



The impact of climate change on sea levels

Grade(s): 7th Grade Science
 Lesson Duration: Class Two+ 45-minute class periods
 Course Name(s): Earth Science
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BIG IDEAS

The impact of climate change on sea levels.
 Using satellite data to analyze real-world environmental changes.
 Correlation between photosynthesis, carbon dioxide levels, and sea level rise

EDUCATION STANDARDS

Science and Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
<p>Analyzing and Interpreting Data: Students use various NASA datasets (sea level rise, carbon dioxide levels, and global temperature data) to identify patterns and trends. Analyze data to understand relationship between photosynthesis and atmospheric CO₂; use these insights to make predictions.</p>	<p>ESS3.C - Human Impacts on Earth Systems Human activities, such as the burning of fossil fuels, release greenhouse gases into the atmosphere, which contribute to global warming. This, in turn, leads to changes in climate patterns, sea level rise, and melting ice. Reducing these impacts requires understanding and</p>	<p>Cause and Effect: Mechanism and Explanation Understanding cause and effect relationships is crucial in explaining changes in Earth's systems, such as the connection between increased greenhouse gases and rising sea levels. This concept helps students explore the causes behind observed phenomena (e.g., the effect of</p>

<p>Using Mathematics and Computational Thinking: Students perform calculations to determine the rate of sea level rise and proportional relationships between carbon dioxide levels and temperature changes.</p> <p>Constructing Explanations and Designing Solutions: Students construct explanations based on evidence gathered from the data and develop potential solutions to mitigate sea level rise, such as strategies to increase photosynthesis or reduce CO₂ emissions.</p> <p>Obtaining, Evaluating, and Communicating Information Students gather information from NASA resources, evaluate the credibility and relevance of data, and effectively communicate their findings through written explanations and presentations.</p> <p>Asking Questions and Defining Problems Students ask questions about the causes of sea level rise and define the problems associated with increased atmospheric CO₂.</p>	<p>modifying human behaviors, technologies, and practices.</p> <p>ESS2.D - Weather and Climate The complex interactions between the geosphere, biosphere, hydrosphere, and atmosphere influence global and regional climate. Changes in these systems can lead to long-term climate shifts, including changes in sea levels and the distribution of organisms.</p> <p>LS1.C - Organization for Matter and Energy Flow in Organisms Plants, algae, and some microorganisms use the energy from light to make sugars (food) from carbon dioxide and water through photosynthesis.</p> <p>ESS3.D - Global Climate Change Human activities, such as fossil fuel combustion and deforestation, increase greenhouse gas concentrations, which affect the Earth's climate. This can result in climate change and long-term impacts such as sea level rise, changes in weather patterns, and ocean acidification.</p>	<p>increased CO₂ on global temperatures and sea level).</p> <p>Patterns Observing and identifying patterns in data helps students make sense of phenomena. Recognizing patterns in sea level changes and CO₂ concentration over time allows students to predict future trends.</p> <p>Stability and Change This concept involves understanding what causes stability or change in a system. It encourages students to consider feedback loops, like how changes in photosynthesis rates can alter atmospheric CO₂, leading to either climate stability or instability.</p> <p>Energy and Matter: Flows, Cycles, and Conservation The flow and conservation of energy and matter are essential in understanding photosynthesis and climate change. This concept helps students understand the carbon cycle and the role of plants in regulating atmospheric CO₂.</p>
<p>Common Core State Standards: Math: CCSS.MATH.CONTENT.7.RP.A.2: Recognize and represent proportional</p>		

relationships between quantities

ITEEA Standards:

Standard 1: The Nature of Technology

Students will develop an understanding of the characteristics and scope of technology.

This lesson helps students understand how technology is used to collect and analyze climate data, such as satellite imagery and global positioning systems.

Standard 3: Relationships Among Technologies and Other Fields

Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

This lesson shows how technology intersects with environmental science, geography, and mathematics by utilizing geospatial tools and climate data.

Other Standards: *(as needed)*

MEASURABLE STUDENT LEARNING OBJECTIVES

Students will be able to analyze sea level rise data using NASA's Earth System Data Explorer.

Students will be able to identify patterns in sea level rise and explain its causes.

Students will be able to calculate and predict the rate of sea level increase using historical data.

Students will explain the role of photosynthesis in regulating atmospheric carbon dioxide and its indirect impact on sea level rise.

MATERIALS NEEDED

Computers with internet access

Access to the following NASA websites:

- [MY NASA DATA](#)
- [Climate Change](#)
- [Earth Observations](#)
- [Earth Observatory](#)
- [Climate Time Machine](#)
- [Learning and Educational Activities and Resources from NASA Science](#)
- [Landsat Science](#)
- [Visible Earth](#)

Google Earth or similar mapping tool

Graphing paper and calculators

Plant photosynthesis models or diagrams

ENGAGING CONTEXT/PHENOMENON

Start the lesson by showing students satellite images from [Earth Observatory](#) that illustrate changes in ice coverage over time and ask them to predict how this connects to plant life and the carbon cycle. Ask students to brainstorm why changes in [atmospheric CO₂](#) might affect sea levels and what role photosynthesis might play in regulating CO₂ levels.

How can photosynthesis have such a profound effect on climate. I show students [Net Primary Productivity](#)

[Chlorophyll Concentration](#), [Seeing Photosynthesis from Space](#), and a video from [NASA | Seeing Photosynthesis from Space](#) to start a conversation in class. Can the different

phenomena be linked?

DATA INTEGRATION

Students will use MY NASA DATA, Climate Time Machine, and Earth Observations to analyze sea level changes and correlate them with other climate data, such as CO₂ levels, temperature, and photosynthesis rates in specific biomes.

TEACHER BACKGROUND KNOWLEDGE

Teachers should have a basic understanding of sea level rise, photosynthesis, and how carbon dioxide impacts the greenhouse effect. Familiarize yourself with the different links to NASA material and photosynthesis resources to provide more context during class discussions.

DIFFERENTIATION OF INSTRUCTION

For struggling students, provide step-by-step guides for navigating the data tools. For advanced students, include additional challenges, such as comparing CO₂ data from heavily forested areas with regions experiencing deforestation.

REAL-WORLD CONNECTIONS FOR STUDENTS

Discuss how rising sea levels can impact their local community and other areas around the world. Highlight the importance of photosynthesis in maintaining climate stability and how deforestation could accelerate sea level rise.

POSSIBLE PRIOR or MISCONCEPTIONS

Students might think that sea level rise is caused only by melting ice caps, without considering thermal expansion of water and photosynthesis's role in CO₂ regulation. They may not realize the long-term impact of small changes in atmospheric carbon dioxide on global temperatures and sea levels.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
<p>Engage Introduce the lesson with an anchoring phenomenon.</p> <p>Facilitate student questions, discussion, etc. as appropriate.</p> <p>Learn about what students</p>	<p>Lesson Objective Analyze the causes of sea level rise and the role of photosynthesis in regulating CO₂ levels.</p> <p>Standards Addressed MS-ESS3-5, MS-LS1-6</p> <p>Materials & Resources Visible Earth, Climate Change, NASA DATA, Earth Observations Plant photosynthesis images</p> <p>Procedure: Show images of changing ice coverage and global CO₂ concentration maps b</p>

<p>already know and want to know.</p>	<p>from Earth Observations. Ask students: “What is the role of plants in regulating carbon dioxide?” “What happens if there are fewer plants?” Facilitate a discussion on the connections between plant life, CO₂ levels, and global temperatures.</p> <p>Formative/Summative Assessments Exit slip: Write down one connection between plants and sea level rise.</p> <p>Modifications Use guided questions for students needing more support.</p>
<p>Explore Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.</p>	<p>Lesson Objective Use data to identify trends in sea level rise and CO₂ levels.</p> <p>Standards Addressed MS-ESS3-5, MS-LS1-6</p> <p>Materials & Resources Climate Change, NASA DATA, Earth Observations Calculators and graph paper</p> <p>Procedure: Have students access CO₂ data and sea level data on Climate Change Guide them in plotting both CO₂ and sea level changes over the past 50 years. Ask them to identify patterns and calculate the average rate of increase for both datasets.</p> <p>Formative/Summative Assessments Students create a dual line graph of CO₂ levels and sea level rise and write a short interpretation.</p> <p>Modifications Use pre-made graphs for students needing more support.</p>
<p>Explain Facilitate opportunities for students to explain their understanding of the concepts and processes and make sense of new concepts.</p>	<p>Lesson Objective Explain the link between photosynthesis, carbon dioxide, and sea level rise.</p> <p>Standards Addressed MS-ESS3-5, MS-LS1-6</p> <p>Materials & Resources Climate Change, NASA DATA, Earth Observations, NASA Earth Observatory articles, Google Earth</p> <p>Procedure: Review the graphs and patterns observed during the Explore phase.</p>

	<p>Show a video from NASA Earth Observatory on the role of greenhouse gases and the carbon cycle. NASA A Year in the Life of Earth's CO₂ Have students pair up and explain the patterns they see and why they think they're happening.</p> <p>Formative/Summative Assessments Short paragraph explaining how photosynthesis and CO₂ levels impact sea level rise.</p> <p>Modifications Use sentence starters to support ELL students.</p>
<p>Elaborate Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.</p>	<p>Lesson Objective Apply knowledge to predict future changes and assess photosynthesis's impact.</p> <p>Standards Addressed MS-ESS3-5, MS-LS1-6, CCSS.MATH.CONTENT.7.RP.A.2</p> <p>Materials & Resources Climate Change, NASA DATA, Earth Observations, Graphing tools</p> <p>Procedure: Students use the trend data to make predictions about future CO₂ levels and sea level rise in 50 years. Discuss how large-scale deforestation or reforestation could alter these predictions.</p> <p>Formative/Summative Assessments Students present their predictions in a short presentation, including strategies to use photosynthesis to mitigate CO₂.</p> <p>Modifications Allow oral presentations for students who struggle with written communication.</p>
<p>Evaluate Students are encouraged to assess their understanding and abilities. It also provides opportunities for teachers to evaluate their progress toward achieving the educational</p>	<p>Lesson Objective Assess understanding of the lesson objectives.</p> <p>Standards Addressed MS-ESS3-5, MS-LS1-6</p> <p>Materials & Resources Rubric for presentations Peer evaluation forms</p> <p>Procedure: Students present their predictions and strategies. Use a rubric to evaluate accuracy and understanding.</p>

objectives of the lesson.	<p>Formative/Summative Assessments Final project score based on the rubric.</p> <p>Modifications Provide a checklist for students with executive functioning challenges.</p>
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REFERENCES

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