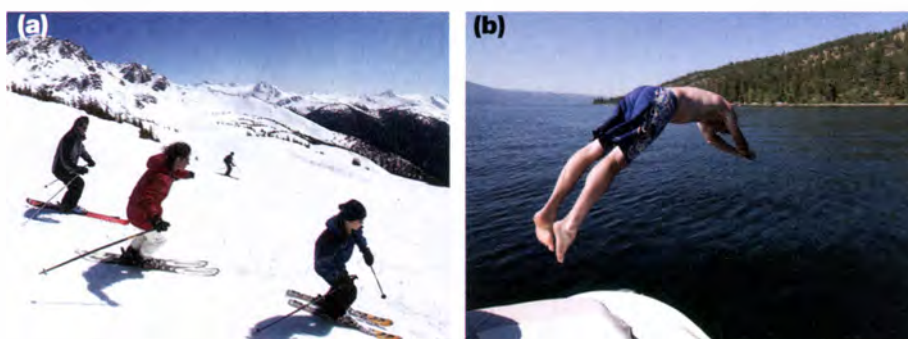


## Impacts of Climate Change on Human Life

Do you enjoy winter activities, or would you rather wait for summer (**Figure 1**)? If this is the case, you might think climate change would be a good thing. But will it really? What about the rest of the world? How will climate change affect human life? How will it affect your life?



**Figure 1** Climate change can affect both (a) winter and (b) summer recreational activities.

### Climate Change in Ontario

Since it is farther north, Canada will experience greater warming than countries closer to the equator. Ontario's average temperatures could increase by 3 to 6 °C in winter and by 4 to 8 °C in summer in 100 years.

Some of the changes to Ontario's climate could be considered positive. Our winters will be milder, with fewer extremely cold days and less snow. The growing season will be longer.

Climate change will also be bad for Ontario. We will experience more extremely hot, humid days in the summers. Rainfall patterns will also shift. We will likely have more rainfall overall, but some areas will be drier and some wetter. We will experience more heavy rainstorms.

## Impacts on Human Health

Climate change, especially increased temperatures, can cause lower air quality. Increasing air pollution would cause problems for people already suffering from conditions like asthma and lung disease.

Heat waves are also likely to increase heat-related illnesses and deaths. Increasing temperatures and changes in precipitation may also bring a higher risk of diseases carried by water, insects, ticks, and rodents (Figure 2).



**Figure 2** Wood ticks, like this one, can carry Lyme disease.

## Impacts on Property

Climate change is expected to bring an increase in both the number and severity of storms. Violent storms bring stronger winds and heavier rain and snowfall, which result in more property damage. Dramatic storm events have caused extensive damage to parts of Ontario in recent years (Figure 3).

**August 20, 2009** Multiple tornados touched down across southern Ontario. The City of Vaughan declared a state of emergency after a tornado damaged 600 homes.



**January 5–10, 1998** The worst ice storm in Canadian history hit Ontario and Québec. It destroyed trees and brought down power lines, leaving 4 million people without electricity.



**August 19, 2005** A ridge of severe storms swept across southern Ontario. High winds, hail, and 153 mm of rainfall caused massive damage in the City of Toronto.



**Figure 3** Recent storms have caused damage to parts of Ontario.

## Impacts on Transportation

Climate change also affects transportation both on land and on water. Extreme heat, severe storms, and overall increasing temperatures will affect transportation across Canada (**Table 1**).

**Table 1** Impacts of Climate Change on Transportation

Advantages	Disadvantages
<ul style="list-style-type: none"><li>- loss of Arctic sea ice may create an open summer shipping lane from the Atlantic to the Pacific, reducing shipping distances and times, and saving money and energy</li></ul>	<ul style="list-style-type: none"><li>- pavement can soften and railway track can buckle in hot temperatures</li><li>- Arctic permafrost thawing will destroy frozen highways</li><li>- severe storms make driving more hazardous</li><li>- lower water levels in Great Lakes may cause channels and harbours to become too shallow for fully loaded ships</li></ul>



**Figure 4** Pine trees turn red after being killed by mountain pine beetles in this British Columbia forest.

## Impacts on Forestry

Changes in temperature and precipitation will have a significant effect on forests. The effects will be difficult to predict and will vary by location (**Table 2**).

**Table 2** Impacts of Climate Change on Forestry

Advantages	Disadvantages
<ul style="list-style-type: none"><li>- risk of forest fire may decrease depending on precipitation</li><li>- longer growing seasons</li><li>- faster growth rates</li></ul>	<ul style="list-style-type: none"><li>- risk of forest fire may increase depending on precipitation</li><li>- invasive species, including forest pests, may benefit (<b>Figure 4</b>)</li><li>- tree species from southern latitudes may out-compete native species</li></ul>

## Impacts on Agriculture

Agriculture is very closely linked to climate. For example, temperatures, the length of the growing season, the amount and timing of rainfall, and frost all affect crop and livestock production. Climate change can have both advantages and disadvantages for agriculture in Canada (**Table 3**).

**Table 3** Impacts of Climate Change on Agriculture

Advantages	Disadvantages
<ul style="list-style-type: none"><li>- longer growing seasons</li><li>- faster growth rates</li><li>- ability to switch to more valuable crops</li></ul>	<ul style="list-style-type: none"><li>- more heat stress for crops and livestock</li><li>- greater risk of crop damage from storms, insect pests, and weeds</li><li>- altered rainfall patterns</li></ul>

## RESEARCH THIS ROBINS, RISING SEAS, AND SOFT GROUND



**SKILLS:** Researching, Identifying Alternatives, Analyzing the Issue, Communicating

Tuktoyaktuk (tuk-toy-yak-took) is a small coastal Inuit community in the Northwest Territories. The community is experiencing many effects of global warming. Sea levels are rising and permafrost is thawing. Wildlife is changing both on the land and in the sea. For example, people in Tuktoyaktuk recently saw robins and orcas in the area. Changes in ice conditions have also made travelling by snowmobile more dangerous.

1. Go online to investigate the issues facing this remote community.
- A. How is climate change threatening their traditional diet of niqituinnaq—caribou, seals, and other native animals? **1.1**
- B. How do rising sea levels pose a health threat to the community? **1.1**
- C. What additional cultural and economic effects are being felt in Tuktoyaktuk? **1.1**
- D. What actions are being taken by the community to address these serious issues? **1.1**
- E. What responsibility do other Canadian citizens have in assisting the residents of Tuktoyaktuk as they cope with climate change? **1.1** **4**



GO TO NELSON SCIENCE

### 10.3 Wrap Up

- Changes expected to Ontario's climate include milder winters and more extremely hot summer days. Rainfall patterns will also shift.
- Climate change affects health by increasing pollution, heat waves, and disease risks.
- Climate change is expected to bring an increase in more violent storms that can result in heavy property damage.
- Other possible effects of climate change include the opening of summer shipping lanes through the Arctic, increased risk of forest pests, and a longer growing season.



### CHECK YOUR LEARNING

1. (a) Describe how the climate of Ontario might change in the future.  
(b) Explain why it is difficult to plan for some of these changes. **K/U** **C**
2. Suppose you were a researcher in Ontario. What are three factors you could study to monitor the effects of climate change on transportation? **4.1** **4**
3. Explain how climate change can be both positive and negative for farming. **K/U**
4. What are some of the forestry issues associated with climate changes in Canada? **4.1**
5. How might people living in cities be affected differently by climate change than people living in rural areas? **4**
6. Describe some of the risks to human health that may be increased by climate change. **4.1**
7. How might climate change influence transportation on land and on water? **4.1**

## Action and Adaptation

We know that climate change is already happening. The greenhouse gases we have emitted over the past century make it unavoidable. We can act now to reduce the worst impacts of climate changes: the sooner, the better.



**Figure 1** The Peary caribou of the western Arctic have declined in numbers by 95 % since the early 1960s. This dramatic decline may be the result of climate change.

### DIG DEEPER

#### Did You Know?

##### Rising Greenhouse Gases

Canada's greenhouse gas emissions have increased more than 26 % since 1990.

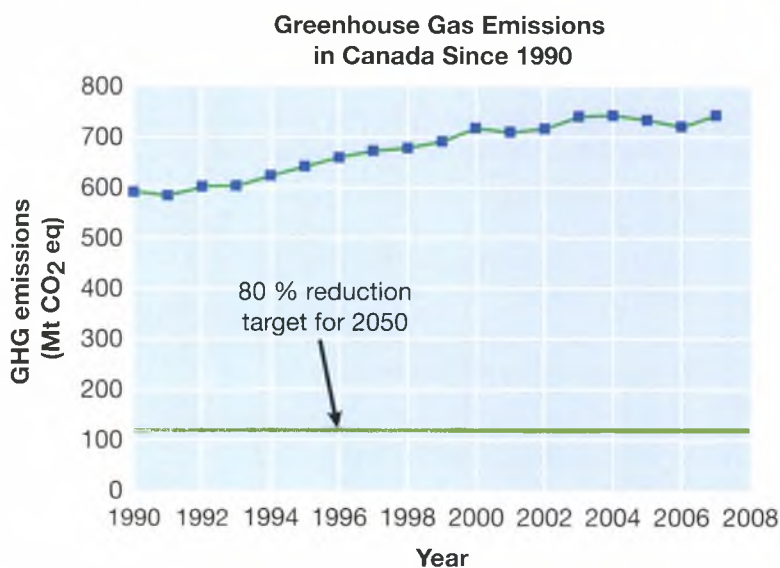
### Taking Action

Average global temperatures have risen by 0.6 °C over the last 200 years. If we continue to release greenhouse gases as we have been, global temperatures could increase from 2 to 6 °C on average this century. Most scientists agree that we must keep increases to a maximum of 2 °C. This would avoid the most serious impacts of climate change, such as drastic sea level rises and species extinctions (**Figure 1**).

How do we limit temperature increases? The simple answer is to drastically cut back on our emissions. But by how much?

*The scientific consensus is that by 2050, all industrialized nations will need to cut their annual greenhouse gas emissions to 80 % or more below their 1990 emission levels (**Figure 2**).*

This will require a commitment from all levels of government, and the co-operation of businesses, organizations, and individuals.



**Figure 2** Canada's greenhouse gas (GHG) emissions have been rising since 1990

## The Federal Government

The federal government of Canada works with other governments around the world on climate change. Unfortunately, Canada's history in this area has been rocky. In 2002, Canada joined the Kyoto Protocol, committing to a reduction of greenhouse gas emissions by 2012.

In 2006, the federal government stated it could not meet its Kyoto commitment. It developed its own plan for reducing emissions. This plan has been heavily criticized within Canada and internationally. Without strong international agreements in place, significant global progress on climate change is unlikely. 

## The Provincial Government

Ontario's provincial government has already committed to the 80 % reduction target by 2050. In August 2007, it introduced Go Green: Ontario's Action Plan on Climate Change. This action plan includes the following:

- reduction of greenhouse gas emissions by 6 % by 2014, 15 % by 2020, and 80 % by 2050
- decision to stop burning coal at the four remaining coal-fired generating stations by 2014
- planting of 50 million trees in southern Ontario by 2020
- 902 km of new or improved rapid transit routes (MoveOntario 2020)

In 2010, the Ontario government reached an agreement with Samsung corporation to invest \$7 billion in green energy. This includes 2500 megawatts of solar and wind power generation, the building of four manufacturing plants, and the creation of 16 000 jobs between 2013 and 2015.

Between 2004 and 2006, Ontario's greenhouse gas emissions decreased slightly, but overall they were still 7 % higher than in 1990 (**Figure 3**).

### DIG DEEPER

#### Web Link

To learn more about the Kyoto Protocol and the Canadian government's current response to climate change,

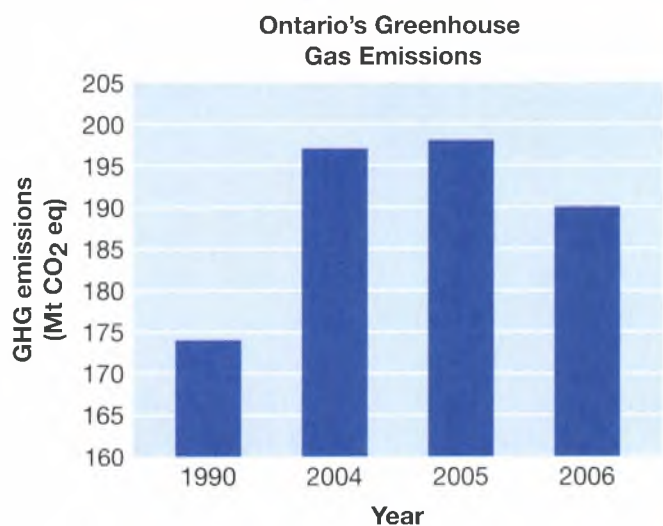
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### DIG DEEPER

#### Did You Know?

#### Reducing Ontario's Greenhouse Gas Emissions

Closing Ontario's last four coal-fired generating stations is equal to taking almost 7 million cars off our roads.



**Figure 3** The decrease in greenhouse gas emissions between 2004 and 2006 is mainly due to reduction in the use of coal-fired generating plants and the mild winter in 2006 that reduced natural gas use.

## DIG DEEPER




### Career Link

Roofers with special training may be involved in green roof construction. To learn more about jobs in the growing field of green roof construction,

GO TO NELSON SCIENCE

## Municipal Government

Many municipal governments (governments of cities and towns) are improving public transit and creating laws to promote energy conservation and reduce greenhouse gas emissions. Recently, the City of Toronto passed legislation that requires many new buildings to include green roofs (**Figure 4**). 



**Figure 4** Green roofs, reduce heating and cooling costs, and remove carbon dioxide from the air.



**Figure 5** Organizations can encourage carpooling by creating carpool-only parking spots.

## Organizations

Both for-profit and non-profit organizations can play an important role in reducing greenhouse gas emissions. They can take direct action, educate others, and act as role models for others. For example, organizations can:

- use more energy-efficient equipment and technologies
- switch to renewable energy supplies
- reduce waste
- design and market innovative “green” consumer products
- encourage employees to reduce their carbon footprint (**Figure 5**)

## Individuals

More than one-third of Canada’s greenhouse gas emissions result directly from the activities of individuals. Greenhouse gas emissions are influenced by our food, transportation, home heating and cooling methods, electricity usage, and even our recreation choices. We will explore ways we can reduce our personal greenhouse gas emissions later on in this chapter.

## Adapting to a Changing Climate

Even if we take steps to reduce emissions, some changes in climate will still happen. It is important to plan for climate change. Planning how to deal with future climate changes is called **adaptation**. It is a sensible approach for any citizen, organization, or government. For example:

- Municipal governments are deciding how to deal with flooding.
- Health care workers are planning for increased illness from air pollution and heat stress.
- Foresters are planning for more wildfires and insect pests.
- Farmers are considering changing the crops they grow and how they grow them.
- Conservation organizations are considering ways to help threatened species.

► **adaptation:** an adjustment to or way of coping with change

## 10.4 Wrap Up

- Industrialized nations will have to cut their greenhouse gas emissions at least 80 % by 2050 to avoid the worst impacts of climate change.
- The federal government can take action against climate change by signing international agreements.
- Ontario's provincial government has committed to reduce greenhouse gas emissions through Go Green: Ontario's Action Plan on Climate Change.
- Municipal governments can improve public transit, promote energy conservation, and reduce greenhouse gas emissions.
- Organizations can help through direct action, educating others, and acting as role models for others.
- Individuals can help by changing their behaviour.
- We will have to adapt to some amount of climate change.



### CHECK YOUR LEARNING

1. What role does the federal government play in international climate change agreements? **KC**
2. What are some of the things municipal and provincial governments can do to reduce climate change? **CC**
3. Why would taking action now to reduce greenhouse gas emissions help with adapting to climate change? **KU**
4. Describe some of the things being done to prepare for and adapt to climate change. **KU**