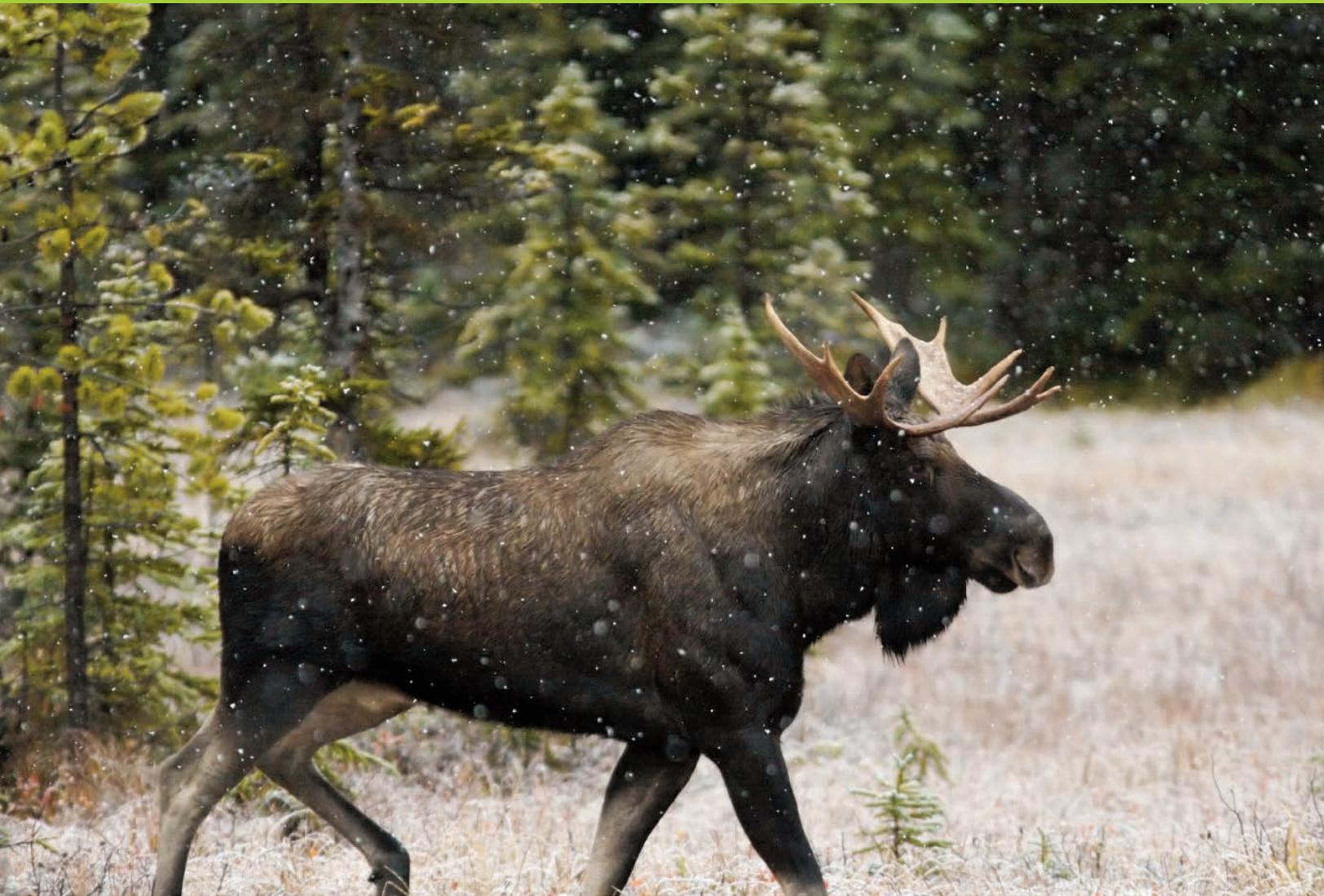


# The Heat is On!

# N°. 35

## SENIOR

Science | Social Studies | Geography



### LESSON SUMMARY

Students will research themes of climate change in Ontario and predict the impacts of climate change on a local forested environment.

## Activity Information

- Estimated Duration:** Two class periods (one for explanation and discussion, with project work/homework; one for presentations)
- Materials:** *Futures Wheel*
- Setting:** Indoors
- Key Vocabulary:** Acid rain, global warming, greenhouse effect, weather patterns

## Teacher Background

The earth's climate is controlled and balanced by a number of factors, including: the sun, the atmosphere, the oceans, fresh water and land. It is naturally variable, with warming and cooling trends part of normal cycles. Climatic conditions vary within a single year, from one year to the next, over decades, centuries and millennia. Historically, there have been repeated fluctuations between colder and warmer conditions (e.g. the ice age).

The **greenhouse effect** is also a natural phenomenon and helps keep the earth habitable – without it, the temperature of this planet would probably hover about 33 °C colder than it is now. The greenhouse effect refers to the heat-trapping quality of the atmosphere and is created by greenhouse gases. These gases, which include water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), are part of a complex natural system that influences our climate. Within this system, other elements, such as trees and oceans, play an important role by absorbing and storing atmospheric CO<sub>2</sub>.

Human activities, particularly those that consume energy derived from the combustion of fossil fuels, produce large quantities of greenhouse gases. Once in the atmosphere, these gases insulate the earth, reducing the loss of heat into space. The increasing emissions of greenhouse gases are threatening to raise temperatures and change the planet's climate. This "enhanced" greenhouse effect, commonly referred to as "climate change" or "global warming", has the potential to warm the planet at a rate never before experienced in human history.

**The United Nations Framework Convention on Climate Change** defines climate change as:

“A change of climate which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods.”

In other words, climate change is an overall change in weather patterns, as a result of what humans do (e.g. drive cars, burn wood and other fuels, harvest trees, build roads).

Some projected impacts of climate change in Ontario include:

- The likelihood of increased frequency and severity of forest fires
- The possible decline of more than one metre of water levels in the Great Lakes by the year 2050; disruptions in navigation routes; reduced shipping capacity
- A likely decrease in rainfall; an increased need for more irrigation in southwestern Ontario farmland (particularly in drought-prone soils and for shallow-rooted crops, such as potatoes)
- The disappearance of cold water fish species, such as lake trout and lake whitefish, from southern Ontario as their habitat changes
- The northward shift of moose (easily distressed by heat); increased population of white-tailed deer
- More frequent freezing rain occurrences, affecting energy transmission, as well as road and airline safety
- The broader spread of warmer climate diseases, such as Lyme disease, malaria and West Nile virus

One opinion suggests that, since CO<sub>2</sub> is the main fuel for photosynthesis, Ontario’s forests could become more productive in the long term. According to this rationale, in marginal soils areas where drought is not a limiting factor, rising temperatures could increase the rate of litter decomposition. This would enable forests in these areas, particularly in the clay belt of northeastern Ontario, to become more productive.

It is more likely, though, that existing forest species would have to decline and die before new species, better suited to the altered climate, could get established. Until this new equilibrium was reached, forests would undergo a period of significant disruption. As a result, we would need to adjust the way we manage these resources and the wildlife they support.

As with agriculture, the health and productivity of Ontario’s forests are intricately linked to climate. Trees are particularly vulnerable to long term change, as they have such long life cycles. In future, they will likely experience more extreme storms and wind damage, greater stress due to drought and increasingly severe fire and insect disturbances. As a result, we will need to adjust the way we manage these resources and the wildlife they support.

## Teacher Preparation

Familiarize yourself with the *Futures Wheel*.

## ACTIVITY

**Step 1** Ask your students to write down five things that they know, have read or heard about climate change. Ask them to consider the following:

- What is the difference between weather and climate?
- What is global warming?
- What is the greenhouse effect? What are greenhouse gases?
- Why are climate change and global warming in the news so much today?
- What are some potential national, regional and local issues?
- What are some social and cultural implications of climate change?
- What is “wrong” with the current trend in global warming?

List the students’ responses on the blackboard or flip chart and attempt to group them into categories (e.g. forestry, agriculture, employment, water).

**Step 2** Have a class discussion regarding the various impacts of climate change (e.g. do these impacts vary depending on different forest communities?) Explain to your students that they are going to research climate change as it applies to the following forested communities across the province:

- Southwestern Ontario (London, Windsor)
- Central Ontario (Peterborough, Barrie)
- Southern Ontario (Toronto, Pickering)
- Northern Ontario (Timmins, Sault St. Marie)
- Eastern Ontario (Kingston, Ottawa)

Divide the students into groups to research the geographic regions listed above, one region per group.

**Step 3** Each group must consider ecological, environmental, economic and social impacts of climate change on the group's chosen geographic region.

If any of your students are from farming communities, what impact do they think climate change might have on their local farms? What could the direct impacts be on the watershed and spring run-off? Would a slight increase in temperature affect the choice of plant species to be grown? What indirect impacts might there be at the grocery store, such as the unavailability of certain products or increased prices? You may wish to provide some catalyst questions, such as:

- How would employment be affected in a forest-dependent community?
- How would agriculture be impacted by a changing forest?
- If wildlife habitat changed, how would that affect species numbers?

Each group will now complete research on their geographic region. Students will predict how that particular environment may change as a result of climate change.

**Step 4** Explain to the class the concept of a *Futures Wheel* (page 79). A versatile tool, a *Futures Wheel* can be used to examine the many effects a single decision or situation can have on inter-relationships.

**Step 5** Each group should describe their specific geographic forest region and then create its own *Futures Wheel*, using the following scenario:

- Based on an increase in temperature of 2.5 °C, predict what the impact will be on the forest environment?

Each group should provide at least four "first level" implications (or "spokes") and several secondary implications.

**Step 6** Groups must work cooperatively to present, explain and justify their *Futures Wheel*. One group member will introduce the *Futures Wheel*; individual members of the group will present one implication each. Groups must be prepared to defend the decisions they have reached in their *Futures Wheel* and to answer questions from their peers.

## Evaluation

The quality of students' work will be assessed on the following basis:

1. Knowledge and understanding (35 marks)      Content of *Futures Wheel*, including depth of research
2. Application (25 marks)                              *Futures Wheel* (15), layout and design (10)
3. Communication (20 marks)                          All components of the *Futures Wheel*, including spelling, grammar, punctuation, etc.
4. Thinking and inquiry (20 marks)                  Development and explanation of the *Futures Wheel*

## Extensions

Challenge the class to create a climate change poster for their local forested area. Each team can choose to explore one of the social, environmental, ecological or economic impacts of climate change on the area.

Using the results of the *Futures Wheel* and questions (see Step 6), have each team create the text and graphics for individual panels, describing their researched theme or category. The panels can all be put together to create a class climate change poster.

## CLIMATE CHANGE FUTURES WHEEL EXAMPLE

