



Bird Community Monitoring for Canyon de Chelly National Monument

2009 Summary Report

Natural Resource Data Series NPS/SCPN/NRDS—2012/414



ON THE COVER
Yellow-breasted chat
Photography by: Gary Kinard (<http://www.flickr.com/photos/avianphotos>)

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Jennifer A. Holmes and Matthew J. Johnson

Northern Arizona University
P.O. Box 5614
Flagstaff, AZ 86011-5614

December 2012

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 National Park Service to Northern Arizona University under Colorado Plateau Cooperative Ecosystems Study Unit agreement H1200040002 (Task NAU-307).

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 2009 field crew consisted of Ryan Drum and Greg Creager.

This report is available from the Southern Colorado Plateau Network (<http://science.nature.nps.gov/im/units/scpn/>), and the Natural Resource Publications Management Web site (<http://www.nature.nps.gov/publications/nrpm/>) on the Internet.

Please cite this publication as:

Holmes, J. A., and M. J. Johnson. 2012. Bird community monitoring for Canyon de Chelly National Monument: 2009 summary report. Natural Resource Data Series NPS/SCPN/NRDS—2012/414. 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 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 invasion by non-native species, hydrologic change, soil erosion, and climate change threaten its integrity.

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

In 2009, we began a pilot year and monitored the riparian bird community of the target riparian habitat in CACH, through a Colorado Plateau Cooperative Ecosystems Study Unit agreement with SCPN. In this report, we document monitoring activities of 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 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 to create their sampling frames. 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 then examined, either using an aerial photo or by surveying in the field, and is 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 should be 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.

First, the CACH park staff reviewed the location of the sampling plots and rejected those plots that were in the proximity of archeological sites. Because GIS data are not always accurate, the bird monitoring crew then visited and assessed each sampling plot within the accessible plots to ensure that it fell within the target habitat, and was at least 50 m from a canyon wall. Any plots that did not meet these criteria were rejected. Because of these limitations, 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 of Holmes et al., in preparation). We selected 91 sampling plots within the riparian habitat and rejected 47.

2.2 Field methods

We conducted bird sampling over two survey periods (table 1) at 91 permanent sampling plots, or Variable Circular Plot (VCP) count stations within riparian habitat at CACH (fig. 1). However, the initial survey period was delayed due to exceptional flooding in the canyon. 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).

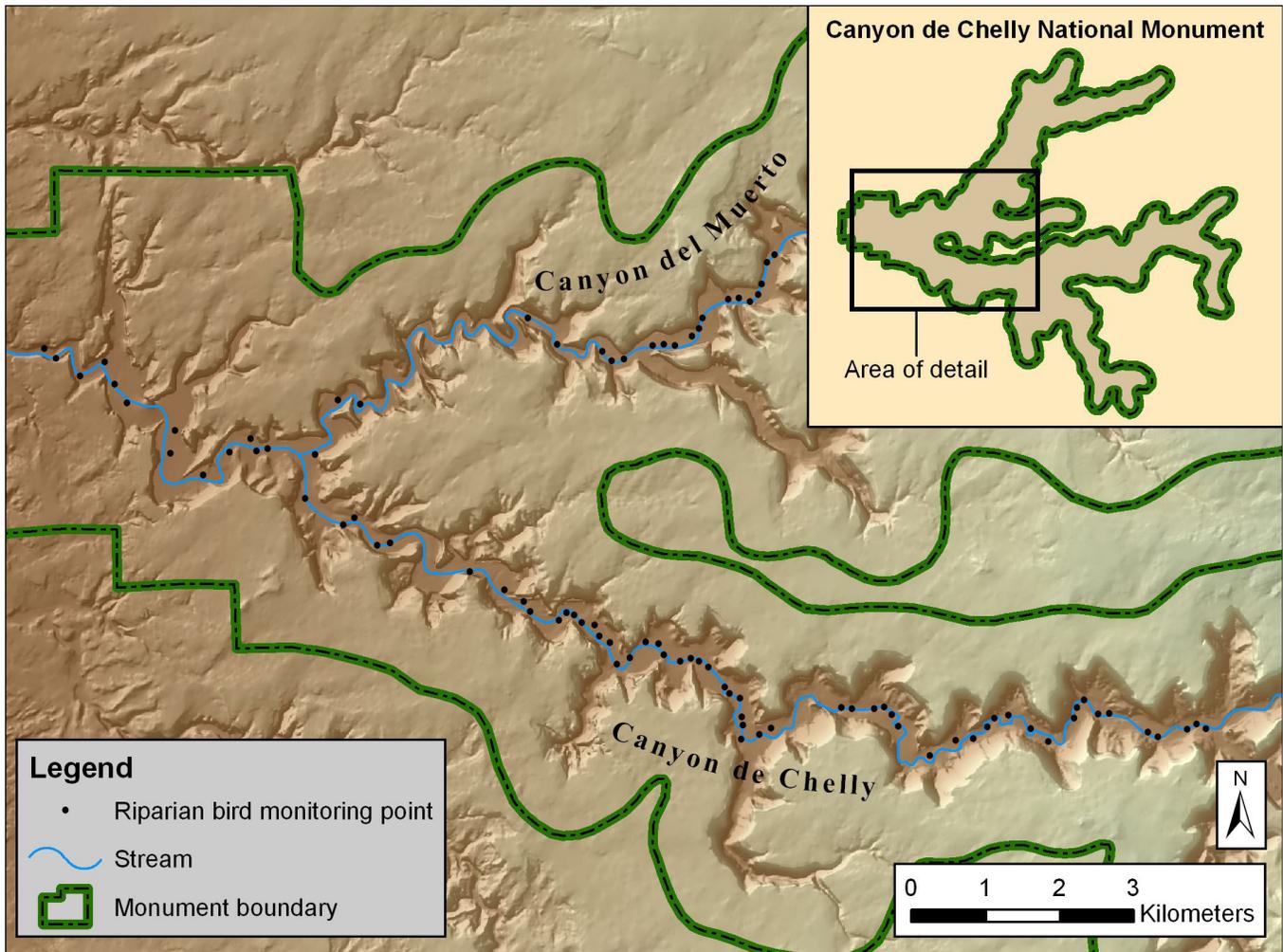


Figure 1. Bird monitoring sampling frame of riparian habitat in Canyon de Chelly National Monument.

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 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 riparian habitat at CACH. The sample unit for bird data is the VCP count station (plot).

Table 1. Survey periods and sampling effort for riparian bird community monitoring at Canyon de Chelly National Monument (CACH), dates VCP counts were conducted in CACH riparian in 2009, and the number of plots sampled

Survey period	Survey dates (2009)	Number of VCP counts
1	5/21–5/25	91
2	6/16–6/29	91

- *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 riparian habitat, 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 warbling vireo was detected on 85 of the 91 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 93.41%.

2.3.2 Habitat data

Habitat data will be used with bird sampling data to examine bird-habitat relationships. For CACH, 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 CACH riparian habitat, we classified five vegetation cover types and six other non-vegetation cover types, as shown in Table 2.

For each cover 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

Tree sapling density. For sapling trees (<10 cm DBH), we identified some to species and others (cottonwoods, elms, junipers and maples) to genus. Tree density was calculated as stems/ha for each species (genus) and size class, and for all species (genus) 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 was calculated as m²/ha for each tree species, and 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.

Table 2. Vegetation cover types in riparian habitat at Canyon de Chelly National Monument

Vegetation cover type	Description
Dense riparian	Dominated by various combinations of Russian olive (<i>Elaeagnus angustifolia</i>), tamarisk (<i>Tamarix ramosissima</i>), Goodding willow (<i>Salix goodingii</i>), and cottonwoods (<i>Populus</i> spp.). Not dominated by cottonwood overstory.
Cottonwood: with dense understory	Dominated by cottonwood overstory and with a dense understory of trees and/or shrubs.
Cottonwood: with open understory	Dominated by cottonwood overstory and a sparse understory with few or no trees and/or shrubs.
Open “meadow”	Few to no trees or shrubs, with grass and/or forb cover.
Restoration treatment area	Riparian areas where Russian olive and/or tamarisk have been cut down and left or removed.
Rock outcrop or cliff	Areas where rock covers the ground, includes sandstone cliffs.
Dry arroyo	A dry deep gully or dry gulch cut by an intermittent stream. Generally devoid of vegetation.
Stream: intermittent	A stream which carries water a considerable portion of time, but which ceases to flow occasionally or seasonally.
Standing water	Surface water that is not flowing in a stream
Dirt road	Distinct roadway with little to no vegetation growing.
Historic structures/ruins	Buildings and archeological sites.

Vegetation strata. In order to describe the vertical structure of the habitat the mean foliar cover and mean height for each stratum (e.g., canopy, subcanopy, and shrub) was calculated for the macroplot, using the cover class and height class midpoints. Then the mean 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 182 VCP counts in riparian habitat at CACH (table 1) and detected 3,236 individuals of 43 species (table 3). The most commonly detected species was the white-throated swift—this species comprised 25.55% of the total number of detections.

Table 3. Bird species and number detected during VCP counts in riparian habitat at Canyon de Chelly National Monument, 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 (%)
white-throated swift	<i>Aeronautes saxatalis</i>	829	25.62
spotted towhee	<i>Pipilo maculatus</i>	363	11.22
warbling vireo	<i>Vireo gilvus</i>	301	9.30
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	258	7.97
chipping sparrow	<i>Spizella passerina</i>	230	7.11
common raven	<i>Corvus corax</i>	184	5.69
house finch	<i>Carpodacus mexicanus</i>	151	4.67
ash-throated flycatcher	<i>Myiarchus cinerascens</i>	150	4.64
black-headed grosbeak	<i>Pheucticus melanocephalus</i>	131	4.05
mourning dove	<i>Zenaida macroura</i>	116	3.58
canyon wren	<i>Catherpes mexicanus</i>	65	2.01
western tanager	<i>Piranga ludoviciana</i>	64	1.98
lesser goldfinch	<i>Carduelis psaltria</i>	58	1.79
American robin	<i>Turdus migratorius</i>	45	1.39
lazuli bunting	<i>Passerina amoena</i>	38	1.17
rock wren	<i>Salpinctes obsoletus</i>	37	1.14
yellow warbler	<i>Dendroica coronada</i>	28	0.87
western wood-pewee	<i>Contopus sordidulus</i>	23	0.71
yellow-breasted chat	<i>Icteria virens</i>	22	0.68
peregrine falcon	<i>Falco peregrinus</i>	20	0.62
Say's phoebe	<i>Sayornis saya</i>	17	0.53
violet-green swallow	<i>Tachycineta thalassina</i>	17	0.53
plumbeous vireo	<i>Vireo plumbeus</i>	15	0.46
blue grosbeak	<i>Passerina caerulea</i>	9	0.28
Wilson's warbler	<i>Wilsonia pusilla</i>	9	0.28
black-chinned hummingbird	<i>Archilochus alexandri</i>	6	0.19
bush-tit	<i>Psaltriparus minimus</i>	6	0.19
western bluebird	<i>Sialia mexicana</i>	6	0.19
brown-headed cowbird	<i>Molothrus ater</i>	5	0.15
Cooper's hawk	<i>Accipiter cooperii</i>	5	0.15
mallard	<i>Anas platyrhynchos</i>	4	0.12
American kestrel	<i>Falco sparverius</i>	3	0.09
Bullock's oriole	<i>Icterus bullockii</i>	3	0.09
hairy woodpecker	<i>Picoides villosus</i>	3	0.09
MacGillivray's warbler	<i>Oporornis tolmiei</i>	3	0.09
white-breasted nuthatch	<i>Sitta carolinensis</i>	3	0.09
Lucy's warbler	<i>Vermivora luciae</i>	2	0.06

Table 3 continued

Common name	Scientific name	Total number of detections	Proportion of all detections (%)
mountain chickadee	<i>Poecile gambeli</i>	2	0.06
cedar waxwing	<i>Bombycilla cedrorum</i>	1	0.03
orange-crowned warbler	<i>Vermivora celata</i>	1	0.03
pine siskin	<i>Carduelis pinus</i>	1	0.03
turkey vulture	<i>Cathartes aura</i>	1	0.03
western kingbird	<i>Tyrannus verticalis</i>	1	0.03

The mean number of individuals detected per species during a VCP count, and the frequency of plots with detections for each species detected in CACH riparian habitat are presented in Table 4. The white-throated swift had the highest mean number of individuals, with an average of 4.55 individuals detected during an eight-minute count. The spotted towhee was the most widespread in the target habitat—it was detected in 96.70% of plots.

Table 4. Mean number of individuals detected per VCP count, and frequency (%) of occupied plots (in which the species was detected) in riparian habitat at Canyon de Chelly National Monument, 2009

Species	Mean # of individuals	Standard deviation	Frequency of occupied plots (%)
white-throated swift	4.55	7.92	65.93
spotted towhee	1.99	1.27	96.70
warbling vireo	1.65	1.26	93.41
blue-gray gnatcatcher	1.42	0.84	96.70
chipping sparrow	1.26	1.37	81.32
common raven	1.01	1.25	80.22
house finch	0.83	1.91	68.13
ash-throated flycatcher	0.82	0.80	82.42
black-headed grosbeak	0.72	0.87	69.23
mourning dove	0.64	0.96	67.03
canyon wren	0.36	0.57	46.15
western tanager	0.35	0.78	38.46
lesser goldfinch	0.32	0.70	41.76
American robin	0.25	0.74	28.57
lazuli bunting	0.21	0.65	21.98
rock wren	0.20	0.44	30.77
yellow warbler	0.15	0.47	19.78
western wood-pewee	0.13	0.50	13.19
yellow-breasted chat	0.12	0.39	13.19
peregrine falcon	0.11	0.31	17.58
Say's phoebe	0.09	0.45	12.09
violet-green swallow	0.09	0.49	7.69
plumbeous vireo	0.08	0.30	15.38
blue grosbeak	0.05	0.26	6.59
Wilson's warbler	0.05	0.26	7.69
black-chinned hummingbird	0.03	0.18	5.49
bushy tit	0.03	0.26	2.20
western bluebird	0.03	0.44	1.10
brown-headed cowbird	0.03	0.16	5.49

Table 4 continued

Species	Mean # of individuals	Standard deviation	Frequency of occupied plots (%)
Cooper's hawk	0.03	0.16	4.40
mallard	0.02	0.21	2.20
American kestrel	0.02	0.17	2.20
Bullock's oriole	0.02	0.13	3.30
hairy woodpecker	0.02	0.17	2.20
MacGillivray's warbler	0.02	0.13	2.20
white-breasted nuthatch	0.02	0.17	2.20
Lucy's warbler	0.01	0.15	1.10
mountain chickadee	0.01	0.15	1.10
cedar waxwing	0.01	0.07	1.10
orange-crowned warbler	0.01	0.07	1.10
pine siskin	0.01	0.07	1.10
turkey vulture	0.01	0.07	1.10
western kingbird	0.01	0.07	1.10

3.2 Summary of bird habitat data

We found five vegetation cover types (cottonwood: with open understory, dense riparian, cottonwood: with dense understory, restoration treatment area, and open meadow) and four other, non-vegetation cover types (stream: intermittent, rock outcrop or cliff, standing water, and dirt road) in the macroplots (0.8 ha circular plots centered on each bird sampling plot) in the CACH riparian sample area. Cottonwood with an open understory had the highest mean percent cover and was recorded on 57.78% of the macroplots. Dense riparian and cottonwood with a dense understory were also common vegetation cover types on the macroplots. Restoration treatment areas were recorded on 18.88% of the macroplots, and these sites had, on average, 10.97% cover. The percent cover was highly variable for all vegetation cover types, as reflected in the relatively high standard deviations (SD; table 5).

Table 5. Mean cover of vegetation and other cover types, standard deviation (SD), range, and frequency (%) in target riparian habitat in Canyon de Chelly National Monument, 2009

Vegetation or other cover type	Cover (%)	SD	Range	Frequency (%)
Cottonwood: with open understory	33.67	34.89	0.00–87.50	57.78
Dense riparian	30.99	36.93	0.00–87.50	52.22
Cottonwood: with dense understory	22.08	30.58	0.00–87.50	47.78
Restoration treatment area	10.97	25.55	0.00–87.50	18.89
Stream: intermittent	8.68	10.91	0.00–37.50	55.56
Open grass-dominated area	7.17	14.16	0.00–62.50	28.89
Rock outcrop or cliff	0.94	3.76	0.00–17.50	6.67
Standing water	0.08	0.79	0.00–7.50	1.11
Dirt road	0.08	0.79	0.00–7.50	1.11

In Table 6, the abundance of trees is expressed in terms of basal area of overstory trees and density of saplings, by species. The abundance of snags is expressed in terms of basal area, and is recorded for all species combined. Five tree genera and one species were recorded on the sampling plots (see Table 6 for scientific and common names of tree species). Table 6 and figure 2 illustrate the basal area of trees by species or genus. Cottonwood (*Populus* spp.) contributed the most to basal area.

Table 6. Basal area of overstory trees and snags, and density of saplings by genus or species in riparian habitat in Canyon de Chelly National Monument, 2009. Basal area (m²/ha) is provided for overstory trees and density (number of stems/ha) is provided for saplings (trees with <10 cm DBH), in two size classes. Common names are provided for each tree species.

Species	Common name	Basal area	SD Basal area	Sapling density by size class	
				2.5 to <5 cm	5 to <10 cm
<i>Populus</i> spp.	Cottonwood	6.01	4.84	14.15	31.12
<i>Eleagnus angustifolia</i>	Russian olive	0.71	0.96	4.95	29.36
<i>Salix exigua</i>	Willow	0.01	0.09	-	-
<i>Juniperus</i> spp.	Juniper	-	-	1.06	0.35
<i>Ulmus</i> spp.	Elm	-	-	0.35	-
<i>Acer</i> spp.	Maple	-	-	-	0.35
All species		6.68	4.60	20.51	61.19
Snags		0.14	0.29		

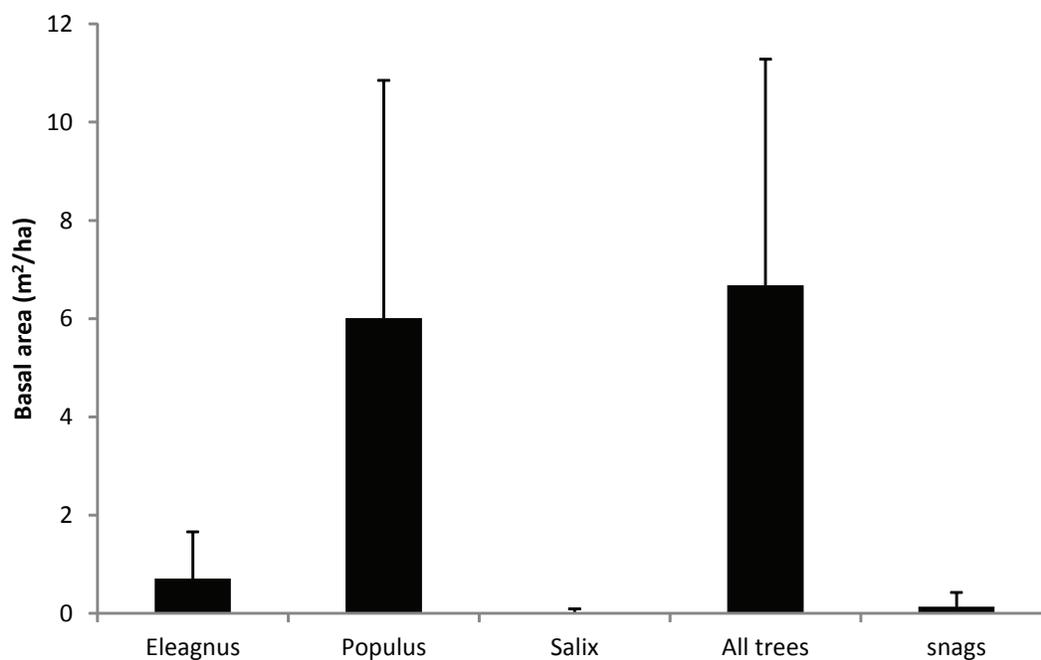


Figure 2. Basal area of trees by genus, total basal area of all trees, and basal area of snags in riparian habitat in Canyon de Chelly National Monument, 2009. Error bars represent one standard deviation.

Table 7. Vertical structure of the riparian habitat in Canyon de Chelly National Monument, 2009. Frequency is expressed as the mean percentage of subplots per macroplot where each stratum occurs. Foliar cover of the strata, expressed as a percentage, and height are provided for where the stratum occur. (Strata do not occur in every plot; mean foliar cover and height are calculated using data from the plots where each stratum occurs).

Vegetation strata	Frequency (%)		Foliar cover (%) (where stratum occurs)			Height (m) (where stratum occurs)		
	Mean	SD	Mean	SD	Range	Mean	SD	Range
Canopy	89	18	40.09	19.48	5.25–87.50	12.52	2.54	7.50–15.00
Sub-canopy	32	32	17.94	12.65	3.00–62.50	6.40	1.52	1.50–7.50
Shrub	84	28	39.96	21.03	3.00–81.25	3.21	1.17	0.25–6.50
Dwarf shrub	7	16	9.97	9.05	3.00–37.50	0.27	0.07	0.25–0.50

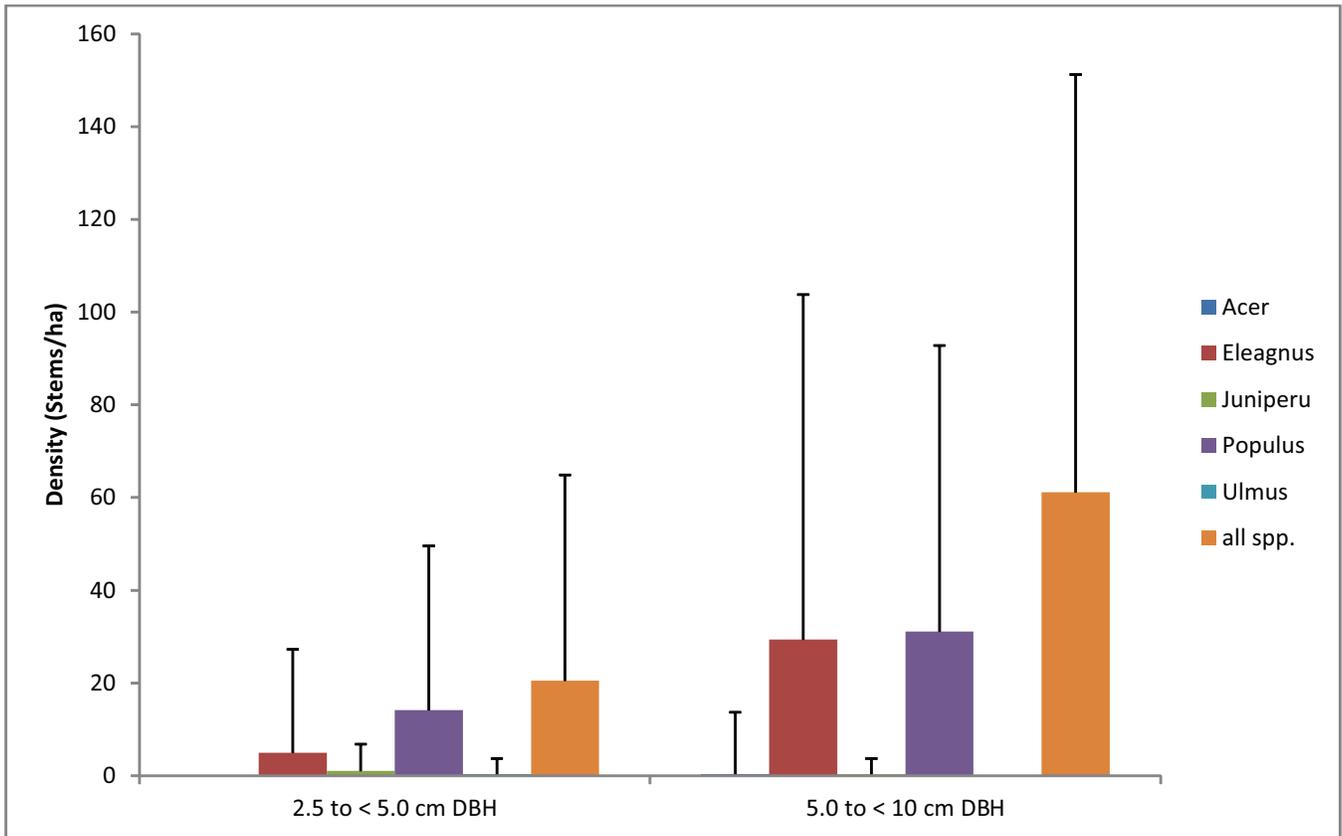


Figure 3. Density of sapling trees by genus and size class in riparian habitat in Canyon de Chelly National Monument, 2009. Error bars represent one standard deviation.

Sapling densities provide insight into the structure and dynamics of the riparian woodland. Cottonwood and Russian olive dominated both of the sapling classes – trees less than 10 cm DBH (table 6 and figure 3).

The vertical structure of the riparian habitat at CACH is relatively complex (table 7 and figure 4). Four vegetation strata, or layers, are present. A canopy layer is present on an average of 89% of the plots, with an average foliar cover of 40.09% on plots where the layer was present. A sub-canopy layer is present on 32% of the plots, with an average foliar cover of 17.94%. A shrub layer is present on 84% of the plots, with an average cover of 39.96% and an average height of 3.21 m on plots where the layer is present. A dwarf shrub layer was uncommon—found, on average, in only 7% of plots.

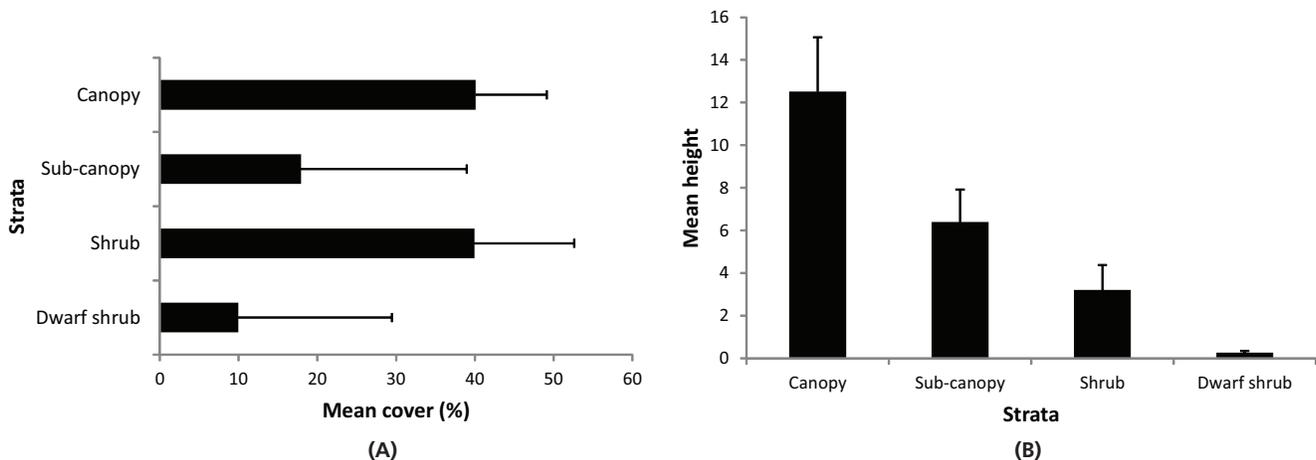


Figure 4. Vertical structure of riparian habitat in Canyon de Chelly National Park, 2009. Vertical structure measured as (A) mean cover per stratum, and (B) mean height per stratum. Error bars represent one standard deviation.

The understory of the riparian habitat at CACH is mainly comprised of shrubs, standing dead woody cover, annual grasses and forbs (table 8). Of these, the amount of shrub cover is likely to have the most influence on bird community composition. There is considerable variation in the amount of cover of shrubs – mean foliar cover for this functional group ranged from 0.50% to 75.00%.

Table 8. Foliar cover of functional groups in target riparian habitat in Canyon de Chelly National Monument in 2009

Functional groups	Mean foliar cover (%)	SD	Range
Total foliar cover	35.37	20.89	2.38–81.25
Perennial grasses, graminoids	2.95	7.67	0.50–44.63
Annual grasses	4.72	5.66	0.50–45.00
Forbs	3.83	3.51	0.50–17.50
Shrubs	28.94	21.14	0.50–75.00
Understory trees (< 1.4 m height)	0.57	0.33	0.50–2.25
Standing dead herbaceous	1.87	2.12	0.50–12.50
Standing dead woody	5.87	5.27	0.50–24.50

4 Discussion

These data represent the pilot year of sampling for the riparian bird community at CACH. The majority of the riparian bird community is comprised of species that are also commonly found in uplands habitats. Yet four riparian obligate species were detected, yellow warbler, yellow-breasted chat, blue grosbeak, and Lucy's warbler.

The Lucy's warbler is of particular interest in that it is on the Rare Species Yellow WatchList, part of the United States WatchList of Birds of Conservation Concern (Butcher et al. 2007). It has a relatively small breeding range that 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 show the Lucy's warbler's range to include northeast Arizona and Canyon de Chelly. Our detections may indicate an expansion of their range, although we did not confirm breeding.

Additional species, warbling vireo, lesser goldfinch, lazuli bunting, and Bullock's oriole, breed in a variety of habitats but primarily use riparian habitat in northern Arizona (Corman and Wise-Gervais 2005). Warbling vireo was the third most commonly detected species in CACH riparian habitat, with an average of 1.65 detections per eight-minute count. In Arizona, this species is most abundant in montane forests with considerable quaking aspen but it has also been documented breeding locally in a few tall cottonwood groves in northern Arizona (Corman and Wise-Gervais 2005). Continued monitoring should provide additional information on this species breeding ecology in northern Arizona and local populations' use of CACH riparian habitat.

As 2009 was a pilot year for bird monitoring in CACH, we limited our identification of most riparian trees to the level of genus. We have refined our habitat sampling techniques to increase efficiency and in future years we will identify trees at the species level. In addition, we will refine our categories for vegetation covers types to include a range of restoration treatment cover types and native riparian cover types. Our long-range plan for the riparian bird community monitoring is to conduct VCP counts every three years to track changes in bird species abundance, distribution, and habitat metrics over time.

5 Literature cited

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