



Bird Community Monitoring for Wupatki National Monument

2011 Summary Report

Natural Resource Data Series NPS/SCPN/NRDS—2013/466



ON THE COVER Say's Phoebe (*Sayornis saya*)
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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 2011, 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. In this report, we document monitoring activities in the 2011 field season 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 $\geq 20\%$ 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, and 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 (fig. 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 (fig. 1) over the course of two survey periods in 2011 (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. (in preparation).

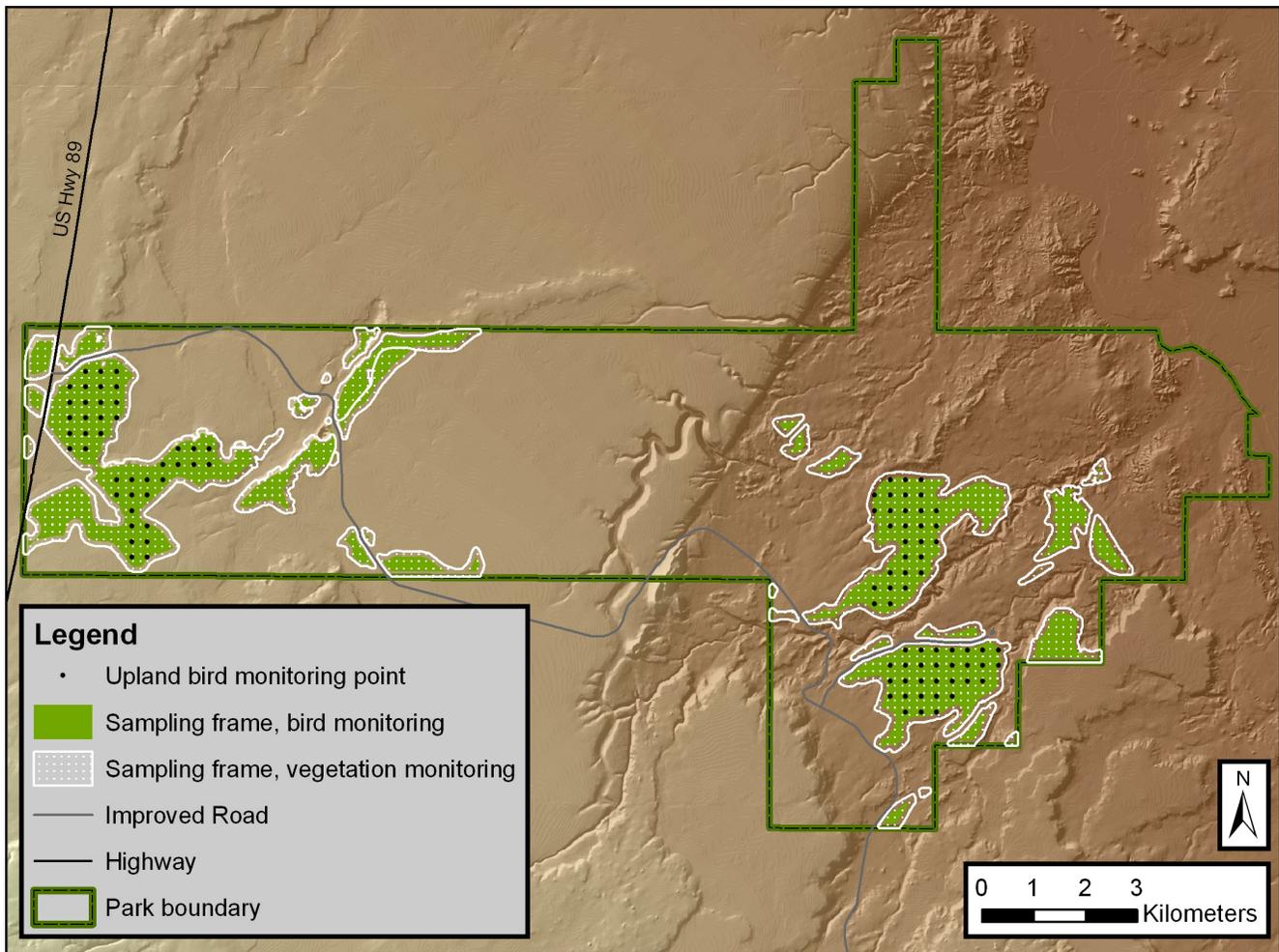


Figure 1. Bird monitoring sampling frame of grassland habitat and upland vegetation monitoring sampling frame in Wupatki NM.

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.

Table 1. Survey periods and sampling effort for bird community monitoring at Wupatki NM (WUPA). Dates are for VCP counts conducted at WUPA in 2011, and the number of plots sampled.

Survey period	Dates	Number of VCP counts
1	5/2–5/5	100
2	5/31–6/6	100

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 by reporting 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 (m²/ha) for each species, and calculated snag basal area for all snags. We calculated mean basal area for the macroplot, and then 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
Grassland: Limy Upland	Mix of grass and shrubs. Common shrubs include fourwing saltbush (<i>Atriplex canescens</i>), rubber rabbitbrush (<i>Ericameria nauseosa</i>), and snakeweed (<i>Gutierrezia sarothrae</i>). Dominant grasses are blue grama (<i>Bouteloua gracilis</i>) and James' galleta (<i>Pleuraphis jamesii</i>).
Sandstone Upland	Variable mix of grass and shrubs. Some sites are dominated by fourwing saltbush, sand sagebrush (<i>Artemisia filifolia</i>) and Apache plume (<i>Fallugia paradoxa</i>) with bush muhly (<i>Muhlenbergia porteri</i>) and James' galleta. Other sites are mainly bare ground (platy red sandstone) with low shrubs, usually shadscale saltbush (<i>Atriplex confertifolia</i>) and mound saltbush (<i>Atriplex obovata</i>).

3 Results

3.1 Summary of bird community data

In 2011, we conducted a total of 200 VCP counts in grassland habitat at WUPA . During these surveys, we detected 713 individuals of 37 species (table 3). The most commonly detected species was the black-throated sparrow, which comprised 22.16% 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 0.79 individuals detected during an 8-minute count. They were also widespread in the target habitat—detected in 51.00% of plots. The pinyon jay had a fairly high abundance (0.13 individuals/count), but a limited distribution—it was only detected in 13.00% of the plots (table 4).

Table 3. Bird species and number detected during VCP counts in grassland habitat at Wupatki NM (WUPA). Data are from VCP counts conducted at WUPA in 2011. 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	<i>Amphispiza bilineata</i>	158	22.16
horned lark	<i>Eremophila alpestris</i>	136	19.07
northern mockingbird	<i>Mimus polyglottos</i>	88	12.34
Brewer's sparrow	<i>Spizella breweri</i>	56	7.85
eastern meadowlark	<i>Sturnella magna</i>	54	7.57
common raven	<i>Corvus corax</i>	32	4.49
pinyon jay	<i>Gymnorhinus cyanocephalus</i>	26	3.65
mourning dove	<i>Zenaida macroura</i>	23	3.23
loggerhead shrike	<i>Lanius ludovicianus</i>	21	2.95
lark sparrow	<i>Chondestes grammacus</i>	17	2.38
Say's phoebe	<i>Sayornis saya</i>	12	1.68
western meadowlark	<i>Sturnella neglecta</i>	11	1.54
violet-green swallow	<i>Tachycineta thalassina</i>	10	1.40
chipping sparrow	<i>Spizella passerina</i>	8	1.12
Bendire's thrasher	<i>Toxostoma bendirei</i>	7	0.98
vesper sparrow	<i>Poocetes gramineus</i>	7	0.98
rock wren	<i>Salpinctes obsoletus</i>	6	0.84
house finch	<i>Carpodacus mexicanus</i>	5	0.70
American kestrel	<i>Falco sparverius</i>	4	0.56
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	4	0.56
broad-tailed hummingbird	<i>Selasphorus platycercus</i>	4	0.56
Cassin's kingbird	<i>Tyrannus vociferans</i>	2	0.28
golden eagle	<i>Aquila chrysaetos</i>	2	0.28
gray flycatcher	<i>Empidonax wrightii</i>	2	0.28
green-tailed towhee	<i>Pipilo chlorurus</i>	2	0.28
ruby-crowned kinglet	<i>Regulus calendula</i>	2	0.28
red-tailed hawk	<i>Buteo jamaicensis</i>	2	0.28
sage thrasher	<i>Oreoscoptes montanus</i>	2	0.28
Scott's oriole	<i>Icterus parisorum</i>	2	0.28

Table 3. continued

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
ash-throated flycatcher	<i>Myiarchus tuberculifer</i>	1	0.14
barn swallow	<i>Hirundo rustica</i>	1	0.14
Cooper's hawk	<i>Accipiter cooperii</i>	1	0.14
common nighthawk	<i>Chordeiles minor</i>	1	0.14
spotted towhee	<i>Pipilo maculatus</i>	1	0.14
warbling vireo	<i>Vireo gilvus</i>	1	0.14
western kingbird	<i>Tyrannus verticalis</i>	1	0.14
white-throated swift	<i>Aeronautes saxatalis</i>	1	0.14

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, 2011.

Species	Number of individuals	SD	Plot frequency (%)
black-throated sparrow	0.79	1.09	51.00
horned lark	0.68	2.28	32.00
northern mockingbird	0.44	1.05	37.00
Brewer's sparrow	0.28	0.85	28.00
eastern meadowlark	0.27	0.62	28.00
common raven	0.16	0.55	18.00
pinyon jay	0.13	0.53	13.00
mourning dove	0.12	0.54	14.00
loggerhead shrike	0.11	0.37	15.00
lark sparrow	0.09	0.33	13.00
Say's phoebe	0.06	0.28	10.00
western meadowlark	0.06	0.30	6.00
violet-green swallow	0.05	0.41	4.00
chipping sparrow	0.04	0.37	4.00
Bendire's thrasher	0.04	0.23	5.00
vesper sparrow	0.04	0.27	4.00
rock wren	0.03	0.17	6.00
house finch	0.03	0.19	4.00
American kestrel	0.02	0.14	4.00
blue-gray gnatcatcher	0.02	0.17	3.00
broad-tailed hummingbird	0.02	0.14	4.00
Cassin's kingbird	0.01	0.10	1.00
golden eagle	0.01	0.10	2.00
gray flycatcher	0.01	0.10	2.00
green-tailed towhee	0.01	0.10	2.00
ruby-crowned kinglet	0.01	0.10	2.00
red-tailed hawk	0.01	0.10	2.00
sage thrasher	0.01	0.10	2.00
Scott's oriole	0.01	0.10	2.00

Table 4 continued

Species	Number of individuals	SD	Plot frequency (%)
ash-throated flycatcher	0.01	0.07	1.00
barn swallow	0.01	0.07	1.00
Cooper's hawk	0.01	0.07	1.00
common nighthawk	0.01	0.07	1.00
spotted towhee	0.01	0.07	1.00
warbling vireo	0.01	0.07	1.00
western kingbird	0.01	0.07	1.00
white-throated swift	0.01	0.07	1.00

3.2 Summary of bird habitat data

We found two vegetation cover types (sandstone upland and grassland: limy upland), and three other land cover types (dry arroyo, roads, and historic structures / ruins) in the macroplots (0.8 ha circular plots centered on each bird sampling plot) 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 (table 5), 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 38.90 m²/ha (table 6) and snag basal area was 1.74 m²/ha. The grassland habitat at WUPA had, on average, canopy closure of 0.11% (SD = 0.68). It had, on average, total shrub and herbaceous cover of 1.55%. Shrub cover ranged from zero to 10.38%, and standing dead herbaceous cover ranged from zero to 10.00% (table 7).

Table 5. Mean cover of vegetation and other land cover types, standard deviation (SD), range, and plot frequency within macroplots in target grassland habitat in Wupatki NM, 2011.

Vegetation cover 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	0.33	1.22	0.00–7.50	12.00
Roads	0.08	0.75	0.00–7.50	1.00
Historic structures / ruins	0.03	0.30	0.00–3.00	1.00

Table 6. Mean basal area and standard deviation (SD) of *Juniperus monosperma* and snags in grassland habitat in Wupatki NM, 2011.

	Common name	Basal area (m ² /ha)	SD
<i>Juniperous monosperma</i>	Oneseed juniper	38.90	83.20
Snags	-	1.74	8.88

Table 7. Mean foliar cover, standard deviation (SD), and range of functional groups in target grassland habitat in Wupatki NM, 2011.

Functional groups	Foliar cover (%)	SD	Range
Understory trees (<1.4 m height)	<0.01	0.02	0.00–0.13
Total shrub and herbaceous cover (no trees) <2 m	1.55	1.83	0.25–10.38
Perennial grasses, graminoids	0.37	0.32	0.00–1.75
Annual grasses	<0.01	0.02	0.00–0.13
Forbs	0.23	0.22	0.00–0.50
Shrubs, dwarf shrubs, and woody vines	1.17	1.88	0.00–10.38
Cacti, succulents	0.03	0.20	0.00–1.88
Standing dead herbaceous	1.05	1.31	0.00–10.00
Woody standing dead	0.88	1.16	0.00–6.00

4 Discussion

These data represent the second 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. Other species detected, such as ruby-crowned kinglet and warbling vireo, were likely migrating through the monument and not breeding there.

Grassland birds are among the most consistently declining species in the United States (U.S. North American Bird Conservation Initiative Committee [NABCI] 2011). Five species that breed at WUPA—the eastern meadowlark, loggerhead shrike, black-throated sparrow, lark sparrow, and horned lark—are among the “top 20 common birds in decline” in the United States (Butcher and Niven 2007). Nationwide, only 13% of the nation's grasslands are publicly owned and managed (NABCI 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 to 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.

One of WUPA's bird species—Bendire's thrasher—is on the federal list of Birds of Conservation Concern (U.S. Fish and Wildlife Service 2002) and is one of the 59 species on the Red WatchList of the United States WatchList of Birds of Conservation Concern (Butcher et al. 2007). “Red” species are of the highest national concern for conservation. Little is known about the natural history of Bendire's thrasher. They generally inhabit sparse desert habitats with scattered trees in the southwestern United States and northwestern Mexico (England and Laudenslayer 1993). NPS lands are important for this species (NABCI 2011) and we have observed a pair of Bendire's thrashers at WUPA during the 2008, and 2011 breeding seasons.

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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