

What's the Deal with Ticks?

LESSON PLAN

ALSO FOR
**SOCIAL STUDIES,
HISTORY, AND
GEOGRAPHY**
LESSON PLAN

GRADE: 10

SUBJECT & STRAND: Academic - Earth and Space Science: Climate Change
OR Applied - Earth and Space Science: Earth's Dynamic Climate

LESSON(S) TOPIC: Ticks & Climate Change

DURATION: 150 minutes

CURRICULUM EXPECTATIONS

ACADEMIC

Big Ideas

- Climate change affects living things and natural systems in a variety of ways.
- People have the responsibility to assess their impact on climate change and to identify effective courses of action to reduce this impact.

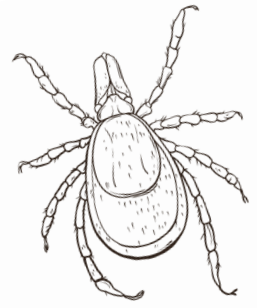
Overall Expectations

- D1.** Analyze some of the effects of climate change around the world, and assess the effectiveness of initiatives that attempt to address the issue of climate change.
- D3.** Demonstrate an understanding of natural and human factors, including the greenhouse effect, that influence Earth's climate and contribute to climate change.

Specific Expectations

- D1.1** Analyze current and/or potential effects, both positive and negative, of climate change on human activity and natural systems.
- D1.2** Assess, on the basis of research, the effectiveness of some current individual, regional, national, or international initiatives that address the issue of climate change, and propose a further course of action related to one of these initiatives.
- D3.4** Identify natural phenomena and human activities known to affect climate, and describe the role of both in Canada's contribution to climate change.
- D3.5** Describe the principal sources and sinks, both natural and/or anthropogenic, of greenhouse gases.
- D3.8** Identify and describe indicators of global climate change.





APPLIED

Big Ideas

- Global climate change is affected by both natural and human factors.
- Climate change affects living things and natural systems in a variety of ways.

Overall Expectations

- D1.** Analyze effects of human activity on climate change, and effects of climate change on living things and natural systems.
- D3.** demonstrate an understanding of various natural and human factors that contribute to climate change and global warming.

Specific Expectations

- D1.1** Analyze, on the basis of research, various ways in which living things and natural systems have been affected by climate change, and communicate their findings.
- D1.2** Analyze ways in which human actions have increased or decreased the production of greenhouse gases.
- D3.5** Describe methods by which greenhouse gases are produced by humans.
- D3.7** Identify indicators of global climate change.

Cross Curricular Connections

Grade 10 Civics and Citizenship, Strand C: Civic Engagement and Action

Big Ideas

- Individuals and groups of people can make a difference in the world.
- Through the critical analysis of issues and the creation of plans of action, students can contribute to the common good.

Overall Expectation

- *C1. Civic Contributions:* analyze a variety of civic contributions, and ways in which people can contribute to the common good.
- *C3. Personal Action on Civic Issues:* analyze a civic issue of personal interest and develop a plan of action to address it.

LEARNING GOALS

- » Understand how climate change affects the population distribution of ticks and the larger natural systems to which they belong
- » Identify natural and human factors that influence climate change
- » Identify human actions that can mitigate climate change

ENVIRONMENTAL EDUCATION CONNECTIONS

KNOWLEDGE

- The nature of ecosystems and biomes, their health, and their interdependence within the biosphere
- The characteristics of human societies, including nomadic, hunter-gatherer, agricultural, industrial, and post-industrial, and the impact of each on the natural environment
- The process of urbanization and the implications of deruralization
- The interconnectedness of political, economic, environmental, and social issues in the present world

SKILLS

- define such fundamental concepts as environment, community, development, and technology, and apply these definitions in local, national, and global contexts
- Use a range of resources, communications skills, and technologies in addressing environmental questions
- Develop problem-solving skills and critical and creative thinking skills, including the ability to reason and apply logic, to recognize and apply abstract patterns, to identify connections and relationships between ideas and issues, and to test ideas against new information and against personal experience and beliefs
- Recognize the need to incorporate an environmental perspective in decision-making models.

ATTITUDES

- Appreciate the resilience, fragility, and beauty of nature and develop respect for the place and function of all living things in the overall planetary ecosystem
- Appreciate the role of human ingenuity and individual creativity in ensuring survival and achieving sustainable progress
- Appreciate the challenges faced by the human community in defining and implementing the processes needed for environmental sustainability
- Maintain a sense of hope and a positive perspective on the future

LESSON PART 1: MINDS ON/GETTING STARTED

(30-35 MIN)

ACTIVITY 1: KWL CHART (INDIVIDUAL/WHOLE CLASS)

- Use chart paper or a whiteboard to create a class KWL (Know, Wonder, Learned) chart about ticks as pictured below

Sample KWL Chart - Topic: Ticks

WHAT WE KNOW	WHAT WE WONDER	WHAT WE LEARNED

- Have students use sticky notes or a whiteboard marker to record at least one thing they know and at least one thing they wonder under the “What We Know” and “What We Wonder” sections of the KWL chart, respectively.
- After every student has had a chance to add their ideas to the KWL chart, regroup as a whole class to debrief the chart.
- Group common ideas into larger categories and have students explain any ideas on the chart that require clarification.
- For now, leave any misconceptions on the KWL chart, these will be addressed in the *Consolidation and Debrief* portion of the lesson.

ACTIVITY 2: BASIC TICK BIOLOGY (WHOLE CLASS)

- Use one or more of the following links to introduce basic tick biology:
 - » [City of Hamilton](#)
 - » [Public Health Ontario](#)
 - » [CanLyme](#)
 - » [Niagara Region](#)
 - » [Government of Ontario](#)
- Review basic tick morphology – four pairs of legs making them arachnids, small head, fused thorax and abdomen, etc..
- Tell students: Today we are going to learn more about ticks, specifically, the relationship between ticks and climate change.
- Pose the following questions: *Do you think there is a relationship between ticks and climate change? If so, can you describe the relationship?*
- Share learning goals to help students monitor learning throughout the lesson:
 - » Understand how climate change affects the population distribution of ticks and the larger natural systems to which they belong
 - » Identify natural and human factors that influence climate change
 - » Identify human actions that can mitigate climate change

LESSON PART 2: WORKING ON IT

(50-65 MIN)

ACTIVITY 1: IDENTIFYING SPATIAL RELATIONSHIPS

(SMALL GROUPS)

- In groups of 2-3, students will conduct spatial analysis to identify relationships between the data layers found in EcoSpark's Ticks & Climate Change Map
- Prior to the lesson, teachers may use ESRI Canada's [K-12 Education Resources](#) tutorials to familiarize themselves with Geographic Information Systems (GIS) and their various uses
- Provide each group with the *Ticks & Climate Change Spatial Analysis Guide* to focus their inquiry
- After students have had a chance to complete the activities on the *Ticks & Climate Change Spatial Analysis Guide*, have the whole class debrief using the following guiding questions to assess student understanding:
 - » How has the tick population distribution in North America changed over time?
 - » How has the tick population distribution in our local community changed over time?
 - » What are some factors contributing to the change in tick population distribution over time?
 - » How might humans be contributing to changes in tick population distribution over time?
 - » Why is it important to be aware of how the tick population distribution is changing in our local communities?
 - » Which species or ticks are the biggest public health concern? Why?
- Inform students that because ticks are blood suckers, they are also vectors for diseases, including Lyme disease.
- Show students the *Climate Change and the Increased Risk of Tick-borne Diseases* infographic to further demonstrate relationship between climate change and spread of tick-borne diseases.
- Inform students that there are ways to manage the spread of tick-borne diseases, this will be the focus of the next activity.

MATERIALS:

- [EcoSpark Ticks & Climate Change Map Link](#)
- ESRI Canada's intro to GIS tutorial (optional)
- Chromebooks/ personal devices/school computers
- *Ticks & Climate Change Spatial Analysis*
- [Climate Change and the Increased Risk of Tick-borne Diseases](#) infographic

OPEN UP INQUIRY

To open up inquiry, only provide students with the questions in the *Ticks & Climate Change Spatial Analysis Guide*, leaving out the analysis procedure. To further open up inquiry, have students create their own questions and procedure for investigation.

ACTIVITY 2: RAISING PUBLIC AWARENESS

(SMALL GROUPS/INDIVIDUAL)

- Individually, have students create an PSA (poster, video, story map, etc.) about ticks using public health messaging on best practices for tick safety and reducing the spread of ticks through actions that mitigate climate change.
- Provide students with web applications for completing PSA, including:
 - » Canva
 - » Piktochart
 - » Sketchnote apps
 - » ESRI Story Map
 - » YouTube
- Tell students that their PSA must meet the success criteria outlined in the *Ticks & Climate Change PSA Rubric*
- Review APA citation guidelines as a class using the following resource: [Owl Purdue](#)
- Review any citizen science data/project citation information used in the activity. Citation formats are usually available on the website. For example, iNaturalist can be cited as:
- iNaturalist. Available from www.inaturalist.org. Accessed [date].
- Provide the following links for students to begin collecting information on ticks and tick safety:
 - » [City of Hamilton](#)
 - » [Government of Ontario](#)
 - » [Niagara Region](#)
 - » [CanLyme](#)
 - » [Public Health Ontario](#)
- Have students complete PSA research in groups to facilitate collaboration and information sharing.

MATERIALS:

- Chromebooks/ personal devices/school computers
- *Ticks & Climate Change PSA Rubric*
- Markers
- Poster paper
- Pencil crayons

GUIDED INQUIRY ALTERNATIVE

- Use the blank version of the *Ticks & Climate Change PSA Rubric* to co-create success criteria for PSA with students. Analyze existing Public Health PSAs of a similar nature with students and ask questions such as:
 - Who is the audience of the PSA?
 - What elements should the PSA include?
 - How will you know that you have gotten your message across?

LESSON PART 3: CONSOLIDATION AND DEBRIEF

(30-50 MIN)

WRAP UP (INDIVIDUAL/WHOLE CLASS)

- Student presentations of ticks and climate change PSA
- To consolidate knowledge, revisit and review the KWL chart from the **Minds On** activity by facilitating a whole class discussion
 - » As a class, note new learning in the “What We Learned” column of the chart
 - » When reviewing the “What We **Know**” and “What We **Wonder**” sections of the chart, use the following symbols to code initial student ideas:

Misconceptions



Confirmed



Still wondering



MATERIALS:

- Computer and projector
- Speakers for video presentations



ADDITIONAL CONSIDERATIONS

EXTENSION ACTIVITIES

- Organize a school/community event to raise local awareness about tick safety and climate change - showcase student PSAs during event
- Host an EcoSpark School Watch session to engage students in citizen science monitoring activities that contribute to climate change research
- Explore the impact of climate change on local animal populations beyond ticks
- Refer to the research article “[Hosts as ecological traps for the vector of Lyme disease](#)” to learn more about how opossums and squirrels have been found to be natural predators of ticks. Based on the research in the article:
 - » Explore with how climate change influences biodiversity and in turn, influences tick population distribution
 - » Assess local and provincial land use, how this influences land fragmentation and the survival rate of natural tick predators

ADAPTING TO DIFFERENT GRADE LEVELS

Senior Level

- Identify and investigate other vectors of diseases that may spread locally due to climate change and what can be done to mitigate the spread of the disease(s)
- Study morphology of various local tick species to correctly distinguish between species
- Research and investigate tick ecology to find additional spatial data on population distribution. Based on research, identify potential future tick “hot spots”

Junior Level

- Investigate the dynamics of food chains and food webs that contain ticks
- Explore how the local population distribution of ticks may affect biodiversity and vice versa
- Simplify spatial analysis of EcoSpark ESRI map by only looking at black legged ticks and historical climate change layers
- Have students create a poster for the PSA on tick safety and climate change

REFERENCES

- Bouchard C, Dibernardo A, Koffi J, Wood H, Leighton PA, Lindsay LR. Increased risk of tick-borne diseases with climate and environmental changes. *Can Commun Dis Rep* 2019; 45(4): 83–9. <https://doi.org/10.14745/ccdr.v45i04a02>
- CanLyme (Canadian Lyme Disease Foundation). (2020). *Tick Prevention*. <https://canlyme.com/lyme-prevention>
- City of Hamilton. (n.d.). *Lyme disease & ticks*. www.hamilton.ca/public-health/health-topics/lyme-disease-ticks
- EcoSpark. (2020). *Ticks & climate change*. <https://arcs.is/OWSzaa>
- ESRI Canada. (2020). K-12 Education Resources. <https://k12.esri.ca/resourcefinder/#/lang=en>
- Government of Ontario. (2019). *Ticks & lyme disease: How to prevent tick bites when outdoors*. <https://files.ontario.ca/moh-lyme-en-factsheet-2019-11-20.pdf>
- Keesing, F., Brunner, J., Duerr, S., Killilea, M., Logiudice, K., Schmidt, K., Vuong, H., & Ostfeld, R. S. (2009). Hosts as ecological traps for the vector of Lyme disease. *Proceedings. Biological sciences*, 276(1675), 3911–3919. <https://doi.org/10.1098/rspb.2009.1159>
- Niagara Region. (n.d.). *Tick identification in Niagara*. www.niagararegion.ca/living/health_wellness/disease-prevent/ticks/identification.aspx
- Ontario Ministry of Education. (2008). *The Ontario curriculum, grades 9 and 10: Science*. www.edu.gov.on.ca/eng/curriculum/secondary/science.html
- Public Health Ontario. (2016). *Blacklegged tick surveillance in Ontario: A systemic review*. Queens Printer for Ontario. www.publichealthontario.ca/-/media/documents/B/2016/blacklegged-tick-surveillance.pdf?la=en
- Public Health Ontario. (2019). *Ontario lyme disease map 2019: Estimated risk areas*. Queen's Printer of Ontario. www.publichealthontario.ca/-/media/documents/L/2019/lyme-disease-risk-area-map-2019.pdf?la=en

SCHOOL WATCH LESSON PLAN

School Watch introduces students, grades 6 to 12, to the world of citizen science through customized curriculum-linked classroom and on-site activities.

EcoSpark's School Watch program provides the lesson plans and tools - such as butterfly nets, binoculars, and tree measuring tools - to deliver citizen science projects suitable for most school grounds. EcoSpark staff lead facilitated two-hour outdoor sessions with students, on or near the school grounds, to bring curriculum based concepts to life. In addition to providing the necessary equipment we supply data sheets and other project materials such as identification keys.

EcoSpark believes strongly in the benefits of outdoor education but also recognizes that during the Covid-19 crisis not all education will take place in traditional school learning environments. In addition to our in-person programs we have modified remote learning options available with flexible scheduling and delivery variations based on board, school and teacher needs and requirements.

For more information or questions, please contact:
schoolwatch@ecospark.ca
 or 647-258-3280 x 2003