

Time

1-2 periods

Targeted Curriculum Expectations

-describe the characteristics (e.g. complex, Interconnected, life supporting, driven by solar Energy) of natural systems (e.g., climate, biomes, the lithosphere, the hydrosphere);
 -explain how human activities affect, or are affected by, the environment

Background Information

In this first lesson of regional climate change, students will show what they know or think they know about climate change. Students will read and discuss articles about climate change, enabling them to build their current understanding of the issue. In doing so, they will acquire understanding of key concepts and terms needed to better understand climate change and its regional and global impacts.

Teaching/Learning Sequence

Minds On → Pre-assessment Graffiti activity. Show what they know.

Provide groups with large sheet of paper and markers. Have group members think for one minute about what they know about climate change. After thinking, students have one minute to record what they know or think they know. Share. Post collection of knowledge on the wall to be added to or revised as needed.

ACTION! Whole Class → Group read and share

1. Working in groups of three or four students read one article on climate change (BLM 1.1,1.2,1.3,1.4). Tell groups to be prepared to explain what they have learned from the reading. Allow students three minutes to record by drawing, labeling or writing what they have learned in the article using the placemat (BLM 1.5). Next, students will do a round table sharing their visual interpretation of what they have learned. Each member has two minutes to share.
2. Following readings have students count off from 1-4 to form new groups. Newly formed groups should have members who have read different articles. Do a round table, each member has three minutes to share what they have learned.
3. Group share- Pick one student from each placemat section to share his or her visual interpretation of the reading. Teacher circulates to assist and clarify misconceptions.
4. Cut placemats sections into four, grouping similar article information into a collage. Post on the placemat sections as a collective collection of ideas and knowledge gained regarding climate change.

Consolidation and Connection → Individual Activity

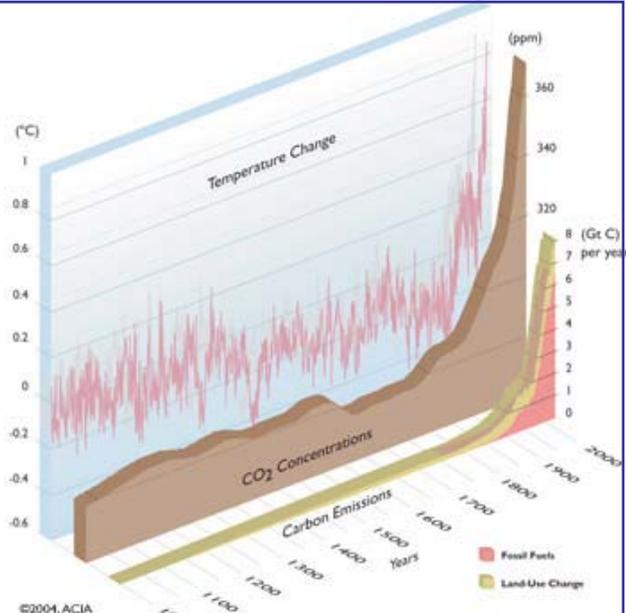
Provide copy of readings to students (BLM 1.1,1.2,1.3,1.4). Students use readings to individually complete introduction to climate change questions (BLM 1.6). Assess students understanding of Climate change, provide additional resources if further understandings are needed.



What is climate change?

Climate change is a variation or change in the climate (temperature, wind, precipitation patterns) in a specific location, region, or of the entire planet. This change in weather patterns persists for a long period of time ranging from decades to millions of years. Climate change may be caused by a variety of factors including natural processes; however, scientific evidence shows that the current period of climate change is caused by human activities.

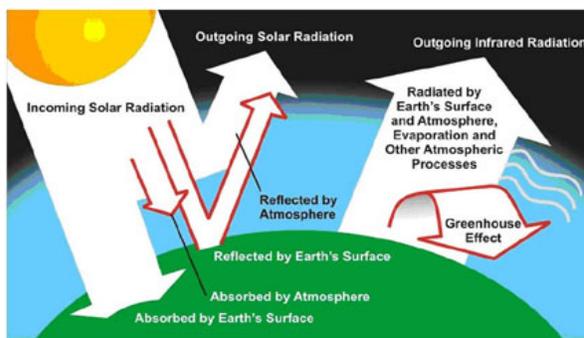
Study the graph to the right. When on the graph do you see a rapid increase in carbon emissions and carbon concentrations? What human activities were happening during this time period? What happened to the average global temperature during this same time period?



This figure illustrates the interaction between human generated carbon emissions, atmospheric carbon dioxide content and average global temperatures (ACIA, 2004).

What is the greenhouse effect?

The greenhouse effect refers to the role of our atmosphere in insulating the planet from heat loss. Sunlight enters our atmosphere and a portion is absorbed by the earth's surface. A large amount of this sun's energy is reflected back or bounces off the earth's surface as thermal infrared radiation and travels toward the atmosphere. At this point, greenhouse gases (water vapour, carbon dioxide, methane and nitrous oxide) in the atmosphere trap the thermal radiation and reflect it back toward the earth's surface. These gases are acting as a blanket to keep the earth warm. Under normal conditions, where the atmosphere contains naturally occurring concentrations of greenhouse gases, this effect keeps the average global temperature at 14°C instead of a very cold -19°C. We definitely need this blanket to keep us warm. But unfortunately, humans are increasing the concentrations of these gases in the atmosphere contributing to an increase in global temperatures. Humans are causing the blanket to keep us too warm!



How do humans contribute to climate change?

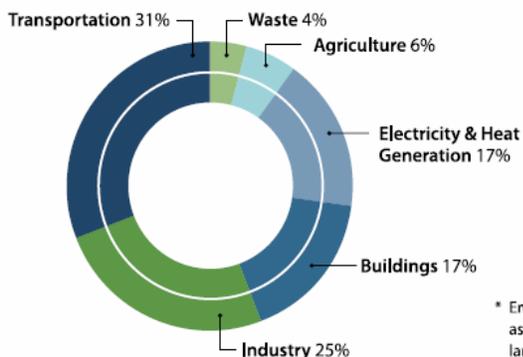
Humans contribute to climate change by artificially increasing the levels of greenhouse gas occurring in our atmosphere. Burning fossil fuels such as natural gas, gasoline and coal release a large amount of carbon dioxide, methane, and nitrous oxide into the atmosphere where it collects. This activity thickens the insulating blanket around the earth and traps a higher percentage of the thermal infrared radiation reflecting off the earth's surface, increasing average global temperatures.

Humans have released so much carbon into the atmosphere through the burning of fossil fuels and deforestation that the atmosphere contains 32 percent more carbon dioxide today than at the beginning of the 20th century!

Burning fossil fuels for transportation is the most common source of greenhouse gas release by humans. Other forms of greenhouse gases including methane and nitrous oxide which is often produced by humans through waste disposal and industrial practices. The release of any of these gases is known as Greenhouse Gas (GHG) emissions. Most activities that humans do at home, school and work need power. That means each time you turn on a light, use an appliance or ride in a car you are directly adding to the concentration of greenhouse gases in the atmosphere. This is not very good news. The good news is that we can make changes in our communities to reduce the amount of GHG released. What can you do?

Ontario's 2007 Emissions by Sector

(Source: 2009 National Inventory Report)



* Emissions from waste include emissions associated with solid waste disposal on land, wastewater handling and waste incineration.

Study the graph. Think about the human activities that produce greenhouse gases in each sector. How can we reduce GHG emissions in each sector? What do you think this graph will look like in 30 years?

Source: Ontario Climate Change Action Plan Annual Report 2008-2009

Regional Impact of Climate Change

In the Region of Peel, climate change could mean warmer winters, hotter summers and more frequent extreme weather events. Scientists predict that there will be long-term, damaging impacts to our built, natural and human systems. Scientists also know that there will be times when we can find benefits and local opportunities with a changing climate. Some examples of both of these negative and positive impacts of climate change are illustrated below.

Climate Facts....

- In southern Ontario, the number of days exceeding 30°C will more than double by the 2050s
- Extreme daily precipitation events (such as thunderstorms) will become more frequent and severe
- UV levels will increase



CLIMATE CHANGE IMPACTS



Human Systems

1. Increased risk to human health (higher health care costs: increased heat stroke, allergens, respiratory complications, and disease)
2. Higher demand for public cooling centres
3. Potential for displaced people and injuries due to flooding
4. Residents may be isolated and without power due to extreme weather events (e.g. ice storm 1998)

Built System

1. Increased temperatures could lead to higher demand for cooling units; increased utility bills and brown/black-outs.
2. Increased water use could lead to increased cost in water bills and increased cost to deliver and repair water systems
3. Storm damage may cause building damage and increased clean up costs
4. Frequent weather events may increase costs to maintain buildings, roads, bridges and other public structures.



Natural Systems

1. Changes in temperature and precipitation patterns may cause: loss and/or shift in plant and animal species
2. Increase erosion, flooding
3. Reduced lake levels and river levels,
4. Increased damage and mortality to trees
5. Increased loss of agriculturally productive land leading to loss of food production
6. Increased abundance of invasive species and pest infestations.

The debate is over about whether or not climate change is real. Irrefutable evidence from around the world - including extreme weather events, record temperatures, retreating glaciers, and rising sea levels - all point to the fact climate change is happening now and at rates much faster than previously thought.

-David Suzuki-

A Global Problem that has A Regional Solution

Climate change is here and it is time to take action! We as citizens in the Region of Peel must recognize that while it is up to each community, region, province and nation to do their part in dealing with the effects of climate change. The impacts of climate will impact your future, where you live, work, and play.

We can respond to climate change by reducing greenhouse gas (GHG) emissions. This act of reducing greenhouse emission is called **mitigation**. The federal government estimates that 80% of Canada's greenhouse gas emissions are associated with the production of or consumption of fossil fuels for energy purposes. We can mitigate by:

1. Reducing energy use
2. Switching to renewable sources of energy (solar, wind, thermal energy)
3. Capturing landfill gases, and
4. Increasing use of public transit.

Mitigation reduces the build-up of greenhouse gases in the atmosphere and slows climate change over the long term.

We can also take action to prepare for the impacts of climate change. **Adaptation** are actions to reduce the negative impacts of climate change or take advantage of potential new opportunities. Adaptation actions include programs that reduce the impacts of severe storms or weather events that cause flooding, heat waves, ice storms, high winds, erosion, change in lake levels and pest infestations. Adaptation activities include:

1. Upgrading storm sewer systems
2. Developing emergency alert systems
3. Providing "cooling centers"
4. Using thermal energy to heat and cool buildings, and
5. Building storm resistance structures.

There are also actions that will both reduce greenhouse gas emissions and help prepare for climate change (**mitigation and adaptation**). These actions include planting trees, building green roofs, buying local food, and reducing water use (saves electricity to pump water and saves water for use during dry spells). Can you explain why these actions both mitigate and adapt to climate?

What Can You Do to Combat Climate Change?

Visit <http://www.peelregion.ca/planning/ecofootprint/> to take a Carbon footprint test.

I can Mitigate by...

1. Walking to school, friends, parks
2. Taking public transit
3. Turning off lights
4. Turning down the heat by 1 or 2 degrees in my house
5. Using fans instead of air conditioning
6. Finding recreational activities that do not involve using electricity

I can help Adapt to Climate Change by...

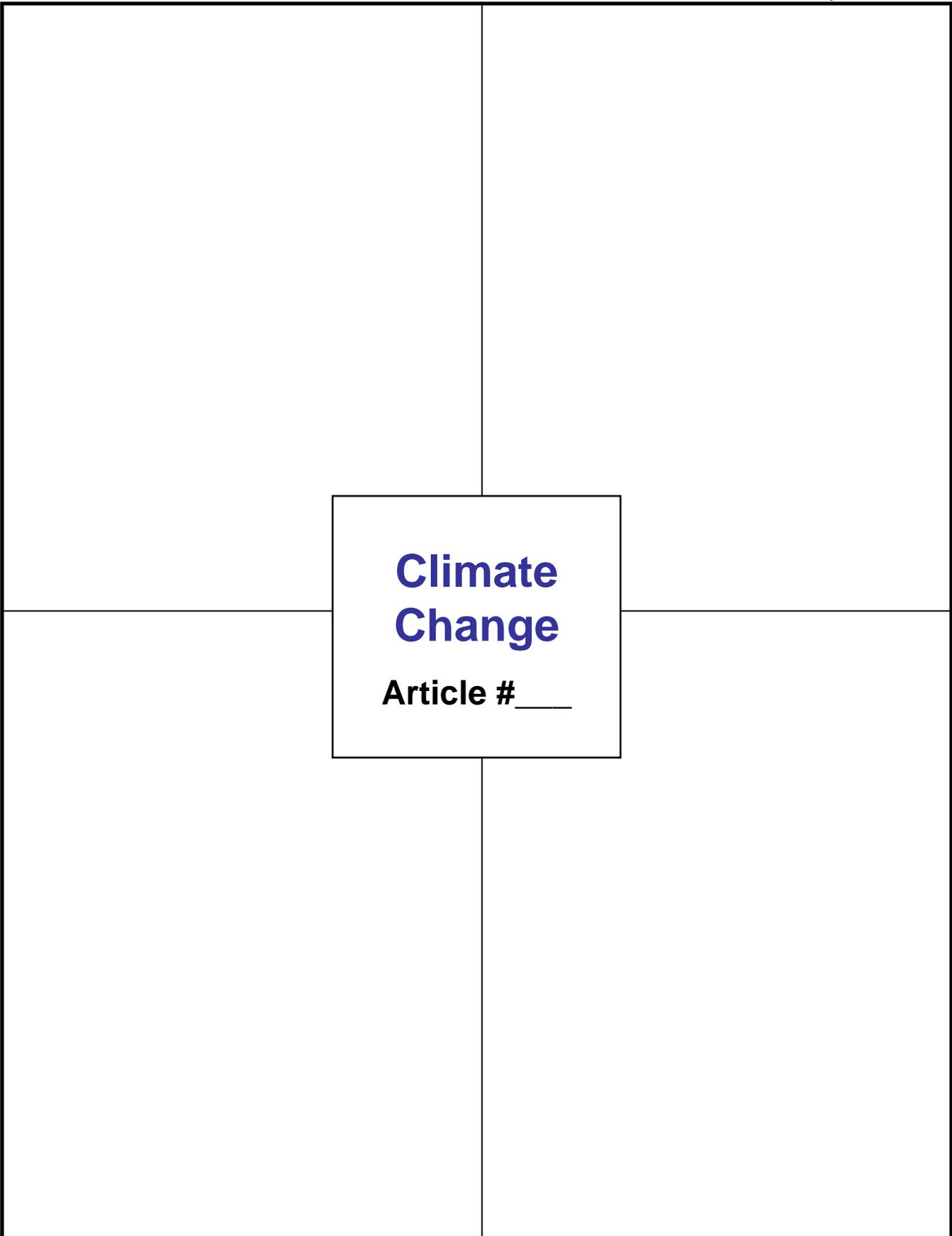
1. Not buying a house on the flood plain
2. Listening for heat alerts, flood and storm warning and advisories
3. Drinking lots of water when out in the heat
4. Getting involved in committees dealing with climate change issues.
5. Building awareness of my own carbon footprint to make lifestyle changes

I can mitigate and adapt by...

1. Taking shorter showers (water conservation)
2. Planting a tree
3. Growing a garden
4. Buying local food
5. Volunteering to restore plant and animal habitat

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Climate Change

1. Define Climate Change
2. How do humans contribute to climate change?
3. How do you contribute to climate change?
4. Draw a diagram illustrating the greenhouse effect.
5. What does GHG stand for? How do humans produce GHGs?
6. Why is it important to take actions against climate change?
7. What could you do to combat climate change?
8. List the impacts of climate change in a chart form.
9. What is mitigation? How can we mitigate climate change?
10. List 3 things you can do to mitigate climate change.
11. How are we adapting to the impacts of climate change?
12. List 3 things you can do to adapt to climate change.

Extension: Design a poster illustrating how high school students can take action to reduce the impacts of climate change.