Monitoring Wyoming's Birds: 2009 Field Season Report

April 2010

ROCKY MOUNTAIN BIRD OBSERVATORY

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***Mission**: To conserve birds and their habitats*

***Vision**: Native bird populations are sustained in healthy ecosystems*

***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.*

RMBO 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 and appreciation for birds.*

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

***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.*

***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.*

Suggested Citation:
Rehm-Lorber, J. A., J. A. Blakesley, D. C. Pavlacky, Jr., and D. J. Hanni. 2010. *Monitoring the Birds of Wyoming: 2009 Field Season Report (Revised).* Tech. Rep. M-MWB-09-01. Rocky Mountain Bird Observatory, Brighton, CO. 64 pp.

***Cover Photo**:* Mountain Bluebird, Brewer's Sparrow, Green-tailed Towhee; By Nancy Bell. Used with permission.

Contact Information:
Jora Rehm-Lorber jora.lorber@rmbo.org
David Hanni david.hanni@rmbo.org
Rocky Mountain Bird Observatory
PO Box 1232
Brighton, CO 80603
303-659-434

EXECUTIVE SUMMARY

Rocky Mountain Bird Observatory (RMBO), in conjunction with the USDA Forest Service (USFS), USDI Bureau of Land Management (BLM), Wyoming Game and Fish Department and Wyoming Natural Diversity Database (WYNDD), conducted its eighth season of landbird monitoring in Wyoming (Monitoring Wyoming's Birds; MWB). In 2008, Rocky Mountain Bird Observatory implemented a new spatially balanced sampling design based upon Bird Conservation Regions (BCRs) and management boundaries in the state of Colorado and the BCR 16 portion of Wyoming. The new "Integrated Monitoring in Bird Conservation Regions" (IMBCR) design (Skorkowsky et al, in prep.) features our historical field and statistical methods of point transect stations and distance sampling, allowing IMBCR data to be compared to the historical bird monitoring data. The IMBCR design also allows for comparison of density estimates across public and private lands and to the results of other long-term monitoring projects throughout the country. The success of the pilot implementation of the IMBCR design in 2008 led to expansion of the design across all of Wyoming in 2009.

RMBO completed 131 of 137 (96%) planned transect surveys, WYNDD completed 37 of 35 (100%) of planned surveys and the National Park Service (NPS) completed 2 of 2 (100%) of planned surveys in 2009 (168 of 174 total planned surveys completed; 97% overall completion rate). This was the highest transect completion rate since the inception of MWB. RMBO, WYNDD and NPS conducted 1,933 point counts and detected 15,258 birds of 155 species across Wyoming's five BCR's. We estimated BCR- and stratum-wide density and population sizes for 43 landbird species. Strata include management entities, geographic areas and landscape features. We could not determine statewide density estimates for 2009 because of insufficient sample effort in three strata in BCR 10. Observers recorded 77 bird species that hold special conservation and management designations in Wyoming. Eighteen of these species were recorded in sufficient numbers to estimate density. This is the first year we used occupancy modeling to provide estimates for low density species. We estimated occupancy rates for 15 species of concern.

We obtained precise density estimates (coefficients of variation <50%) in at least one stratum for 33 species in BCRs 9 and 10 combined, 24 species in BCR 16, 14 species in BCR 17 and eight species in BCR 18. We will be able to detect population trends for these species within our targeted timeframe of 30 years or less, given similar sampling effort and avian population dynamics in future years.

The use of occupancy modeling allows monitoring of populations of avian species that are rare or difficult to detect and therefore result in detection rates too low for density estimation. This additional analytical method greatly increases the effectiveness of monitoring Wyoming's species of concern.

The spatially-balanced sampling design in Wyoming, which contributes to regional, BCR-wide monitoring, serves as a model for other long-term monitoring efforts because of its ability to address the conservation and management needs of a wide range of stakeholders, landowners and governmental entities at both local and regional scales. The IMBCR design represents one method for achieving effective collaboration and coordinated bird monitoring efforts in North America and could be applied to other BCRs and regions across the continent.

ACKNOWLEDGEMENTS

Stratification and allocation of survey effort for MWB were determined in collaboration with partner agencies and organizations, each of which contributed funding to this project in 2009: Wyoming Game and Fish Department, USDI Bureau of Land Management, US Forest Service Rocky Mountain Region, Medicine Bow, Shoshone and Black Hills National Forests, Grand Teton and Yellowstone National Parks and Wyoming Audubon. Robert Skorkowsky of US Forest Service was instrumental in developing the IMBCR design, creating the sampling frame geodatabase, and establishing monitoring partnerships among state and federal agencies. Andrea Orabona of Wyoming Game and Fish Department organized meetings among partner agencies and organizations to establish stratification and coordinate funding.

Many individuals helped make the 2009 field season a success. Doug Smith, Stacey Gunther and Christie Hendrix of Yellowstone NP were of great help to executing surveys within Yellowstone NP; Megan Ruehmann conducted surveys within Grand Teton NP. Hannah Griscom from the Wyoming Natural Diversity Database (WYNDD) coordinated surveys in Thunder Basin National Grassland. Two field technicians from WYNDD conducted surveys in Thunder Basin National Grassland (Kerry Cutler and Jennifer Faulkner), which was a substantial contribution to this year's data. The 2009 RMBO field crew faced many challenges locating new survey locations. Field technicians Mike Blaalid, Thomas Riecke, Eric Ripma, and Walt Wilson helped make this field season a success. Chandman Sambuu managed and updated the RMBO database and produced a new online mapping tool allowing for easier navigation and planning to survey sites. Fort Collins office staff Paul Franco and Sarah Kormos researched and contacted county assessors and private landowners, granting the field crew access and establishing the relationships that enable multi-ownership monitoring to be sustainable. Rob Sparks, GIS specialist, produced sample allocation maps for this report. We thank Gary White, professor emeritus of Colorado State University who wrote the initial SAS code for running the multi-scale occupancy models and Paul Lukacs of the Colorado Division of Wildlife who wrote code in program R for generating density estimates from detection probabilities. Finally, this report benefited greatly from review by RMBO staff.

This report fulfills requirements in RMBO's agreement with the USDA Forest Service (07-CS-11020603-049_m2,) and contracts with USDI Bureau of Land Management (BLM-000724) Wyoming Department of Game and Fish (WYGF-000724) and Wyoming Audubon.

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INTRODUCTION

Many bird species serve as indicators of habitat quality, with changes in their populations linked to changes in ecological health (Morrison 1986; Hutto 1998; Rich et al. 2004). Understanding bird population dynamics is critical to conservation efforts. Reported declines of North America's breeding birds (Rich et al. 2004) has led to the widespread use of landbird monitoring to identify the severity of declines and their causes. Effective population monitoring identifies species at particular risk, tracks population trends over time and assesses the effects of land management decisions on breeding bird habitat. Many breeding birds in Wyoming are identified as priority species for conservation in Wyoming state plans (WGFD 2005; Nicholoff 2003), National Forest Plans (Management Indicator Species and Sensitive Species), and the Partners in Flight North American Landbird Conservation Plan (PIF Species Assessment Database, Wyoming Partners in Flight) (Rich et al. 2004). Population monitoring also helps to achieve the intent of legislation such as the Migratory Bird Treaty Act (1918), National Environmental Policy Act (1969), Endangered Species Act (1973) and the National Forest Management Act (1976). Despite the widespread use of monitoring to address these issues, there is an ongoing need to coordinate bird monitoring among organizations and integrate them across regional and international boundaries (NABCI 2007).

Rocky Mountain Bird Observatory began landbird monitoring in Wyoming in 2002. From 2002-2008 a vegetation (habitat-based) stratified design was used (Hanni et al. 2009). There are several limitations to a habitat-based sampling design. First, vegetation changes occur over time because of natural events and changes in land management. As these changes occur, habitat-based transects need to be re-located. Such relocations do not allow us to relate changes in bird population density to changes in landscape conditions. Second, fluctuating budgets and financial constraints occasionally meant we had to omit some habitats from sampling in some years. Third, habitats often overlap and efforts to place sampling transects within homogeneous stands resulted in excluding certain micro-habitats from sampling. Finally, our original design required that sampling locations be within 1.6 km of a road, which may have introduced road-bias to the survey results. Overall, these factors made it difficult to combine data across strata to estimate species' densities on the larger geographic scale needed for regional long-term monitoring. To address these challenges RMBO and its partners developed the Integrated Monitoring in Bird Conservation Regions (IMBCR) design (Skorkowsky et al, in prep) to meet the following monitoring objectives:

- Integrate existing bird monitoring efforts in the region to provide better information on distribution and abundance of all breeding birds, especially for high priority species;
- Provide basic habitat association data for most bird species to address habitat management issues;
- Provide long-term status and trend data for all regularly occurring breeding species throughout Wyoming, with a target of detecting an average annual rate of population change of ≥3.0% per year within 30 years, with power = 0.8 and alpha = 0.1;
- Maintain a high-quality database that is accessible to all of our collaborators as well as to the public over the internet, in the form of raw and summarized data and;

- Generate decision support tools that help guide conservation efforts and provide a better measure of conservation success.

To achieve these objectives and overcome the disadvantages of habitat-stratified sampling, RMBO and its partners implemented the new IMBCR sampling design across most of Colorado and the BCR 16 portion of Wyoming in 2008. The success of the pilot implementation of the IMBCR design in 2008 led to expansion of the design across all of Wyoming in 2009. The primary level of stratification in the IMBCR design is Bird Conservation Regions (BCRs). In 1999 The North American Bird Conservation Initiative (NABCI) delineated BCRs in North America based upon eco-regions with similar bird communities, resource management issues, and biotic and abiotic characteristics (NABCI 2007). Within Wyoming each BCRs was stratified based on fixed attributes (often land ownership or land management boundaries), without regard to existing vegetation conditions. In contrast to the historical, vegetation-stratified sampling, built into the IMBCR sampling design is the ability to combine data across strata (and across monitoring programs) in order to estimate bird population status and trends across large areas.

Within each stratum, generalized random-tessellation stratification (GRTS), a spatially balanced sampling algorithm, was used to select sample units (Stevens and Olsen 2004). The GRTS design has several appealing properties with respect to long-term monitoring of birds at large spatial scales:

- Spatially-balanced sampling is generally more efficient than simple random sampling of natural resources (Stevens and Olsen 2004). Incorporating information about spatial autocorrelation in the data can increase precision in density estimates;

- Sample units can be weighted according to any factor expected to influence species' distributions, to adjust the probability that sample units will be selected (Stevens and Olsen 2004). The sample weight can be accounted for in data analyses; (No sample weighting was applied within the 2009 sample unit selection process for Wyoming);

- All sample units in the sampling frame are ordered, such that any set of consecutively numbered units is a spatially well-balanced sample (Stevens and Olsen 2004). In the case of fluctuating budgets, we can adjust the sampling effort among years within each stratum while still preserving a random, spatially-balanced sampling design.

Other Important properties of the IMBCR study design are:

- All areas and all vegetation types are available for sampling;
- Strata are based on fixed attributes; this will allow us to relate changes in bird populations to changes on the landscape through time;
- The portion of each BCR within Wyoming can be stratified differently, depending upon local needs and areas to which one wants to make inferences;
- Aggregation of strata-wide estimates to BCR- or state-wide estimates is built into the design;
- Local population trends can be directly compared to regional trends;
- Coordination among partners can reduce the costs of monitoring per partner.

Under the IMBCR design, sampling units were defined as 1-km^2 cells. Creation of the state-wide grid of cells and attribution of cells was a joint effort of Forest Service Rocky Mountain Region and RMBO. Within each cell there were 16 points, placed in a four by four grid, spaced 250 meters apart. All spatial data were compiled using ARCGIS 9.3 (ESRI). Data analysis using the GRTS design requires that a minimum of two cells are sampled within each stratum.

METHODS

Study Area and Stratification

Wyoming contains portions of five Bird Conservation Regions (Figure 1). Within the portion of each BCR that occurs in Wyoming, strata were defined based on land ownership or management entity (Figures 2-3). Samples were allocated among strata based on a consensus among RMBO, Wyoming Game and Fish Department, BLM, US Forest Service, National Park Service and Wyoming Audubon. See Table 1 for sample allocation in each stratum.

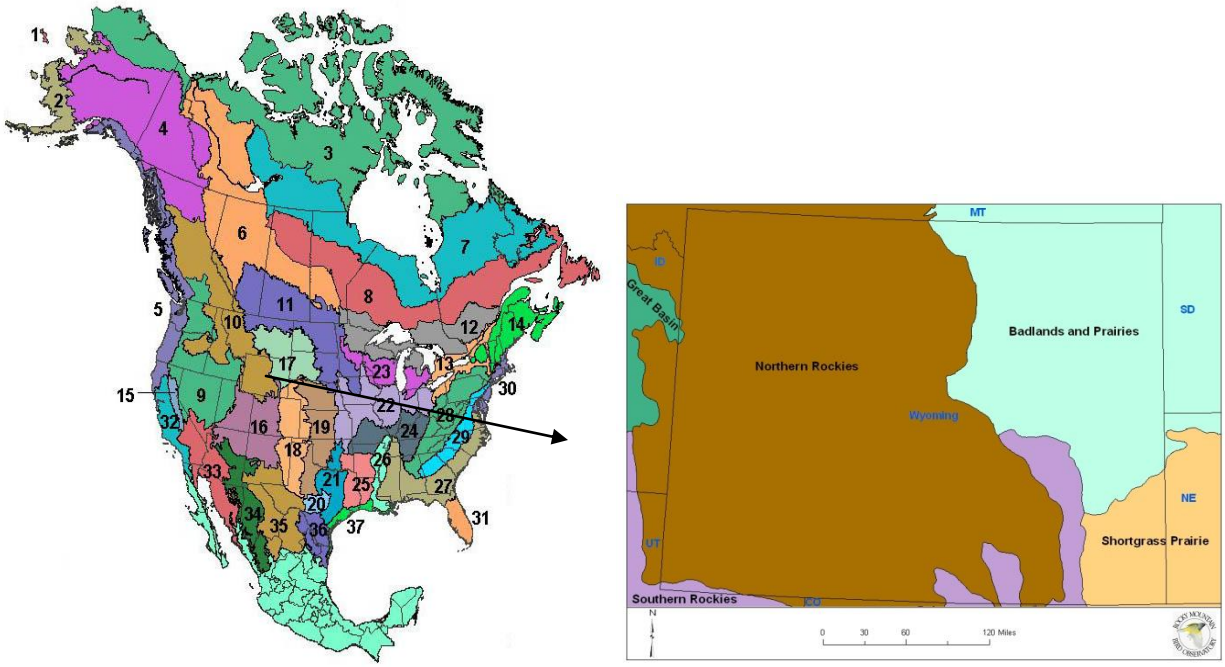

Figure 1. Bird Conservation Regions throughout North America, excluding Hawaii and Mexico. Inset illustrates geographic boundaries of BCRs 9, 10, 16, 17 and 18 within Wyoming (Source: http://www.nabci-us.org/map.html).

BCR 9 – Great Basin

The Great Basin is a complex region covering the eastern slopes of several mountain ranges through Washington, Oregon, Idaho, California, Nevada, Utah and Wyoming. The region is characterized by grassland and sagebrush in the lowlands, pinyon/juniper and ponderosa pine forests in the mid elevations and pine/fir/spruce forests in the higher elevations (NABCI 2000). BCR 9 represents a very small portion of Wyoming which is mainly composed of lands managed by Region 4 of the USDA USFS. For 2009 data analyses, we pooled BCR 9 and BCR 10 data because sample sizes for BCR 9 were too small to analyze independently.

BCR 10 – Northern Rockies

The Northern Rockies BCR comprises more than half the state of Wyoming and is dominated by a coniferous forest at higher elevations and shrub steppe/grassland throughout the Wyoming basin (NABCI 2000). This BCR includes several national parks and a large amount of other public land and open space. Many high priority bird species, such as Brewer's Sparrow and Clark's Nutcracker breed in this region. Eighteen strata were created in BCR 10. BLM lands were represented by 9 strata, based on BLM Field Offices (Casper, Cody, Kemmerer, Lander, Pinedale, Rawlins, Rock Springs, and Worland). National Forest strata were Big Horn, Medicine Bow, Region 4 Forests, Shoshone non-roadless, and Shoshone wilderness/roadless. Region 4 forests were lumped into on stratum in 2009 due to lack of participation. We anticipate Region 4 participation in future years that will allow the stratum to be divided into individual management units. One stratum was created for each of the three units within the Greater Yellowstone Inventory and Monitoring Network: Big Horn National Recreation Area, Grand Teton National Park and Yellowstone National Park. Grand Teton and Yellowstone National Parks were coincident with designated Important Bird Areas (vhttp://iba.audubon.org/iba/stateIndex.do?state=US-WY). One stratum was created for the Wind River Indian Reservation. The final stratum in Wyoming BCR 10 sampled all other lands and was dominated by privately owned land. One other lands transect fell within Pathfinder National Wildlife Refuge which is an Important Bird Area (IBA) located near Alcova,

Wyoming. BCR 16 – Southern Rockies/Colorado Plateau

This region comprises portions of seven states with a small band entering Wyoming in the southeast corner of the state and three fingers tracing mountain ranges in the south-central to southeast part of the state. At lower elevations this BCR is characterized by shortgrass prairie, and at higher elevations, stands of pine, fir and spruce interspersed with large aspen stands and montane shrubland. This region provides critical habitat for species such as Grasshopper Sparrow and Mountain Bluebird (NABCI 2000). Four strata were created in BCR 16: all BCR 16 BLM lands, Medicine Bow and Wasatch National Forests, and all other lands, a stratum dominated by privately owned land.

BCR 17– Badlands and Prairies

This BCR covers the northeast corner of Wyoming and consists of extensive tracts of dry, mixed grass prairie, providing nesting habitat for many high priority grassland species that are in severe decline (NABCI 2010). The low density of wetlands and small, irrigated farmlands results in these areas receiving concentrated use by waterfowl. BCR 17 in Wyoming also covers the Bear Lodge Mountains in Black Hills National Forest, which is the western-most range of a variety of high priority neotropical migrants (NABCI 2000). Six strata were created in BCR 17. BLM lands were represented by 9 strata, based on BLM Field Offices (Buffalo, Casper and Newcastle). One stratum was created for each of two Forest Service administered areas: the Wyoming portion of the Black Hills National Forest and Thunder Basin National Grassland. The final stratum in Wyoming BCR 17 sampled all other lands and was dominated by privately owned land.

BCR 18 – Shortgrass Prairie

The shortgrass prairie BCR covers the eastern half of Colorado, and substantial portions of New Mexico, Texas, Nebraska, Kansas and the far southeast corner of Wyoming. McCown's Longspur and Lark Bunting are some high priority breeders of the highly endangered shortgrass prairie ecosystem (NABCI 2000). In BCR 18 we created 3 strata consisting of BLM, Department of Defense and all other lands; the latter stratum was dominated by private lands.

Table 1. Planned and completed surveys within Wyoming, 2009.

BCR	Agency[1]	Region, Forest, or Field Office[2]	Abbreviated stratum name	Planned	Completed
9	None	None	BCR 9	2	2
10	BLM	Buffalo FO	Buffalo	2	1
10	BLM	Casper FO	Casper	2	2
10	BLM	Cody FO	Cody	2	1
10	BLM	Kemmerer FO	Kemmerer	2	2
10	BLM	Lander FO	Lander	2	2
10	BLM	Pinedale FO	Pinedale	8	8
10	BLM	Rawlins FO	Rawlins	8	8
10	BLM	Rock Springs FO	Rock Springs	8	8
10	BLM	Worland FO	Worland	2	2
10	Forest Service	Big Horn NF	Big Horn NF	10	10
10	Forest Service	Medicine Bow NF	Medicine Bow NF	2	2
10	Forest Service	Region 4	USFS R4	2	2
10	Forest Service	Shoshone NF, non-roadless	Shoshone NF	23	23
10	Forest Service	Shoshone NF, roadless/wilderness	Shoshone-roadless	2	2
10	NPS	Big Horn Canyon NRA	Big Horn Canyon	2	0
10	NPS	Grand Teton NP	Grand Teton	2	2
10	NPS	Yellowstone NP	Yellowstone	2	2
10	Tribal	Wind River Indian Reservation	Wind River	2	0
10	Other	All	Other Lands	2	1
16	BLM	All	BLM	2	2
16	Forest Service	Medicine Bow NF	Medicine Bow NF	23	24
16	Forest Service	Wasatch NF	Wasatch NF	2	2
16	Other	All	Other Lands	10	10
17	BLM	Buffalo FO	Buffalo	2	2
17	BLM	Casper FO	Casper	2	3
17	BLM	Newcastle FO	Newcastle	2	2
17	Forest Service	Black Hills NF	Black Hills NF	10	10
17	Forest Service	Thunder Basin NG	Thunder Basin NG	10	11
17	Other	All	Other Lands	10	8
18	BLM	All	BLM	2	2
18	DOD	All	DOD	2	2
18	Other	All	Other Lands	10	10

[1] BLM = USDI Bureau of Land Management; DOD = Department of Defense; Forest Service = USDA Forest Service; NPS = National Park Service; Other = State, Private, and Federal lands not included in other strata.

[2] FO = Field Office; NF = National Forest; NG = National Grassland; NP = National Park; NRA = National Recreation Area;

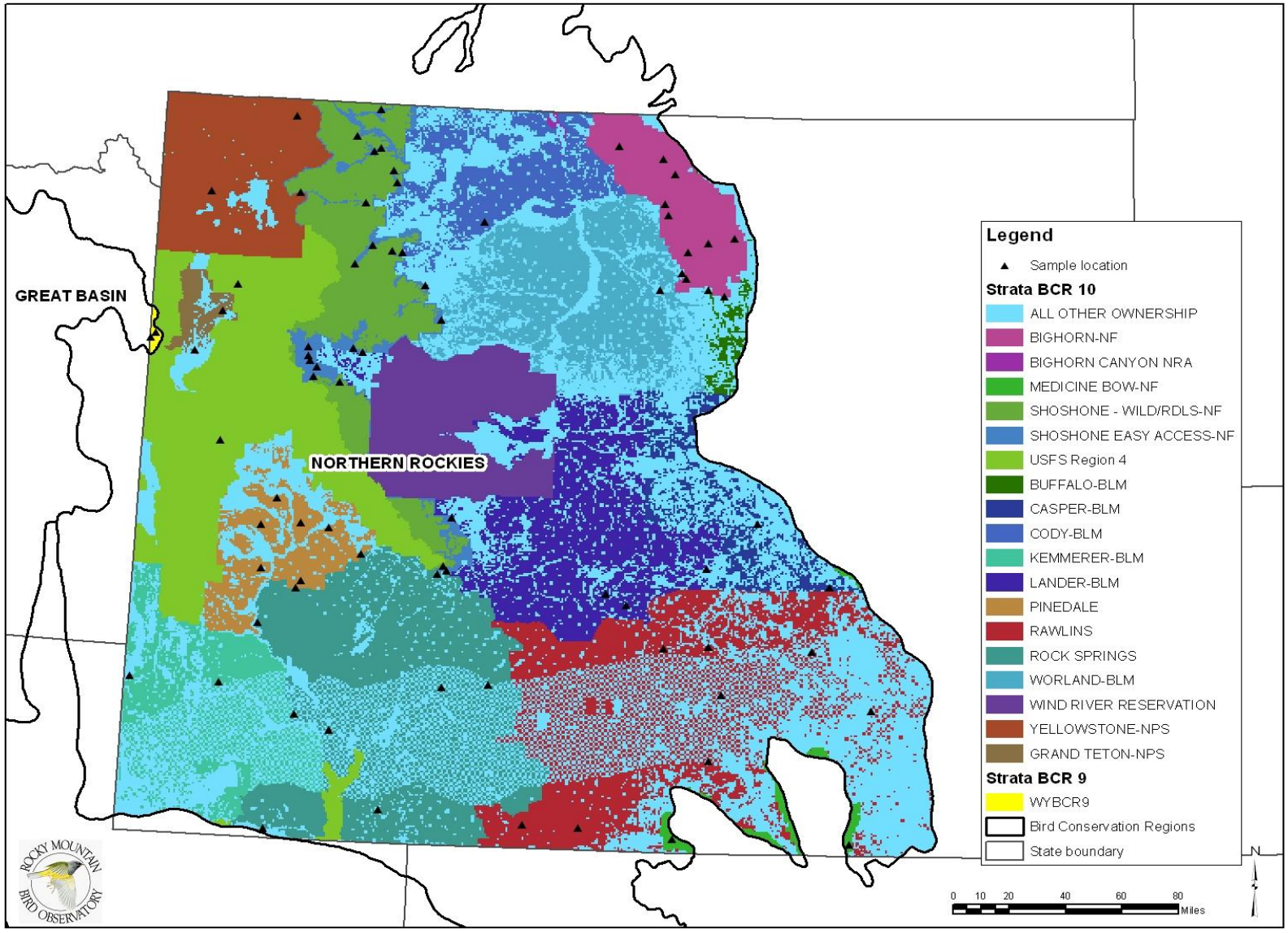

Figure 2. Stratification and sample locations in The Great Basin (9) and Northern Rockies (10) Bird Conservation Regions, Wyoming.

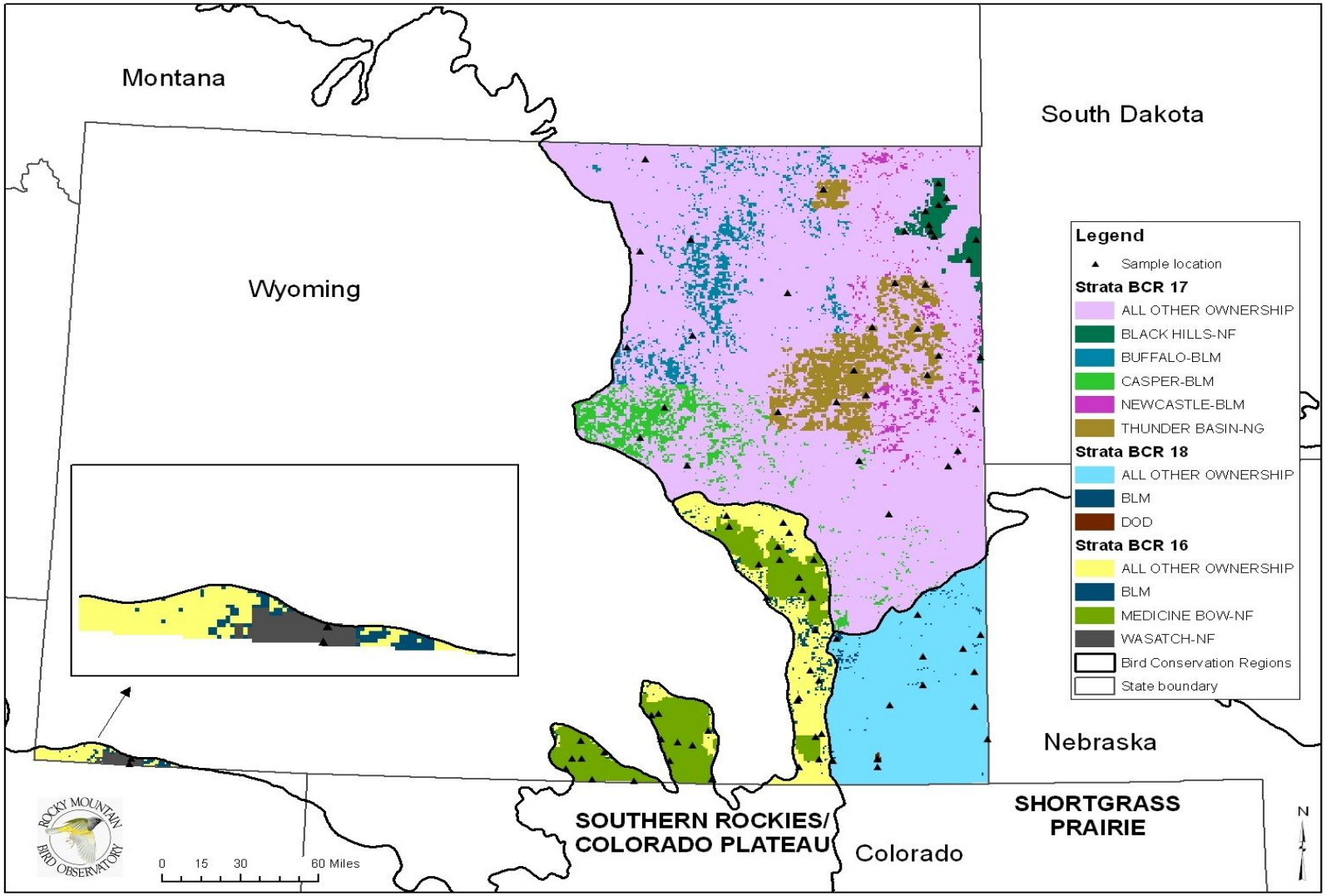

Figure 3. Stratification and sample locations in the Southern Rockies/Colorado Plateau (16), Badlands and Prairies (17) and Shortgrass Prairie (18) Bird Conservation Regions, Wyoming.

Sampling methods

Buckland et al. (2001) developed the concepts and methods of distance analysis. Distance sampling 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). Distance analysis relies on three assumptions: 1) all birds at and near the sampling point (distance = 0) are detected; 2) distances of birds are measured accurately; and 3) birds do not move in response to the observer's presence. Our sampling protocol met these assumptions reasonably well.

Occupancy estimation is commonly used to quantify the proportion of sample units occupied by an organism (MacKenzie et al. 2002). Occupancy estimation theory uses a detection probability to adjust the proportion of sites occupied to account for species that were present but undetected (MacKenzie et al. 2002). We used our data to estimate the site occupancy of priority species for which we had too few detections to estimate population density. Occupancy estimation requires multiple surveys to the sample unit in time or space (MacKenzie and Royle 2005). Under our sampling framework, we used a removal model to estimate a detection probability from the sequential 1-2 minute sampling intervals. The 16 grid points served as spatial replicates for estimating the proportion of points occupied within the 1-km^2 sampling cells. The assumptions of occupancy estimation are 1) the probabilities of detection and occupancy are constant across the sample units, 2) each point is closed to changes in occupancy over the sampling season, 3) the detection of species at each point are independent and 4) the target species are never falsely detected (MacKenzie et al. 2006).

Observers conducted point counts (Buckland et al. 2001) following protocol established by Leukering (2000) and modified by Hanni et al. (2009). Observers conducted surveys in the morning, from ½-hour before sunrise to 11 AM. At each sample unit observers established an access point (AP) which they recorded with a GPS unit, allowing future technicians to locate the sample unit as quickly as possible. From the AP, the observer navigated to the nearest point within the 16-point grid and determined the most efficient route to survey all points. Observers attempted to survey all 16 points.

At each point, observers conducted a five-minute survey. For every bird detected during the five minute period, we recorded species, sex, horizontal distance from the observer, minute the bird was detected, and type of detection (e.g. call, song or visual). Observers measured distances using high quality laser rangefinders. When it was not possible to measure distance to a bird, observers estimated distance by measuring to some nearby object. Observers recorded the presence of all low density species heard and seen when traveling the 250 meters between points. Observers did not include individual birds detected on a previous point. Observers also recorded birds flying over but not using the immediate surrounding landscape.

We considered all non-independent detections of birds, i.e. flocks or pairs of conspecific birds together in close proximity, as part of a 'cluster' rather than as separate independent observations. Observers recorded clusters by recording the number of birds detected within the cluster along with a letter code to keep track of each distinct cluster.

At the start and end of each 16-point sampling unit, observers recorded time and atmospheric data (i.e., temperature in degrees Fahrenheit, cloud cover, precipitation, and wind speed). We navigated to each point using hand-held Garmin® Global Positioning System (GPS) units. Observers logged all GPS data in Universal Transverse Mercator (UTM) North American Datum 83. Before beginning each 5 minute survey, observers recorded vegetation data, within a 50-m

radius of the point, including structural stage, forest canopy closure, mean canopy height, types and relative proportions of overstory trees, sub-canopy tree species composition, percent coverage and types of shrubs, and types and relative proportions of ground cover. Observers recorded vegetation data prior to the bird data collection to allow birds, potentially disturbed by our approach, time to return to their normal habits prior to the beginning of the point transect survey.

For more detailed information about survey methods, refer to RMBO's *Field Protocol for Spatially Balanced Sampling of Landbird Populations* on our Avian Data Center website: http://www.rmbo.org/PUBLIC/MONITORING/protocols/Field_protocol_for_spacially_balanced_sampling_final_2009.pdf.

Field Personnel

Field personnel in 2009 included five RMBO employees, three WYNDD employees and one National Park Service employee. All technicians had excellent aural and visual bird-identification skills. Technicians completed an intensive five-day training program at the beginning of the field season to ensure full understanding of field protocols, to practice bird identification, and to practice distance estimation in a variety of habitats.

Data Analyses

Distance Analyses

We used the analysis software Distance 6.0 to generate detection probabilities using our point transect data (Thomas et al. *in press*). We generated density estimates for species for which we had at least 60 independent detections (n). We excluded flyovers and low density detections from analyses. We pooled our two samples in BCR 9 with our 78 samples in BCR 10 because of BCR 9's small sample size and the similar management and vegetation characteristics within these areas. The two Shoshone National Forest (SE and SR) strata were combined for analysis and the two Medicine Bow national forest strata (MB) in BCR's 10 and 16 where combined for analysis. The Casper BLM field office comprises portions of BCRs 10 and 17 and these two strata were also combined for analysis. We used Akaike's Information Criterion (AIC) corrected for small sample size (AICc) and model selection theory to select the most parsimonious detection function for each species (Burnham and Anderson 2002). After we calculated detection probabilities in Distance, we used the SPSURVEY package (Kincaid 2008) in Program R (R Development Core Team 2008) to estimate density and its variance for each bird species.

Occupancy Analyses

Under the sampling framework, RMBO used a removal model to estimate a detection probability from the sequential 1-2 minute sampling intervals. The 16 grid points served as spatial replicates for estimating the proportion of points occupied within the sampling cells. We used a multi-scale occupancy model (Nichols et al. 2008) to estimate 1) the proportion of 1-km^2 sampling units occupied by a species (Psi); 2) the proportion of points occupied by a species given presence within the1-km^2 sampling units (Theta); and 3) the probability of detecting a species given presence (p). We constrained Theta and p by holding these parameters constant. Our application of the multi-scale model is analogous to a within-season robust design (Pollock 1982) where the points are the primary samples for estimating Theta and the sampling intervals at each point are the secondary samples for estimating p (Nichols et al. 2008). We considered both Theta and p to be nuisance variables that were important for generating unbiased estimates of Psi. Theta can be considered an availability parameter or the

probability that a species was present and available for sampling at the points (Nichols et al. 2008). We estimated the detection probabilities (p) using a removal model with 3 intervals. Using the five 1-minute intervals recorded during sampling, we binned minutes 1 and 2, and minutes 3 and 4 to meet the assumption of a monotonic decline in the detection rates. After the target species was detected at a point, we set all subsequent sample intervals at that point to missing data. We truncated the data, using only detections within 125 m of the sample points; this allows us to use bird detections over a consistent plot size and ensures that the points were independent (points are spread 250 m apart). Truncating allows us to estimate Theta (the proportion of points occupied within each sample unit).

RMBO used program SAS (PROC NLMIXED, SAS Institute 2008) to estimate the model parameters and account for unequal interval length. Gary White from Colorado State University wrote the initial SAS code for running the multi-scale occupancy models. We combined stratum-level estimates of Psi using a weighted mean indexed by stratum area. We estimated the sampling variance and standard error for the weighted mean of Psi using the delta method (Powell 2007) in program SAS (PROC IML, SAS Institute 2008). We estimated occupancy for all priority species that had a minimum of 10 detections after truncating the data to observations within 125m of each point.

Unless otherwise specified, all birds are reported by common name, in taxonomic order, under the American Ornithological Union guidelines, 7th edition (http://www.aou.org/checklist/north/full.php).

RESULTS

State of Wyoming and BCRs

RMBO completed 131 of 137 (96%) planned transect surveys, WYNDD completed 37 of 35 (106%) of planned surveys and the National Park Service (NPS) completed 2 of 2 (100%) of planned surveys in 2009 (168 of 174 total planned surveys completed; 97% overall completion rate). Technicians completed 100% of 2 planned surveys in BCR 9, 92% of 85 planned surveys in BCR 10, 100% of 39 planned surveys in BCR 16, 94% of 36 planned surveys in BCR 17, and 100% of 16 planned surveys in BCR 18 (Table 1). The most common reason for surveys not being conducted was an inability to survey the transect within the sampling time frame (Table 2). These transects were at lower elevations primarily in grassland and shrub steppe, where birds breed early in the season. We were not granted permission to survey the two planned samples on the Wind River Indian Reservation in 2009.

Field technicians conducted 1,933 point counts among the 168 transects between 17 May and 27 July 2009. We detected 15,258 birds of 155 species across Wyoming's five BCR's (Appendices C-E). We estimated stratum-level densities and population sizes (Tables 3, 5 and 6) of 43 landbird species. We obtained precise density estimates with low coefficients of variation (<50%) in at least one stratum for 33 species in BCRs 9 and 10 combined, 24 species in BCR 16, 14 species in BCR 17 and eight species in BCR 18. A minimum of two samples in each stratum are required to calculate statewide density estimates. Because we did not complete two surveys within three strata in BCR 10 (Table 1), we were unable to estimate densities within BCR, BCR 9 and statewide densities in 2009. We will ensure that the minimum samples are conducted to produce these results in future years.

In 2009, field technicians recorded 77 bird species that hold conservation and management designations in Wyoming (Appendix A and B). We recorded 18 of these species in sufficient

numbers to calculate density estimates. We estimated species occupancy rates for strata that had at least eight sampling units surveyed (n = 11 strata). We present estimates of the proportion of sample units occupied for 17 species of concern for which we were not able to generate density estimates (Tables 4 and 7).

Detailed species accounts including maps, density estimate graphs and tables are available at www.rmbo.org/PUBLIC/MONITORING/speciesAccounts.aspx.

Table 2. Reasons that planned surveys were not completed in Wyoming, 2009.

Reason transect was not surveyed	BCR 9	BCR 10	BCR16	BCR 17	BCR 18
Inaccessible	0	1	0	0	0
Ran out of time	0	2	0	2	0
Denied access	0	2	0	0	0
Unable to contact landowner	0	2	0	0	0
Total	0	7	0	2	0

Table 3. Estimated densities per km2 (D), population sizes (N), percent coefficient of variation of estimates (%CV), and lower (LCL) and upper (UCL) confidence limits of breeding bird species by Bird Conservation Region, Wyoming 2009. BCR 9 and BCR 10 are not included since the minimum number of samples were not completed in at least one stratum.

	BCR 16					BCR 17					BCR 18				
Species	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**
Mourning Dove	1.51	17,481	33	10,331	29,580	2.32	148,737	36	84,189	262,773	1.97	24,170	48	11,495	50,823
Northern Flicker	3.27	37,876	30	23,541	60,941	1.21	77,544	69	27,821	216,132	0.30	3,690	81	1,143	11,913
Western Wood-Pewee	4.13	47,839	33	28,243	81,032	0.31	19,986	56	8,514	46,915	--	--	--	--	--
Dusky Flycatcher	5.16	59,882	65	22,555	158,983	4.20	269,703	54	116,623	623,718	--	--	--	--	--
Western Kingbird	1.48	17,210	47	8,303	35,673	3.02	193,862	49	89,803	418,500	7.35	90,156	36	50,625	160,555
Warbling Vireo	12.11	140,366	45	69,174	284,826	0.91	58,597	25	39,341	87,277	--	--	--	--	--
Clark's Nutcracker	0.66	7,661	33	4,534	12,945	--	--	--	--	--	0.57	7,048	35	4,050	12,265
Black-billed Magpie	0.33	3,821	49	1,783	8,190	0.49	31,352	80	9,911	99,177	0.15	1,873	60	750	4,679
Common Raven	0.88	10,215	21	7,210	14,472	0.59	38,076	33	22,407	64,704	46.15	565,756	27	368,547	868,492
Horned Lark	20.52	237,900	34	139,059	406,996	57.81	3,709,634	50	1,704,182	8,075,069	--	--	--	--	--
Black-capped Chickadee	1.34	15,572	62	6,109	39,691	11.42	732,487	68	265,055	2,024,252	--	--	--	--	--
Mountain Chickadee	41.59	482,249	28	306,914	757,749	0.21	13,203	88	3,783	46,084	--	--	--	--	--
Red-breasted Nuthatch	4.94	57,235	30	35,097	93,337	1.60	102,356	46	49,627	211,111	0.16	1,954	83	593	6,435
Rock Wren	2.58	29,885	26	19,763	45,192	0.79	50,465	48	23,910	106,513	0.98	11,987	83	3,650	39,364
House Wren	14.59	169,100	43	85,424	334,738	5.20	333,760	80	104,506	1,065,930	--	--	--	--	--
Ruby-crowned Kinglet	11.34	131,460	26	85,726	201,594	0.18	11,380	32	6,830	18,961	0.80	9,787	80	3,062	31,284
Mountain Bluebird	9.26	107,365	35	61,341	187,921	2.69	172,804	51	78,704	379,410	--	--	--	--	--
Swainson's Thrush	1.05	12,170	55	5,246	28,232	0.84	54,109	83	16,357	178,996	0.78	9,551	68	3,481	26,208
Hermit Thrush	7.72	89,494	20	64,256	124,646	--	--	--	--	--	0.22	2,746	84	826	9,124
American Robin	19.99	231,820	24	156,819	342,691	19.32	1,239,367	36	694,201	2,212,661	1.62	19,827	64	7,542	52,125
Sage Thrasher	0.76	8,818	63	3,411	22,795	0.41	26,015	87	7,579	89,294	--	--	--	--	--
Yellow Warbler	1.11	12,851	40	6,774	24,381	1.10	70,351	77	22,965	215,517	--	--	--	--	--
Yellow-rumped Warbler	25.33	293,707	27	190,359	453,163	12.60	808,659	58	334,429	1,955,359	0.00	56	102	14	224
Ovenbird	--	--	--	--	--	1.35	86,496	17	65,325	114,529	2.33	28,590	69	10,265	79,627
Western Tanager	4.97	57,641	34	33,223	100,005	2.06	132,407	52	58,819	298,063	--	--	--	--	--
Green-tailed Towhee	12.00	139,160	25	92,433	209,509	2.64	169,552	66	63,103	455,572	0.01	93	100	24	366

	BCR 16					BCR 17					BCR 18				
Species	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**	**D[1]**	**N**	**%CV**	**LCL(N)**	**UCL(N)**
Spotted Towhee	2.44	28,246	49	13,197	60,454	0.29	18,672	66	6,918	50,397	8.65	106,033	85	31,608	355,705
Chipping Sparrow	14.97	173,527	61	68,415	440,135	17.04	1,093,442	44	547,701	2,182,970	1.09	13,371	50	6,171	28,971
Brewer's Sparrow	17.20	199,453	42	102,741	387,202	54.28	3,482,966	50	1,604,665	7,559,865	5.95	72,966	43	36,803	144,662
Vesper Sparrow	1.50	17,384	63	6,749	44,776	9.45	606,263	73	207,667	1,769,924	--	--	--	--	--
Lark Sparrow	2.93	33,982	35	19,324	59,760	5.26	337,608	53	149,637	761,706	22.89	280,577	38	153,732	512,081
Sage Sparrow	0.80	9,226	62	3,627	23,468	1.02	65,691	69	23,646	182,494	15.93	195,255	64	74,284	513,226
Lark Bunting	7.11	82,390	81	25,748	263,639	46.17	2,962,444	39	1,589,570	5,521,038	--	--	--	--	--
Lincoln's Sparrow	2.63	30,539	59	12,422	75,078	--	--	--	--	--	46.29	567,451	9	490,223	656,845
Grasshopper Sparrow	--	--	--	--	--	5.89	378,081	70	133,698	1,069,166	7.07	86,659	84	26,049	288,294
White-crowned Sparrow	1.20	13,889	90	3,930	49,082	--	--	--	--	--	--	--	--	--	--
Dark-eyed Junco	28.97	335,845	16	258,477	436,371	9.81	629,485	57	262,009	1,512,357	--	--	--	--	--
Western Meadowlark	11.12	128,936	20	92,453	179,815	34.02	2,183,110	19	1,613,845	2,953,176	--	--	--	--	--
Brewer's Blackbird	5.74	66,576	40	35,079	126,355	5.66	363,054	75	120,829	1,090,869	--	--	--	--	--
Brown-headed Cowbird	6.34	73,488	38	40,150	134,508	13.68	878,021	50	403,982	1,908,306	--	--	--	--	--
Pine Siskin	37.38	433,424	31	262,557	715,487	1.92	123,503	68	44,592	342,053	--	--	--	--	--

[1] D = (birds/km2);

Forest Service Lands

Field technicians surveyed 86 of 84 (102%) assigned transects on National Forests throughout Region 2 within Wyoming in 2009 (Table 1). Two extra transects was completed by WYNDD on Medicine Bow and Thunder Basin. Technicians conducted 977 point counts within these 84 transects between 21 May and 27 July 2009. Technicians detected 8,600 birds of 40 species on Forest Service Lands.

RMBO estimated National Forest-wide density and population sizes of 40 species (Table 4); 18 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). We estimated species densities and population sizes for individual National Forests and Thunder Basin National Grassland within Regions 2 and 4. RMBO estimated the proportion of transects occupied (Psi) by 17 MIS (Appendix A) or regionally sensitive species (Appendix B) National Forest-wide (Table 5).

Region 2

Big Horn

Field technicians surveyed 10 of 10 (100%) assigned transects on Big Horn National Forest (Fig. 4). Technicians conducted 117 point counts within these 10 transects between 17 June and 8 July 2009. RMBO estimated National Forest-wide density and population sizes of 28 species (Table 4); 11 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). The data yielded robust density estimates (CV < 50%) for 14 of these species (Table 4). RMBO estimated the proportion of transects occupied (Psi) by 12 sensitive species in Big Horn National Forest (Table 5).

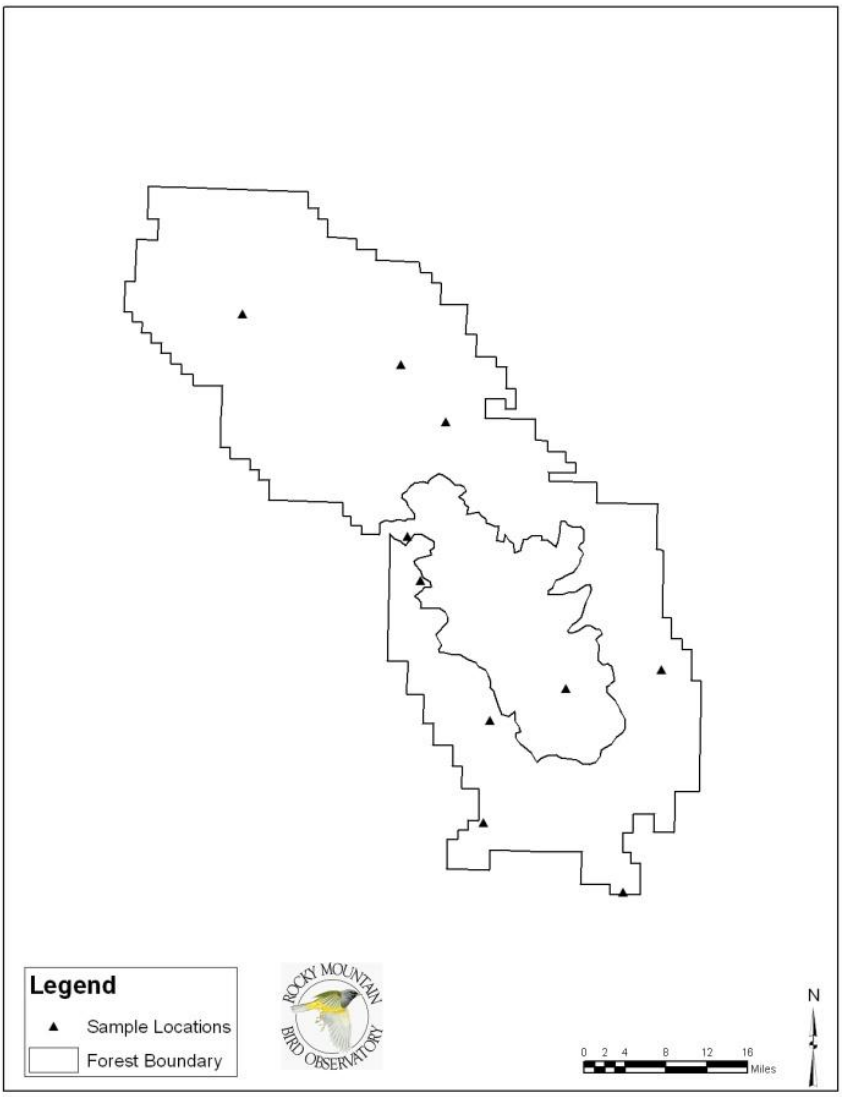

Figure 4. Sample locations on the Big Horn National Forest in 2009.

Black Hills

Field technicians surveyed 10 of 10 (100%) assigned transects on Black Hills National Forest (Fig. 5). Technicians conducted 115 point counts within these 10 transects between 25 May and 9 July 2009. RMBO estimated National Forest-wide density and population sizes of 24 species (Table 4); 11 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). The data yielded robust density estimates (CV < 50%) for 12 of these species (Table 4). RMBO estimated the proportion of transects occupied (Psi) by 9 priority species in Black Hills National Forest (Table 5).

The Black Hills National Forest occurs in both Wyoming as well as South Dakota, with the majority of this management unit occurring in South Dakota. The 2009 monitoring that was implemented on the Black Hills National Forest included extensive sampling on the South Dakota portion of the National Forest. This information is not presented in this report, however the data combined for the entire National Forest is presented in the 2009 report prepared for Bird Conservation Region 17. This information can be found at the following link: http://www.rmbo.org/dataentry/postingArticle/dataBox/BCR17_final_report.pdf .

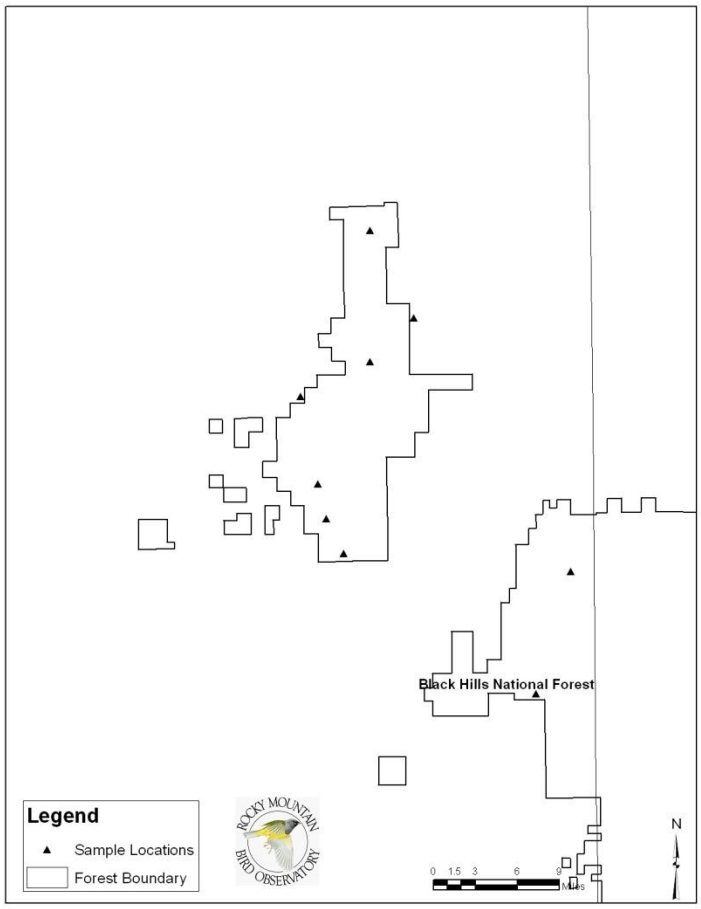

Figure 5: Sample locations on the Wyoming portion of the Black Hills National Forest in 2009.

Medicine Bow

Field technicians surveyed 26 of 25 (104%) assigned transects on Medicine Bow National Forest (Fig. 6). The data for the Medicine Bow National Forest includes 2 samples from the small portion of the Forest in BCR 10 and 26 samples from the BCR 16 portion of the National Forest. These data are pooled in the analysis for this unit, in order to present a management unit-wide estimate. Technicians conducted 253 point counts within these 26 transects between 9 June and 15 July 2009. RMBO estimated National Forest-wide density and population sizes of 32 species (Table 4); 12 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). The data yielded robust density estimates (CV < 50%) for 21 of these species (Table 4). RMBO estimated the proportion of transects occupied (Psi) by nine priority species in Medicine Bow National Forest (Table 5).

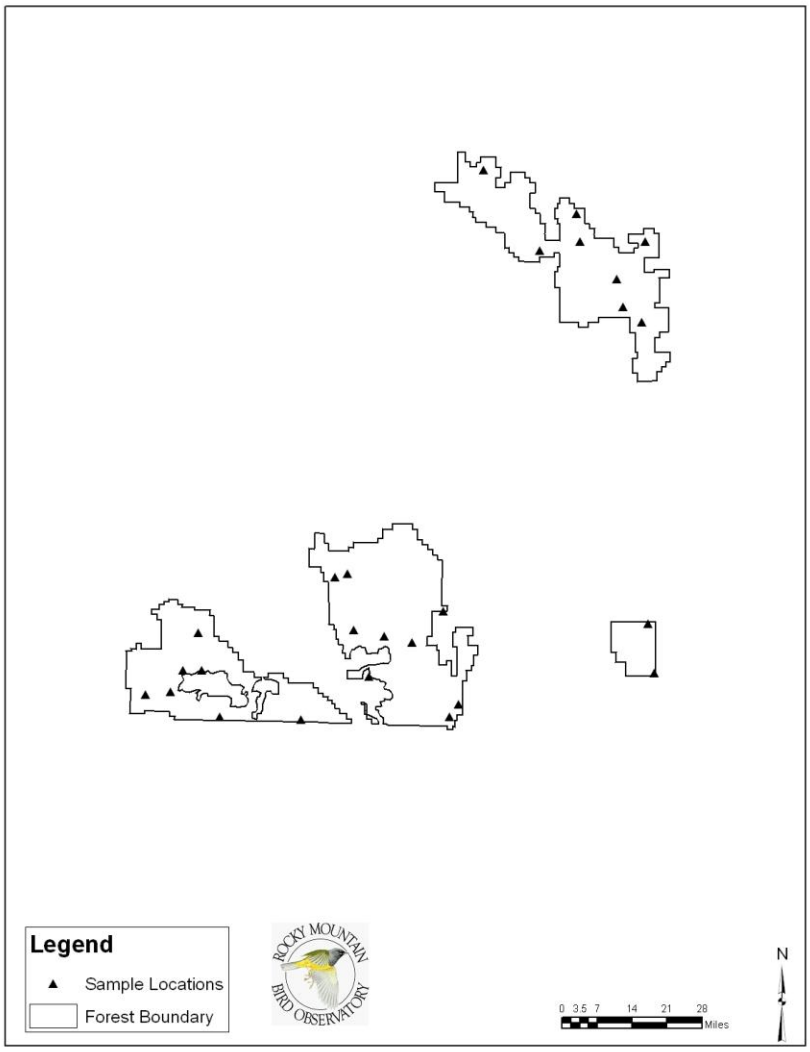

Figure 6: Sample locations on the Medicine Bow National Forest in 2009.

Shoshone

Field technicians surveyed 25 of 25 (100%) assigned transects on Shoshone National Forest (Fig. 7). Technicians conducted 281 point counts within these 25 transects between 22 June and 27 July 2009. The Shoshone National Forest was divided into 2 strata due to accessibility concerns (managed areas and roadless-wilderness areas) and the associated higher costs of more remote field work. For 2009 the majority of the sampling effort (23) was put in the more easily accessed stratum and only 2 samples were placed in the roadless-wilderness portion of the National Forest. This was done in 2009 since it was the first year of this new design; however the proportional distribution of sampling units may shift in future years depending on local needs. RMBO estimated National Forest-wide density and population sizes of 40 species (Table 4); 18 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). The data yielded robust density estimates (CV < 50%) for 12 of these species (Table 4). RMBO estimated the proportion of transects occupied (Psi) by 14 priority species in Shoshone National Forest (Table 5).

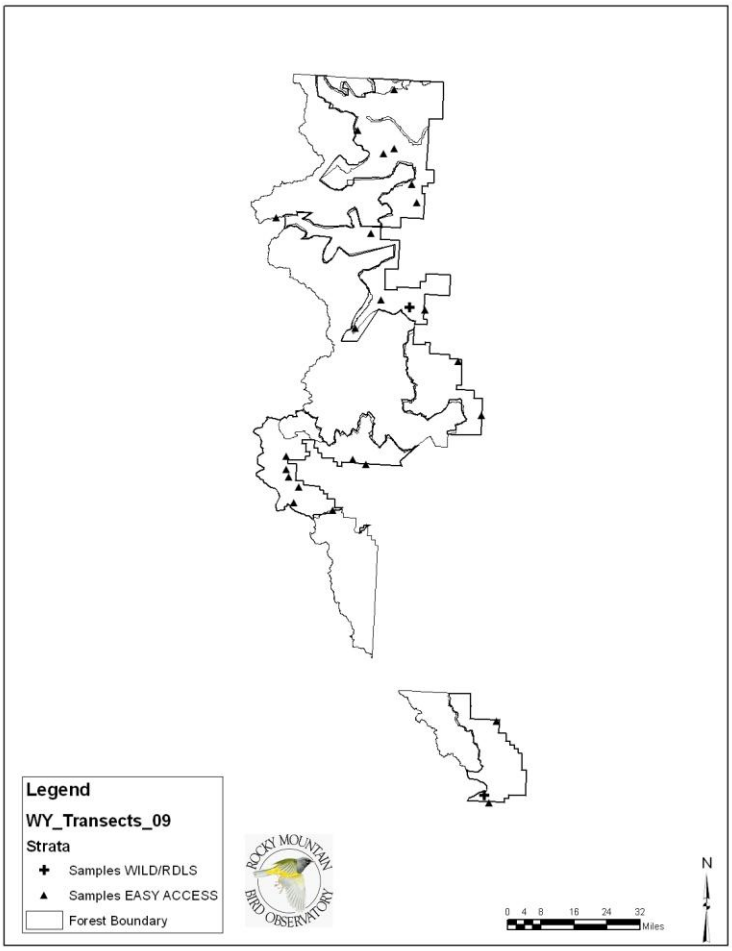

Figure 7: Sample locations on the Big Horn National Forest in 2009.

Thunder Basin

Field technicians surveyed 11 of 10 (110%) assigned transects on Thunder Basin National Grassland (Fig. 8). Technicians conducted 136 point counts within these 11 transects between 21 May and 29 May 2009. RMBO estimated National Forest-wide density and population sizes of 15 species (Table 4); nine of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A). The data yielded robust density estimates (CV < 50%) for seven of these species (Table 4). RMBO estimated the proportion of transects occupied (Psi) by one priority species in Thunder Basin National Grassland (Table 5).

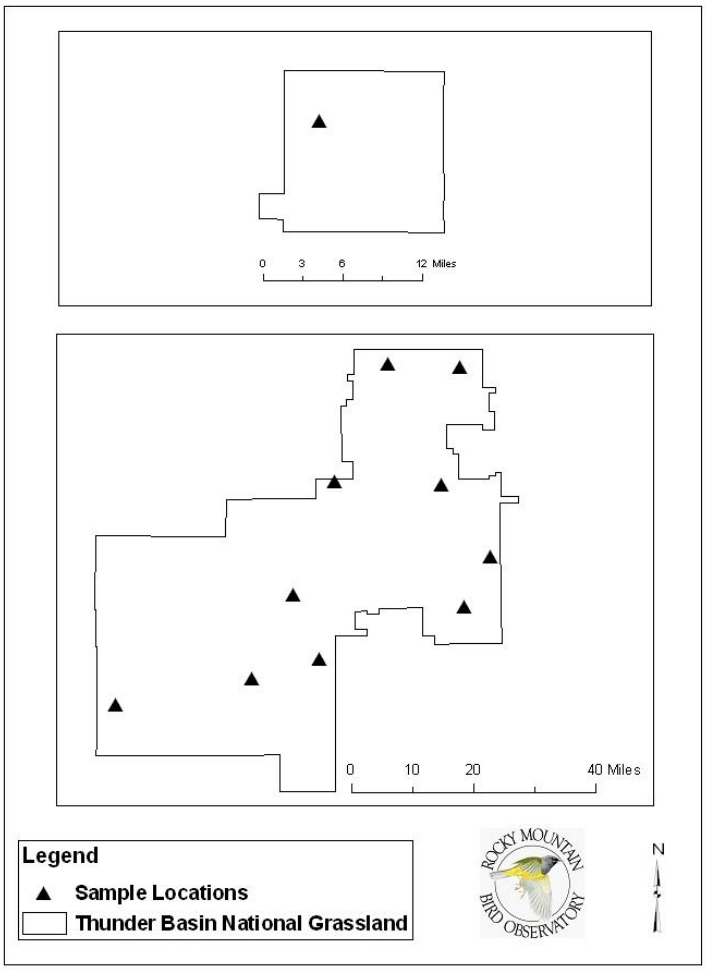

Figure 8: Sample locations on the Thunder Basin National Forest in 2009.

Region 4

During 2009 National Forest Management Units in US Forest Service Region 4 did not participate in the Monitoring Wyoming Birds Program. The partnership collaborated to ensure that the statistical minimum amount of sampling occurred on these lands so that the goals of the broader partnership would still be achieved. However the level of samples that occurred on individual Region 4 National Forests was too low to provide stratum level estimates for priority species on these units. In total this resulted in only 6 sampling units on USFS Region 4 National Forest Lands in Wyoming.

In WY-BCR 10, all Region 4 management units were pooled and presented as one stratum. This pooled stratum included the Bridger Teton National Forest, in this pooled stratum; the statistical minimum of 2 samples was selected to be sampled. These happened to occur on The Bridger Teton National Forest.

The small portion of BCR 9 in Wyoming is dominated by lands managed by the Targhee National Forest. Two sampling units were sampled in 2009 in WYBCR9, these samples occurred on this National Forest.

Finally, there is a small portion of the Wasatch National Forest in the BCR-16 portion of Wyoming. This portion of the Wasatch was set up as a stratum, since the rest of WY-BCR16 was fully stratified. Again, the statistical minimum of 2 samples was placed and conducted in this stratum.

In future years of the monitoring partnership it is hoped that USFS Region 4 units will be able to participate. This would allow for stratum level estimates such as those presented for the Region 2 National Forests as well as contribute to the broader goals of the monitoring partnership.

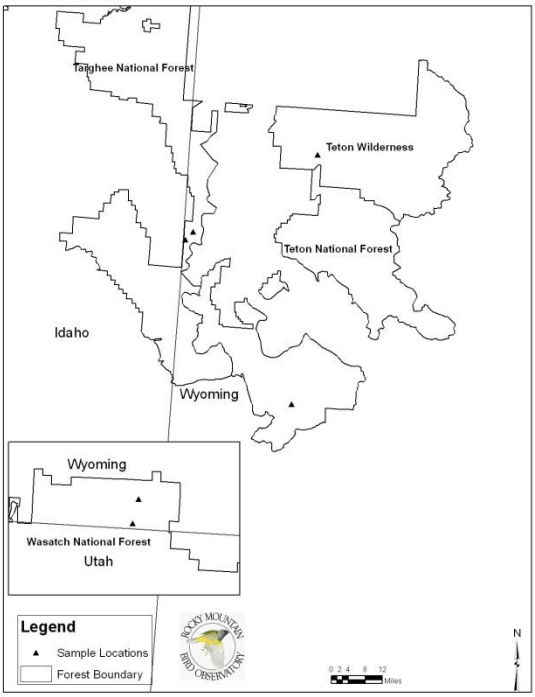

Figure 9: Sample locations within Region 4 of the National Forest in 2009**.**

Table 4. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species within USDA Forest Service National Forests and National Grasslands, Wyoming, 2009. S indicates the number of transects surveyed. Priority species are in bold.

	Big Horn NF (S=10)				Black Hills National Forest (S=10)				Medicine Bow NF (S=25)				Shoshone NF (S=25)			
Species	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**
Mourning Dove	--	--	--	0	0.13	144	93	1	1.36	8,323	43	35	0.46	4,746	38	38
Northern Flicker	1.77	8,334	43	6	3.30	3,579	54	11	6.20	37,809	35	90	0.84	8,774	23	31
Western Wood-Pewee	0.40	1,904	83	1	8.63	9,368	33	21	7.23	44,087	33	74	0.26	2,716	40	7
Dusky Flycatcher	5.33	25,099	48	7	13.94	15,120	25	18	1.95	11,885	58	32	9.58	99,752	90	18
Warbling Vireo	3.05	14,375	63	5	--	--	--	0	14.18	86,500	37	151	19.92	207,434	92	38
Clark's Nutcracker	3.18	14,969	41	12	54.01	58,597	25	87	1.62	9,857	36	36	4.03	41,936	75	45
Black-billed Magpie	0.07	332	87	1	--	--	--	0	--	--	--	0	0.16	1,626	37	24
Common Raven	1.39	6,551	36	19	--	--	--	0	0.82	5,023	39	40	0.44	4,567	25	65
Horned Lark	1.09	5,150	88	2	--	--	--	0	1.88	11,476	78	11	2.64	27,490	54	53
Black-capped Chickadee	--	--	--	0	--	--	--	27	--	--	--	0	0.62	6,496	66	8
Mountain Chickadee	69.04	325,315	22	61	--	--	--	0	60.81	371,083	19	273	93.63	974,829	91	100
Red-breasted Nuthatch	4.45	20,981	52	7	45.30	25,203	17	70	7.08	43,194	27	78	15.67	163,107	91	30
Rock Wren	0.96	4,501	56	6	1.13	49,152	83	7	5.11	31,192	35	76	3.34	34,784	90	30
House Wren	6.35	29,913	43	13	6.46	1,230	57	13	17.49	106,710	33	124	4.73	49,241	77	26
Ruby-crowned Kinglet	37.80	178,110	21	66	10.49	7,008	32	18	24.51	149,575	26	304	25.01	260,428	77	118
Mountain Bluebird	7.71	36,328	79	4	8.19	11,380	56	21	--	--	--	0	0.87	9,019	36	24
Swainson's Thrush	--	--	--	0	5.29	8,888	56	9	1.86	11,378	54	12	4.03	41,924	59	36
Hermit Thrush	15.47	72,872	32	54	--	--	--		13.70	83,569	21	276	21.11	219,758	91	88
American Robin	42.07	198,239	26	63	68.25	5,745	25	114	37.81	230,727	26	126	31.57	328,684	82	125
Sage Thrasher	--	--	--	0	--	--	--	0	--	--	--	0	0.06	644	64	3
Yellow Warbler	0.20	950	86	1	1.03	74,055	43	5	1.94	11,853	33	40	1.03	10,749	75	16
Yellow-rumped Warbler	45.45	214,172	21	73	25.34	1,113	23	40	44.68	272,653	22	410	15.28	159,050	23	108
Ovenbird	--	--	--	0	79.72	27,492	17	142	--	--	--	0	0.05	530	83	1
Western Tanager	1.82	8,553	46	4	17.08	86,496	34	37	11.05	67,419	30	125	11.01	114,623	95	26

Species	Big Horn NF (S=10)				Black Hills National Forest (S=10)				Medicine Bow NF (S=25)				Shoshone NF (S=25)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Green-tailed Towhee	3.88	18,293	70	10	--	18,535	0	0	20.69	126,250	31	96	0.97	10,065	46	27
Spotted Towhee	0.59	2,783	84	2	4.51	4,890	53	15	2.13	13,004	53	28	1.92	19,996	60	31
Chipping Sparrow	16.64	78,408	26	22	70.80	76,813	25	92	7.17	43,734	40	68	34.92	363,556	90	66
Brewer's Sparrow	--	--	--	0			0	0	0.29	1,740	84	12	4.68	48,756	38	78
Vesper Sparrow	--	--	--	0	4.71	5,111	56	17	0.86	5,269	59	41	1.78	18,568	41	71
Lark Sparrow	--	--	--	0	1.74	1,892	61	5	3.23	19,702	59	24	0.16	1,646	90	5
Sage Sparrow	0.47	2,210	85	1	--	--	--	0	--	--	--	0	0.09	901	90	2
Lark Bunting	--	--	--	0	--	--	--	0	--	--	--	0	0.16	1,667	84	7
Savannah Sparrow	--	--	--	0	--	--	--	0	--	--	--	0	0.19	1,991	94	1
Lincoln's Sparrow	8.13	38,290	72	7	--	--	--	0	5.75	35,088	64	35	14.62	152,176	101	18
White-crowned Sparrow	2.93	13,821	89	5	--	--	--	0	7.71	47,048	76	19	6.71	69,854	20	45
Dark-eyed Junco	94.73	446,363	15	109	44.21	47,967	28	50	57.16	348,763	18	349	50.38	524,558	66	115
Western Meadowlark	--	--	--	0	0.36	396	82	2	1.39	8,453	71	66	0.86	8,949	41	52
Brewer's Blackbird	--	--	--	0	--	--	--	0	5.06	30,893	50	29	1.29	13,415	55	16
Brown-headed Cowbird	0.84	3,947	94	3	36.60	39,713	20	50	3.34	20,372	43	20	0.07	691	89	1
Pine Siskin	28.29	133,320	30	17	113.83	123,503	68	11	57.49	350,786	30	132	169.71	1,767,020	116	34

Table 4 Continued

Species	Targhee-BCR 9 (S=2)				Thunder Basin NG (S=10)				USFS Region 4 (S=2)				Wasatch NF (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Mourning Dove	2.54	302	32	4	3.02	13,657	29	27	--	--	--	0	--	--	--	0
Northern Flicker	4.31	513	54	3	--	--	--	0	3.63	59,422	37	2	--	--	--	0
Western Wood-Pewee	35.46	4,220	101	18	3.02	2,549	29	27	--	--	--	0	--	--	--	0
Dusky Flycatcher	3.71	441	101	1	--	--	--	0	--	--	--	0	--	--	--	0
Warbling Vireo	65.44	7,787	49	22	--	--	--	0	7.51	122,998	100	2	13.39	2,409	100	6
Clark's Nutcracker	7.74	921	101	6	--	--	--	0	4.89	80,048	101	3	--	--	--	0
Black-billed Magpie	--	--	--	0	0.56	169,997	90	3	--	--	--	0	--	--	--	0
Common Raven	0.71	85	101	2	--	--	--	0	--	--	--	0	1.07	193	52	4

	Targhee-BCR 9 (S=2)				Thunder Basin NG (S=10)				USFS Region 4 (S=2)				Wasatch NF (S=2)			
Species	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**
Horned Lark	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Black-capped Chickadee	49.47	5,887	105	12	--	--	--	0	--	--	--	0	--	--	--	0
Mountain Chickadee	158.49	18,860	77	13	37.61	13,203	27	80	190.60	3,119,708	56	25	41.38	7,449	41	10
Red-breasted Nuthatch	93.03	11,070	26	30	--	--	--	0	38.59	631,603	65	11	13.95	2,512	34	6
Rock Wren	--	--	--	0	2.92	9,286	88	3	--	--	--	0	--	--	--	0
House Wren	49.99	5,949	94	21	--	--	--	0	--	--	--	0	--	--	--	0
Ruby-crowned Kinglet	94.93	11,296	40	34	2.05	13,782	37	15	31.74	519,530	100	9	10.47	1,885	100	5
Mountain Bluebird	5.37	639	60	3	--	--	--	0	--	--	--	0	2.68	483	26	2
Swainson's Thrush	59.20	7,044	49	21	--	--	--	0	14.24	233,128	103	4	--	--	--	0
Hermit Thrush	--	--	--	0	--	--	--	0	21.16	346,393	5	12	6.28	1,131	33	6
American Robin	66.52	7,916	37	24	--	--	--	0	21.01	343,820	65	5	6.24	1,122	102	3
Sage Thrasher	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Yellow Warbler	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Yellow-rumped Warbler	51.60	6,141	49	17	--	--	--	0	42.18	690,329	15	11	22.77	4,098	23	10
Ovenbird	--	--	--		--	--	--	0	--	--	--	0	--	--	--	0
Western Tanager	66.37	7,898	73	30	--	--	--	0	55.89	914,818	65	20	--	--	--	0
Green-tailed Towhee	9.46	1,126	100	5	--	--	--	0	--	--	--	0	--	--	--	0
Spotted Towhee	10.08	1,199	100	7	--	--	--	0	3.64	59,539	100	2	--	--	--	0
Chipping Sparrow	88.49	10,531	14	24	--	--	--	0	9.32	152,471	101	2	--	--	--	0
Brewer's Sparrow	--	--	--	0	3.05	26,470	88	12	--	--	--	0	--	--	--	0
Vesper Sparrow	--	--	--	0	5.86	131,585	88	9	--	--	--	0	--	--	--	0
Lark Sparrow	--	--	--	0	29.11	27,536	48	51	--	--	--	0	--	--	--	0
Sage Sparrow	--	--	--	0	6.09	5,332	44	26	--	--	--	0	--	--	--	0
Lark Bunting	--	--	--	0	1.18	557,429	52	4	--	--	--	0	--	--	--	0
Savannah Sparrow	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Lincoln's Sparrow	28.30	3,367	113	5	--	--	--	0	7.15	117,005	113	1	--	--	--	0
White-crowned Sparrow	71.49	8,508	80	25	--	--	--	0	21.67	354,756	101	6	--	--	--	0
Dark-eyed Junco	139.81	16,638	24	33	123.32	36,263	19	578	240.82	3,941,816	24	45	47.66	8,579	9	15
Western Meadowlark	--	--	--	0	8.02	265,517	68	17	--	--	--	0	--	--	--	0

Species	Targhee-BCR 9 (S=2)				Thunder Basin NG (S=10)				USFS Region 4 (S=2)				Wasatch NF (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Brewer's Blackbird	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Brown-headed Cowbird	14.03	1,670	30	4	58.74	33,955	10	381	--	--	--	0	--	--	--	0
Pine Siskin	367.12	43,687	28	22	7.51	55,957	46	10	249.17	4,078,374	67	9	6.56	1,181	102	1

[1] D = (birds/km2);
[2] n = number of independent detections used to estimate D and N;

Table 5. Estimated site occupancy (Psi; proportion of sample units occupied), percent coefficient of variation of Psi (%CV) and number of transects with detections (n Tran) of priority species on USDA Forest Service National Forest and National Grasslands, 2009

Species	Big Horn NF (S=10)			Black Hills NF (S=10)			Medicine Bow NF (25)			Shoshone NF (25)			Thunder Basin NG (10)		
	Psi	%CV	N tran	Psi	%CV	N tran	Psi	%CV	N tran	Psi	%CV	N tran	Psi	%CV	N tran
American Three-toed Woodpecker	0.53	75	2	--	--	0	--	--	7	--	--	0	--	--	0
Broad-tailed Hummingbird	0.13	95	1	--	--	0	--	--	8	0.59	69	3	--	--	0
Brown Creeper	0.76	33	5	0.28	64	2	0.06	99	1	0.09	33	7	--	--	0
Cassin's Finch	0.27	64	2	--	--	0	--	--	0	0.63	63	8	--	--	0
Cordilleran Flycatcher	0.72	33	5	0.58	40	4	--	--	0	0.01	99	1	--	--	0
Golden-crowned Kinglet	0.13	96	1	--	--	0	0.15	56	3	0.01	99	1	--	--	0
Loggerhead Shrike	--	--	0	--	--	0	--	--	0	--	--	0	0.51	74	2
MacGillivray's Warbler	--	--	0	0.43	49	3	0.57	24	11	0.56	68	3	--	--	0
McCown's Longspur	--	--	0	--	--	0	--	--	0	--	--	0	--	--	0
Olive-sided Flycatcher	--	--	0	--	--	0	0.16	46	4	0.01	98	1	--	--	0
Plumbeous Vireo	0.15	96	1	0.59	40	4	0.23	49	4	0.03	69	2	--	--	0
Red Crossbill	0.24	63	2	0.81	21	7	0.18	46	4	0.05	40	4	--	--	0
Red-naped Sapsucker	0.16	96	1	0.78	34	5	--	--	8	0.06	48	4	--	--	0
Song Sparrow	--	--	0	0.17	96	1	0.30	47	4	0.06	48	4	--	--	0
Townsend's Solitaire	0.84	32	5	0.85	32	5	0.20	56	3	0.80	64	8	--	--	0
White-throated Swift	0.11	95	1	0.11	95	1	--	--	0	0.02	68	2	--	--	0
Wilson's Warbler	0.13	95	1	--	--	0	0.21	48	4	0.56	71	2	--	--	0

National Parks

Field technicians surveyed 4 of 4 (100%) assigned transects on National Park lands in Wyoming in 2009 (Table 1). Technicians conducted 50 point counts within these four transects between 12 June and 17 July 2009. RMBO estimated density and population sizes of 31 species; 12 of these are priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A).

Yellowstone

One field technician surveyed 2 of 2 (100%) assigned transects in Yellowstone National Park. The technician conducted 32 point counts within these two transects between 2 July and 17 July 2009. RMBO estimated park-wide density and population sizes of 23 species (Table 6); seven of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A and B). The data yielded robust density estimates (CV < 50%) for 9 of these species (Table 6). With an increased sample size in Yellowstone, or within the Greater Yellowstone Inventory and Monitoring Network, we will be able to generate density and population sizes for more species of particular park concern and provide occupancy estimates for additional species. Yellowstone is a nationally recognized Important Bird Area.

Grand Teton

One park service employee surveyed 2 of 2 (100%) assigned transects in Grand Teton National Park. Technicians conducted 18 point counts within these two transects between 12 June and 15 July 2009. RMBO estimated park-wide density and population sizes of 26 species (Table 6); 12 of these are USFS priority species classified as either sensitive species or management indicator species (MIS) in US Forest Service Region 2 (Appendix A and B). The data did not yield robust density estimates (CV < 50%) for any species, likely because of the low sampling effort. With an increased sample size in Grand Teton, or within the Greater Yellowstone Inventory and Monitoring Network, we will be able to generate density and population sizes for more species of particular park concern and provide occupancy estimates for additional species. Grand Teton and the Teton basin is a nationally recognized Important Bird Area.

Table 6. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on National Park Service lands, 2009. S indicates the number of transects surveyed. Priority species are in bold.

	Yellowstone NP (S=2)				Grand Teton NP (S=2)			
Species	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**
Mourning Dove	0.48	3610.65	1.01	1	--	--	--	0
Northern Flicker	--	--	--	0	7.66	6560.45	1.00	4
Western Wood-Pewee	4.43	33651.3	1.01	3	21.01	17987.3	1.01	8
Dusky Flycatcher	5.56	42245	0.12	2	4.95	4233.9	1.01	1
Warbling Vireo	4.46	33873.6	1.00	2	3.97	3394.89	1.00	1
Clark's Nutcracker	7.74	58787.5	0.53	8	3.44	2945.92	1.01	2
Common Raven	0.54	4062.17	1.01	2	0.95	814.24	1.01	2
Black-capped Chickadee	--	--	--	0	--	47050.5	1.05	10
Mountain Chickadee	80.28	609512	0.13	19	7.36	6297.32	1.01	1
Red-breasted Nuthatch	27.91	211884	0.07	12	16.54	14157	1.00	4
House Wren	1.79	13555.1	1.00	1	28.57	24453.5	1.00	9

Species	Yellowstone NP (S=2)				Grand Teton NP (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Ruby-crowned Kinglet	37.69	286157	0.13	18	14.89	12746.4	1.00	4
Mountain Bluebird	1.34	10192.2	1.03	1	2.39	2042.98	1.03	1
Swainson's Thrush	29.60	224712	1.03	14	--	--	--	0
Hermit Thrush	12.57	95396.7	0.33	12	1.86	1593.48	1.00	1
American Robin	37.42	284064	0.69	18	7.39	6326.58	1.02	1
Sage Thrasher	--	--	--	0	13.09	11203.4	1.01	9
Yellow-rumped Warbler	45.53	345667	0.61	20	4.05	3464.36	1.01	1
Western Tanager	9.96	75582.3	0.23	6	5.90	5050.03	1.03	2
Green-tailed Towhee	--	--	--	0	5.05	4320.19	1.00	2
Spotted Towhee	3.24	24595.5	0.33	3	--	--	--	0
Chipping Sparrow	35.95	272939	0.40	13	--	--	--	0
Brewer's Sparrow	--	--	--	0	112.13	95987.1	1.02	26
Vesper Sparrow	--	--	--	0	17.70	15153.8	1.01	10
Savannah Sparrow	477.64	3626236	1.04	63	--	--	--	0
Lincoln's Sparrow	29.71	225563	1.13	7	15.09	12918	1.13	2
White-crowned Sparrow	2.14	16283.3	1.01	1	3.81	3263.91	1.01	1
Dark-eyed Junco	60.37	458355	0.37	19	62.14	53190.7	1.00	11
Western Meadowlark	--	--	--	0	8.15	6980.18	1.00	7
Brown-headed Cowbird	--	--	--	0	4.68	4003.4	1.00	1
Pine Siskin	213.60	1621666	0.47	13	366.31	313561	2.59	3

[1] D = (birds/km2);
[2] n = number of independent detections used to estimate D and N.

BLM Lands

Field technicians surveyed 86 of 84 (100%) assigned transects on Bureau of Land Management lands throughout Wyoming in 2009 (Table 1). Technicians conducted 558 point counts within these 43 transects between 17 May and 3 July 2009. Technicians detected 3,686 birds of 97 species on Bureau of Land Management lands.

RMBO estimated density and population sizes of 35 species; 18 of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). We estimated species densities and population sizes for individual field offices or in some cases, within all BLM lands of an individual BCR. RMBO estimated the proportion of transects occupied (Psi) by 2 MIS (Appendix A) on Rawlins and Rocksprings field office lands (Table 7).

BLM BCR 18

Field technicians surveyed 2 of 2 (100%) assigned transects on Bureau of Land Management lands throughout BCR 18 in 2009 (Table 1). Technicians conducted 19 point counts within these 2 transects between 19 May and 2 June 2009. Technicians detected 123 birds of 18 species on BCR 18 Bureau of Land Management lands. RMBO estimated density and population sizes of nine species (Table 6); five of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department

of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for 2 species (Table 6).

BLM BCR 16

Field technicians surveyed 2 of 2 (100%) assigned transects on Bureau of Land Management lands throughout BCR 16 in 2009 (Table 1). Technicians conducted 21 point counts within these 2 transects between 17 May and 15 June 2009. Technicians detected 160 birds of 29 species on BCR 18 Bureau of Land Management lands. RMBO estimated density and population sizes of 11 species (Table 6); seven of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data did not yield robust density estimates (CV < 50%) for any species (Table 6).

Buffalo

Field technicians surveyed 3 of 4 (100%) assigned transects on Buffalo Bureau of Land Management lands within BCRs 10 and 17 in 2009 (Table 1). Technicians conducted 28 point counts within these 3 transects between 11 June and 3 July 2009. Technicians detected 249 birds of 36 species on Buffalo field office Bureau of Land Management lands. RMBO estimated density and population sizes of 14 species (Table 6); two of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for two species (Table 6).

Casper

Field technicians surveyed 4 of 4 (100%) assigned transects on Casper Bureau of Land Management lands throughout BCRs 10 and 17 in 2009 (Table 1). Technicians conducted 52 point counts within these 4 transects between 20 May and 23 June 2009. Technicians detected 336 birds of 28 species on Casper field office Bureau of Land Management lands. RMBO estimated density and population sizes of 16 species (Table 6); 10 of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for 3 species (Table 6).

Kemmerer

Field technicians surveyed 2 of 2 (100%) assigned transects on Kemmerer Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 28 point counts within these two transects between 5 June and 6 June 2009. Technicians detected 136 birds of 15 species on Kemmerer field office Bureau of Land Management lands. RMBO estimated density and population sizes of seven species (Table 6); six of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for 2 species (Table 6).

Lander

Field technicians surveyed 2 of 2 (100%) assigned transects on Lander Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 31 point counts within these two transects between 27 May and 28 May 2009. Technicians detected 349 birds of 47 species on Lander field office Bureau of Land Management lands. RMBO estimated density and population sizes of 20 species (Table 6); 11 of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming

Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for six species (Table 6).

Newcastle

Field technicians surveyed 2 of 2 (100%) assigned transects on Newcastle Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 12 point counts within these two transects between 3 June and 23 June 2009. Technicians detected 95 birds of nine species on Newcastle field office Bureau of Land Management lands. RMBO estimated density and population sizes of three species (Table 6); all of which are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for one species (Table 6).

Pinedale

Field technicians surveyed 8 of 8 (100%) assigned transects on Pinedale Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 128 point counts within these eight transects between 3 June and 22 June 2009. Technicians detected 825 birds of 16 species on Pinedale field office Bureau of Land Management lands. RMBO estimated density and population sizes of seven species (Table 6); all of which are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for four species (Table 6).

Rawlins

Field technicians surveyed 8 of 8 (100%) assigned transects on Rawlins Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 109 point counts within these eight transects between 24 May and 15 June 2009. Technicians detected 711 birds of 31 species on Rawlins field office Bureau of Land Management lands. RMBO estimated density and population sizes of 15 species (Table 6); nine of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for nine species (Table 6). RMBO estimated the proportion of transects occupied (Psi) by two priority species in Rawlins (Table 7).

Rocksprings

Field technicians surveyed 8 of 8 (100%) assigned transects on Rocksprings Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 110 point counts within these two transects between 1 June and 24 June 2009. Technicians detected 440 birds of 27 species on Rocksprings field office Bureau of Land Management lands. RMBO estimated density and population sizes of 15 species (Table 6); 10 of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data yielded robust density estimates (CV < 50%) for eight species (Table 6). RMBO estimated the proportion of transects occupied (Psi) by one priority species in Rocksprings (Table 7).

Worland

Field technicians surveyed 2 of 2 (100%) assigned transects on Worland Bureau of Land Management lands within BCR 10 in 2009 (Table 1). Technicians conducted 20 point counts within these two transects between 18 May and 13 June 2009. Technicians detected 150 birds of 17 species on Worland field office Bureau of Land Management lands. RMBO estimated

density and population sizes of 12 species (Table 6); seven of these are priority species classified as sensitive species by USDI Fish and Wildlife Service, Partners in Flight or Wyoming Department of Game and Fish (Appendix B). The data did not yield robust density estimates (CV < 50%) for any species (Table 6).

Table 6. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on Bureau of Land Management lands, Wyoming, 2009. S indicates the number of transects surveyed. Priority species are in bold.

	BLM-BCR18 (S=2)				BLM-BCR16 (S=2)				Buffalo (S=3)				Casper (S=4)			
Species	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**	**D[1]**	**N**	**%CV**	**n[2]**
Mourning Dove	--	--	--	0	5.80	3,751	101	8	2.08	5,506	101	3	1.62	8,456	68	5
Northern Flicker	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Western Kingbird	9.42	1,611	101	7	--	--	--	0	--	--	--	0	5.15	26,799	53	3
Western Wood-Pewee	--	--	--	0	--	--	--	0	--	--	--	0	2.04	10,618	101	14
Dusky Flycatcher	--	--	--	0	4.24	2,743	101	1	--	--	--	0	--	--	--	0
Warbling Vireo	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Black-billed Magpie	0.70	120	38	3	--	--	--	0	--	--	--	0	0.35	1,844	71	4
Common Raven	0.45	77	101	1	0.41	264	101	1	2.33	6,194	101	6	0.25	1,282	52	2
Horned Lark	127.87	21,866	11	38	88.36	57,169	100	28	62.02	164,532	54	25	65.28	339,729	37	48
Mountain Chickadee	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Red-breasted Nuthatch	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Rock Wren	--	--	--	0	0.89	574	101	1	--	--	--	0	--	--	--	0
House Wren	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Ruby-crowned Kinglet	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Mountain Bluebird	4.52	773	103	2	6.14	3,971	103	3	3.91	10,361	103	2	--	--	--	0
American Robin	--	--	--	0	--	--	--	0	9.07	24,064	102	3	--	--	--	0
Sage Thrasher	--	--	--	0	--	--	--	0	8.33	22,096	101	7	0.75	3,919	101	27
Yellow Warbler	--	--	--	0	6.74	4,362	101	6	--	--	--	0	0.34	1,766	101	1
Yellow-rumped Warbler	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Western Tanager	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Green-tailed Towhee	--	--	--	0	13.11	8,485	101	6	12.39	32,865	100	6	1.31	6,801	100	8
Spotted Towhee	--	--	--	0	18.10	11,711	100	11	--	--	--	0	--	--	--	0
Chipping Sparrow	--	--	--	0	--	--	--	0	8.04	21,343	101	2	3.82	19,874	101	3
Brewer's Sparrow	--	--	--	0	11.09	7,175	102	3	137.62	365,105	45	39	75.50	392,922	45	49
Vesper Sparrow	--	--	--	0	--	--	--	0	10.14	26,899	101	7	13.44	69,957	101	14

Species	BLM-BCR18 (S=2)				BLM-BCR16 (S=2)				Buffalo (S=3)				Casper (S=4)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Lark Sparrow	8.44	1,444	100	4	--	--	--	0	--	--	--		2.88	15,012	100	5
Sage Sparrow	--	--	--	0	--	--	--	0	9.98	26,467	101	4	--	--	--	0
Lark Bunting	3.05	522	101	2	--	--	--	0	50.12	132,972	64	38	18.36	95,557	101	21
Lincoln's Sparrow	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Grasshopper Sparrow	--	--	--	0	--	--	--	0	--	--	--	0	6.46	33,633	107	7
White-crowned Sparrow	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Dark-eyed Junco	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Western Meadowlark	20.97	3,586	4	19	23.96	15,505	92	24	24.78	65,744	31	26	34.54	179,758	23	97
Brewer's Blackbird	5.38	919	102	1	--	--	--	0	13.93	36,960	102	3	--	--	--	0
Brown-headed Cowbird	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Pine Siskin	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0

Table 6 Continued.

Species	Kemmerer (S=2)				Lander (S=2)				Newcastle (S=2)				Pinedale (S=8)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Mourning Dove	--	--	--	0	3.44	33,777	23	7	1.27	1,300	101	1	0	1,753	51	4
Northern Flicker	--	--	--	0	8.90	87,480	100	8	--	--	--	0	--	--	--	0
Western Kingbird	--	--	--	0	--	--	--	0	--	--	--	0	--	--	--	0
Western Wood-Pewee	--	--	--	0	3.05	29,981	11	2	--	--	--	0	--	--	--	0
Dusky Flycatcher	3.18	18,229	101	1	51.70	508,112	59	18	--	--	--	0	--	--	--	0
Warbling Vireo	--	--	--	0	6.91	67,904	100	3	--	--	--	0	--	--	--	0
Black-billed Magpie	--	--	--	0	0.00	--	--	0	--	--	--	0	0	238	87	1
Common Raven	0.31	1,753	101	1	1.38	13,572	101	5	--	--	--	0	0	1,233	54	5
Horned Lark	25.12	144,002	6	11	0.00	--	--	0	5.33	5,461	100	1	88	324,136	17	176
Mountain Chickadee	--	--	--	0	29.90	293,900	101	7	--	--	--	0	--	--	--	0
Red-breasted Nuthatch	---	--	--	0	7.20	70,791	37	3	---	--	--	0	---	--	--	0
Rock Wren	1.33	7,628	101	2	22.23	218,525	101	37	--	--	--	0	1	2,683	85	5
House Wren	--	--	--	0	7.37	72,461	100	4	--	--	--	0	--	--	--	0
Ruby-crowned Kinglet	--	--	--	0	28.10	276,196	100	13	--	--	--	0	--	--	--	0

Species	Kemmerer (S=2)				Lander (S=2)				Newcastle (S=2)				Pinedale (S=8)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Mountain Bluebird	--	--	--	0	18.29	179,782	46	12	--	--	--	0	3	9,979	79	8
American Robin	--	--	--	0	38.62	379,628	91	16	--	--	--	0	--	--	--	0
Sage Thrasher	23.37	133,989	16	25	0.84	8,300	101	1	--	--	--	0	14	51,272	27	68
Yellow Warbler	--	--	--	0	2.28	22,444	40	3	--	--	--	0	--	--	--	0
Yellow-rumped Warbler	--	--	--	0	14.10	138,586	69	6	--	--	--	0	--	--	--	0
Western Tanager	--	--	--	0	1.71	16,835	103	1	--	--	--	0	--	--	--	0
Green-tailed Towhee	9.73	55,802	100	6	52.75	518,467	31	36	--	--	--	0	0	1,308	84	1
Spotted Towhee	--	--	--	0	1.11	10,957	100	1	--	--	--	0	--	--	--	0
Chipping Sparrow	--	--	--	0	74.22	729,521	15	26	--	--	--	0	--	--	--	0
Brewer's Sparrow	94.27	540,432	23	34	20.03	196,914	76	8	--	--	--	0	112	413,688	26	185
Vesper Sparrow	6.83	39,147	101	6	18.50	181,861	56	18	--	--	--	0	12	45,894	28	50
Lark Sparrow	--	--	--	0	2.59	25,432	100	2	--	--	--	0	--	--	--	0
Sage Sparrow	35.27	202,217	66	18	10.62	104,381	101	6	--	--	--	0	70	259,867	21	156
Lark Bunting	--	--	--	0	--	--	--	0	152.34	156,151	10	63	--	--	--	0
Lincoln's Sparrow	--	--	--	0	39.43	387,573	95	9	--	--	--	0	--	--	--	0
Grasshopper Sparrow	--	--	--	0	--	--	--	0	32.09	32,893	107	6	--	--	--	0
White-crowned Sparrow	--	--	--	0	6.64	65,284	101	3	--	--	--	0	--	--	--	0
Dark-eyed Junco	--	--	--	0	26.24	257,917	100	8	--	--	--	0	--	--	--	0
Western Meadowlark	2.25	12,880	100	3	2.03	19,945	100	3	29.71	30,448	17	17	0	1,208	88	2
Brewer's Blackbird	3.65	20,918	102	1	6.59	64,785	102	2	--	--	--	0	--	--	--	0
Brown-headed Cowbird	--	--	--	0	8.15	80,075	38	3	--	--	--	0	--	--	--	0
Pine Siskin	--	--	--	0	81.30	799,049	20	4	--	--	--	0	--	--	--	0

Table 6 Continued

Species	Rawlins (S=8)				Rocksprings (S=8)				Worland (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Mourning Dove	0.84	11,690	48	6	0.97	14,674	32	7	--	--	--	0
Northern Flicker	0.32	4,415	83	1	--	--	--	0	--	--	--	0

Species	Rawlins (S=8)				Rocksprings (S=8)				Worland (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Western Kingbird	0.47	6,547	89	2				0	1.28	10,825	101	1
Western Wood-Pewee	--	--	--	0	--	--	--	0	--	--	--	0
Dusky Flycatcher	--	--	--	0	--	--	--	0	--	--	--	0
Warbling Vireo	--	--	--	0	--	--	--	0	--	--	--	0
Black-billed Magpie	0.15	2,114	86	2	0.45	6,823	77	6	--	--	--	0
Common Raven	2.21	30,869	21	29	0.62	9,434	33	8	2.57	21,746	101	6
Horned Lark	134.33	1,874,388	19	229	45.49	689,249	13	79	15.98	135,338	100	5
Mountain Chickadee	--	--	--	0	--	--	--	0	--	--	--	0
Red-breasted Nuthatch	--	--	--	0	--	--	--	0	--	--	--	0
Rock Wren	1.03	14,308	52	6	2.71	41,053	33	16	1.86	15,772	101	2
House Wren	--	--	--	0	--	--	--	0	--	--	--	0
Ruby-crowned Kinglet	--	--	--	0	--	--	--	0	--	--	--	0
Mountain Bluebird	1.97	27,498	50	5	0.39	5,918	88	1	6.44	54,561	103	3
American Robin	0.61	8,515	89	1	1.81	27,488	62	3				
Sage Thrasher	8.65	120,637	39	36	7.38	111,775	30	31	6.54	55,408	101	5
Yellow Warbler				0	0.64	9,751	86	3	--	--	--	0
Yellow-rumped Warbler	--	--	--	0	--	--	--	0	--	--	--	0
Western Tanager	--	--	--	0	--	--	--	0	--	--	--	0
Green-tailed Towhee	4.17	58,149	52	10	2.48	37,540	44	6	36.34	307,674	100	16
Spotted Towhee	--	--	--	0	--	--	--	0	--	--	--	0
Chipping Sparrow	--	--	--	0	0.80	12,190	85	1	4.42	37,464	101	1
Brewer's Sparrow	98.29	1,371,480	27	138	59.28	898,245	31	84	131.97	1,117,420	102	34
Vesper Sparrow	9.06	126,460	27	31	11.59	175,573	53	40	36.65	310,276	53	23
Lark Sparrow	--	--	--	0	--	--	--	0	10.03	84,893	100	5
Sage Sparrow	24.67	344,184	33	49	26.61	403,250	33	50	--	--	--	0
Lark Bunting	0.53	7,430	46	2	--	--	--	0	--	--	--	0
Lincoln's Sparrow	--	--	--	0	2.47	37,417	99	2	--	--	--	0
Grasshopper Sparrow	--	--	--	0	--	--	--	0	--	--	--	0
White-crowned Sparrow	--	--	--	0	--	--	--	0	51.48	435,841	101	15

Species	Rawlins (S=8)				Rocksprings (S=8)				Worland (S=2)			
	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]	D[1]	N	%CV	n[2]
Dark-eyed Junco	--	--	--	0	--	--	--	0	--	--	--	0
Western Meadowlark	9.23	128,849	32	48	0.57	8,665	44	3	20.97	177,540	75	20
Brewer's Blackbird	6.56	91,552	65	7	8.36	126,654	82	9	5.11	43,251	102	1
Brown-headed Cowbird	1.54	21,554	61	2	--	--	--	0	--	--	--	0
Pine Siskin	--	--	--	0	1.91	28,910	85	1	--	--	--	0

[1] D = (birds/km2);
[2] n = number of independent detections used to estimate D and N;

Table 7. Estimated site occupancy (Psi; proportion of sample units occupied), percent coefficient of variation of Psi (%CV) and number of transects with detections (n Tran) of priority species on Bureau of Land Management lands, Wyoming 2009. S indicates the number of transects surveyed.

	Rawlins (S=8)			Rocksprings (S=8)		
Species	**Psi**	**%CV**	**N tran**	**Psi**	**%CV**	**N tran**
American Three-toed Woodpecker	--	--	0	--	--	0
Broad-tailed Hummingbird	--	--	0	--	--	0
Brown Creeper	--	--	0	--	--	0
Cassin's Finch	--	--	0	--	--	0
Cordilleran Flycatcher	--	--	0	--	--	0
Golden-crowned Kinglet	--	--	0	--	--	0
Loggerhead Shrike	--	--	0	--	--	0
MacGillivray's Warbler	--	--	0	--	--	0
McCown's Longspur	0.265	61	2	0.132	94	1
Olive-sided Flycatcher	--	--	0	--	--	0
Plumbeous Vireo	--	--	0	--	--	0
Red Crossbill	--	--	0	--	--	0
Red-naped Sapsucker	--	--	0	--	--	0
Song Sparrow	--	--	0	0.179	95	1
Townsend's Solitaire	--	--	0	--	--	0
White-throated Swift	--	--	0	--	--	0
Wilson's Warbler	--	--	0	--	--	0

DISCUSSION

This report provides BCR-wide density and population estimates for 43 landbird species in Wyoming using Distance sampling theory. Simulations using 10 years of data from a similar avian monitoring program (J. Blakesley, unpublished) indicated that it would be possible to detect an average annual 3% decline in the population of a species within 25 years with 80% power and CV $\leq$ 40%. A similar trend could be detected within 30 years with CV $\leq$ 50%. It is important to note that the ability to detect population trends for any species is a function of not only the sampling effort but also the abundance and annual variation in abundance of that particular species. Some grassland bird species shift their breeding ranges from year to year based on environmental conditions. These species may require more precise density estimates to monitor population trends within 25-30 years.

We also provide occupancy estimates for an additional 15 species. Habitat-based monitoring in Wyoming yielded density estimates for 71 species in 2008 (Hanni et al. 2009) and 77 species in 2007 (White and Sparks 2008). These numbers are notably higher than those in this report because the density estimates comprised seven and six years, respectively, of pooled data for many of the habitats surveyed. This year, we were unable to estimate densities for 12 species with 40-60 detections each. We will likely be able to estimate density for these species in 2010, when we will be able to pool two years of data. Overall, we were able to determine densities for 28% of the species we detected during surveys. We expect this percentage to increase through additional sampling in the future.

We were able to estimate density and population size precisely (CV < 50%) for many species at the BCR-level. In addition, we obtained precise density estimates of many species for strata in which at least eight grids were sampled. Note the overall more precise estimates for the non-roadless portion of the Shoshone NF (n = 23 samples) and BCR 16 portion of the Medicine Bow NF (n = 24 samples) compared to other strata. Although we could not estimate statewide density using 2009 data, the IMBCR design will produce statewide density and population estimates in future years, given at least two samples are surveyed in each stratum within Wyoming.

For the first time, we used occupancy modeling to provide estimates for 17 priority species with insufficient data to estimate density. The use of occupancy modeling as an additional analysis method greatly increases our effectiveness in monitoring Wyoming's species of concern. Rare species present formidable challenges for sampling and monitoring wildlife populations. As suggested by MacKenzie et al. (2005), we improved inferences about populations of rare species by estimating site occupancy instead of abundance, and borrowing information about detectability from other places or times. By estimating a common detection parameter over the entire state of Wyoming, we were able to estimate site occupancy for strata and regions that would otherwise have insufficient numbers of samples and detections (MacKenzie et al. 2005).

Although we successfully estimated site occupancy for species with as few as 10 detections, we identified three limitations of occupancy estimation as applied to the current sample design. First, the occupancy model occasionally failed to converge when strata contained only two sample units. This limitation prevented us from estimating site occupancy for some regions. Second, small sample sizes in strata comprised of large geographic areas may have produced biased estimates of site occupancy. Because we estimated regional site occupancy using a weighted mean indexed by stratum area, small-sample estimates from large strata often

received more weight than large-sample estimates from small strata. For example, when estimating site occupancy for the Shoshone National Forest, small-sample (n = 2) estimates from the Shoshone-Roadless stratum (8,311 km^2) received 80% of the weight, whereas large-sample estimates (n = 23) from the Shoshone stratum (2,101 km^2) received only 20% of the weight. Occupancy estimates derived from two samples will be either 0 or greater than 0.5, which resulted in small Forest-wide estimates of occupancy (Psi < 0.1) when the Shoshone-Roadless estimate was 0 and large Forest-wide estimates of occupancy (Psi > 0.5) when the Shoshone-Roadless estimate was greater than 0.5. Finally, several occupancy estimates exhibited low precision with Coefficients of Variation exceeding 50%. Optimal sample designs for estimating the site occupancy of rare species involves increasing the number of sample units rather than increasing the number of repeat surveys at each sample unit (MacKenzie and Royle 2005). Therefore, we anticipate that increasing the number of sample units in each stratum will improve the precision of the occupancy estimates. We recommend avoiding the allocation of only two sample units per stratum in the future, especially in large strata. Strata with fewer than approximately 10 samples are not expected to produce robust estimates of occupancy.

The multi-scale occupancy model can easily be extended to investigate habitat relationships for species of conservation concern. The probability of occupancy for the 1 km^2 sample units can be modeled as a function of habitat covariates such as vegetation cover and land use. The habitat relationships can be used to identify habitats that support populations of species of conservation concern and these habitats can then be prioritized for protection by management. Habitat models may reveal spatial trends in occupancy related to habitat loss or land use that are symptomatic of population declines, and suggest land management strategies for species recovery.

Understanding species' population trends on multiple scales requires 10 to 30 years of density estimates (D). Eventually we will post-stratify 2009 samples by vegetation cover types, calculate density estimates for species with large enough sample sizes, and compare resulting estimates with historical estimates from the MWB (2002-2008) habitat-stratified samples.

RMBO and its monitoring partners were able to complete 97% of the planned surveys in 2009, which is the highest completion rate since the inception of MWB. Furthermore, unlike the IMBCR design, the previous MWB monitoring design did not include private land. Bird monitoring programs in general have avoided private lands, citing increased workload to obtain permission and an overall lower completion rate. RMBO's successful survey effort on private lands this year demonstrates that accessing private lands is possible and can be accomplished efficiently. We are actively improving our ability to contact landowners in a timely manner by hiring a landowner liaison and effectively managing a landowner database.

Many breeding landbird species occurring in Wyoming were adequately sampled in 2009. However, several Pinyon-Juniper woodland specialists previously detected under the original MWB sampling design were under-sampled in 2009. Some of these species (Juniper Titmouse, Ash-throated Flycatcher, Black-throated Gray Warbler and Scott's Oriole) are priority species within Wyoming. This habitat could be better sampled by increasing the sampling effort within strata where Pinyon-Juniper is most common (such as Kemmerer, Rock Springs and Worland BLM strata). Alternatively, appropriate strata could be sub-stratified based on a static physical attribute associated with Pinyon-Juniper.

The IMBCR sampling design, which contributes to regional, BCR-wide monitoring, serves as a model for other long-term monitoring efforts because of its ability to address the conservation and management needs of a wide range of stakeholders, landowners and governmental entities

at both local and regional scales. The IMBCR design represents one method for achieving effective collaboration and coordinated bird monitoring efforts in North America (NABCI 2007) and could be applied to other BCRs and regions across the continent.

The IMBCR sampling design is not limited to estimating population density and occupancy rates of birds. This design could be used to estimate nesting success or other demographic parameters. Furthermore, our sampling design could be used to monitor the distribution and population dynamics of additional taxonomic groups, including reptiles, small mammals and plants. A spatially balanced design using similar stratification and cell weighting for ponds and wetlands could be used to monitor shorebirds and amphibians, whereas a design with larger sample cells would be appropriate for monitoring large mammals. Identifying and monitoring the distributions of plants and animals at multiple spatial scales over time will help scientists and land managers face challenges associated with climate change and other natural and anthropogenic changes to the environment.

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APPENDIX A

Management Indicator Species (MIS) and priority species detected in Wyoming, USDA Forest Service (USFS).

Species	Big Horn NF	Black Hills NF	MedBow NF	Thunder Basin NG	Shoshone NF	Wasatch NF	Region 2
Ruffed Grouse		MIS			MIS		
Greater Sage-Grouse				MIS			R2SS
Dusky Grouse					MIS		
Bald Eagle					MIS		
Northern Harrier							R2SS
Northern Goshawk			MIS		MIS		R2SS
Ferruginous Hawk							R2SS
Peregrine Falcon					MIS		R2SS
Mountain Plover							R2SS
Burrowing Owl							R2SS
Short-eared Owl							R2SS
Lewis's Woodpecker							R2SS
Hairy Woodpecker					MIS		
American Three-toed Woodpecker			MIS				R2SS
Black-backed Woodpecker		MIS					R2SS
Olive-sided Flycatcher							R2SS
Loggerhead Shrike							R2SS
Red-breasted Nuthatch	MIS						
Brown Creeper		MIS					
Golden-crowned Kinglet		MIS	MIS				
Wilson's Warbler			MIS				
Brewer's Sparrow	MIS				MIS		R2SS
Sage Sparrow							R2SS
Lark Bunting							
Grasshopper Sparrow		MIS					R2SS
Song Sparrow		MIS					
Lincoln's Sparrow			MIS				
McCown's Longspur							R2SS

Management	Code	Definition
US Forest Service (Region 2)	R2SS	US Forest Service Region 2 Sensitive Species
US Forest Service	SOLC	Species of Local Concern
US Forest Service	MIS	Management Indicator Species

APPENDIX B

Priority species (Species of Concern) detected in Wyoming by management designation: USDI Fish and Wildlife Service (USFWS), Partners in Flight (PIF) and Wyoming Game and Fish Department (WGFD).

	USFWS					PIF					
Species	**BCR10**	**BCR16**	**BCR17**	**BCR18**	**Region 6**	**PIF-BCR10**	**PIF-BCR16**	**PIF-BCR17**	**PIF-BCR18**	**WY-PIF**	**WGFD**
Ruffed Grouse						RS					
Greater Sage-Grouse						CC,RC,CS,RS	CC,RC	CC,RC,CS,RS		WY-I	SGCN
Dusky Grouse						CC,RC	CC			WY-III	
American White Pelican										WY-II	SGCN
Great Blue Heron											SGCN
Bald Eagle										WY-I	SGCN, T
Northern Harrier		BCC		BCC	BCC	RC		RC	RC	WY-III	
Northern Goshawk						RC,RS		RC		WY-I	SGCN
Swainson's Hawk	BCC	BCC			BCC	CC,RC	CC,RC	CC	CC,RS	WY-I	SGCN
Ferruginous Hawk	BCC	BCC	BCC	BCC	BCC	RC	RC	RC,RS	RC,RS	WY-I	SGCN
Golden Eagle	BCC	BCC	BCC		BCC		RC	RC		WY-III	
Peregrine Falcon	BCC	BCC	BCC	BCC	BCC					WY-I	SGCN
Prairie Falcon	BCC	BCC	BCC	BCC	BCC		RC		RC	WY-III	
Sandhill Crane											SGCN
Mountain Plover	BCC	BCC	BCC	BCC	BCC					WY-I	SGCN
American Avocet										WY-III	
Willet										WY-III	
Upland Sandpiper	BCC		BCC		BCC					WY-I	SGCN
Wilson's Phalarope	BCC	BCC	BCC		BCC					WY-I	
Burrowing Owl		BCC	BCC	BCC	BCC			RC	RC,RS	WY-I	SGCN
Short-eared Owl		BCC	BCC		BCC	CC		CC,RC	CC	WY-I	SGCN
Common Nighthawk							RC		RC		
Common Poorwill										WY-III	
White-throated Swift						CC	CC,RS	CC	CC	WY-II	
Broad-tailed Hummingbird							RS			WY-II	
Lewis's Woodpecker	BCC	BCC	BCC	BCC	BCC	CC,RC	CC,RC,CS,RS	CC,RC	CC,RC	WY-II	SGCN
Red-headed Woodpecker					BCC			CC,RC	CC,RC	WY-III	
Williamson's Sapsucker	BCC	BCC			BCC	CS,RS	CS,RS			WY-II	

	USFWS					PIF					
Species	**BCR10**	**BCR16**	**BCR17**	**BCR18**	**Region 6**	**PIF-BCR10**	**PIF-BCR16**	**PIF-BCR17**	**PIF-BCR18**	**WY-PIF**	**WGFD**
Red-naped Sapsucker	BCC		BCC		BCC	CS,RS				WY-II	
American Three-toed Woodpecker										WY-II	SGCN
Black-backed Woodpecker								RC		WY-II	SGCN
Olive-sided Flycatcher						CC,RC	CC			WY-II	
Dusky Flycatcher						CS,RS				WY-II	
Cordilleran Flycatcher							RS			WY-II	
Say's Phoebe							RS	RS	RS	WY-III	
Loggerhead Shrike	BCC				BCC	RC	RC	RC	RC	WY-II	
Plumbeous Vireo							RS			WY-II	
Warbling Vireo							RS				
Pinyon Jay		BCC				CC	CC,RC,CS,RS	CC,RC	CC		
Clark's Nutcracker						CS,RS	CS,RS			WY-III	
Black-billed Magpie							RS	RC			
Violet-green Swallow							RS				
Northern Rough-winged Swallow								RC		WY-III	
Pygmy Nuthatch	BCC						RC			WY-II	SGCN
Brown Creeper										WY-II	
Rock Wren							RS			WY-III	
Canyon Wren							RC			WY-III	
Marsh Wren										WY-II	
Golden-crowned Kinglet						RS				WY-II	
Western Bluebird							RS			WY-II	
Mountain Bluebird							RC,CS,RS	RC			
Townsend's Solitaire						RS				WY-II	
Veery										WY-III	
Sage Thrasher								RC		WY-II	SGCN
Yellow Warbler									RC		
Ovenbird										WY-III	
MacGillivray's Warbler										WY-II	
Wilson's Warbler										WY-II	
Green-tailed Towhee							CS,RS				
Brewer's Sparrow	BCC		BCC		BCC	CC,RC	CC,RC	CC,RC	CC,RC	WY-I	SGCN
Vesper Sparrow								RC		WY-II	
Lark Sparrow									RC	WY-II	

	USFWS					PIF					
Species	**BCR10**	**BCR16**	**BCR17**	**BCR18**	**Region 6**	**PIF-BCR10**	**PIF-BCR16**	**PIF-BCR17**	**PIF-BCR18**	**WY-PIF**	**WGFD**
Sage Sparrow		BCC					RC			WY-I	SGCN
Lark Bunting				BCC		RC		RC,CS,RS	RC,CS,RS	WY-II	SGCN
Grasshopper Sparrow			BCC		BCC			RC,CS,RS	RC,CS,RS	WY-II	SGCN
McCown's Longspur	BCC			BCC	BCC	CC,RC		CC,RC,CS,RS	CC,CS,RS	WY-I	SGCN
Lazuli Bunting						RS				WY-III	
Western Meadowlark								RS	RS		
Bullock's Oriole										WY-III	
Black Rosy-Finch						CC,CS,RS	CC			WY-III	SGCN
Cassin's Finch						RC,CS,RS	RC				
Red Crossbill						RS					
Pine Siskin							RC,RS				

Management	**Code**	**Definition**
US Fish and Wildlife Service (BCR X)	BCC	Birds of Conservation Concern for BCR X
US Fish and Wildlife Service (Region 6)	BCC	Birds of Conservation Concern for Region 6 (Mountain-Prairie)
PIF Species Assessment Database 2005: BCR X (PIF-BCRX)	CC	Continental Concern
PIF Species Assessment Database 2005: BCR X (PIF-BCRX)	CS	Continental Stewardship
PIF Species Assessment Database 2005: BCR X (PIF-BCRX)	RC	Regional Concern
PIF Species Assessment Database 2005: BCR X (PIF-BCRX)	RS	Regional Stewardship
Wyoming Partners in Flight (WY PIF)	WY-I	Wyoming Partners in Flight Level I Priority (Conservation Action)
Wyoming Partners in Flight (WY PIF)	WY-II	Wyoming Partners in Flight Level II Priority (Monitoring)
Wyoming Partners in Flight (WY PIF)	WY-III	Wyoming Partners in Flight Level III Priority (Local Interest)
Wyoming Game and Fish Dept. (WGFD)	SGCN	Species of Greatest Conservation Need (Wyoming Comprehensive Wildlife Conservation Plan 2005)

APPENDIX C

Number of birds detected in the Great Basin Bird Conservation Region (BCR 9), Wyoming, 2009.

Species	BCR 9
Ruffed Grouse	1
Dusky Grouse	3
Red-tailed Hawk	1
Mourning Dove	4
Red-naped Sapsucker	2
Downy Woodpecker	1
Hairy Woodpecker	6
Northern Flicker	3
Western Wood-Pewee	18
Dusky Flycatcher	2
Warbling Vireo	22
Clark's Nutcracker	7
Common Raven	2
Tree Swallow	6
Black-capped Chickadee	12
Mountain Chickadee	19
Red-breasted Nuthatch	32
White-breasted Nuthatch	1
House Wren	22
Ruby-crowned kinglet	34
Mountain Bluebird	3
Townsend's Solitaire	1
Swainson's Thrush	22
American Robin	29
Yellow-rumped Warbler	18
MacGillivray's Warbler	8
Wilson's Warbler	5
Western Tanager	33
Green-tailed Towhee	5
Spotted Towhee	7
Chipping Sparrow	25
Fox Sparrow	1
Song Sparrow	3
Lincoln's Sparrow	5
White-crowned Sparrow	25
Dark-eyed Junco	38
Black-headed Grosbeak	4
Blue Grosbeak	1
Brown-headed Cowbird	5
Cassin's Finch	3
Pine Siskin	41
Points Surveyed*	**24**

*The sampling unit was a grid of 16 points; however, because not all points were surveyed within each grid, the number of points is provided here.

APPENDIX D

Number of birds detected in Wyoming by stratum in the Northern Rockies Bird Conservation Region (BCR 10), 2009.

		BLM								
Species	Other Lands	Buffalo	Casper	Cody	Kemmerer	Lander	Pinedale	Rawlins	Worland	Rock Springs
Canada Goose								6		
Mallard	1									
Blue-winged Teal										
Cinnamon Teal	1									
Northern Shoveler	1									
Northern Pintail	1									
Green Winged Teal							1			
Chukar				1						
Ring-necked Pheasant									2	
Ruffed Grouse										
Greater Sage Grouse										
Dusky Grouse										
Great Blue Heron										
Turkey Vulture						1		2		
Northern Harrier								1		
Sharp-shinned Hawk										
Cooper's Hawk		1								
Swainsons Hawk								1		
Red-tailed Hawk										
Ferruginous Hawk										
Golden Eagle			1					4		1
American Kestrel										
Prairie Falcon						1				
Sandhill Crane							3			

		BLM								
Species	Other Lands	Buffalo	Casper	Cody	Kemmerer	Lander	Pinedale	Rawlins	Worland	Rock Springs
Killdeer	1		2							
Mountain Plover								9		
American Avocet	9						1			
Spotted Sandpiper										
Willet	16				3		7	1		
Wilson's Snipe										
Wilson's Phalarope	1									
California Gull								1		
Eurasian Collared-Dove										
Mourning Dove					1	8	4	7		9
Great Horned Owl										
Common Nighthawk					1					1
White-throated Swift										
Broad-tailed Hummingbird		1								
Red-headed Woodpecker										
William's Sapsucker						1				
Red-naped Sapsucker		1				1				
Downy Woodpecker										
Hairy Woodpecker		2				1				
American Three-toed Woodpecker										
Northern Flicker						12		3		
Olive-sided Flycatcher						1				
Western Wood-Pewee						2				
Least Flycatcher										
Dusky Flycatcher					1	20				
Cordilleran Flycatcher										
Say's Phoebe				1		1				1
Western Kingbird								2	1	
Eastern Kingbird									1	

		BLM								
Species	Other Lands	Buffalo	Casper	Cody	Kemmerer	Lander	Pinedale	Rawlins	Worland	Rock Springs
Loggerhead Shrike					1					
Plumbeous Vireo						2				
Warbling Vireo						4				1
Red-eyed Vireo										
Gray Jay										
Stellar's Jay		1								
Clark's Nutcracker										
Black-billed Magpie							1	2		6
American Crow										
Common Raven		5		11	2	5	11	33	6	10
Horned Lark	52		22	4	13		185	233	5	86
Tree Swallow								1		1
Violet-green Swallow								6		
Cliff Swallow										1
Barn Swallow										
Black-capped Chickadee										
Mountain Chickadee		1				8				
Red-breasted Nuthatch		3				3				
White-breasted Nuthatch						1				
Brown Creeper		1								
Rock Wren				15	2	38	6	7	2	19
Canyon Wren										
House Wren						4				1
Golden-crowned Kinglet										
Ruby-crowned Kinglet		12				15				
Mountain Bluebird						15	8	5	4	2
Townsend's Solitaire		2				1				
Swainson's Thrush										
Hermit Thrush		8								

		BLM								
Species	Other Lands	Buffalo	Casper	Cody	Kemmerer	Lander	Pinedale	Rawlins	Worland	Rock Springs
American Robin		5				27		1		3
Sage Thrasher	5			1	34	1	108	36	5	43
Brown Thrasher										
European Starling								1		
American Pipit										
Cedar Waxwing		1								
Orange-crowned Warbler						2				
Yellow Warbler						3				3
Yellow-rumped Warbler		9				8				
Ovenbird										
MacGillivray's Warbler						4				
Common Yellowthroat										
Wilson's Warbler										
Western Tanager						1				
Green-tailed Towhee					6	43	2	12	17	10
Spotted Towhee						1				
Chipping Sparrow		1				27			1	1
Brewer's Sparrow	30		19	26	41	9	235	154	38	106
Vesper Sparrow	5		14	17	6	20	67	31	23	52
Lark Sparrow	1					3			7	
Sage Sparrow				4	18	6	177	50		61
Lark Bunting	2		22	9				2		
Savannah Sparrow								1		
Fox Sparrow										
Song Sparrow						4				1
Lincoln's Sparrow						9				3
White-crowned Sparrow						3			15	
Dark-eyed Junco		3				8				
McCown's Longspur								22		1

		BLM								
Species	**Other Lands**	**Buffalo**	**Casper**	**Cody**	**Kemmerer**	**Lander**	**Pinedale**	**Rawlins**	**Worland**	**Rock Springs**
Lazuli Bunting						1				
Red-winged Blackbird	1									
Western Meadowlark	27		16	22	6	6	9	67	21	6
Brewer's Blackbird	2				1	3		8	1	10
Common Grackle									1	
Brown-headed Cowbird				1		3		2		
Black Rosy Finch										
Pine Grosbeak										
Cassin's Finch		1				6				
House Finch						1				
Red Crossbill										
Pine Siskin		2				5				1
American Goldfinch										
Points Surveyed*	12	**6**	**16**	**13**	**28**	**31**	**128**	**109**	**20**	**110**

*The sampling unit was a grid of 16 points; however, because not all points were surveyed within each grid, the number of points is provided here.

Number of birds detected in Wyoming by stratum in the Northern Rockies Bird Conservation Region (10), 2009 continued.

	National Forest					National Park	
Species	**Medicine Bow NF**	**Big Horn NF**	**Shoshone NF**	**Shoshone-roadless**	**USFS R4**	**Grand Teton**	**Yellowstone**
Canada Goose			1				
Mallard			5				
Blue-winged Teal							3
Cinnamon Teal							
Northern Shoveler							
Northern Pintail							
Green Winged Teal							
Chukar							
Ring-necked Pheasant							
Ruffed Grouse			1	2			
Greater Sage Grouse	1						
Dusky Grouse	2		1				
Great Blue Heron			2				
Turkey Vulture			3				
Northern Harrier		2					
Sharp-shinned Hawk		1	2				
Cooper's Hawk		1	2				
Swainsons Hawk							
Red-tailed Hawk		2	6	1	1	1	
Ferruginous Hawk			1				
Golden Eagle			1				
American Kestrel	1	1	4				
Prairie Falcon			1				
Sandhill Crane						1	
Killdeer							
Mountain Plover							

	National Forest					National Park	
Species	**Medicine Bow NF**	**Big Horn NF**	**Shoshone NF**	**Shoshone-roadless**	**USFS R4**	**Grand Teton**	**Yellowstone**
American Avocet							
Spotted Sandpiper							5
Willet							
Wilson's Snipe							3
Wilson's Phalarope							
California Gull							
Eurasian Collared-Dove		1					
Mourning Dove	1		38				1
Great Horned Owl			1				
Common Nighthawk			2				
White-throated Swift		3	14				
Broad-tailed Hummingbird	1	1	2	1			
Red-headed Woodpecker			1				
William's Sapsucker		2	1				
Red-naped Sapsucker	1	2	5				
Downy Woodpecker		2	5	1			
Hairy Woodpecker	4	7	20	2	2		1
American Three-toed Woodpecker	2	2					
Northern Flicker	8	7	39		3	6	
Olive-sided Flycatcher			3				1
Western Wood-Pewee		3	8		1	10	3
Least Flycatcher			3				
Dusky Flycatcher		12	22	3		1	2
Cordilleran Flycatcher		14	2				
Say's Phoebe							
Western Kingbird							
Eastern Kingbird			1				
Loggerhead Shrike							
Plumbeous Vireo		1	2				

	National Forest					National Park	
Species	**Medicine Bow NF**	**Big Horn NF**	**Shoshone NF**	**Shoshone-roadless**	**USFS R4**	**Grand Teton**	**Yellowstone**
Warbling Vireo	6	5	39	9	2	1	3
Red-eyed Vireo			1				
Gray Jay		7	8		1		3
Stellar's Jay			1		7		
Clark's Nutcracker	2	12	47	6	3	3	10
Black-billed Magpie		1	24				
American Crow			15				
Common Raven	4	20	67			2	2
Horned Lark		2	53				
Tree Swallow		2	6			2	
Violet-green Swallow		3	6				
Cliff Swallow			2			1	7
Barn Swallow			23				
Black-capped Chickadee			11			10	
Mountain Chickadee	3	64	86	20	27	1	19
Red-breasted Nuthatch	2	7	24	6	11	4	12
White-breasted Nuthatch		1	3	1			
Brown Creeper		17	12		1		
Rock Wren	9	6	36	7			
Canyon Wren			1				
House Wren	10	14	28	2		9	1
Golden-crowned Kinglet		1	1		3		
Ruby-crowned Kinglet	6	79	122	9	9	6	21
Mountain Bluebird	6	5	30			2	1
Townsend's Solitaire		9	14	2	2		4
Swainson's Thrush			38	1	4		16
Hermit Thrush		62	76	20	12	1	12
American Robin	11	84	138	13	7	2	39
Sage Thrasher			3			9	

	National Forest					National Park	
Species	**Medicine Bow NF**	**Big Horn NF**	**Shoshone NF**	**Shoshone-roadless**	**USFS R4**	**Grand Teton**	**Yellowstone**
Brown Thrasher			1				
European Starling							
American Pipit		1	44	1			
Cedar Waxwing							
Orange-crowned Warbler							
Yellow Warbler		1	16	1			
Yellow-rumped Warbler	2	78	113	6	11	2	20
Ovenbird			2				
MacGillivray's Warbler			2	1	3		1
Common Yellowthroat	3		2				
Wilson's Warbler		1	1	1			1
Western Tanager	4	6	23	9	22	4	6
Green-tailed Towhee	23	11	38			3	
Spotted Towhee		2	35	1	2		5
Chipping Sparrow		22	57	11	2		16
Brewer's Sparrow			84			26	
Vesper Sparrow	1		75			10	
Lark Sparrow	7		5				
Sage Sparrow		1	2				
Lark Bunting			7				
Savannah Sparrow			1				71
Fox Sparrow					1		
Song Sparrow	1		6		1		5
Lincoln's Sparrow		8	20	3	1	2	7
White-crowned Sparrow	13	5	56	2	7	1	1
Dark-eyed Junco	8	111	104	13	45	13	19
McCown's Longspur							
Lazuli Bunting		1					
Red-winged Blackbird			4				

	National Forest					National Park	
Species	**Medicine Bow NF**	**Big Horn NF**	**Shoshone NF**	**Shoshone-roadless**	**USFS R4**	**Grand Teton**	**Yellowstone**
Western Meadowlark			60			7	
Brewer's Blackbird	5		17				
Common Grackle							
Brown-headed Cowbird		3	1			1	
Black Rosy Finch			6	5			
Pine Grosbeak		3			3		
Cassin's Finch		4	11	3			2
House Finch			1				
Red Crossbill		2	7		1		
Pine Siskin	2	29	41	5	10	3	22
American Goldfinch	1	1	9				
Points Surveyed*	**16**	**117**	**256**	**25**	**19**	**18**	**32**

*The sampling unit was a grid of 16 points; however, because not all points were sampled within each grid, the number of points is provided here.

APPENDIX E

Number of birds detected in Wyoming by stratum in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16), 2009.

			National Forest	
Species	BLM	Other Lands	Medicine Bow NF	Wasatch NF
Blue-winged Teal	1			
Wild Turkey			2	
Great Blue Heron		2		
Turkey Vulture		3		
Bald Eagle	1			
Cooper's Hawk	1			
Red-tailed Hawk	2	6	1	
Ferruginous Hawk		2		
Golden Eagle	3	5		
American Kestrel	1	6	5	
Peregrine Falcon			1	
Prairie Falcon		1		
American Coot	1			
Killdeer	2	6		
Spotted Sandpiper			1	
Willet			1	
Wilson's Snipe				1
Wilson's Phalarope	1			
Mourning Dove	8	8	25	
Common Nighthawk	1	6		
Common Poorwill			1	
White-throated Swift	1			
Broad-tailed Hummingbird	1	2	19	2
Belted Kingfisher			1	
William's Sapsucker			3	
Red-naped Sapsucker		1	15	
Downy Woodpecker			7	
Hairy Woodpecker			69	5
American Three-toed Woodpecker			14	
Northern Flicker		6	46	
Olive-sided Flycatcher			23	
Western Wood-Pewee			57	
Dusky Flycatcher	5	13	6	
Say's Phoebe	3	1		
Western Kingbird		15	1	

Species	BLM	Other Lands	National Forest	
			Medicine Bow NF	Wasatch NF
Eastern Kingbird			1	
Loggerhead Shrike		5		
Plumbeous Vireo	2	1	15	
Warbling Vireo		21	44	6
Red-eyed Vireo		1	3	
Gray Jay				2
Stellar's Jay		1	2	
Pinyon Jay		2	1	
Clark's Nutcracker			11	
Black-billed Magpie		8	2	
American Crow			3	
Common Raven	1	14	18	6
Horned Lark	28	65	8	
Tree Swallow			1	
Violet-green Swallow		4	3	
Black-capped Chickadee			16	
Mountain Chickadee		14	147	13
Red-breasted Nuthatch		5	26	6
White-breasted Nuthatch		3	6	
Pygmy Nuthatch			4	
Brown Creeper			1	
Rock Wren	1	11	62	
Canyon Wren			1	
House Wren		33	65	
Golden-crowned Kinglet			10	
Ruby-crowned Kinglet			92	10
Blue-gray Gnatcatcher	13			
Western Bluebird		1	1	
Mountain Bluebird	4	38	25	2
Townsend's Solitaire		2	6	
Veery			1	
Swainson's Thrush			11	
Hermit Thrush		2	130	17
American Robin		16	140	6
Sage Thrasher		7		
Cedar Waxwing			2	
Yellow Warbler	6		18	
Yellow-rumped Warbler		20	155	14
Ovenbird			1	
MacGillivray's Warbler			30	
Common Yellowthroat			56	

Species	BLM	Other Lands	National Forest	
			Medicine Bow NF	Wasatch NF
Wilson's Warbler			15	
Yellow-breasted Chat	13			
Western Tanager		2	57	
Green-tailed Towhee	6	24	109	
Spotted Towhee	13	3	24	
Chipping Sparrow		33	28	
Clay-colored Sparrow		2		
Brewer's Sparrow	4	55	3	
Vesper Sparrow		9	5	
Lark Sparrow		15	14	
Sage Sparrow		5		
Lark Bunting		63		
Song Sparrow		1	12	
Lincoln's Sparrow			10	
White-crowned Sparrow			11	
Dark-eyed Junco		1	160	17
McCown's Longspur		1		
Black-headed Grosbeak			2	
Lazuli Bunting			1	
Red-winged Blackbird	4		13	
Western Meadowlark	28	178	21	
Brewer's Blackbird		8	19	
Brown-headed Cowbird		13	13	
Pine Grosbeak			7	
Red Crossbill		7	12	17
Pine Siskin			63	3
American Goldfinch		2	4	
Evening Grosbeak			1	
Points Surveyed*	**21**	**113**	**237**	**32**

*The sampling unit was a grid of 16 points; however, because not all points were surveyed within each grid, the number of points is provided here.

APPENDIX F

Number of birds detected in the Badlands and Prairies Bird Conservation Region (BCR 17), Wyoming, 2009.

Species	Other Lands	BLM			Forest Service	
		Buffalo	Casper	Newcastle	Black Hills NF	Thunder Basin NG
Canada Goose	5					
Mallard		1				
Green-winged Teal						1
Ruffed Grouse					1	
Wild Turkey					5	
Turkey Vulture	2	1	2		1	1
Northern Harrier						3
Northern Goshawk					2	
Swainson's Hawk	1	1	3			
Red-tailed Hawk	2			1	5	3
Ferruginous Hawk	2		2			
Golden Eagle	1		3			
American Kestrel	2	1	6		3	
Prairie Falcon			1			
Killdeer	2					7
Upland Sandpiper				1		
California Gull			1			
Mourning Dove	11	3	5	1	1	30
Great-horned Owl	2					
Common Nighthawk		3			2	
White-throated Swift					1	
Lewis' Woodpecker					2	
Red-naped Sapsucker					12	
Downy Woodpecker					4	
Hairy Woodpecker	2				10	
Black-backed Woodpecker					1	
Northern Flicker	3				13	1
Western Wood-Pewee			4		21	
Dusky Flycatcher	4				19	
Cordilleran Flycatcher					9	
Say's Phoebe						3
Western Kingbird	9		14	1		6

Species	Other Lands	BLM			Forest Service	
		Buffalo	Casper	Newcastle	Black Hills NF	Thunder Basin NG
Eastern Kingbird	1				3	3
Loggerhead Shrike	1		1	1		2
Plumbeous Vireo					12	
Warbling Vireo					89	
Red-eyed Vireo					7	
Gray Jay					4	
Blue Jay					5	
Pinyon Jay	1					
Black-billed Magpie	5		4			
American Crow					12	
Common Raven	5	6	2			
Horned Lark	73	25	26	1		80
Tree Swallow	1					
Violet-green Swallow		2	3		3	
Cliff Swallow	4					
Barn Swallow	1	1			1	
Black-capped Chickadee	10				28	
Mountain Chickadee						5
Red-breasted Nuthatch	2				70	
White-breasted Nuthatch	6				9	
Brown Creeper	1				5	
Rock Wren	3				7	15
House Wren	9				13	
Ruby-crowned Kinglet					18	
Blue-gray Gnatcatcher	2					
Eastern Bluebird					1	
Mountain Bluebird	5	2	1		22	
Townsend's Solitaire	1				6	
Swainson's Thrush	1				9	
American Robin	25	3			119	1
Gray Catbird	1					
Sage Thrasher		7	2			
European Starling	2					
Cedar Waxwing	3				3	
Yellow Warbler	4		1		5	
Chestnut-sided Warbler					1	
Yellow-rumped Warbler	15				42	
American Redstart					56	

Species	Other Lands	BLM			Forest Service	
		Buffalo	Casper	Newcastle	Black Hills NF	Thunder Basin NG
Ovenbird					145	
MacGillivray's Warbler					9	
Common Yellowthroat	3				2	
Western Tanager	3				40	1
Green-tailed Towhee	4	6	2			
Spotted Towhee					15	13
Chipping Sparrow	15	2	3		93	11
Brewer's Sparrow	57	39	36			64
Vesper's Sparrow	24	7			17	30
Lark Sparrow	11		6		5	5
Sage Sparrow	1	4				
Lark Bunting	111	38	1	64		626
Grasshopper Sparrow	6		7	6		18
Song Sparrow					1	
Dark-eyed Junco	8				50	
McCown's Longspur	1					
Black-headed Grosbeak					14	
Red-winged Blackbird	9					5
Western Meadowlark	134	32	103	19	3	419
Brewer's Blackbird	8	3				13
Brown-headed Cowbird	16				50	24
Bullock's Oriole			1			
Red Crossbill					19	
Pine Siskin					11	
American Goldfinch	2	2			1	
points surveyed*	**73**	**22**	**36**	**12**	**115**	**136**

*The sampling unit was a grid of 16 points; however, because not all points were surveyed within each grid, the number of points is provided here.

APPENDIX G

Number of birds detected in the Shortgrass Prairie Bird Conservation Region (BCR 18), Wyoming, 2009.

Species	BLM	Other Lands	Department of Defense
Canada Goose		1	1
Great Blue Heron		1	
Turkey Vulture	2	5	3
Swainson's Hawk		2	4
Red-tailed Hawk	1	4	
Ferruginous Hawk	1	7	
Golden Eagle	2	3	
American Kestrel		10	1
Prairie Falcon		1	
Killdeer	4	2	2
Mountain Plover	3		
California Gull		1	
Rock Pigeon			4
Eurasian Collared-Dove			1
Mourning Dove		15	14
Downy Woodpecker			1
Northern Flicker		2	3
Say's Phoebe		1	
Western Kingbird	7	35	1
Eastern Kingbird	1	6	
Loggerhead Shrike	1	5	
Black-billed Magpie	3	8	
American Crow		2	3
Common Raven	1	2	
Horned Lark	38	82	9
Violet-green Swallow	1	2	
Rock Wren		1	
House Wren		2	
Blue-gray Gnatcatcher		1	
Western Bluebird		1	
Mountain Bluebird	2	3	
American Robin		1	37
Sage Thrasher		1	
European Starling		2	31
Yellow Warbler		8	1
Western Tanager			1

Species	BLM	Other Lands	Department of Defense
Green-tailed Towhee		7	
Chipping Sparrow			1
Brewer's Sparrow		18	2
Vesper's Sparrow		4	
Lark Sparrow	4	19	
Lark Bunting	2	97	
Grasshopper Sparrow		29	
McCown's Longspur		3	
Red-winged Blackbird		2	2
Western Meadowlark	49	327	37
Brewer's Sparrow	1	8	
Common Grackle			4
Bullock's Oriole		4	
House Finch			8
American Goldfinch			2
House Sparrow			4
Points Surveyed*	**19**	**115**	**22**

*The sampling unit was a grid of 16 points; however, because not all points were surveyed within each grid, the number of points is provided here.