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FIRE EFFECTS ON MARTEN HABITAT IN THE SELWAY–BITTERROOT WILDERNESS[1,2]

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Abstract: An investigation in the Selway–Bitterroot Wilderness of north-central Idaho helped evaluate the effects of fire on marten (*Martes americana*) habitat and food sources. Voles (Microtinae) were the most abundant item in the marten diet, occurring in 79 percent of 129 marten scats. These were most abundant in mesic habitats. A total of 2,896 trap days during November 1973 through March 1974 and November and December 1974 resulted in 80 captures of 13 marten and 255 track observations. Marten used a variety of forest types. The highest activity when snow depths were normal was in stands having an Engelmann spruce/subalpine fir (*Picea engelmanni/Abies lasiocarpa*) overstory, canopy cover greater than 30 percent, mesic habitat type, and an overstory age greater than 100 years. The effects of fire on marten habitat and foods are discussed.

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Fire is an important agent in directing the evolution of plant and animal communities in northern coniferous forests (Ahlgren and Ahlgren 1960, Heinselmann 1970, Habeck and Mutch 1973). It is a dominant force in establishing and maintaining seral plant and animal communities. Marten, however, generally are associated with climax forest communities of North America (Marshall 1951*a*, deVos 1952, Miller et al. 1955, Ingram 1973). Fires are cited as one of the destructive forces causing the disappearance of this species from its range (Brabant 1922, Seton 1929, Yeager 1950, Edwards 1954, Miller et al. 1955, Lutz 1956, Ingram 1973). The long-range effects of fire on marten and its food sources are unknown (Yeager 1950). A 2-year study conducted in 1973 and 1974 in the Selway–Bitterroot Wilderness of north-central Idaho evaluated the effects of past fires on marten habitat and food sources.

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THE STUDY AREA

The study occupied a 21 km^2 area within the Selway–Bitterroot Wilderness including the drainages of Rhoda, Lizard, and Wounded Doe creeks and drainages emptying into Fish Lake. The area lies within the spruce/fir (*Picea/Abies*) zone at an elevation of 1,350 to 2,400 m. Estimated mean temperature for July was 18 C and for January −7 C (Finklin, U.S.F.S., personal communication). Estimated mean annual precipitation was 180 cm (Finklin, personal communication). Much of this was snow. The 10-year mean snow depth at Fish Lake

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for March was 280 cm (U.S.D.A. Soil Conservation Service Snow Survey Records). Lightning storms occurred an average of 13 days during the months of July and August (Finklin, personal communication). Wildfires burned large portions of the area during 1890, 1910, 1919, 1953, and 1961. Fire and topography have resulted in considerable vegetation diversity dominated by subalpine fir and Engelmann spruce in climax and seral communities. Lodgepole Pine (*Pinus contorta*) is the dominant seral species. Prevalent understory species include beargrass (*Xerophyllum tenax*), false huckleberry (*Menziesia ferruginea*), huckleberry (*Vaccinium membranaceum*), whortleberry (*V. scoparium*), and mountain heath (*Phyllodoce empetriformis*).

METHODS

Marten Habitat

We live-trapped marten and recorded tracks on a portion of the study area from November 1973 through March 1974 and November and December of 1974 to obtain information on winter habitat. Live traps were spaced at approximately 250-m intervals along lines transecting several forest types and physiographic features. We ran a 6.4-km trapline at Rhoda Point and an 8-km trapline at Fish Lake during the 1973–74 trapping season. The Fish Lake trapline was increased to 16-km during November–December 1974. Traps were checked every 24 hours. To minimize marten losses, we did not trap at temperatures below −18 C. National Live Trap Company 15 × 18 × 61 cm single-door live traps were mounted in trees and covered with plastic shrouds to keep them free of snow.

A description of each trap site consisted of: dominant overstory species, age of stand by increment boring, average dbh of overstory, ocular estimates of canopy cover (stand density) and percent composition of overstory species, dominant and subdominant understory species, distance to adjoining forest type, habitat type according to Daubenmire and Daubenmire (1968), aspect, slope, elevation, physiographic characteristics, and map location. Information on the fire history of areas sampled was obtained from aerial photographs, U.S. Forest Service fire history maps, and age of overstory trees.

An observation was recorded for each trap site when a marten was captured or if tracks were observed between the trap site and the previous site. Only 1 observation per day could be made at each site. The total observations from each site during the season provided an index of marten use. This provided use intensities for the various habitats sampled. All marten were eartagged. Recaptures provided information on distribution and on forest types used by individual marten. Animals were sexed and aged according to characteristics described by Marshall (1951*b*).

Additional information on marten habitat was obtained from descriptions of activity sites recorded throughout the study area.

Marten Food Habits

Marten scats provided information on food habits. The percentage occurrence of each item indicated its importance in the diet. Comparing unknown items from scats with known hair and tooth samples collected in the study area aided identification of rodents. The herbarium at the University of Idaho provided reference material for identifying plant materials.

Rodent Habitat

Rodents were trapped in various climax forest types, stages of succession, and ecotones between forest types and burns during the summers to delineate habitats used

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Table 1. Food items occurring in 129 marten scats collected on the study area during 1973–74.

	Summer–fall (48 scats)		Winter (81 scats)		Total (129 scats)	
	No. scats	% scats	No. scats	% scats	No. scats	% scats
Mammals (total)	46	96	81	100	127	99
Microtinae (total)	34	71	68	84	102	79
Microtus sp.	18	38	21	26	39	30
Phenacomys intermedius	4	8	3	4	7	5
Clethrionomys gapperi	9	19	37	46	46	36
Unknown	13	27	18	22	31	24
Cricetidae						
Peromyscus maniculatus	1	2	1	1	2	2
Unknown	2	5	2	2	4	3
Zapus princeps	1	2			1	1
Sorex sp.			1	1	1	1
Citellus columbianus	7	15	1	1	8	6
Unknown *Citellus*	1	2			1	1
Tamiasciurus hudsonicus			6	7	6	5
Eutamius amoenus	2	5			2	2
Lepus americanus	2	5			2	2
Ochotona princeps	1	2	2	2	1	1
Glaucomys sabrinus	1	2	4	5	3	2
Unknown mammal	4	8			8	6
Fruits (total)	9	19	6	7	15	12
Vaccinium scoparium	2	5	1	1	2	3
Vaccinium membranacium	6	13	5	6	7	5
Sorbus sp.					5	4
Unknown	2	5			2	2
Bird	4	8	3	4	7	5
Insects (total)	9	9	2	2	11	9
Coleoptera (Beetle)	4	8			4	3
Orthoptera (Grasshopper)	4	8	2	2	6	5
Hymenoptera (Wasp)	4	8	1	1	5	4

by rodents occurring in the marten diet. A sample plot, 15.2 m × 53.2 m, consisted of 3 parallel transect lines with 8 stations per line. Lines and stations were spaced 7.6 m apart. Traps were grouped in pairs and confined to a 1-m radius at each station. A total of 48 snap traps was set in each plot. We sampled each plot for one 3-day period. The number of each rodent species captured was recorded. A description of each plot used the same criteria recorded at marten trap sites.

RESULTS

A total of 2,896 trap days resulted in 80 captures of 13 marten and 255 track observations. These indicated that marten used a variety of forest types during the winter. Forests having a canopy cover greater than 30 percent, Engelmann spruce/subalpine fir overstory, stand age greater than 100 years, and the mesic subalpine fir/false huckleberry habitat types had the highest marten activity. During the 1973–1974 season, snow depths exceeded the 10-year mean. Marten activity was greater at Rhoda Point where these forest types occupied a greater percentage of the surrounding area than at Fish Lake. Recapture data indicated an individual's home range encompassed a number of forest types, but its highest activity was in or near mature mesic spruce/fir stands with canopy cover greater than 30 percent.

Multiple regression analysis of site factors on marten observations indicated that overstory type, age of stand, habitat type, and stand density as measured by canopy cover explained 50 percent ($R^2 = 0.50$) of all variation in marten activity during the 1973–74 season and that the regression was significant ($P < 0.01$). The November–December 1974 data had an $R^2 = 0.15$ and was significant only at the 0.25 level. Mild weather and low snow depths during the latter season are believed responsible for the variation in marten activity during this period.

The marten diet included a wide variety of food items (Table 1). Voles were the most abundant item, occurring in 79 percent of the 129 scats analyzed.

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Table 2. Number of rodents captured on plots.

Plot description			No. of rodents captured	
Habitat type	Age (years)	No. understory plant species	Voles	Others
Mesic habitats				
Subalpine fir/pachistima	225	*	4	9
Subalpine fir/pachistima	225	*	8	8
Subalpine fir/pachistima	200	35	6	3
Subalpine fir/Sitka alder	40	36	5	5
Subalpine fir/Sitka alder	58	23	4	11
Subalpine fir/false huckleberry	60	37	3	8
Subalpine fir/false huckleberry	250	15	3	
Subalpine fir/false huckleberry	250	14	4	
Subalpine fir/false huckleberry	10	38		
Subalpine fir/false huckleberry	200	18	5	
Average per mesic plot		27	4.2	4.2
Xeric habitats				
Subalpine fir/beargrass	56	11	5	2
Subalpine fir/beargrass	70	9	1	
Subalpine fir/beargrass	215	6	4	2
Subalpine fir/beargrass	15	*		10
Subalpine fir/beargrass	80	15		
Subalpine fir/beargrass	10	16		3
Subalpine fir/whortleberry	56	7	1	1
Average per xeric plot		10.7	1.6	2.6

* The number of understory plants was not recorded.

Mesic habitat types supported the greatest number of rodents and the greatest number of understory plant species (Table 2). Voles, particularly red-backed (*Clethrionomys gapperi*), were most abundant on mesic sites, while deer mice (*Peromyscus maniculatus*) and chipmunks (*Eutamius amoenus*) predominated on xeric sites.

DISCUSSION

Fire affects marten cover and food sources. Brabant (1922), Seton (1929), Yeager (1950), Edwards (1954), Miller et al. (1955), Lutz (1956), and Ingram (1973) cited fire as detrimental to marten cover and food. Fires burned approximately one-half of our study area during 1910, leaving stringers and islands of undisturbed forest. This resulted in a mosaic of forest types and successional patterns because of varying fire intensities, crown or ground fires, burning patterns, moisture regimes, soils, prefire vegetation types, and other factors. This mosaic of forest types on our area supports a diversity of cover and food types favorable for marten.

Marten utilized voles more than any other single food item (Table 1). This was also the case in Alaska (Lensink et al. 1955), British Columbia (Quick 1955), Alberta (Cowan and Mackay 1950), Montana (Weckwerth and Hawley 1962), and Wyoming (Murie 1961). Mesic sites in our study area supported the greatest understory plant species diversity and the greatest vole populations. Xeric sites appeared suitable only for deer mice; they probably lacked sufficient food and cover for voles. This was especially evident immediately following a fire as indicated in Table 2 and the work of Tevis (1956), Gashwiler (1959, 1970), Ahlgren (1966), Hooven (1969), and Krefting and Ahlgren (1974).

Marten activity was highest during the first winter season when snow depths were considered normal, in stand densities greater than 30 percent. Marshall (1951*a*) found marten used most intensively the dense subalpine fir stands. Densely stocked stands provided the greatest cover and food availability.

No difference in marten activity was observed during the second winter trapping season between stand densities of greater

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than or less than 30 percent. Below normal snow depth and mild weather during this time allowed marten to burrow through the snow with little difficulty to obtain rodents. Low snow depth also made available more cover in the form of shrubs and logs.

Track observations made during the 1973–74 winter season indicated that marten passed through but did not hunt in openings less than 100 m in width. Robinson (1953) found that marten avoided bait placed 25 yards within openings during the winter. Further, Hawley and Newby (1957) felt that openings served as psychological barriers.

Open meadows and burns, avoided by marten in the winter, may be used in the summer and fall seasons if they provide adequate cover and food. The high occurrence of fruits, insects, and ground squirrels (*Citellus columbianus*) in the summer–fall diet offers evidence marten used open areas. Voles, which occurred in 71 percent of the summer–fall diet, were abundant in mesic sites within meadows and burns (Table 2). It appears from other work as well that marten do not require the cover of dense stands during the summer (Dice 1921, Grinnell et al. 1937, Marshall 1951*a*, Hagmeier 1956, Streeter and Braun 1968).

On our study area, fire has been an important agent in establishing and maintaining a diversity of forest communities. It creates and maintains openings where abundant fruits, insects, ground squirrels, and voles provide food items for the marten during the summer. Mature spruce/subalpine fir forests, as part of the forest community diversity, provide the necessary cover and food during the winter. A mosaic of forest communities supporting discontinuous fuel types can also be expected to result in smaller and generally cooler fires, which would result in less marten habitat being replaced through time and space.

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