

**Nova Scotia Habitat Conservation Fund - 2008 - Year 2/3 Final Report**  
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**Project Name:**        **An Individual Based Model of American Marten (*Martes americana*) in Cape Breton, N.S.**

**Goals and Objectives**

The ultimate goal of this research is to compliment the efforts of the Nova Scotia Marten Recovery Team (NSMRT) and the Nova Scotia Department of Natural Resources (NSDNR) towards achieving a viable self-sustaining marten population in Cape Breton Island (CBI). We aim to accomplish this by recommending augmentation and management strategies based on the results of simulated empirical testing within the framework of an individual based model (IBM) of the CBI marten population.

**Background**

Over-trapping and habitat fragmentation have been identified as the main causes of marten decline in Nova Scotia (Austin-Smith 2006). The Cape Breton Island (CBI) marten population is currently estimated to be below 50 individuals (Scott 2001). The NS Marten Recovery Team (NSMRT) has elected to undertake an augmentation project to supplement the population; a costly and time-consuming effort that will be facilitated through the development of an individual-based model (IBM).

Individual-based models are built from the perspective of individual organisms and their behaviour (Grimm & Railsback 2005). The bottom-up strategy of such models is to compile relevant information about entities at a lower level of the system (i.e. individuals), formulate theories about their behaviour, incorporate these into a computer simulation model, and observe the emergence of system-level properties related to particular questions (Grimm et al. 2005). Most IBMs are spatially explicit as the rules for an agent's behaviour are often governed by space. Mechanistic, bottom-up IBMs have become a popular tool as they are based on simple rules but can generate complex real-world patterns (e.g. Tews et al. 2007).

Using an IBM approach is the only feasible way to explore various management strategies and scenarios to realistically predict effects on the CBI marten population based on time frames much larger than would be practical through traditional study. The IBM will provide a tool ensuring that resources dedicated to marten recovery are invested wisely. This research aims to determine the best management strategy for species recovery through making recommendations pertaining specifically to the logistics of the augmentation itself (i.e. number of individuals, locations, and time frames for release) and habitat management.

The Nova Scotia Department of Natural Resources (NSDNR) Wildlife Division and the NSMRT have expressed interest in the proposed research and its practical applications to species recovery. In addition to providing invaluable information at the initial stages of augmentation the IBM will be developed in such a way as to allow for future management recommendations. The model's parameters can be adjusted at any point as input variables change or more information becomes available, providing consistent open concept predictive capacity in the face of changing circumstances.

## **Outline of Work Completed**

### Coarse Woody Debris Component

Data was collected from 126 plots in the Cape Breton Highlands and regression modeling was used to predict CWD volume from other forest attributes. CWD quantity was associated with forest type (natural, managed, dead/depleted), cover type (deciduous, mixed-wood, coniferous), and stand age. The density of CWD in the population (n= 71,483 stands) ranged from 0.02-1739.7m<sup>3</sup>/ha with a mean of 54.4+/-39. m<sup>3</sup>/ha across all forest types. CWD volumes were higher in dead/depleted stands (62.207+/-40.085m<sup>3</sup>/ha) than managed (58.330+/-53.519m<sup>3</sup>/ha) or natural (53.473+/-38.587 m<sup>3</sup>/ha) forests. Hardwood stands had less CWD on average (32.272+/-24.865m<sup>3</sup>/ha) than did softwood (57.146+/-50.175m<sup>3</sup>/ha) or mixed stands (58.625+/-21.711m<sup>3</sup>/ha). Managed hardwood forests had the highest average volume of all stand types (115.957+/-67.75 m<sup>3</sup>/ha), followed by managed mixed-wood forests (114.521+/-72.162m<sup>3</sup>/ha). Natural hardwood forests had the least CWD (29.666+/-19.728m<sup>3</sup>/ha). When CWD volume was compared with stand age, the typical U-shaped distribution was evident with the least CWD in stands 30-49 years of age.

### Geographic Information Systems (GIS) Based Habitat Component

A version of the habitat suitability index (HSI) model has been developed, parameterized, and implemented (using Arc GIS). A series of graphical representations of the optimality of habitat in Cape Breton as it relates to marten requirements has been produced for the present (2008) and future (2015, 2020, 2025, and 2030) using stand maturation techniques described in the DNR yellow book as employed previously by the Marten Habitat Sub-Committee. I am currently working on analyzing and validating the results of the HSI application through developing alternate versions of the habitat model. A quantitative comparison between outputs of various model structures and parameters will be performed. Telemetry data from collared translocated marten will be obtained during the summer of 2009 and will be used to further validate the HSI as well as to determine habitat site selection, post-release movement patterns, and home range fidelity through use of the ArcGIS animal movement extension.

### The Individual-based Model

Literature review of marten demographic parameters has been completed. Preliminary parameterization of the model and its structure have begun. The model will be run using HexSim software, which is a descendent of PATCH programs designed for implementing individual based models of terrestrial wildlife. The IBM is expected to be complete by June of 2009.


### **Year 3 - The Future of the Project**

The first 2 years of this research have been conducted in close association with Nova Scotia Department of Natural Resources (NSDNR) Wildlife Division, the NSMRT, and Parks Canada. This cooperative approach to marten recovery efforts has led to the potential for the current research to expand into conducting the aerial telemetry tracking of those translocated individuals fitted with radio collars (~3 trips per month). NSDNR Wildlife Division is currently overseeing the data collection, but limited man-power is resulting in temporal gaps in the data. Therefore, in addition to completing the IBM component of this research, telemetry effort will be included given that it will address this limitation and will make efficient use of resources given that spatial data obtained can be used in direct combination with the previously developed HSIs to provide insight to dispersal patterns following release, habitat usage, home range establishment, species movement patterns, and survival rates.

Ground surveys in areas where marten presence has been confirmed through telemetry efforts will provide data which can be used in further habitat usage analysis (e.g. generalized linear or additive modeling through logistic regression) and in validation of the HSI developed in the second year of this study. Dependent on the number of marten presences detected, it is estimated that ground surveys will take approximately 10 days.

The CWD prediction data has been requested by DNR Wildlife Division for its potential applicability to predicting the quantity of CWD in the remainder of NS. The presentation of the CWD and habitat components of this research received the award for the best student presentation at the Atlantic Society of Fish and Wildlife Biologists conference last fall for the work to date.

This research would not have been possible without the support of the Nova Scotia Habitat Conservation Fund - thank you sincerely,



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