

# Habitat selection and fidelity by White-throated Sparrows (*Zonotrichia albicollis*): generalist species, specialist individuals?

Patrick Rousseau, André Desrochers, and Adam S. Hadley

**Abstract:** Individuals from habitat generalist species are often thought to be habitat generalist themselves, but this assumption should be examined in light of mounting evidence for native and phenotypic habitat preference. We experimentally tested whether the White-throated Sparrow (*Zonotrichia albicollis* (Gmelin, 1789)) exhibits habitat preferences at the individual level. The White-throated Sparrow was a habitat generalist species in our study area, with high occupancy of clearcuts as well as mature forests. However, males in mature forests whose territories were clear-cut in the winter following their breeding season ( $n = 14$ ), dispersed twice as far as males from uncut mature forests ( $n = 21$ ). New territories selected by males after clearcuts contained significantly more mature forest than what remained in the territory that they abandoned, but not as much mature forest as was found in their former territory. Gain in uncut habitat after dispersal was positively correlated with dispersal distance. Clear-cut locations left vacant by dispersing males were colonized by new conspecifics. Our results suggest that individual sparrows use only a subset of their species' wide range of habitats. We question the assumption that individuals from a generalist species are versatile and unlikely to be affected by habitat disturbance.

**Key words:** habitat selection, breeding dispersal, clear-cutting, individual specialization, site fidelity, territory fidelity, White-throated Sparrow, *Zonotrichia albicollis*.

**Résumé :** Il est souvent présumé que les individus d'une espèce généraliste sur le plan de l'habitat sont eux-mêmes généralistes. Il convient toutefois de réévaluer cette supposition à la lumière d'un ensemble croissant de données témoignant de l'existence de préférences natales et phénotypiques en matière d'habitat. L'étude consistait à vérifier de manière expérimentale si le bruant à gorge blanche (*Zonotrichia albicollis* (Gmelin, 1789)) manifeste des préférences d'habitat au niveau individuel. Dans la zone d'étude, le bruant à gorge blanche était une espèce généraliste, occupant aussi bien des parterres de coupes forestières que des habitats de forêt mature. Cela dit, les mâles de forêt mature dont les territoires avaient fait l'objet d'une coupe à l'hiver, après leur saison de nidification ( $n = 14$ ), s'étaient dispersés sur des distances deux fois plus grandes que ceux dont le territoire demeurait intact ( $n = 21$ ). Les nouveaux territoires sélectionnés par les mâles de territoires ayant fait l'objet d'une coupe contenaient significativement plus de forêt mature que ce qui restait dans les territoires abandonnés, mais pas autant que dans leur territoire initial. Après la dispersion, le gain en habitats non coupés était positivement corrélé avec la distance de dispersion. Les territoires abandonnés après une coupe étaient colonisés par d'autres individus de l'espèce. Les résultats suggèrent que, en tant qu'individus, les bruants n'utilisent qu'une portion de la gamme d'habitats utilisés par l'espèce. Nous remettons en question le postulat voulant que les individus d'une espèce généraliste soient versatiles et insensibles aux perturbations d'habitat.

**Mots-clés :** sélection d'habitat, dispersion de reproduction, coupe à blanc, spécialisation individuelle, fidélité au site, fidélité au territoire, bruant à gorge blanche, *Zonotrichia albicollis*.

## Introduction

Bird species are often found in highly specific sets of habitat, based on vegetation structure, dominant tree species, patch size, and other attributes (Cody 1981). By contrast, certain species appear to have broad habitat requirements, and those species are often assumed to be composed of generalist individuals. However, the latter assumption may not be true; generalist species may be composed of individuals exhibiting

narrow, but different habitat preferences (Bolnick et al. 2003). Individual preferences in habitat may arise from genetic and phenotypic variation, as well as variation in post-fledging experience (Bolnick et al. 2009). As seen with life history and other attributes (e.g., Pettifor et al. 1988), optimal habitat may be specific to each individual of a given species (Edelaar et al. 2008), irrespective of whether the species is a generalist or not. In such a case, changes in the environment may affect not only species with narrow habitat requirements,

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but also generalist species by favoring certain individuals and negatively impacting others, both in the short term and over evolutionary time.

One of the clues enabling us to investigate consistent differences in the way individuals perceive habitat quality is breeding dispersal, i.e., between-year shifts in breeding sites. Breeding dispersal often indicates low habitat quality (Krebs 1971; Holmes et al. 1996; Seamans and Gutiérrez 2007), and therefore is expected to generally increase following major changes in habitat characteristics. However, if the post-disturbance habitat remains equally suitable for the individuals concerned, then breeding dispersal should remain unaffected. Thus, breeding dispersal responses to habitat disturbance may be used to assess habitat quality from the point of view of individuals, as opposed to the entire species.

Because of their dynamic structure, landscapes dominated by forestry practices are well suited for the study of breeding dispersal as a response to habitat disturbance. Unsurprisingly, anthropogenic reductions in the amount of mature forest are known to increase breeding dispersal in species strictly associated with this habitat (Hartley 2003; Betts et al. 2006; Seamans and Gutiérrez 2007). However, in the case of species found in both mature and regenerating forests, increased breeding dispersal following a clearcut should occur only if individuals exhibit habitat specialization with respect to forest-stand age.

White-throated Sparrow (*Zonotrichia albicollis* (Gmelin, 1789); hereafter sparrow) is known to occur in a broad range of habitats ranging from open shrubland to mature forest (Germaine et al. 1997; Norton and Hannon 1997; Gobeil and Villard 2002). Here, we looked for habitat specialist individuals in this species by comparing dispersal responses of sparrows subjected or not to winter clearcuts. Specifically, we predicted that (i) the sparrow occupies all forest age classes in our study area (i.e., is a “generalist”), (ii) individual male sparrows initially breeding in mature forest are less faithful to their territories and disperse farther from disturbed (clearcut) territories than those returning to uncut territories, and (iii) individuals whose territory has been clearcut disperse to forest stands similar to those that they occupied before dispersal.

## Materials and methods

### Study area

We conducted fieldwork at the Forêt Montmorency, a 66 km<sup>2</sup> managed boreal forest 75 km north of Quebec City, Quebec, Canada (47°13′–47°26′N, 71°00′–71°14′W). This forest is composed mostly of balsam fir (*Abies balsamea* (L.) P. Mill.), with small numbers of white spruce (*Picea glauca* (Moench) Voss), black spruce (*Picea mariana* (P. Mill.) B.S.P.), and white birch (*Betula papyrifera* Marsh.); the latter most frequently found in young (<20 years) stands (Darveau et al. 1997). Elevation ranges from 600 to 1100 m. In May, June, and July, mean temperatures are 6.9, 12.4, and 14.7 °C and mean precipitations are 106.4, 134.5, and 145.7 mm, respectively (Environment Canada 2007).

Forêt Montmorency is managed for timber, mostly with clearcuts, i.e., the removal of all commercial stems bigger than 10 cm diameter at breast height. Geospatial data from the third (2000) and fourth (2004) Survey Program of Que-

bec Forests and from Forêt Montmorency’s inventories were used to divide the study area into recent (<3 years) clearcuts, stand heights (<2, 2–4, 4–7, and >7 m), open water, roads, and alder (genus *Alnus* Mill.) patches. The four height classes roughly correspond to stands <10, 10–20, 20–30, and >30 years old, respectively (for details see Darveau et al. 1997). As suggested by Paton (1994), we classified forest edges based on canopy height, and considered them “abrupt” when height difference was >5 m between stands and “soft” when height difference was 3–5 m (Manolis et al. 2002). We delineated roads from an orthophoto taken during summer 2006 (1 : 10 000). We performed all mapping analyses with ArcGIS® version 9.3 (ESRI 2008).

### Habitat occupancy

To address whether sparrows occupy all stand age classes in 2003, 2004, and 2006, point-count stations were placed based on random *x* and *y* coordinates constrained by a minimum distance of 200 m between stations (*n* = 261, mean distance to roads = 98.2 m, maximum = 961 m). Additional point-count stations were placed on roads (*n* = 167), also based on random coordinates along the center of the road, spaced by at least 200 m from other stations. Each point-count station was visited twice by an experienced observer during the breeding season (27 May – 21 July), between 0400 and 1000 EST, under conditions with no rain or strong winds. Sampling order was randomized with respect to habitat type and area, to avoid possible bias owing to plant phenology. During each point count, birds within a radius of 50 m were noted during three successive 5 min passive bird counts and a 15 min bird count with sparrow song playbacks. We opted for a point-count radius of 50 m because distances estimates beyond this are unreliable (Allredge et al. 2007) and unlimited point counts would have little information content, because sparrows could be heard at a distance from almost any location in the study area.

To account for imperfect detection, we conducted single-season site occupancy analyses (MacKenzie et al. 2003, 2006). Models were fit by maximum likelihood with program PRESENCE version 4.1 (<http://www.mbr-pwrc.usgs.gov/software/presence.html>, accessed 20 December 2011). We compared models with sparrow occupancy and detection probability as a function of combinations of forest-stand age, age-squared, and distance to road (Table 1). We did not consider stand vegetation composition, as it was highly correlated with stand age (young stands having greater deciduous cover). Model comparisons and estimates were corrected for underdispersion ( $\hat{c} = 0.1$  for the most complex model). We used a model selection and multimodel inference approach (Burnham and Anderson 2002), based on Akaike’s information criterion corrected for small sample size (AIC<sub>c</sub>).

### Breeding dispersal

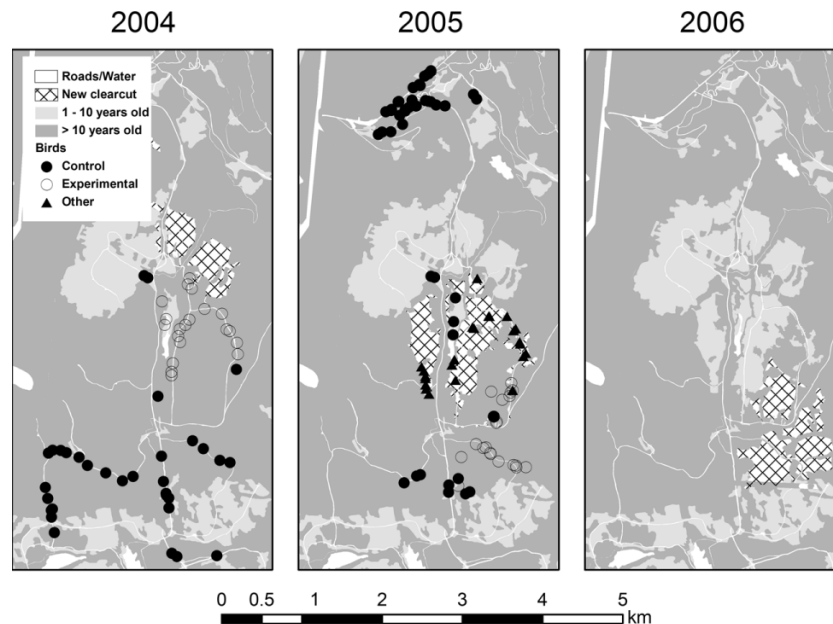
In 2004–2005, we captured 96 male sparrows in mist nets using playbacks of conspecific songs and alarm calls. We marked birds with a unique combination of two coloured plastic bands and a US Fish and Wildlife Service aluminium band for easy visual identification. We captured birds between 0500 and 1600 EDT from 16 May to 13 July in mature stands left uncut in the following year (control) or clearcut in the winter following the breeding season (treat-

**Table 1.** Comparison of multiseason models for habitat occupancy ( $\psi$ ) and detection probability ( $p$ ) of White-throated Sparrows (*Zonotrichia albicollis*), based on 428 point-count stations at Forêt Montmorency, Quebec, during 2003, 2004, and 2006.

Model	$K$	AIC <sub>c</sub>	$\Delta_i$	$w_i$
$\psi(\text{age}, \text{age}^2), p(t, \text{age}, \text{age}^2)$	7	1117.05	0	0.370
$\psi(\cdot), p(t, \text{age}, \text{age}^2)$	5	1118.70	1.65	0.162
$\psi(\text{age}, \text{age}^2, \text{road}), p(t, \text{age}, \text{age}^2)$	8	1119.06	2.01	0.136
$\psi(\text{age}, \text{age}^2), p(t, \text{age}, \text{age}^2, \text{road})$	8	1119.07	2.02	0.135
$\psi(\cdot), p(t, \text{age}, \text{age}^2, \text{road})$	6	1120.71	3.66	0.059
$\psi(\text{road}), p(t, \text{age}, \text{age}^2)$	6	1120.76	3.71	0.058
$\psi(\text{age}, \text{age}^2, \text{road}), p(t, \text{age}, \text{age}^2, \text{road})$	9	1120.95	3.90	0.053
$\psi(\text{road}), p(t, \text{age}, \text{age}^2, \text{road})$	7	1122.73	5.68	0.022
$\psi(\text{age}, \text{age}^2), p(t)$	5	1126.23	9.18	0.004
$\psi(\text{age}, \text{age}^2, \text{road}), p(t)$	6	1128.28	11.23	0.001
$\psi(\cdot), p(t)$	3	1166.14	49.09	0
$\psi(\text{road}), p(t)$	4	1166.85	49.80	0

**Note:** All models shown were also run with time-independent detection probability, but they performed poorly ( $\Delta_i > 3.9$ ). Thus, only time-dependent detection models are shown. “age”, age of forest stand; “road”, distance to nearest forestry road.

**Fig. 1.** Location of clearcuts in 2004–2006 and mean locations of color-marked White-throated Sparrows (*Zonotrichia albicollis*) before dispersal (2004 and 2005 only).

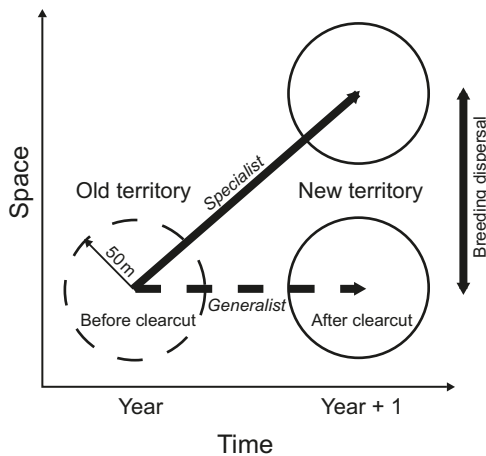


ment; Fig. 1). Treatment stands were spatially clustered each year (Fig. 1), but we assume that there was no effect of the zone per se on sparrow population structure (parental age groups, previous breeding experience, etc.) and associated dispersal behavior, independently of treatment effects. We distinguished sexes by the presence of a cloacal protuberance for males and brood patch for females (Pyle 1997). We used information on mate and flattened wing length to determine sexes in ambiguous cases (Atkinson and Ralph 1980; Schlinger and Adler 1990). Females were not considered in this study because we were unable to catch enough individuals.

We searched for banded males throughout the study area in 2005 and 2006, using a rotation among former banding locations each day. Given that we spent 5–6 h searching and documenting sparrows each day, we assume that search effort was sufficiently homogeneous to prevent substantial bias in

spatial coverage. The search was systematic, i.e., we covered each hectare of the study area irrespective of habitat, with regular use of playback to elicit responses by territorial males. In 2005, we also searched recent clearcuts (<1 year old) outside of the banding areas for sparrows to document the colonization and occupancy of this habitat by the species. We mapped locations of resident males captured or observed from 10 May to 14 July during 2004, 2005, and 2006. We recorded the capture location for each bird in 2004, and 1–39 locations for each individual in 2005 and 2006 obtained with a playback method to determine the borders of the sparrow territories (Falls 1981). We assume that all individuals responding to playback were territory holders (Nowicki et al. 1998). Each location was recorded with a Trimble Geo-Explorer II GPS receiver, with an averaging procedure yielding an accuracy of <2 m (Hadley and Desrochers 2008). We

**Fig. 2.** Dispersal scenarios for generalist and specialist White-throated Sparrows (*Zonotrichia albicollis*) in response to forest clear-cutting.



estimated the location of each territory by tracing a 50 m radius circle centered on each male's capture location (2004) or the centroid of the minimum convex polygon delimiting its recorded locations (2005, 2006). Thus, each year, every bird observed was assigned a 0.79 ha circular area corresponding approximately to the species' territory size in our study (minimum convex polygons of 28 males with >7 locations: mean = 0.71 ha, SE = 0.08) and other studies (Falls and Kopachena 1994).

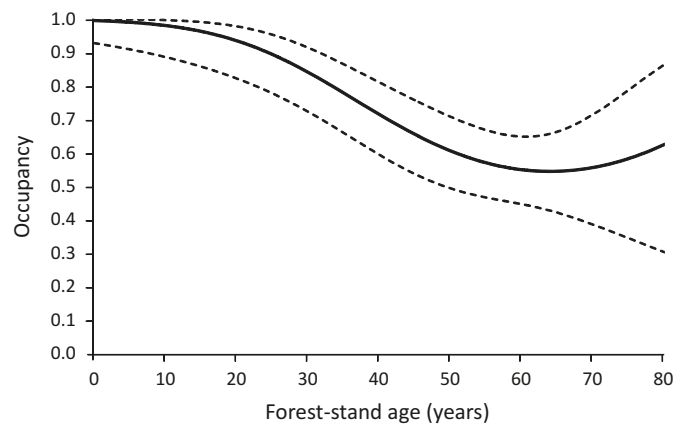
For each male observed in two consecutive years, three locations were compared (Fig. 2): (1) the original territory, (2) the postdispersal territory, and (3) the site of the original territory after the clearcut. Breeding dispersal distances were calculated between original and postdispersal territory centroids (see above). Returning males were considered faithful to their former territory when the breeding dispersal distance was <100 m.

There was no year effect on breeding dispersal distances of control birds (Student's  $t$  test,  $t = -0.71$ ,  $n = 21$ ,  $p = 0.5$ ), thus we pooled data from both series of breeding dispersal events (2004–2005 and 2005–2006). Eight individual males were observed in 2004, 2005, and 2006. Four of the latter individuals were controls each year, and their dispersal events were considered independent. The four others belonged to separate treatments in 2004–2005 and 2005–2006, and we retained their first dispersal event only for analysis. We used Fisher's exact tests to compare return rates and territory fidelity between sites, as mark–recapture analyses provided unreliable estimates because of small sample sizes (Rousseau 2008). Dispersal distances and habitat metrics were highly skewed and were analyzed using nonparametric methods. All statistical analyses were performed with SAS version 9.2 (SAS Institute Inc. 2009). We used an  $\alpha = 0.05$  level of significance for every statistical test.

## Results

Sparrow occupancy estimates were >0.7 throughout the entire range of stand ages (Fig. 3). The model with stand age and its square affecting occupancy ranked highest, but the null model with respect to occupancy performed similarly, with a  $\Delta_i < 2.0$  (Table 1). Thus, there was little evidence for an effect of stand age or distance to road on

**Fig. 3.** Occupancy of forest stands at different ages by White-throated Sparrow (*Zonotrichia albicollis*). The solid line is the estimated occupancy, whereas the broken lines are the 95% confidence limits.



sparrow occupancy, after accounting for detection probability (Table 1). However, it is noteworthy that sparrow detection probability was lower in older forest stands (estimate from highest ranking model =  $-0.43$ , SE = 0.12).

Based on an hypothetical territory size of 0.79 ha (see Materials and methods), treatment males had, on average, 69% of their territory clear-cut (median 86%, range 9%–100%,  $n = 35$ ). Return rates, territory fidelity, and breeding dispersal distances of control males were similar between breeders in mature forests and recent clearcuts (Table 2), although sample sizes were small. Return rates to the study area (i.e., the entire set of sites surveyed for this study) were also similar between control and treatment males (Fisher's exact test, 35% vs. 41%,  $n = 96$ ,  $p = 0.7$ ). However, territory fidelity was significantly higher for control males than treatment males (Fisher's exact test, 90% vs. 50%,  $n = 96$ ,  $p < 0.02$ ). Additionally, the median dispersal distance of treatment males (86 m) was more than twice that of control males (33 m) (Mann–Whitney  $U$  test,  $n = 35$ ,  $p = 0.0004$ ). To address the different territory delineation methods in 2004 vs. 2005–2006, we analyzed the 2005 and 2006 dispersal data separately and found no evidence of year effects.

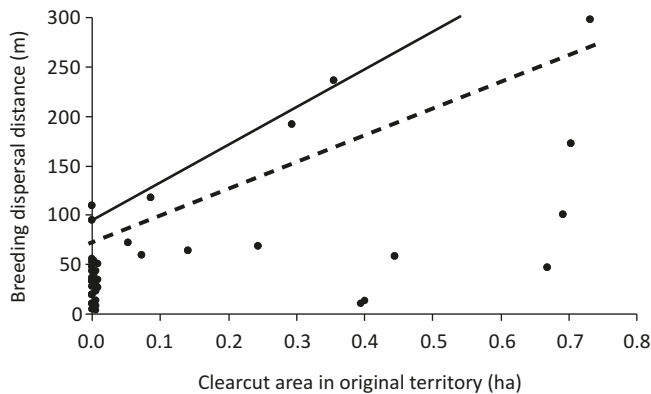
The higher the proportion of the original territory that was clear-cut, the farther males dispersed (ANOVA,  $F_{[1,41]} = 4.8$ ,  $p = 0.04$ ,  $r^2 = 0.13$ ; Fig. 4). This relationship was more evident once two outliers (dispersal distance >700 m) were removed from the data set ( $F_{[1,39]} = 21.4$ ,  $p < 0.0001$ ,  $r^2 = 0.41$ ). The territories of treatment birds had more recent clearcut area, less abrupt edges, and less mature stand area compared with their original territories (Wilcoxon's signed-rank tests; recent clearcut,  $t = 2.6$ ,  $p = 0.02$ ; abrupt edge,  $t = -2.3$ ,  $p = 0.03$ ; mature stand,  $t = -5.0$ ,  $p = 0.0009$ ). Returning treatment birds had less recent clearcut and more low regeneration in their new territory than what was left in the territory they had before (Wilcoxon's signed-rank test; recent clearcut,  $t = -1.9$ ,  $p = 0.04$ ; low regeneration,  $t = 2.1$ ,  $p = 0.03$ ). Thus, on average, postdispersal territories for treatment males had an intermediate level of recently clearcut area and area of mature forest similar to the original "territory" after clearcut (Fig. 5). The amount of uncut habitat in the new territory increased with increasing breeding dispersal distance

**Table 2.** Return rates, territory fidelity, and breeding dispersal by White-throated Sparrows (*Zonotrichia albicollis*) breeding in mature forest and recent (1 year old) clearcuts.

Measure	Mature forest	Recent clearcut	Test	<i>p</i>
Return rate (%)	35 (60)	50 (12)	Fisher's exact	0.3
Territory fidelity(%) <sup>a</sup>	90 (21)	100 (6)	Fisher's exact	1.0
Median dispersal distance (m)	33 (21)	46 (6)	Mann–Whitney <i>U</i>	0.5

**Note:** Numbers of dispersal events are in parentheses.  
<sup>a</sup>Dispersal distance <100 m.

**Fig. 4.** Linear regression between breeding dispersal distances of White-throated Sparrows (*Zonotrichia albicollis*) and area clear-cut in the original territory. The broken line represents the linear regression drawn without two outliers not shown in the graph (0 ha: 1016 m; 0.7 ha: 858 m).



(linear:  $F_{[1,13]} = 5.8$ ,  $p = 0.03$ ,  $r^2 = 0.3$ ; quadratic:  $F_{[2,12]} = 4.0$ ,  $p = 0.05$ ,  $r^2 = 0.4$ ; Fig. 6). The relationship remained similar without the outlier (linear:  $F_{[1,12]} = 15.1$ ,  $p = 0.002$ ,  $r^2 = 0.56$ ; quadratic:  $F_{[2,11]} = 17.5$ ,  $p = 0.0004$ ,  $r^2 = 0.76$ ).

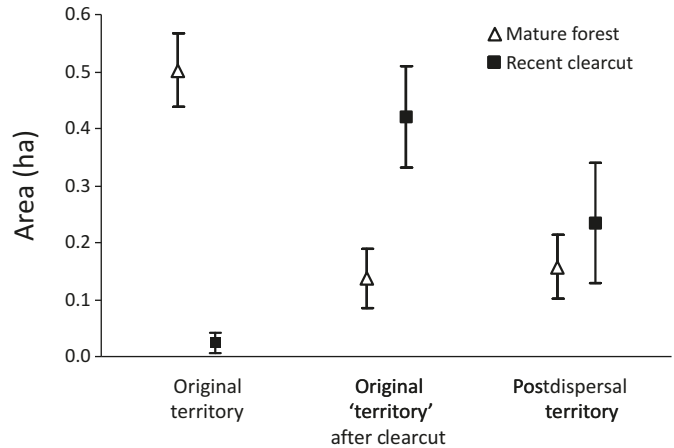
**Discussion**

The White-throated Sparrow was a generalist species at the Forêt Montmorency. This species is known to breed successfully in a wide range of forest habitats, from month-old clearcuts to old-growth stands (Falls and Kopachena 1994). In addition, return rates, territory fidelity, and breeding dispersal distances did not differ between clearcut and mature-forest stands. Thus, this species can be considered to be a generalist in the study area, responding comparably to dramatically different forest habitats.

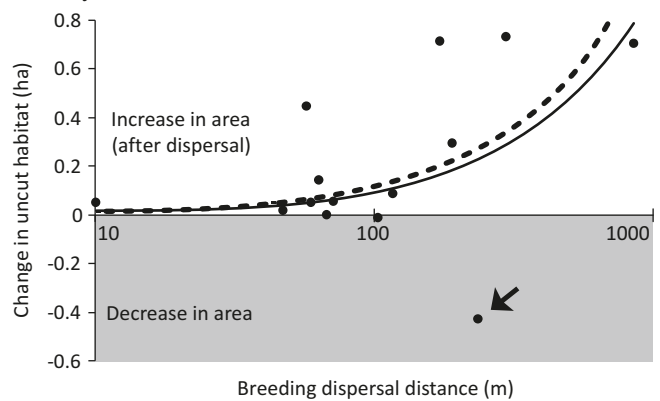
Our results supported the prediction that sparrows experiencing a winter clearcut in their territory would be less faithful to their territory in the following breeding season. Despite the fact that we used a liberal definition of territory fidelity (see Hoover 2003; Howlett and Stutchbury 2003), males that returned to the Forêt Montmorency to find their territory clear-cut were only half as faithful as control males to their former territories. Furthermore, treatment males dispersed over twice as far as control males. Since sparrows were in their wintering grounds when the silvicultural treatment was done, and sampling effort was similar over the entire study area, it is not surprising that similar proportions of individuals returned to the study area, irrespective of treatment.

Our prediction regarding the similarity between new post-dispersal territories and original territories was partially supported. Indeed, the composition of postdispersal territories of

**Fig. 5.** Area of mature forest and recent clearcut in the original and postdispersal territories of White-throated Sparrows (*Zonotrichia albicollis*) and in the original “territories” after clearcut (mean ± SE).



**Fig. 6.** Quadratic regression between the amount of uncut habitat in the new territory (vs. the old one), and breeding dispersal distance (log scale) of White-throated Sparrows (*Zonotrichia albicollis*). The broken line represents the linear regression drawn without the outlier shown by the arrow.



treatment males was intermediate between that of the composition of their original territories before clearcut vs. after clearcut. If treatment males had been strictly mature-forest specialists, they would have moved far enough to colonize mature-forest stands unaffected by the clearcut. It thus seems that sparrows caught in the mature forest were not strictly restricted to those habitats or that gains in forested habitat were more than offset by the cost of dispersal per se. For example, it is possible that recent clearcut areas found in postdispersal territories of treatment males reflected their reluctance to disperse outside a “neighbourhood” of conspecifics (Beletsky and Orians 1989; Fletcher and Miller 2006) or even hetero-

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specifics (Mönkkönen and Forsman 2002) and their associated benefits in terms of “public information” (Doligez et al. 2002). In such a case, relocated males would be expected to breed later than those suffering no major changes in their territory, but unfortunately we did not have precise information on territory establishment dates to test this idea. Furthermore, responses to major habitat changes can be delayed by site fidelity of breeding individuals (Wiens and Rotenberry 1985; Hagan et al. 1996). Two methodological factors may have weakened support for our prediction regarding the similarity between new postdispersal territories and original territories. First, the habitat classification that we used presumably does not reflect sparrow habitat completely, thus obscuring factors that may play an important role in habitat selection by sparrows. Second, the more abundant abrupt edges found in their original territories (vs. postdispersal territories) may have arisen from a bias in the location of initial captures, which often occurred near roads to facilitate fieldwork (although site occupancy analysis did not reveal a strong effect of road distance on detection or on occupancy). Third, although we searched the study area thoroughly for any returning males, detection probability of sparrows was lower in older forest stands, which may have led to an underestimation of stand ages used by returning males. This possible bias could explain why dispersers apparently moved to somewhat younger stands than predicted based on their previous territory. In any case, even though clearcuts are a habitat readily used by sparrows, they were apparently not suitable for most individuals with previous breeding experience in mature-forest stands.

Breeding dispersal has long been known to reflect habitat quality, with greater breeding dispersal associated to low-quality habitats, especially in birds (Krebs 1971; Holmes et al. 1996). This observation seems to hold true in forested habitats. Black-throated Blue Warbler (*Dendroica caerulescens* (Gmelin, 1789)) and Blackburnian Warbler (*Dendroica fusca* (Statius Muller, 1776)) were reported to disperse to new territories following clearcuts (Betts et al. 2006). Hartley (2003) also reported that male Hermit Thrushes (*Catharus guttatus* (Pallas, 1811)) were nearly nine times more likely to disperse to adjacent, uncut sites in the year following the removal of 10%–20% of trees in their territories. Contrary to the species cited above, habitat produced by clear-cutting remains suitable for nesting sparrows, and shifts in territory locations did not occur because of a shift of the habitat outside of the species’ ecological niche.

Our inference regarding individual habitat preference is obviously limited to males preferring mature forests and may indeed occur only in one sex. However, it is impossible from our approach to determine whether it would be driven by females or males, given mate fidelity in the species (Rousseau 2008). Furthermore, habitat selection and specialization may be associated to the two plumage morphs in sparrows (Falls and Kopachena 1994), but our sample sizes were too small to allow a meaningful comparison of plumage morphs with respect to breeding dispersal.

Among-individual variation in resource use can be explained by the specialization of different individuals of a population to specific resources as reviewed by Bolnick et al. (2003) among 93 vertebrate and invertebrate taxa. Thus, in addition to factors like sex, age, and morphotype, individual specialization is increasingly recognized for its profound in-

fluence on animal’s behaviours such as foraging behavior, diet, and breeding decisions (Bolnick et al. 2003). Individual specialization in terms of habitat selection has received little empirical support and our study may provide an interesting avenue of research on individual habitat specialization in birds.

Although our definition of habitat ignored aspects such as competition, predation, food, and conspecifics, this study shows that individuals from a habitat generalist species may use only a subset of their species’ ecological niche. We highlight the possibility that forestry practices could lead to significant changes in the behavioral and possibly, genetic, diversity of a species by favoring clearcut and young-forest specialists to the detriment of mature-forest specialists. This phenomenon may well be more common than previously thought, and so-called “generalist” species may respond strongly to management practices that would otherwise appear innocuous for them.

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