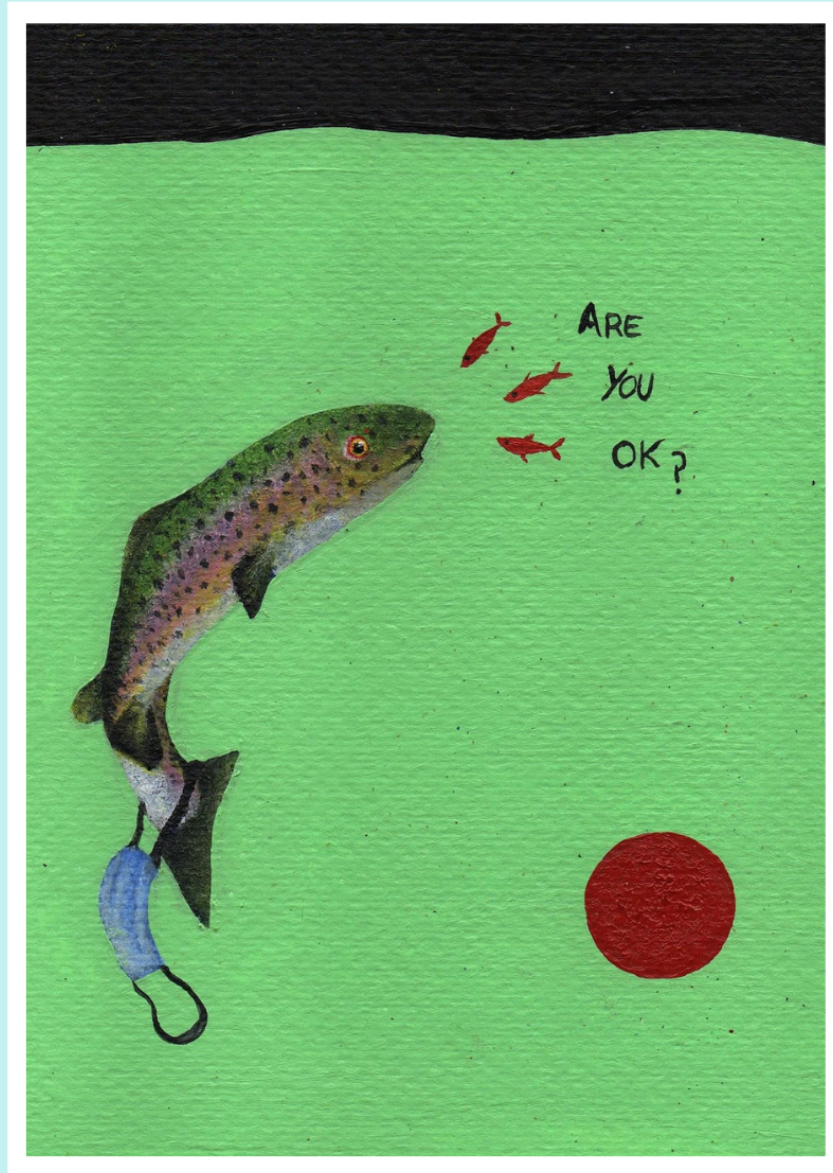


# CHAPTER 2:

## How does climate change affect our world?

*A Project of Learning for a Sustainable Future*  
*Contributors: Janice Haines, Nathalie Lauriault*



Art by Belen  
Gonzalez for  
ArtistsForClimate.org

A project of



Supported by Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) Program



Ressources naturelles  
Canada

Natural Resources  
Canada

Canada

## Chapter 2. How Does Climate Change Affect Our World?

These inquiries delve deeper into the multifaceted environmental effects of climate change. We encourage students to harness their curiosity about the local environment by examining changes to systems and through systems thinking, specifically ecosystems, biodiversity, and habitat loss, or by connecting with a community expert and exploring restorative practices. We have included a multitude of external resources and guiding questions to help support and extend student research and action.

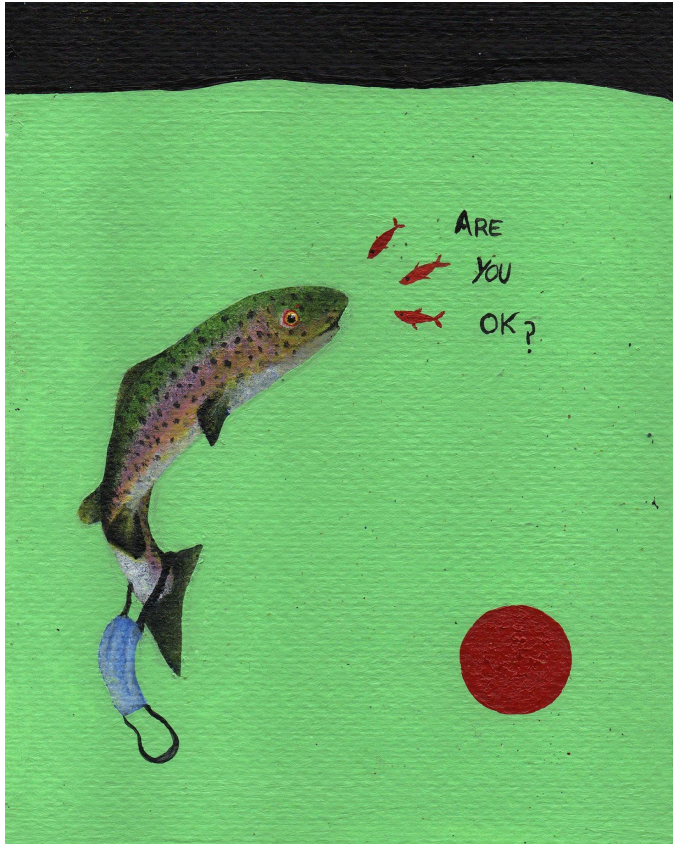


Photo by Belén González (Matitafore)

### Before you Begin: Background Information for Educators

Regions across Canada are already experiencing the effects of climate change. Many ecosystems are changing rapidly, and animals' habitats are changing at a faster rate than they can adapt. The [Living Planet Report](#) shows an average decline of 60% in animal populations between 1970 and 2014. In order to conceptualize some of the major environmental effects that can be attributed to climate change and trends that could emerge in coming years, the effects have been broken down into the following sub-categories: changes in temperature and precipitation, changes to the [cryosphere](#) (portions of Earth's surface where water is in solid form, including ice caps, glaciers, sea ice, snow cover, etc.), changes to freshwater resources, changes to ocean climate, and biodiversity changes.

### Changes in Temperature and Precipitation:

- In Canada, temperatures have increased by [1.5 degrees](#) above pre-industrial levels. Canada's position in the far northern hemisphere means that we are experiencing the effects of climate change at a higher rate than many other regions in the world.
- Warmer air has the potential to absorb more [surface water](#), resulting in both droughts and more intense precipitation events. Overall trends indicate that [Canada has become wetter in the past decade](#), with increased rainfall and decreased snowfall across many regions of southern Canada.
- Temperature and weather extremes are expected (very hot and very cold as well as very wet and very dry) leading to a higher risk of associated environmental hazards such as floods and droughts.
- Overall temperature warming is enhanced in the northern latitudes of the country.

### Changes to the Cryosphere (parts of the earth's surface characterised by the presence of frozen water)

- [Permafrost](#) temperatures in Northern Canada have been consistently rising 0.2 degrees per decade over the past 20-30 years.
  - Globally between 2007 and 2016, [there has been an average increase of 0.29°C ± 0.12°C in permafrost temperatures](#).
  - The effects of melting permafrost include the release of harmful [greenhouse gases](#) previously trapped within the ice and the reduction of structural support in regions previously covered by permafrost.
- [Glaciers have been melting at an accelerated rate since the beginning of the 20th century](#)—glaciers lost 11% and 25% of their surface area in Alberta and British Columbia, respectively, between 1985 and 2005. In British Columbia, respectively, between 1985 and 2005 ([Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation; Chapter 2, 2014](#)).

### Changes to Freshwater Resources

- Changes to freshwater resources across Canada are difficult to categorize as a whole due to the extreme regional variation that exists.
- Canadian data shows that water quality has remained stable in the vast majority of monitoring stations across the country (81%) between 2002 and 2016, improved in 10% of locations, and decreased in 9%.
- However, the levels of [PBDEs](#) (Polybrominated diphenyl ethers, persistent organic pollutants) remain above prescribed guidelines in the following locations: The Great Lakes, Pacific Coastal, and St. Lawrence.
- Excessive nutrients in both the Winnipeg River Basin and The Great Lakes area have caused detrimental [algae blooms](#) in these locations.



- Water levels across the Great Lakes (the largest surface freshwater system on Earth) broke seasonal or all-time record highs in both 2019 and 2020. These changes in water level are a wake-up call that these types of extreme conditions are not a worry for the future, but happening now. “Adaptation planning must manage uncertainty, rather than try to avoid it” (Kwakkel et al., 2016 - from [NRCAN National Issues Report](#), Chapter 4)
- “Combined changes in precipitation phase (e.g., rain or snow), earlier snowmelt, ice cover retreat and decreasing glacier mass affect Canadian river flows and lake levels. Future trends identified in Canada’s Changing Climate Report (Bush and Lemmen, 2019) and other studies, include: less water availability in southern basins, particularly in summer; increased frequency and intensity of water-related extremes; reduced water quality and more harmful algae blooms.” ([NRCAN National Issues Report](#) p. 196-197)

### **Changes in the Ocean Climate**

- [Trends in the Pacific, Atlantic and Arctic oceans indicate long-term warming of approximately 0.1 percent per decade](#), in both surface temperatures and bottom waters.
- Ocean temperature, acidity, and oxygen levels are affected by increasing atmospheric carbon dioxide levels.
  - Since the 1980’s the ocean has absorbed between 20-30% of total anthropogenic carbon dioxide emissions.
- The rate of ocean warming has more than doubled since 1993 ([IPCC](#)).
- Ocean levels are rising at a concerningly fast rate (in part due to the melting ice caps), which is increasing the risks of flooding and potential contamination of freshwater and groundwater, among other issues.
  - In Canada, a country surrounded by three different ocean bodies, the changes to ocean levels, temperature, and composition are of paramount importance.
- “NASA measures sea level around the globe using satellites. The Jason-3 satellite uses radio waves and other instruments to measure the height of the ocean’s surface – also known as sea level. It does this for the entire Earth every 10 days, studying how global sea level is changing over time.”
  - For resources explaining the effects of climate change on the oceans to young children visit [NASA’s Climate Kids](#).

### **Biodiversity changes in Canada:**

- Increases in the frequency and intensity of droughts, forest fires, and insect outbreaks in combination with direct human impacts like deforestation, pollution, and overharvesting are resulting in habitat loss and threatening the survival of many species ([Canada and a Changing Climate](#)).
- Changes to season lengths and times (such as earlier springs) are changing the growth and reproduction patterns of many plant species, which directly affects animals that rely on them for food and habitat.
- Physical changes in the landscape (e.g., higher water levels or human barriers such as roads, farms, and dams) can prevent animals from accessing food or breeding/rearing areas and can result in habitat loss.
- “The capacity of ecosystems and individual species to adapt to climate change through range shifts, however, is not without limits. Organisms are limited in the range of environments to which they can adapt.” ([NRCAN p. 284](#))



- “Since biodiversity is critical to ecosystem resilience and functioning, it is important to consider ecosystem services within the context of broader life support systems when investigating climate change impacts, ecosystem responses, climate change adaptation and greenhouse gas (GHG) emissions reduction (Biodiversity Adaptation Working Group, 2018).” ([NRCan p. 278](#))

**Human Impacts & Disproportionate Effects:**

Note: Environmental racism and environmental justice can be discussed in age appropriate ways. Suggested Resource to learn more: [Environmental racism in Canada: What is it and what can we do about it?](#)

**General Introduction to the Inquiries in this Chapter:**

This chapter offers 3 different structured and scaffolded inquiries to support *How Does Climate Change Affect Our World*. Each of the 3 inquiries begin with a provocation followed by numerous strategies and examples.

These steps can be completed in their entirety as stated. However, as inquiry is an organic and fluid process based on student input, educators may wish to adapt, modify or replace the suggested steps to create their own inquiry with their class. We therefore suggest that teachers review the whole chapter first in order to create a plan that will work best with their particular group of learners. The following 3 inquiries are connected to curricular concepts as shown in this chart. These curricular concepts are applicable across Canada.

Curricular connections	Concepts
Science	Ecosystems Systems Interdependence Changes Characteristics Stewardship Environment Sustainability
Social Studies	Physical features Location Systems Natural resources Human activities Interrelationships Cause Human-environmental interaction

The Arts	Improvisation Body Space Movement Interpretation Line Shape Form Colour
Physical Education and Health and Wellness	Fulfillment Contribution Connection Relationships Self-awareness Choice
Language	Communication Retelling Interpretation Objectivity

### Prior to Provocations: Journaling

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. Students scaffold their thinking throughout their learning journey. The entries can be a combination of personal reflections and assigned reflections. This can be done as illustrations, concept maps or written reflections.

## Inquiry 1: Systems in our World

Students will be introduced to systems and how a system is made up of interdependent parts. It is important for them to understand the basics of systems before they can understand how they are affected by climate change. They will discover through various activities how all the parts need to work together to create a healthy system, illustrated through different examples from all over the world and within the natural environment.

### Resources:

- Bike (can be as an artifact or images [Bike Parts](#))
- Art activity: play doh or pipe cleaners
- [Put the "Quest" in Question](#)

- This resource explains how you can use system thinking to tackle the Sustainable Development Goals. [Using Systems Thinking to Tackle the Sustainable Development Goals \(SDGs\)](#)

## **Inquiry 2: Systems in our Community**

---

Students will explore their local community through a neighbourhood walk, noting the systems at work that make it function. Students will begin to discover how they are part of different systems like their community, and how they can take responsibility and make positive contributions that can ultimately have an effect on climate change.

### **Resources:**

- [A Kid's Guide to Building Great Communities](#)
- [Put the "Quest" in Questions](#)
- [Community Game Board](#)
- [Systems for Community Game Part 2](#)
- [Descriptive Words for Places in Your Community](#)
- [Scenarios for Dream Community](#)
- [Animal or Insect](#)
- [Footage Of One Tree Over 365 Days Bringing Out Animals](#)

## **Inquiry 3: Systems in our Natural World**

---

Students will explore the systems at work in a local natural habitat. They will discover and understand the importance of how all parts of the natural world are connected. Students will realize that humans create climate change and can affect the natural system. They will be encouraged to find solutions to help the natural habitat.

### **Resources:**

- [Kindergarten - K-ESS2 Earth's Systems](#)
- [Natural Systems](#)
- [Bottle Ecosystem](#)
- [Rainforest in Canada! Where? - Pacific Rim National Park Reserve](#)
- [Put the "quest" in questions](#)
- Places to look for a local community expert:
  - Naturalist groups
  - Climate adaptation representative (municipal, provincial)
  - Ministry of Natural Resources
  - Conservation Authority/Agency
  - Conservation NGO



## Chapter 2 : How Does Climate Change Affect Our World?

### Inquiry 1: Systems in Our World

- < **Provocations** – *Artifact*
- < **Question Generation** – *“I Wonder” Wall, Question Formation Technique, Video Question Lesson*
- < **Knowledge Building** – *Knowledge Building Circle*
- < **Determining Understanding** – *Small Group Activity, “is/can/has” chart*
- < **Pursuing Learning** – *Art, Drama, Home Extension, Video*
- < **Consolidation** – *What’s All True*
- < **Assessment** – *Illustrate a system, Video*
- < **Take Action**



#### A. Provocation

---

To hook student interest, use the following provocation to initiate student thinking.

#### Artifact

Bring in a bike as an [Artifact](#) or look at this picture of a bike and explain to the students that the bike is a **system**. Have the students explore and manipulate the different parts of the bike.



Possible Questions:

- Why is the bike a **system**?
- How does it work?

Note: If you have a bike, you can spend some time moving the different parts, take it apart so that students see how a system is made of interdependent parts. If you use the picture, also print off [bike parts](#) so you can talk about how they work together.



## B. Question Generation

---

At this point in the inquiry, we want to harness students' curiosity and build off of the provocation that has captured their interest by generating meaningful questions to continue to drive the learning process. This section will outline an idea for question generation based on the provocation that your class engaged with.

Create an [“I Wonder” Wall](#).

Start with these two questions or a couple of your own and post them around the bike.

- *I wonder how one part impacts the other parts of the bike?*
- *I wonder what would happen if we took the tire off?*

Have the students come up with their own “I Wonder” questions. In groups, create as many questions as possible.

To generate questions, use the [Question Formulation Technique](#) to guide you:

- Ask as many questions as you can
- Do not stop to answer, judge or to discuss the questions
- Write down every question exactly as it is stated
- Change any statement into a question

Once the board is filled with many questions, group the duplicate questions together.

Next, watch this video: [“Put The Quest in Questions”](#) to help identify different types of questions to ask, inspire questions by developing tools and vocabulary to pose questions. Teach the students the difference between [open and closed](#) questions. Using an “O” for open and an “C” for closed, sort the questions into those that can be answered with some simple research (closed) and those that may lead to further investigation or a deeper inquiry (open). Review the questions together and prioritize those that they think will help the class better understand systems.



## 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 provocation and ideas that have been generated thus far in the inquiry process.

Engage in a class [Knowledge Building Circle](#) (outside is recommended if possible) using one of the questions that you generated from the bicycle activity or the “I Wonder” wall or the example below.

Possible [Umbrella Question](#): “What is a system?”



## D. Determining Understanding

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


### Small Group Activity:

Divide the class into groups of 3 or 4. Ask each group to identify another system in the real world. Each group must be able to share their evidence of why it is a system.

Examples: car, solar system, human body, community, school, etc.

# System









@nattylaurialt  
#learningtransfer





After completing the activity, complete this chart to help determine students' understanding of systems.

A SYSTEM...		
is	can	has





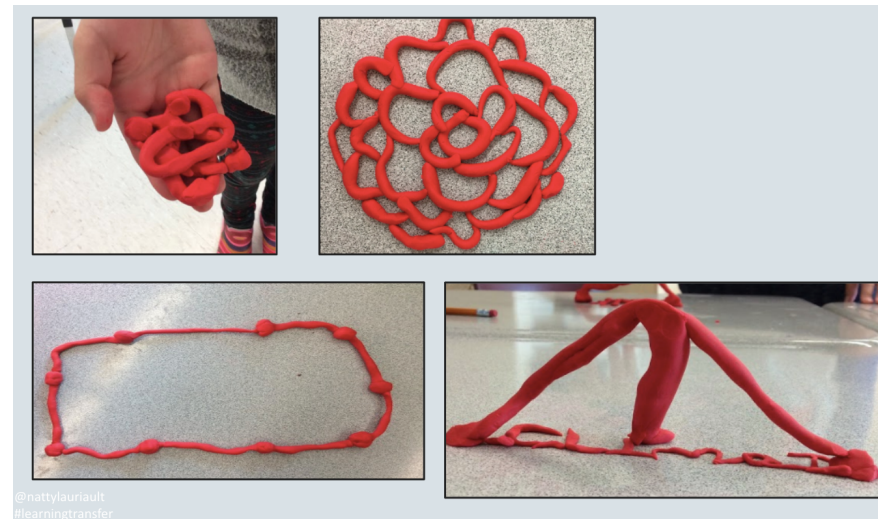
## E. Pursuing Learning

---

At this point, students can begin researching to answer their general questions, or some of the following activities can be incorporated into the process to ensure that students understand basic concepts of systems and the relationship to climate change. The activities listed below will enrich the understanding of the concept of a system and the relationship to climate change.

**Art:** In pairs or independently, have students interpret what a system is using plasticine or pipe cleaners.

Example:



**Drama:** Create a People System ( *adapted from: source: Tribes Learning communities by Jeanne Gibbs*)

One person begins the activity by assuming an interesting position and making a repetitive movement with a repetitive sound. The next person connects physically in whatever creative way he or she chooses, making a different movement or sound. People keep adding themselves to the system. Once the system is working, lightly tap one of the students (on the shoulder) or pass them a bean bag or other object to indicate to the student to sit up. Explain that this part is broken, notice what happened to the system. How does one faulty part of a system affect the whole system?

EXTENSION Video

### [What Are Systems?](#)

“Systems educator Linda Booth Sweeney considers what is a system and what’s not, what systems do, and why understanding systems is important.”

**Home extension:** Encourage students to go home and look for other systems in their world. Invite them to share their findings and evidence of why it is a system.



## 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.

Use the “All True” strategy from [Learning that transfers](#). Some additional information is found at [What's All True Explanation](#)? Students brainstorm while the teacher notes all the things they know that are true about the concept of systems.

**Possible Question:** What is all true about systems?

**And**

Explain how the bicycle is a system that helps the world. It reduces the carbon footprint and is a healthy system. Encourage students to find other systems in the world that are healthy systems.



## 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.

### Illustrate a System

Students will demonstrate their understanding by showing how a tree is a system. They are encouraged to present their understanding using the medium of their choice. As a class, make a list of the different presentation media (e.g., dance, visual art, concept map, film).

### Extension

This first video: “[Trees | Educational Video for Kids](#)” and a second video: “[Mangroves as a System](#)” are great examples of a tree system. Watch one or both of the videos and have the students compare and explain how a tree in their schoolyard/ neighbourhood is also a system.



## Take Action:

---

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. Remind students that even when things get hard and seem so big they can always do something by taking an action. Their actions will create an impact.

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

Ask the students what things can be done to make sure that all of the systems we talked about are working well and will help climate change?

Are there any projects that your students could partner with a community expert to increase biodiversity or help to restore a specific habitat?

One system that was talked about was a bicycle. What can we do with a bicycle that will help climate change? What can we do to encourage other students and people in our community to ride their bikes more often such as to school and work?

### Other Ideas for Taking Action:

- Habitat restoration
- Conduct a clothing drive
- Collect food donations for the local food bank
- Innovate sustainable solutions for school or community questions and problems
- Share your learning within your school and share your learning outside the class

## Action Project Examples

How could you use these great examples to come up with action projects with your K-2 students?

**“POLLINATOR GARDEN”** – Algonquin Public School- Woodstock, ON (2017) K-2

- The main focus of the project is to inform and support young children in developing their understanding of insect life cycles and the interconnectedness of the beautiful creatures to our lives and to begin to foster an appreciation for nature and how they can have a direct impact on their local and national environment. They learned about the decline in the Monarch Butterfly populations during a professional development workshop and decided to plant a pollinator garden. [See their project here.](#)
- 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*. <https://bit.ly/3mpPtY>
- 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. [Young Voices for the Planet](#)
  - Resources for Kids Taking Action: [Young Voices for the Planet | Award-Winning Film Series and Civic Engagement & Democracy Curriculum | For Kids](#)
- The Great Plant Hunt from Ecoschool Global
  - The campaign aims to educate students about biodiversity, its importance and encourages them to take positive action. [About the Campaign — Eco Schools](#)
- 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. [Warming-Waste-Water-Watts-Wildlife \(Alcoa W5\) — Eco Schools](#)
- Community Conversations for Climate Change
  - In this activity, students talk to members of their community about some of the environmental and climate changes they have noticed since they were young. [Community Conversations for Climate Change | The World's Largest Lesson](#)

## Chapter 2: How Does Climate Change Affect Our World?

### Inquiry 2: Systems in our Community

- < **Provocations** – *Neighbourhood Walk*
- < **Question Generation** – *“I Wonder” Wall, Question Formation Technique, Video Question Lesson*
- < **Knowledge Building**– *Neighbourhood Walk, Community game*
- < **Determining Understanding** – *Think/Pair/Share*
- < **Pursuing Learning** – *Book, 3D Art (Dream Community), Descriptive Words*
- < **Consolidation** – *Scenarios, Candy Wrapper Exercise*
- < **Assessment** – *Video, Choice of Media*
- < **Take Action**



#### A. Provocation:

---

To hook student interest, use the following provocation to initiate student thinking.

#### Neighbourhood Walk

Take students on a [Neighbourhood Walk](#). Before setting off, tell students that they will go outside to look for systems in the community. Remind them that a system is made up of interdependent parts and that all parts work together. Some examples include a road system, home settings, park, and forest.

Take photographs of the systems your students notice in the neighbourhood.

#### Possible questions:

- What systems do you notice?
- Could we add parts to make it a better system?
- Could we take away parts to make it a better system?



#### B. Question Generation

---

At this point in the inquiry, we want to harness students' curiosity and build off of the provocation that has captured their interest by generating meaningful questions to continue to drive the learning process. This section will outline an idea for question generation based on the provocation that your class engaged with.

Continue to add to your [“I Wonder” Wall](#). Post photographs of the systems that the students noticed on their neighbourhood walk. Have the students come up with their own “I Wonder” questions. In groups, create as many questions as possible.

Possible Questions:

- I wonder what would happen if there were no road signs?
- I wonder what would happen if we added another school to the neighbourhood?
- I wonder what would happen if we planted more trees?
- I wonder if there are the same amount of trees in all neighbourhoods?
- I wonder if all communities are set up in similar ways?

\*Remember to generate questions following [Question Formulation Technique](#) rules for producing questions:

- Ask as many questions as you can
- Do not stop to answer, judge or to discuss the questions
- Write down every question exactly as it is stated
- Change any statement into a question

Add more questions to the board and put the duplicate questions together.

Watch the “[Put The Quest in Questions](#)” video (feel free to repeat the video as a reminder or review some of the prior lessons).

Have the students categorize the questions again using an “O” for open and an “C” for closed. Remind them that the closed questions can be answered with some simple research and the open questions may lead to further investigation or a deeper inquiry. Review and prioritize those questions that they think will help the class better understand systems in their community.



## 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 provocation and ideas that have been generated thus far in the inquiry process.

**Part 1-** Take another neighbourhood walk in your community. Use this [Community Game Board](#) to emphasize activities which stimulate more selective observation. Students use all their senses to identify different aspects of the community. Page 56 of [A Kid’s Guide to Building Great Communities](#) offers an example of the game that can be modified to your class needs.

**Possible questions:**

- Why is it important to use all your senses while making observations?
- What did you learn about the community that you did not notice before?

**Part 2-** When back in class, invite the students to review the things that they found and think about which systems that they interact with. Use system pictures, [Systems for Community Game Part 2](#), to sort the items. See if students can explain which system each picture could be a part of.





## **D. Determining Understanding**

---

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

Work together with your class to complete the following activity.

After spending some time learning about their community and the different systems that make it work, explore the [Think Pair Share](#) strategy to determine next steps.

### **Possible Questions:**

- We are all part of the classroom. Let's consider how!
- Are you part of the classroom system? How?
- Are you part of the school system? How?
- Are you part of the school yard system? How?
- Are you part of the community system? How?
- Are you part of the world system? How?
- How are you responsible for helping your community? What kinds of things can you do or do you do to help out?
- What makes you feel like you are part of the community?
- How are you part of a system?



## **E. Pursuing Learning:**

---

At this point, students can begin researching to answer their general questions, or the following activity can be incorporated into the process to ensure that students understand basic concepts of systems, community and climate change.

Read the book: [All Are Welcome](#) by [Alexandra Penfold](#) illustrated by [Suzanne Kaufman](#)  
Readers will follow a group of children through a day in their school, where everyone is welcomed with open arms. A school where students from all backgrounds learn from and celebrate each other's traditions. A school that shows the world as we will make it to be.

Have a discussion about different communities in the local/broader areas. Talk about the assets that different communities might have.

- How are rural and urban communities the same and different?

### **Potential Questions:**

- Should all communities have parks and trees?
- Do all communities have parks and trees?
- Are all communities the same? How are they different?
- What do all communities need so all people can access them and feel happy?
- What are some of the rules and laws that impact communities?

### Activity

As a class, build a dream community that is inclusive and accessible by all. *What would a dream community need for people of all identities to feel like they belong and have a space in the community?*

Place a large white paper in an area of the classroom where it is accessible to the students. Explain to the students that as a class they will add to the board to create a dream community. They can choose whatever type of medium they'd like (paint, crayon, markers) or use boxes and recycled materials. Use the [descriptive words](#) found in this link to help students think of places in their community



## 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.

Try to be “solutionaries”. Think about how your decisions affect everyone including the plants and animals: [What is a Solutionary?](#)

Once your community is built, look at these different [Scenarios for a Dream Community](#) and see what kinds of places that your students might add to their community depending on the problem that they have encountered.

**Extension:** [The Candy Bar Wrapper Exercise](#) (page 8)

Help students identify their own sphere of responsibility. Ask this question, “How far will you lean out of bed to pick up a candy bar wrapper?”

### Possible Questions:

- What does “sense of responsibility” mean?
- Does accepting responsibility mean that you will do something?



## 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.

### How the Systems Interact

Watch the following [video](#) prompt of a tree and note how many different animals pass by this tree in a year.

Students then choose an [Animal or Insect](#) and think of three ways a tree is important to this animal or insect (e.g., home, food, shelter). Students are encouraged to present their understanding using a medium of their choice. As a class, make a list of the different presentation media (e.g., dance, visual art, concept map, video, etc.).



### Take Action:

---

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.

Remind students that even when things get hard and seem so big they can always do something by taking action. Their actions will create an impact.

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

Ask the students what things we can do to make sure that all of the systems we talked about are working well and will help climate change?

Are there any projects that your students could partner with a community expert to increase biodiversity or help to restore a specific habitat?

One system that we talked about was a bicycle. What can we do with a bicycle that will help climate change? What can we do to encourage other students and people in our community to ride their bikes to school and work?

### Other Ideas for Taking Action:

- Habitat restoration
- Conduct a clothing drive
- Collect food donations for the local food bank
- Innovate sustainable solutions for school or community questions and problems

- Share your learning within your school and share your learning outside the class

## Action Project Examples

---

How could you use these great examples to come up with action projects with your K-2 students?

**“POLLINATOR GARDEN”** – Algonquin Public School- Woodstock, ON (2017) K-2

- The main focus of the project is to inform and support young children in developing their understanding of insect life cycles and the interconnectedness of the beautiful creatures to our lives and to begin to foster an appreciation for nature and how they can have a direct impact on their local and national environment. They learned about the decline in the Monarch Butterfly populations during a professional development workshop and decided to plant a pollinator garden. [See their project here.](#)
- 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*. <https://bit.ly/3mpPtY>
- 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. [Young Voices for the Planet](#)
  - Resources for Kids Taking Action: [Young Voices for the Planet | Award-Winning Film Series and Civic Engagement & Democracy Curriculum | For Kids](#)
- The Great Plant Hunt from Ecoschool Global
  - The campaign aims to educate students about biodiversity, its importance and encourages them to take positive action. [About the Campaign — Eco Schools](#)
- 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. [Warming-Waste-Water-Watts-Wildlife \(Alcoa W5\) — Eco Schools](#)
- Community Conversations for Climate Change
  - In this activity, students talk to members of their community about some of the environmental and climate changes they have noticed since they were young. [Community Conversations for Climate Change | The World’s Largest Lesson](#)

## Chapter 2: How Does Climate Change Affect Our World?

### Inquiry 3: Systems in the Natural World

- < **Provocations** – *Posters, See/Think/Wonder, Think/Pair/Share*
- < **Question Generation** – *“I Wonder” Wall, Question Formulation Technique,*
- < **Knowledge Building**– *Invite a Speaker, Knowledge Building Circle*
- < **Determining Understanding** – *3-2-1 Strategy*
- < **Pursuing Learning** – *Science Experiment*
- < **Consolidation** – *Science Experiment*
- < **Assessment Idea**– *Story, Art*
- < **Take Action**



#### A. Provocation:

---

An initial provocation, also sometimes referred to as a “hook,” is used to spark interest and curiosity.

#### Poster

Posters can be a great way of gaining student attention and interest. This [link](#) identifies the advantages to poster use in education and suggests 6 attributes of an effective poster.

Use the following poster along with the [See / Think / Wonder](#) strategy to initiate discussion with your students.





**Possible questions:**

- What do you notice about the animals?
- What systems do you notice in the poster?

AND

Display the quote:

*"Look deeper into nature and then you will understand everything much better."* - Albert Einstein

Use the [Think Pair Share](#) strategy. Students first spend some time thinking about the quote, then turn to a partner and discuss their answers with each other.



**B. Question Generation**

At this point in the inquiry, we want to harness students' curiosity and build off of the provocation that has captured their interest by generating meaningful questions to continue to drive the learning process. This section will outline an idea for question generation based on the provocation that your class engaged with.

**I Wonder Wall**

Continue to add to your [“I Wonder” Wall](#). Post photographs of [Natural Systems](#) (ocean, grassland, [temperate rainforest](#), lakes, mountains, wetlands). Have students come up with their own “I Wonder” questions about the natural systems.

In groups, create as many questions as possible.

**Possible Questions:**

- I wonder what animals live in these different systems?
- I wonder what would happen if I built a house here?
- I wonder what would happen if the water was polluted with plastics?
- I wonder what would happen to the plants and animals if there was a huge fire in the mountains?

Remember to generate questions following [Question Formulation Technique](#) rules for producing questions:

- Ask as many questions as you can
- Do not stop to answer, judge or to discuss the questions
- Write down every question exactly as it is stated
- Change any statement into a question

Add more questions to the board and put any duplicate questions together.

Feel free to repeat the [“Put The Quest in Questions”](#) video or some of the lessons).

Have the students categorize the questions again using an “O” for open and an “C” for closed. Remind them that the closed questions can be answered with some simple research and the open questions may lead to further investigation or a deeper inquiry. Review and prioritize those questions that they think will help the class better understand natural systems.



## **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 provocation and ideas that have been generated thus far in the inquiry process.

**Invite a speaker**

Invite a local community expert to learn about local climate impacts and local climate action responses.

Places to look for a local community expert:

- Naturalist groups
- Climate adaptation representative (municipal, provincial)
- Ministry of Natural Resources
- Conservation Authority/Agency
- Conservation NGO
- Indigenous Elders/Communities

Students can have the questions they generated on hand to prompt them to ask the speaker. Following the visit from the speaker, hold a [Knowledge Building Circle](#) example (outside is recommended if possible) so that students can voice what they've learned and build on their previous knowledge.

*Possible Question:*

- How is climate change affecting the systems in our community and natural world?



## **D. Determining Understanding**

---

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

After hearing from your community expert, explore this strategy and follow up with the second poster to determine next steps.

**Summarize Guest Speaker** using the [3-2-1 Strategy](#):

3-2-1		
3 things I learned	2 things I want to learn more	1 question I have

Note: For younger students it is recommended you do this as a whole class exercise.

### **Poster**

Ask the students how human habitation affects the natural systems.



(Source: [Kindergarten - K-ESS2 Earth's Systems](#) )

**Possible Questions:**

Is there a relationship between animals and humans?

How do humans affect the environment? (address this question from both a positive and negative perspective).



**E. Pursuing Learning: Impacts on the Environment**

At this point, students can begin researching to answer their general questions, or some of the following activities can be incorporated into the process to ensure that students understand basic concepts of systems, community, natural world and climate change.

**Science experiment: [Build a Bottle Ecosystem](#)**

The purpose of this experiment is to show how an ecosystem works. By varying certain parts of the system, we will show how the ecosystem can be affected.

Before starting the experiment, divide the class into 4 groups. Each group will build a bottle ecosystem but each will be slightly different.

Create an ecosystem so that you can make comparisons between the [control](#) and their bottles. Each group should use this worksheet to document the process: [Bottle Ecosystem](#)

Group 1: add more pebbles (half soil and half pebbles)

Group 2: add some moss instead of soil

Group 3: add compost instead of soil

Group 4: add only one seed and no pebbles

**Possible questions:**

- How is your bottle a system?
- How does the system work?
- By changing one interdependent part of the system, does it affect the other parts? How?
- Which bottle seems to be doing the best? Why?
- If you add something to your bottle or take away something will it help make it better?

Interesting article to share with the students: [The sealed bottle garden still thriving after 40 years without fresh air or water | Daily Mail Online](#)



## **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.

Once the [Bottle Ecosystem](#) is complete, have students observe it over the next few days, encouraging them to record their observations in their journals.

Older students are encouraged to measure the growth of their plants.

**Possible Question:**

Can you think of other situations in the real world where changing something affects other systems?



## **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.

## **Story**



Once upon a time there was a forest and all living things lived peacefully together. The birds ate the seeds that the trees produced. The mice hid under the trees for shelter and warmth. The birds also built nests in the trees. Their young felt safe there, away from predators. Caterpillars ate the leaves and then cocooned to become beautiful butterflies. In the Fall, the squirrels buried the nuts the tree produced to prepare for winter. They also liked to climb up and down the trees for exercise.

One day, a family came along and cut down the trees to build a beautiful log house. Suddenly, all the living things were confused and didn't know where to find shelter, food and water!

Can you help the family by showing them what they could do to help the natural world stay happy and safe?

Instructions:

- On a large sheet of paper, invite students to draw a wooden house in the center of the paper.
- Encourage students to draw things around the house that humans could add to improve or help the natural environment.



### **Take Action:**

---

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.

Remind students that even when things get hard and seem so big they can always do something by taking an action. Their actions will create an impact.

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

- Ask the students what things can be done to make sure that all of the systems we talked about are working well and will help climate change?
- Are there any projects that your students could partner with a community expert to increase biodiversity or help to restore a specific habitat?
- One system that we talked about was a bicycle. What can we do with a bicycle that will help climate change? What can we do to encourage other students and people in our community to ride their bikes to school and work?

### **Other Ideas for Taking Action:**

- Habitat restoration
- Conduct a clothing drive
- Collect food donations for the local food bank
- Innovate sustainable solutions for school or community questions and problems

- Share your learning within your school and share your learning outside the class

## Action Project Examples

How could you use these great examples to come up with action projects with your K-2 students?

### “POLLINATOR GARDEN” – Algonquin Public School- Woodstock, ON (2017) K-2

- The main focus of the project is to inform and support young children in developing their understanding of insect life cycles and the interconnectedness of the beautiful creatures to our lives and to begin to foster an appreciation for nature and how they can have a direct impact on their local and national environment. They learned about the decline in the Monarch Butterfly populations during a professional development workshop and decided to plant a pollinator garden. [See their project here.](#)
- 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*. <https://bit.ly/3mpPtY>
- 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. [Young Voices for the Planet](#)
  - Resources for Kids Taking Action: [Young Voices for the Planet | Award-Winning Film Series and Civic Engagement & Democracy Curriculum | For Kids](#)
- The Great Plant Hunt from Ecoschool Global
  - The campaign aims to educate students about biodiversity, its importance and encourages them to take positive action. [About the Campaign — Eco Schools](#)
- 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. [Warming-Waste-Water-Watts-Wildlife \(Alcoa W5\) — Eco Schools](#)
- Community Conversations for Climate Change
  - In this activity, students talk to members of their community about some of the environmental and climate changes they have noticed since they were young. [Community Conversations for Climate Change | The World’s Largest Lesson](#)