# The Eastern Ontario Model Forest's

# 1998-1999 State of the Forest Report

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## HIGHLIGHTS

**The Eastern Ontario Model Forest** is a gathering of people and organizations, working together to improve the forests of eastern Ontario. As part of this effort, the 1998/1999 *State of the Forest Report* provides a picture of the health of the region's forests. The report presents information on a set of six criteria and eighteen local level indicators that cover a range of environmental, social and economic concerns and uses the Criteria and Indicators framework developed by the Canadian Council of Forest Ministers. While these eighteen indicators are by no means complete, they do represent a practical starting point. The intention is that they will be improved and added to over time and in subsequent State of the Forest Reports.

The information gathered on these indicators has come from a variety of sources and locations. Wherever possible, efforts were made to use existing studies and data already being gathered by local, provincial and national agencies.

The following highlights the significant findings for each of the six criteria covered in this report:

## BIOLOGICAL DIVERSITY: CRITERION ONE

**Biological diversity** refers to the variety of living organisms that are found within our forests. Conserving biodiversity is one of the fundamental principles of sustainable forest management. It is based on the notion that we must "keep all the parts" in our forests in order to ensure that they remain productive and resilient to disturbance.

### Significant Findings

**Percentage of area forested:**

- The reduction in forest cover within the Model Forest is likely the most significant change to natural forest conditions resulting from human settlement. By 1880 land clearing for agriculture had reduced 32 of the 45 surveyed townships in the EOMF to less than 30% forest cover. Today, forest cover has recovered slightly and is estimated at roughly 34%.

**Percentage of interior forest space:**

- Some species require a forest buffer in order to protect them from predators and invasive species. Using GIS technology to remove a 100m buffer from all identified forested areas, it is estimated that there is 201,757 ha of forest interior space in the Model Forest. This represents 39% of the total forested area. A total of 34% of the region's woodlots are estimated to contain forest interior space.

**Population changes over time of selected species:**

- Songbird populations were analyzed and of the selected species, 3 forest edge or edge/interior species found within the EOMF showed a significant increase since 1987. No significant trends were detected for forest interior species.
- An analysis of bird species occurrences within large unmanaged and undisturbed woodlots revealed that 4 forest interior species showed negative trends and 6 edge/interior species showed positive trends. While no inferences can be made about

the bird populations outside of these monitoring sites, a decline in 4 forest interior species within their core habitat is of concern and warrants further investigation.

## FOREST HEALTH: CRITERION TWO

**Maintaining forest health** is an important prerequisite to sound stewardship and the sustainable use of our forested lands. Forests are considered healthy when their inherent ecological processes are functioning within a natural range of variability.

## Significant Findings

**Disturbance & Stress:**

- **Ice Storm 1998:** On January 4th-9th, 1998, the worst ice storm in recent memory swept across the region. Woodlots that contained early successional species such as trembling aspen, hybrid poplar and white birch, suffered severe damage. The damage to the other hardwoods was variable and patchy, with some stands being completely stripped of their fine and main branches while other areas suffered relatively little damage. The extent of the damage to conifers varied from species to species, hitting red pine plantations and eastern white cedar the hardest. Eastern white pine, white spruce, and balsam fir suffered relatively little damage.
- **Diseases:** Butternut Canker is new to the Model Forest and evidence of infection has been found in over 90% of sites tested. Dutch elm disease, which decimated elm populations in the 1960's, is now affecting the new generations of elm.
- **Insects:** Forest tent caterpillar and spruce budworm are the insects that have most significantly affected the forests of eastern Ontario. The last reported outbreak of tent caterpillar was in 1996 when only 1,646 ha of defoliation were reported. Spruce budworm damage has been recently on the rise with 15,755 ha reported defoliated in 1998. Gypsy moth defoliation has been more extensive. Defoliation in the Model Forest by this insect peaked in 1986 at 32,861-ha. The Gypsy moth is back at work in the region. After six years of no detected incidences of moderate/major defoliation, 1,388-ha were reported defoliated by the Gypsy moth near Charleston Lake in 1998.

**Forest Stand Health:**

- The Ontario Ministry of Environment's Sugar Maple Decline Index (DI) indicates that there has been an improvement in tree condition since 1994 with the trees on non-Canadian Shield sites improving at a faster rate than those forests in the north and on the Shield..
- CFS permanent oak plots in the Model Forest reveal that crown dieback appears to be decreasing over time with 24% of the sampled trees showing moderate defoliation in 1993 and only 4% in 1997.
- The Acid Rain Early Warning System (ARNEWS) plots in Model Forest show a recent decline in the health of sugar maple trees in 1996 with light defoliation occurring in as much as 66% of the trees. These trees seemed to have recovered in 1997 to previous year levels with approximately 90% of the sampled trees showing virtually no crown dieback.

## SOIL & WATER: CRITERION THREE

**Soil and water** are the building blocks for all plants. Maintaining good soil and water quality is essential if the forests are to remain healthy, resilient and able to withstand the stresses caused by both humans and nature.

### Significant Findings

**Riparian areas:**

- Natural vegetation cover in riparian areas reduces runoff and siltation into water bodies, stabilizes banks and prevents bank erosion, and helps to regulate fish habitat by maintaining cool water temperatures. A GIS query was used to calculate the percentage of natural vegetation cover in 15-metre wide buffers around all lakes, rivers and streams in the Model Forest. Lanark County and Leeds Grenville have the highest degree of watercourse protection with almost 40% natural vegetation cover within a 15-metre buffer. Prescott-Russell and Stormont, Dundas and Glengarry have the lowest water course protection at 21%.

**Buffering capacity of soils in EOMF:**

- Buffering capacity relates to the ability of soils to neutralize incoming acid precipitation. The Paleozoic bedrock soils that principally lie east of Hwy. 15 have a generally high buffering capacity. The soils associated with the Precambrian bedrock to the west of Hwy. 16 have a low buffering capacity.

**Soil acidification:**

- Despite the high buffering capacity of much of the region's soils, research suggests that acid deposition is currently exceeding the highest level for which no long-term harmful effects will occur.

## GLOBAL IMPACTS: CRITERION FOUR

**Global impacts** such as climate change and pollution are major issues facing Canada and the world. Forests play an important role in global ecological cycles by recycling the Earth's water, carbon, oxygen, and other life-sustaining elements. Impacts such as global warming and pollution can threaten the "recycling" capacity of the forests. Knowledge of the impact associated with such things as ground level ozone and global warming is important to ensure that the forests – and the demands placed on them – are sustainable.

### Significant Findings

**Ground level ozone:**

- Along with acid precipitation, ground level ozone is one of the two main regional air pollutants in Ontario. Ground level ozone concentrations in the EOMF are periodically above the critical level causing leaf discoloration and premature leaf drop to sensitive tree species.

**Climate change:**

- Climate change is a major factor determining the sustainability of our forests. A warming climate could alter where a tree species will grow, and result in increased intensity of fires and drought.

## BENEFITS TO SOCIETY: CRITERION FIVE

The forests and woodlots in eastern Ontario provide us with many benefits. From a commercial perspective they supply timber and maple syrup, provide jobs in both forestry and recreation, and contribute to the economy in many other indirect ways. Forests provide numerous recreational opportunities and have both cultural and spiritual importance to the people of eastern Ontario.

### Significant Findings

**Volume of sawlogs and pulpwood produced:**

- The sawmills and pulpmills in eastern Ontario consumed over 460,000 $m^3$ of sawlogs and pulpwood in 1998. Pulpwood makes up 80% (369,000 $m^3$) of this volume, hardwood sawlogs represent 17% (79,800 $m^3$), and conifer sawlogs account for the remaining 3% (12,400 $m^3$) of the volume purchased.
- The bulk of this wood (73% or 336,800 $m^3$) is imported from outside of the region with the vast majority coming from New York State. Local private lands provide roughly 25% (114,300 $m^3$) of the total wood purchased and Crown land only 2% (9,654 $m^3$).

**Regional wood prices:**

- The most valuable hardwood species in the Model Forest are black cherry, red oak, and hard maple, which average approximately $540 per 1000 board feet for #1 common. These are followed by yellow birch, soft maple, ash, white oak, basswood and butternut which average $330 per 1000 board feet for #1 common. A comparison of local log prices with those in the Bancroft area reveals that prices in the two regions are fairly similar.

**Employment in forest industry:**

- While still an important source of jobs, total employment in forestry related sectors in the Model Forest declined by 18% between 1991 and 1996.

## RESPONSIBILITY AND COMMITMENT: CRITERION SIX

Measuring our success in achieving sustainable development and sustainable forest management requires an examination of more than just biological, ecological and economic concerns. Ultimately it is about people. It is about all of us, the way in which we conduct our daily activities, and how we have organized ourselves as a society.

### Significant Findings

**Community involvement in forest management:**

- Tree-cutting bylaws are one way that local governments can help to regulate and improve logging practices on private land. Two of the five upper-tier municipalities in the Model Forest (Lanark County and RMOC) currently have tree-cutting bylaws in place.
- In accordance with the *Planning Act,* both the United Counties of Prescott & Russell and RMOC have taken steps to identify and protect significant woodlands in their region.

**Private land management and conservation practices:**

- With 88% of the forested land in the Model Forest privately owned, it is the daily activities of individual woodlot owners that could potentially have the largest impact on the 'state of the forest'. A number of these private lands contain features that the OMNR has identified as being worthy of protection and thus eligible for a tax reduction under the Conservation Land Tax Incentive Program (CLTIP). Of the 33,827 ha of private land that the OMNR has identified as being eligible for the program, 15,157 ha (45%) are currently enrolled.

**Participation in forest and environmental education programs and outdoor recreation:**

- Nine post-secondary education programs within the Model Forest were identified as being related to the environment. Seven out of the nine programs have started within the last decade, indicative of a growing concern and awareness for environmental issues in society. With the exception of the Forest Technician Program at Algonquin College, the majority of the programs show either static or slightly rising first year enrollment.
- There are six Provincial Parks and numerous outdoor recreation centres and Conservation Authorities in the Model Forest that provide outdoor recreational opportunities. Within the Provincial Parks, total-park visitation, number of school groups/guided walks, and number of camper nights have all increased substantially for the five-year period of 1993 to 1997.

# 1. SUSTAINABLE FOREST MANAGEMENT

## 1.1 FORESTS: WHY SHOULD WE CARE?

Forests are arguably one of the few truly renewable natural resources that we have. Without a doubt, forests are also ecologically critical. Their inherent life-giving qualities maintain the quality of our soils, purify our water, store carbon and greenhouse gases, and provide a home for most of the species on this earth. In addition to these ecological properties, forests also provide an economic base for such diverse industries as logging, sawmilling, furniture manufacturing, tourism and maple syrup production.

Forests also have both spiritual and cultural importance to the people of eastern Ontario. The First Nations of eastern Ontario were part of the forest they lived in, and identified themselves with it in mind and body. Many urban dwellers today find comfort in the simple knowledge that healthy forests exist and that there are still places where man's presence is less conspicuous and "Nature is in relative balance".

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## 1.2 HOW DO WE SUSTAIN OUR FORESTS?

If we agree that forests are important and provide us with many values, then the next question we must ask is "how do we sustain our forests?". This is a particularly challenging question in eastern Ontario where we have lost much of the original forest cover and where development, urbanization, and poor logging practices continue to threaten the remaining woodlots that we have. To answer this question, we have to first recognize the principle that our original forests functioned well without any intervention from people. The goal therefore is to learn to conduct our activities in forests and woodlots so as not to disrupt their inherent life-giving qualities.

The guiding principle for our activities should be sustainability. Sustainable forest management has been defined as maintaining and, where necessary, enhancing the long-term health of our forests, while providing economic, social, and cultural benefits for both present and future generations. There has been much written about 'sustainable forest practices' and readers are encouraged to obtain and read a copy of the Eastern Ontario Model Forests "Code of Forestry Practice" for a good primer on the subject.

Fortunately, society is now starting to recognize the importance of sustaining our forests and people's actions are starting to change. These actions are both numerous and diverse. For example, a number of municipalities are now working to identify and protect their 'significant woodlands'. Many Ontario forest owners are committing to the long-term health of their woodlots while in turn receiving a reduction on their property taxes under the Managed Forest Tax Incentive Program. Both federal and provincial governments are actively engaged in monitoring and reporting on forest health and in promoting the benefits of good forest management. These are but a few of the steps that society is taking to ensure that we sustain our forests over the long-term.

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## 1.3 How do we measure our success?

While the concept of sustainable forest management is easy to conceptualize, it is a tricky one to put into practice. In forest management, as in other disciplines, we learn as we go and our understanding is never complete. As stewards of the land it is important that we monitor the results of our activities, and change our practices in light of new information and observations.

Monitoring and measuring are therefore critical in understanding our success in achieving the sustainable management of our forests. To this end, this 1998-1999 "State of the Forest Report" provides benchmark information on a number of critical measures of ecological and social/economic health related to the region's forests. To help present this information in an organized and orderly fashion, and to allow comparisons to other Model Forests across Canada, this report uses the Criteria and Indicators framework developed by the Canadian Council of Forest Ministers (see side bar below).

Criteria and Indicators (often abbreviated to C & I) is simply a new term for an old concept. It involves selecting a number of measures (or indicators) of forest and social/economic health and tracking them over time to see whether we are achieving the sustainable management of our forests. These indicators are often grouped together under common themes referred to as Criteria. The challenge is to develop a set of indicators that measure all of the aspects of our forests, as well as our social and economic systems, which must be sustained. While no single criterion or indicator will provide a measure of sustainability, a comprehensive set of criteria and indicators do provide us with information on trends or changes in the state of our forests over time.

**CCFM Criteria for Sustainable Forest Management**

1. **Conservation of Biodiversity**
2. **Maintenance and Enhancement of Forest Ecosystem Condition and Productivity**
3. **Conservation of Soil and Water Resources**
4. **Forest Ecosystem Contributions to Global Ecological Cycles**
5. **Multiple Benefits to Society**
6. **Accepting Society's Responsibility for Sustainable Development**

## 1.4 Criteria and Indicators in the Eastern Ontario Model Forest

The Eastern Ontario Model Forest (EOMF) has decided to take a practical and adaptive approach to the use of criteria and indicators. While the EOMF initially identified over 100 indicators as being locally relevant, a 'starter set' of only eighteen indicators has been selected and is reported on in this first *State of the Forest Report*. The goal of this report is to provide the EOMF and its constituents with a means of measuring progress on achieving sustainable forest management and to help identify critical areas where further efforts are required.

The set of eighteen indicators presented in this report is by no means comprehensive and the intention is that they will be improved upon over time. The selection of these indicators has been guided by the reasoning that a modest plan that is actually carried out is preferable to an ambitious plan that cannot be finished.

A word of caution is advised when using criteria and indicators and in interpreting the measures presented in this report. While indicators can provide us with insight into the health of forests, care must be taken to distinguish the impacts of forestry practices from those of other causes, whether industrial, agricultural, recreational or urban. In a heavily altered and settled landscape such as eastern Ontario, the bulk of the impacts are non-forestry related. However, a better understanding of forest health can help us to tailor both our forest management and land use planning activities to mitigate or perhaps even reverse any unwanted trends.

As part of its overall mission, the EOMF is committed to tracking trends in the health of the region's forests and forest dependent communities and to building upon criteria and indicators. This report is the first of a planned series of *State of the Forest Reports* that over time will improve our understanding of the forests of eastern Ontario and improve our collective management practices.

## 2. THE EASTERN ONTARIO MODEL FOREST

***"The Eastern Ontario Model Forest is an alliance of people and organizations, working together to sustain and improve the many values of eastern Ontario's forests."***

### Quick Facts

**Location:**
That part of Eastern Ontario which includes the Counties of Lanark, Leeds, Grenville, Dundas, Stormont, Glengarry, Prescott and Russell, the Regional Municipality of Ottawa-Carleton, and the lands of the Mohawk community of Akwesasne. The boundaries are the Lanark-Leeds County lines to the west, the Ottawa River to the north, the Quebec border to the east, and the St. Lawrence River to the south (see Map1).
**Total Area:**
1.5 million hectares
**Original Peoples:**
Algonquins, St. Lawrence Iroquians and Mohawks
**Population:**
1 million people
**Area of Productive Forest:**
570,000 hectares (38% of the total land area)
**Ownership of Forested Land:**
88% privately owned, 12% Crown land
**Forest Region:**
Wholly contained within the Great Lakes-St. Lawrence Forest Region
**Nature of the Forest:**
36% coniferous, 64% hardwoods.
**Common Tree Species:**
Sugar maple, beech, yellow birch, red maple, white pine, red pine, jack pine (planted), cedar, hemlock, oak, basswood, hickories, poplar and white birch.

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### 2.1 MODEL FOREST NETWORK

The Eastern Ontario Model Forest is one of eleven large scale working forest models across Canada that have been established by the federal government's Canadian Forest Service (see Map2). Together, these model forests represent the five major Forest Eco-regions of Canada. The goal of the model forest program is to support the efforts of Canada's provincial governments, First Nations, and private landowners as they develop new ways to sustainably manage Canada's forest resources. The model forest program recognizes that achieving the sustainable management of our forest resources will require a balance between the various economic, environmental and social needs of those who live in and rely on our forests.

## 2.2 FOREST HISTORY

### 2.2.1 The Ecological Region

The forests of eastern Ontario lie within the Great Lakes-St. Lawrence (GLSL) Forest Region, south and east of the Canadian Shield. The GLSL Forest Region occupies a broad geographic range in Ontario and Quebec as well as southeastern Manitoba and northwestern New Brunswick. The forests are dominated by sugar maple and beech, with red maple, yellow birch, basswood, white ash, largetooth aspen, and red and bur oaks. White oak, red ash, grey birch, rock elm, blue beech and bitternut hickory occur intermittently. Black ash is common on poorly drained areas which may also include black spruce and eastern white cedar. Eastern hemlock, eastern white pine and white spruce are common on shallow, acidic or eroding materials. White pine, red pine, and red oak are common on coarse textured drier soils.

Natural disturbances in the GLSL forest region can be grouped into two main types. The first category is smaller scale disturbances that remove individual trees or small groups of trees. This is termed “gap” type disturbance and it typically occurs over a longer time scale of many years. Blow-downs due to ice storms, and wind and tree mortality are examples of gap type disturbances. The uneven-aged tolerant hardwood stands that occur over much of the GLSL forests originate from, and are adapted to, gap-type disturbances.

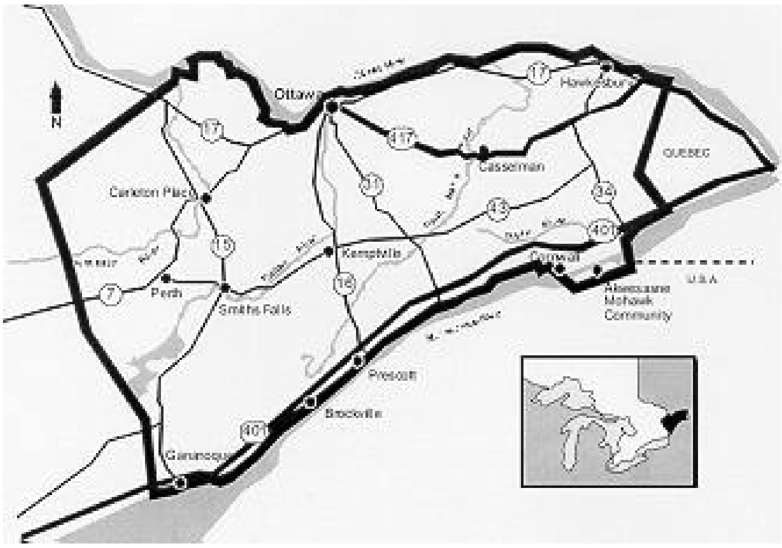
The second category involves those disturbances that occur at a larger scale and a higher intensity that may replace the stand. Canopy fires and large area windthrow are examples of stand replacing disturbances. The intolerant forests in eastern Ontario of poplar and white birch that have re-grown on former agricultural land are an example of even-aged stands that have resulted from stand replacing disturbances.

In reality, a spectrum of disturbances exists, from individual tree mortality at one end and landscape level fires at the other. The forests in eastern Ontario have adapted to these natural disturbances over tens of thousands of years. This is an important consideration for those concerned with forest health. Research is showing that to the extent that our forestry management activities emulate or mimic natural disturbances, then biological diversity can be maintained or perhaps restored. On the other hand, widespread disturbances that are not common to a forest type, such as clearcutting in a hard maple forest, will negatively affect some native species.

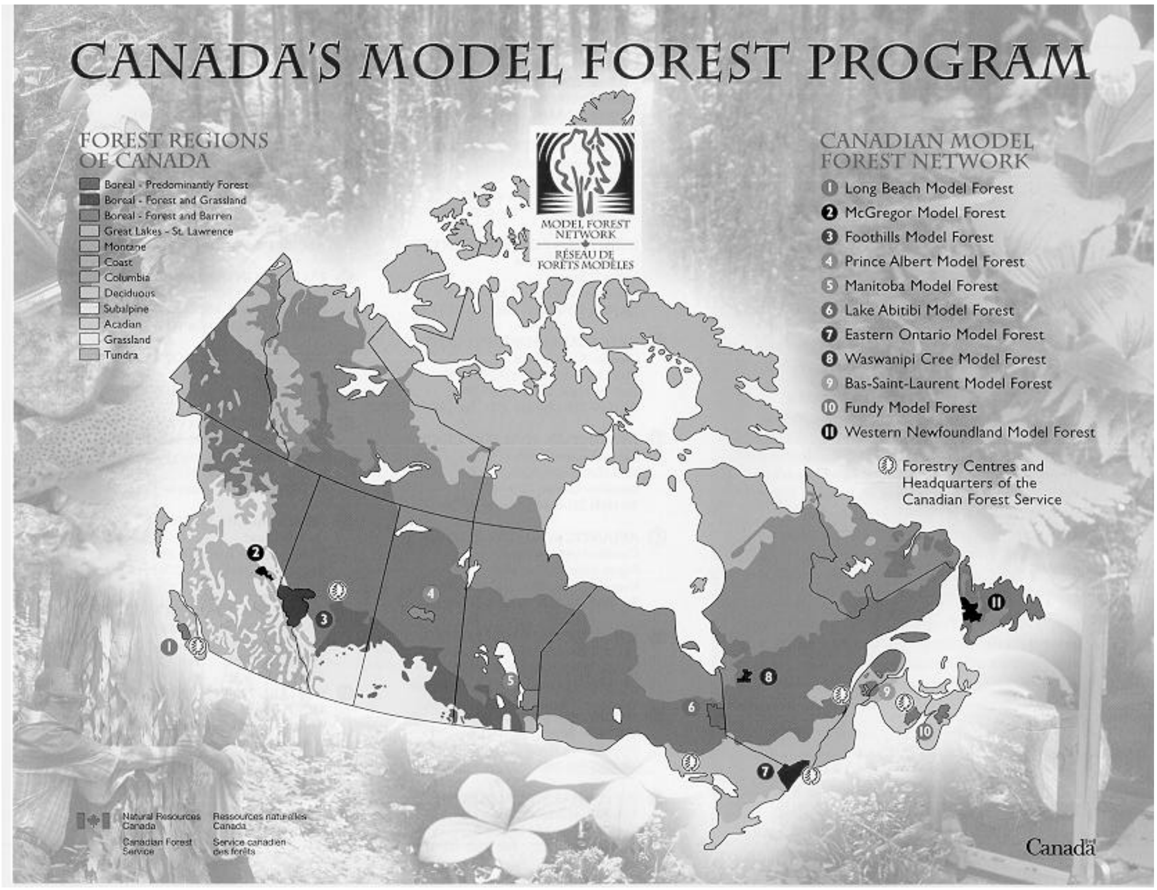
### 2.2.2 The Original Forest

A few centuries ago, all of eastern North America was blanketed by temperate deciduous forest. Unfortunately, almost all remnants of these original forests are now gone from this region. To help us understand what these forests looked like, the description of trees from original surveyors’ notebooks provide the best source of historical information. A recent study of these surveyor notes (Keddy, 1993) found that hemlock-pine combinations were most common in till and rock regions, sugar maple-elm often occurred on clay plains, and limestone and till plains frequently had sugar maple-beech combinations. On sandy plains, hemlock was the most frequent tree species recorded

## Map 1: Eastern Ontario Model Forest Location and Boundaries




## Map 2: Canada's Model Forest Program



followed by sugar maple, white pine and white spruce. The survey records suggest that like today, many wetland areas were dominated by cedar with black ash, tamarack, alder and spruce as secondary species.

It is hard to imagine what these original forests would have looked like. A few remnant stands of intact original forest in the Great Lakes States suggest that the dominant trees would have been much larger than what we see today and that the forest floor would have been littered with large, heavily decaying logs. For example, white pine of 40 metres in height and 2 metres in diameter were not uncommon.

Perhaps the most powerful image we can conjure up of the original forests comes from anecdotal observations made by early settlers. A settler in Beckwith Township (Lockwood 1991) described the forest as follows:

*"There is something in the ponderous stillness of these forests -- something in their wild, torn, mossy darkness, their utter solitude and mournful silence which impresses the traveler with a new respect each time he sees them...In upper Canada the endless hills of pine give way at last, or at most stand thinly intermingled with gigantic beeches, tall hemlocks and ash, with maples, birch and wild sycamore, the underwood of these great leafy hills. Mile after mile, and hour after hour of such a route was passed - a dark black solitude, with here and there a vista opening up, showing massive trunks, grey as cathedral ruins, which bore the rich canopy leaves aloft"*

**2.2.3 First Nations**

Historically, Iroquian settlements were located all along the St. Lawrence, usually at the mouths of smaller tributary rivers. By 1350, the St. Lawrence Iroquois had developed agriculturally oriented economies and cleared land around their settlements. With population increases around the middle of the 15th century, the villages gave rise to clusters of village sites covering extensive areas. These peoples were the ancestors and predecessors of the Mohawks, who occupied the area by the 1600's, and who are part of the Haudenosaunee (Iroquois) Confederacy of today.

**2.2.4 European Settlement**

The first Europeans explored eastern Ontario in the 1600s. By the early nineteenth century, settlement had extended westward beyond the Ottawa River. However, as recently as the mid-1800's, parts of eastern Ontario were still described by settlers as unbroken forest and impassable swamps.

By the mid-1800's, both loggers and settlers were rapidly removing forest cover. Once the best land for agriculture had been settled along the St. Lawrence and Ottawa Rivers, roads were extended in a network along the edge of the Precambrian shield. In 1856 the Hastings Road was built northwards into south-central Ontario and the Mississippi Road opened up the northwestern corner of Lanark County.

The primary objective of the settlers was to remove forest and replace it with fields to produce agricultural products. Trees were seen as an obstacle to development and were often felled and burned to make way for crops. In fact, for early settlers, it was a requirement for land title ownership that they clear their property of trees within a certain number of years. By the early 1880's, 32 townships had already reached levels of forest cover of less than 30% and 8 townships reported less than 10% cover.

Maps in the late 1800's show a network of railways and canals crossing eastern Ontario and linking it with other centres such as Parry Sound, Toronto and Montreal. One century later, the Ottawa-Hull metropolitan area has become the fourth largest in Canada with a population size approaching one million people. The transition from forest to farms to cities has occurred in just a few human generations, or about the life span of a sugar maple tree!

## 2.3 TODAY'S FORESTS

The forests of eastern Ontario have changed significantly from what they were two centuries ago. Settlement, road building, farming, and urban sprawl have all had significant impacts. While the trend in deforestation continued up until the mid-1900's, since that time the amount of forest cover has been slowly increasing. Today, the total forest cover has increased to roughly 34% with a high of 57% in Lanark County to an estimated 21% in Stormont, Dundas and Glengarry Counties. In fact, this trend towards increasing forest cover is observable across much of north-eastern North America and is because of the re-growth of forests on abandoned former agricultural land that is now considered too marginal to farm economically.

The majority of the land in the Model Forest (88%) is now privately owned by many thousands individuals each with their own values and goals for their properties. Today, there is a growing recognition that in order to maintain healthy economies and communities, we need to sustain healthy forests. The Eastern Ontario Model Forest is an assembly of people committed to promoting sustainable forest management in the region. This *State of the Forest Report* represents an effort to measure our success in achieving sustainable management of the area's valuable forest resources.

## 3. BIOLOGICAL DIVERSITY: CRITERION ONE

| Indicator 1.1 | Indicator 1.2 | Indicator 1.3 | Indicator 1.4 | Indicator 1.5 |
|---|---|---|---|---|
| *Percentage and amount of area forested* | *Percentage and amount of interior forest space* | *Protection of sites of biological significance* | *Number of known species at risk* | *Population levels and changes over time of selected species* |

***Biological diversity*** *(biodiversity) refers to the variety of living organisms that are found within our forests. Conserving biodiversity is one of the fundamental principles of sustainable forest management. It is based on the notion that we must "keep all the parts" in our forests in order to ensure that they remain productive and resilient to disturbance. The following indicators are important measures of biodiversity in the EOMF.*

## Quick Facts

**Percentage of area forested:**

- The reduction in forest cover within the Model Forest is likely the most significant change to natural forest conditions resulting from human settlement. By 1880 land clearing for agriculture had reduced 32 of the 45 surveyed townships in the EOMF to less than 30% forest cover. Today, forest cover has recovered slightly and is estimated at roughly 34%.

**Percentage of interior forest space:**

- Some species require a forest buffer in order to protect them from predators and invasive species. Using GIS technology to remove a 100m buffer from all identified forested areas, it is estimated that there is 201,757 ha of forest interior space in the Model Forest. This represents 39% of the total forested area. A total of 34% of the region's woodlots are estimated to contain forest interior space.

**Percentage of area protected:**

- Roughly 2% of the EOMF is currently protected in the form of parks, conservation areas and other parks.
- The OMNR has designated another 19,245 ha as Provincially Significant ANSI's. Provincially Significant ANSI's are eligible for a 100% property tax reduction under the Conservation Land Tax Incentive Program. Another 32 sites totaling 17,174 ha are currently being proposed as Provincially Significant.

**Number of known species at risk:**

- 20 species found within the EOMF are classified as vulnerable, threatened or endangered while another 24 species are considered at risk.

**Population changes over time of selected species:**

- Songbird populations were analyzed and of the selected species, 3 forest edge or edge/interior species found within the EOMF showed a significant increase since 1987. No significant trends were detected for forest interior species.

- An analysis of bird species occurrences within large unmanaged and undisturbed woodlots revealed that 4 forest interior species showed negative trends and 6 edge/interior species showed positive trends. While no inferences can be made about the bird populations outside of these monitoring sites, a decline in 4 forest interior species within their core habitat is of concern and warrants further investigation.

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## INDICATOR 1.1: PERCENTAGE AND EXTENT OF AREA FORESTED

**Description:**
Over thousands of years the plants and animals in the EOMF have adapted to certain landscape level habitat conditions. These conditions would have been characterized by the size, shape and location of habitats such as forests, wetlands, and clearings and in the frequency and size of natural disturbances such as windstorms and fires. While plants and wildlife are able to adapt to some degree of change, the larger the change, the more likely it is that some species will be unable to survive. Within the Model Forest, the reduction in forest cover is likely the most significant change to natural forest conditions resulting from human settlement. If the interest is to maintain or restore biodiversity in the Model Forest, then it is important to know how much forest cover is lost and whether or not the current practices are at least maintaining (and hopefully increasing) the amount of forest cover.

**Findings:**
In the late 1600's, the EOMF was almost entirely forested and as part of the eco-zone known as the Mixed Wood Plains, supported a greater diversity of trees and plants than any other eco-zone in Canada. However by the mid-1800's, settlers in the region had started to remove significant amounts of forest cover. Map 3 shows the percent forest cover in the region for the years 1861, 1880 and 1979. Note that by 1861, 17 townships in the Model Forest had already reached levels of forest cover of less than 30%. Forest cover continued to decline over the next twenty years, and by 1880 there were 32 surveyed townships with less than 30% forest cover. By 1979, the amount of forest cover had increased and only 16 townships had less than 30% forest cover. In fact, at that time the OMNR estimated the forest cover in the region was up to 36.4%.

An analysis done on a combination of aerial photos and satellite images taken around 1991 suggests that the EOMF forest cover was approximately 34% of the total area (see Table 1, Map 4 & Graph 1). Lanark County had the greatest amount of forest cover at 57.6% followed by Leeds & Grenville with 38.9%. Stormont, Dundas and Glengarry at 21.1% had the lowest percentage of forest cover.

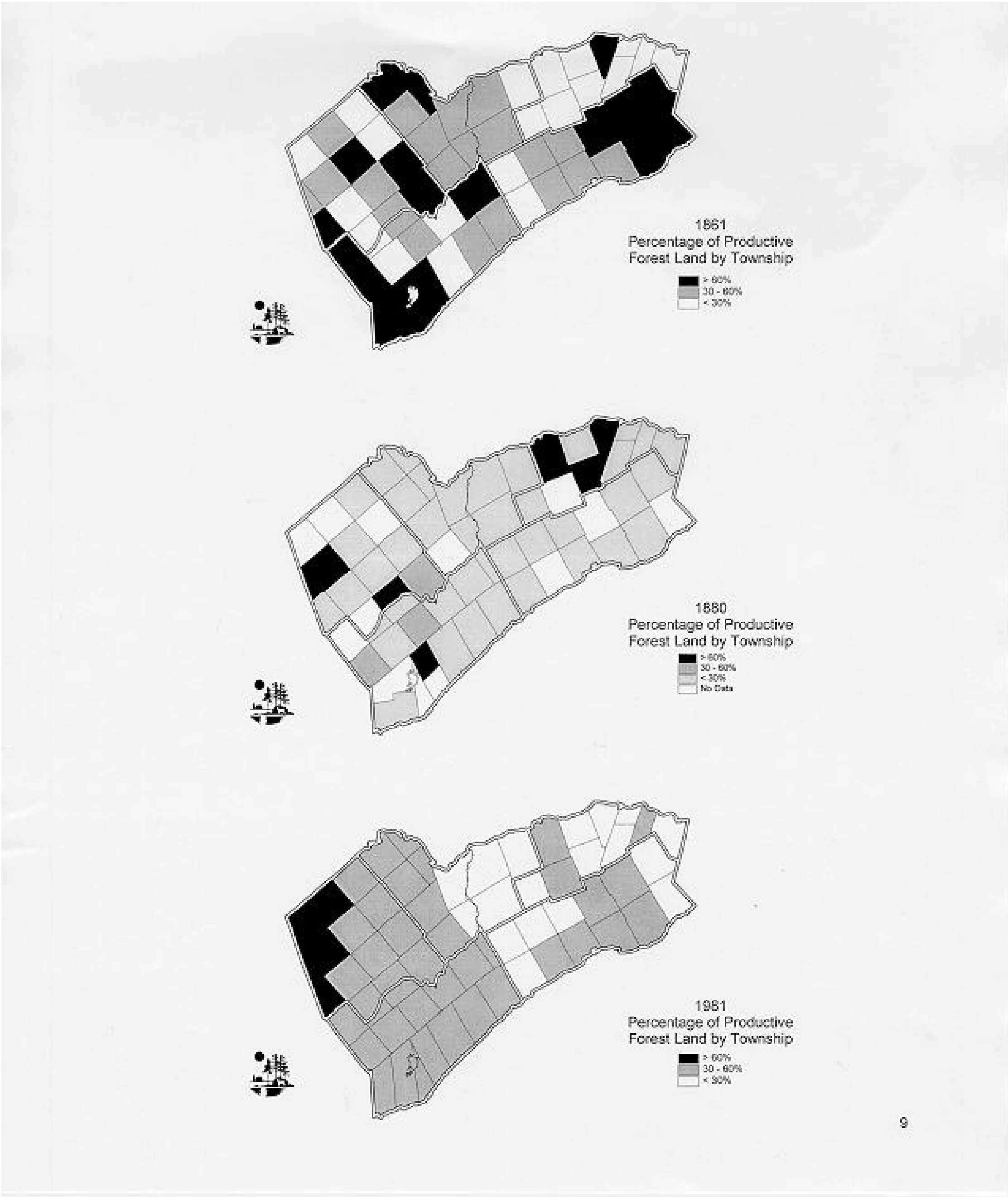
The discrepancies between the OMNR's 1979 estimate of 36.4 % and 1991 estimate of 34% could be due to differences in measurement and calculation methodologies. Recent improvements in land area measurement techniques would indicate that the 1991 data is likely the more accurate. Therefore, while forest cover has increased from its low levels at the turn of the century, there are no indications that it increased between 1979 and 1991. More research and accurate forest cover information is required in order to better define the current trends.

**Table 1: Forested Area by County**

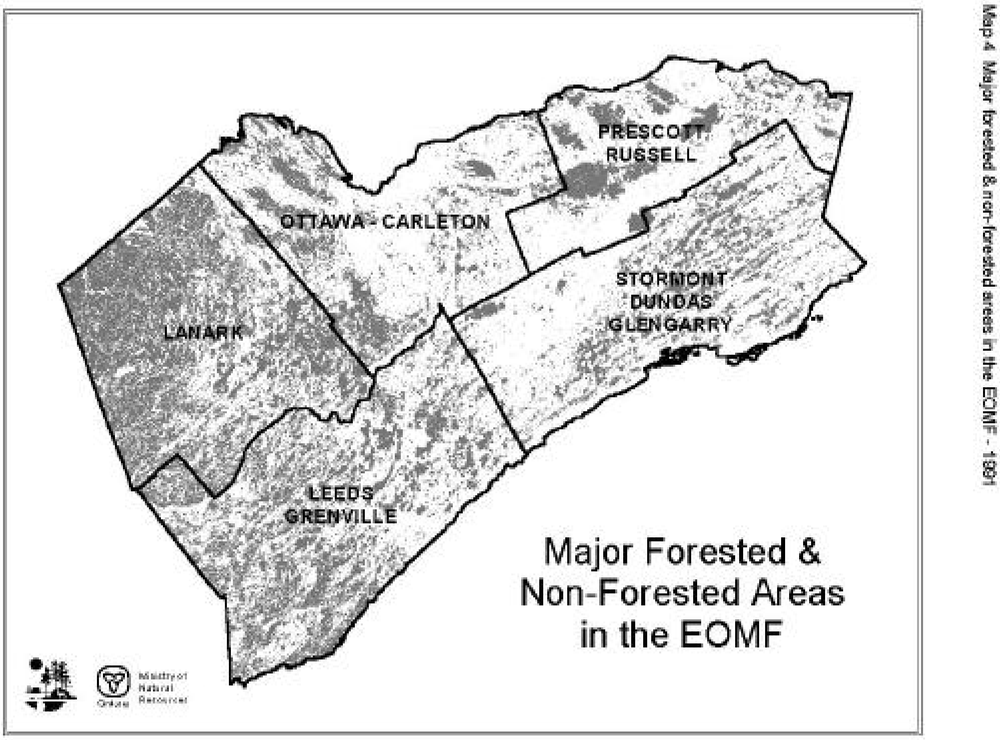
| County | Forested Area (ha) | Total Area (ha) | # of Woodlots | Average Woodlot size (ha) | % Forested Area – 1991 | % Forested Area – 1979 |
|---|---|---|---|---|---|---|
| Lanark | 183,575 | 319,988 | 8,258 | 22.2 | 57.4% | 55.6% |
| Leeds & Grenville | 139,665 | 359,394 | 8,537 | 16.4 | 38.9% | 41.3% |
| Prescott-Russell | 46,553 | 201,351 | 1,558 | 29.9 | 23.1% | 24.5% |
| RMOC | 68,734 | 280,814 | 3,872 | 17.8 | 24.5% | 28.5% |
| Stormont, Dundas & Glengarry | 70,372 | 333,612 | 3,599 | 19.6 | 21.1% | 21.1% |
| **Total EOMF** | 508,899 | 1,495,159 | 25,824 | 19.7 | 34.0% | 36.4% |

*Source: GIS query run by EOMF on Ontario Hydro forest cover data set*

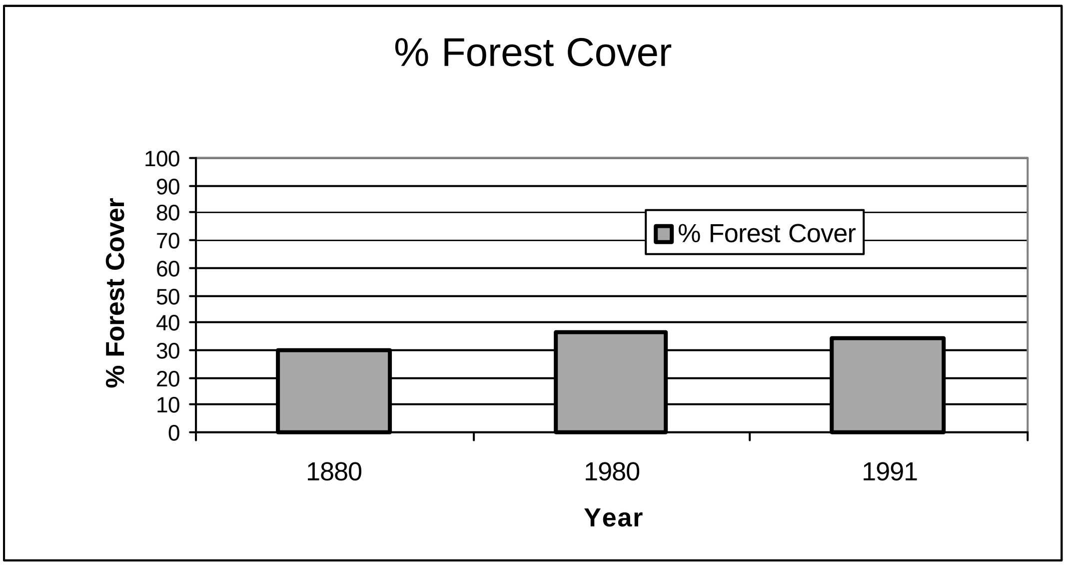
**Map 3: Percent Forest Cover by Township in a) 1861, b) 1880 (from Keddy, 1993) and c) 1981 (EOMF GIS Query)**



**Map 4: Major Forested & Non-Forested Areas in the EOMF - 1991**



**Graph 1: Changes in Amount of Forest Cover from 1880 to 1991**

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## INDICATOR 1.2: PERCENTAGE AND AMOUNT OF INTERIOR FOREST SPACE

**Description:**
While the increase in the region's forest cover throughout this century is promising and likely means that some animal and plant species have been better able to survive, many species require the protection offered by interior forest spaces. Many predators such as feral cats, foxes, coyotes and raccoons hunt mainly in the forest edge and do not penetrate the forest interior. Species that live in the forest interior therefore have some degree of protection from these predators. Nest parasitism by the brown-headed cowbird, which thrives in forest edge environments and invades the nests of interior forest bird species, is another example of the impacts of forest fragmentation.

Although forest fragmentation, and the associated increase in the amount of forest edge, may actually increase the numbers of species inhabiting a particular area, it is also likely to result in a loss in species diversity across the whole landscape. If the aim is to conserve species diversity in the Model Forest, then it is important to understand the extent of forest fragmentation (as measured by interior forest space) and whether the current practices are affecting this in a positive or negative manner.

Researchers have suggested that effective forest buffer widths should be somewhere between 100 to 300 metres (Strobl, personal communication). The OMNR currently uses a 200-metre forested strip to delineate and define interior forest space. Due to the heavily fragmented forest cover in the Model Forest, a buffer of only 100 metres was used to define interior forest space in this report. Map 4 shows those core forested areas that remain in the Model Forest once a 100-metre perimeter edge is removed.

**Findings:**
A comparison of Map 3 and Map 4 reveals that the removal of a 100-metre buffer from the perimeter of the region's forested areas results in a significant decline in the amount of forest cover . Even the large contiguous forested areas in Lanark County that are observable in Map 4 are reduced to much smaller and isolated fragments on the map of forest interior space. Approximately 39% of the forested area within the EOMF classifies as forest interior, representing a total of 201,757 ha (see Table 2). Looking at the counties individually, the United Counties of Prescott and Russell has the highest with an estimated 59% of its forested area classifying as forest interior (see Graph 2). This high percentage is in part due to the presence of the 10,000 ha Larose Forest. The Larose Forest is actually an excellent working example of the significant impact that forest restoration can have. In the early 1900's, the Larose Forest was little more than an eroding sand bowl. Early efforts to plant a nurse crop of pine were successful in restoring forest cover to this site, and it is now being managed to succeed to more natural hardwood forest. Forest restoration efforts could also contribute to increased forest cover in other townships in the EOMF where forest cover is less than 30%.

It is worth pointing out that while Prescott-Russell suffers from the second highest loss of forest cover in the region, it actually has the greatest percentage of forest interior and thus may actually provide more functional forest habitat in a relative sense.

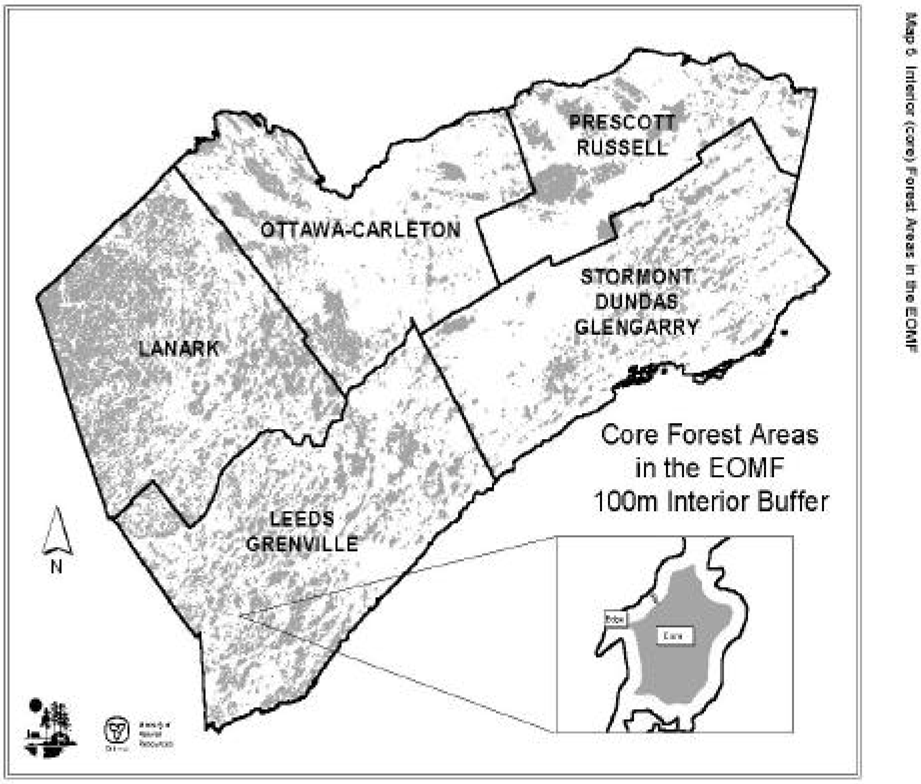
For a region that is generally considered to be heavily deforested, RMOC compares relatively favourably on the forest interior measures. Of the four counties, RMOC has the second largest average forest interior size at 25.0 ha and the third highest interior forest space as a percentage of total forested area. Not surprisingly, the heavily forested Lanark County has the largest number of woodlots with interior forest space and the largest area of interior forest space. Lanark's low average forest interior size is surprising and could possibly be due to the large number of lakes, rivers and streams in that region, reducing the amount of forest interior space calculated.

**Table 2: Forest Interior Space by County**

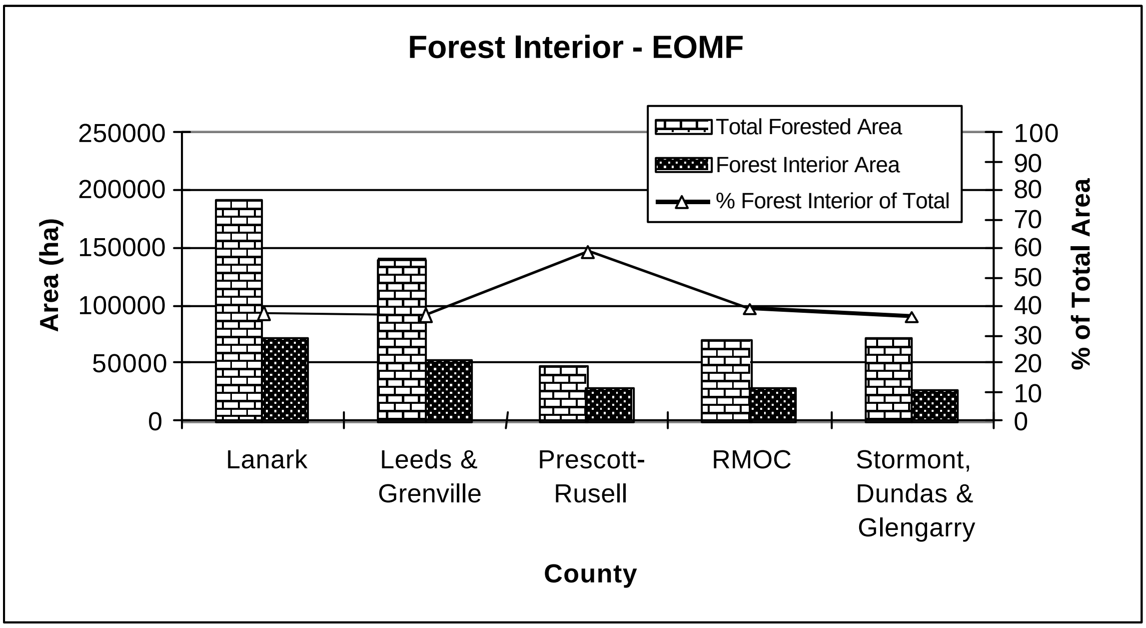
| **County** | **# of Woodlots with Forest Interior Space** | **Average Interior Forest Size (ha)** | **Amount of Interior Forest (ha)** | **Interior Forest as % of Total Forested Area** |
|---|---|---|---|---|
| Lanark | 3,241 | 22.1 | 71,539.7 | 37.3% |
| Leeds & Grenville | 2,659 | 19.2 | 51,036.8 | 36.5% |
| Prescott-Russell | 449 | 60.7 | 27,248.6 | 58.5% |
| RMOC | 1,070 | 25.0 | 26,778.3 | 39.0% |
| Stormont, Dundas & Glengarry | 1,282 | 19.6 | 25,153.8 | 35.7% |
| **Total EOMF** | 8,701 | 23.3 | 201,757.2 | 39.0% |

*Source: GIS query run by EOMF*

## Map 5: Interior (core) Forest Areas in the EOMF



**Graph 2: Forest Interior Area Compared to Total Forested Area in the EOMF**




## INDICATOR 1.3: IDENTIFICATION AND PROTECTION OF LOCAL SITES OF BIOLOGICAL SIGNIFICANCE

**Description:**
In order to maintain biodiversity it is important to identify and protect specific areas that contain or support locally unique landscape features, ecosystems, plant and/or animal species. The EOMF has the largest limestone plain in Canada, supporting a large area of alvar vegetation as well as some of the largest and rarest wetlands left in southern Ontario. The southern most extension of the Precambrian shield (known as the Frontenac Axis) is located within the EOMF and serves as an important corridor for the movement of plant and animal species. Located in the lowlands to the east are some of the largest and best examples of bogs remaining in southern Ontario. These are just some of the unique environmental features found within the Model Forest.

Sites such as these can be protected by the OMNR and Parks Canada by designating them as Provincial Parks, National Parks, Conservation Reserves or Areas of Natural and Scientific Interest (ANSI's). Although people are familiar with most of these designations, ANSI’s are relatively new to natural heritage system planning. They are further divided into life science and earth science categories and are defined as significant undisturbed representative segments of Ontario's biodiversity and natural landscapes and geological processes, respectively. ANSI's play an important role in protecting Ontario's biodiversity, which in turn contributes to the health of the environment and forests. It is important to understand what ANSI's, Conservation Reserves and Parks have been identified within the EOMF and of these, how many are now protected.

**Findings:**
As seen in Table 3, 31,832 ha in the Model Forest currently have some form of official protection either as provincial and national parks, conservation reserves and other park land. This represents 2.07% of the total area. That being said, the degree of protection offered to these sites varies considerably. The International Union for Conservation of Nature and Natural Resources (IUCN) ranks protected areas according to their level of protection and management objectives. IUCN Category 1 offers the highest degree of protection and Category 5 the least protection.

**Table 3: Protected Areas in the EOMF by Equivalent IUCN Category**
(see Appendix B for complete listing of names)

| IUCN Category | Area (ha) | % of landscape |
|---|---|---|
| I | 603 | 0.04% |
| II | 5,749 | 0.37% |
| III | 0 | 0.00% |
| IV | 8,092 | 0.53% |
| V | 17,388 | 1.13% |
| Total | 31,832 | 2.07% |

Source: Dendron 1994
Brief IUCN Definitions
IUCN 1: Areas managed mainly for science or wilderness protection.
IUCN 2: Protected areas managed mainly for ecosystem conservation and recreation.
IUCN 3: Protected areas managed mainly for conservation of specific natural features
IUCN 4: Protected areas managed mainly for conservation through management intervention
IUCN 5: Protected areas managed mainly for landscape conservation and recreation

The low percentage of the landbase in protected areas in IUCN Categories 1-5 in the Model Forest is not surprising given that more than 80% of the land is privately owned. There are however, a large number of sites that exist on private land that could be considered 'protected'. Such sites would include areas under conservation easements, provincially significant Areas of Natural and Scientific Interest (ANSI's) under the Conservation Land Tax Incentive Program, and areas under the Managed Forest Tax Incentive Program that are managed primarily for environmental protection and wildlife or aesthetic values. Unfortunately, there is little information on the total amount of private land that would fall under this category.

Some information is available however on the designation of Provincially Significant ANSI's. All provincially significant ANSI's are eligible for a 100% reduction in taxes if the site is protected and registered under the Conservation Land Tax Incentive Program (CLTIP). While many ANSI's have been identified by the OMNR, only those formally designated as provincially significant are eligible for the CLTIP. Table 4 shows that there are presently 19,245 ha of land within the Model Forest that have been designated by the OMNR as provincially significant. However, table 5 shows that there are additional 32 sites totaling 17,174 ha that are currently proposed Provincially Significant ANSI's. Unfortunately, the OMNR's process for designating ANSI's has been under review for the last several years and until the review is finished, no new designations can occur.

**Table 4: Existing Provincially Significant Areas of Natural and Scientific Interest in the EOMF**

| Existing ANSI's in EOMF | | | | | | |
|---|---|---|---|---|---|---|
| **County** | **Earth Science** | **Life Science** | **Private** | **Crown** | **Private/ Crown** | **Area (ha)** |
| Lanark | 0 | 3 | 450 | 0 | 3400 | 3850 |
| Leeds & Grenville | 0 | 9 | 2250 | 0 | 3170 | 5420 |
| Prescott-Russell | 0 | 1 | 0 | 0 | 4200 | 4200 |
| RMOC | 2 | 4 | 0 | 425 | 5350 | 5775 |
| Stormont, Dundas & Glengarry | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 2 | 17 | 2700 | 425 | 16070 | 19245 |
| *Source: Query run by OMNR, Kemptville District* | | | | | | |

**Table 5: Proposed Areas of Natural or Scientific Interest in the EOMF**

| Proposed ANSI's in EOMF | | |
|---|---|---|
| **County** | **Number** | **Area (ha)** |
| Lanark | 5 | 4,500 |
| Leeds & Grenville | 12 | 7,377 |
| Prescott-Russell | 0 | 0 |
| RMOC | 13 | 4,957 |
| Stormont, Dundas & Glengarry | 2 | 340 |
| **Total** | 32 | 17,174 |
| *Source: Query run by OMNR Kemptville District (note: majority of above proposed ANSI's are Life Science)* | | |

## INDICATOR 1.4: NUMBER OF KNOWN SPECIES CLASSIFIED AS EXTINCT, VULNERABLE, THREATENED, ENDANGERED OR AT RISK ON PROVINCIAL (COSSARO) OR LOCAL LISTS

***Endangered species (End)*** *are those native species that are at risk of extinction throughout all or a significant portion of their Ontario range if the limiting factors are not reversed.*
***Threatened species (Thr)*** *are those native species at risk of becoming endangered through all or a portion of their Ontario range if the limiting factors are not reversed*
***Vulnerable species (Vul)*** *are those native species especially sensitive to human activities or natural disturbances.*

**Description:**
Species that are "in trouble" are good indicators of threats to biodiversity. While forest-dependent species may become at risk for reasons that have nothing to do with forestry activities, forest management must take special care not to further negatively impact

these species. The benefits of conserving species at risk and their habitats are obvious. If measures are not taken to eliminate the risk of extinction of certain species, we will lose species diversity, threaten ecosystem stability and deny future generations the chance of appreciating these species.

The OMNR's Natural Heritage Information Centre monitors species at risk in Ontario that have been identified by COSSARO (Committee on the Status of Species at Risk in Ontario). The Canadian Wildlife Service of the federal government also maintains a list of species at risk as identified by COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

**Findings:**
Eastern Ontario has a total of 20 species classified as vulnerable, threatened or endangered and another 24 species provincially ranked as rare (see Table 6 & 7). The eastern elk is already extinct. This list continues to grow each year and habitat loss is one of the primary causes for these declines. In the EOMF, species declines can likely be attributed to reductions in interior forested area and continued pesticide and herbicide use.

**Table 6: Species in the EOMF that are either Provincially or Globally Vulnerable, Threatened or Endangered**

| Species | Status | | Known Occurrence by County | | | | |
|---|---|---|---|---|---|---|---|
| | MNR [1] | Fed. [2] | Lanark | Prescott & Russell | Stor., Dun. & Glen. | Leeds & Grenville | Ottawa & Carleton |
| **Birds** | | | | | | | |
| Black Tern | Vul | Nar | ō | | ō | ō | ō |
| Cerulean Warbler | Vul | Vul | ō | | | ō | |
| Henslow's Sparrow | End | End | | | ō | ō | ō |
| King Rail | | End | | | | ō | |
| Least Bittern | | Vul | ō | | | ō | ō |
| Migrant Loggerhead Shrike | End | End | ō | | ō | ō | ō |
| Peregrine Falcon | End | End | | | | ō | |
| Piping Plover | End | End | | | | ō | |
| Prairie Warbler | Vul | Vul | ō | | | ō | |
| Red-shouldered Hawk | Vul | Vul | ō | | | ō | ō |
| **Mammals** | | | | | | | |
| Southern Flying Squirrel | | Vul | | | | | |
| **Reptiles** | | | | | | | |
| Spotted Turtle | Vul | Vul | | ō | ō | ō | ō |
| Eastern Spiny Soft-shell | Thr | Thr | | ō | | | |
| **Fish** | | | | | | | |
| Northern Brook Lamprey | | Vul | | | | | ō |
| River Redhorse | | Vul | ō | ō | | | ō |
| Pugnose Shiner | | Vul | | | | ō | |
| **Plants** | | | | | | | |
| Broad Beech Fern | | Vul | | | | ō | |
| Blunt-lobe Woodsia | | Thr | | | | ō | |
| Deerberry | | Thr | | | | ō | |
| Prairie White-fringed Orchid | | Vul | ō | | | ō | ō |
| *Source: Query run by Natural Heritage Information Centre* | | | | | | | |

[1]As designated by COSSARO (the Committee On the Status of Species At Risk in Ontario)
[2]As designated by COSEWIC (the Committee On the Status of Endangered Wildlife in Canada)

In addition to species that are officially listed by COSSARO and COSEWIC, Table 7 below lists a number of species that occur within the Model Forest that are considered to be either provincially or globally rare.

**Table 7: Other Species in the EOMF that are either Provincially or Globally Rare**

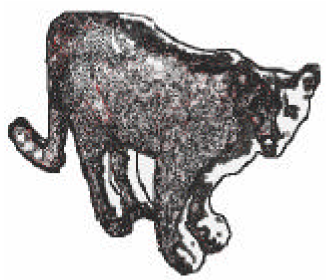
| Common Name | Provincial Rank[1] | Global Rank[2] |
|---|---|---|
| **Birds** | | |
| Great Black-backed Gull | Very Rare – Breeding | Very Common |
| Yellow Palm Warbler | Extremely Rare – Breeding | Very Common |
| **Reptiles** | | |
| Five Lined Skink | Rare to Uncommon | Very Common |
| Black Rat Snake | Rare to Uncommon | Very Common |
| **Mammals** | | |
| Small-footed Bat[3] | S3S4 | G3 |
| **Fish** | | |
| Lake Sturgeon | Rare to Uncommon | Rare to Uncommon |
| Cutlips Minnow | Extremely Rare – Very Rare | Very Common |
| **Plants** | | |
| Cloud Sedge | Very Rare | Very Common |
| Fogg's Goosefoot | Very Rare | Rare to Uncommon? |
| Handsome Sedge | Rare to Uncommon – Common | Common |
| Heartleaf Alexanders | Extremely Rare | Very Common |
| Long Sedge | Rare to Uncommon | Common – Very Common |
| Mosquito Fern | Extremely Rare | Very Common |
| Muhly | Very Rare | Very Common |
| New England Sedge | Rare to Uncommon | Very Common |
| Northern Dropseed | Very Rare | Very Common |
| Purple-stemmed Cliffbrake | Rare to Uncommon | Very Common |
| Puttyroot | Very Rare | Very Common |
| Ram's-head Lady's-slipper | Rare to Uncommon | Rare to Uncommon |
| Round-leaved Yellow Violet | Extremely Rare | Very Common |
| Slender Muhly | Very Rare | Very Common |
| Smith's Bulrush | Very Rare? | Very Common? |
| Toothed Umbrella-sedge | Extremely Rare | Common |
| Witch Grass | Rare to Uncommon | Common |
| *Source: Query run by Natural Heritage Information Centre* | | |

[1]Provincial ranks are assigned by considering the known number of extant sites province-wide and the degree to which they are potentially or actively threatened with destruction.
[2]Global ranks are assigned in much the same way as provincial ranks but consider all global factors
[3]Although a hibernaculum does not exist in the EOMF, one does exist in Renfrew County

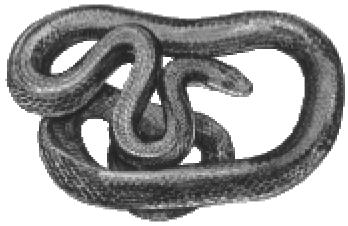
## Background Information on Selected Species at Risk within the Model Forest

The **red shouldered hawk** was once the most common hawk in southern Ontario. As large tracts of woods disappeared their numbers declined and eventually they were surpassed by the then less common red-tailed hawk. Red-shouldered hawks tend to return to their nesting grounds in early spring and are noisy and conspicuous while displaying. This probably is the best opportunity to catch a glimpse of these buteos. Slightly larger than a crow but smaller than a raven, they are easily identified by their bright red breast feathers. Red-shouldered hawks usually nest in mature, closed canopy stands of maple-beech-yellow birch, preferring beech trees with an average diameter of 50cm or greater and forest tracts of 200ha or more. Their nests are constructed in the primary fork of a tree, using fine to medium sized twigs. These birds are now listed as vulnerable in Ontario with the cause of decline primarily attributed to habitat loss.

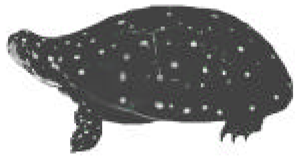
The **eastern cougar** currently remains an Ontario mystery. The last substantiated sighting was in 1884, but since the 1950's over 1000 sightings have been reported. In 1973 a cougar was shot in Manitoba, 60km from the border and in 1992 a young male cougar was shot in Quebec only 10km from the border. The latter has since been identified as the Chilean subspecies and therefore an escapee (Sutherland, pers.comm. 1999). However, historically the eastern cougar lived in large undisturbed, forested areas throughout Ontario and is currently considered endangered. The OMNR asks anyone who has spotted a cougar to report their sightings to the closest OMNR biologist.



The **black rat snake,** at 1 to 2 metres in length, is Canada's largest snake. It is almost entirely black, with faint blotching and a whitish throat and lips. The pattern on younger snakes is brighter but fades with age. The snake's habitat includes open woodlands, fields, and abandoned buildings. Its range is confined to small areas in the counties of **Lanark** and **Leeds-Grenville**. The black rat snake is threatened by persecution, loss of hibernation habitat, and its long life-cycle which makes i especially susceptible to even small increases in the mortality rate of adults (e.g. as a result of road kill). It is now classified by COSEWIC as "threatened".



The **spotted turtle** is at home in marshy meadows, bogs, swamps and small ponds and is easily identifiable with its many yellow spots. Although the Blandings turtle also has yellow spots it can quickly be distinguished by the presence of a hinged plastron. Behaviorally, the spotted turtle fulfills its stereotype as it is seldom in a hurry. When disturbed, it reacts slowly, usually entering the water to burrow in the muddy bottom. This species has been classified as vulnerable nationally and provincially.



The **cerulean warbler** is a small neotropical migrant with a quiet song. The difficulty in spotting this bird is further compounded by its tendency to spend the majority of its time in the upper canopy of large deciduous trees. The cerulean warbler is a forest interior species as it is very sensitive to fragmentation of breeding habitat. Nests are constructed high in the trees, at heights ranging from 7.5 to 18m. Although it's population has declined significantly throughout Canada, undoubtedly due to the decline in deciduous forest cover, the cerulean warbler still exists in the **Frontenac Axis** of the EOMF where large tracts of forest occur. This species has been classified as vulnerable, nationally and provincially.

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## INDICATOR 1.5: POPULATION LEVELS AND CHANGES OVER TIME OF SELECTED SPECIES

***Forest Interior Species*** *are species that nest primarily within the interior of forests and rarely occur near the edge.*
***Forest Edge Species*** *are species that typically use the forest perimeters, nearby fields or large clearings within a forest during breeding season.*
***Edge/Interior Species*** *are species that have territories located entirely within the interior forests, but can use forest edge or in some instances can extend a single territory across more than one forest fragment.*

**Description:**
Certain species can act as “indicator species” because if their habitat needs are met, it is likely that there will be sufficient habitat for other species that occupy or use a similar niche. In this way, it is possible to assess the overall ability of the forest to support wildlife diversity without having to do a census of each and every species - an impossible task. Unfortunately there is very limited information available about most wildlife species. One notable exception is the ongoing work by the Canadian Wildlife Service, the OMNR, and numerous volunteers to monitor bird populations across Ontario. Birds represent an important part of Ontario's biodiversity, with almost 300 species known to

breed in the province. They inhabit a wide diversity of habitat types, and are relatively easy to monitor because they are both visually and aurally conspicuous. Monitoring bird populations can provide insight into the health of the environment and forests.

**Findings:**
To gain insight into bird population levels, an analysis was conducted on data from the Canadian Wildlife Service Breeding Bird Survey (BBS) and compared to the Forest Bird Monitoring Program (FBMP). The BBS is a roadside survey that began in 1966 primarily focusing on landbirds. This point count survey involves identifying routes 24.5 miles long with a total of 50 stops located at 0.5-mile intervals. Routes are then randomly selected and surveyed each year by moving in succession along the stops and recording all birds heard within a 0.25-mile radius and within a 3-minute period. Over the years approximately 10-15 routes have been selected within the Model Forest region.

The FBMP is also a point count survey, but focuses on large unmanaged woodlots and was designed specifically to supplement the BBS data. Approximately 8-10 FBMP sites currently exist in the Model Forest. Due to differences in their survey methods, only the BBS data can represent population trends of birds found within the EOMF. However, the specific site trends identified using the FBMP data are ecologically significant and should not be ignored.

The OMNR has recently selected 16 target species to develop a streamlined FBMP survey (Twiss, personal communication). Although the selection was primarily based on the use of an easily identifiable song, whether they provided some indication of ecological change was also considered. Using BBS data collected from the Great Lakes Plain and the St. Lawrence River Plain, trend analysis for the target species was conducted and compared to that reported by Cadman et al (1998) for the FBMP.

The BBS data in Table 8 shows significant positive trends for the White-throated Sparrow, Yellow-bellied Sapsucker and Red-eyed Vireo; all species that utilize forest edge at some point in their life cycle. For those forest interior species that allowed an analysis to be conducted there were no significant trends detected. However, because the BBS data is collected along roadsides, the forest interior species are often under-represented and in this case there was insufficient data for three of the selected species.

An analysis of the FBMP data is presented below in Table 9. The FBMP was designed to supplement the BBS database by sampling large unmanaged and undisturbed woodlots. Even within these *optimal* sites, an analysis showed that 4 forest interior species showed negative trends and 6 interior/edge species showed positive trends. A significant decline in 4 forest interior species within their core habitat is of concern and warrants further investigation.

**Table 9: Number of Birds showing either Significant Increasing or Decreasing Trends Based on FBMP Data 1987-1997 (p£0.2)**

| | Species Type | | |
|---|---|---|---|
| **Trend** | **Forest Interior** | **Forest Edge** | **Edge/Interior** |
| **Increasing** | 2 | 3 | 6 |
| **Decreasing** | 4 | 3 | 2 |

*Source: Cadman et al, 1998*

# 4. FOREST HEALTH: CRITERION TWO

| **Indicator 2.1** | **Indicator 2.2** |
|---|---|
| ***Natural disturbance & stress by type and severity*** | ***Forest stand health*** |

*__Maintaining forest health__ is an important prerequisite to sound stewardship and the sustainable use of our forested lands. Forests are considered healthy when their inherent ecological processes are functioning within a natural range of variability. Healthy forests are able to adapt to changes, stresses and disturbances. Fire, storms, insects, and diseases are all naturally occurring disturbances that change both the composition and patterns of the regional forests. However, human activities and disturbances - such as logging, urban development, pollution and climate change can add increased stress, with the risk that the overall productivity and resilience of the forest may actually decline. The following indicators were selected as they depict the health of the forests within the EOMF*

## Quick Facts

**Disturbance & stress:**

- **Ice Storm 1998:** On January 4th-9th, 1998, the worst ice storm in recent memory swept across the region. Woodlots that contained early successional species such as trembling aspen, hybrid poplar and white birch, suffered severe damage. The damage to the other hardwoods was variable and patchy, with some stands being completely stripped of their fine and main branches while other areas suffered relatively little damage. The extent of the damage to conifers varied from species to species, hitting red pine plantations and eastern white cedar the hardest. Eastern white pine, white spruce, and balsam fir suffered relatively little damage.
- **Diseases:** Butternut Canker is new to the Model Forest and evidence of infection has been found in over 90% of sites tested. Dutch elm disease, which decimated elm populations in the 1960's, is now affecting the new generations of elm.
- **Insects:** Forest tent caterpillar and spruce budworm are the insects that have most significantly affected the forests of eastern Ontario. Forest tent caterpillar damage peaked in the region in 1953 with over 776,000 ha of forest receiving moderate to severe defoliation. The last reported outbreak of tent caterpillar was in 1996 when only 1,646 ha of defoliation were reported. Spruce budworm damage in the region peaked in 1968 when almost 190,000 ha were reported with moderate to severe defoliation. Spruce budworm damage has been recently on the rise with 15,755 ha reported defoliated in 1998. Gypsy moth defoliation has been more extensive. Defoliation in the Model Forest by this insect peaked in 1986 at 32,861-ha. The Gypsy moth is back at work in the region. After six years of no detected incidences of moderate/major defoliation, 1,388-ha were reported defoliated by the Gypsy moth near Charleston Lake in 1998 (Howse and Scarr, 1998). While it is too early to tell, this could signal the beginning of another gypsy moth infestation and defoliation

levels will have to be monitored closely in upcoming years. The Asian long-horned beetle is a newly arrived insect in Ontario that has the potential to significantly damage hard maple stands.

**Forest Stand Health:**

- The Ontario Ministry of Environment has developed a Decline Index (DI) as a means of estimating sugar maple health. Preliminary results indicate that there has been an improvement in tree condition since 1994 with the trees on non-Canadian Shield sites improving at a faster rate than those forests in the north and on the Shield. Monitoring sites within the Model Forest consistently report lower DIs compared to the provincial average. This could be partially due to the ability of soils in the region to buffer against acid precipitation.
- Two permanent oak plots in the Model Forest reveal that crown dieback appears to be decreasing over time with 24% of the sampled trees showing moderate defoliation in 1993 and only 4% in 1997.
- The Acid Rain Early Warning System (ARNEWS) plots in Model Forest show a recent decline in the health of sugar maple trees in 1996 with light defoliation occurring in as much as 66% of the trees. These trees seemed to have recovered in 1997 to previous year levels with approximately 90% of the sampled trees showing virtually no crown dieback.

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## INDICATOR 2.1: NATURAL DISTURBANCE & STRESS BY TYPE AND SEVERITY

**Description:**

The ability of forests to adapt to disturbance depends upon the severity of the disturbance. Disturbances that occur naturally within the EOMF include storms, insects, drought, diseases and, to a lesser extent, fire. Measuring and reporting on the intensity and extent of disturbance can provide information that can assist in decision making and improve forest and woodlot management activities. For example, research now suggests that it is possible to maintain, and perhaps restore biodiversity at the landscape level if forest management emulates or mimics natural disturbances. However, disturbances that are novel to a forest are all bound to negatively affect some native species. It is these disturbances that must be minimized through forest and woodlot management if the intention is to conserve biodiversity.

Within the EOMF, natural disturbances can be grouped into two main types. The first category involves smaller scale disturbances that kill individual trees or small groups of trees. This is termed a “gap” type disturbance and is typically caused by such things as beaver ponds, small blow downs due to ice storms or wind and isolated disease or insect infestations. Many of the woodlots in the EOMF that have uneven-aged stands of shade tolerant species such as sugar maple and beech originate from, and are adapted to, gap-type disturbances.

The second category involves those natural disturbances that occur at a larger scale and a higher intensity and may actually replace the stand. Occurring less frequently in the

EOMF, these disturbances include high velocity wind storms, large intense fires, severe ice storms, and widespread major disease and insect infestations.

In reality then, a spectrum of disturbance exists, from individual tree mortality at one end to landscape level disturbances at the other. For example, while ice storms usually cause gap-type disturbances that result in the death of individual trees within a stand, the ice storm of 1998 was so severe that in some instances whole stands were actually destroyed. This section presents information on the extent of ice storm, disease, and insect damage within the Model Forest.

**Findings – (**Ice Storm)**:**

**Damage Summary:** In January 1998, the worst ice storm in recent memory swept across the region, leaving downed power lines and a broken and heavily damaged forest in its wake. From January 4th - 9th freezing rain continually blanketed Eastern Ontario and in some areas, 3.5 inches of rain fell in a 24-hour period. Although it did not rain continuously, the total number of hours of freezing rain and drizzle exceeded 80 hours - nearly double the norm.

The damage to woodlots depended upon the location, species type, and quality of management. In the words of one local forester, “it was the well-managed woodlots with good stocking that handled the ice storm the best. The most heavily damaged woodlots contained species such as poplar and white birch that typically re-grow after a clearcut.” In general, woodlots that contained early successional species such as trembling aspen, hybrid poplar and white birch, suffered severe damage. In some areas, these species were stripped of all major branches, leaving just one stem. The damage to the other hardwoods was variable and patchy, with some stands being completely stripped of their fine and main branches while other areas suffered relatively little damage. The extent of the damage to conifers varied from species to species, hitting red pine plantations and eastern white cedar the hardest. Eastern white pine, white spruce, and balsam fir suffered relatively little damage. Table 10 summarizes the susceptibility of individual tree species to ice damage that was derived from the observed extent of damage from the ice storm of 1998.

**Table 10: Susceptibility of Species to Ice Damages**

| Susceptible | Intermediate | Resistant |
|---|---|---|
| Elm | Beech | Hemlock |
| Basswood | Red Oak | Ironwood |
| Birch | White Oak | Spruce |
| Black Cherry | Sugar Maple | Balsam Fir |
| Butternut | Ash | Hickory |
| Poplar | White Cedar | Bur Oak |
| Silver Maple | Red Pine | |
| Red Maple | Tamarack | |
| Jack Pine | White Pine | |
| Scots Pine | | |

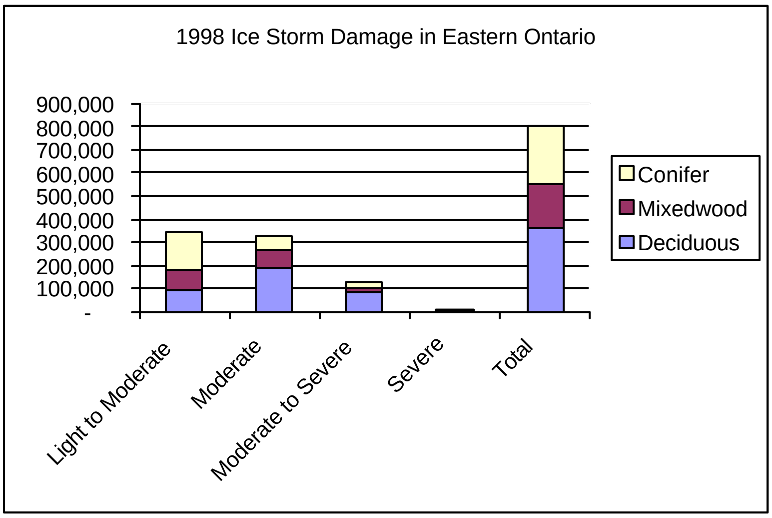
Table 11 and Chart 3 show the extent of ice storm damage by severity category and forest type.

**Table 11: Severity of Damage by Species (Source: Cathy Nielsen, OMNR Kemptville)**

| | Area Damaged by Forest Cover Type (ha) | | | |
|---|---|---|---|---|
| **Severity of Damage[1]** | **Deciduous** | **Mixedwood** | **Conifer** | **Total** |
| Light to Moderate | 93,901 | 81,247 | 164,445 | 339,593 |
| Moderate | 189,671 | 80,344 | 55,757 | 325,772 |
| Moderate to Severe | 78,826 | 25,398 | 26,515 | 130,739 |
| Severe | 3,165 | 832 | 447 | 4,444 |
| **Total** | **365,563** | **187,821** | **247,164** | **800,548[2]** |

[1]Severe: 50% to 100% of the trees within this area have severe damage (>75% branch loss, or downed or snapped off trees).
Moderate to severe: >75% of trees are moderately damaged (25% to 75% branch loss) with the remainder of the trees severely damaged.
Moderate: approximately 100% of the trees have moderate damage (very few light to severe trees observed).
Light to moderate: 25% to 75% of the trees are moderately damaged with the remainder of the trees lightly damaged (<25% branch loss).
Light: scattered pockets of light or moderate damage
[2]Note: The total area exceeds total forested area of EOMF because numbers in Table 11 include all damaged areas in Eastern Ontario.

**Chart 3: 1998 Ice Storm Damage in EOMF**




**Recovery:**
As people in eastern Ontario now know, severe ice storms can affect many trees, however trees can be amazingly resilient. Maple sugar bush owners, who were weeks away from preparing for the spring sap flow, felt the immediate effects of this storm. Fortunately, the damage occurred during the winter when trees are dormant and further damage by insects or disease is less likely than if injury occurs during the growing season. Recovery from the ice storm will depend on the health of the tree and the extent of the damage. In time, healthy trees that did not suffer major structural damage (e.g. split trunks or broken tops) will likely recover. While it is difficult to make generalizations and the response varies from species to species, the following table presents information on the extent of crown damage and the survival rate for hardwood species:

**Table 12: Relationship between Crown Loss and Survival in Hardwoods**

| Extent of Crown Loss | Probability of Survival | Growth Suppression |
|---|---|---|
| 0-30% | Excellent | Minimal, short term |
| 30-50% | Good | Variable, short term |
| 50-75% | Moderate | Moderate, long-term |
| > 75% | Poor | Severe, long-term |
| Source: Cathy Nielsen, OMNR Kemptville | | |

The response of conifers to ice storm damage is somewhat different. It is generally agreed that trees broken below the live crown, or with a majority of crown removed or uprooted will not survive and severely damaged conifers will be susceptible to bark beetles and wood borers (VanDyke, 1999). However the bark beetles found invading dead and dying trees in the areas affected by the ice storm in 1998 are not aggressive and it is unlikely that they will cause significant damage to surrounding healthy trees (Irland, 1998).

**Diseases:**
While many diseases are naturally occurring and play an important role in forest succession, a number of human-introduced diseases have been a cause of significant change and stress to forests within the EOMF. For example, elm was once a major component of the forests in eastern Ontario that was virtually eliminated with the introduction of Dutch Elm disease. Large gaps in the forests resulted from this dieback, allowing a variety of shade intolerant species such as white birch and aspen to move into the centre of woodlots. CFS studies indicate that the disease is still widespread and it is now attacking the new generations of elm in Model Forest (Sajan and Smith, 1996). Butternut canker, a relatively new disease first discovered in Ontario in 1991, poses a potentially serious threat to butternut. In 1992 a survey was conducted, testing locations throughout southern Ontario for the presence of this disease. Eight locations were surveyed in the EOMF and 90% of the trees in these sites were infected with butternut canker (Sajan et al, 1993).

Another introduced disease, white pine blister rust, is currently affecting white pine causing reduced reproduction and possibly fatality (EOMF, 1997). A series of evaluations conducted on young white pine plantations in the Model Forest revealed an infection rate of between 1% and 2% (Sajan and Smith 1996). At each of the locations tested, the trees were considered to be severely affected because the main stems of the trees were damaged.

Table 12.1 summarizes some preliminary information on known tree disease occurrences within the Model Forest. The extent and severity of the incidences of these diseases should be tracked and reported on in future ‘State of the Model Forest Reports’.

**Table 12.1: Selected Disease Occurrences in EOMF**

| Disease | Species Affected | Introduced/ Natural | Remarks |
|---|---|---|---|
| Dutch Elm Disease | elm | Introduced | evidence it is still spreading in EOMF |
| Scleroderris Canker | red pine, Scots pine | Both natural and introduced varieties | 1995 tests of 17 pine plantations in EOMF revealed no incidences |
| Butternut Canker | Butternut | Introduced | Still spreading. Estimated >90% of trees affected in EOMF but no known whole-tree moralities yet. |
| White Pine Blister Rust | white pine | Introduced | Evaluations of plantations in EOMF reveal an infection rate of between 1%-2% |
| Armillaria Root Rot | Multiple species | Natural | Survey in nearby Marmora Twp. revealed 1% mortality in 2m tall red pine plantation |
| Diplodia Tip Blight | Primarily ornamental conifers- Austrian, Scots, & mugho pine but also red pine | Introduced | Evidence of incidences across Ontario. Most common on trees growing along highways. |
| Source: (Sajan et al, 1993), (Sajan and Smith, 1996) | | | |

**Insects:**

The most significant insects infesting eastern Ontario forests are the forest tent caterpillar, the spruce budworm and the gypsy moth. All of these insects have the ability to impact tree growth and cause mortality because they defoliate the branches. Research suggests that growth loss to trees begins to occur when the defoliation levels approach 30%. Table 13 presents some information on the extent of insect defoliation across the Model Forest over the last several decades.

Defoliation by the tent caterpillar reached an all time high in 1953 causing growth loss in over 775 000 ha across the Model Forest. Their numbers have declined and since 1966 their impact has not exceeded 100 000 hectares. The most recent large-scale infestation peaked in the EOMF in 1991 with 39,940 ha of defoliation. In 1996, only 1,626 ha of tent caterpillar defoliation was observed. There have been no reported incidences of moderate to severe tent caterpillar defoliation in the Model Forest since that time. Spruce budworm defoliation in the region peaked in the late 1960's and early 70's reaching a high of 188,419 ha. However in recent years, this insect has been the most significant cause of insect induced defoliation and mortality across the Model Forest. In fact in 1995, spruce budworm damage in the Model Forest accounted for 86% of the damage reported across all of southern Ontario (Sajan and Smith, 1996). This insect causes moderate to severe defoliation in white spruce and balsam fir, of which spruce plantations have been the most heavily hit. In 1998, 15,755 ha of forest in eastern Ontario were reported to have received moderate to severe levels of spruce budworm defoliation, the highest recorded level since 1975. Much of this was concentrated in a number of pockets of defoliation that were mapped in the Ottawa River Valley from Pembroke south-east to the Almonte-Carp area (Howse and Scarr, 1998).

To a lesser extent the jack pine budworm and the introduced gypsy moth have also contributed to forest stress in the EOMF. While no major infestations of Jack pine budworm have been detected in the Model Forest in recent years, low population levels, causing a 2 percent defoliation were detected in 1995 in a 1-ha Christmas tree plantation in Oxford-on-Rideau Township (Sajan and Smith, 1995). In comparison, Gypsy moth defoliation has been more extensive. Defoliation in the Model Forest by this insect peaked in 1986 at 32,861-ha. After six years of no detected incidences of moderate/major defoliation, 1,388-ha were reported defoliated near Charleston Lake in 1998 (Howse and Scarr, 1998). While it is too early to tell, this could signal the beginning of another gypsy moth infestation and defoliation levels will have to be monitored closely in upcoming years.

Chart 4 shows the frequency and extent of the occurrence of insect disturbances within the EOMF.

**Chart 4: Area in EOMF Defoliated by Insects 1947-1998**

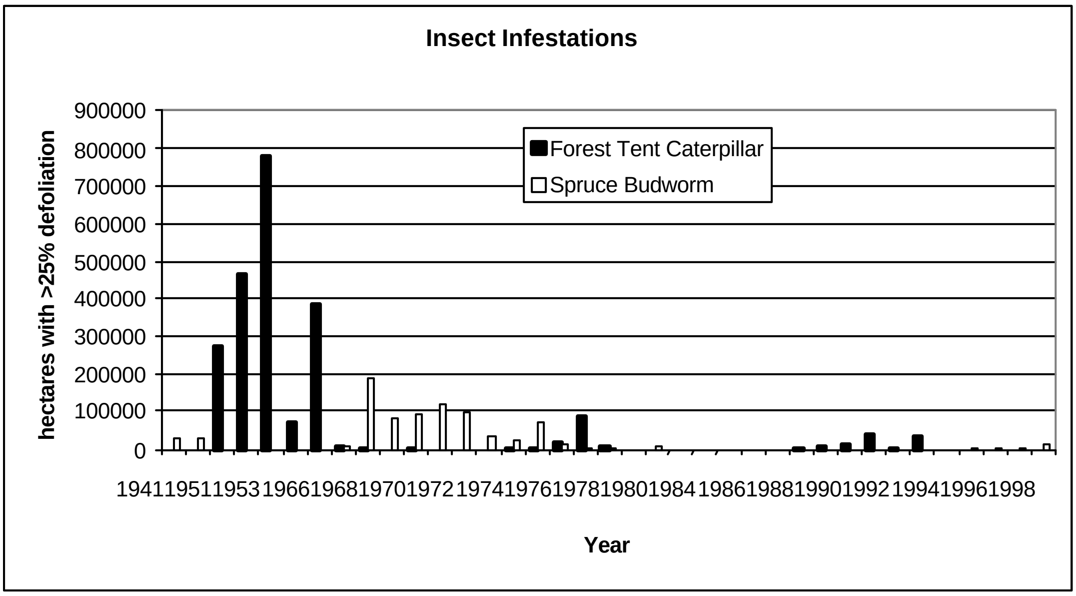


**Table 13: The Impact of Insect Infestations on the EOMF**

| | Number of hectares with moderate to severe defoliation (>25%) in the EOMF | | | |
|---|---|---|---|---|
| Year | Forest Tent Caterpillar | Spruce Budworm | Jack Pine Budworm | Gypsy Moth |
| 1941 | | 28,745 | | |
| 1942 | | 29,989 | | |
| 1951 | 274,041 | | | |
| 1952 | 469,644 | | | |
| 1953 | 776,729 | | | |
| 1965 | 68,998 | | | |
| 1966 | 384,099 | | | |
| 1967 | 7,697 | 8,266 | | |
| 1968 | 3,951 | 188,419 | | |
| 1969 | | 80,282 | 3,439 | |
| 1970 | 3,797 | 89,219 | | |
| 1971 | | 117,687 | 3,286 | |
| 1972 | | 97,904 | 1,982 | |
| 1973 | | 36,433 | 2,627 | |
| 1974 | 2,723 | 27,916 | | |
| 1975 | 3,621 | 72,639 | | |
| 1976 | 21,234 | 15,688 | | |
| 1977 | 85,696 | 5,267 | | |
| 1978 | 10,031 | 3,450 | | |
| 1979 | | 953 | | |
| 1980 | | 9,455 | | |
| 1983 | | | | 577 |
| 1984 | | | | 3,875 |
| 1985 | | | | 14,230 |
| 1986 | | | | 32,861 |
| 1987 | 282 | | | 2,638 |
| 1988 | 4,280 | | | 4,653 |
| 1989 | 10,983 | | | 13,042 |
| 1990 | 15,463 | | | 845 |
| 1991 | 39,940 | | | 229 |
| 1992 | 7,415 | 84 | | |
| 1993 | 34,799 | 511 | | |
| 1994 | | 947 | | |
| 1995 | 1,338 | 5,638 | | |
| 1996 | 1,626 | 4,880 | | |
| 1997 | | 6,870 | | |
| 1998 | | 15,755 | | 1,388 |
| *Source: Query run by CFS, SSM - R. Sajan* | | | | |

**Other Cause of Stress:**
There are a number of other causes of stress such as drought which impact the forests of eastern Ontario to varying degrees. While there is limited information on the history of drought damage in the Model Forest, it is something that woodlot and forest managers should be aware of. Sites that are typically prone to drought damage are hill tops and areas with shallow soil conditions. While drought was a major concern in the early 1990's, recent drought damage has been minimal. Typical drought induced symptoms, such as yellowing of foliage and premature dropping of leaves, were observed in 1995 in the southwest portion of Leeds and Grenville County. The damage was concentrated on hardwood species (Sajan and Smith, 1995). Drier than normal summers in 1997 and 1998 also has likely been an added stress to many tree species.

Research suggests that fire has long played a role in eastern Ontario forests. For example, trees such as eastern white pine and red oak are specifically adapted to fire and are naturally present in the Model Forest. A further investigation into the presence/absence of charcoal in lake sediments and fire-adapted species distribution is necessary to fully understand the significance of fire in the EOMF.

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## INDICATOR 2.2: FOREST STAND HEALTH

**Description:**
The health of individual trees in our forests can be assessed by tracking over time a number of characteristics such as crown transparency, mortality, defoliation, bark vigour and annual growth. For example, crown transparency is measured by the amount of skylight visible through the leafy portion of a tree. A higher-than-normal transparency of a hardwood such as sugar maple could indicate significant stress.

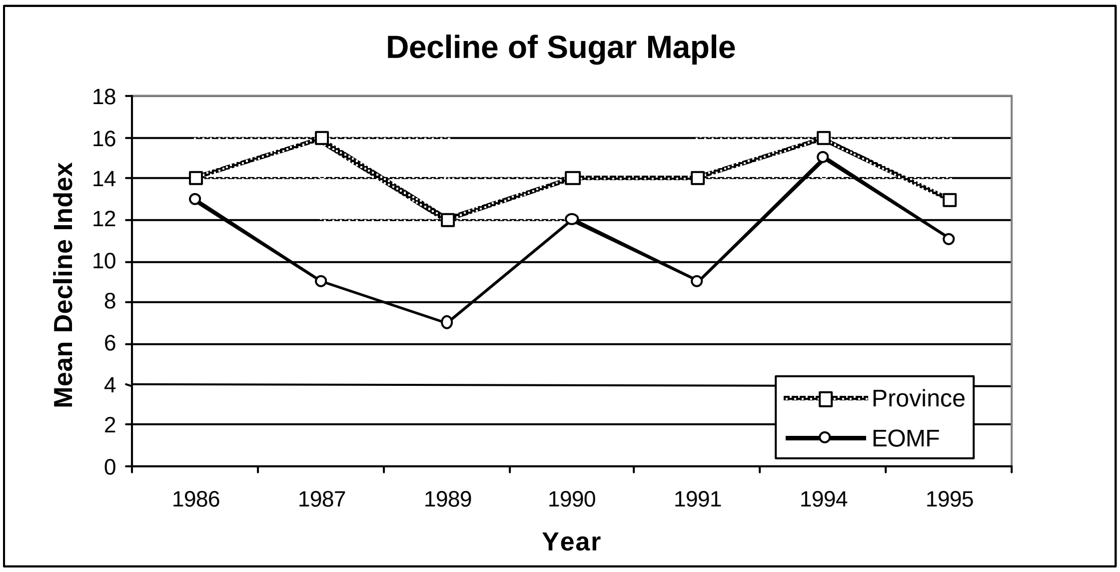
If stands of trees are assessed in many different woodlots, a picture of the health of the forests across the landscape materializes. Fortunately, the Ministry of Environment, the Canadian Forest Service and the OMNR have been monitoring forest health for a number of years. The results of these investigations in the EOMF are presented below.

**Findings:**
**Ontario Ministry of the Environment Sugar Maple Health Studies:** The Ontario Ministry of Environment developed a Decline Index (DI) as a means of estimating sugar maple health. Calculation of the DI uses a formula encompassing four variables: % branch dieback, % undersized foliage, % of crown with slight leaf discoloration and % crown with severe leaf discoloration. Preliminary results indicate that there has been a significant improvement in tree condition since 1994 with the tress on non-Shield sites improving at a faster rate than those forests in the north and on the Shield (Mclauglin, D. pers. comm., 1999). Additionally, a study by the Canadian Forest Service examining sugar maple condition between 1987 and 1995 found similar results.

For this report, a comparison was conducted between sugar maple decline on sites throughout the province to those sites specifically within the Model Forest (see Chart 5). The lower the DI, the healthier the trees on the site. Note that sugar maple decline in the

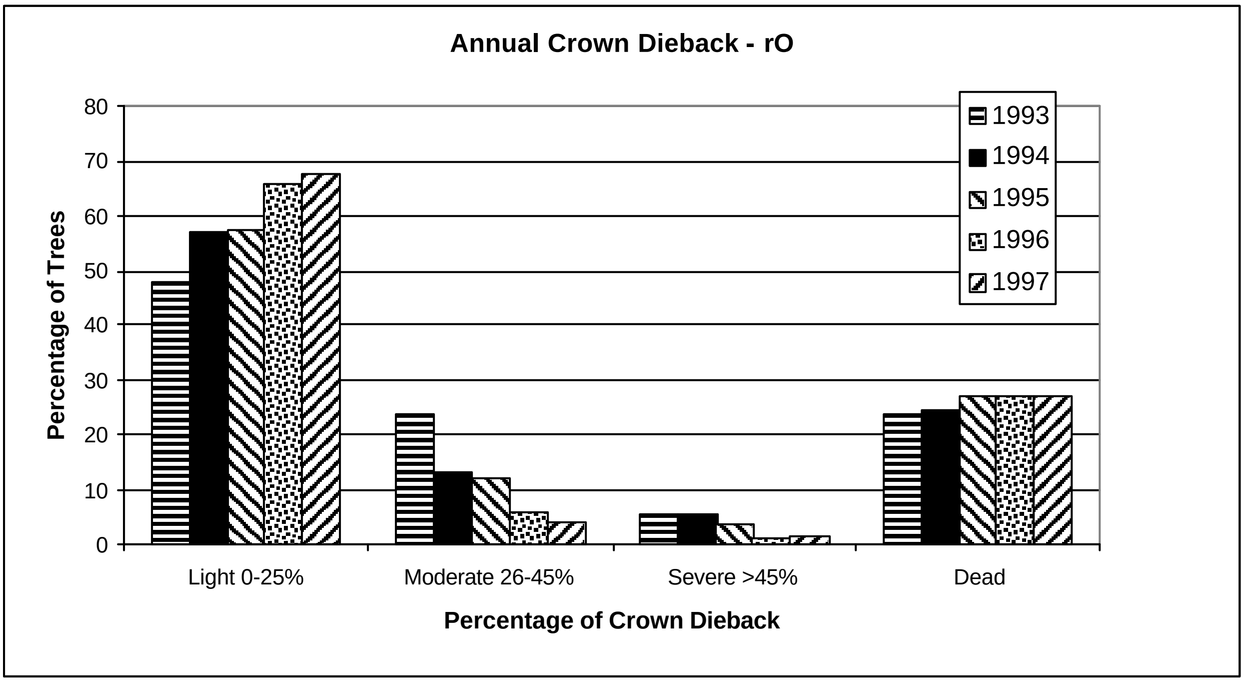
Model Forest has consistently been lower than that observed for the rest of the province and could be due to the presence of soils with a high ability to reduce the acidity of incoming acidic deposition (see discussion under Criterion 3 for more details on buffering capacity of soils in EOMF).

**Chart 5: Comparison of the Provincial and EOMF Mean Decline Index for Sugar Maple. Data from the Ministry of Environment.**




**Canadian Forest Service Oak Health Studies:** The CFS has two permanent oak plots in the EOMF and a comparison of the percentage of dead crown and tree mortality for the years 1993 - 1997 is presented in Chart 6. Based on 200 sampled trees, the level of crown dieback appears to be decreasing over time with 24% of the sampled trees showing moderate defoliation in 1993 and only 4% in 1997. At the same time, there is an increasing number of trees with light crown die-back, which is in part due to previously moderately defoliated oak improving and being reclassified in the light die-back category.

**Chart 6: Summary of Crown Dieback and Tree Mortality of Red Oak at Two Locations in the Kemptville District.**




**Canadian Forest Service Maple Health Plots:** Two projects have been monitoring sugar maple health in the EOMF: the North American Maple Project (NAWP) and Acid Rain Early Warning System (ARNEWS). NAWP sampled both untapped (Chart 7) and tapped (Chart 8) maple trees. The data depicts similar trends showing a recent decline in the health of sugar maple trees in 1996 with light defoliation occurring in as much as 66% of the trees. These trees seemed to have recovered in 1997 to previous year levels with approximately 90% of the sampled trees showing virtually no crown dieback.

The ARNEWS plots however, show a decline in tree health, beginning in 1993 with 85% showing virtually no crown dieback and ranging down to 0% in 1997 (Chart 9) with the shift towards that of light defoliation. This graph represents a plot containing only 13 trees and therefore caution must be used when interpreting this data.

One plot, containing 58 coniferous trees was also sampled in the Kemptville district through the ARNEWS project. A comparison of the percentage of dead crown and tree mortality for the years 1993 - 1997 is presented in Chart 10. Annual crown dieback appears to be increasing over time with over 90% of the sampled trees showing only light defoliation in 1993 and 37-48% of the trees showing moderate defoliation in 1996 and 1997.

**Chart 7: Summary of Crown Dieback and Tree Mortality of Sugar Maple at the North American Maple Project Plot in the Kemptville District. Trees are currently being tapped for maple syrup production.**

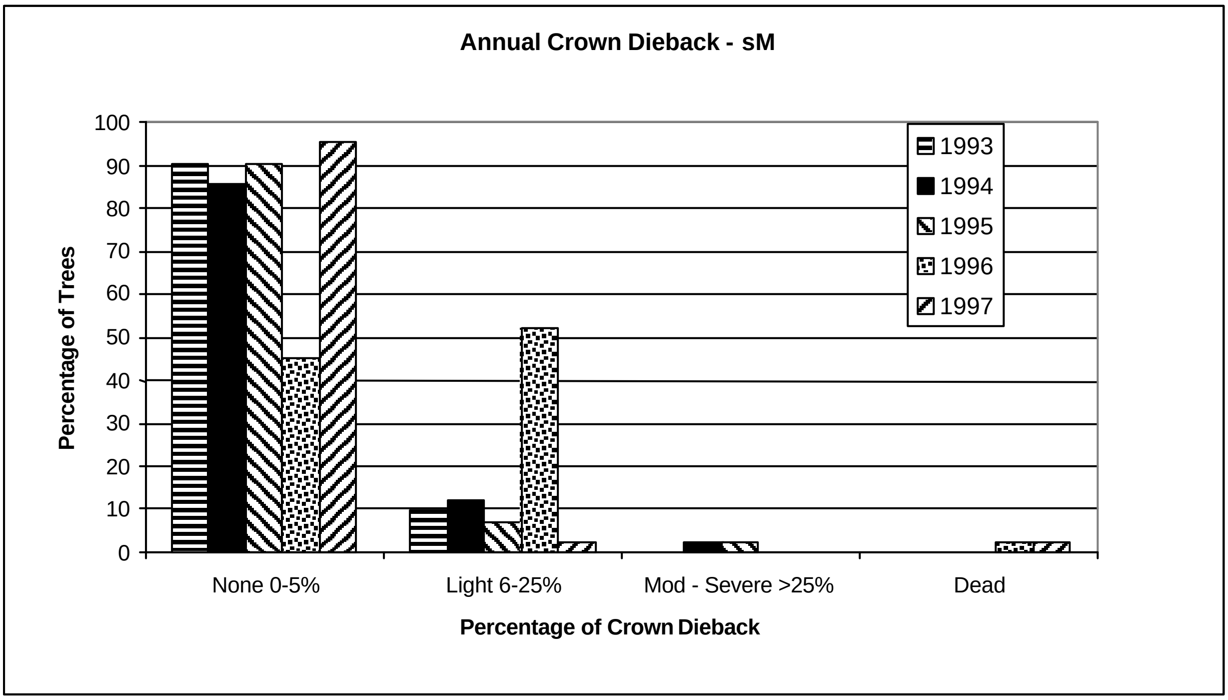



**Chart 8: Summary of Crown Dieback and Tree Mortality of Sugar Maple at the North American Maple Project Plot in the Kemptville District. Trees are not tapped for maple syrup production.**

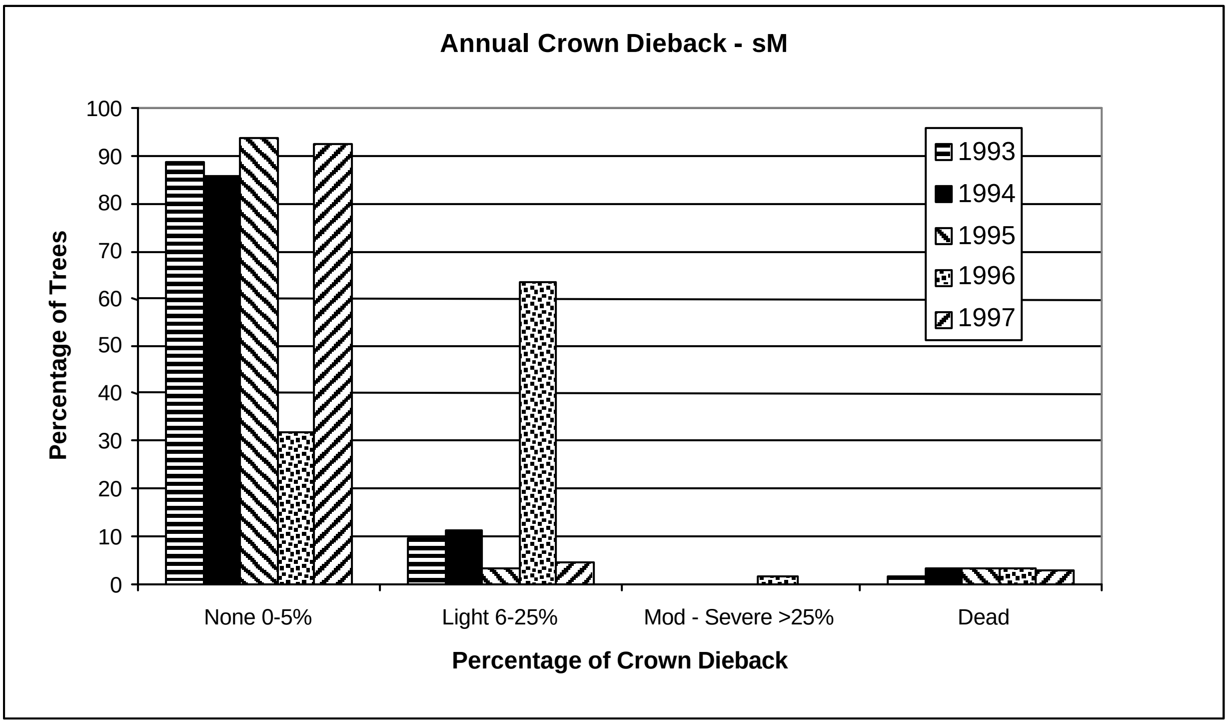


**Chart 9: Summary of Crown Dieback and Tree Mortality of Sugar Maple at the Acid Rain National Early Warning System Plot in the Kemptville District.**

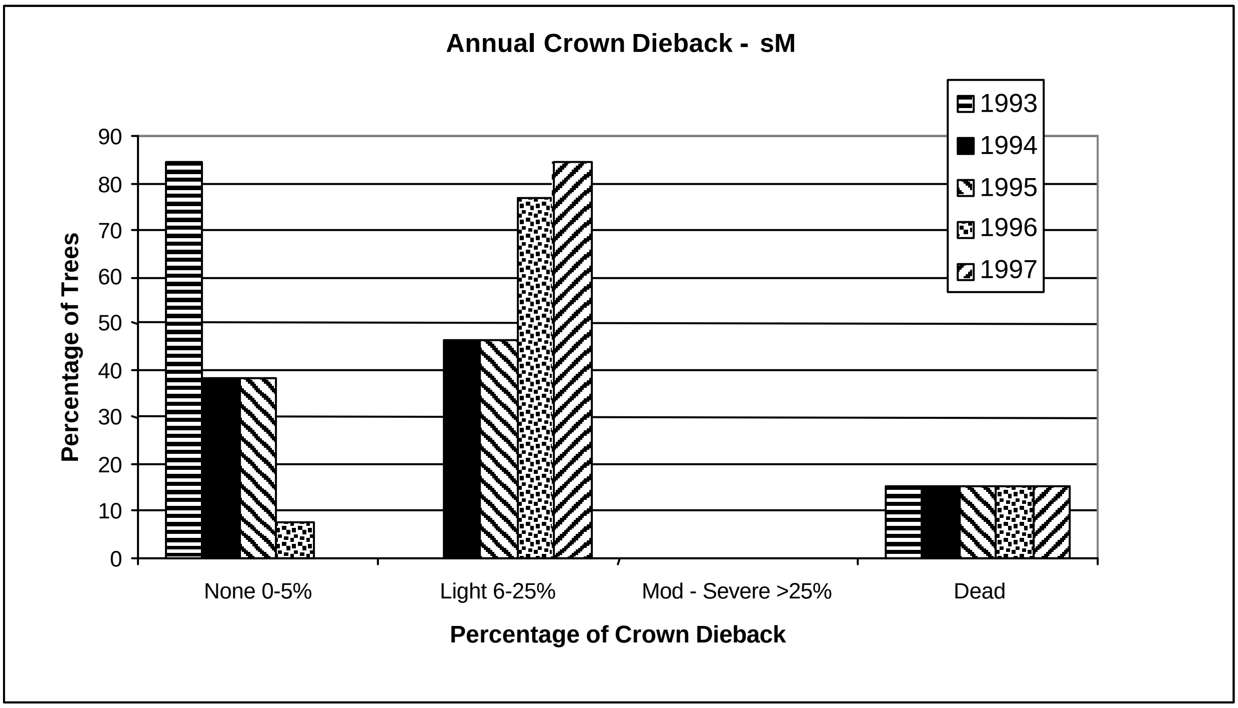
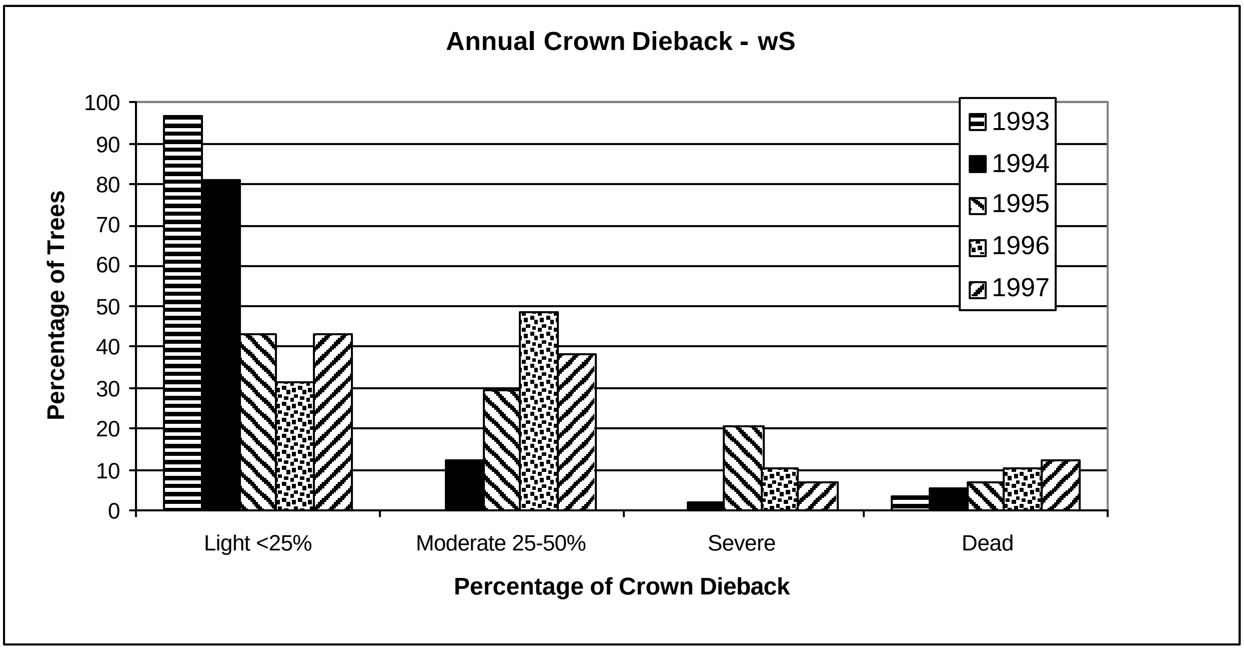



**Chart 10: Summary of Crown Dieback and Tree Mortality of White Spruce at the Acid Rain National Early Warning System Plot in the Kemptville District.**



# 5. SOIL AND WATER: CRITERION THREE

| **Indicator 3.1** | **Indicator 3.2** |
| --- | --- |
| ***Percentage of riparian areas with natural vegetation cover*** | ***Buffering Capacity and Soil Acidification*** |

***Soil and water*** *are the building blocks for all plants. Maintaining good soil and water quality is essential if the forests are to remain healthy, resilient and able to withstand the stresses caused by both humans and nature. Changes in soil and water quality are common occurrences. Some of these changes are caused by natural disturbances such as unusually high rainfall or spring melt. Any number of human activities can cause other disturbances. For example, removing forest cover around the edges of lakes and streams can increase water temperature and the amount of soil erosion. Fertilizers and herbicides that run off farmland into rivers and streams change the water quality. Acid rain from industrial and vehicle emissions can result in acidification of soils. Given the above, the amount of riparian forest cover and soil acidification have been selected to provide practical and measurable ways of assessing water and soil quality across the EOMF.*

## Quick Facts

**Riparian Areas:**

- Riparian areas reduce runoff and siltation of water bodies, stabilize banks and prevent bank erosion, provide important fish habitat by maintaining cool water temperatures and increase ecosystem stability by providing animal corridors.
- A GIS query was used to calculate the percentage of natural vegetation cover in 15-metre wide buffers around all lakes, rivers and streams in the Model Forest. Lanark County and Leeds Grenville have the highest degree of watercourse protection with almost 40% natural vegetation cover within a 15-metre buffer. Prescott-Russell and Stormont, Dundas and Glengarry have the lowest water course protection at 21%.
- With a growing public awareness of the importance of riparian areas and as more land owners adopt 'best management practices', an increase in the percentage of natural vegetation cover in a 15m buffer would be expected in subsequent State of the Forest Reports.

**Buffering capacity of soils in EOMF:**

- Buffering capacity relates to the ability of soils to neutralize incoming acid precipitation. The Paleozoic bedrock soils that principally lie east of Hwy. 15 have a generally high buffering capacity. The soils associated with the Precambrian bedrock to the west of Hwy. 15 have a low buffering capacity.

**Soil acidification in EOMF:**

- Despite the high buffering capacity of much of the region's soils, research suggests that acid deposition is currently exceeding the highest level for which no long-term harmful effects will occur.

## INDICATOR 3.1: PERCENTAGE OF RIPARIAN AREAS WITH NATURAL VEGETATION COVER

**Description:**
Riparian areas are those portions of fields and forests that are immediately adjacent to the edge of a water body such as a river, stream or lake. The leaves and treetops provided by forest cover in riparian areas play an important role by intercepting and slowing down the rate at which rainfall enters water bodies. When lands are cleared right to the water's edge it can lead to increased runoff, water flow and siltation. Above average rates of water flow and siltation can negatively impact forest and ecosystem health by allowing nutrients and water that would normally be used for forest growth to enter the drainage system and not be utilized by the forest.

Bank stabilization is highly dependent on riparian forest cover. The network of roots associated with vegetation provides banks with strength and structure. With the loss of that vegetation banks begin to deteriorate causing collapse, increased siltation and ultimately a loss in once viable land. Riparian forest cover also provides shade and cool conditions during the hot summer months. Loss of shade over water bodies can substantially increase water temperatures, negatively impacting fish habitat. Young brook trout migrate up cool water channels that enter lakes, for refuge and feeding.

Forest interior species often utilize forested riparian areas as a means of moving from one forested area to another. This immigration/emigration significantly adds stability to ecosystems and maintains biodiversity by allowing areas to be repopulated following a species extirpation (local extinction).

These are only a few of the important benefits to maintaining forested riparian areas. Knowing the amount of riparian forest cover can provide insight into the extent of soil erosion, water quality and ecosystem health.

**Findings:**
The best-management practices (BMPs) for fish and wildlife habitat management advocated by Agriculture Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) recommend that natural vegetation buffers around riparian areas should be a minimum of 3 metres wide and ideally wider than 18 metres in order to provide reasonable water quality protection (Agriculture Canada 1996). In fact, buffers of 50 metres or more adjacent to marshes and wetlands are recommended where possible. For example, mallard ducks commonly nest up to 300 metres from wetland edges.

Unfortunately, conducting a detailed analysis of the extent of natural vegetation cover in riparian areas in the Model Forest is difficult due to GIS data and software limitations. However to provide an initial coarse level assessment of this variable, a GIS query was conducted to calculate the percentage of natural vegetation cover in 15-metre wide buffers around all lakes, rivers and streams in the Model Forest (see Table 14). Lanark

County and Leeds Grenville have the highest degree of water coarse protection with almost 40% natural vegetation cover within a 15-metre buffer. Prescott-Russell and Stormont, Dundas and Glengarry have the lowest water coarse protection at 21%. This is not surprising given the high amount of agricultural activity in both of these Counties.

With a growing public awareness of the importance of riparian areas and as more land owners adopt 'best-management practices', an increase in the percentage of natural vegetation cover in a 15-metre buffer would be expected in subsequent State of the Forest Reports.

**Table 14: Natural Vegetation Cover over Riparian Areas in EOMF**

| County | % of 15-metre Buffer Naturally Vegetated |
|---|---|
| Lanark | 39.7% |
| Leeds & Grenville | 39.6% |
| Prescott-Russell | 21.1% |
| RMOC | 33.4% |
| Stormont, Dundas & Glengarry | 21.1% |
| Source: GIS Query run by EOMF | |

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## INDICATOR 3.2: BUFFERING CAPACITY AND SOIL ACIDIFICATION

**Description:**
Airborne pollutants are an example of a "human-caused", or anthropogenic disturbance or stress known to occur in the Model Forest. Knowledge of the severity and impact of pollutants such as acid rain is crucial to our understanding of forest ecosystems. Factories continue to deposit sulphur dioxide, particulate sulphate, nitric acid, particulate nitrate and ammonia into the atmosphere which consequently falls back to the earth in the form of acid rain. There is growing evidence that increases in the acidity of soils due to acid rain are leading to declining rates of forest health. Some soils however, have the ability to reduce the acidity of incoming acidic deposition (a buffering capacity). Therefore it is important to understand what soils exist within the EOMF and ultimately whether they have a buffering capacity with respect to acid rain.

**Findings:**
**Buffering Capacity:** Both Precambrian and Paleozoic bedrock exist within the EOMF. Generally the Precambrian bedrock is found to the west of Hwy. 15. Common rocks found within this type of bedrock are granite and gneiss, both of which are very hard and produce soils that have a limited buffering capacity.

The Paleozoic bedrock is dominant in the lowlands to the east of Hwy. 15. Paleozoic bedrock is much softer, and contains sandstones, limestones, shales and dolomite. Components such as these produce soils that are neutral or alkaline resulting in a much higher buffering capacity. One exception is the Edwardsburg Sand Plain in the south of the Model Forest which contains soils that are acidic.

**Soil Acidification:** While much of the region's soils may have a high buffering capacity, it is still important to monitor the extent of acid precipitation. Natural Resources Canada maintains sample plots within the EOMF, which indicate that acid deposition is currently exceeding critical levels. The critical level is defined as the highest deposition of acidifying compounds that will not cause chemical changes leading to long-term harmful effects on aquatic and terrestrial ecosystems. The critical level varies with the soil type. Natural Resources Canada estimates that a level of 500eq/(ha·yr) exceedence of the critical level is associated with an annual productivity loss of 10%. The plots within, or in close proximity of the EOMF on Precambrian bedrock showed exceedence levels of 352, 222 and 342eq/(ha·yr). The plot on Paleozoic bedrock showed an exceedence level of only 31eq/(ha·yr). By comparison, plots along Georgian Bay in central Ontario showed exceedences in excess of 600 eq/(ha·yr).

Soil acidification caused by acid rain will likely affect forest health in the EOMF. Preliminary results of the Decline Index discussed in Criterion 2, indicate that tree health declines at a higher rate on sites that have a lower buffering capacity (Mclauglin, D. pers. comm., 1999). Additionally, Natural Resources Canada (1998) reports that the nutrient status of sugar maple seedlings declines as soil acidification increases and base saturation decreases. This suggests that the greatest effects will be observed on those forests associated with the Precambrian bedrock.

Although, soils associated with the Paleozoic bedrock are currently not showing high exceedence of the critical level, acid rain may still be affecting the trees directly by altering the chemical characteristics of leaf cuticles, causing a decline in frost hardiness, and inhibiting reproductive processes (NRCAN 1998).

## 6. GLOBAL IMPACTS: CRITERION FOUR

| ***Indicator 4.1*** | ***Indicator 4.2*** |
|---|---|
| ***Ground level ozone and pollution deposition*** | ***Climate trends*** |

**Global impacts** such as climate change and pollution are major issues facing Canada and the world. Forests play an important role in global ecological cycles by recycling the Earth's water, carbon, oxygen, and other life-sustaining elements. Impacts such as global warming and pollution can threaten the "recycling" capacity of the forests. Knowledge of the impact associated with such things as ground level ozone and global warming is important to ensure that the forests – and the demands placed on them – are sustainable.

### Quick Facts

**Ground level ozone:**

- Along with acid precipitation, ground level ozone is one of the two main regional air pollutants in Ontario.
- Ground level ozone concentrations in the EOMF are periodically above the critical level causing leaf discoloration and premature leaf drop to sensitive tree species.

**Climate change:**

- Climate change is a major factor determining the sustainability of our forests. A warming climate could alter where a tree species will grow, and result in increased intensity of fires and drought.

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### INDICATOR 4.1: GROUND LEVEL OZONE AND POLLUTION DEPOSITION

**Description:**

Ground level ozone is a pollutant that is produced when sunlight passes through high concentrations of airborne industrial pollutants. When ozone levels become too high, they become toxic to vegetation, altering the way trees store carbon, causing premature defoliation and increasing their susceptibility to disease and insect attack. Even though the source of these pollutants may be at great distances from eastern Ontario, it is important to gain a better understanding of the extent to which these factors are affecting forest health in the region.

**Findings:**

Natural Resources Canada (1998) reported that south-central Ontario receives the highest rate of ground level ozone in eastern Canada and the Canadian Council of Forest Ministers (1997) reported this same area is periodically exposed to ozone concentrations above the critical level. In fact, elevated concentrations of ozone are common during the summer months when growing plants are most vulnerable to injury. Little information is currently available about the full effects of ground level ozone on eastern Ontario's forest health. However, the Canadian Forest Service has recently been monitoring ground level ozone concentrations in this area and analysis of the data is pending.

**THE IMPACT OF GROUND LEVEL OZONE** can be assessed relatively simply by looking for visible injury on sensitive plant species. Black cherry and white ash are two trees within the EOMF that show a consistent response to elevated ozone concentrations. The leaves of these trees tend to display a stippled discoloration ranging from red to purple to brown, and may drop prematurely. Sugar maple however, is a species of medium sensitivity and won't show signs of injury unless ozone levels are high. Woodlot owners should periodically examine their trees throughout the summer to determine

## INDICATOR 4.2: CLIMATE TRENDS

**Description:**
As fossil fuels such as oil, gasoline, and natural gas continue to be burned, more carbon dioxide ($CO_2$) and other greenhouse gases are released into the atmosphere. Increased concentrations of these gases have been linked to climate change. Understanding the relationship between forests and global warming is important for two reasons. Firstly, global warming has the potential to change the growth and productivity of forests and the range of tree species, as well as the range and frequency of natural disturbances (e.g. fires, insects and diseases). Secondly, forests play a critical role in the world's carbon cycle by absorbing carbon dioxide during photosynthesis and storing it as they grow. Knowledge of the relationship between a tree's age and the rate and amount of carbon it stores can help in assessing the forests potential role in reducing carbon emissions from industrial sources.

**Findings:**
Global temperatures over the past century have been steadily increasing and this trend is predicted to continue. While to a large extent the impacts on the forests are still unknown, the rate at which this change is happening is of major concern. The forests in the EOMF have their own set of species that have adapted to regional climate, habitat type and disturbance patterns: an adaptation that took millions of years. With the predicted rate of climate change a barrage of new disturbances will be introduced, from an evolutionary perspective, almost instantaneously. These disturbances will range from diseases, non-native insects, and pollutants to increased $CO_2$ levels. Because the species will not likely have the necessary time to adapt, each of these factors could have a detrimental effect on species distribution. For example, $CO_2$ levels are expected to double in the next century, which in turn is expected to alter precipitation levels. Water availability is a key factor governing tree species distribution and could cause immediate declines in vulnerable species.

Forests also play a key role in absorbing and storing carbon through the process of photosynthesis. Young trees - regenerating naturally or planted by landowners - absorb a substantial amount of carbon at a rate that tends to increase with each year. Upon maturity, the amount of carbon contained within the tree continues to increase but the rate of absorption decreases and their role shifts from atmospheric carbon reduction to carbon reservoir. Throughout much of this century, forest cover within the EOMF has been steadily increasing, having a positive impact on the $CO_2$ levels worldwide.

The Canadian Forest Service has selected sugar maple and balsam fir sites in Ontario, Quebec, New Brunswick and Newfoundland and is currently monitoring climatic and environmental variables that influence or control carbon cycling. While no information specific to the EOMF currently exists it is important that landowners are aware of the potential threat this issue can have on forest health.

# 7. BENEFITS TO SOCIETY: CRITERION FIVE

| Indicator 5.1 | Indicator 5.2 | Indicator 5.3 |
|---|---|---|
| *Production of timber forest products* | *Regional wood prices* | *Employment in forest-related sectors* |

*The forests and woodlots in eastern Ontario provide us with many benefits. From a commercial perspective they supply timber and maple syrup, provide jobs in both forestry and recreation, and contribute to the economy in many other indirect ways. Forests provide numerous recreational opportunities and have both cultural and spiritual importance to the people of eastern Ontario. While early European settlers viewed and treated the forests as an inexhaustible resource, there is now a growing recognition of the link between healthy forests and environments and healthy economies. The following indicators have been chosen to provide measures of the economic health of forest related industries in the model forest.*

## Quick Facts

**Volume of sawlogs and pulpwood produced:**

- The sawmills and pulpmills in eastern Ontario consumed over 460,000 $m^3$ of sawlogs and pulpwood in 1998. Pulpwood makes up 80% (369,000 $m^3$) of this volume, hardwood sawlogs represent 17% (79,800 $m^3$), and conifer sawlogs account for the remaining 3% (12,400 $m^3$) of the volume purchased.
- The bulk of this wood (73% or 336,800 $m^3$) is imported from outside of the region with the vast majority coming from New York State. Local private lands provide roughly 25% (114,300 $m^3$) of the total wood purchased and Crown land only 2% (9,654 $m^3$)

**Regional wood prices:**

- The most valuable hardwood species in the Model Forest are black cherry, red oak, and hard maple, which average approximately $540 per 1000 board feet for #1 common. These are followed by yellow birch, soft maple, ash, white oak, basswood and butternut which average $330 per 1000 board feet for #1 common. Beech, hickory, elm and poplar are the least valuable hardwood species averaging $230 per 1000 board feet for #1 common. Depending upon the species, prices for #1 common are up to 80% higher than those for # 2 grade.
- A comparison of local log prices with those in the Bancroft area reveals that prices in the two regions appear to be fairly similar. While hard maple prices are slightly higher in Bancroft, red oak commands a higher price on average in the Model Forest.

**Employment in forest industry:**

- While still an important source of jobs, total employment in forestry related sectors in the Model Forest declined by 18% between 1991 and 1996.

## INDICATOR 5.1: PRODUCTION OF TIMBER AND NON-TIMBER FOREST PRODUCTS

**Description:**
In this section, information is presented on the production of timber and non-timber products in the Model Forest. With respect to timber products, the regions many sawmills purchase wood from a variety of sources (i.e. private and Crown land) and different regions (e.g. Ontario, Quebec and New York). The degree to which local sawmills buy wood from outside of the region is one indication of the level of forest management in the Model Forest. Due to the limited forest cover in the Model Forest, one would naturally expect sawmills to purchase some wood from other regions. In time however, an increase would be expected in the relative amounts of sawlogs and pulpwood available within the Model Forest as more woodlot owners become aware of the benefits of good forest management.

Maple syrup is the most common marketed non-timber forest product in the Model Forest. Below is presented some information on the number of taps and volume of maple syrup produced within the Model Forest. A steady or increasing yield of maple syrup over time is one indication that the region's sugar bushes are being sustainably managed.

**Findings:**
**Sawlog and Pulpwood Production and Consumption:** The production and consumption of sawlogs and pulpwood in eastern Ontario is one of the more complex in the province. The reasons for this include: the high percentage of wood on private land of which the OMNR knows little about, the high number of small sawmills in the region, outdated forest resource inventories (FRI) and the large volumes of wood imported from and exported to other regions such as upper New York State and Quebec. Fortunately, all mills that process more than 100,000 board feet of wood annually are required to file a mill license with the OMNR. The mill license returns tell us what species each mill is purchasing and where they are purchasing their wood from. Table 15 summarizes the 1998 mill license return information filed by mills within the Model Forest.

**Table 15: 1998 Volume of Sawlogs and Pulpwood Purchased in EOMF by Source**

| Hardwoods | | Private Land | Crown Land | Out of Province | Total |
|---|---|---|---|---|---|
| Maple (Mh&Mr) | | 6,046 | 508 | 7,135 | 13,690 |
| Hard Maple | | 1,334 | 16 | 8,789 | 10,139 |
| Red Maple | | 332 | 0 | 6,301 | 6,633 |
| Oak All | | 3,748 | 65 | 3,956 | 7,769 |
| Beech | | 659 | 70 | 3,580 | 4,309 |
| Basswood | | 4,393 | 324 | 6,985 | 11,702 |
| Yellow Birch | | 379 | 68 | 2,743 | 3,190 |
| White Birch | | 527 | 41 | 1,462 | 2,029 |
| Poplar | | 2,310 | 341 | 5,227 | 7,878 |
| Other Hardwoods | | 1,935 | 113 | 10,367 | 12,415 |
| **Total** | | **21,663** | **1,545** | **56,544** | **79,752** |
| | | | | | |
| **Softwoods** | | | | | |
| White Pine | | 3,269 | 226 | 492 | 3,988 |
| Red Pine | | 95 | 66 | 0 | 161 |
| Jack Pine | | 0 | 0 | 0 | 0 |
| Spruce | | 281 | 0 | 0 | 282 |
| Balsam Fir | | 4 | 0 | 0 | 4 |
| Cedar | | 7,386 | 0 | 0 | 7,386 |
| Larch | | 0 | 0 | 0 | 0 |
| Hemlock | | 574 | 45 | 0 | 619 |
| **Total** | | **11,611** | **337** | **492** | **12,440** |
| | | | | | |
| **Pulpwood** | | | | | |
| Roundwood (Hw) | | 80,128 | 7,771 | 89,226 | 177,125 |
| Whole-Tree Chips | | 932 | 0 | 190,592 | 191,524 |
| **Total** | | **81,060** | **7,771** | **279,818** | **368,649** |
| | | | | | |
| **Grand Total** | | **114,333** | **9,654** | **336,854** | **460,841** |
| Source: OMNR 1997 Mill License Returns | | | | | |

Due to its size, the information presented in Table 15 can be difficult to interpret. However, the graphical display of this information presented in the charts 11 - 14 gives a clearer picture of the woodflows and wood production in the Model Forest.

**Chart 11: 1998 Total Sawlog and Pulpwood Purchases of Mills within EOMF by Source**


**Chart 12: 1998 Sawmill Hardwood Sawlog Purchases of Mills within EOMF by Source**

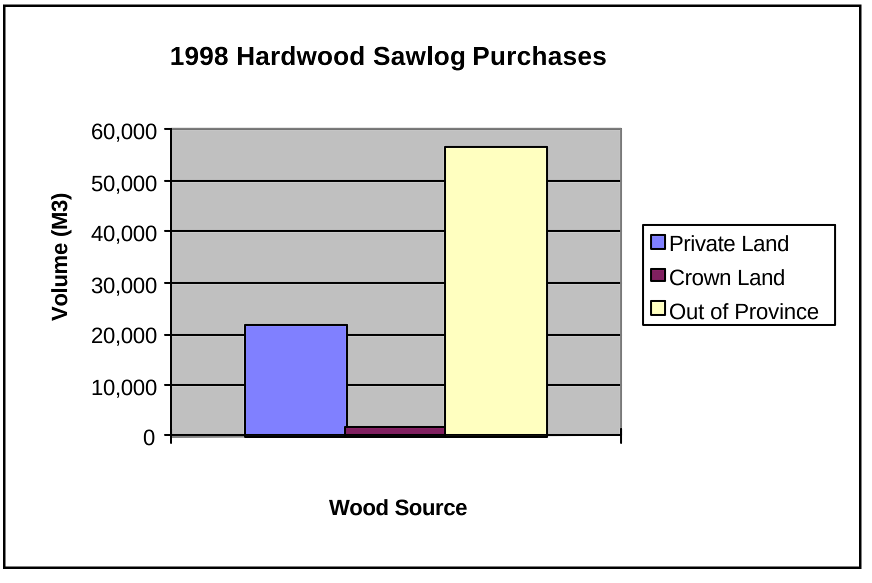
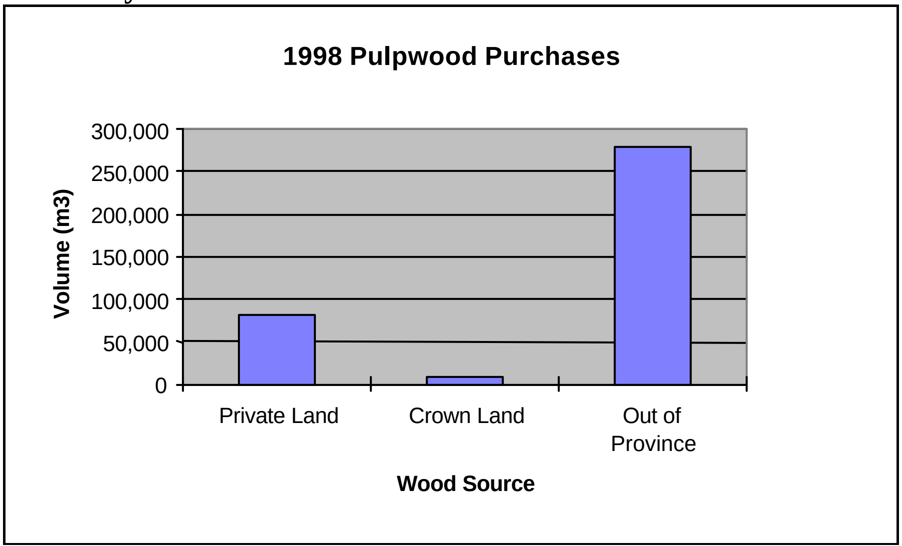


**Chart 13: 1998 Sawmill Softwood Sawlog Purchases of Mills within EOMF by Source**


**Chart 14: 1998 Eastern Ontario Sawmill Pulpwood Purchases of Mills within EOMF by Source**




Based on a review of Table 15 and the charts above, the wood purchases in eastern Ontario can be characterized as follows:

- The primary wood using industry in eastern Ontario consumes over 460,000 $m^3$ of sawlogs and pulpwood annually. Pulpwood makes up 80% (369,000 $m^3$) of this volume, hardwood sawlogs represent 17% (79,800 $m^3$), and conifer sawlogs account for the remaining 3% (12,400 $m^3$) of the volume purchased.
- The bulk of this wood (73% or 336,800 $m^3$) is imported from outside of the region with the vast majority coming from New York State. Private lands provide roughly 25% (114,300 $m^3$) of the total wood purchased and Crown land only 2% (9,654 $m^3$)
- Sources outside of the province provide over 70% (56,500 $m^3$) of the hardwood sawlogs purchased by local mills. Discussions with mill owners reveal that the

majority is purchased in upper New York State. Private lands and Crown lands respectively provide 27% and 2% of the hardwood sawlog purchased.

- Unlike hardwoods however, the majority (93%) of the softwood sawlogs are purchased from local private land with Crown land and outside sources providing only 3% and 4% of the softwood sawlog purchases respectively.

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## INDICATOR 5.2: REGIONAL WOOD PRICES

**Description:**
Regional wood prices are the prices that local mills pay for logs or pulpwood that are delivered to their yard. Wood prices are one indication of the financial sustainability of woodlot operations. Wood prices in a region are influenced by a number of variables including; wood supply, number of local mills; the strength of domestic and international markets; and local site conditions. Higher prices mean that the woodlot owner can better afford to manage for such things as biodiversity that might add to the overall logging costs of the operation. However, at the same time, higher prices also run the risk of providing an added incentive to overharvest the forest for short-term profit. The following presents some information on regional stumpage prices and prices from other parts of the province.

**Findings:**
Tables 16, 17, and 18 provide a summary of wood prices in the Model Forest broken down by product type (hardwood sawlogs, softwood sawlogs, and pulpwood) and species.

**Table 16: Eastern Ontario Hardwood Sawlog Prices - 1998**

| Average Regional Hardwood Sawlog Prices 1998 ($/1000 fbm) | | | |
|---|---|---|---|
| **Species** | **#1 Common** | **#2 Common** | **# 3 Common** |
| Hard Maple | $495 | $270 | $140 |
| Soft Maple | $350 | $245 | $130 |
| Yellow Birch | $390 | $245 | $140 |
| Basswood | $315 | $225 | $130 |
| Ash | $325 | $225 | $140 |
| Red Oak | $540 | $350 | $140 |
| White Oak | $325 | $225 | 140 |
| Cherry | $575 | $350 | 140 |
| Butternut | $275 | $215 | 130 |
| Poplar | $225 | $165 | 130 |
| Beech | $240 | $170 | 130 |
| Hickory | $230 | $165 | 130 |
| Elm | $230 | $165 | 130 |
| Source: EOMF telephone survey of 1998 sawmill prices | | | |

Chart 15 below provides a graphical ranking of hardwood sawlog prices in the Model Forest in 1998. As has been the case for several years now, the most valuable hardwood species in the Model Forest are black cherry, red oak, and hard maple, which average approximately $540 per 1000 board feet. These are followed by yellow birch, soft maple, ash, white oak, basswood and butternut which average $330 per 1000 board feet. Beech, hickory, elm and poplar are the least valuable hardwood species averaging only $230 per 1000 board feet.

**Chart 15: 1998 Average #1 Common Hardwood Sawlog Prices**

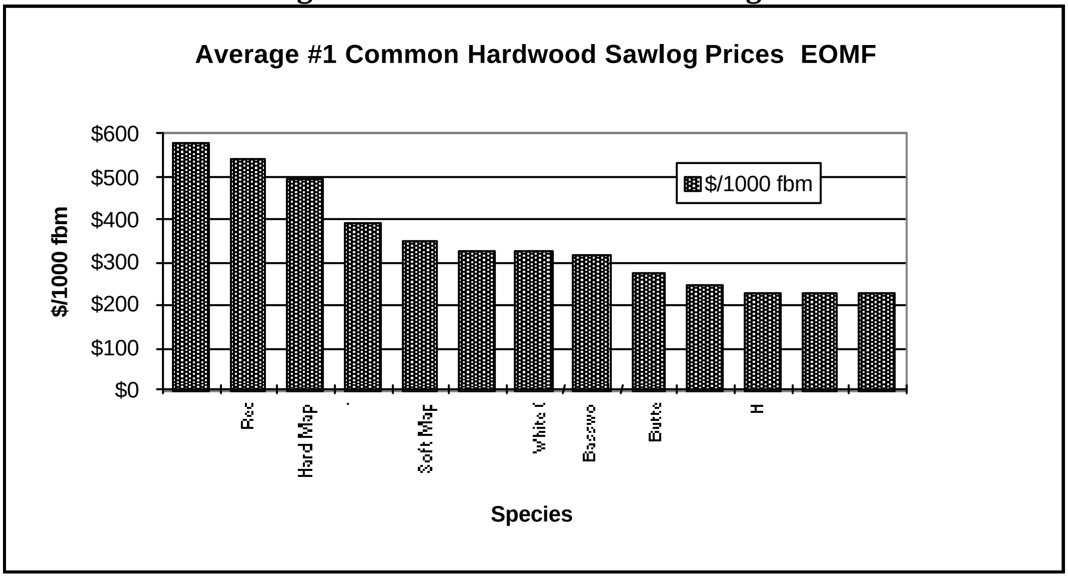


**Table 17: Regional Softwood Sawlog Prices - 1998**

| **Species** | **Sawlog Prices ($/1000 fbm)** |
|---|---|
| Cedar >8” | $450 |
| White Pine >10" | $430 |
| Red Pine > 10” | $315 |
| Hemlock >10” | $300 |
| Spruce >8” | $280 |
| Source: Survey of 1998 sawmill price lists | |

**Table 18: Regional Pulpwood Prices - 1998**

| **Species** | **Pulpwood Prices per Green Tonne** |
|---|---|
| Spruce Boltwood | 55 |
| Poplar Boltwood | 32 |
| White Birch Boltwood | 35 |
| Red & White Pine Boltwood | 50 |
| Source: Survey of 1998 sawmill price lists | |

For comparison purposes, Table 19 shows average hard maple and red oak sawlog prices in the Model Forest and those of a major sawmill operating in the Bancroft/Minden area. The mill in the Bancroft/Minden area was chosen because site conditions in that region are roughly similar to those found in the more heavily forested regions in the Model Forest (principally Lanark County). Wood prices in the two regions appear to be fairly similar. While hard maple prices are slightly higher at the Bancroft mill, red oak commands a higher price on average in the Model Forest.

**Table 19: Comparison of Regional Hardwood Sawlog Prices - 1998**

| | Hard Maple | | Red Oak | |
|---|---|---|---|---|
| **Region** | **#1 Common** | **#2 Common** | **#1 Common** | **#2 Common** |
| Bancroft/ Minden | 500 | 300 | 520 | 320 |
| EOMF | 495 | 270 | 540 | 350 |

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## INDICATOR 5.3: EMPLOYMENT IN FOREST-RELATED SECTORS

**Description:**
The forests of eastern Ontario are an important source of employment in a wide variety of timber and non-timber related activities. Forest based employment provides both economic and social benefits. Statistics Canada gathers information on employment in a variety of different industries through its Employed Labour Force survey. Unfortunately, the design of the Employed Labour Force Survey makes it difficult to determine employment levels in non-timber forest related industries such as eco-tourism or maple syrup production. The following section presents information on employment levels in forestry related industries.

**Table 20: Employment in Forest Industry and Related Processing Industries**

| Forest Industry Category | 1991 | 1996 | % Change |
|---|---|---|---|
| Logging | 730 | 230 | -68% |
| Forestry Services | 485 | 205 | -58% |
| Sawmilling, Planing and Shingle Mills | 110 | 200 | 82% |
| Veneer and Plywood | 180 | 30 | -83% |
| Sash, Door and other Millwork | 565 | 760 | 35% |
| Wooden Box and Pallet | 140 | 125 | -11% |
| Coffin & Casket | 40 | 0 | -100% |
| Other wood Industries | 110 | 175 | 59% |
| Pulp and Paper Industry | 1950 | 1485 | -24% |
| Paper Box and Bag Industry | 325 | 580 | 78% |
| Total | 4635 | 3790 | -18% |
| Source: Hardy Stevenson 1996, Query run by Statistics Canada for EOMF 1999 | | | |

**Findings:**
Table 20 compares employment levels in 1991 and 1996 for selected forest related industries. Note that while the forestry related sectors still employed almost 6,000 directly in the region in 1996, these numbers were down 18% from the 1991 levels. Logging, Forestry Services, Veneer and Plywood, and Coffin & Casket all received large

relative percentage declines in employment between 1991 and 1996. Significant increases in employment were reported in Sawmilling, Other Wood Industries and Paper Box and Bag Manufacturing.

To help understand the relative importance of forestry related employment across the Model Forest region, an analysis was done comparing total employment in all industries to total forestry related employment for each upper-tier municipality and the results are presented in Table 21. Note that employment in forest related industries represents 0.82% of total employment in all industries in Eastern Ontario compared to 1.4% for the rest of the province. This tells us that the economy in Eastern Ontario is relatively less dependent upon the forestry sector then is the rest of the Ontario economy. This is not surprising given the low levels of forest cover here compared to most other parts of the province. Forestry related employment is the highest in SDG and Lanark County representing 3.92% and 1.55% of total employment respectively. The extremely high percentage for SDG is almost entirely attributable to the Domtar pulp and paper mill in Cornwall.

**Table 21: Forestry Related Employment Compared to Total Employment in All Industries for EOMF and Ontario**

| Region | All Industries | Forest Industries | % |
|---|---|---|---|
| SDG | 48,185 | 1,890 | 3.92% |
| Prescott-Russell | 34,560 | 290 | 0.84% |
| Ottawa-Carleton | 361,295 | 1,010 | 0.28% |
| Leeds and Grenville | 44,815 | 625 | 1.39% |
| Lanark County | 27,400 | 425 | 1.55% |
| Total EOMF | 516,255 | 4,240 | 0.82% |
| Total Ontario | 5,077,670 | 70,890 | 1.40% |
| Query run by Statistics Canada for EOMF 1999 | | | |

## 8. RESPONSIBILITY AND COMMITMENT: CRITERION SIX

| ***Indicator 6.1*** | ***Indicator 6.2*** | ***Indicator 6.3*** | ***Indicator 6.4*** |
| --- | --- | --- | --- |
| *Community involvement in sustainable forest management* | *Implementation of integrated resource management plans* | *Private land management and conservation practices* | *Mutual learning mechanisms* |

*Measuring our success in achieving sustainable development and sustainable forest management requires an examination of more than just biological, ecological and economic concerns. Ultimately it is about people. It is about all of us, the way in which we conduct our daily activities, and how we have organized ourselves as a society. The initial indicators chosen for this criterion provide insight into the extent to which woodlot owners, communities, governments and educational institutions have accepted responsibility for, and made moves towards, the sustainable management of the forest resources.*

### Quick Facts

**Community involvement in forest management:**

- Tree-cutting bylaws are one way that local governments can help to regulate and improve logging practices on private land. Two of the five upper-tier municipalities in the Model Forest (Lanark County and RMOC) currently have tree-cutting bylaws in place.
- In accordance with the *Planning Act*, both the United Counties of Prescott & Russell and RMOC have taken steps to identify and protect significant woodlands in their region. In time, other municipalities will hopefully follow suit.

**Private land management and conservation practices:**

- With 88% of the forested land in the Model Forest privately owned, it is the daily activities of individual woodlot owners that could potentially have the largest impact on the 'state of the forest'. A number of these private lands contain features that the OMNR has identified as being worthy of protection and thus eligible for a tax reduction under the Conservation Land Tax Incentive Program (CLTIP). Of the 33,827 ha of private land that the OMNR has identified as being eligible for the program, 15,157 ha (45%) are currently enrolled. To ensure the long-term protection of the region's unique or fragile resources, the amount of land and number of properties under the CLTIP should increase over time.
- The woodlot owner response to a 1998 survey of management practices and objectives revealed some positive trends. 88% of the respondents reported having some form of formal management plan for their woodlot. Encouragingly, 66% of the respondents reported using the tree-marked selection harvesting system. Tree marking and the selection system is the recommended way of harvesting the region's shade tolerant forest types (e.g. hard maple & beech) and ensures a sustainable harvest of valuable products over time. When asked to rank the priority of their woodlot management objectives, 76% of the respondents reported that Environmental Stewardship was very important. It should be pointed out that this survey contained a large sample bias and thus the results do not allow us to make any inferences about the broader population of woodlot owners in the region.

**Participation in forest and environmental education programs and outdoor recreation:**

- Nine post-secondary education programs within the Model Forest were identified as being related to the environment. Seven out of the nine programs have started within the last decade, indicative of a growing concern and awareness for environmental issues in society. With the exception of the Forest Technician Program at Algonquin College, the majority of the programs show either static or slightly rising first year enrollment.
- There are six Provincial Parks and numerous outdoor recreation centres and Conservation Authorities in the Model Forest that provide outdoor recreational opportunities. Within the Provincial Parks, total park visitation, number of school groups/guided walks, and number of camper nights have all increased substantially for the five-year period of 1993 to 1997.

**Mutual learning mechanisms:**

- Mutual learning mechanisms are ways in which information and viewpoints are shared in a manner that involves all participants in both learning and teaching. A review of the EOMF Workplans indicates that there are at least 4 past, present, or ongoing Model Forest projects specifically designed to bring together different interests and perspectives on an equal basis.

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## INDICATOR 6.1: COMMUNITY AND PUBLIC INVOLVEMENT IN SUSTAINABLE FOREST MANAGEMENT

**Description:**
The extent to which local communities are actively involved in the monitoring and planning of their forests is an indication of the extent to which society is committed to sustainable forest management. For example, tree-cutting bylaws are one way in which many local governments across Ontario are now trying to improve tree-cutting practices on private land. In accordance with Ontario's Planning Act, many municipalities are starting to take steps towards identifying and protecting significant woodlands in their region. The following presents some information on the extent of the involvement of local governments in the management of woodlots across the region.

**Findings:**
**Number of upper-tier municipalities with tree-cutting bylaws:** There are many different mechanisms to protect trees in our communities, both regulatory and non-regulatory. The two regulatory mechanisms on private land are the Trees Act and the Municipal Act. The government of Ontario is currently in the process of combining features of these two acts to make it easier for local governments to control tree cutting on private land. Currently, the Trees Act enables upper-tier municipalities to pass tree-cutting bylaws and to promote good forestry practices. As shown in Table 22, the County of Lanark and the Regional Municipality of RMOC are the only two municipalities in the Model Forest that have by-laws under the Trees Act.

The Municipal Act enables lower-tier municipalities with populations over 10,000 to pass by-laws to preserve individual trees on private land. No information is currently available on lower-tier municipalities in the EOMF that have passed such bylaws.

**Table 22: Summary of Upper-tier Municipal Tree-Cutting Bylaws in EOMF**

| County /Region | Tree cutting Bylaw? (Yes/No) | Year passed | Current Plans to Pass Bylaw? (Yes/No) |
|---|---|---|---|
| RMOC | Yes | 1987 | |
| Lanark | Yes | 1982 | |
| Prescott-Russell | No | | No |
| Leeds-Grenville | No | | No |
| SDG | No | | No |

**Number of upper-tier municipalities that have taken steps to identify significant woodlands and protect them within their land-use plans:** In 1997, the Province issued a comprehensive land use and resource-planning policy called the Provincial Policy Statement (PPS). The PPS contains policies regarding natural heritage features and has conditions for the complete protection of significant wetlands and the habitat of endangered and threatened species. The PPS also states that development may be permitted, conditional upon an environmental impact assessment, in the following natural heritage areas:

- significant woodlands
- significant Areas of Natural and Scientific Interest (ANSI's)
- significant valleylands
- significant wildlife habitat
- fish habitat

The Planning Act requires that upper-tier municipalities should give due consideration to the PPS and should implement it in their plans to the extent possible, given local conditions and sensitivities. For the purposes of this report, a survey was conducted of upper-tier municipalities to determine what efforts they have taken to identify and protect significant woodlands in their region. This information is presented below in Table 23. Two of the Model Forest's five upper-tier municipalities (RMOC and the United Counties of Prescott-Russell) have taken steps to identify their significant woodlands and require an environmental impact assessment of any development proposals in such areas. Both Leeds & Grenville and SDG are currently revising their Official Plans and the identification of Significant Woodlands is in-process.

**Table 23: Municipal Handling of Significant Woodlands**

| County | Significant woodlands identified | Policy requiring EA of development proposals |
|---|---|---|
| Lanark | No | No |
| Leeds & Grenville | In-process | In-process |
| Prescott-Russell | Yes | Yes |
| RMOC | Yes | Yes |
| Stormont, Dundas & Glengarry | In-process | In-process |
| *Source:Private Land Stewardship Coordinators & discussions with Municipal staff* | | |

**Number of county-level local governments with greening programs & forestry personnel on staff:** A number of local governments across Ontario have developed 'greening' programs with the aim of facilitating the naturalization of parks and open areas. Some local level governments are also starting to hire foresters or forest technicians to help with land-use and environmental planning exercises or to assist with the enforcement of tree-cutting bylaws. At the County Level within the Model Forest, only RMOC has implemented an official 'greening program' to date however a number of lower-tier municipalities and towns have developed similar programs of their own. Additionally, both RMOC and Lanark County currently have a forester either on staff or on contract.

**Table 24: Local Governments with Greening Programs and Forestry Personnel on Staff**

| County | Greening Programs | Start Date | Forestry Personnel on Staff |
|---|---|---|---|
| Lanark | No | N/A | Yes |
| Leeds & Grenville | No | N/A | No |
| Prescott-Russell | No | N/A | No |
| RMOC | Yes | 1992 | Yes |
| Stormont, Dundas & Glengarry | No | N/A | No |
| *Source:Private Land Stewardship Coordinators & discussions with Municipal staff* | | | |

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## INDICATOR 6.2: FOREST MANAGEMENT AND LAND CONSERVATION PRACTICES AND OBJECTIVES

**Description:** With so much of the forested land in the EOMF privately owned, it is the daily activities of individual woodlot owners that could potentially have the largest impact on the 'state of the forest'. For example, many of these woodlots contain sensitive or unique habitats that may require protection in order for them to survive. As discussed in the previous section under Criteria 5, the private woodlots in the EOMF also provide a significant amount of the timber supply purchased by local sawmills and pulpmills. The ability of these woodlots to supply timber in the long-term is directly related to the types of harvesting and management woodlot owners are currently practicing.

Government programs such as the Managed Forest Tax Incentive Program (MFTIP) and the Ontario Conservation Land Tax Incentive Program (CLTIP) were designed to encourage the long-term stewardship of Ontario's private lands. The following section reports on several measures that provide an indication of the extent of participation in the CLTIP and the MFTIP and the nature of woodlot use and management within the EOMF.

**Findings:**

**Participation in Conservation Land Tax Incentive Programs:** The OMNR has identified a number of conservation lands across Ontario considered to be highly significant and worthy of protection. Particularly in the case of southern and eastern Ontario, many of these conservation lands are privately owned. Areas identified as conservation lands include significant wetlands and provincially significant Areas of Natural and Scientific Interest (ANSI's). The CLTIP offers a 100% reduction in property taxes (up to $25,000) for eligible conservation lands if individuals agree to maintain the land in its natural state. Table 25 presents information on the extent of participation under the CLTIP in the EOMF. Of the 33,827 ha of private land that the OMNR has identified as being eligible under the program, 15,157 ha (45%) are currently enrolled. To ensure the long-term protection of the region's unique or fragile resources, the number of properties under the CLTIP should increase over time.

**Table 25: Participation in the CLTIP**

| Region | Total Area Under CLTIP | Total Area Eligible for CLTIP | % |
|---|---|---|---|
| SDG | 1647 | 4085 | 40% |
| Prescott-Russell | 2867 | 4313 | 66% |
| Ottawa-Carleton | 3215 | 7966 | 40% |
| Leeds and Grenville | 3392 | 8959 | 38% |
| Lanark County | 4036 | 8503 | 47% |
| Total EOMF | 15157 | 33827 | 45% |

*Source: Query run by Ministry of Municipal Affairs & Housing*

**Private Woodlot Use and Management within the EOMF**

As stated, it is the daily activities of individual woodlot owners that potentially have the largest impact on the 'state of the forest' in eastern Ontario. To better understand woodlot owners' activities, the Ontario Woodlot Association and the EOMF jointly sponsored a 1998 survey of woodlot owners across eastern and south-central Ontario. The survey results discussed below provide a clearer picture of a sample of woodlot owners' management objectives and practices in the region. A word of caution is required when interpreting these survey results. Because the survey's respondents were not randomly selected and surveys were only sent out to those woodlot owners who are members of the Ontario Woodlot Association (OWA) and the EOMF, the results are biased. For example, we might expect that OWA and EOMF members would be more likely to have written management plans compared to non-OWA/EOMF members. Thus while the survey does give us insight into the forestry practices of the respondents, we cannot make inferences about all woodlot owners in the EOMF.

**Existence of Woodlot Management Plans**

As seen in Table 26, a total of 83% of the respondents had some form of property management plan. Having a management plan is crucial to sound forest management and is where the landowner identifies their objectives and strategies and provides a description and inventory of the woodlot.

**Table 26: Existence of Woodlot Management Plans**

| | |
|---|---|
| % of respondents with a management plan | 83% |
| % of respondents with no management plan | 17% |
| *Source: OWA Woodlot Owner Survey* | |

**Methods of Tree Harvesting**

Choice of harvesting methods is another key indicator of woodlot sustainability. As seen in Table 27, there were four principal tree-harvesting methods practiced by the respondents.

**Table 27: Respondents' Harvesting Methods**

| Harvesting Practices | % of Respondents Using Method |
|---|---|
| a) selection cut with prior tree marking | 66% |
| b) selection cut without prior tree marking | 26% |
| c) diameter limit cut | 2% |
| d) clearcut | 2% |
| e) other | 4% |
| *Source: 1998 OWA Woodlot Owner Survey* | |

The high percentage of respondents (66%) reporting using a selection cutting system with prior tree marking is a positive indication that many people are doing the right thing. A tree marked selection cut is the recommended practice for the tolerant hardwood forests of eastern Ontario (e.g. maple, beech, yellow birch and oak). It involves having a trained tree marker select those trees to be cut leaving behind a healthy crop of vigorous, high quality trees in the stand. This allows for s steady stream of income and produces valuable trees over the long-term, benefiting present and future generations.

Selection cutting without tree marking is less preferred than a marked cut. Without the benefit of a trained tree marker, this type of selection cut runs the risk of high-grading because the operator may now select only the largest or most valuable trees to cut. High-grading leaves a stand full of lower quality trees. Selection cutting without tree marking was reported by 26% of the respondents.

A diameter limit cut is where you cut all trees larger than some certain diameter limit - usually above a pulpwood diameter. While some logging operators may advocate this harvest approach because it maximizes their net revenue, woodlot owners should be aware that it will have serious negative long-term impacts on the forest's health. This practice favours the cutting of faster growing trees over slower growing trees - essentially another form of high-grading. Encouragingly, only 2% of the respondents reported using a diameter limit cut on their properties.

If selection cutting lies at one end of the spectrum of harvest intensities, clearcutting lies at the other, involving the complete removal of all trees in the stand. Only 2% of the respondents reported using clearcutting techniques.

**Woodlot Management Objectives**
The respondents long-term management objectives listed in Table 28 indicate a strong commitment to forest sustainability. A full 76% of the respondents listed environmental stewardship as very important whereas only 2% reported the opposite.

**Table 28: Respondents Long-term Management Objectives**

| | % of Respondents Ranking Management Objective as | | |
|---|---|---|---|
| **Management Objective** | **Very Important** | **Somewhat Important** | **Not Important** |
| a) environmental stewardship | 76% | 22% | 2% |
| b) wildlife enhancement | 67% | 31% | 2% |
| c) investment | 39% | 43% | 18% |
| d) income generation | 38% | 38% | 24% |

Source: 1998 OWA Woodlot Owner Survey

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## INDICATOR 6.3: PARTICIPATION IN FOREST & ENVIRONMENTAL EDUCATION AND OUTDOOR RECREATION

**Description:** A population that is involved in forest and environmental education, training, or awareness programs is more likely to actively practice good forestry. Check to make sure this is what you were meaning Visiting parks and participating in other outdoor recreational pursuits is another way that people can deepen their appreciation for, and understanding of, nature. The measures presented for this indicator provide information on post-secondary education programs related to the environment and forestry and on park visitation within the Model Forest.

**Findings:**
**Enrollment and employment of graduates for post-secondary programs related to the environment and forestry:** There are a total of nine programs related to the environment or forestry that are offered by post-secondary institutions within the Model

Forest. Details regarding the starting date, annual first year enrollment and percentage of graduating students finding work in their field is presented in Table 29.

It is interesting to note that seven out of the nine programs have started within the last decade, indicative of a growing concern and awareness for environmental issues in society. With the exception of the Forest Technician Program at Algonquin College, the majority of the programs show either static or slightly rising first year enrollment.

**Visitation trends at provincial parks in the EOMF:** There are six provincial parks in the Model Forest that provide outdoor recreational opportunities. In addition to these parks there are numerous outdoor recreation centres and Conservation Authorities. As firm visitation numbers are not available from the latter two, this report will only present information on provincial park visitation.

There are three different measures of park visitation or usage that are presented below: total park visitation, number of school groups/guided walks, and number of camper nights. As can be seen in tables 30-32, the visitation figures for all of the categories with the exception of school group visitation to parks, have increased substantially for the five-year period of 1993 to 1997.

**Table 29: Enrollment and Employment Statistics for Post-secondary Programs Related to the Environment and Forestry**

| | | | **Enrollment & % Graduates Working in Relevant Field** | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **1995/96** | | **1996/1997** | | **1997/98** | |
| **University/ College** | **Program** | **Start Date** | **1st year Enroll.** | **Employ.** | **1st year Enroll.** | **Employ.** | **1st year Enroll.** | **Employ.** |
| Carleton University | Environmental Science | 1990 | 15 | 16/28 | 12 | 10/26 | 13 | 15/19 |
| | Environmental Engineering | 1992 | 20-30 | 80%-90% | 20-30 | 80%-90% | 20-30 | 80%-90% |
| University of Ottawa | Environmental Studies | 1996 | N/A | N/A | 20 | N/A | 60 | N/A |
| | Environmental Science | 1997 | N/A | N/A | N/A | N/A | 19 | N/A |
| Algonquin College | Forestry Technician | 1969 | 45 | 71% | 33 | 83% | 31 | N/A |
| | Environmental Studies | 1994 | N/A | N/A | N/A | N/A | N/A | N/A |
| La CitJ Collegiale | Forestry Technician | 1974 | N/A | 88% | N/A | 46% | N/A | N/A |
| | Travail Forestier | 1997 | N/A | N/A | 8 | N/A | 6 | N/A |
| | Wildlife Management | 1995 | N/A | N/A | N/A | N/A | N/A | 50% |
| Source: EOMF telephone and fax survey of educational institutions | | | | | | | | |

**Table 30: Park Visitation (1993 & 1997)**

| Provincial Park | # Visitors | | |
|---|---|---|---|
| | 1993 | 1997 | % Change |
| Charleston Lake | 78,941 | 83,624 | 5.9 |
| Fitzroy Harbour | 69,992 | 72,837 | 4.1 |
| Murphy's Point | 53,120 | 59,607 | 12.2 |
| Rideau River | 46,807 | 45,209 | -3.4 |
| Silver Lake | 35,289 | 35,171 | -0.3 |
| Voyageur | 0 | 107,003 | NA |
| TOTAL | 284,149 | 403,451 | 42.0 |
| *Source: Ontario Provincial Parks Statistics 1993 and 1997. Ontario Ministry of Natural Resources. 1994 and 1998* | | | |

The average annual increase in park visitation in the EOMF region, from 1993 to 1997 was 9.2%.

**Table 31: School Groups & Guided Walks**

| Provincial Park | School Groups | | | Guided Walks | | |
|---|---|---|---|---|---|---|
| | 1993 | 1997 | % Change | 1993 | 1997 | % Change |
| Charleston Lake | 151 | 73 | -51.7 | 848 | 941 | 11.0 |
| Murphy's Point | 413 | 292 | -29.3 | 2,863 | 3,053 | 6.6 |
| Voyageur | 0 | 618 | NA | 0 | 801 | NA |
| TOTAL | 564 | 983 | 42.6 | 3,711 | 4,795 | 29.2 |
| *Source: Ontario Provincial Parks Statistics 1993 and 1997. Ontario Ministry of Natural Resources. 1994 and 1998.* | | | | | | |

The four-year average annual increase in school group visits and guided walks in the region were 14.9% and 6.6% respectively.

**Table 32: Camper Nights**

| Park | Camper Nights Year | | | % Change 1987-1997 |
|---|---|---|---|---|
| | 1987 | 1993 | 1997 | |
| Charleston Lake | 56,590 | 62,783 | 66,804 | 18.0 |
| Fitzroy Harbour | 29,700 | 36,164 | 38,476 | 29.5 |
| Murphy's Point | 20,742 | 29,523 | 38,003 | 83.2 |
| Rideau River | 28,565 | 25,157 | 20,835 | -27.0 |
| Silver Lake | 20,653 | 20,382 | 24,004 | 16.2 |
| Voyageur | 0 | 0 | 63,987 | NA |
| TOTAL | 156,250 | 174,009 | 252,109 | 61.3 |
| *Source: Ontario Provincial Parks Statistics 1993 and 1997. Ontario Ministry of Natural Resources. 1994 and 1998.* | | | | |

On average, the number of camper-nights in the region increased at an annual rate of 4.9% from 1987 to 1997. However, during this period, the *rate of increase* changed significantly. From 1.8% over the 1987 to 1993 period, the average annual increase in camper nights rose to almost 10% during 1993 to 1997.

## INDICATOR 6.4: MUTUAL LEARNING MECHANISMS

**Description:** A diversity of perspectives and viewpoints must be considered in order to move towards Sustainable Forest Management. There is no single "expert" with all the answers. Mutual learning mechanisms describe ways in which information and viewpoints are shared in a manner that involves all participants in both learning and teaching. This section presents information on specific projects undertaken by the Model Forest that seek to bring together different interests and perspectives on an equal basis.

**Findings:** Table 33 below provides a brief description of Model Forest projects that bring together different interests, perspectives, and knowledge systems on an equal basis. Note, while there are numerous Model Forest initiatives that have the involvement of multiple interests, only those projects having the specific goal of sharing of information and "learning from others" are deemed to be a Mutual Learning Mechanism.

**Table 33: Examples of Model Forest Projects that Promote Mutual Learning**

| Project Title | Project Duration | EOMF Partners | Project Description |
|---|---|---|---|
| Community Science | 1997-02 | Mohawk Council of Akwesasne & local "Knowledge-holders" | There are many local "experts" that are not involved with the EOMF. This project seeks to identify and learn from the expertise of these individuals. |
| Akwesasne Partnership | 1992-02 | Mohawk Council of Akwesasne (MCA) & Federal Department of the Environment | This initiative seeks to establish the sharing of information and knowledge systems between the EOMF and the MCA |
| Algonquin Partnership | 1995-96 | CFS, Kitigan Zibi First Nation, Golden Lake First Nation, MCA, Petawawa National Forestry Institute | The goal of this initiative was to establish relationships the Algonquins at Golden Lake and Maniwaki and to identify traditional forest values as defined by the communities. |

| | | | |
|---|---|---|---|
| St. Lawrence River Institute Conference | 1994-ongoing | Numerous partners including St. Lawrence River Inst. of Env. Sciences, OME, MCA, Department of the Environment, Great Lakes Pollution Prevention, Environment Canada, Domtar, Ontario Hydro, Cornwall Electric, Nestle Canada, and the City of Cornwall. | This program brings together government, industry, academia, First Nations, and conservation NGO's to share concerns and discuss opportunities for the management and rehabilitation of the St. Lawrence River ecosystem. |
| *Source: EOMF Information Report No. 39, EOMF Work Plan 1997-1998, EOMF Work Plan 1998-1999* | | | |

# Appendix A

# Where to From Here?

The following summarizes the data gaps and difficulties encountered in measuring and reporting on the above indicators and discusses possible future directions for the Model Forest's work on local level indicators of sustainable forest management.

## BIOLOGICAL DIVERSITY: CRITERION ONE

### INDICATORS 1.1 & 1.2: PERCENTAGE OF AREA FORESTED & INTERIOR FOREST SPACE DATA LIMITATIONS

In order to get complete forest cover data for the whole model forest region, a number of data sets had to be combined. The choice of data set to use for each County was made on the basis of 1) availability 2) data reliability. Each data set had its own associated data standards, assumptions and levels of accuracy. This resulted in an inconsistency in the accuracy of the information from one County to the next.

While some information was available on forest cover types (e.g. wetlands, mature hardwood, mixed wood, agricultural etc) and species and age class distributions, the data is quite old and now considered outdated and thus it was not used in this report.

The lack of information on forest structure and composition makes it difficult to assess, even from a coarse filter perspective, the extent to which the region's existing land cover is capable of conserving native biodiversity.

**Future Directions:**
The limited and outdated information available on forest cover and quality in the Model Forest was one of the biggest gaps identified during the course of this study. The Model Forest should consider investigating the benefits and costs of new "remote sensing" technologies that use spectral analysis of satellite imagery to estimate forest cover information. This will allow the model forest to track changes in land cover over time and may help provide a coarse assessment of forest quality.

This report presented measures of interior forest space using a 100-metre buffer. Further interpretation of the impacts of reduced forest cover and interior forest space is required. Model Forest staff may want to contact Margaret McLauren at the OMNR STTU in Bracebridge for information on the minimum forest cover required to maintain a full compliment of bird species. Further investigation and a literature review should also be conducted into the relative impacts of natural breaks in the forest (e.g. rivers & lakes) versus fragmentation from such things as roads and development.

As the extent and coverage by roads is considered to be a key determinant of ecological integrity (Noss, 1996), the Model Forest might want to consider conducting a case study of changes in road densities over time in a heavily forested area such as Lanark County.

Future additions/modifications to the existing set of indicators on forest cover and interior forest space might include:

- An analysis of changes in land cover over time (e.g. agriculture, abandoned pasture, forested areas, suburbs and urban development, forest types
- An analysis and interpretation of changes in forest structure and quality over time (e.g. species and age class distribution, stocking density, basal area etc)
- An analysis of the range woodlot sizes by County (Table 1)
- An analysis of the range of interior forest space by County (Table 2)
- A comparison of interior forest cover in Model Forest to that in other region in south-central Ontario
- An analysis and interpretation of changes in land cover types over time
- A case study analysis of road densities in Lanark County

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## INDICATOR 1.3: IDENTIFICATION AND PROTECTION OF LOCAL SITES OF BIOLOGICAL SIGNIFICANCE

**Data Limitations:**

Due to the lack of available information on the status of protected areas on private land, the findings for this indicator focussed almost exclusively on public land. However with almost 90% of the land base in private lands, there report is clearly only presenting part of the “whole picture”. The analysis of protected areas on public land may also be outdated as it was based on a 1994 report (Delcan, 1994) that used an older version of the National Conservation Area Database Directory.

**Future Directions:**

Given their large share of the landbase, private lands play a major role in conserving and protecting unique, sensitive and representative landforms and sites in the region. The Model Forest may want to investigate what means exist for the protection of private lands (e.g. conservation easements, land trusts, restrictive covenants) and investigate the feasibility of assessing the status and extent of these types of private land protection in the Model Forest.

Future additions/modifications to the existing set of indicators as well as further research on protected areas might include:

- An analysis of changes in the status of protected areas on public land using the most recent National Conservation Area Database Directory.
- An investigation of the adequacy of representation in the Model Forest and the identification of potential sites that may contribute to the Province’s representation goals.
- An analysis of the status of protected areas on private land.

## INDICATOR 1.4: SPECIES CLASSIFIED AS VULNERABLE, THREATENED, ENDANGERED OR AT RISK

**Data Limitations:**
The analysis and discussion in this report was based on information provided by the OMNR's Natural Heritage Information Centre in Peterborough. There are difficulties in the interpretation of this information, particularly when trying to interpret the potential impacts of related forest management activities.

**Future Directions:**
The Model Forest may want to focus its future indicator efforts on only those "listed" species in the region that are dependent upon forest cover for habitat. This work could also be cross-referenced to Jacque Bouvier's work with the Model Forest on Habitat Suitability Indices.

## INDICATOR 1.5: POPULATION LEVELS AND CHANGES OVER TIME OF SELECTED SPECIES

**Data Limitations:**
There is very limited data available on trends in species populations in the Model Forest. The analysis and discussion in this report was based on data provided by the CWS on bird populations derived from their Bird Breeding Survey (BBS) and the Forest Bird Monitoring Program (FBMP). Unfortunately, the limited sample size precluded an analysis of only those sites based in the Model Forest and the results presented are based on trends observed across the broader Great Lakes Plain and the St. Lawrence Plains eco-zone. The information was presented on the assumption that observable trends across the broader eco-zone are also likely occurring within sub-regions such as the Model Forest. This may not be the case. Furthermore, little investigation has been conducted into the potential causes of the trends presented in this section, making a discussion and interpretation of the data difficult.

**Future Directions:**
The OMNR currently tracks some information on population levels of fur-bearing mammals based on trapping records. The Model Forest may want to present this information in future "State of the Forest" reports.

Some work is currently at the provincial and national level on indicator bird species as well as on improving the classification of particular species as being "forest dependent". Future local level indicators work on trends in bird populations should keep abreast of these developments.

Future additions/modifications to the existing set of indicators as well as further research on trends in species populations might include:

- An analysis of trends in fur-bearing mammal populations.
- An analysis of trends in bird populations within the Model Forest as the sample size from the BBS increases over time.

## FOREST HEALTH: CRITERION TWO

### INDICATOR 2.1 & 2.2: NATURAL DISTURBANCE BY TYPE AND SEVERITY & FOREST HEALTH DATA LIMITATIONS

There was a significant amount of information available for this indicator due to on-going long-term studies of the CFS, OMNR, and the MOE. The information presented on the impacts of the ice storm on tree mortality and growth is based on expert opinion and experiences in other regions. Long-term monitoring of individual tree species responses to the damage will be conducted over the next several years and should be reported on in future "State of the Forest" reports.

A limitation of the crown dieback information presented under Indicator 2.2 is that a tree with a very small crown that has already dropped all of its dead branches may get a "No crown dieback rating" despite the fact that it may be severely declining and has suffered extensive past crown dieback.

**Future Directions:**

With the establishment of new forest health plots as a result of last year's ice storm, the Model Forest will be in a good position to report on the medium and long-term impacts of the ice storm on tree health and stand dynamics. Future "State of the Forest Reports" should compare predicted mortality rates and stand responses to those actually measured in the plots. Further work is also required on the impact of the ice storm on polewood and other regeneration.

Future Model Forest local level C&I work should continue to report on the insect, disease, decline index and crown die-back information presented in this report.

## SOIL AND WATER: CRITERION THREE

### INDICATOR 3.1: % OF RIPARIAN AREAS WITH NATURAL VEGETATION COVER

**Data Limitations:**

Querying limitations with the existing GIS program at the EOMF limited the analysis of this indicator to measuring only the percentage of a specified buffer width that has natural vegetation cover versus actually measuring the length of riparian zone that has the specified buffer width.

Also see discussion under Indicator 1.1 and 1.2.

**Future Directions:**
Future additions/modifications to the existing set of indicators as well as further research on vegetation cover over riparian areas might include:

- An analysis of vegetation cover over riparian areas by type of water body (e.g. river, stream, lake)
- A comparison of natural vegetation over riparian areas between off-shield and on-shield locations
- A comparison of natural vegetation over riparian areas between EOMF and other areas in south-central Ontario
- A comparison of natural vegetation over riparian areas between EOMF and other eco-zones

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### INDICATOR 3.2

**Future Directions:**
Environment Canada has produced a map of Southern Ontario showing the acid buffering capacity of soils. The Model Forest may want to consider digitizing this information so it can be used in future GIS analysis.

## GLOBAL IMPACTS: CRITERION FOUR

### INDICATOR 4.1: GROUND LEVEL OZONE AND POLLUTION DEPOSITION

**Data Limitations:**
While the CFS has established a series of permanent plots across eastern Canada to assess the impacts of ground level ozone on vegetation, no data is yet available. The Model Forest should keep abreast of this research and report on any available findings in the next “State of the Forest Report”.

**Future Directions:**
See above

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### INDICATOR 4.1: CLIMATE TRENDS

**Data Limitations:**
Most of the research to date on this subject has been focused on the national and international level and preliminary results make it difficult to draw causal connections

between global warming and changes in forest dynamics and composition. The Model Forest should keep abreast of ongoing developments in this field of research and report on any findings that have implications for woodlot owners in Eastern Ontario.

**Future Trends:**

See above

## BENEFITS TO SOCIETY: CRITERION FIVE

### INDICATOR 5.1: PRODUCTION OF TIMBER AND NON-TIMBER PRODUCTS

**Data Limitations:**

While the OMNR's mill license returns made conducting an analysis of wood production relatively easy, data availability difficulties were encountered in sourcing information on non-timber products such as maple syrup. Although they are technically capable of doing so, OMAFRA's Kemptville office was unable to supply regionally specific information on maple syrup production.

**Future Directions:**

The Model Forest should repeat the analysis of mill license returns for the next "State of the Forest Report" in order to assess trends in wood purchasing. Particular attention should be paid to trends in wood sources over time.

Future C&I efforts should also focus on improving reporting on the production of non-timber forest products with particular attention paid to maple syrup and possibly nuts, mushrooms and ginseng.

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### INDICATOR 5.2: REGIONAL WOOD PRICES

**Data Limitations:**

Data for this indicator was derived from telephone interviews of mill owners/supervisors and an analysis of faxed log prices. In the process, difficulties were encountered in sourcing log prices outside of the region and a number of local mills were unwilling to participate. The Model Forest might want to consider establishing relationships with a larger number of local mill owners. This would improve the sharing of information and provide the Model Forest with practical input and advice from businesses whose livelihoods depends upon long-term forest health.

**Future Directions:**

See above.

## INDICATOR 5.3: EMPLOYMENT IN FOREST-RELATED SECTORS

**Data Limitations:**

While significant data was acquired from Statistics Canada on employment, income, and level of education in forestry related industries, time and resource constraints limited the breadth of the analysis in this report.

The design of Statistics Canada's Labour Force Survey made it difficult to determine employment figures for such non-timber industries as eco-tourism and as a result only forestry related industry statistics were presented for this indicator.

**Future Directions:**

The Model Forest should consider doing a more thorough analysis of the forest industry data from the 1996 Labour Force Survey that was sourced for this report. The Model Forest's future C&I efforts should also consider using the recently developed SIC codes for the tourism industry that are being used in next Labour Force Survey. These categories should hopefully allow some reporting on employment trends in eco-tourism and outdoor recreation related industries.

# RESPONSIBILITY AND COMMITMENT: CRITERION SIX

## INDICATOR 6.1: COMMUNITY INVOLVEMENT IN SUSTAINABLE FOREST MANAGEMENT

**Future Directions:**

The analysis of municipalities tree-cutting bylaws, handling of significant woodlands and greening programs was very coarse in this report and is intended to be only be a first step. Future additions/modifications to the existing set of indicators as well as further research might include:

- An investigation into the effectiveness of local tree-cutting bylaws (e.g. # charges laid annually, awareness of bylaw by woodlot owners and loggers, etc)
- An analysis of the success of local municipalities attempts to protect significant woodlands from development
- A comparison of the methods used by municipalities to identify and classify significant woodlands.
- An investigation into non-governmental community level efforts to protect natural areas

## INDICATOR 6.2: FOREST MANAGEMENT AND LAND CONSERVATION PRACTICES

**Data Limitations:**

One of the most significant data limitations encountered in the course of writing this report was the lack of reliable data on the activities of individual woodlot owners across the region. As stated in the report, it is the actions of these woodlot owners that probably have the single largest impact on forest health. While the results are interesting, the 1998 OWA survey of woodlot owners was not designed to allow us to make inferences about the broader woodlot owner population.

**Future Directions:**

The Model Forest should consider conducting a statistically valid survey of land-owners in order to better understand what is actually taking place on the ground.

## INDICATOR 6.3: PARTICIPATION IN FOREST AND ENVIRONMENTAL EDUCATION AND OUTDOOR RECREATION

**Data Limitations:**

Problems with data availability precluded reporting on visitation trends at private outdoor interpretation centres and even the region's Conservation Authorities had limited information on their annual visitation.

**Future Directions:**

The Model Forest might want to consider investigating the potential usefulness and interest in standardizing visitation data gathering and reporting procedures for private outdoor education, interpretation centres and Conservation Authorities.

## INDICATOR 6.4: MUTUAL LEARNING MECHANISMS

**Data Limitations:**

By its nature, this is a descriptive indicator that is difficult to measure. The information presented in this report is based on a review of the Model Forest's Work Plans and thus represents only a small sample of mutual learning mechanisms in the region. Only those programs whose specific purpose was to promote the sharing of ideas were included under this indicator. The Model Forest might want to consider using its network of partners to conduct a qualitative study of other mutual learning mechanisms in place across the region.

# APPENDIX B
# PROTECTED AREAS IN THE EOMF

(Source: Dendron 1994)

| IUCN Category | Name | Size |
|---|---|---|
| 1 | Blue and Long Mountains/Spruce Bog | 426 |
| 1 | NR Zone 1&2 Murphys Point Prov. Park | 177 |
| | *sub-total* | 603 |
| | | |
| 2 | Silver Lake Prov. Park | 43 |
| 2 | Rideau River Prov. Park | 98 |
| 2 | Fitzroy Prov. Park | 185 |
| 2 | Carillon Prov. Park | 1417 |
| 2 | Murphys Point Prov. Park | 1240 |
| 2 | Charleston Lake Prov. Park | 902 |
| 2 | Voyageur Prov. Park | 1464 |
| 2 | St. Lawrence Islands National Park | 400 |
| | *sub-total* | 5749 |
| | | |
| 4 | Mountain Prov. Wildlife Area | 1457 |
| 4 | Upper Canada Migratory Bird Category | 2660 |
| 4 | Beckett Creek Migratory Bird Sancutary | 100 |
| 4 | Missippi Lake Bird Sanctuary | 430 |
| 4 | Nopiming Crown Game Preserve | 676 |
| 4 | Shirley Bay Crown Game Preserve | 1849 |
| 4 | Gananoque Prov. Wildlife Area | 580 |
| 4 | Hoople Creek Prov. Wilidlife Area | 105 |
| 4 | Mississippi Lake National Wildife Area | 235 |
| | *sub-total* | 8092 |
| | | |
| 5 | Portland Bay Conservation Area | 2 |
| 5 | Perth Wildlife Reserve Cons Area 146 | 171 |
| 5 | Bradley Creek Cons. Area | 3 |
| 5 | Mill of Kintail Cons. Area 141 | 68 |
| 5 | Pakenham Bridge Cons. Area | 2 |
| 5 | Portland Cons. Area 133 | 18 |
| 5 | Mill Pond Cons. Area 144 | 567 |
| 5 | Pottawatoni and Jones Falls Cons. Area | 116 |
| 5 | Rideau Ferry Yacht Club Cons. Area 145 | 7 |
| 5 | Shore Ridges Cons. Area | 290 |
| 5 | W.A. Taylor Cons. Area 148 | 7 |
| 5 | J. Henry Tweed Cons. Area | 6 |
| 5 | Lyn Valley Cons. Area | 7 |
| 5 | Metcalfe Cons. Area 142 | 3 |
| 5 | Russell Cons. Area 150 | 5 |

| | |
|---|---|
| 5 Glencairn Cons. Area | 3 |
| 5 High Falls Cons. Area 151 | 2 |
| 5 Hay Bay Cons. Area | 1 |
| 5 Hog's Back Park NCC | 23 |
| 5 Gray's Creek Cons. Area | 43 |
| 5 Baxter Cons. Area 147 | 68 |
| 5 Foley Mtn. Cons. Area | 241 |
| 5 Mer Bleue NCC | 1086 |
| 5 Dickinson Square Cons. Area 149 | 2 |
| 5 Charleston Lake Cons. Area | 2 |
| 5 Buell's Creek Cons. Area 138 | 532 |
| 5 St. Albert Cons. Area | 1 |
| 5 Rockcliffe Park NCC | 62 |
| 5 Sawmill Creek Land NCC | 23 |
| 5 Central Eperimental Farm Arboretum NCC | 450 |
| 5 Mooney's Bay Park NCC | 27 |
| 5 Carlsbad Springs NCC | 1655 |
| 5 Brittania Woods NCC | 30 |
| 5 Vincent Massey PArk NCC | 25 |
| 5 Stillwater Park Marina NCC | 16 |
| 5 The Greenbelt NCC | 11824 |
| *sub-total* | 17388 |
| | |
| Grand Total | 31832 |

# APPENDIX C
# LITERATURE CITED & CONSULTED

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