Nelson Forest Region	Impact of Harvesting on Habitat Use by Foraging Bats by Scott Grindal	
	Extension Note 028	

INTRODUCTION

- ***Bat activity and species diversity is greater at lower elevations***
- ***Small cutblocks (.5 to 1.5 ha) do not appear to influence bat activity***

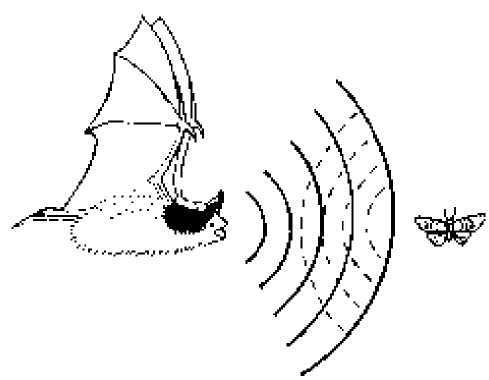
Unlike many other vertebrate organisms, there is a limited amount of information on the effects of forest harvesting on bats. Most of the previous work on the ecology of bats has been conducted in caves or human-made structures, and very little is known about what role bats may play in forest ecosystems. For example, bats may be important in controlling insect populations, some of which may be forest insect pests (Machmer and Steeger, 1995).

Roosting and foraging habitat are two basic requirements of bats. Roosting habitat provides areas for reproduction and daytime shelter, whereas foraging habitat fulfills obvious energy and nutrient requirements. If bats have specific tree-roost requirements, then forest harvesting would likely have a negative impact on their roosting ecology (Vonhof 1995). However, the impact of forest harvesting on the foraging ecology of bats is less evident. Forest harvesting creates openings in the forest, and previous studies suggest that gaps and the resulting edge habitat are important foraging areas for some bat species (Fenton 1990). This study was designed to assess the impact of forest harvesting on habitat use by foraging bats in areas associated with cutblocks and lakes, and in forests of different ages and biogeoclimatic subzones.

METHODS

The study took place during the summers of 1993, 1994, and 1995 in the West Arm Demonstration Forest (WADF) in the Kootenay Lake forest district. Most of the sampling occurred in association with cutblocks and lakes in the Kokanee, Redfish, and Bradley Face drainages.

Ultrasonic bat detectors were used for 90 minutes immediately after sunset to monitor bat activity. These detectors monitor the high frequency sound, or echolocation, that bats produce in order to navigate and forage in complete darkness (Figure 1). Two types of bat activity (commuting: travelling or searching for prey, and foraging: feeding attempts) were differentiated based on the patterns of echolocation calls. Bats prey exclusively on insects, and light-suction traps paired with the bat detectors were used to assess insect availability.



Bat activity and insect availability data were collected in three habitat types: existing cutblocks, cutblock/forest edges, and undisturbed forest. Samples were also taken in four stand age-classes (81-100, 101-120, 121-140, and 141-250 years), and three biogeoclimatic subzones: Interior Cedar Hemlock Dry Warm (ICHdw) and Interior Cedar Moist Warm (ICHm2) and Engelmann Spruce-Subalpine Fir (ESSF). Additionally, bat activity was monitored before (1994) and after (1995) cutting of three block sizes (0.5, 1.0, and 1.5 ha) on Bradley Face.

Bat activity in lake areas was sampled to assess the importance of riparian habitat. A similar protocol was used as in the cutblock sampling (i.e. detectors placed in the center of the lakes, lake/forest edges, and undisturbed forest). Bats were captured in mist-nets to determine diversity and relative abundance. Fecal pellets from these bats were collected and analyzed to assess diet composition.

RESULTS

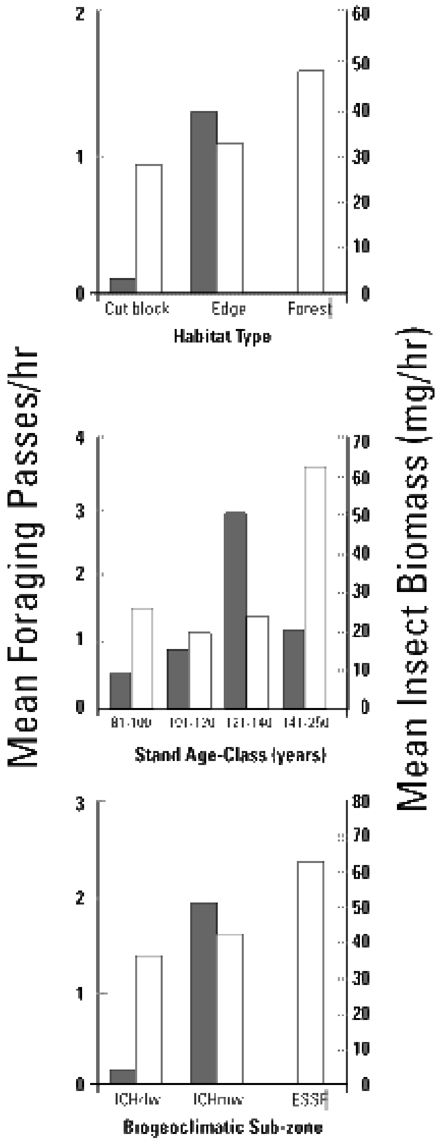


Figure 2. *Bat activity (dark bars) and insect availability (White bars) in the different habitat types, stand age classes and biogeoclimatic zones in WADF.*

Foraging activity was greatest along the edge, intermediate in the center of cutblocks and lowest in the forest (Figure 2). However, commuting activity was recorded in the forest, suggesting that bats do use this habitat for roosting. Insect availability patterns paralleled those of bat activity, except in the forest where there was much more prey relative to bat activity (Figure 2). No distinct trends or differences existed for foraging activity or insect biomass among the four stand age-classes (Figure 2). However, both foraging activity and insect availability decreased with increasing elevation, corresponding to the biogeoclimatic sub-zones (ICHdw > ICHmw > ESSF; Figure 2). Bat activity increased after cutblocks were created in the forest. However, bat activity did not differ among the three cutblock sizes (Figure. 3).

Foraging activity in lake areas (Figure 4) showed similar patterns to that of the cutblocks. Foraging activity was greatest in the open areas of the lake and edge habitat, with minimal activity in the forest. Overall foraging activity in habitat types associated with lakes was approximately 39 times greater than those associated with cut blocks.

In total, 238 individuals of nine of the eleven different bat species expected to be in the area (Nagorsen and Brigham 1993) were caught (Table 1). All bats (predominantly juveniles and breeding females) were captured in the ICHdw and ICHmw sub-zones, with no captures in the ESSF, though bats were detected in this zone. All insect orders identified in each habitat type were common prey species for most of the bat species in WADF.

DISCUSSION

The results of this study suggest that forest harvesting may create suitable foraging habitat for bats along edges and in the openings of cutblocks. The preference for edge habitat may be that this is where bats can forage optimally, due to a combination of high prey availability and easily navigated habitat. In contrast, forest habitat was not an important foraging area.

However, the forest habitat may be important as a prey source for bats, as well as for potential roosting habitat. Therefore, there must be a balance between the creation of beneficial feeding areas along cutblock edges, and the requirements for prey resources and suitable roosting areas potentially associated with forest habitat.

Species		**# caught**
California	*Myotis californicus*	58
Western Long-eared	*M. evotis*	36

Little Brown	*M. lucifugus*	53
Fringed	*M. thysanodes*	1
Long-legged	*M. volans*	16
Yuma	*M. yumanensis*	56
Big Brown	*Eptesicus fuscus*	6
Hoary	*Lasoiris comereis*	1
Silver-haired	*Lasionycteris noctivagans*	11
Total		**238**

Table 1. *Bat species and numbers caught in WADF from 1993 to 1995*

Cutblock size did not appear to influence bat activity, although this may be due to the relatively small range of cutblock sizes under examination (0.5 to 1.5 ha). Riparian habitats (lakes, and most likely other aquatic habitats) appear to be much more important foraging areas than cutblocks for bats. Therefore, it is essential to maintain riparian habitat quality through appropriate forest management.

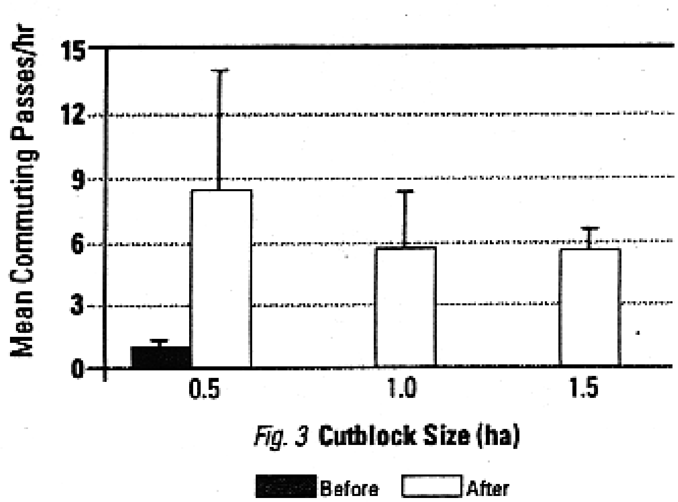


Figure 3. *Mean (+1 SE) bat activity before (dark bar) and after (white bar) harvesting of three different sized cut blocks on Bradley Face.*

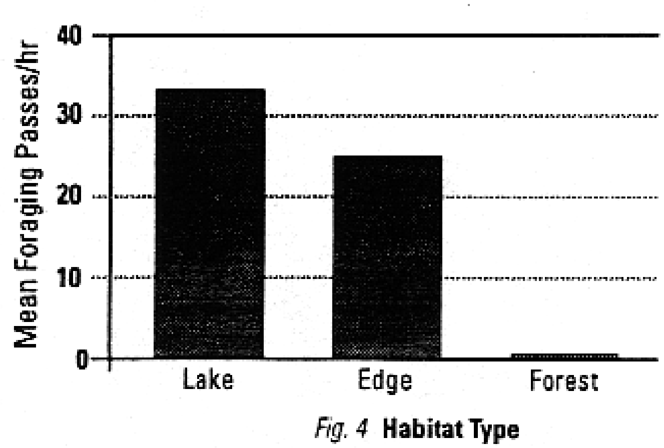


Figure 4. *Bat activity in habitat types associated with lakes in WADF.*

Stand age-class did not appear to have a significant effect on bat foraging activity or prey availability. However, bat foraging activity varied with biogeoclimatic subzone, likely due to climate differences influencing prey availability along an elevational gradient. Thus, forest harvesting would have the greatest impact on bats in the ICHdw and ICHmw subzones (low elevations), where bat activity and species diversity were greatest. Lower elevational subzones (ICHdw and ICHmw2) may also be important to bats because the reproductive activity tends to occur there. Therefore, forest harvesting at lower elevations may negatively affect bat populations through potential disturbance to breeding individuals or their offspring. This potential negative impact at lower elevations may be compounded by the loss of prey source and roosting habitat (i.e. the forest), as discussed above.

Bats are the major predators of nocturnal flying insects, and therefore may act to control insect populations. Lepidoptera (moths) and Coleoptera (beetles) species comprise 96 % of major forest insect pests in the Nelson Forest Region (Unger and Stewart 1992). Based on fecal analyses, these two insect orders represent a large proportion of the insects consumed by bats in the Nelson area. Therefore, it is reasonable to assume that bats may play an important role in controlling potential insect pests in a forest ecosystem.

The results of this study suggest that the impact of forest harvesting varies with the spatial scale under examination (i.e. at the habitat type, stand age-class, or biogeoclimatic subzone level). Thus, to accurately assess the overall impact of habitat disturbances, more than one spatial scale should be examined. For bats, this requires data on habitat requirements and the potential effects from forest harvesting over varying temporal and spatial scales.

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