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Winter Homes
Southern bats challenge foresters by switching habitat
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Little is known about the winter roosting habits of most North American forest bats. Many species migrate to warmer climes or hibernate in caves or human-made structures during winter. As a result, most bat research in temperate climates has been conducted during summer, and land managers rely heavily on this summer data for their year-round management strategies. Our research suggests this can be a risky approach for some forest bats since information gathered from summer studies may not apply in other seasons.

Summer studies of various tree-roosting species have shown that they typically choose larger-than-average trees. Limited research, however, suggests quite different roost selection in winter, presumably to find more suitable thermal conditions.

Indiana bats (*Myotis sodalis*), for example, use snags as summer roosts but switch to mines and caves for winter hibernacula. Red bats (*Lasiurus borealis*) usually roost in the foliage of hardwood trees in summer but have been reported winter-roosting in leaf litter in five states from Arkansas to Illinois, suggesting this may be common for the species. The winter ecology of other foliage-roosting bats remains relatively unknown.

Our study, funded in part by BCI's North American Bat Conservation Fund grants, examined winter roosts of Seminole bats (*Lasiurus seminolus*) in a managed forest landscape.

The research was conducted on property owned by the MeadWestvaco Corporation in the South Carolina counties of Charleston, Colleton and Dorchester. The study area is managed using MeadWestvaco's Ecosystem-Based Forestry approach, which creates a landscape of varied ages and timber types, both pine and hardwood. The goal is to provide diverse habitats across the company's managed forests to promote wildlife and biodiversity.

In the winters (January and February) of 2004 and 2005, we used mist nets over small ponds in the study area to capture Seminole bats and attached tiny radio-transmitters (each barely one-sixth the weight of a penny) to their backs. We radiotracked 12 male Seminole bats to 47 unique roost locations. These included: 13 roosts in the canopy of hardwood trees; two in the canopy of pine trees; six in hanging vines in the overstory; four in midstory trees; nine in pine-needle clusters suspended from understory vegetation; and 13 in the pine-leaf litter on the forest floor.

Bats using overstory hardwoods roosted near the top of the canopy on small branches near clusters of dead leaves, within clumps of Spanish moss or on vines hanging from high branches. Understory roosts were typically located beneath clusters of pine needles that had fallen from taller trees and had become suspended in low-hanging vines or branches. The needles formed a roof-like mat around and over the bat. Bats roosting on the forest floor were under about a half inch (1 centimeter) of pine-leaf litter. Canopy roosts were usually

located near the edge of older stands of mixed pine and hardwood, while roosts among pine needles or leaf litter were located inside young, dense stands of loblolly pine.

Summer studies, by contrast, have found Seminole bats roosting almost exclusively in overstory pine trees. Our research during the summers of 2003 and 2004 on this study area reached the same conclusion: All 104 Seminole bat roosts we observed were located in the canopy of live loblolly pines.

The few previous winter studies (undertaken nearly 50 years ago in Georgia and Florida) reported Seminole bats roosting exclusively in or on clumps of Spanish moss. Our use of radiotelemetry allowed us to detect a much greater variety of roost structures than previous researchers, who were mostly limited to direct observation.

Interestingly, there appeared to be a general relationship between temperature and height of the roost from the forest floor. The bats selected roosts in the canopy of hardwood trees on nights with minimum temperatures of more than 50 degrees F (10 degrees C). As temperatures fell, bats opted for roosts that provided additional shelter, often closer to the forest floor. During the coldest period of the study, when nighttime lows ranged from 39 to 20 degrees F (4 to -7 degrees C), many of the tracked bats chose roosts on or near the forest floor.

The seasonal changes in roost-site selection probably are part of a strategy to maintain maximum warmth during the winter days. Hardwood trees lose their foliage during winter, admitting much more sunlight than evergreen pines. Roost sites close to and on the forest floor offer warmer ambient temperatures and protection from wind during the coldest winter periods.

We also examined the minimum area that included all of the roost trees for each bat (roosting area) and documented dramatic seasonal differences. The average roosting area was considerably larger in winter than in summer. Bats in winter probably need larger areas to acquire the resources they need. In winter, each bat was observed roosting in various habitat types (both old hardwood and young pine stands) across the landscape. Summer roosts, however, were generally located within the same pine stand.

Future research to determine the winter roosting needs of female Seminole bats could prove especially useful, since their requirements might differ substantially from those of males.

Nonetheless, what we learned during this study has important implications for forest management. When implementing land-management activities, especially in winter, forest managers need to consider seasonal differences in roosting behavior of forest bats. Bats' use of understory trees and leaf litter in winter suggests that prescribed fire, a common forestry- and wildlife-management technique in southern forests, may adversely affect bat populations during certain times.

Many bat species have a low tolerance for roost disturbance. Such disturbance, as when driven from understory roosts by fire, expends critical winter fat stores and increases vulnerability to daytime predators. Winter burns also may result in direct mortality of torpid bats roosting on or near the ground. Many bats hibernate or enter prolonged periods of inactivity and may not be able to arouse from such states quickly enough to escape fire. However, the relationship between ambient temperature and roost-site selection could prove valuable in planning prescribed burns to avoid times when bats are most vulnerable.

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