MONITORING THE BIRDS OF COCONINO, KAIBAB AND PRESCOTT NATIONAL FORESTS: 2010 FIELD SEASON REPORT

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ROCKY MOUNTAIN BIRD OBSERVATORY

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

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

***Core Values**: (Our goals for achieving our mission)*

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.*

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EXECUTIVE SUMMARY

Rocky Mountain Bird Observatory, in conjunction with the USDA Forest Service, conducted landbird monitoring throughout Coconino, Kaibab and Prescott National Forests in 2010. This project used a spatially balanced sampling design and a survey protocol implemented in portions of 13 states in 2010 as part of a program titled "Integrated Monitoring in Bird Conservation Regions" (IMBCR). The IMBCR design allows inferences to avian species occurrence and population sizes from local to BCR scales, facilitating conservation at local and national levels.

In Coconino National Forest, we surveyed 49 out of 50 planned transects. We did not survey one transect due to a wildfire burning in the area. Field technicians conducted 624 point counts, detecting 5,447 birds of 119 species throughout the Forest between 2 May and 2 July 2010.

In Kaibab National Forest, we surveyed 45 out of 45 planned transects. Field technicians conducted 546 point counts, detecting 5,282 birds of 102 species throughout the Forest between 19 May and 5 July 2010.

In Prescott National Forest, we surveyed 50 out of 50 planned transects. Field technicians conducted 532 point counts, detecting 6,195 birds of 114 species throughout the Forest between 1 May and 24 June 2010.

We estimated forest-level densities and population estimates for 62 species in Coconino National Forest, 59 species in Kaibab and 61 species in Prescott. The data yielded robust density estimates (CV < 50%) for 52 of these species in Coconino, 45 in Kaibab and 48 in Prescott. Given similar sampling effort in future years, we would be able to detect an average annual change of three percent in populations of these species within 15 – 30 years.

We used our data to estimate the proportion of transects occupied for all species with special designation at some level as determined by our partners and species for which we had insufficient detections to estimate population density. We estimated the proportion of transects occupied for 67 species in Coconino, 63 species in Kaibab and 62 species in Prescott.

The spatially-balanced random sampling design implemented in Coconino, Kaibab and Prescott National Forests serves as a model for other long-term monitoring efforts. Its use allows managers to make inferences regarding avian population and occupancy at the local and regional scale and can therefore assist a wide range of stakeholders, landowners and government entities with project level planning and monitoring. Recent Forest Service planning initiatives place increased emphasis on monitoring across spatial scales broader than the forest unit itself, aggregating data across land management units when possible. Because data collected as part of the IMBCR program can be used at multiple scales, it represents a method for achieving effective collaboration in North American bird monitoring.

When implemented in National Forests, the IMBCR design can be used to monitor Management Indicator Species (MIS), defined as any species, groups of species, or species habitat elements selected to track the effects of resource management on population recovery, maintenance of population viability, or ecosystem diversity. There are many other species not listed as MIS that are good indicators for habitat conditions on National Forests. Rather than targeting only MIS we simultaneously survey for all landbirds. This could provide information about which species would serve as ideal management indicators in the future.

ACKNOWLEDGEMENTS

Stratification and allocation of survey effort in Coconino, Kaibab and Prescott National Forests were determined in collaboration with the US Forest Service. We thank Cecelia Overby from Coconino National Forest, Chirre Keckler and Valerie Stein Foster from Kaibab National Forest and Kim Hartwig from Prescott National Forest for their support and interest. Thanks to Jeff Waters from Kaibab National Forest for providing a training facility in Williams and Chris Dennison from Kaibab National Forest for the use of radios and telecommunications training. The 2010 Rocky Mountain Bird Observatory field crew, including Jacob Cooper, Holly Garrod, Christine Harvey, Dylan Radin and Tim Weber faced many challenges throughout the season. Their perseverance and dedication made this field season a success. Chandman Sambuu managed and updated the RMBO database. We thank all of the private landowners for allowing access to their land to conduct surveys. Rob Sparks and Frank Cardone of RMBO 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 and Forest Service staff.

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ACRONYMS

AIC	Akaike's Information Criterion
AICc	Akaike's Information Criterion corrected for small sample size
AZGFD	Arizona Game and Fish Department
BCR	Bird Conservation Region
CNF	Coconino National Forest
GPS	Global Positioning System
GRTS	Generalized Random-Tessellation Stratification
IMBCR	Integrated Monitoring in Bird Conservation Regions
KNF	Kaibab National Forest
MIS	Management Indicator Species
NABCI	North American Bird Conservation Initiative
PIF	Partners in Flight
PNF	Prescott National Forest
RMBO	Rocky Mountain Bird Observatory
SOC	Species of Concern
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

INTRODUCTION

Monitoring is an essential component of wildlife management and conservation science (Witmer 2005, Marsh and Trenham 2008). Common goals of population monitoring are to estimate the population status of target species and to detect changes in populations over time (Thompson et al. 1998, Sauer and Knutson 2008). Effective monitoring programs can identify species that are at-risk due to small or declining populations (Dreitz et al. 2006), provide an understanding of how management actions affect populations(Alexander et al. 2008, Lyons et al. 2008), evaluate population responses to landscape alteration and climate change (Baron et al. 2008, Lindenmayer and Likens 2009), as well as provide basic information on species distributions.

It is becoming increasingly necessary to monitor the consequences of environmental change over large spatial and temporal scales and address questions much larger than those that can be answered within individual management units (Lindenmayer and Likens 2009). Population monitoring at eco-regional landscapes provides an important context for evaluating population change at both local and regional scales, with the potential to identify causal factors and management actions for species recovery (Manley et al. 2005, Sauer and Knutson 2008). Bird Conservation Regions (BCRs) provide a spatially consistent framework for bird conservation in North America (US North American Bird Conservation Initiative Monitoring Subcommittee 2007). The BCRs represent distinct ecological regions with similar bird communities, vegetation types and resource management interests (US North American Bird Conservation Initiative Committee 2000). Population monitoring in BCRs can be implemented within a flexible hierarchical framework of nested units, where information on status of bird populations can be partitioned into smaller units for small-scale conservation planning, or aggregated up to support large-scale conservation efforts for a species' geographic range. By focusing on scales relevant to management and conservation, monitoring in BCRs can easily be integrated within an interdisciplinary, holistic approach to bird conservation that combines monitoring, research and management (Ruth et al. 2003).

The apparent large-scale declines of avian populations and the loss, fragmentation and degradation of native habitats highlight the need for extensive and rigorous landbird monitoring programs (Rich et al. 2004, US North American Bird Conservation Initiative Monitoring Subcommittee 2007). Population monitoring helps to achieve the intent of legislation such as the Migratory Bird Treaty Act (1918), National Environmental Policy Act (1969), Endangered Species Act (1973), the National Forest Management Act (1976) and various state laws (Manley 1993, Sauer 1993).

Before monitoring can be used by land managers to guide conservation efforts, sound program designs and analytic methods are necessary to produce unbiased population estimates (Sauer and Knutson 2008). At the most fundamental level, reliable knowledge about the status of avian populations requires accounting for spatial variation and incomplete detection of the target species (Pollock et al. 2002, Rosenstock et al. 2002, Thompson 2002). Addressing spatial variation entails the use of probabilistic sampling designs that allow population estimates to be extended over the entire area of interest (Thompson et al. 1998). Adjusting for incomplete detection involves the use of appropriate sampling and analytic methods to address the fact that few, if any, species are so conspicuous that they are detected with certainty during surveys even when present (Pollock et al. 2002, Thompson 2002). Accounting for these two sources of variation ensures observed trends reflect true population changes rather than artifacts of the sampling and observation processes (Pollock et al. 2002, Thompson 2002).

The North American Bird Conservation Initiative's "Opportunities for Improving Avian Monitoring" (NABCI 2007) provided goals and recommendations for avian monitoring programs:

> Goal 1: Fully integrate monitoring into bird management and conservation practices and ensure that monitoring is aligned with management and conservation priorities.
>
> Goal 2: Coordinate monitoring programs among organizations and integrate them across spatial scales to solve conservation or management problems effectively.
>
> Goal 3: Increase the value of monitoring information by improving statistical design.
>
> Goal 4: Maintain bird population monitoring data in modern data management systems. Recognizing legal, institutional, proprietary and other constraints provide greater availability of raw data, associated metadata and summary data for bird monitoring programs.

With the US NABCI Monitoring Subcommittee (2007) guidelines in mind, Rocky Mountain Bird Observatory (RMBO) and its partners designed a broad-scale monitoring program titled "Integrated Monitoring in Bird Conservation Regions" (IMBCR) (Blakesley and Hanni 2009). Important properties of the IMBCR design are:

- 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.
- Each state's portion of a BCR 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.

Using the IMBCR design, RMBO'S landbird monitoring objectives are to:

1. Provide robust density, population and occupancy estimates that account for incomplete detection and are comparable at different geographic extents;
2. Provide long-term status and trend data for all regularly occurring breeding species throughout the study area;
3. Provide a design framework to spatially integrate existing bird monitoring efforts in the region to provide better information on distribution and abundance of breeding landbirds, especially for high priority species;
4. Provide basic habitat association data for most bird species to address habitat management issues;
5. 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;
6. Generate decision support tools that help guide conservation efforts and provide a better measure of conservation success.

When implemented in National Forests, the IMBCR design can be used to monitor Management Indicator Species (MIS) and Species of Concern (SOC), a concept adopted by the U.S. Forest Service (USFS). MIS is defined as any species, groups of species, or species habitat elements

selected to track the effects of resource management on population recovery, maintenance of population viability, or ecosystem diversity. MIS serve as a barometer for species viability at the Forest level and also serve as a surrogate for addressing other species ecological needs. The intended use is to be an indicator of habitat quality, track effects of management on the habitat and predict future conditions. Furthermore, there are many other species not mentioned in the preceding categories that are good indicators for habitat conditions on National Forests. Rather than targeting only MIS we simultaneously survey for all landbirds. This could provide information about which species would serve as ideal management indicators in the future.

Program History

In 2005, Kaibab National Forest (KNF) initiated a pilot monitoring program for landbirds (Noble 2005) using a habitat-stratified sampling design and distance sampling (Buckland et al. 2001). KNF expanded the effort in 2006, re-sampling the 2005 transects and adding new transects. It soon became apparent that in order to meet the Forest's objective to effectively monitor MIS, an effort was necessary beyond that which the KNF could sustain on its own. In 2007, RMBO began working with KNF to efficiently meet their monitoring objectives. KNF is the funding partner and assisted with logistical coordination while RMBO collected, analyzed and summarized the survey data.

Beginning in 2006, Coconino National Forest (CNF) monitored birds on 19 transects in Ponderosa Pine and Pinyon-Juniper following the habitat-stratified point transect protocol developed by RMBO (Leukering 2000). In 2008, RMBO partnered with CNF to maintain and expand their landbird monitoring program. The program retained the original 19 transects and added 39 new transects, including transects in Aspen, for the 2008 season.

In 2009, CNF and Prescott National Forest (PNF), along with RMBO, decided to begin monitoring using the new IMBCR study design. This is the first year that the IMBCR design has been implemented in KNF and the second year it has been implemented in Coconino and Prescott National Forests.

METHODS

Study Area

The CNF stratum covers an area of 7426 km^2 in north-central Arizona (Figure 1). CNF's elevation ranges from 2,600 feet in the Verde River Valley to 12,633 feet at Humphrey's Peak. Major habitat types include desert scrub, pinyon-juniper woodland, ponderosa pine forest, mixed conifer forest and alpine tundra (Coconino National Forest 2011).

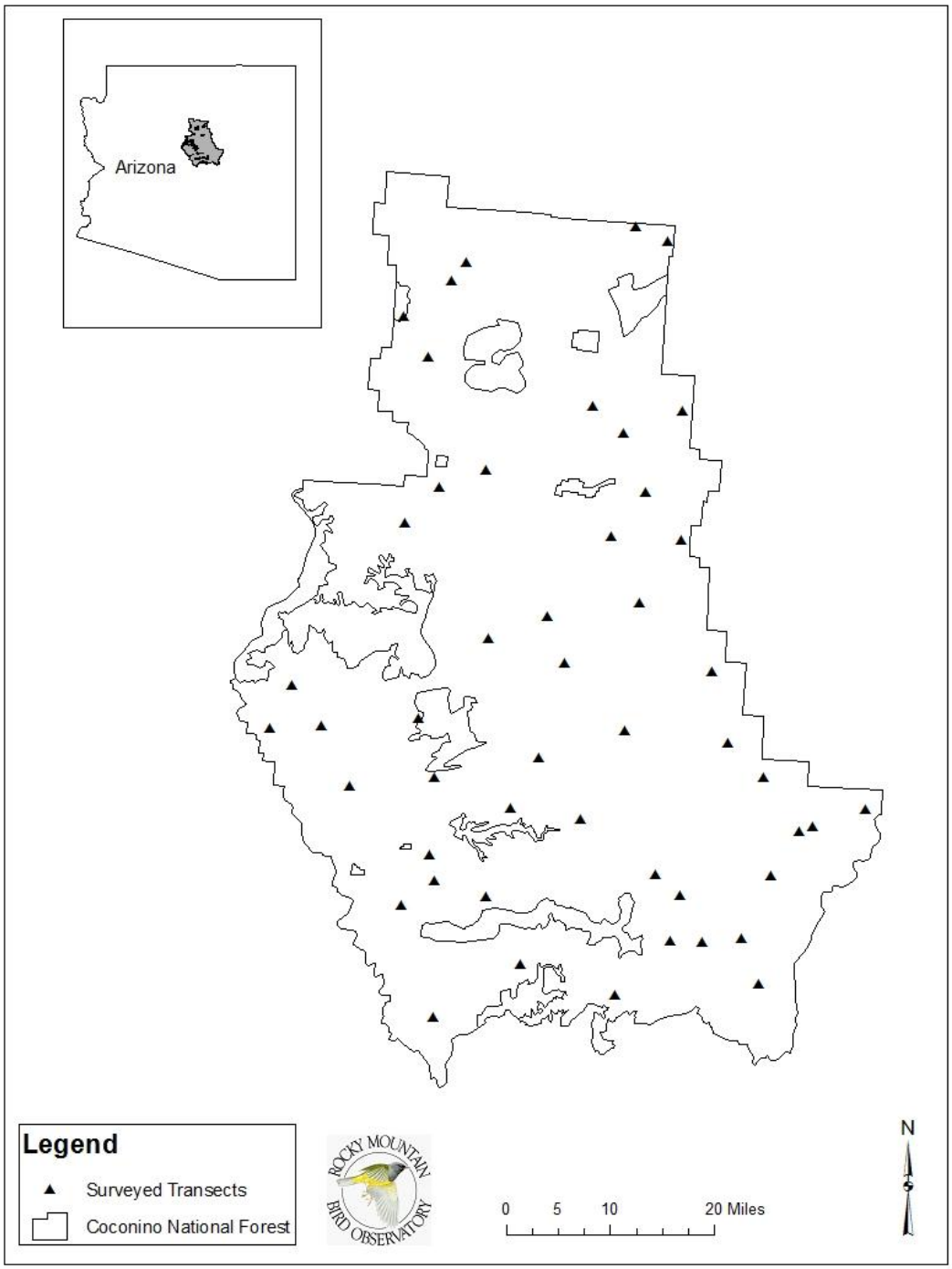

Figure 1. Map of Coconino National Forest with sample locations, 2010.

The KNF stratum covers an area of 5990 km^2 in northern Arizona (Figure 2). KNF's elevation ranges from 3,000 feet 10,418 feet at Kendrick Mountain. Major habitat types include pinyon-juniper woodland, ponderosa pine forest and spruce-fir forest. KNF is split into three sections with one section (North Kaibab) on the north end of the Grand Canyon, one section (Tusayan) on the south end of the Grand Canyon and a third section along I 40 between Williams and Flagstaff (Kaibab National Forest 2011).

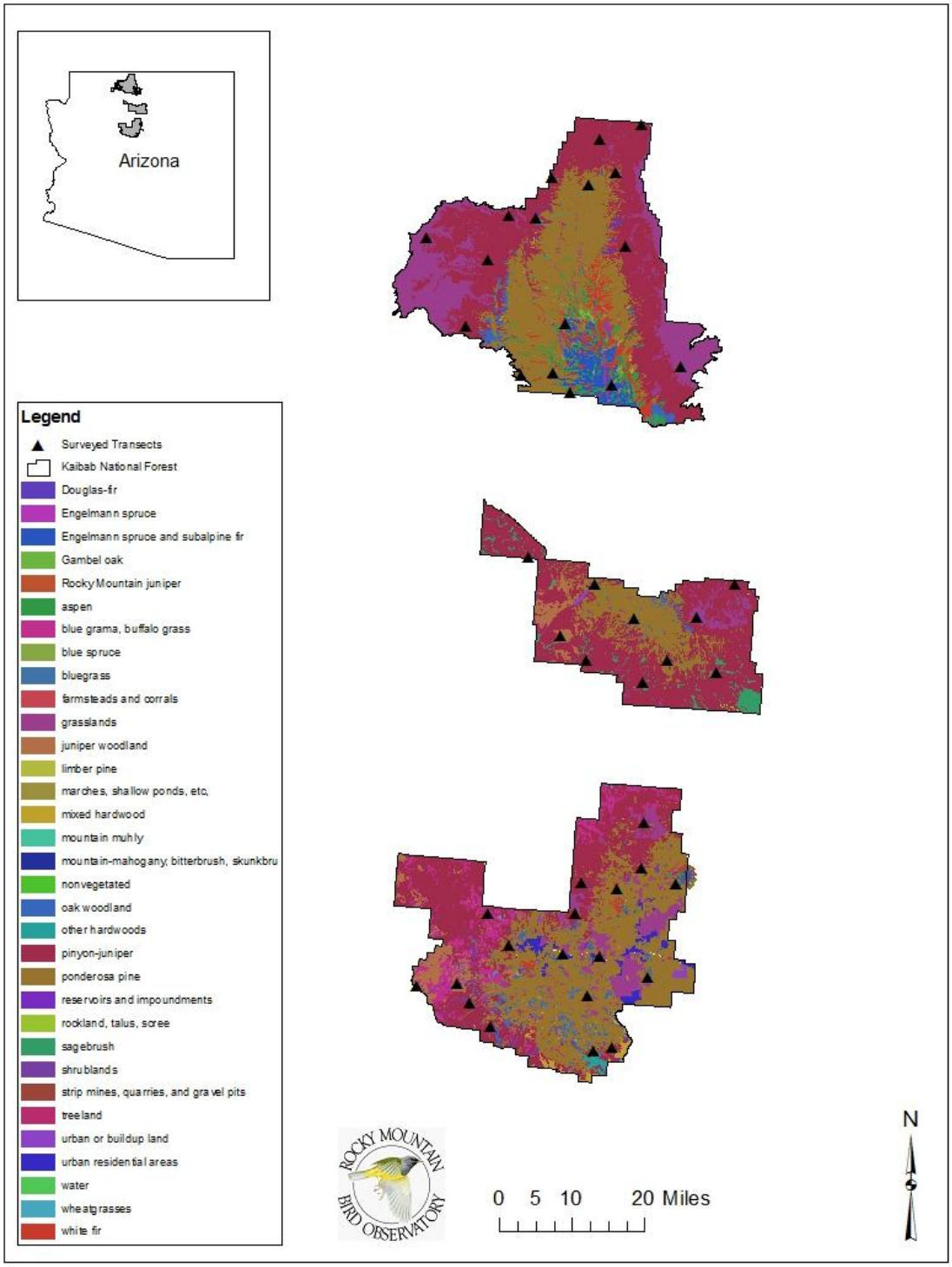

Figure 2. Map of Kaibab National Forest with habitat types and sample locations, 2010.

The PNF stratum covers an area of 5,243 km^2 in north-central Arizona, to the west of CNF (Figure 3). PNF's elevation ranges from 3,000 feet to 8,000 feet. PNF is split into two sections with Prescott and Chino Valley in between. Major habitats include desert scrub, chaparral, pinyon-juniper woodland and ponderosa pine forest (Prescott National Forest 2011).

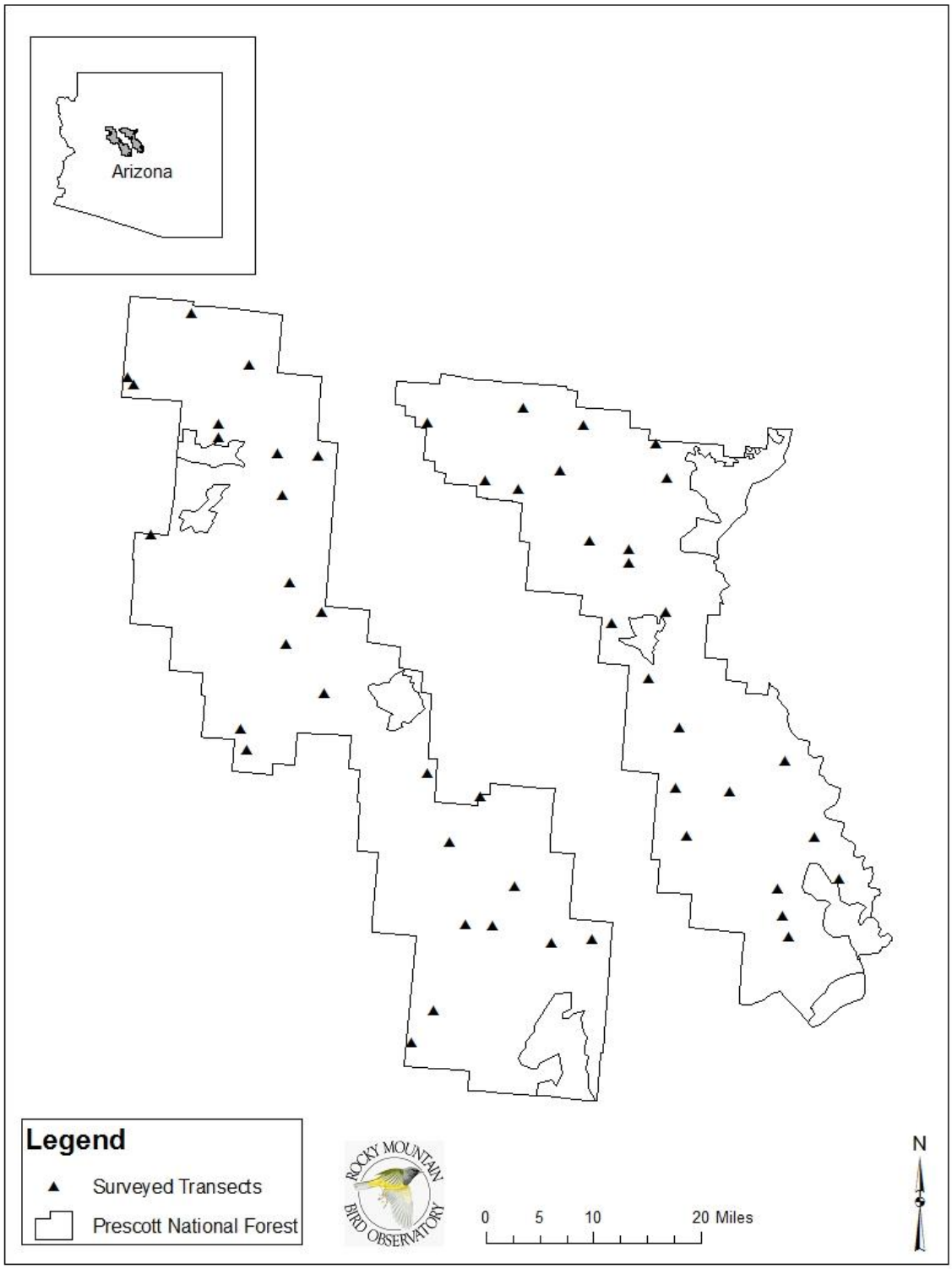

Figure 3. Map of Prescott National Forest with sample locations, 2010.

Sampling Design

RMBO and its partners defined Coconino, Kaibab and Prescott National Forests as the sampling frame; the broad-scale area selected to make inferences about bird populations. Within each Forest, the IMBCR design uses generalized random-tessellation stratification (GRTS), a spatially balanced sampling algorithm, to select sample units (Stevens and Olsen 2004). The GRTS design has 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;

- 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.

The IMBCR design defined sampling units as 1-km^2 cells that were used to create a uniform grid over each National Forest. All spatial data were compiled using ARCGIS 9.2 (Environmental Systems Research Institute 2006). RMBO and its partners allocated samples among strata to reflect partners' management and conservation priorities. In the CNF and PNF, we allocated 50 sampling units in each Forest; in KNF, we allocated 45 sampling units for the 2010 survey year.

Sampling Methods

Within each grid cell we established a 4 x 4 grid of 16 points spaced 250 meters apart. We surveyed birds from points using methods that allow for estimating detection probability through the principles of Distance sampling, Removal modeling and Occupancy estimation. Distance sampling theory was developed to account for the decreasing probability of detecting an object of interest (e.g., a bird) with increasing distance from the observer to the object (Buckland et al. 2001). The detection probability is used to adjust the count of birds to account for birds that were present but undetected. Application of distance theory requires that three critical assumptions be met: 1) all birds at and near the sampling location (distance = 0) are detected; 2) distances of birds are measured accurately; and 3) birds do not move in response to the observer's presence (Buckland et al. 2001, Thomas et al. 2010). Removal modeling is based on mark-recapture theory; detection probability is estimated based on the number of birds detected during consecutive sampling intervals (Farnsworth et al. 2002). In this design, sampling intervals consist of 1-2 minutes segments of a complete sampling period. Removal modeling can also incorporate distance data.

Occupancy estimation is most commonly used to quantify the proportion of sample units (i.e., grid cells) occupied by an organism (MacKenzie et al. 2002). The application of occupancy models requires multiple surveys of the sample unit in space or time to estimate a detection probability (MacKenzie et al. 2006). Occupancy estimation 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 proportion of grid cells occupied for all species with special designation at some level across all BCRs, as determined by our partners (e.g. MIS and SOC) and species for which we had insufficient detections to estimate population density. 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 identified (MacKenzie et al. 2006).

Field technicians with excellent aural and visual bird-identification skills conducted field work in 2010. Prior to conducting surveys, technicians completed an intensive five-day training program to ensure full understanding of field protocols and to practice bird identification and distance estimation in a variety of habitats.

Field technicians conducted point counts (Buckland et al. 2001) following protocol established by RMBO (Hanni et al. 2009). Observers surveyed transects in the morning, beginning ½-hour before sunrise and concluding their survey no later than 11 AM. We extended the survey duration at each point from five to six minutes in 2010 because an even number of minute intervals facilitated the estimation of site occupancy. For every bird detected during the six minute period, we recorded species, sex, horizontal distance from the observer, minute we detected the bird and type of detection (e.g., call, song, visual). Observers measured distances using laser rangefinders. When it was not possible to measure the distance to a bird, observers estimated distance by measuring to some nearby object. Observers recorded birds flying over but not using the immediate surrounding landscape. The "fly over" detections were not included in the estimates of density, population size or occupancy. Observers also recorded the presence of species which are rare or difficult to detect (i.e., woodpeckers, owls, raptors) while they traveled between points within a transect. We used the opportunistic detections of these rare species for distribution mapping purposes only.

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 independent observations. Observers recorded the number of birds detected within the cluster along with a letter code to keep track of each distinct cluster.

In an effort to estimate density

At the start and end of each transect, observers recorded time, ambient temperature, cloud cover, precipitation and wind speed. Technicians navigated to each point using hand-held Global Positioning System (GPS) units. Before beginning each six-minute count, surveyors recorded vegetation data (within a 50 meter radius) and distance from a road (if within 100 meters). We recorded vegetation data according to the dominant habitat type and structural stage and the relative abundance, percent cover and mean height of trees and shrubs by species, as well as grass height and groundcover. We recorded vegetation data quietly to allow birds, potentially disturbed by our approach, time to return to their normal habits prior to the beginning each count.

For more detailed information about survey methods and vegetation data collection protocols, 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/downloads.aspx

Data Analysis

Distance Analysis

Analysis of distance data was accomplished by fitting a detection function to the distribution of recorded distances. The distribution of distances can be a function of characteristics of the

object (e.g., for birds, its size and color, movement, volume of song or call and frequency of call), the surrounding environment (e.g., density of vegetation) and observer ability. Because detectability varies among species, we analyzed the data separately for each species.

We used the analysis software Distance 6.0 (Thomas et al. 2010) to estimate detection probabilities using our point count data. We estimated densities of species for which we obtained a sufficient number of independent detections ($n \geq 60$) pooled across field seasons. We excluded birds flying over but not using the immediate surrounding landscape and birds detected between-points from analyses. We fit the following functions to the distribution of distances for each species: Half normal key function with cosine series expansion and Hazard rate key function with cosine series expansion (Buckland et al. 2001). We combined data across years and strata to estimate global detection functions and compared these models with models that estimated detection probability as a function of year. We modeled year as a covariate using the Multiple Covariate Distance Sampling engine in program Distance. In addition, when sample sizes allowed, we modeled year as a categorical variable, to allow more flexibility in modeling detection probability. 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).

We used the SPSURVEY package (Kincaid 2008) in Program R (R Development Core Team 2008) to estimate density, population size and its variance for each bird species. These analyses were greatly facilitated by R code written for us by Paul Lukacs of the Colorado Division of Wildlife.

Occupancy Analysis

Under the sampling framework, we used a removal design (MacKenzie et al. 2006) to estimate a detection probability for each species by partitioning the six-minute count into three sequential two-minute sampling intervals. After the target species was detected at a point, we set all subsequent sampling intervals at that point to missing data (MacKenzie et al. 2006). The 16 grid points served as spatial replicates for estimating the proportion of points occupied within the sampled grid cells. We used a multi-scale occupancy model (Nichols et al. 2008) to estimate 1) the probability of detecting a species given presence (p), 2) the proportion of points occupied by a species given presence within sampled grid cells (Theta) and 3) the proportion of grid cells occupied by a species (Psi). We evaluated four estimation models for stratum-specific Psi with different structure for p and Theta. The first model constrained p and Theta by holding these parameters constant. The second model constrained p, but allowed Theta to vary across BCRs. The third model allowed p to vary across BCRs, but constrained Theta. The fourth model allowed both p and Theta to vary across BCRs. We used model 1 for species with less than 10 detections in the BCRs and models 2 through 4 for species with greater than 10 detections in the BCRs. As with the Distance analyses, we used Akaike's Information Criterion (AIC) corrected for small sample size (AIC_c) and model selection theory to select the most parsimonious model from which p, Theta and Psi estimates were derived for each species (Burnham and Anderson 2002).

Our application of the multi-scale model was analogous to a within-season robust design (Pollock 1982) where the minute intervals at each point were the secondary samples for estimating p and the points were the primary samples for estimating Theta (Nichols et al. 2008). We considered both p and Theta 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). As mentioned above, we estimated the probability of detection (p) using a removal design with 3

sampling intervals. Using the six 1-minute intervals recorded during sampling, we binned minutes 1 and 2, minutes 3 and 4 and minutes 5 and 6 to meet the assumption of a monotonic decline in the detection rates through time. We truncated the data, using only detections within 125 m of the sample points. Truncating the data at 125 m allowed us to use bird and squirrel detections over a consistent plot size and ensured that the points were independent (points were spread 250 m apart), which in turn allowed us to estimate Theta (the proportion of points occupied within each grid cell).

We used program MARK (White and Burnham 1999) to fit the multi-scale occupancy models and estimate the model parameters. 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 combined estimates of Psi using the delta method (Powell 2007) in program SAS (PROC IML, SAS Institute 2008). We estimated occupancy for all priority species that were detected on a minimum of 10 points after truncating the data to observations within 125 m of each point. Occupancy estimates for species occurring on fewer than 10 points are not reported here because of unreliable model convergence.

Squirrel Analyses

We estimated detection (*p*) and occupancy (Psi) probabilities for Abert's and Red Squirrels using the single season occupancy model (MacKenzie et al. 2002). We used this single-scale occupancy model because the squirrel data did not fit the removal design, resulting in unacceptably low detection rates. We estimated detection probabilities from the 16 spatially replicated point counts within each of the 1 km^2 sample units (MacKenzie et al. 2006). The model estimated the probability (p_{it}) that a species was detected at replicated point count *t*, given presence at sample unit *i*, and the probability (ψ_i) that the species was present at sample unit *i* (MacKenzie et al. 2002). We used a model that held detection constant across BCRs to estimate squirrel occupancy because both species occurred on fewer than ten points in each National Forest. The spatial replication of point counts can be used to estimate detection and occupancy from a single visit (MacKenzie et al. 2006), but under certain circumstances, spatial replication can result in biased estimates (Kendall and White 2009).

RESULTS

Field technicians surveyed 144 of 145 planned transects throughout CNF, KNF and PNF in 2010. Technicians conducted 1,702 point counts within the 144 transects between 1 May and 5 July 2010. We detected 16,924 birds of 143 species, 18 Abert's Squirrels and 13 Red Squirrels (Appendices A, C and E). We recorded 70 priority species as designated by USFS, Partners In Flight (PIF), Arizona Game and Fish Department (AZGFD), and U.S. Fish and Wildlife Service (USFWS), including Abert's Squirrel and Red Squirrel (Appendices B, D and F).

We obtained sufficient numbers of observations to estimate density for 64 species, including 9 MIS or SOC. We obtained precise density estimates (CV ≤ 50%) for 60 species in at least one Forest.

We estimated the proportion of sample units occupied for 83 species, including 13 MIS or SOC and 39 species for which sample sizes were too small to estimate density. We also estimated occupancy for Abert's Squirrel and Red Squirrel, which are MIS in CNF and KNF. We achieved precise occupancy estimates (CV ≤ 50%) for 58 species in at least one Forest.

Coconino National Forest (CNF)

Field technicians surveyed 49 of 50 planned transects throughout CNF in 2010. We did not complete one survey for safety reasons because of a large fire burning nearby. Technicians conducted 624 point counts within the 49 transects between 2 May and 2 July 2010. We detected 5,447 birds of 119 species, 3 Abert's Squirrels and 2 Red Squirrels (Appendix A). Technicians recorded six MIS in CNF (Appendix B).

In 2010 RMBO estimated densities and population sizes for 62 species, 3 of which are MIS (Table 1). The data yielded robust density estimates (CV < 50%) for 52 of these species. The following five species had the highest estimated densities of species recorded in CNF (listed in order from highest to lowest density) – Chipping Sparrow, Violet-green Swallow, Grace's Warbler, Yellow-rumped Warbler and Juniper Titmouse.

We estimated the proportion of transects occupied (Psi) by 66 bird species, 4 of which are MIS (Table 2). The data yielded robust occupancy estimates (CV < 50%) for 41 of these species. We also estimated the proportion of transects occupied by Abert's Squirrel and Red Squirrel. The following five species had the highest estimated occupancy rates, at the transect level, of species recorded in CNF (listed in order from highest to lowest occupancy rate) – Broad-tailed Hummingbird, Ash-throated Flycatcher, Plumbeous Vireo, Lesser Goldfinch and Western Bluebird.

This monitoring design and current sampling intensity is providing population information for four of the six avian MIS recorded in CNF in 2011. This includes density and occupancy estimates for Hairy Woodpecker, Juniper Titmouse and Pygmy Nuthatch and occupancy estimates for Lucy's Warbler. It also provides occupancy estimates for two mammal species designated as MIS: Abert's Squirrel and Red Squirrel.

Table 1. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (% CV) and number of independent detections (n) of breeding bird species in Coconino National Forest, 2009 – 2010. S indicates the number of transects used in analyses. Management Indicator Species are bolded.

	Coconino NF (S=106)				
Species	**Year**	**D**	**N**	**% CV**	**n**
Acorn Woodpecker	2009	1.81	13,415	46	25
	2010	1.04	7,702	43	13
American Crow	2009	0.02	113	88	1
	2010	0.20	1,499	50	12
American Kestrel	2009	0.04	288	90	1
	2010	0.26	1,905	57	6
American Robin	2009	12.81	95,162	17	117
	2010	9.49	70,488	20	106
Ash-throated Flycatcher	2009	7.80	57,888	14	83
	2010	9.73	72,246	15	133
Barn Swallow	2009	3.05	22,631	86	5
	2010	4.20	31,171	72	6
Bewick's Wren	2009	8.36	62,097	19	74
	2010	1.25	9,266	31	10
Black-chinned Sparrow	2009	2.06	15,294	33	21
	2010	4.55	33,774	40	42
Black-headed Grosbeak	2009	3.25	24,161	29	32
	2010	7.53	55,885	30	43
Black-throated Gray Warbler	2009	4.08	30,319	34	41
	2010	3.52	26,129	34	32
Black-throated Sparrow	2009	4.51	33,528	31	44
	2010	8.44	62,657	28	80
Blue-gray Gnatcatcher	2009	2.83	21,002	61	3
	2010	4.16	30,920	58	4
Broad-tailed Hummingbird	2009	24.81	184,211	18	62
	2010	21.09	156,648	21	47
Brown-headed Cowbird	2009	8.36	62,067	17	64
	2010	4.18	31,054	25	29
Bushtit	2009	25.93	192,575	28	34
	2010	3.15	23,412	59	6
Cactus Wren	2009	0.41	3,051	48	7
	2010	0.12	895	76	3
Canyon Towhee	2009	2.03	15,078	34	14
	2010	1.09	8,072	40	12
Cassin's Kingbird	2009	1.73	12,875	32	18
	2010	1.40	10,377	34	25
Chipping Sparrow	2009	16.75	124,396	18	123

	Coconino NF (S=106)				
Species	**Year**	**D**	**N**	**% CV**	**n**
Chipping Sparrow (cont'd)	2010	38.99	289,571	22	149
Common Raven	2009	2.07	15,368	20	71
	2010	2.38	17,686	25	74
Cordilleran Flycatcher	2009	4.29	31,887	36	23
	2010	3.64	26,995	34	25
Dark-eyed Junco	2009	17.61	130,755	16	125
	2010	14.62	108,571	22	94
Eastern Meadowlark	2009	2.49	18,466	80	32
	2010	--	--	--	0
Gambel's Quail	2009	0.84	6,248	26	41
	2010	2.39	17,721	30	84
Grace's Warbler	2009	19.43	144,284	17	156
	2010	27.78	206,290	15	202
Gray Flycatcher	2009	9.56	71,009	24	40
	2010	13.96	103,697	24	75
Gray Vireo	2009	1.30	9,674	23	19
	2010	1.60	11,896	32	30
Hairy Woodpecker	2009	2.13	15,846	32	16
	2010	5.01	37,181	25	34
Hepatic Tanager	2009	2.69	19,942	37	18
	2010	2.21	16,395	30	19
Hermit Thrush	2009	2.73	20,298	28	42
	2010	6.23	46,246	28	47
Horned Lark	2009	1.05	7,795	62	8
	2010	1.01	7,531	48	7
House Finch	2009	9.54	70,815	46	64
	2010	5.30	39,344	31	76
House Sparrow	2009	4.94	36,715	88	12
	2010	1.23	9,130	84	3
House Wren	2009	6.34	47,089	35	31
	2010	2.22	16,486	51	16
Juniper Titmouse	2009	12.60	93,589	24	94
	2010	23.69	175,958	28	76
Lark Sparrow	2009	7.85	58,261	27	85
	2010	4.79	35,571	30	47
Lesser Goldfinch	2009	6.03	44,807	38	35
	2010	8.59	63,771	23	68
Mountain Chickadee	2009	31.16	231,428	20	210
	2010	9.30	69,057	30	55
Mourning Dove	2009	6.06	45,026	14	143
	2010	4.92	36,550	14	100

	Coconino NF (S=106)				
Species	**Year**	**D**	**N**	**% CV**	**n**
Northern Flicker	2009	5.20	38,617	16	116
	2010	2.62	19,482	23	53
Northern Mockingbird	2009	9.00	66,813	16	207
	2010	7.17	53,252	19	202
Phainopepla	2009	8.55	63,521	26	52
	2010	3.32	24,641	38	28
Pinyon Jay	2009	0.56	4,193	60	11
	2010	0.58	4,299	30	21
Plumbeous Vireo	2009	9.24	68,602	15	135
	2010	20.59	152,869	16	193
Pygmy Nuthatch	2009	40.42	300,140	19	173
	2010	23.22	172,407	19	90
Red-breasted Nuthatch	2009	0.80	5,953	58	10
	2010	0.39	2,880	81	3
Red-tailed Hawk	2009	0.27	2,017	40	9
	2010	0.20	1,485	47	6
Rock Wren	2009	4.37	32,432	42	42
	2010	0.66	4,928	29	15
Rufous-crowned Sparrow	2009	1.80	13,396	37	17
	2010	1.98	14,730	23	24
Scott's Oriole	2009	2.30	17,048	33	29
	2010	3.03	22,515	19	51
Spotted Towhee	2009	10.63	78,956	21	107
	2010	8.45	62,737	26	77
Steller's Jay	2009	8.90	66,087	21	97
	2010	6.61	49,086	18	92
Vesper Sparrow	2009	--	--	--	0
	2010	0.21	1,593	48	4
Violet-green Swallow	2009	38.54	286,173	26	89
	2010	28.52	211,802	25	74
Virginia's Warbler	2009	0.75	5,584	42	6
	2010	3.46	25,693	43	25
Warbling Vireo	2009	2.72	20,164	61	6
	2010	7.50	55,661	63	15
Western Bluebird	2009	20.17	149,756	16	121
	2010	11.41	84,727	23	62
Western Kingbird	2009	0.91	6,785	38	8
	2010	--	--	--	0
Western Meadowlark	2009	--	--	--	0
	2010	2.16	16,053	40	78
Western Scrub-Jay	2009	2.83	21,027	20	44

	Coconino NF (S=106)				
Species	**Year**	**D**	**N**	**% CV**	**n**
Western Scrub-Jay (cont'd)	2010	6.25	46,435	19	88
Western Tanager	2009	4.23	31,437	19	62
	2010	8.62	64,017	15	116
Western Wood-Pewee	2009	3.01	22,387	21	59
	2010	1.51	11,230	28	38
White-breasted Nuthatch	2009	11.69	86,840	19	130
	2010	6.26	46,468	17	63
Yellow-rumped Warbler	2009	28.73	213,346	20	154
	2010	25.54	189,680	26	124

Table 2. Estimated proportion of sample units occupied (Psi), percent coefficient of variation of Psi (% CV) and number of transects with one or more detections (n Tran) of breeding bird species, Abert's Squirrel and Red Squirrel in Coconino National Forest, 2010. Dashes indicate the data were insufficient for estimating site occupancy. A Psi estimate equal to 1 indicates the species was detected on all transects surveyed. S indicates the number of transects used in analyses. Management Indicator Species are bolded.

	Coconino NF (S=49)		
Species	**Psi**	**% CV**	**n Tran**
Abert's Squirrel	0.043	109	1
Ash-throated Flycatcher	0.539	13	26
Bewick's Wren	0.170	32	8
Black-chinned Hummingbird	0.310	34	9
Black-chinned Sparrow	0.102	42	5
Black-throated Gray Warbler	0.245	25	12
Black-throated Sparrow	0.205	28	10
Blue-gray Gnatcatcher	0.126	38	6
Broad-tailed Hummingbird	0.607	13	27
Brown Creeper	0.029	99	1
Brown-headed Cowbird	0.417	19	18
Bullock's Oriole	0.069	56	3
Bushtit	0.192	46	5
Cactus Wren	0.041	69	2
Canyon Towhee	0.144	38	6
Canyon Wren	0.030	100	1
Cassin's Kingbird	0.223	28	10
Clark's Nutcracker	0.070	56	3
Common Nighthawk	0.078	71	2
Common Yellowthroat	0.030	99	1
Cooper's Hawk	0.200	93	2
Cordilleran Flycatcher	0.303	25	12

	Coconino NF (S=49)		
Species	**Psi**	**% CV**	**n Tran**
Curve-billed Thrasher	0.076	74	2
Downy Woodpecker	0.033	99	1
European Starling	0.021	99	1
Gambel's Quail	0.208	28	10
Grace's Warbler	0.368	13	18
Gray Flycatcher	0.391	18	19
Gray Vireo	0.211	28	10
Green-tailed Towhee	0.145	35	7
Hairy Woodpecker	0.449	18	18
Hepatic Tanager	0.252	27	11
Horned Lark	0.062	56	3
Juniper Titmouse	0.417	17	20
Ladder-backed Woodpecker	0.171	46	5
Lark Sparrow	0.252	25	12
Lesser Goldfinch	0.535	14	25
Loggerhead Shrike	0.104	72	2
Lucy's Warbler	0.067	56	3
Mountain Bluebird	0.066	56	3
Northern Rough-winged Swallow	0.100	58	3
Olive-sided Flycatcher	0.077	56	3
Orange-crowned Warbler	0.045	69	2
Phainopepla	0.125	38	6
Pine Siskin	0.104	42	5
Pinyon Jay	0.132	38	6
Plumbeous Vireo	0.538	13	26
Purple Martin	0.127	44	5
Pygmy Nuthatch	0.438	16	21
Red Squirrel	0.021	99	1
Red-faced Warbler	0.158	36	7
Rock Wren	0.157	35	7
Ruby-crowned Kinglet	0.041	69	2
Rufous-crowned Sparrow	0.209	28	10
Say's Phoebe	0.064	70	2
Scott's Oriole	0.370	20	17
Sharp-shinned Hawk	0.089	111	1
Spotted Towhee	0.329	21	16
Townsend's Solitaire	0.094	48	4
Vesper Sparrow	0.067	56	3
Virginia's Warbler	0.146	35	7
Warbling Vireo	0.125	38	6
Western Bluebird	0.505	15	23

Species	Coconino NF (S=49)		
	Psi	% CV	n Tran
Western Meadowlark	0.145	35	7
Western Scrub-Jay	0.359	20	17
White-throated Swift	0.048	70	2
White-winged Dove	0.022	99	1
Williamson's Sapsucker	0.052	70	2

Kaibab National Forest (KNF)

Field technicians surveyed 45 of 45 planned transects throughout KNF in 2010. Technicians conducted 546 point counts within the 45 transects between 19 May and 5 July 2010. We detected 5,282 birds of 102 species, 14 Abert's Squirrels and 11 Red Squirrels (Appendix C). Technicians recorded 6 MIS in KNF (Appendix D).

In 2010 RMBO estimated densities and population sizes for 59 species, 4 of which are priority species (Table 3). The data yielded robust density estimates (CV < 50%) for 45 of these species. The following five species had the highest estimated densities of species recorded in KNF (listed in order from highest to lowest density) - Blue-gray Gnatcatcher, Chipping Sparrow, Warbling Vireo, Gray Flycatcher and Juniper Titmouse.

We estimated the proportion of transects occupied (Psi) by 62 bird species, 4 of which are MIS (Table 4). The data yielded robust occupancy estimates (CV < 50%) for 36 of these species. We also estimated the proportion of transects occupied by Abert's Squirrel and Red Squirrel. The following five species had the highest estimated occupancy rates, at the transect level, of species recorded in KNF (listed in order from highest to lowest occupancy rate) – Ash-throated Flycatcher, Plumbeous Vireo, Gray Flycatcher, Hairy Woodpecker and Western Bluebird.

This monitoring design and current sampling intensity is providing population information for four of the six avian MIS recorded in KNF in 2011. This includes density and occupancy estimates for Hairy Woodpecker, Juniper Titmouse and Pygmy Nuthatch and occupancy estimates for Wild Turkey. It also provides occupancy estimates for two mammal species designated as MIS: Abert's Squirrel and Red Squirrel.

Table 3. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (% CV) and number of independent detections (n) of breeding bird species in Kaibab National Forest, 2009 – 2010. S indicates the number of transects used in analyses. Management Indicator Species are bolded.

Species	Kaibab NF (S=45)				
	Year	D	N	%CV	n
Acorn Woodpecker	2010	0.27	1,627	51	3
American Crow	2010	0.09	213	42	5
American Kestrel	2010	0.10	244	60	2
American Robin	2010	6.73	40,342	22	65
Ash-throated Flycatcher	2010	14.44	86,483	15	173
Bewick's Wren	2010	6.55	39,210	28	45

	Kaibab NF (S=45)				
Species	**Year**	**D**	**N**	**%CV**	**n**
Black-chinned Sparrow	2010	0.14	812	88	1
Black-headed Grosbeak	2010	11.06	66,274	24	55
Black-throated Gray Warbler	2010	27.15	162,616	17	211
Black-throated Sparrow	2010	3.30	19,776	64	25
Blue-gray Gnatcatcher	2010	60.91	364,836	51	48
Broad-tailed Hummingbird	2010	12.13	72,678	34	23
Brown-headed Cowbird	2010	5.40	32,351	21	34
Bushtit	2010	1.28	7,690	61	2
Cassin's Kingbird	2010	1.21	7,253	42	19
Chipping Sparrow	2010	47.40	283,897	16	160
Common Raven	2010	1.17	6,979	19	33
Cordilleran Flycatcher	2010	2.22	13,270	46	14
Dark-eyed Junco	2010	14.04	84,084	19	78
Eastern Meadowlark	2010	0.09	553	84	1
Gambel's Quail	2010	0.55	3,295	53	18
Grace's Warbler	2010	25.26	151,280	22	154
Gray Flycatcher	2010	35.78	214,347	15	169
Gray Vireo	2010	2.70	16,144	39	42
Hairy Woodpecker	2010	9.71	58,144	24	58
Hepatic Tanager	2010	1.85	11,096	37	14
Hermit Thrush	2010	8.23	49,268	30	50
Horned Lark	2010	2.36	14,126	88	13
House Finch	2010	1.69	10,096	29	21
House Wren	2010	2.53	15,184	48	16
Juniper Titmouse	2010	34.80	208,425	24	99
Lark Sparrow	2010	8.05	48,248	29	72
Lesser Goldfinch	2010	4.62	27,652	28	33
Mountain Chickadee	2010	21.08	126,289	26	112
Mourning Dove	2010	1.51	9,045	19	29
Northern Flicker	2010	3.66	21,928	17	64
Northern Mockingbird	2010	1.44	8,647	30	36
Phainopepla	2010	0.13	764	90	1
Pinyon Jay	2010	1.82	10,911	30	57
Plumbeous Vireo	2010	21.80	130,589	13	181
Pygmy Nuthatch	2010	33.82	202,590	23	115
Red-breasted Nuthatch	2010	0.77	1,933	66	5
Red-tailed Hawk	2010	0.08	190	71	2
Rock Wren	2010	1.26	7,538	35	23
Scott's Oriole	2010	0.38	2,298	65	6
Spotted Towhee	2010	13.26	79,412	26	102
Steller's Jay	2010	4.54	27,215	22	56

	Kaibab NF (S=45)				
Species	**Year**	**D**	**N**	**%CV**	**n**
Vesper Sparrow	2010	3.98	9,962	37	65
Violet-green Swallow	2010	32.04	191,907	18	80
Virginia's Warbler	2010	4.19	25,071	44	25
Warbling Vireo	2010	36.85	220,759	38	60
Western Bluebird	2010	16.50	98,823	18	80
Western Kingbird	2010	0.24	1,417	91	2
Western Meadowlark	2010	1.24	7,409	44	41
Western Scrub-Jay	2010	6.00	35,914	22	75
Western Tanager	2010	10.43	62,486	15	120
Western Wood-Pewee	2010	4.63	27,718	23	104
White-breasted Nuthatch	2010	9.77	58,511	18	87
Yellow-rumped Warbler	2010	16.26	97,393	31	66

Table 4. Estimated proportion of sample units occupied (Psi), percent coefficient of variation of Psi (% CV) and number of transects with one or more detections (n Tran) of breeding bird species, Abert's Squirrel and Red Squirrel in Kaibab National Forest, 2010. Dashes indicate the data were insufficient for estimating site occupancy. A Psi estimate equal to 1 indicates the species was detected on all transects surveyed. S indicates the number of transects used in analyses. Management Indicator Species are bolded.

	Kaibab NF (S=45)		
Species	**Psi**	**% CV**	**n Tran**
Abert's Squirrel	0.235	61	5
American Three-toed Woodpecker	0.071	70	2
Ash-throated Flycatcher	0.694	10	30
Bewick's Wren	0.242	28	10
Black-chinned Hummingbird	0.299	32	9
Black-chinned Sparrow	0.022	97	1
Black-throated Gray Warbler	0.447	17	20
Black-throated Sparrow	0.067	55	3
Blue-gray Gnatcatcher	0.308	23	13
Broad-tailed Hummingbird	0.370	21	14
Brown Creeper	0.067	67	2
Brown-headed Cowbird	0.527	14	20
Bullock's Oriole	0.051	68	2
Bushtit	0.180	51	4
Canyon Wren	0.033	99	1
Cassin's Finch	0.086	55	3
Cassin's Kingbird	0.174	34	7
Clark's Nutcracker	0.106	48	4
Common Nighthawk	0.177	50	4
Cordilleran Flycatcher	0.145	42	5

	Kaibab NF (S=45)		
Species	**Psi**	**% CV**	**n Tran**
Downy Woodpecker	0.143	47	4
Eastern Meadowlark	0.022	98	1
Evening Grosbeak	0.032	97	1
Gambel's Quail	0.139	36	6
Grace's Warbler	0.425	12	19
Gray Flycatcher	0.667	11	29
Gray Vireo	0.231	28	10
Greater Roadrunner	0.030	99	1
Green-tailed Towhee	0.046	68	2
Hairy Woodpecker	0.663	13	24
Hepatic Tanager	0.234	29	9
Horned Lark	0.022	97	1
Juniper Titmouse	0.489	16	21
Ladder-backed Woodpecker	0.084	69	2
Lark Sparrow	0.351	21	15
Lazuli Bunting	0.025	97	1
Lesser Goldfinch	0.334	22	14
Loggerhead Shrike	0.056	100	1
Mountain Bluebird	0.099	47	4
Olive-sided Flycatcher	0.091	55	3
Phainopepla	0.023	98	1
Pine Siskin	0.255	26	11
Pinyon Jay	0.427	19	17
Plumbeous Vireo	0.673	10	29
Purple Martin	0.059	70	2
Pygmy Nuthatch	0.564	13	24
Red Crossbill	0.172	34	7
Red Squirrel	0.045	69	2
Rock Wren	0.206	30	8
Ruby-crowned Kinglet	0.113	41	5
Sage Sparrow	0.023	97	1
Say's Phoebe	0.074	70	2
Scott's Oriole	0.072	54	3
Spotted Towhee	0.429	17	19
Townsend's Solitaire	0.052	68	2
Vesper Sparrow	0.240	27	10
Virginia's Warbler	0.162	32	7
Warbling Vireo	0.207	29	9
Western Bluebird	0.626	13	25
Western Meadowlark	0.136	37	6
Western Scrub-Jay	0.446	17	19
White-throated Swift	0.056	67	2

Species	Kaibab NF (S=45)		
	Psi	% CV	n Tran
Wild Turkey	0.222	78	3
Williamson's Sapsucker	0.173	36	6

Prescott National Forest (PNF)

Field technicians surveyed 50 of 50 planned transects throughout PNF in 2010. Technicians conducted 532 point counts within the 50 transects between 1 May and 24 June 2010. We detected 6,195 birds of 114 species and 1 Abert's Squirrel (Appendix E). Technicians recorded 18 SOC in PNF (Appendix F).

In 2010 RMBO estimated densities and population sizes for 61 species, 9 of which are priority species (Table 5). The data yielded robust density estimates (CV < 50%) for 48 of these species. The following five species had the highest estimated densities of species recorded in PNF (listed in order from highest to lowest density) - Spotted Towhee, Juniper Titmouse, Blue-gray Gnatcatcher and Black-chinned Sparrow.

We estimated the proportion of transects occupied (Psi) by 61 bird species, 13 of which are priority species (Table 6). The data yielded robust occupancy estimates (CV < 50%) for 43 of these species. We also estimated the proportion of transects occupied by Abert's Squirrel. The following five species had the highest estimated occupancy rates, at the transect level, of species recorded in PNF (listed in order from highest to lowest occupancy rate) – Western Scrub-Jay, Brown-headed Cowbird, Ash-throated Flycatcher, Lesser Goldfinch and Spotted Towhee.

This monitoring design and current sampling intensity is providing population information for 12 of the 18 avian SOC recorded in PNF in 2011. This includes density and occupancy estimates for Brown Headed Cowbird, Grace's Warbler, Gray Vireo, Hairy Woodpecker, Juniper Titmouse, Pinyon Jay, Pygmy Nuthatch, Spotted Towhee and Virginia's Warbler. It also includes occupancy estimates for Lucy's Warbler, Orange-crowned Warbler and Purple Martin.

Table 5. Estimated densities per km^2 (D), population sizes (N), percent coefficient of variation of estimates (% CV) and number of independent detections (n) of breeding bird species in Prescott National Forest, 2009 – 2010. S indicates the number of transects used in analyses. Species of Concern are bolded.

Species	Prescott NF (S=104)				
	Year	D	N	%CV	n
Acorn Woodpecker	2009	0.74	3,896	64	9
	2010	1.12	5,888	57	12
American Kestrel	2009	--	--	--	0
	2010	0.10	526	84	2
American Robin	2009	6.28	32,921	31	50
	2010	1.37	7,159	74	13
Ash-throated Flycatcher	2009	9.03	47,348	12	92
	2010	17.93	94,017	12	209
Barn Swallow	2009	--	--	--	0

	Prescott NF (S=104)				
Species	**Year**	**D**	**N**	**%CV**	**n**
Barn Swallow (cont'd)	2010	0.79	4,139	86	1
Bewick's Wren	2009	19.63	102,899	14	152
	2010	6.73	35,296	22	46
Black-chinned Sparrow	2009	14.01	73,442	20	125
	2010	21.34	111,879	16	168
Black-headed Grosbeak	2009	9.18	48,119	22	79
	2010	15.60	81,798	29	76
Black-throated Gray Warbler	2009	1.48	7,755	45	13
	2010	10.11	53,012	20	78
Black-throated Sparrow	2009	15.77	82,657	19	147
	2010	19.42	101,831	16	157
Blue-gray Gnatcatcher	2009	5.39	28,239	67	5
	2010	34.19	179,240	44	28
Broad-tailed Hummingbird	2009	1.39	7,305	63	3
	2010	16.32	85,563	24	31
Brown-headed Cowbird	2009	12.39	64,937	19	83
	2010	13.02	68,282	16	77
Bushtit	2009	30.25	158,594	24	53
	2010	10.35	54,267	29	16
Cactus Wren	2009	2.08	10,901	32	31
	2010	1.08	5,681	40	23
Canyon Towhee	2009	3.79	19,869	27	25
	2010	4.50	23,618	27	34
Cassin's Kingbird	2009	3.96	20,774	32	36
	2010	5.38	28,187	20	82
Chipping Sparrow	2009	4.67	24,476	32	30
	2010	15.66	82,080	27	51
Common Raven	2009	1.96	10,302	22	59
	2010	0.64	3,365	27	17
Dark-eyed Junco	2009	8.69	45,569	24	54
	2010	1.64	8,608	50	9
Eastern Meadowlark	2009	2.04	10,708	51	23
	2010	3.62	18,996	47	36
Gambel's Quail	2009	2.78	14,556	18	128
	2010	7.10	37,211	14	213
Grace's Warbler	2009	4.70	24,623	37	33
	2010	3.71	19,451	44	23
Gray Flycatcher	2009	4.50	23,580	38	18
	2010	20.31	106,485	19	93
Gray Vireo	2009	1.93	10,144	35	27
	2010	7.20	37,765	18	115

	Prescott NF (S=104)				
Species	**Year**	**D**	**N**	**%CV**	**n**
Hairy Woodpecker	2009	0.61	3,196	53	4
	2010	2.59	13,584	37	15
Hepatic Tanager	2009	2.96	15,533	43	19
	2010	5.18	27,154	29	38
Hermit Thrush	2009	0.37	1,949	71	5
	2010	0.62	3,259	68	4
Horned Lark	2009	15.74	82,535	44	105
	2010	7.65	40,093	48	45
House Finch	2009	11.58	60,699	25	68
	2010	7.36	38,584	21	90
House Wren	2009	5.14	26,959	43	22
	2010	4.07	21,332	51	25
Juniper Titmouse	2009	8.58	44,979	22	56
	2010	38.76	203,235	28	106
Lark Sparrow	2009	3.80	19,906	27	36
	2010	6.22	32,591	25	52
Lesser Goldfinch	2009	5.71	29,950	34	29
	2010	12.74	66,790	17	86
Mountain Chickadee	2009	4.41	23,115	30	26
	2010	1.90	9,974	50	10
Mourning Dove	2009	8.67	45,468	12	179
	2010	11.31	59,310	10	206
Northern Flicker	2009	1.08	5,640	35	21
	2010	0.52	2,740	42	9
Northern Mockingbird	2009	15.94	83,583	12	321
	2010	8.20	43,008	18	197
Phainopepla	2009	23.31	122,197	27	124
	2010	6.53	34,253	30	47
Pinyon Jay	2009	0.28	1,484	76	7
	2010	0.55	2,882	39	17
Plumbeous Vireo	2009	1.64	8,609	33	21
	2010	5.38	28,205	36	43
Pygmy Nuthatch	2009	6.14	32,191	50	23
	2010	2.42	12,691	54	8
Red-breasted Nuthatch	2009	0.09	480	89	1
	2010	0.15	795	83	1
Red-tailed Hawk	2009	0.10	542	58	3
	2010	0.20	1,025	49	5
Rock Wren	2009	6.30	33,016	45	53
	2010	2.54	13,331	29	49
Rufous-crowned Sparrow	2009	5.77	30,238	22	52

	Prescott NF (S=104)				
Species	**Year**	**D**	**N**	**%CV**	**n**
Rufous-crowned Sparrow (cont'd)	2010	13.28	69,631	20	137
Scott's Oriole	2009	3.20	16,780	26	34
	2010	6.14	32,172	16	88
Spotted Towhee	2009	27.48	144,059	12	242
	2010	49.80	261,122	15	387
Steller's Jay	2009	1.78	9,344	41	17
	2010	1.18	6,186	61	14
Vesper Sparrow	2009	--	--	--	0
	2010	0.13	660	87	2
Violet-green Swallow	2009	1.36	7,118	67	3
	2010	6.72	35,256	35	17
Virginia's Warbler	2009	1.43	7,509	69	10
	2010	2.92	15,319	48	18
Warbling Vireo	2009	--	--	--	0
	2010	5.27	27,657	47	9
Western Bluebird	2009	0.19	998	92	1
	2010	2.81	14,712	42	13
Western Kingbird	2009	5.80	30,424	34	51
	2010	1.93	10,142	42	15
Western Meadowlark	2009	--	--	--	0
	2010	0.75	3,920	50	23
Western Scrub-Jay	2009	4.56	23,902	19	62
	2010	11.17	58,555	15	134
Western Tanager	2009	3.20	16,771	26	41
	2010	5.40	28,335	22	62
Western Wood-Pewee	2009	2.08	10,920	30	39
	2010	3.13	16,397	23	67
White-breasted Nuthatch	2009	2.12	11,137	36	21
	2010	2.68	14,049	39	23
Yellow-rumped Warbler	2009	1.28	6,706	84	6
	2010	8.46	44,337	34	35

Table 6. Estimated proportion of sample units occupied (Psi), percent coefficient of variation of Psi (% CV) and number of transects with one or more detections (n Tran) of breeding bird species in Prescott National Forest, 2010. Dashes indicate the data were insufficient for estimating site occupancy. A Psi estimate equal to 1 indicates the species was detected on all transects surveyed. S indicates the number of transects used in analyses. Species of Concern are bolded.

	Prescott NF (S=50)		
Species	**Psi**	**% CV**	**n Tran**
Ash-throated Flycatcher	0.784	8	37
Bewick's Wren	0.434	17	20
Black-chinned Hummingbird	0.265	39	7
Black-chinned Sparrow	0.622	11	31
Black-throated Gray Warbler	0.424	17	21
Black-throated Sparrow	0.549	13	27
Blue Grosbeak	0.091	48	4
Blue-gray Gnatcatcher	0.446	17	21
Broad-tailed Hummingbird	0.332	23	14
Brown-headed Cowbird	0.802	11	32
Bullock's Oriole	0.264	27	11
Bushtit	0.589	29	14
Cactus Wren	0.144	35	7
Canyon Towhee	0.565	17	22
Canyon Wren	0.134	52	4
Cassin's Kingbird	0.605	14	26
Common Nighthawk	0.044	100	1
Cooper's Hawk	0.119	117	1
Curve-billed Thrasher	0.253	46	6
Eastern Meadowlark	0.040	69	2
Gambel's Quail	0.677	11	32
Grace's Warbler	0.101	30	5
Gray Flycatcher	0.602	12	29
Gray Vireo	0.493	15	23
Greater Roadrunner	0.265	33	9
Green-tailed Towhee	0.207	28	10
Hairy Woodpecker	0.201	32	8
Hepatic Tanager	0.310	24	13
Horned Lark	0.103	42	5
Juniper Titmouse	0.553	14	26
Ladder-backed Woodpecker	0.341	36	9
Lark Sparrow	0.366	20	17
Lazuli Bunting	0.068	56	3
Lesser Goldfinch	0.764	9	35
Loggerhead Shrike	0.175	60	3

Species	Prescott NF (S=50)		
	Psi	% CV	n Tran
Lucy's Warbler	0.069	56	3
Northern Rough-winged Swallow	0.037	100	1
Orange-crowned Warbler	0.024	99	1
Phainopepla	0.252	25	12
Pine Siskin	0.084	48	4
Pinyon Jay	0.183	32	8
Plumbeous Vireo	0.271	24	13
Purple Martin	0.028	100	1
Pygmy Nuthatch	0.063	56	3
Red Crossbill	0.022	99	1
Rock Wren	0.416	19	18
Ruby-crowned Kinglet	0.061	56	3
Rufous-crowned Sparrow	0.549	14	26
Scott's Oriole	0.670	11	30
Sharp-shinned Hawk	0.206	86	2
Spotted Towhee	0.725	9	36
Townsend's Solitaire	0.050	69	2
Vesper Sparrow	0.023	99	1
Virginia's Warbler	0.105	42	5
Warbling Vireo	0.272	24	13
Western Bluebird	0.224	28	10
Western Meadowlark	0.124	38	6
Western Scrub-Jay	0.846	7	40
White-throated Swift	0.025	99	1
White-winged Dove	0.138	39	6
Yellow Warbler	0.044	69	2

DISCUSSION

This was the second year of bird monitoring in CNF and PNF using the IMBCR design and the first year in KNF. The number of individuals detected was greatest in PNF, despite the fact that we surveyed the least number of points there. There is more open habitat in PNF relative to the other two Forests, which gives technicians greater visibility. This may increase the ability to detect bird species in that Forest. We detected the most species in CNF this season and the least in KNF. This is most likely due to the large range of elevation and variety of habitats that occur in CNF. Conversely, KNF is not as variable in elevation and habitat types. In CNF, the two species most commonly recorded were Northern Mockingbird and Grace's Warbler. Grace's Warbler is most often found in ponderosa pine habitat while Northern Mockingbird inhabits desert scrub and chaparral habitats. In KNF, the most commonly recorded species were Black-throated Gray Warbler, Ash-throated Flycatcher, Chipping Sparrow, Pinyon Jay and Plumbeous Vireo, which are all generally found in pinyon-juniper habitat.

This year we collectively analyzed data across all three forests, using 2009 and 2010 data. This approach allowed us to estimate common detection probabilities for species that would have otherwise had an insufficient number of detections. By combining our data, we were able to estimate density for 62 species in CNF, 59 in KNF and 61 in PNF. If we had not combined data across years and Forests, we would have been able to estimate density for only 38 species in CNF, 26 in KNF and 33 in PNF.

Simulations using 10 years of data from a similar avian monitoring program (J. Blakesley, RMBO, unpublished) indicated that it would be possible to detect an average annual 3% change in the population of a species within 25 years with 80% power and CV ≤ 40%. A similar trend could be detected within 30 years with CV ≤ 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 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.

This year we estimated the proportion of sites occupied for species with insufficient data to estimate density and/or that are designated as priority species by our partners. By evaluating the strength of evidence for four occupancy estimation models, we effectively accounted for regional variation in detection and availability, resulting in robust estimates of the proportion of occupied sites on the landscape. Occupancy estimation increases the number of bird species that we are able to effectively monitor and provides managers with information about populations of rare and uncommon species (MacKenzie et al. 2005). We transitioned from five minute to six minute counts this year to facilitate analysis of occupancy rates incorporating the removal-in-time method.

The data for avian density and occupancy and vegetation collected with the IMBCR design can be used to develop habitat models to support conservation and management. For example, we can post-stratify the data using vegetation variables collected at each point to generate habitat-specific density estimates. Analytic methods for modeling covariate effects on density using Distance sampling theory may be particularly useful for evaluating population responses to habitat management (Royle et al. 2004).The multi-scale occupancy model can also be extended to investigate habitat relationships for species of conservation concern. This approach may especially useful for guiding habitat management and evaluating population responses to habitat conditions at both local and regional scales. Habitat modeling may ultimately reveal

spatial trends related to land use or habitat loss that are symptomatic of population declines and suggest land management strategies for species recovery.

Our 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, this sampling design could be used to monitor the distribution and population dynamics of additional taxa, 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. The design should prove useful for estimating occupancy of rare or infrequently detected species using observations of tracks and feeding sign, as well as remote devices such as hair traps, camera traps and acoustic recorders (MacKenzie et al. 2006). For example, the Abert's squirrel (*Sciurus aberti*) is an MIS for USFS Region 3, but secretive habits and low detection rates complicate the estimation of abundance or occupancy. The observation of Abert's squirrel feeding sign at the point count locations would likely increase the probability of detecting the species and allow the estimation of the proportion of sample cells occupied. 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.

The IMBCR design 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 government entities at both local and regional scales. IMBCR monitoring represents one method for achieving effective collaboration in North American bird monitoring and could be applied to other BCRs and regions across the continent.

LITERATURE CITED

Alexander, J. D., J. L. Stevens, G. R. Geupel, and T. C. Will. Decision support tools: bridging the gap between science and management. 13 February-16 February, 2008 2008.

Baron, J. S., S. H. Julius, J. M. West, L. A. Joyce, G. Blate, C. H. Peterson, M. Palmer, B. D. Keller, P. Kareiva, J. M. Scott, and B. Griffith. 2008. Some guidelines for helping natural resources adapt to climate change. International Human Dimensions Programme on Global Environmental Change Update 2:46-52.

Blakesley, J. A., and D. J. Hanni. 2009. Monitoring Colorado's Birds, 2008. Technical Report M-MCB08-01. Rocky Mountain Bird Observatory, Brighton, Colorado, USA.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, Oxford, UK.

Burnham, K. P., and D. R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach. Springer-Verlag, New York, New York, USA.

Coconino National Forest. 2011. About Us: Statistics. <http://www.fs.fed.us/r3/coconino/about/index.shtml>. 15 February 2011.

Dreitz, V. J., P. M. Lukacs, and F. L. Knopf. 2006. Monitoring low density avian populations: An example using Mountain Plovers. Condor 108:700-706.

Environmental Systems Research Institute. 2006. ArcGIS, version 9.2. Environmental Systems Research Institute, Incorporated, Redlands, California, USA.

Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. Auk 119:414-425.

Hanni, D. J., C. M. White, J. A. Blakesley, G. J. Levandoski, and J. J. Birek. 2009. Field protocol for spatially-balanced sampling of landbird populations. Unpublished report. Rocky Mountain Bird Observatory, Brighton, Colorado, USA.

Kaibab National Forest. 2011. About the Forest. <http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATlA!/?ss=110307&navtype=BROWSEBYSUBJECT&cid=FSE_003840&navid=170000000000000&pnavid=null&position=BROWSEBYSUBJECT&ttype=main&pname=Kaibab>. 15 February 2011.

Kendall, W. L., and G. C. White. 2009. A cautionary note on substituting spatial subunits for repeated temporal sampling in studies of site occupancy. Journal of Applied Ecology 46:1182-1188.

Kincaid, T. 2008. Unpublished report. United States Environmental Protection Agency, Washington, D. C., USA.

Leukering, T. 2000. Point Transect Protocol for Monitoring Colorado's Birds. Unpubl. document. Rocky Mountain Bird Observatory. Brighton, Colorado, USA.

Lindenmayer, D. B., and G. E. Likens. 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. Trends in Ecology and Evolution 24:482-486.

Lyons, J. E., M. C. Runge, H. P. Laskowski, and W. L. Kendall. 2008. Monitoring in the context of structured decision-making and adaptive management. Journal of Wildlife Management 72:1683-1692.

MacKenzie, D. I., J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royle, and C. A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83:2248-2255.

MacKenzie, D. I., J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Elsevier, Burlington, Massachusetts, USA.

MacKenzie, D. I., J. D. Nichols, N. Sutton, K. Kawanishi, and L. L. Bailey. 2005. Improving inferences in population studies of rare species that are detected imperfectly. Ecology 86:1101-1113.

Manley, P. N., M. D. Schlesinger, J. K. Roth, and B. Van Horne. 2005. A field-based evaluation of a presence-absence protocol for monitoring ecoregional-scale biodiversity. Journal of Wildlife Management 69:950-966.

Manley, P. N., W. M. Block, F. R. Thompson, G. S. Butcher, C. Paige, L. H. Suring, D.S. Winn, D. Roth, C. J. Ralph, E. Morris, C. H. Flather, and K. Byford. 1993. Guidelines for monitoring populations of Neotropical migratory birds on National Forest system lands. USDA Forest Service Monitoring Task Group Report, Washington, D. C., USA.

Marsh, D. M., and P. C. Trenham. 2008. Current trends in plant and animal population monitoring. Conservation Biology 22:647-655.

Nichols, J. D., L. L. Bailey, A. F. O'Connell, N. W. Talancy, E. H. C. Grant, A. T. Gilbert, E. M. Annand, T. P. Husband, and J. E. Hines. 2008. Multi-scale occupancy estimation and modelling using multiple detection methods. Journal of Applied Ecology 45:1321-1329.

Noble, B. 2005. Kaibab National Forest Landbird Surveys: 2005 Migratory Breeding Season. USDA Forest Service. Kaibab National Forest. Flagstaff, Arizona, USA.

Pollock, K. H. 1982. A capture-recapture design robust to unequal probability of capture. Journal of Wildlife Management 46:752-757.

Pollock, K. H., J. D. Nichols, T. R. Simons, G. L. Farnsworth, L. L. Bailey, and J. R. Sauer. 2002. Large scale wildlife monitoring studies: statistical methods for design and analysis. Environmetrics 13:105-119.

Powell, L. A. 2007. Approximating variance of demographic parameters using the delta method: a reference for avian biologists. Condor 109:949-954.

Prescott National Forest. 2011. About Us. <http://www.fs.fed.us/r3/prescott/about/index.shtml>. 15 February 2011.

R Development Core Team. 2008. R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004. Partners in Flight North American landbird conservation plan. Cornell Lab of Ornithology, Ithaca, New York, USA.

Rosenstock, S. S., D. R. Anderson, K. M. Giesen, T. Leukering, and M. F. Carter. 2002. Landbird counting techniques: current practices and an alternative. Auk 119:46-53.

Royle, J. A., D. K. Dawson, and S. Bates. 2004. Modeling abundance effects in distance sampling. Ecology 85:1591-1597.

Ruth, J. M., D. R. Petit, J. R. Sauer, M. D. Samuel, F. A. Johnson, M. D. Fornwall, C. E. Korschgen, and J. P. Bennett. 2003. Science for avian conservation: Priorities for the new millennium. Auk 120:204-211.

SAS Institute. 2008. SAS/STAT. Version 9.2. SAS Institute, Incorporated, Cary, North Carolina, USA.

Sauer, J. R. Monitoring Goals and Programs of the U.S. Fish and Wildlife Service. Finch, D. M., and P.W. Stangel, 21 September-25 September, 1993 1993.

Sauer, J. R., and M. G. Knutson. 2008. Objectives and metrics for wildlife monitoring. Journal of Wildlife Management 72:1663-1664.

Stevens, D. L., Jr., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99:262-278.

Thomas, L., S. T. Buckland, E. A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. R. B. Bishop, T. A. Marques, and K. P. Burnham. 2010. Distance software: design and

analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology 47:5-14.
Thompson, W. L. 2002. Towards reliable bird surveys: accounting for individuals present but not detected. Auk 119:18-25.
Thompson, W. L., G. C. White, and C. Gowan. 1998. Monitoring vertebrate populations. Academic Press, San Diego, California, USA.
US North American Bird Conservation Initiative Committee. 2000. Bird Conservation Regions descriptions: a supplement to the North American Bird Conservation Initiative: Bird Conservation Regions map. US Fish and Wildlife Service, Arlington, Virginia, USA.
US North American Bird Conservation Initiative Monitoring Subcommittee. 2007. Opportunities for improving avian monitoring. Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Arlington, Virginia, USA.
White, G. C., and K. P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46:120-139.
Witmer, G. W. 2005. Wildlife population monitoring: some practical considerations. Wildlife Research 32:259-263.

APPENDIX A

Number of birds detected in Coconino National Forest, by ranger district, 2009 – 2010, with priority designations as determined by US Forest Service, Partners In Flight, Arizona Game and Fish Department, and US Fish and Wildlife Service (see Appendix B for more specific information). Priority species are marked with an asterisk. Management Indicator Species are bolded. Species most likely detected as migrants are italicized.

	Mogollon Rim		Mormon Lake		Peaks		Red Rock		
Species	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**	**Total**
Abert's Squirrel*	17	2	1		4	**1**			25
Acorn Woodpecker	23	13	9	8	5	1	5		64
American Crow			2	4		13		1	20
American Kestrel	3	4		1	3	8	1		20
American Robin	50	61	13	6	59	56	13	13	271
American Three-toed Woodpecker*		1							1
Anna's Hummingbird	6		11		1		1	7	26
Ash-throated Flycatcher*	18	46	12	25	33	13	81	84	312
Baltimore Oriole		1							1
Band-tailed Pigeon*	1	1	3						5
Barn Swallow		1			9	8			18
Bell's Vireo							1		1
Bewick's Wren	19	3	14	6	13		48	8	111
Black Phoebe	4	2							6
Black-chinned Hummingbird		1				2	10	10	23
Black-chinned Sparrow*	2		2	13			28	42	87
Black-headed Grosbeak	7	10	6	11	15	14	18	24	105
Black-tailed Gnatcatcher							1	4	5
Black-throated Gray Warbler*	21	15	21	17			7	10	91
Black-throated Sparrow*	1	15			8	26	123	74	247
Blue Grosbeak					6		1		7
Blue-gray Gnatcatcher				1		1	6	5	13
Brewer's Blackbird		8		3					11
Brewer's Sparrow		18						4	22
Bridled Titmouse					2				2
Broad-tailed Hummingbird	30	18	12	7	23	15	10	26	141
Brown Creeper	7		2		6	2			17
Brown-headed Cowbird	23	13	11	13	9	2	30	27	128

Species	Mogollon Rim		Mormon Lake		Peaks		Red Rock		Total
	2009	2010	2009	2010	2009	2010	2009	2010	
Bullock's Oriole		3	1				4	1	9
Bushtit	15	1	3		16	1	38	9	83
Cactus Wren*			2		1		4	3	10
Canyon Towhee*	8	11					14	18	51
Canyon Wren*	2	2			7		6	1	18
Cassin's Kingbird*	5	11		1	8	11	12	18	66
Chipping Sparrow	52	62	45	35	40	73	21	58	386
Clark's Nutcracker*		1			1	7			9
Cliff Swallow	1								1
Common Merganser*	2	4							6
Common Nighthawk	2	6			9		2		19
Common Raven	39	32	24	22	41	68	42	29	297
Common Yellowthroat		2							2
Cooper's Hawk*	2	2					2		6
Cordilleran Flycatcher*	23	35	9	1	4	4			76
Costa's Hummingbird*								4	4
Crissal Thrasher*								1	1
Curve-billed Thrasher							3	8	11
Dark-eyed Junco	58	42	38	27	64	83	5		317
Downy Woodpecker*	4		2			1			7
Dusky Flycatcher		4				1		1	6
Eastern Meadowlark	11		33						44
Eurasian Collared-Dove				8		3			11
European Starling					8	4			12
Gambel's Quail*	8	5	4		9		111	92	229
Grace's Warbler*	133	187	20	19	41	33		7	440
Gray Flycatcher	33	32	28	24	8	12	11	26	174
Gray Vireo*	6	2			5	3	12	32	60
Great Blue Heron	1		6						7
Great Horned Owl			1					2	3
Greater Pewee			1		1				2
Greater Roadrunner	1						1	4	6
Great-tailed Grackle					2		9		11
Green-tailed Towhee*	1	10				4	1	6	22

Species	Mogollon Rim		Mormon Lake		Peaks		Red Rock		Total
	2009	2010	2009	2010	2009	2010	2009	2010	
Hairy Woodpecker*	23	29	4	9	8	10	4	5	92
Hepatic Tanager*	12	10	4	10	4	8	10		58
Hermit Thrush	42	25	10	15		7		6	105
Hooded Oriole*								1	1
Horned Lark	5	7	3	7					22
House Finch	14	8	2	10	24	72	43	55	228
House Sparrow					16	9		1	26
House Wren	25	9	4	2	5	6	2		53
Juniper Titmouse*	23	15	29	25	51	12	20	47	222
Killdeer	1		2	1	1				5
Ladder-backed Woodpecker	3	2					2	9	16
Lark Sparrow	25	21	10	18	20	18	51	25	188
Lazuli Bunting			1						1
Lesser Goldfinch	14	29	18	15	8	24	11	43	162
Lewis's Woodpecker					1				1
Loggerhead Shrike*	4	2				1			7
Lucy's Warbler*							5	9	14
*MacGillivray's Warbler**		1							1
Mountain Bluebird	3		2	8	5	4			22
Mountain Chickadee	120	25	30	16	85	37	5		318
Mourning Dove	42	30	44	10	29	44	104	55	358
Northern Flicker	62	35	24	3	52	42	4	1	223
Northern Mockingbird	42	57	27	32	8	44	177	162	549
Northern Pygmy-Owl								1	1
Northern Rough-winged Swallow	1	2	1	14				19	37
Olive Warbler*	3	5	9		3				20
Olive-sided Flycatcher*		5				1	1		7
Orange-crowned Warbler*								2	2
Osprey	3								3
Peregrine Falcon*					1	1		3	5
Phainopepla*	2		4		2		93	47	148
Pine Siskin	6	2	4	4		18		7	41
Pinyon Jay*	48	51		14	17	3			133
Plumbeous Vireo*	86	109	23	51	41	51	12	10	383

Species	Mogollon Rim		Mormon Lake		Peaks		Red Rock		Total
	2009	2010	2009	2010	2009	2010	2009	2010	
Purple Martin*	2	8	3	4					17
Pygmy Nuthatch*	149	63	42	25	98	47	1	4	429
Red Crossbill	9	1	28		16	6			60
Red Squirrel*	14	2			3		1		20
Red-breasted Nuthatch	8	5			2		1		16
Red-faced Warbler*	12	29		3		3			47
Red-tailed Hawk	5	3	4		4	1	6	4	27
Red-winged Blackbird								2	2
Rock Pigeon						12			12
Rock Wren	2	4			12	8	34	7	67
Ruby-crowned Kinglet*	2	2					2	1	7
Rufous-crowned Sparrow	3	4					19	27	53
Say's Phoebe	9		3		3			7	22
Scott's Oriole*	3	14	1	1	5	2	28	58	112
Sharp-shinned Hawk						1		1	2
Song Sparrow			3						3
Spotted Sandpiper		1							1
Spotted Towhee*	26	34	28	6	32	13	46	57	242
Steller's Jay	49	44	23	17	45	55	7	4	244
Townsend's Solitaire	8	4	2		1	5			20
Turkey Vulture	10	8	2	3		4	4	11	42
Verdin			4				2		6
Vesper Sparrow						5		1	6
Violet-green Swallow	89	53	19	37	34	43		101	376
Virginia's Warbler*	4	18					5	14	41
Warbling Vireo	4	19	3	1	3	1			31
Western Bluebird*	59	59	54	11	62	39	12	1	297
Western Kingbird			1		3		8	2	14
Western Meadowlark		23	1	39	5	17		12	97
Western Screech-Owl							1		1
Western Scrub-Jay	12	6	8	15	5	30	33	70	179
Western Tanager	37	65	13	18	12	48	10	36	239
Western Wood-Pewee	17	11	8	2	28	34	8	9	117
White-breasted Nuthatch	71	31	36	11	32	34	14	2	231

Species	Mogollon Rim		Mormon Lake		Peaks		Red Rock		Total
	2009	2010	2009	2010	2009	2010	2009	2010	
White-throated Swift*	2		30				59	9	100
White-winged Dove		2			5		4		11
Wild Turkey			7				2		9
Williamson's Sapsucker		1				1			2
Wilson's Warbler		4						1	5
Yellow-rumped Warbler	106	52	35	69	48	29	2	10	351

APPENDIX B

Priority Species recorded in Coconino National Forests in 2010, with management designation as designated by U.S. Forest Service (USFS), Partners In Flight (PIF), Arizona Game and Fish Department (AZGFD), and US Fish and Wildlife Service (USFWS).

	USFS[1]		PIF[2]		USFWS[4]		Density	Occupancy
Species	Region 3	Coconino NF	BCR 34	AZGFD[3]	BCR 34	Region 2	Estimated	Estimated
Abert's Squirrel		MIS						X
American Three-toed Woodpecker				SGCN				
Ash-throated Flycatcher			RS				X	X
Band-tailed Pigeon			CC					
Black-chinned Sparrow			CC,RS		BCC	BCC	X	X
Black-throated Gray Warbler			RC		BCC		X	X
Black-throated Sparrow			RS				X	X
Cactus Wren			RC				X	X
Canyon Towhee			RC,CS,RS		BCC		X	X
Canyon Wren			RS					X
Cassin's Kingbird			RC,RS				X	X
Clark's Nutcracker				SGCN				X
Common Merganser				SGCN				
Cooper's Hawk			RS					X
Cordilleran Flycatcher			RS				X	X
Costa's Hummingbird	AZ,NM		CC			BCC		
Crissal Thrasher			CS,RS					
Downy Woodpecker				SGCN				X
Gambel's Quail			CS,RS				X	X
Grace's Warbler			CC,RS		BCC	BCC	X	X
Gray Vireo	AZ,NM		CC,RC,RS		BCC	BCC	X	X
Green-tailed Towhee				SGCN				X
Hairy Woodpecker		MIS					X	X
Hepatic Tanager			RS				X	X
Hooded Oriole			RS					

Species	USFS[1]		PIF[2]	AZGFD[3]	USFWS[4]		Density	Occupancy
	Region 3	Coconino NF	BCR 34		BCR 34	Region 2	Estimated	Estimated
Juniper Titmouse		MIS	RC,RS				X	X
Loggerhead Shrike	AZ,NM,OK		RC			BCC		X
Lucy's Warbler		MIS	CC,RC,CS,RS		BCC	BCC		X
MacGillivray's Warbler				SGCN				
Olive Warbler			RS		BCC	BCC		
Olive-sided Flycatcher			CC	SGCN				X
Orange-crowned Warbler				SGCN				X
Peregrine Falcon	AZ,NM			SGCN	BCC	BCC		
Phainopepla			RC,CS,RS		BCC		X	X
Pinyon Jay			CC,RC		BCC	BCC	X	X
Plumbeous Vireo			RS				X	X
Purple Martin				SGCN				X
Pygmy Nuthatch		MIS	RS				X	X
Red Squirrel		MIS						X
Red-faced Warbler			CC,CS,RS		BCC	BCC		X
Ruby-crowned Kinglet				SGCN				X
Rufous-crowned Sparrow			RS				X	X
Scott's Oriole			CS,RS				X	X
Spotted Towhee			RC,RS				X	X
Virginia's Warbler			CC,RS				X	X
Western Bluebird			RS				X	X
White-throated Swift			CC,RS					X

[1] R3SS = USFS Region 3 Sensitive Species; MIS = Management Indicator Species for Coconino National Forest.
[2] BCR 34 = Sierra Madre Occidental Bird Conservation Region; CC = Continental Concern Species; RC = Regional Concern Species; CS = Continental Stewardship Species; RS = Regional Stewardship Species.
[3] SGCN = Species of Greatest Conservation Need.
[4] BCR 34 = Sierra Madre Occidental Bird Conservation Region; BCC = Bird of Conservation Concern.

APPENDIX C

Number of birds detected in Kaibab National Forest, by ranger district, 2010, with priority designations as determined by U.S. Forest Service, Partners In Flight, Arizona Game and Fish Department, and US Fish and Wildlife Service (see Appendix D for more specific information). Priority species are marked with an asterisk. Management Indicator Species are bolded. Species most likely detected as migrants are italicized.

Species	North Kaibab	Tusayan	Williams	Total
Abert's Squirrel*	10		4	14
Acorn Woodpecker	1		3	4
American Crow		1	9	10
American Kestrel			3	3
American Robin	31	19	45	95
American Three-toed Woodpecker*	1	1		2
Anna's Hummingbird			1	1
Ash-throated Flycatcher*	73	91	70	234
Barn Swallow			1	1
Bewick's Wren	29	22	5	56
Black-chinned Hummingbird	4	6	4	14
Black-chinned Sparrow*	1			1
Black-headed Grosbeak	29	22	33	84
Black-throated Gray Warbler*	127	93	31	251
Black-throated Sparrow*	30	1		31
Blue-gray Gnatcatcher	57	7	5	69
Brewer's Sparrow	19		3	22
Broad-tailed Hummingbird*	13	8	14	35
Brown Creeper	6			6
Brown-headed Cowbird	6	11	30	47
Bullock's Oriole			9	9
Bushtit	5	3	1	9
Canyon Wren*		3		3
Cassin's Finch*	2	7		9
Cassin's Kingbird*		1	31	32
Chipping Sparrow	69	48	112	229
Chukar	12			12
Clark's Nutcracker*	4	1	4	9
Common Nighthawk*	2		6	8

Species	North Kaibab	Tusayan	Williams	Total
Common Raven	8	17	66	91
Cordilleran Flycatcher*	2		15	17
Dark-eyed Junco	38	22	54	114
Downy Woodpecker*		1	3	4
Dusky Flycatcher	3		3	6
Eastern Meadowlark*			1	1
Eurasian Collared-Dove		1	4	5
Evening Grosbeak	2			2
Gambel's Quail*		2	21	23
Grace's Warbler*	124	29	49	202
Gray Flycatcher	61	73	66	200
Gray Vireo*	32	2	12	46
Great Blue Heron			1	1
Great Horned Owl		1		1
Greater Roadrunner			1	1
Green-tailed Towhee*			4	4
Hairy Woodpecker*	28	17	45	90
Hepatic Tanager*	2	6	11	19
Hermit Thrush	59	1	6	66
Horned Lark	22			22
House Finch	20	7	9	36
House Wren	10	4	11	25
Hutton's Vireo		1		1
Juniper Titmouse*	39	43	44	126
Ladder-backed Woodpecker	4			4
Lark Sparrow	14	11	88	113
Lazuli Bunting	7			7
Lesser Goldfinch	5	5	38	48
Loggerhead Shrike*			1	1
Mallard			4	4
Mountain Bluebird*	2	3	12	17
Mountain Chickadee	30	57	62	149
Mourning Dove	8	12	24	44
Northern Flicker	33	23	39	95
Northern Goshawk*	1			1

Species	North Kaibab	Tusayan	Williams	Total
Northern Mockingbird	14	4	35	53
Olive-sided Flycatcher*	2		2	4
Osprey*			1	1
Phainopepla*			2	2
Pine Siskin*	45	5	16	66
Pinyon Jay*	48	91	85	224
Plumbeous Vireo*	53	77	80	210
Purple Martin*		12	2	14
Pygmy Nuthatch*	44	68	98	210
Red Crossbill	36	54	6	96
Red Squirrel*	11			11
Red-breasted Nuthatch	7		1	8
Red-faced Warbler*			1	1
Red-tailed Hawk	2	1	4	7
Red-winged Blackbird			1	1
Rock Wren*	23	3	1	27
Ruby-crowned Kinglet*	46		1	47
Sage Sparrow*	27			27
Say's Phoebe*	1		1	2
Scott's Oriole*	1	2	7	10
Spotted Towhee*	66	20	28	114
Steller's Jay	24	18	40	82
Townsend's Solitaire		1	2	3
Turkey Vulture	15	2	3	20
Vesper Sparrow	23	16	33	72
Violet-green Swallow*	35	78	62	175
Virginia's Warbler*	29		6	35
Warbling Vireo*	64	1	3	68
Western Bluebird*	29	42	79	150
Western Kingbird			4	4
Western Meadowlark	5	8	36	49
Western Scrub-Jay	29	33	43	105
Western Tanager	74	14	61	149
Western Wood-Pewee	16	40	65	121
White-breasted Nuthatch	27	46	42	115

Species	North Kaibab	Tusayan	Williams	Total
White-throated Swift*	5			5
Wild Turkey*	5		1	6
Williamson's Sapsucker*	35		2	37
Wilson's Warbler		1	4	5
Yellow-rumped Warbler	49	6	30	85

APPENDIX D

Priority Species recorded in Kaibab National Forest in 2010, with management designation as designated by U.S. Forest Service (USFS), Partners In Flight (PIF), Arizona Game and Fish Department (AZGFD), and US Fish and Wildlife Service (USFWS).

	USFS[1]		PIF[2]			USFWS[4]			Density	Occupancy
Species	Region 3	Kaibab NF	BCR 16	BCR 34	AZGFD[3]	BCR 16	BCR 34	Region 2	Estimated	Estimated
Abert's Squirrel		MIS								X
American Three-toed Woodpecker					SGCN					X
Ash-throated Flycatcher				RS					X	X
Black-chinned Sparrow			CC	CC,RS			BCC	BCC	X	X
Black-throated Gray Warbler			RC	RC			BCC		X	X
Black-throated Sparrow			RC	RS					X	X
Brewer's Sparrow			CC,RC			BCC				
Broad-tailed Hummingbird			RS						X	X
Canyon Wren			RC	RS						X
Cassin's Finch			RC		SGCN	BCC				X
Cassin's Kingbird				RC,RS					X	X
Clark's Nutcracker			CS,RS		SGCN					X
Common Nighthawk			RC							X
Cordilleran Flycatcher			RS	RS					X	X
Downy Woodpecker					SGCN					X
Eastern Meadowlark				RC					X	X
Gambel's Quail				CS,RS					X	X
Grace's Warbler			CC,RC	CC,RS		BCC	BCC	BCC	X	X
Gray Vireo	R3SS		CC,RC,RS	CC,RC,RS		BCC	BCC	BCC	X	X
Green-tailed Towhee			CS,RS		SGCN					X
Hairy Woodpecker		MIS							X	X
Hepatic Tanager				RS					X	X

	USFS[1]		PIF[2]			USFWS[4]			Density	Occupancy
Species	Region 3	Kaibab NF	BCR 16	BCR 34	AZGFD[3]	BCR 16	BCR 34	Region 2	Estimated	Estimated
Juniper Titmouse		MIS	RC,RS	RC,RS		BCC			X	X
Loggerhead Shrike	R3SS		RC	RC				BCC		X
Mountain Bluebird			RC,CS,RS							X
Northern Goshawk	R3SS	MIS		RC	SGCN					
Olive-sided Flycatcher			CC	CC	SGCN					X
Osprey					SGCN					
Phainopepla				RC,CS,RS			BCC		X	X
Pine Siskin			RC,RS							X
Pinyon Jay			CC,RC,CS,RS	CC,RC		BCC	BCC	BCC	X	X
Plumbeous Vireo			RS	RS					X	X
Purple Martin					SGCN					X
Pygmy Nuthatch		MIS	RC	RS					X	X
Red Squirrel		MIS								X
Red-faced Warbler				CC,CS,RS			BCC	BCC		
Rock Wren			RS						X	X
Ruby-crowned Kinglet					SGCN					X
Sage Sparrow			RC							X
Say's Phoebe			RS							X
Scott's Oriole				CS,RS					X	X
Spotted Towhee				RC,RS					X	X
Violet-green Swallow			RS						X	
Virginia's Warbler			CC,RC,RS	CC,RS					X	X
Warbling Vireo			RS						X	X
Western Bluebird			RS	RS					X	X
White-throated Swift			CC,RS	CC,RS						X
Wild Turkey	R3SS	MIS			SGCN					X

	USFS[1]		PIF[2]			USFWS[4]			Density	Occupancy
Species	Region 3	Kaibab NF	BCR 16	BCR 34	AZGFD[3]	BCR 16	BCR 34	Region 2	Estimated	Estimated
Williamson's Sapsucker			CS,RS							X

[1] R3SS = USFS Region 3 Sensitive Species; MIS = Management Indicator Species.
[2] BCR 16 = Southern Rockies/Colorado Plateau Bird Conservation Region; BCR 34 = Sierra Madre Occidental Bird Conservation Region; CC = Continental Concern Species; RC = Regional Concern Species; CS = Continental Stewardship Species; RS = Regional Stewardship Species.
[3] SGCN = Species of Greatest Conservation Need.
[4] BCR 16 = Southern Rockies/Colorado Plateau Bird Conservation Region; BCR 34 = Sierra Madre Occidental Bird Conservation Region; BCC = Bird of Conservation Concern.

APPENDIX E

Number of birds detected in Prescott National Forest, by ranger district, 2009 – 2010, with priority designations as determined by US Forest Service, Partners In Flight, Arizona Game and Fish Department, and US Fish and Wildlife Service (see Appendix F for more specific information). Priority species are marked with an asterisk. Species of Concern are bolded. Species most likely detected as migrants are italicized.

	Bradshaw		Chino Valley		Verde		
Species	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**	**Total**
Abert's Squirrel	3	1					4
Abert's Towhee	1						1
Acorn Woodpecker	11	16	1	1			29
American Kestrel			2	2	1	2	7
American Robin	16	7	29	9	8		69
Anna's Hummingbird	12	28	1	3	4	9	57
Ash-throated Flycatcher*	29	47	116	204	17	26	439
Barn Swallow						2	2
Bell's Vireo	3		1		2		6
Bewick's Wren	43	19	126	33	12	12	245
Black-chinned Hummingbird	10	10	3	9	2		34
Black-chinned Sparrow*	78	106	100	89	19	30	422
Black-headed Grosbeak	32	20	63	87	9	19	230
Black-tailed Gnatcatcher	2	1				6	9
Black-throated Gray Warbler*	6	15	12	73	1	11	118
Black-throated Sparrow*	115	69	154	92	49	43	522
Blue Grosbeak	8	3		4		4	19
Blue-gray Gnatcatcher	2	6	3	29	3	6	49
Brewer's Sparrow		21		62		30	113
Bridled Titmouse*	1			5			6
Broad-tailed Hummingbird			6	29		16	51
Brown Creeper	2						2
Brown-crested Flycatcher	1		1		1		3
Brown-headed Cowbird*	31	41	35	58	51	21	237
Bullock's Oriole	1	1	6	25	4	8	45
Bushtit	47	7	64	19	21	6	164
Cactus Wren*	16	22	3	1	23	8	73
Canyon Towhee*	18	13	18	33	9	4	95

Species	Bradshaw		Chino Valley		Verde		Total
	2009	2010	2009	2010	2009	2010	
Canyon Wren*	6	3	25	8	1		43
Cassin's Kingbird*	12	24	42	69	5	30	182
Cassin's Sparrow					1		1
Cassin's Vireo		2					2
Cedar Waxwing		11		24			35
Chipping Sparrow		8	35	95	5	3	146
Cliff Swallow				1	2		3
Common Nighthawk				1			1
Common Poorwill*			3	1		2	6
Common Raven	21	11	68	66	13	10	189
Cooper's Hawk*		3	2	3			8
Cordilleran Flycatcher*				1			1
Costa's Hummingbird*		5					5
Crissal Thrasher*	1			4	1	3	9
Curve-billed Thrasher	1	11			2	4	18
Dark-eyed Junco	16	11	30	1	9		67
Double-crested Cormorant			3				3
Downy Woodpecker	1				1		2
Dusky Flycatcher				4			4
Eastern Meadowlark*			36	63	1		100
Eurasian Collared-Dove				5	6		11
Gambel's Quail*	89	78	142	175	54	54	592
Grace's Warbler*	12	15	18	10	8		63
Grasshopper Sparrow	1						1
Gray Flycatcher	8	25	54	98	1	15	201
Gray Vireo*	11	33	12	88	16	20	180
Great Horned Owl				1			1
Greater Roadrunner		7		24	1		32
Green-tailed Towhee*		7		11		8	26
Hairy Woodpecker*	4	7	1	14		3	29
Hammond's Flycatcher	1						1
Hepatic Tanager*	5	13	18	43	2		81
Hermit Thrush	4		4	5			13
Hooded Oriole*				1			1

Species	Bradshaw		Chino Valley		Verde		Total
	2009	2010	2009	2010	2009	2010	
Horned Lark		1	189	270	2	2	464
House Finch	26	32	43	106	24	31	262
House Wren	10	24	14	2	1	2	53
Hutton's Vireo				1	1		2
Juniper Titmouse*	7	17	71	125		8	228
Killdeer				1		1	2
Ladder-backed Woodpecker	3	5	4	11	2	4	29
Lark Sparrow	4	7	25	50	16	38	140
Lazuli Bunting		2		3		1	6
Lesser Goldfinch	20	46	10	79	10	22	187
Loggerhead Shrike*			4	4		2	10
Lucy's Warbler*		1			4	9	14
MacGillivray's Warbler*		2		3	1		6
Mountain Chickadee	11	6	17	11			45
Mourning Dove	80	79	131	144	45	76	555
Northern Cardinal	4	4	1	1		1	11
Northern Flicker	14	9	11	4		2	40
*Northern Harrier**				1			1
Northern Mockingbird	102	64	199	180	106	71	722
Northern Rough-winged Swallow		2		3			5
Olive Warbler*				4			4
Orange-crowned Warbler*			1	1			2
Peregrine Falcon*			1	1			2
Phainopepla*	49	49	135	8	85	27	353
Pine Siskin		2	4	2		9	17
Pinyon Jay*	1		68	47		1	117
Plumbeous Vireo*	7	24	20	24	2	4	81
Purple Martin*		1					1
Pygmy Nuthatch*	18	8	14	4			44
Red Crossbill				2			2
Red Squirrel			1		1		2
Red-breasted Nuthatch			1			1	2
Red-faced Warbler	2						2
Red-tailed Hawk	6	2	5	8	4	2	27

Species	Bradshaw		Chino Valley		Verde		Total
	2009	2010	2009	2010	2009	2010	
Red-winged Blackbird				3	1		4
Rock Wren	13	14	28	43	33	14	145
Ruby-crowned Kinglet*				2		1	3
Rufous-crowned Sparrow*	28	45	37	73	9	45	237
Say's Phoebe	6		5	1	1		13
Scott's Oriole	11	25	38	66	13	33	186
Sharp-shinned Hawk		1		1		1	3
Spotted Towhee*	149	194	125	173	28	75	744
Steller's Jay	9	5	9	11			34
Townsend's Solitaire						3	3
Turkey Vulture	10		3	15	1	3	32
Verdin	2	3					5
Vesper Sparrow				2			2
Violet-green Swallow	2	21	4	44		23	94
Virginia's Warbler*	8	7	4	6	2	8	35
Warbling Vireo		7		10		4	21
Western Bluebird*	1	6		18			25
Western Kingbird	5		63	30	15	9	122
Western Meadowlark				14		21	35
Western Scrub-Jay	23	42	54	127	5	25	276
Western Tanager	9	30	26	45	7	13	130
Western Wood-Pewee	11	40	31	30	4	13	129
White-breasted Nuthatch	14	20	4	5	4	1	48
*White-crowned Sparrow**		1		1		3	5
White-throated Swift*	3					2	5
White-winged Dove	8	19	3		6	14	50
Wild Turkey			1				1
Wilson's Warbler	1			9	1	1	12
Yellow Warbler*				1		2	3
Yellow-rumped Warbler	7	18		24	1	3	53
Zone-tailed Hawk*			2	1			3

APPENDIX F

Priority Species recorded in Prescott National Forest in 2010, with management designation as designated by US Forest Service (USFS), Partners In Flight (PIF), Arizona Game and Fish Department (AZGFD), and US Fish and Wildlife Service (USFWS).

	USFS[1]		PIF[2]		USFWS[4]		Density	Occupancy
Species	**Region 3**	**Prescott NF**	**BCR 34**	**AZGFD[3]**	**BCR 34**	**Region 2**	**Estimated**	**Estimated**
Ash-throated Flycatcher			RS				X	X
Black-chinned Sparrow			CC,RS		BCC	BCC	X	X
Black-throated Gray Warbler			RC		BCC		X	X
Black-throated Sparrow			RS				X	X
Bridled Titmouse			RS					
Brown-headed Cowbird		SOC					X	X
Cactus Wren			RC				X	X
Canyon Towhee			RC,CS,RS		BCC		X	X
Canyon Wren			RS					X
Cassin's Kingbird			RC,RS				X	X
Common Poorwill			RS					
Cooper's Hawk			RS					X
Cordilleran Flycatcher		SOC	RS					
Costa's Hummingbird	R3SS		CC			BCC		
Crissal Thrasher		SOC	CS,RS					
Eastern Meadowlark			RC				X	X
Gambel's Quail			CS,RS				X	X
Grace's Warbler		SOC	CC,RS		BCC	BCC	X	X
Gray Vireo	R3SS	SOC	CC,RC,RS		BCC	BCC	X	X
Green-tailed Towhee				SGCN				X
Hairy Woodpecker		SOC					X	X
Hepatic Tanager			RS				X	X
Hooded Oriole			RS					
Juniper Titmouse		SOC	RC,RS				X	X
Loggerhead Shrike	R3SS		RC			BCC		X

Species	USFS[1]		PIF[2]	AZGFD[3]	USFWS[4]		Density Estimated	Occupancy Estimated
	Region 3	Prescott NF	BCR 34		BCR 34	Region 2		
Lucy's Warbler		SOC	CC,RC,CS,RS		BCC	BCC		X
MacGillivray's Warbler		SOC		SGCN				
Northern Harrier				SGCN				
Olive Warbler			RS		BCC	BCC		
Orange-crowned Warbler		SOC		SGCN				X
Peregrine Falcon	R3SS	SOC		SGCN	BCC	BCC		
Phainopepla			RC,CS,RS		BCC		X	X
Pinyon Jay		SOC	CC,RC		BCC	BCC	X	X
Plumbeous Vireo			RS				X	X
Purple Martin		SOC		SGCN				X
Pygmy Nuthatch		SOC	RS				X	X
Ruby-crowned Kinglet				SGCN				X
Rufous-crowned Sparrow			RS				X	X
Spotted Towhee		SOC	RC,RS				X	X
Virginia's Warbler		SOC	CC,RS				X	X
Western Bluebird			RS				X	X
White-crowned Sparrow				SGCN				
White-throated Swift			CC,RS					X
Yellow Warbler					BCC	BCC		X
Zone-tailed Hawk	R3SS							

[1] R3SS = USFS Region 3 Sensitive Species; SOC = Species of Concern.
[2] BCR 34 = Sierra Madre Occidental Bird Conservation Region; CC = Continental Concern Species; RC = Regional Concern Species; CS = Continental Stewardship Species; RS = Regional Stewardship Species.
[3] SGCN = Species of Greatest Conservation Need.
[4] BCR 34 = Sierra Madre Occidental Bird Conservation Region; BCC = Bird of Conservation Concern.