



# Response of woodpeckers to changes in forest health and harvest: Implications for conservation of avian biodiversity

Mark C. Drever<sup>a,\*</sup>, Kathy Martin<sup>a,b</sup>

<sup>a</sup> Centre for Applied Conservation Research, Department of Forest Sciences, University of British Columbia, 2424 Main Mall, Vancouver, British Columbia, Canada V6T 1Z4

<sup>b</sup> Environment Canada, Pacific Wildlife Research Centre, 5421 Robertson Rd, RR1, Delta, British Columbia, Canada V4K 3N2

## ARTICLE INFO

### Article history:

Received 11 May 2009

Received in revised form 27 November 2009

Accepted 30 November 2009

### Keywords:

Indicators

Woodpeckers

Mountain pine beetle

Trembling aspen

Forest birds

Variable retention

## ABSTRACT

Woodpeckers (family Picidae) merit specific monitoring and management efforts, both as keystone/facilitator species and as indicators of forest condition. Recent studies indicated that species richness of woodpeckers was correlated with richness of all forest birds, thus suggesting potential exists for management practices that can address needs of woodpeckers in particular and other forest birds in general. We used data from a long-term study (1995–2008) from forest sites in the interior of British Columbia to evaluate how abundances of seven woodpecker species varied with habitat variables previously identified as associated with forest bird richness. We found that tree species richness had either a neutral or positive effect on the abundance of all woodpecker species, whereas abundances of most woodpecker species tended to be lower in stands with high densities of lodgepole pine. Abundances of most woodpecker species were positively correlated with density of beetle-killed pines. Relative to control sites, higher densities of most woodpecker species were found at harvested sites where most trembling aspen and large Douglas-fir trees had been retained. Therefore, management strategies that favour a mixture of tree species, with particular attention to retention of aspen, should safeguard populations of most woodpecker species. Abundances of individual woodpecker species were weakly but positively inter-correlated before the beetle outbreak, and less so during and post-outbreak. It thus appears that no strong trade-offs exist among woodpecker species. These results, combined with previously identified positive correlations between woodpecker and forest bird richness, indicate woodpeckers can be managed as a suite for the purpose of managing avian biodiversity as a whole.

Crown Copyright © 2009 Published by Elsevier B.V. All rights reserved.

## 1. Introduction

Woodpeckers (family Picidae) have many ecological roles within communities of forest-dwelling vertebrates – they excavate cavities in trees for nesting that are subsequently used by a variety of other forest species (known as the ‘nest web’, Martin and Eadie, 1999; Martin et al., 2004), and when foraging they often remove the bark of dead and dying trees, exposing the underlying substrate for foraging by other birds (Bull and Jackson, 1995). As keystone or facilitator species, woodpeckers merit specific monitoring efforts and targeting by management agencies (Simberloff, 1999; Mikusiński, 2006). In addition, woodpeckers are good indicators of overall forest avian diversity, and richness of woodpecker species has been found to be correlated with overall diversity and abundance of forest birds at both local and larger spatial scales in both Europe and North America (Mikusiński et al., 2001; Virkkala, 2006; Drever et al., 2008). The correlation between richness of

woodpeckers and forest birds in general likely results from similar responses to variation in forest composition and structure. In a previous study, we identified a set of habitat variables that affected both measures of avian diversity in similar ways (Drever et al., 2008). Therefore, potential exists for a management system that addresses needs of woodpeckers in particular and other forest birds in general. If all woodpeckers within a locality can be managed as a suite of species by using the same set of habitat targets and forest harvest practices, then such a set may hold promise for the management of overall forest bird richness.

Elucidating species-specific relationships between woodpecker abundance and these habitat variables will be necessary for developing robust guidelines for the management of woodpeckers (Roberge et al., 2008). In particular, we need to determine whether habitat variables that are correlated with overall forest bird richness affect all woodpecker species similarly. While abundances of individual species can be expected to vary positively with overall species richness, such that sites with greater richness should have more individuals than sites with lower species richness (Drever et al., 2008), negative relationships among species in a guild may be expected to occur when local species richness is lower than

\* Corresponding author. Tel.: +1 604 827 5843; fax: +1 604 822 9102.

E-mail address: [mdrever@interchange.ubc.ca](mailto:mdrever@interchange.ubc.ca) (M.C. Drever).

richness of regional species pool (e.g., due to competition for foraging or nesting resources, Drever et al., 2009). Such relationships may result in negative inter-correlations in abundance among woodpeckers. In such cases, managers would face a trade-off wherein management practices that benefit one species might disadvantage another, and thus preclude the management of woodpeckers as a single guild or suite of species.

In this paper, we follow up on Drever et al. (2008) who found a positive correlation between richness of woodpeckers and forest birds in general in the interior of British Columbia, Canada. In the same study sites as Drever et al. (2008), we use long-term abundance data (1997–2008) of forest birds from a large number of sites that varied in stand composition and condition and experienced a range of forest harvest practices. We examine how these temporal and spatial differences in stand composition and forest harvest affected abundances of seven woodpecker species. The variation in stand composition that occurred on these sites allows us to make inferences over a wide variety of forest types in interior British Columbia. In addition, mountain pine beetle populations (*Dendroctonus ponderosae*) erupted during the study period, resulting in wide-spread mortality of lodgepole pine (*Pinus contorta* var. *latifolia*, 40% of trees on the sites), over the study area. This outbreak has been the largest ever recorded in the province of British Columbia and in North America (BCMFR, 2007), and thus our results address a research gap on influence of (ever-increasing) bark beetle outbreaks on woodpecker community dynamics.

The woodpecker species found at our study sites were: northern flicker, red-naped sapsucker, pileated woodpecker, downy woodpecker, hairy woodpecker, American three-toed woodpecker (hereafter three-toed woodpecker), and black-backed woodpecker (respectively, *Colaptes auratus*, *Sphyrapicus nuchalis*, *Dryocopus pileatus*, *Picoides pubescens*, *P. villosus*, *P. dorsalis*, *P. arcticus*). We briefly summarize the tree species used for nesting and review the tree species used for foraging by these seven woodpecker species, and then tackle two objectives. First, we assessed whether abundances of these seven species are correlated with the set of habitat variables that Drever et al. (2008) identified at these same study sites as associated with both species richness of woodpeckers and forest birds in general. Second, Drever et al. (2008) found that the maximum number of woodpecker species at any one time per site was lower than the regional pool of seven species, suggesting that local ecological processes, such as competition, may limit richness of woodpeckers. We therefore assessed whether abundances of these seven woodpecker species are inter-correlated to identify pairs of species that may have had negative correlations. Our overall goal was to determine whether woodpeckers can be managed as a suite of species, or whether managers seeking to use woodpeckers as a tool to monitor and maintain forest avian biodiversity must account for trade-offs within the suite.

## 2. Methods

### 2.1. Study sites

We collected data at 23 study sites in the Cariboo-Chilcotin region of British Columbia, all located within 50 km of the City of Williams Lake (52°08'30"N, 122°08'30"W). The sites varied between 8 and 32 ha in area, and were all mature forest stands (80–120 years old) at the start of the study, varying between sites of mixed deciduous/coniferous composition surrounded by grasslands, shallow ponds, and wetlands, to sites composed predominantly of dry coniferous forest with deciduous riparian zones bounded by small streams. The predominant coniferous species were lodgepole pine, Douglas-fir (*Pseudotsuga menziesii*), and

hybrid white-Engelmann spruce (*P. glauca* × *engelmannii*), with occasional Rocky Mountain juniper (*Juniperus scopulorum*). The deciduous component of the forest was dominated by trembling aspen (*Populus tremuloides*), with occasional black cottonwood (*Populus balsamifera*), alder (*Alnus* spp.), paper birch (*Betula papyrifera*), and willow (*Salix* spp.). Lodgepole pine and Douglas-fir were present at all sites, and sites with maximum tree species richness (six species) always included aspen. The outbreak of mountain pine beetles progressed over the study period, with incidence of beetle attacks on pines increasing sharply after 2002 (Drever et al., 2009). The number of 'red-attack' pines, whose foliage had turned red following death of the tree, peaked in 2004, and most sites had nearly 100% mortality of mature lodgepole pine trees by 2007 (Martin et al., 2006; Drever et al., 2009).

These 23 sites experienced three basic types of forestry treatments during the study period (1997–2008). The 'uncut' sites were 14 sites of mature forests of areas ranging from 8 to 26 ha with no previous forest harvest activities, including two sites that had single tree removal operations of large-diameter Douglas-fir 20–40 years before the start of the study. Basal areas of these sites were 12–41 m<sup>2</sup>/ha. The 'partial harvest' sites included two mature forest sites of areas 20–30 ha where 15–30% of trees were removed in 1997 and 2000 for small-scale commercial uses or hazard reduction resulting from the beetle outbreak. Residual post-harvest basal areas ranged between 11 and 18 m<sup>2</sup>/ha. The 'variable retention' treatments were seven sites of areas 7–32 ha where 50–90% of all trees were removed between 1999 and 2002, including almost all pine and spruce. These treatments were referred to as 'clear cuts with reserves' by operators, and were done with the goal of retaining coniferous understory and most of the mature aspen for visual cover and general wildlife habitat, such as known nests for raptors and other wildlife. As such, most aspen and Douglas-fir of various diameter classes were retained, either as reserves or spread throughout the cut blocks. Residual post-harvest basal areas ranged between 3 and 24 m<sup>2</sup>/ha. After harvesting, all in-block roads and landings were rehabilitated.

### 2.2. Tree species used by nesting woodpeckers

Between 1 May and 31 July from 1995 to 2008, we conducted systematic searches for nesting woodpeckers at all sites, for an average of 6–7 observer h of searching time per site per week. Cavities were found by following individual birds and by re-checking nesting cavities that were active in previous years. We determined occupancy of cavities by looking for signs of recent excavation, such as fresh wood chips, or by listening for excavation, by tapping at the base of trees, and by observing breeding birds or hearing begging nestlings. In addition, finding occupied nests was facilitated by detecting general locations of woodpeckers during point count/playback surveys on the same sites. Cavities within reach of a ladder (<5.2 m) were inspected for nesting activities (fresh nesting material, eggs, chicks, and incubating adults) visually with flashlights and mirrors. From 2005, a TreeTop Peeper camera system (Sandpiper Technologies, Manteca, CA) was used to monitor cavities up to 17 m above the ground and in trees too unstable to reach with a ladder. Nests were considered occupied if they contained at least one egg or nestling. See Martin et al. (2004) and Aitken and Martin (2007) for full details.

### 2.3. Point counts/playbacks and vegetation plots

We enumerated woodpeckers using point counts (Hutto et al., 1986) combined with playbacks (Johnson et al., 1981), conducted from 05:00 to 09:30 h twice annually during mid-May to mid-June of each year, from 1997 to 2008 (note different start year from nesting studies). Point count stations were spaced 100 m apart, and

Download English Version:

<https://daneshyari.com/en/article/88224>

Download Persian Version:

<https://daneshyari.com/article/88224>

[Daneshyari.com](https://daneshyari.com)