



Bird Community Monitoring for Canyon De Chelly National Monument

2015 Summary Report

Natural Resource Report NPS/SCPN/NRDS—2016/1067



ON THE COVER

Chipping sparrow (*Spizella passerina*)

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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 Canyon de Chelly National Monument (CACH), Southern Colorado Plateau Network (SCPN) and park staff selected the riparian habitat as an important ecosystem for vegetation and bird community monitoring. This habitat contributes substantially to the biodiversity of the region, but it faces several threats, including the invasion of nonnative species, hydrologic change, soil erosion, and climate change.

The riparian woodlands at CACH have been undergoing extensive restoration through the selective thinning of nonnative plants, primarily Russian olive (*Elaeagnus angustifolia*) and tamarisk or salt cedar (*Tamarix* spp.). The objectives for this restoration are 1) to reduce the density of nonnatives to reflect historical conditions, 2) to increase the native plant cover, and 3) to restore the hydrological regime.

In 2015, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN, we continued monitoring the bird community of the target riparian habitat in CACH, which had been initiated in 2009, and continued in 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. For upland monitoring, SCPN generally uses ecological sites developed by the U.S. Natural Resources Conservation Service (NRCS) to create their sampling frames (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). For riparian monitoring, the bird sampling frame initiates from an individual stream length of a targeted system, and a GIS stream line is identified using the National Hydrography Dataset. A line of points are then placed evenly, usually 150 m apart, along the stream. Each point is examined using an aerial photo or by surveying in the field and then moved to the center of the widest occurrence of riparian vegetation (using a line perpendicular to the stream line). These points within the target riparian habitat form the sampling frame. If there is not at least a 50 m radius of riparian vegetation surrounding a point, it is rejected. In other cases where the riparian vegetation zone is sufficiently wide, additional sampling points can be placed in the zone, as long as the 150 m spacing between points can be maintained. The process is repeated until the entire target riparian area has been assessed for placement of potential sampling points.

CACH 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 traveling time (by car and foot) from the CACH headquarters. The crew then assessed each sampling plot to ensure that (1) it fell within the target habitat, and (2) it was at least 50 m from a canyon wall. Any plots that did not meet these criteria were rejected. We selected 91 sampling plots within the target riparian habitat and rejected 41. Only a relatively small area was available for sampling at CACH, and all logistically feasible plots were sampled (i.e., a “census approach” was taken; see Appendix A of Holmes et al. 2015).

2.2 Field methods

We conducted bird sampling at 91 permanent sampling plots, or Variable Circular Plots (VCP) in riparian habitat at CACH (Figure 1) over the course of two survey periods in 2015 (Table 1). A brief description of 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 Canyon de Chelly NM in 2015. Includes the dates that VCP counts were conducted and the number of plots sampled.

Survey period	Dates (2015)	Number of VCP counts
1	7 May–12 May	91
2	3 June–8 June	91
Total		182

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 9 VCP counts.

Habitat sampling was conducted 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 types and other land cover types. Then, in the four subplots, we recorded tree and snag basal area, tree density, canopy closure, and foliar vegetation cover by functional group (e.g., forbs, shrubs). We measured basal area

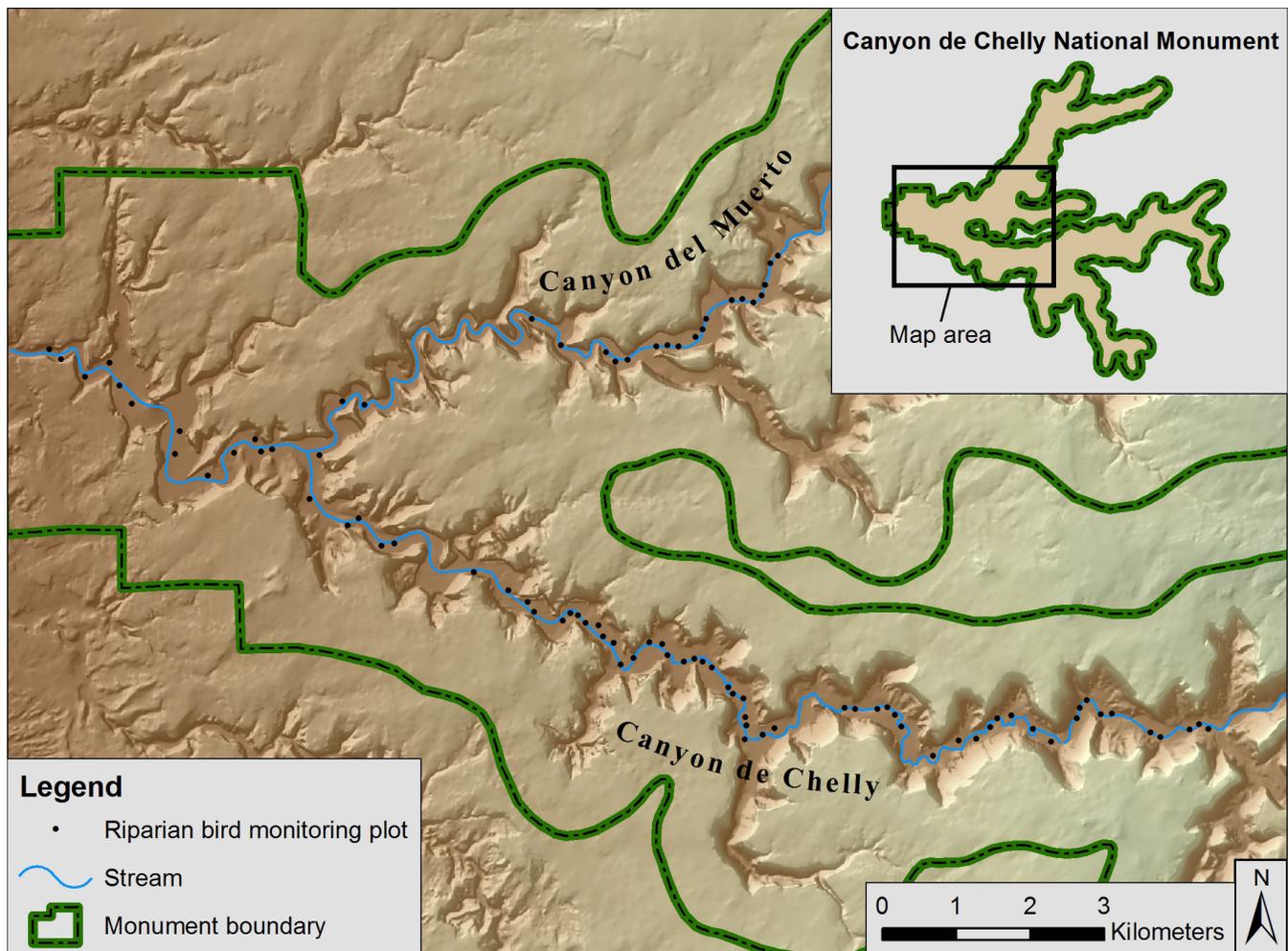


Figure 1. Bird monitoring sampling frame of riparian habitat in Canyon de Chelly NM.

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 riparian habitat at CACH. 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, 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 warbling vireos were detected on 85 of the 91 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 0.93 (93%).

2.3.2 Habitat data

We use habitat data and bird sampling data to examine bird-habitat relationships. For CACH, habitat data were collected within a circular 0.8 ha macroplot that 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 CACH, we classified vegetation into 7 cover types and 6 other, non-vegetation cover types, as shown in Table 2. For each cover type we calculated

- mean percent cover for each vegetation type and for other landcover types in the target habitat (using the cover class midpoints) and standard deviation

Table 2. Vegetation cover types and other landcover types in riparian habitat at Canyon de Chelly NM. Cover types were updated to correspond with the park's vegetation map.

Cover type	Description
Riparian Woodland and Shrubland (dense) (no cottonwood)	Riparian areas dominated by various combinations of Russian olive (<i>Elaeagnus angustifolia</i>), tamarisk (<i>Tamarix ramosissima</i>), Goodding's willow (<i>Salix goodingii</i>), boxelder (<i>Acer negundo</i>) and cottonwoods (<i>Populus</i> spp.). Dense cottonwood overstory not present.
Riparian Woodland and Shrubland (dense)(cottonwood)	Dominated by various combinations of Russian olive, tamarisk, Goodding's willow, boxelder and cottonwoods. Dense cottonwood overstory present.
Riparian Woodland and Shrubland (open)	Dominated by open cottonwood overstory and a sparse understory with few trees and/or shrubs.
Restoration treatment area: cleared	Riparian areas where Russian olive and/or tamarisk have been cut down and debris left or removed. No native trees and shrubs are present.
Shrub-Steppe and Scrub	Areas dominated by shrub layer consisting of various combinations of big sagebrush (<i>Artemisia tridentata</i>), prickly pear (<i>Opuntia</i> spp.), rubber rabbitbrush and Mormon-tea (<i>Ephedra</i> spp.). May contain pinyon juniper, but cover is less than 10%.
Semi-desert Grassland	Few to no trees and shrubs. Herbaceous layer dominated by native or exotic grasses. Cover of both shrub and tree layers is less than 10%.
Agriculture/Pasture	Areas that have been used by canyon residents for farming or pasturelands.

- 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 (m²/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.

Sapling density. We calculated density (stems/ha) for each species and size class, and for all species within a size class. We calculated mean density for the macroplot, and mean species density 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.

3 Results

3.1 Summary of bird community data

In 2015, we conducted a total of 182 VCP counts in riparian habitat at CACH. During these surveys, we detected 2,923 individuals of 49 species (Table 3). The most commonly detected species was the chipping sparrow, which comprised 12.28% 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 CACH riparian habitat are presented in Table 4. The chipping sparrow had the highest mean number of individuals, with an average of 1.97 individuals detected during an 8-minute count. They were also widespread in the target habitat—detected in 93.41% of plots. Other abundant and widespread species include blue-gray gnatcatcher, spotted towhee, house finch, and warbling vireo.

Table 3. Bird species and number detected during VCP counts in riparian habitat at Canyon de Chelly NM 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 (%)
chipping sparrow	<i>Spizella passerina</i>	359	12.28
blue-gray gnatcatcher	<i>Poliophtila caerulea</i>	332	11.36
spotted towhee	<i>Pipilo maculatus</i>	296	10.13
white-throated swift	<i>Aeronautes saxatalis</i>	277	9.48
house finch	<i>Carpodacus mexicanus</i>	272	9.31
warbling vireo	<i>Vireo gilvus</i>	245	8.38
common raven	<i>Corvus corax</i>	179	6.12
lesser goldfinch	<i>Carduelis psaltria</i>	120	4.11
mourning dove	<i>Zenaida macroura</i>	93	3.18
black-headed grosbeak	<i>Pheucticus melanocephalus</i>	92	3.15
yellow warbler	<i>Setophaga petechia</i>	90	3.08
ash-throated flycatcher	<i>Myiarchus cinerascens</i>	67	2.29
canyon wren	<i>Catherpes mexicanus</i>	48	1.64
American robin	<i>Turdus migratorius</i>	45	1.54
western tanager	<i>Piranga ludoviciana</i>	39	1.33
rock wren	<i>Salpinctes obsoletus</i>	36	1.23
yellow-breasted chat	<i>Icteria virens</i>	35	1.20
black-chinned hummingbird	<i>Archilochus alexandri</i>	33	1.13
cedar waxwing	<i>Bombycilla cedrorum</i>	32	1.09
Lucy's warbler	<i>Vermivora luciae</i>	30	1.03
peregrine falcon	<i>Falco peregrinus</i>	25	0.86
plumbeous vireo	<i>Vireo plumbeus</i>	23	0.79
dusky flycatcher	<i>Empidonax oberholseri</i>	16	0.55
lazuli bunting	<i>Passerina amoena</i>	16	0.55
Say's phoebe	<i>Sayornis saya</i>	15	0.51
hairy woodpecker	<i>Picoides villosus</i>	14	0.48
western wood-pewee	<i>Contopus sordidulus</i>	13	0.44
pine siskin	<i>Spinus pinus</i>	12	0.41
western bluebird	<i>Sialia mexicana</i>	11	0.38
brown-headed cowbird	<i>Molothrus ater</i>	8	0.27

Table 3. (*continued*) Bird species and number detected during VCP counts in riparian habitat at Canyon de Chelly NM 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 (%)
Cooper's hawk	<i>Accipiter cooperii</i>	8	0.27
blue grosbeak	<i>Passerina caerulea</i>	7	0.24
red-tailed hawk	<i>Buteo jamaicensis</i>	5	0.17
Canada goose	<i>Branta canadensis</i>	3	0.10
evening grosbeak	<i>Coccothraustes vespertinus</i>	3	0.10
house wren	<i>Troglodytes aedon</i>	3	0.10
pinyon jay	<i>Gymnorhinus cyanocephalus</i>	3	0.10
Wilson's warbler	<i>Wilsonia pusilla</i>	3	0.10
broad-tailed hummingbird	<i>Selasphorus platycercus</i>	2	0.07
Cassin's kingbird	<i>Tyrannus vociferans</i>	2	0.07
turkey vulture	<i>Cathartes aura</i>	2	0.07
yellow-rumped warbler	<i>Setophaga coronata</i>	2	0.07
American kestrel	<i>Falco sparverius</i>	1	0.03
Bullock's oriole	<i>Icterus bullockii</i>	1	0.03
hermit thrush	<i>Catharus guttatus</i>	1	0.03
juniper titmouse	<i>Baeolophus ridgwayi</i>	1	0.03
ruby-crowned kinglet	<i>Regulus calendula</i>	1	0.03
spotted sandpiper	<i>Actitis macularius</i>	1	0.03
western scrub-jay	<i>Aphelocoma californica</i>	1	0.03

Table 4. Mean number of individuals detected per VCP count, standard deviation (SD), and the proportion of plots in which the species was detected (plot frequency) in riparian habitat at Canyon de Chelly NM, 2015.

Species	Number of individuals		Plot frequency (%)
	Mean	SD	
chipping sparrow	1.97	1.38	93.41
blue-gray gnatcatcher	1.82	1.08	100.00
spotted towhee	1.63	1.05	96.70
white-throated swift	1.52	3.69	65.93
house finch	1.49	1.36	90.11
warbling vireo	1.35	0.91	92.31
common raven	0.98	1.01	79.12
lesser goldfinch	0.66	0.99	60.44
mourning dove	0.51	0.78	58.24
black-headed grosbeak	0.51	0.68	62.64
yellow warbler	0.49	0.73	54.95
ash-throated flycatcher	0.37	0.53	54.95
canyon wren	0.26	0.48	37.36
American robin	0.25	0.58	31.87
western tanager	0.21	0.49	32.97
rock wren	0.20	0.44	32.97
yellow-breasted chat	0.19	0.52	24.18
black-chinned hummingbird	0.18	0.40	32.97

Table 4. (continued) Mean number of individuals detected per VCP count, standard deviation (SD), and the proportion of plots in which the species was detected (plot frequency) in riparian habitat at Canyon de Chelly NM, 2015.

Species	Number of individuals		Plot frequency (%)
	Mean	SD	
cedar waxwing	0.18	1.17	14.29
Lucy's warbler	0.16	0.43	24.18
peregrine falcon	0.14	0.42	19.78
plumbeous vireo	0.13	0.36	20.88
dusky flycatcher	0.09	0.35	13.19
lazuli bunting	0.09	0.35	12.09
Say's phoebe	0.08	0.28	15.38
hairy woodpecker	0.08	0.31	12.09
western wood-pewee	0.07	0.28	13.19
pine siskin	0.07	0.40	4.40
western bluebird	0.06	0.30	7.69
brown-headed cowbird	0.04	0.21	7.69
Cooper's hawk	0.04	0.21	8.79
blue grosbeak	0.04	0.22	6.59
red-tailed hawk	0.03	0.16	5.49
Canada goose	0.02	0.17	2.20
evening grosbeak	0.02	0.22	1.10
house wren	0.02	0.13	3.30
pinyon jay	0.02	0.17	2.20
Wilson's warbler	0.02	0.13	3.30
broad-tailed hummingbird	0.01	0.10	2.20
Cassin's kingbird	0.01	0.15	1.10
turkey vulture	0.01	0.10	2.20
yellow-rumped warbler	0.01	0.10	2.20
American kestrel	0.01	0.07	1.10
Bullock's oriole	0.01	0.07	1.10
hermit thrush	0.01	0.07	1.10
juniper titmouse	0.01	0.07	1.10
ruby-crowned kinglet	0.01	0.07	1.10
spotted sandpiper	0.01	0.07	1.10
western scrub-jay	0.01	0.07	1.10

3.2 Summary of bird habitat data

We found seven vegetation cover and six other landcover types in the macroplots in the CACH sampling area (Table 5). Two types of riparian woodland (open, and dense with cottonwood) combined covered, on average, 59.91% of the macroplots. Restoration treatment areas were recorded on 24.18% of the macroplots and these sites had, on average, 11.98% cover. The percent cover was highly variable for all vegetation cover types, as reflected in the relatively high standard deviations (SD; Table 5).

In Table 6, the abundance of trees within each species is expressed in terms of basal area of overstory trees, and sapling density, by size class. The abundance of snags is expressed in terms of basal area, recorded for all species combined. Table 6 and Figure 2 illustrate basal area of trees by species or genus and snags. Of the 5 tree species and 1 genera recorded on the sampling plots, cottonwood had the highest basal area (see Table 6 for scientific and

Table 5. Mean cover of vegetation and other land cover types, standard deviation (SD), range, and frequency of these types in macroplots in target riparian habitat in Canyon de Chelly NM, 2015.

Vegetation or other land cover type	Cover (%)			
	Mean	SD	Range	Frequency (%)
Riparian Woodland and Shrubland (open)	37.36	32.43	0.00–87.50	81.32
Riparian Woodland and Shrubland (dense)(cottonwood)	22.55	28.86	0.00–87.50	59.34
Restoration Treatment Area: cleared	11.98	25.63	0.00–87.50	24.18
Riparian Woodland and Shrubland (dense)(no cottonwood)	11.02	22.46	0.00–87.50	27.47
Semi-desert Grassland	5.96	11.71	0.00–62.50	37.36
Stream (intermittent)	3.14	3.17	0.00–7.50	60.44
Agriculture/Pasture	2.40	10.08	0.00–87.50	12.09
Rock Outcrop or Cliff	0.44	2.25	0.00–17.50	4.40
Shrub-Steppe and Scrub	0.41	3.93	0.00–37.50	1.10
Stream (perennial)	0.28	1.38	0.00–7.50	4.40
Other	1.30	7.21	0.00–62.50	6.59
Dry Arroyo	0.10	0.54	0.00–3.00	3.30
Historic Structures/Ruins	0.03	0.31	0.00–3.00	1.10

Table 6. Basal area of overstory trees (DBH > 10 cm), by species, and snags; and mean density (number of stems/ha) of saplings (DBH < 10 cm), by species, in riparian habitat in Canyon de Chelly NM, 2015. Scientific and common names are provided for each tree species.

Species	Common name	Basal area (m ² /ha)	Sapling density by size class	
			2.5 to <5.0 cm DBH	5.0 to <10.0 cm DBH
<i>Populus spp.</i>	Cottonwood	9.44	0.35	4.55
<i>Salix exigua</i>	Willow	8.15	160.55	19.59
<i>Elaeagnus angustifolia</i>	Russian olive	1.86	55.62	90.25
<i>Salix amygdaloides</i>	Willow	0.16	9.44	17.84
<i>Salix gooddingii</i>	Goodding's willow	0.08	8.40	4.55
<i>Acer negundo</i>	Box elder	0.01	–	–
All species	n/a	46.06	234.36	136.77
Snags	n/a	0.40	–	–

common names of tree species). Table 6 and Figure 3 illustrate the density of sapling trees (less than 10 cm DBH) by species and size class. Willows dominated the small size class (2.5 to <5 cm DBH), while Russian olive dominated the larger (5 to <10 cm DBH). The average canopy closure in the riparian habitat was 63.71% (SD = 25.34).

Within the riparian understory, the functional group with the highest foliar cover was forbs, followed by perennial grasses, graminoid (Table 7). There was considerable variation in the amount of total shrub and herbaceous cover—mean foliar cover ranged from 0 to 43.75%.

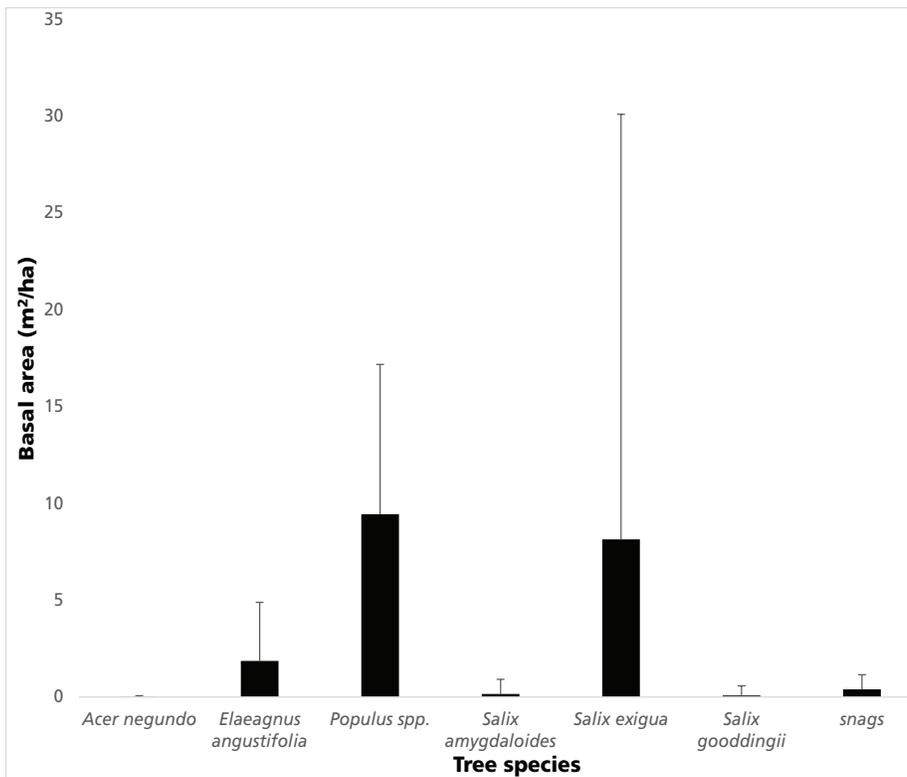


Figure 2. Basal area of trees, by species, and snags in riparian habitat in Canyon de Chelly NM, 2015. Error bars represent one standard deviation.

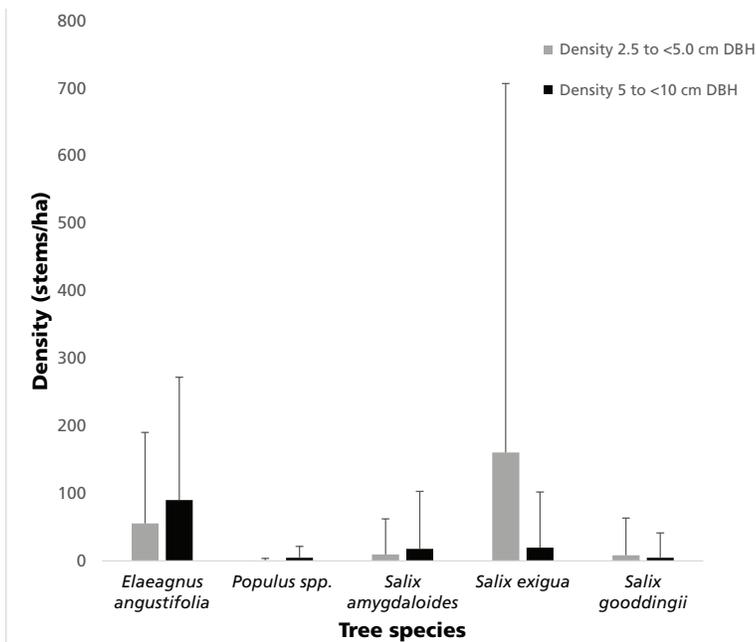


Figure 3. Size structure of sapling trees. Mean density (number of stems/ha) of sapling trees in two size classes (2.5 to <5.0, and 5.0 to <10.0 cm DBH) in riparian habitat in Canyon de Chelly NM, 2015. Error bars represent one standard deviation.

Table 7. Mean foliar cover, standard deviation (SD), and range of functional groups in target riparian habitat in Canyon de Chelly NM, 2015.

Functional group	Foliar cover (%)		
	Mean	SD	Range
Tree seedlings	0.84	1.80	0.00–13.75
Total shrub and herbaceous cover (no trees)	10.14	9.99	0.00–43.75
Perennial grasses, graminoids	2.49	4.40	0.00–32.75
Annual grasses	1.07	2.12	0.00–15.00
Forbs	6.53	7.88	0.00–43.75
Shrubs, dwarf shrubs and woody vines	0.25	1.30	0.00–11.25
Cacti, succulents	0.27	0.96	0.00–4.38
Standing dead herbaceous	0.73	1.80	0.00–16.38
Woody standing dead	0.20	0.53	0.00–4.50

4 Discussion

These data represent the third year of sampling for the riparian bird community at CACH. As in previous years, the majority of species in the riparian bird community are also commonly found in upland habitats. For example, we detected more chipping sparrows than any other bird species. In northern Arizona, they use a wide variety of open woodland habitats (Wise-Gervais 2005).

Four riparian obligate species were detected: yellow warbler, yellow-breasted chat, blue grosbeak, and Lucy's warbler. Lucy's warbler is of particular interest. It has a relatively small breeding range, which extends from extreme southern Utah and Nevada south to southeastern California and northern Sonora and east to New Mexico and extreme western Texas. Published range maps, including the Arizona Breeding Bird Atlas (Corman and Wise-Gervais 2005), do not include northeast Arizona and Canyon de Chelly NM in the Lucy's warbler's range. We detected this species in 2009 (two detections), 2012 (three detections), and again in 2015 when we had 30 detections. These records indicate an expansion of the species' range, although we did not confirm breeding.

Our long-range plan for riparian bird community monitoring in CACH is to conduct VCP counts every three years 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.

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