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NEST PLACEMENT IN SAGE THRASHERS, SAGE SPARROWS AND BREWER'S SPARROWS

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Aside from the obvious variation in nest placement among species (Preston 1946, Preston and Norris 1947, Cruickshank 1956), nest-site selection may vary among individuals of a population (Preston and Norris 1947) or between early and later nests in a population during 1 season (Nice 1937, Best 1978, Rich 1978). Factors affecting nest placement may be primarily ecological (Goddard and Board 1967, Holcomb and Twiest 1968, Burger and Shisler 1978, Evans 1978, McCrimmon 1978), geographical (Schaefer 1976) or related to the thermal environment (Ricklefs and Hainsworth 1969; Calder 1973, 1974; Austin 1974, 1976). Differential success of nests placed in different sites may influence the evolution of nest placement within a species (Goddard and Board 1967, Holcomb and Twiest 1968, Austin 1974, Caccamise 1977, Best 1978, Evans 1978).

In this paper I present preliminary information on nest placement in the Sage Thrasher (*Oreoscoptes montanus*), Sage Sparrow (*Amphispiza belli*) and Brewer's Sparrow (*Spizella breweri*). These 3 species are reported to require sagebrush (*Artemisia* sp.) habitat for successful breeding (Braun et al. 1976). Although more information on these species is becoming available (Trost et al. 1975; Reynolds and Rich 1978; Rich 1977, 1978) the continuing destruction of sagebrush habitat for agricultural purposes necessitates continuing study of their biology.

MATERIALS AND METHODS

The study was conducted on a 50-ha study area northwest of Blackfoot, Bingham Co., Idaho, from March to July of 1976 and 1977. Habitat on the study area is described by Kuchler (1964) as sagebrush steppe dominated by sagebrush (*A. tridentata*). The grasses, *Poa sandbergii*, *Sitanion hystrix* and *Agropyron spicatum*, were common.

Nests were found incidental to other research, which involved repeated and thorough traversing of the study area. For both active and old nests (when attributable to a specific bird species) from previous years 6 variables were measured: (1) height from ground to bottom of nest, (2) height of sage containing nest, (3) circumference of sage, (4) distance from the edge of nest sage to next 2 nearest sage, (5) location of nest in the study area, and (6) height from bottom of nest to top of sage containing the nest. The last variable was termed "cover height," though it is not strictly a measure of cover for Brewer's and Sage sparrows. These sparrows place their nests towards the edge of the sage so that the maximum sage height is not, necessarily, directly over their nests. To facilitate comparisons thrasher nests were considered as either ground nests or sage nests. A 1-way analysis of variance was then performed on each variable for the 4 groups. The Student-Newman-Keuls multiple range test for unequal sample sizes was used to compare means when a significant F value resulted

TABLE 1
MEAN (±SD) NEST, SAGE AND COVER HEIGHT

Species	N	Nest height (cm)	Sage height (cm)	Cover height (cm)
Sage Sparrow	14	19.6 ± 10.9[a]	67.1 ± 8.4	47.4 ± 9.2
Brewer's Sparrow	27	28.2 ± 7.7	66.9 ± 11.3[b]	38.7 ± 10.9
Sage Thrasher-ground	61	0.0 ± 0.0	69.2 ± 12.0[b]	69.2 ± 12.0
Sage Thrasher-sage	114	23.1 ± 9.9[a]	83.6 ± 14.4	60.5 ± 11.5

[a] Not significantly different at $P \leq 0.05$.
[b] Not significantly different at $P \leq 0.05$. (All other pairs within a category significantly different at $P \leq 0.05$.)

from the analysis of variance (Zar 1974). Simple linear regressions were computed for the relationship between the independent variable—sage height, and the dependent variables—nest and cover height. A Chi-square goodness-of-fit test to the Poisson distribution was made for the horizontal distribution of thrasher nests with units of 0.25 ha and 1.00 ha (Zar 1974). Distribution of Brewer's and Sage sparrow nests was not examined, due to their small sample sizes.

A vegetation profile was constructed from 165 sample points along a single transect which bisected the study area. A 2-m rod marked at 1 dm intervals was placed vertically every 3 m and the total number of contacts with dead and live vegetation was recorded. Percentage cover of plant species was determined according to Daubenmire (1959). Four 50-m transects were positioned so as to sample what appeared to be the most and least dense vegetation in the study area.

RESULTS

Nest and sage height.—All nests were found either in or beneath sage. Of the measurements taken only nest height, sage height and cover height had significant F values. Table 1 presents statistics for nest placement and the results of the multiple range tests. Sage Sparrow (SS), Brewer's Sparrow (BS) and thrasher nests on the ground (STg) were in sage of the same height but each was at a different height within the sage—STg being the lowest, SS intermediate and BS highest. Sage-nesting thrasher nests (STs) were placed in taller sage than SS nests, but nests of the 2 were placed at the same height above the ground. Cover height was significantly different for each group. Thus, each group selected a unique site vertically in the sage.

For BS, SS and STs there was a tendency for birds to nest higher in taller sage (Fig. 1). Increasing height of cover above the nest with higher nests was shown for STs and BS. Comparison of the 2 regression lines—cover height and nest height—for each species indicates a preference, not for a constant height but rather for a proportion of the sage height available. The above comparison also reveals the influence that sage height alone has on nest-site selection.

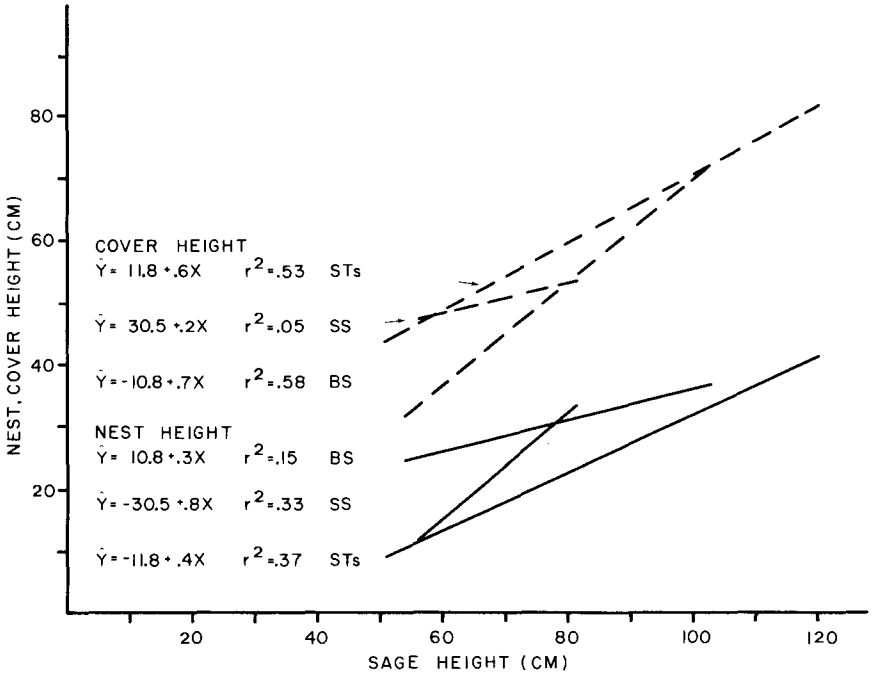

FIG. 1. Linear regressions of nest and cover height on sage height for Sage Sparrows (SS), Brewer's Sparrows (BS) and sage-nesting Sage Thrashers (STs).

Vegetation profile.—The resemblance between nest height frequency profile and vegetation profile suggests the importance to Sage Thrashers of having dense vegetation surround the nest (Fig. 2). Vegetation in the first interval was primarily grass, while the rest of the profile represents sage only. Both SS and STs nests were in the densest part of the sage, whereas BS nests were towards the edge of the densest portion. STg nests were placed in the relatively dense grass beneath the sage.

Horizontal distribution of thrasher nests.—To examine effects of larger scale differences in sage density and/or height on placement of nests I compared the number of nests in each 0.25 ha to the number in a random distribution. The nests were randomly distributed over the study area with a significant goodness-of-fit to the Poisson distribution (N = 164, χ^2 = 4.5584, df = 3, $P > 0.10$. The variance to mean ratio was 1.1528—close to the theoretical value of 1.0000. Similar results were obtained with units of 1.00 ha.

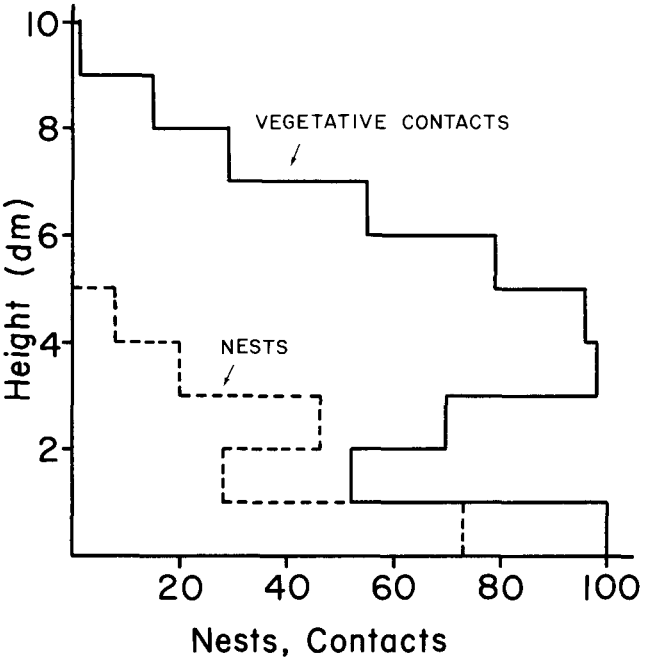

FIG. 2. Vertical vegetation density profile of the habitat and vertical frequency distribution of 175 Sage Thrasher nests.

DISCUSSION

Each of the 3 species, as well as the 2 subsets of thrashers, located their nests in a unique position vertically within the habitat. This may have been a result of interspecific competition for nest-sites (Burger and Shisler 1978), as the 3 species had broadly overlapping territories in the study area. However, the spacing of nests and density of sage did not suggest a shortage of sites. On the 50-ha study area there was about 1 nest per 1.25 ha for all species. The 4 vegetation transects revealed that sage covered from 11–44% of the study area, depending on the transect. Since the sage appeared rather evenly distributed each pair of birds had a computed 0.14–0.55 ha of "pure" sage in which to find a suitable site. Also, the breeding schedules for the 2 more abundant species did not overlap appreciably. Thrashers began laying in late April and early May, while Brewer's Sparrows did not begin laying until early June. Furthermore, if the random distribution of thrasher nests was not a sampling ar-

tifact at least this species seemed to find suitable sites everywhere in the study area.

Nest size.—Gross size of nests may have played a major role in vertical placement differences among the species. Thrashers built rather large nests of coarse sticks roughly 20 cm in diameter and 10 cm deep, requiring a site devoid of leaves and with substantial support. Ground nests benefited from both the support of the entire ground and the gap in foliage density (Fig. 2) which occurred slightly above the ground. Nests placed off the ground tended to be supported by the main branches of sage. The lack of large supporting branches higher in the sage may explain why frequency of nests decreased faster than vegetation density at greater heights (Fig. 2).

Sage Sparrows built smaller grass nests about 12 cm in diameter and 5 cm deep, which were supported by smaller branches. Although nests of this species were at the same mean height as STs nests they were placed more to the periphery of the sage where branches were smaller. Brewer's Sparrows built the smallest nests, about 8 cm in diameter and 4 cm deep. Their nests were located in the finest growth near the edge of the sage.

Vegetation and thermal environment.—For Sage Sparrows and certainly for thrashers it was important to maintain a certain density of vegetation around and above the nest (Fig. 2). This may have been variously related to wind protection, shading and heat loss. Overhead cover may also have been important in reducing heat loss from adults at night (Calder 1973) although this factor may not be as important as initially thought (Smith et al. 1974). Since Brewer's Sparrows nested in the most recent growth of individual sage there was less vegetation above their nests than above those of other species. Heat dissipation from the nest as a result of wind (Ricklefs and Hainsworth 1969, Austin 1974) may have been more important to Brewer's Sparrows. They nested relatively late in the year when air temperatures were at their maximum.

Of particular interest is H.W. Henshaw's (1875) observation of a platform of twigs placed 8 in above a thrasher nest so as ". . . to screen the setting bird from the rays of the almost tropical sun." I found 4 such platforms, 2 of which were almost certainly nests of a previous year. In the 2 other cases the platforms were too decomposed to permit identification. Only through direct observation would it be possible to claim that shading platforms were deliberately constructed for that purpose. More likely, sites which will benefit from the shade of a previous year's nest are selected.

Thrasher nest shifts.—Possibly, thrashers build later nests higher in the sage to benefit from cooler air temperatures off the ground and higher rates of wind-facilitated heat dissipation (Rich 1978). An increase in nest

height as the season progresses has been reported for several other species (Best 1978, references in Welty 1975:272–3). This has been attributed to foliage development whereby the growth, e.g., of grass, provides cover at greater heights (Walkinshaw 1968). Best (1978) found this growth inadequate to explain the shift in Field Sparrow (*Spizella pusilla*) nests. In the present study the vertical growth of grass and forbs between the time of early and late nesting would not have been appreciable. Though sage is an evergreen species it does produce a growth of deciduous leaves each year (D. Wilde, pers. comm.). The chronology and extent of this growth are not known but could be important.

SUMMARY

Sage Sparrows, Brewer's Sparrows, ground-nesting and sage-nesting Sage Thrashers each selected a unique vertical position for nest placement in their sagebrush habitat. All nests were located in or beneath sagebrush. Each species nested higher in taller sagebrush. Sage-nesting thrashers and Brewer's Sparrows also had more cover over the nest in higher sage. This indicated their preference for placing a nest at a proportion of the sage height available, rather than at a constant height. Sage Thrashers and Sage Sparrows selected sites within the densest portion of the sage while Brewer's Sparrows selected sites above the densest portion. Sage Thrasher nest height frequency profile corresponded well with the vertical vegetation density profile. Though the species' territories overlapped extensively there seemed to be enough sage for each pair of birds so that interspecific competition for nest-sites did not have to occur. Nest size differences among the species may have been one of the most important factors influencing vertical placement.

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