SOCIETY AND ECONOMY

Canada in a Changing Climate

A Lesson Plan for Grade 9 and 10 Geography and Science Classes
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Overview

This teachers guide is designed to accompany the Natural Resources Canada report called Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (2014), available at www.nrcan.gc.ca/environment (Climate Change > Impacts and Adaptation). This report addresses current sensitivities to climate, as well as the risks and opportunities that climate change presents. The report also discusses adaptation options, approaches, and planning. It aims to inform the public and decision-makers about the importance of employing both adaptation and mitigation measures to significantly reduce the risks and magnitude of climate change.

By participating in activities like the ones in this module, students will develop a better understanding of the factors that contribute to climate change; and of the effects of climate change on society, the economy, and the environment. They will also explore the notion of adapting to climate change — both its existing effects and expected ones — to not only mitigate risks but also take advantage of possible opportunities.

The activities in this module aim to develop a variety of 21st-century skills such as critical thinking, creativity, collaboration, and communication. Teachers can present the activities as a module or individually.

Teacher Backgrounder

Climate Change: A Definition

What is climate change?

The term climate change refers to significant changes in average weather patterns (i.e., precipitation, temperature, wind, and other indicators) that persist within a climate system, caused directly or indirectly by human activity. Climate change can involve both changes in average conditions and changes in variability, including extreme events. While there has always been variation in the Earth’s climate, there is consensus in the scientific community that since the Industrial Revolution, human activity has increased the amount of greenhouse gases being released into the atmosphere; and that this is leading to a statistically significant increase in the Earth’s temperature — hence the expression “global warming.” Climate change is happening now.

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1 Most of the information in this section, unless otherwise noted, is taken from the report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, F.J. Warren and D.S. Lemmen, editors (2014); Government of Canada, Ottawa, ON. http://www.nrcan.gc.ca/environment

2 The Intergovernmental Panel on Climate Change uses the term “climate variability” for changes in weather patterns due to natural causes, and reserves “climate change” for shifts due to direct or indirect human activity.

3 http://www.climatechange.gc.ca/default.asp?lang=En&n=65CD73F4-1
It is this human-induced enhancement of the greenhouse effect that is of concern. Ongoing emissions of greenhouse gases have the potential to warm the planet to levels that have never been experienced in the history of human civilization.  

How does climate change affect us?

Researchers agree that we are seeing the impacts of climate change in Canada in various areas, including the following.

- **Natural resources development (forestry, energy, mining):** Climate change exacerbate climate extremes (e.g., extreme heat, cold, precipitation) and the resulting impacts and hazards. It also leads to gradual changes, such as permafrost degradation, sea level rise, and plant species migration — all of which affect the forestry, energy, and mining sectors. Climate change will also present new opportunities for the natural resource sectors, particularly in relation to northern economic development.

- **Industry:** Industrial activity is sensitive to variations in weather and to extreme events. The type of impacts and their extent depend on the industry, but production, operations, and revenue among and within sectors can be affected.

- **Human health:** Climate-sensitive diseases and disease vectors are moving northward into Canada (e.g., Lyme disease) and will likely continue to expand their range. In addition, new research suggests climate change will exacerbate health issues related to air pollution in some parts of Canada.

- **Water resources and infrastructure:** Well-maintained infrastructure is more resilient to a changing climate. This is especially true with respect to gradual changes in temperature and precipitation patterns. But there are key vulnerabilities associated with extreme weather events, which can overwhelm the capacity of water infrastructure.

- **Food production:** The impacts of climate change differ significantly between agriculture, fisheries, and non-commercial food supply, but common effects include increased losses from invasive pests and diseases, and risks to the transportation systems these sectors rely on.

- **Biodiversity:** Climate-related shifts in species distributions have already been documented for plants and animals in Canada. In many areas, shifts in species range are likely to result in novel ecosystems that have different species combinations, structural attributes, and ecological functions than existing ones.
Adaptation and Mitigation Measures

A changing climate presents both risks and opportunities for Canada’s regions and resource sectors. In this vast country with its diverse climate and economy, addressing climate change requires targeted and collaborative action that reduces greenhouse gas emissions (mitigation) and helps us adapt to climate impacts (adaptation).

### Adaptation

Adaptation involves modifying our decisions, activities, and ways of thinking to adjust to a changing climate. Here are some examples of adaptation measures to deal with climate change:

- modifying building codes to ensure that buildings can withstand flooding and/or other extreme events
- protecting coastal development with structures such as seawalls, dikes, beach nourishment, sand dunes
- regulating building development and taking measures against hazards (e.g., flood-proofing, flood hazard maps, flood warnings)
- expanding crops northward as the weather warms (e.g., sugar maple for maple syrup production)
- adjusting seeding and harvesting times

### Mitigation

Mitigation aims to reduce the causes of climate change. It is designed to reduce greenhouse gas emissions at the source or to support “sinks” that absorb or eliminate greenhouse gases. Here are some examples of mitigation measures:

- improving energy efficiency in all economic sectors to reduce our dependence on fossil fuels
- participating in a carbon tax scheme to incite industries to find creative ways to reduce greenhouse gas emissions
- increasing local agricultural capacity to avoid the transportation of food over long distances
- limiting deforestation, and/or replanting
- converting agricultural land to forests

There can be co-benefits, or synergies, between these two responses to climate change: in some cases, actions taken to adapt also serve to reduce greenhouse gas emissions, or mitigation actions also reduce vulnerability to climate change (see Figure 1). For example, green roofs — where vegetation is planted on the roofs of buildings — have adaptive benefits (e.g., moderated stormwater runoff, reduced urban-heat-island effect, and improved air quality) as well as mitigative value (e.g., reduced energy consumption, reduced greenhouse gas emissions, and increased carbon dioxide absorption). However, there is also the potential for conflict between adaptation and mitigation, where adaptation choices can increase greenhouse gas emissions. Using air conditioners to deal with higher temperatures, for example, means increased energy use and related emissions.
Climate change is happening now, which is why government, industry, and social enterprises around the world are actively engaged in developing adaptive strategies to reduce the negative impacts to society and the environment.
Glossary and Key Vocabulary

**Adaptation measure**: Any action that reduces the negative impacts of climate change or allows us to take advantage of new opportunities resulting from climate change.

**Biodiversity**: The variety of species and ecosystems and the relationships between them.

**Climate change**: A significant change in the Earth’s climate. The Earth is currently getting warmer because people are adding heat-trapping greenhouse gases to the atmosphere. The term “global warming” refers to warmer temperatures, while “climate change” refers to the broader set of changes that go along with warmer temperatures, including changes in weather patterns, the oceans, ice and snow, and ecosystems around the world. (epa.gov)

**Crop management and planning**: Planning and managing agricultural crops in order to optimize the use of soil nutrients.

**Ecosystems**: Community of living organisms (plants, animals and microbes) that interact with the physical components of their environment (air, water, soil).

**GHG sink**: Mechanism which is natural (e.g. photosynthesis) or man-made (e.g. underground carbon capture and storage) and which absorb atmospheric GHG (usually carbon or methane).

**Greenhouse gas emissions (GHG)**: Gases that allow the Sun’s rays to reach the Earth, but which absorb the infrared radiation reflected back by the surface of the Earth. They trap a portion of the solar energy, which reheats the planet’s surface sufficiently to maintain life. The accumulation of greenhouse gas emissions due to human activity amplifies the natural “greenhouse effect” and is the main contributor to global warming. (NRCan)

**Issues**: Things that can be gained or lost in terms of money (economic), society (social), laws (political), or the environment (environmental).

**Mitigation measure**: Action designed to reduce greenhouse gas (GHG) emissions in the atmosphere or to support GHG sinks.

*Definitions attributed to “NRCan” were taken or adapted from the Natural Resources Canada glossary, found at [https://cfs.nrcan.gc.ca/terms](https://cfs.nrcan.gc.ca/terms).*
**Suggested Resources**

**Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation**  
F.J. Warren and D.S. Lemmen, editors (2014); Government of Canada, Ottawa, ON  

**Canada's Marine Coasts in a Changing Climate**  
D.S. Lemmen, F.J. Warren, T.S. James, and C.S.L. Mercer Clarke, editors (2016); Government of Canada, Ottawa, ON  

**Climate Change: What Is Happening and How Do We Know?**  
Katherine Hayhoe (Nov. 12, 2016); Presentation at the Science Teachers Association of Ontario conference (start at 4:00 minutes)  
[http://youtu.be/-9LKaPWMaMc?t=246](http://youtu.be/-9LKaPWMaMc?t=246)

**Natural Resources Canada glossary**  
[https://cfs.nrcan.gc.ca/terms](https://cfs.nrcan.gc.ca/terms)

**Adapting to climate change**  
Quebec Centre for Biodiversity Science website  
[http://qcbs.ca/research/research-contracts/adapting-to-cc/](http://qcbs.ca/research/research-contracts/adapting-to-cc/)

**Intergovernmental Panel on Climate Change** – See most recent Synthesis Report (indicators, impacts, adaptation and mitigation options)  
[https://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml](https://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml)

**Climate change**  
Natural Resources Canada website, Forest Topics  
(effects, impacts, mitigation, and adaptation),

**Adaptation Library: Resources for Climate Adaptation**  
[http://www.adaptationlibrary.com](http://www.adaptationlibrary.com)

**Impacts and Adaptation**  
Natural Resources Canada website, Climate Change  

**Forest pest management**  
Natural Resources Canada website, Forest topics (includes videos)  

**Facing the Change: 5 Canadian Communities Threatened by Climate Change Now**  
CBC Radio  
### Strategic Planning by Province

<table>
<thead>
<tr>
<th>Province</th>
<th>Plan/Policy</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Climate Leadership Plan</td>
<td><a href="https://www.alberta.ca/climate-change.aspx">https://www.alberta.ca/climate-change.aspx</a></td>
</tr>
<tr>
<td>BC</td>
<td>Climate Leadership Plan</td>
<td><a href="http://climate.gov.bc.ca/">http://climate.gov.bc.ca/</a></td>
</tr>
<tr>
<td>NS</td>
<td>Climate Change Nova Scotia</td>
<td><a href="https://climatechange.novascotia.ca/">https://climatechange.novascotia.ca/</a></td>
</tr>
<tr>
<td>NB</td>
<td>New Brunswick: Climate Change</td>
<td><a href="http://www2.gnb.ca/content/gnb/fr/ministeres/egl/environnement/content/changements_climatiques.html">http://www2.gnb.ca/content/gnb/fr/ministeres/egl/environnement/content/changements_climatiques.html</a></td>
</tr>
<tr>
<td>ON</td>
<td>Climate Change Centre</td>
<td><a href="http://www.climatechangunavut.ca/">http://www.climatechangunavut.ca/</a></td>
</tr>
<tr>
<td>NFL</td>
<td>Climate Change</td>
<td><a href="http://www.ecc.gov.nl.ca/climate_change">http://www.ecc.gov.nl.ca/climate_change</a></td>
</tr>
</tbody>
</table>
## Learning Outcomes in Geography and Science

### Canadian National Standards for Geography, grades 9 and 10 (2001)

<table>
<thead>
<tr>
<th><strong>The World in Spatial Terms</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use maps and other geographic representations to analyze world events and suggest solutions to world problems.</td>
</tr>
<tr>
<td>• Use map projections to identify common factors that affect the development of spatial understanding and preferences.</td>
</tr>
<tr>
<td>• Use mental maps to answer geographic questions.</td>
</tr>
</tbody>
</table>

### Places and Regions

| • Evaluate how humans interact with physical environments to form places. |
| • Identify human and physical changes in regions and explain the factors that contribute to those changes. |
| • Interpret the connections between and within the parts of a regional system. |
| • How individuals view places and regions on the basis of their stage of life, gender, social class, ethnicity, values, and belief systems. |
| • Use regions to analyze geographic issues and answer geographic questions. |

### Physical Systems

| • Describe the ways in which Earth’s physical processes are dynamic and interactive. |
| • Describe how physical processes affect different regions of the Canada and the world. |
| • Evaluate ecosystems in terms of their biodiversity and productivity |

### Human systems

| • Analyze population issues and propose policies to address such issues. |
| • Classify and describe the spatial distribution of major economic systems and evaluate their relative merits in terms of productivity and the social welfare of workers. |
| • Analyze how cooperation and conflict influence the development and control of social, political, and economic entities on Earth. |

### Environment and Society

| • Explain the global impacts of human changes in the physical environment Analyze examples of changes in the physical environment that have reduced the capacity of the environment to support human activity. |
| • Explain the ways in which individuals and societies hold varying perceptions of natural hazards in different environments and have different ways of reacting to them. |

### Canadian Common Framework of Science Learning Outcomes, grades 9 and 10 (1997)

<table>
<thead>
<tr>
<th><strong>Nature of science and technology</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Illustrate how science attempts to explain natural phenomena</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Relationships between science and technology</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Apply the concept of systems as a tool for interpreting the structure and interactions of natural and technological systems</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Social and environmental contexts of science and technology</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Compare examples of how society supports and influences science and technology</td>
</tr>
<tr>
<td>• Defend a decision or judgement and demonstrate that relevant arguments can arise from different perspectives</td>
</tr>
<tr>
<td>• Describe possible positive and negative effects of a particular scientific or technological development, and explain why a practical solution requires a compromise between competing priorities</td>
</tr>
<tr>
<td>• Explain how society’s needs can lead to developments in science and technology</td>
</tr>
<tr>
<td>• Identify and describe science- and technology-based careers related to the science they are studying</td>
</tr>
<tr>
<td>• Provide examples of Canadian contributions to science and technology</td>
</tr>
<tr>
<td>• Provide examples to illustrate that scientific and technological activities take place in a variety of individual or group settings</td>
</tr>
<tr>
<td>• Provide examples of how science and technology affect their lives and their community</td>
</tr>
<tr>
<td>• Provide examples of how Canadian research projects in science and technology are funded</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Skills: Initiating and planning</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identify questions to investigate that arise from practical problems and issues</td>
</tr>
<tr>
<td>• State a prediction and a hypothesis based on available evidence and background information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Skills: Performing and recording</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Select and integrate information from various print and electronic sources or from several parts of the same source</td>
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<table>
<thead>
<tr>
<th><strong>Skills: Analysing and interpreting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interpret patterns and trends in data, and infer and explain relationships among the variables</td>
</tr>
<tr>
<td>• Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots</td>
</tr>
<tr>
<td>• Identify and evaluate potential applications of findings</td>
</tr>
<tr>
<td>• Identify new questions or problems that arise from what was learned</td>
</tr>
<tr>
<td>• Provide a statement that addresses the problem or answers the question investigated in light of the link between data and the conclusion</td>
</tr>
</tbody>
</table>
### Skills: Communication and teamwork
- Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others
- Communicate questions, ideas, intentions, plans, and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language, and other means
- Develop, present, and defend a position or course of action, based on findings
- Evaluate individual and group processes used in planning, problem solving, decision making, and completing a task
- Identify multiple perspectives that influence a science-related decision or issue

### Grade 10 Life Science (Sustainability of ecosystems)
- Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen
- Explain why different ecosystems respond differently to short-term stresses and long-term changes
- Explain various ways in which natural populations are kept in equilibrium and relate this equilibrium to the resource limits of an ecosystem
- Explain how the biodiversity of an ecosystem contributes to its sustainability
- Analyse the impact of external factors on an ecosystem
- Describe how soil composition and fertility can be altered and how these changes could affect an ecosystem

### Grade 10 Earth And Space Science (Weather dynamics)
Describe and explain heat transfer within the water cycle
- Describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents
- Describe how the hydrosphere and atmosphere act as heat sinks within the water cycle
- Describe and explain the effects of heat transfer within the hydrosphere and atmosphere on the development, severity, and movement of weather systems
- Analyse meteorological data for a given time span and predict future weather conditions, using appropriate methodologies and technologies

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Activity 1: What do you know about climate change?

Summary

This first brainstorming activity is designed to encourage students to activate their prior knowledge of climate change from an objective point of view and to get a better understanding of the overall knowledge shared by the group. It is important to remember that while more than 97% of scientists who publish work in academic journals agree that it is highly likely that human activity is responsible for global warming (and this number continues to rise), there will always be skeptics and those who deny this reality. To see a list of scientific groups that agree that humans are contributing to global warming, visit the NASA’s climate change website at https://climate.nasa.gov/scientific-consensus/.

Duration: 60 minutes

Learning outcomes

- Describe the various ways that human activity and technology impact both balance and interactions in the environment
- Describe the effect of human activity on greenhouse gas (GHG) emissions
- Define the vocabulary associated with climate change

Competency outcomes

- Critical thinking
- Research
- Communication
- Collaboration

Material:

- 3 packs of sticky notes in 3 different colours (e.g. 4 green, 4 yellow and 4 red per student)
- “Sharpie” style markers (1 per student)
- Climate change infographic
- Adapting to our Changing Climate in Canada poster (also available on the Natural Resources Canada website > Climate change publications, at http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/images/assess/2016/adaptation_poster_e.jpg)
- Computer with Internet access and projector
- Internet access for students (optional)
- Copies of the Student BLM: What are Greenhouse Gases (GHG) and what do they do?

What to do:

1. In order to help students think objectively, ask them the following question:

   *Over the last several years, we’ve seen that while there are many people who are concerned about the alarming effects of climate change and its impact on our environment, others still argue that climate change is an exaggerated phenomenon and that there is no reason to panic. What do you think about this?*
2. In order to answer this question in detail, students must first answer the question: *What do you know about climate change?* (It is important that they give their personal interpretations regarding what they have seen or heard themselves.)

3. Hand out 3 to 4 sticky notes in each colour to the students so that they can note down everything that they have seen or heard about climate change. They may note down as many statements about climate change as they like, but just one statement per sticky note:
   - Green sticky notes: “factual” statements (with explanations as to why they have no doubts about their veracity);
   - Yellow sticky notes: statements that they are not sure about or which are unproven (with explanations); and
   - Red sticky notes: statements about things they have seen or heard which they believe to be false (with explanations).

4. Divide the table or wall into three distinct sections (columns: the green column should contain "factual statements", the yellow column "unproven statements" and the red column "false statements"). Explain to the students that they can come up and stick their Sticky notes in the appropriate column once they’ve finished writing their climate change statement.

5. Once all students have finished writing down their statements and have stuck the sticky notes in the appropriate columns, take a look at the distribution of the colours on the table or wall and ask the students what their first impressions are.
   - Are there more yellow, green or red notes?
   - What do you notice?

6. With the students, try to create new categories for more sticky notes (e.g. causes, effects, consequences, actions). Assign a few sticky notes to groups of two students and ask them to put those notes into different categories.

7. Ask them to take it in turns to read some of the explanations given for the climate change statements and initiate a class discussion regarding the various explanations that the class has come up with for each category (green, red, yellow statements).

8. In order to connect the students’ explanations to current information on climate change, hand out student notebooks to each student. Ask them to each note down 1 to 2 statements in each category that they would like to learn more about.

9. To help them with their research, show them:
   - The collection of infographics included in this kit
   - A video illustrating what climate change is, such as *How does climate change affect biodiversity?* (California Academy of Sciences) [https://www.youtube.com/watch?v=XFmovUAWQUQ](https://www.youtube.com/watch?v=XFmovUAWQUQ)
• The website Skeptical Science (https://skepticalscience.com) which explores the concepts that people are skeptical about.

• Copies of the Student BLM: What are Greenhouse Gases (GHG) and what do they do?

10. Finally, ask students the following: Based on your observations and explanations, what conclusions can we come to?

How are falsehoods spread? The Serengeti Strategy

In the same way that a group lions will attempt to isolate a zebra on the outskirts of its group so that they can capture it more easily, a scientist may be targeted by individuals who mobilize their resources to attack and weaken him or her. The fight to defend themselves will take up a lot of the scientist’s energy and resources. The strategy succeeds not only in isolating a scientist from his or her colleagues (easier to attack an individual than to attack a group), but also serves as a warning to other scientists seeking to make their studies public. This strategy has been used to discredit Rachel Carson (effects of DDT on the environment) as well as the scientists who revealed the truth about the harmful effects of tobacco consumption.

http://www.meteo.psu.edu/holocene/public_html/Mann/articles/articles/MannBullAtomSci15.pdf
Activity 1–Student BLM: What are Greenhouse Gases (GHG) and what do they do?

a) Look at the picture above. In your own words, describe the role played by greenhouse gases on the Earth.

b) Are GHGs good for life on Earth or not? Explain.

c) Research the following greenhouse gases and note where they come from.

<table>
<thead>
<tr>
<th></th>
<th>Natural sources</th>
<th>Man-made/anthropogenic sources (caused by humans)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water vapour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide (N₂O)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorofluorocarbon (CFC)</td>
<td></td>
<td></td>
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</tbody>
</table>
Activity 2: Climate Change Mind Map

Summary

In this activity, students will draw a conceptual map showing 1) the physical impacts of climate change on the environment, and 2) their socio-economic consequences. Following the activity on Adaptation and Mitigation (p. 20), they will revisit the map to offer 3) adaptation strategies to address those consequences.

Duration: Two 60-minute sessions

Learning outcomes

After participating in the activity, students will be able to:

• Identify physical impacts of climate change on the environment, and
• Discuss the consequences of climate change on society and the economy.

Competency outcomes

During this activity, students will develop or improve these abilities:

• Critical thinking
• Collaboration
• Communication

Set-up and materials

- Computer and projector (for video capsules)
- Climate Change and the Environment infographic
- Climate Change and the Economy infographic
- Climate Change: Health and Urban Living infographic
- Copies of Mind Map Rubric for students
- Copies of the Climate Change and Society Mind Map student worksheet
- Chart paper (one sheet per group of two to three students)
- Coloured markers or pencils

Tip: Some students may find it easier to put their ideas on sticky notes so they can move them around during the planning phase.

What to do

1. Brainstorm some impacts of climate change and their socio-economic consequences. If you like, show this helpful video to fuel the discussion: The Impacts of Climate Change (Climate Commission), found at www.youtube.com/watch?v=lhkgmXXOM1A.

2. Hand out a large sheet of chart paper to teams of two to three students and ask them to write “Climate change and society” at the centre of the sheet.

From the centre of the map, ask students to creatively build three distinct concept levels as in the example below (see Figure 1).

Tip: Tell students to use the Climate Change and Society Mind Map worksheet to sketch out their ideas.
Level 1: Physical impacts of climate change, e.g., rising temperature or increased precipitation (two to three per map)

Level 2: Consequences of these impacts on society and the economy, e.g., longer growing seasons, damaged roads (one to two per impact)

The next level will be filled out later, following the Adaptation and Mitigation activity (p. 20), so ask students to leave some room for this:

Level 3: Adaptation measures that could be taken to deal with these consequences, e.g., expand agriculture northward, reroute main transportation arteries (one to two per consequence)

3. Students should feel free to unleash their creativity and represent the concepts with shapes, text and drawings, using connecting lines between concepts to justify the link.

Tip: Students can use Climate Change and the Environment, Climate Change and the Economy, and Climate Change: Health and Urban Living infographics as tools to help complete their mind maps.

4. Ask students to present their conceptual maps to the class. Encourage dialogue by asking students with similar concepts to add their interpretations to the discussion.

Extension

• Ask students to cut out their concepts to make a large classroom concept wall. Use different cardboard backdrops (attached with glue) to identify the three levels — this will keep the hierarchy visible.

Figure 1. Example of a multi-level mind map
Activity 2–Student BLM: Climate Change and Society Mind Map

Draw a sketch of your mind map including 1) the impacts of climate change and 2) the consequences of these impacts on society and the economy.

What I learned from my classmates’ presentations:
**Activity 2–Teacher BLM: Mind Map Rubric**

<table>
<thead>
<tr>
<th>Category</th>
<th>Exemplary</th>
<th>Proficient</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts and terminology</td>
<td>Shows an understanding of the topic’s concepts and principles and uses appropriate scientific terminology</td>
<td>Makes some mistakes in terminology or shows a few misunderstandings of concepts</td>
<td>Makes many mistakes in terminology and shows a lack of understanding of many concepts</td>
<td>Shows no understanding of the topic’s concepts and principles</td>
</tr>
<tr>
<td>Relationships between concepts</td>
<td>Provides highly relevant and original links between concepts</td>
<td>Provides adequate links between concepts</td>
<td>Provides some/few links between concepts</td>
<td>Provides no links between concepts</td>
</tr>
<tr>
<td>Adaptation solutions</td>
<td>Provides highly relevant and realistic solutions</td>
<td>Provides relevant solutions</td>
<td>Provides few relevant solutions</td>
<td>Provides no solutions</td>
</tr>
<tr>
<td>Work ethic</td>
<td>Plans the concept map in a highly effective manner</td>
<td>Plans the concept map in an effective manner</td>
<td>Plans the concept map in an adequate manner</td>
<td>Does not plan the concept map</td>
</tr>
<tr>
<td>Communication</td>
<td>Presents the concept map in a highly effective manner and provides examples to support the analysis</td>
<td>Presents the concept map in an effective manner</td>
<td>Presents concept map in an adequate manner</td>
<td>Presents the concept map in an ineffective manner</td>
</tr>
<tr>
<td>Design and layout</td>
<td>The design and layout contribute greatly to the flow and clarity of the map in an original manner. An original and effective design is used to denote the hierarchy of levels.</td>
<td>The design and layout contribute to the clarity of the map in an effective manner. The hierarchy of levels is evident.</td>
<td>The design and layout contribute to the clarity of the map in an adequate manner. The hierarchy of levels is present.</td>
<td>The design and layout do not contribute to the clarity of the map. Attention has not been paid to the hierarchy of levels.</td>
</tr>
<tr>
<td>Collaboration skills</td>
<td>Consistently works toward group goals and encourages people to work well together</td>
<td>Frequently works toward group goals and encourages people to work well together</td>
<td>Adequately works toward group goals and encourages people to work well together</td>
<td>Rarely works toward group goals</td>
</tr>
</tbody>
</table>
Activity 3: Adaptation and Mitigation

**Summary**

In this activity, students collaborate to define and identify the concepts of adaptation and mitigation as they pertain to climate change.

**Duration:** 60 to 75 minutes

**Learning outcomes**

After participating in the activity, students will be able to:

- Define and differentiate the concepts of adaptation and mitigation as they pertain to climate change,
- Identify examples of adaptation and mitigation measures, and
- Discuss the importance of using both adaptation and mitigation measures to fight against climate change.

**Competency outcomes**

During this activity, students will develop or improve these abilities:

- Collaboration
- Inference
- Research
- Critical thinking

**Set-up and materials**

- Computer, tablet, or dictionary (one per team)
- Colour printout of the Adaptation and Mitigation Goals, cut into strips
- Copies of the Adaptation or Mitigation? student worksheet
- Copies of the Climate Change: Adaptation and Mitigation infographic
- Adapting to Our Changing Climate in Canada poster

**Tip:** Check out Natural Resources Canada’s new poster, Adapting to Our Changing Climate in Canada. It will help you learn more about our changing climate, the impacts it’s having, and how Canadians are adapting. Request your copy using the online order form or by calling 1-800-387-2000 (Product # M174-13/2016). Alternatively, you can download the web-accessible version.

**What to do**

1. Following the Conceptual Map activity, launch the discussion on adaptation and mitigation by watching the video capsule called “Climate change adaptation: It’s time for decisions now” (GIZ online) at [www.youtube.com/watch?v=FO46sPwm4xk](http://www.youtube.com/watch?v=FO46sPwm4xk).

2. On the blackboard or Smart Board, write “Adaptation Measures” (on one side) and “Mitigation Measures” (on the other side).

   **Brainstorming phase:** Ask students if they know what these words mean (synonyms, resemblances) and write their ideas under each heading.

   **Research phase:** Ask students to find two or three words related to these concepts using the Internet or the dictionary.

   **Validation phase:** Synthesize the results and work with students to define the concepts.
3. Provide students with the following examples of adaptation measures and mitigation measures with respect to biodiversity and nature. Work with students to refine their definitions further.

**Adaptation measures:**
- Revise building code to ensure flood-resistant basements.
- Protect, revegetate, and stabilize sand dunes to reduce erosion.
- Fly fuel in to mines (costing mining companies millions of dollars) to get around shortened winter road season.

**Mitigation measures:**
- Replace fossil-fuel-based energy with renewable energy sources like wind and solar.
- Plant millions of trees to absorb and trap carbon dioxide from the atmosphere.
- Feed cattle seaweed instead of traditional hay and grains to reduce the methane content of cow belching and flatulence.

4. As a whole-class activity, ask students to help you classify the **Adaptation and Mitigation Goals** as either “Adaptation” or “Mitigation.”

5. Hand out the **Adaptation or Mitigation?** student worksheet.

6. Assign two measures per pair of students and ask them to justify whether they fall under “Adaptation” or “Mitigation.”

7. Ask each pair to join another group to compare answers.

8. As a class, decide where each example should be classified and why. Hand out the **Climate Change: Adaptation and Mitigation** infographic to compare answers.

**Tip:** Your class answers may vary from the **Climate Change: Adaptation and Mitigation** infographic. The important part for assessment purposes is that students are able to justify their choice based on the goals of adaptation and mitigation.

**Extension**

- Return to the **Mind Map** activity (p. 16) and ask students to assign adaptations to their consequences.

- Some students may have experienced climate change impacts, large or small (e.g., recurrent flooding; earlier spring melt runs). They may also have witnessed adaptation measures (e.g., their village may have been relocated; they may now go smelt fishing earlier in the season). Tap into any first-hand knowledge and make connections to their lives outside the classroom by inviting students to share their stories.

- When it comes to adaptation or mitigation, discuss whether one is more important than the other. Are there some measures that address both at the same time?

- Discuss how the following might be barriers to climate change adaptation:
  - Short-term thinking
  - Using uncertainty as a reason to do nothing
  - Unrealistic optimism

**For a more detailed discussion on this topic, see the Natural Resources Canada report** **Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation**, p. 273–74.

- Read the following article and justify whether this is an example of adaptation or mitigation: **P.E.I. farmer assists in near-eradication of methane from cow farts**
Activity 3—Teacher BLM: Adaptation and Mitigation Goals

Cut these goals into strips and work with students to assign each to either adaptation or mitigation.

- Improve the ability of animals and plants to thrive under different climate conditions.
- Build resilience to extreme weather and climate changes.
Increase species’ capacity to adapt.

Cut down greenhouse gas emissions.

Trap greenhouse gas emissions.
**Activity 3–Student BLM: Adaptation or Mitigation?**

What type of measure does each example below represent: adaptation or mitigation? Justify your answer.

<table>
<thead>
<tr>
<th>Designate more forests as protected areas.</th>
<th>Adaptation</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve roads, bridges and building design to resist weather damage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protect homes and buildings from flooding.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invest in ways to absorb rainwater, like «green» roofs and porous driveways.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote water and energy conservation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptation</td>
<td>Mitigation</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Invest in or provide rebates for energy-efficient fridges, furnaces, and appliances.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote cycling, walking and taking transit as alternatives to driving.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase sources of renewable energy like wind and solar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve industrial processes to use less energy and materials.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Activity 4: Graphic Encounters

## Summary

In this activity, students travel around the classroom making observations about various maps and graphs related to climate change. Students are then asked to “translate” the information into an infographic, highlighting the information they found most compelling. They are also asked to provide suggestions of a target audience for this information.

**Duration:** two 60-75 minutes sessions

## Learning outcomes

After participating in the activity, students will be able to:

- Explain how physical processes help to shape features and patterns on Earth’s surface,
- Compare and interpret maps and graphs to explain how climate change can affect physical processes on Earth, and
- Explain ways in which living things and natural systems are affected by climate change.

## Competency outcomes

During this activity, students will develop or improve these abilities:

- Research
- Communication
- Creativity
- Critical thinking
- Collaboration

## Teacher backgrounder

### THE ADAPTATION PROCESS

Like any process involving changes in thinking and practice, adapting to a changing climate involves deepening levels of engagement (phases) and actions that can be taken in support of decision-making (steps). The figure below summarizes these phases and steps, which integrate observations on how adaptation is occurring in Canada with common elements of several adaptation planning frameworks. Although presented as a linear process, organizations may take different pathways as they transition and iterate through these phases and steps.

Phases in the adaptation process include awareness, preparation, implementation and iterative learning. The seven steps are:

1. **Awareness of climate change:** the adaptation process begins once an individual or organization becomes aware of a changing climate as a threat or opportunity.
2. **Awareness of the need to adapt:** an awareness of the magnitude of the problem helps to identify adaptation as a solution.
3. **Mobilizing resources:** awareness can lead individuals and organizations to dedicate human and/or financial resources to help clarify the nature of threats or opportunities.
4. **Building capacity to adapt:** involves applying scientific information, financial resources, and skills to focused activities such as issue screening, risk assessment and in-depth analysis to generate the understanding needed for informed decision making.
5. **Implementing targeted adaptation actions:** concrete actions are put in place to reduce vulnerability (risk or exposure) to climate change and/or to take advantage of opportunities.
6. **Measuring and evaluating progress**: measuring and evaluating the effectiveness of adaptation actions and related assumptions and uncertainties provides the feedback necessary for improved management.

7. **Learning, sharing knowledge with others and adjusting**: the last step leads to refinements in the adaptation actions implemented and transfer of lessons to future adaptation.

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**Set-up and materials**

- 10 climate maps/graphs printed on legal or ledger size paper*
- 10 sheets of chart paper
- 10 copies of **Guiding Questions**
- One marker per student
- One pack of sticky notes per student
- One **double-sided** copy per student of **Graphic Encounters: Assignment and Rubric** (Day 2)
- Laptops or access to computer room (optional) (Day 2)

*If you have a small class, you may want to use fewer than 10 images. The ratio should be one image per team of three students.*

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4 The climate maps and graphs used in this activity are taken from:

a) Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, F.J. Warren and D.S. Lemmen, editors (2014); Government of Canada, Ottawa, ON; and

b) Canada’s Marine Coasts in a Changing Climate, D.S. Lemmen, F.J. Warren, T.S. James, and C.S.L. Mercer Clarke, editors (2016); Government of Canada, Ottawa, ON.

Both reports are available at: [http://www.nrcan.gc.ca/environment](http://www.nrcan.gc.ca/environment)
What to do

Day 1

1. Hang the maps and graphs (p. 29) around the classroom, with a sheet of chart paper below each. Hang a copy of the Guiding Questions above each image.
2. Explain to students that climate change adaptation and mitigation decisions are rooted in scientific evidence. When decision-makers and scientists interpret the data, they are trying to figure out what effect it will have on the world we live in.
3. Ask students to form groups of three and place themselves under one map or graph. Give them one minute to silently contemplate the image before they start to talk to their group about it.
4. Give them three minutes to write their ideas on the first two guiding questions on the chart paper; any questions they have should go on the sticky notes. They can discuss these with their group, but each student should be writing down his or her own ideas on the chart paper (whether or not the others find it interesting).
5. Ask the students to rotate to the next map or graph and repeat steps 2 and 3. Before writing out their ideas, they should read what other students have written and put check marks next to the items they agree with rather than re-writing an idea.
6. After several rounds (choose the number of rounds based on the time available), discuss the discoveries made by the students.

Tip: Ask the last group of students to have analyzed the map or graph to lead the discussion.

7. Before the end of class, ask each student to put his or her name under the map or graph they found most compelling and that they would like to continue exploring. The students are free to form new groups based on their preferred image.

Day 2

1. Introduce the “create an infographic” assignment to the students. It is strongly recommended that you spend some time analyzing a few existing infographics with the students so that they know what is expected of them, starting with the six infographics that accompany this resource.

Tip: To learn more about using infographics as a teaching and assessment tool, visit Kathy Schrock’s Infographics as a Creative Assessment at http://bit.ly/schrockinfographics.

2. Download the two Natural Resources Canada reports that the maps and graphs in this assignment are taken from (Canada in a Changing Climate; and Canada’s Marine Coasts in a Changing Climate) so that they are readily available to students.

We’d love to see your students’ creations! Send photographs or short videos of your class’s infographics to:

jarmstrong@techno-science.ca
Click on the thumbnail to open a high-resolution image. It is recommended that you leave the image descriptor as it appears in the document to challenge students’ interpretation skills.

Canada's Marine Coasts in a Changing Climate, p. 11

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 28
FIGURE 16: Permafrost temperatures at 15 m depth for 10 communities in Nunavut (from Ednie and Smith, 2015). Steady increases are seen at all sites during the period of observation, ranging from 0.04°C/year in Igloolik to 0.29°C/year in Resolute. The average increase is 0.15°C/year for all sites.

FIGURE 18: Dangerous travel areas (red) identified by residents of Makkovik and Postville, Nunatsiavut, NL (from Riedellisperger, 2013). Abandoned sea-ice travel routes are depicted as dark red lines. Inland trails (grey lines) now provide safer and more dependable travel routes.
Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 12

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 213
Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 34

**FIGURE 19:** Trends in Arctic sea ice extent over the period 1979-2012 shown as time series of the percentage difference in ice extent in March and September relative to the mean values for the period 1979-2000. The rate of decrease for the March and September ice extents is -2.6% and -13% per decade, respectively (as determined by least squares linear regression). Both trends are statistically significant (Source: Perovich et al., 2012).

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 165.
FIGURE 3: Risk maps for establishment and spread of the Lyme disease vector *Ixodes scapularis* under (1971-2000) and projected future climate (2020s to 2080s) after Ogden et al., 2008a. The green zone indicates the main extent of locations where *I. scapularis* may become established. The orange and red zones indicate areas with increasingly high risk for *I. scapularis* population emergence. The grey zone indicates areas where the risk of *I. scapularis* population emergence is very low (Source: Ogden et al., 2008a).

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 201.

Canada’s Marine Coasts in a Changing Climate, p. 172.
Guiding Questions

1. In your own words, what is this image trying to convey?

2. What do you notice? Is there anything strange or surprising? Do you see trends?

3. Can you think of any environmental, economic, or social consequences of this data?

4. On sticky notes, write down any questions you have about this image.
Activity 4–Student BLM: Assignment and Rubric

The first step towards adaptation implementation is awareness of climate change, potential impacts, and the need to adapt. Increased awareness of climate change can occur spontaneously (e.g. through the experience of extreme events) or through planned activities (e.g. workshops, awareness-raising campaigns, learning modules or publications).

In this assignment, your team will “translate” the map or graph you chose into an infographic that clearly communicates its message and importance to an audience. The infographic must convey both the information contained in the image as well as a summary of further research your team will conduct to support your ideas. Start with the two reports produced by Natural Resources Canada (Canada in a Changing Climate; and Canada’s Marine Coasts in a Changing Climate) that your teacher has downloaded for you.

<table>
<thead>
<tr>
<th>Graphic Encounters Rubric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main idea</strong></td>
</tr>
<tr>
<td>Infographic conveys the main idea in a clear and compelling manner</td>
</tr>
<tr>
<td><strong>Research</strong></td>
</tr>
<tr>
<td>Infographic reflects research into the environmental and/or social significance of the data</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
</tr>
<tr>
<td>Graphics are relevant, chosen to enhance and support the data</td>
</tr>
<tr>
<td><strong>Layout and design</strong></td>
</tr>
<tr>
<td>The layout of the graphics and text purposely enhances the communication of the main ideas. The flow of information is uncluttered and well organized.</td>
</tr>
<tr>
<td><strong>Language</strong></td>
</tr>
<tr>
<td>Language is used in a precise and concise manner with no errors in spelling, grammar or punctuation.</td>
</tr>
<tr>
<td><strong>Audience</strong></td>
</tr>
<tr>
<td>Infographic clearly identifies and supports the relevance of the information for at least two socio-economic sectors.</td>
</tr>
<tr>
<td><strong>Infographic elements</strong></td>
</tr>
<tr>
<td>Contains a title that reflects the main idea of the infographic</td>
</tr>
<tr>
<td>Contains at least 5 images</td>
</tr>
<tr>
<td>Each image contains a concise statement to help audience understand it</td>
</tr>
<tr>
<td>Contains (on the back) a reference list for research and images, with references cited properly</td>
</tr>
</tbody>
</table>

See reverse for team worksheet.

5 From Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 274.
Names: ________________________________________________________________

Image chosen: __________________________________________________________

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. ________

OR

Canada’s Marine Coasts in a Changing Climate, p. ________

Further research notes (environmental and/or social relevance of the data):

Information to include:

On the back of the infographic, please answer the following:

In your opinion, which of the following sectors should be concerned by this information? (Choose at least two.) Why?

1. Energy (oil and gas, wind, solar)
2. Food production
3. Mining
4. Forestry
5. Tourism
6. Housing/construction
7. Insurance
8. Manufacturing
9. Biodiversity
10. Infrastructure and transportation
11. Health and social well-being
Activity 5: Funding Frenzy

Adaptation involves making adjustments in our decisions, activities and ways of thinking in response to observed or expected changes in climate, with the goals of (a) reducing harm and (b) taking advantage of potential opportunities. Adaptation can include behavioural changes, operational modifications, technological interventions, planning changes and revised investment practices, regulations and legislation.

While adaptation in the natural environment occurs spontaneously, adaptation in human systems often benefits from careful planning that is guided by both scientific research and detailed understanding of the systems involved.6

One of the most commonly cited barriers to adaptation is deficiencies in information for decision making. Decision makers are looking for the right type of information, at an appropriate scale and level of detail that is accessible and understandable.7

Summary

In this role-play activity, students will act as stakeholders in a working group session. They will try to build consensus on how best to use federal funding to address their climate change adaptation needs.

Duration: Two 60-75 minute sessions

Learning outcomes

After participating in the activity, students will be able to:

- Describe socio-economic impacts of climate change from a variety of stakeholder perspectives
- Recognize and analyze differing priorities for climate change research
- Demonstrate an understanding and appreciation of the consensus process

Competency outcomes

During this activity, students will develop or improve these abilities:

- Communication
- Critical thinking
- Collaboration
- Creativity and innovation

Set-up and materials

- Stakeholder Profiles (each student should get his/her own copy)
- Stakeholder Note-Taking Sheet (one per student)
- Alliance-Building Sheet (one per student)
- Laptop or iPad (one per group) with access to one common Google Slides document

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7 Ibid., p. 276.
Tip: One Google Slides document saves document loading time; and allows groups to access each other’s slides. As another time-saver, consider creating slides for each stakeholder group ahead of time with the following headings: socio-economic importance; impacts of climate change; research needs (social and/or scientific).

What to do

Day 1

1. Introduce the activity with the following scenario:

   The federal government has just announced the creation of the Climate Adaptation Research Fund to be administered by the National Research Council (NRC) of Canada. The National Research Council is the Government of Canada’s premier organization for research and development. Working with clients and partners, the NRC provides innovation support, strategic research, and scientific and technical services to develop and deploy solutions to meet Canada's current and future industrial and societal needs. This $1 million fund is to be used for research-based projects that will enable Canada to adapt to climate change impacts across a variety of sectors like forestry, agriculture, mining, etc. This research can be used for scientific study (science and technology focus), for social science research (focus on people and societal issues), or a mixture of both. Your interest group has been asked to make a pitch to the federal government on how best to use these funds for your sector.

   Your group will have two to three minutes to present your case, highlighting your socio-economic importance and the relevance of your research needs.

2. Divide class into teams of two to three students. Each team receives copies of a specific stakeholder profile.

   Tip: For classroom management purposes, ensure that each member of the group receives his or her own copy of the profile. Use page protectors so that the profiles can be used again next year.

3. Tell students that they will be preparing three to four slides in Google Slides for their “pitch.” The pitch should include the socio-economic importance of their sector and the impacts on it of climate change, as well as their research needs (social and/or scientific).

   Tip: Consider assigning each student a sub-topic so that everyone is accountable and each student has a part to present.

4. Ask students to silently read their profile, highlighting words or expressions they don’t understand. Give them time to discuss their understanding of the profile with their team to ensure they are on the same page.

5. Explain that there is not much time to prepare for this presentation: they will have another 10 minutes to re-read the profile, plus 15 to 20 minutes to figure out what to put on the slides and decide who says what. Emphasize that they should focus on content first and only work on making their slides attractive if they have time.

6. Place the desks in a U-shape facing the projection screen.
7. **Just before the first group presents**, tell the class that you have *just* received news from the people at the NRC.

   *The NRC has decided that they will only be funding four studies to deepen the significance of each study. This means that after the initial pitches are made, the groups are going to have to build alliances with each other in order to find common ground for a study. The NRC has prepared note-taking sheets to facilitate the job of trying to find issues and research needs in common. You should ask questions to find out more about the other groups’ positions. It is very important to listen to each presentation and jot down your initial thoughts.*

8. Hand out the **Stakeholder Note-Taking Sheet** to each student. Ask them to take notes during the presentations.

9. For homework, ask students to fill out their **Alliance-Building Sheet** to prepare for their group meeting next class. The sheet indicates who you would like to merge with around a specific issue, and your reasons to support this decision.

**Day 2**

10. Ask the students to get into their **original** stakeholder groups to discuss their notes. As a team, they should decide on which strategic alliances could be formed with the other sectors.

11. Give students 10 minutes to approach potential allies to discuss their common interests based on their Alliance-Building Sheets.

   **Tip:** More than two teams may want to build alliances together. If this is the case, split them into subgroups for intensive brainstorming; they can then come back together to merge their discussions.

12. Ask students, as an alliance, to come up with a joint pitch for the funding, using a similar format to their original presentation (common socio-economic importance/impacts; common research needs). They should also highlight the win-win aspect of this alliance.

   **Tip:** Consider assigning each student (or pairs) a sub-topic so that everyone is accountable and each student has a part to present.

13. Ask each alliance to prepare three to four slides in Google Slides for their presentation.

14. As a class, decide who gets funding and how much (optional).

15. Generate a whole-class discussion of the consensus-building activity. *How did it feel to shift from competitor to collaborator? What skills did you have to use in these different roles? Which did you prefer and why? What were the advantages or disadvantages?*
Activity 5–Teacher backgrounder

THE ADAPTATION PLATFORM

The Adaptation Platform, a unique mechanism in Canada, brings together representatives from industry, professional and not-for-profit organizations, federal, provincial and territorial governments, and researchers to tackle shared climate change adaptation priorities (See Figure 1). Collaboration between the public and private sectors, and across jurisdictions and disciplines, is essential to address the complex and cross-cutting issue of climate change adaptation.

![Canada's Climate Change Adaptation Platform](http://www.nrcan.gc.ca/environment/impacts-adaptation/adaptation-platform/10027)

Platform participants are both the users and producers of adaptation knowledge and tools. As a result, the Platform’s work is demand-driven, facilitating the analysis and implementation of adaptation action, and directly responding to the needs of decision-makers in Canada’s public and private sectors. By providing the structure to pool financial resources, knowledge, and people, the Adaptation Platform works to create new information and tools for adaptation and get these products to the appropriate users.

Canada’s Adaptation Platform is structured around several components: a plenary body, a series of subject-matter specific working groups, a secretariat and a broad network of individuals engaged in delivering adaptation actions. Additionally, Regional Adaptation Collaboratives (including the Pan-Territorial Adaptation Partnership) are active across the country performing outreach and enhancing regional dissemination of Platform results.
Natural Resources Canada, chair of the Adaptation Platform, has committed ongoing resources to support the overall Platform, selected Working Group activities, and to provide the secretariat function.

Subject-matter specific Working Groups focus efforts on shared adaptation priorities within their particular subject matter area. Plenary members, comprised of senior-level representatives of governments and national organizations, identify critical and emerging adaptation priorities in Canada and to support collaborative efforts in focused areas of work. Plenary members also generate support for adaptation action and disseminate adaptation knowledge within their organizations and extended networks.  

These consensus-building activities are an integral part of the adaptation planning process (see Figure 2).

![Figure 2. Steps in the adaptation planning process (Eyzaguirre and Warren, 2014). Source: Canada’s Marine Coasts in a Changing Climate, p. 83.](image-url)

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Figure 3: Number of climate change adaptation articles by Canadian researchers by sector (2000–2013). Source: Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 12.

More information
For more information on climate change impacts and adaption, see Natural Resources Canada’s website: www.nrcan.gc.ca/environment/impacts-adaptation.

For a list of additional resources, including regional initiatives, please consult Canada’s Marine Coasts in a Changing Climate, p. 273.
**Activity 5–Student BLM: Stakeholder Glossary**

**Building code:** code used by the construction industry to ensure that safety conditions are met

**Commodity:** trade goods, articles of commerce

**Consumption:** the use of goods to satisfy needs (e.g. water or energy consumption)

**Cost-benefit analysis:** evaluate the potential costs and benefits of a decision

**Crop:** a cultivated plant that is grown commercially on a large scale

**Drainage basin:** an area where water collects from rivers and streams

**Ecosystem services:** The variety of resources and processes that are supplied by ecosystems and benefit human societies. These include products like clean drinking water and processes such as the decomposition of wastes

**Erosion:** condition in which the earth’s surface is worn away by the action of water and wind

**GDP:** the measure of a country’s economy. It is the total market values of goods and services produced by a country.

**Hydroelectricity:** electricity produced by water power

**Hydrological:** refers to water

**Infrastructure:** the combination of facilities and equipment needed for the functioning of a country or area (e.g. water infrastructure or transportation infrastructure)

**Resilience:** ability to “bounce back” after an event

**Retrofit:** to substitute or add parts to an existing structure to adapt it to new conditions

**Smelting:** extract metals by heating

**Stakeholder:** a person or organization that has an interest (or stakes) in a specific issue

**Supply chain:** the network of companies involved in producing, handling and/or distributing a specific product (e.g. seed producer > farmer > processing plant > distributor > grocery store)

**Threshold:** a state or level marking a boundary (tipping point)

**Vulnerability:** the state of being vulnerable or exposed to a threat, such as hazards associated with changing weather and climate patterns, the sensitivity of specific populations, and the ability of individuals and communities to take protective measures.
### Activity 5–Student BLM: Stakeholder Note-Taking Sheet

<table>
<thead>
<tr>
<th>Stakeholder:</th>
<th>Socio-economic relevance/importance</th>
<th>Impacts of climate change (positive/negative)</th>
<th>Research needs — societal issues</th>
<th>Research needs — science and technology issues</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
Activity 5–Student BLM: Alliance-Building Sheet

**Stakeholder:** ____________________________  **Team member names:** ____________________________

<table>
<thead>
<tr>
<th></th>
<th>Socio-economic similarities</th>
<th>Socio-economic differences</th>
<th>Research needs similarities</th>
<th>Research needs differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder 1</td>
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<tr>
<td>Stakeholder 2</td>
<td></td>
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</tr>
</tbody>
</table>

**Potential win-win solutions**

---

**Rubric**

The Alliance-Building Sheet includes an analysis of at least **two** stakeholder groups. Each analysis:

<table>
<thead>
<tr>
<th></th>
<th>Exemplary</th>
<th>Proficient</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearly compares similarities and differences in socio-economic impacts between their profile and the other stakeholder’s.</td>
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<tr>
<td>Clearly compares similarities and differences in research needs between their profile and the other stakeholder’s.</td>
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<tr>
<td>Provides creative potential win-win solutions, i.e., solutions that would benefit both parties.</td>
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</tbody>
</table>
## Activity 5–Teacher BLM: Presentation Rubric

<table>
<thead>
<tr>
<th>Activity</th>
<th>Exemplary</th>
<th>Proficient</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of content Socio-economic profile of the stakeholder</td>
<td>The slides communicate the socio-economic profile of the stakeholder with a high degree of effectiveness.</td>
<td>The slides communicate the socio-economic profile of the stakeholder with considerable effectiveness.</td>
<td>The slides communicate the socio-economic profile of the stakeholder with some effectiveness.</td>
<td>The slides communicate the socio-economic profile of the stakeholder with limited effectiveness.</td>
</tr>
<tr>
<td>Understanding of content Research needs of the stakeholder and their importance.</td>
<td>The slides communicate the research needs of the stakeholder and their importance with a high degree of effectiveness.</td>
<td>The slides communicate the research needs of the stakeholder and their importance with considerable effectiveness.</td>
<td>The slides communicate the research needs of the stakeholder and their importance with some effectiveness.</td>
<td>The slides communicate the research needs of the stakeholder and their importance with limited effectiveness.</td>
</tr>
<tr>
<td>Viewpoint Questions are answered from the viewpoint of the stakeholder</td>
<td>Consistently answers questions from the viewpoint of the stakeholder.</td>
<td>Frequently answers questions from the viewpoint of the stakeholder.</td>
<td>Sometimes answers questions from the viewpoint of the stakeholder.</td>
<td>Rarely answers questions from the viewpoint of the stakeholder.</td>
</tr>
<tr>
<td>Oral communication Information is given with appropriate use of notes, eye contact, clarity, and volume</td>
<td>Consistently gives information with appropriate use of notes, eye contact, clarity and volume.</td>
<td>Frequently gives information with appropriate use of notes, eye contact, clarity and volume.</td>
<td>Sometimes gives information with appropriate use of notes, eye contact, clarity and volume.</td>
<td>Rarely gives information with appropriate use of notes, eye contact, clarity and volume.</td>
</tr>
<tr>
<td>Active listening Active listening skills are demonstrated by providing thoughtful responses to other students’ statements and asking questions of presenters</td>
<td>Consistently demonstrates active listening skills.</td>
<td>Frequently demonstrates active listening skills.</td>
<td>Sometimes demonstrates active listening skills.</td>
<td>Rarely demonstrates active listening skills.</td>
</tr>
</tbody>
</table>
## Activity 5–Teacher BLM: Group Collaboration Rubric

<table>
<thead>
<tr>
<th></th>
<th>Exemplary</th>
<th>Proficient</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contribution to group</strong></td>
<td>Consistently contributes knowledge, opinions and skills.</td>
<td>Frequently contributes knowledge, opinions and skills.</td>
<td>Adequately contributes knowledge, opinions and skills.</td>
<td>Rarely contributes knowledge, opinions or skills.</td>
</tr>
<tr>
<td><strong>Problem-solving</strong></td>
<td>Consistently looks for and suggests solutions; and/or refines solutions suggested by others.</td>
<td>Frequently looks for and suggests solutions; and/or refines solutions suggested by others.</td>
<td>Adequately looks for and suggests solutions; and/or refines solutions suggested by others.</td>
<td>Rarely looks for and suggests solutions or refines solutions suggested by others.</td>
</tr>
<tr>
<td><strong>Consensus-building skills</strong></td>
<td>Consistently values the knowledge, opinion and skills of all group members and encourages their contributions.</td>
<td>Frequently values the knowledge, opinion and skills of all group members and encourages their contributions.</td>
<td>Adequately values the knowledge, opinion and skills of all group members and encourages their contributions.</td>
<td>Rarely values the knowledge, opinion and skills of all group members or encourages their contributions.</td>
</tr>
<tr>
<td><strong>Time Management</strong></td>
<td>Consistently stays focused on task.</td>
<td>Frequently stays focused on task.</td>
<td>Adequately stays focused on task.</td>
<td>Rarely stays focused on task.</td>
</tr>
<tr>
<td><strong>Collaboration skills</strong></td>
<td>Consistently works towards group goals and encourages people to work well together.</td>
<td>Frequently works towards group goals and encourages people to work well together.</td>
<td>Adequately works towards group goals and encourages people to work well together.</td>
<td>Rarely works towards group goals.</td>
</tr>
</tbody>
</table>