



Fundy Model Forest

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“The Fundy Model Forest (FMF) is a partnership of 38 organizations that are promoting sustainable forest management practices in the Acadian Forest region.”

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Canadian Institute of Forestry
Canadian Forest Service
City of Moncton
Conservation Council of New Brunswick
Fisheries and Oceans Canada
Indian and Northern Affairs Canada
Eel Ground First Nation
Elgin Eco Association
Elmhurst Outdoors
Environment Canada
Fawcett Lumber Company
Fundy Environmental Action Group
Fundy National Park
Greater Fundy Ecosystem Research Group
INFOR, Inc.
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Maritime College of Forest Technology
NB Department of the Environment and Local Government
NB Department of Natural Resources
NB Federation of Naturalists
New Brunswick Federation of Woodlot Owners
NB Premier's Round Table on the Environment & Economy
New Brunswick School District 2
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Nova Forest Alliance
Petitcodiac Sportsman's Club
Red Bank First Nation
Remsoft Inc.
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Sussex and District Chamber of Commerce
Sussex Fish and Game Association
Town of Sussex
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Village of Petitcodiac
Washademoak Environmentalists



Fundy Model Forest Interim Report: April 2003

Habitat Requirements of Forest Birds in the Fundy Model Forest

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Summary

In the development of the 2002 management planning objectives for Crown land, the Fish and Wildlife branch of the Department of Natural Resources and Energy (DNRE) has made extensive use of the 'indicator species' approach. Crown land licensees will be required to retain certain types and sizes of forest that meet the needs of indicator species. The Fish and Wildlife branch was forced to rely on incomplete data and research literature from other areas of the continent. This is problematic due to recent scientific findings which reveal that the habitat requirements of species can significantly vary from region to region (Rosenburg et al. 1999). This uncertainty is of concern for two major reasons: (1) If the species-habitat and species-area relationships are incorrect or have been underestimated, it is possible that target species *will not be effectively protected* in 2002 Crown land forest management plans. (2) If species-area relationships are overestimated, it is possible that *annual allowable cuts for Crown land are being restricted more than is necessary*.

The primary goal of this project is to develop scientifically-based habitat associations for birds that are DNRE vertebrate indicator species. All of this information will serve as a sound scientific basis for current and future Crown land management policy and will heighten policy credibility not only with licensees, but with the New Brunswick public as a whole.

This project has three major objectives:

- (1) Determine aspatial (stand structure, stand composition) habitat relationships for avian indicator species. This includes such stand attributes as vegetative species composition and the size and physical distribution of species within the stand.
- (2) Determine spatial (patch size) habitat requirements of avian indicator species.
- (3) Examine aspatial and spatial habitat requirements for a range of other bird species to determine if they might serve as better indicator species in upcoming forest management planning exercises.

Summary of Progress in 2002-2003

Research and implementation objectives from 2002 have been successfully implemented. A total of 370 sample points representing the full range of patch sizes (5-1000 ha) and landscape cover (10% - 80%) were established in the 4000 km² area in the Greater Fundy Ecosystem region (Fig.1).

110 individuals from four focal species were captured and banded in 2002, bringing our banded bird total to 304. We expect that with one additional year of re-sighting, this sample size should give us an estimate of survival. Re-sight rate averaged approximately 25% for all four focal species. Initial results suggest that there could be a difference in site-fidelity and survival between fragmented vs. unfragmentated landscapes for Black-Throated Blue, Ovenbird and Blackburnian Warbler.

Currently, detailed stand level results were tabulated in 2001-2002 and used as guidance in NBDNRE 2007 Crown Forest Management Planning (Beaudette pers. comm..) (See 2001-2002 Final Report). Landscape level data from 2002 is currently being analyzed. Preliminary results of landscape analysis is summarized in this report below.

Initial landscape-level models that allow managers to predict the presence/absence and reproductive success of forest birds on the basis of patch size and/or landscape cover will be available by late spring 2002. To our knowledge, this approach that allows separation of the influence of configuration (patch size) and composition (landscape cover) variables is new to

wildlife science. It will be useful to provincial and industrial forest managers in that they will be able to determine the appropriate amounts and distribution of habitat in managed landscapes.

Landscape Methods

A total of 370 sample points representing the full range of patch sizes (5-1000 ha) and landscape cover (10% - 80%) were established in the 4000 km² area in the Greater Fundy Ecosystem region (Fig.1)(Table 1). Points were placed at three distances from the patch edge (defined below): 75m, 325m, 575m. "Landscapes" are defined as circles with radii 2 * the predicted median dispersal distance of Blackburnian Warbler and Ovenbird (2276 m) (Bowman 2003). At least two landscapes per patch treatment were established. However in some cases due to the large size of landscapes, multiple sample patches (~3-4) were contained within sample landscapes. All territorial bird species were recorded with the use of point count and playback methodologies (see 2003 proposal for details). Vegetation and stand structure was sampled at all 370 points.

Table 1. A priori sampling design for 2002 and 2003. Sampling was stratified across patch size and landscape cover (N for landscapes is in brackets).

Patch Size (ha)	High cover (80-100%)	Medium cover (35-75%)	Low cover (1-20%)
< 5	4 (2)	4 (2)	4 (2)
5 – 20	4 (2)	4 (2)	4 (2)
20 – 50	4 (2)	4 (2)	4 (2)
50 – 100	4 (2)	4 (2)	4 (2)
100 - 500	4 (2)	4 (2)	4 (2)
500 +	4 (2)	4 (2)	4 (2)
Total patches (landscapes)	40 (12)	40 (12)	40 (12)

Criteria for patch selection and point establishment

1. Edge is defined as sharp gradients between habitat with high probability of occurrence ($p > 0.3$), adjacent to low probability of occurrence ($p < 0.1$). The difference between probabilities of 'patch' vs 'non-patch' should be maximized (e.g. patch = 0.7, surrounding area = 0.01).
2. A patch can be considered discrete if it is > 50 m (53.5 m) from an adjacent patch (this is the mean territory radius of Blackburnian Warblers). Or discrete if > 30 m (Villard et al. 1995). It is unlikely that birds would establish territories across gaps of this width.
3. Agricultural land (including blueberry fields) and urban development should be kept to a minimum ($< 5\%$) of all sampled landscapes. This study is not concerned with the influence of fragmentation caused by agriculture.
4. "Cover" is defined as the total area where probability of occurrence is > 0.3 .

In preliminary analysis, we selected five birds that have been previously correlated with large scale landscape pattern (Robbins et al. 1989, Villard et al. 1995). These species are: Black-throated Blue Warbler, Blackburnian Warbler, Ovenbird, and White-breasted Nuthatch and Brown Creeper.

Statistical Analysis and Landscape Data

We used GIS to derive all landscape level variables. These included: patch size (and log patch size), % landscape occupied by mature forest (at multiple scales: 250, 500, 1000, 2000 m radii), % landscape occupied by plantation, % of landscape in appropriate 'habitat' for defined species. 'Habitat' was defined by using stand level habitat relationships derived in the first phase of research (2001). We used logistic regression to determine the importance of landscape level variables as predictors of forest bird species presence/absence and evidence of reproductive activity (see 2003 proposal for details). Both response variables were treated as binomial (0,1). Only reproductive activity results are reported below. In all cases we searched for stand-level variables that explained the most variability in bird presence/ absence or reproductive success ($p < 0.05$). We selected models with the lowest AIC value. This reflects the most parsimonious

model (Burnham and Anderson 1998). These significant variables were retained in landscape models, effectively statistically controlling for stand-level variability.

Results

Of five species examined, three (White-breasted Nuthatch, Brown Creeper, and Blackburnian Warbler) showed correlations with large-scale landscape patterns (>250 m radius)(Table 2). The reproductive activity of White-breasted Nuthatch was most strongly correlated with the size of mature hardwood patch (Fig. 2)(log transformed)(pseudo $r^2 = 0.18$, $p < 0.001$), however both the presence of plantations within 2 km and the amount of mature hardwood forest within 500 m explained a significant amount of variability (combined model: pseudo $r^2 = 0.38$, $p < 0.001$). Blackburnian Warbler reproductive activity was best explained by the amount of mature forest within 1 km ($r^2 = 0.06$, $p < 0.005$). Brown Creeper was correlated with the log of mature patch area (pseudo $r^2 = 0.06$, $p < 0.03$) (Fig. 3).

Table 2. Influence of landscape-level factors on the observed reproductive activity of five forest bird species. All large scale relationships were tested while controlling for local-level (<250 m radius) effects. Only significant ($p < 0.05$) relationships are reported.

Species	Variable	Coefficient	Pseudo r^2	P
White-breasted Nuthatch	Mature hardwood forest within 500 m radius	0.06	0.08	0.001
	Plantations within 2 km	-0.0058	0.08	0.01
	Log hardwood patch size	0.31	0.2	0.001
Blackburnian Warbler	Mature forest within 250 m radius	0.11	0.067	0.0001
	Mature forest within 1000 m radius	0.007	0.063	0.0001
Ovenbird	Ovenbird habitat within 250 m	0.07	0.03	0.03
Black-throated Blue Warbler	Hardwood forest within 250 m	0.08	0.04	0.01
Brown Creeper	Mature forest within 250 m radius	0.094	0.03	0.02
	Log mature forest patch size	0.24	0.06	0.03

Preliminary Discussion

We have found that landscape pattern and composition influence the reproductive activity of some forest birds. However, it is important to note that these broad-scale variables do not explain a large amount of the variance in any of these species. This could be due to error in GIS interpretation, inaccurate estimates of what constitutes 'landscape' scale, and other unmeasured factors that contribute to reproductive activity in these species. Satellite imagery change detection data may be available by 2004 for the Fundy Model Forest (Hay, Pers. Comm. 2003).

This should greatly increase our estimates of landscape composition. Further, with future work we expect to be able refine our definitions of landscape-scale 'habitat' and the appropriate scale of analysis for each species. Including more stand-level variables in analysis will also contribute to model fit.

As White-breasted Nuthatch is strongly correlated to hardwood forest, our initial recommendation is that this species be retained as a DNRE indicator for this habitat type. However, it would be prudent to increase the area requirement from 60 ha to 200 ha as this is where a threshold exists. Further, as we now have quantitative evidence that this species is area-dependent, DNRE spatial criteria for this cover type should be implemented (previously these have been provided as 'guidelines'). Similarly, we have found previously that Blackburnian Warbler is correlated with mixedwood forest (Betts et al. *In Prep*). This species should be considered as an indicator of mature contiguous mixed forest.

Work in 2003-2004

Landscape results must still be generated for an additional 20 species. Further, over the next 6 months we hope to publish stand-level results that are tested using external data (northern New Brunswick). In 2003 it will be critical to collect more census and site-fidelity data to verify the relationships noted in this report (see below).

Field Season 2003

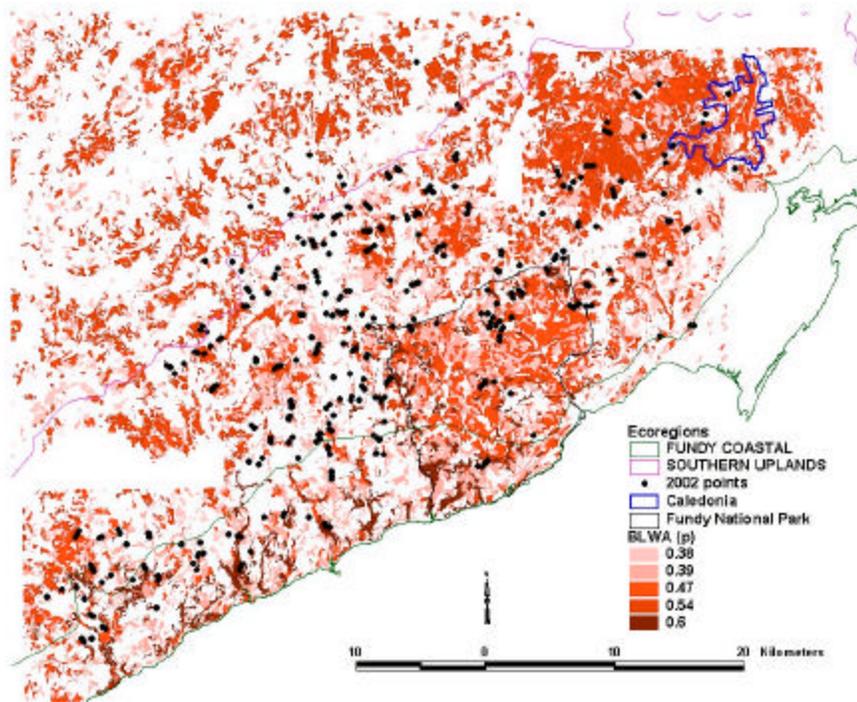
We plan to apply to FMF for project funding for a fourth year in 2003-2004. By conducting an additional field season (2003) several benefits will be realized: (1) We will gain an entirely new measure of habitat quality (resettlement rate – see FMF proposal 2003), (2) Conclusions will be more reliable as they will be based on multi-year data (landscape-level data has only been collected for one year). (3) An additional year will give us much better estimates of survival (see FMF proposal 2003). For the necessary extensive research to be implemented, a wide range of funding sources will be necessary (see Budget in 2003 proposal).

Funding Update: March 31, 2003

We have so far been granted \$10,000 from Fundy National Park and \$15,000 from the Wildlife Trust Fund for our 2003-2004 field season. In kind support from DNRE is once again being provided in the supply of two field trucks.

Fig. 1. Spatial distribution of sample points in 2002 according to two criteria: (a) patch size, and (b) landscape cover (High = >80%, Med = 30-50%, Low = 0 – 30%). Habitat map is for Blackburnian Warbler (probability of occurrence) based on models developed in 2002 based on 2001 data.

(a)



(b)

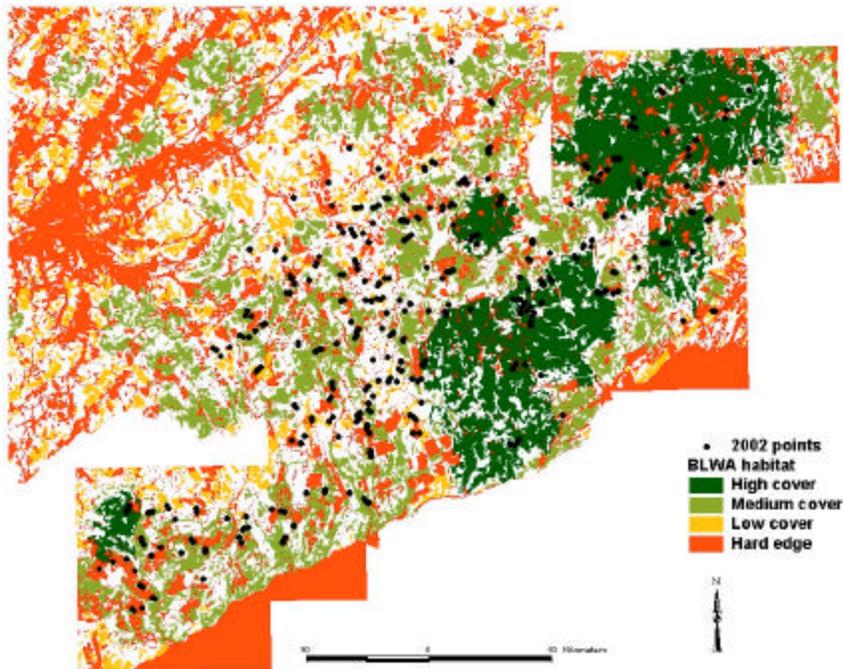


Fig. 2 Probability of White-breasted Nuthatch reproductive activity as predicted by mature hardwood forest patch size (ha) (original predictor log transformed).

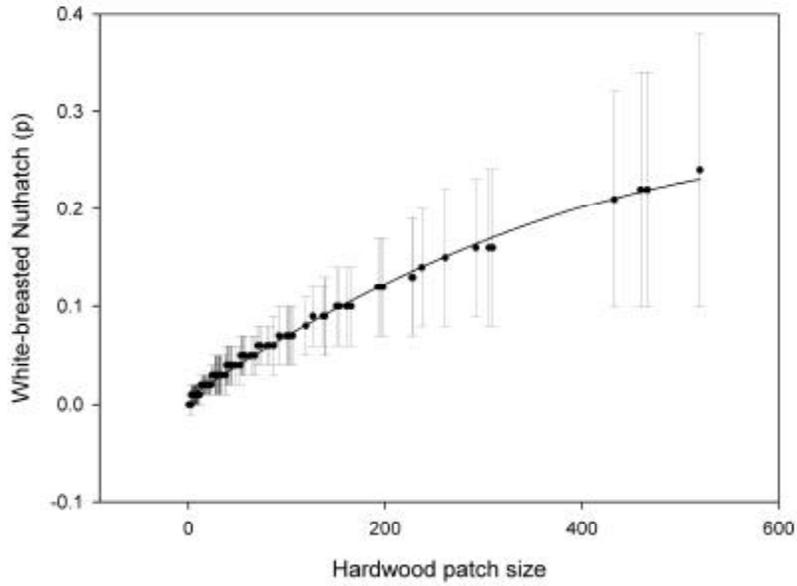
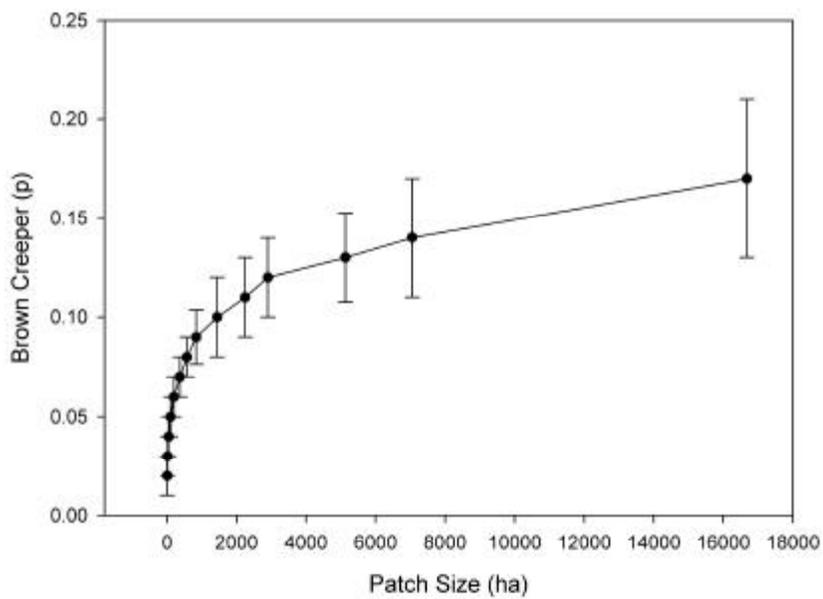


Fig. 3 Probability of Brown Creeper reproductive activity as predicted by mature forest patch size (ha) (original predictor log transformed).



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