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Bird Community Monitoring for Wupatki National Monument

2014 Summary Report

Natural Resource Report NPS/SCPN/NRDS—2016/1034

ON THE COVER
Bendire's thrasher (*Toxostoma benderei)*
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Bird Community Monitoring for Wupatki National Monument

2014 Summary Report

Natural Resource Report NPS/SCPN/NRDS—2016/XXX

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June 2016

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Funding for this project was provided by the National Park Service to Northern Arizona University under Colorado Plateau Cooperative Ecosystems Study Unit agreement H2370-09-4001 (Task P13AC00996).

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This report is available from the Southern Colorado Plateau Network website (http://science.nature.nps.gov/IM/units/scpn/index.cfm), and the Natural Resource Publications Management Web site (http://www.nature.nps.gov/publications/nrpm/) on the Internet. To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

Holmes, J. A., and M. J. Johnson. 2016. Bird community monitoring for Wupatki National Monument: 2014 summary report. Natural Resource Data Series NPS/SCPN/NRDS—2016/1034. National Park Service, Fort Collins, Colorado.

NPS 322/133331, June 2016

Contents

Figures . . . iv
Tables . . . v
1 Introduction . . . 1
2 Methods . . . 1
2.1 Sampling frame . . . 1
2.2 Field methods . . . 1
2.3 Data summary . . . 3
2.3.1 Variable Circular Plot count data . . . 3
2.3.2 Habitat data . . . 3
3 Results . . . 4
3.1 Summary of bird community data . . . 4
3.2 Summary of bird habitat data . . . 6
4 Discussion . . . 8
5 Literature cited . . . 8

Figures

Figure 1. Bird monitoring sampling frames of grassland habitat and upland vegetation monitoring sampling frame in Wupatki NM. 2

Tables

Table 1. Survey periods and sampling effort for bird community monitoring at Wupatki NM in 2014. 2

Table 2. Vegetation cover types in grassland habitat at Wupatki NM. 3

Table 3. Bird species and number detected during VCP counts in grassland habitat at Wupatki NM in 2014. 4

Table 4. Mean number of individuals detected per VCP count, standard deviation (SD), and the proportion of plots in which each species was detected (plot frequency) in grassland habitat at Wupatki NM, 2014. 5

Table 5. Mean cover of vegetation and other land cover types, standard deviation (SD), range, and frequency of these types in macroplots in target grassland habitat in Wupatki NM, 2014. 6

Table 6. Mean basal area and standard deviation (SD) of *Juniperus monosperma* and snags in grassland habitat in Wupatki NM, 2014. 6

Table 7. Mean foliar cover, standard deviation (SD), and range of functional groups in target grassland habitat in Wupatki NM, 2014. 7

1 Introduction

The National Park Service Inventory and Monitoring Program was designed to determine the current status and monitor long-term trends in the condition of park natural resources, providing park managers with a strong scientific foundation for making decisions and working with other agencies and the public for the protection of park ecosystems. The goal of bird community monitoring is to provide status and trends data on bird communities in several predominant habitats where integrated upland or riparian vegetation monitoring is also occurring.

For Wupatki National Monument (WUPA), Southern Colorado Plateau Network (SCPN) and monument staff selected grassland as an important ecosystem for vegetation and bird community monitoring. This habitat is largely composed of perennial grasses and shrubs, and covers a large area of the monument. The grassland habitat of WUPA's upland bird community faces several threats, including climate change and the invasion of nonnative species. These threats have the potential to alter the composition and structure of the grasslands and affect the distribution and abundance of grassland bird species.

In 2014, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN, we continued monitoring the upland bird community of the target grassland habitat in WUPA, which had been initiated in 2008, and continued in 2011. In this report, we document monitoring activities in the 2014 field season at Wupatki National Monument and summarize the data that were collected.

2 Methods

2.1 Sampling frame

A sampling frame is the area within which we randomly locate our monitoring sites, and hence, the area to which statistical inferences can be made based on monitoring data. We derived the sampling frames for vegetation and bird community monitoring at WUPA from the maps of two ecological sites, Limy Upland and Sandstone Upland, developed by the U.S. Natural Resources Conservation Service (NRCS; See Appendix A of DeCoster et al. 2012). Ecological sites are landscape divisions with characteristic soils, hydrology, plant communities, and disturbance regimes and responses, and are based on soil survey data (Butler et al. 2003).

We merged the two ecological sites into one, henceforth referred to as grassland habitat. To complete the bird community monitoring sampling frame, we modified the map of the sampling frame using Geographical Information System (GIS) technology to eliminate

- areas that were not within the target habitat (roads, buildings, and infrastructure)
- areas near paved roads and the monument boundary
- areas with slopes ≥20% to prevent erosion from occurring as a result of the field work

We created a set of spatially distributed sampling plots in a simple grid sampling design. WUPA staff first reviewed the sampling plots and rejected those plots that landed in the proximity of archeological sites. Next the bird monitoring crew evaluated the accessibility of each plot in the field; none were deemed inaccessible. The crew then assessed each sampling plot to ensure that (1) it fell within the target habitat, (2) had a slope of less than 20%, and (3) did not contain a major disturbance. Any plots that did not meet these criteria were rejected. Three plots on the western edge of the monument were rejected because they were too close to Highway 89, and traffic noise would have interfered with bird sampling. One plot was rejected because it fell close to an inhabited dwelling. One hundred plots were selected for monitoring (Figure 1).

2.2 Field methods

We conducted bird sampling at 100 permanent sampling plots, or Variable Circular Plot (VCP) count stations, in grassland habitat at WUPA (Figure 1) over the course of two survey periods in 2014 (Table 1). A brief description of the field methods we employed is provided here. A more detailed description can be found in Holmes et al. (2015).

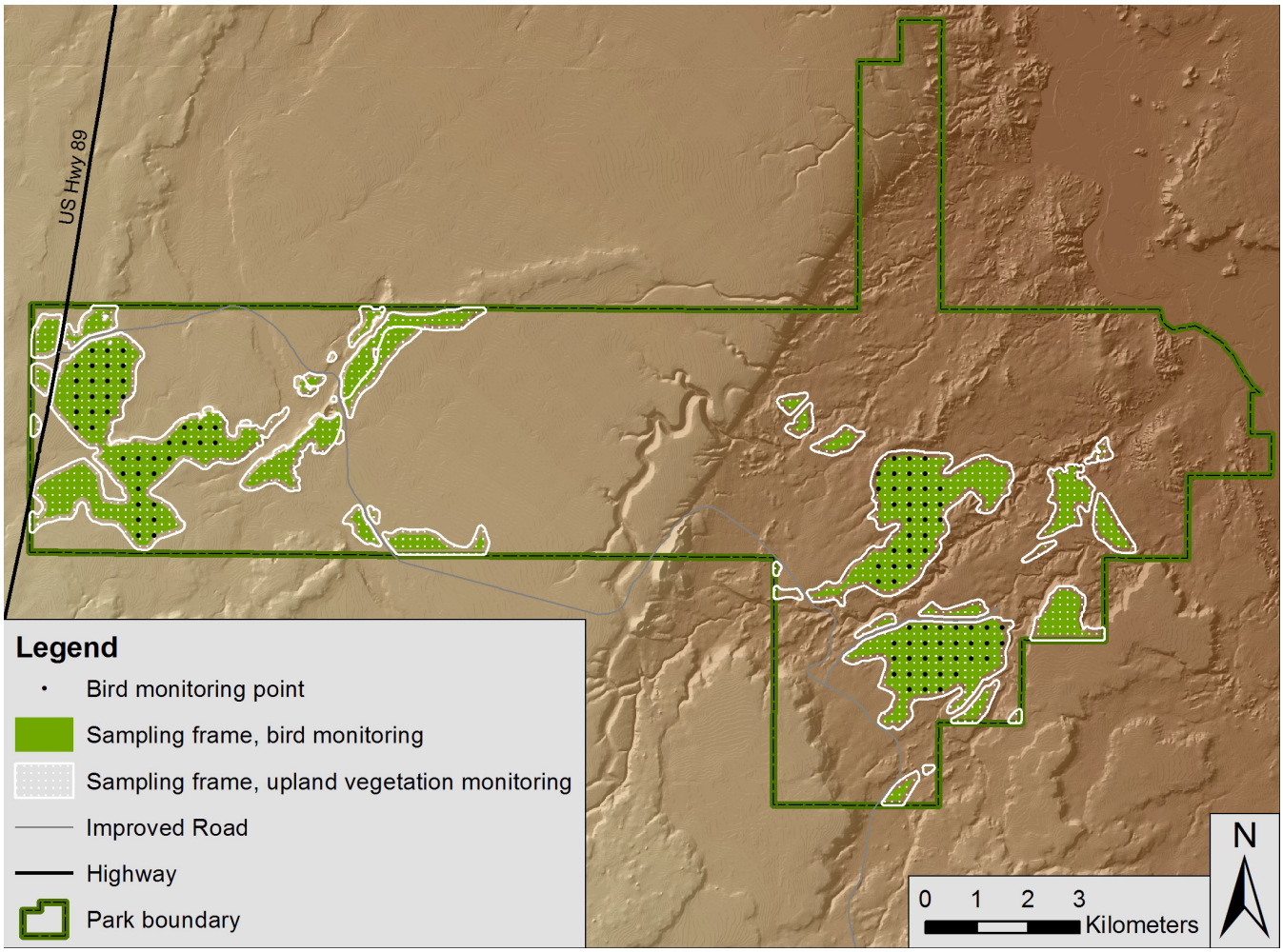

Figure 1. Bird monitoring sampling frame of grassland habitat, and upland vegetation monitoring sampling frame in Wupatki NM.

Table 1. Survey periods and sampling effort for bird community monitoring at Wupatki NM in 2014. Includes the dates that VCP counts were conducted and the number of plots sampled.

Survey period	Dates	Number VCP counts
1	4/29–5/4	100
2	6/10–6/14	100

At each sampling plot, we conducted a VCP count, noting all birds seen or heard during an 8-minute sampling period, regardless of the distance from the observer. We recorded (1) the species, (2) method of detection, (3) gender (if known), and (4) distance from the sampling plot center to the individual bird. Distances were measured to the nearest meter using a laser range finder. During a single morning, one technician conducted approximately ten VCP counts.

We conducted habitat sampling on a 50 m radius macroplot centered on a VCP sampling plot, and in four subplots within the macroplot. First, for the macroplot, we estimated and recorded the area occupied by vegetation and other land-use types. For the four subplots, we recorded foliar vegetation cover by functional group (e.g. forbs, shrubs), canopy closure, and tree and snag density and basal area. We measured basal area using a Cruz-All (a type of angle gauge), and canopy closure using a spherical densiometer. Ocular estimates of foliar cover were

made using a modified Braun-Blanquet cover class scale.

2.3 Data summary

2.3.1 Variable Circular Plot count data

We summarized the following data for the target grassland habitat at WUPA. The sample unit for bird data is the VCP.

- Observed species richness (unadjusted for detectability) is the number of species detected within a given area and specified time.
- Mean number of individuals detected for each species is reported as the average number of individuals detected per 8-minute VCP count. To calculate mean number of individuals detected for each species in grassland habitat using a simple grid sampling design, the data for all plots are averaged across the two survey periods, and a mean number of individuals detected and standard deviation are calculated for the target habitat. Detectability-based density estimates are not reported here, but they will be derived for multi-year trend reports.
- Frequency is the proportion of plots in which each species was detected. To calculate species frequency, we calculated the proportion of plots in the target habitat in which the species was detected. For example, if black-throated sparrows were detected on 60 of the 100 plots in the target habitat, during one or both of the two visits to that plot, the proportion of plots occupied in the target habitat is 0.60 (60%).

2.3.2 Habitat data

We will use habitat data and bird sampling data to examine bird-habitat relationships. For WUPA, habitat data were collected within a circular 0.8 ha macroplot which contained 4 subplots and was centered on each bird sampling plot. Data were summarized at 2 levels: the macroplot and the target habitat. The means and standard deviations for the target habitat were calculated from the macroplot data.

Vegetation cover types. For WUPA, we classified vegetation into two cover types as shown in Table 2. For each cover type, we calculated

- mean percent cover for each vegetation cover type and other land cover types in the target habitat (using the cover class midpoints) and standard deviation
- frequency, the number of macroplots where a specific cover type had been recorded as a proportion of the total number of macroplots

Basal area. We calculated tree basal area (m^2/ha) for each species, and basal area for all snags. We calculated mean basal area for the macroplot, and mean basal area and standard deviation for the target habitat.

Foliar cover of functional groups. We calculated the mean foliar cover for each functional group for the macroplot, using the cover class midpoints; and the mean and standard deviation for the target habitat.

Table 2. Vegetation cover types in grassland habitat at Wupatki NM.

Vegetation cover type	Description
Limy Upland	Mix of grass and shrubs. Common shrubs include fourwing saltbush (*Atriplex canescens*), rubber rabbitbrush (*Ericameria nauseosa*), and snakeweed (*Gutierrezia sarothrae*). Dominant grasses are blue grama (*Bouteloua gracilis*) and James' galleta (*Pleuraphis jamesii*).
Sandstone Upland	Variable mix of grass and shrubs. Some sites are dominated by fourwing saltbush, sand sagebrush (*Artemisia filifolia*) and Apache plume (*Fallugia paradoxa*) with bush muhly (*Muhlenbergia porteri*) and James' galleta. Other sites are mainly bare ground (platy red sandstone) with low shrubs, usually shadscale saltbush (*Atriplex confertifolia*) and mound saltbush (*Atriplex obovata*).

3 Results

3.1 Summary of bird community data

In 2014, we conducted a total of 200 VCP counts in grassland habitat at WUPA. During these surveys, we detected 1,239 individuals of 41 species (Table 3). The most commonly detected species was the black-throated sparrow, which comprised 23.65% of the total number of individuals detected.

The mean number of individuals detected per species during a VCP count, and the frequency of detections for each species detected in WUPA grassland habitat are presented in Table 4. The black-throated sparrow had the highest mean number of individuals, with an average of 1.47 individuals detected during an 8-minute count. They were also widespread in the target habitat—detected in 65.00% of plots. The northern mockingbird was detected in 72% of the plots with an average of 0.89 individuals detected during an 8-minute count. The horned lark was also abundant (average of 0.84 individuals detected during an 8-minute count) but was only detected in 38% of the plots The common raven had a fairly high abundance (0.33 individuals/count), but a more limited distribu-

Table 3. Bird species and number detected during VCP counts in grassland habitat at Wupatki NM in 2014. Species are listed in descending order of the total number of individuals detected.

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
black-throated sparrow	*Amphispiza bilineata*	293	23.65
northern mockingbird	*Mimus polyglottos*	178	14.37
horned lark	*Eremophila alpestris*	169	13.64
eastern meadowlark	*Sturnella magna*	130	10.49
Brewer's sparrow	*Spizella breweri*	128	10.33
common raven	*Corvus corax*	66	5.33
mourning dove	*Zenaida macroura*	65	5.25
Say's phoebe	*Sayornis saya*	22	1.78
loggerhead shrike	*Lanius ludovicianus*	21	1.69
ash-throated flycatcher	*Myiarchus cinerascens*	18	1.45
house finch	*Carpodacus mexicanus*	15	1.21
western kingbird	*Tyrannus verticalis*	12	0.97
green-tailed towhee	*Pipilo chlorurus*	10	0.81
common nighthawk	*Chordeiles minor*	9	0.73
lark sparrow	*Chondestes grammacus*	9	0.73
pinyon jay	*Gymnorhinus cyanocephalus*	9	0.73
chipping sparrow	*Spizella passerina*	8	0.65
vesper sparrow	*Pooecetes gramineus*	8	0.65
crissal thrasher	*Toxostoma crissale*	7	0.56
western meadowlark	*Sturnella neglecta*	7	0.56
rock wren	*Salpinctes obsoletus*	6	0.48
western scrub jay	*Aphelocoma californica*	6	0.48
Bendire's thrasher	*Toxostoma bendirei*	5	0.40
blue-gray gnatcatcher	*Polioptila caerulea*	5	0.40
white-throated swift	*Aeronautes saxatalis*	5	0.40
broad-tailed hummingbird	*Selasphorus platycercus*	3	0.24
Eurasian collared dove	*Streptopelia decaocto*	3	0.24
violet-green swallow	*Tachycineta thalassina*	3	0.24
gray flycatcher	*Empidonax wrightii*	2	0.16
northern harrier	*Circus cyaneus*	2	0.16

tion—it was only detected in 33.00% of the plots (Table 4).

Table 3 *continued*

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
prairie falcon	*Falco mexicanus*	2	0.16
Scott's oriole	*Icterus parisorum*	2	0.16
warbling vireo	*Vireo gilvus*	2	0.16
yellow-rumped warbler	*Setophaga coronata*	2	0.16
American kestrel	*Falco sparverius*	1	0.08
Brewer's blackbird	*Euphagus cyanocephalus*	1	0.08
black-throated gray warbler	*Setophaga nigrescens*	1	0.08
Cassin's kingbird	*Tyrannus vociferans*	1	0.08
greater roadrunner	*Geococcyx californianus*	1	0.08
turkey vulture	*Cathartes aura*	1	0.08
white-crowned sparrow	*Zonotrichia leucophrys*	1	0.08

Table 4. Mean number of individuals detected per VCP count, standard deviation (SD), and the proportion of plots in which each species was detected (plot frequency) in grassland habitat at Wupatki NM, 2014.

Species	Number of individuals	SD	Plot frequency (%)
black-throated sparrow	1.47	1.64	65.00
northern mockingbird	0.89	1.11	72.00
horned lark	0.84	1.61	38.00
eastern meadowlark	0.65	1.05	37.00
Brewer's sparrow	0.64	1.87	49.00
common raven	0.33	1.11	33.00
mourning dove	0.32	0.72	36.00
Say's phoebe	0.11	0.37	17.00
loggerhead shrike	0.10	0.35	16.00
ash-throated flycatcher	0.09	0.30	17.00
house finch	0.08	0.60	7.00
western kingbird	0.06	0.40	6.00
green-tailed towhee	0.05	0.26	8.00
common nighthawk	0.04	0.25	7.00
lark sparrow	0.04	0.21	8.00
pinyon jay	0.04	0.23	8.00
chipping sparrow	0.04	0.26	6.00
vesper sparrow	0.04	0.22	7.00
crissal thrasher	0.04	0.25	5.00
western meadowlark	0.04	0.21	6.00
rock wren	0.03	0.22	4.00
western scrub jay	0.03	0.20	5.00
Bendire's thrasher	0.02	0.16	5.00
blue-gray gnatcatcher	0.02	0.19	4.00
white-throated swift	0.02	0.21	3.00
broad-tailed hummingbird	0.02	0.16	2.00

Table 4 *continued*

Species	Number of individuals	Standard deviation	Plot frequency (%)
Eurasian collared dove	0.02	0.12	3.00
violet-green swallow	0.02	0.16	2.00
gray flycatcher	0.01	0.10	2.00
northern harrier	0.01	0.10	2.00
prairie falcon	0.01	0.10	2.00
Scott's oriole	0.01	0.10	2.00
warbling vireo	0.01	0.10	2.00
yellow-rumped warbler	0.01	0.10	2.00
American kestrel	0.01	0.07	1.00
Brewer's blackbird	0.01	0.07	1.00
black-throated gray warbler	0.01	0.07	1.00
Cassin's kingbird	0.01	0.07	1.00
greater roadrunner	0.01	0.07	1.00
turkey vulture	0.01	0.07	1.00
white-crowned sparrow	0.01	0.07	1.00

Table 5. Mean cover of vegetation and other land cover types, standard deviation (SD), range, and frequency of these types in macroplots in target grassland habitat in Wupatki NM, 2014.

Vegetation or other land-cover type	Cover (%)	SD	Range	Frequency (%)
Sandstone Upland	51.63	43.25	0.00–87.50	59.00
Grassland: Limy Upland	35.88	43.25	0.00–87.50	41.00
Dry arroyo	0.03	0.30	0.00–3.00	1.00
Roads	0.15	1.06	0.00–7.50	2.00
Historic structures / ruins	0.13	0.59	0.00–3.00	5.00

Table 6. Mean basal area and standard deviation (SD) of *Juniperus monosperma* and snags in grassland habitat in Wupatki NM, 2014.

Species	Common name	Basal area (m^2/ha)	2.5 to <5 cm
Juniperus monosperma	Oneseed juniper	33.42	57.84
Snags	-	1.54	8.68

3.2 Summary of bird habitat data

We found two vegetation cover types (sandstone upland and limy upland), and three other land cover types (dry arroyo, roads, and historic structures / ruins) in the macroplots in the WUPA sampling area (Table 5). When we calculated the mean percent cover for each vegetation type, Sandstone Upland was the most common cover type, accounting for, on average, 51.63% of the overall vegetative cover of the macroplots.

There were few trees in the WUPA grassland. On average, the basal area of oneseed junipers in the macroplots was 33.42 m^2/ha (Table 6) and snag basal area was 1.54 m^2/ha. The grassland habitat at WUPA had, on average, canopy closure of 0.15% (SD = 0.86). The functional groups with highest foliar cover were perennial grass (11.33% cover) and shrubs (5.91% cover). Shrub cover ranged from zero to 33.75%, and standing dead herbaceous cover ranged from zero to 20.75% (Table 7).

Table 7. Mean foliar cover, standard deviation (SD), and range of functional groups in target grassland habitat in Wupatki NM, 2014.

Functional groups	Foliar cover (%)	SD	Range
Total shrub and herbaceous cover (no trees) <2 m	17.85	9.66	2.75–45.00
Perennial grasses, graminoids	11.33	10.74	0.00–37.50
Annual grasses	0.06	0.44	0.00–4.38
Forbs	0.67	1.73	0.00–15.63
Shrubs, dwarf shrubs, and woody vines	5.99	7.04	0.00–33.75
Cacti, succulents	0.04	0.26	0.00–1.88
Standing dead herbaceous	2.86	2.76	0.00–20.25
Woody standing dead	2.95	3.65	0.00–20.75

4 Discussion

These data represent the third year of sampling for the grassland bird community at WUPA. The density of shrubs and juniper trees *(Juniperus monosperma)* in grassland habitat at WUPA was variable and a considerable amount of pinyon-juniper woodlands occurred in the landscape adjacent to the monument. WUPA's bird community was primarily comprised of species typically found in the region's grasslands and shrublands, but also included species that are typically associated with pinyon-juniper habitats, including pinyon jay, Scott's oriole, and gray flycatcher.

SCPN monitors bird communities within network parks as a core vital sign representing the overall health and condition of park natural resources. Similarly, the North American Bird Conservation Initiative (NABCI), U.S. Committee (2014) uses birds as indicators of ecosystem health by examining population trends of obligate species for a single habitat, using data from continental-scale monitoring programs. WUPA grassland species are included in the list of 24 obligate breeding birds that make up the report's grassland indicator, and in the list of 17 obligate birds that make up the aridlands indicator. According to the report, the grasslands indicator declined by nearly 40%, but the decline flattened out in 1990. Yet, some eastern grassland species have continued to decline, including the eastern meadowlark, the fourth most detected species in WUPA grasslands in 2014. The aridlands indicator is the most steeply declining of all habitat indicators—with an overall loss of 46% since 1968. In particular, Bendire's thrasher, detected each of the three years of monitoring at WUPA, is one of the two fastest declining species in the aridlands indicator. It is also on The State of the Birds 2014 Report's Red Watch List (NABCI 2014)—species with extremely high vulnerability due to small populations, small range, high threats, and rangewide declines, and the federal list of Birds of Conservation Concern (U.S. Fish and Wildlife Service 2002).

The report's Watch List consists of 233 species most in need of conservation action, with the goals to promote proactive conservation for species and to highlight the species most in danger of extinction without significant action. The report also identifies 33 common birds in steep decline—those having lost more than half their global population over the past four decades. According to the North American Breeding Bird Survey, Bendire's thrasher declined 90% between 1966 and 2014 (allaboutbirds.org). The pinyon jay, which was also detected in WUPA in 2014, is on the Watch List as a yellow species—species that are either range restricted or are more widespread, but declining and under high threats (NABCI 2014). The pinyon jay declined 88% between 1966 and 2014, according to the North American Breeding Bird Survey (allaboutbirds.org). The WUPA bird community includes five common species in steep decline (NABCI 2014)—common nighthawk, loggerhead shrike, horned lark, eastern meadowlark, and Brewer's blackbird.

Nationwide, only 13% of the nation's grasslands are publicly owned and managed (NABCI, US Committee 2011). Most grasslands are on private lands and are not managed to maintain native habitat; thus, WUPA provides some of the extremely limited grasslands managed for native habitat for the region's grassland bird species. Further monitoring at WUPA should provide data to track changes in these species' abundance, occurrence and habitat over time.

Our long-range plan is to conduct VCP counts at WUPA every three years, and continue collecting data on bird species abundance, distribution, and habitat metrics. When sufficient data have been collected, we will analyze changes in these data over time.

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NPS 322/133331, June 2016

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