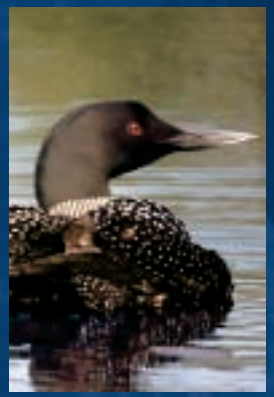
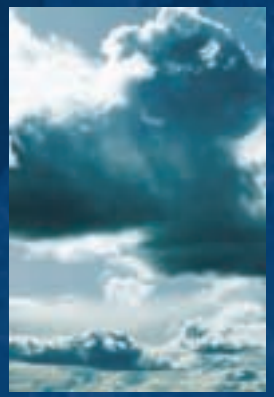
Environment Canada Environnement Canada

Tracking Key Environmental Issues

Air and water



Nature

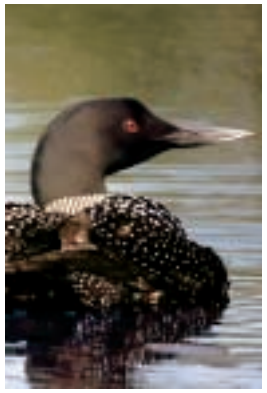


Climate change and severe weather

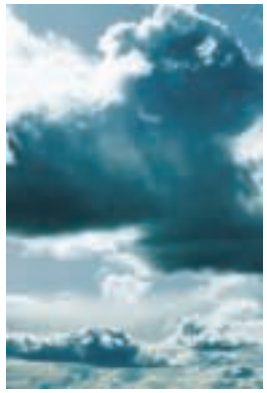
Canada

Tracking Key Environmental Issues

Air and water



Nature



Climate change and severe weather

National Library of Canada cataloguing in publication data

Main entry under title:

Tracking key environmental issues

Text in English and French on inverted pages.
Title on added t.p. : Suivi des grands enjeux environnementaux.
Issued also on the Internet
ISBN 0-662-65640-7
Cat. No. En40-615/2001

1. Environmental indicators — Canada.
2. Sustainable development — Canada.
3. Ecosystem health — Canada.
4. Environmental policy — Canada.
I. Canada. Environment Canada.

TD26.T72 2001 363.7'02'0971 C2001-980001-0E

Additional copies of this publication are available in limited numbers at no charge from:
Inquiry Centre
Environment Canada
Ottawa, Ontario K1A 0H3

Tel.: 1-800-668-6767 (Toll-free in Canada) and (819) 997-2800
Fax: (819) 953-2225
E-mail: enviroinfo@ec.gc.ca

Also available on Environment Canada's Green Lane at www.ec.gc.ca/

Published by authority of the Minister of the Environment

Design: DAX Communications Inc.

Minister's Message to Canadians

We need to better understand the environmental challenges before us if we are to achieve our vision of a country where governments and citizens make responsible decisions about the environment for the benefit of present and future generations. This report, part of the Government of Canada's commitment to inform Canadians about the health of our environment, is an overview of our environmental challenges and a step forward in providing the knowledge to fulfill that vision.

Tracking Key Environmental Issues is part of Environment Canada's new approach to environmental management—an environmental innovation agenda that is based on knowledge, incentives, and partnerships. Our goal in establishing this new approach is to make the environment an integral part of decision-making by all levels of government, by businesses and industries, and by individuals.

The need for more innovative ways of protecting our natural heritage is increasingly evident. Although we have achieved considerable environmental progress over the years, we face increasing demands on our natural resources from a growing population and an expanding economy. As well, our growing scientific knowledge is highlighting new concerns about the impacts of pollution on human health.

We must rethink old methods, use new tools, and forge stronger partnerships if we are to better protect our environment and conserve our quality of life. We need stronger science and more reliable information to help us know where we are, where we want to be, and how we are going to get there. For this reason, we are working towards a Canadian Information System for the Environment and investing in this country's science capacity to make government more accountable, to increase our knowledge on the environment, and to make it more broadly available.

I encourage you to provide your comments on this report. Your views will help us to shape future reports into accessible tools that will support our progress towards sustainability through a better understanding of the environment.

The Honourable David Anderson, P.C., M.P.
Minister of the Environment

Table of Contents

Minister's Message to Canadians iii
Introduction: Connecting with Canadians 2
Air and Water 4
- Air quality 6
- Acid rain 10
- Freshwater quality 14
- Freshwater use 18
- Toxic contaminants in the environment 22

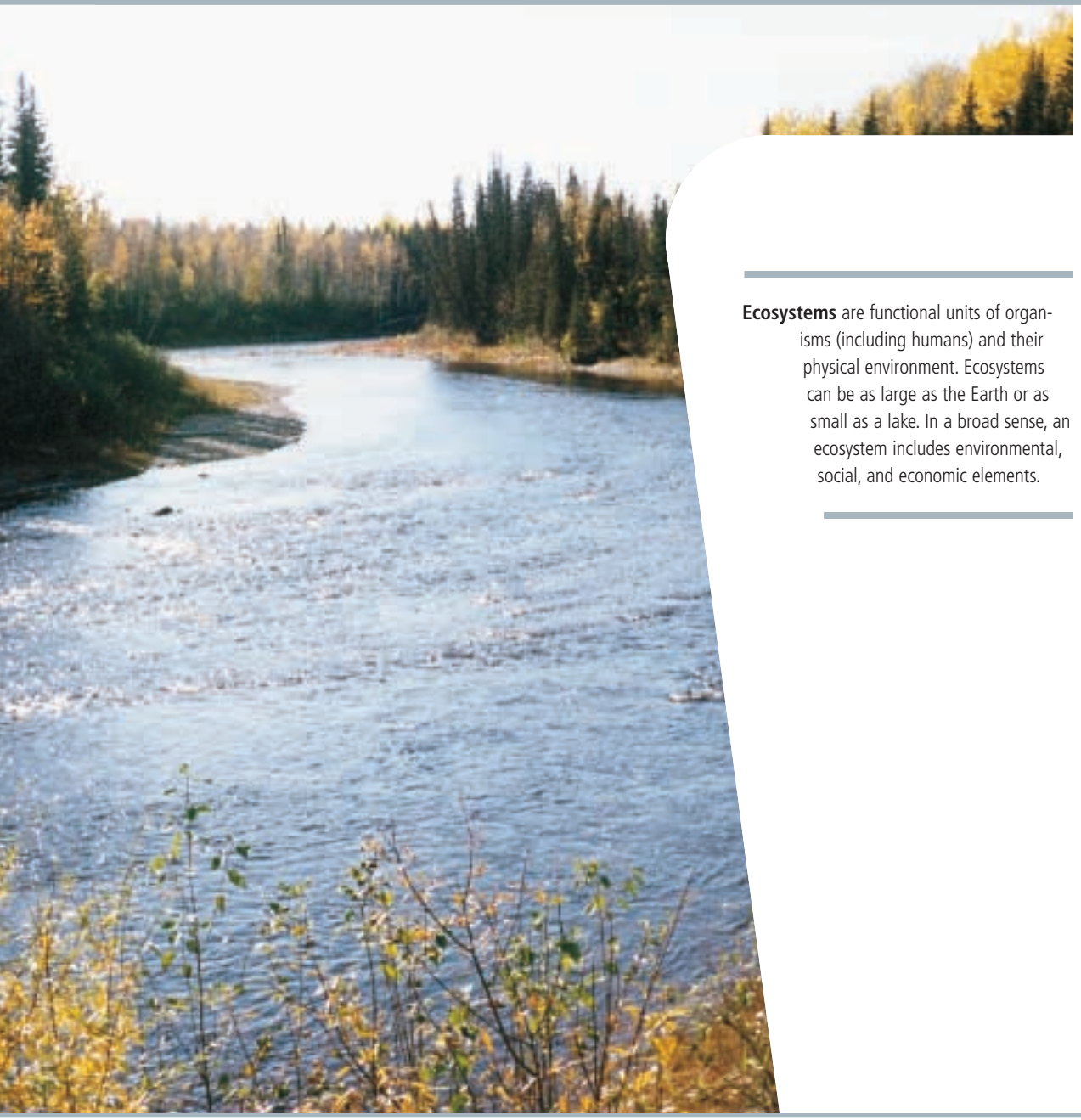
Nature 26
- Species at risk 28
- Natural areas 34

Climate Change and Severe Weather 38
- Climate change 40
- Severe weather 44

Getting to the Path Ahead 48
Further Information Sources 50
- Government agencies and their web sites 50
- Publications 51

Photo Credits 52
Comments Please 53

Introduction: Connecting with Canadians



Ecosystems are functional units of organisms (including humans) and their physical environment. Ecosystems can be as large as the Earth or as small as a lake. In a broad sense, an ecosystem includes environmental, social, and economic elements.

The Government of Canada will report regularly on the results achieved in addressing the top environmental concerns of Canadians.

The federal government is committed to accountability and reporting, answering in part the concern that Canadians consistently express over environmental issues. Canadians value clean air, clean water, and the bountiful natural assets for which the country is widely known. We are proud that Canada is steward of about 20% of the world's remaining natural areas, 9% of the world's renewable fresh water, and 25% of the world's wetlands. We are also aware that protecting and maintaining the health of ecosystems require continuous attention, both in Canada and around the world.

This report provides an overview of the status and trends of some key environmental issues of concern to Canadians. It is not intended to be comprehensive; rather, its aim is to illustrate the state of our environmental knowledge as well as the state of the environment. Past reporting on trends in the state of the environment has taught us of the need to track indicators of the overall state or health of our ecosystems. Such indicators will become the "canary in the coal

mine," early warning signals for emerging environmental problems, as well as signposts for our path towards environmental sustainability.

For purposes of this overview, five key areas are examined: Air, Water, Nature, Climate Change, and Severe Weather. The report looks at what we know about the issues in these areas, as well as what we need to know in order to take more effective action. Each snapshot also reports on actions taken to date and provides sources for more information. Future reporting will address other environmental issues of concern, such as waste recycling and ozone layer depletion.

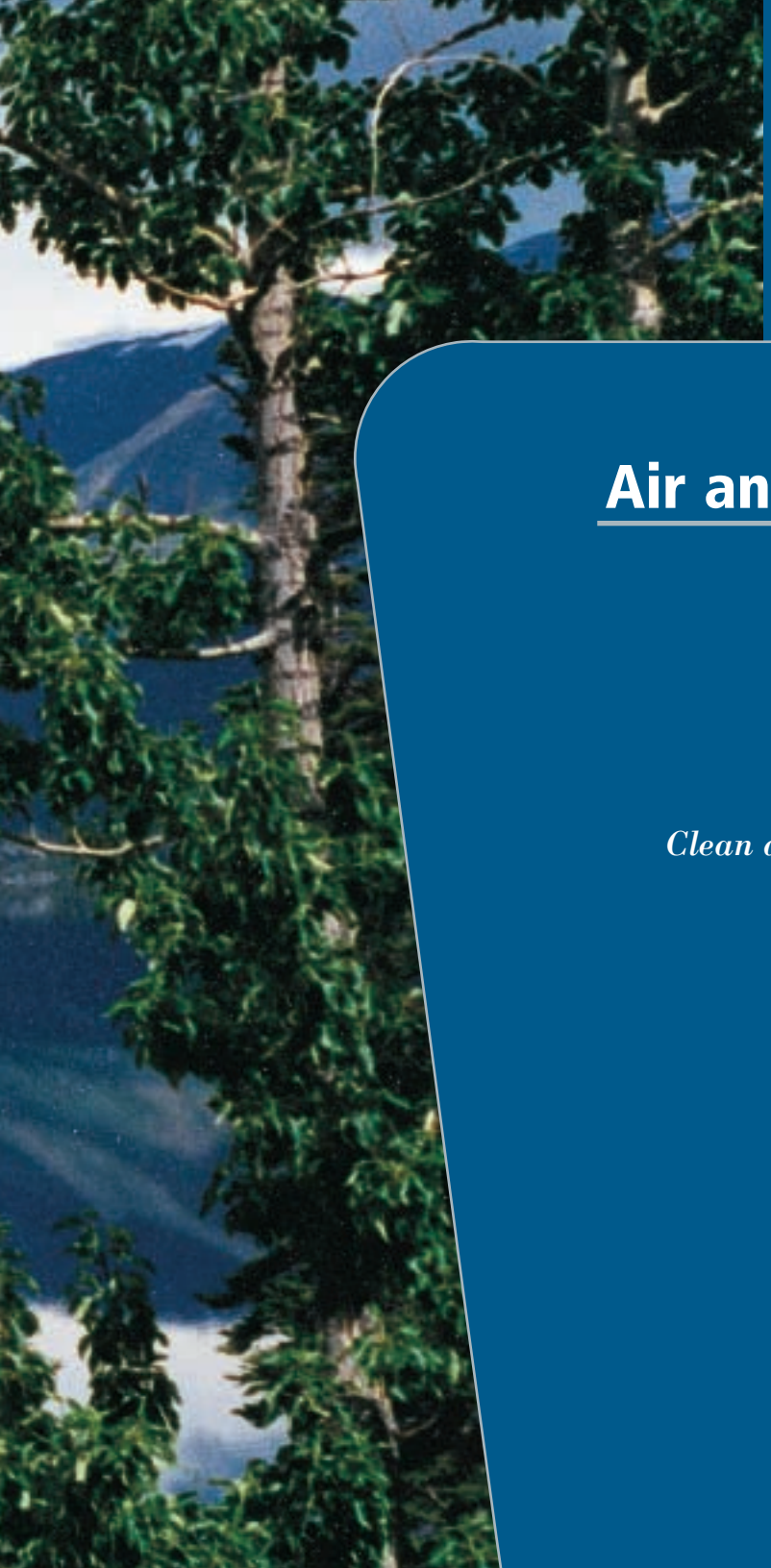
For some environmental issues, the most recent data available are several years old, or are available only for parts of Canada. There are gaps in the scientific monitoring that generates the data, as well as gaps in our knowledge and understanding of the working of ecosystems.

In order to address these problems and improve our knowledge, the federal government is investing in improved management of our environmental information and knowledge. Efforts in this regard will be strengthened by working in partnerships with others, such as the National Round Table on the Environment and the Economy. The Round Table is currently preparing a national process that will lead to a recommended set of sustainable development indicators for Canada.

A second important initiative is the creation of a national Task Force mandated to review the state of Canada's environmental information and make recommendations on how knowledge of environmental issues and trends can be improved. This includes identifying the monitoring needs, analytical and management tools, and technology required to make the links among the array of social, economic, and environmental information available. The national Task Force will also examine ways of making this information more accessible to Canadians, enabling them to improve their stewardship of the environment, and serving as a basis for sound public policies.

A major step to further connect with Canadians and assist them in making environmentally responsible decisions is the planned development of a comprehensive, interconnected, and accessible environmental information system that all Canadians can readily use—the Canadian Information System for the Environment. The national Task Force will make recommendations on its design. Through renewed attention to environmental knowledge, better ways will emerge for organizing and presenting the information on the state of the environment and for making this information readily accessible to Canadians.

Sustainable development means development that meets the needs of the present without compromising the ability of future generations to meet their own needs.



Air and Water

Human health and well-being depend
on the quality of our air and water.
Clean air and water are essential to the health and survival of
everything that lives on the planet.

Air quality

Fossil fuels are oil, gas, coal, and other fuels that were formed under the Earth's surface from the fossilized remains of plants and tiny animals that lived millions of years ago.

Smog has become a common term for urban air pollution. It contains two key components:

fine airborne particles, which are small particles from smoke and fumes that can be inhaled into the lungs; and

ground-level ozone, which is formed when pollutants such as nitrogen oxides and volatile organic compounds react with sunlight.

What is the issue?

Canada's air quality is affected by pollutants that come from the combustion of fossil fuels in vehicles, homes, power plants, smelters, and other industries. Average air pollution levels in Canada have improved over the last 25 years, but smog remains a serious health concern in a number of highly populated parts of the country.

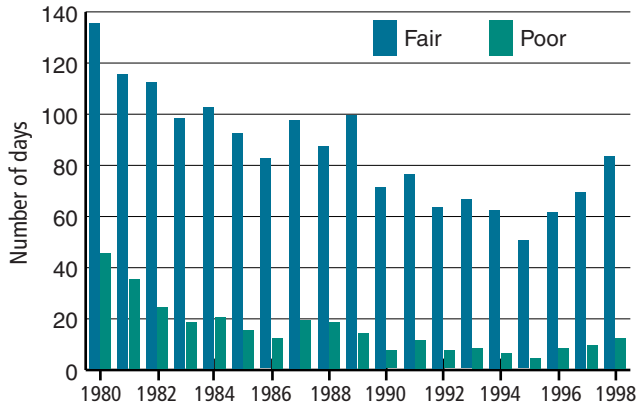
Smog can affect our health by irritating the eyes, nose, and throat, reducing lung capacity, and aggravating respiratory or cardiac diseases. It has also been implicated in premature deaths. Especially vulnerable are the elderly, children, and those with heart or lung disease. Recent studies suggest that there are no safe levels of human exposure to fine airborne particles and ground-level ozone, the two main air pollutants that make up smog. Government of Canada scientists have determined that air pollution results in tens of thousands of hospital and medical visits and over 5 000 premature deaths annually.

What do we know?

Air quality is assessed in terms of "good," "fair," and "poor" days based on the Index of the Quality of Air. A national assessment of air quality has shown general improvement since 1980. However, the number of fair and poor air quality days increased between 1995 and 1998 as a result of higher levels of ground-level ozone and fine airborne particles.

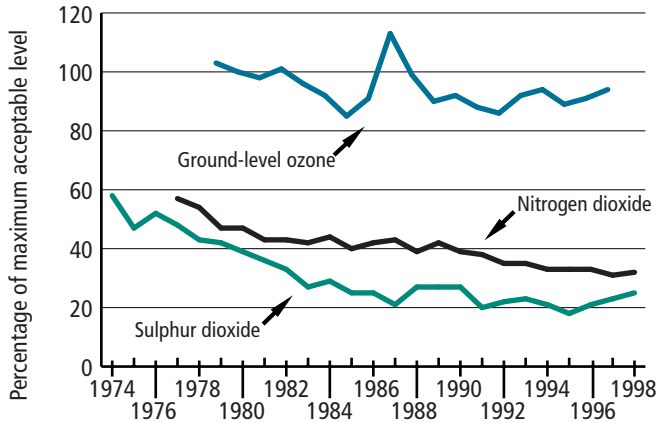
High ground-level ozone concentrations tend to peak during the spring and summer. The pollutant is a concern principally in the Windsor–Quebec City corridor and, to a lesser extent, in the southern Atlantic region and the Lower Fraser Valley of British Columbia. Although subject to

Number of days of fair and poor air quality in Canada, 1980–1998



Note: This is a retrospective analysis of air quality.
Source: Air Quality Information System, Environmental Protection Service, Environment Canada.

Levels of ground-level ozone, nitrogen dioxide, and sulphur dioxide in Canada, 1974–1998



Note: Maximum acceptable levels refer to the National Ambient Air Quality Objectives.
Source: Air Quality Information System, Environmental Protection Service, Environment Canada.

annual variation, the overall trend for the number of days when ground-level ozone is of concern across these regions has been downward since the early 1980s. However, increases in high ground-level ozone days have occurred recently in the urbanized Windsor–Quebec City corridor between 1996 and 1998.

Levels of PM_{10}—airborne particles less than 10 micrometres in size—tend to vary, depending on the region, the level of pollutant emissions from both local and long-range sources, and the season. However, high levels may occur in all seasons and affect most populated regions of Canada. These levels often occur during periods of high ozone, because the two contaminants share the same causal or precursor pollutants.

Although the trend shows that yearly average concentrations of even finer particles ($PM_{2.5}$) decreased by about one-third from 1985 to 1998 for 11 Canadian cities in the $PM_{2.5}$ monitoring program, some of these Canadian cities continue to regularly record daily levels that are high enough to pose a health risk. Also, the yearly average concentrations of $PM_{2.5}$ have risen recently, over the 1996–1998 period.

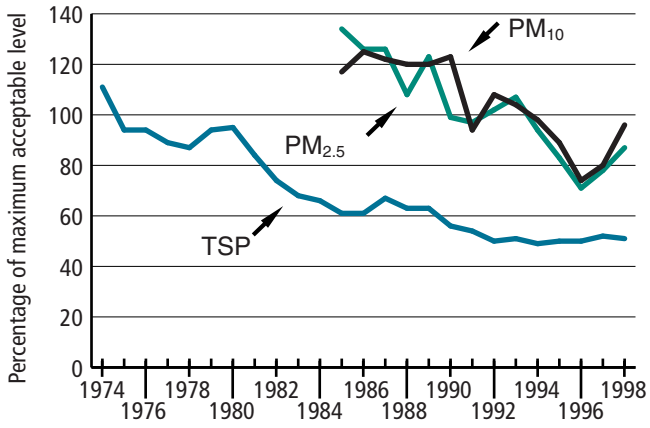
The levels of the various pollutants in our air closely mimic the amounts emitted by numerous human activities. Thus, as emissions decrease, air quality improves. These emissions are tracked by the National Emissions Inventory of Criteria Air Contaminants. In 1995, the inventory reported nationwide emissions of 1.5 million tonnes of $PM_{2.5}$,

The **Index of the Quality of Air** provides a common scale for integrating individual pollutant concentrations by relating each pollutant measured to its corresponding National Ambient Air Quality Objectives (NAAQO). A subindex is generated for each pollutant measured, and the pollutant with the highest subindex value determines the index for that time period. The index provides only an indication of health risk, as there are no safe levels of exposure to either ground-level ozone or airborne particles (PM_{10} and $PM_{2.5}$). Thus, any improvements in ambient levels of these smog pollutants are expected to have public health benefits.

$PM_{2.5}$ airborne particles are solid or liquid droplets less than 2.5 micrometres (a micrometre is one-thousandth of a millimetre) in size. They can penetrate deep into the lungs and pose the highest risk to human health. They come directly from natural sources, such as forest fires, and from human activity, such as fossil fuel combustion and industrial processes. They can also be formed indirectly through chemical reactions in the atmosphere involving air pollutants and other particles.

The **criteria air contaminants** are pollutants for which ambient air quality criteria have been implemented. These pollutants include airborne particles, sulphur oxides, nitrogen oxides, volatile organic compounds, and carbon monoxide. The levels of these contaminants in the air are measured by the National Air Pollution Surveillance (NAPS) Network at 152 stations in 55 cities across Canada.

Levels of airborne particles in Canada, 1974-1998: total suspended particulates (TSP), PM_{10}, and $PM_{2.5}$



Note: Maximum acceptable levels for TSP refer to the National Ambient Air Quality Objectives; $PM_{2.5}$ is the Canada-wide Standard, and PM_{10} is based on several provincial standards.
Source: Air Quality Information System, Environmental Protection Service, Environment Canada.

2.5 million tonnes of nitrogen oxides, 3.6 million tonnes of volatile organic compounds, 2.6 million tonnes of sulphur dioxide, and 17 million tonnes of carbon monoxide. The inventory also shows that the main sources of these pollutants are the fossil fuels used in vehicles, power plants, and industries, such as smelters.

What additional information do we need?

In order to succeed in addressing clean air issues, we need to expand what we know. For instance, we need:

- a better understanding of how pollutants change after they are released to the atmosphere;
- an improved understanding of how pollutants affect air quality, people, and the environment;
- more comprehensive and up-to-date information on air quality and emissions in order to track air pollution trends and advise Canadians of existing or potential air quality problems; and
- improved information on the mechanisms, costs, and potential benefits of preventing or controlling air pollution.

What are we doing based on the information we have?

Clean air requires an efficient approach involving actions and strategies that lead to reductions of many different pollutants at the same time. Reduced emissions of air pollutants not only will improve air quality but also will reduce the impacts of climate change and acid rain.

As part of a new approach to address smog under the Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment, new Canada-wide standards have been developed for $PM_{2.5}$ airborne particles and ground-level ozone. Federal, provincial, and territorial Ministers of the Environment agreed to these standards in June 2000. At the same time, they endorsed Joint Initial Actions related to smog, to be developed over the next five years.

In a joint effort, the federal and New Brunswick Environment departments have successfully pilot-tested a program to forecast certain ambient air pollutant levels and warn Canadians of impending smog episodes, and this

work has been expanded to other provinces. To support this forecasting and other air research, the Government of Canada is investing in an expansion of the NAPS Network.

PM_{10} airborne particles are being added, along with precursors of smog (sulphur dioxide, nitrogen oxides, volatile organic compounds, and ammonia), to the List of Toxic Substances under the *Canadian Environmental Protection Act*. A new agreement to significantly reduce the flow of pollutants across the border between Canada and the United States was brought into force in December 2000. To meet this commitment, the Government of Canada has announced a 10-year, $120.2 million investment in new measures to accelerate action on clean air, by focusing on cleaner vehicles and fuels, initial measures to reduce smog-causing emissions from industrial sectors, improvements to the NAPS Network and expansion of the public reporting by industry on pollutant releases.

In communities across Canada, Canadians are promoting clean air choices—alternative transportation, cleaner gasoline, and energy efficiency.

Further information

For more information on air quality issues, check the following:

Canadian Council of Ministers of the Environment:
www.ccme.ca

Canadian Environmental Protection Act, 1999:
www.ec.gc.ca/ceparegistry/

Clean air:
www.ec.gc.ca/air/menu_e.shtml

Criteria Air Contaminants inventory and air quality trends:
www.ec.gc.ca/pdb/ape/cape_home_e.cfm

Fraser Valley:
www.ecoinfo.org/env_ind/region/smog/smog.htm

Montreal Urban Community:
www.cum.qc.ca/rsqa

Ontario:
www.airqualityontario.com

Pollution and toxics:
www.ec.gc.ca/pollut_e.html

Acid rain

Acid rain is caused by the chemical conversion in the atmosphere of sulphur dioxide (from metal smelters and coal- and oil-fired power plants) and nitrogen oxides (from motor vehicle emissions) into sulphuric and nitric acid. Diluted forms of these acids fall to earth as rain, hail, drizzle, freezing rain, or snow or are deposited as acid gas or dust. Normal rain is slightly acidic, but acid rain can be as much as 100 times more acidic.

What is the issue?

Just over 45% of Canada's total surface area is highly sensitive to acid rain. Much of this area is in eastern Canada, where the Canadian Shield's thin, coarsely textured soil and granite-type bedrock have little ability to neutralize acidic pollutants. This region continues to receive acid rain at levels above the tolerance level for the environment. About half of the acid deposition in eastern Canada comes from sources in the United States.

The effects of acid rain are severalfold:

- High levels of acid rain can result in the acidification of lakes, rivers, and streams and can cause metals to leach from surrounding soils into the water system. Both acidification and metal leaching can seriously impair the ability of water bodies to support aquatic life.
- Prolonged exposure to acid deposition causes forest soils to lose valuable nutrients, contributing to declining growth rates in trees. Until recently, it was believed that the supply of nutrients would be replenished through natural processes. It is now evident that, at least in the short term, this does not happen.
- Acid rain has been linked to increased rates of deterioration of structures containing cement, limestone, or sandstone.
- Recent research indicates a relationship between decreased lung function or increased cardiorespiratory mortality and long-term exposure to acid rain-causing pollutants.

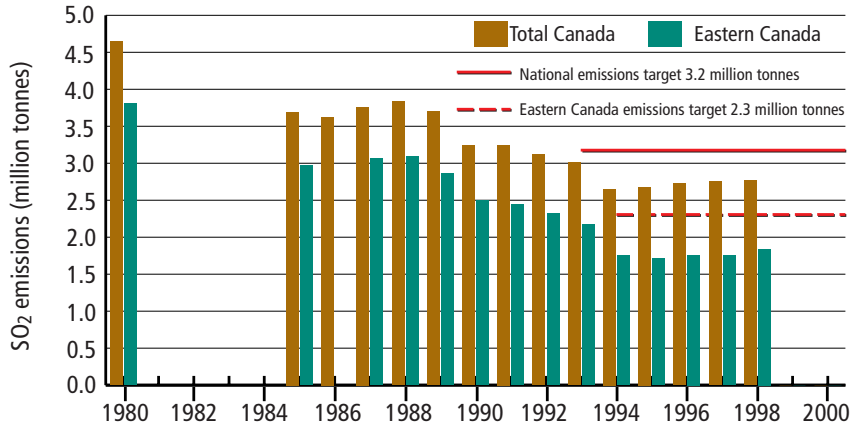
What do we know?

While considerable progress has been made in reducing acid rain, many areas in Canada are still being damaged. Since 1980, eastern Canada has reduced its emissions of sulphur dioxide by more than half, and emissions across the country declined by 42% over the same period. There has been minimal progress in reducing nitrogen oxide emissions in both Canada and the United States, however, and Canadian emissions of nitrogen oxides have remained relatively unchanged since 1980.

In areas where acid deposition has decreased in large amounts, such as the greater Sudbury region of Ontario, there have been striking ecological improvements. However, reductions in lake acidity in other regions of Ontario, Quebec, and Atlantic Canada have been modest, and some surface waters are continuing to acidify.

Even after commitments laid out in the Canada–U.S. Air Quality Agreement are fully met in 2010, large areas in eastern Canada, encompassing tens of thousands of lakes, will continue to receive acid deposition above critical load limits. To meet critical load limits in all of eastern Canada, sulphur dioxide emissions will need to be reduced by up to 75% in key emitting areas of both Canada and the United States.

Sulphur dioxide (SO_2) emissions in Canada, 1980–1998



Source: Pollution Data Branch, Environmental Protection Service, Environment Canada.

Although sulphate deposition has been decreasing, more progress needs to be made in reducing nitrogen oxide emissions and nitrate deposition. Otherwise, the contribution of nitrate deposition to acidification will eventually erode the benefits gained from reductions in sulphur dioxide emissions and sulphate deposition.

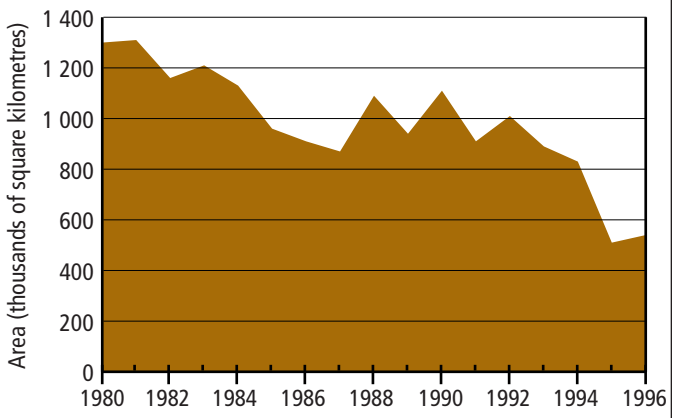
What additional information do we need?

Continued monitoring will bring a better understanding of the effects of acid deposition on sensitive lakes, rivers, streams, and forests, and on the fish, wildlife, and other organisms that they support. At the same time, more

The **critical load** for aquatic ecosystems is the amount of wet sulphate deposition that must not be exceeded in order to protect at least 95% of lakes in a region from acidifying to a pH level of less than 6.0.

pH is a measure of acidity, with pH 7.0 being neutral and pH values below 7.0 being acidic. Many studies suggest that a pH of at least 6.0 is needed to protect most aquatic organisms.

Area in eastern Canada receiving wet sulphate deposition above critical load limits, 1980–1996



Source: National Atmospheric Chemistry Database and Analysis Facility, Meteorological Service of Canada, Environment Canada.

information is needed on the effects of high acidity levels and the elevated levels of metals that result, particularly their effects on the ability of ecosystems to support life and be economically productive. Part of this knowledge is needed to establish critical load limits for nitrate deposition in sensitive ecosystems.

Further research and monitoring will help to clarify the links between human health and exposure to particulate matter, particularly sulphate and acidic aerosols.

What are we doing based on the information we have?

Progress on the acid rain issue has been largely due to several key agreements, including the Eastern Canada Acid Rain Program (1985) and the Canada–U.S. Air Quality Agreement (1991). Canada is committed to a permanent national limit on sulphur dioxide emissions of 3.2 million tonnes per year and a 10% reduction in projected nitrogen oxide emissions from stationary sources by 2000.

The Canada-wide Acid Rain Strategy for Post-2000 was signed by the Canadian Ministers of Energy and Environment in October 1998. It provides a framework for further actions, such as establishing new sulphur dioxide emission reduction targets in Ontario, Quebec, New Brunswick, and Nova Scotia; pursuing further emission reduction commitments from the United States; minimizing increases in emissions in areas where acid deposition is still below levels that cause harm; and ensuring the adequacy of acid rain monitoring.

Further information

For more information on the acid rain issue, check the following:

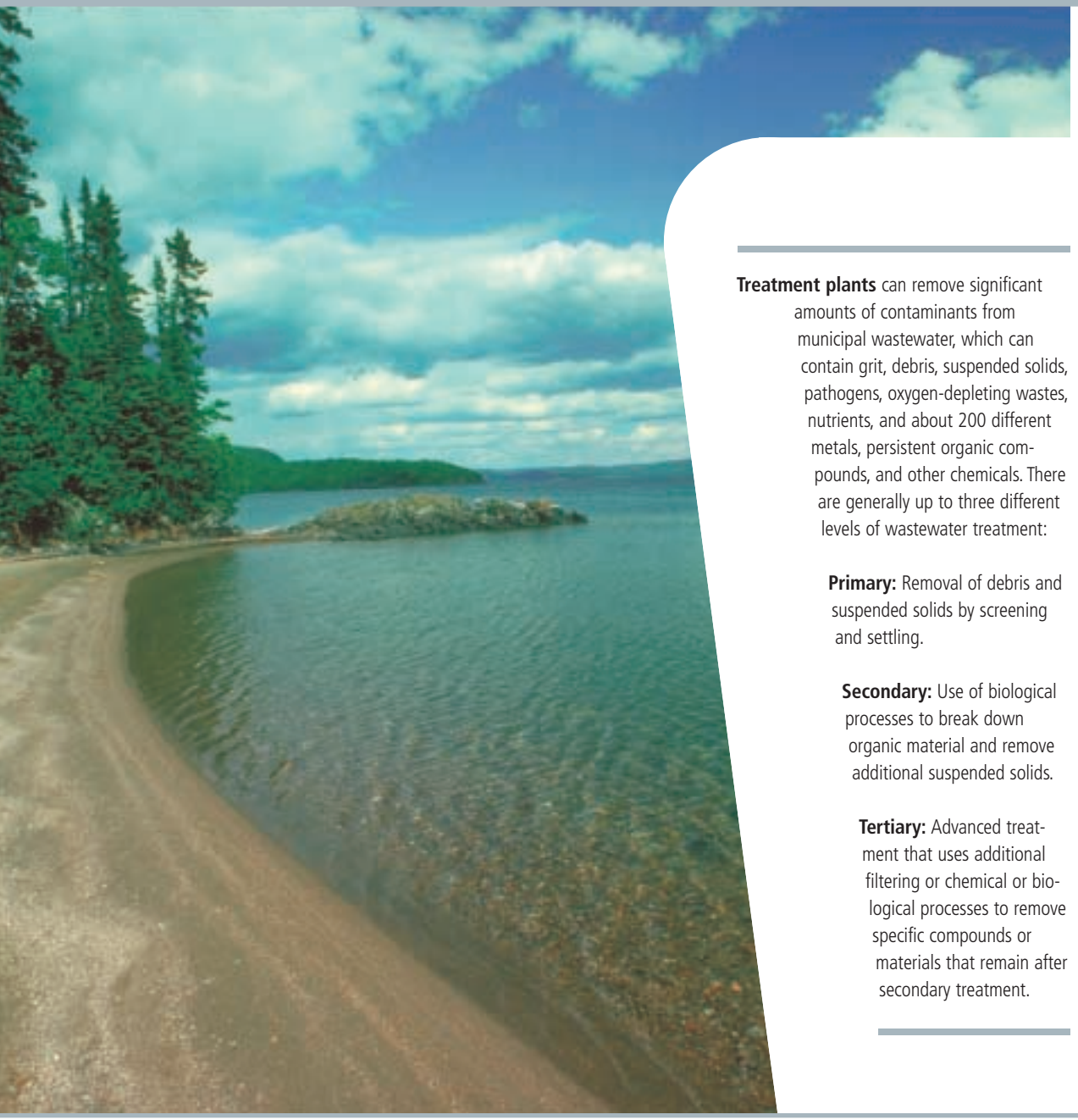
Annual Progress Report (1999) on the Canada-wide Acid Rain Strategy for Post-2000:
www.ccme.ca/3e_priorities/3eb3_acidrain.html

Canada-wide Acid Rain Strategy for Post-2000:
www.ec.gc.ca/special/ar_strat_e.html

Environmental Indicator Bulletin on Acid Rain:
www.ec.gc.ca/ind/English/AcidRain/default.cfm

Environment Canada's acid rain web site:
www.ec.gc.ca/acidrain/index.html

Freshwater quality



Treatment plants can remove significant amounts of contaminants from municipal wastewater, which can contain grit, debris, suspended solids, pathogens, oxygen-depleting wastes, nutrients, and about 200 different metals, persistent organic compounds, and other chemicals. There are generally up to three different levels of wastewater treatment:

Primary: Removal of debris and suspended solids by screening and settling.

Secondary: Use of biological processes to break down organic material and remove additional suspended solids.

Tertiary: Advanced treatment that uses additional filtering or chemical or biological processes to remove specific compounds or materials that remain after secondary treatment.

What is the issue?

Canadians rely on high-quality fresh water for drinking water, recreation, livestock watering, and crop irrigation. Fresh water is also vital for aquatic life. Canadians consider protecting water quality and maintaining the integrity of aquatic ecosystems to be important environmental issues.

Human activity affects the quality of water resources throughout the country. Threats to water quality come from municipal wastewater discharges (sewage, combined sewer overflows, and stormwater runoff), effluent from septic systems, industrial effluent, waste from intensive livestock operations, agricultural runoff, and the deposition of atmospheric pollution.

What do we know?

Municipal wastewater discharges represent one of the largest sources of pollutant releases by volume to Canadian waters. Progress is being made, however. The percentage of the municipal population in Canada receiving some form of sewage treatment has risen dramatically in the last two decades, from 72% of the population on municipal sewage systems in 1983 to 97% in 1999. Quebec experienced the largest improvements, moving from very little treatment in 1983 to mostly primary and secondary wastewater treatment by 1999.

Industries across Canada also discharge hundreds of substances into rivers and lakes daily. The impact of these discharges depends on the nature of the substances and the volumes released. Since 1993, the National Pollutant Release Inventory has been reporting the amounts of over

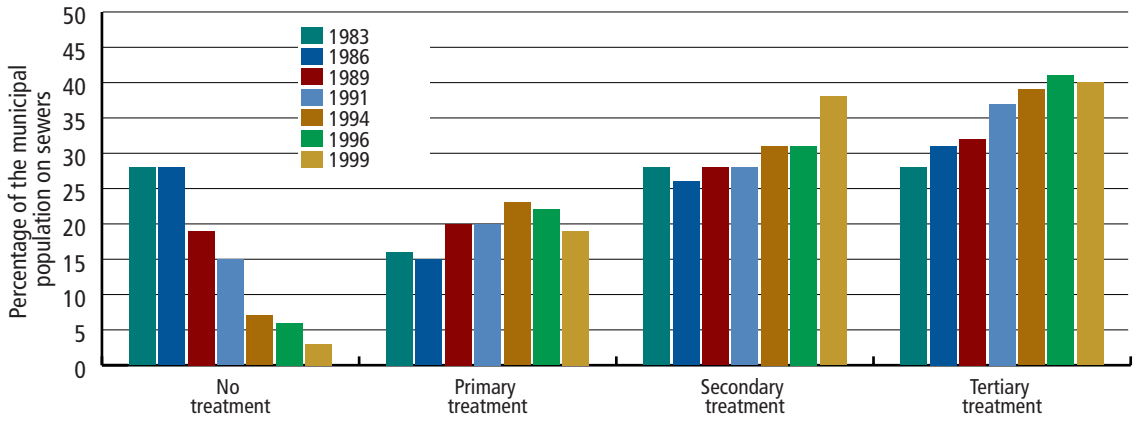
100 pollutants released to surface waters, as well as to air and land, from selected facilities across Canada, under the authority of the *Canadian Environmental Protection Act*. However, the impacts of these releases, if any, are generally not known.

A number of jurisdictions provide information on water quality to their citizens. These take the form of water quality summaries or indices for selected sites, bacteria counts on beaches, and boil water advisories. Usually the information focuses on known potential trouble spots with histories of deterioration in water quality.

Although the state of water quality data today does not allow for a comprehensive national picture, trends can be reported for some regions of the country. British Columbia is one of the jurisdictions most active in monitoring and reporting on its water quality. A recent federal–provincial report (March 2000) on the surface water quality of 63 water bodies in areas of intense human activity in British Columbia reported that water quality has remained stable for 59% of the water bodies (37/63), has improved for 32% (20/63), and has deteriorated for 10% (6/63) since 1985. Several other jurisdictions show comparable results, although the data analyses are not as complete as in British Columbia.

Under the 1972 Canada–U.S. Great Lakes Water Quality Agreement, 17 Canadian Areas of Concern were identified in the Canadian Great Lakes because of high levels of contamination. Remedial action plans were developed for each area. In spite of progress, only one Area of Concern has been removed from this list.

Provision of wastewater treatment in Canada, 1983–1999



Source: Adapted from Municipal Water Use Database, Policy and Communications, Economic and Regulatory Affairs, Environmental Economics Branch, Environment Canada, Ottawa. www3.ec.gc.ca/MUD/eng/Default.cfm.

What additional information do we need?

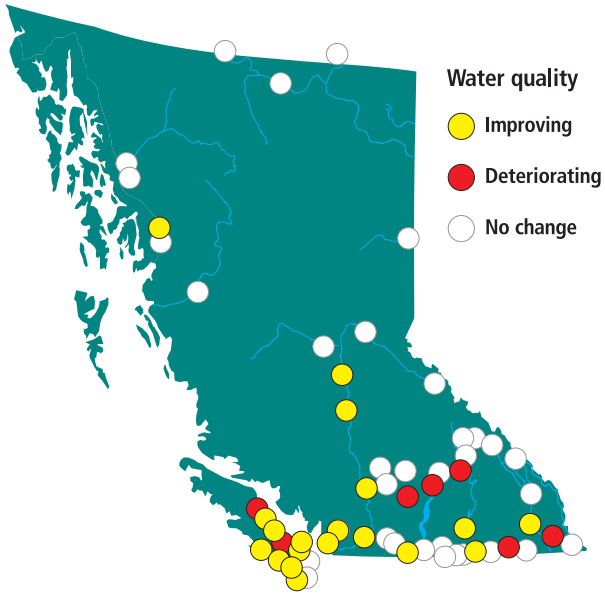
Management of water resources in Canada is a shared responsibility among municipal, provincial, territorial, and federal governments. This can mean difficulty in putting together a regional or national overview of water quality information. While governments collectively monitor water quality for known and potential "hot spots," the complexity of the ecosystems means that there is only rudimentary knowledge about the status and trends in ecosystem health. Monitoring efforts related to changes in aquatic ecosystem health are insufficient to provide an adequate early warning of the potential effects of climate change, long-range transport of air pollutants, increased ultraviolet radiation, acid rain, toxic chemicals, and impacts from various land uses.

To improve our knowledge base, we need standardized information that can be reported to Canadians about:

- the quantity and characteristics of toxic chemicals and other pollutants released into water bodies by point and non-point sources;

Many **volunteers** monitor the quality of water in our lakes, rivers, and streams. One example is the Clean Annapolis River Project, in which some 100 volunteers perform regular water quality tests and observations at sites on the Annapolis River and its tributaries in an effort to chart water quality changes in the watershed and determine the origin of pollutants.

Water quality in British Columbia since 1985



Source: British Columbia Ministry of Environment, Lands and Parks and Environment Canada. 2000. Water quality trends in selected British Columbia waterbodies. www.elp.gov.bc.ca/sppl/soerpt/index.html.

- the quality of both raw and treated drinking water from surface water and groundwater sources across Canada, analyzed against Canadian water quality guidelines; and
- the ecological and socioeconomic effects resulting from pollutants in aquatic ecosystems.

What are we doing based on the information we have?

Environment Canada and other federal departments conduct considerable research on the quality of Canada's waters. Canadian water quality guidelines have been developed cooperatively by Canadian governments to provide limits that protect the beneficial uses of water and measure quality. In November 1999, the Canadian Council of Ministers of the Environment (CCME) released national water quality guidelines for over 100 substances of concern in the Canadian environment. Canadian industry, government, and other stakeholders are working together to monitor the environmental effects of pulp and paper effluents. A similar environmental effects monitoring program for the metal mining sector is being established. The continued development of the National Water Quality Index by the CCME will help to standardize the communication of information on water quality trends at regional and national levels.

In the spring of 2000, the federal government announced a six-year, $2.6 billion investment in Canada's physical infrastructure. This money, along with matching funds from municipal and provincial/territorial governments, will total over $6 billion in investments. A portion is for "green infrastructure" projects, such as municipal wastewater sewage initiatives.

The federal, provincial, and territorial governments, communities and community groups, industry, and Aboriginal peoples have been working together through Ecosystem Initiatives to protect and restore targeted ecosystems across the country. There are currently five Ecosystem Initiatives across Canada: Georgia Basin, Northern Rivers, Great Lakes, St. Lawrence Vision 2000, and the

Atlantic Coastal Action Program. Environment Canada is able to address priority areas and issues of concern—ensuring that Canadians have clean air and water, protecting and conserving nature, and taking action on climate change.

In February 2000, the Government of Canada announced an additional $8 million annually to continue its part to clean up the Great Lakes Areas of Concern. More recently, Environment Canada announced the $30 million five-year Great Lakes Sustainability Fund for community projects essential to restoring the environment in Areas of Concern. Examples include cleanup of contaminated sediments and stewardship projects to reduce urban and agricultural sources of pollution.

Further information

For additional information on freshwater quality, consult the following:

Alberta: Measuring Up report:
www.treas.gov.ab.ca/measuring/index.html

British Columbia's State of the Environment Reporting:
www.elp.gov.bc.ca/sppl/soerpt/index.html

British Columbia water quality trends:
www.elp.gov.bc.ca/wat/wq/trendsWQS/

Environment Canada:

Atlantic Region web site:
www.ns.ec.gc.ca/index_e.html

Canadian Water Quality Guidelines:
www.ec.gc.ca/ceqg-rcqe

Ecosystem Initiatives:
www.ec.gc.ca/ecos_e.html

Environmental Indicator Bulletin on Municipal Water Use and Wastewater Treatment:
www.ec.gc.ca/Ind/English/Urb_H2O/

Freshwater web site:
www.ec.gc.ca/water/index.htm

Great Lakes:
www.on.ec.gc.ca/glimr/intro-e.html

Municipal Water Use Database (MUD) web site:
www3.ec.gc.ca/MUD/eng/Default.cfm

National Pollutant Release Inventory:
www.ec.gc.ca/pdb/npri/

Pacific and Yukon Region ecosystem web site:
ecoinfo.org

Prairie and Northern Region water quality web site:
www.mb.ec.gc.ca/water/science/fh00s03.en.html

Quebec Region St. Lawrence Vision 2000:
www.slv2000.qc.ec.gc.ca/index_a.htm

Manitoba State of the Environment:
www.gov.mb.ca/environ/pages/soe97/

Nova Scotia State of the Environment:
www.gov.ns.ca/envi/soer/index.htm

Freshwater use

What is the issue?

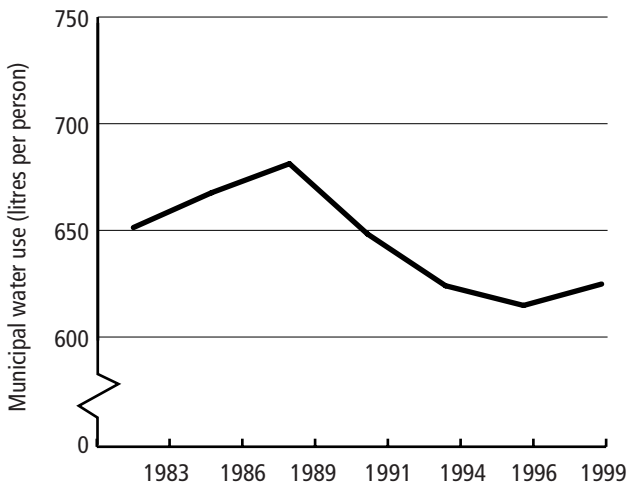
Canadians consume higher quantities of water per person than citizens of any other country in the world, except for the United States. Municipal water use strains the capacity of surface reservoirs and groundwater supplies and results in high energy and economic costs for treating and distributing water, as well as for treating wastewater. Even after treatment, the water released may be of poorer quality, which will affect the water downstream from the treatment site. In drought-prone areas, excessive water use decreases water levels and stream flows. In turn, this affects the natural capability of rivers and lakes to deal with pollutants.

What do we know?

Canada's water supply is generous by any standard, but it is not always plentiful where it is needed most. Ninety percent of Canadians live in a narrow band within 300 kilometres of Canada's southern border, while 60% of the water supply flows north. This concentration of people puts high and competing demands on some local water supplies, affecting the quality of the water and creating moderate to severe seasonal water shortages.

Approximately eight million Canadians continue to rely exclusively on groundwater for their daily water needs. Municipalities dependent on groundwater, notably those in Prince Edward Island, southern Ontario, the southern Prairies, and the interior of British Columbia, experience more frequent water shortages than those relying on surface water. In 1999, about 26% of Canadian municipalities with water distribution systems reported problems with water availability within the previous five years.

Municipal water use* in Canada, 1983–1999

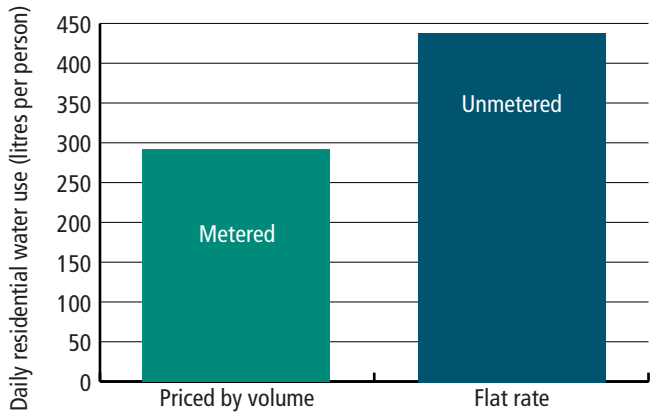


Note: * Water use values are based on, (1) municipalities that responded in a given year, and (2) a regional level estimate for all municipalities that did not respond, or in earlier years, were not surveyed.
Source: Adapted by Indicators and Assessment Office, Environment Canada, from Municipal Water Use Database (MUD).

Overall, daily municipal water use in Canada for all sectors showed a decrease from the high point of 694 litres per capita in 1989 to 628 litres per capita in 1996. Recently, however, per capita water use increased slightly to 638 litres per capita in 1999, and the population being served by municipal water systems is increasing. As a result, total water volume used is going up.

There is severe deterioration in the current water and wastewater infrastructure in Canada. The result is less efficient water and wastewater treatment and a large loss

Daily water use in metered and unmetered households in Canada, 1999



Note: A municipality was considered "metered" if more than 75% of the population served water was metered and "unmetered" if less than 25%. The few centres with 25-75% of the population metered were not included in the analysis.
Source: Indicators and Assessment Office, Environment Canada; adapted from Municipal Water Use Database, Policy and Communications, Economic and Regulatory Affairs, Environmental Economics Branch, Environment Canada, Ottawa. www3.ec.gc.ca/MUD/eng/Default.cfm.

of water through leaks in the waterworks, sometimes comprising as much as 30% of municipal water use. The cost of rebuilding the infrastructure to maintain adequate service levels has been estimated at $40–70 billion over the next 10 years.

Generally, Canadians who pay for water use much less when their water bills are based on the amount actually used. For example, in 1999, Canadian households paying for water by volume (i.e., metered) used about 288 litres per day. Households paying a flat rate used 433 litres of water a day, 50% more than the metered households. Between 1991 and 1999, the municipal population using water meters increased by just over 4%.

What additional information do we need?

More and more demand is being placed on water supplies in southern Canada: demands from the commercial, residential, and industrial sectors; and demands for water for agriculture, power generation, exports, and hydrological diversions. Comprehensive assessments of the impacts of these multiple water uses on the integrity of aquatic ecosystems are required.

Temperature changes are already affecting the hydrological cycles of many of our surface water and groundwater bodies (more details are in the *Climate change* section of this report). By assessing and predicting the potential impacts of climate change, we can get a clearer picture of the effects it might have on the quantity and quality of Canada's freshwater supplies.

What are we doing based on the information we have?

The use of water meters in certain Canadian municipalities has led to increased water conservation. Some municipalities have initiated leak detection and correction programs to reduce water loss in their existing distribution systems. These programs can recover funds, help prevent water shortages, and defer the need to develop new supply sources.

The federal government has provided the funding for a $100 million Green Municipal Investment Fund, a permanent revolving fund to support implementation of environmental projects, and a five-year, $25 million Green Municipal Enabling Fund, providing cost-shared grants for environmental feasibility studies. Both funds are administered by the Federation of Canadian Municipalities and focus on innovative solutions, including the promotion of energy reduction and water conservation in Canadian municipalities.

The federal government's "green infrastructure" projects will provide much-needed assistance to repair and add to the municipal water infrastructure. For further information, see the *Freshwater quality* section.

Further information

For more information on the freshwater use issue, check the following:

Environment Canada's freshwater web site:
www.ec.gc.ca/water/index.htm

Infrastructure Canada web site:
www.tbs-sct.gc.ca/ino-bni/Main/main_e.asp

Municipal Water Use Database web site:
www3.ec.gc.ca/MUD/eng/Default.cfm

Toxic contaminants in the environment

Persistent contaminants can take decades, or even centuries, to break down naturally. This longevity, combined with a high solubility in fat, means that the pollutants tend to accumulate in the tissues of some animals and increase in concentration in successively higher levels of food webs. As a result, top predators can have very high concentrations in their tissues. The levels of some organochlorine contaminants in the eggs of fish-eating birds, for example, may be as much as 25 million times the concentrations in the waters in which the fish live.

What is the issue?

Legislation such as the *Canadian Environmental Protection Act* has helped to significantly reduce the amount of toxic chemicals entering the Canadian environment. However, Canadian ecosystems and organisms continue to be exposed to potentially harmful levels of many toxic pollutants, including persistent organochlorine compounds. As persistent contaminants can accumulate at high concentrations in the tissues of wildlife, Canadians—particularly northern Canadians—who rely on locally harvested food are at greater risk from these toxic chemicals.

Minute concentrations of toxic contaminants adhering to inhalable airborne particles can be absorbed deep into the lungs. Thus, toxics in air, particularly urban air, are also a threat to human health.

What do we know?

Every year, approximately 6 million tonnes of hazardous waste are generated in Canada. In addition, hazardous waste is imported into Canada: total imports increased from 383 000 tonnes in 1994 to 663 000 tonnes in 1999. Although over 70% of these imports were destined for recycling in 1994, only 40% went to recycling operations in 1999.

The presence of toxic contaminants in the soil, water, and air is the subject of selected monitoring and research. A particular focus has been top predators, such as eagles, Herring Gulls, Great Blue Herons, Polar Bears, and the Beluga (White Whale).

Double-crested Cormorants, fish-eating birds at the top of the food chain, are an important indicator of toxic contamination. Concentrations of DDE (a derivative of the pesticide DDT) in Double-crested Cormorant eggs have declined between 70% and 91% since the early 1970s in sampling sites across southern Canada. The decline levelled off in the 1990s, perhaps because of the slow release of contaminant residues from bottom sediments or the long-range atmospheric transport of the pollutant from countries still using DDT.

Similarly, concentrations of polychlorinated biphenyls, or PCBs, in eggs of Double-crested Cormorants have declined between 68% and 78% since the early 1970s. The inconsistent trends in the 1990s may be due to the release of PCBs still in use, the continued escape of PCBs from storage and dump sites, and the long-range transport of PCBs from other countries.

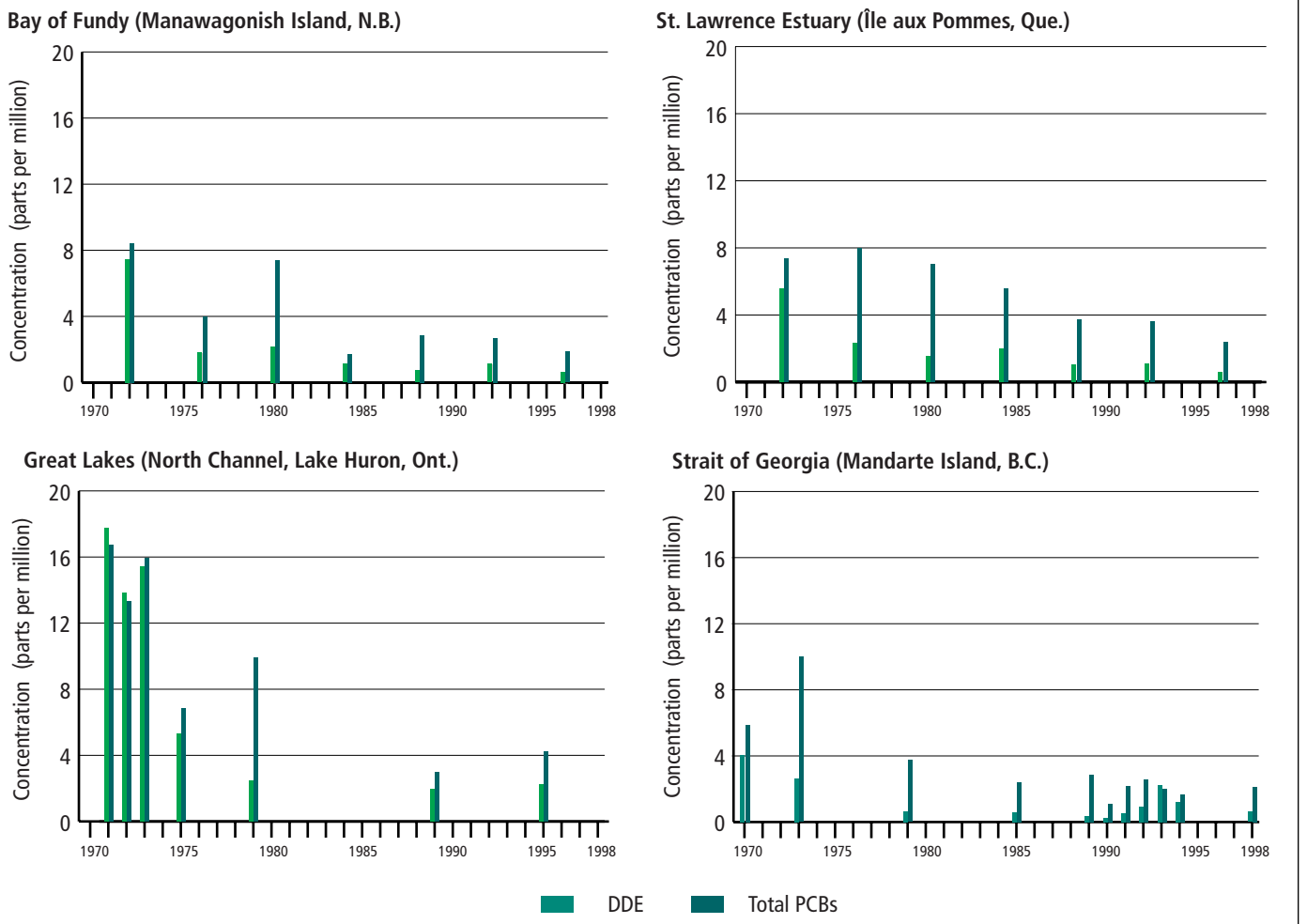
What do we need to know?

The sources of toxic contaminants must be determined, and a full understanding is needed of how these contaminants actually enter the environment. Pesticides are a major source of persistent organic pollutants, including the dozens of chemical compounds that are intentionally released into the environment to serve as herbicides, insecticides, fungicides, and rodenticides. Other sources are emissions from vehicles and industries and releases through the use of solvents and other industrial compounds. A fuller understanding of the impacts of all of these pollutants on the health of humans and other living organisms is needed.

The ***Canadian Environmental Protection Act, 1999*** states that a substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that:

- have or may have an immediate or long-term harmful effect on the environment or its biological diversity;
- constitute or may constitute a danger to the environment on which life depends; or
- constitute or may constitute a danger in Canada to human life or health.

Concentrations of DDE and PCBs in Double-crested Cormorant eggs, 1970–1998



Source: Wildlife toxicologists in the regional offices of Environment Canada (Pacific and Yukon, Ontario, and Atlantic regions) and the Wildlife Toxicology Division, Canadian Wildlife Service, Environment Canada, Ottawa.

What are we doing based on the information we have?

Regulations have been adopted in Canada over the past two decades to ban the use of organochlorine compounds or to severely restrict their release into the environment. The risk continues, however, because of the slow release of residual chemicals and the long-range transport of air pollutants from other countries still using toxic substances banned in Canada. More recent Canadian actions to address this issue include, for example, a section of the *Canadian Environmental Protection Act, 1999* that addresses virtual elimination of PCBs, DDT, and certain other substances. The *Canadian Environmental Protection Act, 1999* also provides enhanced authority to control the export and import of hazardous waste, whether it is destined for final disposal or recycling.

In 1998, Canada signed an international Persistent Organic Pollutants Protocol to reduce atmospheric emissions of DDT, PCBs, and 14 other persistent organic pollutants. The agreement was negotiated under the auspices of the United Nations Economic Commission for Europe, which includes Canada, the United States, and countries of Europe and the former Soviet Union. It is the first major multinational, legally binding agreement to place controls on emissions of these hazardous pollutants.

Negotiation of a global Convention of Persistent Organic Pollutants (POPS) under the United Nations Environment Programme were completed in December 2000. The draft convention sets out control measures covering the production, import, export, disposal, and use of 12 of these pollutants. It calls for the promotion of the best available technologies and practices for replacing existing uses of POPs while preventing the development of new ones. The 122 Countries involved in the negotiations are to draw up national implementation strategies and develop action plans for carrying out their commitments. Canada played a leadership role in developing this draft convention. The Convention will be formally adopted at a Conference in Stockholm, May 2001, and will enter into force when ratified by 50 countries, a process that is expected to take about four years.

Further information

For additional information on toxic chemicals, please refer to the following:

Environment Canada:

- Atlantic Region toxic chemicals:
  www.ns.ec.gc.ca/pollution/toxichemical.html
- Environmental indicator bulletin on toxic contaminants:
  www.ec.gc.ca/ind/English/Toxic/default.cfm
- National Wildlife Toxicology Program:
  www.cws-scf.ec.gc.ca/nwrc/wildtox.htm
- Ontario Region pollution prevention web site:
  www.on.ec.gc.ca/pollution/
- PCBs in cormorant eggs in British Columbia:
  www.ecoinfo.org/env_ind/region/cormorant/pcbs.htm
- Prairie and Northern Region Toxic Substances Division:
  www.mb.ec.gc.ca/pollution/e00s26.en.html
- Quebec Region wildlife ecotoxicology:
  www.qc.ec.gc.ca/faune/faune/html/ecotoxicology.html

Government of British Columbia toxic contaminants indicator:
www.env.gov.bc.ca/sppl/soerpt/15-glance.html

Toxic Substances Research Initiative:
www.hc-sc.gc.ca/ehp/ehd/tsri/index.htm

Nature

Nature is part of the Canadian identity, providing substantial economic, social, and environmental benefits. Avoiding the loss of biodiversity is one of the most critical steps in preserving the natural legacy that we will pass on to future Canadians.

Species at risk

Biodiversity refers to the variety of life on Earth. More specifically, it encompasses the different animals, plants, and other organisms living in a certain area, the range of possible genetic characteristics within each of these populations, and the variety of ecosystems that these populations inhabit.

What is the issue?

Wildlife populations and their habitats have been disappearing rapidly due to extensive human activities that have resulted in deforestation, the spread of nonnative species, the loss of wetlands, and air and water pollution. The world's plants, animals, and other organisms all play a key role in maintaining the Earth's atmosphere, climate, landscapes, and water in a way that will allow for our continued economic sustainability. Loss of species impairs the Earth's ability to provide those services on which people and economic prosperity depend. Canadians need to know more about their country's natural legacy and its significance to ecological processes and functions.

What do we know?

Canada is home to approximately 70 000 known species of wild plants, animals, and other organisms. New species are still being discovered. In the early 1990s, as many as 60 new insect species were identified in the canopies of old-growth forests in the Carmanah Valley and South Moresby on the west coast.

Despite these new species, studies are showing that a growing number of species are at risk of eventual extinction. Recent surveys of Belugas of the southeast Baffin Island-Cumberland Sound population indicate that fewer than 400 Belugas are left out of a population that numbered about 5 000 in the early 1920s. In the St. Lawrence, from the estimated original population of 5 000 Belugas, only about 500 remain. Causes of the decline in populations include exploitation, alteration of habitats, and disturbances caused by ships and leisure craft. Degradation of water quality and environmental contaminants such as PCBs,

The **Committee on the Status of Endangered Wildlife in Canada (COSEWIC)**, established in 1978, is an independent organization of wildlife scientists and experts from across the country. COSEWIC determines the level of risk of extinction for a species using rigorous assessment criteria. **Species** is defined as any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora. The various categories of this classification are:

Extinct: a species that no longer exists.

Extirpated: a species no longer existing in the wild in Canada, but occurring elsewhere.

Endangered: a species facing imminent extirpation or extinction.

Threatened: a species likely to become endangered if limiting factors are not reversed.

Special concern (**vulnerable**)**:** a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Not at risk: a species that has been evaluated and found to be not at risk.

Data deficient: a species for which there is insufficient scientific information to support status designation.

Species at risk in Canada, November 2000

Status	Birds	Mammals		Fish	Amphibians & reptiles	Molluscs	Butterflies & moths	Plants	Lichens & mosses	Totals
		Terrestrial	Marine							
Extinct	3	1	1	6	0	1	0	0	0	12
Extirpated	2	2	2	2	1	1	3	2	0	15
Endangered	20	9	6	9	8	5	3	45	2	107
Threatened	6	6	6	16	9	1	2	30	0	76
Special concern	22	17	8	41	17	1	2	43	3	154
Total	**53**	**35**	**23**	**74**	**35**	**9**	**10**	**120**	**5**	**364**

Source: Committee on the Status of Endangered Wildlife in Canada.

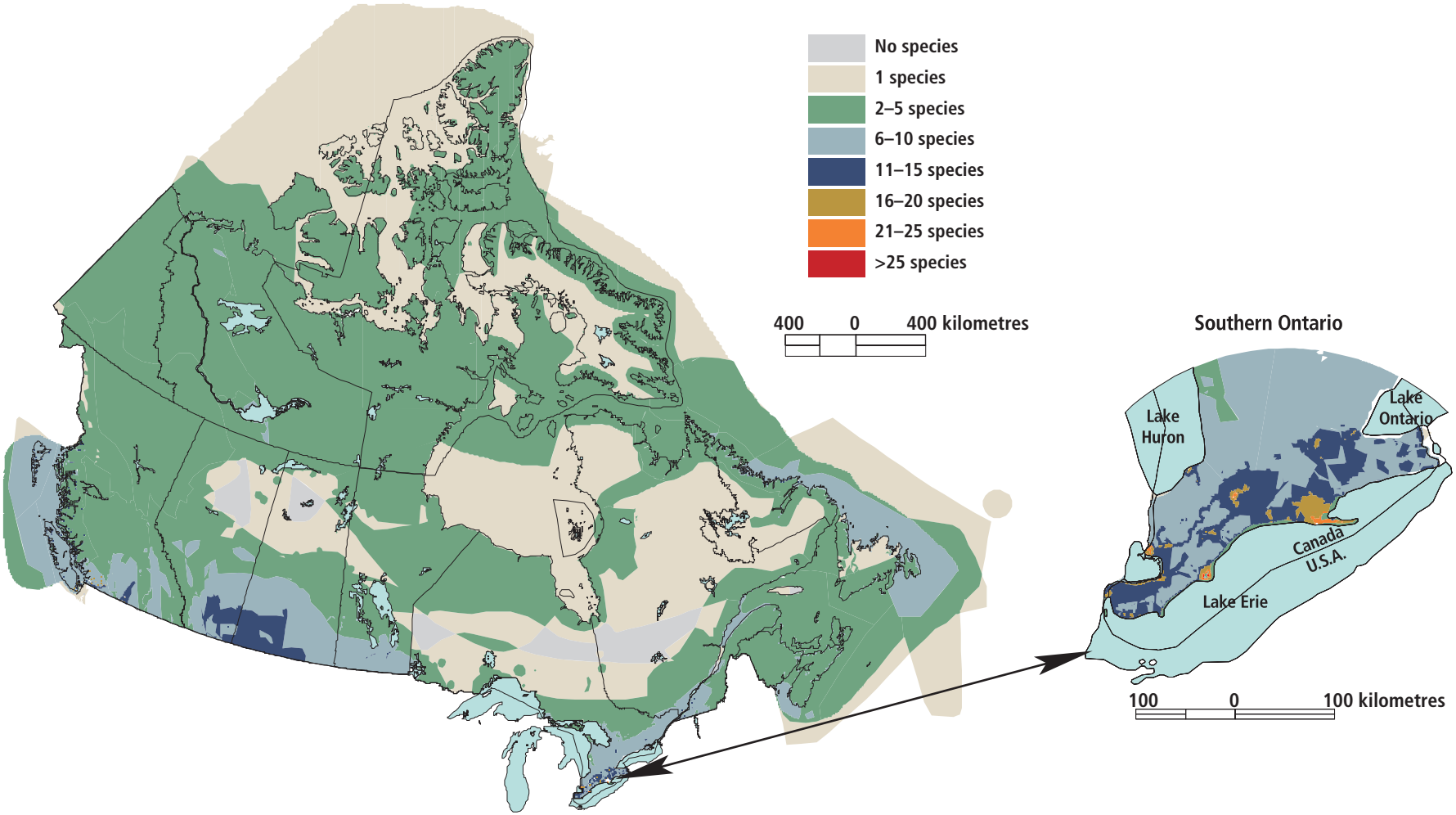
DDT, mirex, and heavy metals such as lead, mercury, and selenium are also linked to declines in Beluga populations.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determined that a total of 337 species were at risk of imminent or eventual extinction (i.e., endangered, threatened, or of special concern) in Canada as of November 2000. Of the 123 species reexamined by scientists in recent years, 27 have seen their status deteriorate. The Prairie grasslands, southern Ontario, and the southern Okanagan region of British Columbia are some of the areas where a large number of species have been identified as being at risk.

What do we need to know?

Declines in species populations are usually linked to habitat destruction or fragmentation as a result of various land-use activities, such as forestry, agriculture, and urbanization. Toxic chemical exposure also plays a role. Some wildlife biologists also believe that acid rain and ultraviolet radiation are partially the cause of population declines of some species of waterfowl and amphibians. The complex ways in which an ecosystem works can make it difficult to find a single cause for changes in wildlife

Species at Risk in Canada



Source: Indicators and Assessment Office and Knowledge Integration Branch, Environment Canada, Ottawa www.sis.ec.gc.ca/cgi-eas/endanew.exe

populations. More scientific knowledge about ecosystem processes, the related stresses from human activity, and their effects on species is necessary. Further knowledge of the spatial distribution of species at risk and of species' migratory behaviour, population size, and population trends is also required to provide Canadians with an understanding of causes behind the disappearance of various species of wildlife and of the science of species recovery.

What are we doing based on the information we have?

The recently proposed Species At Risk Act (SARA) is designed to help prevent wildlife in Canada from becoming extinct and to provide for the recovery of species at risk. The proposed legislation will include the COSEWIC list in a public registry and will provide the authority to prohibit the killing of endangered or threatened species as well as the destruction of their critical habitats on all lands in Canada. Mandatory recovery strategies and action plans for endangered or threatened species and management plans for species of special concern are also being proposed under the legislation.

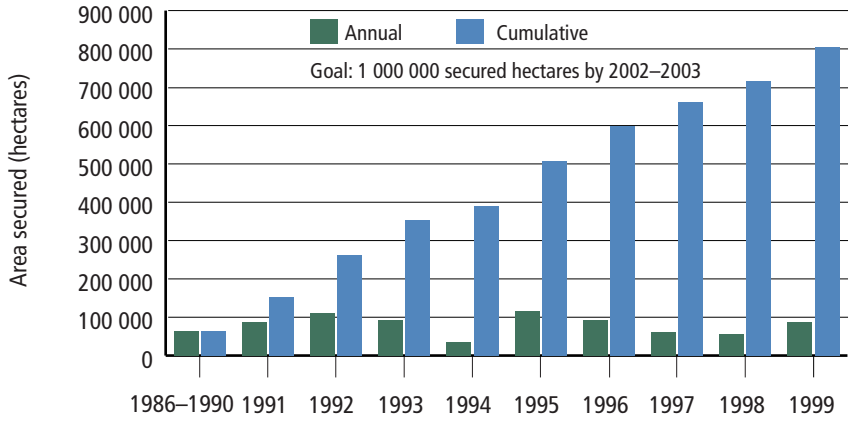
SARA is one component of the Government of Canada's strategy to protect species at risk; the two other components are the Accord for the Protection of Species at Risk and the Habitat Stewardship Program. Individual wildlife species are being protected through the implementation of hunting regulations and restrictions, the Habitat Stewardship Program and recovery plans, and habitat protection plans.

A national ban on the use of lead shot for hunting most migratory birds came into effect in September 1999, after research indicated that at least a quarter of a million waterfowl died each year after mistakenly eating lead pellets. Humans and predatory wildlife consuming these birds were also at risk of lead exposure.

There are already a number of recovery activities under way in Canada under the Recovery of Nationally Endangered Wildlife (RENEW) program launched in 1988, and these will complement the federal recovery process under the proposed Species at Risk Act (SARA). Under the 1996 Accord for the Protection of

Environment Canada's **Ecological Monitoring and Assessment Network (EMAN)** is developing an early-warning system for the detection, description, and communication of ecosystem change. A national volunteer monitoring program is a key part of EMAN. A wealth of information and details on getting involved is included in the EMAN website at: *www.cciw.ca/eman-temp/intro.html*.

Annual and cumulative accomplishments of the North American Waterfowl Management Plan in Canada, 1986–1999



Source: Canadian Wildlife Service, Environmental Conservation Service, Environment Canada, Ottawa.

Species at Risk with the provinces and territories, and under the proposed SARA, the scope of the national recovery program has expanded to include all endangered and threatened species and, where possible, extirpated species. Recovery planning for groups of species or particular ecosystems, such as the southern Okanagan Valley in British Columbia and the Carolinian forest in Ontario, are also being focused on. In the last year, recovery efforts have included the establishment of 47 recovery teams, the approval of 17 recovery plans, and the preparation of 21 draft recovery plans. Through the Habitat Stewardship Program, approximately $5 million were given in 2000-2001 to over 60 partnership projects with local and regional organizations and communities.

Ecosystems at risk are being protected through agreements such as the trilateral North American Waterfowl Management Plan (NAWMP), where waterfowl

populations can be restored through the establishment of wetland habitat throughout North America. Plan activities benefit a whole range of wildlife species including many that are endangered. More than 805 700 hectares have been conserved in Canada since the establishment of NAWMP in 1986. Canada's goal is to secure 1 million hectares by 2002-2003.

Further information

For further information on the issue of species at risk, please consult:

Canadian Wildlife Service:
www.cws-scf.ec.gc.ca/cws-scf/cwshom_e.html

Cetaceans of Canada, Beluga:
www.mi.mun.ca/mi-net/fishdeve/cetace13.htm

Committee on the Status of Endangered Wildlife in Canada:
www.cosewic.gc.ca/cosewic/default.cfm

Environment Canada's Green Lane, nature site:
www.ec.gc.ca/envpriorities/nature_e.htm

Map search for species at risk in Canada:
www.speciesatrisk.gc.ca/Species/English/enda_english.cfm

North American Waterfowl Management Plan:
www.nawmp.ca/

Recovery of Nationally Endangered Wildlife (RENEW):
www.cws-scf.ec.gc.ca/es/renew/RENEW99_00/eng/index.htm

Species at risk:
www.cws-scf.ec.gc.ca/sara/main.htm

Natural areas

Consistent and comparable information on **protected areas** in Canada is difficult to find. Various databases that contain basic quantitative, descriptive, and geographic information provide different pictures of the overall status and trends of Canada's network of protected areas. These differences can be explained by the use of different criteria representing protected areas, such as size, representation of the natural region, management standards, and scale. This section uses the database developed by the Canadian Council on Ecological Areas in association with Environment Canada.

What is the issue?

Across Canada, many natural areas are rapidly disappearing, along with critical habitat for the many plant and animal species that they support. Losses of habitats are clustered largely in southern Canada, because diversity and pressure for development are the highest there. Protected areas help conserve natural ecosystems and maintain biodiversity, provide ways to understand ecosystem trends, and can also provide a source of species for reintroduction to restored areas. Protected areas include nature reserves, designated wilderness areas, national parks, habitat/species management areas such as migratory bird sanctuaries, and other conservation areas.

What do we know?

Canada is characterized by large natural tracts of land, diverse landscapes, and many different ecosystems. The country contains over 20% of the world's Arctic regions, 10% of its forests, and 25% of its wetlands, and it has the longest coastline on the planet. In 1997, 8.6% of Canada's land area, or almost 859 000 square kilometres, was protected in approximately 3 100 sites through the combined efforts of governments and conservation agencies.

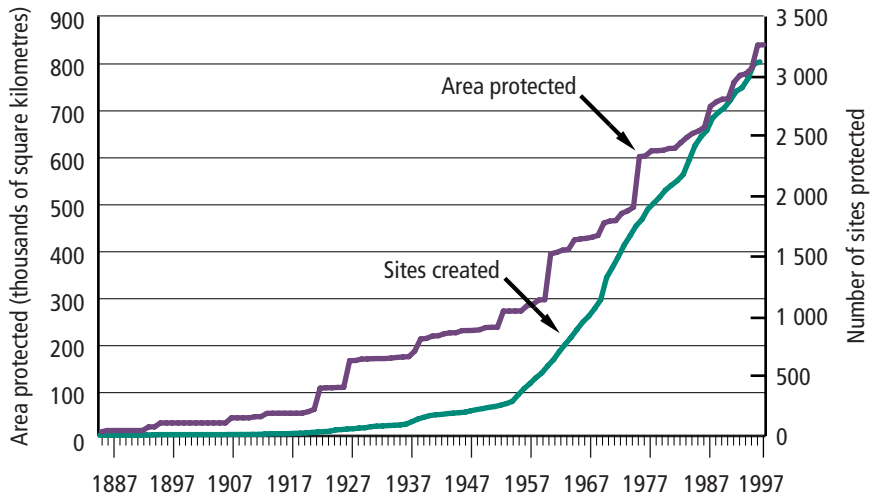
From 1990 to 1997, the total area under protection in Canada increased by roughly 17%. Despite these increases, the total representative natural regions in Canada still fall short of the 12% protection target endorsed by Members of Parliament in 1991.

Establishing conservation areas helps to maintain biodiversity but does not completely guarantee the protection of species. Protected areas are increasingly affected by habitat fragmentation and alteration from the effects of development, as well as from competition and disease from exotic or nonnative plant and animal species. Tourism and recreational facilities can cause additional pressures. Some protected areas allow logging, hunting, and mining, while others exclude virtually all human activities.

What additional information do we need?

The protection of ecosystems in Canada is shared by governments at various levels, as well as by non-governmental organizations and individual landowners. To complete Canada's network of protected areas, we need to identify gaps in the representation of biodiversity in the existing set of areas that have been designated for the preservation of native species and ecosystems. The first step is learning as much as possible about the many different terrestrial and aquatic ecosystems throughout the country. At the same time, we need to identify areas of species or special characteristics that should have priority for protection or sustainable use.

Area and number of protected areas in Canada, 1885–1997



Sources: Canadian Conservation Areas Database, Canadian Council on Ecological Areas; Environment Accounts and Statistics Division, Statistics Canada.

Protected areas in Canada are classified using the classification system of the **World Conservation Union**, formerly the International Union for the Conservation of Nature and Natural Resources (IUCN). The two categories offering the highest degree of protection under this system are nature reserves or wilderness areas and national parks or their equivalent.

What are we doing based on the information we have?

Canada continues its progress towards completing a network of protected areas representing Canada's land-based natural regions (e.g., ecological reserves, wildlife areas, parks, etc.). In order to protect special sites, wildlife organizations, businesses, and private groups are making acquisitions through purchase or donation. Private stewardship agreements between individual landowners and governments are also helping to protect ecosystems.

The Government of Canada's Millennium Partnership Program provided financial support to "Natural Legacy 2000," a nationwide initiative that helps Canadians to protect the long-term health of Canadian landscapes. This initiative is being delivered by four of Canada's largest nature conservation organizations: Ducks Unlimited Canada, the Canadian Nature Federation, the Nature Conservancy of Canada, and the World Wildlife Fund (Canada). The initiative focuses on saving endangered species, building a protected areas network, conserving ecologically significant private lands, conserving wetlands, and protecting bird habitat. The EcoGifts expanded program set out in Budget 2000 provides for a 50% reduction in capital gains tax payable on donations of ecologically sensitive lands.

Some of Canada's protected areas are designated under the terms of international treaties or agreements that recognize areas for their contribution to global conservation goals. The Ramsar Convention, for example, provides a framework for the conservation of wetlands of international importance. Biosphere reserves, established under the Man and the Biosphere Programme of the United Nations Educational, Scientific and Cultural Organization, respond to a wide range of objectives, including scientific research, training, monitoring, and demonstration, as well as conservation.

Further information

For additional information on the natural areas issue, check the following:

Canadian Council on Ecological Areas:
www.cprc.uregina.ca/ccea/

Canadian Nature Federation:
www.cnf.ca/

Canadian Parks and Wilderness Society:
www.cpaws.org/

Ducks Unlimited Canada:
www.ducks.ca/

Ecological Monitoring and Assessment Network web site:
www.cciw.ca/eman-temp/intro.html

Natural Legacy 2000:
www.naturallegacy2000.com/

Nature Conservancy of Canada:
www.natureconservancy.ca/

Parks Canada, Canadian Heritage:
www.parkscanada.gc.ca/parks/main_e.htm

Wildlife Habitat Canada:
www.whc.org/

World Conservation Union classification system:
www.iucn.org/

World Wildlife Fund (Canada):
www.wwfcanada.org/

Climate Change and Severe Weather

The atmosphere helps to regulate our global ecosystem.
If the atmosphere changes, the health of the
ecosystem can also change,
bringing with it a number of consequences.
This section looks at climate change and severe weather.

Climate change

More than seven billion observations of Canada's climate collected over the past 150 years are housed in the National Climate Archives in Downsview, Ontario. Most of these have come from the network of more than 2 000 people from every province and territory who are **volunteer climate observers**.

What is the issue?

The average global air temperature has risen about 0.6°C over the past century. The 10 warmest years worldwide, since temperature records began nearly 140 years ago, have all occurred since 1980.

The chemical composition of the atmosphere is changing through the buildup of greenhouse gases, mostly carbon dioxide, methane, and nitrous oxide. This buildup of greenhouse gases, largely from human activity, is upsetting the natural balance in the atmosphere. The result is that the Earth is heating up.

Estimates indicate that a continued warming of the Earth's temperature would trigger a wide range of changes in our climate that could have consequences for our environment, our health, and our economy. Although the precise impacts of climate change are difficult to estimate, the consequences could be serious for humans and the environment on which we depend.

What do we know?

Canada's average annual temperature increased by about 0.9°C between 1948 and 2000. Most of western and northwestern Canada has warmed by between 1.0°C and 1.8°C. Increases in the eastern Arctic and Great Lakes–St. Lawrence lowland have been more modest, and Atlantic Canada has cooled slightly by 0.2°C.

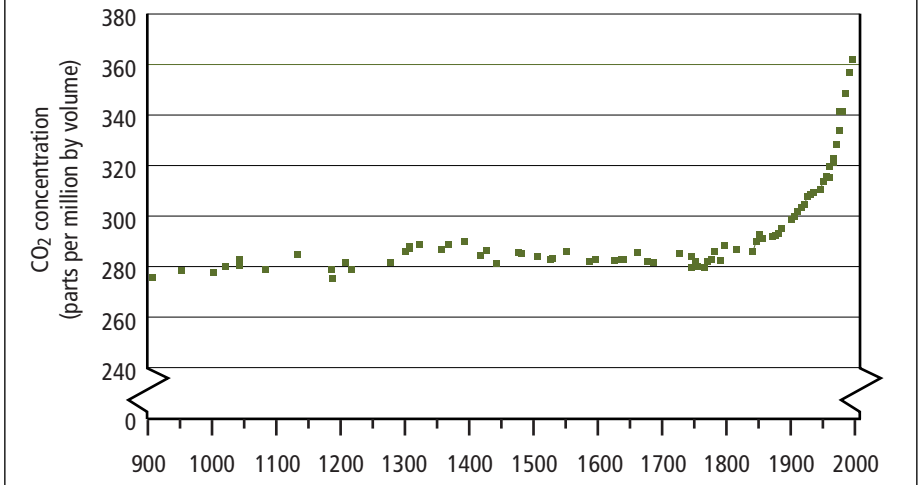
The general global warming trend is linked to increases in the amounts of greenhouse gases in the atmosphere. Carbon dioxide is the most significant greenhouse gas released by human activities, and it comes mostly from the burning of fossil fuels. In 1998, Canadians emitted greenhouse gases in an amount equivalent to about 682 million tonnes of carbon dioxide. Almost 80% of these emissions are attributable to energy production and use. Increases in emissions are due to higher fossil fuel production and increased consumption of energy in the transportation sector.

Projections indicate that, as a northern nation, Canada may experience a greater degree of warming than countries closer to the equator. Canada's average temperature is expected to be more than 5°C warmer by the end of the 21st century, compared with a projected 3°C increase in average global temperature.

What additional information do we need?

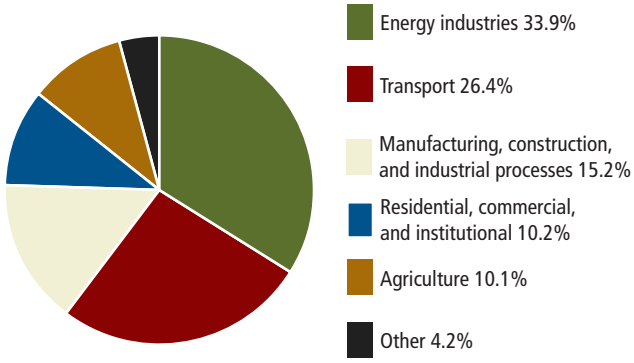
We need to understand and anticipate the potential social, economic, and environmental consequences of climate change. For example, changes to water temperature, currents, and water quality will affect the productivity of fish populations and how they are distributed throughout lakes, rivers, and oceans. Warmer conditions would put stress on forest distribution and growth and are expected to increase the area and frequency of forest fires and pest infestations. The consequences may not all be adverse. We need to understand and develop approaches on how to adapt to both positive and negative aspects of climate change.

Trends in global carbon dioxide (CO_2) concentrations based on data from atmospheric monitoring stations and ice cores from Antarctica and Greenland, 900–1995



Source: Meteorological Service of Canada.

Canada's greenhouse gas emissions by economic area, 1998



Source: Environment Canada. 2000. Canada's greenhouse gas inventory: 1990–1998. Final submission to the United Nations Framework Convention on Climate Change Secretariat. Volume 1 of 2.

What are we doing based on the information we have?

Climate change is a global problem that requires global action. Canada, along with 153 other countries, signed the United Nations Framework Convention on Climate Change in 1992. In 1998, Canada signed the Kyoto Protocol, committing to a reduction in carbon dioxide emissions by 6% below 1990 levels by 2012.

A comprehensive national assessment was completed in 1998 of potential social, biological, and economic impacts of climate change, including sectoral and regional analyses, and options for adaptation.

In spring of 2000, the Government of Canada announced an investment in its climate change initiative of over $500 million through to 2002–2003. This includes a number of critical projects:

- promoting technological innovation;
- enhancing climate change and atmospheric research;
- helping communities to take action;
- expanding purchases of green power;
- renewing the Climate Change Action Fund and energy efficiency and renewable energy programs; and
- helping developing countries to take action.

The first national implementation strategy and first business plan with concrete actions to reduce greenhouse gas emissions were approved in the fall of 2000 by the Energy and Environment Ministers of all but one of the federal, provincial and territorial governments of Canada.

Further information

For more information and a copy of a climate change kit with ideas on how you can reduce greenhouse gas emissions, telephone the toll-free line: 1-800-622-6232. You can also consult the web sites listed below:

Canada Country Study:
www.ec.gc.ca/climate/ccs/ccs_e.htm

Environment Canada:
www.ec.gc.ca/climate/index.html

Government of Canada climate change site:
www.climatechange.gc.ca

Intergovernment Panel on Climate Change:
www.usgcrp.gov/ipcc/

National Climate Change Secretariat:
www.nccp.ca

Severe weather

A **weather-related disaster** is an event resulting in great loss of life and/or property.

What is the issue?

The weather affects us all. The economic and human losses from floods, tornadoes, severe winds, snow, and ice storms can be tragic and are often severe. As the population of Canada grows, population concentrations increase along with chances that extreme weather events will affect more people.

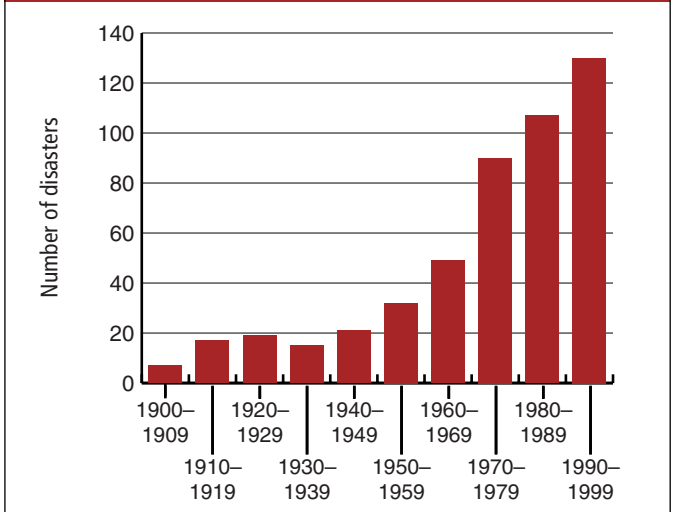
Some researchers indicate that an increase in the frequency and intensity of hurricanes, tornadoes, and other extreme weather events has occurred over the last 15–20 years. However, there is not yet enough scientific evidence to show a link between increasing severe weather and a changing climate.

What do we know?

While there is insufficient scientific evidence supporting a link between weather extremes and global warming trends, there is little debate that Canadians have experienced recent changes in weather patterns and a substantial increase in the number and cost of weather-related disasters.

In the Atlantic Ocean, there has been a dramatic increase in the number of hurricanes since 1995. Between 1995 and 2000, 49 hurricanes occurred—the most active six consecutive years of tropical storms on record, following the four quietest years this century. In Canada, where an average of one or two tropical storms each year enter Canadian waters, 1998 and 1999 each saw an average of four tropical storms.

Weather-related disasters in Canada, 1900–1999



Source: Meteorological Service of Canada.

Few people can remember water levels in the Great Lakes being as low as in the fall of 2000, which marked the 14th consecutive season with above-normal temperatures in Canada. The low levels are due to lower precipitation totals and less runoff from rivers and streams, as well as increasing evaporation losses and greater consumption of water.

Canadian property and casualty insurers are well aware of the havoc caused by weather-related disasters. Ever since the Edmonton tornado in 1987, there has been an increase in both the frequency and severity of multi-million-dollar weather-related disasters. Between 1983 and 1987, such disasters cost Canadians about $500 million. By contrast,

Losses in Canada due to **extreme weather events** from 1987 to 1998 have been estimated by the Meteorological Service of Canada. In addition to the 70–100 lives that were lost and the displacement of over 58 000 people, insurable losses were estimated to be $3 billion and economic losses $7–10 billion, including the following:

Ice storm 1998: $4.2 billion
Saguenay flood 1996: $1.2 billion
Red River flood 1997: $400 million
Calgary hailstorms 1991: $400 million
Edmonton tornado 1987: $300 million
British Columbia blizzard 1996–1997: $200 million

There are some 7 000 **severe weather watchers** across Canada who keep their eyes on the skies for signs of everything from thunderstorms and funnel clouds to blizzards and hailstorms. They are part of a long tradition of volunteer weather watchers. Another program involves specially trained amateur radio operators who can spot and report on severe weather conditions.

between 1993 and 1997, the cost to insurers and taxpayers was more than $1.5 billion. In 1998 alone, the cost of natural disasters more than doubled again to over $4 billion, primarily as the result of the ice storm in eastern Ontario, Quebec, and the Maritime provinces.

What additional information do we need?

The most immediate need is a greater understanding of weather patterns and prediction, so that warnings can be issued in time for communities and individuals to avoid disaster from serious storms and severe weather events. Over the medium and longer term, Canadians and their governments need to know what the future holds in terms of the frequency, intensity, and duration of extreme weather events, such as floods, intense rain and snowfall, and severe droughts. The more knowledge we have, the better decisions we can make. These decisions would affect locations and types of infrastructure (our bridges, buildings, and roads, for instance), as well as the design of towns and cities, planning for emergencies, the management of agricultural enterprises and communication systems, and the design of energy and water networks.

What are we doing based on the information we have?

Timely and accurate weather warnings and advisories issued by Environment Canada have helped to reduce the number of casualties and damage from natural disasters. A national lightning network was recently added, and a national Doppler radar network is being installed, aimed at giving meteorologists the data they need to detect and predict severe weather more quickly and more precisely. Research is ongoing to constantly improve our scientific understanding of the systems that influence weather and the methods and tools to better predict environmental hazards. Environment Canada is also investigating new ways to better deliver weather information to all Canadians, including national telephone and Internet weather information and television WeatherAlert messages.

Further information

For more information on severe weather events, please consult the following:

Climate Change and *Extreme Events: Canada,* by David Etkin, *in* Canada Country Study: Climate Impacts and Adaptation (1997):
www.ec.gc.ca/climate/ccs/pdfs/volume8/vol8ch2.pdf

Environment Canada climate change web site:
www.ec.gc.ca/climate/

Extreme Weather and Climate Change, by David Francis and Henry Hengeveld (1998):
www.msc-smc.ec.gc.ca/saib/climate/Climatechange/eng.pdf

Getting to the Path Ahead

This report is one part of a renewed commitment by the Government of Canada to provide regular updates on environmental issues to Canadians. Future reports will have a more comprehensive picture of all the top environmental issues of concern to Canadians. These reports will also provide an overview of progress made to date in addressing the environmental issues.

While these citizen-oriented reports will initially use existing information and tools, they will reflect over time the renewed investment by the Government of Canada in gathering, analyzing, and interpreting new environmental information through the Environmental Innovation Agenda.

By the end of 2001, a national Task Force will report to the government on a recommended design and strategy for the new Canadian Information System for the Environment, including analytical tools and means for public reporting. This comprehensive environmental information system will help to provide Canadians with up-to-date information on progress in addressing environmental concerns, as well as information that will help them to take action to protect the environment. It will also improve the basis for public policy based on the principle of sustainable development. Key to the success of this initiative will be the engagement of provincial, territorial, and other partners, as well as feedback from Canadian citizens.

One of the most important actions that any individual, organization, business, or government can take to help the environment is to know more about it—to more fully understand the science, the challenges concerning what we need to know, as pointed out in this report, and the possibilities. By simply reading this report and others like it, the first step towards environmental action has been taken. Other steps can be as large in scale as implementing a zero-pollution program in an industrial plant or as individual as making a family decision to drive 100 kilometres less per week. Each is an action based on knowledge, and each is an action that will benefit the environment.

Canadian volunteers from every walk of life can and do make a vital contribution to improving our knowledge and understanding of the environment. They count birds through such programs as the Christmas Bird Count, listen to and record information on frogs through Frogwatch, gather weather data using Stephenson screens in backyards, and contribute through a host of other activities. A good deal of the work that Environment Canada carries out today is made possible by their efforts (see "Citizen Science: volunteers the eyes and ears of Environment Canada" at the Science & The Environment web site www.ec.gc.ca/science/new/enviroaction_e.html).

If you want to learn more about what you can do to help the environment, Environment Canada's EcoAction 2000 web site (www.ec.gc.ca/ecoaction/index_e.htm) provides further examples of what individuals, groups, businesses, and organizations are doing. Similarly, the Millennium Eco-Communities site provides information on what community groups are doing to tackle environmental challenges. (www.ec.gc.ca/eco)

There are many suggestions for such actions, and more information on environmental issues, science, and policy, available on Environment Canada's Green Lane at **www.ec.gc.ca** or by calling the Environment Canada Inquiry Centre at 1-800-668-6767.

Further Information Sources

Government agencies and their web sites

Federal

Agriculture and Agri-Food Canada:
www.agr.ca/index_e.phtml

Environment Canada:

The Green Lane national home page:
www.ec.gc.ca/envhome.html

Atlantic Region:
www.ns.ec.gc.ca/index_e.html

Ontario Region:
www.on.ec.gc.ca/or-home.html

Pacific and Yukon Region:
www.pyr.ec.gc.ca/index_e.htm

Prairie and Northern Region:
www.mb.ec.gc.ca/index.en.html

Quebec Region:
www.qc.ec.gc.ca/envcan/indexe.html

State of Canada's Environment Infobase:
www.ec.gc.ca/soer-ree/english/default.cfm

Indian and Northern Affairs Canada:
www.inac.gc.ca/index_e.html

Natural Resources Canada:
www.NRCan.gc.ca:80/homepage/toc_e.shtml

Provincial/Territorial

Alberta Environment:
www.gov.ab.ca/env/

British Columbia Ministry of Environment, Lands and Parks:
www.gov.bc.ca/elp/

Manitoba Conservation:
www.gov.mb.ca/environ/index.html

New Brunswick Environment and Local Government:
www.gov.nb.ca/elg-egl/index-e.htm

Newfoundland Environment and Labour:
www.gov.nf.ca/env/Labour/OHS/default.asp

Northwest Territories Resources, Wildlife, and Economic Development:
www.rwed.gov.nt.ca

Nova Scotia Department of the Environment:
www.gov.ns.ca/envi/

Nunavut Department of Sustainable Development:
www.gov.nu.ca/eng/Departments/sd.htm

Ontario Ministry of the Environment:
www.ene.gov.on.ca/

Prince Edward Island Fisheries, Aquaculture and Environment:
www.gov.pe.ca/fae/index.php3

Québec Ministère de l'Environnement:
www.menv.gouv.qc.ca/index-en.htm

Saskatchewan Environment and Resource Management:
www.serm.gov.sk.ca/

Yukon Territory Department of Renewable Resources:
www.renres.gov.yk.ca

Publications

Agriculture and Agri-Food Canada. 1998. *The health of our air: toward sustainable agriculture in Canada*. Ottawa.
res2.agr.ca/research-recherche/science/Healthy_Air/pdf.html

Agriculture and Agri-Food Canada. 2000. *The health of our water: toward sustainable agriculture in Canada*. Ottawa.
res2.arg-ca/research-recherche/science/healthy_water/epdf.html

British Columbia Ministry of Environment, Lands and Parks. 2000. *Environmental trends in British Columbia 2000*.
www.elp.gov.bc.ca/sppl/soerpt/

Environment Canada. 2000. *Millennium Eco-Communities: Resource Catalogue.* Includes selected publications and web sites, year 2000. Ottawa.
www.ec.gc.ca/eco/Mec_2000/tosindex_e.htm

Environment Canada. 2000. *State of our Great Lakes. Working towards a healthy and sustainable Great Lakes basin*.
www.on.ec.gc.ca/glimr/state-e.html

Environment Canada, in partnership with the Inter-Agency Steering Committee. 1998. *Compendium of ecosystem health goals, objectives, and indicators*. Ottawa.
www.ec.gc.ca/cehi/en/index_e.htm

Environment Canada and United States Environmental Protection Agency. 1999. *State of the Great Lakes 1999*. Toronto and Chicago.

Gray, C. and T. Tuominen (eds.). 1998. *Health of the Fraser River aquatic ecosystem. Volumes 1 and 2. A synthesis of research conducted under the Fraser River Action Plan. DOE FRAP 1998-11*. Vancouver: Environment Canada.
www.pyr.ec.gc.ca/ec/Frap/fr-eq.html#synthesis

Natural Resources Canada. 1999. *Forest health in Canada: an overview 1998*. Ottawa: Natural Resources Canada, Canadian Forest Service.

Nova Scotia Department of the Environment. 1998. *The state of the Nova Scotia environment 1998*. Halifax.
www.gov.ns.ca/envi/soer/index.htm

Organisation for Economic Co-operation and Development. 1998. *Towards sustainable development: environmental indicators*. Paris, France.

Saskatchewan Environment and Resource Management. 1995, 1997, 1999. *State of the environment reports*.
www.serm.gov.sk.ca/publications.php3

Saskatchewan Environment and Resource Management. *State of the environment fact sheets*.
www.serm.gov.sk.ca/publications.php3

Statistics Canada. 2000. *Human activity and the environment 2000*. Catalogue No. 11509XPE. Ottawa.

United Nations Environment Programme. 1999. *Global environment outlook (GEO) 2000*. New York.
www.unep.org/geo2000/

Watson, R.T., J.A. Dixon, S.P. Hamburg, A.C. Janetos, and R.H. Moss. 1998. *Protecting our planet: securing our future*. United Nations Environment Programme, United States National Aeronautics and Space *Administration, and the World Bank*.

World Resources Institute, United Nations Environment Programme, United Nations Development Programme, and the World Bank. *World resources 2000–2001*. Washington, D.C.: World Resources Institute.
www.wri.org/wr2000/index.html

Photo Credits

Cover & page i: Air and Water: *Tranquility*, by Lynda Maltby, Greely, ON
Nature: *Loon,* Canadian Wildlife Service
Climate Change and Severe Weather: *Cloud majesty*, by Doreen Stoot, Elmwood, ON

Page iii: Minister of the Environment

Page iv: *Quidi Vidi Lake in the morning*, by Vera Ballantyne

Page 2: *Blackstone River*, N.W.T., by Gerry Wright, Fort Simpson, N.W.T.

Pages 4–5: *Tranquility*, by Lynda Maltby, Greely, ON

Page 6: *Clouds*, by Martin Boddington

Page 9: *Cars and exhaust*: Corel CD photo #151024

Page 10: *Home sweet home,* Gatineau Park, by Sabrina Lacroix, Vanier, ON

Page 12: *Refinery*: Corel CD photo #250008

Page 13: *Untitled*, by Bev McMullen, St. Catharines, ON

Page 14: *Lake Pukaskwa*, Ontario: Corel CD photo #344048

Page 17: *Baby on beach*, Lake Nipissing, by Joanne Naismith, North Bay, ON

Page 18: *Kayaker on Rouge River*, QC: Corel CD photo #155002

Page 19: *Water lily*, by Gilles Larche

Pages 20–21: *Dam*, Nipawin, Saskatchewan: Corel CD photo #371050

Page 22: *Beluga*: Corel CD photo #14017

Page 23: *Double-crested Cormorants*, Canadian Wildlife Service

Pages 26–27: *Old-growth forest,* Vancouver Island, by Brad Cumming, Downsview, ON

Page 28: *Whooping Crane*, by Geoffrey Holroyd, Canadian Wildlife Service

Page 31: *Monarch Butterfly*: Corel CD photo #35049

Page 33: *Burrowing Owl*, by G. L. Holroyd, Canadian Wildlife Service

Page 34: *Reverie Estivale*, by Lyn Potvin, Buckingham, QC

Page 37: *Canoeing*: Corel CD photo #155017

Pages 38–39: *Cloud majesty*, by Doreen Stoot, Elmwood, ON

Page 40: *Nanook*, by Ross Norstrom, Gloucester, ON

Page 41: *Spring ice break-up in the Arctic*: Corel CD photo #14079

Page 43: *Saskatchewan Glacier, Columbia Ice Fields*, Alberta: Corel CD photo #371062

Page 44: *Struck by beauty*, by Pierre Trudel, Hull, QC

Page 45: *January 1998 ice storm,* by Caje Rodrigues, Ottawa, ON

Page 47: *Ice storm damage,* by Carolyn Molson, Ottawa, ON

Page 48: *Beckoning solitude*, by Peter Croal, Ottawa, ON

Page 49: *Baby and grandmother*: Corel CD photo #14085

Page 53: *Birch tree*, by Gilles Larche

Page 54: *Little girl in grass*, by O.J. Dell, North York, ON

Comments Please

We would like to know your views on this report. Please tell us what you like best about this publication and what you think needs to be changed or improved.

We welcome your comments by mail, telephone, fax, or e-mail.

Mail: Environment Canada, Ottawa, Ontario K1A 0H3
Tel.: (800) 668-6767 and (819) 997-2800
Fax: (819) 953-2225
E-mail: enviroinfo@ec.gc.ca

The complementary Internet version of this document is located at **www.ec.gc.ca**. Through the Internet, you can also provide us with valuable comments that will influence how and what we produce in our continuing efforts to report to Canadians.