RESOURCE NOTES

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WILDLIFE BIOLOGY

Managing Deadwood For Bat Habitat

by Michael Herder, Arizona Strip Field Office / Grand Canyon - Parashant National Monument

Background

Bats represent a unique and poorly understood component of faunal communities. More than half of the 44 species known to occur in the United States are considered special status species (threatened, endangered, or sensitive). Because of their role as pollinators and insect predators, land management agencies have heightened their awareness of bats as a biological resource and an indicator of ecosystem health. Habitat degradation and fragmentation, particularly in forested environments, pose serious threats to bat populations. However, because they are nocturnal and often difficult to capture, baseline information on distribution, habitat, and roost requirements is largely unavailable.

In recent years, numerous efforts have been undertaken throughout the Western United States to restore unhealthy forests to conditions that existed prior to European settlement. At Mt. Trumbull, in the northwest corner of Arizona, efforts have been underway since 1996 to restore a 12,000 acre ponderosa pine community by harvesting small diameter post-settlement trees. Once restored, the density of the forest will be greatly reduced, affording a measure of protection from high intensity fires. The restored forest will consist of pre-settlement age class trees, suitable replacement trees from among the larger diameter post- settlement trees, and dead standing trees (snags) in open, park-like stands. Prescribed low intensity burns followed by reseeding with native species is used to promote understory growth. A fire return interval of approximately eight years is used to prevent the buildup of ladder fuels reaching from the ground to the canopy.

Numerous studies have been established to determine the effects of these extensive structural changes in forest vegetative communities on various ecosystem components. One such study was an evaluation of the impacts of restoration work on forest dwelling bats. Objectives of the study were to identify and characterize trees, snags, and downed logs used as bat roosts at Mt. Trumbull and to develop a roost preference model for various bat species to predict changes in the availability of suitable roost sites following restoration. The study was funded by grants from the National Fish and Wildlife Foundation, the Arizona Game and Fish Department, and Bat Conservation International.

Methods

Bats were captured within a 15-mile radius of the ponderosa pine restoration project at Mt Trumbull, Arizona. Mist nets were used to capture bats at open water sources, including stock tanks, troughs, and wildlife catchments. Data collected on captured bats included species, gender, reproductive status, and weight. Radio transmitters with a 14-day life (0.4 g) were glued between the shoulder blades of long-legged myotis (*Myotis volans*), a sensitive bat species. Observers were positioned along suspected flight paths with radio telemetry receivers to note the time and direction of travel of radio-tagged bats. Bats were followed during the night while they foraged and returned to their daytime roosts in trees, snags, or rocks. When roosts were located, observers were stationed nearby at dusk to count the total number of bats exiting using red filtered lights, infrared video, and night vision equipment.

Roost trees and snags were characterized by recording location (UTM), tree or snag species, diameter (dbh), height, stage of decay (for snags), slope, aspect, elevation, distance to water, distance to nearest forest opening > 0.5 ha, and distance to nearest restoration treatment area. Preliminary study results revealed that the majority of long-legged myotis roosts were found in ponderosa pine snags. In order to determine if bats were selecting snag roosts with specific characteristics or merely choosing a roost at random from available snags, 60 plots were randomly selected with a suitable snag at the center. Snags chosen to be plot center points were checked to ensure that bats were not present. This allowed for a comparison between snags selected as bat roosts and non-roost snags selected at random. Data collected within these randomly selected plots included basal area, percent canopy closure, number of trees within each of five dbh classes, total trees per acre, number of shrub species, number of individual shrubs, number of snags, number of downed logs, and evidence of recent grazing.

Results

A total of 1163 bats of 16 different species were captured from May through August, 1997-1999. Long-legged myotis were the bat species most commonly netted, making up over 40 percent of the captures. Other sensitive species captured included: fringed myotis (*Myotis thysanodes*), small-footed myotis (*Myotis ciliolabrum*), Townsend's big-eared bat (*Corynorhinus townsendii*), and spotted bat (*Euderma maculatum*). A total of 231.8 hours of capture effort were expended over 91 nights at 22 different locations. Capture success was slightly more than 5.0 bats / hour.

A total of 37 long-legged myotis bats were fitted with radio transmitters over three field seasons. Using a combination of radio telemetry and random snag examination, 59 roosts were located in trees / snags and 4 roosts were found in rocks. Of the 59 forest roosts located, 55 were ponderosa pine snags, two were Gambel oaks.

Discussion

The majority of roosts (89%) used by long-legged myotis were located in pre-settlement age ponderosa pine snags in moderate to advanced state of decay. Exceptions included a ponderosa snag with dbh < 20 inches and a burnt oak sapling with dbh < 12 inches. Several characteristics of these snag roosts differed significantly from randomly selected non-roost snags. In general, preferred roosts were taller, larger in diameter, had at least some exfoliating bark, and were found closer to forest openings than non-roost snags. The differences between roost and non-roost snags were found to be statistically significant, indicating that long-legged myotis preferentially selected snags with these characteristics. Most roosts were also positioned in close proximity to a wash, suggesting bats use natural drainages as flyways between roosts and foraging or watering sites. Cracks, fissures, or peeling bark were the primary features used for roosts in snags. Other roost tree characteristics, such as percent slope, position on slope, aspect, and distance to grazing, treatment areas, or foraging sites showed a high degree of variability. Using the model developed, it is possible to predict which snags would be used by long-legged myotis bats with 80 - 85 percent certainty.

Dead standing and downed wood is a vital component of forest ecosystems for a wide variety of wildlife species including cavity nesting birds, rodents, bats, and numerous invertebrates. Results of this study suggest that ecosystem restoration projects that open the forest canopy may provide more roosting habitat for long-legged myotis bats, provided that all snags are retained. Park-like forest stands with moderate understory vegetation promote better solar heating, provide easier access to roost snags, and reduce the risk that snags will be lost to fire. While some snags will likely be burned as a result of re-establishing a fire regime, loss of deadwood features can be minimized by raking duff away, building protective fire lines, removing adjacent heavy fuels, and pretreatment with water and/or foam. Restoration study plans should provide larger diameter post-settlement trees to replace snags lost during burning. Ideally, the number of trees killed in each prescribed burn should equal the number of snags consumed by the fire. Trees identified for snag replacement should be approximately equal in size to the snags they are replacing. In addition, studies should be established to monitor the "life span" of snags to determine average length of time they spend in each stage of decomposition. A full account of these study results is in preparation.

Contact

Michael Herder
USDI BLM, Arizona Strip Office
Grand Canyon
Parashant National Monument
345 E/ Riverside Drive
St. George, UT, 84790
Phone: (435) 688-3239
Fax: (435) 688-3258
email: michael_herder@blm.gov

National Applied Resource Sciences Center