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Forest Management Considerations for Bats in the Eastern United States

Authored by Angela Larsen-Gray, Ph.D., Darren Miller, Ph.D., Kevin Solarik, Ph.D., and Erik Schilling, Ph.D.

Introduction

Bats are the second most diverse group of mammals, with more than 1,400 species worldwide. The 19 forest bat species in the eastern United States face many threats, from wind energy turbines to habitat loss from land use change, primarily urbanization. However, for bats that hibernate in caves or mines, white-nose syndrome (WNS), an introduced fungal disease, has been the overwhelming cause of severe population declines, greater than 95% for some species. White-nose syndrome has been especially devastating to four bat species that depend on eastern forests; little brown, northern long-eared, Indiana, and tricolored bats. The good news is that, at the landscape scale, forest conditions and forest management are not limiting for these species. Further, many forest management activities can improve roosting and foraging habitat for bats.

Roosting and Foraging Habitat

Bats of eastern forests require areas for roosting, foraging for insect prey, and water (Figure 1). Specific requirements depend on bat species, season, and geography. Notably, conditions needed for roosting often differ from those for foraging, highlighting the importance of diverse forest structure at the stand, forest, and landscape scales. For example, older trees are valuable for roosting, while young forests or forest edges are well-suited for foraging.

Roosting areas need to be diverse to meet requirements of multiple bat species. While some species roost in tree cavities or under exfoliating tree bark, others roost in leaves of live and recently dead deciduous trees, pine needles, and Spanish moss (e.g., tricolored bats). Little brown and big brown bats opportunistically roost in human structures, such as houses, barns, bridges, and culverts. Rock crevices and outcrops may also be used for roosting by some species.

Although all bats in the eastern United States (U.S.) are insectivorous, they forage in different locations based on their body size, wing and jaw morphology, and echolocation characteristics. For example, hoary bats are **open-adapted foragers** that “hawk” insects in open areas -- above the tree canopy, over recent clearcut harvests or young forests, along forest edges and roads, or over water sources. In contrast, northern long-eared bats are **clutter-adapted**, meaning they thrive in structurally complex forest stands. These bats pluck (“glean”) insects from vegetation in older forests, cluttered midstory, and small forest openings. However, most species, including red and evening bats, are **generalists** that forage in various upland, riparian, open, ecotone, or cluttered conditions. Forest management that results in more open canopy conditions, such as thinning, provides foraging areas and increased insect availability for the widest array of bat species. Furthermore, it is the diverse structure maintained across a landscape by active forest management that provides roosting and foraging habitat for most bat species.

Open-adapted foragers

tend to be larger bats that forage in less cluttered environments, like open areas, edges, and regenerating forest stands.

Clutter-adapted foragers

tend to be smaller bats that can more easily maneuver among dense vegetation to forage.

Generalist foragers

forage across various conditions, including open, edge, and cluttered areas.

Importance of Riparian Areas

Particularly important for bats are riparian (streamside) areas, which can provide sites for roosting, foraging, and water in close proximity. Riparian areas are retained during forest harvesting operations, following state-approved forestry best management practices (BMPs). These riparian areas may constitute a substantial part of the forest landscape. For instance, in Minnesota, at least 5-20% of the overstory canopy within a harvested area is typically retained after harvest. Similarly, research conducted in Arkansas, Louisiana, and Texas reported an average of 19% retention within harvested units. While trees are often retained outside riparian areas, especially in stands without riparian areas, most retention in the eastern U.S. is within riparian areas.

Studies have revealed that most bat species exhibit increased foraging activity in or near riparian areas or other water features, irrespective of their unique adaptations. This preference is largely due to characteristics of riparian areas -- presence of older trees, standing dead trees (snags) with advanced decay, and diverse solar exposure conditions. These features are especially important in landscapes with limited forest cover or predominance of young forests. Additionally, in some regions, particularly the southeastern U.S., riparian areas can be very important for day-roosts for tricolored, southeastern myotis, Rafinesque big-eared, northern long-eared, and evening bats. In partially harvested stands, 90% of tricolored bat roosts were found in riparian buffers. Another study found that tricolored bats preferred to roost closer to streams, even in dense deciduous forests.

Management Enhancements for Bats

Forest management practices at the landscape scale can promote a diversity of stand ages, forest types, and stand structures (Figure 1). This is important because no single management strategy at the stand scale can adequately address all bat species' diverse life history requirements. However, specific practices and considerations at the site level can amplify the ecological value of these landscapes, where more than a dozen bat species may coexist.

Management Practices to Consider:

- Retain snags and live trees during harvesting operations to benefit multiple bat, bird, and various other wildlife species.
- Avoid harvest of a known, occupied maternity roost, and, if possible, leave an unharvested buffer (e.g., depending on the species, some states recommend 150 feet) around it to minimize disturbance. This is particularly important during the summer pup-rearing season (exact timing will differ based on species and location) when juveniles cannot fly.
- In areas where bats hibernate, maintain unharvested buffer areas near hibernacula for fall swarming and spring staging. Northern long-eared bats and Indiana bats usually stay within 5-10 miles of the hibernacula following the summer maternity season, though timing varies by physiographic province, latitude, and cave characteristics.¹
- Away from known, occupied maternity roosts and hibernacula entrances, reduce stand basal area through thinning to provide open forest conditions ideal for bats to forage, particularly those adapted for less cluttered conditions.
- Clearcuts (especially those with live and dead tree retention and logging slash) and young forest stands are valuable for foraging because they provide abundant insects for bats and open foraging space.
- Edges of forest stands provide excellent foraging corridors, which are maximized when stand edges are irregular.

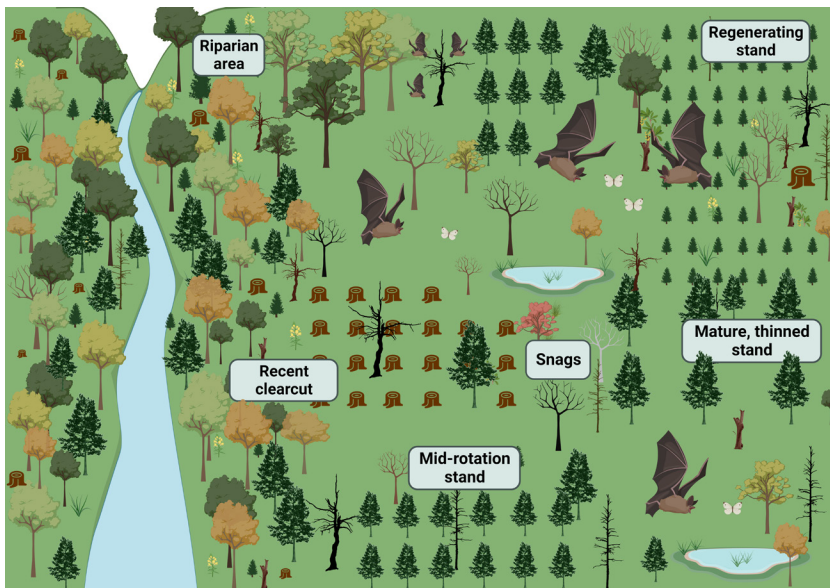


Figure 1. This schematic shows a forest landscape that includes a recent clearcut, regenerating stand, a mid-rotation stand, and a mature, thinned stand. There is also a riparian area additional water sources, and retained features such as snags (i.e., standing dead trees) and live trees that bats need, including a food source (abundant insects). In areas where bats hibernate, they use areas near hibernacula for fall swarming and spring staging, but where bats are active year-round, they are found throughout the landscape. Note that planted pines are depicted here, but other eastern U.S. forest types are also relevant. Created with BioRender.com.

¹ https://www.fws.gov/sites/default/files/documents/Inactive%20Season%20Dates%20for%20Swarming%20and%20Staging%20Areas_0.pdf

Conclusions

Bats are a diverse group with varied habitat requirements that can change seasonally. By creating different successional stages and structural conditions, sustainable, active forest management provides long-term benefits for bat communities at the landscape scale. In areas where bats are known to occur, site-level management flexibility and a little advanced planning can enhance benefits of forests to diverse bat species.

For more information, please see *Forest Management and Bats*.²

References for additional information

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For more information contact info@ncasi.org

² https://www.srs.fs.usda.gov/pubs/misc/misc_2020_perry_001.pdf