Lake Superior State Forest Sustainable Forest Management Pilot Project

REPORT 11

Wildlife Habitat Projections for 15 Species in the Lake Superior State Forest

Tom Clark

January 26, 1999

Table of Contents

List of Tables

List of Figures

1. Introduction

This report summarizes the preliminary habitat projections for 15 wildlife "indicator" species on the basis of a timber-supply forecasting model. Because of the preliminary state of the analysis, this report emphasizes a description of the procedure, its assumptions and limitations.

Forest management is the single largest influence on wildlife habitat quality in today's forests. The forest management planning guide that is being developed for the Lake Superior State Forest (LSSF) must take into consideration the linkage between wildlife and forestry administration in the Michigan Department of Natural Resources (MDNR). One way of facilitating that linkage is by sharing "tools". As part of the LSSF Sustainable Forest Management (SFM) Project, a computer model called the Strategic Forest Management Model (SFMM) (Davis 1998) has been adapted for the LSSF. This model has the ability to be the shared tool between wildlife and forest administration.

SFMM is a timber-supply forecasting tool that is most often used to provide long-term non-spatial projections of wood supply. Beyond that, SFMM has a wildlife component (Clark and Baker 1998) that can project habitat availability on the basis of forest management. It is a simple wildlife habitat supply model. SFMM requires biologists and foresters to develop a common language for describing the forest in order to provide wildlife and timber projections.

The forest description provided by the LSSF SFM Project (Callaghan 1999) was limited to timber resources. The purpose of this report is to extend the forest description to include some wildlife species. An important part of this report will be explaining the limitations and assumptions of the wildlife component. The natural tendency of the general public, on seeing a graph labeled "Moose" or "Deer", is to jump to the conclusion that habitat and population are the same thing.

Discussion of the technical aspects of the wildlife component will be dealt with only as an overview or as it relates to the LSSF. A manual is available describing the details of the SFMM Wildlife Component (Clark and Baker 1998).

2. SFMM Wildlife Component

Often foresters use their own individual system of dividing the forest into functional forest types, often on the basis of silvicultural treatments. These are called Forest Units (FUs). FUs can be expressed in operations inventory (OI) terminology. In recent years, many forest managers across North America have tried to expand these FUs into a more ecologically based system. One of the benefits of FUs is that they provide a common language between foresters and other forest planners, such as biologists.

For their part, biologists represent the life requirements of wildlife species through a habitat matrix. In its simplest form, the matrix correlates forest types (which are not usually the forest units defined by foresters) and age classes with wildlife species. In some cases, the forest types in the matrix are expressed in ecological units or wildlife habitat units instead of forest units.

Wildlife Habitat Units (WHUs) are a concept related to ecological classification. They should be based on soil types, landscape features, vegetation and other ecologically based variables. In other words, ecological classification is based on more than just trees. When it is used properly, ecological classification describes wildlife habitat in a more meaningful way. WHUs can be translated into OI or FU terminology. Connecting habitat information (in the form of WHUs) with forestry information (based on FUs) provides a common language, and allows forecasting of wildlife habitat.

3. Adaptation of SFMM Wildlife Component to the LSSF

In summary, three elements are required if a timber supply model such as SFMM is to be used for wildlife projections: a basic description of the FUs, a wildlife matrix, and a translation matrix between the first two elements. For the LSSF, the OI was used for FUs, as described by the LSSF SFM project (Callaghan 1999). The wildlife habitat matrix from MDNR is used for wildlife habitat units. Appendix 1 provides a summary of the 15 species covered in this report. The crossroads between FUs and WHUs in SFMM is a table that translates between the two systems (Table 1).

Table 1. Translation matrix excerpted from SFMM input file.

```
Table: Fu_HabUnit_Prop(mu,fu_global,hab)

!  MU   .  FU    ----Habitat Unit __--------
                 Up_Cn Up_Mx Up_Dc Lw_Cn Lw_Mx Lw_Dc H_Nfr

 LSSF  . PR      1.000
 LSSF  . PJ      1.000
 LSSF  . SOC     0.375             0.625
 LSSF  . CDR                       1.000
 LSSF  . MSC                       1.000
 LSSF  . ASP                 1.000
 LSSF  . OIH                 1.000
 LSSF  . NHWs                                  1.000
 LSSF  . LHW                                   1.000
```

For this preliminary description of the LSSF, the translation is a very basic relationship because the habitat matrix is fairly simple. From the codes along the top row in Table 1, there are six WHUs subdivided into upland or lowland, and coniferous, deciduous or mixed. A seventh unit (H_Nfr) refers to all of the non-forested area. This resolution of WHUs is appropriate for the current analysis. The first column of this matrix contains the FUs.

The body of the table describes the relationship between FUs and WHUs. Each row must add up to 1.0. That means that each FU is broken down into its component WHUs. Normally each FU will comprise several WHUs. In fact, these tables can be quite complex when the WHUs are similar in number to the FUs, but different in species composition. Looking at the first row, the Red Pine (Pr) FU is classified as only Upland Conifer (Up_Cn) WHU. Therefore, a 1.0 appears beneath Up_Cn. Normally the Pr FU would contain both Up_Cn and Up_Mx. During a more thorough planning exercise, it will be necessary to cross-tabulate the actual stands that are classified in each FU with its WHU classification. Then each of the rows will show the distribution of FUs in terms of WHUs.

Another aspect of WHUs is the age class. Each WHU in the LSSF example has four age classes. In Table 2 are the ages at which each habitat development stage begins, within each habitat unit (years). In SFFM terminology there are five categories with slightly different names. The terminology is as follows: P & S - Pre-sapling (youngest) and sapling, (Michigan - Regenerating); I - Immature, (Michigan - Young); M - Mature

(Michigan - Mature); L Late Succession (Michigan - Old). Of particular importance is the division between Immature and Mature, which is an important, if arbitrary, cutoff for some wildlife species. An example will be discussed later.

Table 2. Excerpt from the SFMM input matrix for the LSSF showing the ages of the development stages.

```
Table: AgeBegnHDS(hab,hds)

! HabUnit     ----- Habitat Development Stage -----
                 P       S       I       M       L

  Up_Cn          0       5      10      60     100
  Up_Mx          0       5      10      60     100
  Up_Dc          0       5      10      50     120
  Lw_Cn          0       5      10     100     150
  Lw_Mx          0       5      10     100     150
  Lw_Dc          0       5      10      50     100
  H_Nfr          0     inf     inf     inf     inf
;
```

4. Assumptions

Before examining the results of the preliminary analysis it is important to look at some of the underlying assumptions in this type of modeling.

SFMM *only* keeps track of habitat change. One of the assumptions that forest managers make is that, if they conserve a broad range of habitat types (site types), all species of wildlife will be able to maintain themselves. It is consistent with the local criteria developed during the LSSF SFM project (Hayes *et al*. 1999) that, as a minimum, forest managers must try to ensure that, at both stand and landscape scales, the type and pattern of habitat that wildlife requires still exist.

SFMM accounts for gains and losses of habitat over a long period -- centuries if required. It is not a population model. Habitat change is only part of the tremendous variability that influences dynamics of natural populations. Other sources of variability include disease, migration, catastrophes of many kinds, climate change, interspecific competition and more. Each of these sources is a complex factor in population change. Each can overwhelm other sources of variation. For example, an intense fire season can wipe out most of the population of some invertebrates in a particular area. A disease can decimate any species. Over the long-term, population "controls" tend to even out. These "density-dependent" population variables rarely push native species to extinction. Once the population becomes too dense or too sparse, other controls take over, pushing the population in the other direction. SFMM measures only one of these population controls – habitat availability.

The use of indicator species is controversial among ecologists. Selection of a few "charismatic" species runs the risk of causing managers to base decisions on a few species to the detriment of most other species. In reality, when as many as 15 species or more are chosen as "equals", it becomes difficult if not impossible to adjust management practices to fine-tune for one or two species. In SFMM, generally, species are chosen as indicators because they represent certain animal groups. The SFMM wildlife component is a coarse-filter tool that allows biologists to screen many species for possible risk. Species for which there seems to be a risk of a significant habitat decline, according to SFMM, will still need further study, and a more sophisticated analysis than is possible with a general model such as this.

5. LSSF Results

The preliminary results of the wildlife forecasts made with SFMM are presented in Figures 1 and 3 for 15 wildlife species. To interpret these projections it is important to understand the scenario for timber harvest that gave rise to them. As a preliminary model, very conservative constraints were placed on the calculation. There were no explicit harvest targets for any species during any time period. Harvest was allowed to fluctuate within ±10% of the current production. Similarly for area, as long as the area harvested was within 20% of current levels, it was allowable. There were no constraints on growing stock or budget. Using this quite liberal scenario, the model came up with a projected harvest in the neighborhood of 200,000 cords per year for the LSSF.

An initial review of the results provides the following observations, which can be misleading, as discussed later. The effect of this scenario on wildlife, as on timber, is conservative – there are no large increases or decreases. The three game species, deer (WTDE), bear (BLBE) and moose (MOOS), show modest increases in habitat over a very long period. A significant increase in area of habitat for the Snowshoe Hare (SNHAW) is counterbalanced by a decline in that for the Redbacked Salamander. Northern Flying Squirrel (NTSQ), and marten (MART) are relatively stable. The flying squirrel decline during the last part of the 100-year modeling period is not significant. The further out from the present the model gets, the less reliable the forecast – just as for weather. The important point to notice is the slight increase over the first 50 years. For the same reason, it is important to review the early decline in salamanders. Although these projections are preliminary, they provide a good illustration of the possibilities.

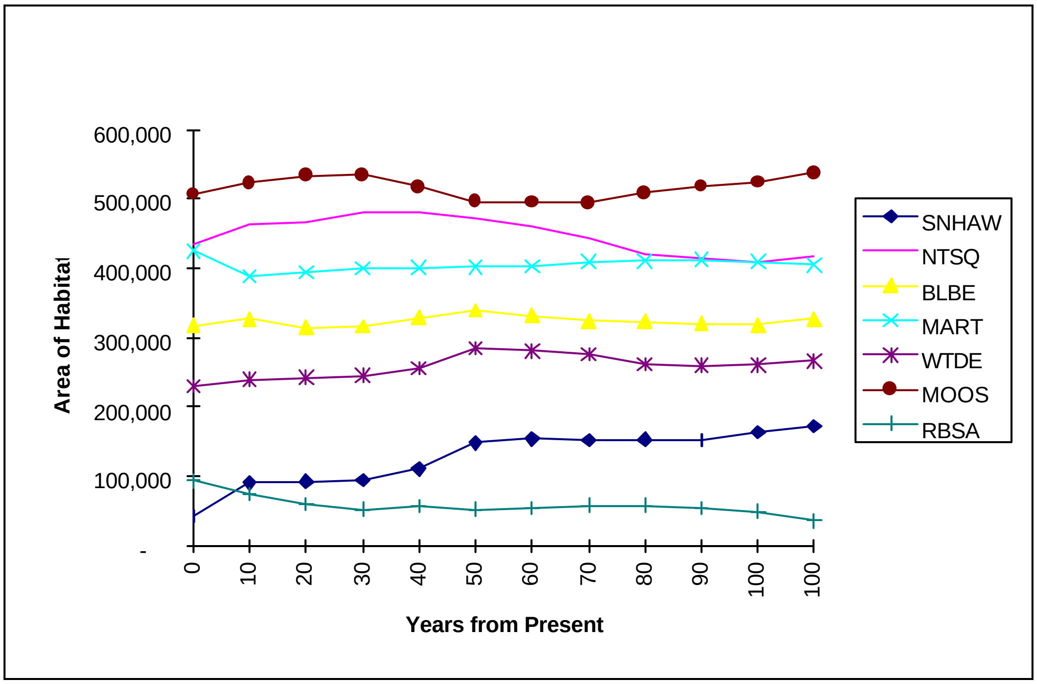

Figure 1. Ungulate and other wildlife indicator species for the LSSF.

The habitat matrix (Appendix 1) shows that the Redbacked Salamander prefers mature forest cover in deciduous upland forest types. It also likes mixed forest, but for this model run the mixed units are not assigned any wildlife habitat units in the Translation matrix (Table 1). By comparison, the flying squirrel has the same requirement, but does relatively well during the period of decline for salamanders. The flying squirrel will also use coniferous uplands and lowland deciduous woods. In other words, it has a broader "niche"[1]. This has helped to mitigate loss of part of its habitat, where the more narrowly adapted salamander suffers some loss of habitat.

[1] With apologies to ecologists, use of this term in this report is not based on the classic definition but on a generic meaning intended to describe, in a general way, the breadth of the habitat used. This meaning of "niche" is a small subset of the true multidimensional niche.

In order to help understand the forest management basis of this illustration, Figure 2 shows the changes in the area of forest units over time. As described above, the forest units are quite stable. Of interest, from a wildlife perspective, is the shift from hardwood to conifer. Although it is somewhat difficult to see in this figure, the lines with tick marks are FUs affiliated with the coniferous WHUs. The lines without tick marks are FUs that are part of the deciduous WHUs. The main shift in FUs is from the aspen ASP unit to the White Pine PW unit. Although this shift is relatively small, it partially explains the loss of habitat for salamanders.

In reality, the main factor in the salamander habitat decline is an artifact of the input data. A cursory review of SFMM output is misleading. The northern hardwood units, both even-age and all-age, are represented in this preliminary input file as being 55 years of age during year 1 of the model. Both hardwood FUs are the same age – 55. This was necessary because of limitations of the OI and time required to make changes to the input file. In any case, the habitat matrix lists mature hardwoods as 50 years old (Table 2). During the first 10-year term of the model this becomes suitable habitat for salamanders, at age 55. Therefore there is an artificially high initial level of salamander habitat. As the model continues through time, and the age distribution of hardwoods becomes more realistic, the area available for salamander habitat declines to a more realistic level. This artifact can be fixed by using a realistic age class distribution for hardwoods as input. This is a good example of how poor data can lead to wildly inappropriate forecasts.

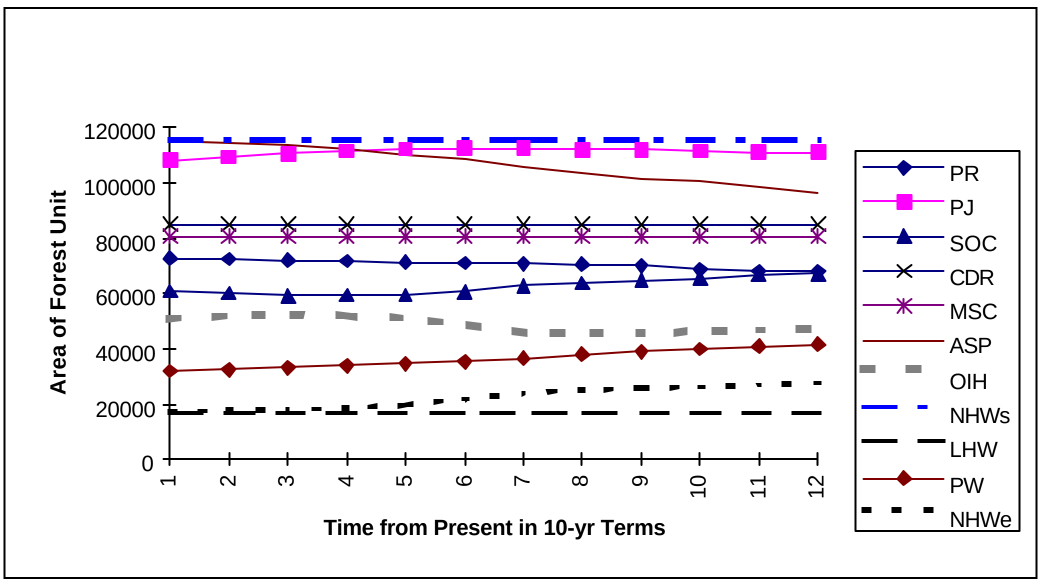

Figure 2. Forest unit change over time.

Habitat for nine bird species are forecast in Figure 3. The same decline seen for salamanders also occurs for the Least Flycatcher, another species that uses only upland deciduous forest, although it will use young forest as well as mature and old.

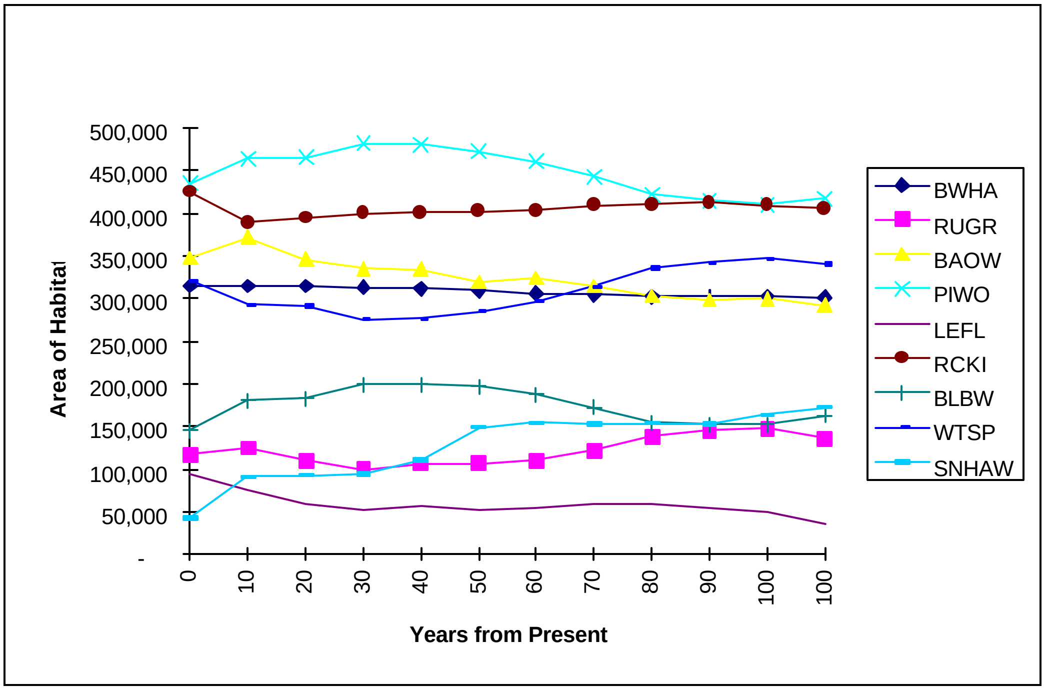

Figure 3. Nine bird indicator species for the LSSF.

6. Next Steps

The next steps that would be helpful in providing a more accurate wildlife model include:

1) Refine the WHUs – At present, mixedwoods are not included in the model because there is no translation from FUs to WHUs. It may be beneficial to use a system for WHUs that is similar to that used for FUs, or, even better, use a system for WHUs and FUs that is similar to ecological units of some type. This may have benefits for timber production and habitat forecasting. This would be a long-term project, but would not prevent the development of forest plans.

2) Define the procedure for habitat forecasting in the forest planning guide – It is the responsibility of the LSSF SFM Team to describe the generic procedure for including wildlife habitat information in forest planning.

References Cited

Callaghan, B. 1999. The Lake Superior State Forest: A Description. Report #3 from the Lake Superior State Forest Sustainable Forest Management Pilot Project. 32 p.

Clark, T, and J. Baker. 1998. SFFM Wildlife Component User Guide. Available from WWW.MUSKOKA.COM/~tc in WORD format.

Davis, R. 1998. Strategic Forest Management Model: A User's Guide. Available at WWW.SFMMSTUFF.COM. Access codes available from LSSF SFM Project Team.

Doepker, B. 1998. Wildlife Habitat Associations in Michigan. Excel Spreadsheet. Michigan Department of Natural Resources.

Hayes, A., T. Clark, and C. Howard. 1999. Establishing Criteria and Indicators for the Lake Superior State Forest. Report #7 from the Lake Superior State Forest Sustainable Forest Management Pilot Project. 33 p.

Appendix 1. 15 Species selected from the Habitat Matrix (Doepker 1998)

					OPEN			UPLAND												LOWLAND					
								DECIDUOUS				CONIFEROUS				MIXED				DECIDUOUS				CONIFERO	
RECNO	SPECIES	DC	CL	OCC	BS	GR	UB	REG	YNG	MAT	OLD	REG	YNG	MAT	OLD	REG	YNG	MAT	OLD	REG	YNG	MAT	OLD	REG	YNG
308	WHITE-TAIL	SW	M	P	X	X	X	X			X				X	X		X	X					X	X
309	MOOSE	UP	M	P	X			X	X			X	X	X		X	X			X				X	X
295	BLACK BEA	UNP	M	P	X	X	X	X		X	X	X				X		X	X			X	X		
297	MARTEN	UP	M	P	X								X	X	X		X	X	X						X
269	SNOWSHOI	UNP	M	P	X			X			X	X			X	X			X					X	
277	NORTHERN	SW	M	P	X					X	X			X	X			X	X			X	X		
45	BROAD WIN	SW	B	LM	X	X	X	X	X	X	X					X	X	X	X		X	X	X		
53	RUFFED GF	SW	B	P	X		X	X	X	X						X	X	X						X	
98	BARRED O\	SW	B	P	X	X				X	X	X		X	X	X		X	X			X	X		
116	PILEATED V	SW	B	P	X					X	X			X	X			X	X			X	X		
123	LEAST FLY(	SW	B	SM	X	X	X		X	X	X														
151	RUBY-CRO\	SW	B	SM	X		X						X	X	X		X	X	X						X
152	BLACKBURI	SW	B	LM	X									X	X			X	X						
223	WHITE-THR	UNP	B	SM	X		X	X				X	X			X	X			X	X			X	X
319	RED-BACKE	SW	H	P	X					X	X							X	X						

This report was completed as part of the requirements for a project funded by the Great Lakes Environmental Protection Fund. The objective of the project was to develop a new forest management planning system for the Lake Superior State Forest that meets sustainable forest management standards, specifically those of the Canadian Standards Association and the Forest Stewardship Council.

Project Partners:

Michigan Department of Natural Resources
Mater Engineering, Ltd.
Smartwood
BioForest Technologies Inc.
Craig Howard
Anne Hayes
Brian Callaghan (Callaghan & Associates Inc.)
Tom Clark (CMC Consulting)

Reports generated by this project include:

Project Summary: The Lake Superior State Forest Sustainable Forest Management Pilot Project

An Assessment of the Michigan Department of Natural Resources' Commitment to Sustainable Forest Management

The Lake Superior State Forest: A Description

Michigan Department of Natural Resources Operations Inventory: Survey Results

Roles and Responsibilities for Forest Management Planning in the Lake Superior State Forest

Public Participation in Forest Management Planning in the Lake Superior State Forest: Finding the Right Pathway

Establishing Criteria and Indicators for the Lake Superior State Forest

Workshop I Summary: Values and Indicators of the Lake Superior State Forest

Workshop II Summary: Establishing Targets, Practices and Responsibilities for the Indicators of the Lake Superior State Forest

Modeling Forest Management on the Lake Superior State Forest

Wildlife Habitat Projections for 15 Species in the Lake Superior State Forest

Risk Assessment of Forest Management for the Lake Superior State Forest

A Forest Management Planning Guide for the Lake Superior State Forest

Further information on this report or any of the reports listed may be obtained from:

BioForest Technologies Inc.
105 Bruce Street, Sault Ste. Marie, ON P6A 2X6
Phone: 705-942-5824 Fax: 705-942-8829
Email: bforest@soonet.ca

Cover designed by Carmen Misasi-(705) 759-8918