

Demographic monitoring of breeding grassland birds in the Northern Great Plains

Bird Conservancy of the Rockies
2016 Interim Performance Report
January 20, 2017



A Bird Conservancy field technician uses a wing ruler to measure a Baird's sparrow in eastern Montana. Photo by S. Robinson, 2016.

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BIRD CONSERVANCY OF THE ROCKIES

Mission: conserving birds and their habitats through science, education and land stewardship

Bird Conservancy of the Rockies conserves birds and their habitats through an integrated approach of science, education and land stewardship. Our work radiates from the Rockies to the Great Plains, Mexico and beyond. Our mission is advanced through sound science, achieved through empowering people, realized through stewardship and sustained through partnerships. Together, we are improving native bird populations, the land and the lives of people.

Goals

1. Guide conservation action where it is needed most by conducting scientifically rigorous monitoring and research on birds and their habitats within the context of their full annual cycle
2. Inspire conservation action in people by developing relationships through community outreach and science-based, experiential education programs
3. Contribute to bird population viability and help sustain working lands by partnering with landowners and managers to enhance wildlife habitat
4. Promote conservation and inform land management decisions by disseminating scientific knowledge and developing tools and recommendations.

Bird Conservancy accomplishes its mission by:

Monitoring long-term bird population trends to provide a scientific foundation for conservation action

Researching bird ecology and population response to anthropogenic and natural processes to evaluate and adjust management and conservation strategies using the best available science

Educating people of all ages through active, experiential programs that create an awareness of and appreciation for birds

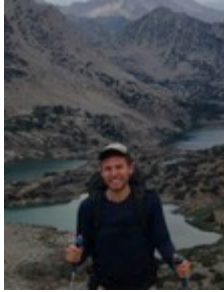
Partnering with state and federal natural resource agencies, private citizens, schools, universities and other non-governmental organizations to build synergy and consensus for bird conservation

Fostering good stewardship on private and public lands through voluntary, cooperative partnerships that create win-win situations for wildlife and people

Sharing the latest information on bird populations, land management and conservation practices to create informed publics

Delivering bird conservation at biologically relevant scales by working across political and jurisdictional boundaries in western North America and beyond.

The Bird Conservancy International Team



Jacy Bernath-Plaisted, MS: Jacy is the most recent addition to the International team at Bird Conservancy, being hired the week this report was authored! Jacy will oversee and coordinate the field effort for this demographic work in 2017 and onward. Jacy's background in grassland bird demographic work through his MS at the University of Manitoba makes him well suited to lead our teams of technicians across our study locations.



Dr. Maureen Correll: Mo joined the International team at Bird Conservancy in February 2016 and leads the demographic monitoring program in the NGP. Mo's background in *Ammodramus* sparrow demographics through her dissertation work has prepared her well to lead this project. Mo's interest in remote sensing has also driven her to explore the use of UAVs as tools to collect habitat information for grassland birds on the breeding and wintering grounds.



Nancy Drilling, MS: Nancy is part of the IMBCR Science team at Bird Conservancy. Nancy's knowledge and experience with bird studies in the NGP prepared her to provide field and project leadership to this demographic effort in 2015 and 2016. Jacy, Mo, Erin, and Arvind will continue the work Nancy helped to initiate in 2017 and onward.



Nicole Guido, MS student: Nicole joined our team in 2016 as crew leader for our demographic site in eastern Montana. Nicole will be returning in 2017 as crew leader and MS student investigating the use of UAVs as tools for collecting habitat information on grassland songbirds on the breeding grounds. Nicole will be pursuing her degree at the University of Maine, co-advised by Mo Correll and Kate Ruskin.



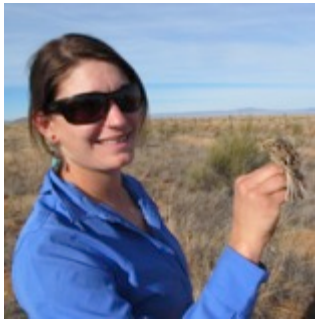
Greg Levandoski: Greg (on left) was the first hired member of Bird Conservancy's International team in 2007. Greg provides integral support and context for our demographic work in the NGP through his habitat stewardship program in the wintering grounds in the Chihuahuan Desert in Mexico. Greg also helped develop the conceptual framework of our geolocator effort in the NGP.



Arvind O. Panjabi, MS: Arvind is the founder and director of the International program. His efforts to explore the demographics of grassland songbirds across their full annual cycle has provided a conceptual vision for the development of the Baird's Sparrow IPM. Through Arvind's leadership Bird Conservancy also maintains a stewardship program on the wintering grounds.



Allison Shaw, MS: Allison joined the International team in 2015 and provides database and GIS support to our demographic project. Allison holds an MS in botany and also serves as our local plant identification expert.



Erin H. Strasser, MS: Erin leads our winter demographic work in the Chihuahuan Desert in Mexico, a project initiated in 2012. Erin's expertise in the fitting, tracking, and recovery of VHF radio transmitters as well as the analysis of the collected data make her integral to our training effort for field technicians in the NGP. Field technicians in the NGP follow identical protocols (including harness attachment) to those Erin implements in the Chihuahuan Desert.



Erin Youngberg: The other Erin on International's team, Erin provides financial and administrative support to the demographic work in the NGP. We hope to recruit Erin in 2017 to help in our geolocator recovery effort.

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Executive Summary

Grassland bird populations have declined by >75% since the 1960's, and conservationists have limited knowledge of the factors influencing these negative population trends, especially in managed rangelands in the Northern Great Plains (NGP). To address this knowledge gap, Bird Conservancy of the Rockies (BCR), with the support of numerous partners, initiated a pilot study in 2015 to monitor breeding grassland bird demographic rates and identify factors limiting survival. Following this initial field season we adjusted methods, added study plots in North Dakota and an additional study site in northeastern Montana, and added a migratory connectivity component. Between early May and early August 2016 we monitored demographic rates of breeding populations of Baird's Sparrow and Grasshopper Sparrow, Sprague's Pipit, and Chestnut-collared Longspur at two field sites in the Northern Great Plains. We monitored nest success and productivity of all species (n = 280), radio tagged adult Baird's and Grasshopper Sparrows (n = 179) to determine adult survival, tagged nestlings (n = 63) of these same species to measure post-fledgling survival, conducted point count surveys on each study plot to estimate local population density, and deployed geolocators Baird's and Grasshopper sparrows (n = 141) to explore migratory routes of these birds during the non-breeding season. We also conducted preliminary analyses on nest habitat selection in Baird's Sparrows, Grasshopper Sparrows, and Chestnut-collared Longspurs and found that all species were selecting for high grass cover at nest sites, while preferences in other habitat characteristics were limited to the species level. This project will help fill critical information gaps in our knowledge of grassland bird population dynamics and how rangeland managers can influence population growth through grazing and habitat management. Here we share insights and preliminary results from the 2016 field season.

Highlights from 2016

Preliminary data analysis

In a preliminary analysis of habitat selection data for nesting songbirds, we found that Baird's sparrows showed preference for nesting sites with less-variable cover and less bare ground. Grasshopper sparrows, surprisingly, selected for higher Kentucky Bluegrass and a combination of bare ground, dead grass, and litter. Chestnut-collared Longspurs strongly selected for low visibility (high vegetative cover) and low cover of Kentucky Bluegrass, as well as high forb and dead grass cover. All three species selected for higher percent cover of dead grass. Baird's Sparrow most often departed from preferences of the other two species. We are also working to create float curves for these species to help accurately identify nest age during incubation stage in the field.

Additional study site establishment

In North Dakota, we established a second study plot within the Little Missouri National Grassland in southwest Golden Valley County. This plot was located approximately 6.5 km from the study plot established and monitored in 2015. In Montana, we established two study plots, approximately 18 km apart, in northeast Valley County.

Protocol additions and refinements

Prior to the 2016 field season, we revised our protocols to reflect lessons learned during the 2015 season. We refined our method of capturing females and deployed lighter radio tags on nestlings. We also implemented a new study design to better capture the effects of vegetation structure and composition on adult, juvenile, and nest survival. We refined our nest search methods. We also added a grid of point count locations across all study plots to estimate local bird density during the breeding season. Finally, we added a migratory connectivity component to our work by deploying 147 geolocators on Baird's and Grasshopper Sparrows across the NGP.

New partnerships

We forged several new partnerships in 2016. Bird Conservancy joined forces with National Audubon, the University of Manitoba, and the University of Oklahoma to deploy geolocators on Baird's and Grasshopper Sparrows in and around Brooks in Alberta, Canada, widening the geocator data coverage of both species' breeding ranges. Bird Conservancy and the University of Manitoba also paired efforts with the Canadian Wildlife Service (CWS) to submit a grant proposal to establish a third demographic monitoring site in Alberta, Canada. A Master's student, co-advised by Dr. Nicola Koper at the University of Manitoba and Dr. Barry Robinson at CWS, will begin at the University of Manitoba in 2017 to explore adult survival at this study location.

The University of Maine loaned Bird Conservancy a Phantom 4 Unmanned Aerial Vehicle (UAV) for use in habitat data collection in 2017. A Master's student, Nicole Guido, will be starting school at the University of Maine in Fall 2017 to explore collection of habitat measurements for grassland birds using these types of UAVs, co-advised by Dr. Kate Ruskin at the University of Maine and Dr. Mo Correll at Bird Conservancy of the Rockies.

Outreach efforts

Two film crews visited the North Dakota study site during 2016. A crew from *Grasslands Live* (grasslandslive.org) filmed field efforts to attach geolocator tags on sparrows. This group educates the general public about the North American grassland biome, focusing on K-12 classroom interactions. Secondly, North Dakota Dept. of Game and Fish staff produced a video about the grassland bird project for their weekly webcast. The video was shown on the evening news throughout the state and posted on the department's YouTube channel. It can be seen at: <https://www.youtube.com/watch?v=IZV15DhrMs8>. Finally, partners from the Northern Great Plains Joint Venture, ND Game and Fish, and Bureau of Land Management visited the study site during the field season to learn about the project firsthand.



Bird Conservancy technicians return to the field vehicle after a full day on the Montana prairie. Photo by S. Burns.

Project Background

The breeding grassland bird assemblage in the Northern Great Plains is in decline. Specialist birds reliant upon this landscape for breeding and foraging habitat have experienced >80% population declines as a group since 1966 (Sauer et al. 2015). Four of these were recently identified as potential grassland bird focal species for the NFWF NGP conservation business plan (NFWF 2016). Numerous conservation plans and initiatives including the National Fish and Wildlife Foundation (NFWF), North Dakota and Montana State Wildlife Action Plans, Partners in Flight, Northern Great Plains (NGPJV) and Prairie Potholes Joint Ventures (PPJV), and Region 6 of the US Fish and Wildlife Service (USFWS) identify the NGP as a critical breeding area for grassland birds of greatest conservation need, including these species. Limited knowledge of factors influencing population trends and how to improve vital rates in wild populations, especially in managed rangelands in the NGP, is a significant barrier to effective and stream-lined conservation of these species. Over the last several years, BCR has developed and refined the study design and field protocols necessary to successfully carry out regional demographic monitoring for a subset of these species, specifically the Baird's and Grasshopper Sparrow (Figure 1). This project is the beginning a long-term vision to assess demographic rates in these species across their full annual cycle to determine which rates most strongly influence population trends, and what environmental factors most strongly influence demographic rates. This effort is to be carried out over 5-6 years to allow for sufficient annual variation in climate and other environmental factors that could influence demographic rates on both the breeding and wintering grounds.



Figure 1. Adult Baird's (left) and Grasshopper (right) Sparrows in the hand. Photos by John Pulliam

Objectives

Declines in grassland birds in the NGP could be driven by low productivity and/or age- or sex-specific survival rates on their breeding, migration or wintering grounds, or by complex seasonal interactions between various phases of the annual cycle. Given the importance of the NGP as a breeding area for grassland birds, knowledge of demographic rates in grassland bird populations in this area and how they are influenced by various environmental parameters is needed to guide conservation and management in the region. However, data on vital rates are lacking or are incomplete for most migratory grassland songbirds, as are data on factors influencing vital rates, site fidelity, and local movement patterns. With this project, we aim to quantify nest productivity, and adult and juvenile survival, in multiple breeding populations in the NGP and assess how home range patterns influence survival. We will also assess the influence of vegetation, grazing, climate and other parameters on these vital rates to inform grassland management in the NGP.

Our objectives for our demographic work in the NGP are to:

- 1) Estimate baseline rates of reproduction (nest success and productivity) in Baird's and Grasshopper Sparrows and other focal species as allowed by sample size
- 2) Estimate baseline rates of survival in Baird's and Grasshopper Sparrows
- 3) Examine the influence of vegetation characteristics (including grazing management), climate and other environmental factors on demographic rates
- 4) Develop recommendations to share with BCR's stewardship program and other organizations to inform management strategies for grassland birds.
- 5) Inform integrated population models to assess how vital rates during various stages of the life cycle influence population size and growth across years.

Field sites

Little Missouri Grasslands - North Dakota

Our demographic monitoring site in North Dakota (Figure 2, top panel) was established in 2015 under a 3-year grant from North Dakota Game and Fish (NDGF), with additional support from US Fish and Wildlife Service Region 6 and the Northern Great Plains Joint Venture (NGPJV). The Little Missouri Grasslands are owned by the Forest Service (FS) and are grazed to varying extents by cattle ranchers holding leases managed by the FS. Field sites in this area are often dominated by exotic grasses (e.g. Kentucky Bluegrass [*Poa pratensis*], Crested Wheatgrass [*Agropyron cristatum*]) although native vegetation also occurs in some areas.

Eastern Montana

Northeastern Montana is one of the last strongholds in the U.S. for Baird's Sparrow and Sprague's Pipit, and has proven to be a high-density area for grassland birds. Added in 2016 through funding from the National Fish and Wildlife Foundation (NFWF) Conoco Phillips SPIRIT award and renewed through 2018, this site (Figure 2, bottom panel) provides a different ecological snapshot of NGP grasslands. Our study plots in this location are owned by the Bureau of Land Management (BLM) and by private ranchers. These grasslands are dominated by native vegetation. Local ranchers holding leases to these properties graze both plots.



Figure 2. Study plots in the Little Missouri National Grasslands, ND (top) and Bureau of Land Management (BLM) property in eastern MT. Photos by M. Johnson (top) and S. Burns (bottom).

Field Methods

We implement standardized field protocols across our study sites for measuring adult and juvenile survival, nest success, population density, vegetation community makeup, and migratory connectivity for grassland birds. Protocols are based on review of existing literature, recommendations from other grassland scientists, and our experiences in the field.

Radio telemetry

Between mid-May and early-August adult male Baird's and Grasshopper Sparrows are captured using target and passive mist-netting methods for deployment of radio-transmitters for monitoring survival (Figure 3). At capture, all birds are fitted with USGS aluminum bands and one or more color bands and measured for standard morphometrics. Technicians collect one primary feather (P1) and several body feathers from each bird for isotopic analyses to assess migratory connectivity (along with partners at University of Colorado-Denver and USGS). Finally, we attach Lotek PicoPip VHF radio transmitters to adult male and female sparrows and one or two nestlings per nest (Figure 5) using an elastic figure-8 leg loop harness (Rappole and Tipton 1991). We postpone trapping females until the nestling stage and ensure a short handling time when attaching the transmitters (< 8 minutes). This resulted in much lower nest abandonment rates when compared to 2015. Two nestlings per nest were randomly selected and fitted with 0.4g radio transmitters. The nestlings were required to weigh at least 12g and display sufficient feather development (most pin and primary feathers beginning to unsheath) to qualify for a radio tag. Birds are recaptured if at all possible to remove tags prior to migration. Individuals are tracked daily to generate daily survival probabilities and identify causes of mortality. Coordinates are recorded to estimate home ranges, movement patterns, and determine relationships with vegetation parameters.



Figure 3. Bird Conservancy technician Sasha Robinson wields an antenna used to locate birds fitted with VHF transmitters. We use these daily locations to estimate adult survival during the breeding season (photo by S. Robinson).

Nest search and monitoring

We use opportunistic and rope-drag (Lipsey 2015) methods to discover nests at each field site of breeding Baird's (Figure 5) and Grasshopper Sparrows, Chestnut-collared Longspurs, Sprague's Pipits, and Lark Buntings (when they occur). Once found, nests are aged using egg floatation methods (e.g. Liebezeit 2007, Figure 4) or nestling aging methods (e.g. Pyle et al. 2008). We monitor each nest by visiting every 3 days until fledge or failure, taking detailed information about the context of each visit to assess nest status (active, abandoned, depredated, fledged). These data inform estimation of nest success and fecundity in the NGP and will also be used to produce a float curve for aging passerine eggs in the NGP.

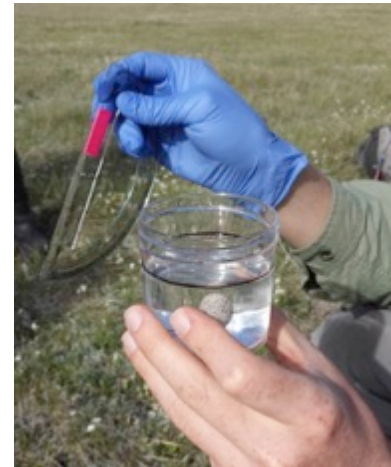


Figure 4. Technicians float an egg to estimate nest age. Photo by N. Richardson

Point count surveys

We follow Bird Conservancy's Integrated Monitoring of Bird Conservation Regions (IMBCR) point count protocol to estimate bird densities within the study areas using 6-minute passive point count surveys that employ distance sampling (Buckland et al. 2001) and time-removal methods (Royle and Dorazio 2008). We selected point count locations by placing a 250m grid over our study site, and visited each location twice during the breeding season (June 1 – June 30) leaving at least 10 day in between visits. We conducted 6-minute point counts at each selected location following Integrated Monitoring of Bird Conservation Regions (IMBCR) methods (White et al. 2015). These data let us estimate local density each year on the study plots. We can use these estimates along with regional IMBCR estimates to measure change in these populations.



Figure 5. Left: a juvenile Grasshopper sparrow is banded on day 7 (photo N. Richardson) Middle: Hungry Baird's sparrow nestlings beg for food (photo M. Johnson). Right: Bird Conservancy technician Maureen Johnson measures vegetative cover using a Robel pole (photo K. Bell).

Vegetation sampling

We survey a 100-meter grid across each study plot to assess vegetation community composition and structure across the landscape. At each point we employ a modified BBIRD Grasslands Protocol (Martin et al. 1997) using a Daubenmire frame (25 x 50 cm) and Robel pole (Figure 5) to assess cover, structure, and composition. Data were collected at each landscape grid points twice (early and late season) to capture changes in vegetation structure, cover, and composition to assess the influence of grazing and seasonal changes on vegetation. We also collected vegetation data at each focal species' nest within three days post-fledge or failure as well as at a corresponding random point within the plot. These data will be used to explore the selection of habitat variables by breeding birds as well as the influence of these habitat differences on survival and nest success. We also survey vegetation at each nest site and a corresponding random location using similar methods to explore habitat selection by nesting birds on the breeding grounds.

Geolocator deployment and recovery

In partnership with the National Audubon Society, University of Oklahoma, and the University of Manitoba we deploy geolocators on Baird's and Grasshopper Sparrow adults (Figure 6) across their breeding ranges in the NGP (Figure 7) in an attempt to map migratory pathways and connectivity between breeding populations in the NGP and the birds' wintering grounds (e.g., Bridge et al. 2013). Geolocators are produced by Migrate Tech or Eli Bridge, and are attached using harness configurations similar to our VHF transmitters, but constructed from StretchMagic plastic cord and crimp beads to allow for harness sizing and fitting on individual birds.



Figure 6. A crew moves a set of mist nets to target for adult sparrows in the Little Missouri Grasslands in North Dakota. Geolocators were deployed on >140 birds using these methods in 2016. Photo by M. Correll.

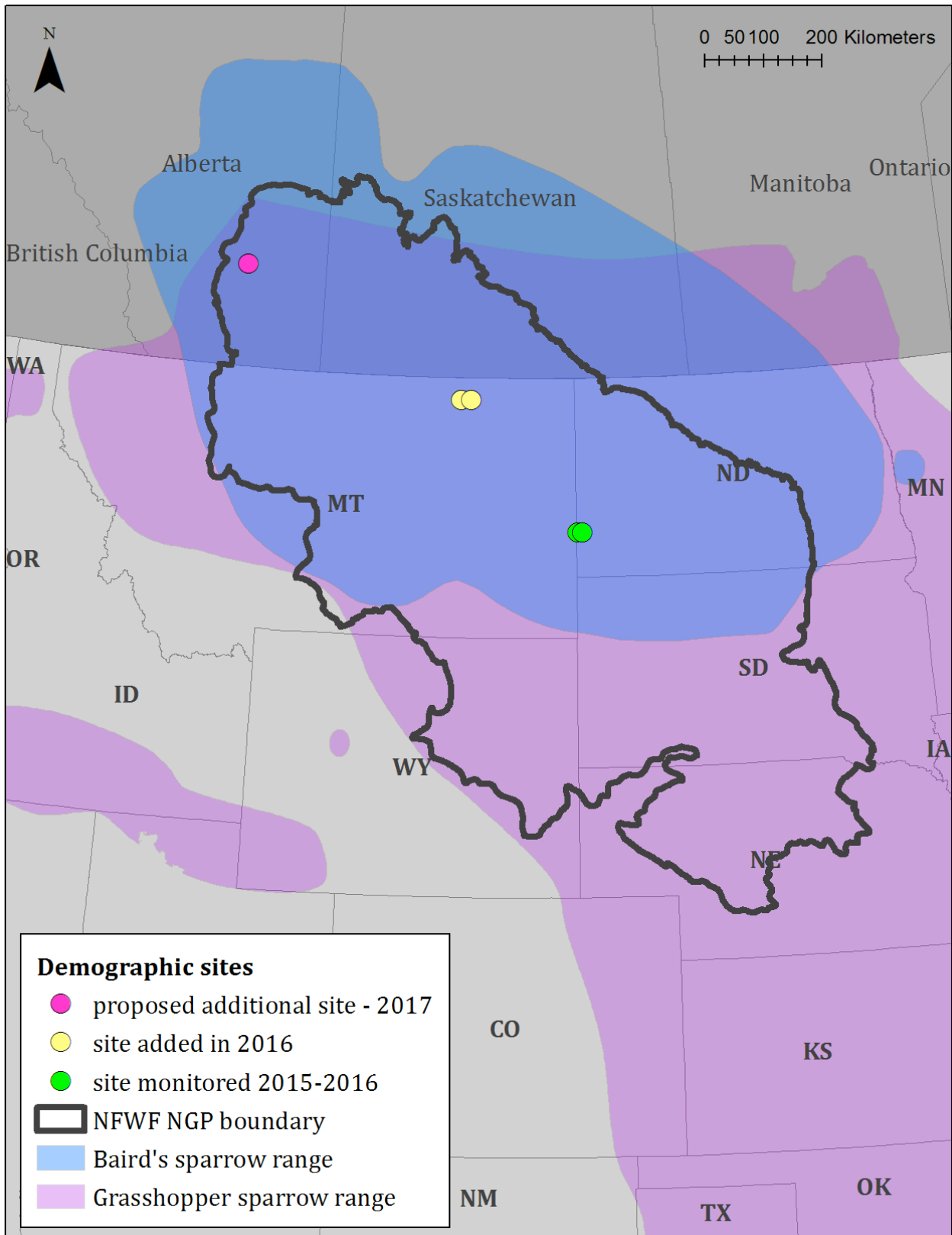


Figure 7. Current and projected demographic monitoring sites in the Northern Great Plains (NGP).

Analyses and Results

Adult Survival

Radio transmitters were attached to 97 sparrows in North Dakota (31 Baird's males, 7 Baird's females, 39 Grasshopper males, 20 Grasshopper females [Figure 8], Table 1). In Montana, we deployed radio transmitters on 82 sparrows (35 Baird's males, 12 Baird's females, 29 Grasshopper males, 6 Grasshopper females). A large proportion of tagged birds went missing in 2016, especially in North Dakota,



Figure 8. Grasshopper Sparrow with VHF radio transmitter. Photo by S. Robinson.

compared to just 28% of birds tagged in North Dakota in 2015. We speculate that missing birds dispersed following a failed or aborted breeding attempt, perhaps as a result of increasingly dry conditions throughout the breeding season. Abandonment after a failed nesting attempt has been observed in male Grasshopper Sparrows breeding in Kansas (E. Williams and A. Boyle, pers. comm.).

Table 1. Number of transmitters deployed on adult sparrows in 2016 and the fates of tagged birds. ND = North Dakota, MT = Montana.

| | Baird's Sparrow | | | | Grasshopper Sparrow | | | | Total | |
|---------------------------|-----------------|-----------|----------|-----------|---------------------|-----------|-----------|----------|-------------------------|-------------------------|
| | male | | female | | male | | female | | ND | MT |
| | ND | MT | ND | MT | ND | MT | ND | MT | | |
| Bird died | 3 | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 5 5% | 4 5% |
| Missing | 21 | 5 | 6 | 8 | 29 | 19 | 17 | 6 | 73 75% | 38 46% |
| Tag fell off | 2 | 1 | 0 | 1 | 4 | 3 | 2 | 0 | 8 8% | 5 6% |
| Survived ¹ | 5 | 27 | 0 | 3 | 5 | 5 | 1 | 0 | 11 11% | 35 43% |
| Total birds tagged | 31 | 35 | 7 | 12 | 39 | 29 | 20 | 6 | 97 | 82 |

¹ Survived includes those with tags removed at end of season

Juvenile Survival

Nestling sparrows were fitted with radio transmitters when approximately 7 to 8 days old. Overall, 16% of tagged nestlings survived at least 20 days after fledging, with another four birds surviving 20 days before they went missing (Table 2). The maximum number of days that a fledgling was known to have survived after leaving the nest was 26 days for

GRSP and 34 days for BAIS. All monitored fledglings that died did so within three days of fledging (Figure 2). The elevated mortality within the first three days post-fledging is consistent with investigations of fledgling Grasshopper Sparrows in Iowa (Hovick *et al.* 2011).

Table 2. Number of transmitters deployed on nestling sparrows in 2016 and the fates of tagged birds. ND = North Dakota, MT = Montana.

| | Baird's Sparrow | | Grasshopper Sparrow | | Total | |
|-----------------------------|------------------------|-----------|----------------------------|----------|--------------|-------------|
| | ND | MT | ND | MT | ND | MT |
| Died in nest | 1 | 3 | 0 | 0 | 1 (3%) | 3 (12%) |
| Died after fledging | 4 44% | 11 48% | 18 62% | 0 | 22 (58%) | 11 (44%) |
| Probable predation | 2 | 4 | 10 | --- | 12 (32%) | 4 (16%) |
| Unknown cause of death | 2 | 7 | 8 | --- | 10 (26%) | 7 (28%) |
| Missing | 2 | 3 | 4 | 0 | 6 (16%) | 3 (12%) |
| Tag fell off | 1 | 2 | 2 | 2 | 3 (8%) | 4 (16%) |
| Survived¹ | 1 11% | 4 17% | 5 17% | 0 | 6 (16%) | 4 (16%) |
| Total birds tagged | 9 | 23 | 29 | 2 | 38 | 25 |

¹ Survived includes those with tags removed at end of season

Nest Monitoring

We monitored the success of 135 nests in North Dakota and 124 nests in Montana for five species (apparent nest fates shown in Table 3). In 2016, apparent nest success was lowest for Grasshopper Sparrows breeding in Montana, and highest for Chestnut-collared Longspurs in the same state. Reasons for nest failure included abandonment, predation, and cowbird parasitism. We plan to use exposure models to fully analyze results after the field season in 2017 to account for annual variation across our study sites. We also plan to use a post-hoc fate-assignment approach, assigning fates using a dichotomous key to be developed this year.

Point count surveys

We conducted point count surveys at 46 locations in North Dakota (VERN = 21, WEIN = 25) and 47 locations in Montana (BLM = 26, S = 21). These sites were surveyed twice between June 1 and June 30, with a minimum of 10 days between counts. These data

will allow us to model density of grassland birds in these areas while accounting for detection probability differences among time, species and space.

Table 3. Summary of nest monitoring efforts in the Northern Great Plains in 2016.

| state | Species | apparent fate | number of nests | % total | totals |
|----------------------------|----------------------------|----------------------|------------------------|----------------|---------------|
| Montana | Baird's Sparrow | Failed | 15 | 28.8% | 52 |
| | | Fledged | 34 | 65.4% | |
| | | Unknown | 3 | 5.8% | |
| | Chestnut-collared Longspur | Failed | 25 | 23.4% | 107 |
| | | Fledged | 82 | 76.6% | |
| | Grasshopper Sparrow | Failed | 7 | 77.8% | 9 |
| | | Fledged | 2 | 22.2% | |
| | Lark Bunting | Failed | 2 | 50.0% | 4 |
| | | Fledged | 2 | 50.0% | |
| | Sprague's Pipit | Failed | 7 | 26.9% | 26 |
| | | Fledged | 16 | 61.5% | |
| | | Unknown | 3 | 11.5% | |
| | Unknown | Failed | 2 | . | 2 |
| | North Dakota | Baird's Sparrow | Failed | 6 | 30.0% |
| Fledged | | | 14 | 70.0% | |
| Chestnut-collared Longspur | | Failed | 29 | 40.8% | 71 |
| | | Fledged | 42 | 59.2% | |
| Grasshopper Sparrow | | Failed | 52 | 59.1% | 88 |
| | | Fledged | 36 | 40.9% | |
| Lark Bunting | | Failed | 2 | . | 2 |
| Unknown | | Failed | 3 | . | 3 |

Vegetation surveys

We conducted vegetation surveys at 326 grid points in North Dakota and 282 surveys in Montana (BLM = 154, SATH = 128). We also conducted vegetation surveys at each nest location within 1 week after the nest fledged or failed and simultaneously at a random point within the plot to assess used habitat versus available habitat on the landscape.

We explored our nest vegetation data habitat selection in a preliminary analysis of habitat use vs. availability in nesting grassland birds at two spatial scales. We explored habitat selection in Baird's Sparrows, Grasshopper Sparrows, and Chestnut-collared Longspurs using Classification Trees (CART, Figure 8, 9). In all figures, blue boxes represent selected variables, while green indicate available variables. The higher a split in the tree is in the figure, the more important a variable was during analysis. The

numbers included in each box are percentages that show the split in the data between available (data from randomly selected points) and selected (data from nest points) based on the identified threshold, which is indicated in bold black lettering at each split in the tree. For example in Figure 8, 72% of the dataset had bare ground below 2.5% cover of the entire Daubenmire frame. Of all selected (nest) sites, 68% had of them had bare ground below 2.5% cover. Our two spatial scales were defined as 1) a 5-meter radius around the nest site, and 2) a Daubenmire frame (25 x 50 cm) placed directly around the nest site. We analyzed each species separately and as a guild/group using "species" as a categorical variable in combined species analyses. Classification trees not included in figures can be found in Appendix A.

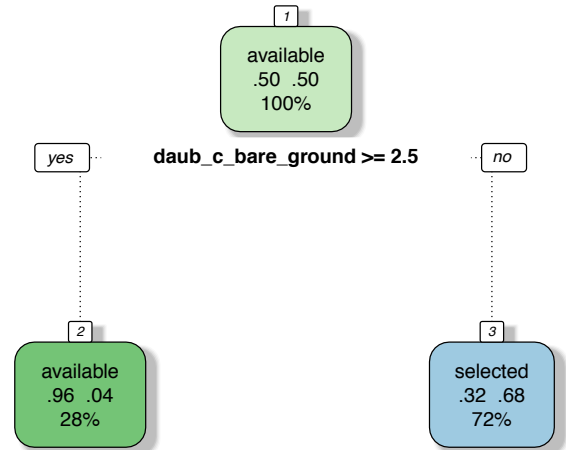


Figure 9. Classification tree exploring fine-scale (Daubenmire frame) habitat selection for Baird's Sparrow.

In our species-specific analyses, we found little differentiation in used vs. available habitat in Baird's and Grasshopper Sparrows (e.g. Figure 9) in either spatial scale examined. This is partially due to low sample size; robust reanalysis after the 2017 field season will likely yield more informative results at the species level. Baird's sparrows showed preference for nesting sites with less-variable cover (5m radius scale) and less bare ground (Daubenmire scale). Grasshopper sparrows, surprisingly, selected for higher Kentucky Bluegrass cover at the 5m-radius scale than was available on the landscape. At the fine-scale, Grasshopper sparrows selected for a combination of bare ground, dead grass, and litter than was available. Chestnut-collared Longspurs produced more complicated trees than either sparrow species, likely due to its large sample size in 2016 (46% of all nests monitored), and is the most robust dataset analyzed here. Chestnut-collared Longspurs strongly selected for low visibility (high vegetative cover) and low cover of Kentucky Bluegrass at the 5m-radius scale. This species also selected for high forb and dead grass cover at the finer spatial scale examined.

In our all-species analyses we found all three species selected for higher percent cover of dead grass at the finer spatial scale examined (Figure 10). All other selection mechanisms were driven at the species level, with Baird's Sparrow most often departing from preferences of the other two species.

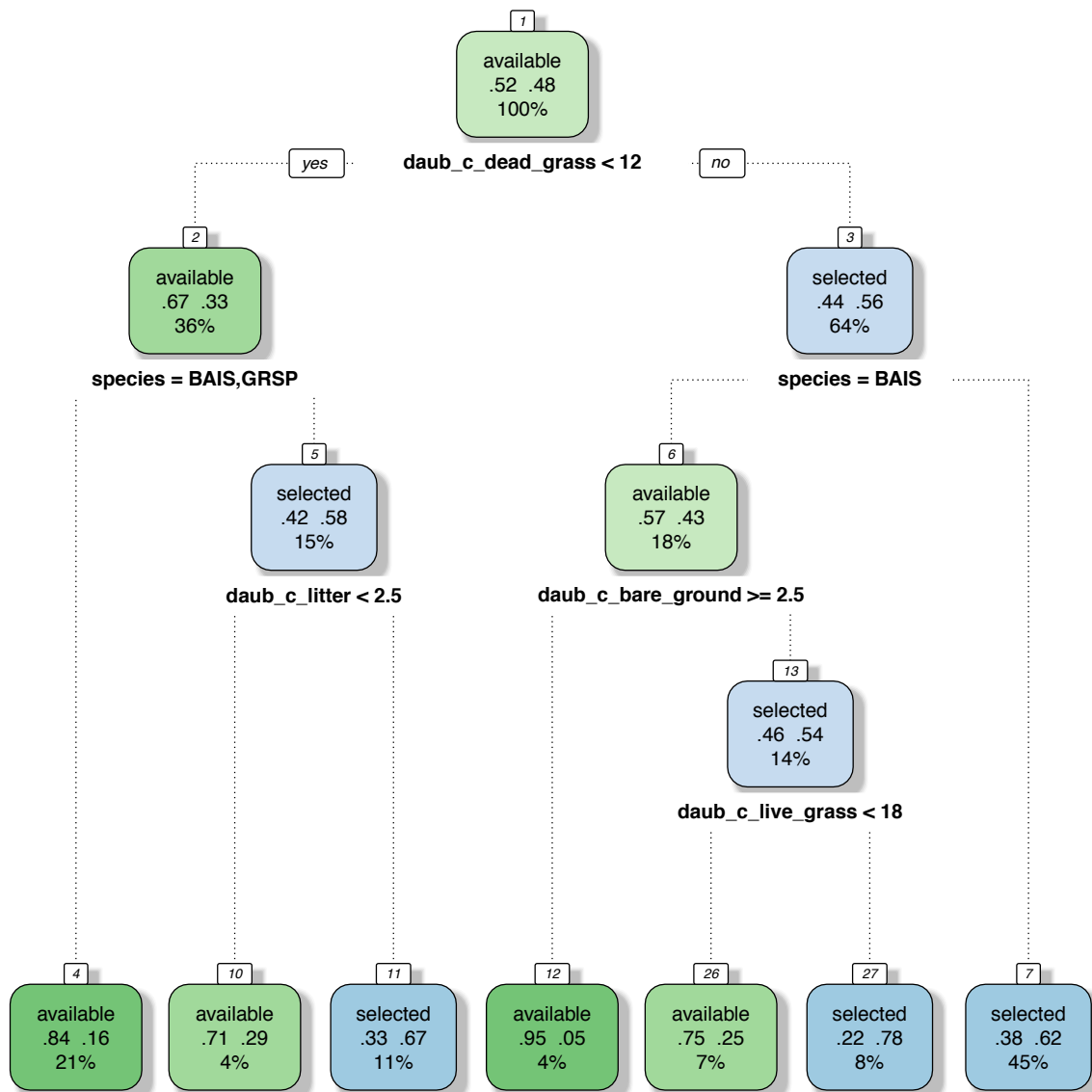


Figure 10. Classification tree showing fine-scale habitat selection for nest location in grassland birds of the Northern Great Plains in 2016.

Geolocator deployment

We attached geolocators to 50 sparrows (36 GRSP, 14 BAIS) in North Dakota and 52 sparrows (36 BAIS, 16 GRSP) in Montana. Capture locations were adjacent to our demography monitoring plots. The University of Manitoba also attached geolocators to 40 sparrows (33 BAIS, 7 GRSP) in southeast Alberta, CA. We hope to return to all field sites in 2017 to recover a portion of these deployed geolocators.

Next steps

Drivers of grassland bird survival in the NGP

We continue to partner with National Audubon's Science program through Dr. Curtis Burkhalter to model survival of Baird's and Grasshopper Sparrow survival in the NGP. We will coordinate these analysis efforts with those of our winter survival work (see Strasser et al. 2016) to produce comparable winter and breeding season survival estimates for both species.

Full Annual Cycle (FAC) conservation through Integrated Population Models (IPMs)

Through collaboration with Bird Conservancy's IMBCR analysts, we plan integrate our modeled species survival estimates for the NGP into an IPM (Hostetler et al. 2015) based on regional density estimates from the IMBCR program (White et al. 2015) and winter survival rates from our winter demographic monitoring program (Strasser and Panjabi 2016). We have submitted grant proposals for 2017 and 2018 to help support this analytical work.

Peer review and publication

At the time of this report we are also midway through the production float curves for Baird's and Grasshopper Sparrows and Chestnut-collared Longspurs for a manuscript describing these patterns following Liebezeit et al. (2007).

Ongoing data collection

The goals for data collection for this project are to have at least 5-6 years of concurrent demographic monitoring on the breeding and wintering grounds to assess the impact of seasonal demographic rates on annual changes in abundance, while incorporating sufficient annual variation in demographic rates to draw robust. We currently have support through North Dakota Department of Fish and Game to continue data collection at our North Dakota sites through 2017 and have received support through an additional NFWF Conoco Phillips SPIRIT grant for continued work at our Montana field site in 2017 and 2018. As mentioned previously (see "forging new partnerships") we have submitted a joint proposal with the University of Manitoba and CWS for expansion of this demographic project into Alberta, Canada in 2017 and 2018. The Bobolink Foundation has also graciously donated funds to support analyst time for 2017.

Acknowledgements

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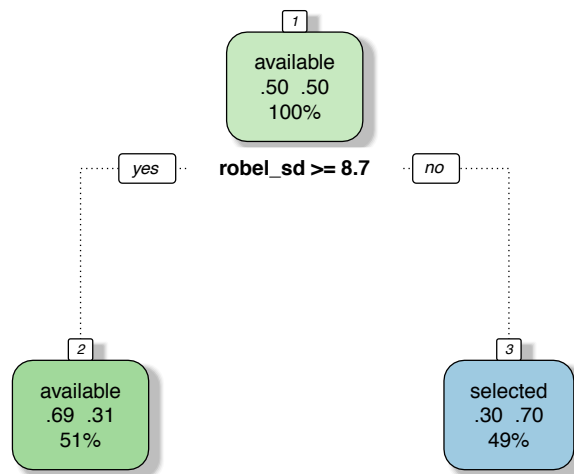
Literature Cited

- Bridge, E.S., J. F. Kelly, A. Contina, R. M. Gabrielson, R. B. MacCurdy, and D.W. Winkler. 2013. Advances in tracking small migratory birds: a technical review of light-level geolocation. *Journal of Field Ornithology* 84 (2): 121-137.
- Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., & Thomas, L. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press.
- Calvert, A.M., S.J. Walde and P. D. Taylor. 2009. Non-breeding drivers of population dynamics in seasonal migrants: conservation parallels across taxa. *Avian Conservation and Ecology - Écologie et conservation des oiseaux* 4(2): 5.
- Hostetler, J.A., T.S. Sillett, and P.P. Marra. 2015. Full-annual-cycle population models for migratory birds. *Auk* 132 (2):433-449.
- NFWF, 2016. Business plan for the Northern Great Plains. National Fish and Wildlife Foundation Business Plan. Plan available at: http://www.nfwf.org/greatplains/Documents/ngp_busplan_w.appendix.pdf.
- Liebezeit, J.R., P. A. Smith, R. B. Lanctot, H. Schekkerman, I. Tulp, S. J. Kendall, D. M. Tracy, R. J. Rodrigues, H. Meltofte, J. A. Robinson, and C. Gratto-Trevor. 2007. Assessing the development of shorebird eggs using the flotation method: species-specific and generalized regression models. *The Condor*, 109(1): 32-47.
- Lipsey, M. 2015. Cows and Plows: Science-based conservation for grassland songbirds in agricultural landscapes. Dissertation. University of Montana, Missoula, MT, USA.
- Martin, T.E., C.R. Paine, C.J. Conway, W.M. Hochachka, P. Allen, and W. Jenkins. 1997. BBIRD Field Protocol. Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana, USA.
- Rappole J.H. and A.R. Tipton. 1991. New harness design for attachment of radio transmitters to small passerines. *Journal of Field Ornithology* 62:335-337.
- Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski-Jr., and W.A. Link. 2015. The North American Breeding Bird Survey, results and analysis 1966 - 2014. Version 3.23.2011 USGS Patuxent Wildlife Research Center, Laurel, MD.
- Strasser E.H. and A.O. Panjabi. 2016. Identifying limiting factors for grassland birds wintering in the Chihuahuan Desert. Final report submitted to U.S. Forest Service International Program. Bird Conservancy of the Rockies, Brighton, CO, USA.
- White, C.M., M.F. McLaren, N.J. Van Lanen, D.C. Pavlacky Jr., J.A. Blakesley, R.A. Sparks, J.J. Birek and D.J. Hanni. 2015. Integrated Monitoring in Bird Conservation Regions (IMBCR): 2014 Field Season Report. Rocky Mountain Bird Observatory. Brighton, Colorado, USA.

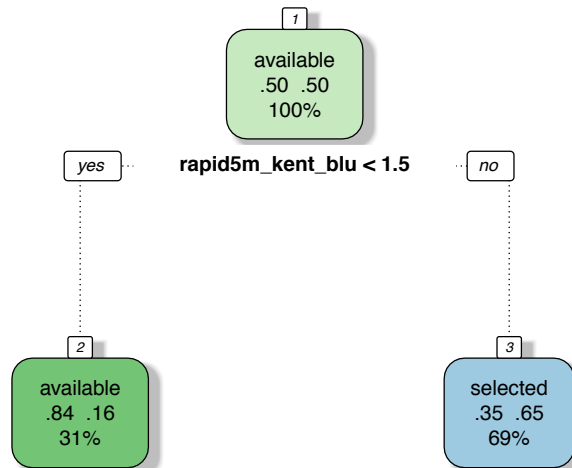
Appendices

Appendix A. Classification trees for habitat selection in nesting grassland birds

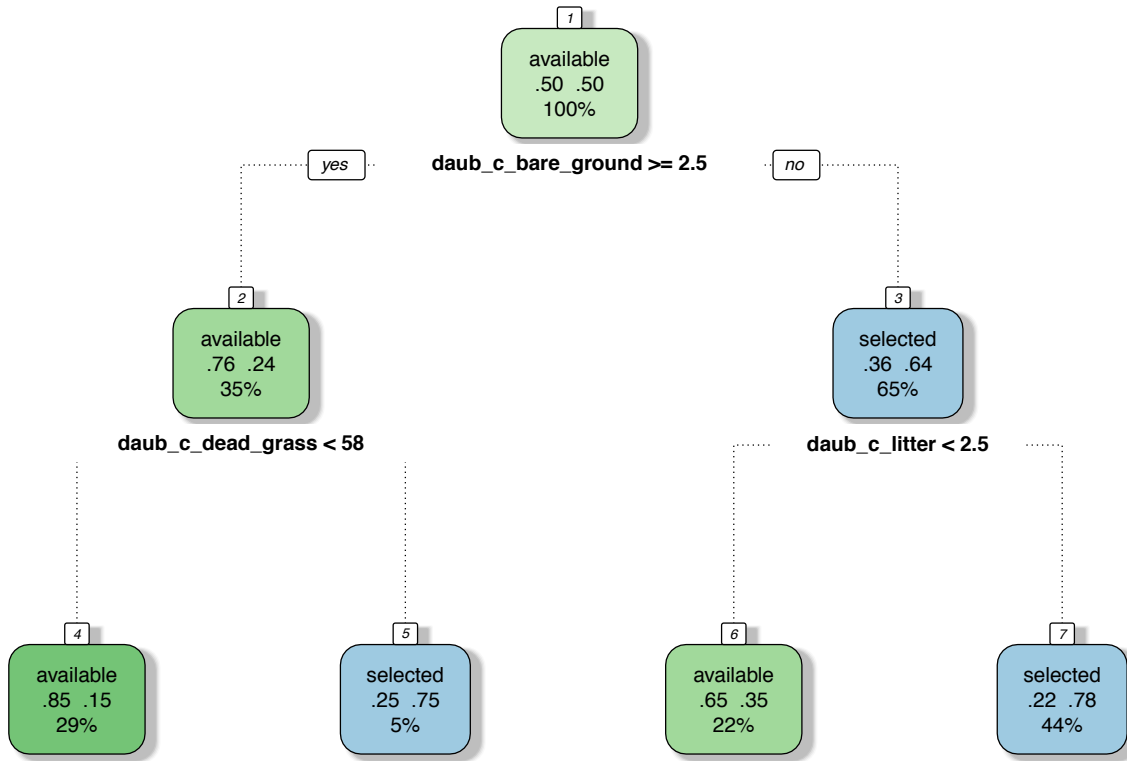
Baird's Sparrow – 5m radius



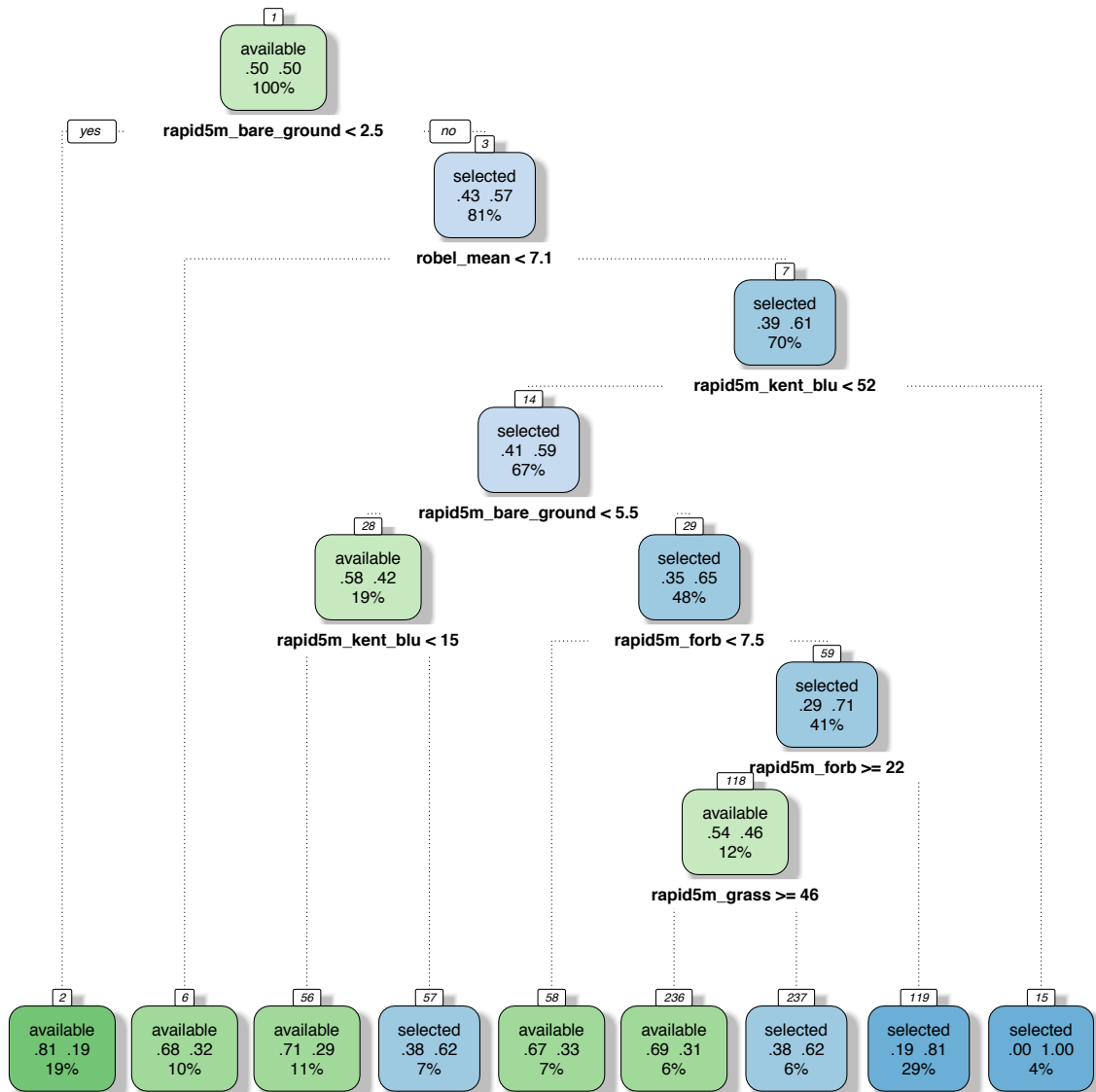
Grasshopper Sparrow - 5m radius



Grasshopper Sparrow – Daubenmire



Chestnut-collared Longspur – 5m radius



Chestnut-collared Longspur – Daubenmire

