown's longspur	*Rhynchophanes mccownii*	276	198
Say's pheobe	*Sayornis saya*	3	0
mountain bluebird	*Sialia currucoides*	0	3
Brewer's sparrow	*Spizella breweri*	577	235
western meadowlark	*Sturnella neglecta*	384	376
European starling	*Sturnus vulgaris*	0	1
tree swallow	*Tachycineta bicolor*	3	0
willet	*Tringa semipalmata*	0	2
American robin	*Turdus migratorius*	20	7
sharp-tailed grouse	*Tympanuchus phasianellus*	6	0
eastern kingbird	*Tyrannus tyrannus*	3	9
western kingbird	*Tyrannus verticalis*	3	2
mourning dove	*Zenaida macroura*	53	30
	Totals	**3,458**	**1,866**
	Grand total number of observations	**5,324**	