Monitoring the Birds of Kaibab National Forest: 2007 Field Season Report

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In Cooperation With:

ROCKY MOUNTAIN BIRD OBSERVATORY

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EXECUTIVE SUMMARY

Birds are excellent indicators of environmental quality and change. In addition, they are one of the most highly visible and valued components of our native wildlife. Monitoring birds provides data needed not only to effectively manage bird populations, but also to understand the effects of human activities on the ecosystem and to gauge their sustainability. Because bird communities reflect an integration of a broad array of ecosystem conditions, monitoring entire bird communities at the habitat level offers a cost-effective means for monitoring biological integrity at a variety of scales.

In 2007, Rocky Mountain Bird Observatory (RMBO), in conjunction with Kaibab National Forest (KNF), implemented Year 1 of *Monitoring Birds of Kaibab National Forest* (MBKNF), a partnership effort using a protocol similar to other RMBO monitoring programs as delineated by Panjabi (2006). RMBO has designed this program to provide statistically rigorous long-term trend data for populations of most diurnal, regularly breeding bird species in the Kaibab National Forest, including some U.S. Forest Service Region 3 Sensitive Species and KNF Management Indicator Species (MIS). In the short term, this program provides information needed to effectively manage and conserve bird populations in KNF, including the spatial distribution, abundance, and relationship to important habitat characteristics for each species. This cooperative project supports KNF's efforts to comply with requirements set forth in the National Forest Management Act and other statutes and regulations. It also contributes to RMBO's broader landscape-scale breeding bird monitoring program, which currently includes 11 states in the Rocky Mountain and Great Plains regions.

This year, RMBO staff conducted 73 point transect surveys (815 point counts) in three habitats (Woodland / Grassland, Mixed-Conifer, and Ponderosa Pine) within KNF. RMBO staff averaged 11.2 point count stations per transect and recorded 101 breeding bird species distributed throughout KNF. Many species were observed on only a few occasions however, we included density estimates for only those species with a minimum of 60 detections with the exception of Juniper Titmouse (n=54). We were able to calculate density estimates for three MIS species: Hairy Woodpecker, Juniper Titmouse, and Pygmy Nuthatch.

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INTRODUCTION

Program History

In 2005, KNF initiated a pilot monitoring program for landbirds using protocol developed by Buckland et al (2001). This effort was expanded in 2006, resampling the 2005 transects and adding new transects. However, it became apparent that, in order to meet the Forest's monitoring objectives, an effort was necessary beyond that in which KNF could sustain on its own. In 2007, RMBO began working with KNF. KNF is a funding partner and assisted with logistical coordination while RMBO collected, analyzed, and summarized the survey data. Fiscal Year 2007 marked the first year of implementing the MBKNF program. This program is designed to improve our knowledge and provide population status and trend data for most diurnal, regularly-occurring breeding landbirds of the Forest, focusing on MIS of Kaibab National Forest. In 2007, we completed 73 transects, including many of those surveyed by KNF in previous seasons.

Reasons for Monitoring

Much like the canary in the coalmine, birds can be excellent indicators of biological integrity and ecosystem health (Morrison 1986, Croonquist and Brooks 1991, Bureau of Land Management 1998, Hutto 1998, O'Connell et al. 2000, Rich 2002, U.S. EPA 2002, Birdlife International 2003). Because they comprise a diverse group of niche specialists, occupy a broad range of habitats, are sensitive to both physical and chemical impacts on the environment, and often reflect the abundance and diversity of other organisms with which they coexist, birds can be useful barometers of environmental change and for measuring the sustainability of human activities on ecosystems.

Bird communities reflect an integration of a broad array of ecosystem conditions, including productivity, vegetation structure and composition, water quality, and landscape integrity (Adamus et al. 2001). The response of bird communities to changes in the environment can be examined at a variety of spatial scales, making them a powerful and practical tool for evaluating the broader effects of resource management, conservation and restoration activities, or other environmental changes. And because birds are generally abundant, conspicuous, and relatively easy to identify, they offer tremendous logistical and economic advantages over other taxonomic groups for monitoring their populations. Also, birds are popular with the public and there is a strong and growing interest, both nationally and internationally, to manage and conserve bird populations, many of which are exhibiting long-term population declines (Sauer et al. 2003).

Aside from serving as environmental indicators, birds are a tremendous economic resource in and of themselves. A recent federal economic report found that 46 million birdwatchers across America spent $32 *billion* in 2001 on bird watching and related activities (USFWS 2003). This spending generated

$85 billion in overall economic output and $13 billion in federal and state income taxes, and supported more than 863,000 jobs. In addition to being an economic attraction, birds also pollinate, disperse seeds, and consume pests of ecologically and economically important plants, thereby providing ecosystem services worth many billions of dollars. Thus declines in bird populations diminish a valuable economic resource that could have profound negative implications for regional and local economies, both directly and indirectly.

In order for birds to be conserved on a global scale, people in all areas must assume responsibility to conserve the species and habitats for which they are stewards, and population monitoring forms the backbone of avian conservation. Without current monitoring data, conservation efforts are not likely to be effective. For these and other reasons, monitoring is mandated by legislation such as the National Environmental Policy Act (1969), Endangered Species Act (ESA; 1973, as amended), and the Forest Management Act (1976), as well as by various state laws, Forest plans, Preserve management plans, and other long-range plans (Sauer 1993, Manley et al. 1993).

Given the declines of many species of North American breeding birds, there is an urgent need for monitoring programs that serve as an "early-warning system" to identify decreases in populations and their causes. Such information can be used by natural resource managers to proactively prevent such negative trends. RMBO's monitoring programs are designed to be comparable, repeatable, data rich, long-term, multi-scale and accessible, so that managers can make informed decisions to effectively conserve birds and their habitats.

Monitoring Objectives

RMBO's bird monitoring programs are designed to provide population trend or status data on regularly-occurring breeding species within each program area. Initially, we expect to collect data to provide "early-warning" information for all species that can be monitored through a habitat-based approach. After establishing this monitoring framework, we anticipate collecting more demographic information and testing *a priori* hypotheses to determine the possible reasons for known declines and to better inform management decisions. Herein we discuss the initial "early-warning" monitoring framework, the monitoring goals and progress.

The specific objectives of RMBO's monitoring program are:

1.) to integrate existing bird monitoring efforts in the region to provide better information on distribution and abundance for most breeding landbirds, especially priority species;
2.) to provide basic habitat association data for most bird species to address habitat-management issues;
3.) to provide long-term trend or status data on most regularly occurring breeding species in the region, with a target of detecting a minimum rate

of population change of ±3.0% per year over a maximum time period of 30 years;

4.) to maintain a high-quality database that is accessible to all of our collaborators as well as the public in the form of raw and summarized data and,

5.) to generate decision support tools such as population density models that help guide conservation efforts and provide a better measure of our conservation success.

METHODS

Study Area

Habitats

In 2007, RMBO in coordination with biologists from KNF selected three vegetation cover types (Woodland/Grassland, (WG), Mixed-Conifer (MC) and Ponderosa Pine (PP)) in which to place 90 point-count transects. These habitats were selected because: 1) they comprise the bulk of the KNF landscape; 2) most active management occurs in these cover types; and 3) recognition of funding and logistical support.

Woodland / Grassland

Woodland / Grassland cover type describes the combination of pinyon-juniper woodland and savannah grasslands. These vegetation types could not be differentiated a priori and so were combined. The most common vegetation within this vegetation type is pinyon pine (*Pinus edulis*) and juniper (*Juniperus spp.*) interspersed with sage (*Artemisia spp.*) shrubland.

Mixed-Conifer

Mixed-Conifer forest describes mid-elevation, conifer-dominated stands made up of a diversity of tree species. On transects distributed throughout KNF, the most commonly recorded overstory species are ponderosa pine (*Pinus ponderosa*), spruce (*Picea spp.*), Douglas Fir (*Pseudotsuga menziesii*) and quaking aspen (*Populus tremuloides*). Saplings, composed of various spruce and pine species, make up the understory.

Ponderosa Pine

Ponderosa Pine cover type is composed of arid conifer stands dominated by ponderosa pine that are typically lower in elevation than mixed-conifer stands. In addition to ponderosa pine, the most common tree species are juniper and pinyon pine. The most frequently encountered shrubs in ponderosa are common juniper (*Juniperus communis*) and Gambel oak (*Quercus gambelii*).

Field Personnel

Field work in 2007 was conducted by RMBO staff, consisting of four experienced biological technicians with excellent aural and visual bird-identification skills.

Each technician also completed a four-day training program at the beginning of the field season to ensure full understanding of the field protocols and to practice bird identification and distance estimation in a variety of habitats.

Site Selection

The majority of the survey sites for the *MBKNF* project were initially selected by KNF in 2005 and 2006. In 2007, RMBO technicians established the majority of the transects located in the North Kaibab district of KNF using RMBO's regional monitoring protocol (Panjabi 2006). All transect locations were randomly selected and stratified by vegetation type. Wilderness Areas were not included as potential survey locations.

Point Transect Protocol

RMBO staff conducted point transects (Buckland et al. 2001) in order to sample bird populations in each habitat selected for monitoring. Each transect was surveyed by one observer following protocol established by Leukering (2000) and modified by Panjabi (2006). RMBO technicians conducted all transect surveys in the morning, between ½-hour before sunrise and 11 AM; most surveys (90%) were completed before 10:30 am. To maximize efficiency, observers located the selected stand on the ground at least a day prior to the survey. For new transects, observers used this pre-survey visit to establish an access point for each stand and a random distance and bearing from the access point (between 0-400 m) at which the first point count station would be located. On the morning of the survey, the observer began the point transect at the first count station and then continued along the pre-selected bearing for all remaining points if possible. In many cases, the pre-selected bearing eventually would lead the transect out of the target habitat, or to some obstruction (e.g., cliff or private land), forcing the observer to change the bearing of the transect. When this happened, the observer back-tracked to the last point and randomly turned the transect right or left, at an angle perpendicular to the original bearing, and then alternated right or left if additional turns were necessary.

Observers conducted up to 15 five-minute point counts at stations located at 200 or 250-m intervals along each point transect, recording all bird detections on standardized forms. Each one-minute interval of every point count was noted on the datasheet so that bird detections were recorded as part of a specific one-minute interval. Flyovers, birds flying over but not using the immediate surrounding landscape, were recorded but excluded from analyses of density. For each bird detected, observers recorded the species, sex, detection method (e.g., call, song, drumming, etc.), and distance from the observation point. Whenever possible, observers measured distances using Bushnell® Yardage Pro 500™ laser rangefinders. When it was not possible to measure the distance to a bird, observers used rangefinders to estimate distance by measuring to some nearby object. Observers treated the 250-m intervals between count stations as parts of a line transect, and recorded individuals on a short list of low-density species (all grouse, raptors, woodpeckers, and a few other rare or uncommon

species) and measured the distance and bearing to each from where it was detected along the transect line. They also recorded bearings and distances to individuals of the same low-density species when they were detected at count stations. Birds initially detected on points that were again detected while moving between points were not included in the line-transect data. Similarly, birds detected between points, and then again during the subsequent point count, were removed from the line-transect data and included only on the point count. Detections of squirrels were also recorded following the same methodology as used for birds, however insufficient numbers were detected to allow meaningful estimations of densities.

Beginning in 2004, RMBO considered all non-independent detections of individual birds as part of a 'cluster' together with the first independently observed bird, rather than as a separate independent observation. This means that if the detection of an individual bird is dependent upon the previous detection of another individual, the resulting observation is recorded as one independent detection. We then record a cluster size of *C*, where *C* is the original individual detected plus the sum of any additional individuals detected as a result of the first individual.

At the start and end of each transect observers recorded the time and atmospheric data (i.e., temperature in degrees Fahrenheit, cloud cover, precipitation, and wind in the Beaufort scale). They measured distances between count stations using hand-held Garmin® E-trex™ Global Positioning System (GPS) units. All GPS data were logged in Universal Transverse Mercator (UTM) North American Datum 1927. At each count station, observers recorded UTM coordinates, whether or not the station was within 100 m of a road, and vegetation data, including the structural stage, canopy closure of the forest, mean canopy height, the types and relative proportions of overstory trees, the sub-canopy volume and tree species composition, and the percent coverage and types of shrubs within a 50-m radius of the point. Observers recorded these data prior to beginning each bird count.

Data Analysis

We used program Distance (Thomas et al. 2006) to generate density estimates (*D*) using only data collected at point count stations. The notation, concepts, and analysis methods of Distance were developed by Buckland et al. (2001). In distance analysis, a unique detection function is fit to each distribution of distances associated with a species in a given habitat. Because the detection function is unique to each species in each habitat, Distance analysis avoids some serious problems inherent in traditional analyses of point count data (e.g., unquantifiable differences in detectability among habitats, species, and years). Distance analysis relies on three assumptions, all of which are reasonably well met by *MBKNF*: 1) all birds at distance=0 are detected, 2) distances of birds

close to the point are measured accurately, and 3) birds do not move in response to the observer's presence.
Buckland et al. (2001) recommend a minimum of 60-80 observations to fit a detection curve to distance sampling data. Fortunately, it is possible using program Distance to construct a common detection function across similar habitats, and obtain separate density estimates for each habitat type. It is not valid, however to construct a common detection across dissimilar habitats. It will also be possible in future years to estimate common detection functions across years in the same habitat. In 2007, we combined data to fit a common detection function among Mixed Conifer and Ponderosa Pine habitats for those species with insufficient sample sizes for generating separate detection probabilities in each habitat.

Because we considered only independent detections in our analyses of density, the number of *observations* (*n*) reported for each species may be lower than the number of *individuals* (*N*) observed. This is especially true for species that tend to associate in groups (e.g., swifts, swallows, crossbills, etc.). Note however, that in the habitat accounts in the "Results" section, the number of observations reported (*n*) reflects only the number of independent detections *used to estimate density* (i.e., after any truncation or removal of outliers), and may be less than the total number of independent detections or the total number of individuals observed. The total number of individuals recorded in each habitat, including between point detections of low-density species, is provided in Appendix B.

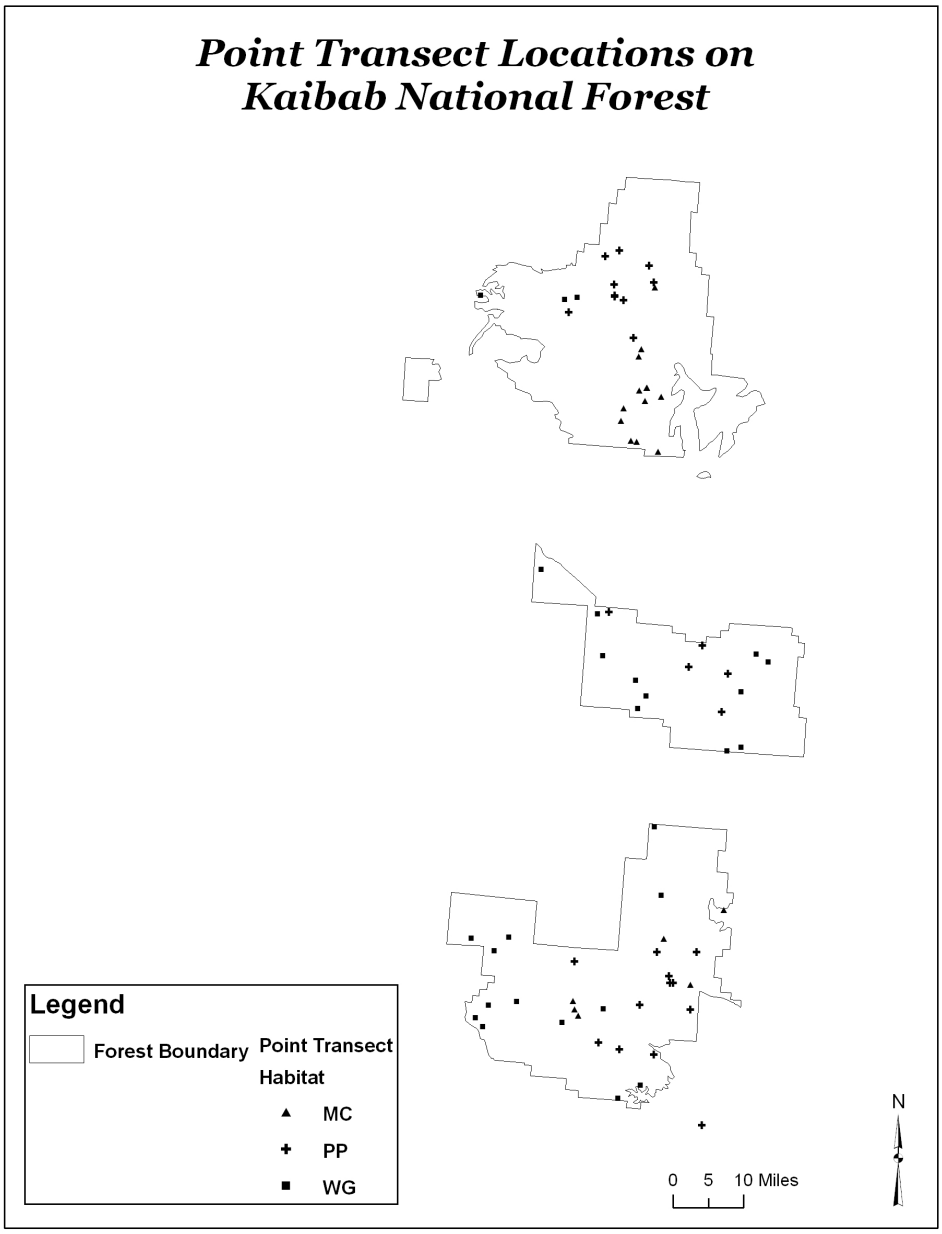
RESULTS

RMBO staff conducted a total of 815 point counts along 73 point transects in three habitats (Figure 1) between 20 May and 14 July, 2007 on the forest-wide *MBKNF* project.

We recorded 6690 birds of 101 species on *MBKNF* point-count transects in 2007. We provided density estimations for 38 species/habitat relationships. Please note that the number of birds in Appendix B includes between point detections of low-density species and species detected as flyovers.

The total number of species detected on *MBKNF* point counts in each habitat in 2007 ranged from 63 in Mixed-Conifer to 82 in Woodland / Grassland. While these totals reflect the spectrum of possible species across a range of sites within a habitat type, it should be understood that some species included in each total were largely peripheral to the habitat in which they were recorded. Thus, species richness measures reflect both the within- and between-habitat diversity of the sites surveyed in each habitat category.

Figure 1. Distribution of transects targeted for bird monitoring under *Monitoring the Birds of Kaibab National Forest*.



Woodland / Grassland (WG)

We conducted 296 point counts along 27 transects in Woodland / Grassland habitat in KNF. We recorded 2027 birds representing 82 species.

Table 1. Estimated densities in woodland / grassland forest in Kaibab National Forest, summer 2007[1]. MIS species are highlighted in bold.

Species	D	LCL	UCL	%CV	n
Gray Flycatcher	44.80	29.90	67.15	25	70
Ash-throated Flycatcher	44.14	31.54	61.77	20	130
Juniper Titmouse	**79.79**	**50.08**	**127.13**	**28**	**56**
Mountain Chickadee	101.78	67.50	153.48	25	132
White-breasted Nuthatch	42.35	24.81	72.28	33	62
Bewick's Wren	22.31	13.56	36.71	30	62
Black-throated Gray Warbler	37.57	21.13	66.78	35	72
Spotted Towhee	31.37	19.29	51.00	29	94
Chipping Sparrow	51.58	22.70	117.20	53	86

[1] *D* = estimated density (birds/km^2); *LCL* and *UCL* = lower and upper 90% confidence limits on *D*; *%CV* = percent coefficient of variation of *D*; *n* = number of observations used to estimate.

Mixed-Conifer (MC)

We conducted 188 point counts along 19 transects in Mixed-Conifer habitat in KNF. We recorded 1820 birds representing 63 species.

Table 2. Estimated densities in mixed-conifer forest in Kaibab National Forest, summer 2007[1]. MIS species are highlighted in bold.

Species	D	LCL	UCL	%CV	n
Hairy Woodpecker	**20.22**	**12.36**	**33.08**	**30**	**32***
Northern Flicker	20.20	14.77	27.61	18	57*
Western Wood-Pewee	21.06	13.83	32.07	25	50*
Warbling Vireo	61.62	43.13	88.03	21	101
Violet-green Swallow	42.01	28.26	62.46	24	44*
Mountain Chickadee	125.87	89.20	177.62	21	88
House Wren	28.83	15.71	52.89	37	51*
Ruby-crowned Kinglet	37.40	24.50	57.09	25	64
Hermit Thrush	46.28	33.04	64.82	20	160*
Yellow-rumped Warbler	123.95	87.61	175.36	21	184*
Western Tanager	84.43	63.44	112.37	17	141
Dark-eyed Junco	98.75	75.68	128.83	16	106

[1] *D* = estimated density (birds/km^2); *LCL* and *UCL* = lower and upper 90% confidence limits on *D*; *%CV* = percent coefficient of variation of *D*; *n* = number of observations used to estimate density.
* Mixed Conifer and Ponderosa Pine data were combined to fit the detection function; sample size of combined data was ≥ 60.

Ponderosa Pine (PP)

We conducted 331 point counts along 27 transects in Ponderosa Pine habitat in KNF. We recorded 2843 birds representing 79 species.

Table 3. Estimated densities in ponderosa pine forest in Kaibab National Forest, summer 2007[1]. MIS species are highlighted in bold.

Species	D	LCL	UCL	%CV	n
Hairy Woodpecker	**18.82**	**11.84**	**29.90**	**28**	**52***
Northern Flicker	15.23	11.74	19.74	15	74*
Western Wood-Pewee	27.63	20.76	36.77	17	113*
Plumbeous Vireo	26.44	18.67	37.44	21	104
Steller's Jay	21.61	14.89	31.36	23	98
Common Raven	3.27	2.21	4.84	23	49*
Violet-green Swallow	20.77	10.70	40.31	41	32*
Mountain Chickadee	85.30	65.22	111.58	16	176
White-breasted Nuthatch	43.81	32.89	58.37	17	148
Pygmy Nuthatch	**102.49**	**74.89**	**140.25**	**18**	**159**
Western Bluebird	31.64	20.89	47.93	25	67
Hermit Thrush	7.32	4.08	13.14	36	44*
American Robin	15.36	10.45	22.59	23	82
Yellow-rumped Warbler	14.42	8.73	23.81	30	38*
Grace's Warbler	32.38	22.19	47.27	23	123
Western Tanager	29.66	20.77	42.35	22	160
Dark-eyed Junco	53.19	42.12	67.18	14	229

[1] *D* = estimated density (birds/km^2); *LCL* and *UCL* = lower and upper 90% confidence limits on *D*; *%CV* = percent coefficient of variation of *D*; *n* = number of observations used to estimate density.
* Mixed Conifer and Ponderosa Pine data were combined to fit the detection function; sample size of combined data was ≥ 60.

DISCUSSION AND RECOMMENDATIONS

Prospects for Population Monitoring

The habitat-stratified point transects produced excellent estimates with low coefficients of variation for three MIS species in at least one habitat surveyed in 2007. Thus we should be able to detect habitat-specific population trends for Hairy Woodpecker, Juniper Titmouse, and Pygmy Nuthatch within our maximum target of 30 years. Other techniques or analyses would have to be implemented to monitor other MIS on the KNF list. However, the addition of transects in 2008 (to bring the total to 30 transects per habitat) may allow for the inclusion of other MIS species.

Riparian and wetland habitats were not sampled in 2007, which would account for the lack of detections of several MIS species such as Cinnamon Teal, Lincoln's Sparrow, Lucy's Warbler and Yellow-breasted Chat. In the future, riparian transects would have to be established and conducted in KNF to obtain enough detections to monitor these species. The cost to implement this would be to establish at least 20 transects in riparian corridors.

Additional transects should be added in forested habitats to increase the number of detections of secretive (e.g. Wild Turkey) and low-density species (e.g. Red-naped Sapsucker) to produce reliable annual estimates. Program Distance allows the user to pool years to increase the number of detections of the species to generate a robust detection function if the data collection continues over several years.

Some species are not adequately detected by the protocols used for monitoring songbirds. In these cases (Northern Goshawk, Mexican Spotted Owl) KNF monitors them in separate efforts.

One way to monitor the health of bird populations, especially small ones, is to monitor reproductive output at nests. While this method can be more labor intensive than count-based monitoring, depending on the species in question and the detail of information needed, monitoring reproductive output does not necessarily imply high costs. Because of the already extensive point transect effort undertaken each year, implementing additional field techniques to target other high-priority species can be done cost-effectively.

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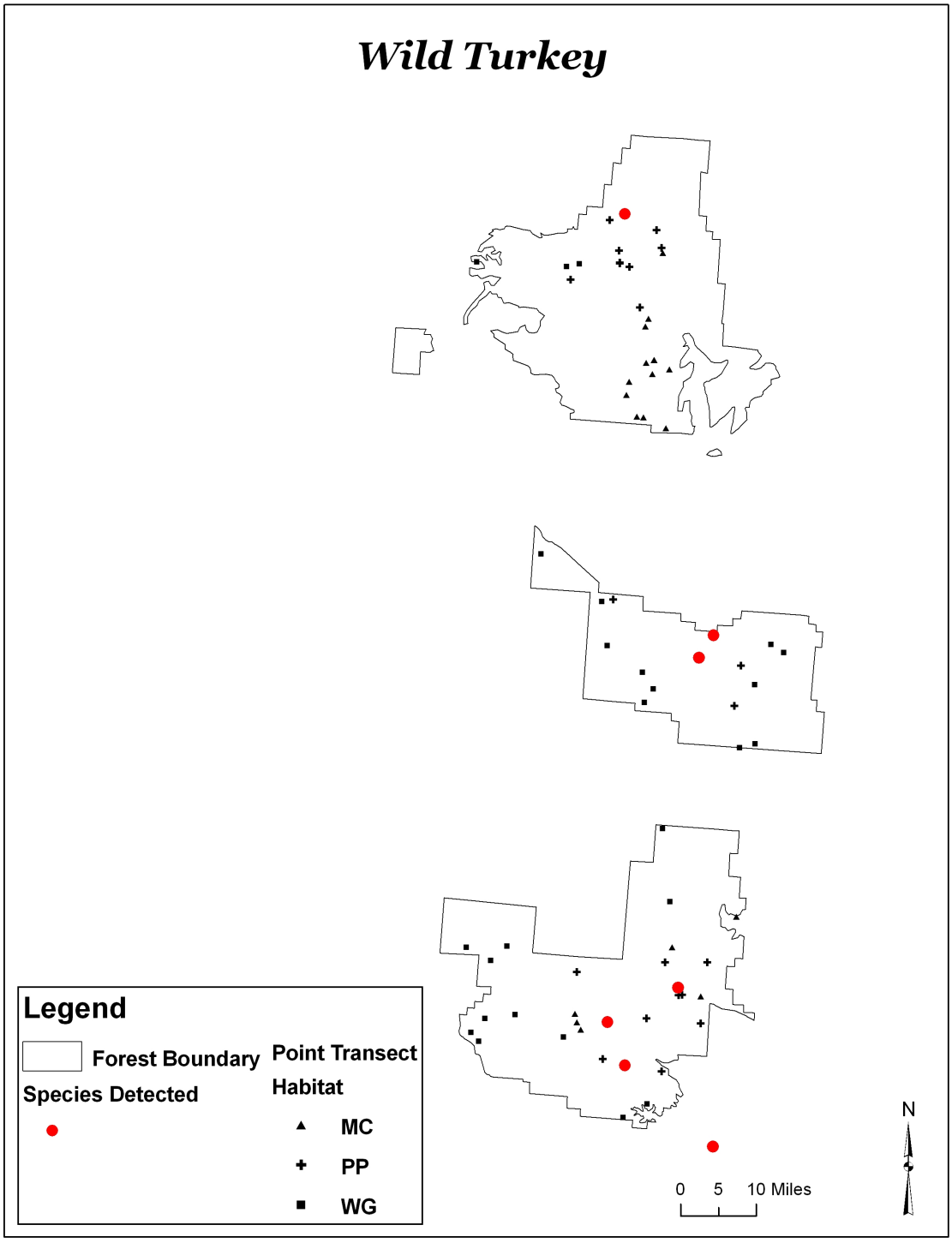
APPENDIX A. SPECIES DISTRIBUTION MAPS

In this section we present a map for each MIS species in Kaibab National Forest detected in 2007. Maps for all species detected are available from the RMBO ftp site:

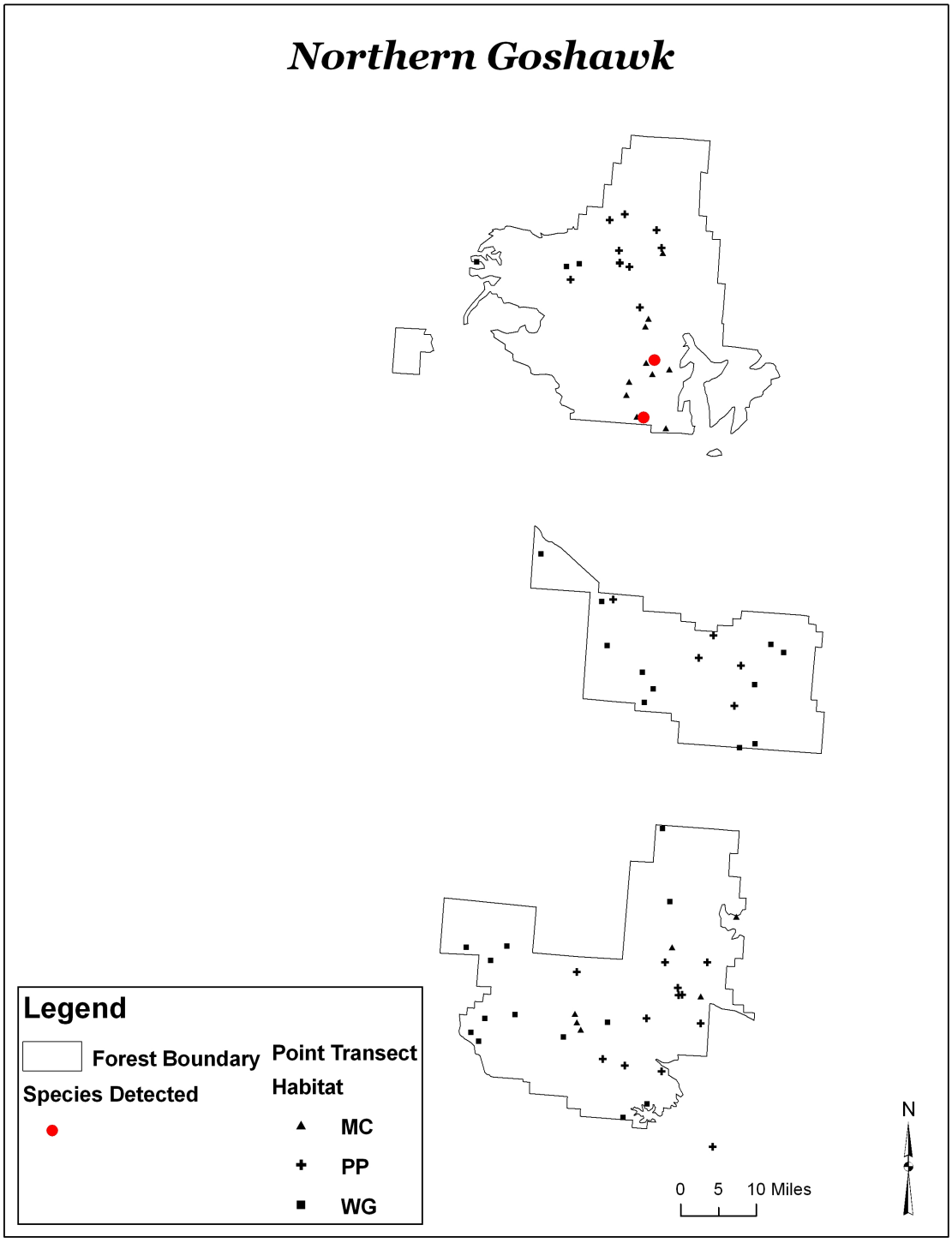
ftp://209.169.25.239/public/Monitoring/Monitoring_Maps/AZ_DistributionMaps07/

The geographic distribution maps in the following accounts depict the locations of species of management interest that were detected on point transects in 2007. Also, the location of each dot does not necessarily indicate the precise location of the point at which the species was observed, but rather the access point (starting point) of that transect. It is important to keep in mind that the maps only reflect the presence and distribution of the species across the sites we surveyed, and should not be interpreted as the definitive range of the species within KNF.

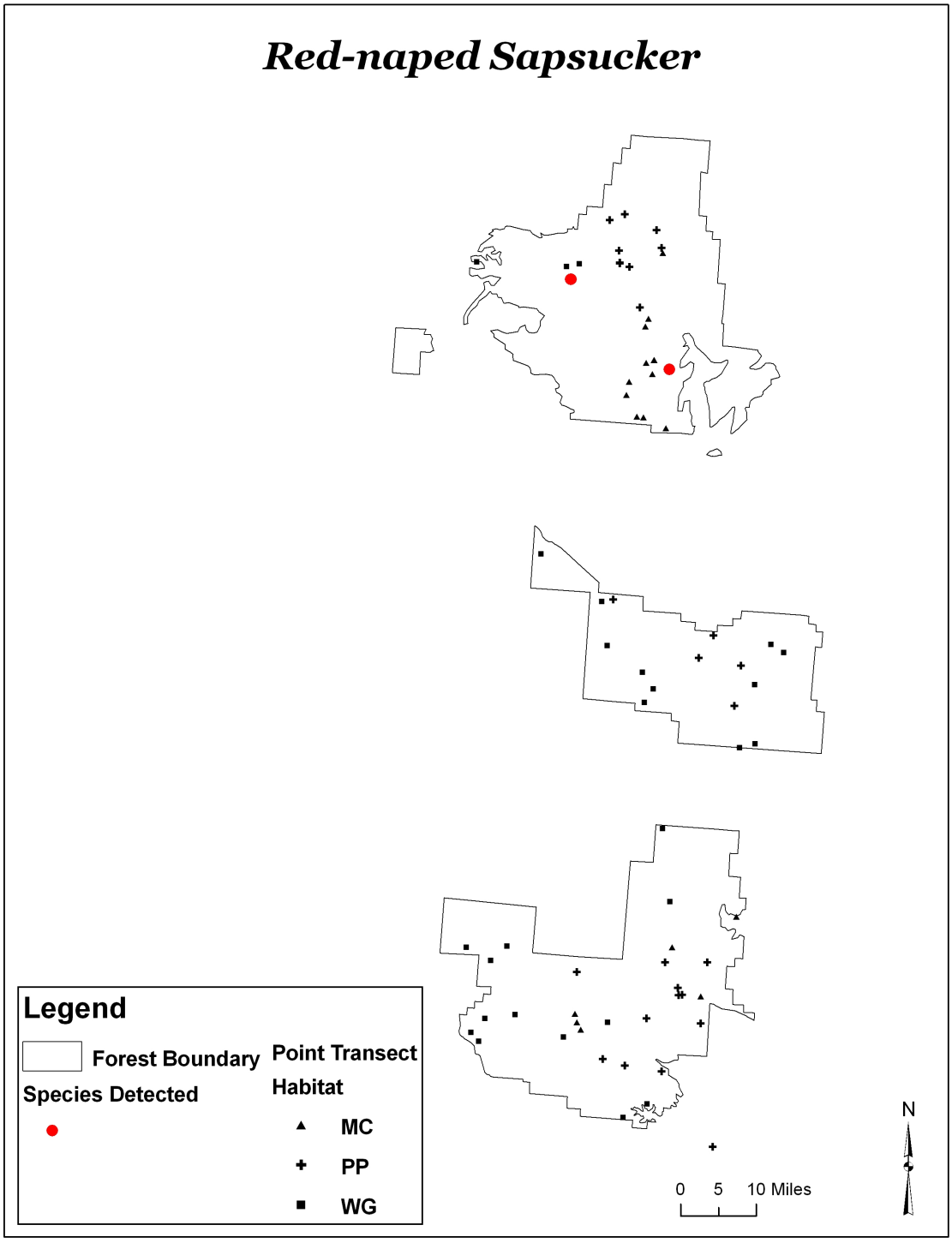
Wild Turkey
(Meleagris gallopavo)



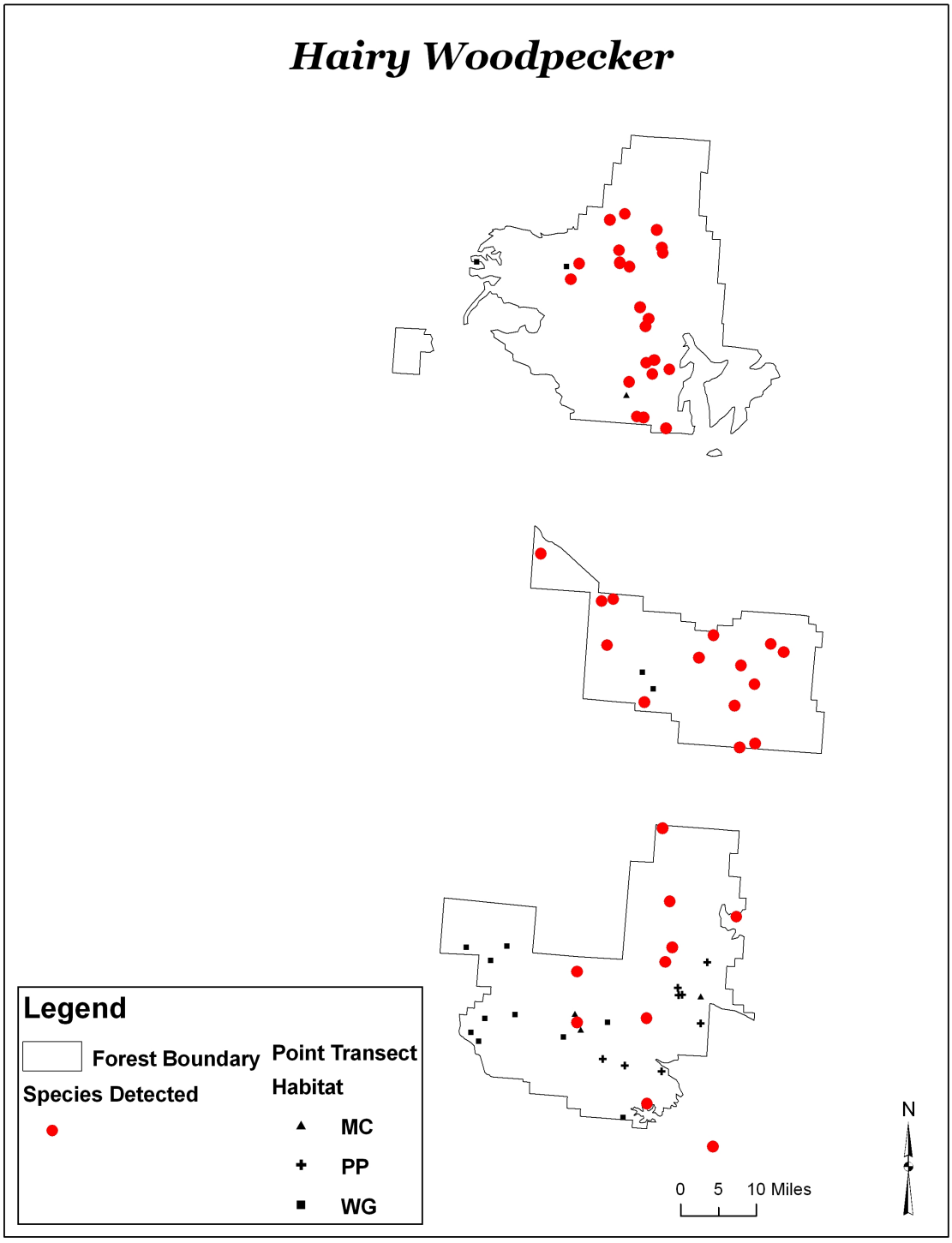
Northern Goshawk
(Accipiter gentilis)



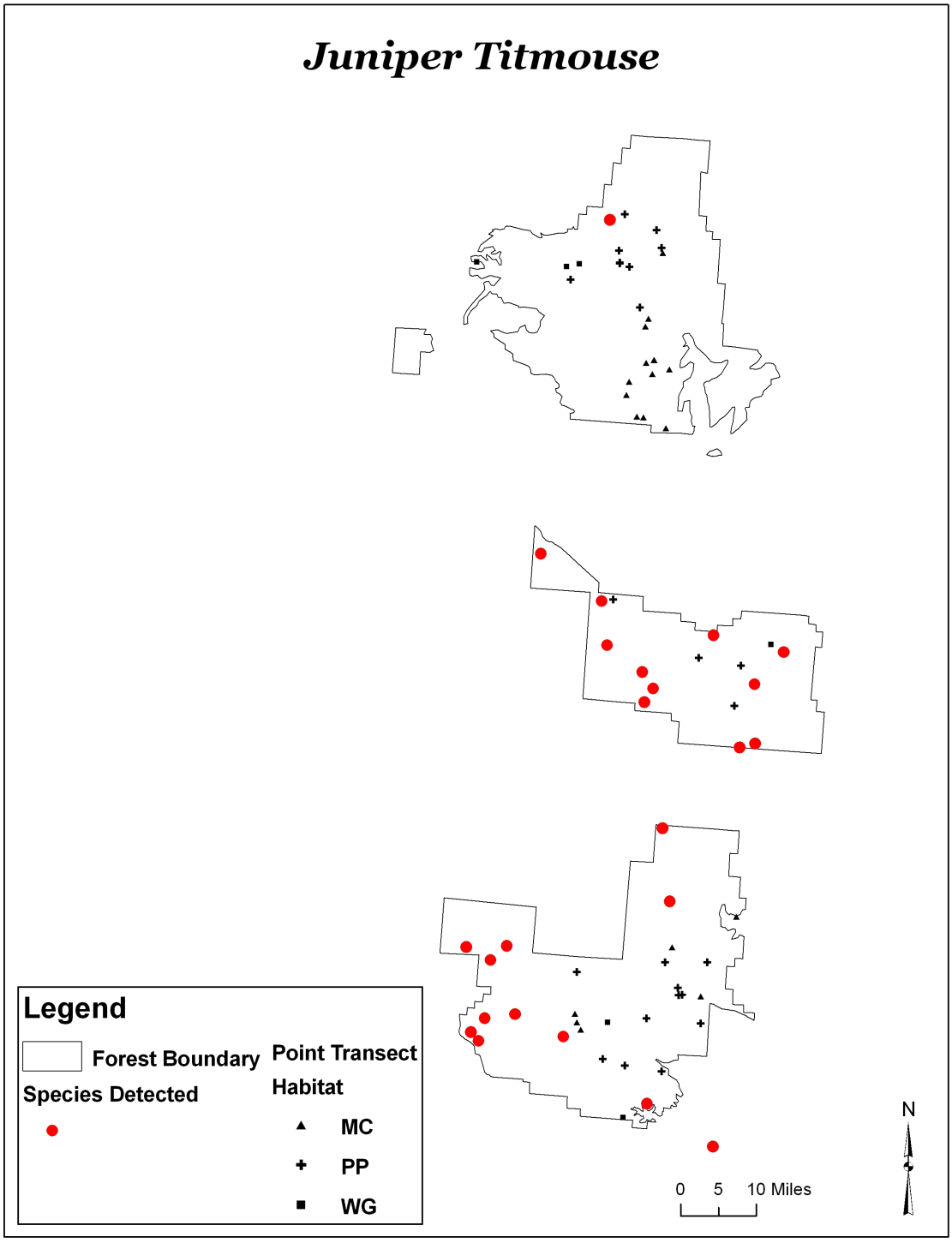
Red-naped Sapsucker
(Sphyrapicus nuchalis)



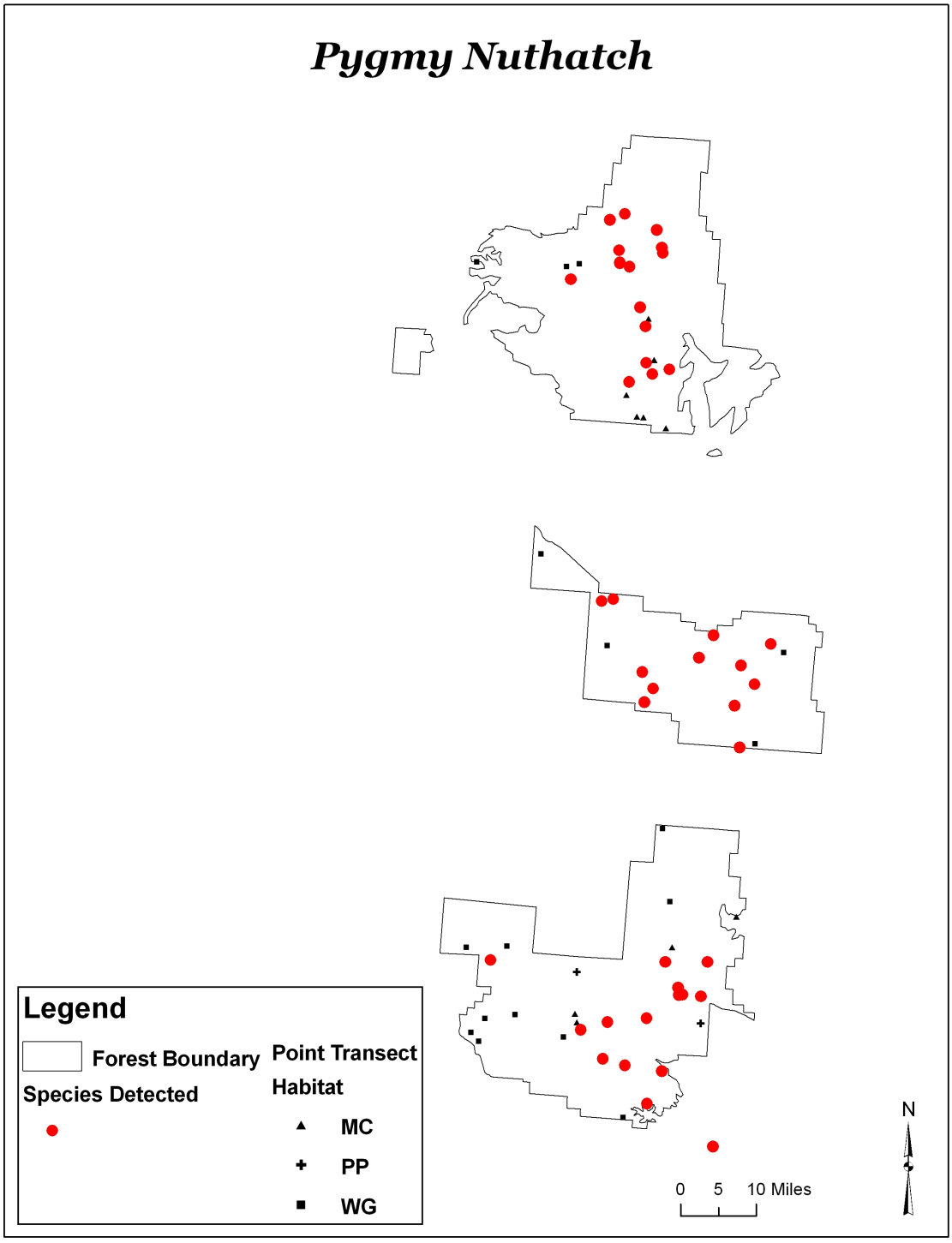
Hairy Woodpecker
(Picoides villosus)



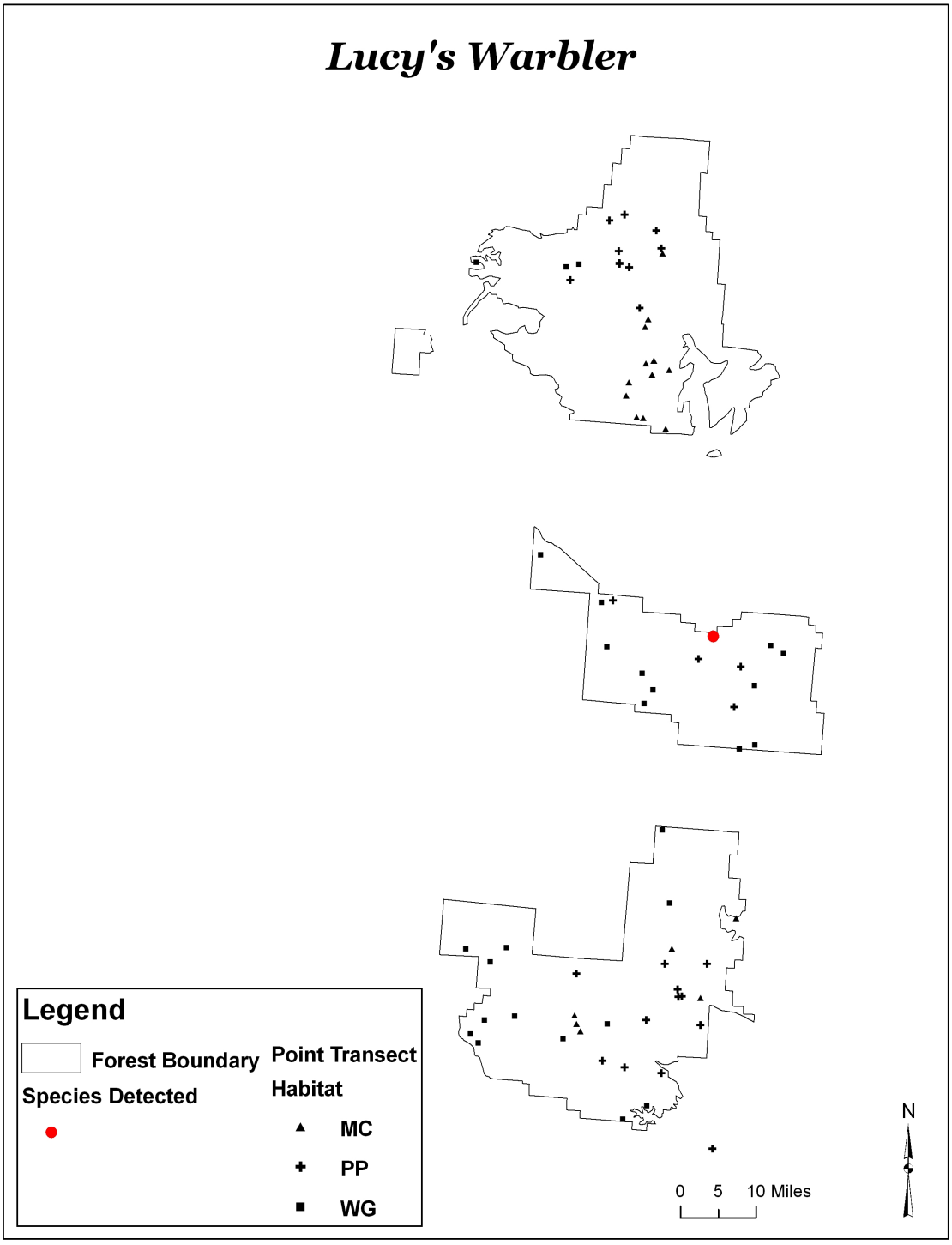
Juniper Titmouse
(Baeolophus ridgwayi)



Pygmy Nuthatch
(Sitta pygmaea)



Lucy's Warbler
(Vermivora luciae)



APPENDIX B. LIST OF ALL BIRD SPECIES OBSERVED IN KAIBAB NATIONAL FOREST FROM 2007, WITH SPECIES TOTALS BY HABITAT.

Species[1]	MC[2]	PP[2]	WG[2]	Total # of individuals 2007
Common Goldeneye	1	2	--	3
Blue Grouse	6	--	--	6
Wild Turkey	**--**	**9**	**1**	**10**
Great Blue Heron	--	1	--	1
Turkey Vulture	1	3	5	9
Cooper's Hawk	2	1	1	4
Northern Goshawk	**2**	**--**	**--**	**2**
Red-tailed Hawk	--	5	5	10
American Kestrel	--	2	1	3
Band-tailed Pigeon	1	--	--	1
Mourning Dove	8	41	31	80
Common Nighthawk	--	5	5	10
White-throated Swift	8	3	12	23
Black-chinned Hummingbird	--	4	2	6
Broad-tailed Hummingbird	30	28	7	65
Rufous Hummingbird	--	1	--	1
Acorn Woodpecker	1	10	1	12
Williamson's Sapsucker	56	4	--	60
Red-naped Sapsucker	**2**	**1**	**--**	**3**
Ladder-backed Woodpecker	--	--	1	1
Downy Woodpecker	7	3	5	15
Hairy Woodpecker	**52**	**84**	**28**	**164**
American Three-toed Woodpecker	1	--	--	1
Northern Flicker	59	92	41	192
Olive-sided Flycatcher	4	1	--	5
Western Wood-Pewee	51	123	29	203
Hammond's Flycatcher	--	16	1	17
Gray Flycatcher	1	9	85	95
Dusky Flycatcher	1	15	10	26
Cordilleran Flycatcher	12	2	--	14
Say's Phoebe	--	--	1	1
Ash-throated Flycatcher	--	22	162	184
Cassin's Kingbird	--	--	3	3
Western Kingbird	--	1	3	4
Gray Vireo	--	--	26	26
Plumbeous Vireo	10	111	30	151
Hutton's Vireo	--	--	1	1
Warbling Vireo	105	35	2	142
Steller's Jay	36	108	34	178
Western Scrub-Jay	1	13	28	42
Pinyon Jay	--	--	47	47
Clark's Nutcracker	6	5	--	11
American Crow	--	--	20	20
Common Raven	23	66	94	183
Purple Martin	3	5	3	11
Tree Swallow	--	2	1	3
Violet-green Swallow	87	78	16	181

Species[1]	MC[2]	PP[2]	WG[2]	Total # of individuals 2007
Northern Rough-winged Swallow	--	3	5	8
Black-capped Chickadee	1	--	--	1
Mountain Chickadee	95	203	158	456
Juniper Titmouse	**--**	**6**	**103**	**109**
Bushtit	--	--	30	30
Red-breasted Nuthatch	50	5	7	62
White-breasted Nuthatch	34	184	79	297
Pygmy Nuthatch	**52**	**348**	**38**	**438**
Brown Creeper	20	19	5	44
Rock Wren	--	--	1	1
Canyon Wren	2	1		3
Bewick's Wren	--	1	66	67
House Wren	53	15	1	69
Golden-crowned Kinglet	--	1	--	1
Ruby-crowned Kinglet	67	8	2	77
Blue-gray Gnatcatcher	--	--	32	32
Black-tailed Gnatcatcher	--	--	2	2
Western Bluebird	3	78	13	94
Mountain Bluebird	2	15	53	70
Townsend's Solitaire	14	20	3	37
Hermit Thrush	173	57	8	238
American Robin	24	92	48	164
Northern Mockingbird	--	--	30	30
Olive Warbler	5	8	2	15
Virginia's Warbler	19	31	9	59
Lucy's Warbler	**--**	**1**	**--**	**1**
Yellow Warbler	5	9	1	15
Yellow-rumped Warbler	190	47	6	243
Black-throated Gray Warbler	--	19	76	95
Hermit Warbler	2	4	--	6
Grace's Warbler	15	130	4	149
MacGillivray's Warbler	--	1	2	3
Hepatic Tanager	--	2	1	3
Western Tanager	153	182	56	391
Green-tailed Towhee	--	--	2	2
Spotted Towhee	3	5	107	115
Chipping Sparrow	29	36	96	161
Brewer's Sparrow	--	1	11	12
Black-chinned Sparrow	--	--	3	3
Vesper Sparrow	--	10	12	22
Lark Sparrow	2	4	20	26
Black-throated Sparrow	--	--	10	10
Lincoln's Sparrow	--	--	2	2
Dark-eyed Junco (Gray-headed)	112	260	47	419
Black-headed Grosbeak	28	40	29	97
Blue Grosbeak	--	--	1	1
Western Meadowlark	--	10	15	25
Brown-headed Cowbird	3	20	30	53
Scott's Oriole	--	--	1	1
Pine Grosbeak	5	3	--	8
Cassin's Finch	5	--	--	5

Species[1]	MC[2]	PP[2]	WG[2]	Total # of individuals 2007
House Finch	4	4	7	15
Pine Siskin	9	5	--	14
American Goldfinch	--	2	--	2
Abert's Squirrel	26	27	3	56
Red Squirrel	28	8	7	80

[1] Common names are from the A.O.U. check-list of North American Birds, Seventh Edition (2003).

[2]Habitats: MC=mixed-conifer; PP=ponderosa pine; WG=woodland/grassland