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# MARTEN USE OF SUCCESSIONAL FOREST STAGES DURING WINTER IN NORTH-CENTRAL WASHINGTON

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ABSTRACT-Marten (*Martes americana*) use of successional forest stages in north-central Washington was determined during winter by counting marten tracks along 65 transects in 6 different forest stages. Red squirrel (*Tamiasciurus hudsonicus*) tracks and middens were counted and small rodents were trapped to determine association of marten activity with successional stages used by these species. Marten frequented older aged (>82 years old) Engelmann spruce (*Picea engelmannii*)/subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*) forests where voles (*Microtus* spp. and *Clethrionomys* spp.) and red squirrel middens were available. Younger-aged (≤43 years old) forests were used infrequently by marten. Mature and old-growth forests are important habitats for marten, providing voles for prey during critical winter periods. For these reasons, mature and old-growth stands should be managed for marten.

## INTRODUCTION

Mature and old-growth conifer forests are preferred habitats of marten (*Martes americana*) (Buskirk et al. 1989; Koehler and Hornocker 1977; Marshall 1951; Spencer et al. 1983). Wild fires destroyed many of these forests in the western United States during the late 1800's and early 1900's. Little is known about the status of marten or their use of habitats in areas where early successional forests predominate (Steventon and Major 1982). During the winter of 1986-1987, we investigated uses of successional forest stages by marten, voles (*Microtus* spp. and *Clethrionomys* spp.), and red squirrels (*Tamiasciurus hudsonicus*) to determine if selection for habitats by marten was associated with habitats used by voles and red squirrels, potential prey of marten (Koehler and Hornocker 1977; Lensink et al. 1955; Marshall 1946; Soutiere 1979; Weckwerth and Hawley 1962).

## STUDY AREA AND METHODS

The 1795 km$^2$ study area was located in Okanogan County, north-central Washington, near the Canadian border (49°N, 120°W). Major fires occurred during the late 1800's, 1929, and 1970 and resulted in a mosaic of forest successional stands. U.S. Forest Service LANDSAT-generated maps showed the study area to be 31.8% lodgepole pine (*Pinus contorta*) forests, 20.6% Engelmann spruce (*Picea engelmannii*)/subalpine fir (*Abies lasiocarpa*) forests, 27.5% Douglas fir (*Pseudotsuga menziesii*) forests, 15.2% ponderosa pine (*Pinus ponderosa*) forests, and 5% alpine meadows. Elevations within the study area ranged from 750 to 2540 m. Temperatures ranged from -23° to 10°C and mean annual precipitation was 31 cm at 660 m elevation (Nat. Oceanic and Atmos. Admin. 1987), with precipitation occurring mainly as snowfall during winter. Snow depths exceeded 1 m above 1980 m elevation.

We determined marten use of forest successional stages during winter by counting tracks along transects located from 1350 to 2075 m elevation. To assess possible influences of prey distribution on marten use of habitats during winter (1 December-31 March), we counted red squirrel tracks along transects and used pitfall traps to capture small rodents. We also tallied red squirrel middens to assess possible association of marten with numbers of middens, potential resting sites for marten (Buskirk 1984).

Sixty-five transect lines (each 100 m long) were placed along the road that bisected the study area. Transects were spaced at ≥225-m intervals to ensure independence of snowshoe hare (*Lepus*

TABLE 1. Number of marten tracks recorded in Okanogan County forest stands during 8 surveys, December 1986-March 1987.

| Dominant overstory[1] | Stand age (years) | Number of transects | Number of marten tracks |
|---|---|---|---|
| SSAF | ≥100 | 15 | 6 |
| LP | ≥82 | 18 | 4 |
| LP | 43 | 9 | |
| LP | 20 | 5 | |
| DFWLA | ≥43 | 13 | 1 |
| Meadow | | 5 | |

[1] LP = lodgepole pine, SSAF = Engelmann spruce and subalpine fir, DFWLA = Douglas fir, western larch, aspen.

*americanus*) track counts (Koehler, 1990). Based on species and age from increment boring of dominant overstory trees, 6 successional stages were identified. Five transect lines were placed in 20-year-old lodgepole pine stands, 9 in 43-year-old lodgepole pine stands, 18 in ≥82-year-old lodgepole pine stands, 15 in ≥ 100-year-old Engelmann spruce / subalpine fir stands, 13 in ≥43-year-old Douglas fir, western larch, and aspen stands, and 5 in meadows. The number of transects placed in each stand was proportional to the estimated area of each within the study area.

During winter we counted the number of marten and red squirrel tracks intersecting the transects within 24 to 36 hours after a snowfall. Difficulty of counting >3 tracks on red squirrel runways required that we count tracks as 3, 6, 9, or 12 depending on intensity of runway use. We counted red squirrel middens in forests within 10 x 100 m plots positioned perpendicular from the center of track count transects.

We determined relative abundance of voles, deer mice (*Peromyscus* sp.) and other small rodents among forest types by placing 2 pitfall trap-plots in 43-year-old lodgepole pine stands, 4 in ≥82 year-old stands of lodgepole pine, and 3 in ≥100-year-old stands of Engelmann spruce /subalpine fir. The trap-plots consisted of a 15.25-m-long drift fence of hardware cloth with 4 (3.1 liter) cans placed as pitfall-traps along the fence (Koehler and Hornocker 1989). Each pitfall contained 1 liter of ethanol to kill and preserve specimens. Covers were placed as a roof 10 cm above pitfalls to exclude snow and debris. Rodent species and number of captures were tallied in spring after snow melt (May or June) and used as a relative index for comparisons among successional forest stages.

Numbers of marten and red squirrel tracks counted during winter were totaled for each transect. Kruskal-Wallis tests and Tukey-type multiple comparisons (Zar 1984) were used to examine differences in marten and red squirrel track counts among successional forest stages and also used to examine differences in number of squirrel middens among successional stages.

## Results and Discussion

Based on the low numbers of marten tracks encountered, we considered marten un common on the study area. Tracks were counted on 11 occasions during 8 surveys in December 1986 through March 1987 (Table 1). Ten of 11 tracks were recorded in stands ≥82 years old. Although there were no statistically significant differences in numbers

TABLE 2. Winter counts of red squirrel tracks and summer counts of middens in Okanogan County forests, 1987. Counts followed by a common letter were not significantly different ($p > 0.05$, Tukey-type multiple comparisons).

| Dominant overstory[1] | Stand age (years) | Mean number tracks / 100 m ± SD | Mean number middens |
|---|---|---|---|
| LP | 20 | 2.4 ± 1.8AB | 2.6AB |
| LP | 43 | 4.2 ± 2.5A | 4.5A |
| DFWLA | ≥43 | 1.9 ± 2.3B | 3.4AB |
| LP | ≥82 | 1.5 ± 1.2B | 2.3AB |
| SSAF | ≥100 | 1.1 ± 0.5B | 4.9A |
| Meadow | | 0.2 ± 0.3B | 0.0B |

[1] LP = lodgepole pine, SSAF = Engelmann spruce and subalpine fir, DFWLA = Douglas fir, western larch, aspen.

TABLE 3. Species and numbers of small mammals captured during the winter of 1986-1987 in pitfall traps in 3 forest stands in Okanogan County.

| Dominant overstory[1] | Stand age (years) | No. of plots | Mammal species | No. captured | Captures/ 1000 trap days |
|---|---|---|---|---|---|
| SSAF | 200 | 3 | Voles | 4 | 1.56 |
| | | | Deer mice | 0 | 0.00 |
| | | | Shrews | 0 | 0.00 |
| LP | 82 | 4 | Voles | 2 | 0.60 |
| | | | Deer mice | 1 | 0.30 |
| | | | Shrews | 2 | 0.60 |
| LP | 43 | 2 | Voles | 0 | 0.00 |
| | | | Deer mice | 0 | 0.00 |
| | | | Shrews | 1 | 0.57 |

[1] SSAF = Engelmann spruce and subalpine fir, LP = lodgepole pine.

of marten tracks among successional forest stages ($x^2$ = 10.12, df = 5, P = 0.072) possibly because of small sample sizes, marten tracks occurred most frequently in ≥ 100-year-old Engelmann spruce / subalpine fir stands. Winter track counts of red squirrels were higher in 43-year-old lodgepole pine stands than in any other cover type except 20-year-old lodgepole pine ($x^2$ = 23.49, df = 5, $p$ = 0.0003, Table 2). Midden counts were highest in ≥ 100-year-old Engelmann spruce/subalpine fir and 43-year-old lodgepole pine stands ($x^2$ = 14.3, df = 5, $p \leq 0.01$, Table 2). Small mammal trapping in December-May showed voles present in ≥ 100-year-old Engelmann spruce/subalpine fir and ≥ 82-year-old lodge pole pine forest stands (Table 3).

This study indicates that marten used older-aged forests where voles were present. They did not use younger-aged forests where, based on track counts, red squirrels were most active during winter. This is consistent with reports of the importance of voles and low occurrence of red squirrels in the diet of marten (Koehler and Hornocker 1977; Soutiere 1979; Weckwerth and Hawley 1962). The presence of voles in the ≥ 82-year-old stands and their absence in 43-year-old stands may influence the selection for older-aged stands and the infrequent use of younger-aged successional stages by marten. Marten use of ≥ 100-year-old Engelmann spruce/subalpine fir stands also coincides with sites where red squirrel middens were most abundant. Middens may serve as resting sites for marten and their presence may also influence the selection for older-aged successional stages by marten (Buskirk 1984).

These observations show the importance of older-aged stands as habitat for marten during winter. Although clear-cuts and early successional stands may be used by marten during snow-free seasons (Koehler and Hornocker 1977; Soutiere 1979; Steventon and Major 1982), marten require mature forest stands during winter where prey (Koehler and Hornocker 1977) and rest sites (Buskirk et al. 1989) are available. For these reasons it is important to manage for mature and old growth stands as habitat for marten.

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