

NGSS UNIT OVERVIEW

ECOLOGY

Performance Expectation 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.

Performance Expectation MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Performance Expectation MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

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

Performance Expectation MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>1. Talking It Over: The Miracle Fish? This activity introduces students to the concept of ecology—the study of organisms and their interactions with other organisms and the environment — through a reading about the introduction of Nile perch into Lake Victoria in Africa. Students consider how this change to the biological component of the ecosystem has affected populations of other species of fish. After obtaining empirical evidence about past changes in the ecosystem, students construct arguments to predict what will happen in the future. Students then examine trade-offs and decide whether humans should have introduced Nile perch into Lake Victoria—a decision that is informed but not prescribed by science. This activity provides an opportunity to assess student work related to the crosscutting concept of connections to nature of science: Science addresses questions about the natural and material world, but while scientific knowledge can describe the consequences of actions, it does not necessarily prescribe the decisions that society takes.</p>	<p>MS-LS2.A MS-LS2.C MS-LS4.D</p>	<p>Engaging in Argument from Evidence</p>	<p>Cause and Effect Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World</p>	<p>Mathematics: 6.EE.C.9 Literacy/ELA: RST.6-8.1 WHST.6-8.1 WHST.6-8.9</p>
<p>2. Project: Introduced Species Students obtain information about a number of introduced species and use their growing knowledge and understanding about ecology to investigate the effects of one of these introduced species on an ecosystem. When communicating the results of their investigation, they explain how this species interacts with other species in the ecosystem, and how this introduced species affects (or could affect) the flow of energy in the ecosystem.</p>	<p>MS-LS2.A MS-LS2.C MS.LS4.D MS-ETS1.B</p>	<p>Obtaining, Evaluating, and Communicating Information Constructing Explanations</p>	<p>Cause and Effect Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World</p>	<p>Literacy/ELA: RST 6-8.1 RST 6-8.8 WHST.6-8.9 SL8.4 SL8.5</p>

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>3. Investigation: Data Transects In this activity, students engage in the practice of analyzing and interpreting data to look for patterns among living and non-living components in ecosystems, and they hypothesize what might be causing those patterns. They explore how ecologists use the transect method to collect ecological data, which gives them an opportunity to become familiar with the nature of science concept that scientific disciplines share common rules of obtaining and evaluating empirical evidence. Students also explore the core idea of populations of organisms being dependent on their environmental interactions both with other living things and with nonliving factors.</p>	MS-LS2.C MS-LS4.D MS-ETS1.B	Analyzing and Interpreting Data Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Patterns Cause and Effect	Mathematics: 6.SP.B.5 RST.6-8.3
<p>4. Field Study: Taking a Look Outside Students explore patterns and relationships in their local environment by planning and carrying out an investigation using the transect method learned in the previous activity. Students must decide how to organize their data to allow them to look for patterns among biotic and abiotic components in the ecosystem. Students are encouraged to ask scientific questions about their local ecosystem and determine how they would test these questions.</p>	MS-LS2.C MS-LS4.D	Planning and Carrying Out Investigations Analyzing and Interpreting Data Asking Questions Connections to Nature of Science: Science Knowledge Is Based on Empirical Evidence	Patterns Cause and Effect	Mathematics: 6.SP.B.5 Literacy/ELA: RST.6-8.3
<p>5. Laboratory: A Suitable Habitat Students plan and conduct an investigation to explore a species' habitat requirements by looking at how individuals respond to and interact with different physical components in the environment. Students construct an argument from evidence for the habitat requirements of the species and where it is likely to be in nature. They explore the behaviors and structures of individuals that help those organisms survive in their environment.</p>	MS-LS2.A MS-LS2.C MS-LS4.C MS-LS1.D	Planning and Carrying Out Investigations Engaging in Argument from Evidence Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Patterns Cause and Effect Stability and Change	Mathematics: 6.SP.B.5 Literacy/ELA: WHST.6-8.1
<p>6. Investigation: Ups and Downs Students analyze data on population size to detect patterns over periods of time, and discover that there can be periods of relative stability and periods of small and large changes in population size. They consider what might cause changes in population size, including both biotic and abiotic changes in the environment.</p>	MS-LS2.A MS-LS2.C	Analyzing and Interpreting Data Engaging in Argument from Evidence	Patterns Cause and Effect Stability and Change	Mathematics: MP.2 Literacy/ELA: RST.6-8.3

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>7. Laboratory: Coughing Up Clues Students investigate and collect data on an owl’s diet to determine the owl’s place and role in a food web. They construct a simple model of a food web to begin understanding how matter and energy move in, through, and out of an ecosystem. In subsequent activities, students continue to develop their models.</p>	<p>MS-LS2.A MS-LS2.B</p>	<p>Constructing Explanations Planning and Carrying out Investigations Analyzing and Interpreting Data Developing and Using Models</p>	<p>Energy and Matter Systems and System Models</p>	<p>Mathematics: 6.RP.A.3 Literacy/ELA: RST.6-8.3</p>
<p>8. Reading: Eating for Matter and Energy Students deepen their understanding of food webs and the roles that different kinds of organisms play in an ecosystem. Students continue revising their owl food webs to model the flow of energy and to explain how disruptions to the ecosystem affect the food web. They also incorporate their initial understandings of the cycling of matter into their models. Student groups then create models to account for the fact that only 10% of the energy remains in an ecosystem from one level of the food web to the next.</p>	<p>MS-LS2.B MS-LS2.A</p>	<p>Developing and Using Models Constructing Explanations</p>	<p>Energy and Matter Systems and System Models Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p>	<p>Mathematics: MP.2 MP.4 6. RP.A.1 Literacy/ELA: RST.6-8.7 WHST.6-8.9</p>
<p>9. Laboratory: Population Growth Students plan and carry out an investigation to determine the effect of resource availability on population growth in Paramecium. They collect, analyze, and interpret data to provide evidence that greater food availability results in greater population growth. The activity provides an opportunity to assess student work related to Performance Expectation MS-LS2-1</p>	<p>MS-LS2.A</p>	<p>Analyzing and Interpreting Data Planning and Carrying Out Investigations</p>	<p>Cause and Effect Energy and Matter Scale, Proportion, and Quantity</p>	<p>Mathematics: MP.2 6. RP.A.1 Literacy/ELA: WHST.6-8.1</p>
<p>10. Investigation: Interactions in Ecosystems Students explore and explain the types of interactions among biotic and abiotic components in ecosystems. They consider the causes and effects of these interactions and learn that these types of interactions occur as patterns across all ecosystems. The activity provides an opportunity to assess student work related to Performance Expectation MS-LS2-2.</p>	<p>MS-LS2.A</p>	<p>Constructing Explanations</p>	<p>Patterns Cause and Effect</p>	<p>Mathematics: 6.EE.C.9 Literacy/ELA: WHST.6-8.1</p>

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>11. Laboratory: Cycling of Matter Students carry out an investigation on decomposers to explore how matter cycles in an ecosystem. They add to their understanding of how the biotic and abiotic components of an ecosystem interact. They revise and expand their food web models, which already capture how energy flows through an ecosystem, to explain how matter cycles from the abiotic components of an ecosystem, through the biotic components, and back to the abiotic components.</p>	<p>MS-LS2.B MS-LS2.A</p>	<p>Developing and Using Models Planning and Carrying Out Investigations Constructing Explanations</p>	<p>Energy and Matter Systems and System Models Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p>	<p>Literacy/ELA: RST.6-8.3</p>
<p>12. Modeling: Modeling the Introduction of a New Species Students develop a model for an ecosystem and then introduce a new species to explain how this new component in the system affects the flow of energy and cycling of matter throughout the ecosystem. The activity provides an opportunity to assess student work related to Performance Expectation MS-LS2-3.</p>	<p>MS-LS2.B MS-LS2.C</p>	<p>Developing and Using Models</p>	<p>Energy and Matter Systems and System Models Connections to nature of science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p>	<p>Literacy/ELA: WHST.6-8.1</p>
<p>13. Investigation: Abiotic Impacts on Ecosystems Students explore how abiotic changes in the environment can impact ecosystems. They explain how these abiotic disruptions affect the flow of energy and cycling of matter in ecosystems. These disruptions can lead to cycles of stability and change over time and at different scales. Students are assessed on their abilities to construct an explanation for why a top predator is the last organism to arrive in a disrupted ecosystem.</p>	<p>MS-LS2.C MS-LS2.B</p>	<p>Constructing Explanations</p>	<p>Stability and Change Energy and Matter</p>	<p>Literacy/ELA: WHST.6-8.1</p>

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>14. Investigation: Effects of an Introduced Species Students use computers to analyze a large data set on the effects of the zebra mussel on the Hudson River ecosystem. They analyze and interpret data to argue how the introduction of the zebra mussel affected populations of other organisms as well as the abiotic environment. Students are assessed on how well they use empirical evidence to construct an argument for how a change to the biological component of an ecosystem affects other populations. The activity provides an opportunity to assess student work related to Performance Expectation MS-LS2-4..</p>	<p>MS-LS2.A MS-LS2.C MS-LS4.D MS-ESS3.C</p>	<p>Engaging in Argument from Evidence Using Mathematics and Computational Thinking Analyzing and Interpreting Data Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence</p>	<p>Cause and Effect Patterns Stability and Change</p>	<p>Mathematics: 6.SP.B.5 Literacy/ELA: WHST.6-8.1</p>
<p>15. Talking It Over: Too Many Mussels Students explore potential solutions to the invasive zebra mussel problem. Students engage in the design process by developing initial criteria and constraints by which to evaluate solutions. After reading about several actual solutions, they revise their criteria and constraints, and then argue for the best solution(s) to maintain the natural ecosystem. The activity provides an opportunity to assess student work related to Performance Expectation MS-LS2-5.</p>	<p>MS-LS4.D MS-ETS1.A MS-ETS1.B MS-ESS3.C</p>	<p>Engaging in Argument from Evidence</p>	<p>Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World</p>	<p>Literacy/ELA: RI.8.8 WHST.6-8.1</p>
<p>16. Projects: Presenting the Facts Students explore how abiotic changes in the environment can impact ecosystems. They explain how these abiotic disruptions affect the flow of energy and cycling of matter in ecosystems. These disruptions can lead to cycles of stability and change over time and at different scales. Students are assessed on their abilities to construct an explanation for why a top predator is the last organism to arrive in a disrupted ecosystem.</p>	<p>MS-LS2.A MS-LS2.C MS-LS4.D MS-ETS1.A MS-ETS1.B MS-ESS3.C</p>	<p>Obtaining, Evaluating, and Communicating Information</p>	<p>Cause and Effect Patterns Stability and Change</p>	<p>Literacy/ELA: RST.6-8.8 RI.8.8 WHST.6-8.2 SL.8.5</p>