

## INQUIRY CHAPTER ONE:

# What is Climate Change and Why Care?



## EMPOWERING LEARNERS IN A WARMING WORLD

A Climate Change Inquiry Guide for Secondary Educators

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# 1. What is Climate Change and Why Care?

In this initial inquiry, there are more activities than a class will most likely complete. We have included several activities so that every kind of class will find ideas, questions, activities that inspire learning.

Climate change is a wicked problem that is increasingly affecting human health, species distribution, and the ability of the earth's ecosystems to sustain our physical, economic, social, and environmental needs. The reports from the Intergovernmental Panel on Climate Change (IPCC) and other leading scientific organizations have become increasingly urgent. Alongside this urgency, media reporting consistently uses a doomsday framing, which can leave viewers with a sense of anxiety or paralysis.

In this inquiry, we suggest that educators begin by asking their students to identify one action that they've seen or heard of recently that inspires them about addressing climate change. We also suggest to frame learning pathways broadly by connecting to actions that students identify as personally relevant and important to them.



Photo: (2019). Michael Weatley Photography

## Before you begin: Background Information for Educators

Canada's climate is changing at an accelerated rate: since 1948 Canada's annual average land temperature has increased by 1.5°C—roughly double the global average level of warming ([Natural Resources Canada](#)). “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems” ([IPCC](#)). It is true that there are many natural forces that play a role in determining the Earth's climate: the Earth's orbit around the sun, changing ocean currents, very large volcanic eruptions and the Earth's tilt, and there is a great deal of evidence that the world has warmed and cooled in decades before humans existed. However climate changes have never occurred at a pace as rapid or as drastic as we have seen since pre-industrial time, and these changes cannot be explained by any natural phenomena ([Prairie Climate Centre](#)). These changes are a cause for concern but, more importantly, they are also a call to action to mitigate current and future effects.

Some of the many impacts of climate change include: biodiversity, ecosystems, species loss and extinction. If the global community is able to limit the increase in temperature to 1.5 degrees, the impacts on terrestrial, freshwater and coastal ecosystems are expected to be lower. According to the [Council of Canadian Academies' expert panel on climate change risks and adaptation potential](#), Canada faces substantial risk with a likelihood of significant losses, damages, or disruptions in Canada over a 20 year timeframe in the following areas: agriculture and food; coastal communities; ecosystems; fisheries; forestry; geopolitical dynamics; governance and capacity; human health and wellness; Indigenous ways of life; northern communities; physical infrastructure; and water.

Overall, Canadians are quite certain that climate change is happening. According to a [recent survey conducted by Dr. Ellen Field and Learning for a Sustainable Future](#), 85% of all Canadians believe that climate change is happening. However, the population is less certain that humans are the primary cause of the warming climate; only 43% of respondents think that climate change is caused mostly by human activity. When this understanding is contrasted with the widespread scientific consensus that climate change is human caused, the urgent need for more comprehensive education on the subject is made clear. In a thorough literature review, [Cook and colleagues](#) found that after examining 11,944 climate abstracts from 1991 to 2011, 97.1% endorsed the consensus position that humans are causing global warming.

Another finding from the report, [Canada, Climate Change and Education: Opportunities for Public and Formal Education](#), found that 46% of students ages 12-18 are categorized as “aware,” meaning they understand that human-caused climate change is happening, but they do not believe that human efforts to stop it will be effective. This is an opportunity for schools to help students understand that there are strategies and solutions to address climate change if all sectors take action today.



## A. Provocations: Understanding Climate Change

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To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

### Idea 1: Affinity Mapping

Begin by asking students to identify one action that they've seen or heard of recently that inspires them about addressing climate change. Alternatively, you could ask students about one inspiring example of 'collective action' that they have seen around the world that proves countries or large groups of people can work together to accomplish change. Another alternative is to ask students to identify "a worry" they have about climate change.

Then together, create an Affinity Map to group, label and characterize the issues under different big ideas or related themes.

Example affinity map:



*Photo from: LSF PD workshop at Thames Valley District School Board (2019)*

### Idea 2. Videos

- 1) [New report warns of climate change risks for Canadian communities](#) [The National]-  
3:34 minutes

A news report done for the federal government highlights the top six areas of risk for Canadian communities.

- 2) [Climate Change 101 with Bill Nye](#) [National Geographic]- 4:09 minutes  
Climate change is a real and serious issue. In this video Bill Nye, the Science Guy, explains what causes climate change, how it affects our planet, why we need to act promptly to mitigate its effects, and how each of us can contribute to a solution.
- 3) [My Cheeseburger Footprint](#) [Margaret Sanchez]- 2:14 minutes  
This video tracks the 10 pounds of carbon dioxide gas emitted from the production of a single cheeseburger.
- 4) [The Physics of the Greenhouse Effect](#) [PBS]- 2:15 minutes  
This video segment describes how human activities are increasing greenhouse gas concentrations and explains what effect this might have on global temperatures.
- 5) [Climate Change: The Earth's giant game of Tetris](#) [Joss Fong]- 2:48 minutes  
This video explains climate change through the game of Tetris.
- 6) **Three finalists from [Climate Speaks 2019: Slam Poetry](#)** (High-school students from across New York describe, through eloquent and creative poetic language, their experiences and ideas about climate change)
  - a) [On Climate Denial](#) by Jordan Sanchez
  - b) [Earth's Downfall](#) by Jenny Gomez
  - c) [Off-Beat](#) by Eliza Schiff

### Idea 3. Neighborhood Walk

Take your class outside on a [Neighbourhood Walk](#) to look for opportunities for local climate change learning. Ask students to identify natural, human, and built systems that impact climate change and to look for evidence of systems or features that may have been altered by climate change (purposefully or not).

During your walk-about, look at both the *natural environment* (flooding areas, stress of trees, buds or flowering at irregular times, etc.) and *built-environment* (non-permeable or permeable surfaces, energy sources, transportation options, opportunities for energy efficiency or active transportation, potential community partners, etc.).

Ask students to document their observations through photos, sketches and notes.

Some other examples of features to note on the walk:

- Bike paths
- Parks (natural areas)
- Cars

- Storm sewers
- Local businesses
- No idling zones

## B. Question Generation

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At this point in the inquiry, we want to harness students' curiosity and build off of the provocations that have captured their interest by generating meaningful questions to continue to drive the learning process. This section will outline several pathways for question generation depending on the provocation(s) that your class engaged with.

### Idea 1. Affinity Mapping: Climate Inspiration

Working with the issues generated in your Affinity Mapping exercise, use the [Question Formulation Technique \(QFT\)](#).

With these questions, repeat the original [Affinity Mapping](#) exercise to see how the questions group together.

Once all questions have been sorted, develop categories and ask students to work in groups or individually to develop [Umbrella Questions](#) focused on the “big ideas” of climate change. These questions will help ground the inquiry.

### Idea 2. Video Follow up Questions

General Questions:

- What did you hear that surprised you?
- Is there anything that you need to do more research on before you are fully convinced?
- How does this new information connect to what you already know about climate change?

#### Video 1

Speaking about community leaders, the CBC reporter says that their response options are: “they can either adapt or adapt.” What do you think he is really trying to say with this statement?

#### Video 2

What are some of the differences between historical climate changes and the current climate changes we are seeing today? Why is this distinction important?

Bill Nye says that the most important thing to take away from this video is that ‘climate change is real and it’s happening.’ This is a simple statement supported by a lot of evidence, but it is something that is not agreed upon by everyone; why could this still be the case? How might it be slowing progress?

### Video 3

The connection in this video between human activity and greenhouse gases is not the most obvious one. Are you surprised at the impacts of a cheeseburger? Why or why not? Are there certain foods that you think would emit less greenhouse gases in production?

### Video 4 and 5

Create a visualization of the greenhouse effect and depict some of the ways in which humans are increasing greenhouse gas concentrations.

Students as teachers: invite students to describe the greenhouse effect in their own words. How might you teach a peer, younger student, or parent about this phenomenon?

How does Tetris accurately depict the greenhouse effect? Can you think of another analogy that works in its place?

**Video 6** (choose one video, or divide students into groups to analyze different poems)

- Watch the video at least twice, once alone and once in a group or as a class
- What messages were these students trying to get across?
  - Pull out the specific words and phrases that make you think that is the message
- How does the title of the poem relate to the spoken words?
- How did they use emotion and performance to convey this message?
  - How did it make you feel?

### Idea 3. Neighbourhood Walkabout Follow-up

*Adapted from Peel Region's Grade 9 [My Climate Awareness Lesson plan](#)*

a) After the walk, students will individually reflect on how the features that they observed in their neighbourhood exploration can be adapted to climate change or contribute to mitigating it. Students are to print or display the photos that they have taken and post sticky notes on each photograph describing how the feature or system positively or negatively affects climate change and how it has been or can be adapted to climate change.

b) Map the interconnections. Create a large foundation map of the community walk. Post on the classroom wall.

c) Sort photographs into categories and create map symbols for the categorized features

d) Ask students to place symbols in appropriate places around the map.

e) Individually ask students to post three of their photographs around the map.

f) After all students have posted their photos, provide each student with three pieces of yarn.

g) Individually, students must find at least three climate change interconnections among the features/systems in the region. Students use string or markers to create a web of climate change interconnection on the map. Using sticky notes, students must describe their chosen

interconnections and post it on the map.

**Tool: Journal**

Encourage students to record their thinking and learning throughout the learning process. The main reason for developing a journal is for students to then be able to look back and track their growth and progression with their connection to climate change. The entries can be a combination of personal reflections and assigned reflections. A journal can either be in a handwritten notebook or on a Google document.



## C. Knowledge Building

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### De Bono's Six Thinking Hats

At this stage, students may be ready to engage in a group knowledge building activity. [De Bono's Six Thinking Hats](#) will encourage students to open their minds to many alternative ways of thinking about the provocations and ideas that have been generated thus far in the inquiry process. Each student will be assigned one of six different coloured "hats", each thinking hat will indicate a different perspective or way of thinking about what climate change is, and why it is important to care about this issue. This activity tends to be very effective when students are working in groups.

The following chart provides a brief outline of what each coloured hat represents:  
(For a more detailed description of these hats, and question examples, please see our *Active Thinking Strategy Bank*)

White	Information	Asking for information from others.
Black	Judgement	Playing devil's advocate. Explaining why something won't work.
Green	Creativity	Offering possibilities, ideas.
Red	Intuition	Explaining hunches, feelings, gut senses.
Yellow	Optimism	Being positive, enthusiastic, supportive.
Blue	Thinking	Using rationalism, logic, intellect.

There are several options for which question to choose to fuel this exercise: you could use one of

the questions generated after the provocations, the umbrella question that the class came up with, or you can take the freedom to focus in on a piece of information, perspective, or observation that the class was particularly drawn to thus far.



## D. Determining Understanding

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Ask students to fill out the “Know” and “Want” columns of a [KWL \(Know-Want-Learned\) Chart](#) in relation to the umbrella questions.

Use responses to inform and guide the learning process. They can provide insight into which concepts need clarity, what many students are already well informed about, and a general direction that many students want to pursue.

### Sample KWL Chart:

TOPIC:		
K – What I Already Know	W – What I Want to Know	L – What I Learned



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## E. Pursuing Learning: Foundational Climate Science Concepts

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At this stage, students may begin research to pursue their umbrella questions, or some of the following activities could be integrated into the process to ensure that students have an

understanding of foundational climate science. The activities listed below provide foundational climate science and address predominant misconceptions:

- Weather vs climate
- Greenhouse effect
- Carbon dioxide trends

### Activity 1: What's the difference between weather and climate?

Activity from a laboratory experiment at the Little Shop of Physics at Colorado State University

This activity is designed to provide clarity on the terms *weather* and *climate*. Through a hands-on demonstration (using M&M's) students will simulate documenting weather trends in a certain region over time. Students should understand, be able to explain and easily distinguish examples of weather vs. climate.

- Weather is a day-to-day state of the atmosphere, with short-term variation (minutes to weeks). It is what is happening when you look outside right now.
- Climate describes the range of what you might expect in a certain location at a general time of year. It describes the average and long-term weather trends.

Engage your students in the demonstration [here](#)

**EXTENSION - Get Outside:** Challenge students to find photo examples of climate and weather from the school yard. In the example below, students used photos of geese about to migrate to show climate.

**L.Gorman, Science - Grade 10**

1. To learn the difference between Climate and Weather, students went out into the schoolyard and took pictures of evidence of both, and created a photoshoot slideshow.
2. I always feel it's better for students to explore, and make their own connections, when learning certain new concepts, rather than me explicitly teaching it; more engaging when they go outside!
3. Technology always poses a challenge: access to it, slow systems, distractions, etc. Also, students found it challenging to find examples of climate around them.  
Next step: how do I assess this?



**In your own words, explain what weather is.**

Weather is when you look outside and see whats happening today. Like if it's raining or snowing. Or if it's sunny or cloudy. Or if it's hot or cold out.

The weather at school is windy today. This is weather cuz it could be something different tomorrow or next year on todays date. Like not windy.

The weather at school is warm (18 deg.) today. This is weather cuz it could be a lower temperature, colder like -25 in the winter time.

The climate at school is about to get cold soon so all the geese are getting ready to fly away. It gets cold every year soon.

I think climate is when you expect to see that same kinda thing at this time of year. Like its always hot in summer and cold in winter. U now what to buy for summer clothes when its spring cuz its supposed to be hot in the summer. And then you buy big jackets in the fall cuz is supposed to be cold in the winter

From: LSF PD workshop on sharing teaching practices in Rainbow District School board

## **Activity 2: Natural Greenhouse Effect: Life Giving vs. Life Threatening**

*Courtney Strutt, a M.Ed student at Lakehead's adaptation of Tom Puk's macromodel Stop Peeing into the Drinking Water (2017)*

This activity was designed to learn about the natural greenhouse effect through an active, embodied simulation. It requires a large open space for students to be actively running around. Each student represents either water vapour, carbon dioxide, a greenhouse gas or a light/heat wave, embodying different roles and experiencing the natural, life-giving wonder of the greenhouse effect.

This activity is followed by a debrief and discussion to help students consolidate their understanding of this natural process. Following the discussion, students will enact a different simulation: the anthropogenic greenhouse effect that is currently exacerbating climate change. Changing the ratios of molecules to represent the current state of the atmosphere should drastically change the outcome of the game. These differences should be discussed and used to motivate a “what now” discussion with your students.

See full instructions for the simulation [here](#)

## **Activity 3: Carbon Dioxide Trends**

*Activity from Climate Change: Connections and Solutions, Western Washington University (2013)*

In this activity students will explore long-term atmospheric carbon dioxide trends over the past 45 years. They will predict future carbon dioxide emissions based on the graph as well as examine historical carbon dioxide data.

After a discussion about the greenhouse effect and the human activities that contribute to it, students will work in pairs using climate data provided by Western Washington University to graph the data and note any trends that they observe. This resource provides discussion questions that address general correlations like carbon dioxide and time of year, predicting carbon dioxide levels in future years based on past data, and predicting activities that may speed or slow increasing levels.

Access the full lesson [here](#) (page 19).



## **F. Consolidation**

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This step is designed to encourage students to integrate and synthesize key ideas. When students make connections and see relationships within and across lessons, this helps them to solidify knowledge and deepen understanding.

### **Idea 1. Journal reflection prompts:**

- This is why I care about climate change.

- Thinking about my umbrella question, this is why I think the question is important and what I currently know.
- Reflect how you would explain (text or drawing) any of the following to a classmate, family member, or neighbour: climate vs. weather, how the greenhouse effect works, carbon dioxide as a primary cause for climate change.

### **Idea 2. Visual processing cards:**

Using a deck of [visual processing cards \(chiji or climer cards\)](#), spread these out on the floor or on a table. Ask students to pick a card that reflects something that they have learned today. This is ideally facilitated in a circle and can be a go-around, popcorn-style, or a jigsaw.

### **Idea 3. Mental health check:**

Engaging in learning and teaching about climate change can be profoundly depressing, since coming to terms with the environmental and societal challenges required means confronting challenges that are on a scale that has never before been faced by humanity. While climate change is a large-scale problem, it is also a direct result of our collective choices and actions. There are strategies that can mitigate the worst projections and too often we do not focus enough on these.

If students are feeling overwhelmed, then build in reflection time to write in journals, spend time outside in a natural space, and honour emotions such as anxiety, grief, and despair. While the future is uncertain, there are many examples of positive actions happening all around the world, and too often these stories do not get media coverage (check out [The Happy Broadcast](#) to get some good news for a change!). Finding actions that students can get involved in is paramount and in the subsequent thematic inquiries there are many examples of school projects and activities. As we collectively oscillate between optimism and outrage, stories of the past can also be important for active hope pathways.

#### **Case Study: Two Billion Trees and Counting - The Legacy of Edmund Zavitz**

Edmund Zavitz (1875-1968) rescued Ontario from the ravages of increasingly more powerful floods, erosion, and deadly fires. Wastelands were taking over many hectares of once-flourishing farmlands and towns. Sites like the Oak Ridges Moraine were well on their way to becoming a dust bowl and all because of extensive deforestation.

Zavitz held the positions of chief forester of Ontario, deputy minister of forests, and director of reforestation. His first pilot reforestation project was in 1905, and since then Zavitz has educated the public and politicians about the need to protect Ontario forests. By the mid-1940s, conservation authorities, provincial nurseries, forestry stations, and bylaws protecting trees were in place. Land was being restored.

Just a month before his death, the one billionth tree was planted by Premier John Robarts. Some two billion more would follow. As a result of Zavitz's work, the Niagara Escarpment, once a wasteland, is now a UNESCO World Biosphere. Recognition of the ongoing need to plant trees to protect our future continues as the legacy of Edmund Zavitz.

This massive tree planting campaign occurred in the last hundred years—just think what could be accomplished in the next hundred years!

## Assessment Idea



Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

### < RAFT Strategy

The [RAFT](#) (Role, Audience, Format and Topic) is a strategy that helps students understand their role and how to effectively communicate their ideas clearly to their chosen audience. It incorporates the principles of Universal Design Learning (UDL) by encouraging multiple formats for their assignment, and the topic they'll be writing about. Teachers put the different choices for each category on the board and allow students to select their individual RAFT. Check [here](#) for more information on this strategy.

### Sample Ideas for Each Category of the RAFT Strategy

RAFT			
R - Role	A - Audience	F - Format	T - Topic
<b>Journalist</b> <b>Blogger</b> <b>News anchor</b> <b>Instagram influencer</b> <b>Student</b> <b>Politician</b> <b>Scientist</b>	Newspaper reader Internet followers Teacher Students Parents Politicians General Public	Blog Rant Video Poster Newspaper article Letter Campaign	To be chosen by the group or individual

		Commercial	
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## G. Take Action:

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Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco-anxiety.

### Ideas for Taking Action:

- Educate your community about the risks posed by climate change
  - Create posters that represent some of the local risks to your community
  - Organize an assembly to present information in an engaging manner
- Perform a school-wide waste audit, and make a plan for a less wasteful path forward
- Take a personal or class pledge to make lifestyle changes
  - Reduce meat intake
  - Reduce use of single-use plastics
  - Walk or bike to school

### Action Project Examples:

- Project Drawdown, Chelmsford Valley District Composite Schools - Chelmsford, ON
  - Students were asked to research the 100 solutions to climate change on the [Project Drawdown Website](#) and then chose one that they thought was viable at the family level that they could encourage others to implement. Students then created a video, slideshow, infographic, or newspaper article outlining the actual costs and challenges of implementing the solution. Students were quite excited to learn that there are things that can be done by individuals to create change. They asked many questions, and researched actual current prices required to implement, after which they concluded if the solution was/was not viable for them and/or the average family.
- Multifaceted Sustainability Awareness Campaign - Grant Park High School Green Team - Winnipeg, MB (2019)
  - By creating and selling hoodies and plants-in-a-bag, the Grant Park Green Team raised money to support a number of sustainability initiatives including: an assembly on the topic of turning social media passion and activism into real change, encouraging students to make a pledge to change something for an entire month, working to change the school light bulbs to LED, better access to recycling around the

school, and investing in materials for a school wide vermicomposting system. [See their project here](#)