



Bird Community Monitoring for Mesa Verde National Park

2009 Summary Report

Natural Resource Data Series NPS/SCPN/NRDS—2012/420



ON THE COVER

Black-throated gray warbler

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1 Introduction and background

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 Mesa Verde National Park (MEVE), Southern Colorado Plateau Network (SCPN) and park staff selected the Loamy Mesa Top Pinyon-Juniper ecological site as an important ecosystem for vegetation and bird community monitoring. The Mesa Top Pinyon-Juniper woodland is a unique ecosystem containing old-growth pinyon-juniper woodland. It faces numerous threats, including changing fire regimes, climate change, and invasion by non-native species.

In 2009, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN, we continued monitoring the upland bird community of the target pinyon-juniper habitat in MEVE which had been initiated in 2007. In this report, we document monitoring activities in the 2009 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. SCPN generally uses ecological sites developed by the U.S. Natural Resources Conservation Service to create their sampling frame. 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). The sampling frames for vegetation and bird community monitoring at MEVE were derived from the map of the Loamy Mesa Top Pinyon-Juniper ecological site (see Appendix A of DeCoster et al. 2012). The Loamy Mesa Top Pinyon-Juniper ecological site is henceforth referred to as pinyon-juniper habitat (fig. 1).

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 ecological site (roads, buildings, and infrastructure)
- areas that were expected to differ substantially from the norm for the target habitat, such as areas that have experienced fire of moderate to high burn severity, and mechanically treated areas, because these areas would have increased ecological variation, making it more difficult to detect trends
- areas with slopes $\geq 30\%$ to prevent erosion from occurring as a result of the field work
- areas containing arthropod monitoring sites

We created a simple grid of plots for the target pinyon-juniper habitat. MEVE park 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 and rejected plots that were inaccessible. Sites were rejected as inaccessible if they were greater than two hours of traveling time (by car and foot) from the Morefield campground. Because GIS data are not always accurate, the bird monitoring crew then visited and assessed each sampling plot within the accessible points to ensure that (1) it fell within the target habitat, (2) had a slope of less than 30%, and (3) did not contain a major disturbance. Any plots that did not meet these criteria were also rejected. Because of these limitations, only a relatively small area was available for sampling at MEVE, and all logistically feasible plots were sampled (i.e., a “census approach” was taken; see Appendix A of Holmes et al., in preparation). We selected 86 sampling plots within the target pinyon-juniper habitat and rejected 82.

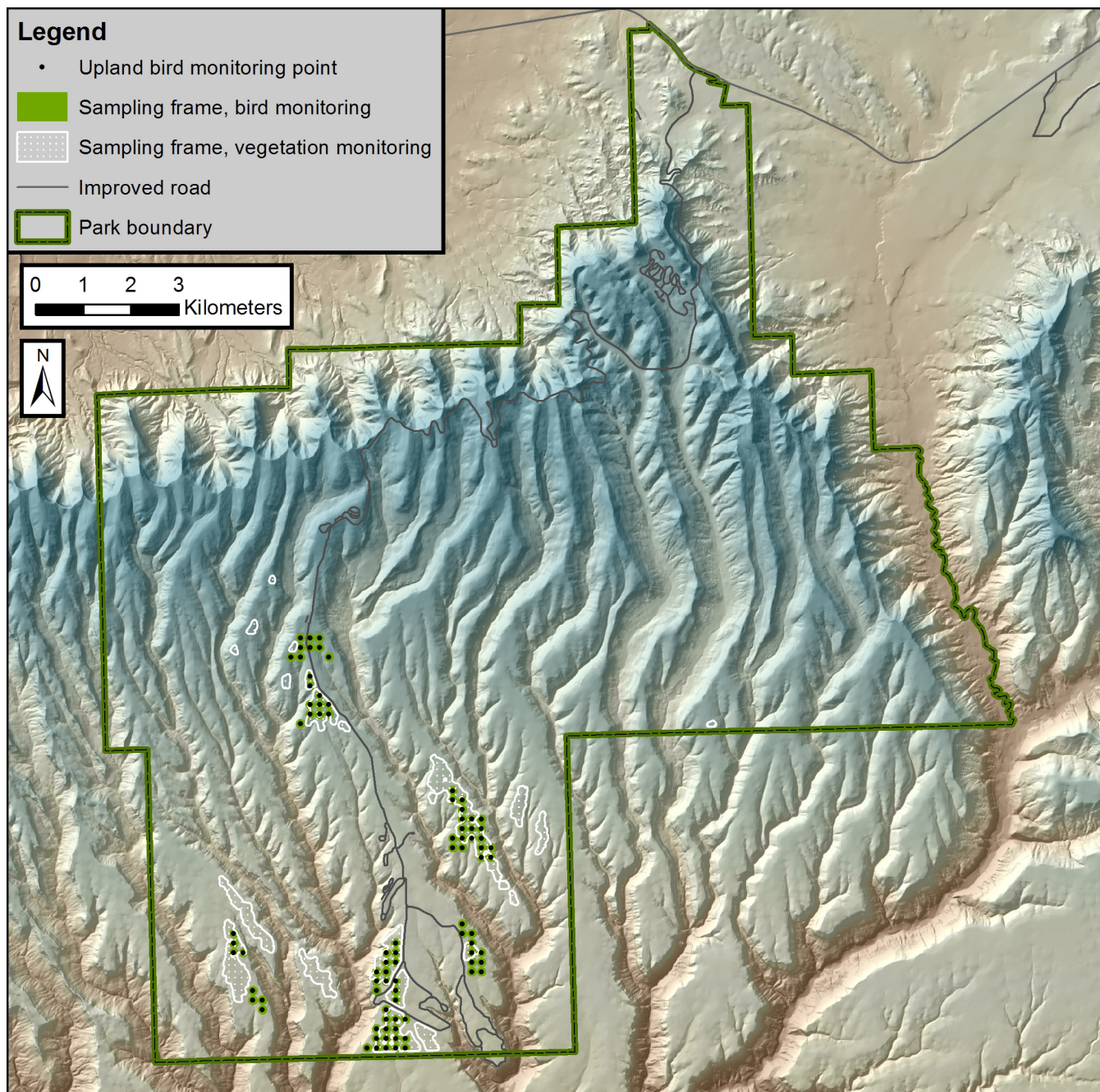


Figure 1. Bird monitoring sampling frame of pinyon-juniper habitat and upland vegetation monitoring sampling frame in Mesa Verde National Park

2.2 Field methods

We conducted bird sampling at permanent sampling plots, or Variable Circular Plot (VCP) count stations within pinyon-juniper habitat at MEVE (fig. 1) over two survey periods (table 1). A total of 86 sampling plots were sampled. 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).

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 the species, method of detection, gender (if known), and

Table 1. Survey periods and sampling effort for pinyon-juniper bird community monitoring at Mesa Verde National park, dates VCP counts were conducted in pinyon-juniper habitat in 2009, and the number of plots sampled

Survey Period	Dates (2009)	Number VCP point counts
1	5/6–5/11	86
2	6/3–6/7	86

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, approximately ten VCP counts each were conducted by two technicians surveying separate groups of sampling plots.

Habitat sampling was conducted on a 50 m radius macroplot centered on a sampling plot, and in four subplots within the macroplot. First we estimated and recorded the area occupied by vegetation types and other land-use types in the macroplot. Then we recorded tree and snag density and basal area, canopy closure, and foliar vegetation cover by functional group (e.g. forbs, shrubs), for the four subplots. We measured basal area using an 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

The following data were summarized for the target habitat (pinyon-juniper woodland) at MEVE. The sample unit for bird data is the VCP point count station (plot).

- *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 pinyon-juniper habitat with 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 “occupied” by each species. To calculate species frequency, we calculated the proportion of plots in the target habitat in which the species was detected. For example, if a gray flycatcher was detected on 30 of the 86 plots in the target habitat, during any or all of the two visits to that plot, the proportion of plots occupied in the target habitat is 0.35.

2.3.2 Habitat data

Habitat data will be used with bird sampling data to examine bird-habitat relationships. For MEVE, 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 two 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 MEVE pinyon-juniper habitat, we classified three vegetation types as shown in Table 2. For each vegetation type we calculated

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

Table 2. Vegetation cover types in pinyon-juniper habitat at Mesa Verde National Park

Vegetation cover type	Description
Pinyon-Juniper, Loamy Mesa Top (target habitat)	Open pinyon-juniper canopy (~30% cover) with an understory of antelope bitterbrush (<i>Purshia tridentata</i>), Datil yucca (<i>Yucca baccata</i>), muttongrass (<i>Poa fendleriana</i>), and opuntia (<i>Opuntia</i> sp.). Mountain mahogany (<i>Cercocarpus montanus</i>) and big sagebrush (<i>Artemisia tridentata</i>) are less common components.
Gambel Oak / Fendlerbush patch ^a	Areas with fendlerbush (<i>Fendlera rupicola</i>) and gambel oak (<i>Quercus gambellii</i>) present, and little to no trees. Found in more northern portions of the sampling frame.
Shrub -dominated	Areas with few or no trees and high shrub cover, including big sagebrush and fendlerbush, and relatively high forb cover.

^a Although areas of gamble oak and fendlerbush are considered to be part of the pinyon- juniper vegetation type, we estimate the percent cover of gambel oak / fendlerbush vegetation type separately from pinyon-juniper.

Tree sapling density. For sapling trees (< 10 cm DBH), we calculated density (stems/ha) for each species and size class, and for all species within a size class. Mean density was calculated for the macroplot, and then a mean species density and standard deviation were calculated for the target habitat.

Basal area. Basal area (m²/ha) was calculated for each species, and snag basal area was calculated for all snags. Mean basal area was calculated for the macroplot, and then mean basal area and standard deviation were calculated for the target habitat.

Foliar cover of functional groups. The mean foliar cover for each functional group was calculated for the macroplot, using the cover class midpoints. Then the mean and standard deviation were calculated for the target habitat.

3 Results

3.1 Summary of bird community data

In 2009, we conducted a total of 172 VCP counts in pinyon-juniper habitat at MEVE (table 1), and detected 2,443 individuals of 55 species (table 3). The most commonly detected species was the black-throated gray warbler—this species comprised 23.95% of the total number of individuals detected.

The mean number of individuals detected per species during a VCP count, and the frequency of plots with detections for each species detected in MEVE pinyon-juniper habitat are presented in Table 4. The black-throated gray warbler had the highest mean number of individuals, with an average of 3.40 individuals detected during an eight-minute point count. Black-throated gray warblers were also widespread in the target habitat, detected in 100% of plots (table 4).

Table 3. Bird species and total number of detections during VCP counts in pinyon-juniper habitat at Mesa Verde National Park, 2009. 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 gray warbler	<i>Dendroica nigrescens</i>	585	23.95
spotted towhee	<i>Pipilo maculatus</i>	235	9.62
common raven	<i>Corvus corax</i>	225	9.21
chipping sparrow	<i>Spizella passerina</i>	198	8.10
gray flycatcher	<i>Empidonax wrightii</i>	158	6.47
juniper titmouse	<i>Baeolophus ridgwayi</i>	149	6.10
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	90	3.68
white-throated swift	<i>Aeronautes saxatalis</i>	82	3.36
mourning dove	<i>Zenaida macroura</i>	74	3.03
plumbeous vireo	<i>Vireo plumbeus</i>	67	2.74
Bewick's wren	<i>Thyromanes bewickii</i>	60	2.46
ash-throated flycatcher	<i>Myiarchus cinerascens</i>	51	2.09
dusky flycatcher	<i>Empidonax oberholseri</i>	46	1.88
western scrub-jay	<i>Aphelocoma californica</i>	35	1.43
black-headed grosbeak	<i>Pheucticus melanocephalus</i>	31	1.27
gray vireo	<i>Vireo vicinior</i>	24	0.98
hermit thrush	<i>Catharus guttatus</i>	24	0.98
broad-tailed hummingbird	<i>Selasphorus platycercus</i>	20	0.82
American robin	<i>Turdus migratorius</i>	19	0.78
western bluebird	<i>Sialia mexicana</i>	19	0.78
white-breasted nuthatch	<i>Sitta carolinensis</i>	18	0.74
brown-headed cowbird	<i>Molothrus ater</i>	17	0.70
lesser goldfinch	<i>Carduelis psaltria</i>	17	0.70
western tanager	<i>Piranga ludoviciana</i>	17	0.70
barn swallow	<i>Hirundo rustica</i>	16	0.65
Virginia's warbler	<i>Vermivora virginiae</i>	13	0.53
wild turkey	<i>Meleagris gallopavo</i>	12	0.49
cedar waxwing	<i>Bombycilla cedrorum</i>	11	0.45
mountain chickadee	<i>Poecile gambeli</i>	11	0.45
house finch	<i>Carpodacus mexicanus</i>	10	0.41
pinyon jay	<i>Gymnorhinus cyanocephalus</i>	10	0.41
violet-green swallow	<i>Tachycineta thalassina</i>	10	0.41

Table 3 continued

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
hairy woodpecker	<i>Picoides villosus</i>	9	0.37
northern flicker	<i>Colaptes auratus</i>	8	0.33
pine siskin	<i>Carduelis pinus</i>	8	0.33
black-chinned hummingbird	<i>Archilochus alexandri</i>	6	0.25
Clark's nutcracker	<i>Nucifraga columbiana</i>	5	0.20
Townsend's solitaire	<i>Myadestes townsendi</i>	5	0.20
turkey vulture	<i>Cathartes aura</i>	5	0.20
western wood-pewee	<i>Contopus sordidulus</i>	5	0.20
cliff swallow	<i>Petrochelidon pyrrhonota</i>	5	0.20
green-tailed towhee	<i>Pipilo chlorurus</i>	4	0.16
yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	4	0.16
Brewer's sparrow	<i>Spizella breweri</i>	3	0.12
Steller's jay	<i>Cyanocitta stelleri</i>	3	0.12
yellow-rumped warbler	<i>Dendroica coronada</i>	3	0.12
American goldfinch	<i>Carduelis psaltria</i>	2	0.08
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	2	0.08
bushtit	<i>Psaltiriparus minimus</i>	2	0.08
house wren	<i>Troglodytes aedon</i>	2	0.08
ruby-crowned kinglet	<i>Regulus calendula</i>	2	0.08
tree swallow	<i>Tachycineta bicolor</i>	2	0.08
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	2	0.08
lazuli bunting	<i>Passerina amoena</i>	1	0.04
red-winged blackbird	<i>Agelaius phoeniceus</i>	1	0.04

Table 4. Mean number of individuals detected per VCP count, and frequency of occupied plots (plots in which the species was detected) in pinyon-juniper habitat at Mesa Verde National Park, 2009

Species	Mean # of individuals	Standard deviation	Frequency of occupied plots (%)
black-throated gray warbler	3.40	1.22	100.00
spotted towhee	1.37	1.26	87.21
common raven	1.31	2.02	80.23
chipping sparrow	1.15	1.15	84.88
gray flycatcher	0.92	0.74	91.86
juniper titmouse	0.87	0.93	81.40
blue-gray gnatcatcher	0.52	0.77	56.98
white-throated swift	0.48	2.44	22.09
mourning dove	0.43	0.72	56.98
plumbeous vireo	0.39	0.58	59.30
Bewick's wren	0.35	0.56	46.51
ash-throated flycatcher	0.30	0.59	40.70
dusky flycatcher	0.27	0.55	37.21
western scrub-jay	0.20	0.55	26.74
black-headed grosbeak	0.18	0.44	31.40
gray vireo	0.14	0.36	23.26
hermit thrush	0.14	0.45	20.93

Table 4 continued

Species	Mean # of individuals	Standard deviation	Frequency of occupied plots (%)
broad-tailed hummingbird	0.12	0.34	22.09
American robin	0.11	0.35	18.60
western bluebird	0.11	0.38	16.28
white-breasted nuthatch	0.10	0.34	16.28
brown-headed cowbird	0.10	0.35	15.12
lesser goldfinch	0.10	0.44	12.79
western tanager	0.10	0.32	17.44
barn swallow	0.09	0.51	9.30
Virginia's warbler	0.08	0.32	9.30
wild turkey	0.07	0.26	13.95
cedar waxwing	0.06	0.59	2.33
mountain chickadee	0.06	0.33	9.30
house finch	0.06	0.32	6.98
pinyon jay	0.06	0.28	9.30
violet-green swallow	0.06	0.32	8.14
hairy woodpecker	0.05	0.22	10.47
northern flicker	0.05	0.24	8.14
pine siskin	0.05	0.36	3.49
black-chinned hummingbird	0.03	0.21	5.81
Clark's nutcracker	0.03	0.25	3.49
Townsend's solitaire	0.03	0.17	5.81
turkey vulture	0.03	0.20	4.65
western wood-pewee	0.03	0.17	5.81
cliff swallow	0.03	0.25	3.49
green-tailed towhee	0.02	0.15	4.65
yellow-headed blackbird	0.02	0.30	1.16
Brewer's sparrow	0.02	0.23	1.16
Steller's jay	0.02	0.17	2.33
yellow-rumped warbler	0.02	0.17	2.33
American goldfinch	0.01	0.11	2.33
Brewer's blackbird	0.01	0.15	1.16
bushtit	0.01	0.15	1.16
house wren	0.01	0.11	2.33
ruby-crowned kinglet	0.01	0.11	2.33
tree swallow	0.01	0.11	2.33
white-crowned sparrow	0.01	0.11	2.33
lazuli bunting	0.01	0.08	1.16
red-winged blackbird	0.01	0.08	1.16

3.2 Summary of bird habitat data

We found one vegetation cover type (pinyon-juniper) and three other cover types (dry arroyo, historic structures/ruins, and rock outcrop) in the macroplots (0.8 ha circular plots centered on each bird sampling point) in the MEVE sample area (table 5). Pinyon-juniper, the target habitat, was recorded on 100% of the macroplots. When we calculated the mean percent cover for each cover type, pinyon-juniper was the most common cover type, accounting for, on average, 87.50% of the overall vegetative cover of the macroplots (table 5). The average canopy closure was 34.59% (SD=9.19, range 14.52–54.49).

Table 6 and figure 2 illustrate the basal area of trees and snags. The abundance of trees is expressed in terms of basal area of overstory trees by species. The abundance of snags is expressed in terms of basal area, recorded for all species combined. Two tree species—Utah juniper and two-needle pinyon—were recorded on the sampling plots (see table 6 for scientific and common names of tree species). The basal area of Utah juniper was considerably higher than that of two-needle pinyon (fig. 2).

Table 6 also shows sapling density by species. Sapling densities provide insight into the structure and dynamics of the forest. Two-needle pinyon dominated both of the sapling size classes (trees 2.5 to less than 5 cm DBH and trees 5 cm to less than 10 cm DBH; fig. 3).

Table 5. Mean cover of vegetation and other cover types, standard deviation (SD), and range; and frequency (%) in target pinyon-juniper habitat in Mesa Verde National Park, 2009

Vegetation or other cover type	Cover (%)	SD	Range	Frequency (%)
Pinyon-juniper	87.50	0.00	87.50-87.50	100.00
Dry arroyo	0.94	3.78	0.00-17.50	6.98
Historic structures / ruins	0.41	2.65	0.00-17.50	2.33
Rock outcrop	0.81	3.71	0.00-17.50	4.65

Table 6. Basal area of overstory trees and snags, and density of saplings by species in pinyon-juniper habitat in Mesa Verde National Park, 2009. Basal area (m²/ha) is provided for overstory trees (with diameter at breast height (DBH) greater or equal to 10 cm), and density (number of stems/ha) is provided for saplings (<10 cm DBH). Common names are provided for each tree species.

Species	Common name	Basal area	Sapling density by size class	
			2.5 to <5 cm	5 to <10 cm
<i>Juniperus osteosperma</i>	Utah juniper	22.53	71.44	59.22
<i>Pinus edulis</i>	Two-needle pinyon	1.86	164.71	92.53
All species		24.40	246.51	153.23
Snags		5.74		

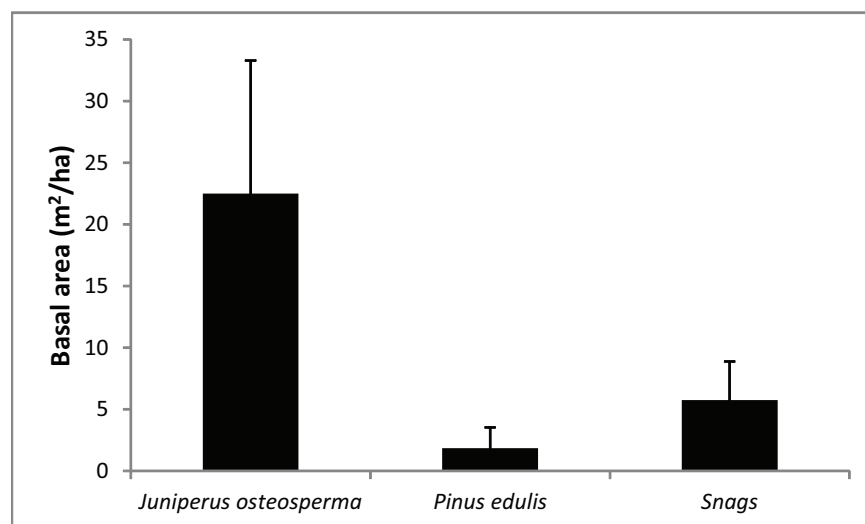


Figure 2. Basal area of trees, by species, and snags in pinyon-juniper habitat in Mesa Verde National Park, 2009. Error bars represent one standard deviation.

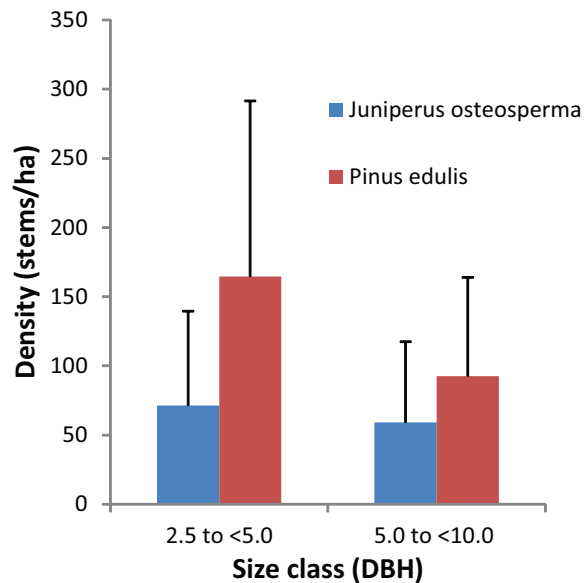


Figure 3. Size structure of sapling trees in pinyon-juniper habitat in Mesa Verde National Park (MEVE), 2009. Mean density (number of stems/ha) of sapling trees (<10 cm DBH), in MEVE pinyon-juniper habitat, by species and size class. Error bars represent one standard deviation.

The understory of the pinyon-juniper habitat at MEVE is mainly comprised of shrubs, perennial grasses, and standing dead woody cover (table 7). There is considerable variation in the amount of total foliar cover, and the amount of foliar cover each functional group contributes to a particular plot (as reflected in the standard deviations, SD). For example, the amount of total foliar cover ranges from 4.13% to 68.75%, and perennial grass and graminoids cover ranges from zero to 37.50%.

Table 7. Foliar cover of functional groups in target pinyon-juniper habitat in Mesa Verde National Park, 2009

Functional groups	Mean foliar cover (%)	Standard deviation	Range
Total foliar cover	27.93	13.44	4.13–68.75
Perennial grasses, graminoids	11.98	9.64	0.50–37.50
Annual grasses	0.69	1.10	0.50–9.75
Forbs	2.90	2.30	0.50–12.75
Shrubs	13.41	10.12	0.50–50.00
Understory trees (< 1.4 m height)	2.95	3.08	0.50–17.75
Standing dead herbaceous	2.36	1.98	0.50–10.38
Standing dead woody	5.74	4.92	0.50–29.50

4 Discussion

These data represent the second year of sampling for the pinyon-juniper bird community at MEVE. The pinyon-juniper habitat at MEVE has a relatively high density of trees and snags, including older, larger pinyon and juniper trees. The bird community includes several pinyon-juniper obligate species, some of which are on the Yellow WatchList of declining species (Butcher et al. 2007). These include the pinyon jay, gray vireo, Brewer's sparrow and Virginia's warbler.

The pinyon jay is of particular interest in MEVE because it can play a role in reforestation of burned areas by bringing in pinyon seeds from some distance and planting them (see Balda 2002). Pinyon jays coevolved as non-migratory mutualists with pinyon pines. Jays disperse the large wingless seed of pinyon pines over long distances, which can result in relatively rapid colonization. At the same time, the jays obtain energy and nutrients from the seeds. The pinyon jay was uncommon in the park during our bird counts and was detected at only 9.30% of the plots.

Another pinyon-juniper obligate, the gray vireo, was fairly common during the breeding season. We detected the gray vireo on 23.26% of the plots. Brown-headed cowbirds are brood parasites and are known to parasitize gray vireo nests (Barlow et al. 1999). The presence of livestock and feral horses in the park may affect cowbird abundance and may impact gray vireo nest success. However, the incidence of brood parasitism in the park, and the extent to which it impacts the park's gray vireo population are unknown.

Our long-range plan for pinyon-juniper bird community monitoring has been to conduct VCP point counts every three years in order to track changes in bird species abundance, distribution, and habitat metrics over time. Trend analyses will be conducted once sufficient data have been collected.

5 Literature cited

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