



Exploring the Biosphere through Coding and NASA Data

Grade(s): 6-7

Lesson Duration: 3 Day Lesson Plan (50- minute classes)

Course Name(s): Eyes on Earth

Lesson Author: *Petway, Nashville, Tennessee*

BIG IDEAS

This lesson highlights the interconnectedness of Earth's systems, emphasizing how natural phenomena like Hurricane Helene impact local and global ecosystems. Students engage in data analysis, technology use, and modeling to understand and simulate these interactions, fostering computational thinking and problem-solving in environmental science contexts.

EDUCATION STANDARDS

6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

7.LS2.4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Science Performance Expectations (or state Science standard):

7.LS2.1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

8.ESS3.1: Interpret data to explain that Earth's resources are unevenly distributed as a result of past geologic processes.

6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

<p>Science and Engineering Practices:</p> <ul style="list-style-type: none"> <i>*Analyzing and interpreting data</i> <i>*developing and using models</i> <i>*using math and computational thinking</i> 	<p>Disciplinary Core Ideas:</p> <ul style="list-style-type: none"> <i>*ESS2.D: weather and climate</i> <i>*LS2.A: independent relationships in ecosystems.</i> <i>*ESS3.A natural resources</i> 	<p>Crosscutting Concepts:</p> <ul style="list-style-type: none"> <i>*patterns</i> <i>*cause and effect</i> <i>*stability and change</i>
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<p>Common Core State Standards:</p> <p>Math: 6.SP.B.5: Summarize numerical data sets in relation to their context, such as by reporting the number of observations, describing the nature of the attribute under investigation, and giving quantitative measures of center and variability</p> <p>7.RP.A.2: Recognize and represent proportional relationships between quantities..</p> <p>and/or</p> <p>ELA: RI.6-8.7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.</p> <p>W.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.</p> <p>State Math or ELA Standards: <i>If applicable</i></p>		
<p>ITEEA Standards: <i>If applicable</i></p>		
<p>Other Standards: 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.</p> <p>7.LS2.4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p>		

MEASURABLE STUDENT LEARNING OBJECTIVES

Students will be able to:

- Understand the components of the biosphere and how ecosystems interact within it.
- Use computer science skills to analyze and visualize biosphere-related data.
- Explore NASA’s Earth science data and tools.
- Connect data analysis to understanding the impacts of natural events on ecosystems.
- Apply coding skills to create simulations that demonstrate the impact of environmental changes on ecosystems.

MATERIALS NEEDED

ENGAGING CONTEXT/PHENOMENON

I will start the lesson by focusing on the local impact of Hurricane Helene on Tennessee's biosphere. I pose the question, "What is the biosphere, and why is it important to understand its function, especially in the context of local events?" Students will have time to explore <https://earthobservatory.nasa.gov/images/153390/hurricane-helene-stirs-up-gulf-coast-waters> to look at similarities and differences.

DATA INTEGRATION

In this lesson, students are using NASA's Earth science data, specifically satellite imagery from the NASA Worldview tool. They are analyzing pre- and post-Hurricane Helene imagery to observe changes in vegetation, water levels, and urban areas. Students engage in data analysis by recording their observations, identifying patterns, and hypothesizing the impact of environmental changes. Additionally, they incorporate this data into Scratch projects to model how these changes affect local ecosystems, such as deforestation or habitat shifts caused by flooding. This hands-on analysis helps students develop skills in data interpretation and visualization.

TEACHER BACKGROUND KNOWLEDGE

Biosphere and Ecosystems: Understanding the components of the biosphere and how ecosystems interact and respond to natural events. Teachers can refer to resources like the [NASA Earth Science Division](#) and National Geographic's Guide to Ecosystems for foundational knowledge.

Data Analysis and Satellite Imagery: Familiarity with analyzing satellite imagery and understanding how to interpret data from NASA's Worldview tool. The [NASA Worldview Tutorial](#) provides step-by-step instructions on how to use this platform effectively.

Scratch Programming: Basic skills in using Scratch to guide students in creating coding projects that visualize data. The Scratch Educator Guide offers helpful tutorials and resources for teachers to build coding proficiency.

Storm Impacts and Environmental Change: Knowledge of how natural phenomena, such as hurricanes, impact ecosystems and lead to changes in biodiversity and habitat structure. Teachers can read more on this through articles like NOAA's Hurricane Science and [NASA's Storms and Ecosystems](#).

DIFFERENTIATION OF INSTRUCTION

To meet the unique needs of students in the class, this lesson can be adjusted by implementing differentiated instruction, such as using simplified language and visual aids for ELL students, providing guided notes or templates, and offering step-by-step instructions for those needing additional support. Ensuring accessibility through audio-visual supports like captions and assistive technology will help students with hearing or reading challenges. Collaborative learning can be fostered by pairing students in mixed-ability groups and facilitating small group discussions for peer learning and focused interaction. Flexible pacing options, such as allowing extra time and breaking the lesson into smaller, manageable segments, can help students process information effectively. Interactive elements like digital worksheets and coding templates can make tasks more engaging, while behavioral and emotional support, including positive reinforcement and

individual check-ins, will encourage participation and build confidence. Preparing these modifications in advance ensures that all students can participate fully and benefit from a supportive learning environment.

REAL-WORLD CONNECTIONS FOR STUDENTS

This lesson has a real-life connection as it explores the impact of natural events, such as Hurricane Helene, on local ecosystems, helping students understand how environmental changes affect their communities and the broader biosphere. The lesson is culturally responsive by incorporating diverse perspectives and encouraging students to share their experiences or observations related to local weather events and environmental changes. Suggested teaching practices include using real-world data, facilitating discussions that connect students' backgrounds and local knowledge, and applying collaborative learning strategies. Students will relate to the lesson by recognizing how weather patterns, natural disasters, and environmental shifts influence their surroundings, encouraging them to think critically about sustainability and their role in environmental stewardship.

POSSIBLE PRIOR or MISCONCEPTIONS

Students may come to this lesson with the basic idea that the biosphere includes all living things and that weather can impact the environment. Some might already understand that major storms can cause visible damage, like fallen trees and flooding, but they may not realize the deeper ecological impacts, such as habitat loss or changes to biodiversity. Others might think that environmental changes happen gradually and may not connect immediate storm effects to long-term ecosystem changes. Students could also hold misconceptions, such as believing that human activity is the only factor affecting ecosystems or not recognizing the interconnectedness of different parts of the biosphere. Addressing these ideas in the lesson by explaining the rapid and lasting impacts of natural phenomena and integrating data analysis will help deepen their understanding and correct any misconceptions.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation <i>(Visit BSCS to learn more about the 5E instructional model)</i>
<p>Engage</p> <p>I will start the lesson by focusing on the local impact of Hurricane Helene on Tennessee’s biosphere. I pose the question, “What is the biosphere, and why is it important to understand its function, especially in the context of local events?” Students will have time to explore https://earthobservatory.nasa.gov/images/153390/hurricane-helene-stirs-up-gulf-coast-waters to look at similarities and differences.</p>	<p>Lesson Objective</p> <ul style="list-style-type: none"> • Students will understand the components of the biosphere and how ecosystems interact within it. • Students will explore NASA’s Earth science data and tools. <p>Standards Addressed 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. 7.LS2.4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p>

I encourage students to ask questions and participate in a discussion to gauge their initial understanding. I ask questions such as, “What do you know about hurricanes?” or “How do you think local ecosystems are impacted by major storms?” I document what students already know and what they want to learn throughout the lesson to tailor subsequent activities.

Materials & Resources

- NASA Worldview tool
- Student worksheets for tracking observations
- Classroom projector and computer access
- [Hurricane Helene Stirs Up Gulf Coast Waters](#)

Procedure:

- **What I Do:** I start by posing the anchoring question and showing the introductory video. I facilitate the class discussion, prompting students to share their current knowledge and questions. Then, I guide students through accessing the NASA Worldview tool and explain how they will explore local satellite imagery to observe changes related to Hurricane Helene.
- **What Students Do:** Students engage by responding to questions, sharing their ideas, and watching the video. They then explore NASA Worldview, making initial observations and recording notes on their worksheets.

Formative/Summative Assessments

- *Formative:* I assess students based on their participation in the class discussion and their completion of the initial observation worksheet, taking note of their contributions and understanding as I circulate the room.
- *Summative:* Students submit completed worksheets with detailed observations that demonstrate their ability to use the data tool and identify ecosystem changes.

Modifications

- I provide simplified language or visual aids for ELL students to support their understanding.
- I arrange peer partners or small group discussions for students needing additional help.
- I offer step-by-step guides for students who need assistance navigating the NASA Worldview tool.
- I ensure that video captions are enabled for accessibility to support all learners.

<p>Explore</p> <p>Students will engage in hands-on activities by using the NASA Worldview tool to investigate pre- and post-Hurricane Helene imagery, focusing on local changes in vegetation, water levels, and urban areas.</p>	<p>Lesson Objective</p> <p>Students will use computer science skills to analyze and visualize biosphere-related data.</p> <p>Standards Addressed</p> <ul style="list-style-type: none"> • 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • 7.LS2.1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. • 8.ESS3.1: Interpret data to explain that Earth’s resources are unevenly distributed as a result of past geologic processes. <p>Materials & Resources</p> <ul style="list-style-type: none"> • NASA Worldview tool • Student worksheets for recording observations • Computers or tablets with internet access <p>Procedure:</p> <ul style="list-style-type: none"> • What I Do: I guide students as they navigate NASA Worldview, demonstrating how to use the tool to select specific dates and locations to observe changes. I circulate the room, providing assistance as needed and prompting students to think critically about what they are observing. • What Students Do: Students use the NASA Worldview tool to select imagery of Tennessee before and after Hurricane Helene. They record their observations on the provided worksheets, noting changes and hypothesizing reasons for those changes. <p>Formative/Summative Assessments</p> <ul style="list-style-type: none"> • <i>Formative:</i> I monitor student progress as they work, checking their observation notes and asking guiding questions to assess understanding. • <i>Summative:</i> Students turn in completed observation worksheets that reflect their ability to analyze data and identify changes within the biosphere.
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	<p>Modifications</p> <ul style="list-style-type: none"> • Provide scaffolding with step-by-step instructions for students who need extra support. • Allow students to work in pairs or small groups to foster collaborative learning. • Offer simplified instructions and visual aids for ELL students to ensure accessibility.
<p><u>Explain</u></p> <p>I create opportunities for students to explain their observations from the Explore phase and connect their findings to broader biosphere concepts. Students share their observations and discuss how different ecosystems respond to significant weather events like Hurricane Helene</p>	<p>Lesson Objective</p> <ul style="list-style-type: none"> • Students will understand the components of the biosphere and how ecosystems interact within it. • Students will explore NASA’s Earth science data and tools. <p>Standards Addressed</p> <ul style="list-style-type: none"> • 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • 7.LS2.1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. • 8.ESS3.1: Interpret data to explain that Earth’s resources are unevenly distributed as a result of past geologic processes. <p>Materials & Resources</p> <ul style="list-style-type: none"> • Student observation worksheets • Classroom projector for sharing examples • Discussion prompts for guiding student explanations <p>Procedure:</p> <ul style="list-style-type: none"> • What I Do: I facilitate a class discussion where students explain their observations, asking guiding questions such as, “What patterns did you notice in the changes to local ecosystems?” and “How do these changes affect the biosphere as a whole?” I encourage students to connect their data analysis to ecosystem processes and provide examples for clarification. • What Students Do: Students present their observations, respond to questions, and engage in peer discussions to deepen their understanding of biosphere interactions and data interpretation.

	<p>Formative/Summative Assessments</p> <ul style="list-style-type: none"> • <i>Formative:</i> I assess student understanding based on their explanations and participation in the discussion. • <i>Summative:</i> Students provide written summaries that reflect their understanding of how the data they analyzed relates to ecosystem changes. <p>Modifications</p> <ul style="list-style-type: none"> • Provide sentence starters or discussion prompts to support ELL students. • Use visual aids or diagrams to reinforce key concepts for students who need additional support. • Allow students to work in small groups to build confidence in sharing their explanations.
<p><u>Elaborate</u></p> <p>I provide opportunities for students to apply the concepts they have learned and extend their understanding by challenging them to create a simple Scratch project that simulates the impact of a storm on local ecosystems. Students use biosphere data they explored earlier to model scenarios, such as how deforestation due to flooding impacts animal habitats.</p>	<p>Lesson Objective</p> <ul style="list-style-type: none"> • Students will use computer science skills to analyze and visualize biosphere-related data. • Students will understand the components of the biosphere and how ecosystems interact within it. <p>Standards Addressed</p> <ul style="list-style-type: none"> • 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • 7.LS2.1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. • 8.ESS3.1: Interpret data to explain that Earth’s resources are unevenly distributed as a result of past geologic processes. <p>Materials & Resources</p> <ul style="list-style-type: none"> • Scratch coding platform • Data collected during the Explore phase • Computers or tablets with internet access <p>Procedure:</p> <ul style="list-style-type: none"> • What I Do: I introduce the coding activity and guide students on

	<p>how to use Scratch to create their simulations. I provide examples of how data can be incorporated into their projects and circulate the room to offer support.</p> <ul style="list-style-type: none"> • What Students Do: Students develop their Scratch projects, applying the data and observations they recorded to simulate ecosystem changes. They build models showcasing impacts like deforestation or habitat shifts due to flooding. <p>Formative/Summative Assessments <i>Formative:</i> I monitor students' progress as they work on their Scratch projects, providing feedback and support as needed. I check that students are correctly applying data and observations from the Explore phase in their coding <i>Summative:</i> Students submit their completed Scratch projects for assessment, demonstrating their understanding of ecosystem interactions and their ability to model environmental impacts using coding.</p> <p>Modifications Provide templates or coding guides for students who need extra support with Scratch. Allow students to work in pairs or small groups for collaborative learning and peer assistance. Use visual aids and step-by-step instructions to help ELL students and those requiring more guidance</p>
<p>Evaluate Students are encouraged to assess their understanding and abilities through reflective activities. This phase also provides opportunities for me to evaluate their progress toward achieving the lesson's educational objectives.</p>	<p>Lesson Objective Students will reflect on their learning to assess their understanding of biosphere interactions and data visualization. Students will demonstrate their grasp of ecosystem interactions through coding projects and peer feedback.</p> <p>Standards Addressed 8.ESS3.1: Interpret data to explain that Earth's resources are unevenly distributed as a result of past geologic processes. 6.ESS2.4: Analyze and interpret data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.</p> <p>Materials & Resources Completed Scratch projects Peer review forms Reflection worksheets</p> <p>Procedure:</p> <ul style="list-style-type: none"> • What I Do: I facilitate a peer review session where students present their Scratch projects. I guide them through constructive feedback practices and lead a class discussion on what they learned.

- **What Students Do:** Students present their projects, give and receive peer feedback, and complete a reflection worksheet to self-assess their learning and project outcomes.

Formative/Summative Assessments

Formative: I observe presentations and peer interactions to assess students’ understanding and engagement.

Summative: Students submit their reflection worksheets and revised projects for final evaluation based on a rubric assessing their coding, analysis, and understanding of ecosystem interactions

Modifications:

Provide additional support during presentations for students who need help speaking or explaining their projects.

Offer simplified feedback forms for ELL students.

Allow students to present in small groups or pairs to reduce anxiety and build confidence.

REFERENCES

NASA Earth Science Division. (n.d.). *Earth science*. Retrieved from <https://science.nasa.gov/earth-science>

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