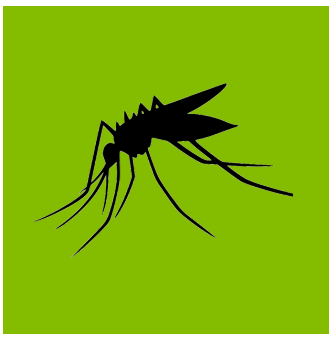
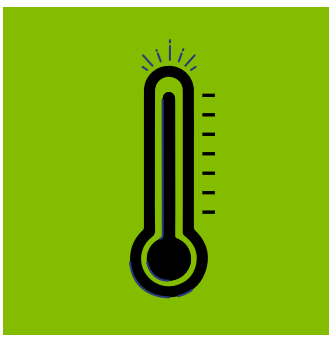
GRADE 6
TEACHER'S KIT

Building awareness of climate sensitive infectious diseases in Canada





CANADIAN PUBLIC HEALTH ASSOCIATION
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Financial contribution from

Public Health Agency of Canada
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CONTENTS

INTRODUCTION

The lessons in the following toolkit are designed to guide Grade 6 students towards an early understanding of climate change, and the impact it is having on all living things. One of the consequences of these changes is the increasing presence of climate sensitive infectious diseases within Canadian communities. Climate sensitive infectious diseases include many zoonotic, water-borne and food-borne diseases such as Lyme disease, West Nile virus, hantavirus, E. coli, giardiasis and salmonellosis.

The Canadian Public Health Association, in consultation with experts in health research, climate change and education, have created this toolkit to provide students with an enriching learning experience. It will allow students to develop an understanding of how climate change is influencing the spread of infectious diseases in Canada, and learn prevention strategies that will protect them from climate sensitive infectious diseases.

CURRICULUM LINKS

Prior to developing this resource, an extensive review of the Grade 6 curriculum in all the provinces and territories was completed. Many of the lessons will provide opportunities for cross-curricular learning, borrowing on skills from Science, Math, Language, Geography, Physical Education, Health, and Art. The lessons as they are will fit into the goals and curriculum expectations of all provinces and territories in Canada.

HOW TO USE THE TOOLKIT

The lesson plans in this resource are designed to be used sequentially and will take approximately five 40-minute lesson blocks to complete. By following the sequence, your students will be able to develop an understanding of how climate change works, how it affects ecosystems, and why climate sensitive infectious diseases are a growing concern in Canada.

Lessons can be adapted and modified based on school resources and the needs of the students. Teachers are encouraged to use the big ideas as the guiding questions for the lessons, if a lesson needs to be changed. Lyme disease is used as the example of a climate sensitive infectious disease in lessons 3-5. A different climate sensitive infectious disease can be used as the example in these lessons if you believe it would be more relevant to the issues facing your community (e.g. West Nile virus, hantavirus, giardiasis, E. coli or salmonellosis). See page 20 for additional online and video resources.

THE POSTER

At the conclusion of this toolkit, students are invited to create a poster about a climate sensitive infectious disease that is unique to their region of Canada. The details relating to the poster contest can be found on page 11 of the toolkit.

LESSON 1

PURPOSE

The purpose of this lesson is to demonstrate the impact of climate change on the Earth. Using two plastic bottles, you will be simulating two atmospheres. One with higher levels of carbon dioxide and one with normal air. Students will see a parallel between the experiment and how greenhouse gases are causing the temperature of the Earth to rise.

BIG IDEA

How does climate change increase global temperature?

MATERIALS

- Two clear 2L plastic bottles
- 1 Small bottle for collecting CO_2
- 1 Balloon
- 1 Scale
- Tape
- Malt vinegar
- Baking soda
- Two thermometers (traditional or digital)
- Blue Sticky Tac or plasticine (to seal)
- Table lamp or another light source that produces moderate heat.
- Water

EXPERIMENT STEPS

1. Place a thermometer inside each 2L bottle, in the same position. Fill the bottom section of the two bottles with some water about ¼ of the way. Seal the lid with the cap, sticky tack or plasticine.
    a. If the thermometers can't fit through the top of the 2L bottles, cut the top off the two plastic bottles. Add the thermometers and water to the bottle as described, then tape the top of the bottle back on and seal the lid.

2. Place a source of light, either a lamp or a bulb in between the two bottles at an equal distance.

3. Use the scale to measure 45g (3 tbsp) of baking soda. Fill the bottom of the balloon with the baking soda. Fill the small bottle about ¼ of the way with vinegar. Stretch the opening of the balloon over the mouth of the bottle and lift the balloon up above the bottle so the baking soda falls into the bottle. Allow the reaction to happen and for CO_2 to be created which will rise into the balloon. Be careful not to let the balloon pop off or for the gas to escape.

4. Pinch or twist the neck of the balloon and remove it from the small bottle. Take the cap off one of the bigger 2L bottles, and then squeeze the sides of the bottle gently. Place the opening of the balloon into the bottle and allow the gas to escape into the 2L bottle. Remove the balloon and quickly reseal the 2L bottle.

5. Every 10 minutes your class can observe the changes in temperature between the two 2L bottles.

HOOK

The lesson starts off by tapping into the student's prior knowledge about climate change. Discussion questions could include:

What is the weather?

Weather describes the environmental conditions that are happening at the current moment, like rain, snow or wind.

What is the difference between weather and climate?

Climate is a more than just a few days of rain or sun, it is a pattern of expected weather conditions during certain times of the year.

Now that you know the difference between weather and climate, what do you think climate change might mean?

Field a few responses and if none come close to the concept, clarify that climate change is a change in normal weather conditions in an area over a longer period.

WORKING ON IT

1. Introduce the experiment to the students by explaining that they are going to be viewing a representation of the greenhouse effect. We will be exposing two clear bottles to the same heat source from an equal distance. The only variable is that one bottle will have additional CO_2 introduced into the bottle and the other will just have normal air.

   Without giving too many specifics of what might happen, have the students make a hypothesis, using the resource in Appendix A, on what they think might happen in the experiment and explain why.

2. While the students write down their hypothesis, turn on the light and begin the experiment by recording the starting temperatures in each of the bottles.

3. While the lamp heats up the two bottles, watch the NASA Kids video on the Greenhouse effect. *Source: NASA Climate Kids*

4. Check in with the students and see if they think they should change their hypothesis based on what they know now. Every 10 minutes check back in on the bottles and record any changes that might have happened in the temperature of the two bottles. Have the students record their observations in the chart provided in Appendix A. Continue the conversation with the students as they start to see patterns forming.

CONSOLIDATE

1. After the students record the results of the experiment, host a discussion on why they think the bottle with the additional CO_2 in it is hotter than the one without.
2. Relate the experiment back to the concept of climate change and how the bottle with additional CO_2 is a representation of climate change. As the heat from the sun reflects off the surface of the water, the additional greenhouse gas in the atmosphere refract the light in different directions, which prevents some of the heat from escaping the earth.

LESSON 2

PURPOSE

This lesson is focused on how much the Canadian climate has changed over the past 20 years. It would be beneficial to preface this lesson with a review of integers and how integers are used in the measurement of temperature. Students will be using a data set of Canada's climate changes over the past 20 years to graph the change.

BIG IDEA

How has climate change impacted Canada?

MATERIALS

- Graph paper
- Ruler
- Pencil
- Print out of Appendix B or project the graph
- Print out of Appendix C or project the data

HOOK

To begin the lesson, do a recap with the group of students about the experiment from the other day.

What was the experiment we completed yesterday supposed to represent?

As you engage the students back into the topic, link the conversation into the graph in Appendix B, which represents the yearly average temperature between 1960 and 1985. Ask the students to make observations about the chart and record any of the observations on the board.

WORKING ON IT

1. The students will be working on making their own broken line graphs to display the change in climate over the past 20 years. They will be comparing their graphs to the one they saw at the beginning of the lesson, to see what changes have occurred over the past 20 years.

2. Review the components of a broken line graph and highlight that this line graph uses both negative and positive numbers. Using the example graph in Appendix B, highlight how the negative numbers fall below the x axis and the positive numbers are above the x axis.

3. At this stage, the students will be using a set of data to create their own broken line graphs like the one above. Have students set up a graph using the same layout as the graph above on their graph paper, but they will be labelling the years on their chart 1986-2016.

4. Encourage the students to plot the data points clearly with pencil before connecting the dots, using the data from Appendix C. Also, encourage them to connect the dots using a ruler.

CONSOLIDATE

From the graph the students will have created, they will be able to make some comparisons between the two charts. Have the students respond to the following question on the back of their graph paper or on a separate sheet of paper.

> ***Compare your graph with the graph you were shown at the beginning of the class. Can you see any similarities or differences between the two? Explain your observations and refer to specific examples from the graph.***

LESSON 3

PURPOSE

This lesson will highlight the impact climate change has had on different regions in Canada by examining how the habitat range of different animals has changed. Understanding the concept of habitat change will allow students to understand why many climate sensitive infectious diseases are becoming more common in Canada. The students conclude the lesson by researching a few infectious diseases that are becoming more common in Canada.

BIG IDEA

How does climate change affect the habitats of insects and animals?

What are some infectious diseases that are becoming more common in Canada?

MATERIALS

- Projector
- Copies of Appendix E
- Computers

HOOK

Lead a discussion on how climate change has affected the Earth. Some possible discussion questions can be found below.

> ***If less heat is escaping from the Earth, what kind of things might change in the environment? Can you think of any examples?*** Consider making a list of these animals.
>
> ***Ask the students to name a few animals that live in a warmer climate but could not survive a Canadian winter without help.***
>
> ***Why some of the animals they listed would have a hard time surviving a Canadian winter?***
>
> ***Do you think only certain mammals and reptiles would have a hard time surviving Canadian winters?***
>
> ***Why could it impact insects as well?***
>
> ***What if the opposite situation were to occur, what if the Canadian winters would become warmer?***
>
> ***Would it become easier for mammals, reptiles, and insects to survive in places they could not live in before?***

WORKING ON IT

1. Project the map in Appendix D. Use the tick as an example of how the habitats of some living things are changing. Go over the labels and key features of this thematic map and ask the class:

   What kind of conclusions can you make when looking at this map?

   What changes from the first map to the last map?

2. The goal is for the students to understand that climate change is causing many animals and insects to travel into areas they never used to inhabit before. Some of these animals and insects carry disease which can be transferred to humans.
   Climate change is affecting the habitats of insects and animals, allowing them to move to areas where they never used to live. Some animals and insects carry diseases which they can give to humans through bites or contaminating food or water.

3. Hand out the organizer in Appendix E. Using the Government of Canada website found at www.canada.ca/en/public-health/services/diseases.html have the students fill out the organizer by searching the different diseases in their database.

CONSOLIDATE

The diseases they have researched have all become more common due to climate change. Highlight some of the climate sensitive diseases that are becoming more common in your region of Canada. Ask your students to start thinking about what disease they would like to research further for their poster at the end of the unit.

LESSON 4

PURPOSE

Lesson 4 highlights the impact that climate change is having on the geographic range of certain species, using the tick as an example. The activity will demonstrate how a growing habitat range of an animal increases the potential for human encounters with these animals, and can increase the risk of these animals spreading an infectious disease to humans.

BIG IDEA

How does changing the habitat range of some animals impact the safety of humans?

MATERIALS

- A large clear area such as a gymnasium or field
- Soft dodgeballs
- Pylons or other markers

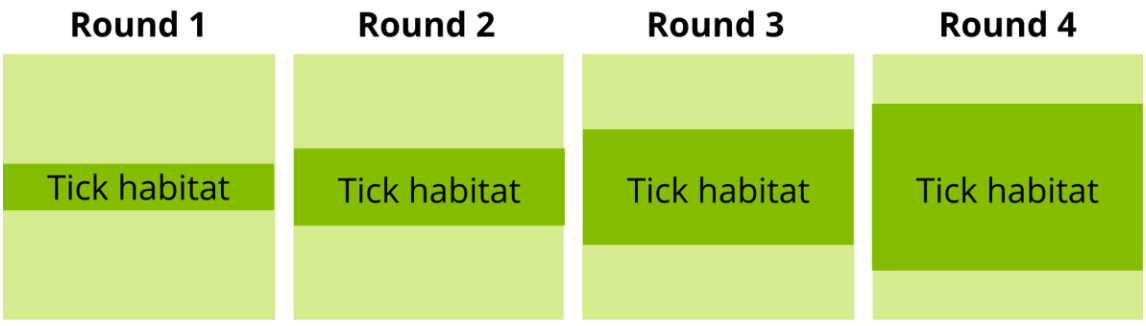
DIRECTIONS

1. Choose one student to be the “tick” and give them one soft dodgeball. They will stand in the middle of the playing area (tick habitat) which is denoted by pylons or other markers. The rest of the students will line up at the edge of the playing field. On ‘go’, they must run through the tick habitat to the other edge of the playing zone.

2. The tick must try to ‘bite’ other members of the class while they run through the tick habitat by hitting them below the waist with a soft dodgeball. If a student is ‘bitten’ within the tick habitat, they must immediately sit down. If a student catches a dodgeball before it hits them, they prevented the tick bite and can leave the tick habitat.

3. For the next round, expand the tick habitat by moving the pylons further apart. All students who are in the tick habitat become ticks for the next round. Give each tick a soft dodgeball.

4. Keep playing rounds until all but one of the students are bitten. This student becomes the tick for the next game.



CONSOLIDATE

Following a few rounds of the game, host a follow up conversation on their experiences playing the game.

> ***How much more challenging did the game become as you increased the area which the ticks could move in?***
>
> ***Do you see any connections between this game and what we have learned about the habitats of certain species expanding?***

Connect the conversation back to the prior learning about how climate change is allowing different species to survive in areas which they could not survive in before.

To link into the next lesson, see if the students figured out any strategy that could help them prevent getting bitten by the ticks and make it safely out of the habitat. Highlight the connection between focusing on catching the ball and prevention of tick bites. Refer to the Resources at the end of this document for kid friendly videos and websites on tick bite prevention.

LESSON 5

PURPOSE

This lesson is based on a narrative from the perspective of an Algonquin boy who is learning about ticks and mosquitoes carrying Lyme disease and West Nile virus. The book provides practical safety tips for people looking to stay safe while enjoying the outdoors.

MATERIALS

- Copies of Appendix F and Appendix G

HOOK

Begin the class by projecting the e-book on the overhead.

Potential pre-reading questions:

> ***Have your parents ever given you advice on how to stay safe when you are playing outside?***
>
> ***What are some safety tips you know to follow when exploring in nature?***

Read the book to the students.

Grandpa's Wisdom - An Algonquin Reflection on West Nile Virus and Lyme Disease

WORKING ON IT

Post Reading:

Identify some of the strategies that were brought up in the book that can help people protect themselves from Lyme disease and West Nile Virus when they are exploring in nature.

Hand out the worksheet in Appendix F and Appendix G and give the students some time to reflect on the story to answer the reading comprehension questions and complete the word search on the key vocabulary.

Revisit the different parts of the book as needed.

CONSOLIDATE

During the next period, the students will begin designing their posters. Allow the students some time to start researching the topics they decided on in Lesson 3. They should be collecting important information relating to the disease and preparing to design a poster that will highlight it to their community.

CREATING A POSTER

Throughout the activities, your students have had an opportunity to research, analyze and learn about Lyme disease or another climate sensitive infectious disease that is prominent in your community. At this point, your students will be consolidating their learning by creating a poster.

The poster contest is designed to raise awareness of the emergence and changing patterns of Lyme disease and other climate sensitive infectious diseases, which can be found within our local communities. It is also an opportunity for your students to examine how climate change has contributed to an increase in the occurrence of these diseases and identify essential information that should be shared with their friends, family and community.

The deadline to submit entries to the contest is 31 March 2023. Prizes will be awarded to a National Winner, a National Runner-up, and Regional Winners. Winners will be notified between late April and early May 2023. The winning posters will be featured on the Canadian Public Health Association website and used to raise awareness of climate sensitive infectious diseases in Canada.

PROCEDURE

1. Review the principles of good poster design. Effective posters should:
    - ¶ Use a big and colourful visual
    - ¶ Experiment with different printing techniques
    - ¶ Include space between elements
    - ¶ Correct spelling
    - ¶ Be easy to read from a distance, using large and bold writing
    - ¶ Have contrast between the background and text

2. Gather and distribute materials for the poster creation.
    - ¶ Paint, marker, pencil, pastels and/or pencil crayon.
    - ¶ Paper that is no larger than 17” x 11” (432mm x 279mm) and no smaller than 11” x 8.5” (279mm x 216mm).

3. Have students choose a climate sensitive infectious disease to feature on their posters. All posters must:
    - ¶ Include a drawing that demonstrates how to prevent their chosen climate sensitive infectious disease.
        - ¶ Examples of climate sensitive infectious diseases include: Lyme disease, West Nile virus, hantavirus, E. coli, giardiasis, and salmonellosis. For more information, read this information sheet.
    - ¶ Include a call to action, which tells people what they can do to help prevent the disease.
        - ¶ A call to action is a phrase which that tells the reader what action to take, and how to take it (e.g. *“Prevent tick bites, walk on cleared paths”*)

4. Submit the posters to the Canadian Public Health Association either by mail, or electronically. The deadline for submission is **March 31, 2023.**

To mail your poster:

- Print the entry form (single form / multiple forms)
- Glue the completed entry form to the back of your poster
- Mail posters flat (not folded or rolled)
- Mail to: Grade 6 Poster Contest

  c/o Canadian Public Health Assoc

  404 – 1525 Carling Ave.

  Ottawa ON K1Z 8R9

To submit electronically:

- Fill in the online submission form
  - There is a bulk submission option for teachers to facilitate submitting multiple posters on behalf of students.
  - Upload a photo or scan of your poster in the form. If necessary, crop the image to the edges of the poster

POSTER GUIDELINES

- No computer drawings or clipart
- All designs must be unique. No copying from other resources (textbooks, web sites, magazines etc.)
- No cut and pasted materials or three-dimensional submissions
- All text must be clear and easily readable
- Text can be written in English, French, and/or a language relevant to the student's local community

RULES

- Individual entries only.
- Open to Grade 6 students registered in a Canadian school during the 2022-2023 school year.
- Posters must focus on prevention a climate sensitive infectious disease.
- Posters must use the materials and format outlined above.
- Submissions that do not meet the poster guidelines will be disqualified.
- Posters submitted with incomplete entry forms will be disqualified.

For more information about the poster contest, please visit: www.cpha.ca/contest

Question:

_____

What question are you trying to answer in this experiment?

Hypothesis: I think that _____

Which bottle will have a higher temperature after 1 hour?

_____

Why do you think that will happen?

Recording Data:

Time:	Bottle One Temperature (°C)	Bottle Two Temperature (°C)

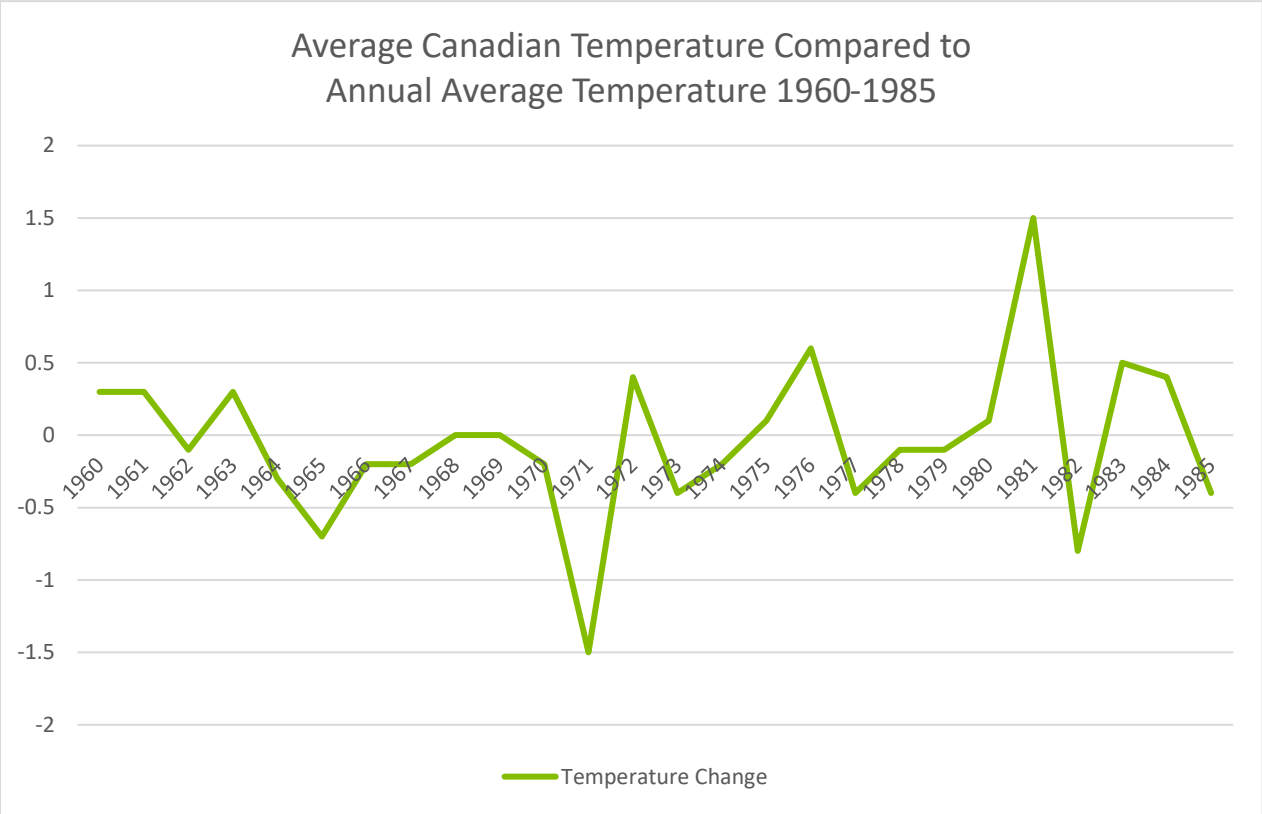
Results: What did you learn from the experiment?

_____

_____

_____

APPENDIX B: AVERAGE TEMPERATURE GRAPH



Data Source: Prairie Climate Centre

http://prairieclimatecentre.ca/2017/10/seeing-is-believing-historical-records-prove-canada-is-warming/

APPENDIX C: TEMPERATURE CHANGE IN CANADA 1986-2016

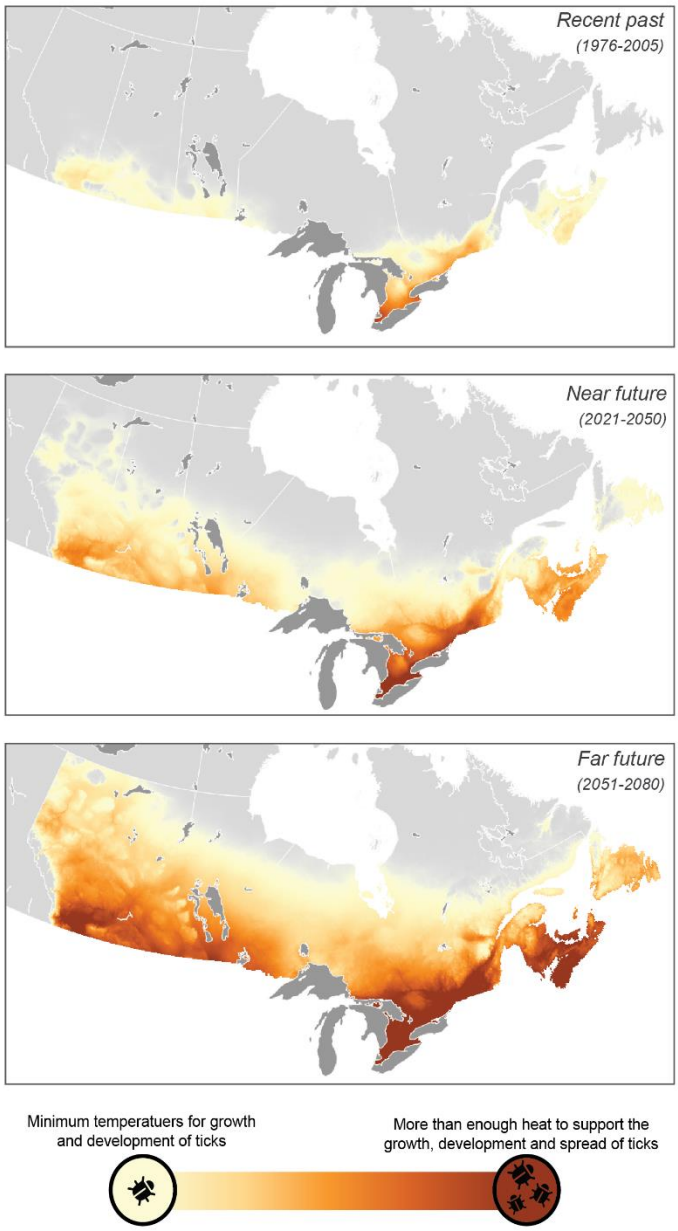
Year	Temperature Change
1986	1.2
1987	3.1
1988	0.6
1989	-0.5
1990	0.5
1991	-0.1
1992	0.9
1993	0.5
1994	0.2
1995	0.0
1996	-1.9
1997	1.6
1998	1.4
1999	2.6
2000	0.0
2001	3.5
2002	2.5
2003	1.4
2004	0.1
2005	1.5
2006	3.4
2007	1.1
2008	0.6
2009	0.9
2010	2.3
2011	2.4
2012	1.2
2013	-0.5
2014	1.2
2015	2.9
2016	2.9

Data Source: Prairie Climate Centre

http://prairieclimatecentre.ca/2017/10/seeing-is-believing-historical-records-prove-canada-is-warming/

APPENDIX D: CLIMATE CHANGE, TICKS, AND LYME DISEASE RISK IN CANADA

These maps show where temperatures are suitable for the growth and development of blacklegged ticks in future climates if we continue to increase our emissions. Blacklegged ticks can carry Lyme disease. These ticks live in wooded areas, so if you live, work, or play in wooded areas with suitable temperatures, you may be at risk of encountering a tick carrying Lyme disease.



Temperatures sufficient for the growth and development of blacklegged ticks are at least 2860 degree days (the total of all daily temperatures above 0 °C in a year). The colour scale shows 2860 degree days (yellow) to 4000 degree days (red). This map does not apply to the species of Lyme-carrying ticks that live west of the Rocky Mountains. The climate projections on these maps were made using 24 climate models running the "high carbon" emissions scenario (RCP8.5). Climate model data was downscaled and made available by the Pacitic Climate Impacts Consortium (PCIC).

Source: The Climate Atlas https://climateatlas.ca/lyme-disease-under-climate-change

APPENDIX E: CLIMATE SENSITIVE INFECTIOUS DISEASES

Use the Canada public health website at www.canada.ca/en/public-health/services/diseases.html to research the following diseases.

Disease Name	How is it sensitive to climate change?	How do people get infected?	Symptoms	How to Prevent it?
Lyme disease	Blacklegged ticks, which spread Lyme disease, are able to survive longer in warmer temperatures. As Canada gets warmer, ticks are able to live in a bigger area than they used to.			
West Nile virus	Mosquitoes, which spread West Nile virus, are able to survive longer in warmer temperatures. The virus spreads more easily between mosquitoes and humans in warmer temperatures.			
Hantavirus	Rodents carry hantavirus. More rain will increase the number of rodents. Changes in climate will also affect the habitats of rodents, changing where they live.			
E. coli	Big rain storms can contaminate lakes and rivers with E. coli. E. coli bacteria survive better in warmer temperatures.			
Giardiasis	Big rain storms can contaminate lakes and rivers with giardia. Giardia survives longer in colder temperatures.			
Salmonellosis	Big rain storms can contaminate lakes and rivers with salmonella. Salmonella bacteria survive better in warmer temperatures.			

APPENDIX F: GRANDPA'S WISDOM: AN ALGONQUIN REFLECTION ON WEST NILE VIRUS AND LYME DISEASE

1. **What did Mishòmis tell Mahìngan to wear on his feet when he left for the cabin?**

_____

2. **When they entered the forest, what attacked Mishòmis and Mahìngan?**

_____

3. **What did they do to protect themselves?**

_____

4. **Where were the people more likely to find West Nile Virus?**

_____

5. **What did Mishòmis say Mahìngan should do after he plays in the forest?**

_____

6. **Do you think people should stop playing outside because of ticks and mosquitoes? Why yes or no?**

_____

_____

7. **How can you protect yourself from harmful insects?**

_____

_____

APPENDIX G: GRANDPA'S WISDOM WORD SEARCH

Highlight or circle the words and then cross the words off the list as you find them. The words can be found horizontally, vertically, or backwards.

C	H	P	P	T	I	Y	W	I	P	C	S	M	W	X	K	C	A	K	X	M	Y	A
J	A	R	Y	I	E	J	N	O	I	T	U	A	C	U	N	Y	M	P	H	J	K	R
I	B	D	O	N	U	C	A	R	E	F	U	L	Z	E	U	B	W	S	T	I	S	N
A	I	M	B	F	P	I	O	I	T	N	C	M	A	B	J	H	E	S	T	N	A	P
K	T	E	F	E	M	S	O	B	I	E	L	C	C	S	J	O	S	E	H	S	J	L
N	A	U	X	C	A	F	L	I	Y	S	S	T	V	N	F	F	T	S	J	L	M	Y
E	T	E	I	T	D	P	D	T	K	C	O	I	X	O	O	Z	N	A	G	E	O	T
O	A	P	F	I	Y	V	A	E	K	I	C	C	S	I	X	Z	I	E	V	E	S	E
D	X	L	H	O	M	A	Q	Z	W	T	K	K	P	T	B	J	L	S	Y	V	Q	F
I	S	I	I	N	S	E	C	T	M	O	S	A	L	U	K	Z	E	I	U	E	U	A
T	W	E	E	Z	E	R	S	I	E	I	U	E	Z	A	X	V	C	D	R	S	I	S
F	Z	U	J	T	W	V	E	M	J	B	Z	G	N	C	G	O	O	E	U	J	T	A
Z	X	Q	J	E	A	S	K	E	F	I	R	S	V	E	O	E	M	Y	L	L	O	U
U	O	S	B	K	T	A	Q	S	O	T	E	E	D	R	U	K	P	N	Q	K	C	M
S	F	E	V	E	R	R	X	H	N	N	Q	V	D	P	M	Q	I	Q	A	L	V	K
U	Y	L	V	R	S	G	D	R	P	A	R	H	N	S	N	J	T	V	K	K	J	W

ANTIBIOTICS	**GRASS**	**PANTS**
BITE	**HABITAT**	**PRECAUTIONS**
CAREFUL	**INFECTION**	**SAFETY**
CAUTION	**INSECT**	**SLEEVES**
DAMP	**LYME**	**SOCKS**
DEET	**MESH**	**TICK**
DISEASE	**MOSQUITO**	**TWEEZERS**
FEVER	**NYMPH**	**WEST NILE**

RESOURCES

TICKS & LYME DISEASE

British Columbia Centre for Disease Control

Tick Talk

Brochure: Tick Talk for the Whole Family

Canadian Veterinary Medical Association

Tick Talk Canada

Climate Atlas of Canada

Lyme Disease Under Climate Change

Government of Canada

How to check for ticks

OTHER CLIMATE SENSITIVE INFECTIOUS DISEASES

Climate Atlas of Canada

Mosquito borne diseases and climate change

Government of Canada

Diseases and conditions

National Institute of Environmental Health Sciences

Waterborne Diseases and Illnesses

Protecting Yourself from Insect Associated Diseases

CLIMATE CHANGE

Climate Atlas of Canada

Climate Atlas

Climate Change and Health

Climate Kids

Climate Kids

About Climate Change

Indigenous Peoples Atlas of Canada

Climate

Ingenium Canada

Climate Change Adaptations

Climate Change Adaptation Lesson Plans and Infographics

Learning for a Sustainable Future

Toolkits and resources

VIDEOS & ONLINE ACTIVITIES

Lyme disease: Enjoy the outdoors, without a tick

Mosquito borne diseases

Climate Change 101 with Bill Nye | National Geographic

Lyme disease, climate change and public health

Hotter summers, greener lakes

NASA Climate Kids

Climate Crisis, Health Crisis

Climate Science Brain Buster

Could ticks be there? Be tick aware!

MEDIA LITERACY

Media Smarts: Canada's Centre for Digital and Media Literacy

Teaching Your Children Safe Surfing Habits

How to recognize false content online – the new 5 Ws