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BREWER'S SPARROW NEST-SITE CHARACTERISTICS IN A SAGEBRUSH COMMUNITY

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The Brewer's Sparrow (*Spizella breweri*) breeds commonly in sagebrush steppes of western North America (Wiens and Rotenberry 1981), although it also has been recorded in fields with little or no sagebrush (Beaver 1976). Best (1972), Schroeder and Sturges (1975), Rich (1980), Reynolds (1981), and Castrale (1982) documented several aspects of Brewer's Sparrow nesting substrates and nest placement. To further our understanding of nest-site selection by this species, we (1) measured nest-site characteristics in a sagebrush community in southeastern Idaho, (2) assessed nest-site preferences by comparing data at and near nests with samples of available habitat, and (3) measured features of vicinities of nests as well as nesting substrates and placement within substrates.

STUDY AREA AND METHODS

The Idaho National Engineering Laboratory (INEL) site is at an elevation of about 1500 m on the upper Snake River plain. The study area was within the INEL site, approximately 11 km south of Howe, Butte County, Idaho. Four 6.25-ha plots were established on the area and gridded at 25-m intervals. Plots were approximately 200 m apart.

Vegetation on the area was dominated by big sagebrush (*Artemisia tridentata*). Predominant grass species included bluebunch wheatgrass (*Agropyron spicatum*) and Indian rice grass (*Oryzopsis hymenoides*); forbs were a relatively minor component of the flora. Plant litter was primarily scattered wood from dead sagebrush plants; much of the ground was bare.

Study plots were searched for nests at 2-week intervals during May and June of 1980–1982. Because two plots were burned in the fall of 1981, only data from the two unburned plots are reported for 1982. Weighted, plastic streamers, attached to a 12-m rope, were dragged through the vegetation to flush birds from nests. Some nests were located by observing nest construction or feeding of young; others were discovered incidental to other activities.

Canopy coverage and dispersion of sagebrush on the study area were estimated each June by line intercept (Canfield 1941). In 1980 and 1981, 100 regularly spaced samples (25/plot) were taken near grid markers; an additional 20 samples (10/plot) were obtained in 1982. Different grid markers were used each year. Line intercept and distance between adjacent shrubs were recorded along a tape extending 5 m N, E, S, and W from each sampling point. For each sampling locus, the coefficient of variation of intershrub distances was used as an index of dispersion; the greater the index, the more clumped the shrubs.

Percent coverage of herbaceous vegetation, litter, and bare ground

also were measured in June within 20 × 50-cm sample quadrats (Daubenmire 1959). In 1980, 2 samples, and in 1981 and 1982, 4 samples were taken near each grid marker. We measured the height of all sagebrush plants within quadrats. Additionally, each shrub was recorded as dead or with 25, 50, 75, or 100% of the shrub living. For shrubs with foliage, we estimated foliage density as sparse (1), moderate (2), or dense (3). The continuity of the canopy (presence or absence of large gaps) of each shrub also was recorded.

In 1981 and 1982, we estimated coverage of herbaceous vegetation, bare ground, and litter (Daubenmire 1959) at 2.5 and 5 m N, E, S, and W of each active nest. This was done soon after nests were discovered. In July, after the breeding season, the same data were recorded for shrubs supporting nests as for those within quadrats on the study area in general. Also, we estimated canopy coverage and dispersion of sagebrush in nest vicinities by extending a tape 5 m N, E, S, and W from each nest. The height of each shrub intercepting the tape also was recorded. Individual sagebrush plants did not change significantly during the breeding season; thus, shrub data collected at and near nests in July accurately describe nest sites at the time sparrows selected them.

All measures of nest placement within the nesting substrate also were made in July after the breeding season. Nest height (ground to nest rim), distance from the nest rim to the top of the shrub, shortest horizontal distance from the center of the nest to the periphery of the shrub, and number and diameter of supporting branches were recorded.

T-tests and chi-square analyses were used to compare nest sites with the representative sample of vegetation from the study area. Statistically significant, between-year differences in the data were rare; thus, unless stated otherwise, we pooled data from all years. All means are reported plus or minus one standard deviation; statistical significance was set at $P \leq .05$.

RESULTS AND DISCUSSION

Vicinity of nest.—Sagebrush coverage and height of individual shrubs near Brewer's Sparrow nests were greater than on the study area in general (Table 1). Tall, dense sagebrush near the nest may conceal the nest and the adults' activities near the nest. Mean herbaceous plant coverage and bare ground were less around Brewer's Sparrow nests than on the study area. This may have resulted from selective preferences of the birds and/or from the tendency of areas with dense sagebrush to have less herbaceous vegetation ($r = -.27$, $df = 218$, $P < .001$) and bare ground ($r = -.22$, $P < .001$).

Nest substrate.—All nests were in big sagebrush plants. Mean nest-shrub height was markedly greater than the mean of the representative sample of shrubs (nest shrubs: $\bar{x} = 69 \pm 15$ cm, range = 42–104, n = 58; rep. sample: $\bar{x} = 43 \pm 18$ cm, range = 8–127, n = 3053; $t = 10.9$, df = 3109). Although shrubs less than 50 cm tall comprised 70% of all those available, they rarely were used for nesting (7% of all nest shrubs).

TABLE 1. Habitat characteristics near Brewer's Sparrow nests and on the study area in general.

	Brewer's Sparrow			Representative sample		
	$\bar{x}$	SD	n	$\bar{x}$	SD	n
Sagebrush coverage (%)	29*[a]	10	58	26	10	220
Shrub dispersion (%)[b]	78	15	58	78	19	220
Shrub height (cm)	54*	21	1286	43	18	3053
Herbaceous plant coverage (%)	8*	10	256	10	12	2904[c]
Litter coverage (%)	7	9	256	6	8	2904[c]
Bare ground (%)	46*	32	256	53	30	2904[c]

[a] * = Significantly different ($P \leq .05$, *t*-test) from representative sample.
[b] Coefficient of variation of intershrub distances.
[c] 1981 and 1982 data only.

Small shrubs may not provide sufficient cover above the nest (see below). Shrubs more than 104 cm tall were not used as nesting substrates, but they occurred infrequently (less than 1% of all available shrubs). Also, very large shrubs have spreading, open branching structure that may decrease their attractiveness as nest sites.

Brewer's Sparrows preferred to nest in shrubs that were entirely or mostly alive (Table 2); the distribution of nest shrubs among the condition classes differed from that of the representative sample of shrubs ($X^2 = 23.3$, df = 4). Some partly dead shrubs were used, but nests were not placed in the dead portions of the shrubs. Foliage of living shrubs may provide concealment from predators and cover from the elements. Best (1972) found that Brewer's Sparrows occasionally nested in herbicide-killed shrubs lacking foliage but having dense branching.

Although Brewer's Sparrows always nested within foliage, they did not, on the average, select shrubs with dense foliage ($\bar{x} = 1.9 \pm .5$). Mean foliage density of the representative sample of shrubs with foliage was $2.0 \pm .6$; the two means do not differ ($t = 1.26$, df = 2566). Evidently, most shrubs on the study area had foliage of sufficient density to be suitable for nesting.

TABLE 2. Condition of Brewer's Sparrow nest shrubs and a representative sample of shrubs. Values represent percent of total sample.

	Brewer's Sparrow (n = 58)	Representative sample (n = 3043)
Dead	0	18
25% live	0	6
50% live	7	13
75% live	22	15
100% live	71	48

Canopy continuity of shrubs seemed influenced by shrub size. Thus, in the representative sample, we considered only shrubs within the size range used for nesting. Of 1363 shrubs, 678 (50%) had gaps in their canopies; the rest had continuous crowns. Brewer's Sparrows showed no preference for shrubs with either continuous or discontinuous crowns. Twenty-nine (50%) nest shrubs had gaps in their canopies; the others did not.

Nest placement.—Ninety percent of Brewer's Sparrow nests (n = 58) were placed between 20 and 50 cm high ($\bar{x}$ = 39 ± 10 cm). This height range includes the most dense portion of the nest-site vegetation profile (Petersen and Best, unpubl. data). No Brewer's Sparrow nests were found below 20 cm. Nests were situated, on the average, 18 ± 5 cm horizontally from the periphery of the nest shrub and 24 ± 7 cm from the top. Mean number of branches supporting each nest was 5 ± 2, and the diameter of these branches averaged 8 ± 4 mm.

Many studies have documented an increase in nest height with progression of the breeding season (e.g., Best 1978, Nolan 1978, Gates 1979). We observed a similar, significant trend for Brewer's Sparrows. Forty-five nests initiated on or before 15 June averaged 38 ± 8 cm high, but mean height of 10 nests initiated after 15 June was 44 ± 14 cm (one-tailed t = 1.83, df = 53). Seasonal increases in nest height usually are attributed to increased vegetation height or foliage development on shrubs and trees (Best 1978, Nolan 1978, Gates 1979). But big sagebrush is an evergreen, and shrubs did not grow significantly over the course of the study. Thus, the increase in Brewer's Sparrow nest height likely did not result from vegetation development. Changing microclimatic conditions (Horvath 1964, Rich 1978) and increased pressure from ground-dwelling predators (Nolan 1978) have been implicated in some increases in nest height. The shift we documented in nest height was not paralleled by a shift in distance from the nest to the top of the shrub (early nests: $\bar{x}$ = 24 ± 7 cm, late nests: $\bar{x}$ = 24 ± 6 cm), suggesting the importance of a minimum amount of vegetative cover above the nest.

SUMMARY

Brewer's Sparrow nest-site characteristics were studied in southeastern Idaho during 1980–1982. Sagebrush in the vicinity of nest shrubs was taller and more dense than on the study area in general, whereas coverage of herbaceous plants and bare ground were less. Brewer's Sparrows strongly preferred to nest in relatively large, living shrubs. Additionally, nest placement with respect to the ground and the top of the shrub was quite specific. We documented a modest seasonal increase in nest height.

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