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NESTING BIRDS OF THE BLACK FOREST, COLORADO

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The Black Forest is a yellow pine forest that covers part of the region of the Arkansas-Platte divide, between Denver and Colorado Springs, in central Colorado. This timbered area of about 150,000 acres is an eastward extension of the foothill or Transition Life-zone (6000-8500 feet) of the Front Range of the Rocky Mountains, and although the topography is rolling, the elevation is nearly uniform. The Black Forest is interesting biologically because it is composed of a nearly pure stand of climax western yellow pine (*Pinus ponderosa scopulorum*) and because its position is intermediate between the eastern plains and the higher altitudes of the mountains to the west.

The purpose of the investigation here reported was to make a quantitative study of the bird life in the Black Forest in the 1945 nesting season. As far as is known, only one thorough census of a breeding-bird population in a coniferous forest of this type has been taken previously in North America. Cooke (1916) worked in a yellow pine and shrub oak habitat near Flagstaff, Arizona. Among semi-quantitative studies made in various western yellow pine forests, perhaps the most valuable for purposes of comparison is Rasmussen's survey (1941) on the Kaibab Plateau, Arizona.

On the basis of ten-year averages of climatological data from the U. S. Weather Bureau station at Monument, Colorado, the annual mean temperature of the Black Forest is 45.7°F., the annual precipitation is 19.4 inches, and the annual snowfall is about seventy-five inches. The greatest amount of moisture is recorded in the spring and summer months in this region. May, June, July, and August, 1945, were unusually damp, with occasional hailstorms (Hering, 1947*a*).

Shaddle (MS) and Williams and Holch (1946) have carried out research in plant ecology in the Black Forest. Cary (1911) and Aiken and Warren (1914) did pioneer ornithological field work in this part of Colorado, and Sclater's book (1912) was based largely on specimens collected in the same general region. Observations on the distribution of nesting birds in relation to altitudinal life zones in Colorado have been made by Betts (1913), Alexander (1937), Johnston (1943), and others.

Since about 1900, students of ornithology and animal ecology have realized the value of exact field reports on the abundance of species in various habitats. I used suggestions made by Hickey (1943) and Kendeigh (1944), both of whom describe methods of population study. Forests located in rather arid climates (Colorado) and composed of a single conifer usually do not sustain large or varied bird populations; but relatively few data are available from such areas.

The census was taken about fifteen miles northeast of Colorado Springs, in the heavily wooded portion of the Black Forest, on "La Foret," an estate now used as a summer camp. While the greater part of the Forest had been cut over, the timber on this property was at that time largely undisturbed, and many large old pines remained.

Seventy-five acres, in the form of a rectangle one-quarter mile wide and about one-half mile long, and having an elevation of between 7200 and 7300 feet, were chosen so that a creek ran across the northern portion of the plot. Along the wide, sandy creek bottom and slopes leading from the creek were willows three to ten feet tall and young aspens. On dryer ground on either side were a few patches of alder, chokecherry, shrub oak, mountain mahogany, wild rose, and wild raspberry bushes. The forest was composed of pines ranging in size from small seedlings to large trees thirty-five to fifty feet high (fig. 12), and the forest floor was covered with pine needles and cones, grasses,

Fig. 12. General view of the Black Forest, central Colorado.

blossoming herbs, kinnikinic, and a few juniper bushes. There were few stumps or logs. The largest open area was a meadow in the southern half of the tract which covered about four acres (fig. 13). This, and other smaller meadows within the area, were made up of grasses, wild flowers, and a few willows.

The most conspicuous small mammals on the acreage were the tufted-eared squirrels (*Sciurus aberti*). One deer was observed. Several horses, pastured on "La Foret," grazed in the meadows and occasionally trampled the bushes near the creek. Human disturbance was confined to the campers coming to the two buildings on the plot from the central camp east of and outside the acreage boundaries.

The "plot census" was used in the investigation. This is the most dependable of the various methods of censusing bird populations because the observer makes repeated visits to the same area and becomes familiar with the birds in their local environment. A total of 162 hours was spent in the field. Weather permitting, the seventy-five acres could be covered in a day; one portion was usually studied in a morning field trip, and another in the afternoon.

The original map of the plot was constructed by pacing off critical distances with the use of a compass, and this was later compared with an aerial photograph. All birds—residents, visitants, and migrants—were recorded on one mimeographed copy of the map during each field trip, and additional comments were written in notebooks. Nests, when found, were given exact locations by pacing the distances from landmarks, and the

heights of nests and trees were obtained with an Abney hand level. Field work done in 1945 extended over the following periods: May 21 to May 26, June 2 to June 30, and August 10 to August 12, all dates inclusive.

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Fig. 13. View of a 4-acre meadow in the southern half of the study-plot.

NESTING OBSERVATIONS

Twenty species nested within the seventy-five acres of yellow pine forest and creek environment chosen for the census. The following list gives these species in the order of abundance of nesting pairs (the figures in the right column are the total numbers of nesting pairs on the plot):

Robin (*Turdus migratorius*)	9
Western Bluebird (*Sialia mexicana*)	7
Western Wood Pewee (*Contopus richardsonii*)	6
Gray-headed Junco (*Junco caniceps*)	5
Chipping Sparrow (*Spizella passerina*)	5
Violet-green Swallow (*Tachycineta thalassina*)	4
Pygmy Nuthatch (*Sitta pygmaea*)	4
Audubon Warbler (*Dendroica auduboni*)	4
Mourning Dove (*Zenaidura macroura*)	3
Red-shafted Flicker (*Colaptes cafer*)	3
House Wren (*Troglodytes aedon*)	3
Solitary Vireo (*Vireo solitarius*)	3
Green-tailed Towhee (*Chlorura chlorura*)	3
Broad-tailed Hummingbird (*Selasphorus platycercus*)	2
White-breasted Nuthatch (*Sitta carolinensis*)	2

Warbling Vireo (*Vireo gilvus*)	2
Yellow Warbler (*Dendroica aestiva*)	2
Pine Siskin (*Spinus pinus*)	2
Arkansas Goldfinch (*Spinus psaltria*)	2
Yellow-throat (*Geothlypis trichas*)	1

Creek environment.—Four of the twenty nesting species remained in the creek environment during the breeding season and used the deciduous foliage for nesting sites: Warbling Vireo, Yellow Warbler, Yellow-throat, and Green-tailed Towhee. Eight nests (fig. 14) were attributed to these birds, and pairs of each species were well separated along the length of the creek. One nest of the Warbling Vireo was six feet above the

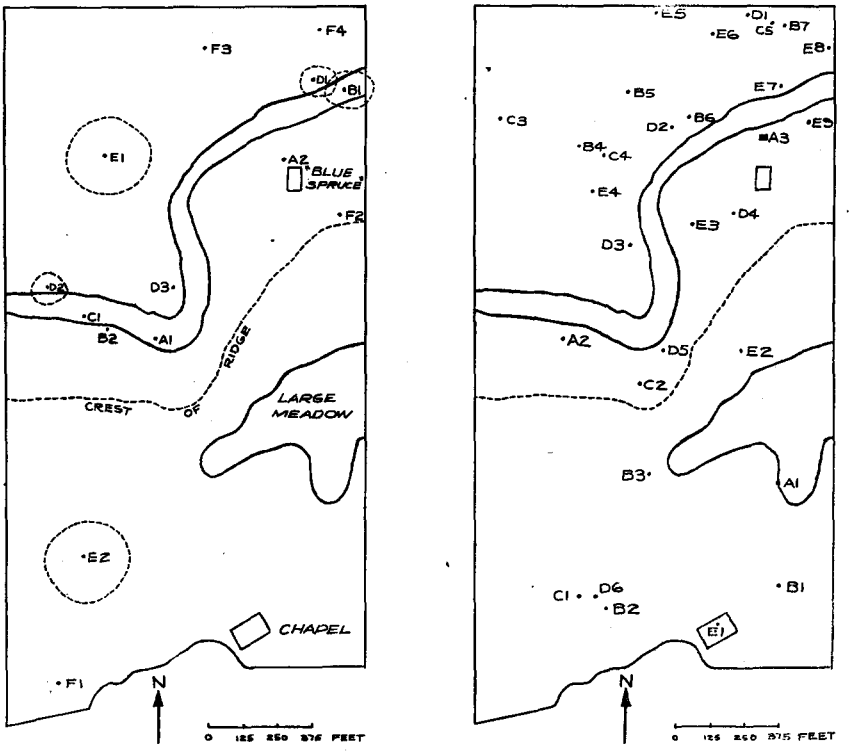

Fig. 14 (left). Distribution of nests on study-plot: A1, A2, Warbling Vireo; BI, B2, Yellow Warbler; C1, Yellow-throat; D1-D3, Green-tailed Towhee; E1, E2, White-breasted Nuthatch; F1-F4, Pygmy Nuthatch.

Fig. 15 (right). Same as preceding: A1, A2, Broad-tailed Hummingbird; A3, perch of male hummingbird; B1-B7, Western Bluebird; C1-C5, Chipping Sparrow; D1-D6, Western Wood Pewee; E1-E8, Robin.

creek bed in a willow bush (*Salix exigua*), and the second was suspended from a branch of a small aspen, about six feet from the ground. One pair of Yellow Warblers whose nest was saddled between five vertical willow branches about two feet from the ground occupied a territorial area of 0.4 acre (fig. 14), and the male defended the territory against a persistent male intruder during the first two weeks in June. The other nest of the Yellow Warbler was never found; neither was the nest of the Yellow-throat, nor the three nests of the towhee. By the behavior of the parent birds, these nests were judged to be hidden in low sites in the creek bushes. Two of the three pairs of Green-tailed Towhees held territories (fig. 14) which the males announced by repeated singing from

perches overlooking the areas. The first pair had an area of 0.4 acre, and the second pair, an area of 0.2 acre.

A male Broad-tailed Hummingbird was seen repeatedly on a perch overlooking the creek near the plot's eastern boundary (fig. 15), the perch being a twig on a dead pine branch about twenty feet from the ground. At intervals, he flew over the creek foliage and then returned to the tree.

Pine interiors.—Six nesting species used only the interiors of old pines for nesting locations: Flicker, Violet-green Swallow, White-breasted Nuthatch, Pygmy Nuthatch, House Wren, and Western Bluebird. Twenty-three breeding pairs of these species were counted. The nests of the House Wren were in pines along the creek banks and were located at an average height of 8.7 feet from the ground. All other species were distributed throughout the forest. Several trees housed more than one nesting species: five pairs utilized five holes on the south side of an old pine in the northeast corner of the acreage (one pair of Flickers, two pairs of swallows, one pair of Pygmy Nuthatches, and one pair of bluebirds). The two pairs of White-breasted Nuthatches were far separated (fig. 14) and had large foraging territories (2.3 acres and 1.7 acres). Of Pygmy Nuthatches (fig. 14) there was one pair per 18.8 acres, and their nesting holes varied from twelve to thirty feet in height, with an average height of 17.5 feet from the ground. The nests of the Western Bluebird (fig. 15) were in old pines at heights varying from nine to thirty-two feet, with an average distance of 15.7 feet above the ground. The bluebirds were quiet residents of the forest, but were seen on several occasions to attack tufted-eared squirrels, to quarrel amongst themselves, and, once, to attack a pair of Western Tanagers. Two or more pairs of bluebirds fed in the large meadow. They remained near the edges, and alternately perched on low branches and fed amidst the grass.

Pine foliage.—Eight of the twenty breeding species constructed their nests in the foliage of the pines. These were Broad-tailed Hummingbird, Western Wood Pewee, Robin, Solitary Vireo, Audubon Warbler, Pine Siskin, Green-backed Goldfinch, and Chipping Sparrow. Thirty-six nests in the foliage of pines were counted, and one nest was on the rafters on the outside of a building (Robin). Interesting courtship behavior of the hummingbirds was noted near the creek during May and the first two weeks in June (Hering, 1947*b*). These birds fed from the creek blossoms, and later, from forest flowers, such as penstemons and wild iris. One hummingbird nest (fig. 15) was in a tall pine at the edge of the large meadow, on a dead limb fifteen feet from the ground. The nest was about two feet from the trunk of the tree and was protected by a limb directly over it. The second nest was in a smaller pine near the creek, on a limb ten feet from the ground, and was constructed about eighteen inches out on the lower part of a Y-shaped limb. Many hummingbirds were seen along the creek in August. The male pewees remained in small clearings around their nesting sites, although the six nests of the Wood Pewee were widely distributed throughout the plot (fig. 15). The population density of this species was one pair per 12.5 acres. Six Robin nests (fig. 15) were located in close relationship to each other in the northeast portion of the plot. The other three nests were separated from nests of the same species by relatively long distances. The Robins flew both short and long distances from the nesting sites to feed, which probably indicates a complex territorial arrangement. Several pairs fed in the large meadow. A great many Robin fledglings were seen in the creek environment after they had left the nests. The nests were uniformly well-supported and varied in height from 6.5 to 17 feet, with an average height of 10.5 feet from the ground. The Solitary Vireos constructed their nests in low branches of small pines; the Chipping Sparrows built at medium heights in larger pines; and the goldfinches, as far as is known, in tall pines. The density of Chipping Sparrows (fig. 15) was one pair per fifteen acres.

For the purpose of testing possible operation of "edge effect" within the study plot, the acreage might be divided into three types of habitats: the open forest, the clearing or meadow within the forest, and the deciduous foliage of the creek. Many of the breeding birds used more than one of these habitats. Several nests were constructed in pines along forest clearings or meadows (three of pewee, two of Chipping Sparrow, one of hummingbird, one of Robin, one of Pine Siskin, one of goldfinch, and one of Audubon Warbler). Several pairs nested in pines along the creek (three of House Wren, three of Audubon Warbler, four of Robin, and one of hummingbird). One species, the Green-tailed Towhee, nested in the creek environment, but used nearby pines for singing perches. Eight of the nesting species were observed while drinking from the creek (Robin, Mourning Dove, Flicker, Pine Siskin, Broad-tailed Hummingbird, Wood Pewee, Western Bluebird, and Solitary Vireo), and six species were seen bathing in the creek (Robin, siskin, junco, Audubon Warbler, towhee, Chipping Sparrow, and Pygmy Nuthatch).

Ground sites.—Two pairs of Mourning Doves nested in tall pines, while the nest of another was on the ground, beneath bushes. One species, the Gray-headed Junco, nested entirely on the ground; two nests of this species were on creek banks and the other three were in the forest. One nest, discovered on June 17, when the three young were nearly able to leave the nest, was on the ground beneath a twenty-inch pine seedling. Three pairs of juncos were far separated on the tract, while two breeding pairs remained near each other throughout the season. The males of the latter two pairs sang rather often, but both families fed on the forest floor without any apparent territorial conflict.

REGULAR VISITORS ON THE STUDY-PLOT

Eight species did not nest on the tract but were regular visitors during the breeding season. These species, with the number of individuals given to the right, were as follows:

Killdeer (*Oxyechus vociferus*)	2
Nighthawk (*Chordeiles minor*)	3
Red-naped Sapsucker (*Sphyrapicus varius*)	2
Olive-sided Flycatcher (*Nuttallornis borealis*)	1
Steller Jay (*Cyanocitta stelleri*)	4
Mountain Chickadee (*Penthestes gambeli*)	1
Black-headed Grosbeak (*Pheucticus melanocephalus*)	2
Spotted Towhee (*Pipilo maculatus*)	1

The Killdeers were believed to be nesting near the edge of a wide sandy creek bed south of the plot. A large aspen tree in a grove east of the plot was the nesting site of the sapsuckers. The Olive-sided Flycatcher remained near an arroyo at the southwest corner of the acreage, but it may have been unmated. The Steller Jays attempted to raid the nests of various smaller birds several times, and one pair was seen bathing leisurely in the creek. The Mountain Chickadee fed in the pines in the southeast corner. The grosbeaks and the Spotted Towhee probably nested in bushes in the aspen grove east of the acreage, but their nests were never found.

In addition to these, regular visitors representing five of the nesting species were as follows: Violet-green Swallow, 2; Pygmy Nuthatch, 2; Western Bluebird, 6; Solitary Vireo, 2; and Green-tailed Towhee, 2. The number of regular visitors on the study-plot totals thirty.

TOTAL POPULATION

In summary, forty-two nests were actually found on the seventy-five acres, and thirty additional nests were each sufficiently verified to be included in the present census. The breeding population thus totals seventy-two pairs per seventy-five acres. These 144 birds plus the 30 regular visitors yield a total population of 174 adults. Expressed in the standard form, this would be 232 adults per hundred acres.

OTHER SPECIES

Four species that were believed to nest elsewhere in the Black Forest were seen on the plot occasionally. The nesting evidence for the Hairy Woodpecker (*Dendrocopos villosus*) and the Black-capped Chickadee (*Parus atricapillus*) was that members of these species were observed, on and off the plot, all through the breeding season. Nesting sites of the Brewer Blackbird (*Euphagus cyanocephalus*) and the House Finch (*Carpodacus mexicanus*) were seen outside the plot.

Four species were never seen on the acreage, but were observed nesting elsewhere in the Black Forest: Downy Woodpecker (*Dendrocopos pubescens*), Mountain Bluebird (*Sialia currucoides*), Common Red-wing (*Agelaius phoeniceus*), and Song Sparrow (*Melospiza melodia*). No Mountain Bluebirds were found in the uninhabited forest, but this species was seen frequently near farm buildings and residences, nesting in bird boxes, and between the rafters in garages and other structures. One breeding pair had constructed its nest between the rafters supporting a large water tank, and the parents flew through the overflow stream of water to feed the young birds.

Fifteen species of birds infrequently seen on the study tract, and whose status in the Black Forest was not determined, are as follows:

Cooper Hawk (*Accipiter cooperi*), Red-tailed Hawk (*Buteo borealis*), Swainson Hawk (*Buteo swainsoni*), Marsh Hawk (*Circus cyaneus*), Sparrow Hawk (*Falco sparverius*), Crow (*Corvus brachyrhynchos*), Creeper (*Certhia familiaris*), Townsend Solitaire (*Myadestes townsendi*), Calaveras Warbler (*Vermivora ruficapilla*), Virginia Warbler (*Vermivora virginiae*), Western Tanager (*Piranga ludoviciana*), Lazuli Bunting (*Passerina amoena*), Evening Grosbeak (*Hesperiphona vespertina*), Cassin Purple Finch (*Carpodacus cassini*), and Common Goldfinch (*Spinus tristis*).

DISCUSSION

In regard to the altitudinal position of the nesting birds, sixteen of the species are found commonly in the Transition Life-zone in Colorado, but four are generally considered summer residents of either higher or lower elevations. Betts (1913) listed the breeding birds of Colorado according to altitudinal distribution. He considered the Yellow-throat and the Green-backed Goldfinch to be characteristic breeding birds of the Plains (Upper Sonoran) Zone (below 6000 feet). Both of these nested on the acreage (7200-7300 feet). Betts listed the Audubon Warbler only under the Mountain (Boreal) Zone (8500-11,500 feet); four pairs of this species nested on the plot. He states that the Gray-headed Junco is found in the Transition Zone, but is a characteristic breeding bird in the Mountain Zone. Five nesting pairs of these juncos were found on the study area. The Olive-sided Flycatcher, a regular visitor on the acreage, is, according to Betts, a characteristic breeding species of the Mountain Zone.

Cooke (1916) took a census on a seventy-acre tract of yellow pine and Gambel shrub oak at 7100 feet, near Flagstaff, Arizona. He found a population of thirty-one breeding pairs of eighteen species. In the standard form, this would be eighty-nine adult birds per hundred acres, as compared with the 232 adults of twenty species found in the Black Forest. Details of his survey were not published, but it is possible that the absence of a creek, and perhaps the lack of moist ground (essential for Robins) could explain this difference in densities. However, the shrub oak theoretically should have broken the monotony of the conifer habitat to offset somewhat the absence of water.

Rasmussen (1941) made a semi-quantitative survey in the yellow pine and aspen forest on the Kaibab Plateau, at an elevation of 6800-8200 feet. The forest had little understory and was composed of pines up to more than one hundred feet high. Rasmussen found the most abundant resident birds to be Pygmy Nuthatch (most uniformly distributed), Steller Jay, Sharp-shinned Hawk, White-breasted Nuthatch, Mountain Chickadee, Cassin Purple Finch, Red-shafted Flicker, Red-backed Junco, Goshawk,

and Red-tailed Hawk. Birds present in the summer, or at least most evident then, were Western Bluebird (most characteristic), Audubon Warbler (most abundant), Williamson Sapsucker (in aspens), Chipping Sparrow, Horned Owl, and Band-tailed Pigeon (uncommon). Noticeably absent from Rasmussen's report, as compared with the Black Forest, were Mourning Doves and goldfinches. However, Rasmussen found the nest of a Lewis Woodpecker (*Asyndesmus lewis*), a species not seen in the Black Forest. He also considered the Cassin Purple Finch as common during the breeding season, and this species did not nest on the Colorado study area.

SUMMARY

A survey of the 1945 nesting population of the Black Forest, in central Colorado, was made by taking a census on seventy-five acres of undisturbed western yellow pines, located at 7200-7300 feet, in the Transition Life-zone.

Forests composed of a single conifer usually do not support a large or varied bird fauna, but seventy-two breeding pairs of twenty species were counted on the plot censused in this study. These, plus thirty regular visitors, gave a total population of 174 adult birds, or a density of 232 per one hundred acres. A willow-bordered creek in the Black Forest tract was possibly responsible for the high density found.

Sixteen species present in the Black Forest are typical of the Transition Life-zone in Colorado. Four others, found nesting on the study area, are considered by others to be characteristic of lower or higher zones in Colorado. Sixteen species not recorded on the study area nested elsewhere in the Black Forest, and an additional fifteen species were seen infrequently. A total of fifty-one species was recorded in the Black Forest.

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