

BREEDING BIRDS OF AN ANCIENT BRISTLECONE PINE STAND IN EAST CENTRAL NEVADA

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ABSTRACT.— This paper describes features of the breeding bird population of a Great Basin ancient bristlecone pine stand on Wheeler Peak in White Pine County, east central Nevada. The bird population was determined by spot-mapping methods on a 20-ha plot during June and July 1981. The density of breeding birds was 82 pairs per 40 ha. Fourteen species were territorial. The most abundant species were the Dark-eyed Junco, Mountain Chickadee, Mountain Bluebird, and Townsend's Solitaire. Other common breeding species included the Cassin's Finch, Yellow-rumped Warbler, Pine Siskin, and Dusky Flycatcher. There were 410 individual breeding birds per km². When expressed as standing crop biomass, the Townsend's Solitaire was the predominant species, followed by the Dark-eyed Junco, American Robin, Mountain Bluebird, and Northern Flicker. Total standing crop biomass was 95 g/ha. None of the breeding birds were restricted to the bristlecone pine stand. The structure of the breeding bird community in the bristlecone pine forest compared best to those of the Rocky Mountain and Northern Boreal forest regions.

Bristlecone pine (*Pinus longaeva*), the oldest living tree of verified age presently known, grows on dry, rocky subalpine habitats in the Great Basin. Scattered stands occur in the Utah Plateaus, west through Nevada to the White, Inyo, and Panamint mountains of eastern California (Cronquist et al. 1972). The bristlecone pine is a gnarled and bushy tree, often exceeding 15 m in height and with a thick, shallowly lobed trunk. It grows at high elevations, sometimes with limber pine (*Pinus flexilis*), Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*).

The longevity and esthetic appeal of the sculptured bristlecone pine trees and their environments have generated interest among scientists and recreationists (Ferguson 1968). Trees over 3,000 years old are common, and several over 4,000 years have been found (Currey 1965). In 1959 the USDA Forest Service designated 11,330 ha of the Humboldt National Forest in the Snake Range of eastern Nevada as the Wheeler Peak Scenic Area in recognition of the exceptional scenic, botanical, and geologic attractions of the area and to provide protection for the ancient bristlecone pine stands on Wheeler Peak and nearby Mount Washington.

The avifauna of these unique stands of ancient trees have received little quantitative

study. This paper describes features of the breeding bird population of a stand of bristlecone pine on Wheeler Peak in White Pine County, east central Nevada.

STUDY AREA AND METHODS

The bristlecone pine stand is at the mouth of a deep glacial cirque on the northeast face of Wheeler Peak (elevation 3,981 m), 62 km southeast of Ely, Nevada. The stand covers about 55 ha and ranges in elevation from about 3,100 m to the upper limits of tree growth near 3,300 m. The slopes are steep and covered with coarse-textured glacial till composed of quartzite blocks (Currey 1965). The area has a dry, cool climate with maximum precipitation occurring in late winter and spring. Mean annual precipitation is about 76 cm (Beasley and Klemmedson 1980).

Bristlecone pine dominates the stand, making up 54% of the total tree composition; limber pine (34%) and Engelmann spruce (12%) are the primary associates (Beasley and Klemmedson 1976). Total basal area ranges from about 19 m²/ha on harsh sites to 43 m²/ha on favorable sites (Table 1). At its lower elevational limits, the stand grades into the mixed-conifer forest of Engelmann spruce, limber pine, and Douglas-fir (*Pseudotsuga menziesii*) typical of the Snake

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Range. The understory vegetation is generally sparse. Common shrubs include gooseberry (*Ribes montigenum*), raspberry (*Rubus idaeus*), common juniper (*Juniperus communis*), and goldenweed (*Haplopappus macronema*).

A 20-ha plot was censused for breeding birds using the Williams spot-map method (International Bird Census Committee 1970). Methodological difficulties and other specific problems of the mapping technique are summarized by Oelke (1981) and Dawson (1981). The census plot was chosen to best represent the stand of bristlecone pine. The upper boundary approached timberline, and a shallow, rocky morainal pond (about 0.8 ha) was included near the lower margin of the plot. The square plot was surveyed and gridded in a Cartesian coordinate system with points flagged and numbered with stakes at 75-m intervals. Ten census visits were made to the plot from 18 June to 17 July 1981. Most of the work was done from sunrise to late morning when birds were most active. To ensure complete coverage, the plot was censused by walking within 50 m of all points on the grid. Observations extended well beyond plot boundaries.

At the end of the sampling period, concentrated groups of observations were circled as indicating areas of activity or approximate territories. Fractional parts of boundary territories were recognized. Results were converted to the number of pairs of breeding birds per 40 ha. Shannon's formula ($H' = -\sum p_i \ln p_i$, where $p_i = N_i/N$ is the proportion of the collection belonging to the i th species) was used to calculate the species diversity index (Shannon and Weaver 1963).

RESULTS AND DISCUSSION

The density of breeding birds occupying the bristlecone pine census plot was 82 pairs per 40 ha (Table 2). Fourteen species were territorial. The most numerous species, each making up more than 10% of the population and collectively accounting for 53%, were the Dark-eyed Junco, Mountain Chickadee, Mountain Bluebird, and Townsend's Solitaire. Other common species, each including 5% to 10% of the population, were the Cassin's Finch, Yellow-rumped Warbler, Pine Siskin, and Dusky Flycatcher. There were 410 individual breeding birds per km². When expressed as standing crop biomass, the Townsend's Solitaire was the predominant species, followed by the Dark-eyed Junco, American Robin, Mountain Bluebird, and Northern Flicker. Those five species made up 65% of the standing crop biomass of the breeding avifauna. Total standing crop biomass was 95 g/ha.

In addition to the 14 territorial species listed in Table 2, the Common Raven (*Corvus corax*), Clark's Nutcracker (*Nucifraga columbiana*), and Rosy Finch (*Leucosticte arctoa*) were commonly observed. Rocky cliffs and talus slopes adjacent to the census plot provided nesting substrates for the Raven and Rosy Finch. The Golden Eagle (*Aquila chrysaetos*), Violet-green Swallow (*Tachycineta thalassina*), Red-breasted Nuthatch (*Sitta canadensis*), Brown Creeper (*Certhia americana*), and Red Crossbill (*Loxia curvirostra*) were infrequent visitors.

Species may be categorized by foraging substrate (air, foliage, timber, or ground) and dietary habits (insectivore, omnivore, or granivore). Categories indicated in Table 2

TABLE 1. Characteristics of Wheeler Peak bristlecone pine stand on 6 sites.^a

Relative site quality	Understory plant cover (%)	Stone cover (%)	Basal area				Mean area per tree (m ²)
			Bristlecone pine (m ² /ha)	Engelmann spruce (m ² /ha)	Limber pine (m ² /ha)	Total (m ² /ha)	
Favorable	8.80	57.3	15.6	15.8	7.1	38.5	30.0
	3.45	59.7	6.9	18.6	9.6	35.1	24.5
	1.94	45.4	7.8	18.4	17.2	43.4	22.0
Harsh	3.08	83.6	13.5	7.3	1.6	22.4	36.5
	3.01	71.5	16.3	7.1	2.8	26.2	46.0
	0.79	89.8	17.0	1.8	0.7	19.5	135.0

^aFrom Beasley and Klemmedson (1980).

are based upon those developed by Salt (1953) as modified by Diem and Zeveloff (1980). The 14 breeding bird species were distributed over eight different foraging categories. Foliage gleaners and ground feeders were equally divided among the species represented, and those forms made up the largest proportion of all foraging categories. Among the foliage feeders, insectivorous species predominated. Ground-gleaning forms were also mainly insectivorous. Three species were largely granivorous. The aerial-sally category was represented by only one species (Dusky Flycatcher), as was the timber-glean-

ing category (White-breasted Nuthatch). Timber-drilling forms were conspicuous by their absence in the bristlecone pine stand. Wiens (1978) showed that foliage-feeding forms numerically dominate the avifauna in North American coniferous forests, with ground-feeding, timber-foraging, and aerial feeders less important, in decreasing order. The avifauna of the bristlecone pine forest appear to generally fit this pattern.

The substrates used for nesting provide additional information about the bird population. Of the 14 breeding bird species, 7 (50%) nest in foliage, 4 (29%) use cavities, and

TABLE 2. Ecological attributes and population density of the breeding birds of an ancient bristlecone pine stand, Wheeler Peak, Nevada, June–July 1981.

Species	Species weight ^a (g)	Nesting substrate ^b	Foraging category ^c	Population density (pairs/40 ha)
Broad-tailed Hummingbird (<i>Selasphorus platycercus</i>)	3.5	F	FNI	4.0
Northern Flicker (<i>Colaptes auratus</i>)	134.1	C	GGI	1.5
Dusky Flycatcher (<i>Empidonax oberholseri</i>)	12.4	F	ASI	5.5
Mountain Chickadee (<i>Parus gambeli</i>)	11.3	C	FGI	11.5
White-breasted Nuthatch (<i>Sitta carolinensis</i>)	17.4	C	TGO	1.0
Rock Wren (<i>Salpinctes obsoletus</i>)	15.9	G	GGI	0.5
American Robin (<i>Turdus migratorius</i>)	69.9	F	GGI	3.5
Hermit Thrush (<i>Catharus guttatus</i>)	29.8	F	FFO	2.5
Mountain Bluebird (<i>Sialia currucoides</i>)	26.6	C	GGI	9.0
Townsend's Solitaire (<i>Myadestes townsendi</i>)	32.9	G	FFO	8.5
Yellow-rumped Warbler (<i>Dendroica coronata</i>)	13.0	F	FGI	6.5
Cassin's Finch (<i>Carpodacus cassinii</i>)	26.6	F	GGG	7.5
Pine Siskin (<i>Carduelis pinus</i>)	11.6	F	FGG	6.0
Dark-eyed Junco (<i>Junco hyemalis</i>)	18.1	G	GGG	14.5
TOTAL NUMBER OF SPECIES = 14		STANDING CROP BIOMASS = 95 g/ha		
TOTAL PAIRS PER 40 HA = 82		SPECIES DIVERSITY INDEX = 2.39		
TOTAL INDIVIDUALS PER KM ² = 410		PLOT SIZE = 20 ha		

^aSpecies weights from Linsdale (1936), Behle (1943), Salt (1957), and Johnson (1965).
^bF = foliage, C = cavity, G = ground.
^cFNI = foliage nectivore–insectivore, GGI = ground-gleaning insectivore, ASI = aerial sally-feeding insectivore, FGI = foliage-gleaning insectivore, TGO = timber-gleaning omnivore, FFO = foliage-feeding omnivore, FGG = foliage-gleaning granivore, GGG = ground-gleaning granivore.

TABLE 3. Features of breeding bird community structure in coniferous forests of different regions of North America.^a

Region	Censuses	Number of species		Density (individuals/km ²)		Standing crop biomass (g/ha)	
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Northwest	17	15.4	6.1	1456	621	283	102
Sierra Nevada	6	21.3	5.0	796	410	251	215
Great Basin ^b	1	14.0	—	410	—	95	—
Rocky Mountain	17	14.0	5.0	736	575	188	147
Northern Boreal	4	14.5	3.9	466	216	80	32
Southeast	10	21.6	5.5	1221	407	281	95
Northeast (mature)	18	22.6	4.2	1341	343	273	146
Northeast (immature)	9	11.1	3.7	329	150	65	50

^aFrom Wiens (1978).
^bData from this study included to facilitate comparisons.

3 (21%) nest on the ground (Table 2). Numerically, foliage nesters made up 43% of the population; ground nesters and cavity nesters each accounted for about 28% of the breeding avifauna of the bristlecone pine stand. The Northern Flicker is the only primary hole-nesting species represented. Secondary cavity nesters (Mountain Chickadee, Mountain Bluebird, White-breasted Nuthatch) made up the bulk of the hole-nesting forms. The Dark-eyed Junco was predominate among the ground nesters.

None of the breeding birds listed in Table 2 are restricted to the bristlecone pine forest. With the exception of the Common Raven, all the birds observed in the Wheeler Peak bristlecone pine stand are included among the 80 species designated as boreal by Behle (1978) in his study of the avifauna of 14 boreal islands in western and southeastern Utah. Also, 11 of the 14 birds that Johnson (1975) called "standard" boreal species of Great Basin montane island avifaunas are represented in the bristlecone pine forest. Johnson considered this standard group of interest ecologically because the species that comprise it nearly always occur together and may be taken to represent the basic community of western American boreal birds.

Wiens (1978) summarized the structure of breeding bird communities in the coniferous forests of different regions of North America (Table 3). In comparison, the number of breeding bird species encountered in the Wheeler Peak bristlecone pine stand is lower than the average number in coniferous forests of the northwestern, northeastern, and southeastern regions and in the Sierra Nevada. The

species total in the bristlecone pine stand is similar to the average number of breeding species recorded in the Rocky Mountain region and the Northern Boreal forest of northwestern Canada and southeastern Alaska. The number of birds per unit area and the standing crop biomass of breeding birds in the bristlecone pine forest compare most favorably with those of the Northern Boreal forest region. Johnson (1975) commented on the seeming paucity of both total species numbers and numbers of individuals of a given species on many montane islands of the Great Basin when compared with areas of similar size in the Sierra Nevada or the Rocky Mountains. The quantitative avifaunal data from the Wheeler Peak stand of bristlecone pine tend to verify this impression.

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