

Chapter 2: How Does Climate Change Affect Our World

Inquiry 3: How is Biodiversity Affected by Climate Change Using a Systems Thinking Approach?

- < **Provocation** –Poster
- < **Question Generation** – Umbrella Questions
- < **Knowledge Building** – Four Corners
- < **Determining Understanding** – Doodling/Sketching
- < **Pursuing learning** – Adventure Scientists
- < **Consolidation** –Card Sort
- < **Assessment** – Headlines
- < **Take Action**



A. Provocation

To hook student interest, introduce the provocation to initiate student thinking.

Poster

A good digital [poster](#) presents information clearly, but doesn't draw on data, as an infographic does.

Example Activity:

Share the following poster from [Ingenium's Let's Talk Energy](#) resource with your students. Explore the visuals before deconstructing the text. Notice the use of colours - grey, green, brown, and blue. Explore the different features of this poster, including the text, font, images and backgrounds and have students relay the "story" and information that this poster conveys. What questions emerge from this exercise?

Climate Change and Biodiversity

Biodiversity is about **living things** and their relationships with each other



This includes **species, ecosystems** and the **ecological processes** of which they are a part

The **earlier arrival** of spring changes the **life cycles** of many plants that provide food and habitat for other species



Many species won't be able to **adapt** quickly enough to changes in their **environment**



Habitat fragmentation



happens when natural landscapes are broken up by development such as river dams and highways, which can interrupt migration routes

Phenological mismatches



happen when the life cycles of dependent species change and no longer match up

E.g., migratory species arrive at a site after their prey has passed

Northern ecosystems are vulnerable to habitat loss and could see an influx of new species and diseases from the south



More CO₂ in the atmosphere and higher temperatures could lead to **longer growing seasons** for forests

Habitat destruction

In **prairie ecosystems**, more droughts will likely harm the growth of natural grasslands



Extreme storms and rising sea levels can cause coastal squeeze



Climate change can cause **Range contraction** when already limited habitats change and shrink further



Climate change can lead to competition for resources among species, as well as bigger and more frequent **infestation outbreaks**



Hybridization

is the mixing of different but similar species, and can drive rare species to extinction or increase adaptability

Climate change causes harmful algae growth in **marine ecosystems**, which are also at risk of pollution, commercial fishing and wetland drainage



Preservation through adaptation



Protect - nature reserves and marine sanctuaries
Connect - wildlife crossings, bridges and corridors
Restore - selective fishing, animal breeding programs

Possible Discussion Questions:

- What is the main point of this poster?
- There are many different font types on this poster. Why do you think these different fonts are used?
- What new vocabulary is being introduced and how does the poster help us learn these new words?
- Which plant and animals in your neighbourhood/community could be further affected by climate change?
- How does the poster make you feel?
- How does the information make you feel?
- What actions do you want to take from the information you have learned from the poster?



B. Question Generation

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 pathways for question generation depending on the provocation(s) that your class engaged with.

Begin by creating [Umbrella Questions](#) to help ground the inquiry.

In the example below, the quotes are from the infographic and the questions are possible ones that stem from the quote. These questions can be used as stated or students can be encouraged to create and ask questions based on the quotes.

Example Activity:

- How is a habitat an example of a system?
- What are some of the problems, caused by climate change, that affect the biodiversity of a habitat?
 - How do each of these problems affect the biodiversity of a habitat?
- "Climate change affects biodiversity"
 - What is biodiversity?
 - How does climate change affect plants and animals?
- "Preservation through Adaptation"
 - What does adaptation mean?
 - What are some of the ways that adaptation can be used to preserve biodiversity?

C. Knowledge Building

At this stage, students may be ready to engage in a group knowledge building activity. It 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.

Use the [Four Corners](#) technique to promote listening, verbal communication, critical thinking, and decision-making.

Example Activity:

Generate a [controversial] statement related to the information presented in the poster or from the questions generated in the [Umbrella Questions](#) strategy. Place 4 choices around the room spaced in such a way that a group of students can come together for a conversation. The choices can be statements such as “strongly agree”, “agree”, “disagree” and “strongly disagree”, or other statements where students need to choose and be able to describe their feelings towards or understandings of.

Examples:

- “The mixing of different but similar species, such as wolf and coyote, will drive the species to become extinct.”
- “Warmer weather is better for birds and animals that depend on plants to survive.”
- “New roads and highways are good for nature as they keep traffic moving, causing less idling time for cars and trucks.”
- Or others...



D. Determining Understanding

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.

After determining your umbrella questions and participating in the four corners activity, explore this strategy to determine next steps.

[Doodling/sketching](#) is a strategy for group mapping of what information is known to date. Watch [this video](#) for tips on how and why to use drawings as “powerful effects on learning”.

Example Activity:

Give each group of 3-4 students a piece of blank chart paper and some markers. Ask them to plan and sketch, together as a group, using pictures and some words, their understanding of some of the concepts introduced through the poster. The point is not the quality of the drawings but the students’ abilities to demonstrate knowledge linguistically, visually and kinesthetically.



E. Pursuing Learning: Impacts on the Environment

At this stage, students may begin research to pursue some of their 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 will enrich the understanding of climate change.

Become an “[Adventure Scientist](#)” who helps active science research by collecting data in the field. Scientists and adventurers, of all ages, spend time in the field collecting valuable data used to make decisions and solve real world problems. Check out their website at the above link.

In partnership with [National Geographic Education](#) and [Adventure Scientist](#), students can participate in a schoolyard biodiversity adventure called [Ring of Darhad: Mongolia Wolverine Expedition](#). Below is the link to the specific lesson on schoolyard biodiversity data collection.

Example Activity 1:

[Lesson Overview](#): Become an adventure scientist by exploring the biodiversity of your schoolyard. Use a field journal to plan and prepare for your adventure, collect data in the field, and draw conclusions from your findings. The link takes you to the lesson, including background information, learning objectives and detailed instructions including a reproducible field journal and data collection tables.

Example Activity 2:

Jobs in a biotic community. Students survey a specific habitat, looking for organisms that inhabit that habitat and look for evidence of these organisms doing their “job”. [Here is a link](#) to the lesson from Ecoliteracy.ca



F. Consolidation

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.

Using the [Card Sort](#) strategy, teachers can check for students’ understanding.

Example Activity:

Create vocabulary/concept cards, using index cards or blank card stock paper. Students, working in groups of 3, are given a stack of cards with new vocabulary, concepts and ideas on them. Have students sort cards into groups that connect with each other and have students explain their connections. For example: biodiversity - living things - ecosystems - species, these cards can all be connected with an explanation as to how they are connected.



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.

The [Headlines](#) routine ensures students summarize what they know and understand in a concise manner.

Example Activity:

Have students write headlines that capture the most important aspect of this topic/issue in this inquiry. Ask, “How does your headline differ from what you would have said yesterday?”



Take Action:

These ideas for action can be utilized at any point in the learning process, whether it's now or after completing more guided inquiries. Note, the suggestions are consistent in each chapter.

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.

Choose any or all of the 4 suggested videos to view, discuss and to spark an inquiry.

- [Save Tomorrow](#) [Young Voices for the Planet] 7:21 minutes
Inspired by the other Young Voices for the Planet films, three 9-year-old girls realize that they might be able to make a difference, too. These youth in Lexington, MA team up together to change a town law (with unanimous support!) to allow solar panels on public buildings. They then turn their passion towards protecting the local forest habitat.
- [How we children save the world](#) [Plant for the Planet]: 5:21 minutes
The story behind Plant for the Planet—a youth perspective on how children can change the world and make a real impact in the climate crisis.
- [Canada Living Report](#) [World Wildlife Fund] 0:59 seconds
WWF's 2017 living planet report brings attention to the significant wildlife loss and takes a look forward to see “what can be done?”
- [Artivism for Nature](#) [World's Largest Lesson] 2:02 minutes
Students explore what it means to be Nature Positive and design a creative image of a tree, uploading it to a virtual forest as a demonstration of their commitment to being Nature Positive and wanting others to be too.

Possible Discussion Questions:

- What is your favourite place to be outdoors?
- How are young people making their voices heard?
- How can a “nature positive” attitude help local habitats and biodiversity?

Ideas for Taking Action:

- Plant trees
- Habitat restoration
- Collect data as citizen scientist such as local bird counts, schoolyard tree and plant surveys or participate in a [local bioblitz](#)

- Join student council and support initiatives and campaigns that help habitats and increase biodiversity
- Share your learning within your school and share your learning outside the class

Action Project Examples

- [Ten Canadian Schools' stories of Climate Action](#)
 - This document outlines a collection of promising practices of climate action taking place in 10 Canadian UNESCO Associated Schools. These 10 schools participated in a worldwide UNESCO pilot project to implement climate action as recommended in the UNESCO (2016) publication, *Getting Climate-Ready: A Guide for Schools on Climate Action*.
- [Young Voices for the Planet](#)
 - This website documents youth speaking out, creating solutions and leading the change. These youth solutions to the climate crisis include stories of California kids banning plastic bags, Florida students saving their school \$53,000 in energy costs, an 11-year-old German boy planting millions of trees and other young people changing laws, changing minds and changing society as they reduce the carbon footprint of their homes, schools and communities.
 - [Check out resources for Kids Taking Action here](#)
- [The Great Plant Hunt from Ecoschool Global](#)
 - The campaign aims to educate students about biodiversity, its importance and encourage them to take positive action.
- [Warming, Waste, Water, Watts, Wildlife \(W5\)](#)
 - Through this project, thousands of students will be given opportunities to assess, design, and build innovative solutions to environmental challenges.
- [Community Conversations for Climate Change](#)
 - In this activity, students talk to members of their community about some of the environmental and climate change they have noticed since they were young.