



Bird Community Monitoring for Mesa Verde National Park

2012 Summary Report

Natural Resource Data Series NPS/SCPN/NRDS—2014/623



ON THE COVER

Chipping sparrow (*Spizella passerina*)
Photograph courtesy of William Lang

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February 2014

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 Southern Colorado Plateau I&M Network of the National Park Service to Northern Arizona University under Colorado Plateau Cooperative Ecosystems Study Unit agreement H1200090005 (Task NAU-415).

The corresponding author and project manager for this project is Jennifer Holmes (Jennifer.Holmes@nau.edu). Other contributions were made by the SCPN staff. The 2012 field crew consisted of Evan Buechley, Stephanie Gobert, Jamie Granger, and Sean Mahoney.

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Please cite this publication as:

Holmes, J. A., and M. J. Johnson. 2014. Bird community monitoring for Mesa Verde National Park: 2012 summary report. Natural Resource Data Series NPS/SCPN/NRDS—2014/623. National Park Service, Fort Collins, Colorado.

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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 nonnative species.

In 2012, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN, we conducted the third year of monitoring of the upland bird community of the target pinyon-juniper habitat in MEVE, which had been initiated in 2007, and continued in 2009. In this report, we document monitoring activities in the 2012 field season and summarize the data that were collected.

2 Methods

2.1 Sampling frame

A sampling frame is the area within which we locate our sites, and hence, the area to which statistical inferences can be made based on monitoring data. The sampling frames for vegetation and bird community monitoring at MEVE pinyon-juniper were derived from the map of the Loamy Mesa Top Pinyon-Juniper ecological site (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). The sampling frame for bird community monitoring at MEVE is henceforth referred to as pinyon-juniper habitat (Figure 1).

To complete the pinyon-juniper bird community monitoring sampling frame in the initial year of monitoring (2007), 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 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 set of spatially distributed sampling plots, in a simple grid sampling design. MEVE 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 rejected plots that were inaccessible. Sites were rejected as inaccessible if they required greater than 2 hours of traveling time (by car and foot) from the Morefield campground. The crew then assessed each sampling plot 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 rejected. We selected 86 sampling plots within the target pinyon-juniper habitat and rejected 82.

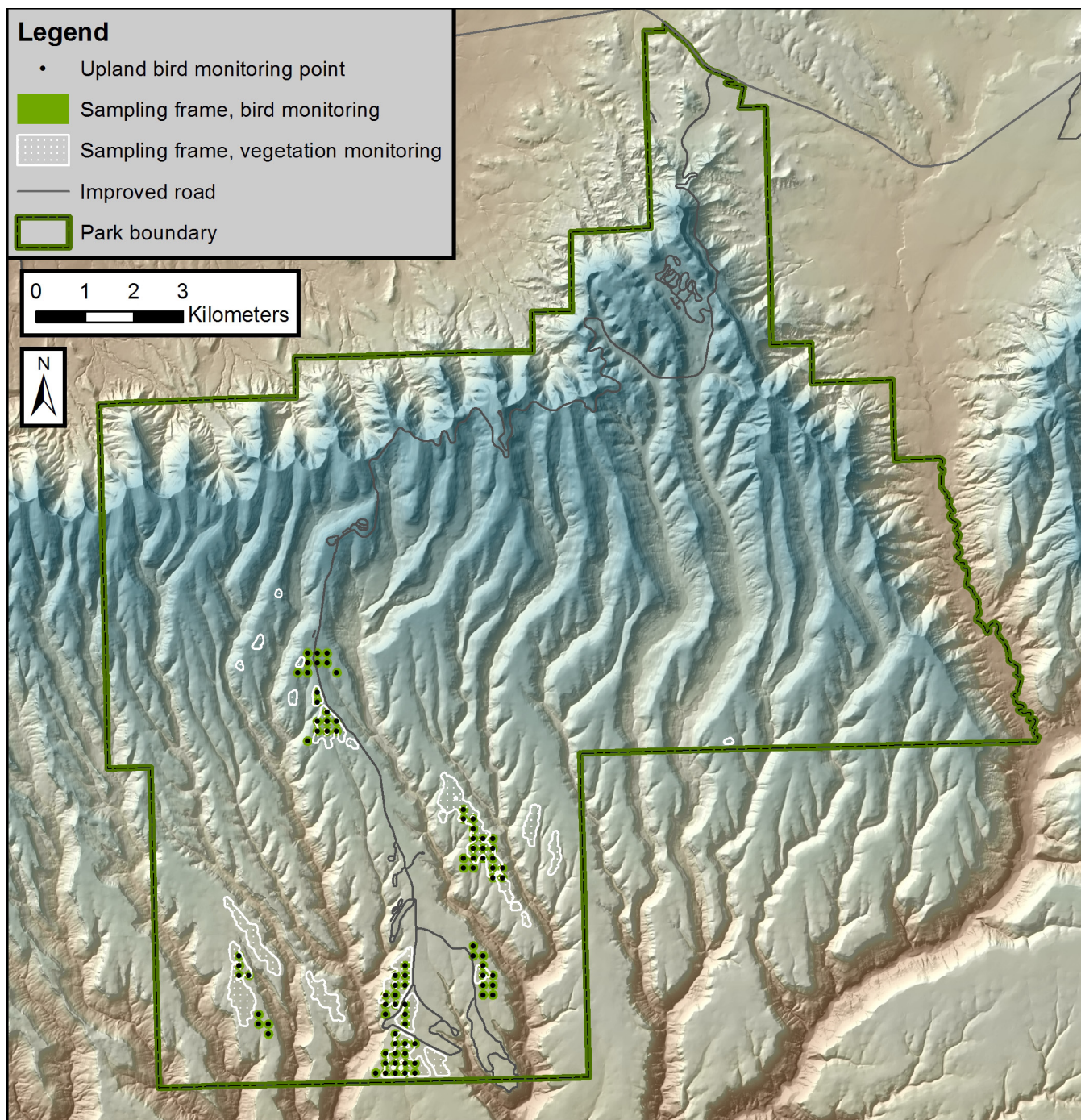


Figure 1. Bird monitoring sampling frame for pinyon-juniper habitat, and upland vegetation monitoring sampling frame in Mesa Verde NP.

2.2 Field methods

We conducted bird sampling at 86 permanent sampling plots, or Variable Circular Plots (VCP), in pinyon-juniper habitat at MEVE over the course of 2 survey periods in 2012 (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 review).

Table 1. Survey periods, dates, and sampling effort (number of plots sampled) for bird community monitoring in pinyon-juniper habitat at Mesa Verde NP, 2012.

Survey period	Dates (2012)	Number of VCP counts
1	27 April–7 May	86
2	31 May–4 June	86

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, each technician conducted approximately 10 VCP counts.

We conducted habitat sampling on a 50 m radius macroplot centered on a VCP sampling plot, and in 4 subplots within the macroplot. First, for the macroplot, we estimated and recorded the area occupied by vegetation and other land-use types. For the subplots, we recorded tree and snag basal area, canopy closure, and foliar vegetation cover by functional group (e.g., forbs, shrubs). 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 pinyon-juniper habitat at MEVE. 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 pinyon-juniper habitat using a simple grid sampling design, the data for all plots are averaged across the 2 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 gray flycatchers were detected on 30 of the 86 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 would be 0.35 (35%).

2.3.2 Habitat data

For MEVE, habitat data were collected within a circular 0.8 ha macroplot that 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 MEVE, we classified vegetation into 4 cover types, and identified 5 additional non-vegetation cover types, as shown in Table 2. For each cover type, we calculated
 - mean percent cover and standard deviation for each vegetation type and other land cover type in the target habitat (using the cover class midpoints)
 - frequency, by reporting the number of macroplots in which 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 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.
- *Sapling density.* For sapling trees, 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.
- *Foliar cover of functional groups.* We calculated the mean percent 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 and other landcover types in pinyon-juniper habitat at Mesa Verde NP.

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 dominated (>40%) by fendlerbush (<i>Fendlera rupicola</i>) and Gambel oak (<i>Quercus gambellii</i>), found in more northern portions of the area.
Shrub-dominated	Areas with few or no trees (<15% cover), high shrub cover, including big sagebrush and fendlerbush, and relatively high forb cover. Not dominated (i.e., <40% cover) by Gambel oak / fendlerbush cover type.
Cleared grassland	Areas of southern Chapin Mesa that have been cleared of pinyon-juniper, dominated by grasses, with little to no shrub cover.
Historic structures / ruins	Standing or partially standing historic buildings or ruins, without vegetation.
Dry arroyo	A dry deep gully or dry gulch cut by an intermittent stream. Generally devoid of vegetation.
Rock outcrop	Areas of rock formation above the surface of the surrounding land.
Stream (intermittent)	A stream that carries water a considerable portion of time, but that ceases to flow occasionally or seasonally.
Dirt road	Distinct roadway with little to no vegetation growing.

^aAlthough areas of Gambel 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.

3 Results

3.1 Summary of bird community data

In 2012, we conducted a total of 172 VCP counts in pinyon-juniper habitat at MEVE. During these surveys, we detected 1,663 individuals of 51 species (Table 3). The most commonly detected species was the black-throated gray warbler, which comprised 21.77% of the total number of individuals detected. Other commonly detected species include the chipping sparrow, Bewick's wren, gray flycatcher, spotted towhee and juniper titmouse.

Table 3. Bird species and number detected during VCP counts in pinyon-juniper habitat at Mesa Verde NP in 2012. 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>	362	21.77
chipping sparrow	<i>Spizella passerina</i>	173	10.40
Bewick's wren	<i>Thyromanes bewickii</i>	145	8.72
gray flycatcher	<i>Empidonax wrightii</i>	138	8.30
spotted towhee	<i>Pipilo maculatus</i>	115	6.92
juniper titmouse	<i>Baeolophus ridgwayi</i>	109	6.55
common raven	<i>Corvus corax</i>	72	4.33
plumbeous vireo	<i>Vireo plumbeus</i>	61	3.67
mourning dove	<i>Zenaida macroura</i>	58	3.49
ash-throated flycatcher	<i>Myiarchus cinerascens</i>	51	3.07
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	49	2.95
gray vireo	<i>Vireo vicinior</i>	35	2.10
white-throated swift	<i>Aeronautes saxatalis</i>	33	1.98
black-chinned hummingbird	<i>Archilochus alexandri</i>	31	1.86
western tanager	<i>Piranga ludoviciana</i>	26	1.56
mountain bluebird	<i>Sialia currucoides</i>	23	1.38
brown-headed cowbird	<i>Molothrus ater</i>	16	0.96
lesser goldfinch	<i>Carduelis psaltria</i>	14	0.84
pinyon jay	<i>Gymnorhinus cyanocephalus</i>	14	0.84
western scrub-jay	<i>Aphelocoma californica</i>	14	0.84
hairy woodpecker	<i>Picoides villosus</i>	13	0.78
Virginia's warbler	<i>Vermivora virginiae</i>	13	0.78
bushtit	<i>Psaltiriparus minimus</i>	12	0.72
lazuli bunting	<i>Passerina amoena</i>	9	0.54
mountain chickadee	<i>Poecile gambeli</i>	7	0.42
violet-green swallow	<i>Tachycineta thalassina</i>	7	0.42
white-breasted nuthatch	<i>Sitta carolinensis</i>	7	0.42
western bluebird	<i>Sialia mexicana</i>	7	0.42
turkey vulture	<i>Cathartes aura</i>	6	0.36
Clark's nutcracker	<i>Nucifraga columbiana</i>	4	0.24
hermit thrush	<i>Catharus guttatus</i>	4	0.24
house finch	<i>Carpodacus mexicanus</i>	4	0.24
scaled quail	<i>Callipepla squamata</i>	4	0.24
pine siskin	<i>Carduelis pinus</i>	3	0.18

Table 3 (continued)

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
Steller's jay	<i>Cyanocitta stelleri</i>	3	0.18
western wood-pewee	<i>Contopus sordidulus</i>	3	0.18
Cooper's hawk	<i>Accipiter cooperii</i>	2	0.12
dusky flycatcher	<i>Empidonax oberholseri</i>	2	0.12
northern saw-whet owl	<i>Aegolius acadicus</i>	2	0.12
black-headed grosbeak	<i>Pheucticus melanocephalus</i>	1	0.06
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	1	0.06
broad-tailed hummingbird	<i>Selasphorus platycercus</i>	1	0.06
Cassin's kingbird	<i>Tyrannus vociferans</i>	1	0.06
dark-eyed junco	<i>Junco hyemalis</i>	1	0.06
great blue heron	<i>Ardea herodias</i>	1	0.06
Hammond's flycatcher	<i>Empidonax hammondi</i>	1	0.06
house wren	<i>Troglodytes aedon</i>	1	0.06
northern flicker	<i>Colaptes auratus</i>	1	0.06
orange-crowned warbler	<i>Vermivora celata</i>	1	0.06
rock wren	<i>Salpinctes obsoletus</i>	1	0.06
western meadowlark	<i>Sturnella neglecta</i>	1	0.06

The mean number of individuals detected per species during a VCP count, and the frequency of 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 2.10 individuals detected during an 8-minute count. They were also widespread in the target habitat, detected in 98.84% of the plots (Table 4). Other species that were widely detected across the target habitat include the chipping sparrow, Bewick's wren, and the gray flycatcher.

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 pinyon-juniper habitat at Mesa Verde NP, 2012.

Species	Number of individuals		Plot frequency (%)
	Mean	SD	
black-throated gray warbler	2.10	1.21	98.84
chipping sparrow	1.01	0.95	87.21
Bewick's wren	0.84	0.78	88.37
gray flycatcher	0.80	0.74	84.88
spotted towhee	0.67	0.92	65.12
juniper titmouse	0.63	0.71	70.93
common raven	0.42	0.74	50.00
plumbeous vireo	0.36	0.57	48.84
mourning dove	0.34	0.61	48.84
ash-throated flycatcher	0.30	0.48	47.67
blue-gray gnatcatcher	0.29	0.59	32.56
gray vireo	0.20	0.43	32.56
white-throated swift	0.19	1.04	11.63
black-chinned hummingbird	0.18	0.46	29.07

Table 4 (continued)

Species	Number of individuals		Plot frequency (%)
	Mean	SD	
western tanager	0.15	0.39	27.91
mountain bluebird	0.13	0.58	17.44
brown-headed cowbird	0.09	0.29	16.28
lesser goldfinch	0.08	0.35	12.79
pinyon jay	0.08	0.33	12.79
western scrub-jay	0.08	0.29	15.12
hairy woodpecker	0.08	0.27	15.12
Virginia's warbler	0.08	0.29	11.63
bushtit	0.07	0.32	8.14
lazuli bunting	0.05	0.27	6.98
mountain chickadee	0.04	0.25	4.65
violet-green swallow	0.04	0.29	4.65
white-breasted nuthatch	0.04	0.20	8.14
western bluebird	0.04	0.31	3.49
turkey vulture	0.04	0.39	2.33
Clark's nutcracker	0.02	0.15	4.65
hermit thrush	0.02	0.15	4.65
house finch	0.02	0.19	3.49
scaled quail	0.02	0.15	4.65
pine siskin	0.02	0.17	2.33
Steller's jay	0.02	0.13	3.49
western wood-pewee	0.02	0.13	3.49
Cooper's hawk	0.01	0.11	2.33
dusky flycatcher	0.01	0.15	1.16
northern saw-whet owl	0.01	0.11	2.33
black-headed grosbeak	0.01	0.08	1.16
Brewer's blackbird	0.01	0.08	1.16
broad-tailed hummingbird	0.01	0.08	1.16
Cassin's kingbird	0.01	0.08	1.16
dark-eyed junco	0.01	0.08	1.16
Great blue heron	0.01	0.08	1.16
Hammond's flycatcher	0.01	0.08	1.16
house wren	0.01	0.08	1.16
northern flicker	0.01	0.08	1.16
orange-crowned warbler	0.01	0.08	1.16
rock wren	0.01	0.08	1.16
western meadowlark	0.01	0.08	1.16

3.2 Summary of bird habitat data

We found 4 vegetation cover types and 5 other cover types in the macroplots (0.8 ha circular plots centered on each bird sampling plot) in the MEVE sampling 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, 85.99% of the overall vegetative cover of the macroplots.

Table 5. Mean cover, standard deviation (SD), and range of cover for vegetation and other land cover types, as well as plot frequency in target pinyon-juniper habitat in Mesa Verde NP, 2012.

Cover type	Cover (%)			Frequency (%)
	Mean	SD	Range	
Pinyon-juniper	85.99	9.36	7.50–87.50	100.00
Shrub dominated	2.28	10.11	0.00–87.50	13.95
Gambel oak / fendlerbush	0.41	2.20	0.00–17.50	4.65
Historic structures / ruins	0.33	2.06	0.00–17.50	3.49
Dry arroyo	0.21	1.18	0.00–7.50	3.49
Cleared grassland	0.20	1.89	0.00–17.50	1.16
Rock outcrop	0.16	0.92	0.00–7.50	3.49
Dirt road	0.03	0.32	0.00–3.00	1.16
Stream (intermittent)	0.03	0.32	0.00–3.00	1.16

In Table 6, the abundance of trees within each species is expressed in terms of basal area of overstory trees and sapling density in 2 size classes. The abundance of snags is expressed in terms of basal area, recorded for all species combined. Figure 2 illustrates basal area of trees by species and basal area of snags. Two tree species—Utah juniper and two-needle pinyon—were recorded on the sampling plots, with Utah juniper having a considerably higher basal area (see Table 6 for scientific and common names of tree species). Figure 3 illustrates the density of sapling trees (less than 10 cm DBH) by species and size class. Two-needle pinyon dominated both of the sapling size classes. The average canopy closure in the pinyon-juniper habitat was 37.87% (SD = 11.82).

The understory of the pinyon-juniper habitat at MEVE was mainly comprised of shrubs, perennial grasses, and standing dead herbaceous and woody cover (Table 7). There was considerable variation in the amount of shrub and herbaceous cover—mean foliar cover for this functional group ranged from 1.13% to 43.75%.

Table 6. Basal area of overstory trees, by species, and of all snags, and mean density of saplings by species in pinyon-juniper habitat in Mesa Verde NP, 2012. Basal area is provided for overstory trees (DBH greater or equal to 10 cm), and density is provided for saplings (<10 cm DBH). Scientific and common names are provided for each tree species.

Species	Common name	Basal area (m ² /ha)	Sapling density (stems/ha) by size class	
			2.5 to <5.0 cm DBH	5.0 to <10.0 cm DBH
<i>Juniperus osteosperma</i>	Utah juniper	21.96	48.86	72.92
<i>Pinus edulis</i>	Two-needle pinyon	4.58	174.33	186.17
All species		26.54	223.19	259.09
Snags		5.39		

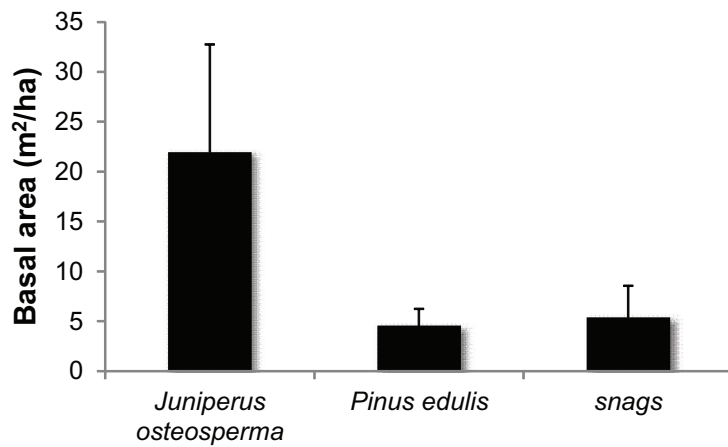


Figure 2. Basal area of trees, by species, and of snags in pinyon-juniper habitat in Mesa Verde NP, 2012. Error bars represent one standard deviation.

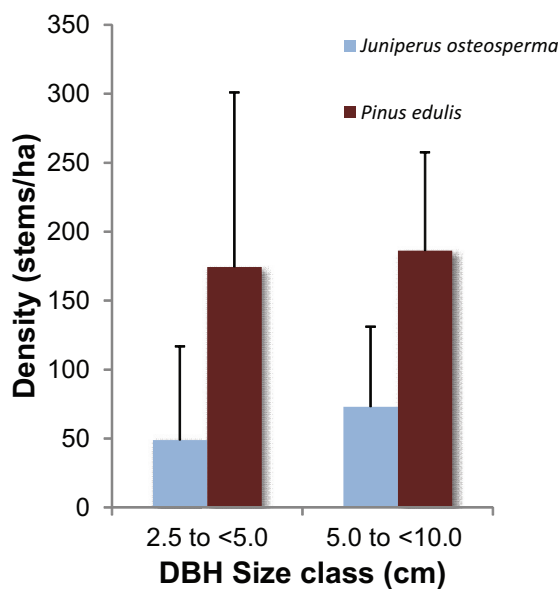


Figure 3. Size structure of sapling trees. Mean density (number of stems/ha) of sapling trees in 2 size classes (2.5 to <5.0, and 5.0 to <10.0 cm DBH) in pinyon-juniper habitat in Mesa Verde NP, 2012. Error bars represent one standard deviation.

Table 7. Mean foliar cover, standard deviation (SD), and range of foliar cover for functional groups in target pinyon-juniper habitat in Mesa Verde NP, 2012.

Functional groups	Foliar cover (%)		
	Mean	SD	Range
Tree seedlings	2.52	2.89	0.00–19.38
Total shrub and herbaceous cover (no trees)	10.40	7.52	1.13–43.75
Perennial grasses, graminoids	2.25	2.17	0.25–13.88
Annual grasses	<0.01	0.01	0.00–0.13
Forbs	1.10	1.36	0.00–10.00
Shrubs, dwarf shrubs and woody vines	5.60	5.59	0.00–31.25
Cacti, succulents	2.05	3.39	0.00–22.50
Standing dead herbaceous	3.33	3.56	0.50–22.50
Woody standing dead	4.37	3.51	0.00–18.88

4 Discussion

These data represent the third 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 black-throated gray warbler continues to be the most common breeding bird in BAND's pinyon-juniper habitat—in 2012 it comprised over 20% of all detections. These birds are insectivorous and forage and nest in tree foliage. They are migratory, and winter primarily in western Mexico (Guzy and Lowther 2012). These warblers breed across much of the western United States and into British Columbia. Across their breeding range, they nest in a variety of habitats, but in Colorado they breed exclusively in mature pinyon-juniper woodlands (Versaw 1998). Much of the warbler's pinyon-juniper breeding habitat has escaped development, but climate change, changing fire regimes, and invasion by nonnative species may threaten it.

Our long-range plan is to conduct VCP counts at MEVE every 3 years and to 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.

5 Literature cited

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