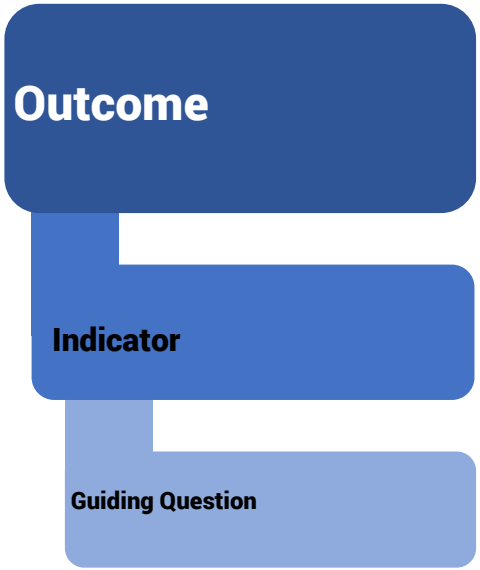
Investigating Climate Change Using a Pasco Greenhouse

Science 8



Learners will evaluate oceanographic and other evidence of climate change inclusive of a Mi'kmaw perspective.

Measure climatic indicators using probeware. (CT/TF)

How can evidence be used to determine that the earth's climate is changing?

Inquiring

It's Getting Warmer

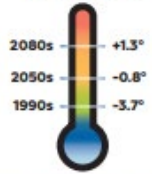
2080s +4.5°
2050s +2.6°
1990s 6.6°
°C

By the end of the century, our average temperature is projected to increase. **+4.5°C**

Days and nights will be more uncomfortable.

	Days warmer than 29°C.		Nights warmer than 18°C.
1990s	2	1990s	2
2050s	14	2050s	17
2080s	32	2080s	39

Our average winter temperature will be above 0°C.



Growing seasons will be longer, which could be an opportunity and a challenge.

Potential Impacts

- Higher temperatures will increase electricity demand to cool buildings.
- Increased food production capacity, but also the increase of new pests and diseases.
- Increased wildfires.
- Drought conditions and water shortages.

Climate change scenarios based on RCP 8.5 (median), which most closely matches global emissions to date. Global results downscaled to our local area. Timeframes based on 30-year periods (1981-2010, 2035 - 2065, 2065-2095)

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Precipitation Patterns Are Changing

Annual precipitation is projected to increase by the end of the century. **+10%**

Expect more rainy days		Expect less snowy days
112	1990s	39
124	2050s	25
132	2080s	17

Precipitation will be more intense, meaning that we'll see heavy rainfalls more frequently.

But... more of that water will evaporate in warmer air or run off in more intense downpours.

Potential Impacts

- More intense rainfall events increase flooding and damage.
- Heavy rains can make slopes unstable and cause landslides.
- Heavy rain and runoff can cause erosion, and damage to property and roadways.
- Outdoor winter activities will have less snow and ice to rely on.

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More Frequent and Intense Storms

It will be more likely for larger storms to hit NS.

More intense storms will bring more powerful and destructive storm surges.

Warming oceans will enable tropical storms to track further north without losing strength.

Peak wind speeds will increase.
+3.7 to 7 km/h higher by the year 2100.

Potential Impacts

- More frequent and intense storms will increase flooding to low-lying areas.
- Heavier rains cause erosion, putting buildings and roads on shaky ground.
- Stronger storm surges damage coastlines and communities.
- Hillsides and other areas weakened by rain become unstable and more susceptible to landslides.

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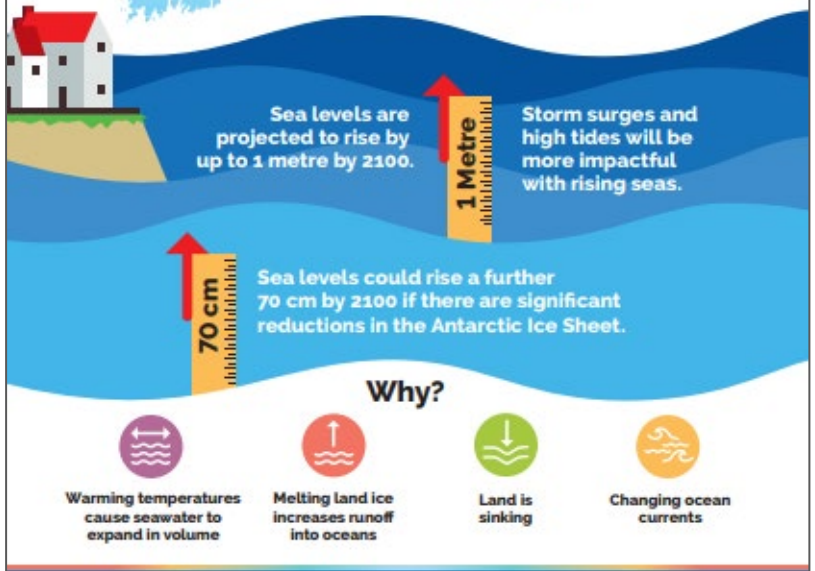
Sea Levels Are Rising



Why?

- Warming temperatures cause seawater to expand in volume
- Melting land ice increases runoff into oceans
- Land is sinking
- Changing ocean currents

Potential Impacts

- Strong storm surges damage coastlines and communities.
- Saltwater could infiltrate and contaminate critical freshwater supplies.
- Seawater pushes further inland.
- Threats to wildlife species and shoreline ecosystems such as dunes and marshes that help protect us from coastal flooding.

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Our Oceans Are Changing

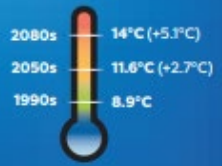
Warming waters

Temperatures are rising significantly in both surface and deep water, leading to longer and more frequent marine heatwaves.

Changing currents

As temperatures change, oceans currents could weaken in some places.

Sea surface temperature is projected to increase.



Decreasing oxygen levels

Warmer temperatures make oxygen less available.

Ocean acidification

Carbon dioxide dissolves in the ocean, which lowers pH and increases acidity.

Potential Impacts

More difficult for our marine species to thrive, causing some to migrate to more suitable habitat.

Acidity can harm organisms that form shells like molluscs, crustaceans, and corals.

Decline of eelgrass beds that filter water, stabilize sediment, and provide habitat for fish.

When marine ecosystems are threatened, so are the human livelihoods that depend on them.

Bernier et al. (eds.). 2016. State of the Atlantic Ocean Synthesis Report. Fisheries and Oceans Canada.

Bush & Lemmen, 2019. Canada's Changing Climate Report. Government of Canada.

Gulev et al., 2021. Atlas. In: Climate Change 2021: The Physical Science Basis. Intergovernmental Panel on Climate Change.

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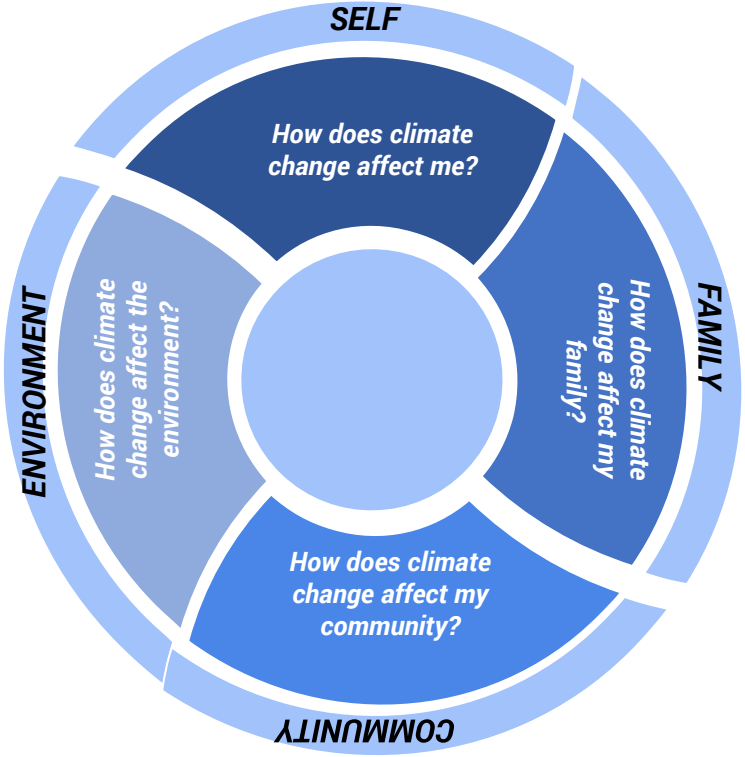


As a class investigate the following question:

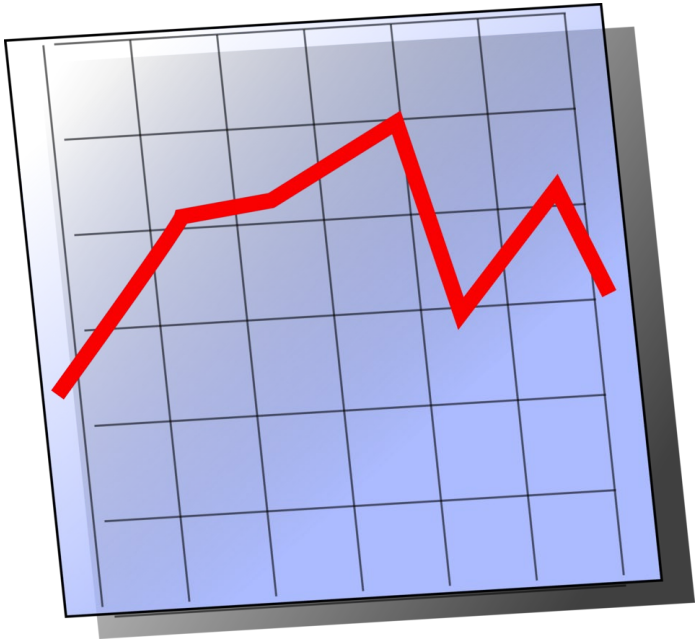
How does increasing the concentration of carbon dioxide affect the temperature inside the greenhouse?

Before Data Collection

1. How often should we collect the data?
2. How do we want to display the data?
3. Make a hypothesis to predict what will happen to the temperature when carbon dioxide is added to the greenhouse.

During Data Collection

1. What do you notice?
2. What patterns and trends do you observe in the data?
3. Describe any anomalies that you observe.



After Data Collection

1. Do the results support your hypothesis?
2. How did the temperature change?
3. What do the results tell us about the impact of carbon dioxide levels on temperature?
4. How does this model represent what is happening in the environment and in what ways does it differ?

Finding Evidence

In small groups

A. Develop a **testable question** that is open-ended and identifies the independent and dependent variables
B. Devise a **method** to carry out an experiment to answer your question
C. Discuss and refine the plan with classmates and teacher
D. Carry out the experiment
E. Communicate findings

How does (Independent Variable) affect (Dependent Variable)?

Independent variable	Dependent variable
• CO_2 level • Soil moisture • Light intensity • Wave length (coloured lights - red, blue or purple) • Temperature • Plant types (local vs. tropical) • Germination (types of seeds)	• Temperature • Soil moisture • Oxygen levels • CO_2 levels • Light intensity • Relative humidity

Check In

1. Create a testable question that can be answered using the Pasco greenhouse. The testable question must relate to the overall question, "*How can evidence be used to determine that the earth's climate is changing?*"
2. Identify the following variables: independent (the variable you change), dependent (the variable you measure), and controlled (variables that you keep the same).
3. Use your testable question and variables to develop a hypothesis.

Communicating

Questions to consider:

1. Based on the measurements that you collected using the greenhouse, what can you conclude?
2. How do your measurements compare to, support or refute those of your classmates?
3. How is your conclusion supported by scientific evidence regarding climate change?
4. What additional questions about climate change could be answered by measuring variables in the greenhouse?