New York City Climate Week: Canadian Wildfires

12th Grade

Lesson Duration: 5, 42 minute periods

AP Environmental Science

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BIG IDEAS

Wildfires, Atmosphere, Albedo, Soil Moisture, Climate change, Human impacts on environment, Remote sensing data

EDUCATION STANDARDS

HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

NGSS Performance Expectation(s)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. • Analyze data using computational models in order to make valid and reliable scientific claims. - ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Science investigations use diverse methods and do not always use the same set of procedures to obtain data. • New technologies advance scientific knowledge. **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based on empirical evidence. • Science arguments are strengthened by multiple lines of evidence supporting a single explanation	**ESS3.D: Global Climate Change** • Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.	**Stability and Change** • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

New York State Next Generation GRADE P-12 English Language Arts Learning Standards:

11-12W6: Conduct research through self-generated question, or solve a problem; narrow or broaden the inquiry when appropriate. Synthesize multiple sources, demonstrating understanding and analysis of the subject under investigation.

MEASURABLE STUDENT LEARNING OBJECTIVES

- Students will be able to ask questions using remote sensing data about wildfires.
- Students will be able to use online sources to collect data to determine how wildfires cause physical changes on Earth.
- Students will be able to construct a claim using evidence and reasoning to describe how wildfires impact one physical change on Earth.
- Students will be able to synthesize data to create an argument based on their individual stakeholder group scenario.
- Students will be able to present data in a socratic seminar round table discussion.

MATERIALS NEEDED

• Pencils or pens • Desktop computer or chromebooks • Mini white boards • EXPO markers	• Post-its • Scenario cards

ENGAGING CONTEXT/PHENOMENON

During June 2023, over 30 million acres of land was destroyed in Canada due to wildfires (Campen& Velev, 2025). The destruction from these wildfires spread into the United States and could be felt all the way in Manhasset, New York. This included devastating impacts of human health, air quality, vegetation, wildlife, and soil (Moore, 2023). Geospatial data from the following two summers show signs that extreme wildfires in Canada will continue to have major impacts on the environment, unless innovative solutions are proposed that consider the viewpoint of all stakeholders.

DATA INTEGRATION

For this unit, students will incorporate remote sensing data to enhance learning about wildfires. At the beginning of the unit, students will observe satellite FIRMS wildfire data to observe recent wildfire spread. Students will then use information from NASA Earth Observatory and NASA Earthdata Worldview platform to collect data on parameters such as air quality, vegetation, deforestation, wind patterns, soil moisture levels, and fire burn associated with the June 2023 wildfire. Using the quantitative data collected, students will be transformed into graphs and tables to present in a padlet. Students will then be split into groups and given one of six stakeholders. Each group will be given one of six datasets from NASA, NOAA, EPA, and the USDA, to analyze for further information for their specific group. The data will then be incorporated into a CER and the final argument for the socratic seminar. Incorporating remote sensing data will allow students to authentically engage in science.

TEACHER BACKGROUND KNOWLEDGE

To prepare for teaching this unit, a teacher should understand how wildfires can impact air quality, vegetation, deforestation, wind patterns, soil moisture levels, and fire burn. When

teaching about air quality, teachers should understand how wildfires can elevate PM 2.5 readings (Burke, et al., 2023). In addition, teachers should understand how the prevailing wings can bring these particulates from Canada to New York. For vegetation, teachers should understand how short-term changes in vegetation and soil moisture are affected by immediate wildfire exposure. This includes an immediate decrease in tree cover, leaf litter, and reflectivity (Moore, 2023). Lastly, teachers should understand the concept of secondary succession when discussing the long-term impacts of wildfires.

DIFFERENTIATION OF INSTRUCTION

In order to modify this lesson for all learners, there are additional scaffolds that can be implemented. Students can use the asking questions, analyzing data, and engaging in scientific argument templates from The Wonder of Science to organize their ideas. In addition, students can use the Model U.N. SEEC format for constructing arguments and the sentence starter questions to prepare for the socratic seminar. These modifications will encourage all students to participate in the writing and speaking tasks of the unit. As an additional modification, videos will be supplemented to readings for students who are visual and auditory learners. Lastly, students will have access to the final evaluation rubric. The rubric can be helpful for students to have clear expectations for how they will be graded. Incorporating these modifications into the lesson can differentiate the lesson for all students to engage in.

POSSIBLE MISCONCEPTIONS

It is important for teachers to plan to pre-emptively address misconceptions about wildfire data. One common misconception is that wildfires always have long-term negative impacts on the environment. While wildfires cause acute destruction, over time, wildfires can cause succession which can replenish soil nutrients and increase biodiversity in the area (NASA Earth Observatory, 2025). Another common misconception is that wildfires only occur when there are high temperatures. Wildfires are not necessarily more common when temperatures are high; however, earlier spring melt and drier conditions can lead to a higher chance of wildfires to occur (Campen & Velev, 2025). Being able to anticipate misconceptions students may have about wildfires can help plan for teachers to address these conceptions to deepen student understanding.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
Engage	**Procedure:** The teacher will instruct students to watch the NOAA Satellites Monitor Canadian Wildfires and Smoke video to provide background information about the wildfires during the summer of 2025. Independently, students will write down five questions they have about the video on a mini-whiteboard. As students are working, the teacher will circulate around the classroom and encourage students to revise their questions. Then, students will share with a partner their findings and generate three testable research questions about the data on a post-it. Before sharing, the teacher will have students observe the FIRMS wildfire data. With a partner, students can revise their questions, making sure to have the questions linked to the FIRMS data set. As a class, students will share one question their group created about the data. The teacher will guide the conversation by writing all questions on a large poster paper. When all questions are shared, students will decide on one question to use as the class goal for this topic. **Objective:** Students will be able to ask questions using remote sensing data about wildfires. **Modifications:** Students can use the "Asking Questions" template from the Wonder of Science as a tool to organize testable questions. **Formative/Summative Assessment:** Teacher will formatively assess student questions during the beginning and middle of the lesson. At the end, the teacher will use the Asking Questions Rubric to grade the final questions. **Standards Addressed:** HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

	Materials: Desktop computers, pencil, post-its **Resources:** Asking Questions Graphic Organizer.pdf Video: https://www.youtube.com/watch?v=5Utibam8Ng4 FIRMS data set: https://firms.modaps.eosdis.nasa.gov/map/#d:24hrs;@0.0,0.0,3.0z Asking Questions Rubric: https://docs.google.com/document/d/1Mfw_PaY0flw8m3c7S_UFtU2Sltb__NtfngxA1WfBwPM/template/preview
Explore	**Procedure:** Students will read through the information on NASA Tracks Wildfires From Above to Aid Firefighters Below. The teacher will then provide a tutorial on how to use the Earth Observatory Dataset by showing students the Getting Started with NASA Worldview video and model how to find the datasets on the Smartboard. Students will be split into groups of four and use the Earth Worldview platform to collect data on their chromebooks or desktop computers. Each group will be assigned one parameter: air quality, vegetation, deforestation, wind patterns, soil moisture levels, and fire burn. Students will create a data table for how their parameter changed from June 5th to June 10th 2023 in Manhasset, NY. Using the data, students will construct a graph for how the variable changed over these five days due to the wildfires. Students groups will post their findings using Padlet for other students to conduct a virtual gallery walk. Students will leave constructive feedback to other groups using the comment feature on Padlet. **Objective:** Students will be able to use online sources to collect data to determine how wildfires cause physical changes on Earth. **Modifications:** Students can use the "Analyzing and Interpreting Data Graphic Organizer" from the Wonder of Science as a tool to organize data and build a graph. **Formative/Summative Assessment:** Teacher will formatively assess students participation within groups during the data collection. The

	teacher will assess the data posted to Padlet using the Analyzing and Interpreting Data Rubric. Students will leave constructive feedback for other groups on Padlet using the Analyzing and Interpreting Data Rubric. **Standards Addressed:** HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. **Materials:** Desktop computers, pencil **Resources:** Analyzing and Interpreting Data.pdf Video: https://www.youtube.com/watch?v=nW8JZJ-5g_0 Analyzing and Interpreting Data Rubric: https://docs.google.com/document/d/11dpWkm1cHw20eqK5c4Lzlxq_LPzvjqANGZQylALDdaQ/template/preview Padlet: https://padlet.com/ NASA Worldview: https://worldview.earthdata.nasa.gov/
Explain	**Procedure:** Students will read through the article NASA Smoke Smothers the Northeast. Students will annotate and highlight the article for important information. Students will synthesize all of the data from the Padlet and the reading into a "CER". Students will peer review a partner's "CER". The teacher will circulate the classroom to ensure students are on task and answer any individual questions. **Objective:** Students will be able to construct a claim using evidence and reasoning to describe how wildfires impact one physical change on Earth. Students will then use the CER to construct a model. **Modifications:** Students can use the Wonder of Science's "Engaging in Argument from Evidence Graphic Organizer" template to help organize their "CER". **Formative/Summative Assessment:** Students will engage in peer-review to evaluate a partner's "CER". The teacher will evaluate the

	student's "CER" using the Constructing Explanations Rubric. **Standards Addressed:** HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. **Materials:** Pencils, Desktop computer **Resources:** Engaging in Argument from Evidence Graphic Organizer Reading: https://earthobservatory.nasa.gov/images/151433/smoke-smothers-the-northeast Constructing Explanations Rubric: https://docs.google.com/document/d/1tvWH6y_Mr-W5ht7AEeijzQp-IO3HQ0GeizUfD9VNQt0/template/preview

Elaborate	**Procedure:** The teacher will introduce the culminating task of the socratic seminar, including the rubric. Students will be split into six new groups and will represent one of the Stakeholder groups. Students will be given scenario task cards including a reading to build a one paragraph argument based on their information. As the students are working, the teacher will circulate and clarify any questions. **Objective:** Students will be able to synthesize data to create an argument based on their individual stakeholder group scenario. **Modifications:** Students can use the MUN argument resource for a template to build an argument. **Formative/Summative Assessment:** Teacher will evaluate student arguments using the Engaging in Argumentation from Evidence Rubric and leave feedback prior to the socratic seminar. **Standards Addressed:** HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. **Materials:** Desktop computers, lab notebook, pencil, **Resources:** Scenario Cards (written below) Resource Group 1: https://csl.noaa.gov/factsheets/csdWildfiresFIREX.pdf Resource Group 2: https://www.earthdata.nasa.gov/dashboard/stories/burn-scar Resource Group 3: https://research.fs.usda.gov/treesearch/56106 Resource Group 4: https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires Resource Group 5: https://science.nasa.gov/earth/explore/wildfires-and-climate-change/

	Resource Group 6: https://wfca.com/wildfire-articles/wildfire-affect-soil-vegetation MUN argument template: https://www.wisemee.com/structure-mun-argument/ Engaging in Argumentation from Evidence Rubric: https://docs.google.com/document/d/1Bh29xhO3F4uE9k9OxH6DlWO6iI5rDo6mCssDa19G4_k/template/preview
Evaluate	**Procedure:** Teacher will arrange the room into two circles before class begins. The teacher will reinforce the rules of the socratic seminar. The teacher will split students into two groups: one observation group and one delegate group. Students who are part of the observing group will take notes. Students who are part of the delegation will present their arguments. All student groups will have an opening statement using the argument constructed from the Elaborate Day. Then, students will be allowed to ask follow-up questions. The teacher will moderate the discussion. The groups will switch halfway through the period to ensure all students participate in the discussion. **Objective:** Students will be able to present data in a socratic seminar round table discussion. **Modifications:** Students can choose to use the socratic seminar sentence structures to formula their ideas: ● I agree with your argument because… ● I disagree with your argument because… ● Have you considered… ● What data supports your claim? ● What are some pieces of data you are overlooking? ● What sources are you using for your data? ● What do you think is the best solution to the problem that addresses the needs of all stakeholders? **Formative/Summative Assessment:** Teacher will evaluate participation using the rubric. Students will also self-grade their participation. **Standards Addressed:** HS-ESS3-5. Analyze geoscience data and the

	results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. **Materials:** Desktop computers, BioRender, Posterpaper **Resources:** Rubric (written below)

SCENARIO CARDS:

Stakeholder Group 1: Your group represents the United Nations member. As a UN member, your primary concern is how the wildfires in Canada affect air quality across borders. Please read through this reading for additional information: https://csl.noaa.gov/factsheets/csdWildfiresFIREX.pdf. Your argument must discuss data about particulates and how these particulates can travel long distances.

Stakeholder Group 2: Your group represents an activist for an environmental group. As an activist, your primary concern is how the wildfires in Canada affect vegetation and biodiversity. Please read through this reading for additional information: https://www.earthdata.nasa.gov/dashboard/stories/burn-scar. Your argument must discuss data about vegetation and how wildfires can alter plant leaf area.

Stakeholder Group 3: Your group represents a local timber company. As an employee of this company, your primary concern is how the wildfires are affecting your livelihood that depends on the large trees in the area. Please read through this reading for additional information: https://research.fs.usda.gov/treesearch/56106. Your argument must discuss data about biomass and how this impacts your careers.

Stakeholder Group 4: Your group represents a fossil fuel executive board. As a part of the board, you are not concerned about the wildfires and would argue that wildfires have always been a problem in Canada. Please read through this reading for additional information: https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires. Your argument must discuss historical wildfire data and how this will affect profits.

Stakeholder Group 5: Your group represents a group of meteorologists. As a meteorologist, you are concerned about how the wildfires have affected the weather such as temperature and wind. Please read through this reading for additional information: https://science.nasa.gov/earth/explore/wildfires-and-climate-change/. Your argument must discuss how the weather is affected by wildfires.

Stakeholder Group 6: Your group represents a group of soil scientists. As soil scientists, you are concerned about how the wildfires have affected the soil in the local area. Please read through this reading for additional information: https://wfca.com/wildfire-articles/wildfire-affect-soil-vegetation/. Your argument must discuss how the soil is affected by wildfires including moisture and albedo.

RUBRIC:

Criteria	**Possible Points**
Argument	☐ 10 points - Clear and focused argument based on stakeholder scenario ☐ 5 points - Some aspects of the argument are unclear or do not relate to the goals of the stakeholder ☐ 0 points - Argument is not relevant to the goal of the project
Use of Data	☐ 20 points - Sufficient data collected to support all interpretations and conclusions ☐ 15 points - Data is collected to support most interpretations and conclusions ☐ 10 points - About half of the data is collected to support about half interpretations and conclusions ☐ 5 points - Most of the data is missing to support interpretations and conclusions ☐ 0 points - No data was collected to support interpretations and conclusions
Clarity of Presentation	☐ 10 points - Strong understanding of basic science relevant to project ☐ 5 points - Understanding of basic science relevant to project but some concepts are incorrect ☐ 0 points - No understanding of basic science relevant to project and/or all concepts are explained incorrectly
Participation in Group	☐ 10 points - Contributions to and understanding of project by all members ☐ 0 points - Contributions to and understanding of project are not equal between all members

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