



Environmental Literacy Unit Plan

Grade: 7, Life Science

Title: *Ecology*

Authors: Gloria Allen, Hardy; Elyse Lerum, Deal; Clinton Harris, Howard University MS2; Joshua Johnson and Raquel Smith, Capital City

NGSS Unit Plan

Title of Unit	Ecology	Grade Level	7
Curricular Theme	<i>Life Science</i>	Time Frame	
Essential Question(s) to be Addressed	How can we creatively address the environmental consequences of human activity?		

Background Information and Context

Students should have a working knowledge of:

- Scientific Investigation
- Energy
- Biological and Life Processes
- Living Systems
- Earth Patterns, Cycles, and Changes
- Earth's Natural Resources

In this unit, students will focus on the following concepts:

- Ecosystems
- Living vs. Non-living Organisms
- Environmental Sustainability
- Human Pollution
- Food Chain/Food Web
- Quantitative & Qualitative Data Collection
- Water Cycle
- Photosynthesis
- Energy Transfer and Conservation
- Scientific Method
- Terrarium Building

For this unit, concepts should be applied through observations and connections with everyday life and technology. Using the “5 E” format will aid in successful competency of this unit. Numerous factors can affect the life processes and the sustainability of an ecosystem. Through investigations (involving a terrarium) that are observational and experimental students will draw conclusions and create hypothesis of the human factor of pollution in an ecosystem. Students should note their qualitative observations and construct and graphs, charts and data tables to make predictions and propose conclusions regarding the biological processes in their terrariums. Energy transfer and conservation, photosynthesis, food chains/food webs, living and non-living organisms, as well as the water cycle are processes that should be focused on in this unit. Instructors are encouraged to introduce students to other biological processes as they arise. Furthermore, human interaction within an ecosystem should be explored to create



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discussions and research regarding acid rain, environmental effect of oil spills, the increase and effect of greenhouse gases, generation of waste and pollution, as well as others.

NGSS Performance Task Expectations: Students who demonstrate understanding can:

- **MS-LS2-1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2.** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- **MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem.
- **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-LS1-6.** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organism.

Applicable Common Core Standards (CCSS ELA and CCSS Math)

ELA/Literacy

- **WHST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **RST.6-8.3.** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **RST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **WHST.6-8.1b.** Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

Mathematics

- **MP.4.** Model with mathematics. (MS-LS2-5)
- **6.RP.A.3.** Use ratio and rate to solve real world and mathematical problems. (MS-LS2-5)
- **6.EE.C.9.** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of the dependent variable in terms of the other quantity or as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context. (MS-LS2-2)

Prior Understandings

- Water as a universal solvent.
- The abilities of large bodies of water to store thermal energy in moderate climates.
- The importance of protecting and maintaining water resources.



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- Natural and human causes to the atmosphere and the importance of maintaining air quality.
- The unique properties of Earth as a planet.
- The health of ecosystems and conservation, health, and safety issues often associated with ecosystems.
- Management of renewable/nonrenewable resources.
- The mitigation of land-use and environmental hazards through preventative measures.

Community Connections: Sustainability Initiative

Built Environment: Tour a green infrastructure site *to serve as inspiration for developing creative solutions to address the environmental consequences of human activity.*

- Canal Park (<http://www.canalparkdc.org/>)
200 M St SE, Washington, DC 20003

A stunning new public park on the site of the historic Washington Canal in the heart of DC's Capitol Riverfront neighborhood. Canal Park will transform an abandoned and contaminated bus parking lot into a sustainable and green neighborhood gathering place and destination for the entire city.

Students could visit Canal Park during the elaborate phase of the unit as a means for further investigating examples of solutions to remedy human impacts on ecosystems. The park contains numerous examples of green infrastructure including rain gardens, native plantings, permeable pavement, geothermal heating, water cisterns to hold drainage from surrounding buildings, and green roof.

- Anacostia Watershed Society (<http://www.anacostiaws.org/programs/education>)
AWS offers a variety of curriculum supports, including the Watershed Explorers program which would be a great fit for the explore portion of the unit. Students would be exposed hydrology, stormwater runoff impacts, food chain relationships, the benefits of riparian buffers, and principles of watershed geography using various maps.
- Koshland Science Museum (<http://www.koshland-science-museum.org/>)
The Koshland Science Museum's current exhibit Earth Lab: Degrees of Change would make a great connection to this unit's explore phase. The museum has an on-site exhibit portion, but also makes much of the content available online in the form of video clips and interactives. Through the Koshland students are able to explore causes, impacts, and responses to climate change highlighting the human impact on ecosystems across the world.
- Washington Youth Garden (<http://www.washingtonyouthgarden.org/>)
The Washington Youth Garden at the National Arboretum offers a variety of educational programming, including a "Soil and Compost" focused program through SPROUT. This garden staff-led field trip would be a great connection for students during the explore or elaborate phase of the unit as a means of exploring soil components, decomposers, and the human impact on these ecosystem components.

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Disciplinary Core Ideas: (Students will know...)

LS1.C: Organization for Matter and Energy Flow in Organisms

- **MS-LS1-6.** Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.
- **MS-LS1-7.** Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.

LS2.A: Interdependent Relationships in Ecosystems

- **MS-LS2-1.** Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Growth of organisms and population increases are limited by access to resources.

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- **MS-LS2-3.** Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- **MS-LS2-4.** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

PS3.D: Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)
- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)

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Science and Engineering Practices: (Students will...)

Constructing Explanations and Designing Solutions

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6)
- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

Developing and Using Models

- Develop a model to describe phenomena. (MS-LS2-2)

Analyzing and Interpreting Data

- Analyze and Interpret data to provide evidence for phenomena. (MS-LS2-1)

Engaging in Argument from Evidence

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Connections to Nature of Science

Science Knowledge Is Based on Empirical Evidence

- Science Knowledge is based upon logical connections between evidence and explanations (MS-LS1-6)
- Science disciplines share common rules of obtaining and evaluating evidence. (MS-LS2-4)

Crosscutting Concepts: (Students will connect...)

Energy and Matter

- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-LS2-3)

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

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Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)

Connections to Nature of Science Scientific Knowledge Assumes and Order and Consistency in Natural Systems

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society makes. (MS-LS2-5)

Performance Task

Performance Task Description:

Students will create a bottle terrarium to analyze the effects of human interactions on specific ecosystems. They will be able to compare data from ecosystems that are interrupted by pollution. The students will interpret data from the ecosystems that are derived from pollution in ecosystems.

Evaluation:

Students will create a public service announcement (PSA) that communicates:

- the measurable effects of the pollutant on the physical and biological components of the ecosystem
- how the models relate to real ecosystems
- the importance of remedying the human impact modeled
- a strategy for remedying the human impact and rationale for its success
- addresses the limitations of the strategy

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Goal	Your task is to create a PSA to creatively share and raise awareness about what you've learned regarding humans' impact on ecosystems. Your PSA should include: - Data-supported arguments regarding the effects of humans on the physical and chemical components of an ecosystem and the organisms within. - An action plan to remedy pollution based on quantitative evidence and observations made over time.
Role	Students take the role of: - video/song producer - graphic designer - ecologist - public relations specialist
Audience	Whole school presentations, possible distributions on YouTube/to other schools depending on the product.
Situation	Your challenge involves creating awareness about the effects of human pollution on ecosystems.
Product/Performance	Students can create pamphlets, posters, commercials, or songs/music videos that will illustrate the solutions to fix human induced pollution. Students will access the effectiveness of their solutions to determine if their system improved overall conditions in their terrarium.
Other Evidence	- PSA delivers information in a creative manner. - PSA includes a brief overview of the terrarium experiment that includes the following: - The flow of energy in the terrariums. - The cycling of matter (water). - The effects of the pollutant on the living and non-living factors. - PSA identifies an ecological problem that arose during the terrarium experiment. - PSA uses data from the terrarium experiment to apply the ecological problem in a global setting. - PSA uses qualitative and quantitative data to argue the importance of implementing a solution to the problem. - PSA proposes a potential solution to remedy the ecological problem.

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Grouping Strategies	Materials and Equipment Required
- Small groups (3-4 students) - Mixed ability groups at the teacher's discretion	1 small seedling plant per terrarium - Grass seeds - Motor oil/cooking oil - Yeast packet - Vinegar 1 feeder fish or snail per terrarium - Litter suggestions (small paper, pencil shavings, fruit peels, etc.) - Soil - Gravel - Sand - Scissors - Measuring cup - Data collection sheet - Tape 2 2-liter bottles per terrarium

Learning Plan/Instructional Sequence

This 7th grade Life Science unit focuses on ecology and addresses many of the Next Generation Science Standards performance expectations related to both matter and energy and interdependent relationships in ecosystems. Early in the unit students will experience a shared exploration of ecological principles through the building and maintenance of bottle terraria. A meaningful watershed or “green” park educational experience mid-unit will allow students to apply and deepen their understanding of ecological principles. The unit concludes with a performance task that requires students to analyze case study data to construct an argument in order to provide testimony and recommendations to DC residents about how humans’ changes to the physical or biological components of our local ecosystem have affected populations.

5E Stage: Engage

Lesson 1: “What’s going on?”

In the initial lesson of the unit, students are provided with images or video footage of a range of interactions within ecosystems as well as ecosystems in various states of change. Students are asked to identify what they see as well as explain what they see taking place. Students are encouraged to think and record ideas independently as well as interact with each other in order for the teacher to best elicit and take note of students’ prior understandings and misconceptions.

Science/Engineering Practice or Crosscutting Concept:

- MS-LS2-4.** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.



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Common Core Connections:

- **WHST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.

Teacher will:

- Present photos/videos of and data from ecosystems in various states (potentially before and after human impact).
- Present photos/videos of various components of ecosystems interacting.
- Ask questions to elicit student prior knowledge, understanding, and interests.
- Take note of student misconceptions.

Students should do:

- Observe photos, videos, and/or data.
- Describe understanding by writing descriptions of what they think is being represented in the photos, videos, and evidence.
- Ask questions.
- Share thoughts and ideas.
- React to scenarios.

Evidence of learning:

- Student journaling/ writing.
- Student questions and discussions.

5E Stage: Explore

Lesson 2: “If you build it . . .”

In this lesson students are challenged to design and create a stable ecosystem contained within a bottle. The teacher may outline parameters for the investigation based on space and material limits and may also draw students’ attention to observations made by students in Lesson 1. Teachers should scaffold as need to support students’ brainstorming around what things (both living and non-living) they would need to create a stable bottle ecosystem. During the initial planning phase of the bottle terraria teachers should use probing questions to draw students’ attention to how the presence (or lack thereof) of various ecological components may impact the long-term stability of a terrarium. Students should also be asked to consider how their terraria may change over time and how the interactions among components may influence the stability of the system as a whole.

Lesson 3: “Construction Zone”

Based on the questioning cycles in the previous lesson students are asked to make revisions as needed to their initial plans. During this lesson students will follow these revised plans to construct their bottle terraria. As the construction progresses the teacher should guide the collection of ideas in regards to the type of data that students believe they could collect to assess the overall health and stability of their terraria. At the close of the lesson students should be

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asked to make predictions about both the short- and long-term changes they expect to see in their terraria and to justify these changes as best they can.

Lesson 4: “Data Time”

In this lesson students will begin to document the state of their bottle terraria as a foundation for future modeling of the flow of energy, the cycling of matter, and the interactions they observe within the ecosystem. Students will begin by drawing their ecosystem in its current state and labeling all of the components they can identify. They will also take time to collect data on the state of the ecosystem and its components (water temperature, turbidity, pH, number and health of various organisms, etc.).

Science/Engineering Practice or Crosscutting Concept:

- **MS-LS2-3.** The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

Common Core Connections:

- **RST.6-8.3.** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Teacher will:

- Provide opportunities for water-quality testing (preferably both in-class and during a MWEE/field trip).
- Guide data collection using various scientific apparatus (test kits, etc).
- Ask questions to guide student thinking about components of terraria.
- Facilitate students building terraria.
- Ask questions to guide student thinking about sustainability of terraria.

Students should do:

- Explore methods for collecting ecosystem data.
- Propose components for terraria and rationalize choices.
- Build terraria.
- Collect data on the physical and biological components of the terraria.
- Develop initial models of interactions within terraria.
- Form hypotheses about how the physical and biological components will/will not change.

Evidence of learning:

Lab journal entries:

- data
- terrarium planning
- terrarium hypotheses
- terrarium diagraming (water cycle, food webs)

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5E Stage: Explain

Lesson 5: “Other Names”

In this lesson students will be introduced to the formal terms for the ecological components and interactions they have been working with. Through direct instruction the teacher will contrast biotic and abiotic factors and outline the trophic levels. Students will work with teacher-provided examples as well as apply the new vocabulary to their bottle terraria by adding to the diagrams created in Lesson 4. Ecosystem data should also be collected during this lesson.

Lesson 6: “Food Webs”

Following the formal introduction of trophic-level vocabulary, this lesson has students examine how changes to one population in a food web impact other populations in the web. The teacher will explicitly highlight one case study using population data. Students will then be asked to examine, diagram, and explain changes in a second food web case study.

Science/Engineering Practice or Crosscutting Concept:

- **MS-LS2-3.** The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

Common Core Connections:

- **RST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **WHST.6-8.1b.** Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context.

Teacher will:

- Explain biologic roles in ecosystems.
- Clarify standard food web notations.
- Encourage revision of initial models.
- Guide further data collection.
- Challenge student understandings.
- Correct initial understandings

Students should do:

- Model with food webs, water cycle.
- Introduce pollutant into ecosystem.
- Collect terrarium data.
- Organize and process data from terrarium.
- Form explanations.
- Revise & defend ideas.



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Evidence of learning:

Lab journal entries:

- terrarium diagramming (water cycle, food webs) further data collection
- terrarium hypotheses
- processed data (graphs)
- data analysis

5E Stage: Elaborate Lesson 7

Science/Engineering Practice or Crosscutting Concept:

- **MS-LS2-4.** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any component of an ecosystem can lead to shifts in all its populations.

Common Core Connections:

- **WHST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.

Teacher will:

- Ask probing questions.
- Direct students to new case studies & data sets for analysis.
- Facilitating lab investigations.
- Guiding data analysis.

Students will do:

- Analyze data.
- Further revise models.
- Support ideas and claims with data.
- Develop deeper connections.
- Predict changes to terraria.
- Analyze case studies.

Evidence of learning:

- case study analyses
- lab journal entries
- revised models
- additional data



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5E Stage: Evaluate

Lesson 8

Science/Engineering Practice or Crosscutting Concept:

- **MS-LS2-4.** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Common Core Connections:

- **RST.6-8.1b.** Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context
- **WHST.6-8.2d.** Use precise language and domain-specific vocabulary to inform about or explain the topic.

Teacher will:

- Introduce performance task.
- Review rubric with students.
- Ask questions to support students' full application of knowledge and understanding.

Students should do:

- Construct an overview of the terrarium experiment that includes: flow of energy and the cycling of (water).
- Describe the effects of the pollutant on the living and non-living factors.
- Use data from the terrarium experiment to apply the ecological problem in a global setting.
- Use qualitative and quantitative data to argue the importance of implementing a solution to the problem.
- Propose a potential solution to remedy the ecological problem.
- Develop creative PSA to share above info.

Evidence of learning:

PSA including:

- food web diagram
- water cycle diagram
- data set selected
- analysis of data set
- description of global application
- proposed solution

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Performance Task Rubric

Component of Task	1	2	3	4
PSA delivers information in a creative manner.	Students do not deliver scientifically accurate information. There is an inequality of completed work amongst group members, and the PSA is not memorable or convincing.	Students deliver scientifically accurate information. There is an inequality of completed work amongst group members , and the PSA is not convincing.	Students clearly deliver the content of their public service announcement in a creative way. All information is scientifically accurate. There is equality amongst group members, and the PSA is memorable, but not convincing.	Students clearly deliver the content of their public service announcement in a creative way. All of the information is scientifically accurate , all group members have an identified role , and the PSA is memorable and convincing.
PSA includes a brief overview of the terrarium experiment that includes the following: - The flow of energy in the terrariums. - The cycling of matter (water) - The effects of the pollutant on the living and non-living factors. - Students use tier 3 level appropriate vocabulary.	Students do not identify and incorporate any the following biological/scientific processes: - Energy flow/energy conservation - Water Cycle - Effects of pollutant(s) on living and nonliving organisms	Students identify and incorporate one of the following biological/scientific processes: - Energy flow/energy conservation - Water Cycle - Effects of pollutant(s) on living and nonliving organisms	Students identify and incorporate two of the following biological/scientific processes: - Energy flow/energy conservation - Water Cycle - Effects of pollutant(s) on living and nonliving organisms	Students clearly identify and fully incorporate all of the following biological/scientific processes: - Energy flow/energy conservation - Water Cycle - Effects of pollutant(s) on living and nonliving organisms.

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PSA identifies an ecological problem that arose during the terrarium experiment.	Students do not identify an ecological problem that has arisen due to the pollutant that was introduced to the terrarium.	Students identify a problem that has arisen in their terrarium but there is no connection to the ecological concepts of energy flow or the cycling of matter.	Students identify an ecological problem that has arisen due to the pollutant that was introduced to the terrarium. They make connections to either the disruption in the flow of energy or the cycling of matter, but fail to establish how they both contribute to an optimal ecosystem.	Students identify an ecological problem that has arisen due to the pollutant that was introduced. Using specific parts of their ecosystem, they make references to the disruptions in the flow of energy (food web breakdown) and the cycling of matter. They also state how the flow of energy and the cycle of matter play a role in the creation of the problem.
PSA uses background research and experimentation to apply the ecological problem in a global setting.	Within their PSA, students do not find a region of the world that is suffering from their exact ecological problem. They do not make any connections between the global setting and their own communities.	Within their PSA, students mention a region of the world that is suffering from their exact ecological problem. They do not give details about how that region is dealing with the issue. They do not connect their findings to what can potentially happen in their own communities.	Within their PSA, students mention a region of the world that is suffering from their exact ecological problem. They connect their findings to what can potentially happen in their own communities, but they do not identify solutions that the region has tried.	Within their PSA, students mention a region of the world that is suffering from their exact ecological problem. They make references to the issues within that region, and they identify solutions that the region has tried. They connect their findings to what can potentially happen in their own communities.
PSA includes an argument and	Students do not create and defend	Students create and defend	Students create and defend	Students create and defend

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defense based on qualitative and quantitative data. (Example: The amount of litter is related to the growth of the seedling.)	an argument that analyzes the effects of human pollution factors on healthy ecosystems.	arguments that analyze the effects of human pollution factors on healthy ecosystems. They utilize either quantitative or qualitative data, but not both.	arguments that analyze the effects of human pollution factors on healthy ecosystems using both qualitative and quantitative data for support. However, the argument is weak, and when challenged, it is apparent that students have not developed strong rebuttals.	arguments that analyze the effects of human pollution factors on healthy ecosystems using both qualitative and quantitative data for support. It is apparent that students anticipate areas of weakness in their argument and have developed strong rebuttals for those moments.
PSA proposes a potential solution(s) to remedy the ecological problem.	Students do not propose a potential solution(s) to remedy the ecological problem.	Students propose a potential solution(s) to remedy the ecological problem, but it is vague and unclear. They are unable to explain the details behind putting the plan into action.	Students clearly propose a potential solution(s) to remedy the ecological problem. They convey an action plan that includes an expected result, but they do not give specifics on implementing the plan (proposal, cost analysis, and a way to evaluate the effectiveness).	Students clearly identify a potential solution(s) to remedy the ecological problem. They convey an entire action plan that includes a proposal, a cost analysis, and a way to evaluate the effectiveness of the solution(s).

* include use of academic vocabulary in rubric

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Universal Access

Supporting English Language Learners

Reading, Writing, or Speaking Activity	Supports for <u>Emerging</u> Learners	Supports for <u>Expanding</u> Learners	Supports for <u>Bridging</u> Learners
	Additional focus on nomenclature and scientific terminology.	Additional focus on nomenclature and scientific terminology.	Additional focus on nomenclature and scientific terminology.
	Document cultural differences of human interactions.	Document cultural differences of human interactions.	Document cultural differences of human interactions.
	Create reminder cards, charts, drawings and graphic organizers to help bolster comprehension.	Create reminder cards, charts, drawings and graphic organizers to help bolster comprehension.	Create reminder cards, charts, drawings and graphic organizers to help bolster comprehension.
	Scaffolding students' activities to chart background knowledge and engage them in modeling.	Scaffolding students' activities to chart background knowledge and engage them in modeling.	Scaffolding students' activities to chart background knowledge and engage them in modeling.
	Adapt and minimize the linguistic load to arrive at main understanding through word banks, nomenclature, definitions and focusing on vital qualitative and quantitative information.	Adapt and minimize the linguistic load to arrive at main understanding through word banks, nomenclature, definitions and focusing on vital qualitative and quantitative information.	Adapt and minimize the linguistic load to arrive at main understanding through word banks, nomenclature, definitions and focusing on vital qualitative and quantitative information.

Supporting Struggling Learners

Activity	Supports for Students who need <u>Minor</u> Support	Supports for Students who Need <u>Intensive</u> Support
Students will create a public service announcement that communicates: the measurable effects of the pollutant on the	Students will receive additional support regarding the performance task with the following: Vocabulary assessments	Students will create mobiles and visual representations of the food chain/food webs in the bottled ecosystem.

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physical and biological components of the ecosystem • how the models relate to real ecosystems • the importance of remedying the human impact modeled • a strategy for remedying the human impact and rationale for its success	• Individual assessments of task completion • Weekly progress reports of tasks • Weekly laboratory journal of essential understandings from each lesson	Students will draw pictures of the changes in the ecosystem and write about the changes in a weekly laboratory journal. Students will write a song/jingle/poem regarding the human effects of pollution and solutions to remedy the problem.
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Supporting Advanced Learners

Activity	Extensions for Advanced Students
Students will create a public service announcement that communicates: • the measurable effects of the pollutant on the physical and biological components of the ecosystem • how the models relate to real ecosystems • the importance of remedying the human impact modeled • a strategy for remedying the human impact and rationale for its success	Students will perform calculations to quantitatively express the effects of human interaction on the biological components of an ecosystem. (For example, calculating the changes in carbon dioxide levels). Students will chart and diagram the food web/food chain of an organism within the bottled ecosystem. Students will be expected to track the energy conversion and transfer of all organisms including the adverse effect of human interaction compared to that of no adverse human effect. Students can also introduce an additional form of pollution related to the human factor to the bottled ecosystem and determine the effects as compared to one type of pollution. Students will create a research project noting the specific portions of the world that human pollution has heavily impacted the ecosystem.

Connecting to the Core: NGSS Aligned Performance Task

ELA Connections (Reading, Writing or Speaking Activity) listed in Learning and Instructional Sequence

- **RST.6-8.1.** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **RST.6-8.2.** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- **RST.6-8.7.** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- **RST.6-8.8.** Distinguish among facts, reasoned judgment based on research findings, and

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speculation in a text.

- **RST.6-8.9.** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- **WHST.6-8.1.** Write arguments focused on discipline-specific content.
 - **A.** Introduce claim(s) about a topic or issue, acknowledge and distinguish claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
 - **B.** Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
 - **C.** Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
 - **D.** Establish and maintain a formal style.
 - **E.** Provide a concluding statement or section that follows from and supports the argument presented.
- **WHST.6-8.2.** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
 - **A.** Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
 - **B.** Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
 - **C.** Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
 - **D.** Use precise language and domain-specific vocabulary to inform about or explain the topic.
 - **E.** Establish and maintain a formal style and objective tone.
 - **F.** Provide a concluding statement or section that follows from and supports the information or explanation presented.

- **Math Connections** (*Listed in Learning and Instructional Sequence*)

- **MP.4.** Model with mathematics. (MS-LS2-5)
- **6.RP.A.3.** Use ratio and rate to solve real world and mathematical problems. (MS-LS2-5)
- **6.EE.C.9.** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of the dependent variable in terms of the other quantity or as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context. (MS-LS2-2)



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Resources

Aquatic System Bio Bottle

http://www.bottlebiology.org/investigations/terraqua_main.html

Compost System Bio Bottle

http://www.bottlebiology.org/investigations/decomp_main.html

Source for the Science and Engineering Practices

[A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas \(2012\)](http://www.nap.edu/openbook.php?record_id=13165) http://www.nap.edu/openbook.php?record_id=13165

Source for the Disciplinary Content and CrossCutting Concepts:

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

Web Version: Authors: NGSS Lead States. **Title:** Next Generation Science Standards: For States, By States (insert specific section title(s) being used if not referring to entirety of the NGSS). **Publisher:** Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. **Copyright Date:** 2013. **URL:** www.nextgenscience.org.