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

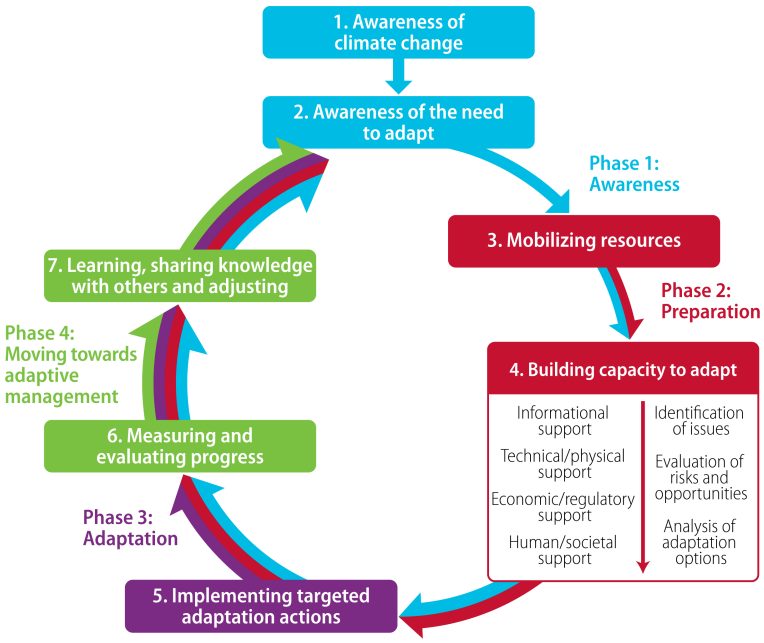
THE ADAPTATION PROCESS

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.



This content is taken directly from Warren, F.J. and Lemmen, D.S., editors (2014) Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation; Government of Canada, Ottawa, ON. p. 260.

Set-up and materials[4]

- ❑ 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.*

[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

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.

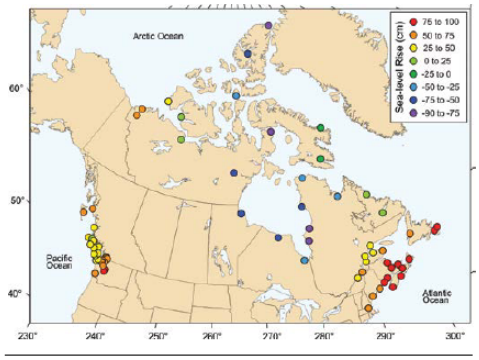
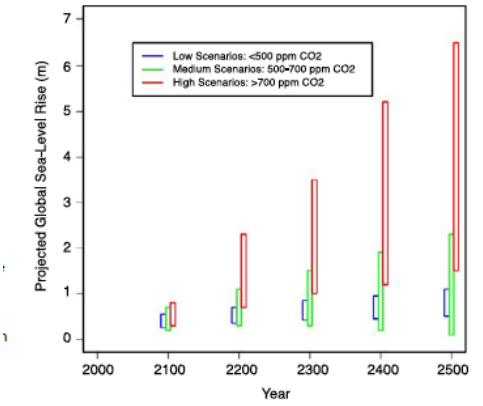
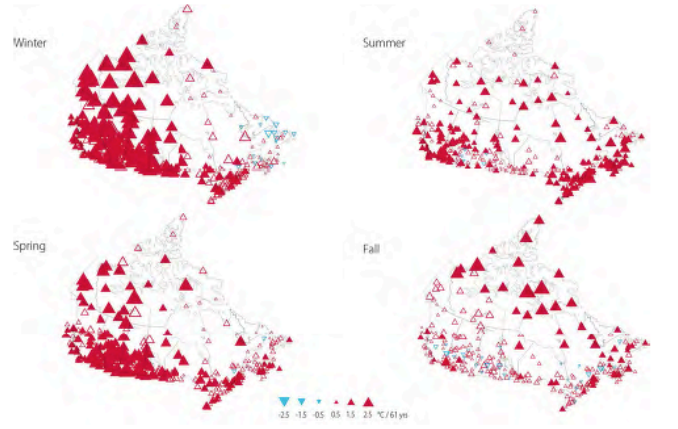
Tip: To learn more about using infographics as a teaching and assessment tool, visit Kathy Schrock's Infographics as a Creative Assessment at http://bit.ly/schrockinfographics.

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

 **FIGURE 3:** Projected relative sea-level change (cm) at 2100 for the median of a high-emissions scenario (RCP8.5) for coastal locations in Canada and the northern United States. *See* Chapter 2 for information on methodology and the climate change scenarios used in this report. Graphs showing projected change in sea level through this century for each of the Canadian sites shown in this figure are found in the relevant regional chapter (Chapter 4, 5 or 6).	Canada's Marine Coasts in a Changing Climate, p.11
 **FIGURE 26:** Projected global sea-level change from 2100 to 2500, based on carbon dioxide concentrations at 2100 (*based on* Figure 13.13 of Church et al., 2013a; see footnote 2).	Canada's Marine Coasts in a Changing Climate, p. 54
 **FIGURE 5:** Trends in seasonal mean temperature for 1950-2010. Upward- (red) and downward- (blue) pointing triangles indicate positive and negative trends, respectively. Filled triangles correspond to trends significant at the 5% level. The size of the triangle is proportional to the magnitude of the trend. The legend may not include all sizes shown in the figure *(Source: Vincent et al., 2012.)*.	Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 28

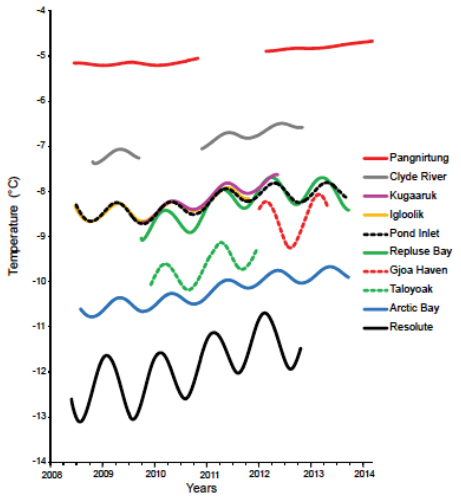


FIGURE 16: Permafrost temperatures at 15 m depth for 10 communities in Nunavut (*from* Ednie and Smith, 2015). Steady increases are seen at all sites during the period of observation, ranging from 0.04°C/year in Igloolik to 0.29°C/year in Resolute. The average increase is 0.15°C/year for all sites.

Canada's Marine Coasts in a Changing Climate, p. 171

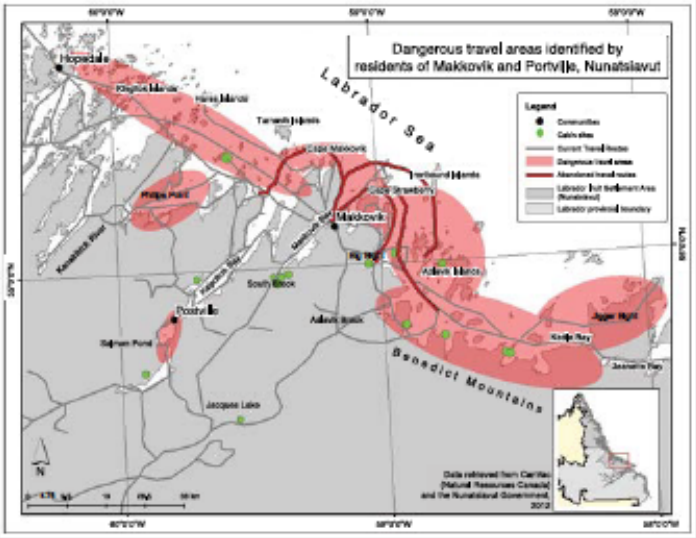


FIGURE 18: Dangerous travel areas (red) identified by residents of Makkovik and Postville, Nunatsiavut, NL (*from* Riedl-sperger, 2013). Abandoned sea-ice travel routes are depicted as dark red lines. Inland trails (grey lines) now provide safer and more dependable travel routes.

Canada's Marine Coasts in a Changing Climate, p. 177

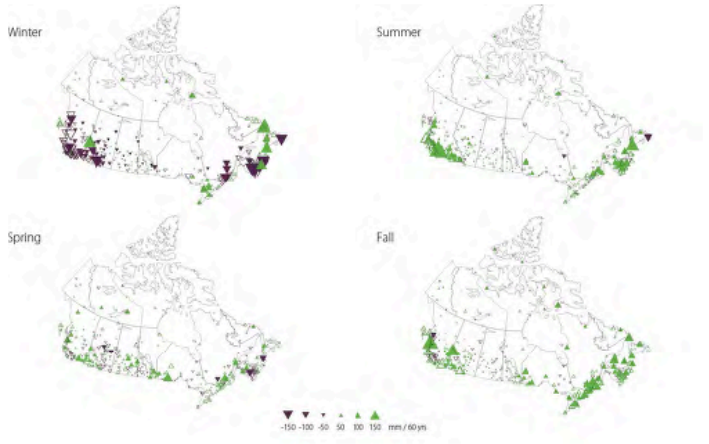


FIGURE 8: Seasonal total precipitation trends for 1950-2009. Upward- and downward-pointing triangles indicate positive and negative trends, respectively. Filled triangles correspond to trends significant at the 5% level. The size of the triangle is proportional to the magnitude of the trend. The legend may not include all sizes shown in the figure *(Source: Mekis and Vincent, 2011a).*

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 8

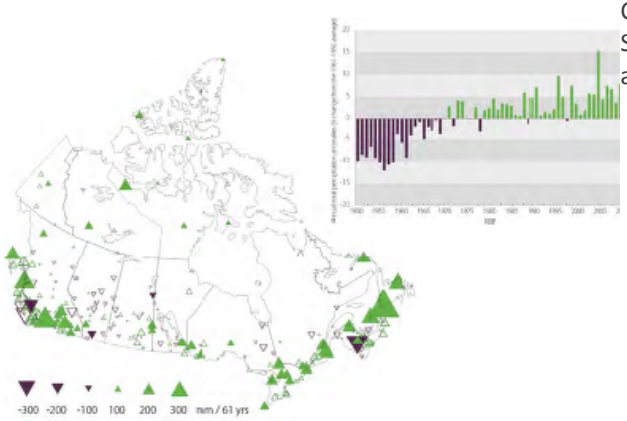


FIGURE 2: Patterns of change in annual total precipitation over the period 1950–2010. Upward (green) and downward (p pointing triangles indicate positive and negative trends, respectively. Filled triangles correspond to trends signi the 5% level (*Source: Mekis and Vincent, 2011b*). ***Inset:*** Annual total precipitation anomalies (expressed in % cha the 1961–1990 average) for Canada, 1950–2010 (*Source: Mekis and Vincent, 2011a; Environment Canada, 2011).*

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 30

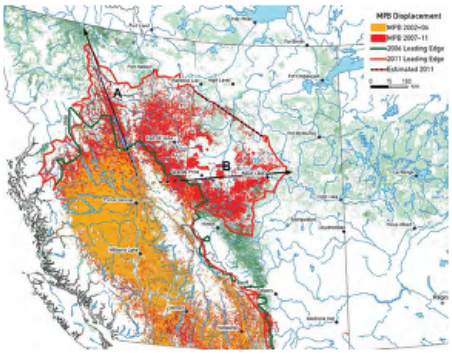
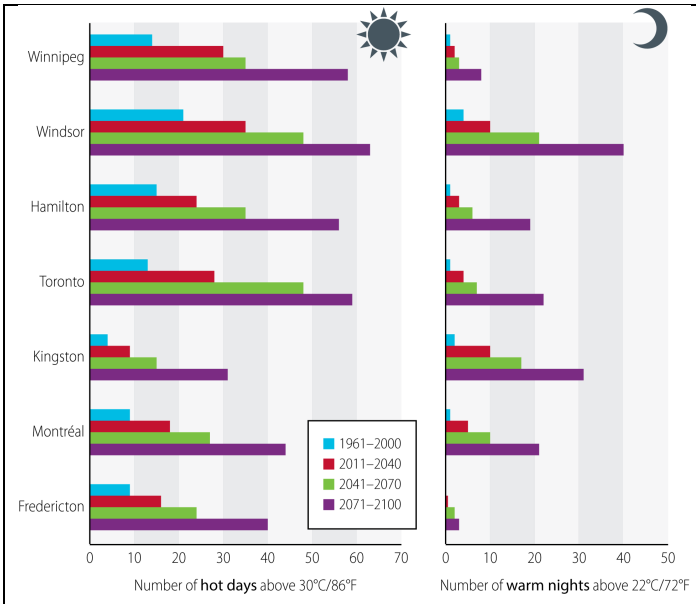


FIGURE 4: Map of Mountain Pine Beetle distribution, showing change for the 2002–2006 and 2007–2011 time periods and direction of change (*Source: Natural Resources Canada, 2012c*).

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 10



Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 12

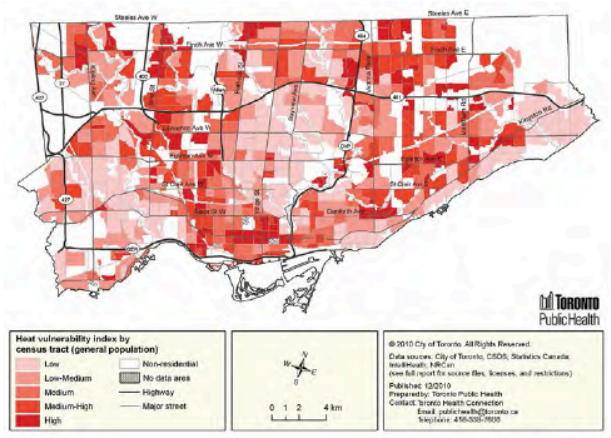


FIGURE 9: Vulnerability to heat in Toronto *(Source: Toronto Public Health, 2011a).*

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

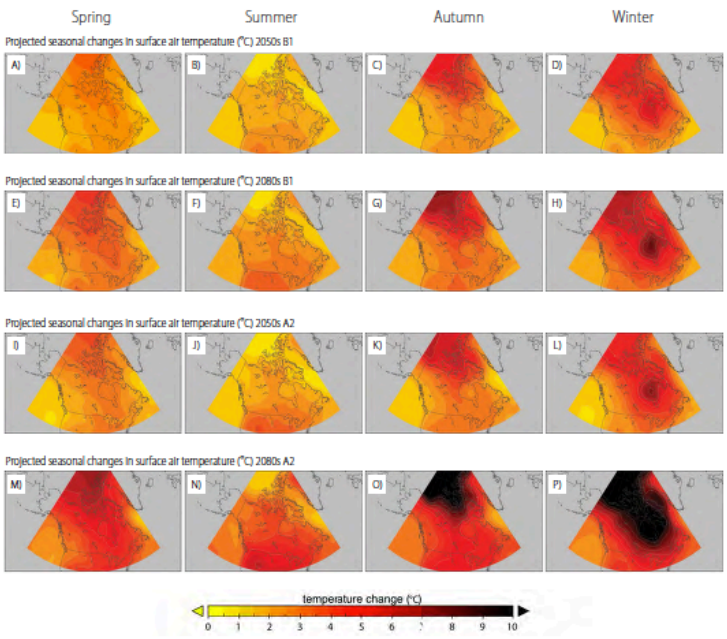


FIGURE 11: Projected seasonal changes in temperature across Canada for the middle and end of the 21st century under various SRES scenarios. Changes are expressed relative to average values between 1961-1990. Row 1 (A-D) is scenario B1 mid-century, row 2 (E-H) is B1 towards the end of the century, row 3 (I-L) is A2 mid-century, and row 4 (M-P) is A2 towards the end of the century. Column 1 (A, E, I, M) is Spring, Column 2 (B, F, J, N) is Summer, Column 3 (C, G, K, O) is Autumn, Column 4 (D,H, L, P) is Winter *(Source: Canadian Centre for Climate Modeling and Analysis).*

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

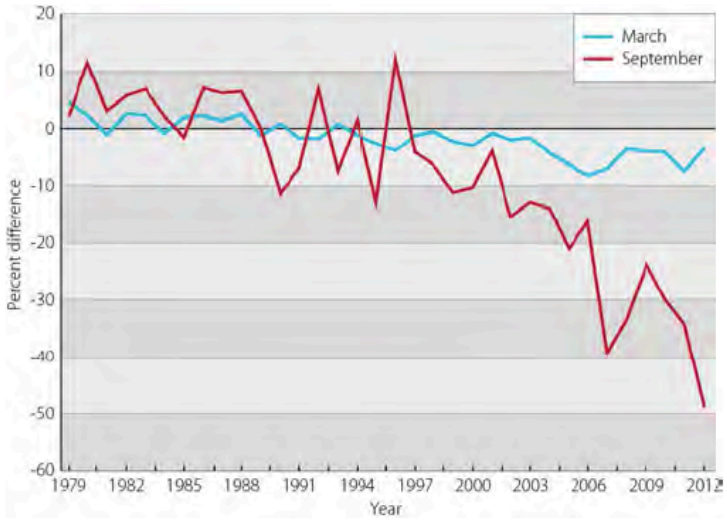


FIGURE 19: Trends in Arctic sea ice extent over the period 1979-2012 shown as time series of the percentage difference in ice extent in March and September relative to the mean values for the period 1979-2000. The rate of decrease for the March and September ice extents is -2.6% and -13% per decade, 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. 8 and 41.

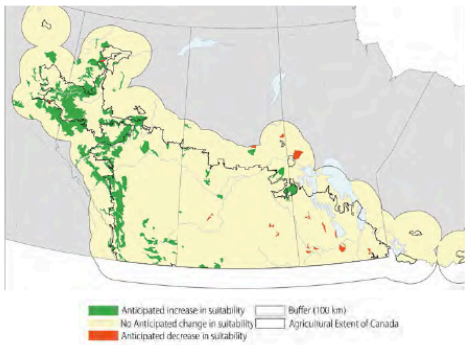


FIGURE 8: Map of Western Canada showing projected significant improvement and decline in land suitability for spring seeded small grain crops *(Source: AAFC, 2012a).*

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 109.

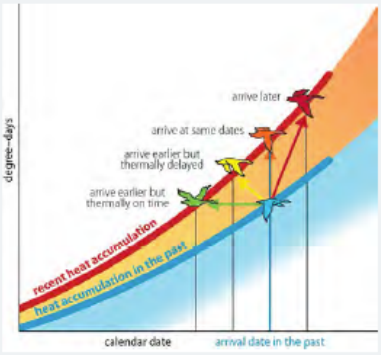


FIGURE 1: Climatic and phenological changes can bring about ecological mismatch of migratory birds. Curves represent the progress of spring in two years, as the increase of degree-days (heat accumulation) over time. The curve for the recent year (red line) lies above that for the past (blue line) because of winter and spring warming, which means that degree-days increase more rapidly. Migratory birds show no change, advancement or delay in arrival date. Species that now arrive at the same or later date face higher degree-days and relatively advanced ecological processes such as insect emergence, and are thus 'thermally delayed'. Even species that have advanced their arrival may experience a thermal delay, if advancement does not fully compensate for increasing temperatures. Only a large advancement in arrival can fully compensate for climate change *(modified from Saino et al., 2010).*

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, p. 165.

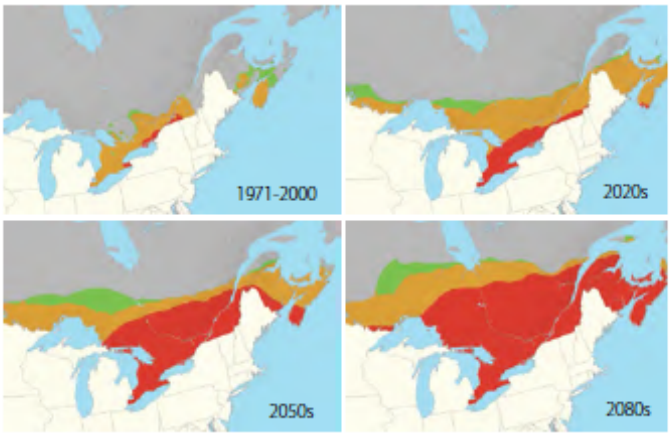


FIGURE 3: Risk maps for establishment and spread of the Lyme disease vector Ixodes scapularis under (1971-2000) and projected future climate (2020s to 2080s) after Ogden et al., 2008a. The green zone indicates the main extent of locations where *I. scapularis* may become established. The orange and red 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.

TABLE 4: Community observations of environmental change in the northern coastal region, compiled from the various sources cited in Section 2.5.

WEATHER

Observations based on traditional knowledge (TK)	Northwest Territories (Inuvialuit Settlement Region)	Nunavut	Quebec (Nunavik)	Labrador (Nunatsiavut)	Quebec (southern Hudson Bay (Cree))	Implications (generalized across communities)
Increasing variability and decreased ability to predict weather	Yes	Yes	Yes	Yes	Yes	Increased danger when travelling on land or ice
Changes in wind velocity, direction and frequency	Yes	Yes	Yes	Yes	Yes	Increased danger when travelling on land or ice; decreased reliability of TK
Increased frequency of thunderstorms and extreme weather events	Yes	Yes	Yes	Yes	No	Increased danger when travelling on land or ice; increased damage to infrastructure; constrained access to resource harvesting; accelerated coastal erosion
Differences in snow: less snow in winter, but more snow in some cases; arriving later in the fall/ winter; lighter and wetter in texture	Yes	Yes	Yes	Yes	Yes	Increased danger/difficulty when travelling on land or ice; constrained access to hunting grounds; changes in hunting routes; decreased reliability of TK; implications for sea ice freeze-up and break-up, and ice consistency and reliability
Increased storm surges and coastal erosion	Yes	Yes	No	No	No	Increased danger when travelling on land or ice; increased damage to infrastructure; constrained access to resource harvesting; accelerated coastal erosion
Increased rain (usually in fall and/ or spring, summer)	Yes	Yes	No	No	No	Implications for infrastructure; implications for sea ice freeze-up and break-up, and ice consistency and reliability

TEMPERATURE

Observations based on traditional knowledge (TK)	Northwest Territories (Inuvialuit Settlement Region)	Nunavut	Quebec (Nunavik)	Labrador (Nunatsiavut)	Quebec (southern Hudson Bay (Cree))	Implications (generalized across communities)
Warmer summer (in some communities)	Yes	Yes	Yes	Yes	No	Implications for aging processes of traditional foods; changing flora/fauna; implications for sea ice
Cooler summer (in some communities)	Yes	Yes	No	Yes	No	Implications for aging processes of traditional foods
Warmer winter; fewer cold days; winter starting later	Yes	Yes	Yes	Yes	Yes	Implications for aging processes of traditional foods; changing flora/fauna; implications for sea ice and travel on ice

Canada's Marine Coasts in a Changing Climate, p. 172.

Activity 4–Teacher BLM: Guiding Questions

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.

Name: _____ **Date:** _____

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).[5]

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.

Graphic Encounters Rubric

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

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