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PATTERNS OF MICROHABITAT USE BY *SOREX MONTICOLUS* IN SUMMER

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Sorex monticolus is found from Alaska to Mexico in a variety of montane and boreal habitats (Hennings and Hoffmann 1977). In previous characterizations of microhabitat used by this species, few measures of physical or vegetative structure were significantly correlated with captures of *S. monticolus*. Typically, only some measure of near-ground cover (or related variables) is significantly associated with abundance. *Sorex monticolus* favors habitats with dense ground cover but seems to have few other microhabitat requirements (Hawes 1977, Terry 1981, Gunther et al. 1983, Reichel 1986, Doyle 1989).

In most montane areas the annual cycle of snow accumulation and melting, followed by herbaceous growth and decay, causes large-scale changes in the near-ground environment. During summer rapid herbaceous growth greatly increases the area covered by dense, near-ground vegetation. Previous studies of microhabitat use by *S. monticolus* have not addressed temporal changes in habitat use relative to this change in available cover (Terry 1981, Doyle 1989).

During summer 1986, in conjunction with a study of microhabitat use by rodents in a montane area, we recorded 104 captures of shrews in Sherman live traps. These shrews all appeared similar, and 17 specimens, retained for positive identification, subsequently were identified as *S. monticolus*. Given the possibility that some of the shrews captured may have been another species, we used a binomial probability to calculate the proportion of the 104 captures that could be regarded as *S. monticolus;* at a .05 level of confidence at least 85% of shrews captured were *S. monticolus*. Based on this, we feel confident that the majority, if not all, of the shrews captured were *S. monticolus*. In this paper we examine temporal patterns of microhabitat use by these shrews during summer in relation to changes in microhabitat.

Study Area and Methods

The study site (111°37′N, 40°26′W) is on the east slope of Mount Timpanogos at an elevation of about 2400 m in Utah County, Utah. The habitat includes stands of aspen (*Populus tremuloides*) and Douglas fir (*Pseudotsuga menziesii*) interspersed with herbaceous meadows and shrub-dominated ridges (principally snowberry, *Symphoricarpos albus*). Three trap grids were located in separate areas considered similar in overall habitat structure. Each grid covered 1 ha and contained 100 trap stations arranged in 10 rows of 10 each. Two folding Sherman traps were placed at each station, and stations were 10 m apart. Grids were trapped in a rotating fashion (see Belk et al. 1988 for details). Trapping began in early June, immediately after snowmelt, and continued until mid-September, resulting in 13,800 trap nights.

Nineteen habitat variables were measured at each trap site characterizing live woody structure (trees and shrubs), dead woody structure (fallen logs), and herbaceous cover and height (see Belk et al. 1988 for details). Five variables were correlated with shrew captures at the .10 level of significance during at least one month. These variables—percent canopy cover, average overstory tree size, average understory tree size, density of fallen logs, and number of woody species—were analyzed with principal-components analysis (SAS Institute, Inc. 1985). Two components had eigenvalues greater than one, but shrews exhibited little variation of habitat use on the second component (all means near

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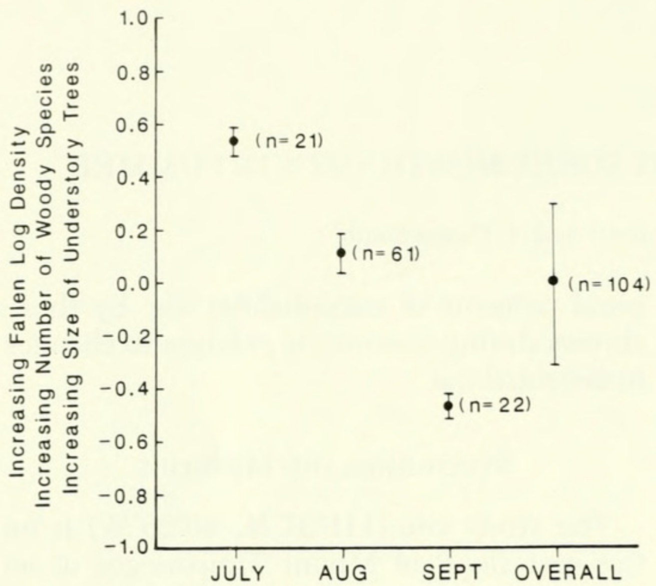

Fig. 1. Distribution of means and 95% confidence intervals of habitat use by shrews on the first principal component for July, August, September, and the entire summer combined.

zero). Accordingly, habitat use by shrews was interpreted only on the first principal component. This component (variable loadings in parentheses) described a gradient of increasing density of fallen logs (0.596), increasing number of woody species (0.628), and increasing size of understory trees (0.415).

Results

No shrews were captured in June; 21, 61, and 22 captures of shrews were recorded for July, August, and September, respectively. Mean habitat use for the entire summer plotted on the first component appeared no different from a random sample (Fig. 1). However, investigation of habitat use partitioned by months revealed temporal variation in habitat use (Fig. 1). Thus, the pattern of habitat use generated from the entire sample was an artifact caused by averaging over time. Habitat used by shrews for each month was much less variable (variance ranged from 0.03 to 0.07) than simulated random samples, with sample sizes about equal to those observed for shrews (variance ranged from 1.28 to 1.81 for five simulations). Thus, it appears that shrews were using the habitat nonrandomly, and observed patterns of variation were not merely artifacts of limited samples.

Habitat use in July was characterized by areas with higher densities of fallen logs, greater numbers of woody species, and larger size of understory trees. This was characteristic of shrubby areas in earlier stages of succession. In August mean habitat use was close to the overall mean of available habitat, representing areas with intermediate values of habitat variables. In September shrews used habitat with lower densities of fallen logs, fewer numbers of woody species, and smaller understory trees, representing areas dominated by climax aspen stands (Fig. 1).

Discussion

No variable or combination of variables was characteristic of habitat used by shrews across all months. Rather, since characteristics of woody vegetation changed little during the summer, it appears shrews are responding to temporal change in the near-ground environment caused by rapid herbaceous growth during early to mid-summer (occurring first in open areas), followed by dessication and matting down of herbaceous growth as autumn approaches. In early summer, soon after snowmelt, areas lacking woody vegetation were mostly bare, having only a thin, compacted layer of litter. Correspondingly, habitat used by shrews included woody ground cover such as fallen logs and shrubs. At the height of the summer season, a few weeks later, herbaceous growth 0.5–1.5 m high covered the entire study area, and most of the habitat was probably suitable for use by shrews. By September herbaceous growth persisted in mesic sites under dense canopies provided by aspen stands, but herbaceous cover in open areas was declining. Accordingly, habitat used by shrews shifted toward areas dominated by mature aspen stands. Such tracking of ground cover by *S. monticolus* accords with previous descriptions of microhabitat use by this species (Terry 1981, Doyle 1989).

Comparison of patterns of microhabitat use between shrews and four species of rodents (*Peromyscus maniculatus*, *Zapus princeps*, *Clethrionomys gapperi*, and *Microtus montanus*) in the same area reveals a strong contrast. Rodent abundance was strongly correlated with 13 habitat variables, and rodents showed strong patterns of habitat partitioning based on these variables (Belk et al. 1988).

Shrew captures were weakly correlated with only five variables and showed relatively little variation on these variables. In this study area coexistence of several rodents may necessitate habitat partitioning, whereas *S. monticolus* appears to be the only shrew in the area (at least other species are rare). However, even when other species of shrews are present, *S. monticolus* is only weakly associated with measurements of physical or vegetative structure (Terry 1981, Doyle 1989). In conclusion, use of microhabitat by *S. monticolus* is strongly affected by temporal variation in distribution of ground cover, and this should be taken into account in future studies of microhabitat use and partitioning by shrews.

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