



Distribution of *Picoides* woodpeckers in relation to habitat disturbance within the Yellowstone area  
by Nancy Jean Hoffman

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management

Montana State University

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Abstract:

Forest structure characterized as old-growth (large diameter trees, snags, down and decaying wood/logs) supports the highest density and diversity of cavity-nesting birds. Prior to the 20th century, forested habitats within the Intermountain West have been shaped by natural disturbances. Subsequently, forests were largely shaped by silvicultural practices and widespread road networks. Broad-scale changes in landscape pattern and patch-scale changes in forest composition and structure may have strong impacts on woodpeckers and snag-dependent avian species. Extensive forest harvest practices along the eastern boundary of the Targhee National Forest, large-scale fires along the adjacent western boundary of Yellowstone National Park, and a diversity of resident, woodpecker species provided an excellent opportunity to improve understanding of, and management practices of, *Picoides* species. The objectives of this study were to determine the distribution of active nest-tree cavities of four *Picoides* species in three lodgepole pine strata (undisturbed, human disturbed, and naturally disturbed) and to estimate habitat characteristics of nest sites used by *Picoides* species. We (i.e., field crews and I) searched for active cavities along 1,500-m transects within each stratum and sampled vegetation within three plot types (i.e., cavity sites, associated random sites, and truly random sites) during two consecutive field seasons (May -September, 1995 and 1996). In each year, active cavities were more likely to be found in the postfire lodgepole pine stratum than in the two other strata (i.e., undisturbed and human disturbed). Within the postfire lodgepole pine stratum, Three-toed and Black-backed woodpeckers were each 0.17 (e -1.77) [90% CI =0.02 (e -3 73) to 0.77 (e -0.26),  $P = .04$ ] times as likely to be found nesting than were Hairy Woodpeckers in 1995. In contrast, within the postfire lodgepole pine stratum in 1996, neither Three-toed Woodpeckers ( $P = 1.00$ ) nor Black-backed Woodpeckers ( $P = 0.52$ ) were more likely to be found nesting than were Hairy Woodpeckers. Size, condition, and quantity of down woody debris differentiated among nest sites of the three *Picoides* species. Because I found burned habitat more likely to be used by *Picoides* species than human disturbed or undisturbed habitat and because forest isolates no longer have the capacity for fire events of representative scale and intensity, I believe there are implications affecting the persistence of the species and their ability to track postfire habitat within the region. Thus, there is a need to consider the frequency, intensity, and juxtaposition of fire over the regional landscape when considering the viability of these rare species.

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DISTURBANCE WITHIN THE YELLOWSTONE AREA

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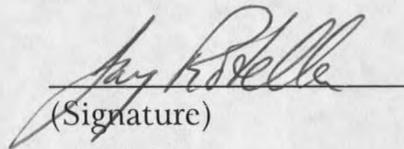
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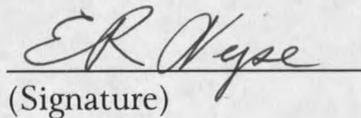
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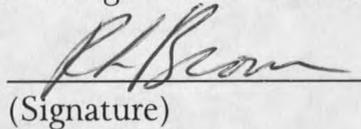
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## ABSTRACT

Forest structure characterized as old-growth (large diameter trees, snags, down and decaying wood/logs) supports the highest density and diversity of cavity-nesting birds. Prior to the 20th century, forested habitats within the Intermountain West have been shaped by natural disturbances. Subsequently, forests were largely shaped by silvicultural practices and widespread road networks. Broad-scale changes in landscape pattern and patch-scale changes in forest composition and structure may have strong impacts on woodpeckers and snag-dependent avian species. Extensive forest harvest practices along the eastern boundary of the Targhee National Forest, large-scale fires along the adjacent western boundary of Yellowstone National Park, and a diversity of resident, woodpecker species provided an excellent opportunity to improve understanding of, and management practices of, *Picoides* species. The objectives of this study were to determine the distribution of active nest-tree cavities of four *Picoides* species in three lodgepole pine strata (undisturbed, human disturbed, and naturally disturbed) and to estimate habitat characteristics of nest sites used by *Picoides* species. We (i.e., field crews and I) searched for active cavities along 1,500-m transects within each stratum and sampled vegetation within three plot types (i.e., cavity sites, associated random sites, and truly random sites) during two consecutive field seasons (May - September, 1995 and 1996). In each year, active cavities were more likely to be found in the postfire lodgepole pine stratum than in the two other strata (i.e., undisturbed and human disturbed). Within the postfire lodgepole pine stratum, Three-toed and Black-backed woodpeckers were each 0.17 ( $e^{-1.77}$ ) [90% CI = 0.02 ( $e^{-3.73}$ ) to 0.77 ( $e^{-0.26}$ ),  $P = .04$ ] times as likely to be found nesting than were Hairy Woodpeckers in 1995. In contrast, within the postfire lodgepole pine stratum in 1996, neither Three-toed Woodpeckers ( $P = 1.00$ ) nor Black-backed Woodpeckers ( $P = 0.52$ ) were more likely to be found nesting than were Hairy Woodpeckers. Size, condition, and quantity of down woody debris differentiated among nest sites of the three *Picoides* species. Because I found burned habitat more likely to be used by *Picoides* species than human disturbed or undisturbed habitat and because forest isolates no longer have the capacity for fire events of representative scale and intensity, I believe there are implications affecting the persistence of the species and their ability to track postfire habitat within the region. Thus, there is a need to consider the frequency, intensity, and juxtaposition of fire over the regional landscape when considering the viability of these rare species.

## INTRODUCTION

Prior to the 20th century, vegetation of the central Rocky Mountains (Intermountain West) was influenced by natural disturbances (fire, insects, avalanches, disease, floods)(Amman 1991, Baker 1992, Arno 1993). Fires and mountain pine beetle (*Dendroctus spp.*) irruptions were the most common natural disturbances in lodgepole pine (*Pinus contorta*)/subalpine fir (*Abies lasiocarpa*) dominated forests (Arno 1993, Gara et al. 1985, Lotan et al. 1985). However, beginning early in the 20th century, fire suppression and silvicultural practices played an increasing role as disturbance agents. These "human" disturbances altered the intensity and frequency of natural disturbances (Hejl 1994, Hutto 1995, Thompson et al. 1995). These land-management practices may degrade or destroy woodpecker habitat by removing potential nesting and foraging substrates and altering primary structural characteristics of the forest.

Because of concern regarding broad-scale alterations of forested landscapes, numerous studies of woodpeckers and other cavity-nesters have been conducted in a variety of forested habitats [Douglas fir (*Pseudotsuga menziesii*), Western larch (*Larix occidentalis*), ponderosa pine (*Pinus ponderosa*), and aspen (*Populus tremuloides*)]. However, assemblages of birds within lodgepole pine forests have been scarcely studied despite recent broad-scale

changes in the spatial and structural characteristics of lodgepole pine forests. In fact, they are among the least studied forest avifaunas in North America (Hein 1980).

Lodgepole pine is distributed broadly throughout the Intermountain West. Mountain pine beetle epidemics, large fuel accumulations, and stand replacement fires are a normal sequence for unmanaged lodgepole pine ecosystems (McGregor and Cole 1985). Although forest managers may view mountain pine beetles as highly destructive to forests, these beetles play an integral role in the historic cycle of fire and lodgepole pine re-invasion that has maintained lodgepole pine forests. The natural cycle creates diverse landscapes that contain a mosaic of forest age classes with variable species composition. In addition, the landscape of the Intermountain West has historically been dominated by even-aged, pure stands of lodgepole pine forests (Lotan and Perry 1983).

Lodgepole pine forests on federal, state, and private lands adjacent to Yellowstone National Park have been intensively managed since mountain pine beetle outbreaks during the 1970's. Clearcutting and deadwood removal have greatly reduced fuel accumulation. Thus, normal lodgepole pine stand dynamics have been altered. Accelerated harvest of dead standing and down trees has affected about 50,000 hectares of habitat

distributed along the western boundary of Yellowstone National Park and the Targhee National Forest.

Broad-scale changes in landscape pattern, and patch-scale changes in forest composition and structure, may affect woodpeckers in lodgepole pine forests. Forest management activities have removed trees of the size and condition selected for by both mountain pine beetles and cavity-dependent avian species (Cole and Amman 1969, Bull 1983). Large-scale removal of dying, dead, and down trees that serve as susceptible hosts for insects and foraging habitat for woodpeckers adversely affects the abundance and diversity of a variety of cavity-nesters (Jackson 1979, Thomas 1979, Conner and Rudolph 1991, Hutto 1995). Because of altered disturbance regimes, woodpeckers as a group may have declined in abundance (Angelstam and Mikusiński 1994). Based on forest changes and bird-habitat relations, Hejl (1994) speculated that Black-backed (*Picoides arctus*), Downy (*P. pubescens*), Hairy (*P. villosus*), and Three-toed (*P. tridactylus*) woodpeckers have declined over the past 100 years.

Black-backed and Three-toed woodpeckers are of special concern due to lack of information regarding their populations within the region and concern that the species may be habitat specialists that depend on disturbance.

Woodpeckers depend on key habitat traits (e.g., diameter of tree, decay and/or

disease level, basal area, tree species, and canopy cover) for excavation and foraging (Jackson 1979, Miller and Miller 1980, Taylor and Barmore 1980, McClelland and Schmidt 1992, Caton 1996). Forest structure characterized as old growth (e.g., large diameter trees, snags, a high incidence of broken tops and diseases, and down and decaying wood/logs) supports the highest density and diversity of cavity-nesters (McClelland and Schmidt 1992).

Significant positive correlations exist between snag density and the abundance of primary cavity-nesters (i.e., species that create their own holes for nesting) in North American coniferous forests (Raphael and White 1984, McComb et al. 1986, Carey et al. 1991). However, researchers disagree about whether or not removing trees affects *Picoides* species. Miller and Bock (1972) suggested that interspecific interactions may increase as the density of trees suitable for nesting declines. However, Lawrence (1967) reported that no intraspecific conflicts occurred among Hairy Woodpeckers in Ontario even when the birds nested in very close proximity. Miller and Miller (1980) suggested that birds may use substandard trees when densities of suitable trees are low, which increases susceptibility of woodpeckers to predation and other hazards. Given the lack of data, studies of how woodpeckers respond to human and natural disturbance are needed in the Intermountain West.

The Targhee National Forest (TNF) adjacent to Yellowstone National

Park (YNP) contains a diversity of primary cavity-nesters. Large tracts of lodgepole pine forest under various disturbance regimes are closely juxtaposed and provide opportunity to study the dynamics of woodpeckers in areas of naturally- and human-disturbed lodgepole pine. Knowledge of factors that limit species abundance is necessary to formulate effective management guidelines and to predict the effects of habitat alteration (Waters et al. 1990).

I designed this study to: (1) determine the nesting distributions of four *Picoides* species (Three-toed Woodpecker, Black-backed Woodpecker, Downy Woodpecker, and Hairy Woodpecker) in three lodgepole pine strata (i.e., undisturbed, human disturbed, and naturally disturbed), (2) estimate habitat characteristics of nest sites used by *Picoides* species, and (3) develop management recommendations for maintaining nesting habitat for *Picoides* species.

## STUDY AREA

The study area straddled the southern portion of the western boundary of Yellowstone National Park and extended about six kilometers east and west of the Targhee National Forest-Yellowstone National Park boundary ( $44^{\circ} 22'$  N,  $111^{\circ} 12'$  W;  $44^{\circ} 26'$  N,  $111^{\circ} 06'$  W) (Fig. 1). Island Park (TNF), within Fremont County, Idaho, and Bechler Meadows (YNP), within Teton County, Wyoming, represented the northern and southern limits of the study area ( $44^{\circ} 22'$  N,  $111^{\circ} 12'$  W;  $44^{\circ} 10'$  N,  $111^{\circ} 07'$  W), respectively.

The study area encompassed about 9,500 ha on the Ashton and Island Park districts of the Targhee National Forest and about 15,100 ha on the Yellowstone National Park (Fig. 1). About 3,400 ha were within the 1994 Robinson Creek burn, a mosaic of burned and unburned forest resulting from a fire that varied in intensity, which was located in the southwest corner of Yellowstone National Park. The remaining 11,700 ha within Yellowstone National Park were located north and south of the 1994 Robinson Creek burn and south of the 1988 North Fork burn along the southern portion of the west boundary of Yellowstone National Park .

The study area was dominated by rhyolite soils and rhyolitic ash-flow tuff. Glacial till derived from rhyolite and basalt with andesite rock fragments









































































































































