
The relations between insectivorous bats (Chiroptera) and managed forest stands determined by a national-scale analysis: what are the management and conservation implications?

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Résumé

Forest management strongly affects the foraging and feeding opportunities of bats at different spatial scales, in production forest systems. Because bats have undergone important declines throughout Europe, most likely due to widespread habitat loss and degradation, it is important to further our knowledge concerning the relations between insectivorous bats and timber harvesting, for conservation purposes.

Acoustic monitoring was carried out in 47 forest massifs in metropolitan France over a period of 7 years. Generalized linear mixed models (GLMM) were used to assess activity levels of 6 hawkers and 4 gleaners in relation to various forest parameters, which are commonly affected by forestry, such as stand composition, structure complexity, vegetation clutter, presence of deadwood, and local-scale microhabitat features.

The influence of forest parameters varied across species; *B. barbastellus* and *H. savii* responded positively to the presence of logging tracks, stand edges and minor roads, demonstrating their use of edge space. Both *Pipistrellus pipistrellus* and *Eptesicus serotinus* showed greater activity in stands with a diversity of tree sizes. All gleaners appear positively associated with under-story vegetation volume. Additionally, *M. nattereri* was less active in zones where ground deadwood exceeds a quantity of three steres, confirming the importance of closed habitats. *M. daubentonii*, *M. brandtii* and *M. mystacinus* all showed greater activity levels in broadleaf dominant stands. Interestingly, *P. kuhlii* activity increased in relation to vegetation whereas, in line with our hypothesis, *H. savii* responded negatively. Both large hawkers were significantly more active where ground deadwood exceeds three steres in quantity, illustrating use of forest gaps. Finally, *B. barbastellus* was the only species to respond significantly to presence of tree microhabitats, its activity increasing where crevices and/or peeling bark are present.

This study demonstrates that bat use of forests is complex and multifaceted. Thus, careful planning is required for their conservation. Maintaining deadwood and heterogeneity at

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the stand level; edge space and dense vegetation zones, should accommodate the two major ecological bat guilds, thus ensuring vital ecosystem functioning in exploited forest systems. Equally, the importance of tree microhabitats should not be discounted.

Mots-Clés: Chiroptera, Deadwood, Tree Basal area, Vegetation volume, Microhabitats, Forestry