



Interim Report on  
Ontario's Biodiversity 2008

Protecting  
what sustains us



# Table of Contents

Message from the Chair of the Ontario Biodiversity Council .....ii  
 Ontario Biodiversity Council Membership .....ii  
 Foreword: Ontario’s Biodiversity Strategy – Reporting .....iv

1.0 Introduction to Biodiversity ..... 1  
 1.1 What is Biodiversity? ..... 1  
 1.2 Why is Biodiversity Important? ..... 1  
 2.0 Ontario’s Biodiversity ..... 3  
 2.1 Ontario’s Ecozones and Ecosystem Diversity ..... 3  
 2.2 Ontario’s Native Species Diversity ..... 12  
 2.3 Ontario’s Genetic Diversity ..... 19  
 3.0 Threats to Ontario’s Biodiversity ..... 20  
 3.1 Pollution ..... 22  
 3.2 Climate Change ..... 24  
 3.3 Habitat Change ..... 26  
 3.4 Invasive Species ..... 27  
 3.5 Unsustainable Use ..... 28  
 4.0 What Is Being Done to Conserve Ontario’s Biodiversity? ..... 30  
 4.1 Strengthening Biodiversity Education and Awareness ..... 30  
 4.2 Promoting Stewardship ..... 31  
 4.3 Working Together Across Resource Sectors ..... 32  
 4.4 Integrating Biodiversity Conservation into Land-Use Planning ..... 32  
 4.5 Prevention ..... 33  
 4.6 Improving Understanding ..... 38  
 4.7 Contributing Policies and Legislation ..... 39  
 5.0 Summary ..... 39

APPENDIX A: Organizations, Programs, and Initiatives That Contribute  
 Towards the Conservation of Ontario’s Biodiversity ..... 40  
 A.1 Examples of Biodiversity Education and Awareness Initiatives ..... 40  
 A.2 Examples of Stewardship Promoting Initiatives ..... 41  
 A.3 Examples of Working Together Across Resource Sectors ..... 42  
 A.4 Examples of Initiatives Integrating Biodiversity Conservation into Land-Use Planning ..... 44  
 A.5 Examples of Prevention Initiatives ..... 46  
 A.6 Examples of Efforts to Improve Understanding ..... 51  
 A.7 Examples of Contributing Policies and Legislation ..... 53



# Message from the Chair of the Ontario Biodiversity Council

The release of *Protecting What Sustains Us: Ontario's Biodiversity Strategy* in 2005 marked an important milestone for the province: for the first time, industry, environmental and conservation groups, representatives of government, Aboriginal leaders, and members of the public worked together to set out a vision for biodiversity conservation in Ontario and to define a five-year action plan of key biodiversity priorities.

*Ontario's Biodiversity Strategy* recognizes that no one party is responsible for protecting biodiversity and ensuring that our natural resources are used sustainably. Neither the government nor the many agencies that work towards these goals have the resources or capacity to achieve all of the objectives of the strategy. All of society must appreciate the importance of biodiversity to our livelihoods, our health, and our spiritual and emotional well-being, and we must all engage in efforts to protect and conserve Ontario's natural heritage.

The Ontario Biodiversity Council has developed the *Interim Report on Ontario's Biodiversity* to fulfill an action item in *Ontario's Biodiversity Strategy* and to set the stage for a more complete report on the State of Ontario's Biodiversity in 2010. While the Ontario Biodiversity Council will lead the 2010 report, we will also be relying upon scientists, conservation practitioners, Aboriginal leaders, business and industry leaders, and the public to work together and contribute to its production.

On behalf of the Ontario Biodiversity Council, I invite you to read this interim report and share it with others. I hope that it will enable you to learn more about Ontario's biodiversity, provide you with insight into some of the efforts under way to conserve biodiversity, and most importantly, demonstrate the level of engagement that is required of everyone in order to achieve the goals of *Ontario's Biodiversity Strategy*. I also hope that the report will inspire you to take action or continue your current dedication to conservation efforts so that, together, **we can protect what sustains us**.

*Jon K. Grant, Chair*

we can protect what sustains us

## Ontario Biodiversity Council Membership

The Ontario Biodiversity Council was created pursuant to Action Item #8 in *Protecting What Sustains Us: Ontario's Biodiversity Strategy*. The Council is composed of volunteer members who are to guide the implementation of *Ontario's Biodiversity Strategy* and to:

- Involve the public, Aboriginal peoples, and a wide range of stakeholders in identifying a set of annual implementation priorities;
- Coordinate implementation planning in association with other groups (e.g., Education and Awareness Task Team (Action Item #1), Biodiversity Stewardship Working Group (Action Item #3), and Ontario Biodiversity Science Forum (Action Item #28));
- Build shared accountability by encouraging improved partnerships and collaboration to advance implementation;
- Evaluate progress and report on implementation annually, with emphasis on the year's priorities;
- Lead a five-year review of the strategy and its implementation, and prepare an updated strategy for 2010-2015.

Name	Organization
Jon K. Grant, Chair	
Jessica Annis	Building Industry and Land Development Association
John Beaucage	Grand Council Chief of the Anishinabek Nation. Union of Ontario Indians
Donna Cansfield	Minister of Natural Resources (Ontario)
Julie Cayley	Ducks Unlimited Canada
Sue Chiblow	Chiefs of Ontario
Evan Ferrari	CPAWS–Wildlands League
Jackie Fraser	AG Care
Josh Garfinkel	Earthroots
Carla Grant	Ontario Forestry Association
Carol Hochu	Ontario Stone, Sand, and Gravel Association
Steve Hounsell	Ontario Power Generation and Ontario Nature
Scott Jackson	Ontario Forest Industries Association
Richard Lindgren	Canadian Environmental Law Association
Don McCabe	Ontario Federation of Agriculture
Dan McDermott	Sierra Club of Canada, Ontario Chapter
Don Pearson	Conservation Ontario
Terry Quinney	Ontario Federation of Anglers and Hunters
Terry Rees	Federation of Ontario Cottagers' Associations
Rick Smith	Environmental Defence Canada
Tattersall Smith	University of Toronto
Mark Stabb	Nature Conservancy of Canada
Adrianna Stech	Ontario Mining Association

Some Council Members are supported by alternate members, including:

Name	Organization
Amber Ellis and Catherine Grant	Earthroots
Chris Hodgson	Ontario Mining Association
Peter Jeffery	Ontario Federation of Agriculture
Jamie Lim	Ontario Forest Industries Association

Note: The *Interim Report on Ontario's Biodiversity* was prepared under the leadership of a sub-committee of the Ontario Biodiversity Council. While this report was accepted by the Ontario Biodiversity Council as a whole, Earthroots and CPAWS–Wildlands League did not endorse the report. Members who were not present to indicate their acceptance of this report were: AG Care, Canadian Environmental Law Association, Chiefs of Ontario, Environmental Defence Canada, Sierra Club of Canada Ontario Chapter, and Union of Ontario Indians.

# Foreword: *Ontario's Biodiversity Strategy* – Reporting

*Protecting What Sustains Us: Ontario's Biodiversity Strategy*, released in 2005, recognizes that all Ontarians have a role in protecting the province's biological diversity. The strategy identifies a number of key actions that will help Ontario reach its biodiversity conservation goals:

- *Protect the genetic, species, and ecosystem diversity of Ontario.*
- *Use and develop the biological assets of Ontario sustainably, and capture the benefits from such use for Ontarians.*

This interim report, an important milestone towards reporting on the state of Ontario's biodiversity in 2010, is not a comprehensive report. Instead, it is a gathering of information from existing sources, presented in plain language and illustrated with focus stories. The goal of this report is to initiate the process leading to the first report in 2010 by describing the path forward and providing background context to highlight some of the issues, challenges, and opportunities ahead.

## Towards 2010

### State of Biodiversity Reporting

State of biodiversity reporting is a form of public reporting that fits within broader state of environment reporting. State of biodiversity reporting for Ontario provides an overall assessment of the province's ecosystem, species, and genetic diversity and describes the conditions and factors that affect biodiversity, as well as the response from Aboriginal communities, government, industry, non-government organizations, private citizens, and others.

Reporting on Ontario's biodiversity provides an opportunity to bring together the various pieces of knowledge including scientific, social, economic, community, practitioner, and Aboriginal knowledge of the land into a broader integrated context.

## What to Expect from the 2010 Report

The 2010 State of Ontario's Biodiversity Report will set the foundation for future reporting by establishing an overall approach, benchmarks, and reporting standards. It will serve as a baseline report, bringing together information from various sources into a common format.

The report will identify pressing issues, help refine future reporting standards, and identify gaps in our knowledge. Over the long term, reporting will inform decision makers on the overall health of Ontario's biodiversity, shape our actions, and document progress.

# 1.0 Introduction to Biodiversity

## 1.1 What Is Biodiversity?

Biodiversity, or biological diversity, is a scientific term referring to the variety of life found around us – including terrestrial, marine and other aquatic ecosystems – and the ecological complexes of which they are a part. Biodiversity describes:

- The diversity of ecosystems, within which living things depend on each other;
- The diversity of species, which has evolved through the course of the history of Earth;
- The genetic diversity of groups and individuals within each species.

Biodiversity loss is the reduction in the variety and types of ecosystems, species, and genes. By this definition, biodiversity can be lost if the diversity itself is lost (e.g., through the extinction of a species) or if the benefits provided by biodiversity are reduced (e.g., through unsustainable use). Biodiversity loss may be measured at many levels, including global, national and regional.

## 1.2 Why Is Biodiversity Important?

Every form of life has its own intrinsic value and is worth protecting, regardless of its value to humans<sup>1</sup>.

Biological diversity is essential for species to survive and withstand threats from pressures such as disease and climate change. In this respect, the diversity of ecosystems, species, and genes is nature's life insurance.

Biodiversity is also essential for the functioning of healthy ecosystems that ultimately supports human well-being. Healthy ecosystems sustain healthy people and support a healthy economy. Ecosystems provide us with many benefits, referred to as ecological goods and services, which are essential to our survival. These include:

- Life-supporting services such as soil formation, photosynthesis, pollination, waste assimilation, and nutrient cycling;
- Products such as breathable air, food, clean water, timber, and fibres;
- Regulation of climate, floods, disease, waste, water quality, and air quality;
- Recreation opportunities that enhance our quality of life through aesthetic enjoyment and spiritual fulfillment;
- Sources of medicines.

### Why Should I Care About Biodiversity?

*Humans are a part of nature, and biodiversity plays a fundamental role in maintaining our health and well-being. We depend upon it for food, fresh water, clean air, and medicines. It also provides us with wood, fibres, and other raw materials without which we wouldn't have homes to live in or clothes to wear. Nature's products, such as timber, fish, precious metals, and aggregates, are the basis of our economy. In short, without biodiversity we wouldn't survive.*

## Did You Know?



Photo: Erich Haber

Plants can be important sources of medicines, but few plants native to Ontario have been screened for their medicinal value. Canada yew, a forest plant once of little commercial interest, is now prized by the pharmaceutical industry because it can be used to produce drugs that fight certain cancers. This development has created a demand for harvesting parts of this shrub on both public and private lands in Ontario.

The Northern Ontario School of Medicine is leading efforts to discover new medicines from natural sources. Researchers are working collaboratively with forest industry workers and Aboriginal communities to examine plants and fungi in an effort to find new treatments for illnesses.

**Note: Canada yew is very poisonous to humans!**

Anyone consuming this plant is likely to become very ill or die. If you know that someone has eaten this plant, contact the Ontario Regional Poison Information Centre immediately at 1-800-268-9017 or 416-813-5900, which is open 24 hours per day, seven days per week.

## Ontario's Resource Economy

In addition to providing ecological goods and services, Ontario's biodiversity contributes to our resource-based economy (Table 1). The primary industries of forestry, agriculture, fishing, hunting, and mining continue to drive the manufacturing and services sectors. Resource-based tourism is becoming increasingly important to the economies of many rural Ontario communities, and fishing, forestry, mining, and trapping remain important sources of income and employment, both directly and indirectly, for many northern Ontario and Aboriginal communities as well as for the province as a whole.

Table 1. Ontario's resource economy

Industry	Value *	# Jobs **
Forestry (Logging, pulp and paper, and wood products)	> \$18 billion <sup>2</sup>	84,400 <sup>3</sup>
Mining (Metallic & non-metallic minerals, including aggregates)	\$9.4 billion (2007) <sup>6</sup>	14,305 <sup>7</sup>
Agriculture (Farm cash receipts)	\$8.8 billion <sup>4</sup>	82,410 <sup>5</sup>
Recreational fishing	>\$2.2 billion <sup>16</sup>	Not available
Renewable energy	Between \$1.8 billion and \$2 billion <sup>12</sup>	>3,600 <sup>13</sup>
Resource-based tourism	\$1.2 billion (2001) <sup>14</sup>	20,526(2001) <sup>15</sup>
Recreational hunting	\$200.6 million (1996) <sup>17</sup>	Not available
Oil and natural gas extraction	\$158.2 million <sup>8</sup>	5,274 <sup>9</sup>
Commercial fishing	\$35.1 million <sup>10</sup>	3,500 (2003) <sup>11</sup>

\* All values from 2005 unless otherwise indicated

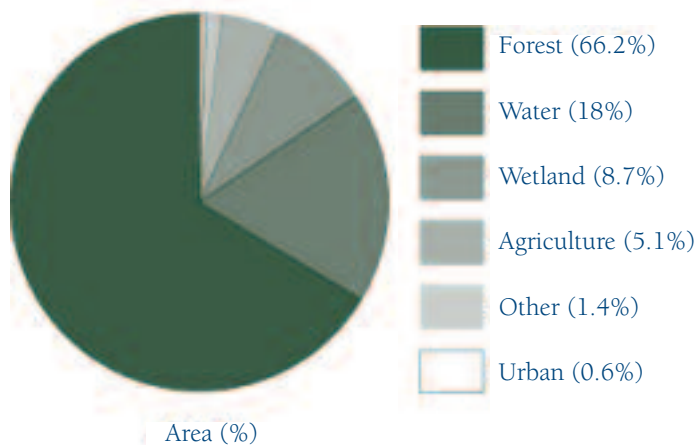
\*\* Direct jobs only



# 2.0 Ontario's Biodiversity

Ontario has a total area of 107.6 million hectares and encompasses a wide range of ecosystems. More than half of Ontario is forest, while nearly a fifth is water (Figure 1). Wetlands, urban areas, agricultural lands, and other areas, including tundra, account for the remainder. Over three-quarters of Ontario's area is Crown or publicly owned land. Most of this publicly owned land occurs in northern Ontario, while southern Ontario is predominantly privately owned land.

Figure 1. Total land and water area in Ontario by land class<sup>18</sup>



Ontario's landscapes and biodiversity were profoundly influenced by the last ice age. Repeated advances and retreats of enormous ice sheets reshaped Ontario's geography, scouring out thousands of lakes, removing surface soil, and displacing entire ecosystems. When the glaciers retreated, they left behind drumlins, eskers, and moraines, which now store groundwater and support diverse biological communities. Meltwater lakes provided dispersal opportunities of cold-water aquatic species into thousands of lakes formed by glacial scouring. Even the Great Lakes are remnants of glacial meltwater lakes and were sculpted out of bedrock by the glaciers. On land, plants and animals recolonized the province from ice-free areas outside Ontario, gradually moving northward as their biology and conditions permitted. No part of Ontario was left untouched by ice, and the influence of ice age events can still be seen in many parts of the province today. As a result, Ontario is home to a dynamic and diverse array of habitats and species that are still responding to environmental perturbations that happened thousands of years ago.

## 2.1 Ontario's Ecozones and Ecosystem Diversity

Ecozones are very large areas characterized by distinctive bedrock that differs from that of the ecozone next to it. This characteristic bedrock, combined with long-term climate patterns, has a major influence on the ecosystem processes and species that live within the ecozone. Ecozones are resilient to short- and medium-term change but respond to continental or global cycles and processes.<sup>19</sup>

Ontario's ecozones provide a natural framework on which to base a discussion of biodiversity at the ecosystem level. From north to south, Ontario's three ecozones are the Hudson Bay Lowlands, Ontario Shield, and Mixedwood Plains (Figure 2). For the purposes of this report, the Great Lakes will also be considered an ecozone.

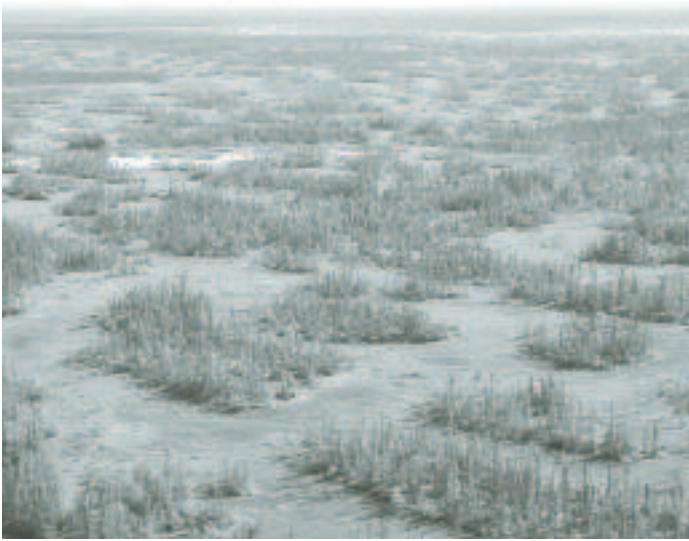


Figure 2  
Figure 2. Ontario's ecozones



# Hudson Bay Lowlands

Photo: Michael J. Oldham



The Hudson Bay Lowlands ecozone in northern Ontario forms about 22 percent of the province. It is an extremely flat area underlain by limestone, and it is the only ecozone in the province that is adjacent to and influenced by salt water and tides. It also contains some areas of permafrost. The climate is cold and humid, with long, cold winters and short, cool summers. The soils in this ecozone are poorly developed. Drainage is also poor, and the area contains much standing or slow-moving water.<sup>20</sup> There are few large lakes, except in the vicinity of bedrock outcrops (e.g., Sutton Lake and Aquatuk Lake).

The Hudson Bay Lowlands ecozone is one of the largest areas of wetlands in the world. The northern part of the ecozone is largely treeless, while areas farther south support open forest.

Ecosystem diversity and species diversity in the Hudson Bay Lowlands are naturally low as a result of the area's climatic extremes and short growing season. The small human population and limited industrial activity in this ecozone have left the natural biodiversity within the Hudson Bay Lowlands relatively intact.

Photo: Wasył Bakowsky



## Coastal Marshes, Wetlands, and Mudflats

*Coastal marshes serve as breeding, moulting, and staging grounds for snow geese and Canada geese. Coastal mudflats are important staging areas for shorebirds, and wetlands throughout the ecozone provide ideal habitat for invertebrates, such as the muskeg emerald dragonfly, which breeds nowhere else in Ontario.*

## Tundra Heaths

*In Ontario, tundra heaths occur along the coast of Hudson Bay. They are characterized by a dense covering of low shrubs and an absence of trees. Tundra swans breed in this area, and other animals, such as Arctic fox and ptarmigan, live in tundra heaths year round.*

Photo: Michael J. Oldham



# Ontario Shield

Photo: Sam Brinker



The Ontario Shield ecozone includes true boreal forest as well as substantial portions of the non-boreal Great Lakes-St. Lawrence forest region. The Ontario Shield is the largest ecozone in the province and is a region of primarily shallow soils overlying ancient granite bedrock. It accounts for approximately 60 percent of Ontario's total area. In general, the climate of the Ontario Shield is cold and moist, with long, cold winters and short, warm summers. Temperature, precipitation, and humidity patterns vary within the ecozone, with more moderate conditions occurring near the Great Lakes. The landscape of the Ontario Shield is varied and depends on local bedrock formations and soils.<sup>21</sup> Lakes and rivers are numerous in many parts of the ecozone.

Ecosystem diversity and species diversity in the Ontario Shield ecozone are higher than in the Hudson Bay Lowlands due to a more moderate climate, a longer growing season, and higher overall productivity. Peatlands are abundant. The Ontario Shield ecozone includes true conifer-dominated boreal forests in its northern and central regions and non-boreal mixed forests in the southern regions. Stands of red and white pine, some of which can be classified as old-growth forests, also occur in this ecozone.

The forests of the Ontario Shield are heavily influenced by natural disturbances such as fire, wind, insects, and beavers (which also have a strong influence on aquatic habitats).



## Red and White Pine Forests



Photo: Sam Brinker

Red and white pine ecosystems are characteristic of the southern portion of the Ontario Shield ecozone. The Temagami region contains the largest continuous band of pine forest remaining in Ontario. About 5 percent of this forest is dominated by pine trees that are at least 120 years old.

## Lowland Black Spruce Forests

Lowland black spruce forests or black spruce bogs usually occur in flat, poorly drained areas and are characteristic of the northern portion of the Ontario Shield ecozone.

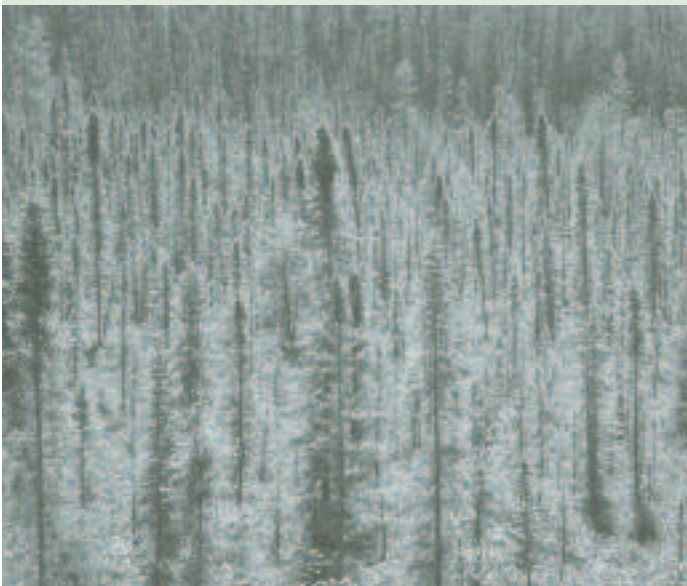


Photo: Wasył Bekowśky



# Mixedwood Plains



Photo: Wasył Bakowsky

The Mixedwood Plains ecozone is the smallest of Ontario's terrestrial ecozones, occupying less than 10 percent of the province. The bedrock of this ecozone is carbonate or limestone sedimentary rock, and its surface features include many glacial formations such as moraines and drumlins. The landscape ranges from the very flat lands of the southwest and southeast areas of the province to the rugged terrain of the Niagara Escarpment. Soils for the most part are well developed. This ecozone has abundant precipitation and a comparatively mild climate moderated by the Great Lakes.<sup>22</sup>

Natural ecosystem diversity and species diversity in the Mixedwood Plains ecozone exist only in isolated remnants of the original landscape. Although previously forested, most of the natural habitat in this ecozone has been converted to agriculture and urban areas. The remaining fragments of original forest account for Ontario's largest diversity of tree species. The Carolinian forest in southwestern Ontario, which occurs primarily in pockets of privately owned land and protected areas, has the highest species diversity of any of Ontario's forest ecosystems and includes many rare species.

## Alvars



Photo: Sam Brinker

Alvars are unusual limestone-bedrock communities with sparse vegetation. Because of their unique geological and physical characteristics, alvars support biological communities that cannot exist elsewhere. Alvars provide important habitat for rare species such as the loggerhead shrike, nodding onion, and lake-side daisy. Major alvar areas in Ontario include Manitoulin Island, the Bruce Peninsula, the Carden Plain, and areas around Napanee and Smiths Falls.

Alvars, tallgrass prairies, and savannas are rare ecosystems that also occur in this ecozone. Wetlands are numerous in certain areas, although many have been drained. There are relatively few lakes in the Mixedwood Plains ecozone, but rivers and streams provide habitat for many aquatic species. Human activity and invasive species have played a significant part in shaping biodiversity in this ecozone, both in terms of displacing native species and altering fundamental aspects of natural ecosystems.

## Tallgrass Prairies and Savannas

Southern Ontario's tallgrass prairies and savannas occur only as remnants, occupying less than 3 percent of their original range. Prairies are dominated by fire- and drought-adapted grasses, sedges, and wildflowers. Savannas have prairie plants and open-grown trees, and provide essential habitat for species such as the northern bobwhite and eastern fox snake. Ojibway Prairie near Windsor is one of southern Ontario's largest tall-grass remnants.



Photo: Gary Allen

# Great Lakes



Photo: Mithe Kindree

The Great Lakes are the largest group of freshwater lakes on Earth. They contain almost 20 percent of the Earth’s surficial, unfrozen fresh water (Table 2). Portions of four of the Great Lakes - Lakes Superior, Huron, Erie, and Ontario – fall within the province of Ontario and account for 8 percent of Ontario’s area. The Great Lakes contain approximately 35,000 islands, including Manitoulin Island in Lake Huron, which is the largest freshwater island in the world. Thousands of hectares of wetlands line the shores of the Great Lakes’ shorelines and are home to a variety of terrestrial and aquatic organisms.

The sand dunes, coastal wetlands, rocky shorelines, lakeplain prairies, savannas, forests, and other ecosystems of the Great Lakes ecozone contain features that are either unique or best represented within the Great Lakes basin. For example, Long Point (on the north shore of Lake Erie), the largest and finest sandspit and sand dune formation in the Great Lakes, was designated a United Nations Educational, Scientific and Cultural Organization World Biosphere Reserve in 1986. Long Point is also considered a globally significant Important Bird Area.<sup>23</sup>

The Great Lakes support a variety of fish and wildlife. Bird populations thrive on the various landscapes, some migrating south in the winter, others making permanent homes there. An estimated 135 species of fish (including 24 extirpated or extinct species) are native to the Ontario waters of the Great Lakes,<sup>24</sup> including small-mouth and largemouth bass, muskellunge, northern pike, cisco, lake whitefish, walleye, and lake trout. Rare species making their home in the Great Lakes region include the northern riffleshell, a globally rare mussel now found in Canada only in the Sydenham River in southwestern Ontario.<sup>25</sup>

Table 2. Great Lakes facts and figures<sup>26</sup>

	Lake Erie	Lake Ontario	Lake Huron	Lake Michigan	Lake Superior
Surface area ( <i>square kilometres</i> )	25,700	18,960	59,600	57,800	82,100
Maximum depth ( <i>metres</i> )	64	244	229	282	406
Average depth ( <i>metres</i> )	19	86	59	85	147
Volume ( <i>cubic kilometres</i> )	484	1,640	3,540	4,920	12,100
Water retention time ( <i>years</i> )	2.6	6	22	99	191

## Great Lakes Coastal Wetlands

Photo: Sam Brinker



Wetlands in areas such as Point Pelee and Long Point on Lake Erie are important waterfowl staging areas and provide habitat for migratory birds. Birds migrating along the Atlantic and Mississippi flyways visit Point Pelee and Long Point en route to northern nesting destinations and southern winter habitats.



## 2.2 Ontario's Native Species Diversity

Most estimates of the total number of species on Earth lie between 5 million and 30 million,<sup>27</sup> but some studies suggest that the total may approach 100 million.<sup>28</sup> There are more than 30,000 documented species of vascular plants, non-vascular plants, invertebrates, and vertebrate animals in Ontario. There are many more micro-organism and invertebrate species that have only partially been documented. Although these species are not well understood, they provide essential functions to ecosystems (e.g., waste assimilation and nutrient cycling).

Native Ontario species are those species that occur naturally in the province. Non-native species are those that are native to other jurisdictions but that occur in the province through intentional or unintentional introduction. Many non-native species have become permanent parts of Ontario's ecosystems. Some non-native species can become invasive species that expand rapidly, displace native species, and alter ecosystem form and function. Native aquatic species that are introduced into Ontario's lakes and rivers outside their natural range (e.g., rock bass) can also pose a threat to biodiversity

### Species at Risk

Conservation efforts often begin with the recognition that a native species is at risk in some way. In 2006, 182 native species were on the Species at Risk in Ontario List (Table 3).<sup>29</sup> Each of these species was placed in one of the following categories:

- **Extinct:** The species no longer exists anywhere in the world.
- **Extirpated:** The species no longer exists in the wild in Ontario.
- **Endangered-Regulated:** The species is facing imminent extinction or extirpation and is regulated under the *Endangered Species Act, 1990*.
- **Endangered-Not Regulated:** The species is facing imminent extinction or extirpation, but is not regulated under the *Endangered Species Act, 1990*.
- **Threatened:** The species is at risk of becoming endangered if limiting factors are not reversed.
- **Special Concern:** The species is sensitive to human activities or natural events.

The *Endangered Species Act, 2007* will come into force in June 2008. At that time, the species at risk classifications will be Extinct, Extirpated, Endangered, Threatened, and Special Concern.

### Did You Know?

*Most earthworms and common dandelions are not native to Ontario. Rainbow trout are from western Canada, and the pigeons on our city streets are from Europe!*



Photo: Simon Dodsworth

## Table 3

Table 3. Number of known native species and species at risk in Ontario, 2006

Group	Total Known Species	Extinct	Extirpated	Endangered-Regulated	Endangered-Not Regulated	Threatened	Special Concern*
Vascular plants	3,055	0	2	23	15	18	11
Non-vascular plants	1,373	1	1	1	0	1	0
Insects: dragonflies and damselflies	169	0	0	0	0	0	0
Insects: tiger beetles	14	0	0	0	0	0	0
Insects: butterflies	164	0	0	2	0	0	2
Crustaceans	n/a**	n/a	n/a	n/a	n/a	n/a	n/a
Molluscs	284	0	0	0	8	0	0
Fish	154	3	4	0	3	10	14
Amphibians	26	0	2	2	1	2	0
Reptiles	27	0	0	3	2	9	4
Birds	479	1	1	10	3	3	10
Mammals	81	1	0	1	1	3	5
Total	-	6	10	42	33	46	46

\* The bald eagle is considered Endangered-Regulated in southern Ontario and of Special Concern north of the French and Mattawa rivers. For a more complete description and listing by species, refer to the Ontario Ministry of Natural Resources' Species at Risk in Ontario List.<sup>30</sup>

\*\* n/a = not available

### Vascular Plants

Vascular plants comprise the majority of familiar plants such as flowering plants, trees, shrubs, herbs, and ferns. The term “vascular” refers to the special liquid-conducting tissues that transport nutrients and water throughout the plant. The vascular system of these species allows them to grow to a much larger size than non-vascular plants. Of the 5,074 known species of vascular plants in Canada, Ontario has the greatest overall diversity, with 3,055 known species.<sup>31</sup> Sixty-nine of Ontario's vascular plant species are considered at risk. Endangered-Regulated species include the cucumber tree, nodding pogonia, and wood poppy. Endangered-Not Regulated species include American chestnut, American ginseng, and Engelmann's quillwort.

## Did You Know?

*White pine is Ontario's official tree and is considered the province's most valuable species for softwood lumber because of its uniform grain. White pine trees also provide habitat for many species of mammals and birds. These trees can live for about 450 years and grow to heights of 30 to 50 metres, making them the tallest conifers in eastern Canada. White pine is common in southern parts of the Ontario Shield ecozone. Threats to white pine include the white pine weevil (a major insect pest) and white pine blister rust (a serious fungal disease). In addition, white pine is susceptible to air pollution damage and can be an indicator of poor air quality.*



Photo: Dave Reid

## Non-Vascular Plants

Non-vascular plants are plants without vascular systems: they have no true roots, stems, or leaves. The lack of a vascular system restricts these plants to relatively small sizes. Mosses, lichens, hornworts, and liverworts are examples of non-vascular plants. Ontario is home to 515 species of moss, 697 species of lichens, 158 species of liverworts, and 3 species of hornworts.<sup>32</sup> Four of Ontario's non-vascular plant species are considered at risk. Macoun's shining moss is extinct, and incurved grizzled moss has been extirpated from the province. Spoon-leaved moss is listed as Endangered-Regulated, and flooded jellyskin (a lichen) is considered a Threatened species.

## Did You Know?

*Spoon-leaved moss is limited to four locations in southwestern Ontario. This species is at the northern limit of its range in Ontario and is listed as an Endangered-Regulated species. Spoon-leaved moss grows in deciduous forest, a habitat that has declined significantly in southern Ontario.*

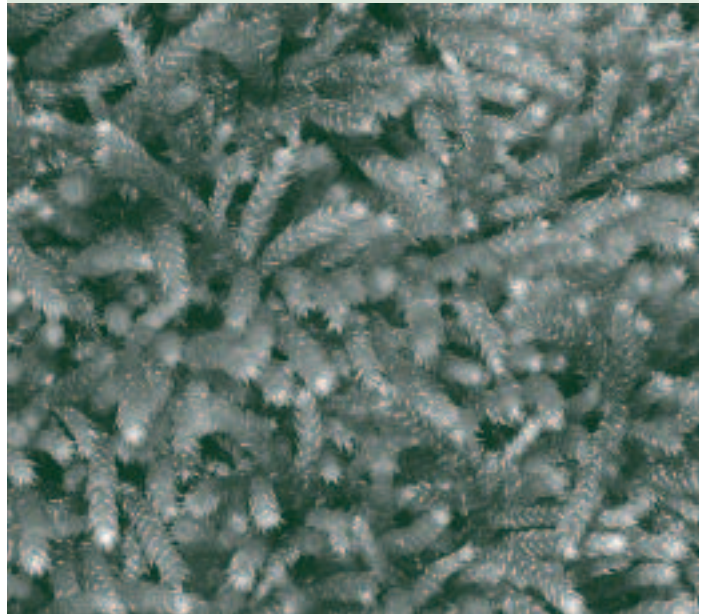


Photo: Ron Gauld

## Insects

Insects are the most diverse group of animals on Earth, with over 800,000 described species – more than all other animal groups combined.<sup>33</sup> Three groups of insects have been catalogued in Ontario: dragonflies and damselflies (169 species), tiger beetles (14 species), and butterflies (164 species).<sup>34,35</sup> Two species of butterflies – the frosted elfin and the Karner blue – have been extirpated from Ontario. Both species are currently listed as Endangered-Regulated on the Species at Risk in Ontario List; however, their status will soon be changed to extirpated.

### Did You Know?



Photo: C.D. Jones

*One person can make a difference. Chris Evans, of Midhurst, Ontario, recently discovered the Hine's emerald dragonfly in the Minesing Wetlands in Simcoe County, Ontario, west of the city of Barrie. The Hine's emerald is one of the rarest of North America's dragonflies. Prior to this year, this species was known only from small sites in Wisconsin, Michigan, Missouri, and Illinois. Mr. Evans contacted the Ministry of Natural Resources' Natural Heritage Information Centre, and now they are working together to gather information on the habitat of this rare dragonfly.*

*The Minesing Wetlands is a vast wetland of international significance spanning an area of over 6,000 hectares. Minesing contains a complex of different wetland types, including fens, marshes, swamps, and bogs, each supporting a number of sensitive flora and fauna, some of which are rare or endangered.*

### Did You Know?

*Crayfish feed on a variety of living and dead organisms, and are an important food source for many fish, birds, mammals, and other animals. Ontario has the highest diversity of crayfish in Canada with nine species. The northern clearwater crayfish, the second most widespread crayfish in Ontario, has been displaced from the Kawartha Lakes region and lakes in northwestern Ontario by the invasive rusty crayfish. Rusty crayfish are native to the southern United States; they were introduced to southern Ontario by visiting anglers who used them as bait.*



Photo: Premek Hamr

## Crustaceans

Similar to insects, crustaceans have three distinct body parts: head, thorax, and abdomen. Crustaceans also have a stiff exoskeleton that must be shed through moulting to allow the animal to grow. There are approximately 30,000 described species of crustaceans worldwide.<sup>36</sup> It is estimated that several hundred species of crustaceans live in Ontario, but exact numbers are not known. The majority are aquatic, living in either freshwater or marine environments. Shrimp and crayfish are familiar examples of crustaceans that occur in Ontario. The biology and life history of Ontario's crustaceans are not well understood and, as a result, comprehensive assessments of the conservation status of Ontario's crustaceans have not yet been undertaken.



## Molluscs

Molluscs are a large and diverse group that includes a variety of familiar animals known for their decorative shells or as seafood. Molluscs range from tiny snails, slugs, and mussels to larger organisms such as squid and octopus. There are approximately 70,000 species of molluscs worldwide.<sup>37</sup> While the vast majority of molluscs live in marine environments, some species live in fresh water and on land. Ontario is home to 284 species of mollusc,<sup>38</sup> 41 of which are freshwater mussels.<sup>39</sup> Eight species of mollusc are considered at risk in Ontario: the kidneyshell, round hickory nut, mudpuppy mussel, northern riffleshell, rayed bean, round pigtoe, snuffbox, and wavy-rayed lampmussel are listed as Endangered-Not Regulated.

### Did You Know?

*The kidneyshell is a freshwater mussel found throughout the Great Lakes basin in the United States. In Canada, the kidneyshell is limited to the East Sydenham River and the Ausable River in southern Ontario. The species has been virtually extirpated from Lake Erie, Lake St. Clair, and the Niagara, Detroit, Grand, and Thames rivers by zebra mussels and the cumulative effects of sewage pollution and agricultural runoff. The remaining populations in the East Sydenham and Ausable rivers are currently threatened by silt and nutrient loading. The kidneyshell is listed as an Endangered-Not Regulated species in Ontario.*



Photo: Shawn Statton

## Fish

Ontario has the highest species richness of freshwater fish of any Canadian province or territory, with a total of 154 species.<sup>40</sup> This richness is probably due to the large number of lakes and rivers in Ontario, the relatively mild climate (in parts), and the fact that the province encompasses three major drainage basins: the Atlantic and Arctic oceans, and the Mississippi drainage basin. Thirty-four of Ontario's freshwater fish species are considered at risk. The blackfin cisco, blue pike, and deepwater cisco are extinct. Four species, including the shortnose cisco and Atlantic salmon (Great Lakes population) have been extirpated. Three species, including aurora trout, are Endangered-Not Regulated, 10 are Threatened, and 14 are considered species of Special Concern.

### Did You Know?

*Lake trout lakes are rare. Only about 1 percent of Ontario's lakes (i.e., approximately 2,200) contain lake trout, but this represents from 20 percent to 25 percent of all lake trout lakes in the world. Lake trout currently live in all the Great Lakes. However, they were extirpated from Lake Ontario and Lake Erie and severely depleted in Lake Huron and Lake Superior by the 1950s as a result of lamprey predation, overfishing, habitat alteration, and pollution. In 1983, a long-term lake trout rehabilitation plan for Lake Ontario was developed and included restocking initiatives. Since 1994, naturally reproducing lake trout have been observed in Lake Ontario, but the abundance of wild lake trout is low and not increasing.<sup>41</sup>*



Photo: Michelle Craigien

## Amphibians

Amphibians are cold-blooded animals that spend part of their time on land and are able to breathe through their skin. Frogs, toads, and salamanders are examples of amphibians. Most amphibians reproduce in fresh water and produce eggs that hatch into juveniles that breathe with exterior gills. After hatching, juveniles transform gradually into adults. There are 5,918 known species of amphibians worldwide,<sup>42</sup> 26 of which are found in Ontario.<sup>43</sup> Seven of Ontario's amphibian species are considered at risk. These include the northern cricket frog and northern dusky salamander (Endangered-Regulated), and the smallmouth salamander (Endangered-Not Regulated). Fowler's toad and Jefferson salamander are considered Threatened species.

Amphibians are often used as indicators of environmental decline or loss of biodiversity because of their vulnerability to the adverse effects of environmental change. Their moist, permeable skin readily absorbs chemicals from the environment, and with a life history that includes both an aquatic and a terrestrial stage, they are exposed to a wider range of pollutants than are other animals. Populations of many amphibian species are believed to be declining on a global scale.

### Did You Know?

*Fowler's toad is a medium-sized toad that lives on sandy beaches and breeds in the marshy shallows of lakes and ponds. While Fowler's toads are usually brown, in Ontario these toads are grey with a few dark blotches. This species is common in the eastern United States, and southern Ontario represents the northern extent of its range. Fowler's toad is found at a small number of scattered locations along the north shore of Lake Erie, primarily at Rondeau, Long Point, and Point Abino. These remaining populations are threatened by habitat alteration by humans and pollution caused by pesticides in runoff due to poor land-use practices. Fowler's toad is listed as a Threatened species in Ontario.*

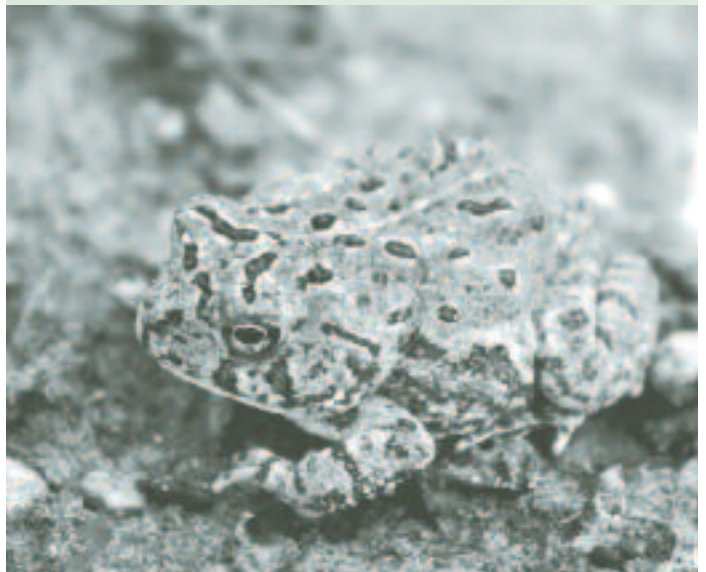


Photo: Sam Brinker

## Reptiles

Reptiles are thick-skinned, cold-blooded animals that breathe using lungs. Unlike the young of amphibians, the young reptiles have no larval stages of development. Lizards, snakes, and turtles are examples of reptiles. There are over 8,000 species of reptiles worldwide,<sup>44</sup> including 27 species in Ontario.<sup>45</sup> Reptiles have the greatest proportion of at-risk species in Ontario: 18 of its 27 reptile species are classified as Endangered, Threatened, or of Special Concern. Three species are Endangered-Regulated: the blue racer, Lake Erie water-snake, and timber rattlesnake. The spotted turtle and wood turtle are Endangered-Not Regulated. Nine species are considered Threatened; these include the eastern foxsnake, eastern hog-nosed snake, and Blanding's turtle. Four species, including the five-lined skink, are considered species of Special Concern.

### Did You Know?

*The eastern massasauga rattlesnake is the only venomous snake that is currently present in Ontario. The eastern timber rattlesnake is also poisonous but has been extirpated from the province. In Ontario, massasaugas are found on the Bruce Peninsula, the eastern and northern islands and shores of Georgian Bay, and near the mouths of the French and Pickering rivers. Smaller, isolated populations are found at Wainfleet Bog on the Niagara Peninsula and Ojibway Prairie in Windsor. Historically, the eastern massasauga rattlesnake inhabited most of southern Ontario, but declined there as habitat was transformed to farmland and urban areas. Today, habitat loss and fragmentation as roads are built through its remaining range are the main threats to the massasauga rattlesnake, now considered a Threatened species in Ontario.*



Photo: J.D. Taylor

### Did You Know?

*Ontario is home to one of the five largest American white pelican colonies in Canada. These birds breed on low, bare islands in Lake of the Woods and feed in the shallow lakes, bays, and marshes of the surrounding landscape. Breeding pairs occupy the Three Sisters Islands in Lake of the Woods, while smaller populations live in the Lake Nipigon and Rainy Lake areas. Recently, breeding pelicans have been confirmed in Lake Superior. The Lake of the Woods population increased steadily from about 50 individuals in 1960 to about 15,000 individuals in 1999<sup>49</sup>. This increase in abundance was probably due to better habitat protection and restrictions on the use of certain pesticides. Current threats to American white pelicans include human disturbance during breeding times. The species is listed as Endangered-Regulated in Ontario but is not considered at risk nationally.*



Photo: J.D. Taylor

## Birds

There are approximately 10,000 living bird species in the world,<sup>46</sup> making them the most diverse class of terrestrial vertebrates. There are 479 known species of birds in Ontario.<sup>47</sup> Many undertake long-distance annual migrations, and the reproductive success of these species is influenced by the quality of habitat in their wintering grounds in the tropics.<sup>48</sup> Both breeding and wintering habitats need to be protected if conservation strategies for such birds are to be successful. Twenty-eight of Ontario's bird species are considered species at risk. Endangered-Regulated species include the golden eagle and the loggerhead shrike. Endangered-Not Regulated species include the barn owl and the northern bobwhite. Threatened species include the peregrine falcon and the hooded warbler. Species of Special Concern include the red-headed woodpecker and the red-shouldered hawk.



## Did You Know?

*There are two species of wolves in Ontario: the grey wolf and the eastern wolf. The grey wolf is found in the boreal and tundra regions, while the eastern wolf, which has been identified as a species of Special Concern, lives in the coniferous and mixed coniferous-hardwood forests of central and northern Ontario. Wolves are predators whose prey includes white-tailed deer, moose, woodland caribou, elk, and beaver. Current estimates suggest that more than 8,000 wolves live in Ontario<sup>52</sup>.*



Photo: J.D. Taylor

## Mammals

There are approximately 5,400 species of mammals, including humans, worldwide.<sup>50</sup> Excluding humans, Ontario is home to 81 species of mammals,<sup>51</sup> ranging in size from the pygmy shrew (two to four grams) to the beluga whale (up to 1,300 kilograms). Eleven of Ontario's mammal species are considered species at risk. These include the eastern cougar (Endangered-Regulated) and the American badger (Endangered-Not Regulated); the grey fox, woodland caribou and wolverine (Threatened); and the polar bear and southern flying squirrel (Special Concern).

## 2.3 Ontario's Genetic Diversity

Genetic diversity is the variety of genotypes present within a species. Genes are the building blocks that determine how an organism will develop and what its traits and abilities will be. More genetic diversity within a species means that the species has a greater ability to adapt to environmental change.

Reductions in the size of populations can have major consequences for their genetic diversity, even if the reduction is for only a short period. Therefore, populations that fluctuate in size tend to have less genetic diversity than might be expected from their average size.

Little specific information is available about the genetic diversity of Ontario's native species, largely because genetic diversity is relatively difficult and expensive to study. Studies of genetic diversity tend to focus on forest tree species, species at risk, or other species where this information is needed to manage on a species-specific basis.

## Did You Know?

*Aurora trout was initially described as a new species, but today it is generally believed to be a form of brook trout. Aurora trout are found in only two lakes: Whirligig Lake and Whitepine Lake in Lady Evelyn-Smoothwater Provincial Park, about 100 kilometres north of Sudbury. A decline in aurora trout was noted as early as the 1940s. By 1967, aurora trout had been extirpated from both lakes as a result of lake acidification. A captive breeding program established in the late 1950s prevented aurora trout from becoming extinct. Decreases in atmospheric pollutants and efforts to increase the pH of the lakes have assisted the recovery of this fish. The species was reintroduced to Whirling and Whitepine lakes, and self-sustaining populations were reestablished in both lakes by the mid 1990s. Aurora trout is listed as Endangered-Not Regulated in Ontario.*



Photo: Ed Smutchnis



# 3.0 Threats to Ontario's Biodiversity

Ontario's Biodiversity Strategy identified five major threats to Ontario's biodiversity: pollution, climate change, habitat change, invasive species, and unsustainable use. These threats can fundamentally and, to a certain extent irreversibly, change the diversity of life and negatively affect human health in Ontario. It is important to note that ecosystems and species may be subject to more than one threat at any given time and that the cumulative stress may lead to greater impacts than individual stresses would alone.

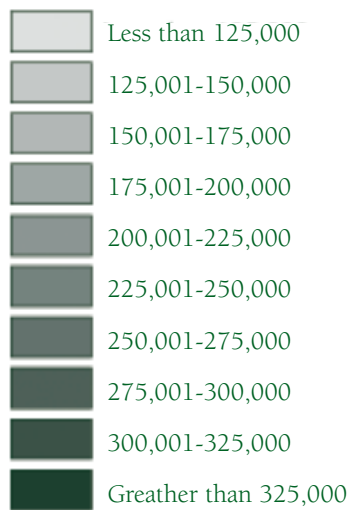
Human population growth, the distribution of that population, and the demands that human populations make on natural resources are the ultimate (sources of) threats to Ontario's biodiversity. Ontario's population exceeded 12.1 million people in 2006<sup>33</sup> and is projected to grow to 16.5 million people by 2031 (Figure 3).<sup>54</sup>

Figure 3a: Ontario population distributions in 1951 and 2006 by census area with ecozone overlay

Ontario's Population Distribution, 1951



Ontario's Population Distribution, 2006



## Figure 3b

Figure 3b: Southern Ontario's projected population change, 2006 to 2031.

The figure shows where most of Ontario's projected 4.4 million new residents are expected to settle: dark colour represents areas that will experience intense population growth.

### Southern Ontario's Projected Population Distribution, 2031



Human populations are highest in the Mixedwood Plains ecozone, followed by the Ontario Shield and Hudson Bay Lowlands ecozones. Figure 3 shows the past and present distribution and the projected distribution of Ontario's population. Between 1951 and 2006, most of Ontario's population growth occurred in southern Ontario (the Mixedwood Plains ecozone), and this trend is expected to continue. The population of the Greater Toronto Area was 5.8 million people in 2006 and is expected to grow to 8.3 million people by 2031.<sup>55</sup>

By comparison, northern Ontario's population is low and has remained relatively constant. The population of northern Ontario (Ontario Shield and Hudson Bay Lowlands ecozones) was 806,000 people in 2006 and is expected to decline to 770,000 people by 2031.<sup>56</sup> Human impacts on biodiversity have been and will probably continue to be greater in the Mixedwood Plains ecozone than in the Ontario Shield and Hudson Bay Lowlands ecozones.

This population growth puts pressure on terrestrial and aquatic ecosystems and leads to habitat change. There is, therefore, a need for sustainable-growth planning. This is being addressed through such initiatives as the Growth Plan for the Greater Golden Horseshoe and the Greenbelt Plan.

### Did You Know?

*An ecological footprint is a measure of the demands humans place on nature. It shows how much biologically productive land and water are needed to produce all the resources we consume and to absorb our waste. Ecological footprints can be calculated for individuals, organizations, cities, regions, countries, or the entire global population. The average Canadian has an ecological footprint of 7.25 hectares. This means it takes 7.25 hectares of biologically productive land and water to support one Canadian. There are 1.9 hectares of land and water available to support the needs of each person on Earth, which means that Canadians consume a disproportionately large share of the Earth's resources. For more information, see the Global Footprint Network website (<http://www.footprintnetwork.org/>).*



Photo: Rick Staniewicz

## 3.1 Pollution

Pollution is the release of contaminants into the Earth's atmosphere, surface waters, soils, groundwater, and sediments. There are many different kinds of pollutants, and each is characterized by its chemical composition, its source, how it moves through the environment after its release, its effects on humans, plants, and animals, and its ultimate fate. Pollutants may be toxic, bioaccumulative, persistent, and/or ozone depleting, and can also contribute to global warming. A few examples of how specific contaminants affect biodiversity are given below:

- Smog is a noxious mixture of air pollutants including ground-level ozone, nitrogen oxides, volatile organic compounds, and particulate matter. Smog is a concern in most major urban centres in Ontario, but because smog travels with the wind, it can affect all of southern Ontario and reach as far north as Sudbury during the peak summer period. Smog damages forests, other natural vegetation, and agricultural crops, and is injurious to human health.
- Acid rain affects the chemical balance of lakes and streams by increasing their acidity and reducing their species diversity. Lakes in the Ontario Shield ecozone are particularly susceptible to the effects of acid rain because their granite bedrock has a low acid-neutralizing capability. While lakes in the Mixedwood Plains ecozone have a higher buffering capacity, they also receive much higher loads of acid rain and still suffer negative impacts. Even with current sulphur emission reduction targets, it has been estimated that the number of fish species per lake will decline by between 6 percent and 15 percent for lakes in central and southern Ontario.<sup>57</sup>
- Nutrient loading from poor land-use practices or municipal wastes may lead to eutrophication (excessive plant and algal growth and decay) and decreased aquatic biodiversity in nearby water bodies.
- Persistent organic pollutants, commonly known as POPs, are manufactured chemicals that break down slowly in the environment. This class of pollutants includes some pesticides (e.g., dichlorodiphenyltrichloroethane [DDT]) and industrial chemicals (e.g., polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons [PAHs], and certain brominated flame-retardants). POPs, which natural processes transport over long distances, remain in the environment long after their release. POPs accumulate in human and animal tissues everywhere but tend to be transported to the north. PCBs and their metabolites have been detected at very high levels in the tissues and milk of polar bears southwest of Hudson Bay. Recent research suggests that high exposure to PCBs in milk decreases the survival rates of polar bear cubs.

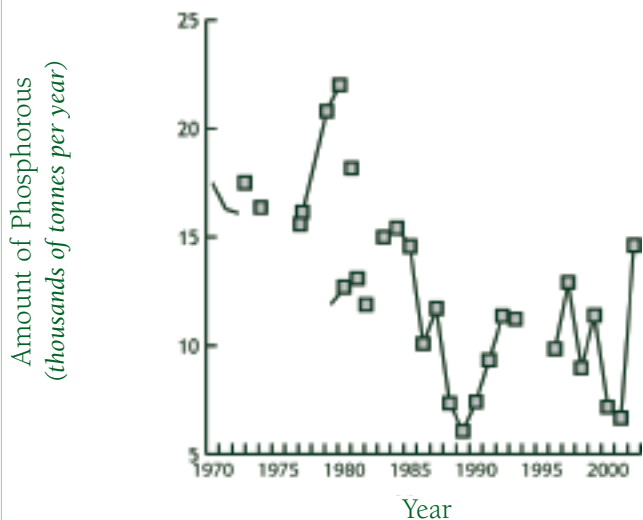
### Did You Know?

*In the late 1960s and early 1970s, thousands of lakes in the Sudbury area became acidic. This resulted in large-scale damage to lake ecosystems, including the widespread loss of fish and invertebrates. A number of lakes were completely fishless. The acidification of these lakes was linked to sulphur dioxide emissions from Sudbury metal smelters. Emissions reductions in the 1970s, 1990s, and early 2000s, as well as ongoing greening efforts by mining companies, helped many lakes to begin to recover. Native species such as lake trout and aurora trout have been reintroduced to a number of lakes. Overall, sulphur dioxide emissions from Sudbury smelters have been reduced by about 90 percent since peak emissions in the 1960s.<sup>58</sup>*

## Did You Know?

Due to phosphorous loading from synthetic fertilizers, municipal waste, and phosphate-based detergents, in the 1950s Lake Erie developed massive algal blooms and a “dead zone” in its centre where oxygen levels were too low for fish and other organisms to stay alive. In the late 1970s and 1980s, phosphorus concentrations in Lake Erie decreased, in part due to the removal of phosphorus from detergents, changes in agricultural practices (e.g., conservation tillage and integrated crop management), and improvements made to sewage treatment plants and sewer systems. Phosphorus concentrations began to rise again in the early 1990s. The reasons for this increase are not fully understood, but it is believed that zebra mussels are contributing to these changes. In the vicinity of zebra mussel infestations, both food web dynamics and nutrient-cycling have been greatly altered. Severe blue-green algae blooms in Lake Erie in recent summers – which made the lake look and smell bad and rendered the water undrinkable – may be related to the interruptions that zebra mussels cause in normal biological and chemical processes.

Total Phosphorus Concentration in Lake Erie’s Central Basin, 1970-2002\*



\* 1984-2002 data: Rockwell, D.C., G.J. Warren, P.E. Bertram, D.K. Salisbury, and N.M.Burns. 2005. The US EPA Lake Erie Indicators Monitoring Program 1970-1983 data: Bertram, P.E. 1993. Total Phosphorus and Dissolved Oxygen in the Central Basin of Lake Erie. *Journal of Great Lakes Research* 19(2):224-236. 1983-2002. *Journal of Great Lakes Research*. 31(2)

- Hormone-disrupting substances, called endocrine disruptors, alter hormone levels in humans and wildlife. Exposure to endocrine disruptors can lead to changes in the growth, development, reproduction, or behaviour of an organism or its offspring. Poor land-use practices, municipal and industrial effluents, and some plastics are sources of endocrine disruptors. Some examples of the effects of endocrine-disrupting substances in wildlife include impaired reproduction and development in fish exposed to effluents from pulp and paper mills, reduced thyroid and immune functions in fish-eating birds, and feminization of fish near municipal effluent outlets.<sup>59</sup>

## Did You Know?

By the 1960s, bald eagles in the Great Lakes basin had almost been wiped out as a result of exposure to pesticides, most notably DDT.<sup>60</sup> DDT affects the development of eggshells, making them thinner and more susceptible to breakage during incubation and causing embryos to die. The use of DDT was restricted in Canada and the United States in the early 1970s, and by the late 1980s, bald eagles had begun to recover.<sup>61</sup> The number of active nests and the number of eaglets per nest have increased steadily since 1990.<sup>62</sup> Biologists have identified bald eagles as a bio-sentinel species, using their health as a measure of the health of aquatic ecosystems in the Great Lakes region.



Photo: Mark Peck



- Pharmaceuticals and personal care products in the environment include prescription and over-the-counter drugs, veterinary drugs, cosmetics, and fragrances. Wastewater treatment facilities are unable to remove some of these products completely, and they may make their way into soils and aquatic environments via sewage, treated sewage sludge, and wastewater plant discharge. There is evidence that some pharmaceuticals and personal care products have the potential to cause adverse health effects such as the disruption of development and reproduction in exposed humans, fish, and wildlife, and the growth of antibiotic-resistant bacteria.

The warming trend over the last 50 years (approximately 0.13 degrees Celsius per decade) is nearly twice that of the last 100 years.<sup>65</sup> Average Canadian and Arctic temperatures increased at almost twice the global average rate in the past 100 years,<sup>66</sup> and sea ice in the Arctic has decreased significantly since 1978. The extreme loss of Arctic ice in the summer of 2007 rendered the Northwest Passage fully navigable for the first time since satellite records began in 1978.<sup>67</sup>

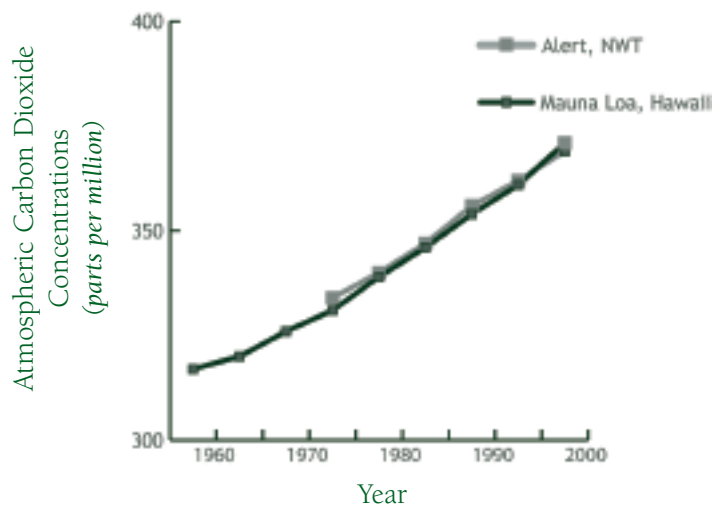
## Did You Know?

Many of the pollutants described in this section are harmful to human health. Our exposure to pollution often occurs without our knowledge. Environmental Defence, a non-governmental organization, conducted studies that show that Canadians from coast to coast – no matter how old they are or where they live, work, or go to school – have a high number of chemical contaminants in their bodies.

## 3.2 Climate Change

Climate change is becoming an increasingly important factor in the conservation of biodiversity. Global atmospheric concentrations of carbon dioxide and methane have increased markedly since 1750 as a result of human activities – primarily the burning of fossil fuels and changes in land use. Carbon dioxide concentrations in 2006 were 381 parts per million (Figure 4),<sup>63</sup> well above the pre-industrial levels of 279 parts per million. Although some scientists disagree,<sup>64</sup> the Intergovernmental Panel on Climate Change has concluded that greenhouse gas emissions from human activity are responsible for most of the observed increase in global temperatures since the mid-20th century.

Figure 4: Atmospheric carbon dioxide concentrations measured at Mauna Loa, Hawaii and Alert, Northwest Territories, 1958-2001<sup>68</sup>



As a result of rapid climate change, climatically tolerant species, such as goldenrod and coyotes, will probably be favoured. Species such as earthworms and many forest understory herbs will have difficulty adapting to climate change.<sup>69</sup> Some species will be unable to disperse fast enough and may become extirpated or extinct. In addition, the slow evolutionary response of many long-lived species makes them more vulnerable to climate change than short-lived species with relatively rapid evolutionary responses. As natural ecosystems become stressed by climate change, short-lived species will have more opportunities to establish themselves. Some of these species may become invasive as a result of their rapid adaptation to climate change as compared to the slow adaptation of native plant communities.

Climate change threatens the ecosystem compositions we associate with Ontario landscapes. Black spruce and jack pine forests, currently associated with the northwest section of the Ontario Shield ecozone, are expected to occupy a smaller geographic range and become less dominant. Conversely, mixed poplar and birch forests, currently characteristic of the southern portion of the Ontario Shield ecozone, are expected to expand their range into the northwest and become more dominant. It is also projected that tree species currently restricted to the Mixedwood Plains ecozone could establish themselves in the Ontario Shield ecozone under changing climatic conditions.<sup>70</sup>

Boreal forests and polar ecosystems are among the natural systems predicted to be most at risk to climate change. Tundra wetlands may become progressively drier. Additionally, in boreal forests, higher temperatures may increase the frequency and size of wildfires, and drought-stressed trees are more vulnerable to insect damage.<sup>71</sup> Climate change will also affect the distribution and intensity of infestations of insect pests in the boreal forest, which will affect the geographic distribution and abundance of other species. For example, spruce budworm is projected to become more damaging in northern parts of the Ontario Shield ecozone and less damaging in southern parts of the Ontario Shield ecozone.<sup>72</sup> As a result, ecosystem functions may be impaired, and threats to the viability of species may emerge.

## Did You Know?

*Most climate models predict that water levels in the Great Lakes will drop over the next century. Higher temperatures mean greater evaporation of water into the atmosphere, less snow in the winter, and consequently less spring run-off and snow melt entering the lakes. This will probably result in less water in the Great Lakes. The frequency and duration of low water levels could increase, dropping water levels below historic minimums. These changes could significantly affect fish, wildlife, wetlands, shoreline habitat, and water quality in the Great Lakes region. They could also affect the commercial and recreational fishing industries, tourism, transportation, and hydroelectric power generation.*

## Did You Know?

*Polar bears are among the species most vulnerable to climate change because they are dependent on sea ice for foraging, resting, and reproduction. Sea ice in Hudson Bay and James Bay currently melts about 20 to 30 days earlier than it did 30 years ago, and this trend is expected to continue for decades. Although the number of polar bears in Ontario (approximately 1,000 individuals) has been stable since the mid-1980s, the body condition of these animals has declined significantly, particularly in pregnant females and juveniles. This change is thought to be due to the increasing trend towards longer ice-free seasons as the climate warms. Declines in body condition were detected in the western Hudson Bay (Manitoba) population of polar bears in the mid- to late 1990s and were followed by a decrease in the number of bears. A similar pattern is expected in Ontario.*



Photo: J.D. Taylor

## 3.3 Habitat Change

Habitat change through human actions is a result of land-use changes in which terrestrial and/or aquatic habitats are lost, degraded, or fragmented. Southern Ontario has the most concentrated human population in Canada; urban development, unsustainable use of resources, and the construction of roads and dams and other infrastructure to support this population continue to reduce the amount of suitable habitat for plants and animals.

Habitat change can result in the expansion of the range of a wildlife species into areas where it was absent previously. Evidence indicates that, historically, the black duck was a common species breeding in southern Ontario, but as the landscape changed from a forested ecosystem to a more prairie-like habitat, the population of this species declined. In concert with this change, the mallard duck distribution expanded eastward from the prairies to take advantage of the habitat that became more conducive to their life-cycle needs.

### Did You Know?

*Prior to 1800, there were 2.38 million hectares of wetlands in southern Ontario. By 1982, this number had dropped to 0.93 million hectares.<sup>73</sup> Wetlands are important to the lifecycles of waterfowl and many other species. In addition, wetlands help to provide clean, secure water sources and moderate the effects of droughts, floods, climate change, and erosion. The loss of wetland habitat is a major threat to many species at risk in Ontario, including the king rail and the smallmouth salamander.*

*In parts of southwestern Ontario, over 90 percent of wetlands have been converted to other uses, and those that remain are under threat. Some reclamation and restoration has occurred: since 1967, 542 hectares in the Bay of Quinte area have been reclaimed from agricultural use and restored to wetland.<sup>74</sup>*



Photo: Sam Brinker

Habitat fragmentation is a process whereby habitats that were once continuous become divided into separate pieces. Many species, such as the fisher and red-shouldered hawk, require minimum range sizes and tend not to inhabit small, isolated woodlands. Forest-interior species, such as the red bat, red squirrel, and Canada warbler, require sheltered and secluded environments away from the influence of forest edges and open fields, and small woodlands may not meet these requirements. Fragmented habitats can also isolate local populations, especially for species with limited mobility (e.g., small mammals, amphibians, reptiles). This reduces the mixing of genetic traits that helps populations survive over the long term. In addition, southern Ontario's heavily fragmented landscape may prevent some species from moving to new, more suitable habitats when climate change makes current habitats unsuitable.

### Did You Know?

*Many of Ontario's forest birds are area-sensitive species, meaning that they need large forest patches to breed and protect their nests from predators and other disturbances. The scarlet tanager and pileated woodpecker are examples of area-sensitive forest bird species. Sightings of these species are increasingly rare in the urbanized and fragmented landscape of southern Ontario. Loss of forest cover and the fragmentation of remaining forests have reduced the amount and quality of available breeding habitats. The impact is most profound in extensive urban areas where urban stresses and lack of suitable habitat limit species diversity and population size.*

Dam construction can negatively affect fish and other aquatic species by fragmenting or isolating populations and by preventing their migration and dispersal. The operation of some hydroelectric facilities can also flood or reduce water levels in important habitats, alter the timing and variability of water flow within rivers, and cause direct mortality of fish that pass through turbines. It is estimated that over 40 percent of the American eel that migrate from Lake Ontario to the Atlantic Ocean to complete their life cycle are killed in hydroelectric generation turbines.<sup>75</sup>

## Did You Know?

*Tallgrass prairies and savannas once covered about 1,000 square kilometres in southern Ontario. Today, less than 3 percent remains. Tall-grass prairies are open systems dominated by grasses such as big and little bluestem, Indian grass, switchgrass, wild bergamot, black-eyed Susan, and bush clover. The largest remaining prairie ecosystems occur in parks and nature reserves, such as Pinery Provincial Park and Ojibway Prairie near Windsor. Many smaller tallgrass remnants exist in isolated patches on private land in southwestern Ontario and the Rice Lake Plains south of Peterborough. Ontario's tallgrass communities provide important habitat for endangered species such as the northern bobwhite. About 20 percent of the plants designated as rare in Ontario are associated with tallgrass prairies.*



Photo: Sam Brinker

## 3.4 Invasive Species

Some species of plants, animals, and micro-organisms may become invasive outside their home ranges when they are accidentally or deliberately transported to new ecosystems. These species may flourish in their new environment as a result of reduced predation and competition, and can cause significant ecological and economic damage. Such species are referred to as “invasive species.” Invasive species and climate change are among the greatest threats to the biodiversity of Ontario's waters, wetlands, and forests. Examples of invasive species include purple loosestrife, zebra mussel, brown spruce long-horned beetle, and Asian long-horned beetle.

Photo: Heather Bickle



More than 180 aquatic species have been introduced to the Great Lakes basin,<sup>76</sup> forever changing the species mix in it. Most of these introductions are suspected to be the result of human actions. New species have been introduced in the Great Lakes at a rate of 20 to 25 new species every two decades since 1820.<sup>77</sup> Non-native species range from tiny plankton that float in the water to shellfish and fish. Some, like coho and chinook salmon and rainbow and brown trout, were released intentionally to provide sport fishing and to keep populations of alewife (another introduced species) under control. Others, like the spiny water flea, zebra mussel, and sea lamprey, entered the lakes via shipping.

## Did You Know?

*Zebra mussels are native to the Caspian Sea region of Asia and are believed to have been transported to the Great Lakes in the ballast water of a transoceanic vessel. Since their discovery in 1988 in Lake St. Clair, zebra mussels have spread to all of the Great Lakes. In Ontario, they have also invaded the Trent-Severn Waterway and Rideau Canal as well as numerous other inland lakes and rivers. They are invisible to the naked eye in their early life stage and can be transferred unknowingly in live wells, bilge water, and baitfish buckets. In their adult stage, zebra mussels can attach to and be transported on boat hulls. Zebra mussel colonies in the Great Lakes have clogged municipal and industrial water intake lines, covered boat hulls, fouled beaches, killed native clams, and disrupted lake ecosystems. Additionally, zebra mussels are believed to be modifying lake water nitrogen and phosphorus cycles and thus contributing to phytoplankton growth and the formation of cyanobacterial blooms in western Lake Erie.*



## Did You Know?

The emerald ash borer is an insect native to eastern Asia that attacks and destroys ash trees. This invasive species was discovered in Ontario in 2002 and probably came here in a shipment of untreated wooden packing material from Asia. The emerald ash borer deposits its eggs in the cracks and crevices of the bark of ash trees. After hatching, the larvae burrow through the bark and feed underneath it. All species of ash trees die within two or three years of infestation. As of December 2007, five areas in southwestern Ontario were under quarantine for the emerald ash borer: Essex County and the municipality of Chatham-Kent, Lambton County, Elgin County, and Middlesex County. In spite of these quarantines, the Canadian Food Inspection Agency recently confirmed the presence of the emerald ash borer in Toronto in the vicinity of Sheppard Avenue East and Highway 404.



Photo: Taylor Scarr

## Did You Know?

Garlic mustard is a shade-tolerant plant from Eurasia that has recently become an aggressive and widespread invader of forests and other areas across much of North America. Many trees—such as maple, ash, and other hardwoods—have a symbiotic relationship with certain fungi: the fungi rely on the trees for energy, and the trees rely on the fungi for nutrients. Garlic mustard targets and poisons these fungi and affects the growth of trees. Removing the garlic mustard plants from an area will not solve the problem because toxic chemicals are left behind in the soil and prevent the reestablishment of native plants and trees.



Photo: Wasył Bakowsky

## 3.5 Unsustainable Use

Use of resources can result in reduced biodiversity if they are harvested beyond sustainable limits. Such use can have an adverse effect on biological resources and, in turn, the economy and community social well-being. When biological resources are used unsustainably, their ability to support the needs of future generations may be compromised.

To conserve biodiversity, resources must be used at a rate that permits them to be maintained indefinitely. In terms of sustainable development, Ontario's natural resources represent "natural capital." Resources over and above those essential for long-term sustainability requirements become available over time as "interest" for use, enjoyment, and development. Development that maintains natural capital and allows for the accumulation of this natural

## Did You Know?

Blue pike, also called blue pickerel, was once an important commercial and recreational fish species in Lake Erie. The population began to decline dramatically in the 1950s, and the last confirmed blue pike was taken from Lake Erie in 1965. Blue pike are now considered extinct. The main cause of its extinction was linked to overfishing, but pollution and competition from invasive species are thought to have been contributing factors. Scientists still debate whether the blue pike was a unique species.



Fish image originally prepared by Ellen Edmonson and Hugh Chriss as part of the 1927-1940 New York Biological Survey. Permission for use granted by the New York State Department of Environmental Conservation

interest is sustainable. Sustainable use requires that social, economic, and ecological values and priorities related to resource use be balanced. For example, logging is a source of income and jobs, and provides us with wood and wood fibre to make many products we need and want. Forests also provide essential ecological services, such as erosion control, and provide opportunities for recreation and emotional and spiritual enrichment. Forests also support a variety of plants, fish, and wildlife. Using forest resources sustainably requires that none of these uses or values be compromised.

When discussing about how to use resources sustainably, it is useful to understand the concept of the carrying capacity of an ecosystem or area. Carrying capacity is the maximum number of individuals of a species that an area or ecosystem can support. This capacity is limited by factors such as the availability of water and food. Social and economic dimensions are also important when determining the carrying capacity of an area. Sometimes the environmental carrying capacity and the social carrying capacity may be different. For example, elk were abundant in Ontario prior to

## Did You Know?

American ginseng is a long-lived, slow-growing perennial herb found in rich, moist, mature deciduous forest. The elongated root of this plant has a high market value and is used to make medicinal tonics. In Ontario, wild American ginseng is found along the Niagara Escarpment and the southeastern edge of the Ontario Shield. Populations of wild American ginseng have decreased significantly in Ontario over the past 150 years because of harvesting, timber extraction, and land clearing for agriculture and development. These threats continue at present, and it has been estimated that at least half of the populations of this plant are declining. Habitat change and over harvesting remain the primary threats to wild American ginseng in Ontario, where it is classified as an Endangered-Not Regulated species.



Photo: Donald Kirk

European settlement but were no longer found in the province by the late 1800s. In 1997, an elk restoration plan was developed, and Ontario's elk population is now estimated at between 450 and 500 individuals. This is below the number that could be supported by the province's natural environment (the environmental carrying capacity), but in some areas there are more elk than local residents want (the social carrying capacity). Wildlife managers seek to achieve a balance between sometimes opposing forces.

# 4.0 What is Being Done to Conserve Ontario's Biodiversity?

*“Never doubt that a small group of thoughtful committed citizens can change the world; indeed, it's the only thing that ever has.” – Margaret Mead*

Aboriginal communities, non-government organizations, industry (including forestry, mining, agriculture, and power generation), individual citizens, and municipal, provincial, and federal governments are leading and supporting initiatives that help conserve biodiversity. These initiatives range in scale from local community projects to province-wide programs. It is too early to tell whether our responses to the factors that threaten biodiversity are going to be effective in the long term. The following pages highlight some of the efforts to conserve biodiversity in Ontario. Additional examples of initiatives to conserve biodiversity, including brief descriptions of each organization or program, can be found in Appendix A.

## Recovery Profile:

Recovery Profile:

### Lake Ontario Atlantic Salmon Restoration Program

*Lake Ontario was once home to one of the most important and well-known fish in the world: the Atlantic salmon. Atlantic salmon were extirpated from Lake Ontario before 1900 as a result of farming, construction of dams on their spawning streams, and overfishing in both streams and Lake Ontario. The Ontario Federation of Anglers and Hunters has partnered with the Ontario Ministry of Natural Resources, Conservation Ontario, the Liquor Control Board of Ontario, Australia's Banrock Station Wines, community groups, the Fishing Forever Foundation, Fleming College, the Canadian Sportfishing Industry Association, and the Trees Ontario Foundation in an effort to restore Atlantic salmon to Lake Ontario. A recovery strategy for Atlantic salmon has been developed. Individuals and conservation groups are participating through various activities, including fish rearing and stocking, stream rehabilitation, mitigation of barriers to fish migration, assessment of restoration efforts, and angler diary programs. For more information, see the Bring Back the Salmon website ([www.bringbackthesalmon.ca](http://www.bringbackthesalmon.ca)).*

## 4.1 Strengthening Biodiversity Education and Awareness

As pressure on the environment grows, it is increasingly apparent that the public must come to understand both the value of biodiversity and the threats to its existence. It is imperative that Ontarians of all ages act on the principle that diverse, healthy ecosystems are essential to our own health, our livelihoods, and our future.

### Examples of Education and Awareness Initiatives (Appendix A.1)

- Biodiversity Education and Awareness Network
- Evergreen
- Ontario EcoSchools
- Ontario Federation of Anglers and Hunters
- Ontario Forestry Association

## Did You Know?

Various agencies, including conservation authorities and school boards, operate nature centres and outdoor schools in Ontario. For instance, the Grand River Conservation Authority operates four Nature Centres in the Grand River watershed. Each year, the centres provide environmental and outdoor education programs to over 50,000 children from school classes, community youth organizations, and family groups. The goals of these programs are to provide children with hands-on activities that teach global environmental concepts, create an appreciation for the environment, and increase public support for local conservation work in the long term.



Photo: John Buterill

## 4.2 Promoting Stewardship

Stewardship is a belief that humans are responsible for the world and should take care of it. The majority of Ontario's ecosystems and species at risk are found in southern Ontario where most land is privately owned. The support of private landowners is crucial to conserving these species in specific and biodiversity in general. Various agencies and organisations are promoting stewardship through education, tools, and support for landowners. Landowners are also encouraged through incentive programs.

### Canada-Ontario Environmental Farm Plan

Environmental farm plans are prepared by farm families to increase their environmental awareness in up to 23 different areas. Through a local workshop process, farmers highlight their farm's environmental strengths, identify areas of environmental concern, and set realistic action plans with time tables to improve environmental conditions. Since April 2005, 11,159 landowners have participated in environmental farm plan workshops, and 8,284 farm plans have been reviewed and deemed appropriate. From 1993 to 2006, participating farmers and project-funding partners invested over \$150 million in environmental improvements to farms.

### Examples of Stewardship Promoting Initiatives (Appendix A.2)

- Alternative Land Use Services
- Community Fisheries and Wildlife Involvement Program
- Conservation Land Tax Incentive Program
- Eastern Ontario Model Forest Private Woodlot Certification
- Federation of Ontario Cottagers' Associations, Inc.
- Managed Forest Tax Incentive Program
- Ontario Stewardship Program
- Species at Risk Stewardship Fund



## 4.3 Working Together Across Resource Sectors

Government, Aboriginal communities, the forest, mining and energy industries, farmers, anglers and hunters, trappers, and other interested groups are working together to achieve the goals of Ontario's Biodiversity Strategy. Some examples of efforts underway in Ontario serve to illustrate the actions taking place to ensure that Ontario's biodiversity provides benefits now and in the future.

### Profile:

#### Profile: The Sydenham Sportsmen's Association

The Sydenham Sportsmen's Association started with simple fish upwelling boxes and grew into a permanent hatchery. The association has stocked salmonids for 25 years, created spawning habitat, done riparian plantings, and erected kilometres of fencing to protect waters and wetlands. It has also branched out into improving wildlife populations (e.g., wild turkeys, peregrine falcons) and enhancing habitat (e.g., providing nesting structures for everything from birds to bats) and has worked extensively with youth.



Photo: Blake Smith

### Profile:

#### Profile: Ontario Stone, Sand, and Gravel Association

The Ontario Stone, Sand, and Gravel Association promotes the wise management of Ontario's aggregate resources by conserving the natural and social environment while maintaining a healthy and competitive aggregate industry. Once aggregate is extracted from a pit or quarry, the site is rehabilitated into productive wildlife habitats, wetlands, golf courses, recreational parks, urban uses, conservation lands, and urban, forest, or agricultural lands. The Royal Botanical Gardens, Don Valley Brick Works Park, and Wainfleet Wetlands Conservation Area are examples of pits and quarries rehabilitated to natural areas. For more information, see the Ontario Stone, Sand and Gravel Association's website ([www.ontariossga.com](http://www.ontariossga.com)).

#### Examples of Working Together Across Resource Sectors (Appendix A.3)

- Aggregates
- Agriculture
- Forestry
- Great Lakes
- Mining
- Renewable Energy

## 4.4 Integrating Biodiversity Conservation into Land-Use Planning

Rapid population growth is expected to continue in southern Ontario over the next 25 years. Our challenge is to plan and accommodate this growth such that its impacts on the environment are minimized, and farmlands, green spaces, and biodiversity are conserved. This section provides some examples of how biodiversity conservation has been integrated into land use planning.

## Profile:

### Profile: Monitoring the Oak Ridges Moraine

*Monitoring the Moraine is a collaborative project between Citizens' Environment Watch, Save the Oak Ridges Moraine, and Centre for Community Mapping. The project is designed to engage community volunteers in science, stewardship, monitoring, and decision making on the Oak Ridges Moraine. The goal of Monitoring the Moraine is to determine the effectiveness of the Oak Ridges Moraine Conservation Plan and to measure changes to the moraine landscape.*

- *Oak Ridges Moraine Conservation Plan*
- *Places to Grow Act, 2005*
- *Planning Act, 1990*
- *Provincial Parks and Conservation Reserves Act, 2006*
- *Provincial Policy Statement, 2005*

## 4.5 Prevention

Ontario's Biodiversity Strategy outlines five threats to biodiversity: pollution, climate change, habitat change, invasive species, and unsustainable use. This section provides some examples of initiatives that have been undertaken to address the five main pressures on Ontario's biodiversity.

### 4.5.1 Reducing Pollution

Pollution affects biodiversity at the species, population, and genetic levels while also impairing ecosystem function and resilience.

## Profile:

### Profile: Building Industry and Land Development Association

*The Building Industry and Land Development Association (BILD) regularly consults with conservation authorities and municipal and provincial governments to assist in the planning and building of sustainable new communities and the redevelopment of existing communities. BILD members are committed to the principles of good community and environmental planning, and through BILD, undertake a variety of projects to showcase emerging and innovative environmental practices. Notably, BILD is a sponsor of the Archetype Sustainable House—a demonstration model intended to educate builders and homebuyers alike about what can be achieved through an environmentally conscious home design. The house is scheduled to be built in 2008 at the Kortright Centre for Conservation, City of Vaughan, by the Toronto and Region Conservation Authority. For more information, see the BILD website ([www.bildgta.ca](http://www.bildgta.ca)).*

## Did You Know?



*Light pollution can also affect biodiversity. Many species of migratory birds travel at night, and brightly-lit buildings in their paths pose a serious threat. Birds become disoriented by the light and collide with the buildings. Each year, millions of migratory birds are killed in North America as a result of collisions with buildings. According to the Toronto-based Fatal Light Awareness Project ([www.flap.org](http://www.flap.org)), these accidents take a significant toll on migratory bird populations. The City of Toronto recognized that the deaths of many migratory birds could be prevented by reducing urban light levels at night. In collaboration with architects, developers, property managers, and bird advocacy groups, the City of Toronto developed "Lights Out Toronto!" and Toronto's new Bird-Friendly Development Guidelines ([www.toronto.ca/lightsout](http://www.toronto.ca/lightsout)). "Lights Out Toronto!" encourages developers, property managers, and residents to take action to reduce bird collisions with buildings. The Bird-Friendly Development Guidelines offer a number of strategies, from building construction to lighting use, that can help reduce bird deaths.*

### Examples of Initiatives Integrating Biodiversity Conservation into Land-Use Planning (Appendix A.4)

- *Greenbelt Act, 2005*
- *Greenbelt Plan*
- *Growth Plan for the Greater Golden Horseshoe*
- *Niagara Escarpment Planning and Development Act, 1990*
- *Niagara Escarpment Plan*
- *Oak Ridges Moraine Protection Act, 2001*
- *Oak Ridges Moraine Conservation Act, 2001*

## Profile:

### Profile: Ontario's Clean Air Action Plan

The Ontario government has made a commitment to work with industry, communities, municipal governments, and other stakeholders to reduce smog-causing pollutants in Ontario by 45 percent by 2015. A five-point action plan to reduce industrial emissions of harmful air pollutants, including compounds that contribute to smog and acid precipitation, was announced in June 2004. The actions are:

- Applying limits on nitrogen oxide and sulphur dioxide emissions—two of the most significant smog-causing pollutants—to more industrial sectors than ever before;
- Making the nitrogen oxide and sulphur dioxide limits more strict in future years;
- Setting new air standards for 40 harmful pollutants;
- Achieving a better picture of industrial emissions through updated technology;
- Taking a faster, risk-based approach to implementing new air standards.

### Examples of Pollution-Reduction Initiatives (Appendix A.5.1)

- Canadian Centre for Pollution Prevention
- Clean Water Act, 2006
- Drive Clean
- Great Lakes Binational Toxics Strategy
- Great Lakes Water Quality Agreement
- Lakewide Management Plans in the Great Lakes Region
- Municipal/Industrial Strategy for Abatement
- Nutrient Management Act, 2002
- Remedial Action Plans

## 4.5.2. Combating Climate Change

In 2007, the theme for the United Nations' International Day for Biological Diversity was biodiversity and climate change. This theme was chosen to highlight the fact that climate change is now regarded globally as a principal threat to biodiversity. The relationship between biodiversity and climate change is a reciprocal one: while biodiversity is threatened by climate change, sustainable management of natural resources can reduce the impacts of climate change. Decreasing greenhouse gas emissions and reducing the energy demands of Ontarians help to combat climate change.

### Examples of Efforts to Combat Climate Change (Appendix A.5.2)

- Go Green Ontario
- Ontario's Greenhouse Gas Targets

## Profile:

### Profile: Ontario Power Generation's (OPG) Evergreen Energy

The renewable-energy portfolio of Ontario Power Generation (OPG) is called OPG Evergreen™ Energy and includes electricity produced from renewable sources such as wind, low impact hydroelectric, biomass, and solar. OPG's green power portfolio consists of 32 EcoLogo-certified facilities (29 small hydroelectric and three wind-powered stations) with a combined capacity of 133 megawatts. The 9-megawatt Huron Wind project, Ontario's first wind farm, was commissioned in December 2002. The Pickering Wind Generating Station, one of North America's largest wind turbines, is a 1.8-megawatt, 117-metre-high wind machine commissioned in 2001 and designed to produce enough power to satisfy about 600 average households a year.

## Did You Know?

Individual citizens can reduce their home energy demand with the assistance of the Ontario Home Energy Audit and Home Energy Retrofit energy conservation initiatives that the Ontario Ministry of Energy launched in 2007. Homeowners are eligible for financial grants to subsidize the costs of completing a home energy audit and of completing energy-saving retrofits in the home. These programs complement the federal ecoENERGY Retrofit-Homes program. Typical home improvements include:

- “Weatherizing” a house (i.e., installing weather stripping, sealing leaks with caulking);
- Replacing the furnace, boiler, or air conditioner with a new high-efficiency model;
- Adding insulation to attics and basements;
- Replacing windows with more energy-efficient windows;
- Investing in a domestic solar hot water system.

For more information, visit the Ontario Ministry of Energy’s Ontario’s Energy Future website ([www.energy.gov.on.ca](http://www.energy.gov.on.ca)).



Photo: Rick Szankiewicz

### 4.5.3 Protecting and Restoring Habitat

All life on Earth needs somewhere to live. Just as Ontarians cannot survive without their homes, our wildlife species cannot survive without habitat.

## Profile:

### Profile: Ontario’s Protected Areas

Ontario is home to 651 regulated and recommended protected areas, including national and provincial parks, conservation reserves, and wilderness areas. These areas have been created to conserve ecosystems that represent all of Ontario’s natural regions, to protect significant elements of Ontario’s natural and cultural heritage, to maintain biodiversity, and to provide opportunities for ecologically sustainable recreation. Protected areas range in size from very small parcels of land in southern Ontario, such as Port Bruce Provincial Park (less than 6 hectares), to large wilderness-class parks in the far north, such as Polar Bear Provincial Park (2.3 million hectares).

Twenty-two new regulated provincial parks and conservation reserves, comprising 165,372 hectares, were established in Ontario in 2006 and 2007. Some of the new parks and conservation reserves feature eagle nesting sites, world-class canoe routes, provincially significant landforms, moose habitat, and fish sanctuaries. In addition, a new national marine conservation area, the Lake Superior National Marine Conservation Area, was created in 2007. Encompassing 1,000,000 hectares of western Lake Superior, it is the largest freshwater reserve in the world. Protected areas account for about 9 percent of Ontario’s area.

#### Regulated and Recommended\* Protected Areas in Ontario

Ecozone	Number of Protected Areas	Amount of Land in Protected Areas (hectares)	Proportion of Ecozone Area Protected (percent)
Hudson Bay Lowlands	18	2,481,540	10
Ontario Shield	567	7,355,540	11
Mixedwood Plains	98	90,135	1
Great Lakes	1	1,000,000	4
Total	651**	10,850,202	9

\* Recommended protected areas are those areas that have been recommended for regulation. All recommended sites have been placed under interim protection.

\*\* For protected areas that occupy more than one ecozone, only those portions of the protected area that occur in a given ecozone are counted in the total amount of land in protected areas for that ecozone.



## Examples of Habitat Protection and Restoration Initiatives (Appendix A.5.3)

- Canadian Parks and Wilderness Society – Wildlands League
- Ducks Unlimited Canada
- Eastern Habitat Joint Venture
- Nature Conservancy of Canada
- Ontario Conservation Authorities
- Ontario Nature
- Trees Ontario

### 4.5.4 Dealing with Invasive Species

Efforts are underway across Ontario to prevent and control invasive species. These efforts involve various organisations and stakeholders working in collaboration with government agencies.

#### What You Can Do to Help Prevent the Spread of Invasive Species

- Inspect your boat, motor, trailer, and boating equipment (e.g., anchors and fishing gear), and remove any visible plants and animals before leaving a water body.
- Drain the water from your motor, live well, bilge, and transom wells on land before leaving a water body.
- Wash and dry your boat, tackle, downriggers, trailer, and other boating equipment to kill harmful species that are not visible.
- Empty your bait bucket on land before leaving any water body.
- Never release live bait into water.
- Learn how to identify exotic species, and call the Invading Species Hotline (1-800-563-7711) if you think an exotic species has spread to a new location in Ontario.
- When camping, don't bring your own firewood. Use only the firewood provided at parks and conservation areas.

For more information, visit the website of the Invading Species Awareness Program ([www.invadingspecies.com](http://www.invadingspecies.com)).



## Examples of Invasive Species Initiatives (Appendix A.5.4)

- Canadian Aquatic Invasive Species Network
- Forest Health Program
- Invading Species Awareness Program

### 4.5.5 Protecting Species at Risk

The recovery of a species is the process by which the decline of a species at risk is stopped or reversed, and threats to its survival are reduced. In Ontario, teams of experts are developing recovery strategies to help species populations recover. Successful recovery means that a wild species continues to exist in its natural habitat, over the long term.

## Profile:

### Profile: Restocking American Eel

The American eel was once abundant in Ontario waters but has declined severely over the last decade as a result of habitat loss, deteriorating habitat quality, habitat fragmentation, mortality as eels pass through hydroelectric turbines, global harvest, and changes in sea conditions. In 2004, the Ontario government banned commercial eel fishing in Lake Ontario and the upper St. Lawrence River and ended sport fishing for eels across Ontario. In an effort to restore American eel populations, Ontario Power Generation released 400,000 young eels into the St. Lawrence River between Gananoque and Brockville in 2007.<sup>78</sup> The Ontario Ministry of Natural Resources oversaw the release. This restocking followed a similar effort in 2006 and is part of a multi-year plan to increase the number of American eels in Lake Ontario. The Ontario Ministry of Natural Resources is working with its partners to develop methods to provide safe downstream migratory routes for eels.

## Did You Know?

Wild turkeys disappeared from the province's landscape in the early 1900s due to unregulated hunting and habitat loss. In 1984, the Ontario Federation of Anglers and Hunters and the provincial government initiated the Wild Turkey Restoration Program which has helped to re-establish a population of roughly 50,000 wild turkeys in Ontario. Today, wild turkeys are found in the southwestern, central, and eastern parts of the province.



Photo: J.D. Taylor

### Examples of Species at Risk Protection Initiatives (Appendix A.5.5)

- *Endangered Species Act, 2007*
- *Species Recovery Strategies*

## 4.5.6 Conserving Genetic Diversity

Conserving genetic diversity is important for both native species and species valued for agriculture, forestry, fisheries, and recreation.

## Did You Know?

The Ontario Ministry of Natural Resources Fish Genetic and Stock Assessment Unit conducts research into a variety of applied and basic research issues. Past projects have included genetic analyses of lake trout and walleye from across Ontario, as well as analyses of native, stocked, and mixed-origin brook trout populations in Algonquin Provincial Park. Many of these projects contribute to our understanding of Ontario's aquatic biodiversity and the effects that different human activities have on aquatic systems.

## Profile:

### Profile: Genetics of the Ontario Black Bear

Over the past five years, the Natural Resources DNA Profiling & Forensic Centre and the Ontario Ministry of Natural Resources have been conducting genetic research on Ontario's black bear populations. This research will give wildlife managers insight into population trends and future wildlife management techniques, and will help conserve the genetic diversity of Ontario's black bear populations. For more information, visit [www.nrdpfc.ca](http://www.nrdpfc.ca).



### Examples of Genetic Diversity Conservation Initiatives (Appendix A.5.6)

- *Biodiversity Institute of Ontario*
- *Forest Gene Conservation Association*
- *Forest Genetics Ontario*
- *Forest Health Monitoring*
- *Natural Resources DNA Profiling & Forensic Centre*
- *Ontario Tree Seed Plant*

## 4.6 Improving Understanding

Research, monitoring, community knowledge, and Aboriginal knowledge of the land improve our understanding of Ontario's biodiversity and provide insight into:

- The threats to biodiversity, including the impacts of climate change, invasive species, habitat loss, pollution, and human use;
- The state and trends of Ontario's biodiversity, including forest resources, natural heritage, fish and wildlife populations, habitat, and species at risk;
- Policy development and management decisions, including evaluating the effectiveness of our actions and ensuring that local community values are considered.

### Profile:

#### Profile: Aboriginal Knowledge of the Land – Whitefeather Forest

*The Whitefeather Forest is a northern boreal landscape within the traditional territories of the Pikangikum First Nation in northwestern Ontario. The Whitefeather Forest initiative combines the best of local Aboriginal knowledge and Western science to develop innovative, state-of-the-art planning and management tools. The Pikangikum First Nation leads this initiative with support from many partners. A land-use strategy, "Keeping the Land," has been completed and approved.*

### Did You Know?

*Citizen science is volunteer environmental monitoring. Anyone can be a citizen scientist – a project exists for every level of skill and time commitment. Hundreds of groups across the country collect data on water quality, air quality, biodiversity, climate change, and so much more in their own communities. The Citizen Science Network ([www.citizenscience.ca](http://www.citizenscience.ca)) maintains an online database of citizen science initiatives across Canada and throughout Ontario.*

### Examples of Efforts to Improve Understanding (Appendix A.6)

- Anishinabek/Ontario Fisheries Resource Centre
- Atlas of the Breeding Birds of Ontario
- Bird Studies Canada
- Forest Ecosystem Science Co-operative
- Mushkegowuk Environmental Research Centre
- Natural Heritage Information Centre
- Science at the Ontario Ministry of Natural Resources
- Wildlife Conservation Society Canada

### Profile:

#### Profile: Watershed Report Cards

*Several of Ontario's conservation authorities have developed state of the watershed reports (also known as watershed report cards) as a means of assessing and reporting on surface water and groundwater quality, forest conditions, and ecosystem health, and providing a summary of features and action plans for their watersheds. The report cards use a standardized set of environmental indicators that measure watershed health, as well as a scoring scheme to encourage consistency. These reports provide the public with easily understood environmental information and demonstrate accountability to stakeholders. Two examples of conservation authority watershed report cards using Conservation Ontario standards can be found at the websites of Credit Valley Conservation ([www.creditvalleycons.com/bulletin/resources.htm](http://www.creditvalleycons.com/bulletin/resources.htm)) and the Upper Thames River Conservation Authority ([www.thamesriver.on.ca](http://www.thamesriver.on.ca)).*



Photo: John Butterill

## 4.7 Contributing Policies and Legislation

Ontario has a foundation of legislation and policy on which to base actions to protect biodiversity and sustainably use biological assets. The Ontario government continues to review and improve policies and programs that contribute to biodiversity conservation.

### Examples of Contributing Policies and Legislation (Appendix A.7)

- *Aggregate Resources Act, 1990*
- *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem*
- *Conservation Authorities Act, 1990*
- *Crown Forest Sustainability Act, 1994*
- *Environmental Assessment Act, 1990*
- *Environmental Protection Act, 1990*
- *Fish and Wildlife Conservation Act, 1997*
- *Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement*
- *Lakes and Rivers Improvement Act, 1990*
- *Ontario Water Resources Act, 1990*
- *Public Lands Act, 1990*

This interim report provided an overview of the state of biodiversity in Ontario, the threats to it, and examples of conservation actions being undertaken. Improving our understanding of biodiversity and the challenges and opportunities facing Ontario is an important step towards success.

The cost of losing Ontario's rich biodiversity is immeasurable, and Ontarians are working hard on many fronts to address the challenges inherent in conserving biodiversity. The examples provided in section 4 of this report illustrate this. Despite the various initiatives presented in this report, considerable work still needs to be done to conserve Ontario's biodiversity in perpetuity. This requires ongoing collaborative efforts among municipal, provincial, and federal governments, community groups, non-governmental organizations, Aboriginal communities, academics, individuals, and others. In addition, continued contributions from each and every Ontarian will be needed. Given the complexity of the issues surrounding biodiversity, there will always be more to learn and do in order to protect what sustains us. To find out what you can do to help conserve biodiversity, contact any of the organizations listed in this report.



Photo: Peter Uhlig



# Organizations, Programs, and Initiatives That Contribute Towards the Conservation of Ontario's Biodiversity

*While many organizations, programs, and initiatives contribute towards the conservation of Ontario's biodiversity, it is impossible to list all of them in this report. The listing below is meant to be representative, not comprehensive.*

## A.1 Examples of Biodiversity Education and Awareness Initiatives

### Biodiversity Education and Awareness Network

The Biodiversity Education and Awareness Network, a group representing non-government and government organizations, is working to make Ontarians more aware of issues surrounding biodiversity and create an understanding of the benefits of biodiversity to natural and human systems. The Biodiversity Education and Awareness Network was created pursuant to the publication of *Ontario's Biodiversity Strategy* and is currently developing an implementation plan for biodiversity education and awareness, including a biodiversity module outline for the college system's landscape/horticultural apprenticeship program.

### Evergreen

Evergreen<sup>79</sup> is a national not-for-profit environmental organization with a mandate to bring nature to our cities through naturalization projects. Evergreen motivates people to create and sustain healthy, natural outdoor spaces and gives them the practical tools to be successful through its three core programs:

- **Learning Grounds** – transforming school grounds;
- **Common Grounds** – conserving publicly accessible land;
- **Home Grounds** – transforming the home landscape.

### Ontario EcoSchools

Ontario EcoSchools<sup>80</sup> is an environmental education program that addresses how schools are run and what students learn. It has been designed collaboratively by school boards to incorporate environmental education, and environmentally responsible action in the school setting. Student success – in both academics and positive contributions to society – is the focus of Ontario EcoSchools.

The purposes of this project are to:

- Provide teachers with environmental education resource units for elementary and secondary grades, based on the Ontario curriculum;
- Provide guides that promote taking individual action to reduce greenhouse gas emissions;
- Align what is taught in classrooms with school operations (curriculum and facilities);
- Save money, reduce our impact on the environment (e.g., conserve energy and minimize waste), and provide related opportunities for learning and action outside the classroom to reinforce classroom education.

### Ontario Federation of Anglers and Hunters

Since 1928, the Ontario Federation of Anglers and Hunters<sup>81</sup> (OFAH), with 82,000 members and 655 member clubs across Ontario, has been a major proponent of fish and wildlife conservation. OFAH is dedicated to conserving Ontario's precious fish and wildlife populations, protecting woodland and wetland habitat, and promoting outdoors education. OFAH conservation programming includes elk and wild turkey restoration, Atlantic salmon restoration, the OFAH/Toronto Sportmen's Show, Ringwood Fish Culture Station, the Community Stream Stewardship Program, and the OFAH/Ontario Ministry of Natural Resources Invading Species Awareness Program, as well as involvement in projects and initiatives with other government and non-government partners. OFAH offers award-winning education programs for all age groups, including the youth-oriented Get Outdoors camps and conferences, Tackle Share,

Family Fishing Weekends, hunter education courses, seminars about wild turkeys, and women's outdoor weekends.

## Ontario Forestry Association

The Ontario Forestry Association<sup>82</sup> is a not-for-profit, registered charity dedicated to raising awareness and understanding of all aspects of Ontario's forests and to developing commitment to stewardship of forest ecosystems. The Ontario Envirothon Program,<sup>83</sup> a program of the Ontario Forestry Association, reaches approximately 5,000 high school students in 24 regions of the province annually. The 2008/09 program, the theme of which is "Biodiversity in a Changing World," will allow the students to explore the vast diversity in Ontario, including the variety of forest, wildlife, and aquatic species. The program gives students the knowledge needed to help them understand nature and their place in it, and arms them with the skills to become future environmental leaders. Envirothon sponsors include the Government of Ontario, Toronto Hydro, Trees Ontario Foundation, Ontario Power Generation, TD Friends of the Environment Foundation, and Canadian Wildlife Federation.

## A.2 Examples of Stewardship Promoting Initiatives

### Alternative Land Use Services

Rural lands contribute significantly to the ecosystem goods and services that biodiversity provides. Alternative Land Use Services<sup>84</sup> (ALUS) is a farmer-developed, farmer-driven pilot project to promote conservation on agricultural lands. ALUS empowers farmers to design and deliver environmental solutions in their communities. Under ALUS, farmers receive payments to produce environmental services from their land – services that provide cleaner air, a secure supply of clean water, improved biodiversity, and carbon sequestration – in addition to the crops and livestock farmers normally grow. The Norfolk County ALUS pilot project, led by the Norfolk Federation of Agriculture and involving Ontario Stewardship, the Norfolk Land Stewardship Council, and other partners, was officially launched on September 20, 2007 as a pilot project over three growing seasons.

## Community Fisheries and Wildlife Involvement Program

The Community Fisheries and Wildlife Involvement Program<sup>85</sup> (CFWIP) provides opportunities for Ontarians to participate in hands-on fish and wildlife management and conservation activities. CFWIP funds volunteer projects that benefit fish and wildlife in the province and improve opportunities for outdoor recreation. Over the past 25 years, thousands of volunteers have helped to conserve biodiversity with financial support and technical advice from the CFWIP. CFWIP has involved as many as 33,000 volunteers in a year, and currently averages about 24,000, doing about 575 projects. Types of projects have included:

- Creating or enhancing habitat (e.g., nesting structures, food and cover plantings, riparian and wetland structural enhancements, livestock-exclusion fencing, inventory);
- Population enhancements (e.g., fish culture, especially walleye and trout; re-introductions, such as peregrines, wild turkey, and elk);
- Monitoring and assessment of wildlife populations;
- Stocking and culture (e.g., fish, wild turkeys).

## Conservation Land Tax Incentive Program

The Conservation Land Tax Incentive Program<sup>86</sup> offers a reduction in property taxes to landowners who agree to protect the natural heritage features that the Ontario Ministry of Natural Resources identifies on their land. Over 16,480 properties were registered in the Conservation Land Tax Incentive Program in 2008.<sup>87</sup>

## Eastern Ontario Model Forest Private Woodlot Certification

In the Eastern Ontario Model Forest Private Woodlot Certification<sup>88</sup> project, woodlot owners can work together with other certified landowners, manufacturers, and retailers to create market- and cost-sharing opportunities that can increase their revenues from the sale of certified forest products.

## Federation of Ontario Cottagers' Associations, Inc.

For over 45 years, the Federation of Ontario Cottagers' Associations<sup>89</sup> has encouraged and supported the stewardship of Ontario's shoreline communities. Representing 550 community volunteer groups, with over 50,000 waterfront property owners, the Federation of Ontario Cottagers' Associations provides a pivotal leadership role protecting Ontario's biodiversity through the Docktalk landowner contact program and many special events delivered in partnership with local members and provincial and federal resource agencies.

## Managed Forest Tax Incentive Program

The Managed Forest Tax Incentive Program<sup>91</sup> offers a reduction in property taxes to landowners of forested land who prepare a plan and agree to be good stewards of their property. In 2007, there were 11,077 properties registered in the Managed Forest Tax Incentive Program, representing 777,327 hectares.

## Ontario Stewardship Program

The Ontario Stewardship Program<sup>92</sup> is a community-based environmental program of the Ontario Ministry of Natural Resources that was initiated in 1995. The strength of the program lies in its community stewardship councils, distributed originally across southern Ontario and now being established in communities across the north. Councils are made up of local landowners, resource users, and interest group representatives who carry out projects based on community priorities. Through the Ontario Stewardship Program, more than 1,500 hectares of wetlands and headwater areas and more than 40 kilometres of shoreline have been restored on private land. In addition, about 1.2 million trees have been planted on private land, and more than 150,000 people have attended educational events.

## Species at Risk Stewardship Fund

The Species at Risk Stewardship Fund<sup>90</sup> is an annual granting program providing \$18 million over four years beginning in the 2007-2008 fiscal year to encourage and support public stewardship activities. The fund is open to individuals and groups across the province including landowners, farmers, Aboriginal peoples, education and research institutions, conservation organizations,

industries, municipalities, stewardship councils, and others who undertake eligible protection and recovery activities.

## A.3 Examples of Working Together Across Resource Sectors

### Aggregates

Aggregates include any combination of sand, gravel, or crushed stone in a natural or processed state. They are used in the construction of highways, dams, and airports, as well as residential, industrial, and institutional buildings. They are also critical ingredients in a number of manufactured products, such as glass, coated paper, paint, and pharmaceuticals. In 2006, there were 2,787 licensed aggregate sites on private land in Ontario, and 3,453 aggregate permits were issued on Crown land. About 85 percent of Ontario's aggregate production takes place in southern Ontario, where the demand is highest. Aggregate extraction is licensed under the *Aggregate Resources Act, 1990*. Among the objectives of the Ontario Ministry of Natural Resources' aggregate management program is minimizing adverse impacts of aggregate operations on the environment and contributing to ecological sustainability by administering the *Aggregate Resources Act, 1990*. The *Aggregate Resources Act, 1990* requires the rehabilitation of all aggregate sites. The operational standards contained in the *Aggregate Resources of Ontario Provincial Standards* set out minimum rehabilitation requirements. These requirements may be varied on a site-specific basis to achieve higher quality rehabilitation and to meet objectives such as: the restoration of a site to its former use or condition; achieving compatibility with surrounding land uses, including aesthetics; enhancing agricultural productivity; encouraging biodiversity; meeting the requirements of the Oak Ridges Moraine Conservation Plan; and meeting the requirements of the Greenbelt Plan.

### Agriculture

Environmental management is an important component of agriculture. Agricultural Groups Concerned about Resources and the Environment (AGCARE) is a coalition of agricultural groups that represents Ontario's 45,000 growers of field and horticultural crops. The organization provides science- and research-based information and policy initiatives on pesticide use, crop biotech-

nology developments, nutrient management, and other related environmental issues surrounding field and horticultural crop production in Ontario. Agricultural pesticide use decreased by 52 percent from 1983 to 2003.<sup>93</sup> Under the *Pesticides Act, 1990*, only certified growers or licensed exterminators may buy and use pesticides classified as persistent, highly toxic chemicals. To become certified growers, farmers must complete a grower pesticide certification course and pass an exam. Nutrient management planning is a best-management practice that aims to optimize crop yield and quality, minimize fertilizer costs, and protect soil and water. It requires that the right amount and type of fertilizer be applied at the right place and at the right time, such that the amount of fertilizer used is minimized. In addition, environmental farm plans, agroforestry, and organic agriculture practices are helping to improve environmental conditions on farms. Over the past 30 years, no-till crop production systems have led to increased soil conservation. In a no-till system, fields are left almost undisturbed and dead plant material remains on the soil. The amount of agricultural land in Ontario prepared using no-till systems increased from an estimated 717,449 hectares in 2001 to an estimated 843,215 hectares in 2006.<sup>94</sup>

## Forestry

Forest management in Ontario has evolved from a primary focus on timber production towards a more ecological approach that considers all forest values. Sustainable forest management – which attempts to meet current demand while maintaining forest productivity and biodiversity in perpetuity – has been legally mandated in Ontario under the *Crown Forest Sustainability Act, 1994*. Under the act, the Ontario Ministry of Natural Resources provides a series of manuals and guides to help the forest industry plan and manage forests sustainably. Forest management planning is done under a directive to maintain biodiversity, in part by emulating natural disturbances and landscape patterns. Species at risk, their habitat, and natural heritage features are given special consideration. The Ontario Ministry of Natural Resources, the forest industry, and non-government organizations have developed forest management guidelines such that harvesting practices emulate natural disturbances. Forest certification confirms Ontario's stringent forestry framework and also provides competitive opportunities for Ontario's forest industry in global marketplaces. Forest companies

holding sustainable forest licences in Ontario are to attain forest certification to a standard acceptable to the Minister of Natural Resources. The standards of the Canadian Standard Association, the Forest Stewardship Council, and the Sustainable Forestry Initiative program are acceptable forest certification standards. As of November 2007, 24.7 million hectares of licensed Crown forest had been certified in Ontario. The Ontario Forest Industries Association plays an important role in the development and maintenance of a regulatory system that provides for the sustainable use of Ontario's renewable forest resources.

## Great Lakes

The Joint Strategic Plan for the Management of Great Lakes Fisheries<sup>95</sup> was developed by the Great Lakes Fishery Commission and is supported by 15 Canadian and U.S. agencies involved in fisheries management in the Great Lakes basin. The goal of the Joint Strategic Plan for the Management of Great Lakes Fisheries is to secure fish communities and to provide from these communities an optimum contribution of fish, fishing opportunities, and associated benefits to meet our needs for food, recreation, cultural heritage, employment and income, and a healthy aquatic ecosystem.

## Mining

Mineral resources are not renewable in the traditional sense, but the practices used to extract these resources can be sustainable. The environmental performance of Ontario's mining industry has shown improvement over the past several decades, given the industry's focus on going beyond regulatory requirements through the implementation of environmental management systems, best practices, and technologies. One of the goals of the Ontario Mining Association is to seek out, promote, and share best practices, including those aimed at preserving biodiversity, to ensure the protection of the natural resources on which the industry and all Ontarians depend. Ontario Mining Association members invest over \$100 million annually in environmental protection and improvement. In addition, they are involved in ongoing voluntary efforts to raise money for rehabilitation of historical mine sites in Ontario, where the provincial government is the sole holder of surface and mineral rights. Funding from the industry contributed to the successful remediation and revegetation of the tailings dam at the Kam Kotia site near Timmins,<sup>96</sup> and similar projects are being



planned in partnership with the Ontario Ministry of Northern Development and Mines. Additionally, the *Mining Act, 1990* regulates prospecting, staking, and exploration for the development of mineral resources to minimize the impact of these activities on the environment and to ensure the rehabilitation of mining lands in Ontario for future land use.

## Renewable Energy

The increasing energy demand from our growing population and economy, combined with the provincial government's commitment to phase out coal-fired generation by 2014, leaves Ontario with a projected energy supply gap of 10,000 megawatts by 2025. Renewable energy is expected to play a critical role in meeting the province's electricity demand. The Ontario government has set a target to produce 10 per cent of the province's electricity from renewable sources by 2010. Since 2004, 43 new renewable energy projects have been initiated (including wind, hydroelectric, bioenergy, and solar photovoltaic projects) and are helping to build a sustainable energy future for Ontario.

While the use of renewable energy reduces greenhouse gas emissions and can improve air quality, production of renewable energy can also have negative impacts on wildlife. Wildlife habitat can be lost when land is cleared for wind farms, direct mortality of species (i.e., birds, bats, and fish) is associated with wind- and water-powered turbines, and waterpower developments can result in habitat fragmentation. These concerns are being addressed through the completion of environmental assessments and waterpower management plans that help to ensure that Ontario's waterpower resources are managed in an economically and ecologically sustainable way. In addition, the Canadian Environmental Choice Program offers Ecologo certification for renewable energy generators with low environmental impacts.

## A.4 Examples of Initiatives Integrating Biodiversity Conservation into Land-Use Planning

### Greenbelt Act, 2005

The *Greenbelt Act, 2005*<sup>97</sup> protects environmentally sensitive land and agricultural land in the Greater Golden Horseshoe – a 150-kilometre-long, 50-kilometre-wide zone along Lake Ontario from Niagara Falls to Oshawa – from urban development and sprawl. The area covered by the *Greenbelt Act, 2005* also includes the Niagara Escarpment Plan Area and the Oak Ridges Moraine Conservation Plan Area, although it defers to the specific policies of those plans for those two areas.

### Greenbelt Plan

The Greenbelt<sup>98</sup> extends 325 kilometres from the eastern end of the Oak Ridges Moraine to the Niagara River in the west. The Greenbelt includes about 404,686 hectares of newly protected land, bringing the total area of land under protection in the Greater Golden Horseshoe to 728,434 hectares – an area larger than Prince Edward Island – and providing safe habitat for 66 species at risk.<sup>99</sup> The Greenbelt Plan<sup>100</sup> sets strict limits on urban boundaries. Areas not currently zoned for urban development will be protected. The plan also delivers policies and guidelines for how lands can be used, including policies on agricultural protection, environmental protection, recreation and tourism, rural communities, infrastructure, and natural resources.

## Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe,<sup>101</sup> prepared under the *Places to Grow Act, 2005*, is a framework for implementing the Government of Ontario's vision for building stronger, prosperous communities by better managing the projected growth of 3.7 million people in this region by 2031. This plan recognizes the realities facing our cities and smaller communities, and acknowledges what governments can and cannot influence. The plan guides decisions on a wide range of issues – transportation, infrastructure planning, land-use planning, urban form, housing, natural heritage, and resource protection – in the interest of promoting economic prosperity. It also creates a clearer environment for investment decisions and will help secure the future prosperity of the Greater Golden Horseshoe.

## Places to Grow Act, 2005

The *Places to Grow Act, 2005*<sup>107</sup> allows the Ontario government to designate any geographic area of the province as a growth plan area and to develop a growth plan in consultation with local officials and stakeholders. The act enables the government to plan for population growth, economic expansion, and the protection of the environment, agricultural lands, and other valuable natural resources in a coordinated and strategic way.

## Niagara Escarpment Planning and Development Act, 1990

The purpose of the *Niagara Escarpment Planning and Development Act, 1990*<sup>102</sup> is to provide for the maintenance of the Niagara Escarpment and land in its vicinity, substantially as a continuous natural environment, and to ensure that only development that is compatible with that natural environment occurs.

## Niagara Escarpment Plan

The United Nations Educational, Scientific and Cultural Organization named the Niagara Escarpment a World Biosphere Reserve in 1990 to recognize the escarpment as an internationally significant ecosystem for its special environment and unique environmental plan, which the Niagara Escarpment Commission administers. The Niagara Escarpment Plan<sup>103</sup> serves to protect unique ecological and historic areas, and maintain and enhance the quality and character of natural streams and water supplies. It also seeks to maintain and enhance the open landscape character of the escarpment through compatible farming or forestry and to preserve the natural scenery while providing opportunities for outdoor recreation and public access. The plan provides for the establishment of a Niagara Escarpment Parks and Open Space System (now with 131 parks and protected areas) and the Bruce Trail. The plan also serves to support municipalities in the Niagara Escarpment Plan Area as they work to ensure that all new developments are compatible with the land use policies in the Niagara Escarpment Plan.

## Oak Ridges Moraine Protection Act, 2001; Oak Ridges Moraine Conservation Act, 2001; and Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine is a prominent geological landform located just north of Toronto that extends 160 kilometres from the Trent River to the Niagara Escarpment. The moraine encompasses 190,000 hectares of land and water. The *Oak Ridges Moraine Protection Act, 2001*<sup>104</sup> and the *Oak Ridges Moraine Conservation Act, 2001*<sup>105</sup> serve to protect the ecological and hydrological integrity of the Oak Ridges Moraine Area, preserve agricultural land, and focus development in approved settlement areas. The purpose of the *Oak Ridges Moraine Conservation Plan, 2002*<sup>106</sup> is to provide land-use and resource-management planning direction to provincial agencies, municipalities, municipal planning authorities, landowners, and other stakeholders on how to protect the ecological and hydrological features and functions of the moraine.

## Planning Act, 1990

The *Planning Act, 1990*<sup>108</sup> guides land-use planning for private land and municipally controlled lands in Ontario. The Ontario Ministry of Natural Resources maintains a strong role in municipal planning to promote the protection and proper management of natural resources, and to ensure that planning and development activities in areas adjacent to Crown land and Crown resources do not hinder the ministry's ability to manage these resources on behalf of the Province of Ontario.

## Provincial Parks and Conservation Reserves Act, 2006

The recently updated *Provincial Parks and Conservation Reserves Act, 2006*<sup>109</sup> provides legislation for the permanent protection of provincial parks and conservation reserves, and makes ecological integrity a first priority when planning and managing within these areas.

## Provincial Policy Statement, 2005

The Provincial Policy Statement<sup>110</sup> provides policy direction on matters relating to land-use planning that are of provincial interest. It is issued under the authority of Section 3 of the *Planning Act, 1990* and applies to all applications, matters, and proceedings commenced on or after March 1, 2005. The Provincial Policy Statement recognizes the complex interrelationships among economic, environmental, and social factors in planning. It includes enhanced policies on key issues that affect our communities, such as the efficient use and management of land and infrastructure; protection of the environment and resources; and ensuring appropriate opportunities for employment and residential development, including support for a mix of uses.

## A.5 Examples of Prevention Initiatives

### A.5.1 Examples of Efforts to Reduce Pollution

#### Canadian Centre for Pollution Prevention

The Canadian Centre for Pollution Prevention<sup>111</sup> is a not-for-profit, non-government organization that encourages actions that avoid or minimize the creation of pollution and waste, and actions that foster a healthier environment and a sustainable society. The centre's core business is the dissemination of pollution-prevention information, but it also provides education and outreach, training, and event management.

#### Clean Water Act, 2006

The *Clean Water Act, 2006*<sup>112</sup> ensures that communities are able to protect their municipal drinking-water supplies by developing collaborative, locally driven, science-based protection plans. Communities will identify potential risks to local water sources – lakes, rivers, and aquifers – and take action to reduce or eliminate these risks.

#### Drive Clean

The Drive Clean<sup>118</sup> program requires emissions testing for vehicles. Vehicle emissions are a major contributor to smog in Ontario, especially in densely populated areas, and contribute to acid rain and global warming. While improvements in the design of vehicle exhaust systems have reduced pollution from individual vehicles, total emissions are expected to increase because of the growing number of vehicles on the road. Ontario's Smog Patrol supports the Drive Clean program by inspecting trucks, buses, and light-duty vehicles suspected of emitting excessive exhaust smoke or of having emissions-control equipment that has been tampered with or removed. From 1999 to 2003, the program reduced smog-causing emissions from light-duty vehicles in the southern Ontario smog zone by more than 81,200 tonnes. It is also estimated that, over the same period, Drive Clean reduced carbon monoxide emissions by over 690,000 tonnes and carbon dioxide emissions by over 100,000 tonnes.

## Great Lakes Binational Toxics Strategy

The Great Lakes Binational Toxics Strategy<sup>113</sup> established a collaborative process by which Environment Canada and the U.S. Environmental Protection Agency, in consultation with other federal departments and agencies, Great Lakes states, the Province of Ontario, and Aboriginal communities, are working to eliminate persistent toxic substances resulting from human activity in the Great Lakes Basin. The aim is to protect the health and integrity of the Great Lakes ecosystem.

## Great Lakes Water Quality Agreement

The purpose of the Great Lakes Water Quality Agreement<sup>114</sup> is to restore and maintain the chemical, physical, and biological integrity of the waters of that ecosystem. The agreement enabled the development of programs, practices, and technology that improve our understanding of the Great Lakes basin ecosystem and eliminate or reduce the discharge of pollutants into the Great Lakes system.

## Lakewide Management Plans in the Great Lakes Region

To meet their commitments under the Great Lakes Water Quality Agreement, the U.S. and Canadian governments committed to developing and implementing Lakewide Management Plans (LaMPs)<sup>115</sup> for open lake waters in the Great Lakes. LaMPs identify critical pollutants that affect beneficial uses of the lakes and present strategies, recommendations, and policy options to restore those beneficial uses. LaMPs have been developed for Lakes Erie, Michigan, Ontario, and Superior.

## Municipal/Industrial Strategy for Abatement

With the signing of the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem, Ontario committed to the management of persistent toxic substances. The Municipal/Industrial Strategy for Abatement<sup>116</sup> program is a provincial response; it addresses levels of persistent toxic substances in industrial direct discharges entering Ontario's waterways and focuses on nine industrial sectors: petroleum, pulp and paper, metal mining, industrial minerals, metal casting, organic chemical manufacturing, inorganic chemical, iron and steel, and electric power generation.

## Nutrient Management Act, 2002

The *Nutrient Management Act, 2002*<sup>117</sup> provides a comprehensive nutrient management framework, including clear environmental protection guidelines, for Ontario's agricultural industry, municipalities, and other generators of materials containing nutrients. The act addresses land-applied materials containing nutrients and includes provisions for the development of new standards for all such materials, a proposal to ban the land application of untreated sewage over a five-year period, and proposed new requirements, such as the review and approval of nutrient management plans, the certification of land applicators, and a new registry system for all land applications.

## Remedial Action Plans

The Great Lakes Remedial Action Plan Program was created in 1987 as part of the Great Lakes Water Quality Agreement. Remedial action plans<sup>119</sup> (RAPs) guide remediation and restoration efforts. A RAP has been developed for each Area of Concern (areas that have experienced environmental degradation) within the Great Lakes basin. There are currently 10 Areas of Concern in Ontario. RAPs have three stages: identifying the severity and underlying causes of environmental degradation; outlining goals and recommended actions that will lead to the restoration and protection of ecosystem health; and implementing the recommended actions and monitoring the progress of restoration and protection efforts to ensure that local goals have been met.



## A.5.2 Examples of Efforts to Address Climate Change

### Go Green Ontario

The Go Green Ontario<sup>120</sup> website contains information about Ontario's Climate Change Plan and details on incentive programs offered by the federal government, provincial government, municipal governments, and private partners to help Ontarians "go green," save money, and fight climate change.

### Ontario's Greenhouse Gas Targets

The Government of Ontario's plan to fight climate change includes setting targets to reduce greenhouse gas emissions.<sup>121</sup> The intent is to meet the targets through many different programs, several of which are briefly described below:

- Investment is being made in renewable energy sources: 690 new wind turbines are up and running or in the works, up from just 10 in 2003.
- A Renewable Standard Offer provides a guaranteed price for electricity produced by small-scale wind, biomass, or small hydroelectric projects. As of August 2007, 140 Standard Offer Contracts have been executed by the Ontario Power Authority, representing over 595 megawatts of renewable energy. In the nine months since the Standard Offer Contract program began, 22 projects representing 23 megawatts of renewable energy have become operational.
- Inefficient incandescent light bulbs will also be banned in Ontario, beginning in 2012. When fully implemented, this ban could save up to six million megawatt-hours of electricity.
- Changes have been made in the Ontario Building Code to introduce energy-efficiency requirements that, over the next seven years, will save enough energy to power 380,000 homes and reduce greenhouse gas emissions by about five megatonnes, the equivalent of taking 250,000 cars off the road.

## A.5.3 Examples of Efforts to Protect and Restore Habitat

### Canadian Parks and Wilderness Society Wildlands League

The Wildlands League,<sup>122</sup> a chapter of the Canadian Parks and Wilderness Society, advocates for lasting conservation solutions in Ontario. Specifically, the league campaigns to expand full protection to all parks and protected areas; advances more environmentally sustainable practices in logging, mining, hydro development, and transportation; and promotes conservation-based land-use planning to improve conservation outcomes, deliver long-term community economic sustainability, and provide a guiding framework for development.

### Ducks Unlimited Canada

Ducks Unlimited Canada<sup>123</sup> works to conserve, restore, and manage wetlands and associated habitats for Canada's waterfowl by conserving habitats, conducting wetland and environmental research, and delivering education programs. Ducks Unlimited and its partners, including more than 1,700 private landowners, have conserved over 364,217 hectares of wetland habitat in Ontario. During the next six years, Ducks Unlimited is aiming to protect and restore over 7,284 hectares of wetland habitat, conserve 70,820 hectares in priority landscapes across southern Ontario, and manage over 24,281 hectares of wetland habitat so that their ecological function is maintained while the needs of conservation partners are met.

### Eastern Habitat Joint Venture

The Eastern Habitat Joint Venture<sup>127</sup> (EHJV) in Ontario was established in 1986 to implement the provincial programs of the North American Waterfowl Management Plan<sup>128</sup> which focuses on the conservation of waterfowl and their wetland ecosystem habitats. More recently, the EHJV has expanded its mission to include the objectives of the North American Bird Conservation Initiative, a program that works to conserve all bird species and the habitats that support them. Since 1986, through the efforts of all partners, over 200,000 hectares of wildlife habitat have been conserved. Additionally, over \$130 million has been spent to conserve, enhance, and protect wetland habitats in the province. Canadian

partners include the Nature Conservancy of Canada, Ducks Unlimited Canada, Wildlife Habitat Canada, Government of Ontario, and Environment Canada.

## Nature Conservancy of Canada

The Nature Conservancy of Canada<sup>124</sup> (NCC) is a private, not-for-profit land conservation organization. Since 1962, NCC and its partners have helped to conserve close to 809,371 hectares of ecologically significant land nationwide through land donation, purchase, and conservation easement. Since 1988, NCC has been instrumental in establishing a network of conservation data centres across Canada that serve as permanent and dynamic data banks of the native biodiversity of the country. The data they house are used to assign a status ranking (i.e., degree of risk) for species and habitat types in each province. Two recent examples of successful projects in Ontario that have been made possible, in large part, by analyzing this data include the Big Picture Project and the Great Lakes Conservation Blueprint. These projects were the result of a partnership between NCC and the Natural Heritage Information Centre. In both cases, information on the status and distribution of biodiversity was analyzed in order to identify key areas of biodiversity significance. NCC, the Ontario government, and non-government partners use the results of this work to inform conservation-related decisions across Ontario.

## Ontario's Conservation Authorities

Ontario's conservation authorities<sup>125</sup> were created in 1946 through the *Conservation Authorities Act, 1990*.<sup>126</sup> Their primary objectives are to ensure Ontario's lakes, rivers, and streams are properly safeguarded, managed, and restored; to protect, manage, and restore Ontario's woodlands, wetlands, and natural habitat; to develop and maintain programs that will protect life and property from natural hazards; and to provide opportunities for the public to enjoy, learn from, and respect Ontario's natural environment.

## Ontario Nature

Since it was established as the Federation of Ontario Naturalists in 1931, Ontario Nature<sup>129</sup> has been a voice for nature in Ontario. Ontario Nature spearheaded the creation of a wilderness area in Algonquin Provincial Park in 1934, worked towards the creation of the Oak Ridges Moraine Conservation Plan in 2001, assisted in the development of the *Greenbelt Act, 2005* and the Greenbelt Plan in 2005, and advocated for Ontario's original *Endangered Species Act, 1971* and its revision in 2007. Ontario Nature also publishes science-based research for scholars and educational materials for young naturalists as well as the quarterly *ON Nature* magazine. Ontario Nature is sustained by the Nature Network, comprising more than 140 member organizations and 25,000 members and supporters.

## Trees Ontario

Trees Ontario<sup>130</sup> is a not-for-profit corporation committed to the greening of Ontario through tree planting efforts on rural lands and in urban areas. The goal of the organization is to help revitalize Ontario's tree planting efforts and to encourage and coordinate the planting of trees and forests throughout the province. Last spring, Trees Ontario, along with its tree planting agencies in Ontario, including regional conservation authorities and local Stewardship Ontario councils, planted almost three million trees, most in southern Ontario. In August 2007, the Ontario government introduced a program to help fund the planting of 50 million trees across the province by 2020. Trees Ontario has partnered with the Ontario Ministry of Natural Resources as the program delivery agent for this initiative and will work with local tree planting agencies in Ontario to plan and implement this initiative as part of its ongoing tree planting programs.

#### A.5.4 Examples of Efforts to Deal with Invasive Species

##### Canadian Aquatic Invasive Species Network

The Canadian Aquatic Invasive Species Network<sup>131</sup> was formed in 2006 and is made up of specialists from many Canadian universities who work in cooperation with federal and provincial government agencies, the shipping and aquaculture industries, and the Ontario Federation of Anglers and Hunters. The network is conducting the first comprehensive study in Canada to examine and identify existing invasions with the goal of predicting and preventing new aquatic invasive species from harming Canada's valued aquatic ecosystems. The network's research will focus on three themes:

- Assessing the vectors and pathways that deliver aquatic invasive species to Canada's ecosystems;
- Identifying key factors that affect establishment success of aquatic invasive species;
- Developing risk assessment models that can be used in aquatic invasive species prevention strategies.

##### Forest Health Program

The Ontario Ministry of Natural Resources' Forest Health Program monitors and reports on the major factors affecting forest health and undertakes control programs, research, and education. The ministry also supports Forest Genetics Ontario, a forest stakeholder cooperative that undertakes genetic resource management, research, and information-sharing activities.

##### Invading Species Awareness Program

In 1992, the Ontario Federation of Anglers and Hunters and the Ontario Ministry of Natural Resources established the Invading Species Awareness Program.<sup>132</sup> The objectives of the program include raising public awareness of invasive species, monitoring the spread of invasive species in Ontario waters, and conducting research on the impacts of invasive species.

#### A.5.5 Examples of Efforts to Protect Species at Risk

##### Endangered Species Act, 2007

With the passage of the *Endangered Species Act, 2007*,<sup>133</sup> Ontario became a North American leader in the protection and recovery of species at risk. The new act provides stronger protection for species at risk; for example, threatened species are now protected, as are the habitats of threatened and endangered species. Recovery strategies are mandatory for both endangered and threatened species.

##### Species Recovery Strategies

The Ontario Ministry of Natural Resources is working with many partners and individuals on recovery projects across Ontario. Currently, about 80 recovery teams are coordinating projects and plans to improve the status of endangered and threatened species. Recovery strategies are under development for more than 80 species, and the government has approved an additional 29 strategies for 35 species. Approved strategies for species listed under the federal *Species at Risk Act, 2003* are posted on the federal government's *Species at Risk Act* Public Registry website.<sup>134</sup> The Ontario Ministry of Natural Resources posts strategies for Ontario species not listed under Canada's *Species at Risk Act, 2003* on the provincial Environmental Registry website.

#### A.5.6 Examples of Genetic Diversity Conservation Initiatives

##### Biodiversity Institute of Ontario

The Biodiversity Institute of Ontario<sup>135</sup> at the University of Guelph houses the Canadian Centre for DNA Barcoding, the world's first organization dedicated to DNA barcode analysis. DNA barcodes are short, standardized gene regions that can be used to identify species. The institute is also home to a major insect collection, a herbarium, and the Limnotron, the world's largest aquatic experimental research facility.

## Forest Gene Conservation Association

The Forest Gene Conservation Association<sup>136</sup> works to promote the importance of the genetic resources of forests in south-central Ontario, with an emphasis on the conservation of genetic diversity of native tree species. In addition to undertaking genetic studies, the Forest Gene Conservation Association runs a seed source certification program and certifies seed collectors.<sup>137</sup>

## Forest Genetics Ontario

Forest Genetics Ontario<sup>138</sup> is a forest stakeholder cooperative that promotes, advocates for, and carries out genetic conservation, genetic resource management, research, and technology transfer and information-sharing activities. The organization undertakes these activities in collaboration with the forest industry, government, scientific and conservation communities, and others.

## Forest Health Monitoring

Since the 1930s, forest health in Ontario has been monitored through a partnership between the Ontario Ministry of Natural Resources and the Canadian Forest Service. Major factors affecting forest health are monitored each year. Annual monitoring detects, identifies, quantifies, assesses, and reports on major forest disturbances such as outbreaks of insects and disease.<sup>139</sup>

## Natural Resources DNA Profiling & Forensic Centre

The Natural Resources DNA Profiling & Forensic Centre<sup>140</sup> is a partnership between the Ontario Ministry of Natural Resources, Trent University, and the Wildlife Forensic DNA Laboratory. The centre undertakes research on natural populations of animals and plants, and the information gathered helps in conserving biodiversity. A number of DNA profiling initiatives are under way on Ontario wildlife species, including caribou, white-tailed deer, elk, wolves, and black bears, as well as on fish through the Fish Genetics and Stock Assessment program.

## Ontario Tree Seed Plant

Ontario Tree Seed Plant<sup>141</sup> was established in 1923 to process tree cones and supply seed for the province's reforestation program. Staff at the seed plant operates state-of-art equipment to collect high quality coniferous, deciduous, and shrub seeds.

## A.6 Examples of Efforts to Improve Understanding

### Anishinabek/Ontario Fisheries Resource Centre

The Anishinabek/Ontario Fisheries Resource Centre<sup>142</sup> was established to serve as an independent source of information on fisheries assessment, conservation, and management, promoting the value of both Western science and Aboriginal knowledge of the land. In the past six years, the centre has completed over 150 fisheries projects with First Nations and government agencies across the province, including creel surveys, index netting projects, tagging studies, fish habitat inventories, and synthesis of existing fisheries data for the purpose of formulating resource management plans.

### Atlas of the Breeding Birds of Ontario

The Atlas of the Breeding Birds of Ontario<sup>147</sup> is a collaborative monitoring project that involves the Ontario Ministry of Natural Resources, Canadian Wildlife Service, Ontario Nature, Bird Studies Canada, and the Ontario Field Ornithologists. It is a volunteer-based project to gather data on the distribution of all breeding bird species in Ontario. The compilation of the two editions of the atlas is one of the largest collaborative monitoring efforts ever to have occurred in the province.

### Bird Studies Canada

Bird Studies Canada<sup>143</sup> is a not-for-profit organization built on the contributions of volunteer citizen scientists. The mission of Bird Studies Canada is to advance the understanding, appreciation, and conservation of wild birds and their habitats. Data from volunteer surveys and target research programs are used to identify significant population changes and help direct conservation planning.



## Forest Ecosystem Science Co-operative

Forest Ecosystem Science Co-operative, Inc.<sup>144</sup> is a not-for-profit organization that facilitates research related to forest sustainability. Working together, members (including representatives from the forest industry, Ontario Ministry of Natural Resources, Canadian Forest Service, Confederation College, and others) and project partners (e.g., consulting firms) maintain a large network of permanent plots as benchmarks of natural forest condition. Projects run in conjunction with universities address habitat requirements of American marten, northern goshawk, and woodland caribou; water quality; the ability of silviculture to emulate natural disturbances; and the relationship between forestry and wetland birds.

## Mushkegowuk Environmental Research Centre

The Mushkegowuk Environmental Research Centre<sup>145</sup> (MERC) is a First Nation-owned independent agency that undertakes and coordinates research relating to environmental and natural resources, with a focus on the western James Bay basin in Ontario. MERC supports the seven First Nations that belong to the Mushkegowuk Council: the Attawapiskat, Fort Albany, Kashechewan, Moose Cree, Taykwa Tagamou, Chapleau Cree, and Missanabie Cree. Given the significant industrial activities that have started to move into the northern portion of the territory and the minimal ecological information that has been collected, MERC's mandate is to address environmental information needs, including traditional knowledge on fish, wildlife, water quality, and land management. MERC has an additional focus on providing training opportunities to Mushkegowuk First Nation members. This will help ensure that both the permanent core staff and fieldworkers in the First Nation will have the ability to upgrade their skills and knowledge in fields relevant to the services of the MERC.

## Natural Heritage Information Centre

The Natural Heritage Information Centre<sup>146</sup> was established in 1993 as a joint venture between the Ontario Ministry of Natural Resources, the Nature Conservancy of Canada, and the Natural Heritage League. The Natural Heritage Information Centre tracks priority species and ecological communities to assist in land-use planning and in support of biodiversity conservation programs.

## Science at the Ontario Ministry of Natural Resources

The Ontario Ministry of Natural Resources<sup>148</sup> has a comprehensive science program that includes world-class specialists and researchers working on hundreds of projects across the province. In collaboration with outside partners, the science program supports policy development and field operations and improves our understanding of how to conserve biodiversity, mitigate the effects of climate change, and prevent the loss of species at risk in Ontario.

## Wildlife Conservation Society Canada

Wildlife Conservation Society Canada<sup>149</sup> was incorporated as a conservation organization in Canada in July 2004. Its mission is to conserve biodiversity by improving understanding of and seeking solutions to critical problems that threaten key species and large wild ecosystems throughout Canada. Wildlife Conservation Society Canada staff implement and support comprehensive field studies that gather information on wildlife needs, and then seek to resolve key conservation problems by working with a broad array of stakeholders, including local community members, conservation groups, regulatory agencies, and commercial interests. Staff also provide technical assistance and biological expertise to local groups and agencies that lack the resources to tackle conservation dilemmas.

## A.7 Examples of Contributing Policies and Legislation

### Aggregate Resources Act, 1990

The *Aggregate Resources Act, 1990*<sup>150</sup> lays out the rules and regulations governing the establishment, operation, and closure of pits and quarries on all Crown land and designated private land in Ontario. The act requires progressive and final rehabilitation of land where aggregates have been extracted to ensure minimal impact on the environment.

### Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem

The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem<sup>151</sup> supports the restoration and protection of the Great Lakes. The agreement outlines how the two governments will cooperate and coordinate their efforts to restore, protect, and conserve the Great Lakes basin ecosystem. In 2007, four new goals were identified relating to respecting biodiversity and demonstrating progress towards the sustainability of the Great Lakes basin: to encourage and enhance Great Lakes sustainability to achieve social, economic, and aquatic ecosystem well-being; to improve the water quality in each of the Great Lakes; to conserve and protect aquatic ecosystem diversity, species diversity, and genetic diversity in the Great Lakes; and to reduce the threat of aquatic invasive species to species and aquatic ecosystems in the Great Lakes.

### Conservation Authorities Act, 1990

The *Conservation Authorities Act, 1990*<sup>152</sup> was originally passed in Ontario in 1946 in response to concern from agricultural, naturalist, and sportsmen's groups that the province's natural resources were in an unhealthy state. The act allowed the provincial government and the municipalities of Ontario to join together to form conservation authorities within watersheds. These conservation authorities are tasked with organizing localized programs for natural resources management, including flood control and mitigation, soil erosion reduction, and preservation of wildlife.

### Crown Forest Sustainability Act, 1994

The *Crown Forest Sustainability Act, 1994*<sup>153</sup> is Ontario's key forestry legislation that provides for the sustainability of Crown forests and governs forest management on Crown land. Forest operations in Crown forests are required by law to manage for the long-term health of the forest and to have regard for plant life, animal life, water, soil, air, and social and economic values, including recreational values.

### Environmental Assessment Act, 1990

Ontario's *Environmental Assessment Act, 1990*<sup>154</sup> provides for the protection, conservation, and wise management of Ontario's environment. The act ensures that potential environmental effects are considered and mitigated prior to the implementation of development or other activities.

### Environmental Protection Act, 1990

The purpose of the *Environmental Protection Act, 1990*<sup>155</sup> for Ontario is to provide for the protection and conservation of the natural environment. Key aspects of the act are prohibiting the discharge of contaminants into the natural environment that cause or are likely to cause an adverse effect and prohibiting the transport, storage, use, or display of anything that contains an ozone-depleting substance.

### Fish and Wildlife Conservation Act, 1997

The *Fish and Wildlife Conservation Act, 1997*<sup>156</sup> came into force in 1999, replacing the *Game and Fish Act*. The act allows the Ontario Ministry of Natural Resources to protect and manage a broader range of game species, such as moose, wild turkey, and black bear, and specially protected wildlife species, such as the northern flying squirrel, the peregrine falcon, and the blue-spotted salamander. The act also provides enhanced enforcement capabilities.

## Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement

The Ontario government strengthened protection of Great Lakes basin waters in 2005 by signing a historic agreement with Quebec and the eight Great Lakes states. The Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement<sup>157</sup> establishes a virtual ban on water diversions, a basin-wide environmental standard for the management and regulation of water uses, better conservation measures, and an increased role for science in decision making.

## Lakes and Rivers Improvement Act, 1990

The purpose of the *Lakes and Rivers Improvement Act, 1990*<sup>158</sup> is to manage the use of the waters of Ontario's lakes and rivers and regulate improvements in them, while preserving public rights in or over water; to protect the interests of riparian owners; to manage fish, wildlife, and other natural resources dependent upon them; to preserve natural amenities; and to ensure the sustainability of locations and the nature of improvements.

## Ontario Water Resources Act, 1990

The purpose of the *Ontario Water Resources Act, 1990*<sup>159</sup> is to provide for the conservation, protection, and management of Ontario's waters and for their efficient and sustainable use, and to promote Ontario's long-term environmental, social, and economic well being.

## Public Lands Act, 1990

The *Public Lands Act, 1990*<sup>160</sup> provides the basis for land-use planning on crown lands. The act allows designation of land use, including the creation of conservation reserves and enhanced management areas where specific categories of land use, including wildlife management and biodiversity conservation, can be emphasized.

# End Notes

1. United Nations World Charter for Nature. 1982. Available at: <http://www.un.org/documents/ga/res/37/a37r007.htm>.
2. National Forestry Database Program, Table 8.2: Economic Profile of the Forest Sector, 1990-2006. Available at: [http://www.nfdp.ccfm.org/compendium/data/2007\\_06/tables/tab82\\_f\\_e.php](http://www.nfdp.ccfm.org/compendium/data/2007_06/tables/tab82_f_e.php).
3. Natural Resources Canada. 2007. Canada's Forests. Statistical Data. Ontario, Domestic Economic Impact. Available at: <http://canadaforests.nrcan.gc.ca/statsprofile/on> (choose Data Type: Domestic Economic Impact).
4. Ontario Ministry of Agriculture, Food and Rural Affairs. 2007. Farm Cash Receipts from Farming Operations, Ontario, 2000-2006. Available at: <http://www.omafra.gov.on.ca/english/stats/finance/receipts.htm>.
5. Ontario Ministry of Agriculture, Food and Rural Affairs. 2007. Number of Census Farms and number of Farm Operators, Canada and the Provinces, 2006. Available at: [http://www.omafra.gov.on.ca/english/stats/census/farm\\_canada.htm](http://www.omafra.gov.on.ca/english/stats/census/farm_canada.htm).
6. Ontario Ministry of Northern Development and Mines. 2007. Value of Ontario Mineral Production. Available at: [http://www.mndm.gov.on.ca/mndm/mines/ims/facts/bulletins/production\\_factse.pdf](http://www.mndm.gov.on.ca/mndm/mines/ims/facts/bulletins/production_factse.pdf).
7. Statistics Canada. 2007. Survey of Employment, Payrolls and Hours. CANSIM Table 2810024 Employment (SEPH), unadjusted for seasonal variation, by type of employee for selected industries classified using the North American Industry Classification System (NAICS), annual (persons).
8. Statistics Canada. 2005. Oil and Gas Extraction. Available at: <http://www.statcan.ca/english/freepub/26-213-XIE/26-213-XIE2005000.pdf>.
9. Statistics Canada. 2007. Survey of Employment, Payrolls and Hours. CANSIM Table 2810024 Employment (SEPH), unadjusted for seasonal variation, by type of employee for selected industries classified using the North American Industry Classification System (NAICS), annual (persons).
10. Fisheries and Oceans Canada. 2007. Summary of Canadian Commercial Catches and Values. Available at: [http://www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/sum0407\\_e.htm](http://www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/sum0407_e.htm).
11. Ontario Commercial Fisheries' Association. 2004. Ontario's Commercial Fishery. Available at: <http://www.ocfa.on.ca>.
12. Independent Electricity System Operator (<http://www.theimo.com>) and Ontario Energy Board (<http://www.oeb.gov.on.ca>).
13. Independent Electricity System Operator (<http://www.theimo.com>) and Ontario Energy Board (<http://www.oeb.gov.on.ca>).
14. Research Resolution & Consulting Ltd. 2003. An Economic Profile of Resource-based Tourism in Ontario, 2001. Prepared for: Ontario Ministry of Tourism and Recreation. Available at: <http://www.tourism.gov.on.ca/english/tourism/eco-profile-rbt2001-e.pdf>.
15. Research Resolution & Consulting Ltd. 2003. An Economic Profile of Resource-based Tourism in Ontario, 2001. Prepared for: Ontario Ministry of Tourism and Recreation. Available at: <http://www.tourism.gov.on.ca/english/tourism/eco-profile-rbt2001-e.pdf>.
16. Fisheries and Oceans Canada. 2007. Survey of Recreational Fishing in Canada, 2005. Available at: [http://www.dfo-mpo.gc.ca/communic/statistics/recreational/Canada/2005/REC2005\\_EN\\_20070727.pdf](http://www.dfo-mpo.gc.ca/communic/statistics/recreational/Canada/2005/REC2005_EN_20070727.pdf).
17. Environment Canada. 2000. The Importance of Nature to Canadians: The Economic Significance of Nature Related Activities. Available at: [http://www.ec.gc.ca/nature/pdf/nature\\_e.pdf](http://www.ec.gc.ca/nature/pdf/nature_e.pdf).
18. Ontario Ministry of Natural Resources. 2006. Forest Resources of Ontario 2006. Forest Information Series. ISBN 1-4249-0934-1.
19. Crins, WJ., P.A. Gray, P.W.C. Uhlig, and M.C. Wester. 2007. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ontario Ministry of Natural Resources.
20. Crins, WJ., P.A. Gray, P.W.C. Uhlig, and M.C. Wester. 2007. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ontario Ministry of Natural Resources.
21. Crins, WJ., P.A. Gray, P.W.C. Uhlig, and M.C. Wester. 2007. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ontario Ministry of Natural Resources.
22. Crins, WJ., P.A. Gray, P.W.C. Uhlig, and M.C. Wester. 2007. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ontario Ministry of Natural Resources.



23. Important Bird Areas of Canada. 2007. Available at: <http://www.bsc-eoc.org/iba/site.jsp?siteID=ON001>.
24. Cudmore-Vokey, B. and E.J. Crossman. 2000. Checklists of the Fish Fauna of the Laurentian Great Lakes and Their Connecting Channels. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2550. Fisheries and Oceans Canada. Available at: <http://www.dfo-mpo.gc.ca/Library/254370.pdf>.
25. Environment Canada. 2006. Species at Risk: Northern Riffleshell. Available at: [http://www.speciesatrisk.gc.ca/search/speciesDetails\\_e.cfm?SpeciesID=582](http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=582).
26. Great Lakes Information Network. Great Lakes Facts and Figures. Available at: <http://glin.net/lakes/ref/lakefact.html>.
27. Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC. Available at: <http://www.maweb.org/documents/document.354.aspx.pdf>.
28. E.O. Wilson and D.L. Perlman. 2000. *Conserving Earth's Biodiversity*. Island Press, ISBN 1 55963 773 0.
29. Ontario Ministry of Natural Resources. 2006. Species at Risk in Ontario List. Available at: [http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01\\_131230.html](http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01_131230.html)
30. Ontario Ministry of Natural Resources. 2006. Species at Risk in Ontario List. Available at: [http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01\\_131230.html](http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01_131230.html)
31. Wild Species 2005. The General Status of Species in Canada. Available at: <http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e>.
32. Natural Heritage Information Centre.
33. E.O. Wilson and D.L. Perlman. 2000. *Conserving Earth's Biodiversity*. Island Press, ISBN 1 55963 773 0.
34. Wild Species 2005. Tiger Beetles. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
35. Wild Species 2000. Butterflies. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
36. E.O. Wilson and D.L. Perlman. 2000. *Conserving Earth's Biodiversity*. Island Press, ISBN 1 55963 773 0.
37. E.O. Wilson and D.L. Perlman. 2000. *Conserving Earth's Biodiversity*. Island Press, ISBN 1 55963 773 0.
38. Ontario Ministry of Natural Resources. 2005. Natural Heritage Information Centre Species Information. Available at: <http://nhic.mnr.gov.on.ca/species.cfm>
39. Wild Species 2005. Freshwater Mussels. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
40. Wild Species 2005. Fishes. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
41. Lantry, B., T. Schaner, J. Fitzsimons, J.A. Hoyle, R. O'Gorman, R. Owens, and P. Sullivan. 2007. The offshore benthic fish community. In: *The State of Lake Ontario in 2003*, B.J. Morrison and S.R. LaPan, Eds., Great Lakes Fisheries Commission Special Publication 07-01. Available at: [http://www.gllc.org/pubs/SpecialPubs/Sp07\\_1.pdf](http://www.gllc.org/pubs/SpecialPubs/Sp07_1.pdf).
42. Global Amphibian Assessment. 2006. Available at: <http://www.globalamphibians.org>.
43. Wild Species 2005. Amphibians. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>. The Allegheny Mountain dusky salamander was recently added to the provincial list, making a total of 26 species (Natural Heritage Information Centre).
44. The Institute for Genomic Research Reptile Database. 2008. How Many Species? Available at: <http://www.reptile-database.org>.
45. Wild Species 2005. Reptiles. Available at: <http://www.wildspecies.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
46. Bird Life International. 2008. Avibase: The World Bird Database. Available at: <http://www.bsc-eoc.org/avibase/avibase.jsp?lang=EN&pg=home>.
47. Natural Heritage Information Centre
48. Norris, R., P.P. Marra, T.K. Kyser, T.W. Sherry and L.M. Ratcliffe. 2004. Tropical winter habitat limits reproductive success on the temperate breeding grounds of a migratory bird. *Proceedings of the Royal Society of London* 271:59-64. Available at: [http://www.uoguelph.ca/ib/pdfs/Norris\\_et\\_al\\_2004a.pdf](http://www.uoguelph.ca/ib/pdfs/Norris_et_al_2004a.pdf).
49. Hewett, M. and D.T. McLeod. 2001. Status of the White Pelican on Rainy Lake, Ontario, 2001. Ontario Ministry of Natural Resources. Fort Frances District Report Series No. 50.
50. E.O. Wilson and D.L. Perlman. 2000. *Conserving Earth's Biodiversity*. Island Press, ISBN 1 55963 773 0.

51. Wild Species 2005. Mammals. Available at: <http://www.wild-species.ca/wildspecies2005/search.cfm?lang=e&sec=9>.
52. Ontario Ministry of Natural Resources. 2007. State of Resources Reporting: Wolves in Ontario. Available at: [http://www.mnr.gov.on.ca/en/Business/SORR/2ColumnSubPage/STEL02\\_163450.html](http://www.mnr.gov.on.ca/en/Business/SORR/2ColumnSubPage/STEL02_163450.html)
53. Statistics Canada Census Data. 2007. Population and Dwelling Counts, for Canada, Provinces and Territories, 2006 and 2001 Censuses. Available at: <http://www12.statcan.ca/english/census06/data/popdwell/Table.cfm?T=101>.
54. Ontario Ministry of Finance. 2007. Table 6: Historical and Projected Ontario Population by Census Division, Every Fifth Year. Available at: <http://www.fin.gov.on.ca/english/economy/demographics/projections/2007/demog07t6.html>.
55. Ontario Ministry of Finance. 2007. Table 6: Historical and Projected Ontario Population by Census Division, Every Fifth Year. Available at: <http://www.fin.gov.on.ca/english/economy/demographics/projections/2007/demog07t6.html>.
56. Ontario Ministry of Finance. 2007. Table 6: Historical and Projected Ontario Population by Census Division, Every Fifth Year. Available at: <http://www.fin.gov.on.ca/english/economy/demographics/projections/2007/demog07t6.html>.
57. Environment Canada. 2005. Acid Rain: Effects on Lakes and Birds in Ontario and Beyond. Available at: <http://www.on.ec.gc.ca/wildlife/acidrain/ar1-e.html>.
58. Keller, W., P. Dillon, J. Heneberry, M. Malette and J. Gunn. 2001. Sulphate in Sudbury, Ontario, Canada, lakes: Recent trends and status. *Water, Air and Soil Pollution* 130:793-798.
59. Environment Canada. 2002. Endocrine Disrupting Substances in the Environment. Available at: [http://www.ec.gc.ca/eds/fact/broch\\_e.htm](http://www.ec.gc.ca/eds/fact/broch_e.htm).
60. Donaldson, G.M., J.L. Shutt and P. Hunter. 1999. Organochlorine contamination in bald eagle eggs and nestlings from the Canadian Great Lakes. *Archives of Environmental Contamination and Toxicology* 36:70-80.
61. Environment Canada. 2001. Great Lakes Fact Sheet: Bald Eagle Populations in the Great Lakes Region. Available at: [http://www.on.ec.gc.ca/wildlife/factsheets/pdf/fs\\_bald-eagle\\_e.pdf](http://www.on.ec.gc.ca/wildlife/factsheets/pdf/fs_bald-eagle_e.pdf).
62. Laing, D. 2006. Southern Ontario Bald Eagle Monitoring Program: 2005 Final Report. Prepared for Bird Studies Canada. Available at: <http://www.bsc-eoc.org/library/BAEA2005.pdf>.
63. National Oceanic & Atmospheric Administration. 2007. How Much Carbon is in the Atmosphere? Available at: [http://www.esrl.noaa.gov/gmd/infodata/faq\\_cat-3.html#9](http://www.esrl.noaa.gov/gmd/infodata/faq_cat-3.html#9).
64. "Over 100 Prominent Scientists Warn UN: Attempting To Control Climate Is 'Futile'." *Canada Free Press*, December 13, 2007." Available at: <http://www.canadafreepress.com/index.php/article/963>.
65. Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: The Physical Science Basis*. Available at: <http://www.ipcc.ch/ipccreports/ar4-wg1.htm>.
66. Gray, P.A. 2007. *Climate Change: A Context for Ontario*. Draft report for the Ontario Ministry of Natural Resources.
67. European Space Agency. 2007. Satellites Witness Lowest Arctic Ice Coverage in History. Available at: [http://www.esa.int/esaCP/SEMYYTC13J6F\\_index\\_0.html](http://www.esa.int/esaCP/SEMYYTC13J6F_index_0.html).
68. Environment Canada. 2002. *Environmental Signals: Canada's National Environmental Indicator Series 2003, Technical Supplement: Carbon dioxide concentrations*. Available at: [http://www.ec.gc.ca/soer-ree/English/Indicator\\_series/techs.cfm?tech\\_id=17&issue\\_id=4&rupp=3#techs](http://www.ec.gc.ca/soer-ree/English/Indicator_series/techs.cfm?tech_id=17&issue_id=4&rupp=3#techs).
69. Malcolm, J.R., A. Markham, R.P. Nielson and M. Garaci. 2005. Migration of vegetation types in a greenhouse world. In: *Climate Change and Biodiversity*, Lovejoy, T.E. and L. Hannah, Eds., Yale University Press.
70. Scott, D. and C. Lemieux. 2007. Climate change and protected areas policy, planning and management in Canada's boreal forest. *Forestry Chronicle* 83(3): 347-357.
71. Fischlin, A., G.F. Midgley, J.T. Price, R. Leemans, B. Gopal, C. Turley, M.D.A. Rounsevell, O.P. Dube, J. Tarazona, and A.A. Velichko. 2007. Ecosystems, their properties, goods, and services. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds. Cambridge University Press, Cambridge.

72. Scott, D. and C. Lemieux. 2007. Climate change and protected areas policy, planning and management in Canada's boreal forest. *Forestry Chronicle* 83(3): 347-357.
73. E.A. Snell. 1987. Wetland Distribution and Conversion in Southern Ontario. Working Paper No. 48, Inland Waters and Lands Directorate, Environment Canada.
74. Environment Canada and Ontario Ministry of Natural Resources. 2003. The Ontario Great Lakes Coastal Wetland Atlas: A Summary of Information (1983-1997). Available at: <http://lake-huron.ca/uploads/pdf/Ontario.Great.Lakes.Coastal.Wetland.Atlas-2003.pdf>
75. Verreault, G. and P. Dumont. 2004. An estimation of American eel escapement from the Upper St. Lawrence River and Lake Ontario in 1996 and 1997. In: *Biology, Management and Protection of Catadromous Eels*, D.A. Dixon, Ed., American Fisheries Society Symposium 33, Bethesda, Maryland.
76. National Oceanic and Atmospheric Administration Great Lakes Aquatic Nonindigenous Species Information System. GLANSIS online database available at: [http://www.glerl.noaa.gov/res/Programs/ncrais/nas\\_database.html](http://www.glerl.noaa.gov/res/Programs/ncrais/nas_database.html).
77. De Lafontaine, Y. and G. Costan. 2002. Introduction and transfer of alien aquatic species in the Great Lakes-St. Lawrence River drainage basin. In: *Alien Invaders in Canada's Waters, Wetlands, and Forests*, R. Claudi, P. Nantel, and E. Muckle-Jeffs, Eds., Natural Resources Canada.
78. Ontario Ministry of Natural Resources. 2007. American Eels Returned to St. Lawrence River: Province And Partner Working to Restore Important Native Species. Available at: [http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/MNR\\_E004191.html](http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/MNR_E004191.html)
79. Evergreen: <http://www.evergreen.ca>.
80. Ontario EcoSchools: <http://www.yorku.ca/ecoschl/index.asp>.
81. Ontario Federation of Anglers and Hunters: <http://www.ofah.org>.
82. Ontario Forestry Association: <http://www.oforest.on.ca>.
83. Ontario Envirothon Program: <http://www.ontarioenvirothon.on.ca/index.html>.
84. Alternative Land Use Services: [http://gorsuch.ca/wiki?title=Alternative\\_Land\\_Use\\_Services](http://gorsuch.ca/wiki?title=Alternative_Land_Use_Services).
85. Community Fisheries and Wildlife Improvement Program: [http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02\\_166030.html](http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_166030.html)
86. Conservation Land Tax Incentive Program: <http://www.mnr.gov.on.ca/en/Business/CLTIP/index.html>
87. National Forest Strategy Coalition. 2005. Highlights of Accomplishments, Advancing the National Forest Strategy 2003-2008, A Sustainable Forest: the Canadian Commitment. Available at: [http://npsc.forest.ca/background/accomplishments2005\\_e.pdf](http://npsc.forest.ca/background/accomplishments2005_e.pdf).
88. Eastern Ontario Model Forest Private Woodlot Certification: <http://certification.eomf.on.ca/index.aspx>.
89. Federation of Ontario Cottagers' Associations: <http://www.foca.on.ca>.
90. Species at Risk Stewardship Fund: [http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/MNR\\_E004164.html](http://www.mnr.gov.on.ca/en/Newsroom/LatestNews/MNR_E004164.html)
91. Managed Forest Tax Incentive Program: [http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02\\_166346.html](http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166346.html)
92. Ontario Stewardship: <http://www.ontariostewardship.org/ontarioStewardship/home/oslindex.asp>.
93. McGee, B., H. Berges and K. Callow. 2004. Survey of Pesticide Use in Ontario, 2003: Estimates of Pesticide use on Field Crops, Fruit and Vegetable Crops, and Other Agricultural Crops. Ontario Ministry of Agriculture and Food. Available at: <http://www.agcare.org/File.aspx?id=752a4ce9-80d2-4287-822b-125e1f7a87b3>.
94. Statistics Canada. 2006. 2006 Census of Agriculture: Farm Data and Farm Operator Data, Table 4.7-4 Tillage practices used to prepare land for seeding. Available at: [http://www.statcan.ca/english/freepub/95-629-XIE/4/4.7-4\\_C.htm](http://www.statcan.ca/english/freepub/95-629-XIE/4/4.7-4_C.htm).
95. Great Lakes Fisheries Commission. 2007. A Joint Strategic Plan for the Management of Great Lakes Fisheries. Miscellaneous Publication 2007-01. Available at: <http://www.glfc.org/pubs/jsp97.pdf>.
96. Ontario Mining Association. 2006. Toward Greener Footprints: The Ontario Mining Association Report on Significant Environmental Achievements. Available at: [http://www.oma.on.ca/environment/resources/Towards\\_Greener\\_Footprints\\_2006.pdf](http://www.oma.on.ca/environment/resources/Towards_Greener_Footprints_2006.pdf).

97. Green Belt Act, 2005: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_05g01\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_05g01_e.htm).
98. Ontario Greenbelt website: <http://www.ourgreenbelt.ca>.
99. Ministry of Municipal Affairs and Housing. 2005. The Greenbelt Area-Quick Facts. Available at: <http://www.mah.gov.on.ca/Page636.aspx>.
100. Ministry of Municipal Affairs and Housing. 2005. Protecting the Greenbelt: The Greenbelt Plan. Available at: <http://www.mah.gov.on.ca/Page189.aspx>.
101. Ontario Ministry of Public Infrastructure Renewal. 2006. Places to Grow: Growth Plan for the Greater Golden Horseshoe. Available at: <http://www.niagara-gta.com/pdf/Growth%20Plan%20for%20the%20Greater%20Golden%20Horseshoe.pdf>.
102. Niagara Escarpment Planning and Development Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90n02\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90n02_e.htm).
103. Niagara Escarpment Plan: [http://www.escarpment.org/Publications/plan\\_intro.htm](http://www.escarpment.org/Publications/plan_intro.htm).
104. Oak Ridges Moraine Protection Act, 2001: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_01o03\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_01o03_e.htm).
105. Oak Ridges Moraine Conservation Act, 2001: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_01o31\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_01o31_e.htm).
106. Oak Ridges Moraine Conservation Plan: <http://www.mah.gov.on.ca/Page1707.aspx>.
107. Places to Grow Act, 2005: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_05p13\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_05p13_e.htm).
108. Planning Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90p13\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90p13_e.htm).
109. Provincial Parks and Conservation Reserves Act, 2006. [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_06p12\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_06p12_e.htm).
110. Provincial Policy Statement: <http://www.mah.gov.on.ca/Page1485.aspx>.
111. Canadian Centre for Pollution Prevention: <http://www.c2p2online.com>.
112. Clean Water Act, 2006: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_06c22\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_06c22_e.htm).
113. Great Lakes Binational Toxics Strategy: <http://binational.net/bns/menu-e.html>.
114. Great Lakes Water Quality Agreement: <http://www.ijc.org/en/activities/consultations/glwqa/agreement.php>.
115. Lakewide Management Plans: [www.great-lakes.net/lakes/ref/lamps.html](http://www.great-lakes.net/lakes/ref/lamps.html).
116. Municipal/ Industrial Strategy for Abatement: <http://www.ene.gov.on.ca/envision/water/misa/index.htm>.
117. Nutrient Management Act, 2002: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_02n04\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_02n04_e.htm).
118. Drive Clean: <http://www.driveclean.com>.
119. Remedial Action Plans: [http://www.on.ec.gc.ca/water/raps/intro\\_e.html](http://www.on.ec.gc.ca/water/raps/intro_e.html).
120. Go Green Ontario: <http://www.gogreenontario.ca>.
121. Ontario's Action Plan on Climate Change. Available at: <http://www.gogreenontario.ca/plan.php>.
122. Canadian Parks and Wilderness Society Wildlands League: <http://www.wildlandsleague.org>.
123. Ducks Unlimited Canada: <http://www.ducks.ca>.
124. Nature Conservancy of Canada: <http://www.natureconservancy.ca>.
125. Conservation Ontario: <http://conservation-ontario.on.ca>.
126. Conservation Authorities Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90c27\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90c27_e.htm).
127. Eastern Habitat Joint Venture in Ontario: <http://www.on.ec.gc.ca/wildlife/ehjv/oejhv-e.html>.
128. North American Waterfowl Management Plan: <http://www.nawmp.ca>.
129. Ontario Nature: <http://www.ontarionature.org>.
130. Trees Ontario: <http://www.treesontario.on.ca>.
131. Canadian Aquatic Invasive Species Network: <http://www.uwindsor.ca/caisn>.
132. Invading Species Awareness Program: <http://www.invasingspecies.com>.



133. Endangered Species Act, 2007: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_07e06\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm).
134. Species at Risk Act Pubic Registry: [http://www.sararegistry.gc.ca/plans/timelines\\_e.cfm](http://www.sararegistry.gc.ca/plans/timelines_e.cfm).
135. Biodiversity Institute of Ontario: <http://www.biodiversity.uoguelph.ca>.
136. Forest Gene Conservation Association: <http://www.fgca.net>.
137. Ontario's Natural Selections: <http://www.ontariosnaturalselections.org>
138. Forest Genetics Ontario: <http://www.fgo.ca>.
139. Ontario Ministry of Natural Resources. 2002. Managing Ontario's Forests: Forest Health in Ontario. Available at: [http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02\\_166919.html](http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166919.html)
140. Natural Resources DNA Profiling and Forensic Centre: <http://web.nrdpfc.ca>.
141. Ontario Tree Seed Plant: [http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02\\_166052.html](http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166052.html)
142. Anishinabek/Ontario Fisheries Resource Centre: <http://www.aofrc.org>.
143. Bird Studies Canada: <http://www.bsc-eoc.org>.
144. Forest Ecosystem Science Co-operative Inc.: <http://www.forestcoop.ca>.
145. Mushkegowuk Environmental Research Centre: <http://www.merc.ontera.net>.
146. Natural Heritage Information Centre: [http://nhic.mnr.gov.on.ca/nhic\\_cfm](http://nhic.mnr.gov.on.ca/nhic_cfm)
147. Atlas of the Breeding Birds of Ontario: <http://www.birdsontario.org/atlas/atlasmain.html>.
148. Ministry of Natural Resources' Science, Information, and Technology website: [http://www.mnr.gov.on.ca/en/STEL02\\_168325.html](http://www.mnr.gov.on.ca/en/STEL02_168325.html)
149. Wildlife Conservation Society Canada: <http://www.wcscanada.org>.
150. Aggregate Resources Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90a08\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90a08_e.htm).
151. Canada-Ontario Agreement Respecting the Great Lakes Basin, 2002: [http://www.on.ec.gc.ca/coa/agreement\\_e.html](http://www.on.ec.gc.ca/coa/agreement_e.html).
152. Conservation Authorities Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90c27\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90c27_e.htm).
153. Crown Forest Sustainability Act, 1994: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_94c25\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_94c25_e.htm).
154. Environmental Assessment Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90e18\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90e18_e.htm).
155. Environmental Protection Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90e19\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90e19_e.htm).
156. Fish and Wildlife Conservation Act, 1997: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_97f41\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_97f41_e.htm).
157. Great Lakes Basin Sustainable Water Resources Agreement: <http://www.mnr.gov.on.ca/200040.pdf>
158. Lakes and Rivers Improvement Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90l03\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90l03_e.htm).
159. Ontario Water Resources Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90o40\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90o40_e.htm).
160. Public Lands Act, 1990: [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90p43\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90p43_e.htm).



52151  
(2.5k P.R. 05 07 08)  
ISBN 978-1-4249-6406-2

Product of the Ontario Biodiversity Council, in partnership with  
the Ministry of Natural Resources  
Cette publication est également disponible en français