Avian Monitoring Report for the Range Monitoring Group

Bird Conservancy of the Rockies

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Bird Conservancy of the Rockies

Connecting people, birds and land

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

Vision: Native bird populations are sustained in healthy ecosystems

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.

Core Values:

1. **Science** provides the foundation for effective bird conservation.

2. **Education** is critical to the success of bird conservation.

3. **Stewardship** of birds and their habitats is a shared responsibility.

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.

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Abstract

Monitoring within Bird Conservation Regions (BCRs), or regions with similar bird and plant communities, can provide valuable information regarding population status of species, including priority species or species of conservation concern. Monitoring can also help evaluate the impact of management actions or conservation practices on wildlife. This report presents Integrated Monitoring in Bird Conservation Regions (IMBCR) program findings for ranches in central eastern Montana, specifically those participating in the Range Monitoring Group (RMG). As the study area is part of BCR17 (Badlands and Prairies), the results from the RMG ranches were compared with regional results for the Montana-portion of BCR17. Specifically, ranchers can compare density estimates for species on their ranches relative to the "big picture" to evaluate how they are managing their land for wildlife, such as birds. Although the RMG ranches represent a small fraction of the total area in BCR17 in Montana (<1%), the ranches still serve as important habitat for many bird species, several of which are priority species. For example, densities of 5 priority species, such as grasshopper and vesper sparrows, were higher within the RMG ranches than in the Montana portion of BCR17. Densities for several gamebirds, like sharp-tailed grouse, were also higher on RMG ranches. Continued monitoring is recommended in order to determine long-term trends, especially for priority species and species that may move around annually in response to precipitation. IMBCR offers unique opportunities including the comparison of local bird populations to broader regional estimates to understand the impact of ranching practices on wildlife. The monitoring data also provide the opportunity to examine how specific factors, like landscape change, are associated with population changes.

Introduction

The Northern Great Plains (NGP) region of the U.S encompasses vast intact grasslands of Montana, North Dakota, South Dakota, Wyoming and northern Nebraska. Stretching from the foothills of the Rockies into the badlands of the Dakotas and Nebraska, the NGP covers over 180 million acres. Characterized by expansive grasslands, it supports a unique assemblage of wildlife adapted to this landscape. These species require large open spaces as habitat to sustain their populations (National Fish and Wildlife Foundation 2016). Much of the region remains in grasslands that are in perennial grass cover, which may include native range, non-native pastures, and hay meadows. Ninety-nine percent of non-urban land in the NGP is used for farming and ranching purposes (Forrest et al. 2004). Comparatively, America's grasslands have received much less conservation attention than other ecosystems. Grasslands are associated with uneventful landscapes, experience harsh climate conditions and are located far from population centers. The NGP is no different, but this intact grassland system also represents an incredible conservation opportunity. The vast majority of the landscape is in cattle grazing which, when managed, is compatible as to the needs of wildlife, and allows conservation efforts and rural communities to co-exist. Effective grassland management requires a unique set of skills, and the potential loss of the ranching way of life is a major threat to this region. Young ranchers are finding it difficult to afford the costs associated with a profitable ranching business and many are migrating to urban centers where they take on other livelihoods. Many grassland birds depend on livestock and ungulate grazing for suitable grassland habitat, and working with ranchers to ensure sustainable livelihoods will ensure longevity of grassland birds.

Bird Conservation Regions (BCRs) provide a spatially consistent framework for bird conservation in North America (Figure 1; U.S. North American Bird Conservation Initiative [NABCI 2007]). BCRs represent distinct ecological regions with similar bird communities, vegetation types and resource management interests (NABCI 2000). Population monitoring within BCRs can be implemented using robust survey methods, so the data can be analyzed at multiple scales. Information on the status of bird populations can be partitioned for small-scale conservation planning (e.g., ranch scale), or aggregated to support large-scale conservation efforts throughout a species' geographic range (e.g., BCR; Woiderski et al. 2017). Bird Conservancy of the Rockies (hereafter, Bird Conservancy), along with various partners, has conducted land bird monitoring for the past decade as part of the Integrated Monitoring in Bird Conservation Regions (IMBCR) program. The IMBCR design provides a spatially consistent and flexible framework for understanding the status and annual changes of bird populations. Birds are often used as indicators of environmental status and change. We can measure bird population size, such as density (number of individuals/km^2) at local scales (e.g., private ranches) and compare populations to the surrounding landscape to evaluate ranching practices for wildlife. Together, we work collaboratively with ranchers on private lands for conservation of grasslands and bird populations.

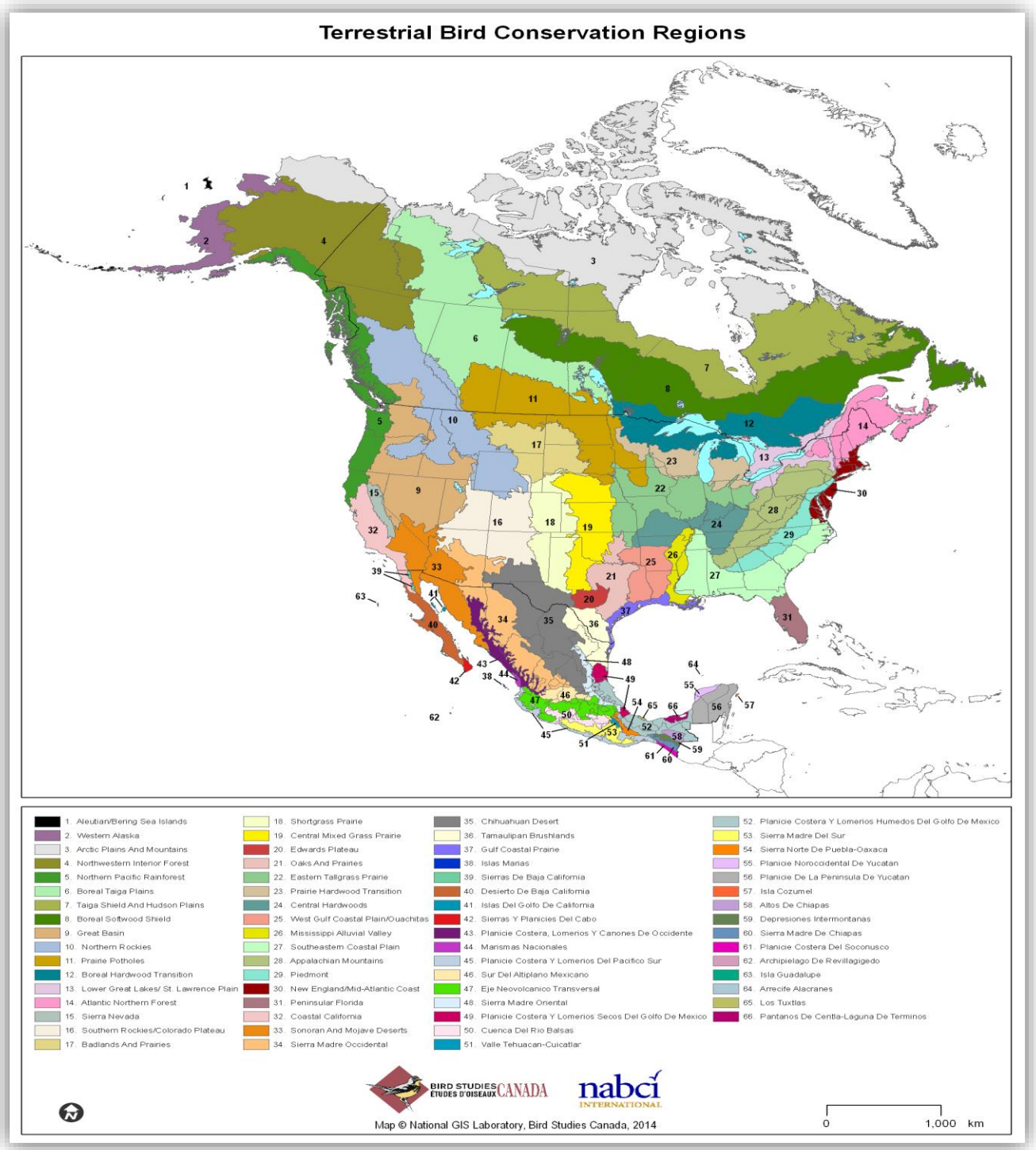

Figure 1. Bird Conservation Regions throughout North America, excluding Hawaii and Mexico

(Source: http://www.birdscanada.org/research/gislab/index.jsp?targetpg=bcr).

Methods

Study Area

We defined the study area as the area containing ranches participating in the Range Monitoring Group's (RMG) avian monitoring. This area is located in the Musselshell Plains of central-eastern Montana and comprises 216 km^2 (83 mi^2). Since the participating RMG ranches are within the larger BCR17 (Badlands and Prairie), results from the RMG ranches were compared with results from the Montana portion of BCR17 (139,918 km^2 or 54,023 mi^2). Estimates for this larger region were produced through the IMBCR program in 2018 for use as a regional comparison.

Sampling Design

The IMBCR design defines sampling units as 1-km^2 grids (247-acre grids), each containing 16 evenly spaced points (Figure 2). We defined potential sampling units by laying a uniform grid of 1 km^2 cells over each RMG ranch in the study area, and then randomly selecting grids with a spatially balanced approach (Stevens and Olsen 2004) using ArcGIS (Environmental Systems Research Institute 2006). Surveyed grids in the surrounding Montana portion of BCR17 were also selected using the same spatially balanced method.

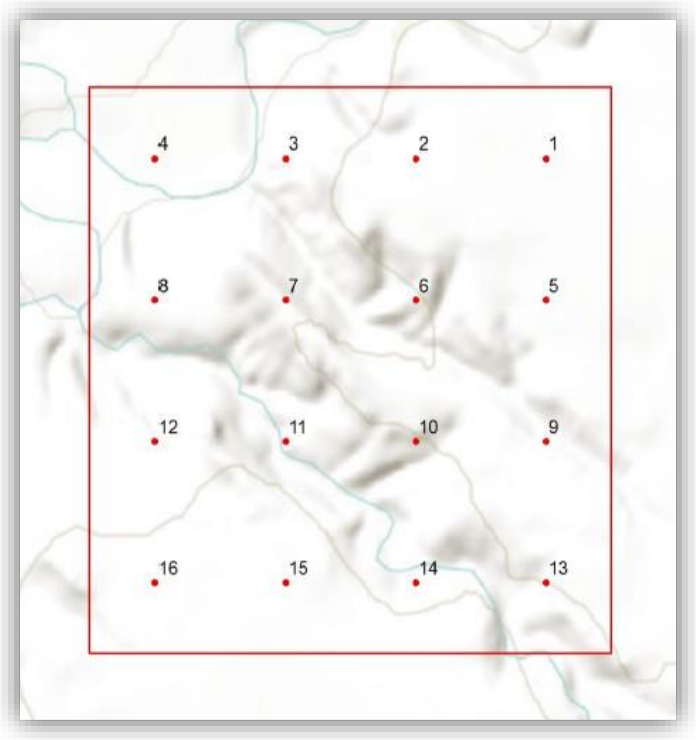

Figure 2. Example 1 km^2 (247-ac) sampling grid using IMBCR design.

Field Methods

Prior to conducting surveys, the observer completed an intensive seven-day training program to ensure complete understanding of field protocols and sufficient knowledge of bird identification. Data collection was attempted at all points within a grid; however, due to safety concerns, inclement weather and other restrictions, not all 16 points were surveyed within every grid.

We conducted avian point count surveys using a distance sampling framework (Buckland et al. 2001) following protocol established by IMBCR partners (Hanni et al. 2018). The observer conducted bird surveys in the morning, beginning ½-hour before sunrise and concluding no later than 10:30 AM. For every bird detected during a six-minute period, the observer recorded the species, sex (if possible), radial distance from the observer, minute interval, and type of detection (e.g., call, song, visual). Distances to each bird were measured using laser rangefinders. When it was not possible to measure the distance to a bird, distance was estimated by measuring to some nearby object. The observer also recorded birds flying over but not using the immediate surrounding landscape. While traveling between points within a grid, the observer recorded the presence of any species that had not been previously detected during one of the six-minute surveys that morning.

At the start and end of each survey, we recorded time, ambient temperature, cloud cover, precipitation and wind speed. The observer navigated to each point using a hand-held Global Positioning System (GPS) unit. Before beginning each six-minute count, we recorded vegetation data within a 50-meter radius. Vegetation data included the dominant habitat type, percent cover and mean height of trees and shrubs by species, average grass height, and ground cover types.

Data Analysis

We developed a Bayesian, zero-inflated N-mixture model (Royle 2004, Sillett et al. 2011) to estimate density and abundance across all species with sufficient data for participating RMG ranches and the Montana portion of BCR 17. We used distance sampling to estimate detection probabilities and adjust counts accordingly for birds present but not detected at survey locations. Distance sampling theory was developed to account for the decreasing probability of detecting an object of interest (e.g., a bird) with increasing distance from the observer to the object (Buckland et al. 2001). Bayesian approaches to density estimation provide several benefits over traditional distance sampling analyses, while providing similar and unbiased estimates of density and abundance. First, with the nested design of IMBCR, point count locations within a 1-km^2 grid are not independent, and Bayesian models provide the flexibility to estimate density at the point count location while correctly accounting for the lack of independence among points. The second benefit is the ability to include covariates to explain changes in density. This allows us to explicitly estimate the response of bird density to variables, such as habitat variables, management actions, or time (i.e., trend). Finally, Bayesian approaches allow for sharing of information across parameters. This can assist in obtaining estimates at sites with little data or provide measures of uncertainty when no birds were detected, such as at low densities and/or small sample sizes. Analyses were completed in Program R (R Core team 2018). For a more detailed description of statistical analyses performed, please contact Adam Green at Bird Conservancy (adam.green@birdconservancy.org).

Results

We completed 73 point count surveys in 5 grids on the RMG ranches during the 2018 field season. Surveys on the RMG ranches were completed between May 30th and June 14th 2018. During surveys on RMG ranches, a total of 1,108 individual birds were detected across 53 different species (15 individuals/survey; see Table 1). Western meadowlark was the most commonly detected species followed by vesper sparrow (Table1). We detected 16 priority species on RMG surveys, as designated by Partners in Flight for BCR 17. Staff from Intermountain Bird Observatory (an IMBCR partner) conducted 350 point count surveys in 29 grids in the Montana portion of BCR17 during the 2018 field season. During surveys in the larger Montana portion of BCR 17, 4,350 individual birds were detected across 124 different species (12 individuals/survey). For comparison, the area of land on the RMG ranches represents <1% of the area for the Montana portion of BCR 17 (83 mi^2 out of 54,023 mi^2).

Table 1. List of all species detected on Integrated Monitoring in Bird Conservation Regions surveys for participating ranches in the Range Monitoring Group. Badlands and Prairies Bird Conservation Region (BCR 17) priority species, as designated by Partners in Flight, are in bold.

Species	**No. of detections**	**Species**	**No. of detections**
American Crow	3	Long-billed Curlew	9
American Goldfinch	1	Mallard	4
American Robin	4	Mountain Bluebird	1
American Wigeon	1	Mourning Dove	68
Black-billed Magpie	1	**Northern Flicker**	1
Black-capped Chickadee	1	**Northern Harrier**	3
Bobolink	4	Northern Shoveler	1
Brewer's Blackbird	3	Red-winged Blackbird	85
Brewer's Sparrow	28	**Ring-necked Pheasant**	47
Brown Thrasher	2	Sandhill Crane	4
Brown-headed Cowbird	44	Savannah Sparrow	2
Canada Goose	19	Say's Phoebe	1
Chipping Sparrow	4	**Sharp-tailed Grouse**	8
Clay-colored Sparrow	1	Spotted Towhee	2
Common Grackle	10	Swainson's Hawk	4
Common Nighthawk	4	Tree Swallow	2
Common Raven	8	Unknown Bird	16
Double-crested Cormorant	1	Unknown Blackbird	5
Downy Woodpecker	3	Unknown Dove	2
Eastern Kingbird	6	Unknown Duck	5
Eurasian Collared-Dove	1	Unknown Gull	1
European Starling	1	Unknown Sparrow	4
Field Sparrow	12	Unknown Woodpecker	1

Gadwall	1	Upland Sandpiper	12
Grasshopper Sparrow	67	**Vesper Sparrow**	155
Horned Lark	8	Western Kingbird	6
House Wren	2	**Western Meadowlark**	340
Killdeer	4	Western Wood-Pewee	6
Lark Bunting	54	Wilson's Snipe	5
Lark Sparrow	4	Yellow Warbler	6

We estimated density and abundance for 48 of the species that were detected on the RMG ranches and also included density estimates for the same species in the Montana portion of BCR17 (Table 2). Of the 48 RMG-detected species for which we estimated density, 16 species are considered priority species by Partners in Flight for BCR17 (PIF 2017). Compared to the larger region of BCR17 in Montana, the RMG ranches exhibited higher densities for 10 species, of which 5 are PIF-priority species (Table 2) and 4 are designated game birds in Montana (mourning dove, ring-necked pheasant, sharp-tailed grouse, and Wilson's snipe). In contrast, densities were higher for 9 species in the surrounding Montana portion of BCR17, including 5 priority species (Table 2). Density estimates were considered significantly different if their 95% credible intervals did not overlap.

Table 2. Estimated densities of detected bird species on RMG ranches (5 sampled grids) and in the Montana portion of BCR17 (29 sampled grids) for 2018. D is estimated density (birds/km^2), Lower and Upper are 95% credible intervals (i.e., we are 95% certain the true density estimate lies within this interval), and N is the total number of estimated individuals in the RMG study area. BCR17 priority species, as designated by Partners in Flight, are in bold. Species highlighted in gray have significantly higher densities on RMG ranches compared to the surrounding region, whereas species marked with an asterisk have significantly lower densities on RMG ranches.

	RMG Ranches				**Montana - BCR17**		
Species	**D**	**Lower**	**Upper**	**N**	**D**	**Lower**	**Upper**
American Crow	0.10	0.04	0.23	21	0.15	0.10	0.22
American Robin*	1.13	0.50	2.27	245	4.81	3.99	5.94
Black-billed Magpie*	0.07	0.03	0.31	15	0.53	0.36	0.96
Black-capped Chickadee	0.34	0.17	1.35	73	1.64	1.11	2.52
Bobolink	1.22	0.68	2.45	265	1.27	1.05	1.64
Brewer's Blackbird	2.52	0.98	7.57	544	2.20	1.45	5.88
Brewer's Sparrow*	16.61	12.46	21.89	3,587	26.49	24.20	30.06
Brown Thrasher	0.49	0.16	1.15	106	0.26	0.14	0.51
Brown-headed Cowbird	21.95	17.28	38.93	4,741	21.12	18.84	35.44
Canada Goose	0.33	0.19	3.69	72	0.14	0.09	1.42
Chipping Sparrow	1.54	0.62	4.31	333	4.35	3.14	5.93
Clay-colored Sparrow	0.42	0.21	1.50	91	1.31	0.72	2.25
Common Grackle	7.61	4.49	26.72	1,643	1.56	0.91	5.42
Common Nighthawk	0.44	0.20	0.96	95	1.07	0.83	1.54

	RMG Ranches				Montana – BCR17		
	D	**Lower**	**Upper**	**N**	**D**	**Lower**	**Upper**
Common Raven	0.20	0.11	0.40	43	0.14	0.10	0.25
Downy Woodpecker	1.64	0.41	4.27	353	0.03	0.01	0.18
Eastern Kingbird	1.97	1.04	4.13	425	0.65	0.37	1.15
Eurasian Collared-Dove	0.03	0.00	0.71	7	0.00	0.00	0.01
Eurasian Starling	0.55	0.12	2.71	118	0.52	0.22	2.73
Field Sparrow	2.33	1.62	3.33	503	1.34	0.98	1.67
Gadwall	0.11	0.05	0.70	24	0.02	0.00	0.13
Grasshopper Sparrow	48.94	43.20	56.15	10,571	25.69	23.21	28.19
Horned Lark*	2.54	1.53	4.84	549	9.25	8.06	14.42
House Wren*	1.19	0.40	2.79	258	10.17	8.70	11.90
Killdeer	0.59	0.32	1.22	128	1.27	0.99	1.91
Lark Bunting*	16.36	13.79	21.06	3,533	24.15	22.28	28.91
Lark Sparrow*	1.25	0.54	2.69	271	8.70	7.19	12.69
Long-billed Curlew	0.51	0.30	0.92	110	0.26	0.18	0.45
Mallard	0.61	0.22	2.10	132	0.34	0.15	1.18
Mourning Dove	8.45	6.94	10.00	1,826	3.58	3.16	4.16
Northern Flicker	0.16	0.05	0.48	35	0.35	0.20	0.55
Northern Harrier	0.26	0.09	0.59	56	0.25	0.14	0.40
Northern Shoveler	0.14	0.05	1.09	31	0.21	0.09	1.17
Red-winged Blackbird	20.59	17.42	30.40	4,448	3.96	3.27	5.75
Ring-necked Pheasant	0.68	0.49	0.93	147	0.13	0.08	0.20
Sandhill Crane	0.01	0.00	0.07	3	0.08	0.05	0.21
Savannah Sparrow*	0.76	0.26	1.81	163	17.84	14.94	21.82
Say's Phoebe	0.12	0.06	0.47	26	0.20	0.10	0.37
Sharp-tailed Grouse	0.92	0.46	3.76	200	0.01	0.00	0.10
Spotted Towhee*	0.38	0.19	1.51	82	3.19	2.48	4.19
Swainson's Hawk	0.21	0.10	0.47	46	0.01	0.00	0.04
Upland Sandpiper	0.59	0.35	1.00	126	0.70	0.55	0.92
Vesper Sparrow	37.87	33.85	43.15	8,179	6.38	5.63	7.30
Western Kingbird	1.64	0.76	4.10	355	0.73	0.42	1.62
Western Meadowlark	45.77	43.13	49.36	9,886	30.31	29.17	31.93
Western Wood-Pewee	1.35	0.81	2.29	291	0.80	0.56	1.18
Wilson's Snipe	0.23	0.09	0.45	49	0.02	0.01	0.07
Yellow Warbler	1.97	0.90	3.95	427	4.48	3.47	5.85

Discussion

The results presented in this report highlight some important findings for the Range Monitoring Group. In terms of area, the RMG ranches represent <1% of the entire Montana portion of BCR17, yet the ranches contained just under half of the species detected in the larger region in 2018 (43%). In addition, more individuals were detected on average during a survey on RMG ranches compared to surveys in the surrounding region.

RMG-participating ranches also had higher densities of several species compared to the surrounding region, including conservation priority songbirds (PIF 2017), such as grasshopper sparrows, and gamebirds, like sharp-tailed grouse (Table 2). Five of these species are also grassland-obligates (grasshopper and vesper sparrows, sharp-tailed grouse, Swainson's hawk, and western meadowlark; Vickery and Herkert 1999) indicating the ranches provide valuable grassland habitat for these species. Overall, these results suggest that RMG ranching practices are beneficial for several avian species and their habitats. It will be important to continue monitoring over time in order to better understand long-term trends on these ranches, especially for grassland birds that often move around year-to-year in response to local precipitation.

The Integrated Monitoring in Bird Conservation Regions Program (IMBCR) collects breeding bird information each year in all or portions of 15 states, covering an area of approximately 20% of all available land in the U.S. Each year, population estimates are calculated for >250 different species at a variety of spatial scales, such as national forests or grasslands, individual states, and entire Bird Conservation Regions. The hierarchical framework that comprises IMBCR provides context for special projects, such as the RMG avian surveys, so that we can evaluate management or conservation practices in project areas. In addition, by using the same sampling design and field protocol as the larger IMBCR program, we can leverage detections for special projects and provide population estimates for more species. For example, if we surveyed birds on RMG ranches separate from the IMBCR program, we would likely have sufficient detections to estimate density for just 8 species. By leveraging detections across the IMBCR program, however, we were able to estimate density for 48 species on RMG ranches. Special projects, such as the RMG avian surveys, also benefit from the sampling design, field protocol, and data analysis expertise of biologists at Bird Conservancy who lead a large breeding bird monitoring effort every year.

Information obtained from IMBCR can be used in a variety of ways, such as:

1) **Bird population estimates can be compared in space and time**. For example, estimates for RMG ranches can be compared to state and regional estimates to determine if avian population change on the ranches is consistent with avian population change over time in the larger region;
2) **Annual population estimates can be compared over time to determine if population changes are a result of population growth or decline and/or range expansion or contraction.** For example, if population densities of a species declined over time, but the occupancy rates remained constant, then the population change was due to declines in local abundance. In contrast, if both density and occupancy rates of a species declined, then population change was likely due to range contraction;

3) **Conservation practices can be evaluated in terms of impact on bird populations.** For example, RMG ranches can evaluate how their ranch management practices influence grasshopper sparrows by comparing grasshopper sparrow density on the ranches to grasshopper sparrow density in the surrounding region; and
4) **Habitat relationships between the bird monitoring data and vegetation data can inform what birds are responding to on the ranches and in the surrounding landscape.** Rather than just comparing if density estimates are higher on RMG ranches compared to the surrounding landscape, we can model bird density with grass cover, grass height, bare ground, shrub cover, and other variables to determine what the birds are responding to on the ranches. This information would then provide insight into how best to manage for conservation priority species or gamebirds.

Future considerations associated with IMBCR and the RMG surveys include:

1) **The large scale effort of IMBCR makes future expansion possible.** If the RMG wants to expand its reach and include more ranches for monitoring, baseline IMBCR efforts can be used in other locations to inform density estimates and provide context for density estimates.
2) **Additional indicators can be added to the relatively simple vegetation data that are currently collected with IMBCR**. Habitat indicators are currently collected at each IMBCR point count; however, other indicators, such as soil properties could also be collected at bird monitoring locations to further inform RMG ranching practices.
3) **Longer term monitoring, especially for priority species, will provide insight into population trends over time.** In addition, if we can expand the effort on RMG ranches and survey a few additional grids, we should be able to increase detections for more species and obtain density estimates for them.

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