

Migrant Forest Songbirds Undertake Breeding Dispersal Following Timber Harvest

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Abstract - We report two observations of breeding dispersal by migratory songbirds, *Dendroica caerulescens* (Black-throated Blue Warbler) and *D. fusca* (Blackburnian Warbler), from their initial territory locations following timber harvest. Forty-eight birds of each species were captured and marked as part of a long-term study on warbler survival in the Greater Fundy Ecosystem, NB. None of the birds banded in unharvested patches were re-encountered in other patches. Maximum movement distances for the displaced Blackburnian Warbler and Black-throated Blue Warbler were 1.3 km and 2.9 km, respectively. These are the longest breeding-dispersal distances reported for these species. Our paper provides the first direct evidence that birds may move once their breeding site has been altered due to timber harvesting. Potential conservation implications are discussed.

Introduction

Timber harvest has been shown to reduce the relative abundance of some bird species associated with mature forest or forest interior (Baker and Lacki 1997, Doyon et al. 2005, Simon et al. 2000). However, little is known about the fate of migratory passerines that hold territories in forest stands that are harvested. One hypothesis is that birds holding territories in harvested forest undertake short-distance breeding dispersal (Hagan et al. 1996). Here we consider breeding dispersal to be movement between successive breeding locations (Greenwood and Harvey 1982). Presumably, such behavior would enable individuals to benefit from knowledge of alternate breeding territories within the local landscape gained in prior breeding seasons (Doligez et al. 2002, Marshall and Cooper 2004).

Rates and distances of breeding dispersal are poorly known for most long-distance migratory passerine species (Hoover 2003). This is because the spatial scale of most mark-recapture studies on passerines (< 100 ha; e.g., Jones et al. 2004) is usually small in relation to putative spatial scales of dispersal. Few studies have examined between-year movements in migratory bird species, and those few have generally examined patchily distributed habitat specialists that are more readily re-encountered at large spatial scales because there is less total habitat area to search (e.g., Cilimburg et al. 2002, Dale et al. 2005, Hansson et al. 2002).

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Between-season shifts in territories have been documented in several studies (e.g., *Dendroica caerulescens* Gmelin [Black-throated Blue Warbler]: mean distance between territory centers = 94 m, range 7–501 m [Holmes and Sherry 1992] and *D. chrysoparia* Sclater and Salvin [Golden-cheeked Warbler]: mean distance = 220 m, max = 3400 m [Jetté et al. 1998]). However, when habitat is unaltered, migratory passerines are usually site faithful, returning to the same territories held in previous years (Holmes and Sherry 1992). In a four-year study on *D. petechia* Linnaeus (Yellow Warblers), all 41 returning males that were banded resided in the same locations as in previous years or within two territories' distance (Yezerinac et al. 1996).

To our knowledge, there are no confirmed records of between-season dispersal in long-distance migrant birds following timber harvest. In this paper, we report two such occurrences for two species of long-distance migrant forest warblers, *D. fusca* Müller (Blackburnian Warbler) and Black-throated Blue Warbler. Both species are considered to be site-faithful (Holmes et al. 2005, Morse 2004).

Methods

We conducted our study within the Greater Fundy Ecosystem (GFE), a 4000-km² managed forest landscape in New Brunswick (NB), Canada (66.08°–64.96°W, 46.08°–45.47°N). Mature forest cover of the GFE is primarily *Acer saccharum* Marsh. (sugar maple), *Fagus grandifolia* Ehrh. (beech), *Betula alleghaniensis* Britt. (yellow birch), *Picea rubens* Sarg. (red spruce), and *Abies balsamea* (L.) Mill. (balsam fir). Intensive forestry activities (i.e., clearcutting, spruce and pine planting, thinning) have occurred here since the early 1970s, resulting in a heterogeneous landscape mosaic. Approximately 40% of the study area is mature (> 70 years), unmanaged forest (NBDNR 1993). Within the GFE, between 0.5–2% of mature forest is harvested per year (Betts et al. 2003).

As part of a long-term study of the survival of mature forest warblers in relation to forest fragmentation, we captured Black-throated Blue Warblers (n = 48) and Blackburnian Warblers (n = 48) with mist nets and marked each with a numbered aluminum US Fish and Wildlife Service band and a unique combination of colored leg bands. Birds were captured during the breeding seasons of 2000–2002 in multiple patches of mature forest (> 80 years) that were uncut at the time of capture. We determined the age of birds as second-year (SY) or after second-year (ASY) breeders using plumage characteristics (Pyle 1997).

For two years following capture, we returned twice each year to capture locations and broadcast song playbacks of the appropriate species. Playbacks were broadcast for 5 minutes at the capture location and at four additional points located 50 m in cardinal directions (N, S, E, W) from the capture location (25 minutes x 2 visits = 50 minutes per year search time). At each of these locations, we noted the presence of all banded and unbanded

birds of both species. In the two instances where birds from different capture locations were re-sighted, second observers were present to confirm band combinations. To ensure that observers were not biased towards seeing a particular individual, band combinations of birds were not provided to field assistants prior to return from the field.

To test whether the spatial extent of our re-sighting method influenced results, we conducted playbacks at both 50 m and 100 m in each cardinal direction in 2001. No banded birds were re-encountered at 100 m that were not re-encountered at 50 m.

During the course of our study, two patches containing banded birds were harvested during the non-breeding season (winter) when birds were not present on the study area. Plot A (159 ha) was harvested during 2000 in strips (hereafter "strip cut;" \approx 15-m wide cut, 30-m wide residual mature forest). Plot B was harvested during 2001 (25 ha) by clearcutting, leaving no residual canopy. We searched about half of the remaining mature forest patches within a 25-km² sub-study area surrounding each harvest block (Fig. 1). Not all patches were searched because our mark-recapture protocol required re-encounter efforts only where birds had previously been banded. Further, due to the extensive spatial extent of the study area, it was not logistically possible to search all potential territory locations within each patch.

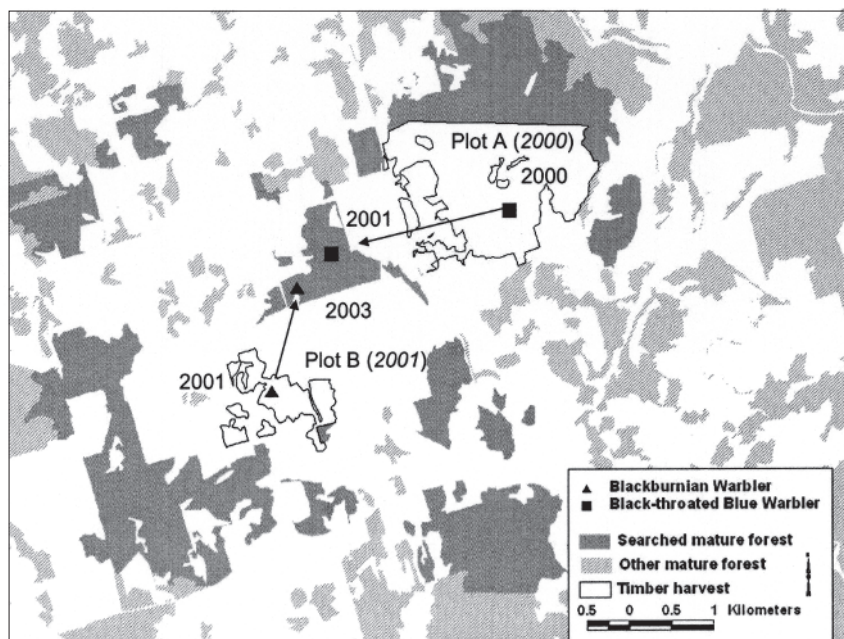


Figure 1. Timing and location of captures and re-sightings of Black-throated Blue and Blackburnian Warblers. Years of harvest (both conducted in winter) are noted in italics for both Plots (A and B). Arrows indicate direction of movement after harvest.

Results and Discussion

In the breeding season one year following timber harvest (June 19, 2001), we re-sighted one of four Black-throated Blue Warblers initially captured in Plot A, in an adjacent mature forest patch 2.2 km from the capture location (Fig. 1). On July 1, the same bird was resighted in a different patch 2.9 km from the capture location and 844 m from the first resight location. Both movement distances are beyond dispersal distances previously reported for this species (Holmes and Sherry 1992). It is unlikely that a territory of this species could be this large (range in territory area = 1–4 ha; Holmes et al. 2005). Thus, this individual may have been observed during an extra-territorial foray (Norris and Stutchbury 2001), may have been non-territorial (i.e., floating between patches), or may have moved his territory during the breeding season. We re-sighted the only Blackburnian Warbler initially banded in Plot B two years later (June 5, 2003), 1.3 km distant in a nearby patch (Fig. 1). This individual was seen in the presence of a female and was thus likely to have been breeding. Neither of these birds was re-sighted in later years of the study. We cannot rule out the possibility that both individuals might have dispersed even in the absence of timber harvesting. Indeed, the Black-throated Blue Warbler that moved from the strip cut was a first-year breeder in the year it was initially captured (2000). First-year breeders may be more likely to disperse (Dale et al. 2005). However, over the course of the study, we did not observe breeding dispersal of individuals originating from non-harvested territories. The mean annual probability of re-encountering marked individuals at the site of initial banding was 0.30 (range = 0.19–0.44) for Black-throated Blue Warblers and 0.22 (range = 0.13–0.25) for Blackburnian Warblers. Aside from the two birds we observed in different locations, all individuals of both species were either re-encountered within a 50-m radius of a banding location or not seen again. We did not re-encounter any banded birds in the harvested blocks during the post-harvest period.

At least two studies have reported increased densities of neotropical migrant warblers in residual mature-forest patches in managed forest landscapes (Hagan et al. 1996, Schmiegelow et al. 1997). Both studies have speculated that increased densities are due to a crowding effect that occurs when individuals are displaced from harvested patches. However, to our knowledge, evidence for such displacement effects has not been observed directly using marked individuals.

Both juveniles and adults of some passerine species prospect for future habitat during and after the breeding season (Doligez et al. 2002, Nocera et al. 2006). There is likely to be an upper limit to the spatial extent that can be searched during a breeding season. Thus, information gleaned from prospecting is likely to be collected over a relatively small spatial scale. Short-distance breeding dispersal is presumably adaptive in that it allows individuals to take advantage of knowledge of the local landscape gained in prior breeding seasons. Also, energy reserves remaining after migration may be insufficient to permit longer-distance dispersal.

Post-harvest breeding dispersal has potential implications at both the individual and population levels. Breeding dispersal entails the risk of missing breeding opportunities if a nesting site and mate are not found (Danchin and Cam 2002). Searching for sites and mates is a time- and energy-consuming activity. Further, when displaced individuals pack into residual patches, competition for territories and mates increases. Displaced individuals could be competitively excluded from residual habitat patches (Burns 2005). Finally, competition for scarce habitat could negatively influence reproductive success of existing territory holders (Hagan et al. 1996). Testing for such population “concussion effects” due to timber harvest may be a fruitful avenue for future research.

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