



CLIMATE READY

Ontario's
Adaptation Strategy
and Action Plan

2011 - 2014



MESSAGE FROM THE MINISTER

I am proud to present Ontario's first Adaptation Strategy and Action Plan.

Depending on where you live, the average temperature in Ontario has increased by up to 1.4°C since 1948. We know that such temperature increases, though small at first glance, go along with huge changes in the patterns of wind and precipitation. Given Ontario's vast size and differing regions, changing weather patterns present a complex challenge, but we know it is one we must meet to secure our future.

The long-term trends are perfectly clear. Our grandparents are correct when they tell us that winters aren't as cold as they used to be, that summer heat waves are hotter and that there are more storms.

In response to the challenge presented by these changes, our government appointed 11 renowned experts from across the province and beyond to provide advice and direction on how to minimize the negative impacts of a changing climate and on how to ensure we are best prepared for these changes. Their recommendations formed the basis of this initial "Adaptation Strategy and Action Plan."

This plan builds on the concrete action Ontario is taking to mitigate climate change and reduce greenhouse gas emissions. All of Ontario's power plants must stop using coal by the end of 2014. Under our Green Energy Act, we are expanding Ontario's use of clean, renewable energy. The Water Opportunities Act will help sustain Ontario's water infrastructure.

While we take action, it is also necessary to recognize that change is already taking place. It is critical that governments at all levels begin to build climate change considerations into their policy decisions at the same time as we address mitigation. This is what our Adaptation Strategy and Action Plan is about.

Climate change adaptation means taking prudent action to protect our families and secure our business investments.

Climate Ready: Ontario's Adaptation Strategy and Action Plan will create a vision and framework for collaboration across ministries and with external partners. All of us in Ontario — businesses, communities and individuals — will be touched by climate change. All of us must learn the skills of adaptation. We are highlighting steps Ontario is taking to ensure that we are well prepared for the challenges changing weather will bring and are in a position to take advantage of opportunities. I welcome your partnership in implementing this plan for a stronger, more resilient Ontario.

—John Wilkinson, Minister of the Environment



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ACKNOWLEDGMENTS

The Government of Ontario would like to thank the Expert Panel on Climate Change Adaptation. The process it undertook in meeting with individual ministries during its mandate, as well as its report and recommendations, “Adapting to Climate Change in Ontario”, was indispensable in moving adaptation work forward in Ontario, and helped form the basis of Ontario’s Adaptation Strategy and Action Plan.

We would like to especially thank the co-chairs of the Expert Panel on Climate Change Adaptation, Dr. David Pearson and Dr. Ian Burton, for their tireless work, advice and guidance in ensuring Ontario’s Adaptation Strategy and Action Plan is a good first step to increasing the province’s resilience in the face of a changing climate.

EXECUTIVE SUMMARY

The Government of Ontario is taking measures to reduce greenhouse gas emissions but also recognizes the need to adapt to the unavoidable impacts of changing weather patterns resulting from heat-trapping gases already in the atmosphere.



We know that extreme weather is becoming more frequent. Across the province we have seen an increase in prolonged heat waves, torrential rain storms, windstorms, even drought. It is no longer a matter of reacting when the next major weather event occurs. Ontario must be prepared by taking prudent steps to deal with a changing climate and the challenges it presents both now and in the long term.

The Minister of the Environment appointed the Expert Panel on Climate Change Adaptation in 2007 to help the government prepare and plan for these impacts. Based on the Panel's advice, we have developed, "Climate Ready: Ontario's Adaptation Strategy and Action Plan", which outlines a strategy with a progressive vision, five broad goals and over 30 actions — initiatives to help prepare us for climate change in Ontario over the next four years, to 2014.

We will continue our efforts to better understand the effects of a changing climate through investments in climate science. This will assist us in minimizing loss and preventing unsustainable investment. We also look to bolster our ability to take advantage of new opportunities that emerge from a changing climate. We will take measures to increase the ability of ecosystems to withstand the impacts of climate change. Working with others, we will create risk-management tools to support adaptation efforts and help communities adapt. We have identified actions across several ministries to help us meet our goals.

Some tangible examples of how we will get there include:

- Minimizing damage by amending the Ontario Building Code and undertaking infrastructure vulnerability assessments to determine vulnerabilities due to the impacts of climate change and sharing the results with the broader public sector.
- Increasing the climate resilience of our ecosystems by developing the Lake Simcoe Adaptation Strategy and creating a model to advance adaptation planning in other watersheds.
- Supporting the development of risk-management tools to manage heat-related illnesses and working with Public Health Units to raise public awareness of health hazards, such as the increased risk of Lyme disease.
- Obtaining a better understanding of the impacts of climate change by continuing to partner with experts to create climate projections throughout the province that will assist in decision-making.
- Working with others through Ontario's Regional Adaptation Collaborative to improve decision-making on adaptation throughout the province.

The Government of Ontario will report annually to the public on its progress towards its long-term adaptation goals and its success in taking climate change impacts and adaptation into full consideration in the Province's policies and programs. These are the first steps in ensuring Ontario's preparedness for the impacts of climate change.

WHAT IS ADAPTATION?

Adaptation is the process societies go through in order to cope with an uncertain future. Adapting to climate change entails taking measures to reduce the negative effects of climate change — or take advantage of the positive effects. For example, faced with greater storm activity, we may change the way we design and build our roads, bridges and buildings to better withstand these weather events.



INTRODUCTION

**IN ONTARIO WE ARE ALREADY
EXPERIENCING CLIMATE CHANGE IMPACTS
WHICH THREATEN OUR HEALTH AND SAFETY,
OUR ENVIRONMENT AND OUR ECONOMY.**

The Government of Ontario is working to ensure that Ontario reduces emissions of the greenhouse gases that are contributing to this change.

We must also prepare to face the difficult challenges and embrace the opportunities that come with a changing climate.

“And now our world is different. The climate has been permanently altered and is on an escalating vector of change, not because of what we are going to put into the atmosphere in the future but as a consequence of what we have already done”.

—Environmental Commissioner of Ontario, 2009/2010 Annual Report.

A violent rainstorm in August 2005 that washed out Finch Avenue in Toronto broke two gas mains and a drinking watermain, took out telephone, hydro and cable lines, and flooded more than 4,200 basements at a cost of almost \$550 million. Flooding in downtown Peterborough in July 2004 caused damage to homes and businesses amounting to \$87 million. The same story has been told in many communities across Ontario, from Rainy River to Hamilton to Sudbury. Insurance companies have been counting the cost of these claims and the numbers are climbing.

In its January 2011 Progress Report on Adaptation to Climate Change, the Insurance Bureau of Canada noted that losses related to water damage are costing Canadian insurers and policyholders up to \$1.5 billion annually — a figure that continues to rise. These losses can be attributed to both the aging of water and wastewater infrastructure and changing weather patterns.

Rainstorms and floods have always been a fact of life in Ontario. So too have droughts and heat waves, ice storms and blizzards, tornadoes and windstorms. But weather is changing and has been for a generation now. Temperatures are higher, especially in winter; more rain is falling in heavy storms and summers have more frequent and longer dry periods. A few of the consequences of rising temperatures, such as a longer growing season and a decreased need for winter home heating, may be beneficial to people. Our natural systems, however, are adapted to today's climate and may have difficulty adjusting to changing weather patterns.

Weather affects all sectors of our economy and our communities from the way we design stormwater drainage systems, bridges and roads, to the type of crops grown by farmers to the water levels in the Great Lakes.

Scientists firmly believe a gradual increase in the amount of the sun's heat being captured by the atmosphere is the main reason for the

“CLIMATE CHANGE
IS THE DEFINING
ISSUE OF OUR
GENERATION –
WE’VE COME A
LONG WAY, BUT
WE HAVE MORE TO
DO, TOGETHER.”

—Premier Dalton McGuinty, News Release,
June 20, 2007.



change in weather events and seasonal weather patterns. The changes have developed over at least 40 years and clearly amount to a change in climate. The Ontario government agrees that an increase in the quantity of heat-trapping gases in the atmosphere has been largely responsible for contributing to climate change and is working to reduce Ontario's emissions of those gases.

Regardless of the cause, changes in weather patterns already impose risks to life, property, and the natural world in Ontario that cannot be ignored. Reducing those immediate risks is the only prudent course of action for all levels of government, as well as communities, corporations, businesses, and individual citizens.

In December 2007, the Minister of the Environment appointed an Expert Panel on Climate Change Adaptation — composed of 11 leading scientists and environmental experts — to help Ontario understand, prepare and plan for the impacts of changing climate on our health, economy, environment and infrastructure.

In November 2009, the Expert Panel presented its advice on how to build a climate resilient province in a report, “Adapting to Climate Change in Ontario”. This report includes more than 50 recommendations across a wide range of sectors and called for a provincewide climate change adaptation strategy and action plan.

In response, the Government of Ontario has prepared, “Climate Ready: Ontario's Adaptation Strategy and Action Plan”. This plan draws on expertise from ministries across government.

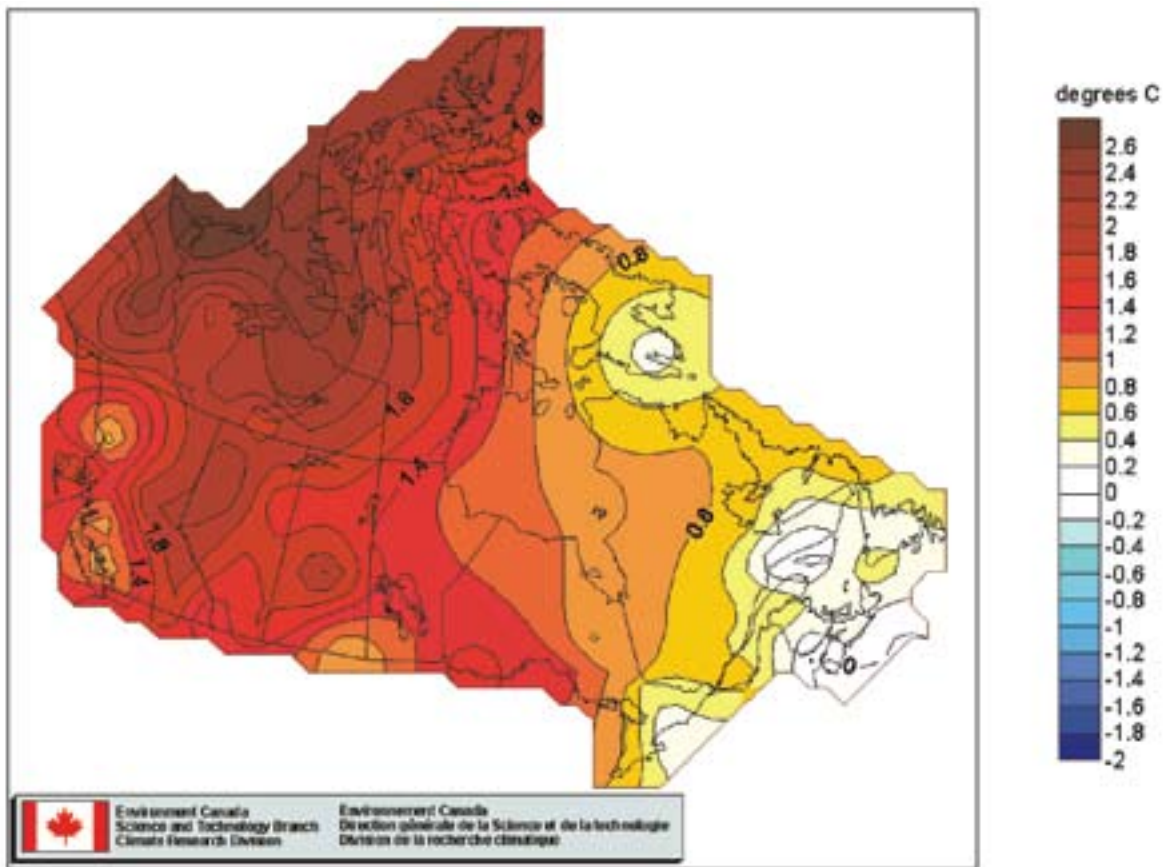
This Plan outlines the Province's strategy and actions to address the impacts of a changing climate over the next four years as Ontario prepares for the risks and opportunities created by a changing climate.

CLIMATE CHANGE IMPACTS IN ONTARIO

Between 1948 and 2008, the average annual temperature in Ontario has increased by up to 1.4°C. The greatest warming has been in the western part of the province (see Figure 1).

Scientists project that by 2050, the average annual temperature in Ontario will increase by 2.5°C to 3.7°C (see Figure 2) (from baseline average 1961-1990). In fact, 2010 was the hottest year on record since nationwide record-keeping began in 1948, and northern Ontario experienced conditions that were at least 20 per cent drier than normal (Environment Canada 2011).

Figure 1: Average Annual Temperature Changes in Canada, 1948-2008 (CCCSN 2009)



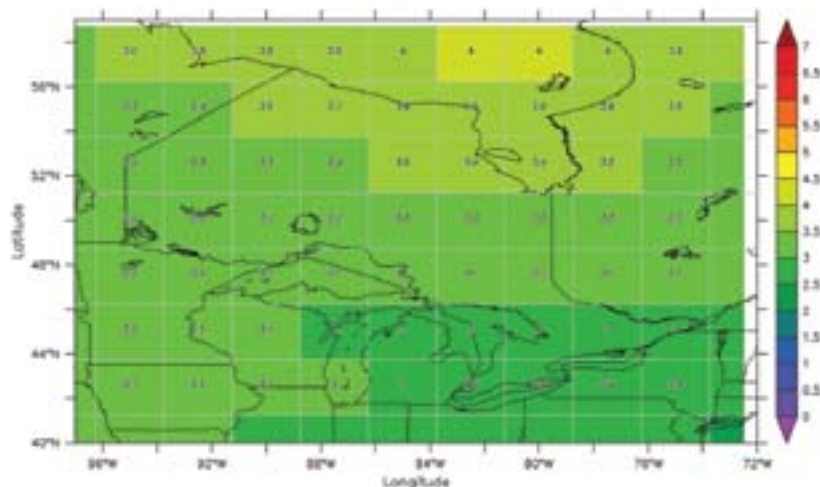
How much warming will occur will depend on what happens to the atmosphere (IPCC 2007). If emissions of heat-capturing gases continue unabated, then the warming trend will accelerate. If emissions are strongly controlled, then warming will be less.

The Expert Panel (2009) highlighted that “more moisture in a warmer atmosphere is expected to cause an increase in extreme weather events — rain, snow, drought, heat waves, wind and ice storms, [and] weather is also likely to be more variable and less predictable year-to-year”. Impacts will be felt differently throughout the province and across all sectors of the economy and society.

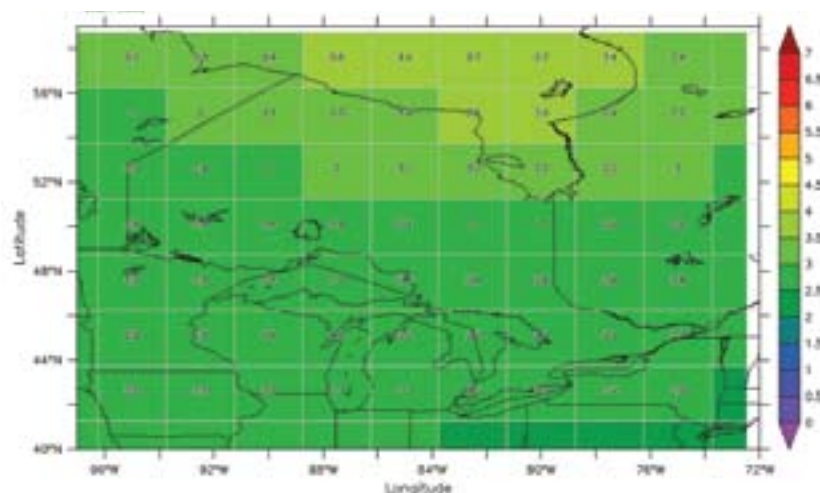
The most pronounced change is expected to occur in the Far North of Ontario during the winter. Southern Ontario can likely expect hotter summers with the number of days over 30°C more than doubling by 2050.

Figure 2: Projected average annual temperature increase in 2050s in Ontario (CCCSN 2009)

Projected increase in average annual temperature in the 2050s compared with 1961-1990 using HIGH GHG emissions (A1B emission scenario)



Projected increase in average annual temperature in the 2050s compared with 1961-1990 using MODERATE GHG emissions (average of A1B and B2 emission scenarios)



WHAT DOES THIS MEAN FOR ONTARIANS?

Many Ontarians have already been affected in one way or another by increased temperatures and extreme weather events that may well have been part of a changing climate. Everyone in the province will be affected in the future as today's trends continue. The impacts are not theoretical; they will affect our day-to-day lives from a growing number of 'heatwave' days in the summer to a broadening spectrum of fruits and vegetables available from Ontario growers due to a longer growing season.

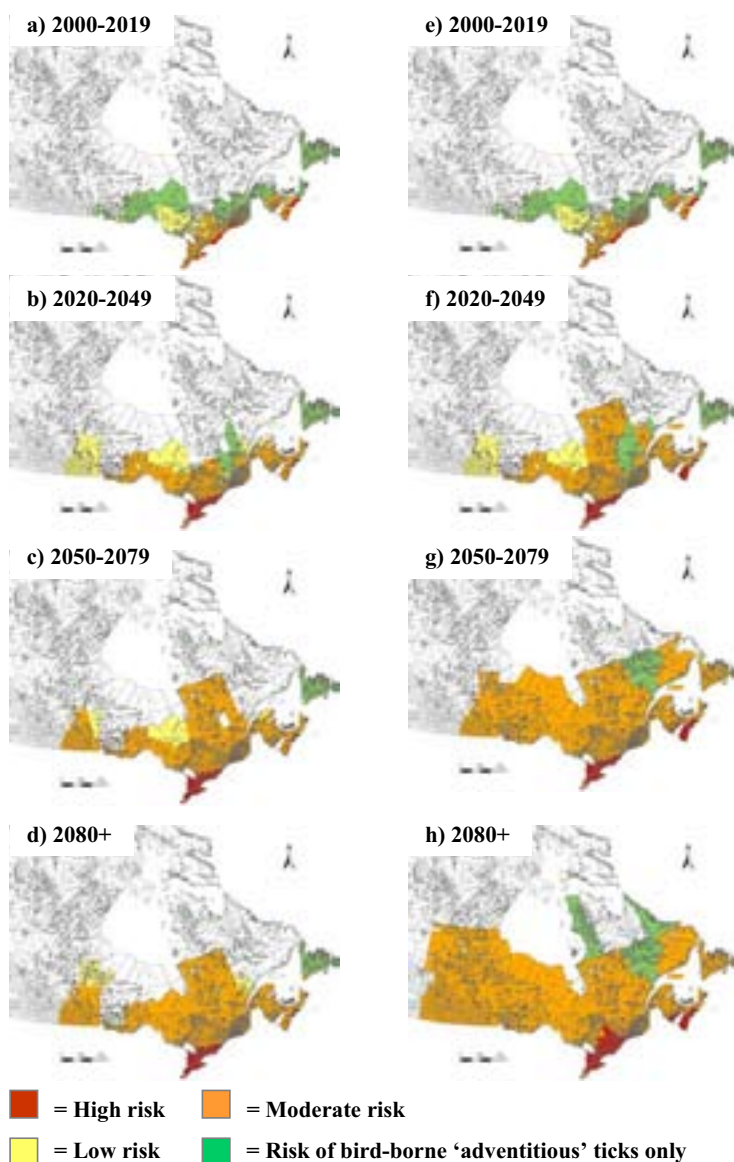
The Government of Ontario recognizes that the impacts of a changing climate need to be considered in all decision-making.

IMPACTS ON HUMAN HEALTH

Ontario's climate had limited the northward spread of warm weather diseases. But recently, warmer temperatures have already begun to allow the appearance and spread of mosquito and tick-borne diseases, such as Lyme disease and West Nile Virus, and the potential spread of malaria (Berrang-Ford et al. 2009).

Projections of the future spread of Lyme disease depicted in a series of risk maps show the risk of infection increasing in central and northern Ontario in the next 20 or 30 years. The maps on the left are scenarios of the slow spread of Lyme disease and the maps on the right depict scenarios of the fast spread of Lyme disease. The maps were developed based on projections from the Canadian Regional Climate Model 2 (CRCM2 A2 emissions scenario).

Figure 3: Projections of Lyme disease spread (Ogden et al. 2008)



IMPACTS ON INFRASTRUCTURE AND PERSONAL PROPERTY

Impacts of weather on buildings, roads, bridges, hydro-transmission lines, stormwater drainage, drinking water and water treatment services, natural gas and communication lines, range from softening of tarmac during summer heat waves and cracking of concrete during freeze-thaw cycles, to catastrophic flooding, road washouts, ice and windstorm damage. The frequency and intensity of all these small- and large-scale effects is changing and infrastructure of all kinds is in danger of becoming subject to conditions for which it was not designed. For example, this means that the environmental performance of some infrastructure, such as wastewater and stormwater infrastructure may become inadequate, which would have impacts on the water quality, water quantity and the ecosystem.

IMPACTS ON THE FAR NORTH

Most communities — including First Nations communities — in the Far North of Ontario depend on winter roads for travel on snowmobile routes, transportation of goods, trucking in building supplies, new vehicles, heavy equipment and many other large items for business and domestic purposes (Far North Science Advisory Panel 2010). In recent years, the cold weather required for freezing lakes and wet ground — deep and hard enough to take the weight of heavy vehicles — has become variable. Climate projections show the high likelihood of increasingly warmer winters and therefore even less winter road access to communities than today. Melting permafrost also threatens water and sewage lines due to ground shifting and heaving.

The Boreal forest and wetlands across the Far North region are considered to be one of the world's largest, most intact ecological systems. The region is projected to be considerably warmer and will receive slightly more precipitation than it does today. These conditions will increase the potential for evapotranspiration (the loss of water through evaporation and through transpiration from plants) and, in turn, may lead to reduced ecosystem soil moisture, lower lake levels and reduced river flow.

It is likely that some of the most dramatic changes will occur near the coast of Hudson Bay and James Bay. A considerably shorter ice-cover season on Hudson Bay and James Bay would lead to much warmer and longer summers, as well as warmer and shorter winters. This, in turn, would lead to the loss of permafrost, changing the surface hydrology and local landscape.

IMPACTS ON AGRICULTURE

The agricultural sector will also need to deal with the potential for increased impacts on farm operations of extreme weather events such as drought and

hail damage as well as pest infestations and increased crop vulnerability from year-to-year (Natural Resources Canada 2007). Overall, water availability is likely to become even more of a challenge for farmers under a changing climate.

Warmer and longer growing seasons may present opportunities for some farmers (for example, crops such as corn and soybeans could potentially benefit). Warmer temperatures could also allow a northward extension of crop production as long as soils are suitable and soil moisture is sufficient. These warmer temperatures may adversely affect some southern agricultural activities such as the ice wine industry, given its dependence on cold winter temperatures for production.

Warmer temperatures in both summer and winter will present challenges for livestock production. While milder temperatures can reduce winter heating bills for livestock barns, livestock pests and diseases previously unable to over-winter here and/or those able to extend their ranges northwards into Ontario pose a threat to our food supply and economy.

IMPACTS ON FORESTRY

The forestry sector will feel the effect of changes in the frequency and severity of disturbances such as fires, drought and severe storms. Damaging insect and disease attacks will also affect Ontario forests. In the long term, the forestry sector will also face changes in its productivity and in the composition of forest species as a result of changes in moisture and temperature (Williamson et al. 2009).



IMPACTS ON FISHERIES, WILDLIFE AND BIODIVERSITY

Species survival is determined by many biotic (e.g., food, competition, symbiotic relationships, and diseases) and abiotic (e.g., climate and access to water) factors. Given that climate change will impact all or most of these forces and factors, the composition, distribution and abundance of Ontario's biodiversity will change during this period of rapid warming. For example, some southern wildlife species will expand northward and northern species are in jeopardy of losing significant areas of habitat in the southern part of their ranges. Similarly, there will be significant changes in the composition of species in aquatic habitats like lakes, rivers, and wetlands. With warming water temperatures, cold and cool water fish (e.g., lake trout, *Salvelinus namaycush*) will lose habitat while warm water species (e.g., smallmouth bass, *Micropterus dolomieu*) will gain habitat.

IMPACTS ON WATER RESOURCES

A changing climate will affect both water quantity and quality. Intense rain storms and changes in the annual snow melt may cause flooding to happen more often. A changing climate may lead to reduced winter ice cover on lakes, lower lake levels and more frequent water shortages due to higher temperatures and increased evaporation rates. In the Great Lakes, a changing climate is expected to cause lower water levels, exacerbate other stresses such as habitat loss and pollution, and increase problems with excess algae growth and invasive species infestations. Climate change may cause changes in water temperature in Lake Simcoe, affecting commercial fisheries and further accelerating the growth of aquatic plants caused by high phosphorus loading.

IMPACTS ON TOURISM AND RECREATION

Warmer winters in Ontario will mean shortened skiing, snowmobiling and ice-fishing seasons. Although downhill skiing operations can increase the use of snowmaking — at increased costs for operators — to account for reduced snowfall and milder winters, snowmobiling and cross country skiing rely heavily on natural snowfall. Projections indicate a reduction in snowmobiling seasons between 30–50 per cent by the 2020s (Natural Resources Canada 2007).

Warmer winters may also present opportunities for certain activities. For example, tourism may benefit from longer golf seasons and other summer activities such as hiking, fishing and biking.



Climate Change Mitigation and Adaptation

Climate co-benefits describe the result of an action or a technology that is designed to both reduce GHG emissions and reduce vulnerability to climate impacts in the future. When something contributes to both climate change mitigation and adaptation, we call that a climate co-benefit.

“Where possible and appropriate, every policy and practice of government, the private sector and civil society should be reshaped and redesigned to achieve three objectives:

The maximum reduction in GHG emissions

The greatest possible reduction in vulnerability through adaptation and climate-resilient development, and

The integration and harmonization of these first two objectives with each other and with other policies such that the joint benefits or co-benefits of actions are maximized” (Expert Panel on Climate Change Adaptation 2009).

Killbear Provincial Park; Credit: Ministry of Natural Resources

As Ontario begins to transition to a low-carbon economy, there are a number of opportunities to take advantage of co-benefits.

Many Ontarians are looking to their own homes as a way to reduce greenhouse gas emissions. In many cases, upgrades and retrofits that promote energy and water efficiency can also increase the resiliency of a home to the impacts of climate change.

Sometimes co-benefits can result from the simplest of actions. For example, many communities throughout Ontario, such as the Town of Eden Mills in Wellington County, have decided to increase their urban forests and tree planting programs as a means to absorb carbon dioxide and combat climate change. In addition to the important role trees play in mitigating climate change, shade helps to cool the urban environment. Cities often experience amplified heating effects due to factors such as construction density, types of construction materials used and the reflection of sunlight off the earth's surface (albedo effect). Increasing and renewing the urban canopy can also generate other co-benefits such as improving local air quality, reducing stormwater runoff, slowing erosion and enhancing biodiversity.



What Can One Person Do?

There are simple steps you can take to be prepared for emergencies that are likely to increase with climate change.

- Creating an emergency kit with enough supplies to support your family and pets for 72 hours including items such as bottled water, food, can opener, blankets, flashlights, batteries, first-aid kit and an emergency plan.
- Knowing where to shut off electricity and gas in homes in the event of a flood.
- Staying informed and following advice from weather watches and warnings, such as those from local Public Health Units about heat waves and health alerts.
- Reducing your greenhouse gas emissions by taking public transit or a bike instead of a car, unplugging your cell phone charger, turning off the lights when not in use, and washing your clothes with cold water and hanging them up to dry.



ADAPTATION STRATEGY

Adapting to a changing climate goes far beyond the mandate of any one ministry and requires a provincewide strategy and action plan that applies across government. Adaptation is an ongoing process that requires the commitment and the flexibility to respond to new information as it emerges from ongoing science and research.

The following sections outline the strategy, including the vision, goals and implementation principles, of the actions that ministries will undertake over the next four years. Figure 4 illustrates the structure of Ontario's Adaptation Strategy and Action Plan.

VISION

A province prepared for the impacts of a changing climate through implementation of policies and programs that minimize risks to our health and safety, the environment and the economy, and maximizes the benefits from opportunities which may arise.

GOALS

To achieve this vision and prioritize actions, five goals have been identified:

1. Avoid loss and unsustainable investment, and take advantage of economic opportunities.
2. Take reasonable and practical measures to increase climate resilience of ecosystems.
3. Create and share risk-management tools to support adaptation efforts across the province.
4. Achieve a better understanding of future climate change impacts across the province.
5. Seek opportunities to collaborate with others.

IMPLEMENTATION PRINCIPLES

Key implementation principles will be used to guide actions. They include:

- Seeking the best available science for decision-making while recognizing that there is uncertainty in climate change projections and the associated impacts.
- Incorporating climate change adaptation into existing policies and programs wherever possible.
- Being flexible when developing action plans to accommodate ongoing improvement in our understanding of climate impacts and potential risks.
- Prioritizing actions that have co-benefits between mitigation and adaptation.
- Contributing to sustainable development, taking into account the effect of decisions on current and future generations.

Figure 4 (opposite): Ontario's Adaptation Strategy and Action Plan

VISION

A province prepared for the impacts of a changing climate through implementation of policies and programs that minimize risks to our health and safety, the environment and the economy, and maximizes the benefits from opportunities which may arise.

GOAL 1

Avoid loss and unsustainable investment, and take advantage of new economic opportunities.

GOAL 2

Take all reasonable and practical measures to increase climate resilience of ecosystems.

GOAL 3

Create and share risk-management tools to support adaptation efforts across the province.

GOAL 4

Achieve a better understanding of future climate change impacts across the province.

GOAL 5

Seek opportunities to collaborate with others.

Action 1:

Require Consideration of Climate Change Adaptation

Cross-cutting Actions

Action 2:

Establish a Climate Change Adaptation Directorate

Action 3: Promote Water Conservation

Action 4: Review the Ontario Low Water Response Program

Action 5: Consider Climate Change Impacts in the Building Code

Action 6: Undertake Infrastructure Vulnerability Assessments

Action 7: Build Climate Change Adaptation into Ontario's 10-Year Infrastructure Plan

Action 8: Integrate Climate Change Impacts into the Environmental Assessment Process

Action 9: Integrate Adaptive Solutions into Drinking Water Management

Action 10: Develop Guidance for Stormwater Management

Action 11: Strengthen the Winter Road Network

Action 12: Protect Animal Health

Action 13: Protect Plant Health

Action 14: Encourage Business Risk-Management Approaches

Action 15: Pilot Adaptation Strategies in the Tourism Sector

Action 16: Conserve Biodiversity and Support Resilient Ecosystems

Action 17: Undertake Forest Adaptation Assessment

Action 18: Build Adaptation into the Great Lakes Agreements

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

- Canada-U.S. Great Lakes Water Quality Agreement

- Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA)

Action 19: Examine Climate Change Impacts on Fisheries

Action 20: Develop the Lake Simcoe Adaptation Strategy

Action 21: Increase Awareness of Land use Planning Tools

Action 22: Integrate Adaptation Policies into the Provincial Policy Statement

Action 23: Consider Climate Change in the Growth Plan for Northern Ontario

Action 24: Raise Awareness about Health Hazards of Climate Change

Action 25: Raise Public Awareness of Lyme Disease

Action 26: Update Intensity-Duration-Frequency Curves

Action 27: Update the Environmental Farm Plan Program

Action 28: Provide Community Outreach and Training

Action 29: Develop the Far North Land use Strategy

Action 30: Incorporate Climate Change into Curriculum

Action 31: Enhance Climate-Related Monitoring

- Water Quality
- Water Quantity
- Natural Resources
- Forests
- Land Cover
- Far North
- Agriculture

Action 32: Undertake Climate Impact Indicators Study

Action 33: Undertake Research Partnerships for Climate Modelling

Action 34: Establish an OPS Climate Modelling Collaborative

Action 35: Establish and Lead Ontario's Regional Adaptation Collaborative

- Developing a Municipal Risk-Management Tool
- Developing Guidance for Building Retrofits
- Creating a Heat Vulnerability Tool
- Integrating Climate Impacts into the Source Protection Framework
- Developing a Weather and Water Information Gateway
- Providing Community Outreach and Training

Action 36: Work with Canadian Council of Ministers of the Environment and Canadian Council of Forest Ministers

Action 37: Participate in the Territorial Approach to Climate Change (United Nations Development Programme)

Future Vision

DELIVERING THE STRATEGY AND ACTION PLAN

ACTION 1

REQUIRE CONSIDERATION OF CLIMATE CHANGE ADAPTATION

The Government of Ontario will require adaptation be a key consideration in updating existing policies and programs, and in developing new policies and programs.

ACTION 2

ESTABLISH A CLIMATE CHANGE ADAPTATION DIRECTORATE

The Government of Ontario will establish a Climate Change Adaptation Directorate to drive implementation of the Adaptation Strategy and Action Plan.

MAINSTREAMING ADAPTATION

ACTION 1 | Mainstreaming adaptation means making sure that legislation, policies and programs are modified to consider climate change adaptation when necessary. Since overall risk to public interest is divided into specific ministry mandates, mainstreaming requires adaptive efforts from every part of the provincial government.

GOVERNANCE AND ACCOUNTABILITY

ACTION 2 | The Government of Ontario will create a Climate Change Adaptation Directorate to drive the implementation of the Climate Change Adaptation Strategy and Action Plan. This Directorate will:

- lead or act as a catalyst for new policy initiatives on adaptation and assist in the review of existing policies and programs as necessary
- coordinate and report on adaptation actions across the province
- develop a risk-management framework to guide adaptation decision-making
- sustain Ontario's Adaptation Strategy and Action Plan into the future and develop new actions in partnership with other ministries
- undertake or co-ordinate economic and climate impact studies on different sectors and communities across the province
- lead the integration of science and policy to create strategies that can be made available to decision-makers
- act as a one-window resource for the public and the Ontario government to connect experts and provide needed information
- lead the establishment of an OPS Climate Modelling Collaborative, and
- chair a cross-ministry steering committee to ensure integration across government programs and policies.

To support the Directorate, the Government of Ontario is creating a cross-ministry steering committee to provide knowledge, advice and official points of contact on adaptation across the Ontario Public Service.

REPORTING ON PROGRESS AND PERFORMANCE MEASURES

The Government of Ontario will report annually to the public on the actions contained in the Strategy and Action Plan. As part of ensuring transparent accountability, the Ministry of the Environment working with its partner ministries and the cross-ministry steering committee, will co-ordinate updates on the progress of the actions described in the Plan. New actions will be brought through the Cabinet Committee process as appropriate and will be included as part of Ontario's Climate Change Annual Report.

An indicator of success of this Adaptation Strategy and Action Plan will be that adapting to climate change increasingly becomes integrated into policies, programs, information, and monitoring across government and beyond. Through the Adaptation Directorate, the Government of Ontario will track programs and evaluate the effectiveness of policy measures to improve Ontario's resilience to climate change impacts.

ONGOING ACCESS TO EXPERTS

Adapting to climate change is a complex issue with rapidly evolving science. This requires careful analysis in order to gauge the impacts for Ontario. It is critical that Ontarians receive the best advice from experts on the impacts of climate change on people, natural assets and the economy.

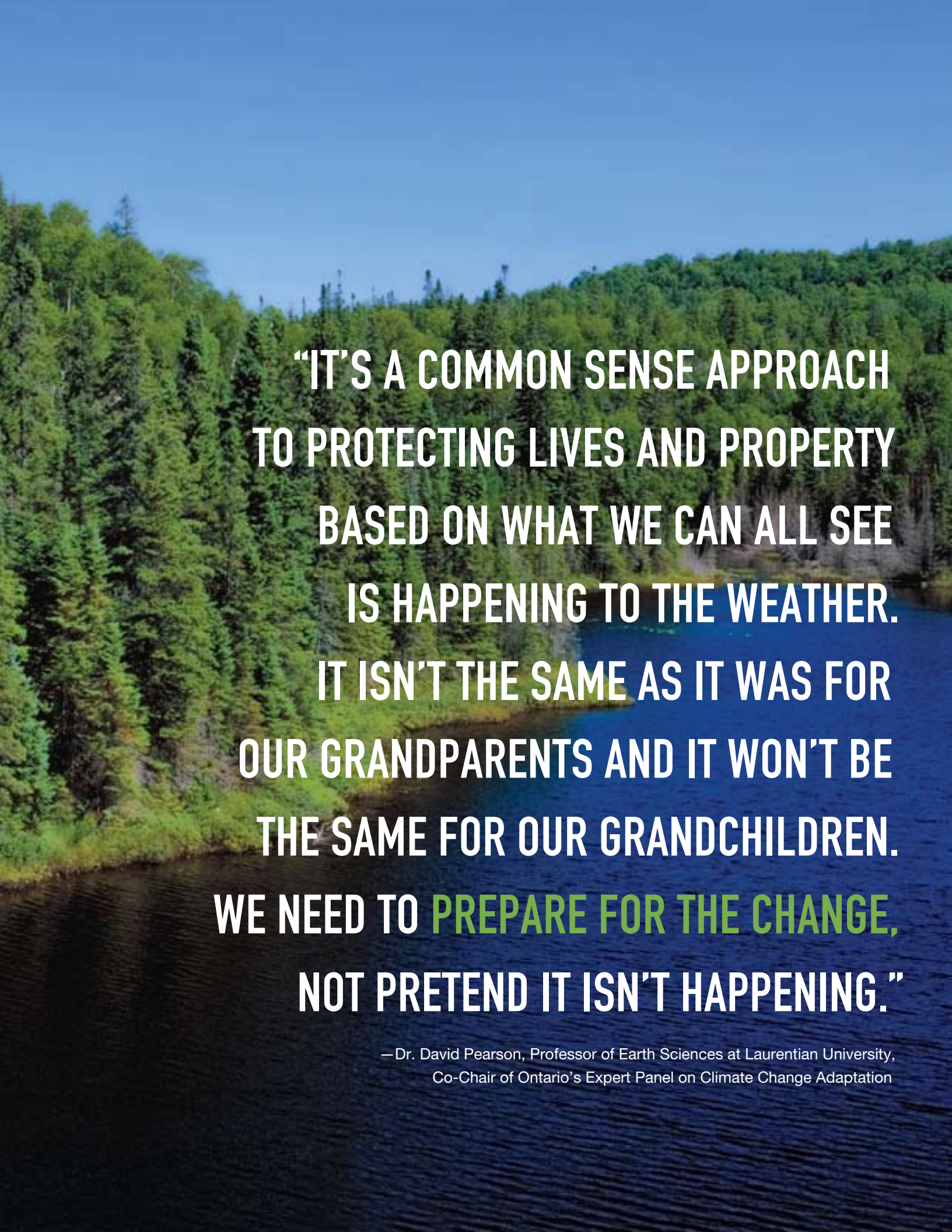
The Ontario government has developed critical relationships with members of the scientific, academic, infrastructure, and insurance sectors through its work with the Expert Panel on Climate Change Adaptation. Ontario is able to exchange information with progressive jurisdictions such as Québec and the United Kingdom where there is a wealth of knowledge and expertise.

Ontario will continue to welcome opportunities to work with the brightest minds around the world and at home to increase the province's resiliency to climate change.

INVESTING IN OUR FUTURE

We know from a number of leading international studies that well-targeted, early investment to improve climate resilience is likely to save money in the long term. This is because the cost of adaptation is likely to increase the longer adaptation action is delayed. The Government of Ontario's plan includes a comprehensive suite of actions across government to ensure that adaptation to a changing climate is well integrated into financial and policy decisions, whether this involves building a new road, updating land use planning legislation or managing natural resources.





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WE NEED TO **PREPARE FOR THE CHANGE,**
NOT PRETEND IT ISN’T HAPPENING.”**

— Dr. David Pearson, Professor of Earth Sciences at Laurentian University,
Co-Chair of Ontario’s Expert Panel on Climate Change Adaptation

GOAL 1

AVOID LOSS AND
UNSUSTAINABLE INVESTMENT,
AND TAKE ADVANTAGE OF NEW
ECONOMIC OPPORTUNITIES.

In the context of a changing climate, loss can be significant and include lives, property and resources.

Shifting wind patterns and changing air temperatures will likely contribute to an increased frequency of extreme weather events in Ontario. Torrential rain, high winds and tornadoes, droughts and heat waves threaten human health and safety in a number of ways. This includes damaging homes and roads, contaminating water supplies and causing illness due to extreme heat.

The Government of Ontario must employ a new way of thinking to deal with and avoid loss caused by climate change impacts.

The Province recognizes the importance of developing, applying and amending risk-management tools — through legislation, policies and programs — to better prepare for the impacts of climate change and avoid making unsustainable investments.

“Climate change will continue to expose local communities to mounting challenges — and costs — of protecting lives and assets against extreme weather and other climate-related risks...Science can give some clues about the changes in climate which will force societies to adapt. But national and local decision-makers will still have to make policy and investment choices under a large degree of uncertainty and cater for a variety of future climate impacts”.

—Swiss Re, *Weathering Climate Change* (2010)

Climate change will affect infrastructure of all kinds — buildings, transportation, energy, water and wastewater infrastructure.

The Stern Review on the Economics of Climate Change (2006) estimated that the annual costs of extreme weather brought on by climate change in developed countries could reach between 0.5 and 1 per cent of world GDP by the middle of the century. For Ontario, this could equate to about \$5.66 billion per year.¹ In the province, the Ontario Disaster Relief Assistance Program has provided over \$60 million since 1998 for flood relief alone. There is an increasing financial imperative to consider climate change impacts in our long-term planning decisions. Among the facts:

- There is strong evidence from other jurisdictions that proactive measures to reduce the impacts of extreme weather will save money over the long term. For example, an independent study from the United States Federal Emergency Management Agency found an investment

¹ Based on a straight pro-rata estimate using Ministry of Finance 2009 gross domestic product.

“IBC commends the provincial government’s leadership on climate adaptation—The government’s actions represent a significant step forward in focusing attention on the impact changing weather patterns are having on communities across Ontario.”

—Don Forgeron, President & CEO Insurance Bureau of Canada



Dunnville just after flooding and ice caused massive damage along the Grand River, Ontario.

payback of \$4 in cost savings for every \$1 spent on disaster mitigation (National Institute of Building Sciences 2005).

- In 2008, Ernst & Young identified climate change as the top risk to the insurance industry.
- Ontario has experienced an increased number of significant urban flood events over the past several years, including floods in Peterborough (2002 and 2004), Ottawa (2004 and 2009), Sudbury (2009) and Hamilton (2005 and 2009).
- Flooding associated with an intense storm system moving across southwestern Ontario in August 2005 caused extensive flood and infrastructure damage resulting in approximately \$550 million in insurance claims alone.
- Flooding damages account for the highest number of property insurance claims in Canada, primarily related to payouts for the clean up of sewage backups.
- Water damage from flooding is now the number one source of household insurance claims in Ontario, overtaking losses due to fire and theft.

Climate change may also bring new opportunities for economic growth in a number of sectors, including agriculture and tourism:

- Warmer temperatures could have a positive effect on some types of nature-based tourism and all-season outdoor recreational activities in Ontario.
- Longer growing seasons could benefit Ontario farmers.
- Warming temperatures could reduce heating costs to business, industry and homeowners (to be balanced against cooling costs).

Ontario's investment and policy decisions need to anticipate and adapt to changes in climate in order to take advantage of the opportunities that will emerge.

The Government of Ontario is focusing action in four distinct areas to avoid severe loss and unsustainable investment, and to take advantage of opportunities for economic growth. These include:

1. water management
2. infrastructure
 - built environment
 - water
 - transportation
 - energy
3. agriculture
4. tourism

WATER MANAGEMENT

Ontario has some of the most valuable freshwater resources in the world.

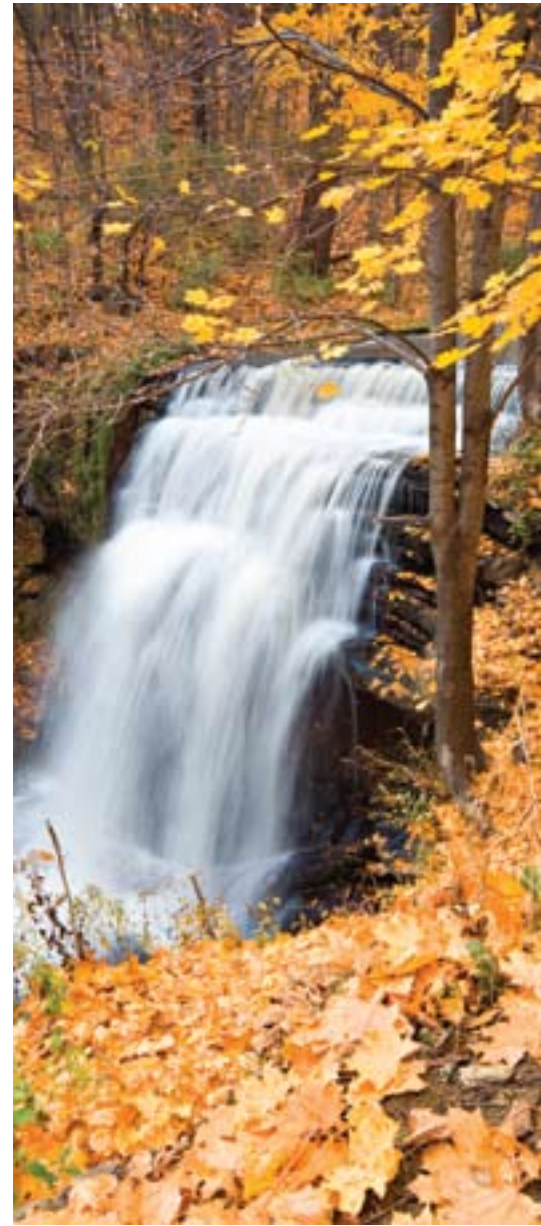
Climate change is expected to result in both low water levels (from changes in precipitation and runoff) and flooding (due to extreme weather events).

As the average summer temperature rises in Ontario, the demand for water for agricultural irrigation and household water use for gardens and lawns also increases.

Growing demand for water and increased variability in precipitation, combined with greater levels of evaporation, shorter winters and altered snowfall patterns will change groundwater recharge and surface runoff patterns, potentially reducing the amount of water in streams and lowering the water supply.

Decreasing water levels cause restricted water supplies which can lead to:

- decreased crop yields through limited irrigation



ACTION 3

PROMOTE WATER CONSERVATION

The Water Opportunities and Water Conservation Act received Royal Assent on November 29, 2010. This act builds on Ontario's expertise in clean water technology, lays the foundation for new jobs and positions Ontario to become the North American leader in the development and sale of new technologies and services for water conservation and treatment.

- decreased hydroelectric generating capacity
- reduced opportunities for shipping transportation
- reduced value of shoreline property

Warmer water temperatures, another expected result of climate change, can worsen microbial and algal problems and change the distribution of warm-water and cold-water fish populations throughout the province.

Increased frequency of extreme weather events can lead to flash flooding events that threaten our infrastructure, including stormwater and wastewater systems.

Well-targeted, early planning and meaningful investment to improve the province's climate resilience are likely to be more effective than complex disaster relief efforts after the event. For example, impacts to infrastructure due to flooding events can be lessened by:

- increasing culvert size so that more water can be conveyed
- applying proactive solutions that encourage groundwater infiltration of stormwater, such as increasing permeable surfaces in built-up areas
- improving protection on electrical and telecommunications infrastructure so that these services are not lost in situations of extreme weather

Specific actions related to water infrastructure are covered in a following section.

ACTION 3 | The act enables the province to develop regulations that will require new and innovative ways to reduce demands on existing water resources and also addresses impacts from a changing climate by:

- creating the Water Technology Acceleration Project (WaterTAP) to help grow globally competitive companies, and provide high-value jobs in Ontario's water and wastewater sector
- encouraging Ontarians to use water more efficiently by using innovative approaches to conservation
- strengthening the sustainability of municipal water infrastructure planning by helping municipalities identify and plan for long-term infrastructure needs

Specifically, the act will, through regulation, require municipalities to create

a Municipal Water Sustainability Plan — including conservation plans, and a risk assessment and risk-management plan which address the challenges of climate change and impacts on water resources.

The Ministry of the Environment is also proposing to partner with municipalities to develop an approach for sustainability planning for water, stormwater and wastewater taking into consideration projected climate change impacts.

ACTION 4 | The Ontario Low Water Response Program was developed in response to the increased occurrence of low water levels provincewide due to changing weather patterns. For example, a severe drought in 1998/99 was a particular cause for concern.

The Ontario Low Water Response Program strives for improved provincial preparedness. The Ministry of Natural Resources' (MNR) Surface Water Monitoring Centre maintains a provincial monitoring network, analyzes data to provide early warnings, and co-ordinates the provincial drought response. Conservation Authorities and the ministry's District Offices support local response in the event of drought.

MNR assesses streamflow and precipitation trends using information gathered from its stream gauge network and the federal government's climate stations.

The Ontario Low Water Response Program is initiated when conditions fall below the prescribed levels and indicate drought. At the watershed level, measures employed may include voluntary conservation and restrictions on non-essential water use. If conditions continue to deteriorate, broader restrictions can come into effect.



ACTION 4

REVIEW THE ONTARIO LOW WATER RESPONSE PROGRAM

The Ministry of Natural Resources, in conjunction with the Ministry of the Environment, the Ministry of Agriculture, Food and Rural Affairs, and the Ministry of Municipal Affairs and Housing will review the Ontario Low Water Response Program to improve the Government of Ontario's ability to reduce the impacts of drought on water supplies.

Flood Management: Early Warning and Response

Given the increased frequency of extreme weather events plus increased development, urbanization and population growth — it will be increasingly important that Ontario maintain a sophisticated flood warning system to protect human life and natural resources. Through the Surface Water Monitoring Centre, climate experts routinely review current weather conditions and monitor weather satellites, weather radar, stream flow and levels, soil moisture conditions, snowpack information and ice break-up potential. This information is used to provide Flood Advisory Messages to Conservation Authorities and the Ministry of Natural Resources' District Offices so that they can track and manage local flooding.

Moir River, Belleville Ontario, April 2008



Conservation Authorities

Conservation Authorities were established under the provincial Conservation Authorities Act to implement programs in resource management in Ontario watersheds. The mandate of Conservation Authorities includes:

- enhancing public safety
- managing water-related natural hazards
- controlling flood and erosion
- forecasting floods and giving warning on imminent flooding
- managing ice and ice hazards
- regulating development in hazard-prone areas
- identifying potential hazards in municipal plans and site plan applications

Many of the programs delivered by Conservation Authorities make important contributions in the protection of life and property from floods and can assist in managing the effects of climate change.

THE BUILT ENVIRONMENT

Increased flooding, prolonged dry periods causing droughts and other severe weather events will pose challenges for Ontario's physical infrastructure.

Much of Ontario's physical infrastructure was built before changes in weather trends were evident. The average age of public infrastructure in Ontario is 15.4 years (Statistics Canada 2009). While natural variations in climate and historic extremes were considered during their design and construction of infrastructure, it is unlikely changes related to more extreme climate conditions have been factored in.

Going forward, it is essential that Ontario consider climate change impacts in the design and maintenance of public infrastructure.

ACTION 5

CONSIDER CLIMATE CHANGE IMPACTS IN THE BUILDING CODE

The Ministry of Municipal Affairs and Housing is consulting on updates to the Building Code to make new buildings in Ontario more resilient to climate change impacts and to enhance their ability to conserve water and energy.

ACTION 6

UNDERTAKE INFRASTRUCTURE VULNERABILITY ASSESSMENTS

The Government of Ontario is to undertake infrastructure vulnerability assessment case studies to better understand infrastructure vulnerabilities due to the impacts of climate change.

Investment Markets Require Disclosure

The Ontario Securities Commission (OSC) requires environmental disclosure from businesses that issue securities. In October 2010, the OSC issued definitive guidance to further clarify how businesses are to disclose risk from climate change within the context of existing reporting obligations (Ontario Securities Administrators 2010). Guidance includes the assessment of environmental risks outlined for disclosure including physical risks of environmental matters, such as the impacts of industrial contamination, changing weather patterns and water availability. Impacts are outlined and include: property damage, health and safety issues, disruptions to operations and increased insurance related costs. The OSC also outlines the need to assess what risk-management, adaptation or mitigation strategies have been, or will be, adopted.

The United States Securities Exchange Commission (SEC) established new guidelines (effective February 2010) requiring public companies to disclose to investors the physical risks their businesses might face due to climate change.

ACTION 5 | Ontario's Building Code is an important policy tool in responding to the direct and indirect effects of climate change. Work is underway by the Ministry of Municipal Affairs and Housing (MMAH) on the development of the next edition of the Building Code. As part of this process, MMAH is:

- developing changes to the Building Code — with public consultation and technical review — that would make buildings in Ontario more resilient to the impacts of extreme weather linked to climate change.
- focusing on enhancements in water and energy conservation for buildings.
- working with other provinces and the federal government through the Canadian Commission on Building and Fire Codes to update climate data (precipitation, wind speed and temperature) which will support the model National Building Code and new provincial building codes across Canada.

ACTION 6 | The Expert Panel recommended the Province undertake vulnerability assessments for representative asset types and geographical locations to better understand the climate change risks to physical infrastructure.

Working with Engineers Canada's Public Infrastructure Engineering Vulnerability Committee's Protocol, the Ministry of Infrastructure and the Ontario Realty Corporation are undertaking a pilot vulnerability assessment of three public buildings. The Ministry of the Environment is proposing to partner with municipalities to assess municipal stormwater and wastewater (sanitary and combined sewers) infrastructure including the update and use of the local rainfall Intensity-Duration-Frequency (IDF) curves. These assessments will help inform the development of infrastructure that is resilient in a changing climate.

Develop Guidance for Building Retrofits

The Institute for Catastrophic Loss Reduction, through its work with the Ontario Regional Adaptation Collaborative, will be providing guidance to homeowners on how best to retrofit their homes to withstand the impacts of a changing climate. More information about the Ontario Regional Adaptation Collaborative can be found in Goal 5.

Building Strong, Building for the Future

The Public Infrastructure Engineering Vulnerability Committee was created to develop a protocol to conduct engineering assessments of the vulnerability of Canada's public infrastructure to the impacts of climate change. It is co-funded by Natural Resources Canada and Engineers Canada. The recommendations arising from the use of this protocol provide a framework to support effective decision-making about infrastructure operation, maintenance, planning and development. This Committee is studying four categories of public infrastructure including:

- buildings
- roads and associated structures
- stormwater and wastewater systems
- water resources



ACTION 7

BUILD CLIMATE CHANGE ADAPTATION INTO ONTARIO'S 10-YEAR INFRASTRUCTURE PLAN

The Government of Ontario will support the objectives of the Adaptation Strategy and Action Plan by considering climate change impacts when making infrastructure investments.

Critical Infrastructure Program

The Government of Ontario developed the Ontario Critical Infrastructure Assurance Program to support continued functioning of critical infrastructure such as electricity and healthcare facilities during emergencies, regardless of the ownership or operator. The provincewide Program:

- identifies and assesses Ontario's key facilities, systems and networks plus their dependencies and inter-dependencies
- provides a strategy to assure continued operations during threats from all hazards

ACTION 8

INTEGRATE CLIMATE CHANGE IMPACTS INTO THE ENVIRONMENTAL ASSESSMENT PROCESS

The Ministry of the Environment will update existing guidelines to incorporate climate impact considerations into the Environmental Assessment process.

Vaughan Tornadoes 2009

On August 20, 2009, two separate tornadoes with winds from 180-250 km/hour (rated F2) caused extensive damage in Vaughan. Several repeated failures of structural resiliency were observed at damage sites. Researchers from the Institute for Catastrophic Loss Reduction (ICLR) have concluded that the damage in Vaughan could have been minimized or avoided if buildings had been constructed to higher standards than the Building Code. The Insurance Bureau of Canada cited the Vaughan tornadoes as one of the costliest extreme weather events of 2009, with insurance costs exceeding \$76 million for the single day event (ICLR 2010).

ACTION 7 | Ontario is developing a new 10-year plan for infrastructure that will be part of the Open Ontario Plan to create jobs and new opportunities for growth. The plan, to be released in 2011, will identify key issues, trends, and priorities to help modernize and expand public infrastructure over the next 10 years. The development of this 10-year plan will take into consideration the potential impacts of climate change on Ontario's public infrastructure to ensure sustainable investment.

ACTION 8 | The Environmental Assessment Act promotes good environmental planning by assessing the potential effects of infrastructure projects before the first shovel goes into the ground. The act applies to most

public and some private projects, including roads, landfills, water and sewer undertakings, and electricity projects.

The act, which came into force in 1976 and was amended in 1997, does not specify that proponents take into account the risks from climate change as part of its environmental assessment of project proposals.

Below are two cases where climate change impacts could be considered in the environmental assessment process:

1. the environmental impact of a project may be greater when coupled with the projected impacts of climate change — for example, a project's demand on a local water supply should also factor in the predicted decline in water supply due to climate change effects such as warmer temperatures and increased evapotranspiration
2. the future climate change risks may impose limitations on a project — for example, building in locations where climate change may increase the risk of flooding due to more frequent and severe rain events.

The Ministry of the Environment (MOE) has guidance documents for proponents seeking environmental assessment and approval. The ministry will review and, where appropriate, update existing guidelines (e.g., Codes of Practices) to incorporate climate change considerations into the Environmental Assessment process. Moreover, as parent class environmental assessments² are renewed or undergo a scheduled review, MOE will require proponents to:

- assess climate change impacts and adaptive actions
- amend the parent documents as appropriate

WATER INFRASTRUCTURE

A wide range of water infrastructure is used to:

- treat wastewater
- manage stormwater
- provide hydroelectric power

2 A parent class environmental assessment refers to an approved procedure for municipalities to follow in the planning of municipal infrastructure projects. There are alternatives to following the parent class environmental assessment procedure such as conducting individual environmental assessments for each project but these can be costly and time consuming. <http://www.municipalengineers.on.ca/classea/manual/manualSimple.asp?docsetID=A523A5DA-6B61-4130-9DF4-3CB77514411B>



ACTION 9

INTEGRATE ADAPTIVE SOLUTIONS INTO DRINKING WATER MANAGEMENT

The Ministry of the Environment is leading an effort to ensure that climate change considerations are integrated into the provincial drinking water safety net and sourcewater protection framework.

- regulate water levels
- supply safe drinking water

All water management and treatment infrastructure will be challenged by the impacts of climate change.

Climate change may pose a threat to both the quantity and quality of our water. With reduced water quantity and with changes in water quality due to warmer water temperatures, physical structures and operational systems must be adapted to cope with the increase in extreme weather events:

- Hydroelectric dams may need to be altered to adapt to lower water levels.
- Stormwater management systems may need retrofitting as storms and heavy rainfall increase.
- Water treatment facilities may need new equipment and processes to deal with changes in microbial populations such as the bacteria and viruses that thrive in warmer waters.

In the past, design standards for new infrastructure have been developed based on historical weather patterns that track the intensity, duration and amount of rainfall. New infrastructure may require designs based on projections of future climate that differ from historical trends. Identifying climate change trends early and incorporating these considerations into design and operation manuals will help ensure that Ontario's water infrastructure is resilient.

ACTION 9 | Ontario's Drinking Water Safety Net assures protection of Ontario's drinking water from source-to-tap under two regulatory frameworks (Safe Drinking Water Act and Clean Water Act). Climate change has the potential to impact many critical elements of this safety net.

To face this threat, a project has been launched bringing together climate change and drinking water experts to evaluate the extent to which our Ontario Drinking Water Safety Net and associated drinking water programs are vulnerable to the effects of climate change. They will be looking at what can be done to protect these systems and ensure the delivery of safe drinking water.

The Ministry of the Environment (MOE) is also assessing the extent to which Ontario's current drinking water management program is capable of addressing adaptation. The intent is to strengthen the drinking water

program by identifying key priorities and “no regret” actions for the short, medium, and long term. All aspects of the program will be examined including drinking water infrastructure, treatment processes, design standards, laboratory analyses, drinking water compliance, certification and training, and source protection.

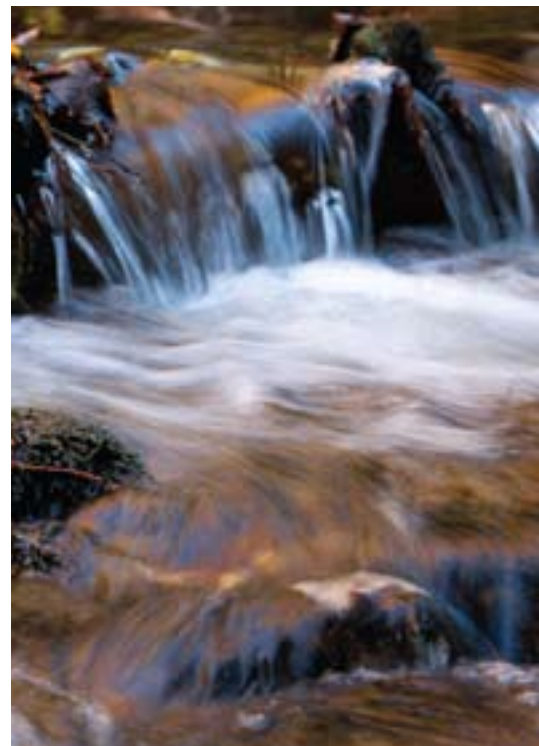
MOE is committed to identifying key climate change risks to Ontario’s Drinking Water Safety Net within its existing programs by 2012, and to addressing those most critical to the success of the safety net in consultation with key partners.

Source Water Protection Framework

The Ministry of the Environment is working to enhance integration of climate change impacts into the source water protection framework established through the Clean Water Act. This process takes an integrated watershed approach to ensure that communities identify risks to their drinking water supplies and take actions to reduce those risks. Climate change has the potential to worsen various threats to water quality and water quantity. Threats could include seasonal changes in water availability due to precipitation trends and increased temperatures.

Assessment Reports prepared by Source Protection Committees identify areas where the quantity and quality might be vulnerable to contamination or depletion now or in the future. Source Protection Plans identify how significant threats identified in the Assessment Reports will be managed within Source Protection Areas and are to be submitted to the Minister of the Environment for approval by 2012. Once the Plans are approved, decisions under the Planning Act (including Official Plans), as well as prescribed provincial instruments, must conform to the mandatory policies in the Plan.

MOE will be integrating climate change data and science into the source protection framework and will evaluate risk-management measures tailored to climate change adaptation. This will help inform policies developed for local Source Protection Plans and ensure that climate change impacts are appropriately managed at the local level.



ACTION 10

DEVELOP GUIDANCE FOR STORMWATER MANAGEMENT

Ensure Ontario's stormwater management systems are sufficiently resilient to handle a range of precipitation patterns to limit the impact on nearshore water quality and on ecosystems.

As part of the technical components of the Assessment Reports, water budgets are science-based tools that follow a tiered process to evaluate the risks to water quantity, as well as the ability of the water supply to meet the community's drinking water needs currently and in the future. These water budgets take into account integration of historical climate data and trends, the impact of drought and an assessment of growth related to water usage.

Under the Clean Water Act, further changes in the technical rules are being considered to include climate change science in future Assessment Reports.

The Ministry of Natural Resources, working with the Ministry of the Environment and Environment Canada, produced a guide for the assessment of hydrologic effects of climate change in Ontario as one approach to integrating climate change projections into hydrologic modelling. This guide will help to inform the development of water budgets under the Clean Water Act and has numerous other target users and applications.

ACTION 10 | The Ministry of the Environment is currently reviewing best management practices in other jurisdictions in support of proposed Municipal Water Sustainability Planning under the Water Opportunities and Water Conservation Act. The review includes municipal water, wastewater and stormwater systems for additional guidance and information on adapting water systems to deal with impacts caused by climate change. Among system issues and practices being reviewed:

- source control (reuse and low impact development)
- sewers for conveyance
- end-of-pipe treatment works
- water conservation
- inflow and infiltration
- by-passes and combined sewer overflows

The Province is expected to present new guidance to address the resilience of stormwater management systems in light of climate change.

The ministry is undertaking pilot and demonstration projects with municipal and industrial leaders in Ontario to assist in developing guidance. For example, the Ministry of the Environment is proposing to partner with municipalities to develop guidance on how reuse and low impact development approaches to manage stormwater can be introduced in the development of business/industrial parks.



Towards Resilient Wastewater Treatment Plants

The Ministry of the Environment, in partnership with the Water Environment Association of Ontario and Environment Canada, has developed the Optimization Guidance Manual for Sewage Works. The Guidance Manual identifies the best of current scientific and engineering methods and practices including operational procedures that allow sewage treatment plants to handle peak flows caused by intense storms. The Guidance Manual is available to the public on Water Environment Association of Ontario's website.

The ministry is also completing a manual for Water and Energy Conservation at Sewage Works, to be completed in 2011.

Safe Operation and Maintenance of Dams in Ontario

Dams are used for many purposes including:

- storing water for flood control
- domestic, industrial and agricultural water supply
- hydroelectric generation
- recreation
- low flow augmentation
- pollution control
- fire fighting

When dams fail, there are direct impacts on downstream communities, including serious social and economic consequences and concerns with water quality. Climate change is expected to cause more variability in water levels and flows with greater extremes in highs and lows. Dams will experience increased stress on structural stability from increased fluctuations in freeze/melt events in winter and will experience increased erosion due to more variable flows.

Ontario requires dam owners to obtain Ministry of Natural Resources' (MNR) approval of new dams and of major repairs to existing dams (and associated structures) under the Lakes and Rivers Improvement Act. Since 2006, MNR has been working collaboratively with a stakeholder advisory panel to modernize provincial requirements for dam safety of dams in Ontario. Enhancements being considered include:

- updating existing design and construction standards
- promoting public safety around dams
- introducing new requirements for dam operation and maintenance
- creating a registry of Ontario dams

- upgrading periodic inspections and emergency preparedness

These changes will strengthen the safe operation and management of dams in Ontario and ensure that they are more resilient to the effects of climate change.

TRANSPORTATION INFRASTRUCTURE

ACTION 11 | Transportation infrastructure will become more vulnerable to climate change impacts from damage caused by extreme weather events and temperature-related damages to roads. In the Far North, winter roads (ice roads) provide important economic lifelines to remote communities. These winter roads, which often cross frozen lakes and swamps, require long freeze-up periods. In the past several years, rising temperatures have cut short those periods and shortened the duration of the winter road networks.

When relatively inexpensive ground transport over winter roads becomes impossible, Northern communities must depend on air transport with often increased costs, barge transport which is not always possible and much slower, or must face substantial new investment to move winter roads to higher ground. There will also be an increasing need and demand for all-weather road access to the Far North should current climate trends continue and the winter road system ultimately becomes too undependable.



ACTION 11

STRENGTHEN THE WINTER ROAD NETWORK

Ministry of Northern Development, Mines and Forestry and Indian and Northern Affairs Canada are working with First Nation communities to deal with the effects of climate change by re-aligning and strengthening the winter road network in Northern Ontario.

The Ministry of Transportation is also replacing diesel generators at some remote airports with solar and wind-powered generation to reduce the need to haul fuel on winter roads.

In the Far North, winter roads provide important economic lifelines to remote communities.



ENERGY INFRASTRUCTURE

The province's energy sector may face numerous challenges from a changing climate such as the impacts of more frequent and severe windstorms, and more intense rainfall on electricity distribution and transmission infrastructure.

Agencies in Ontario responsible for the delivery of electricity are focused on this challenge, continually assessing systems and processes in light of potential weather impacts. Ontario is also committed to ongoing development of clean energy sources that diversify our energy supply and that have a much smaller environmental footprint than fossil fuels.

The Independent Electricity System Operator (IESO) manages Ontario's electricity grid with risks from extreme weather in mind. It is engaged in systematic audits and assessments of processes and standards at the local, regional, and North American level, to ensure high-impact, low-frequency event risks are identified and addressed. As an active participant in the standards development process of the North American Electric Reliability Corporation, IESO is vigilant in its continual review of standards and processes, and is incorporating new strategies and technologies as necessary to ensure the integrity of the Ontario electricity grid.

Hydro One, which owns 97 per cent of transmission assets in Ontario and almost 30,000 km of high-voltage transmission lines, was cited in 2009 by the Research Network for Business Sustainability as a leading energy sector firm in adapting to climate change. This was based on Hydro One's use of an Enterprise Risk-Management model which sets out uniform processes for the company to identify, measure, treat and report on anticipated risk factors. Key business objectives, such as the reliable delivery of electricity, are modelled on an impact-probability risk map which factors magnitude, probability of occurrence and strength of existing controls into an index that demonstrates risk reduction per dollar spent as well as responsibility areas for that risk. This enables climate risk to be factored into investment priority decisions and for appropriate delegation of action to develop concrete action plans.

In 2004, Hydro One opened a new Ontario Grid Control Centre (OGCC), which uses some of the most sophisticated technology in the world to efficiently manage the bulk of Ontario's electricity network in real time. The OGCC operators monitor Ontario's power system remotely, which enables them to respond quickly and effectively to both routine and emergency events. In its October 2006 audit report, the North American Electric Reliability Corporation cited Hydro One's physical and network security, training programs and high-tech grid-control centre as examples of excellence from which other utilities can learn.

To enable quick and efficient response to weather-related and other emergencies, Hydro One has reciprocal agreements in place with North American utilities to provide assistance during significant power outages. In the recent past, Hydro One crews have assisted U.S. utilities following a number of emergencies, including providing assistance to the State of Florida following hurricanes in 2004 and 2005. In 2007, Hydro One crews also assisted Vermont following a severe weather event that resulted in significant outages. In September 2008, more than 170 Hydro One staff (line maintainers) and equipment were sent to Ohio to assist with power restoration when a state of emergency was declared following Hurricane Ike.

The Province is also taking steps to determine the feasibility of connection of remote First Nations communities in the northwest of Ontario to the provincial electricity grid. Remote communities currently rely on diesel fuel generation, which has many drawbacks, including greenhouse gas emissions and risks of potential spills. In addition, many remote communities rely on seasonal winter roads for transportation of fuel, which is becoming increasingly problematic given the shortening winter roads season. To this end, in the recently announced Long-Term Energy Plan, the government announced that it will ask the Ontario Power Authority – the province’s electricity system planner – to develop a plan for remote community connections north of Pickle Lake. The plan may also consider the possibility of onsite generation such as small wind and water to reduce communities’ diesel use.



1998 Ice Storm – Canada’s ‘Largest Natural Disaster’



Electrical utility poles in winter storm

Natural Resources Canada anticipates that there will be more frequent freezing rain events in the future as a result of climate change. Freezing rain caused the 1998 Ice Storm that hit Eastern Ontario and Western Québec. The storm had a significant impact on critical services such as energy, communications and water supply. Ice loading damaged and brought down power lines, telephone cables, transmission towers and utility poles. Over 1,200,000 people in Eastern Ontario experienced loss of electricity for periods of a few hours to almost three weeks. As a result of the storm, 25 people in Ontario and Québec lost their lives. 700,000 insurance claims were filed for storm-related damages in both provinces and total insurance payouts approached \$1.5 billion.

Following the storm, an independent review team at Ontario Hydro (now Hydro One) produced a report with recommendations which have largely been incorporated into Hydro One’s business practices. Among these were to give priority to reinforcing strength and capability of pre-1960’s transmission assets. Since 2003, Hydro One has upgraded over 5,000 km of transmission and distribution assets, improving the reliability of the electricity grid. Another recommendation led to the establishment in 2004 of the Ontario Grid Control Centre in Barrie, with a fully functional back-up facility located in Toronto. Lessons from catastrophic events such as the 1998 Ice Storm have been incorporated into development of a pre-emptive approach to dealing with extreme conditions. The centralized response centre in Barrie uses a command-and-control structured organization which tracks weather patterns across the province, anticipating weather-related catastrophic events and ensuring experienced decision-makers are always available to initiate corrective pre-emptive action. For example, in anticipation of an impending weather event Hydro One now mobilizes human and physical assets such as poles, crews and bucket trucks, from areas outside of the storm’s path into the anticipated problem area, to enable speedy system restoration.



**“WITH THIS REPORT AND
ITS IMPLEMENTATION WE
IN **ONTARIO** PUT OURSELVES
AMONG A SMALL SELECT
GROUP OF **GLOBAL LEADERS**
ON ADAPTATION TO
CLIMATE CHANGE”**

—Dr. Ian Burton, Emeritus Professor at the University of Toronto,
Co-Chair of Ontario’s Expert Panel on Climate Change Adaptation



Green Energy and Green Economy Act

Ontario's Green Energy and Green Economy Act – legislation to protect the environment, stimulate a clean economy and create a new generation of clean jobs – received Royal Assent in May 2009. At the heart of this act is North America's most comprehensive Feed-in Tariff program which sparks the development of renewable energy such as wind, water, solar and biomass/biogas-sourced power. By incorporating more renewable energy into the electricity system, Ontario reduces greenhouse gas emissions, diversifies its energy supply and increases the resiliency of the system.

The act also includes commitments on promotion and development of the Smart Grid – a modern electric system that uses sensors, monitoring, communications, automation and computers to improve the flexibility, security, reliability, efficiency and safety of the electricity system. In its 2009 budget, Ontario committed \$50 million over five years to enable the research, capital and demonstration projects necessary for the development of a Smart Grid in Ontario. Among other benefits, the emerging Smart Grid technologies are expected to have positive impacts on grid reliability by contributing to the reduction of impact, frequency and duration of power outages.

Ontario Innovation Leaders with Climate Co-Benefits

Electrovaya Inc. is an Ontario-based developer and manufacturer of energy storage solutions. The company has 150 patents on its proprietary Lithium Ion SuperPolymer battery technology which allows more energy to be stored in smaller spaces. In 2009, Ministry of Economic Development and Trade invested \$16.4 million in Electrovaya through its Next Generation of Jobs Fund. These funds are dedicated to research and development in technology to be used in zero-emission vehicles.

Lithium Ion SuperPolymer technology can also be used to store surplus power from the electricity grid, providing customers with uninterrupted access to a power supply even if power-generating facilities are compromised during extreme weather events.

AGRICULTURE

Ontario has a strong and diverse agriculture sector that represents close to one quarter of Canada's total farm cash receipts. Climate change brings not only risks for this sector, but also some potential economic opportunities through warmer temperatures and longer growing seasons.

Ontario's farmers have a long history of adapting to and meeting climate challenges. Of key importance for agriculture is ensuring future adaptation is proactive rather than reactive. With successful proactive adaptation in the agri-food industry, Ontario producers may enjoy competitive advantages and strengthen their long-term economic stability.

ACTION 12 | Changes in Ontario's climate may be impacting livestock production across the province. For example, heat stress could pose serious risk during summer heat waves, leading to loss of production and higher cooling costs. New pathogens could pose a threat to our food supply and economy. Warmer temperatures could increase the risk of animal diseases, since pathogens sensitive to cold temperatures may have a higher rate of winter survival in Ontario.

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is working with its partners in the agricultural sector to protect animal health through continuous improvement in early detection, prevention and response to emerging animal diseases.

OMAFRA collaborates in funding for applied research on emerging and evolving animal diseases that are influenced by climate change. This cross-agency work involves key partners such as the Centre for Public Health and Zoonoses (diseases transmissible from animals to humans) and the Animal Health Laboratory at the University of Guelph.

OMAFRA is taking a number of actions to address predicted animal health risks, including new threats due to climate change. The ministry is working to improve coordination/partnerships, infrastructure, research and risk assessment through:

- passing the Animal Health Act, 2009 — a key tool for Ontario to prevent, detect and respond to animal health risks, including those that may emerge as a result of climate change
- preventing new animal disease outbreaks through veterinary outreach activities, evolving biosecurity practices and protocols³, disease surveillance, and early detection; and by working in partnership with the University of Guelph and maintaining links to other disease surveillance initiatives at national and international levels

³ Biosecurity practices are preventive measures designed to reduce the spread of infectious diseases, invasive species, etc.

ACTION 12

PROTECT ANIMAL HEALTH

The Government of Ontario is taking action to address threats to animal health brought about by climate change through the passage of the Animal Health Act and a formal partnership with the Animal Health Laboratory at the University of Guelph that supports detection and surveillance for animal diseases, including those that are emerging and evolving as a result of climate change.



ACTION 13

PROTECT PLANT HEALTH

The Ministry of Agriculture, Food and Rural Affairs is developing new approaches to protect plant health by searching for new crop varieties and cropping systems and encouraging the adoption of Best Management Practices on Ontario farms.



- partnering with the Ministry of Natural Resources, Ministry of Health and Long-Term Care and the Canadian Cooperative Wildlife Health Centre to develop and improve tools and techniques to detect significant wildlife diseases that may be transmissible to livestock — some of which may result from new and emerging climate conditions

ACTION 13 | Warmer summers and shorter winters could open opportunities for warm-season crops like corn, soybeans, forages and horticultural crops through the northward extension of crop production. Climate change, however, also brings significant risks to agricultural operations.

Changes in the frequency and severity of drought, shifts in precipitation and storm intensity, as well as the arrival of new pests, diseases and invasive species, all present risks to production profitability, competitiveness and environmental impact.

The Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is exploring best practices in other jurisdictions, identifying agricultural plant health experts whose expertise may be drawn upon, and investigating opportunities for improving provincial surveillance and response capacity.

OMAFRA continues to collaborate with university and other researchers and helps fund applied research on emerging and evolving plant diseases and pests. Ministry-supported research at the University of Guelph is ongoing:

- to identify risks and opportunities in plant agriculture which are emerging with a changing climate
- to establish how Ontario's agriculture sector can best adapt to anticipated changes in areas such as crop yields, variability and quality

New and more accurate modelling of cropping systems under changing conditions can identify major vulnerabilities and help farmers alter cropping patterns to avoid climate change impacts.

Overall program goals include increased adoption of Best Management Practices (BMP) which foster adaptation to climate change such as water-conserving irrigation, integrated pest management and low-till or no-till practices and the incorporation of buffer strips (i.e., planting permanent vegetation immediately adjacent to water sources to manage pollutants and other environmental concerns). Additionally, OMAFRA aims to continuously improve its outreach materials related to these farm practices as new information becomes available.

ACTION 14 | Business Risk Management (BRM) programs help farmers face the short-term risks that can affect production and profit in their businesses including risks from climate change such as extreme weather, pests and drought.

A suite of BRM programs — AgriInvest, AgriStability, AgriRecovery and AgriInsurance — is available under the *Growing Forward* Framework Agreement, a five-year joint federal-provincial-territorial program. The AgriInsurance and AgriRecovery programs were designed to respond to farmer needs and to help farmers cope with changing climate patterns. Farmers continue to advocate for the adaptation of these programs in order to satisfy future needs.

OMAFRA is working with key agricultural partners, including the Ontario Federation of Agriculture, to review the Environmental Farm Plan process to ensure it adequately considers new risks from climate change and increases farmers' climate resilience. These considerations will be brought forward during federal-provincial-territorial discussions towards developing the successor policy framework to *Growing Forward*.

Ontario Innovation Leaders with Climate Co-Benefits

Leamington Area Drip Irrigation Inc. is a group of 13 farmers who sought improved water efficiency for their operations. After lengthy consultation with agencies and specialists, these farmers created a new communal irrigation system that increases the reliability of water supply and quality to local producers.

The 36 km pipeline, pump house and filter system can precisely monitor the amount of water being delivered from Lake Erie to 2,500 acres of tomato fields in the Leamington area. Participating growers have seen a reduction in energy and input costs and an increase in the quality and yield of their crops. The drip water dispersion technology means water is not lost to evaporation, as happens with standard irrigation.

In 2010, the group won a Premier's Award for Agri-Food Innovation Excellence, which included a \$100,000 prize in recognition of its water conservation initiative.

ACTION 14

ENCOURAGE BUSINESS RISK MANAGEMENT APPROACHES

Through research and consultation, the Ministry of Agriculture, Food and Rural Affairs is evaluating the potential for new business risk-management models to better reflect climate change stimuli including models for new crops. The ministry is also expanding research into the impacts of climate change on crop yields, variability and quality.

ACTION 15

PILOT ADAPTATION STRATEGIES IN THE TOURISM SECTOR

The Government of Ontario is encouraging actions to help build the climate-resiliency of the tourism sector through initiatives to expand summer tourism.



Blue Mountain ski resort, Collingwood.

TOURISM

In 2008, tourism spending in Ontario generated \$22 billion and supported some 300,000 direct and indirect jobs. Most tourist activity in Ontario is influenced by the weather, especially the wide variety of popular outdoor and nature-based activities. Provincial and national parks are important venues for many of these activities.

Cultural attractions such as summer and winter festivals, First Nations events, museums, science centres, theatres, and historical and architectural sites often form part of itineraries or packages that can also be influenced by weather.

The Ministry of Natural Resources recently assessed the implications of climate change for Ontario's provincial parks including potential changes in ecosystems (composition, structure and function), increased forest fire severity, and impacts on tourism.

Park visits are projected to increase as the warm-weather tourism season extends earlier in the spring and later in the fall.

At the same time, climate change is projected to shorten the winter recreation season and decrease the reliability of suitable snow cover in many parts of Ontario. For example, due to uncertain snow conditions the Ministry of Natural Resources no longer grooms cross-country ski trails at Presqu'île Provincial Park, a peninsula south of Brighton, Ontario.

The total value of tourism — plus its spin-off benefits such as sales of recreation equipment — may not change greatly or it could even increase. However, there are likely to be shifts in the balance between winter and warm weather outdoor activities. Successful adaptation would allow a gradual transition rather than disruption in this very important sector of the province's economy.

ACTION 15 | It is now clear that Ontario's tourism industry must address climate change impacts in the near term. Given changes in the length of seasons, the threat of decreasing water levels (affecting water-based tourism) and changing visitor expectations (which are spurring sector-wide adaptation efforts), the Government of Ontario has already taken steps to adapt by supporting tourism-related initiatives. The Ministry of Tourism and Culture has promoted and funded tourism which uses sustainable transportation (e.g., bicycle tourism via The Bike Train). The ministry is also funding tourism operators to develop products focused on locally-sourced food and drink — an important attraction for visitors interested in eco-friendly features.

FUTURE VISION

Infrastructure: In the future, the Government of Ontario is considering expanding vulnerability assessments to conduct additional case studies in geographic regions and asset types not yet assessed within the province.

Integrated Human, Animal and Ecosystem Health: The Ministry of Health and Long-Term Care will be engaging with its partner ministries to explore a One Health approach to identifying, assessing and addressing emerging human, animal and ecosystem health issues in Ontario. This approach will focus on cross-sector surveillance, monitoring and control and mitigation of emerging diseases. It will seek to recognize the linkages between human, animal and ecosystem health domains, and will emphasize environmental conservation. Adopting the One Health concept as a strategic framework in Ontario will help prevent emerging infectious diseases of animal origin — an action far preferable to responding to diseases once they have begun to spread.

Tourism: To ensure that Ontario is well-positioned to retain and grow its tourism industry, the Expert Panel suggested the Ministry of Tourism and Culture provide strategic co-ordination to guide adaptation in different sub-sectors of the tourism industry. To create this strategy, Ministry of Tourism and Culture would need to consult with academics and key stakeholder groups. The ministry would also benefit from new research on risks and potential opportunities.

Ontario would also benefit, economically and environmentally, by helping tourism operators to go green with their energy consumption choices. This could include assistance:

- for selected operators to make existing facilities more energy-efficient
- for tourism operators to diversify their energy supply in favour of renewable sources
- through communications and other support to help the industry better market itself to eco-friendly visitors



GOAL 2

TAKE ALL REASONABLE
AND PRACTICAL MEASURES TO
INCREASE CLIMATE RESILIENCE
OF ECOSYSTEMS.

Ecosystem resilience is the ability of an ecosystem to adapt to stress and change.

In the context of adaptation, an ecosystem's resilience is its ability to absorb disturbances related to climate change while retaining the same basic structure and ways of functioning (IPCC 2007). The Government of Ontario is currently focusing its actions in several specific areas:

- biodiversity
- forest management
- Great Lakes
- Lake Simcoe



BIODIVERSITY

Ontario's Biodiversity Strategy (2005) defines biological diversity (biodiversity) as "the variety of life". Biodiversity is shaped by ecological forces and factors that are expressed through genes, species and ecosystems. Threats to biodiversity include:

- habitat loss
- population growth
- introduction of invasive species
- pollution
- over-consumption or unsustainable use

Climate change increases the threats to biodiversity and can significantly alter the distribution and abundance of species throughout Ontario.

For example:

- Reduced ice cover on the Great Lakes — including changes to freeze-up and break-up times — can affect the food supply for aquatic life, alter fish spawning, and cause birds to change migration patterns.
- The expanded range of southern species into more northerly and easterly/westerly habitats can pose serious and immediate threats such as the Mountain Pine Beetle (Langor 2003, Lemprière et al. 2008:21, Williamson et al. 2009) and the Black-legged Tick that carries



the bacterium that causes Lyme disease (Ogden et al. 2006, Varrin et al. 2007:10).

- The expanded range of southern species into more northerly habitats can alter ecosystems such as the increased presence in southwestern Ontario of the southern flying squirrel and the Carolina chickadee (Bowman et al. 2005, Varrin et al. 2007).
- Reduced sea ice in Hudson's Bay and James Bay changes the body condition, range and survival rate of polar bears by threatening their feeding, mating and resting areas (Obbard et al. 2007).
- Species such as moose, the gray jay and polar bear are already experiencing reduced range (Varrin et al. 2007, Waite and Strickland 2006, and Obbard et al. 2006).

The Expert Panel identified that, while nothing can be done to prevent ecosystems from being exposed to climate change, the Government of Ontario can bolster the resilience of ecosystems through proactive measures.

Species at Risk

More than 190 of Ontario's wild species are at risk; causes include habitat loss, pollution, changing land use activities, spread of invasive species and climate change. The recovery of species at risk is key to conserving Ontario's biodiversity.

The Ministry of Natural Resources protects species at risk and their habitats through the Endangered Species Act, 2007 which emphasizes assessment of species by an independent body which uses the best available science, community knowledge and Aboriginal Traditional Knowledge. The ministry also supports the stewardship efforts of private landowners, resource users and conservation organizations by coordinating the development of recovery strategies for endangered and threatened species and establishing management plans for species of special concern.

Provincial Parks and Conservation Reserves Maintain Biodiversity

Ontario's system of protected areas includes over 650 parks and conservation reserves with an area of over 9.8 million hectares — approximately nine per cent of the area of the province. Protected areas maintain biodiversity by permanently protecting ecosystems representing all of Ontario's natural regions, as well as protecting significant natural features, such as species at risk. The Provincial Parks and Conservation Reserves Act mandates that these areas be planned and managed to maintain or restore their ecological integrity.

The provincial protected areas system plays a vital role in Ontario's ability to lessen and adapt to the impacts of climate change. Protected areas:

- capture and store carbon in their natural ecosystems
- reduce the impacts of natural disasters
- protect ecological services (e.g., purification of air, decomposition of waste)
- act as biodiversity refuges
- support the ecosystem resilience of the landscape

ACTION 16

CONSERVE BIODIVERSITY AND SUPPORT RESILIENT ECOSYSTEMS

The Government of Ontario is taking action to conserve biodiversity and support the resilience of ecosystems.

ACTION 16 | The Province is supporting the protection and recovery of threatened, endangered and extirpated species to safeguard Ontario's biodiversity. The Ministry of Natural Resources (MNR) is undertaking a number of actions including updating Ontario's Biodiversity Strategy in 2011. This update will include integrating awareness of the expected effects of climate change and associated adaptation measures.

In partnership with the Forest Gene Conservation Association, local practitioners and the federal government, MNR will investigate assisted migration for tree species as a potential management tool. Several plantation trials have been established using seedling stock from southern sources for species that are expected to expand their range in Ontario in the future.

The Province is working with conservation partners to track Ontario's biodiversity through the Natural Heritage Information Centre. The Centre



updates information on species of conservation concern, collects information on representative vegetation communities in the Far North and enhances data for coastal areas of the Great Lakes. Ontario continues to protect representative ecosystems, species at risk and other natural features in a system of provincial parks and conservation reserves and managing these areas to protect their ecological integrity.

The Ministry of Natural Resources is putting in place a research chair at Algoma University to study invasive species and the threats they pose to biodiversity. MNR is establishing a new Invasive Species Centre in Sault Ste. Marie and developing an invasive species action plan against pests such as the emerald ash borer and gypsy moth.

The Ontario government is increasing the percentage of high-quality natural tree cover on the landscape through launching the 50 Million Tree Program. The program is currently rebuilding the infrastructure needed for large scale reforestation through a series of private/public partnerships between the Ministry of Natural Resources and environmental non-governmental organizations, seed collectors, private nurseries, planting agencies and contractors.

The Ministry of Natural Resources is protecting genetic diversity by maintaining the provincial tree seed bank, sponsoring completion of a seed management plan for the 50 Million Tree Program, and supporting a Broodstock Management Program for Fish Culture. MNR is also developing a tool to assist municipalities in designing natural heritage systems with a view to maintaining the connectivity of natural features to help conserve biodiversity. Exploring how biodiversity conservation can be further included in provincial land use planning policy such as the Provincial Policy Statement to promote the protection and proper management of natural resources.

The Province is protecting stream habitat, water quality and shoreline naturalization by undertaking stewardship initiatives through the Ontario Stewardship Program, the Managed Forest Tax Incentive Program, the Conservation Land Tax Incentive Program and the Environmental Farm Plan. These programs include activities such as:

- restoring and conserving wetlands
- tree planting
- riparian buffer strip planting (i.e. planting permanent vegetation immediately adjacent to water source)
- livestock fencing
- developing alternative water sources for cattle

FOREST MANAGEMENT

Warmer temperatures and changing rates of precipitation may cause changes to the range of Ontario tree species, as well as to forest community composition and site productivity. Forests will also be affected by changes in the frequency and severity of disturbances such as forest wildfire, drought and wind storms, along with the influx of insects and diseases (Williamson et al. 2009). Increased atmospheric carbon dioxide levels will also impact forest growth in the short-term and alter species abundance and the genetic makeup of forest population (Colombo 2009).

The primary objective of Crown (public) forest management in Ontario is to provide for the sustainability of the forest so that it can meet the social, economic and environmental needs of Ontarians today and in the future. To maintain a forest's sustainability and its long-term health, the complexity of the forest ecosystem must also be maintained. To ensure the resilience of forested ecosystems, it is important that forest management practices are adaptive and conserves large, healthy diverse and productive forests.

ACTION 17 | In 2009, the Ministry of Natural Resources co-sponsored a study of the vulnerability of tree species through the Canadian Council of Forest Ministers. Building on this work, the Ministry of Natural Resources is currently working with other Canadian jurisdictions to develop a framework for managing forest adaptation which will include vulnerability assessment techniques and a 'tool box' of adaptive management techniques for use by agencies, organizations and communities.

Forest Fires Increases as Climate Change

Climate change will increase forest wildfire activity in Ontario due to higher temperatures and more frequent and severe periods of droughts. A hotter, drier environment will increase the number of "fire flaps" particularly in northwestern Ontario. A "fire flap" results from increased fire danger due to two or more weeks with little or no rain, coupled with an ignition source, especially lightning. In Ontario, fires ignited by lightning cause 80 per cent of the burned forest area. Climate change may also result in increased lightning activity.

In ecosystems across the world, including the Boreal Forest Zone, fire is a natural and essential force for maintaining structure and productivity. However, climate change projections for the 21st century suggest that wildland fire in the Boreal Zone will become

ACTION 17

UNDERTAKE FOREST ADAPTATION ASSESSMENT

The Ministry of Natural Resources is researching forest ecosystem vulnerability to climate change impacts.





more severe — with a larger numbers of fires and the likelihood of increased burned area (Natural Resources Canada 2009).

The Ministry of Natural Resources coordinates forest fire detection, monitoring and suppression. It also provides public information and is exploring new approaches to fire management in a changing climate.

Ontario Forest Research Institute

Ontario Forest Research Institute research staff is developing new scientific knowledge to support the sustainable management of Ontario's forests in a changing climate. Researchers are examining tree genetics and the adaptive capacity of tree species by growing a range of species from various sources under controlled conditions to see how trees respond to increasing temperature and concentrations of carbon dioxide. They will combine this information with projections of Ontario's future climate to determine how climate envelopes (the areas with suitable climate for a given tree species or ecosystem) are likely to change. This knowledge will help them to determine if tree species from further south are a better choice for Ontario, and will identify populations more genetically adapted to expected conditions. The Institute will also evaluate adaptation to climate change by comparing natural populations of trees with those planted on an experimental site matched to their seed source. With this information the Institute will refine guidelines for selecting a seed source to ensure trees grow in friendly environments.

GREAT LAKES

Land use changes, the presence of invasive species, habitat loss, pollution and eutrophication (increase of nutrients) threaten the Great Lakes' water quality and fundamental resilience to a changing climate. The condition of the Great Lakes is critical to the health, economy and natural beauty of Ontario. It is imperative that we build upon existing actions and that we consider the ways in which climate change may intensify the impact of these threats — causing lower lake levels, lake temperature changes, extreme storm events and the spread of invasive species.

ACTION 18 | There are a number of agreements intended to manage the quality and quantity of the Great Lakes waters. Ontario will use the Framework of existing programs and Great Lakes Agreements to integrate climate change considerations into Great Lakes management practices.

Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement

The need to adapt to climate change was specifically negotiated into this sub-national agreement among the 10 Great Lakes States and Provinces. The agreement is built on the precautionary principle, stating that “in light of possible variations in climate conditions and the potential cumulative effects of demands that may be placed on the Waters of the Basin, the States and Provinces must act to ensure the protection and conservation of the Waters and Water Dependent Natural Resources of the Basin for future generations. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

The agreement commits Great Lakes and St. Lawrence River Provinces and States to considering climate change uncertainties in periodic assessments of cumulative water use impacts. Ontario is currently in the process of developing regulations and supporting policies, as well as information and science, to fulfill the commitments of the Agreement. Provincial actions include:

- banning out-of-basin and intra-basin transfers with strictly regulated exceptions
- developing water conservation goals, objectives and programs to support basin-wide goals
- developing the information and science needed to support water use decisions, including the assessment of cumulative impacts of water use with consideration of climate change

ACTION 18

BUILD ADAPTATION INTO THE GREAT LAKES AGREEMENTS

The Government of Ontario will promote the consideration of climate change impacts and adaptation actions in all Great Lakes Agreements.

Canada-U.S. Great Lakes Water Quality Agreement

Canada and the United States first signed the Great Lakes Water Quality Agreement (GLWQA) in 1972, committing Canada and the United States to restoring and maintaining the chemical, physical and biological integrity of the Great Lakes basin ecosystem. It was last updated in 1987 and negotiations of amendments to the agreement began in 2009.

Ontario makes significant efforts to ensure that our Great Lakes communities, economies and ecosystems are protected through this process. Ontario's Expert Panel on Climate Change Adaptation reaffirmed this imperative and recommended that all provincial, national and international agreements on the Great Lakes be consistent in considering climate change impacts and adaptation. The Government of Ontario is advocating for a climate change adaptation focus within the amended GLWQA.

Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA)

This agreement outlines how the governments of Canada and Ontario will co-operate on and co-ordinate our efforts to restore, protect and conserve the Great Lakes Basin Ecosystem and help Canada meet its commitments under the GLWQA. One goal of the current COA is to understand the impacts of climate change on this ecosystem. As part of this effort, Ontario supports research to examine the role of climate change on beneficial use impairments (the degradation of water quality) in Areas of Concern (severely degraded areas within the Great Lakes). When a new COA is negotiated, the Government of Ontario will continue to press for the inclusion of strong integration of climate change adaptation considerations.

Planning and Adapting for Climate Change in the Great Lakes

The Government of Ontario is working with Canadian and U.S. governments, academics and nongovernmental organizations (NGOs) in the development of biodiversity conservation plans such as the recently completed Lake Ontario Biodiversity Conservation Strategy. Key recommendations from this strategy include considering the impacts of climate change and taking action to provide corridors that facilitate species migrations and shifts in ecological communities.

ACTION 19 | Maintaining the biodiversity of Ontario's Great Lakes is vitally important; a resilient and healthy fisheries population provides significant social and economic benefits.

The Expert Panel recommended that Ontario analyze the vulnerability of Great Lakes fisheries to climate change to ensure that fisheries management policies and procedures take into account potential impacts on individual species, fish habitat and the aquatic food web.

The Ministry of Natural Resources is sponsoring the development of methods to assess the vulnerability of fish species to climate change at the watershed level.

For example, MNR recently published regional projections of how climate change will affect Ontario Lake Trout populations. This information will help resource managers understand how the future of a top predator such as Ontario Lake Trout will influence food web structure and the stability of the ecosystems that support it.

Climate impact projections are helping resource managers across the province plan for the ecological and economic consequences of climate change.

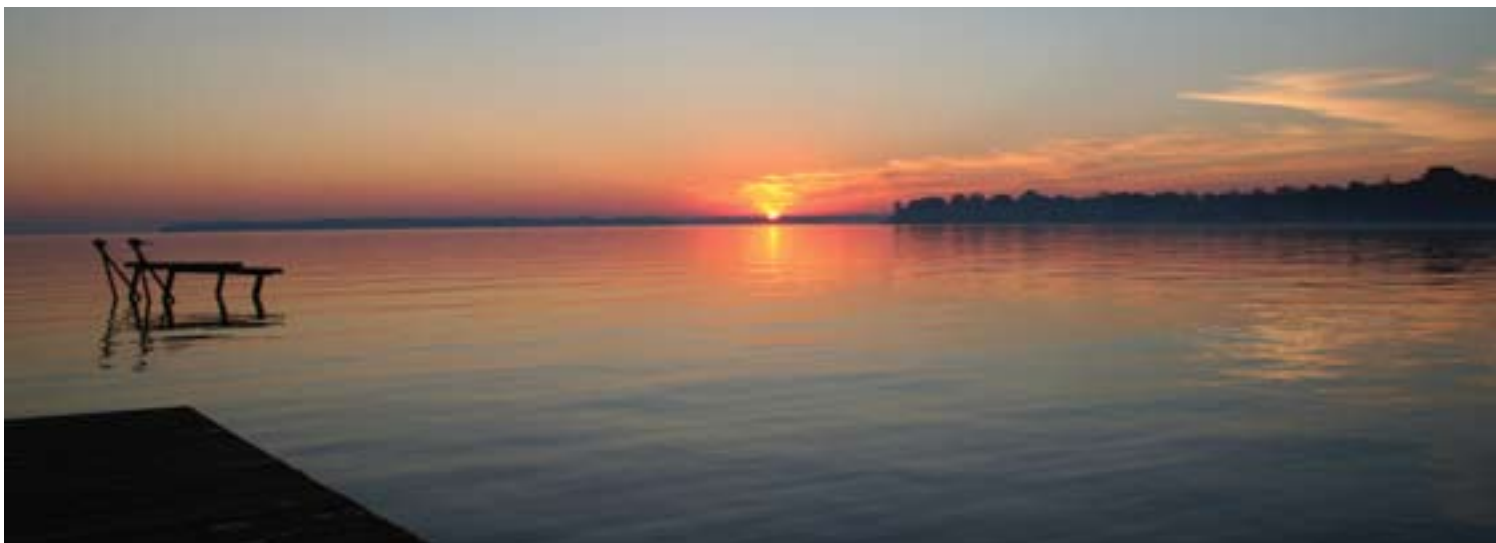
To advance the understanding of climate change impacts on fisheries, MNR is also:

- investigating how existing research can be built upon to develop understanding of how climate change will affect fisheries
- determining how to collaborate with the Great Lakes Fisheries Commission to continue analysis of fisheries vulnerability

ACTION 19

EXAMINE CLIMATE CHANGE IMPACTS ON FISHERIES

The Ministry of Natural Resources will assess the vulnerability of fish species to climate change impacts through research activities.





**“INSURANCE COMPANIES CALL
IT ‘DUE DILIGENCE’; ORDINARY
PEOPLE CALL IT THINKING
AHEAD AND BEING **READY**
FOR WHAT THEY SEE. THAT’S
WHAT ADAPTING TO CHANGING
WEATHER PATTERNS IS
ALL ABOUT.”**

—Dr. David Pearson, Professor of Earth Sciences at Laurentian University,
Co-Chair of Ontario’s Expert Panel on Climate Change Adaptation

LAKE SIMCOE

ACTION 20 | The Lake Simcoe Protection Plan was released in June 2009 to provide a roadmap for restoring and protecting the health of Lake Simcoe. It promotes immediate action to address current threats to the ecosystem — such as excessive phosphorus levels.

Climate change may cause changes in water temperature in Lake Simcoe affecting the coldwater fishery and habitat and further accelerating growth of aquatic plants caused by high phosphorus loading. This negatively impacts the environment and the local economy which is dependent on recreational activities.

The Ministry of the Environment and the Ministry of Natural Resources are bringing together leading climate experts to undertake vulnerability assessments and provide advice to support the development of the Lake Simcoe Adaptation Strategy. The Strategy will identify:

- key recommended adaptation actions
- roles and responsibilities for relevant parties
- potential amendments to the Lake Simcoe Protection Plan to ensure the recommended actions are undertaken

Lake Simcoe Vulnerability Assessments

The Ministry of Natural Resources is currently assessing the vulnerability of wildlife, vegetative cover, species at risk, watershed and lakeside hydrology, aquatic habitat and natural heritage/protected areas in Lake Simcoe and its watershed. Similarly, the Ministry of Agriculture, Food and Rural Affairs has undertaken an assessment of the vulnerability of the agriculture sector in this area. Lake Simcoe is being treated as a pilot project for the development and testing of this type of analysis so that it can lead to meaningful action there and elsewhere. Experts will use selected indicators including future scenarios based on climate change to determine where and how natural systems are most vulnerable, and then develop quantified risk projections and ‘best-bet’ options for adapting to those risks.

ACTION 20

DEVELOP THE LAKE SIMCOE ADAPTATION STRATEGY

The Ministry of the Environment, in collaboration with the Ministry of Natural Resources, the Ministry of Agriculture, Food and Rural Affairs, the local First Nations and Métis communities, the Lake Simcoe Region Conservation Authorities, municipalities and academic institutions will develop a climate change adaptation strategy for the Lake Simcoe watershed by 2011.



To develop and implement the Lake Simcoe Adaptation Strategy, the Government of Ontario will:

- assess and evaluate the risk of climate change impacts on the watershed
- promote, conduct and support additional research to better understand the impacts of climate change in the watershed — including impacts on wetlands, aquatic life, terrestrial species and ecosystems, headwaters, conservation of life cycles, groundwater temperature, and water table levels
- develop an integrated climate change monitoring program to inform decision-making and model the impacts of climate change on the watershed
- begin the development of climate change adaptation plans and promote the building of a Lake Simcoe watershed community of practice in adaptation planning

The Lake Simcoe Adaptation Strategy will create a model that can be shared to support adaptation planning in other watersheds across Ontario and beyond our borders.

FUTURE VISION

Biodiversity: The Government of Ontario will continue efforts to conserve biodiversity, to protect and sustain our natural resources and to maintain the resiliency of ecosystems in a changing climate.

The Expert Panel recommended that the Ministry of Natural Resources guide these efforts by means of vulnerability assessments and by actions that promote resilience of the most affected and vulnerable ecosystems and species.

Ontario will explore ecologically-based climate change vulnerability assessments at the species and ecosystem levels as a critical step in an adaptive management approach to natural resource management.

Forest Management: It is important to evaluate current legislative tools, policies and programs which can help forests adapt to climate change.

Forest policies and programs may evolve in response to climate change. Some possibilities are:

- incorporating climate change into forest management planning processes
- considering climate change scenarios in forecasts of disturbances to the natural environment
- exploring opportunities to enhance reforestation programs in support of adaptation

To ensure resilient and biologically diverse forests under various climate change scenarios, Ontario will continue to sponsor research into adaptive forest management tools and techniques that address:

- protecting forests from the impacts of fire, disease and insects
- developing treatments for the care and cultivation of forests (silvicultural treatments)
- modelling ecosystem processes to assess vulnerability, thresholds, and biological response under various climate change scenarios

Great Lakes: The Government of Ontario will continue to work on restoring and protecting the long-term health of the Great Lakes in light of climate change.

Ontario will continue to improve its understanding of the impacts of climate change through its own research and through sharing research conducted under international agreements.

Lake Simcoe: Assessing vulnerability and evaluating the risk of climate change impacts on watersheds such as Lake Simcoe could provide an example of how this information could be used in the development and implementation of local adaptation plans in Ontario. Similar work could be explored for other critical ecosystems in the province.

Far North: Management approaches that maximize ecosystem resilience and minimize external stressors on biodiversity and ecosystems will be critical in other areas such as the Far North of Ontario.

With the Far North Act of 2010, the Government of Ontario has created the opportunity to work with First Nations in the Far North through a joint body to issue policy statements that may relate to climate change adaptation and mitigation (described in Goal 4).



GOAL 3

**CREATE AND SHARE RISK-
MANAGEMENT TOOLS TO
SUPPORT ADAPTATION EFFORTS
ACROSS THE PROVINCE.**

As we gain a better understanding of the effects of climate change, risk-management tools will be created and shared with communities across the province.

Risk-management tools include:

- best management practices
- guidance materials
- education and training

Over the next four years, the Government of Ontario will provide communities with tools to assist in:

- land use planning
- emergency management
- public health awareness
- water resources management
- infrastructure management

Investment in community outreach and education is critical to ensure that the available tools are effectively used to prepare for the impacts of climate change.

The Government of Ontario is also investing in education for our future decision-makers — our youth — so that they understand climate change and the importance of protecting the environment for all aspects of our economy and society.

LAND USE PLANNING TOOLS

The way communities are planned influences their level of greenhouse gas emissions and their resilience to the effects of climate change.

Land use planning in Ontario is guided by the Provincial Policy Statement (PPS) under the authority of the Planning Act. Community-focused plans, such as the Greenbelt Plan and the Growth Plan for the Greater Golden Horseshoe, are prepared under other legislation. Municipalities make local



ACTION 21

INCREASE AWARENESS OF LAND USE PLANNING TOOLS

The Ministry of Municipal Affairs and Housing is taking action to build local awareness of climate change adaptation tools for land use planning.

planning decisions and prepare planning documents such as official plans and zoning by-laws.

The Province's land use planning framework was designed to allow for the consideration of new science and information. It will be important for the Ontario government to review Provincial land use policies to ensure they are as current as possible in acknowledging and addressing emerging issues such as climate change.

ACTION 21 | In 2007, amendments to the Planning Act came into effect creating a number of new tools. These tools focus on sustainable development and include several measures which can be used for climate change mitigation and adaptation.

These amendments were followed by a series of information sheets including "Planning for Climate Change", and further supported by the release of "Building Blocks for Sustainable Planning" — a series of 12 one-page bulletins providing guidance on why and how to use these new planning tools for climate change mitigation and adaptation. Greater awareness of how to use these planning tools for adaptation to climate change at the local level will encourage widespread use.

Municipalities may use site plan control or a development permit system to require sustainable design features that support:

- water conservation
- energy efficiency
- sustainable transportation options
- improved air and water quality

In water conservation, for example, low-impact development features such as permeable pavement can promote water infiltration, reduce stormwater run-off and encourage water re-use. This will help reduce the strain on municipal wastewater infrastructure, energy use and the natural environment — and help manage the wetter climate predicted for the future.

The Ministry of Municipal Affairs and Housing Taking Action to Build Awareness of Land use Planning Tools

In 2010, the Ministry of Municipal Affairs and Housing created a publicly-accessible Three Dimensional Visualization Portal on its website which provides animated views of what different land use policies can look like on the ground. This tool helps in visualizing planning and design options for sustainable, healthy and economically-resilient communities.

The ministry develops provincewide educational materials and delivers ongoing education sessions on land use planning for partner ministries, municipal planners and conservation authorities. The ministry also promotes other outreach initiatives with the development sector. More information is available at the local Municipal Services Offices.

Ontario, in a partnership with the Association of Municipalities of Ontario (AMO) and the Ontario Professional Planners Institute (OPPI), is developing a new education and outreach initiative called “Why Plan?” for municipal decision-makers. This multi-year initiative, which includes a climate change component, will draw from discussions at educational forums which began with the AMO Conference in August 2010 and OPPI Symposium in Fall 2010.



ACTION 22

INTEGRATE ADAPTATION POLICIES INTO THE PROVINCIAL POLICY STATEMENT

ACTION 22 | In March 2010, the Ministry of Municipal Affairs and Housing launched a review of the Provincial Policy Statement (PPS). The PPS currently contains a number of policies with climate change mitigation and adaptation co-benefits including:

- protecting natural heritage features
- directing development outside of areas prone to flooding hazards
- promoting effective stormwater management, water conservation and efficient water use

ACTION 23

CONSIDER CLIMATE CHANGE IN THE GROWTH PLAN FOR NORTHERN ONTARIO

This review of the PPS will provide an opportunity for the public, ministries, municipalities, Aboriginal communities, local and provincial organizations and other stakeholders (e.g., environmental groups, development sector) to make suggestions to further promote climate change mitigation and adaptation.

Recognizing the importance of integrating various elements of climate change adaptation and mitigation into the land use planning system, the ministry will continue efforts to ensure policy, tools and guidance materials are current by using performance measures and ongoing review.

The Ministry of Municipal Affairs and Housing recognizes the primary implementation role that municipalities play and is committed to regular engagement with the municipal sector, including outreach and training.

ACTION 23 | The Growth Plan for Northern Ontario, 2011 includes Environment as one of its six core themes and recognizes the need for climate change mitigation and adaptation, which is of particular importance in the North.

Average temperatures are rising more quickly in the North than in the rest of Ontario. This will alter the profile of the boreal forest and the sensitive ecology of waterways, lakes and wetlands. It threatens the region's biodiversity, increases the risk of storms and forest fires, and shortens the transportation season for remote communities that rely on temporary ice roads to import essential supplies.

Climate change will also result in new economic opportunities, such as longer growing seasons for agricultural producers and the development of carbon offsets market.

The Plan includes two policies specifically addressing climate change mitigation and adaptation:

- 6.3.3 The Province will work with the federal government, municipalities and others to incorporate climate change mitigation and adaptation considerations, where appropriate, into planning and decision-making, including monitoring programs and tools to measure and understand climate change and its impacts on northern Ontario.
- 6.3.5 The Province will work with the federal government, municipalities and others to include measures to protect and preserve air quality, water quality and quantity, and natural heritage in planning for climate change impacts and environmental sustainability.

EMERGENCY MANAGEMENT TOOLS

The Emergency Management and Civil Protection Act requires municipalities and provincial ministries to have an Emergency Management Program in place.

These programs support emergency preparedness and emergency response. They also ensure a proactive and coordinated approach to reducing risks and managing emergencies due to heat waves, tornadoes, torrential rain, flash floods, fire and human health crises.

Thunder Bay – one of the cities included in the Growth Plan for Northern Ontario



Develop a Municipal Risk-Management Tool under the Ontario Regional Adaptation Collaborative

As part of the Ontario Regional Adaptation Collaborative, the Ministry of Municipal Affairs and Housing will be building a web-based risk-management tool to assist municipalities in the development of adaptation strategies. More information about the Regional Adaptation Collaborative can be found in Goal 5.

TOOLS TO SUPPORT HUMAN HEALTH

Changing climate affects human health in many ways. Extreme weather such as heat waves, high winds and poor air quality can cause serious health issues for Ontarians. So does the increased presence of infectious diseases such as Lyme disease.

A combination of weather extremes — such as soaring heat coinciding with poor air quality — can create a multiplier effect, increasing health impacts. At the community level, the Government of Ontario continues to work with Public Health Units to ensure they have the tools to protect public health from risks due to climate change

Public Health Unit

Ontarians are served by a system of 36 local boards of health that are responsible for the organization and delivery of public health programs and services, disease prevention and the promotion and protection of the health of the people of Ontario.

ACTION 24 | The Ministry of Health and Long-Term Care introduced Ontario Public Health Standards in 2009 under the authority of the Health Protection and Promotion Act.

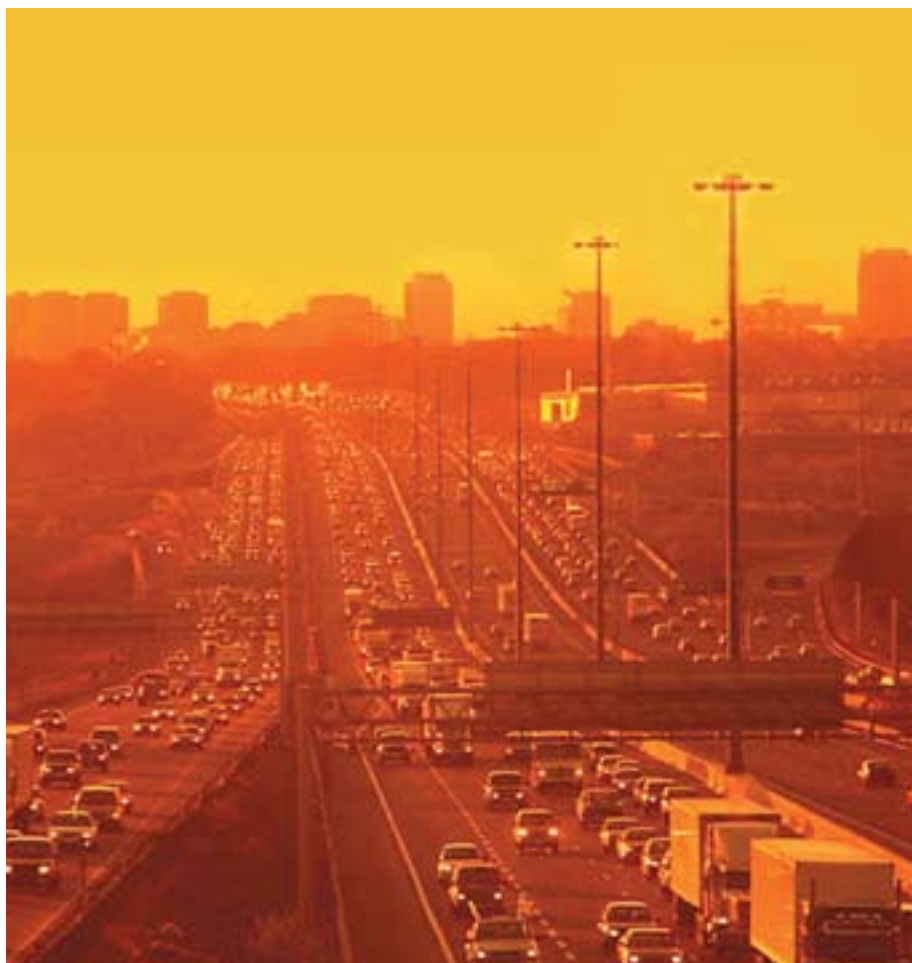
These standards outline what is expected of the boards of health which govern the Public Health Units. The standard for prevention and management of environmental hazards specifically requires increased promotion of public awareness of the health hazards associated with climate change, including emerging health issues associated with extreme weather. A number of Public Health Units have implemented measures related to climate change — for example, heat alert systems in Toronto, London and Niagara are triggered when temperature and humidity become dangerously high.

The ministry is engaged in a range of strategic activities to increase accountability and performance of Public Health Units including the development of accountability agreements and a performance management framework.

ACTION 24

RAISE AWARENESS ABOUT HEALTH HAZARDS OF CLIMATE CHANGE

The Ministry of Health and Long-Term Care established a requirement for increasing public awareness of the health risk factors associated with climate change in the Ontario Public Health Standards and will be undertaking activities to raise awareness in boards of health about this requirement.



ACTION 25

RAISE PUBLIC AWARE- NESS OF LYME DISEASE

The Ministry of Health and Long-Term Care is conducting surveillance, educating the public and notifying them of areas vulnerable to Lyme disease.

Create a Heat Vulnerability Tool under the Ontario Regional Adaptation Collaborative

Increasingly frequent and long-lasting heat waves are a primary health concern across Ontario. Through Ontario's Regional Adaptation Collaborative, Toronto Public Health is mapping heat intensity areas and vulnerable populations most impacted by heat events to improve the way they plan for and react to these events. More information about Ontario's Regional Adaptation Collaborative can be found in Goal 5.

Climate Change Impacts on Air Quality

While Ontario's air quality has improved steadily since 1988, climate change may mean negative impacts on air quality (e.g., increased smog, wildfires, pollen production); increased emissions caused by changed personal behaviours such as greater use of air conditioning is also a factor (Health Canada 2008). To track ambient (outside) air quality conditions in the province and inform Ontarians of poor air quality days, the Ministry of the Environment maintains the Air Quality Index (AQI) which reports air quality conditions and provides information on the potential impacts of air quality on public health.

ACTION 25 | Lyme disease is an emerging infectious disease transmitted to humans through the bite of an infected black-legged tick. In its early stages, Lyme disease produces flu-like symptoms. If untreated, it can become a serious illness, with severe and chronic symptoms.

The tick population which causes Lyme disease has expanded to new areas of Ontario due to warming temperatures. There has been a notable increase in the number of Lyme disease cases within Ontario since 2000 (Ontario College of Family Physicians 2008).

Currently, ticks carrying Lyme disease are found mostly in parks and conservation areas along the north shores of Lake Erie in Ontario and the St. Lawrence River, but it is possible to acquire it anywhere in the province.

Awareness of Lyme disease remains low among the general public. Lyme disease can be difficult to diagnose but the condition is preventable through improved awareness and personal protection. If contracted, this condition is curable with early diagnosis and antibiotic treatment.

The Ministry of Health and Long-Term Care (MOHLTC) is taking actions to protect the public against Lyme disease including:

- conducting surveillance for Lyme disease in human and tick populations
- working with parks and conservation authorities to post signage in areas where Lyme disease is present
- educating Public Health Units on the trends of Lyme disease across Ontario, other parts of Canada and in the United States
- implementing an educational campaign to bring greater awareness of Lyme disease, including education on:
 - how to recognize ticks and tick bites
 - the symptoms of Lyme disease
 - protection measures

Materials for the “Let’s Target Lyme!” Campaign have been distributed to all Public Health Units across the province. MOHLTC will continue to work with partners and stakeholders to increase awareness of Lyme disease. The Province will also increase surveillance to identify new and expanding areas in Ontario where Lyme disease is present.



The distinctive bulls-eye rash pattern associated with Lyme disease



The West Nile Virus is transmitted through mosquito vector

Vector-borne Disease Surveillance

Surveillance for vector-borne disease (diseases transmitted by infectious insects such as mosquitoes, ticks) such as West Nile Virus and Eastern Equine Encephalitis involves collaboration with all 36 Ontario Public Health Units in Ontario and takes place June–October each year. Each Public Health Unit conducts adult mosquito surveillance using light traps and weekly viral testing of captured mosquitoes. Public Health Units conduct local risk assessments for vector-borne diseases using a variety of factors to determine the level of risk in their health unit. Results of the mosquito surveillance are reported to the Ministry of Health and Long-Term Care which reviews and analyzes them in order to determine the level of risk for the province. Analysis is reported in a weekly vector surveillance report which is sent to Public Health Units. Vector surveillance for Lyme disease involves both passive surveillance (the public submit ticks they find on themselves) and active surveillance (the ministry in the field investigating new areas for ticks and testing them for Lyme disease).

WATER RESOURCES TOOLS

Climate change is expected to increase threats to the quality and quantity of Ontario's water. To ensure that communities have access to current information on their water resources, the Government of Ontario is developing an integrated one-window information gateway on water resources and weather patterns, making data easily accessible and available for use in adaptation planning. The Weather and Water Information Gateway is being developed by the Ministry of Natural Resources, in partnership with the Association for Canadian Educational Resources, under the Ontario Regional Adaptation Collaborative (see Goal 5).

TOOLS TO SUPPORT INFRASTRUCTURE DESIGN

Flooding is the leading cause of public emergency in Ontario. Flooding can damage property, interrupt critical services and lead to injury and loss of life (Conservation Ontario 2009).

A number of tools can be used to support infrastructure design as our

climate changes. Intensity-Duration-Frequency (IDF) curves are used to predict rainfall and are a critical risk-evaluation tool to support infrastructure design. Floodplain mapping identifies areas vulnerable to flooding and is used to regulate development in and around a floodplain for the protection of life and property.

ACTION 26 | IDF curves use historical rainfall patterns to project future conditions including rainfall intensities, durations and frequency of occurrence. More frequent and severe rainfall events are beginning to be reflected in precipitation records. Quality rainfall data enables designers to make calculations that meet drainage capacity design standards and avoid the over or under design of drainage elements (e.g. for roads and bridges).

In collaboration with the University of Waterloo, the Ministry of Transportation (MTO) recently developed a web-based tool for IDF curves. This information was traditionally provided in hard copy documentation at MTO District Offices. Using the latest data from Environment Canada, this user-friendly tool can provide IDF curves electronically at any location across Ontario.

MTO has identified the need to collect base data to update IDF curves, and through a joint project with Ministry of Natural Resources, is improving collection of rain gauge data in northern Ontario. The data collected will be used for flood and road condition forecasting and warnings. These gauges may be used with climate station data for verifying and updating IDF curves in Ontario.

TOOLS TO SUPPORT AGRICULTURE

Climate change presents challenges to the agricultural sector including:

- changes in the length of the growing season
- changes in the quantity and quality of water
- increased risk of soil erosion during intense storms
- introduction or expanded range of crop and livestock diseases and pests

ACTION 27 | The Environmental Farm Plan Program — part of the federal and provincial governments' comprehensive *Growing Forward* Framework — is a voluntary environmental education and awareness program. It encourages climate change adaptation on farms by combining training, risk assessment and technical and financial assistance for adopting Best Management Practices. Environmental risks are assessed at each participating farm and an action plan is developed to address challenges.

ACTION 26

UPDATE INTENSITY-DURATION-FREQUENCY CURVES

Given the expected effects of climate change, the Ministry of Transportation is updating its Intensity-Duration-Frequency curves and improving the collection of rain gauge data.

ACTION 27

UPDATE THE ENVIRONMENTAL FARM PLAN PROGRAM

The Ministry of Agriculture, Food and Rural Affairs will update the Environmental Farm Plan Program to increase the agricultural sector's resilience to climate change.

ACTION 28

PROVIDE COMMUNITY OUTREACH AND TRAINING

The Ministry of the Environment has launched the Community Adaptation Initiative to support communities as they assess what climate change means locally and to work with communities so that they put into place effective adaptation strategies.

The Ministry of Agriculture, Food and Rural Affairs is currently working with Agriculture and Agri-Food Canada, the Ontario Farm Environmental Coalition and other partners to review and update the Environmental Farm Plan Workbook. This review will ensure that Environmental Farm Plans adequately consider new risks associated with climate change and adapt to improve resilience.

COMMUNITY OUTREACH AND EDUCATION

ACTION 28 | The Ministry of Environment, in addition to providing risk-management tools across various sectors, is also focused on providing community outreach and education. A changing climate has significant implications at the local level and will require adaptation in different regions of the province to improve resiliency. Two programs in Ontario, the Regional Adaptation Collaborative (a joint federal-provincial program) and the Community Adaptation Initiative (a provincial program) will work with community decision-makers, within municipalities and First Nations communities, to increase adaptation knowledge and expertise at the local level.

COMMUNITY ADAPTATION INITIATIVE

The Ministry of Environment is funding the Community Adaptation Initiative to build on the outreach and training provided by the Ontario Regional Adaptation Collaborative. The Community Adaptation Initiative is a joint project launched by the Clean Air Partnership and the Ontario Centre for Climate Impacts and Adaptation Resources. This two-year program is designed to help Ontarians better prepare for climate change. Its activities include:

- hosting educational workshops in Ontario's northern and rural communities
- hosting citizen forums to engage the public on the subject of climate change impacts and adaptation
- developing videos to share examples of how Ontario communities have begun to adapt to climate change
- developing in-depth case studies which explore some of the most promising adaptation activities in Ontario communities
- developing web-based resources to disseminate important climate

**“ONTARIO HAS DEMONSTRATED
ITS COMMITMENT TO TACKLE
CLIMATE CHANGE THROUGH
ITS COMPREHENSIVE
ADAPTATION STRATEGY.”**

—Paul Kovacs, Executive Director, Institute for Catastrophic Loss Reduction
President, Property and Casualty Insurance Compensation Corporation,
Adjunct Research Professor, Economics, The University of Western Ontario



ACTION 29

DEVELOP THE FAR NORTH LAND USE STRATEGY

The Far North Act, 2010, sets out a requirement that the Minister ensures that a Far North Land Use Strategy is prepared to assist in the preparation of community-based land use plans in the Far North and to guide the integration of matters that are beyond the geographic scope of individual plans. The Far North Land Use Strategy will be the foundation of policy and information that provides the big-picture, broad-scale land use interests in a Far North context to support local community-based land use planning.

information including fact sheets, climate trend data, best practices, and climate science bulletins

- hosting webinars to build adaptive capacity among members of professional associations
- hosting expert-led technical workshops to help stakeholders prepare plans to reduce the impacts of climate change in urban centres

Among the groups and individuals chosen to participate in the Community Adaptation Initiative will be municipal staff and councillors, conservation authorities, industry leaders, non-governmental organizations, local and regional professional associations and representatives of Aboriginal communities. The general public is also welcome to participate.

ABORIGINAL COMMUNITIES

Aboriginal communities in northern Ontario are expected to be disproportionately affected by climate change. Outreach and training will be available to decision-makers including in these communities through the Community Adaptation Initiative.

As part of the Far North Land use Planning Initiative, the Ministry of Natural Resources will also have discussions with interested First Nations regarding the establishment of a joint body. If established, the joint body would advise on the development, implementation and coordination of land use planning in the Far North including making recommendations to the Minister on the Far North Land Use Strategy — including the use of policy statements. The Far North Act identifies climate change and adaptation as matter to consider when drafting policy statements.

ACTION 29 | Supported by the Far North Act, the Ministry of Natural Resources will continue to work with First Nations in the Far North to protect at least 225,000 km² through community-based land use planning. Land use planning helps make wise decisions that support both conservation and environmentally sustainable economic development.

Once a community-based land use plan is initiated by a First Nations it will be jointly prepared by a joint planning team of First Nations and Ontario representatives. In preparing a community-based land use plan the joint planning team is required to taking into account the objectives of the act. The land use planning objectives in the act are:

- a significant role for First Nations in planning

- the protection of areas of cultural value in the Far North and the protection of ecological systems in the Far North by including at least 225,000 square kilometres of the Far North in an interconnected network of protected areas designated in community-based land use plans
- the maintenance of biological diversity, ecological processes and ecological functions — including the storage and sequestration of carbon in the Far North
- enabling sustainable economic development that benefits the First Nations

Advisory support for the Initiative has been provided by the Far North Advisory Council and the Far North Science Advisory Panel.

In its report the Far North Advisory Council identified the importance considering broader regional and provincial goals such as Ontario's commitment to address climate change in land use planning in the Far North.

The Far North Science Advisory Panel's report, "Science for a Changing Far North" (April 2010) states clearly that climate change impacts will have important implications for northern infrastructure and resource development. The impacts of climate change will vary depending on the geographic location of a community.

The report stressed the importance of the Far North Land use Planning Initiative as a way to consider the potential effects of climate change and proposes strategies for enhancing community resilience.

EDUCATION

In addition to providing on the ground outreach and education to communities, the Government of Ontario is committed to investing in environmental education — ensuring that current and future generations are educated and informed about climate change. "Acting Today, Shaping Tomorrow: A Policy Framework for Environmental Education in Ontario Schools" / "Préparons l'avenir dès aujourd'hui – La politiques d'éducation environnementale pour les écoles de l'Ontario" was released by the Ministry of Education in 2009 and provides guidance to all English- and French-language schools and boards on supporting the growth of active, engaged and environmentally-literate students.

ACTION 30

INCORPORATE CLIMATE CHANGE INTO CURRICULUM

As part of ongoing curriculum review, there will be an increased focus on environmental issues such as climate change and its impacts in revised elementary and secondary curriculum policy documents, as appropriate. In addition to the curriculum policy documents, learning resources which support environmental education are available to all of Ontario's 5,000 English- and French-language schools.



ACTION 30 | Currently, education on climate change is addressed largely through the revised elementary science and technology curriculum and the revised secondary science curriculum. For example, in the Grade 8 Science and Technology students are expected to: identify factors (e.g., annual precipitation, temperature, climate change) that affect the size of glaciers and polar ice-caps, and describe the effects of these changes on local and global water systems.

In the Science, Grade 10 (Academic) course, students are expected to:

- analyze some of the effects of climate change around the world and assess the effectiveness of initiatives that attempt to address the issue of climate change
- investigate various natural and human factors that influence Earth's climate and climate change
- demonstrate an understanding of natural and human factors, including the greenhouse effect, that influence Earth's climate and contribute to climate change

Climate change concepts are also explored in The Social Studies (Grades 1-6), History and Geography (Grades 7 and 8) and Canadian and World Studies (Grades 9-12). These curriculum documents are currently under review and there may be opportunities to strengthen learning about environmental concepts, such as climate change. "Standards for Environmental Education in the Curriculum" have been implemented to ensure that, through the curriculum review process, opportunities for students to learn about climate change are considered in revised curricula as appropriate.

Some resources provided to help teachers develop classroom programs for students that address environmental education, including climate change, are:

- "The Ontario Curriculum Grades 1-8 Environmental Education Scope and Sequence of Expectations" / "Le curriculum de l'Ontario de la 1re à la 8e année – portée et enchaînements des attentes et contenus d'apprentissage" and "The Ontario Curriculum Grades 9-12 Environmental Education Scope and Sequence of Expectations" / "Le curriculum de l'Ontario de la 9e à la 12e année – portée et enchaînements des attentes et contenus d'apprentissage", were developed to enable teachers to identify where there are opportunities to integrate environmental education in each grade and subject area. (Scope and Sequence documents are updated annually, and posted electronically, with revised curriculum expectations and opportunities.)

- Teacher Guide 9-12, “Climate Change and You! Meeting the Challenge”, prepared by Ontario Agri-Food Education with the support of the Ministry of Education, explains climate change and supports implementation of revised curriculum.

In addition, the ministry continues to work with many stakeholders to support learning about the environment, including climate change, through the development of curriculum-linked learning resources and professional learning opportunities.

FUTURE VISION

Public Health: The Ministry of Health and Long-Term Care will continue to monitor emerging public health issues including those related to climate change impacts, and advise the Public Health Units of emerging concerns.

The Ministry of the Environment will seek opportunities to collaborate with the Ontario Agency for Health Protection and Promotion to identify and share best practices for protecting human health from the negative effects of climate change.

Public Outreach and Education: The Ministry of the Environment will consider ways to engage the public through outreach and education to inform Ontarians of the changing climate, associated risks and adaptive actions. Efforts will build on existing education resources, such as the Ministry of Natural Resources’ Climate Change Mapping Browser. Through the Community Adaptation Initiative, the Province is also considering the use of education events such as citizen conferences/forums.

Infrastructure: The Government of Ontario is considering ways to strategically expand the number of rain gauges throughout the province to improve data collection for IDF Curves. Research may also be needed to determine if more sophisticated techniques will be required to calculate and update information such as IDF curves and extreme flow statistics in the future.

The Province is seeking a more complete and current floodplain picture for Ontario. Currently, floodplain mapping is updated by the Ministry of Natural Resources and Conservation Authorities, most often as a response to applications for new development. Up-to-date mapping of areas that are historically vulnerable to flooding is limited.

The Ministry of Natural Resources is seeking new methods to update floodplain mapping strategically and proactively in areas of the province most vulnerable to flooding.

“The Ministry of Health and Long-Term Care will continue to monitor emerging public health issues including those related to climate change impacts, and will advise the Public Health Units of emerging concerns.”

GOAL 4

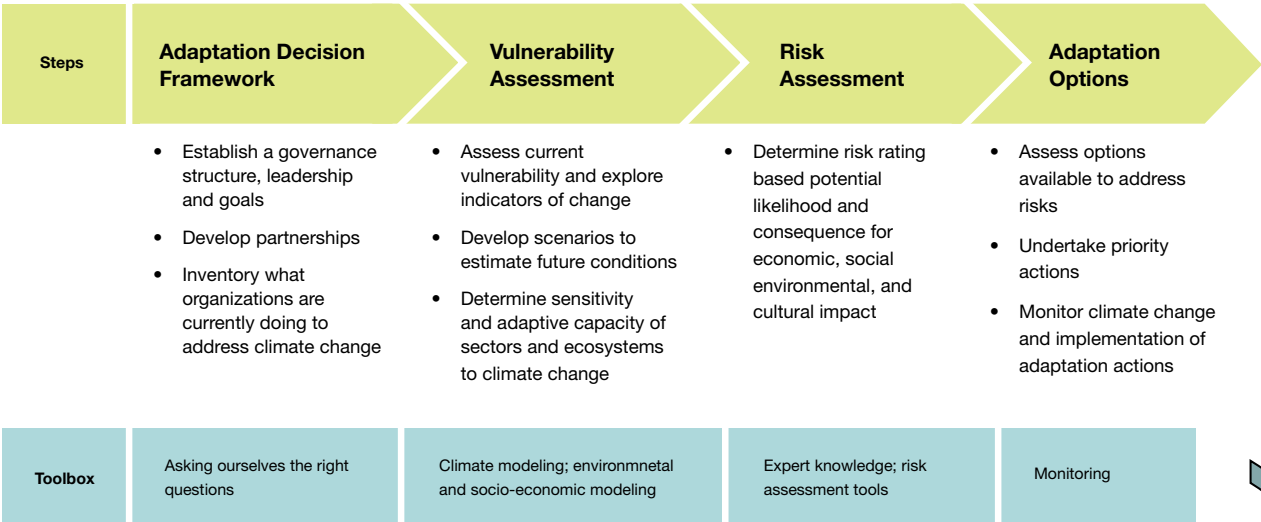
ACHIEVE A BETTER
UNDERSTANDING OF FUTURE
CLIMATE CHANGE IMPACTS
ACROSS THE PROVINCE

In the past, we have looked to historical weather records to make decisions about future actions; however, given the rate the climate is changing past conditions are not necessarily a good indicator of the future.

Governments, organizations, communities and businesses will increasingly need to use future climate projections to make decisions. This technique requires an adaptive approach to management (see Figure 5) in which decisions are routinely re-evaluated and modified to reflect emerging — often unforeseen — needs. Tools that provide the foundations for an adaptive management process include:

- **Monitoring** of climate impacts to assist in observing early trends and tracking historical changes
- **Modelling** to assist in projecting future climate trends at both a global and regional scale
- **Vulnerability assessments** to examine past and current conditions to determine the degree to which a system is susceptible to impacts and its capability to cope with potential impacts of climate change
- **Risk assessment tools** to determine the level of risk related to a situation and to recognize future threats from climate change

Figure 5: Climate Change Adaptation Framework



ACTION 31

ENHANCE CLIMATE-RELATED MONITORING

The Government of Ontario will assess existing monitoring programs to see how effectively they assist in identifying climate change impacts. In the Far North of Ontario, where we anticipate the most climate change impacts, Ontario is developing new monitoring programs to acquire information to inform decision-making.

MONITORING

ACTION 31 | Monitoring environmental conditions — specifically by looking at water, natural resources and conditions throughout the province, including the Far North — provides a better understanding of the implications of climate change and enables better risk-based decisions in a wide variety of sectors.

WATER MONITORING

Changes in climate can affect both water quantity and quality. For example, water levels in the Great Lakes are expected to be lower than they are now. Heavy rain and melting snowfall that causes flooding may happen more often. Warmer temperatures caused by climate change may increase harmful algal blooms and further change ecosystems by causing cold water fish species to migrate north.

Water Quality Monitoring

To track water quality changes, the Ministry of the Environment operates water monitoring networks in the Great Lakes, Lake Simcoe, Lake of the Woods and other inland lakes. Surface and groundwater quality are monitored, as is drinking water quality. Many partners are involved in collecting and analyzing this information to identify trends over time. Building on many years of existing information, changes in water quality resulting from climate change can be evaluated.

Under the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA), two programs were evaluated by Conservation Ontario to determine their ability to detect the effects of climate change and to provide key data for climate and hydrologic models. This review was completed in August 2010. The programs evaluated were:

- The Provincial Groundwater Monitoring Network – Includes work with Conservation Authorities and municipalities to collect and manage information on groundwater level and groundwater quality at over 470 locations across Ontario.
- The Provincial Water Quality Monitoring Network – Collects information on surface water quality from rivers and streams at over 400 locations across Ontario.

The review found that more monitoring stations are needed in the Great Lakes Basin to detect and adapt to climate change. As well, the review recommended that monitoring programs should adopt an integrated approach that measures the components of the hydrologic cycle at one location which will provide relevant information for current and future water management.

The Government of Ontario is improving the surface water monitoring network across the province by adding new sampling programs and monitoring stations — specifically, a sampling program by the Ministry of the Environment examining the water chemistry and biology of several lakes in the Far North. The Province is also undertaking three-year study led by the Ministry of Natural Resources which aims to prioritize and install new stream gauge stations in the Far North to provide better information about climate change.

Water Quantity Monitoring

To track water quantity, the Ministry of Natural Resources (MNR) works in partnership with Environment Canada and Conservation Authorities to collate information on a daily basis at the Surface Water Monitoring Centre. The Centre is located in Peterborough and operates 24/7 to manage water related hazards of flood and drought. It manages a stream gauge network which monitors real time water levels, flow data and uses climate sampling stations which provide precipitation and temperature data, surveys of snow conditions, meteorological forecasts and computer models to determine daily watershed conditions.

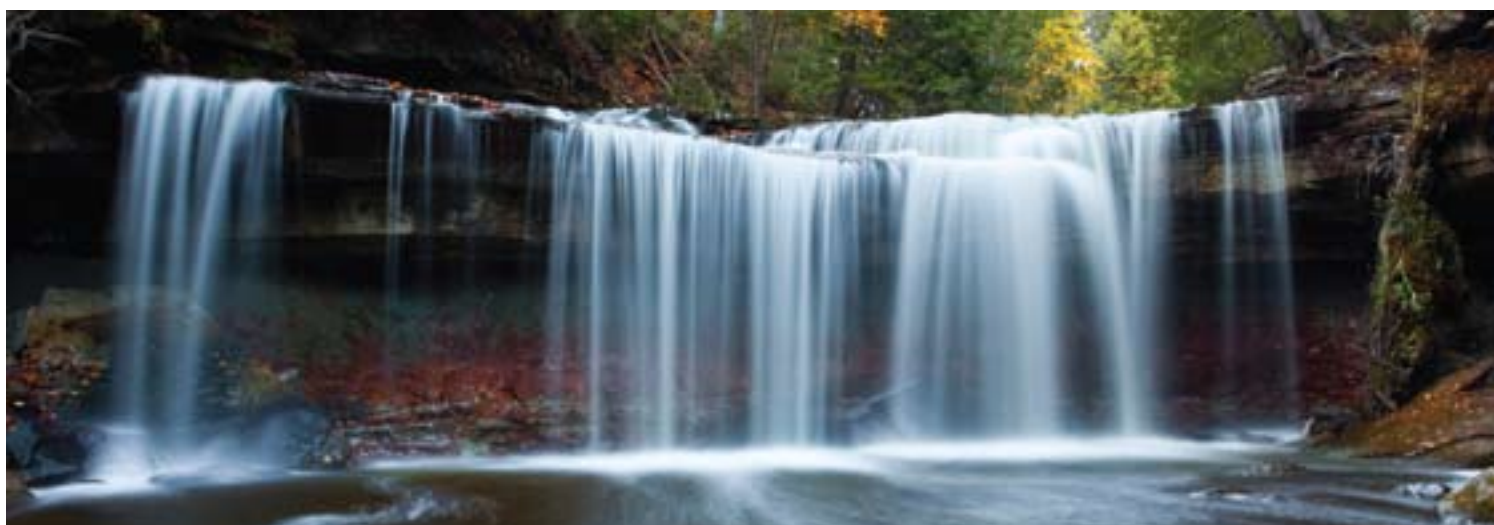
Watershed analysis is shared with a variety of partners. For example, a website managed by MNR provides time-sensitive data and information to water managers across the province. This work helps to predict and minimize the potential impacts of floods and low water which are expected to become more common with climate change.

Natural Resources Monitoring

The Province monitors a variety of natural resources including fish and wildlife populations and forest health. Climate change may affect habitat, species distribution and the make-up of ecosystems. The Ministry of Natural Resources is currently reviewing existing monitoring programs to improve their potential use in the detection of climate change impacts.



Eastern Newt/Red-Spotted Newt
(*Notophthalmus viridescens*)





Caribou in the Far North of Ontario.
Source: Ken Abraham, Ontario Ministry
of Natural Resources

Wildlife Monitoring

The Ministry of Natural Resource's wildlife monitoring programs are intended to track abundance and distribution of wildlife species. For example, the white-tailed deer have recently been spotted as far north as Sioux Lookout and Red Lake. Deer are limited in winter by snow depth and weather severity. In recent years, milder winters with less snow appear to be favouring the deer migration.

Deer carry a type of parasite called a "brainworm" which does not harm them but it can have very serious effects on moose and woodland caribou. Deer may also negatively affect caribou and moose indirectly by increasing the number of predators in their range.

Forest Monitoring

The Ministry of the Environment's Ontario Forest Biomonitoring Network, established in 1986, monitors the effects of regional air quality on the health of mixed hardwood forest ecosystems at 104 forest monitoring plots across southern and central Ontario. In 2008, select forest monitoring plots were enhanced to monitor climate change related impacts on mixed hardwood forest health in Ontario. These include monitoring for:

- various soil and meteorological parameters — air temperature, soil temperature, rainfall, soil moisture, snow depth, relative humidity, light and tree trunk temperature
- plant and song bird phenology or life cycle events — flowering and leafing times of target plant species and arrival of target migratory birds
- downed woody debris and seedling regeneration, understory diversity monitoring and salamander populations

The Canadian Forest Service and the Ministry of Natural Resources have established National Forest Inventory sample plots across Ontario. These plots will assist in understanding baseline forest condition and cumulative climate change impacts.

Land Cover Monitoring

The Ministry of Natural Resources analyzes satellite imagery to look at the state of land cover, map disturbances and land use changes. Data from satellite imagery are essential for studying the impacts of climate variability and climate change on the Earth's surface. This information can be used to provide reliable and up-to-date inventory and monitoring information at a provincial level. The Ontario Ministry of Agriculture, Food and Rural Affairs performs similar analysis focusing on farming operations.

Traditional Knowledge

People living in remote Far North First Nations communities depend on fish and wildlife for food and to support their traditional lifestyles. Working with Trent University, the Ministry of Natural Resources implemented a graduate student research project to examine Traditional Knowledge from two First Nation communities in the Hudson Bay Lowland (Moose Cree and Weenusk Cree) to identify trends in goose population abundance, migration and harvest over time. Understanding the impacts of climate change on these natural assets is needed to help the communities identify and establish adaptation actions.

Far North Monitoring

As snow melts and the bare ground begins to absorb more of the sun's heat, the Far North of Ontario is heating up faster than other regions. The Far North supports a globally significant biological pool of carbon and its peatlands are unique in that they actively capture and store carbon for thousands of years.

There is great uncertainty around how the Far North ecosystem will respond to human development due to a lack of basic data and of projected impacts of climate change. Further action is required to ensure that regional and local estimates of climate change can be established and modelled reliably.

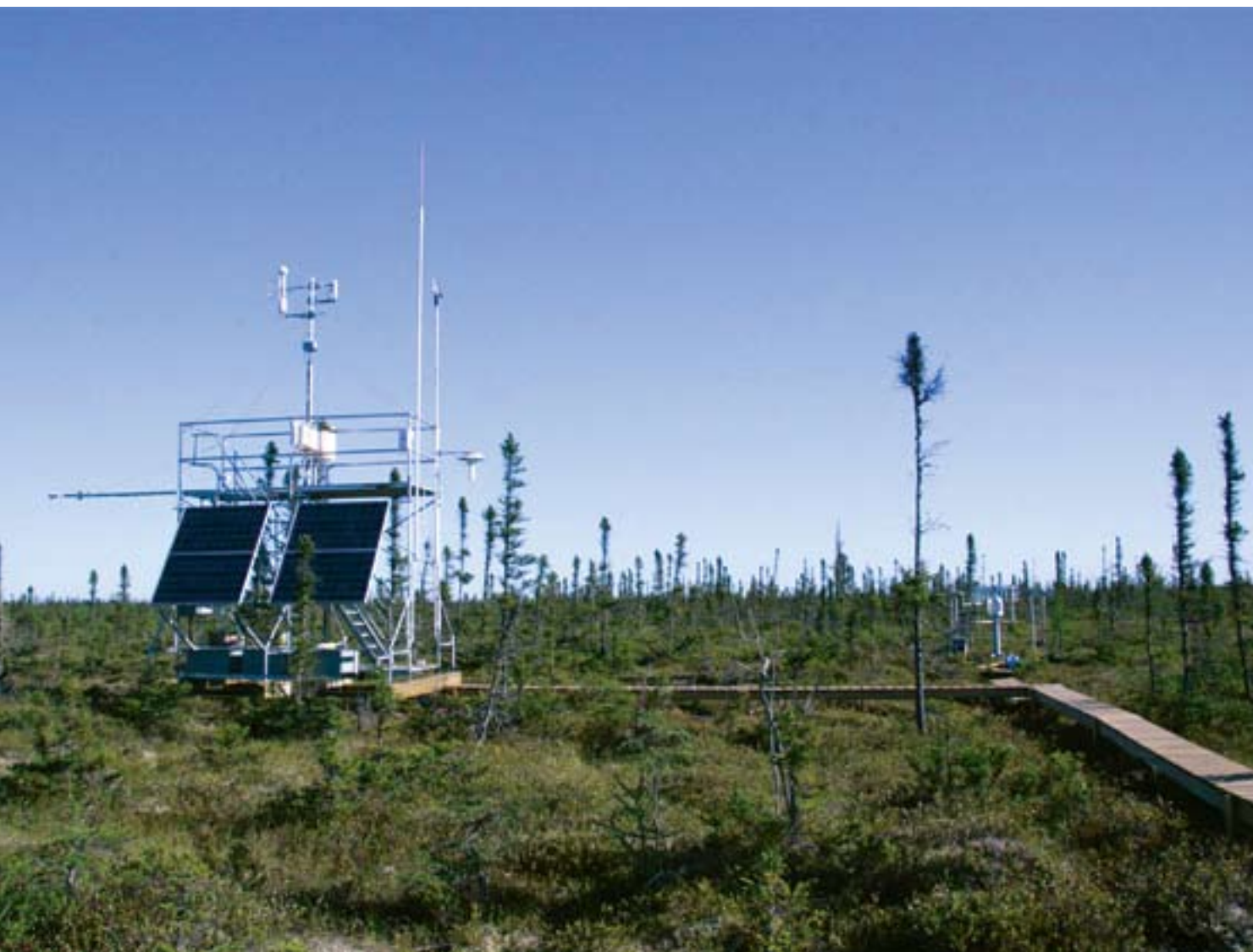
Monitoring of water quality, aquatic ecosystems and many other baseline conditions are critical to land use planning processes and resource management. New initiatives in the Far North include:



Snow geese in the Far North of Ontario.
Source: Ken Abraham, Ontario Ministry
of Natural Resources

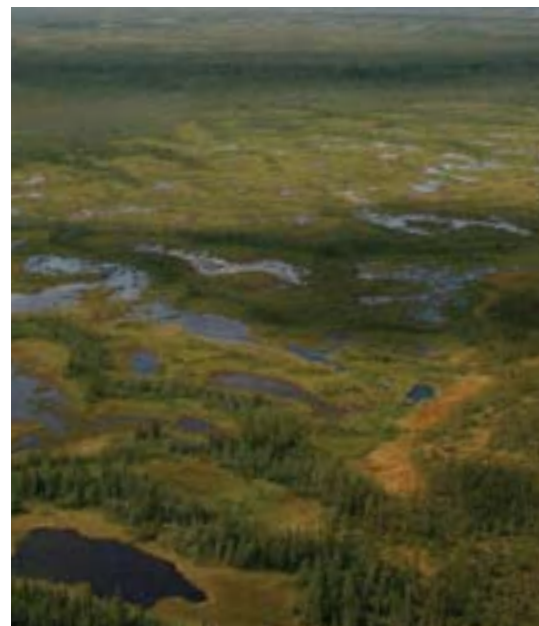
- the Far North Monitoring Network, established by the Ministry of Natural Resources, has stations for long-term monitoring of climate variables — peat temperature and moisture, permafrost temperature and water table depth — at two sites near Hudson’s Bay (this monitoring network will be expanded in future years)
- the two carbon flux monitoring stations in the Hudson Bay Lowlands established by the Ministry of the Environment to better understand carbon cycling in the Far North and how climate change may be affecting this important carbon store
- the addition of new sampling programs and monitoring stations on lakes and streams in the Far North (see Water Quality Monitoring above)

Attawapiskat River Carbon Flux Monitoring Station (90km west of Attawapiskat) in the Hudson Bay Lowlands



Peatland Carbon Storage

The Ministry of Natural Resources is undertaking peatland carbon storage and sequestration research, through remote sensing and field work, to better understand how peatlands store carbon. The project also involves partnerships with the Canadian Forest Service, University of Toronto and Ministry of the Environment to study how historical water and fire activity may impact the ability of peatlands to store carbon. It is expected that the findings from this research will help scientists better understand the present and future climate impacts on peatland carbon storage and sequestration in the Hudson Bay Lowlands.



Peatland Modelling

Due to their remote location, information on watersheds, elevation and hydrology in the northern peatlands remains scarce. Hydrological cycles (water cycles) in these lands influence the region's ability to store or release greenhouse gases. As a result, Ontario's Far North Science Advisory Panel has identified a critical need to expand knowledge of this region.

The Government of Ontario initiated hydrological and geospatial modelling for peatlands in the Far North to better understand the hydrology of this sensitive ecosystem. This can help us better prepare for climate change impacts and inform decisions when assessing the ecological impacts of renewable energy or development proposals, drinking water source protection, as well as community and land use planning.

ACTION 32

UNDERTAKE CLIMATE IMPACT INDICATORS STUDY

The Ministry of the Environment will undertake an indicator study to track the impacts of climate change.

“Climate science-based decisions now are smart investments for the future. Our infrastructure needs to be climate smart.”

—Gordon McBean, Climate scientist

Agricultural Monitoring

The Ministry of Agriculture, Food and Rural Affairs is engaged in a number of monitoring activities which identify the effects of climate change in the agricultural sector. For example:

- Warmer winters will provide conditions for the spread of soybean rust. The Ministry of Agriculture, Food and Rural Affairs is involved with the North American Soybean Rust Sentinel Plot Network which coordinates monitoring for early detection of soybean rust for the soybean production areas of North America. Information gathered throughout Ontario contributes to monitoring and forecasting efforts. The Network provides predictive models and technical resource material for the soybean producers to ensure they are prepared to make sound risk-management decisions.
- The range of the Western Bean Cutworm, which affects corn and dry bean crops, is expanding. The Ministry of Agriculture, Food and Rural Affairs monitors over 400 traps weekly, surveys crops, establishes field plots to investigate pest management options and disseminates educational resources to growers.
- The Spotted Wing Drosophila, a fruit crop pest originating in Asia, first appeared in North America in 2008. The Ministry of Agriculture, Food and Rural Affairs is collaborating with the Canadian Food Inspection Agency to monitor this pest as it could pose an economic threat to Ontario's berry, grape and tender fruit production.

CLIMATE INDICATORS

ACTION 32 | In addition to using existing environmental monitoring programs, the Ministry of the Environment will track economic trends through use of various sector-specific indicators (i.e., golf course open/closing dates, increased/decreased yields by agricultural product, sales of ski lift passes, etc). Social trends will be tracked through use of social and health indicators (i.e., number of heat alert days, reported respiratory distress instances, municipal water-use restrictions, etc). These indicators allow the Province to track direct impacts of climate change on different sectors and portions of our society. This data will be used in conjunction with available climate monitoring data to derive overall trend analysis.

As climate adaptation initiatives are employed, climate impact indicators can also be used to track and assess the success of government policy and programs as outlined in Ontario's Adaptation Strategy and Action Plan.

MODELLING

Climate change models are used to project future climate and to better understand the scale of associated impacts of climate change.

Global climate models can be downscaled to help us better understand climate impacts at a regional or local scale. While these models have limitations, they are an important tool to inform the development of adaptation actions.

The Expert Panel highlighted the importance of enhancing Ontario's climate science and climate modelling capacity in order to project future climate and its impacts. It recommended accessing the best available regional climate projections and working in partnerships across ministries, agencies, municipalities and non-government stakeholders.

Modelling of climate impacts is an emerging area of work for the Province. As models have become more sophisticated and accurate, the Ontario government has been working to build its capacity to identify suitable models and run scenarios that help identify geographic and sector-specific impacts to assist in prioritizing action.

ACTION 33 | The Ministry of the Environment has invested in a series of valuable partnerships to support science-based decision-making in light of climate change. Work is currently focused on fostering these partnerships, increasing knowledge and exploring options for modelling climate change and developing future climate scenarios for Ontario.

To achieve this goal, the Government of Ontario is funding work by different research institutions to downscale projections of climate change indicators — this means taking global climate models (projections over hundreds of kilometres) and applying them to the regional/local scale (projections over tens of kilometres), using state-of-the-art climate modelling techniques.

The accuracy of models is often limited, especially in northern Ontario, due to the data and information that can reliably provide calibration and validation of the model results. To better assess uncertainties in future climate projections, the Province will consider the results from a number of climate models and/or scenarios. The results will provide a clearer picture for all of us as to the local impacts that climate change will have on our communities, health and industries.

The Ministry of the Environment has partnered with the following institutions:

- OURANOS Modelling Consortium — to better understand the horizontal distribution and trends of major climate change indicators

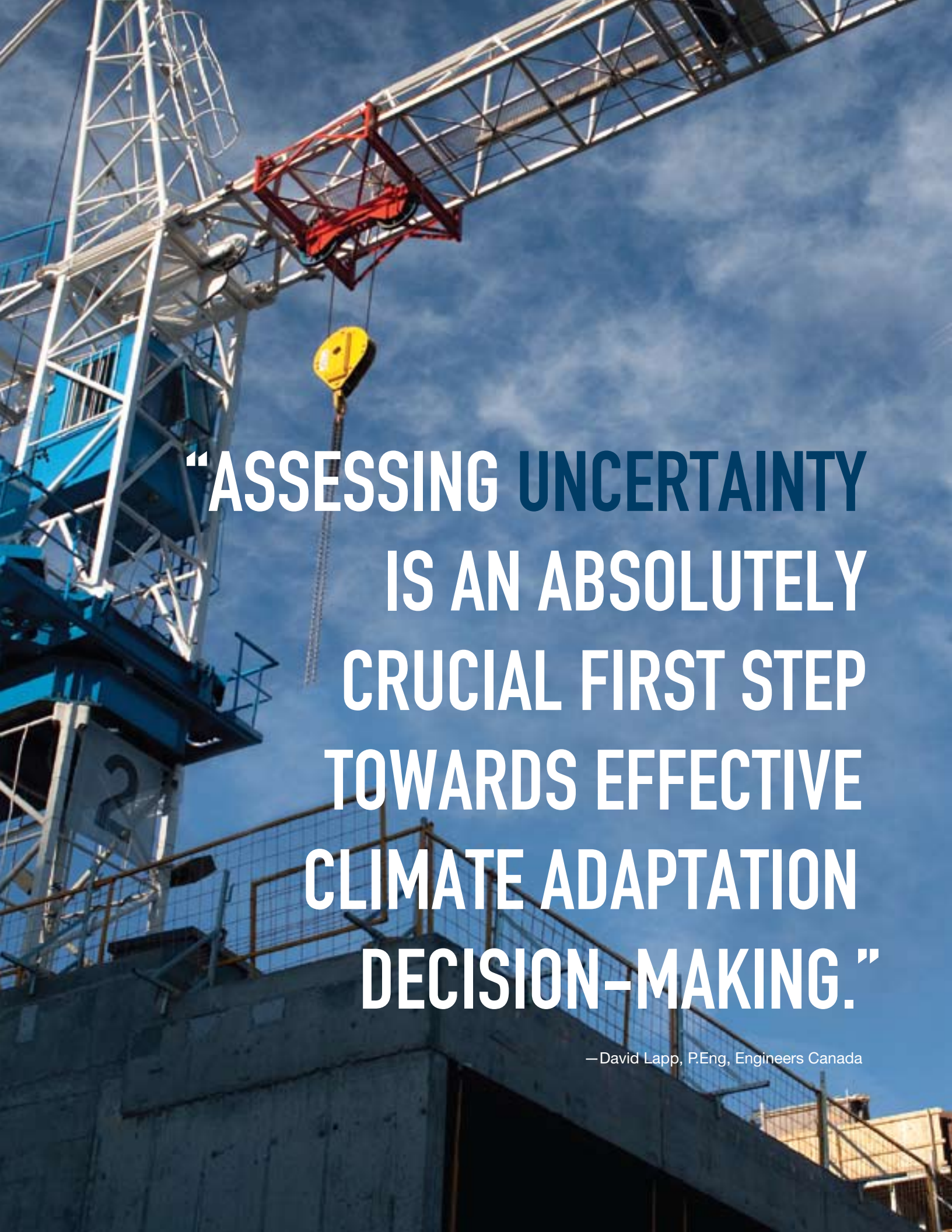
ACTION 33

UNDERTAKE RESEARCH PARTNERSHIPS FOR CLIMATE MODELLING

The Ministry of the Environment is investing in climate change modelling through a number of partnerships with institutions in order to conduct modelling research and to refine information about the impacts of climate change.



Supercomputers at SciNet, used for climate modelling. Source: used with permission of SciNet High Performance Computing Consortium, a member of Compute Canada.



**“ASSESSING UNCERTAINTY
IS AN ABSOLUTELY
CRUCIAL FIRST STEP
TOWARDS EFFECTIVE
CLIMATE ADAPTATION
DECISION-MAKING.”**

—David Lapp, P.Eng, Engineers Canada

over Ontario through combined downscaling using the Canadian Regional Climate Model (CRCM) at 45km resolution. Results can be found at: http://www.ouranos.ca/Ontario/Results_html/index.htm.

- University of Regina — to better understand the horizontal distribution and trends of major climate change indicators over Ontario through combined downscaling using the United Kingdom (UK) Providing Regional Climates for Impacts Studies (PRECIS) model at 25km resolution. Results can be found at <http://env.uregina.ca/moe/>. Efforts currently underway to further downscale to 10km resolution from additional modelled scenarios, with results expected by spring 2011.
- University of Toronto/SciNet — to model Ontario's climate change at 10 km resolution over the province using the United States Weather Research and Forecasting (WRF) model on the SciNet Supercomputer System. Researchers will also use statistical downscaling of applicable International Panel on Climate Change (IPCC) Global Climate Models and scenarios over Ontario to produce projections of climate change indicators at annual, seasonal and monthly scales. Results are expected by spring 2011.
- York University — to investigate future climate change over Ontario and its impacts on air quality using high resolution regional climate and air quality models; and extreme wind trends analysis over Ontario using North American Regional Reanalysis (NARR) high-resolution reanalyzes data. Results are expected by spring 2011.

Existing models are beginning to be applied as a risk-management tool in resource management to predict climate change impacts such as precipitation and temperature. For example:

- The Ministry of the Environment is exploring partnerships with universities to link hydrologic models with climate models to better understand the local impacts of climate change on our water resources.
- The Ministry of Natural Resources and the Canadian Forest Service are using climate models to project future climatic conditions for use in support of vulnerability and risk assessments and in the design of adaptation options for forest management.

ACTION 34

ESTABLISH A CLIMATE MODELLING COLLABORATIVE

The Government of Ontario will establish a Climate Modelling Collaborative to strengthen the application of climate projections in decision-making within the Ontario Public Service.



Climate Change Mapping Browser

As an educational tool for the public, the Ministry of Natural Resources developed the Climate Change Mapping Browser to show how Ontario's climate might be very different in the future. This on-line tool, released in 2007, projects temperature and precipitation patterns based on human activities and greenhouse gas emissions and can be accessed through: <http://www.web2.mnr.gov.on.ca/mnr/ccmapbrowser/climate.html>.

Agricultural Use of Climate Models

The Ministry of Agriculture, Food and Rural Affairs continues to build on its wealth of over 70 years of soil information collected at the county level across the province by looking at innovative ways to use this data. One use is as a basic input to climate modelling to predict changes including erosion sensitivity, infiltration amounts, run off rates, carbon distribution and evapotranspiration. The ministry also uses weather modelling in the development of integrated pest management recommendations.

ACTION 34 | Through early dialogue with key partners, we have heard consistently that governments have a critical role to play in filling information gaps, including high quality climate projections to build understanding and inform decision-making across the public and private sectors. Specifically, there is a need for information on the potential future impacts of climate change at the local level. Models that project potential future climate scenarios at a regional level could assist in gaining this information.

To strengthen climate science and deliver user-friendly products, the Ontario government is establishing a Climate Modelling Collaborative to leverage partnerships and resources that would bring together a wide range of modelling capabilities — from the scientific and technical to policy and program perspectives — to inform policy development within the province.

This collaborative would be guided by the Ministry of the Environment and include representatives from a wide range of ministries and key government agencies impacted by climate change, including: Ministry of Health and Long-Term Care, Ministry of Infrastructure, Ministry of Transportation, Ministry of Natural Resources, Ministry of Agriculture, Food and Rural Affairs and others.

FUTURE VISION

Monitoring: The Government of Ontario will continue to assess existing monitoring programs and work to integrate climate change indicators. Future monitoring programs may benefit from a number of initiatives including:

- examining existing data sets from water quality monitoring networks to evaluate the impacts of climate change on water resources, in partnership with other government agencies and academia
- investigating the installation of several integrated climate-stream water-groundwater monitoring stations in the Far North and in sensitive areas of southern Ontario
- considering methods for growing the stream gauge network as some areas of the province are not adequately covered

Modelling: The Climate Modelling Collaborative for the Ontario Public Service could improve the coordination and sharing of modelling activities across government and set priorities for government investment in climate research in a transparent and fair manner.

Satellite photo of the Great Lakes



GOAL 5

SEEK OPPORTUNITIES TO
COLLABORATE WITH OTHERS.

Adapting to a changing climate is a responsibility shared by all — governments, businesses, communities and individuals.

While climate change is a global issue, adaptation to a changing climate has to happen in the communities and places where the consequences are felt.

The role of government extends to facilitating the collection and sharing of information with communities and stakeholders throughout the province.

Aspects of implementing adaptation that need to be used within government and shared effectively include:

- access to climate change projections, risk-management tools and best adaptation practices
- understanding potential impacts, such as the spread of damaging forest insect pests
- access to the best methodologies for projecting the intensity and return periods for extreme events

Furthermore, there is much to be learned from other jurisdictions within Canada and internationally.

The Government of Ontario will seek opportunities to:

- collaborate with other governments, organizations and communities of interest across Canada and globally
- share experiences and knowledge from all sources
- advance its knowledge and to build capacity on its body of work in adaptation
- develop cooperative actions for promoting and implementing adaptation

Ontario has much to offer through its experience in developing policies and programs, implementing goals and evaluating program success.

The goals and actions outlined in Ontario's first Adaptation Strategy and Action Plan call for leadership from the Province. At the same time, achieving success in addressing Ontario's vulnerabilities to climate change is a shared responsibility across all levels of government and depends on collaboration and partnerships across many sectors, organizations and communities.



ACTION 35

ESTABLISH AND LEAD ONTARIO'S REGIONAL ADAPTATION COLLABORATIVE

The Ministry of the Environment, the Ministry of Natural Resources and the Ministry of Municipal Affairs and Housing are participating in Natural Resources Canada's Regional Adaptation Collaborative Program.

It is essential that Ontario collaborate and strengthen alliances. As a starting point, the following actions identify some specific areas of collaboration.

COLLABORATION IN ONTARIO

ACTION 35 | The Ministry of the Environment, the Ministry of Natural Resources and the Ministry of Municipal Affairs and Housing are participating in Natural Resources Canada's Regional Adaptation Collaborative Program.

Ontario's Regional Adaptation Collaborative exemplifies adaptation action across all five goals in Ontario's broader Adaptation Strategy and Action Plan.

Ontario's Regional Adaptation Collaborative — a joint partnership between three provincial ministries, the federal government, and seven other regional collaborators — has a strong mandate to improve decision-making on adaptation issues throughout the province over a three-year time frame.

Ontario's Regional Adaptation Collaborative members include:

- The Ministry of the Environment
- The Ministry of Natural Resources
- The Ministry of Municipal Affairs and Housing
- Natural Resources Canada
- Clean Air Partnership
- Ontario Centre for Climate Impacts and Adaptation Resources
- Toronto Region Conservation Authority
- Association for Canadian Educational Resources
- Institute for Catastrophic Loss Reduction
- York University
- Toronto Public Health

Ontario's Regional Adaptation Collaborative is bringing together leading climate experts in Ontario to utilize the best available climate science and data, and to develop leading edge risk-management tools that will support

the building of Ontario's resiliency to climate change impacts across key sectors. This information and these tools will support the development of comprehensive adaptation strategies at the community level.

EXPERTISE

Members of Ontario's Regional Adaptation Collaborative have specialized knowledge and on-the-ground experience in:

- education and training
- data management
- water resources management
- drinking water protection
- human health
- infrastructure design and resiliency
- land use planning
- communication

A collaborative approach to addressing these complex issues of adaptation to climate change will allow Ontario's Regional Adaptation Collaborative to benefit from the expertise and unique insight of all the partner organizations.

The goal is to create a legacy of adaptive measures and instruments to function after the program's end date of March 2012.



This will also lead to opportunities for sharing experiences and collaborating with other levels of government and other jurisdictions across Canada.

Ontario's Regional Adaptation Collaborative focuses on three key areas of adaptation planning:

1. **Managing the Risks of Extreme Weather**

Ontario's Regional Adaptation Collaborative will develop, test and, through case studies, apply risk-assessment and risk-management tools for dealing with the impacts of extreme weather events.

2. **Managing Water Resources**

Ontario's Regional Adaptation Collaborative will promote the integration of adaptation to climate change into water resource management across the province, with a strong focus on source water protection.

3. **Integrating Adaptation into Community Planning and Policies**

Ontario's Regional Adaptation Collaborative will provide information, tools and recommendations to help integrate climate change adaptation into planning, policies and processes within municipalities and regions.

Actions underway through the Ontario Regional Adaptation Collaborative include:

DEVELOPING A MUNICIPAL RISK-MANAGEMENT TOOL

As part of Ontario's Regional Adaptation Collaborative, the Ministry of Municipal Affairs and Housing will be developing an Ontario-based risk-management tool to assist other municipalities in the development of adaptation strategies.

This tool will provide a digital matrix that will help municipalities identify vulnerabilities and understand the magnitude of risks using information about frequency and severity of potential climate impacts such as flooding. Risks can be identified and prioritized for each municipal department and also rolled-up and ranked as a comprehensive identification of vulnerabilities for the municipality as a whole.



Emergency Management

In Ontario, the Emergency Management and Civil Protection Act obliges municipalities to produce Hazard Identification and Risk Assessment (HIRA) reports. The tool will not only assist municipalities in producing more sophisticated HIRA analysis, it will also allow them to prioritize adaptive actions to respond to HIRA identified risks. It has potential land use planning applications with implications for altering municipal zoning by-law practices to better accommodate climate change impacts.

The Ministry of Municipal Affairs and Housing will be developing a climate change adaptation toolkit that will support municipalities in using the digital risk-assessment tool. This toolkit will be designed with an emphasis on ease of use and ensure that the tool is useful to a range of communities in Ontario. The tool will be tested in selected communities and training will be delivered to municipal groups across the province by the ministry's Regional Municipal Services Offices staff and a number of stakeholder groups. Once completed, wide dissemination of the toolkit is planned.

DEVELOPING GUIDANCE FOR BUILDING RETROFITS

Through work with the Government of Ontario and the Regional Adaptation Collaborative, the Institute for Catastrophic Loss Reduction (ICLR) is providing guidance to owners of existing structures on how best to retrofit buildings to withstand the impacts of a changing climate.



“According to the 2006 census 85% of Ontario’s population lives in urban centers. We need to address the emerging risks of climate change for the built infrastructure, natural infrastructure and social infrastructure of our cities.”

—Eva Ligeti, Executive Director of Clean Air Partnership, First Environmental Commissioner of Ontario

Institute of Catastrophic Loss Reduction

For more than a decade, the Institute of Catastrophic Loss Reduction has been working with its sister organization in United States, the Institute for Business and Home Safety, and the Department of Engineering at the University of Western Ontario, as well as with homebuilders, the insurance industry and climatologists, to identify best construction practices to reduce the risk of damage to buildings from climate extremes.

The Boundary Layer Wind Tunnel and the Insurance Research Lab for Better Homes at the University of Western Ontario allows engineers to examine all aspects of house construction and a variety of impacts from extreme wind effects to moisture penetration.

As part of Ontario’s Regional Adaptation Collaborative, ICLR will continue to conduct on-site evaluations of Ontario homes damaged by severe weather events and will formulate guidelines to limit future destruction. For example, ICLR was on-site in the days following the 2009 tornadoes in Vaughan to examine damage caused to homes. Following that examination, Institute of Catastrophic Loss Reduction researchers developed a number of recommendations for change in building design and construction techniques to improve the ability of buildings to withstand similar extreme weather events.

In addition to its core work on improving new building construction in Ontario, the Institute of Catastrophic Loss Reduction will also provide guidance to owners of existing structures on how to best retrofit their buildings to withstand the impacts of a changing climate. For example, the installation of backflow valves on domestic sewer lines in the basements of homes is seen as a straightforward example of retrofitting that would save homeowners and insurers significant dollars. Connections between storm and sewer drainage systems often lie at the root of basement back-ups and the urgency of separating the two systems is underscored by the likelihood of increasingly frequent intense rain events.

CREATING A HEAT VULNERABILITY TOOL

The increasing frequency and duration of heat waves is a primary health concern that we will face in Ontario as the climate warms.

Toronto Public Health (TPH) is mapping areas most impacted by heat events

in relation to location of vulnerable populations such as the very young or elderly. This work will support the way Toronto Public Health plans for extreme heat events.

A Toronto Public Health pilot study will use Geographic Information Systems (GIS) mapping to coordinate extreme-heat-response plans to show areas most impacted by heat events as well as population data that identifies clusters of vulnerable populations.

TPH will use community outreach organizations and frontline health care workers who deliver services under the hot weather response plan to develop, test and implement this GIS map-based decision-support tool.

The tool and all support material developed under Ontario's Regional Adaptation Collaborative will be made available on-line for use in other Ontario communities.

INTEGRATING CLIMATE IMPACTS INTO THE SOURCE PROTECTION FRAMEWORK

The Ministry of the Environment is taking action to integrate climate change considerations into the source water protection framework and informing stakeholders' decisions on how to protect local drinking water sources.

The initiatives include:

- a needs assessment to identify and prioritize gaps in monitoring data which enable projections of climate change impacts (e.g. weather stations, monitoring networks)
- assessment of climate change impacts on the effectiveness of risk-management measures
- assessments of how risk management can be adapted or reconfigured to better deal with impacts to water quality and quantity
- coordinating training and developing new training materials with York University and Toronto and Region Conservation Authority on a method of integrating climate change projections into hydrologic modelling conducted in water budgets
- developing, with York University and Toronto and Region Conservation Authority, a suite of training products including guidance documents and tools to be used in workshops and on the web to support decision-making





- establishing an experts' network/community of practice to meet in workshops for the exchange of climate change science in partnership with Toronto and Region Conservation, on behalf of Conservation Ontario and York University

Additionally, York University is assisting the RAC with three research forums on leadership and learning, providing opportunity to supplement peer-to-peer social networking with face-to-face engagement. York University is also developing a social media site which will provide post-training support and updates on emerging best practices to encourage exchange between academics, decision-makers, source protection practitioners and other experts.

DEVELOPING A WEATHER AND WATER INFORMATION GATEWAY

The Ministry of Natural Resources, in conjunction with the Association for Canadian Educational Resources, is developing a web-based information discovery and access tool that will be available to decision-makers in the public and private sector to facilitate adaptation decision-making related to Great Lakes water levels, flooding, drought and stormwater/wastewater management.

When complete, this gateway will be a flexible, scalable and standardized information system that provides long-term access to current and future weather data, as well as data on water resource quality and quantity.

To demonstrate the utility of the gateway, the Ministry of Natural Resources will work with stakeholders on a series of Local Adaptation Demonstration Projects. The projects will focus on different communities with unique climate risks, including:

- flooding (Otonabee Region Conservation Authority and the City of Peterborough)
- stormwater management (Toronto and Region Conservation Authority)
- northern community and integrated risk management (Nickel District Conservation Authority and the City of Sudbury)
- drinking water source protection (Mississippi Valley Conservation Authority and Rideau Source Protection Planning Committee)
- low water response (Nottawasaga Valley Conservation Authority)

Results from these projects will be reviewed at a series of regional/

watershed-based workshops that will be delivered to key stakeholders and decision-makers. The workshops will share best practices and provide instruction on using the water and weather information gateway to design and implement effective adaptation measures.

The ultimate goal is to build local capacity to make informed risk-management decisions at the watershed level through the delivery of relevant data, knowledge and tools.

PROVIDING COMMUNITY OUTREACH AND TRAINING

The Government of Ontario is supporting a wide range of community outreach and training programs through the partnerships with the Ontario Centre for Climate Impacts and Adaptation Resources and the Clean Air Partnership developed under Ontario's Regional Adaptation Collaborative.

Decisions at the local level — made through municipal by-laws, official plans, infrastructure investments, emergency response procedures and drinking water source protection plans — require careful consideration in light of the risks posed by climate change.

Ontario's Regional Adaptation Collaborative will help Ontario communities assess their vulnerabilities and consider appropriate policy responses so that city planners, water managers and other municipal decision-makers can make recommendations that enhance the adaptive capacity of their structural and social systems. Outreach and training will be provided by the Clean Air Partnership and the Ontario Centre for Climate Impacts and Adaptation Resources to ensure communities are prepared to manage the effects of climate change. Programs include:

- an intensive adaptation training program targeting medium to large-sized municipalities; training to be provided on adaptation planning; training sessions to feature speakers with expertise in various areas; a “train-the-trainer” program to be developed to promote wide knowledge-sharing within these communities
- outreach and training to Ontario's northern communities; training will focus on refining tools for adaptation planning customized to the location and socio-economic context of the community



ACTION 36

WORK WITH CCME AND CCFM

Ontario will use its position on the Canadian Council of Ministers of the Environment and Canadian Council of Forest Ministers to encourage collaboration and action to support adaptation to climate change.

COLLABORATION ACROSS CANADA

ACTION 36 | Canadian Council of Ministers of the Environment (CCME) is actively engaged in water issues and has built on its commitment to provide leadership on water by creating a collaborative, strategic, Canada-wide vision entitled, “CCME Setting Strategic Directions for Water”.

This forward-looking framework provides guidance to provinces and territories on how to reduce the impacts of climate change on water resources through adaptive strategies. To further develop adaptation, Ontario is actively collaborating with other governments in Canada on the development of several tools including:

- methods for developing vulnerability assessments for watersheds – information on areas of a community which are particularly vulnerable to climate change is important in order to determine regionally appropriate adaptation measures
- guidance on short, medium and long-term adaptation measures that can be used by communities

In addition, the Government of Ontario is leading a three-year CCME initiative to develop guidance material for decision-makers and practitioners in provinces and territories to evaluate their water monitoring networks, specifically on the ability to detect climate change. The envisioned guidance document would enable identification of future investment needs for water monitoring while maximizing limited resources and contributing scientific information necessary for adaptation planning in preparation for and response to climate change. The project is being completed in several phases.

Canadian Council of Forest Ministers (CCFM) has identified climate change as a priority in their, “Vision for Canada’s Forests: 2008 and Beyond”. As part of a shared commitment to sustainable forest management, the CCFM is developing innovative approaches to mitigate



the effects of climate change and adapt to its impacts on Canada's forests. To inform this work, the CCFM recently released two reports:

- **Vulnerability of Canada's Tree Species to Climate Change and Management Options for Adaptation** — identifies opportunities for incorporating climate change adaptation strategies into the management of Canada's tree species.
- **A Framework for Forest Management Offset Protocols** — explores issues and possible solutions in measuring the carbon storage effects of various forest management activities.

The Ministry of Natural Resources is committed to working with the CCFM to address forest and climate change issues and continues to collaborate with other Canadian provinces and territories on climate change adaptation. Currently, the ministry is participating in efforts to develop practical adaptation tools and techniques for the forest sector. This program is examining approaches to vulnerability assessments for the forest sector and developing other tools for decision-makers.

National Adaptation Community of Practice

Led by the Premier, Ontario hosted a National Climate Change Adaptation Summit in 2008. The Summit brought together scientific and technical expertise and policy leaders from across Canada to focus on actions that can be taken in response to existing and imminent climate change impacts.

A significant gap that was identified was ongoing access to scientific expertise and technical support to assist decision-making. As a result, the Council of the Federation, working with the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), developed a web-based Community of Practice to facilitate this information exchange among experts across the country. The mandate of the Community of Practice is to support all Canadian Provinces and Territories in their efforts to incorporate climate change adaptation into their planning and policies.



“ONTARIO IS EMERGING
AS AN INTERNATIONAL
POLICY LEADER WITH
RESPECT TO ADAPTATION
TO CLIMATE CHANGE.”

—Paul Kovacs, Executive Director, Institute for Catastrophic Loss Reduction
President, Property and Casualty, Insurance Compensation Corporation
Adjunct Research Professor, Economics, The University of Western Ontario

ACTION 37

PARTICIPATE IN THE TERRITORIAL APPROACH TO CLIMATE CHANGE

The on-line Climate Change Adaptation Community of Practice was launched in the summer of 2010. It is already helping to connect policymakers to research professionals across the country. To date, the community includes over 300 research and policy experts. The site will be sponsored for the next two years by the Council of the Federation.

The current vision for the Community of Practice focuses on connecting scientific expertise with the provincial and territorial government decision-makers who require access to science and technical data to improve policies and programs likely to be affected by climate change. The Community of Practice supports the sharing of expertise among different types of experts and increases researchers' understanding of the kinds of information that government needs as well as the ways governments use that information. It features a range of interactive tools, including on-line forums to share information, educational webinars, private research space, an on-line library of adaptation resources and contact information of adaptation experts across Canada.

COLLABORATING GLOBALLY

ACTION 37 | Developed countries and regions cannot address climate change alone. Extreme events, temperature increases and sea level rise have consequences for everyone, particularly in developing countries. Therefore, it is important that developing countries and regions have the tools to foster low-carbon and climate-resilient development.

As part of Ontario's commitment to international action on climate change, Ontario's Minister of the Environment signed a Statement of Intent with the United Nations Development Programme (UNDP) at the United Nations Framework Convention on Climate Change Conference of the Parties (COP15) in December 2009.

The Statement of Intent indicates Ontario's interest in working with the UNDP under its Territorial Approach to Climate Change Program which partners developed sub-national governments with counterparts in developing countries to address climate change.

United Nations Framework Convention on Climate Change

Attending the annual Conference of the Parties, the annual conference established by the United Nations Framework Convention on Climate Change, provides Ontario with an opportunity to secure partnerships and build relationships with like-minded jurisdictions and to share some of the innovative policies and practices that are making a difference in Ontario.

At the sixteenth Conference of the Parties (COP16) held in Cancun in December 2010, Andrew Heintzman, Chair of the Premier's Climate Change Advisory Panel, represented Ontario along with senior staff who participated as observers. Ontario's delegation shared Ontario's experience in tackling climate change with other jurisdictions at events such as the Climate Group's Climate Leaders Summit.

In December 2009, Ontario's Minister of the Environment, accompanied by Dr. Ian Burton, co-chair of Ontario's Expert Panel on Climate Change Adaptation and internationally-recognized climate change expert, participated in the fifteenth Conference of the Parties (COP15) held in Copenhagen. Adaptation was a significant topic of discussion and negotiation. Ontario took the opportunity at COP15 to share the province's experience in tackling climate change with other jurisdictions and to promote Ontario's adaptation initiatives — which included releasing the Expert Panel on Climate Change Adaptation's report, "Adapting to Climate Change in Ontario".

FUTURE VISION

The Government of Ontario understands that adaptation alone is not sufficient to meet all the challenges of a changing climate. However, adaptation is an absolutely necessary step if communities and economies are to deal with the weather disruptions that are becoming more severe and frequent as the planet's climate changes. In pursuing its responsibilities to the people of Ontario, as well as playing its part in the efforts of the global community, the Province will not lose sight of the fact that emissions of greenhouse gases must be reduced. The Government of Ontario will continue to promote adaptation as a prudent approach to reducing risks to life and property in the immediate future.

Adaptation is a new challenge and Ontario must learn from others. At the same time, our province has a lot to offer in the way of knowledge and technology that can help save lives and protect property in other places.

The Government of Ontario welcomes the opportunity to work with federal government partners that recognize the magnitude of the effort required. The Regional Adaptation Collaborative (RAC), which will be completed in March 2012, is a small step in the right direction, but a great deal more strategic planning and funding is required. Ontario encourages the federal government to enhance its commitment and will be pleased to participate in subsequent joint initiatives designed to sustain national and community-based adaptation action.

In the meantime, determining the legacy plan for the projects, plans and tools created by the various Regional Adaptation Collaboratives will be a key aspect of ensuring the benefits of RAC program are maximized. We know that the Community of Practice on adaptation, hosted in Ontario, will be an important means of sharing what has been learned across the country.

The Government of Ontario — working together with other provinces and territories — will continue to share information and decision-support resources generated by the RAC and other adaptation initiatives across the country. Ontario recognizes the need for the federal government to have a continued role in managing a national approach to climate change adaptation in order to drive effective infrastructure design, climate science and other investments in light of a changing climate.

We will continue to encourage the federal government to sustain adaptation funding to enhance resilience across Canada post-2012.

The Government of Ontario will seek to:

- contribute knowledge and technical expertise through national and international initiatives
- build capacity in our ability to understand the implications of a changing climate for all aspects of Ontario's role in international trade and other matters under negotiation including Great Lakes Agreements
- play an active role in encouraging the implementation of effective adaptation planning



CLOSING THANKS

The Ministry of the Environment would like to thank the following ministries for their collaborative support in developing this Adaptation Strategy and Action Plan:

- Ministry of Aboriginal Affairs
- Ministry of Agriculture, Food and Rural Affairs
- Cabinet Office
- Climate Change Secretariat
- Ministry of Economic Development and Trade
- Ministry of Education
- Emergency Management Ontario
- Ministry of Energy
- Ministry of Finance
- Ministry of Health and Long-Term Care
- Ministry of Infrastructure
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources
- Ministry of Northern Development, Mines and Forestry
- Ministry of Research and Innovation
- Ministry of Tourism and Culture
- Ministry of Training, Colleges and Universities
- Ministry of Transportation

REFERENCES

- Berrang-Ford, L., J. D. MacLean, Theresa W. Gyorkos, J. D. Ford, and N. H. Ogden. 2009. Climate Change and Malaria in Canada: A Systems Approach. *Interdisciplinary Perspectives on Infectious Diseases*, 2009, 13pp. <http://www.hindawi.com/journals/ipid/2009/385487.abs.html>.
- Canada. National Round Table on the Environment and the Economy. 2010. Degrees of Change: Climate Warming and the Stakes for Canada. Ottawa: NRTEE.
- Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA), 2007: <http://www.ene.gov.on.ca/en/water/greatlakes/coa/index.php>.
- Canada-U.S. Great Lakes Water Quality Agreement (GLWQA), 1987: <http://www.ijc.org/rel/agree/quality.html>.
- CCCSN. 2009. Ensemble Scenarios for Canada, 2009. Produced by the Canadian Climate Change Scenarios Network (CCCSN.CA). Editor: N. Comer. Adaptation and Impacts Research Section, Environment Canada. <http://ontario.cccsn.ca/?page=ensemblescenarios>.
- Canadian Council of Forest Ministers (CCFM). 2009. Framework for Forest Management Offset Protocols. http://www.ccfm.org/pdf/FFMOP_e.pdf.
- Canadian Council of Forest Ministers (CCFM). 2008. A Vision for Canada's Forests: 2008 and Beyond. http://www.ccfm.org/pdf/Vision_EN.pdf.
- Canadian Council of Forest Ministers (CCFM). 2009. Vulnerability of Canada's Tree Species to Climate Change and Management Options for Adaptation: An Overview for Policy Makers and Practitioners. http://www.ccfm.org/pdf/TreeSpecies_web_e.pdf.
- Canadian Council of Ministers of the Environment (CCME). 2010. CCME Setting Strategic Directions for Water. http://www.scics.gc.ca/cinfo09/830973004_a1e.pdf.
- Colombo, S. 2009. Ontario's Forests and Forestry in a Changing Climate. Ont. For. Res. Inst. CCRR-12. Sault Ste. Marie, ON. 21p.
- Conservation Ontario. 2009. Protecting People and Property: A Business Case for Investing in Flood Prevention. http://www.conservation-ontario.on.ca/projects/floodstatus/pdf/Conserv_ON_Flood09_presentation.pdf.
- Council of Great Lakes Governors. 2005. Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement. http://www.cglg.org/projects/water/docs/12-13-05/Great_Lakes-St_Lawrence_River_Basin_Sustainable_Water_Resources_Agreement.pdf.
- Credit Valley Conservation Authority and Toronto and Region Conservation Authority. 2010. Low Impact Development Stormwater Management Manual. http://www.creditvalleycons.com/sustainability/lid/stormwaterguidance/downloads/LID%20SWM%20Guide%20-%20v1.0_2010_1_no%20appendices.pdf.
- Environment Canada. 2011. Climate Trends and Variations Bulletin – Annual 2010. <http://www.ec.gc.ca/adsc-cmda/default.asp?lang=En&n=77842065-1>.
- Environment Canada and the Ontario Ministry of the Environment. 2007. Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2007. <http://www.ene.gov.on.ca/publications/6263e.pdf>.
- Environmental Commissioner of Ontario. 2010. Redefining Conservation: Annual Report 2009/2010. http://www.eco.on.ca/eng/uploads/eng_pdfs/2010/2010%20Annual%20Report.pdf.

Ernst and Young. 2008. Strategic Business Risk Insurance 2008. http://www.aaiard.com/11_2008/Top_10_risks_for_the_insurance_industry.pdf.

Expert Panel on Climate Change Adaptation. 2009. Adapting to Climate Change in Ontario: Report of the Expert Panel on Climate Change Adaptation. A report submitted to the Ontario Ministry of the Environment. <http://www.ene.gov.on.ca/publications/7300e.pdf>.

Far North Science Advisory Panel. 2010. Science for a Changing Far North: The Report of the Far North Science Advisory Panel. A report submitted to the Ontario Ministry of Natural Resources. <http://www.mnr.gov.on.ca/en/Business/FarNorth/2ColumnSubPage/266512.html>.

Flannigan, M.D., K.A. Logan, B.D. Amiro, W.R. Skinner, and B.J. Stocks. 2005b. Future area burned in Canada. *Clim. Chang.* 72:1–16.

Government of Ontario. 2008. Ontario Tourism Facts & Figures. <http://www.ontla.on.ca/library/repository/ser/224449//2008v07no04.pdf>.

Health Canada. 2008. Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. http://ptaff.ca/blogue/wp-content/uploads/human_health_in_a_changing_climate-cover.pdf.

Institute for Catastrophic Loss Reduction. 2007. Sewer Backup: Homeowner perception and mitigative behaviour in Edmonton and Toronto. http://iclr.org/images/ICLR_20Report_20sewer_20backup.pdf.

Institute for Catastrophic Loss Reduction. 2008. Ice Storm '98. http://www.iclr.org/images/icestorm98_english.pdf.

Insurance Bureau of Canada's Progress Report on Adaptation to Climate Change file. January 2011. http://www.ibc.ca/temp/climate_change_report_HM.html.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The physical science basis. Working Group I contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, et al. (Eds.). Cambridge, U.K.: Cambridge University Press

International Joint Commission. 2009. Great Lakes Water Quality Agreement. <http://www.ijc.org/rel/agree/quality.html>.

Morrison, Murray, Eri Iizumi, Craig Miller, and Gregory Kopp. 2009. Vaughan Ontario Damage Investigation – The August 20, 2009 Tornadoes. http://www.iclr.org/images/Vaughan_Ontario_Damage_Investigation_UWO-draft-report.pdf.

National Institute of Building Sciences. 2005. Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities. <http://nibs.org/index.php/mmc/projects/nhms>.

Natural Resources Canada (NRCAN). 2007. From Impacts to Adaptation: Canada in a Changing Climate 2007. http://adaptation.nrcan.gc.ca/assess/2007/index_e.php.

North American Electric Reliability Council. 2006. Transmission Operator Reliability Readiness Audit Report: Hydro One Networks Inc. http://www.nerc.com/docs/rap/audits/HONE_BA-TOP_ReadinessAuditReport.pdf.

Ogden, Nicholas H., Laurie St-Onge, Ian K. Barker, Stéphanie Brazeau, Michel Bigras-Poulin, Dominique F. Charron, Charles M. Francis, Audrey Heagy, L. Robbin Lindsay, Abdel Maarouf, Pascal Michel, François Milord, Christopher J. O'Callaghan, Louise Trudel, and R. Alex Thompson. 2008. Risk maps for range expansion of the Lyme disease vector, *Ixodes scapularis*, in Canada now and with climate change. *International Journal of Health Geographics*, 7:24. <http://www.ij-healthgeographics.com/content/7/1/24>.

Ontario College of Family Physicians (OCFP). 2008. Addressing the Health Effects of Climate Change: Family Physicians Are Key. <http://www.ocfp.on.ca/local/files/Addressing%20the%20Health%20Effects%20of%20Climate%20Change%20Family%20Physicians%20are%20Key%20April%207,%202008.pdf>.

Ontario Ministry of Education. 2009. Acting Today, Shaping Tomorrow: A Policy Framework for Environmental Education in Ontario Schools. <http://www.lsf-1st.ca/media/ShapeTomorrow.pdf>.

Ontario Ministry of Finance. 2010. Ontario Fact Sheet September 2010. <http://www.fin.gov.on.ca/en/economy/ecupdates/factsheet.html>.

Ontario Ministry of Natural Resources. 2005. Ontario's Biodiversity Strategy: Protecting What Sustains Us. http://www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STEL02_166816.html.

Ontario Ministry of Natural Resources. 2007. Climate change and nature-based tourism, outdoor recreation and forestry in Ontario: Potential effects and adaptation strategies. <http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@climatechange/documents/document/276926.pdf>.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2010. Premier's Award for Agri-Food Innovation Excellence: 2009 Premier's Award Winner, Leamington Area Drip Irrigation Incorporated. http://www.omafr.gov.on.ca/english/premier_award/2009/winners/premier.htm.

Ontario Ministry of the Environment, Environment Canada and Water Environment Association of Ontario. 2010. Optimization Guidance Manual for Sewage Works. <http://weao.org/events/pdf/reports/Optimization-Guidance-Manual-for-Sewage-Works.pdf>.

Ontario Ministry of Transportation. 2008. Highway Infrastructure Innovation Funding Program. http://www.eng.uwo.ca/news/newsletter/jan08/hiiip_guidelines.pdf.

Ontario Securities Administrators. 2010. CSA Staff Notice 51-333: Environmental Reporting Guidance. http://www.osc.gov.on.ca/documents/en/Securities-Category5/csa_20101027_51-333_environmental-reporting.pdf.

Research Network for Business Sustainability. 2009. Current Practices: A Systematic Review of the Literature on Business Adaptation to Climate Change. http://www.nbs.net/wp-content/uploads/NBS_ClimateAdaptation_Practices_2009.pdf and <http://www.ethicscan.ca/docs/RNBS.doc>.

Statistics Canada, 2009. Age of Public Infrastructure: A Provincial Perspective. <http://www.statcan.gc.ca/pub/11-621-m/11-621-m2008067-eng.htm>.

Stern, Nicholas. 2006. The Economics of Climate Change: The Stern Review. http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm.

Swiss Re. 2010. Weathering climate change: Insurance solutions for more resilient communities. http://media.swissre.com/documents/A10485_Climate_adaption_Publication_A4.pdf.

Williamson, T.B., S.J. Colombo, P.N. Duinker, P.A. Gray, R.J. Hennessey, D. Houle, M.H. Johnston, A.E. Ogden, and D.L. Spittlehouse, 2009. Climate change and Canada's forests: From Impacts to Adaptation. Sustain. For. Manag. Netw. and Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB. 104 p. http://nofc.cfs.nrcan.gc.ca/bookstore_pdfs/29616.pdf.

Wotton, B.M., D.L. Martell and K.A. Logan, K.A. 2003. Climate change and people-caused forest fire occurrence in Ontario. *Clim. Chang.* 60:275–295.

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