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Bird Community Monitoring for Petrified Forest National Park

2015 Summary Report

Natural Resource Report NPS/SCPN/NRDS—2016/1066

ON THE COVER
Scaled quail (*Callipepla squamata*)
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Bird Community Monitoring for Petrified Forest National Park

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1 Introduction

The National Park Service (NPS) 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 Southern Colorado Plateau Network (SCPN) of the NPS has identified bird communities as a vital sign for network parks (Thomas et al. 2006). 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 Petrified Forest National Park (PEFO), Southern Colorado Plateau Network (SCPN) and park 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 park. The grassland habitat of PEFO'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 2015, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN, we continued monitoring the upland bird community of the target grassland habitat in PEFO, which had been initiated in 2007, and continued in 2009 and 2012. In this report, we document monitoring activities in the 2015 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 PEFO from the maps of two ecological sites, Clayey Fan and Sandy Loam, 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 2 ecological sites into one, henceforth referred to as grassland habitat. To complete the grassland 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 park boundary
- areas with slopes ≥20% to prevent erosion from occurring as a result of the field work

When monitoring in large target habitats, such as PEFO grassland, we employ a cluster sampling method in which bird sample plots are clustered around a primary sampling unit, so that a cluster of plots can be sampled in a single morning. Primary sampling units are selected in a probabilistic manner from a grid of uniformly-spaced points using a Generalized Random-Tessellation Stratified (GRTS) design (Stevens and Olsen 2004).

PEFO 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 cluster in the field and rejected clusters that were inaccessible. For PEFO grassland, sites were deemed inaccessible if they required greater than 2 hours traveling time (by car and foot) from park headquarters. The bird monitoring crew then visited and 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. Ten clusters were selected

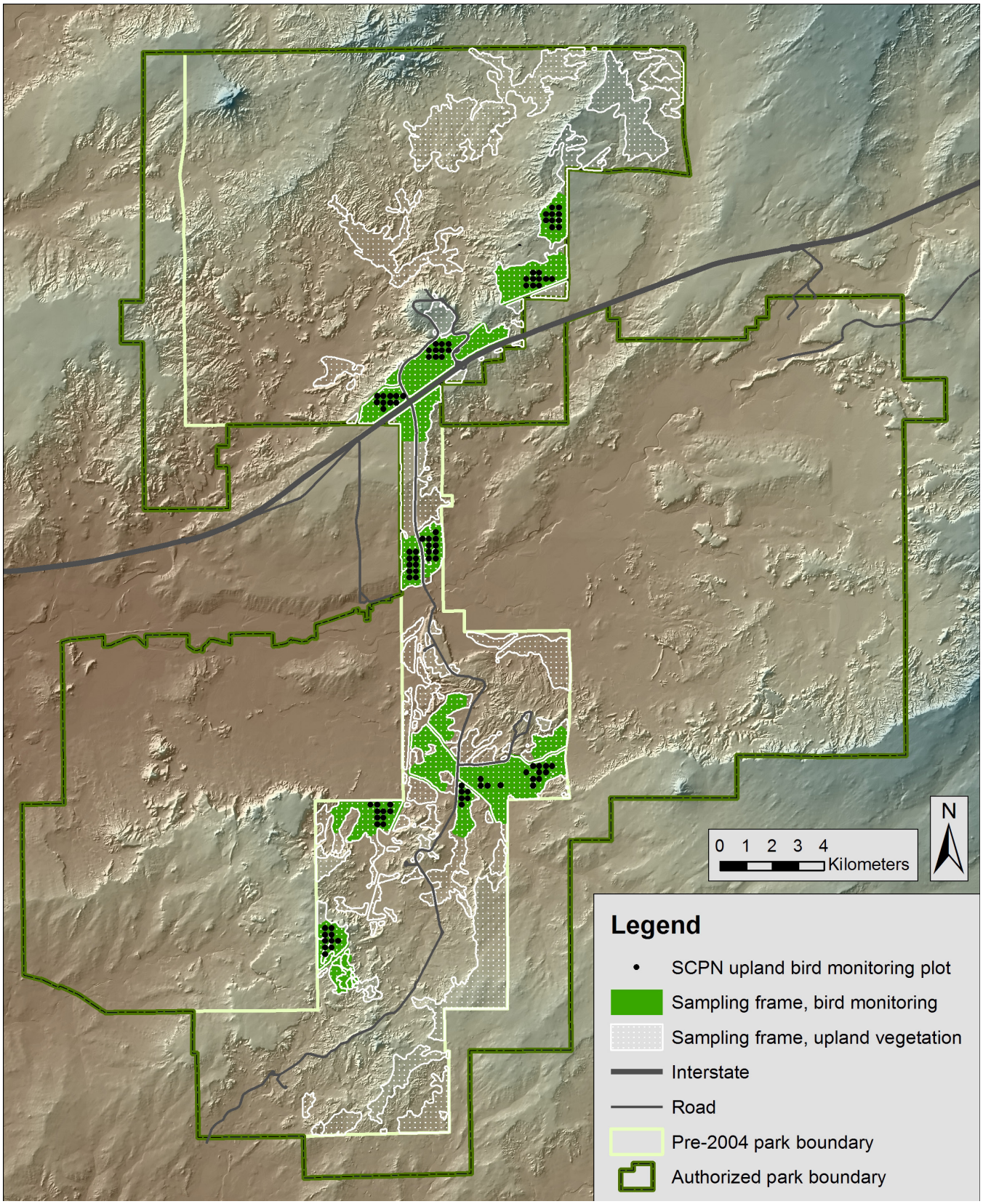

Figure 1. Bird monitoring sampling frame in grassland habitat showing 10 clusters of bird monitoring plots; and upland vegetation monitoring sampling frame in Petrified Forest NP.

for monitoring (Figure 1) and 20 clusters were rejected.

2.2 Field methods

We conducted bird sampling at permanent sampling plots, or Variable Circular Plots (VCP), in grassland habitat at PEFO (Figure 1) over 2 survey periods. We sampled a total of 10 clusters, each containing 10 sampling plots (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).

Table 1. Survey periods and sampling effort for bird community monitoring at Petrified Forest NP; dates that VCP counts were conducted in 2015, and the number of clusters and plots sampled.

Survey period	Dates (2015)	Number of clusters	Number of VCP counts
1	6 May –11 May	10	100
2	4 June – 8 June	10	100
Total		20	200

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 10 VCP counts.

Habitat sampling was conducted on a 50 m radius macroplot centered on a sampling plot, and in four subplots within the macroplot. First, for the macroplot, we estimated and recorded the area occupied by vegetation types and other land cover types. Then, in the four subplots, we recorded foliar vegetation cover by functional group (e.g. forbs, shrubs). 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 PEFO. The sample unit for bird data is the cluster (which contains 10 VCPs).

- 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, the data for a given cluster are averaged across the 2 survey periods, and a mean number of individuals detected per VCP count and standard deviation are calculated. Then the cluster means are used to calculate the mean number of individuals detected and standard deviation 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 or clusters in which each species was detected. To calculate species frequency, we first calculated the proportion of plots in each cluster in which the species was detected. For example, if a bird species was detected on 2 of the 10 plots in a cluster, the plot frequency for that cluster would be 0.20 (20%). We then calculate the mean proportion of plots occupied across the 10 clusters for the target habitat. Cluster frequency is calculated as the proportion of clusters in which the species was detected in at least one plot.

2.3.2 Habitat data

We use habitat data and bird sampling data to examine bird-habitat relationships. For PEFO, habitat data were collected within a circular 0.8 ha macroplot which contained four subplots and was centered on each bird sampling plot. Data were summarized at 3 levels: the macroplot, the cluster, and the target habitat. The means and standard deviations for the cluster were calculated from the macroplot data. The means and standard deviations

for the target habitat were calculated from the cluster data.

Vegetation cover types. For PEFO, we classified vegetation into four cover types and 1 other non-vegetation landcover type, as shown in Table 2. For each cover type, we calculated

- mean percent cover by calculating the mean cover per cluster for each vegetation or other landcover type (using the cover class midpoints), and then calculating the mean of the cluster means to determine the mean and standard deviation for the target habitat
- frequency, and the number of macroplots within a cluster where a specific cover type had been recorded (as a proportion of the 10 macroplots per cluster).

We then calculated the mean and standard deviation of the proportion of macroplots per cluster 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 for the cluster. The mean and standard deviation were then calculated for the target habitat.

Table 2. Vegetation cover types and other landcover types in grassland habitat at Petrified Forest NP. Cover types were updated to correspond with the park's vegetation map.

Cover type	Description
Alkali Sacaton Steppe and Mixed Grasslands	Little to no tree cover (<10%). Includes both grasslands and mixed shrublands often dominated by alkali sacaton (*Sporobolus airoides*), but also including snakeweed (*Gutierrezia sarothrae*), prickly pear (*Opuntia* spp.), galleta (*Hilaria jamesii*) and grama grasses (*Bouteloua* spp.).
Sandsage – Fourwing Saltbush Colorado Plateau Shrubland	Sandsage (*Artemesia filifolia*) and/or four-wing saltbush (*Atriplex canescens*) dominates or co-dominates the shrub layer. Herbaceous layer varies. Occurs on sand dunes and sand sheets and rolling plains.
Barren Wash	Non-vegetated area associated with wash.

3 Results

3.1 Summary of bird community data

In 2015, we conducted a total of 200 VCP counts in grassland habitat at PEFO and detected 1,597 individuals of 22 species (Table 3). The most commonly detected species were the horned lark and the black-throated sparrow, which together comprised over half (52.73%) of the total number of individuals detected.

Table 3. Bird species and number detected during VCP counts in grassland habitat at Petrified Forest NP in 2015. 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 (%)
horned lark	*Eremophila alpestris*	484	30.31
black-throated sparrow	*Amphispiza bilineata*	358	22.42
eastern meadowlark	*Sturnella magna*	330	20.66
western meadowlark	*Sturnella neglecta*	151	9.46
common raven	*Corvus corax*	56	3.51
scaled quail	*Callipepla squamata*	44	2.76
mourning dove	*Zenaida macroura*	39	2.44
northern mockingbird	*Mimus polyglottos*	36	2.25
Brewer's sparrow	*Spizella breweri*	31	1.94
Cassin's kingbird	*Tyrannus vociferans*	12	0.75
Lark bunting	*Calamospiza melanocorys*	12	0.75
broad-tailed hummingbird	*Selasphorus platycercus*	9	0.56
violet-green swallow	*Tachycineta thalassina*	7	0.44
black-chinned hummingbird	*Archilochus alexandri*	6	0.38
house finch	*Haemorhous mexicanus*	5	0.31
Cassin's sparrow	*Aimophila cassinii*	4	0.25
loggerhead shrike	*Lanius ludovicianus*	4	0.25
Cooper's hawk	*Accipiter cooperii*	3	0.19
house sparrow	*Passer domesticus*	3	0.19
American kestrel	*Falco sparverius*	1	0.06
lark sparrow	*Chondestes grammacus*	1	0.06
red-tailed hawk	*Buteo jamaicensis*	1	0.06

The mean number of individuals detected per species during a VCP count, the frequency of detections, and the frequencies of detections for each species detected in PEFO grassland habitat are presented in Table 4. The horned lark and black-throated sparrow have the highest mean number of individuals, with an average of 4.84 and 3.58 individuals detected, respectively, during an 8-minute count. Both species were also widespread in the target habitat—detected on 93% and 96% of the plots. Other species that were relatively common in the target habitat include eastern meadowlark, western meadowlark, common raven, scaled quail, mourning dove, northern mockingbird, and Brewer's sparrow.

3.2 Summary of bird habitat data

We found 2 vegetation cover types (Alkali Sacaton Steppe and Mixed Montane Shrubland, and Sandsage – Fourwing Saltbush Colorado Plateau Shrubland) and one other cover type (Barren Wash) in the PEFO sampling area (Table 5). When we calculated the mean percent cover for each vegetation type, Alkali Sacaton Steppe and Mixed Montane Shrubland was the most common cover type, accounting for, on average, 68.80% of the overall vegetative cover of the macroplots.

Table 4. Mean number of individuals detected per VCP count, standard deviation (SD), mean plot frequency (% of plots per cluster in which the species was detected), and cluster frequency (% of clusters in which the species was detected) in grassland habitat at Petrified Forest NP in 2015.

	Number of individuals			
Species	**Mean**	**SD**	**Plot frequency (%)**	**Cluster frequency (%)**
horned lark	2.42	0.90	93.00	100.00
black-throated sparrow	1.79	0.81	96.00	100.00
eastern meadowlark	1.65	0.81	93.00	100.00
western meadowlark	0.76	0.84	63.00	80.00
common raven	0.28	0.19	37.00	90.00
scaled quail	0.22	0.37	25.00	50.00
mourning dove	0.20	0.23	26.00	50.00
northern mockingbird	0.18	0.15	34.00	80.00
Brewer's sparrow	0.16	0.17	18.00	70.00
Cassin's kingbird	0.06	0.11	6.00	30.00
Lark bunting	0.06	0.13	9.00	30.00
broad-tailed hummingbird	0.05	0.08	9.00	40.00
violet-green swallow	0.04	0.04	6.00	50.00
black-chinned hummingbird	0.03	0.05	6.00	40.00
house finch	0.03	0.08	3.00	10.00
Cassin's sparrow	0.02	0.06	3.00	10.00
loggerhead shrike	0.02	0.05	2.00	20.00
Cooper's hawk	0.02	0.05	3.00	10.00
house sparrow	0.02	0.05	2.00	10.00
American kestrel	0.01	0.02	1.00	10.00
lark sparrow	0.01	0.02	1.00	10.00
red-tailed hawk	0.01	0.02	1.00	10.00

Table 5. Mean cover of vegetation and other land cover types, standard deviation (SD), and range; and mean frequency within macroplots in a cluster in target grassland habitat in Petrified Forest NP, 2015.

	Cover (%)			
Vegetation or other land cover type	**Mean**	**SD**	**Range**	**Frequency (%)**
Alkali Sacaton Steppe and Mixed Montane Shrubland	68.80	19.41	43.75–87.50	80.00
Sandsage – Fourwing Saltbush Colorado Plateau Shrubland	18.75	19.50	0.00–43.75	22.00
Barren Wash	0.39	0.96	0.00–3.00	12.69

Looking at functional groups, the grassland habitat at PEFO had, on average, total shrub and herbaceous cover of 25.40%. There was considerable variation in the amount of shrub cover and perennial grass cover, ranging from 2.35% to 15.06%, and from 6.15% to 24.75%, respectively (Table 6).

Table 6. Mean foliar cover, standard deviation (SD), and range of functional groups in target grassland habitat in Petrified Forest NP, 2015.

	Foliar cover (%)		
Functional group	**Mean**	**SD**	**Range**
Total shrub and herbaceous cover (no trees)	25.40	7.57	9.04–34.38
Perennial grasses, graminoids	14.43	5.26	6.15–24.75
Annual grasses	<0.00	0.01	0.00–0.01
Forbs	3.98	1.56	2.08–6.56
Shrubs, dwarf shrubs and woody vines	9.73	3.90	2.35–15.06
Cacti, succulents	0.40	0.36	0.01–1.05
Standing dead herbaceous	4.47	1.76	2.23–8.40
Woody standing dead	1.68	1.03	0.25–3.79

4 Discussion

These data represent the fourth year of sampling for the grassland bird community at PEFO. SCPN monitors bird communities within network parks as a core vital sign representing the overall health and condition of park natural resources. Similarly, for *The State of the Birds 2014,* 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. Five species detected in PEFO grassland (Cassin's sparrow, vesper sparrow, lark bunting, eastern meadowlark, and western meadowlark) are included in the list of 24 obligate breeding birds that make up the report's grassland indicator. According to the report, the grasslands indicator declined by nearly 40%, but the decline flattened out in 1990. Yet all five PEFO species are listed as significantly declining. In addition, two PEFO species, scaled quail and black-throated sparrow, are in the list of 17 obligate birds that make up the aridlands indicator and both are significantly declining. The aridlands indicator is the most steeply declining of all habitat indicators—with an overall loss of 46% since 1968. In particular, scaled quail, detected each of the four years of monitoring at PEFO, has the second highest declining trend (-3.47) in the aridlands indicator.

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, PEFO provides some of the extremely limited grasslands managed for native habitat for the region's grassland bird species. Further monitoring at PEFO 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 PEFO 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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