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OLD NESTS AS CUES FOR NEST-SITE SELECTION BY BIRDS: AN EXPERIMENTAL TEST IN SMALL EVEN-AGED FOREST PLOTS[1]

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Nest-site selection in birds is a function of various factors, e.g., philopatry, microclimate, degree of concealment from predators, and density and characteristics of vegetation (Welty and Baptista 1988, Gill 1990). Recently, Erckmann et al. (1990) tested experimentally whether old nests were used by Red-winged Blackbirds (*Agelaius phoeniceus*) as cues to assess the quality of habitat for placement of nest-sites ("old-nest" hypothesis). They concluded that old nests were of little or no importance as cues in nest-site selection, based on their findings that nest densities did not necessarily increase in plots containing old nests compared to plots without old nests. Moreover, Erckmann et al. (1990) recommended that the old-nest hypothesis be examined in other avian species.

Management of small (1 ha), even-aged plots for Ruffed Grouse (*Bonasa umbellus*) habitat via forest clear-cutting creates suitable habitat for an assemblage of breeding-bird species that are adapted to nesting in brushy vegetation or along edges (Yahner 1987, 1991). Several of these species, such as Gray Catbirds (*Dumetella carolinensis*) and Field Sparrows (*Spizella pusilla*), arrive on breeding grounds prior to complete leaf-out of vegetation. Furthermore, above-ground nests established during the previous breeding season in even-aged plots can remain intact on nesting substrate into the subsequent breeding season (R. H. Yahner, pers. observ.). Thus, old bird nests may serve as indirect cues of habitat suitability to these birds when establishing nest-sites (after Cody 1985). If this were the case, then I would predict that birds arriving in spring would preferentially select even-aged plots with higher densities of old nests than those with lower densities. In this study, I tested whether numbers of nests established by birds of all species combined in even-aged plots were affected by removing or increasing the numbers of old nests from the previous breeding season.

My study was conducted on a 240-ha portion of the Barrens Grouse Habitat Management Area (HMA), State Game Lands 176, Centre County, Pennsylvania (Yahner 1991). The study area was located within the treated sector of the Barrens Grouse HMA, which was managed by the Pennsylvania Game Commission since 1976 using an even-aged system of forest clear-cutting to create habitat for Ruffed Grouse (Yahner 1991). The study area contained 60 contiguous, 4-ha blocks; each block was subdivided into four 1-ha (100- × 100-m) plots arranged in a clockwise pattern (termed plots A–D). Plot A (western plot) was clear-cut in winter 1976–1977, plot B (northern plot) in winter 1980–1981, and plot C (eastern plot) in winters 1985–1986 or 1986–1987; plot D (southern plot) consisted of 60-year-old forest stands. This resulted in a checkerboard pattern of four age classes in each block (Yahner 1991).

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TABLE 1. Total number of nests, median number of nests/plot, and range of nests/plot established by birds in control, removal, and supplemental groups (n = 10 plots/group) in central Pennsylvania during 1990 and 1991.

	Control		Removal		Supplemental	
	1990	1991	1990	1991	1990	1991
Total no. nests	83	64	87	69	72	69
Median no. nests/plot	9.5	6.5	9.0	6.0	8.5	7.5
Range of nests/plot	2–10	2–12	5–12	1–19	1–11	2–13

Overstory trees (>7.5 cm dbh and >1.5 m tall) in uncut plots were primarily bigtooth aspen (*Populus grandidentata*), quaking aspen (*P. tremuloides*), and pitch pine (*Pinus rigida*). Major understory (2.5–7.5 cm dbh) and shrubs (≤2.5 cm in diam) in all plots were aspen, dwarf chinkapin (*Quercus prinoides*), scrub oak (*Q. ilicifolia*), black cherry (*Prunus serotina*), and blueberry (*Vaccinium* spp.) (Yahner and Cypher 1987, Yahner et al. 1989). Common bird species nesting above ground level in clear-cut plots included Gray Catbird, Rufous-sided Towhee (*Pipilo erythrophthalmus*), Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Common Yellowthroat (*Geothlypis trichas*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Golden-winged Warbler (*Vermivora chrysoptera*), and Field Sparrow (Yahner 1991).

I selected 30 random plots (plot C) in the study area. This age class was selected because plots contained relatively high densities of aboveground nests (Yahner 1991). The 30 plots were randomly separated into three groups of 10, corresponding to control, removal, and supplemental groups.

Nest searches were conducted during late January–February 1991 to estimate the number of nests established by birds in each plot of control, removal, and supplemental groups during the 1990 breeding season. Nest searches were made in these months because aboveground foliage was sparce or absent on nesting substrates, thereby facilitating the detection of nests by investigators. A team of two to five investigators searched each plot for aboveground (0.1–3 m in height), open-cup nests by walking at a slow (2–3 km/hr) pace, in a zigzag fashion, and at a spacing of 2–3 m apart, giving approximately 2–2.5 person hr/plot (Yahner 1991). When an above-ground nest of the 1990 breeding season was found (hereafter termed a 1990 nest), its distance (m) from the nearest plot boundary, height (cm) above ground, species of substrate used for nest placement, and bird species that established the nest (if possible) were noted. A few nests presumably established by birds prior to 1990 were not included in the data set; these were distinguished from 1990 nests by obvious differences in degree of deterioration (Yahner 1982).

The 1990 nests found during the 1991 nest search in both control and supplemental groups were marked with a small metal tag imprinted with a unique number for future identification and were left undisturbed in the field at the site of establishment. All 1990 nests located in the removal group (n = 83) were carefully removed from the nesting substrate; if necessary, these nests were reinforced with chicken wire painted flat black (after Yahner and Cypher 1987). The 83 nests then were randomly divided into 10 subsets (n = 8–9 nests/subset), and one subset was placed in each of the 10 plots of the supplemental group prior to the 1991 breeding season (early March 1991). Care was taken to position these nests at the same distance from the plot boundary and height above ground (attached with a small amount of green wire, after Yahner and Cypher 1987) and, if possible, in the same species of substrate in which it was found originally in the 1991 nest search.

Nest searches again were conducted during late January–February 1992 to estimate the number of nests established by birds in the 30 plots of the control, removal, and supplemental groups during the 1991 breeding season (termed 1991 nests), following identical procedures used during the 1991 breeding season (termed 1991 nests), following identical procedures used during the 1991 nest search. In addition, the number of nests marked or added to plots in control and supplemental groups during 1991 were counted during the 1992 nest search to give information on longevity of nests in the field.

I compared the number of nests established by birds between groups (control, removal, and supplemental) in each year separately (1990 versus 1991 nests) using Mann-Whitney U-tests (Sokal and Rohlf 1981). These analyses determined if the number of nests established by birds in the 1990 breeding season differed among groups prior to experimental manipulation of nest numbers during 1991 and if this trend continued in the 1991 breeding season. To test if the number of nests established by birds were affected by numbers of nests remaining from the previous breeding season, I contrasted the number of 1990 nests to the number of 1991 nests in control, removal, and supplemental groups separately using Wilcoxon's signed-ranks tests (Sokal and Rohlf 1981).

In the 30 plots in 1990 and 1991, 242 and 202 nests were established by birds, respectively (Table 1). The annual number of nests established per plot ranged from one to 19. The species of bird constructing nests were determined for 78 of 202 nests established in 1991, including Gray Catbird (12%, n = 25/202), Field Sparrow (9%, n = 18/202), and Rufous-sided Towhee (8%, n = 13/202). Only 5% of the nests noted during the 1991 nest search were relocated in the 1992 nest search (then two-year-old nests); metal tags but no nest material from an additional 22% of these nests were found again during the 1992 nest search.

The median number of 1990 nests established by birds ranged from 8.5 nests/plot in the supplemental group to 9.5 nests/plot in the control group (Table 1).

However, the number of 1990 nests/plot did not vary between groups ($P > 0.05$, Mann-Whitney U-test), supporting the contention that the number of nests established by birds in each of the three groups of plots during the 1990 breeding season were similar before manipulation of nest numbers in 1991. This also suggested that density and characteristics of vegetation used as nesting habitat were similar among the three groups of plots in my study area.

The median number of 1991 nests established by birds varied from 6.0 nests/plot in the removal group to 7.5 nests/plot in the supplemental group (Table 1). As with the 1990 nests, the number of 1991 nests/plot did not differ between groups ($P > 0.05$). Furthermore, the number of nests established by birds in each group considered separately did not vary between 1990 and 1991 ($P > 0.05$, Wilcoxon's signed-ranks test). Thus, despite a presumed absence of old nests in the removal group and an increase in the number of nests in the supplemental group, the number of nests established by birds in the 1991 breeding season in these two groups was comparable to that in the control group.

I conclude that the number of nests established by the breeding-bird community in small, even-aged plots is not affected by the relative density of old nests. Moreover, I do not believe that old nests act as a proximate cue to the suitability of a habitat for nesting birds in even-aged plots. Similarly, Erckmann et al. (1990) found little support for the old-nest hypothesis in nesting Red-winged Blackbirds using marshes in Washington. Other features of the nesting habitat, such as degree of vegetative concealment in the vicinity of nest-sites or distance of nests from edges, presumably are more relevant to nest-site selection by Gray Catbirds and coexisting species in even-aged plots (Yahner 1987, 1991).

The results of my study obviously depend on success at locating nests in the field. Because nest searches were conducted when vegetative cover was minimal or nonexistent, and because searches in each plot were done slowly and systematically, I am confident that most nests, or at least a similar proportion of the total, were found each year. That relatively few (5%) of the nests that were found or placed in 1991 were relocated in 1992 suggested that even if nests act as possible cues for nest-site selection, they would be effective for no more than two breeding seasons.

A criticism of my study may be that I did not focus on individual species. I considered all species concurrently for two reasons. First, unlike nests of colonial nesting birds (e.g., Red-winged Blackbirds, Erckmann et al. 1990), those of birds in even-aged plots were less common and more widely dispersed. This gave small sample sizes per species. Gray Catbirds, for instance, occupy discrete territories and seldom occur in densities of greater than one pair/ha (e.g., Nickell 1965, Yahner 1986). Thus, nests of all species were considered concurrently to provide adequate sample sizes for statistical analyses.

Second, even-aged plots in central Pennsylvania contain an assemblage of bird species that are adapted to similar brushy vegetation or edges (Yahner 1986, 1987, 1991). Therefore, if the number of nests remaining from the previous breeding season served as cues for nest-site selection by birds in even-aged plots, perhaps any nest placed in vegetation and relatively close to ground level could be interpreted by a variety of coexisting species as a measure of habitat suitability. For example, two abundant and coexisting species that nest in shelterbelts of farmlands in the midwestern United States, the Mourning Dove (*Zenaida macroura*) and the American Robin (*Turdus migratorius*), exhibit pronounced similarities in nest placement (Yahner 1982). This suggests that both species use similar cues in nest-site selection.

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