Forest Service

Northern Region

Old-growth Habitats and Associated Wildlife Species in the Northern Rocky Mountains

1990

Marten
200/10,000 = 20%
500 = 5%

WILDLIFE SPECIES ASSOCIATED WITH OLD-GROWTH HABITATS

Meslow and Wight (1975) found that 69 percent of the birds occurring in Douglas-fir forest types of the Pacific Northwest used old-growth stands. Three species were listed as nesting primarily within old-growth forests: spotted owl, northern goshawk, and Vaux's swift. Bull (1978) identified six species which are primarily associated with old-growth forests in Oregon: great gray owl, barred owl, flammulated owl, white-headed woodpecker, northern three-toed woodpecker, and Townsend's warbler. The marten is associated with mature and old-growth spruce-fir forests in Idaho (Koehler and Hornocker 1977).

In northwestern Montana, McClelland (1977) described a general trend of increased species richness in cavity-nesting birds from young to old-growth stands of larch and Douglas-fir. Old growth was particularly important in providing an adequate number of suitable nesting trees for cavity-nesters. He also noted the association of open-nesters such as the pine grosbeak, Townsend's warbler, varied thrush, black-headed grosbeak, and goshawk with old-growth forests, as well as its value as big game thermal cover.

Based on a literature review, about 40 percent of the 373 wildlife species occuring in the Northern Region were thought to use old-growth forest for feeding and/or reproduction (Harger 1978). Of these, 33 species were thought to be closely associated with old-growth habitats (Table 1).

The following describes the importance to wildlife of various components of old-growth habitats.

Overstory Trees. Large trees are needed to provide suitable nesting sites for large birds. Bark crevices in older trees provide important foraging sites. Large-canopied trees can modify microclimate by providing shade, capturing moisture, and moderating winds.

Dead and Defective Trees. Dead trees (snags) and defective trees (partially dead, spike top, broken top) provide nesting and roosting sites for cavity-users. Snags host invertebrates which are an important food source for woodpeckers.

Down Woody Material. Downfall supports insects and other invertebrates, provides habitat for fungi and saprophytic plants, provides cover and den sites for wildlife, and creates debris dams in streams. Dead woody material holds moisture and contributes to nutrient cycling. In areas with high frequency of fire, this component will be less abundant.

Tree Canopy. A relatively closed canopy, often with two or more layers, creates a more moderate microclimate. Vertical diversity provides a variety of substrates for feeding or nesting, and supports development of forest components such as arboreal lichens.

Decadence. Presence of heart rot, mistletoe, dead or broken tree tops, diseased trees, and saprophytic plants create a variety of microsites and food sources for wildlife.

MANAGEMENT INDICATOR SPECIES

The National Forest Management Act and its implementing regulations require that fish and wildlife habitats be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. In order to estimate the effects of each Forest Plan alternative on fish and wildlife populations, Management Indicator Species (MIS) are to be selected.

Table 1. Species in the Northern Region (north Idaho, Montana, North Dakota, and South Dakota) thought to prefer old-growth components for breeding or feeding (from Harger 1978).

WILDLIFE SPECIES	STRUCTURAL STAGES Breed	Feed	OPTIMUM COVER TYPE
Great Blue Heron	5-6	1	ASP, COT
Northern Goshawk	5-6	3-6	ASP, DF, PP, LPP
Great Gray Owl	6	1	LPP, SAF, SP
Flammulated Owl	5-6	1-2	PP, DF, GF, LPP
Pygmy Owl	5-6	1-6	PP, DF, GF, WL
Saw-whet Owl	5-6	1-6	PP, DF, GF, LPP, SAF, SP
Boreal Owl	5-6	1-6	PP, ASP, SP, SAF, DF
Barred Owl	5-6	3-6	COT, DF, GF
Vaux's Swift	5-6	1-6	ASP, COT, DF, WRC
White-headed Woodpecker	4-6	4-6	PP, WWP
Pileated Woodpecker	4-6	3-6	COT, PP, WL, GF
Three-Toed Woodpecker	4-6	3-6	SAF, WBP
Black-backed Woodpecker	4-6	3-6	PP, DF, WWP
Red-naped Sapsucker	4-6	1-6	BGA, COT
Williamson's Sapsucker	4-6	2-6	PP, WL, GF, SAF, SP
White-breasted Nuthatch	4-6	3-6	PP, DF
Red-breasted Nuthatch	4-6	3-6	PP, ASP, LPP, SAF, SP
Pygmy Nuthatch	4-6	3-6	PP, DF
Brown Creeper	4-6	3-6	DF, LPP, SP, SAF
Great Crested Flycatcher	4-6	2-4	BGA, COT
Hermit Thrush	5-6	2-6	GF, WH, WRC, SAF, SP
Varied Thrush	5-6	2-6	WH, WRC, SP
Townsend's Warbler	4-6	2-6	ASP, COT, PP, DF
Silver-haired Bat	3-6	1-3	PP, DF, WRC, SP
Long-eared Bat	4-6	1-6	PP, DF, GF
Long-legged Myotis	4-6	1-6	LPP, SAF, SP
California Myotis	4-6	1-6	BGA, COT, PP, JPU
Fisher	5-6	3-6	ASP, COT, PP, DF, WWP
Marten	5-6	2-6	LPP, SAF, SP, WRC
Wolverine	3-6	1-6	SAF, WBP
Woodland Caribou	5-6	5-6	SAF, SP, WH, WBP
Boreal Red-back Vole	4-6	4-6	SAF
Northern Flying Squirrel	5-6	5-6	ASP, COT, DF, WWP, SAF

Structural Stages: 1=Grass/Forb, 2=Shrub/Seedling, 3=Pole Trees, 4=Young Trees, 5=Mature Trees, 6=Old-Growth

Cover Types: ASP=Aspen, BGA=Birch/Green Ash, COT=Cottonwood, DF=Douglas-fir, GF=Grand Fir, JPU=Juniper, LPP=Lodgepole Pine, LP=Limber Pine, PP=Ponderosa Pine, SAF=Subalpine Fir, SP=Spruce, WH=Western Hemlock, WL=Western Larch, WRC=Western Redcedar, WWP=Western White Pine, WBP=Whitebark Pine

Several categories of species are to be represented where appropriate: Endangered and threatened plant and animal species; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished or trapped; non-game species of special interest; and plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities (36 CFR 219.19). The first four categories of MIS include "featured species", wherein management activities are directed to providing specific habitat components to meet management objectives for the individual species. The latter category is intended to include ecological indicators, which are selected to represent a larger community of species.

An ecological indicator will ensure the welfare of only those species whose niches are entirely included within its habitat niche and geographic range. To be effective, then, an ecological indicator should have a large home range and be closely associated with a specific habitat.

The goshawk, pileated woodpecker, and marten were identified as MIS by most Forests in the Northern Region to be used as ecological indicators for old-growth components or old-growth habitats. Each of these species have habitat requirements related to stand structure or components which are more likely to be found in old-growth habitats. Their population densities generally are higher in old-growth than in younger stands. In a California study, both marten and pileated woodpecker were found to be sensitive to habitat fragmentation (Rosenberg and Raphael 1986). Each of these species utilize a relatively large home range, which is thought to include the home ranges of other old-growth-associated species.

The habitat requirements of pileated woodpecker, goshawk, and marten, and models for assessing habitat suitability for each are detailed in subsequent sections. Although Schroeder (1987) identified several problems in HSI modeling, they are the most expedient method for evaluating impacts of habitat change.

The requirements of these species in terms of the size and spacing of habitat patches can be used to determine the distribution of old-growth habitats across the landscape.

OLD-GROWTH STAND SELECTION

Landscape Ecology Theory. Forman and Godron (1981) defined landscape patches as communities surrounded by a matrix with a dissimilar community structure or composition. They hypothesized that species diversity within a patch is a function of habitat diversity, disturbance, area, age, surrounding heterogeneity, isolation, and boundary discreteness.

Old-growth habitats offer comparatively high within-stand structural diversity. As forest management progresses through time, old-growth forests will be represented as remnant patches embedded in a younger-aged matrix.

Patch size correlates strongly with the numbers of species and individuals that can be supported and with rates of extinction and recolonization (May 1975, Simberloff and Aberle 1982). Patch size is particularly significant for large, wide-ranging species (Noss and Harris 1986). As acreage decreases, habitat patches become unsuitable for wildlife species with large home ranges. Of 48 old-growth-associated species occurring in the Northern Region, about 60 percent are thought to require stands larger than 80 acres (Harger 1978).

Patch size is modified by its shape due to edge effect. Changes in temperature, humidity, light, and wind, which influence plant species composition, can occur in a band along the ecotone (edge) (Greene 1988). In Douglas-fir old-growth forest, a circular-shaped stand smaller than 25 acres is effectively all "edge" (influenced by the ecotone); within a stand of 80 acres, half of

the patch provides "interior" conditions (Lemkuhl and Ruggerio in prep.). In northern California, Rosenberg and Raphael (1986) found that old-growth Douglas-fir stands of less than 50 acres tended to lack the full complement of vertebrate wildlife, and suggested that isolated stands should exceed 125 acres in size to be effective. Wilcove et al. (1986) estimated that habitat islands should exceed 250 acres to provide for birds inhabiting forest interior.

The abruptness of the edge, or edge contrast, affects stand insularity. Edges between similar cover types and successional stages cause less isolation than do edges between very dissimilar stands. A patch totally surrounded by dissimilar habitat becomes more similar to a true island, with less movement of species between patch and matrix (Forman and Godron 1981).

Selection of Stands to Manage for Old-Growth Conditions. The recommended scale for initial analysis of the quality and distribution of existing old-growth habitats is the watershed scale (typically about 10,000 acres in size). Individual stands or groups of contiguous stands can be evaluated using a scorecard method. The habitat requirements and dispersal capabilities of old-growth Management Indicator Species should be used to determine the size, shape and spacing of old-growth patches across the forest landscape.

If a particular analysis unit does not contain existing stands of high quality, large enough size, or sufficient overall acreage, the best available (nearest to old-growth condition) stands should be selected. Alternatively, old-growth stands in adjacent watersheds could be selected, provided the spacing of old-growth patches does not exceed the mobility of the MIS.

Roads are generally undesirable within an old-growth habitat patch. The road corridor fragments the habitat by creating edge, and access may result in loss of snags to woodcutting.

Landres et al. (1988) point out that selecting old-growth stands based on within-patch habitat conditions required by the MIS, and then predicting or monitoring habitat conditions for those MIS, is circular reasoning. Because old-growth-associated MIS are intended to represent a community of wildlife species, stand selection and management should not be directed only towards providing the minimum characteristics required by the individual species. Management objectives and actions in the selected old-growth patches should be directed towards protecting or enhancing the integrity and longevity of old-growth conditions.

In devising a conservation strategy, Forman and Godron (1981:738) emphasize the importance of recognizing that "no patch stands alone", but is influenced by surrounding patches. Harris (1984) recommended surrounding old-growth habitat islands with a long-rotation management area, and interconnecting these with riparian corridors and other linkages. Similarly, Noss and Harris (1986) suggest that a regional landscape level be used, wherein high-quality nodes, such as an old-growth patch, would be integrated within interconnected "multiple-use modules", where management activities are scheduled to maintain the integrity of the nodes.

Natural disturbance regimes such as fire often occur on a spatial scale larger than a landscape patch (Urban et al. 1987). Providing for well-distributed habitat patches with interconnections between patches thus are necessary to maintain species diversity over the long term.

Goshawk nesting territories include 2-5 nest trees. Alternate nests can usually be found within 325 feet (100 m) of each other, and are almost always within 0.6 mile of each other (Reynolds 1975). Previously-used nest trees are often re-used, even if the nest is no longer intact or evident.

Nest Stands. Throughout western North America, goshawk nest stands consistently have been described as mature to old-growth (Reynolds 1978, Hennessy 1978, Hall 1982, Saunders 1982, Hayward 1983).

The mean canopy cover of 80 percent (measured with spherical densiometer or on aerial photos) surrounding 17 nests in the northern Rockies (Hayward 1983) was very similar to nest sites in northeastern Oregon (Moore 1980), California (Hall 1982), and Arizona (Crocker-Bedford and Chaney 1988). In Utah (Hennessy 1978), canopy cover averaged 63 percent, and in Oregon 61 percent (Reynolds et al. 1982).

Forest stands selected for nesting may be either multi-storied or single-storied, with a relatively open understory (Schnell 1958, Dietzen 1978, Hennessy 1978, Shuster 1980, Hall 1982, Reynolds et al. 1982). Dense understory is believed to make a stand less suitable by inhibiting goshawk flight and providing escape cover for prey species (Reynolds 1978). In the northern Rockies, both single and multi-storied stand structures were used by nesting goshawks (Hayward 1983).

Relatively high basal areas have been recorded at goshawk nest sites in Arizona, California, and Oregon (Moore 1980, Hall 1982, Crocker-Bedford and Chaney 1988). In the northern Rockies, 60 percent of 17 nest stands had basal areas between 160 and 190 ft^2/acre (Hayward 1983).

Goshawk nest stands generally would be considered fully stocked, with moderate to high tree density (Moore 1980, Reynolds et al. 1982, Hall 1982). In the northern Rockies, nest stands had an average of 454 trees/acre larger than 3 inches dbh (Hayward 1983).

Goshawks appear to select nest sites on gentle to moderately steep slopes. In the northern Rockies, slopes of nest stands range from 2-45 percent (average 27 percent), with over 70 percent of nests occurring on the lower one-third or bottom of the slope (Hayward 1983).

Goshawk nests have been reported to occur most frequently on northerly aspects in Utah, Oregon, and California (Hennessey 1978, Reynolds et al. 1982, Hall 1982). In Arizona, Crocker-Bedford and Chaney (1988) found that nests in ponderosa pine types were on northerly aspects, while no difference was observed in mixed conifer forests. In Alaska, nests were found on southerly aspects (McGowan 1975).

Food Habits. Prey items between 200 and 400g appear to be optimum as indicated by mean prey size (Storer 1966, Reynolds 1978, Wikman and Linden 1981). Tree squirrels, ground squirrels, woodpeckers, grouse, jays, and robins are important prey species.

Avian prey items occurred more frequently than mammalian prey in eastern Oregon (54% birds, 42.7% mammals; Reynolds 1978), and in the Sierra Nevada of California (77% birds, 23% mammals; Schnell 1958). Mammalian prey was more important by both number and volume (biomass) in the Coast Range of California (Woodbridge et al. 1985).

Foraging Habitat. The short, rounded wings and long tail of *Accipiter* hawks enables the birds to perform rapid wheeling flights over short distances. Reynolds (1978) indicated that goshawks forage predominantly in the ground-shrub and shrub-canopy zones in forested situations.

Forest habitat, pole stage or larger, which is open enough to allow the goshawk unimpeded flight through the understory, is considered completely suitable for foraging. "Doghair" stands with more than 750 trees/acre, larger than 3 inches dbh, are considered unsuitable foraging habitat (Hayward et al. 1983).

Observations suggest that goshawks hunt forest edges and openings, in addition to hunting within moderate to densely forested stands (Craighead and Craighead 1956, Schnell 1958, Wattel 1973, Fox 1981). Openings are considered fully suitable if all portions of the opening are within 100 yards of an edge; portions of an opening over 500 yards from forest are thought to be unsuitable (Fox 1981).

In Arizona, Crocker-Bedford (pers. comm.) found that goshawk nestling production decreased by 95% following partial cutting, despite leaving buffers averaging 95 acres (range 40-500 acres) around the nests. The harvesting was believed to have adversely affected prey production and availability, and increased competition from Red-tailed Hawks and Great Horned Owls.

Goshawks used plucking posts to dismember and consume prey. Large-diameter snags and stumps are frequently used for this purpose.

Water. Goshawks have been observed bathing during warm weather (Hennessy 1978). Shuster (1980) and Reynolds et al. (1982) suggested that sites near water are preferred for nesting. Open water and moist forest conditions may provide needed protection from heat and sunlight.

Water is not considered to be a limiting factor in boreal coniferous forests of western Montana or northern Idaho. In eatern Montana and in the Dakotas, water availability could be limiting.

Interspersion. Spring-summer goshawk habitat must contain forest stands with suitable structure for nesting, and adjacent foraging habitat with sufficient prey to raise a brood.

In western Montana and northern Idaho (the northern Rockies), over 50 percent of 17 nest sites surveyed were within 0.25 mile of a forest opening (Hayward 1983). However, it was not determined whether these nests occurred near openings through actual nest site selection, or merely reflected typical patterns of vegetation.

Home Range Size. Goshawk territories in the western U.S. have been found 1 to 4 miles apart (Shuster 1976, Dietzen 1978, Hall 1982, Crocker-Bedford and Chaney 1988). In Oregon, Reynolds (1975) measured the average distance between active nest territories as 2.7 miles.

Estimates of breeding population density vary widely. In the western U.S., density estimates range from one pair per 525 acres in Wyoming (Craighead and Craighead 1956); to one per 2,200 acres in Arizona (Crocker-Bedford and Chaney 1988); to one per 3,325 acres in Colorado (Shuster 1976); to one per 6,796 acres in Oregon (Reynolds and Wight 1978).

Dispersal Distance. No data documenting the dispersal distances of juveniles were found.

Marten Habitat Relationships

Tim Patton and Ron Escano

Revised by Nancy Warren

INTRODUCTION

The marten (*Martes americana*) was selected by many of the National Forests in the Northern Region as a Management Indicator Species. It was used to represent species using mature and old-growth habitats, particularly the down woody component.

The following describes the habitat relationships of the marten and a model which provides an index rating of the value of habitat for marten.

ECOLOGY OF THE MARTEN

Distribution. Marten inhabit late successional coniferous forests throughout northern North America in the Canadian and Hudsonian life zones (Marshall 1951, Hagmeier 1956, Strickland et al. 1982). In the western U.S., marten are most abundant in mature to old-growth true fir or spruce-fir forests and generally avoid open, xeric coniferous forests (Weckwerth and Hawley 1962, Koehler and Hornocker 1977, Spencer 1981). The marten is generally nocturnal, and is active throughout the year.

Reproduction. Female marten do not mate until their second year. Litter size ranges from one to four, and kits are whelped in April (Brassard and Bernard 1939). Males do not care for the young.

Denning Habitat. Marten require large snags, stumps, and logs for resting sites and natal dens (Simon 1980, Spencer 1981). Wynne and Sherburne (1984) found that two females with kits used cavity dens until the kits were about eight weeks old; ground logs then were used until the kits were nearly adult size (12-15 weeks).

Food Habits. Microtines, especially red-backed voles (*Clethrionomys gapperi*) and meadow voles (*Microtus pennsylvanicus*), are used more than any other single food item (Cowan and Mackay 1950, Lensink et al. 1955, Weckwerth and Hawley 1962, Koehler and Hornocker 1977, Soutiere 1979). Red squirrel (*Tamiasciurus hudsonicus*), northern flying squirrel (*Glaucomys sabrinus*), and snowshoe hare (*Lepus americanus*) may also be important winter prey (Marshall 1946). In a Montana study, small mammals were the most important food item on an annual basis, with the highest utilization of mammalian prey occurring during the winter months; invertebrates, berries, and passerine birds were the most frequent food items recorded from spring through fall (Weckwerth and Hawley 1962).

Weckwerth and Hawley (1962) believed that fluctuations in small mammal densities in Montana directly affected the carrying capacity of an area for marten. Mech and Rogers (1977) suggested that food availability may be the most important factor limiting marten populations. Thompson and Colgan (1987) found that marten home range sizes were inversely related to food supply.

Feeding Habitat. Koehler and Hornocker (1977) found that mesic coniferous habitat types supported the greatest numbers of rodents. These habitat types therefore would be expected to have high value as marten foraging habitat.

Campbell (1979) reported that winter hunting was confined to dense stands of mature coniferous forest. In Wyoming, Idaho, and Colorado, highest marten activity was recorded in the spruce-fir zone (Yeager and Remington 1956, Koehler and Hornocker 1977, Buskirk et al. 1989). Lodgepole

pine stands are used for foraging, if in proximity to old-growth stands (Spencer et al. 1983). In Washington, marten prefer Douglas-fir, cedar and hemlock types, while cedar swamps were frequented more than any other type in Ontario (deVos and Guenther 1952).

In general, marten prefer forest stands with greater than 40 percent tree canopy closure, and avoid those with less than 30 percent (Koehler and Hornocker 1977, Spencer 1981). Stands with less than 30 percent overhead cover, while used very little, were more likely to be used when snow depths were less than 12 inches (Koehler et al. 1975). Overhead cover provides marten with protection from predators, as well as enhancing the mesic conditions favorable for production of voles.

Marten rarely venture more than 150 feet from forest cover, especially in winter (Koehler and Hornocker 1977, Hargis 1981, Spencer 1981). Koehler and Hornocker (1977) believe that openings, which are avoided in the winter, may be used for summer and fall foraging if adequate food and cover are present. Female marten are less likely to cross open areas than are males (Steventon and Major 1982).

Clark and Campbell (1976) suggested that marten winter densities may be limited more by access routes to get at prey below deep snow than the actual density of rodents present. During winter, trees, logs, slash, etc., projecting above the snow provide marten with access to rodents dwelling below the snow (Koehler et al. 1975, Soutiere 1979).

Resting Habitat. Resting sites are usually beneath forest canopy (Simon 1980, Spencer 1981). Closed canopy forest creates a favorable microclimate by reducing snow depth and providing insulation from cold winds. Spruce-fir cover types were preferred resting sites in Wyoming (Raphael pers. comm.).

Large down logs and stumps are especially important in winter for thermal cover (Buskirk et al. 1989). Winter resting sites typically are found under the snow layer, under stumps, snags or logs, and often in squirrel middens (Marshall 1951, Spencer 1981, Steventon and Major 1982, Buskirk 1984).

Water Requirements. The marten's physiological requirements for water remain unknown. Marten concentrate their foraging activities in mesic habitats and near water, probably because of its effects on vegetation structure and prey abundance (Koehler and Hornocker 1977, Spencer 1981).

Security. Marten are easily trapped and are susceptible to overharvest (Soutiere 1979). The effects of road density on marten have not been quantified. Particularly when roads are located through marten travel corridors (ridges, saddles, and riparian zones) and foraging areas, increasing road access is thought to increase the vulnerability of marten to trapping (M.Frisina, pers. comm.)

Home Range Size. Population densities of marten in good habitat generally average about 1 to 3 per square mile (Burke 1982). Home ranges of resident males are distinct, but female home ranges often overlap other female and male ranges (Clark and Campbell 1976, Powell 1979, Burnett 1981).

In Glacier National Park in Montana, mean home range size was estimated to be about 1.0 square mile for resident males and 0.27 square miles for resident females (Hawley and Newby 1957, Burnett 1981). Similar home range sizes were reported in Wyoming (Clark and Campbell 1976). Larger home range sizes have been reported in other areas: for example, Wyoming, 10 square miles for males and 6 for females (Raphael pers. comm.); Minnesota, 6 square miles for males and 1.7 for females (Mech and Rogers 1977); Maine, 3.5 square miles for males and 0.9 for females (Steventon and Major 1982); and California, 1.4 square miles for males and 1.2 for females (Simon 1980, Spencer 1981).

Buskirk and McDonald *(in press)* analyzed variability in home range size as determined

by radiotelemetry in 9 separate areas. Home range size varied significantly between the 9 study sites, but showed no obvious geographic pattern (latitude, longitude, elevation, or mean annual temperature range). Mean home range sizes (1160 acres for adult females and 1750 for adult males) are about 3 times that predicted for terrestrial carnivores based on body mass (Linstedt et al. 1986).

Soutiere (1978) reported that home ranges were larger in clearcut forests than in uncut or partially cut forests. Similarly, in Ontario Thompson and Colgan (1987) found that home range sizes were larger in cutover than in uncut forest, and increased during years of scarce food supply. Home range sizes in uncut sites varied from 1.21 to 2.45 square miles for males and from 0.36 to 1.53 square miles for females in years of abundant and scarce food availability, respectively.

Marten home ranges must include resting areas and foraging areas, with adequate cover in close proximity. Marten home range boundaries often coincide with edges of topographic or vegetative features such as large open meadows, burns, or streams (Hawley and Newby 1957).

Dispersal Distances. The dispersal capabilities of marten are not well known, but juveniles have been observed to travel up to 24 miles in order to become permanently established in an adequate home range (Hawley 1955). Jonkel (1959) recorded juvenile movements averaging 9.7 miles for seven males (range 2-25 miles) and 7.5 for four females (range 2-15 miles). An average maximum movement of 6.3 miles was observed by Burnett (1981) for two male and one female non-resident juveniles.