NGSS 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. .*

* *Performance expectations marked with an asterisk integrate traditional science content with engineering through a science and engineering practice or disciplinary core idea.*

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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.	MS-LS2.A MS-LS2.C MS-LS4.D	Engaging in Argument from Evidence	Cause and Effect Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World	Mathematics: 6.EE.C.9 Literacy/ELA: RST.6-8.1 WHST.6-8.1 WHST.6-8.9
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.	MS-LS2.A MS-LS2.C MS.LS4.D MS-ETS1.B	Obtaining, Evaluating, and Communicating Information Constructing Explanations	Cause and Effect Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World	Literacy/ELA: RST 6-8.1 RST 6-8.8 WHST.6-8.9 SL8.4 SL8.5

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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.	MS-LS2.A MS-LS2.C MS.LS4.D MS-ETS1.B	Obtaining, Evaluating, and Communicating Information Constructing Explanations	Cause and Effect Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World	Literacy/ELA: RST 6-8.1 RST 6-8.8 WHST.6-8.9 SL8.4 SL8.5
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.	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
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.	MS-LS2.C MS-LS4.D	Planning and Carrying Out Investigations Analyzing and Interpreting Data Asking Questions and Defining Problems 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

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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.	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
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.	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
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.	MS-LS2.A MS-LS2.B	Constructing Explanations Planning and Carrying out Investigations Analyzing and Interpreting Data Developing and Using Models	Energy and Matter Systems and System Models	Mathematics: 6.RP.A.3 Literacy/ELA: RST.6-8.3
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.	MS-LS2.B MS-LS2.A	Developing and Using Models Constructing Explanations	Energy and Matter Systems and System Models Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Mathematics: MP.2 MP.4 6. RP.A.1 Literacy/ELA: RST.6-8.7 WHST.6-8.9

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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	MS-LS2.A	Analyzing and Interpreting Data Planning and Carrying Out Investigations	Cause and Effect Energy and Matter Scale, Proportion, and Quantity	Mathematics: MP.2 6. RP.A.1 Literacy/ELA: WHST.6-8.1
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.	MS-LS2.A	Constructing Explanations	Patterns Cause and Effect	Mathematics: 6.EE.C.9 Literacy/ELA: WHST.6-8.1
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.	MS-LS2.B MS-LS2.A	Developing and Using Models Planning and Carrying Out Investigations Constructing Explanations	Energy and Matter Systems and System Models Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Literacy/ELA: RST.6-8.3
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.	MS-LS2.B MS-LS2.C	Developing and Using Models	Energy and Matter Stability and Change Systems and System Models Connections to nature of science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Literacy/ELA: WHST.6-8.1

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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.	MS-LS2.C MS-LS2.B	Constructing Explanations	Stability and Change Energy and Matter	Literacy/ELA: WHST.6-8.1
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.	MS-LS2.A MS-LS2.C MS-LS4.D MS-ESS3.C	Engaging in Argument from Evidence Asking Questions and Defining Problems Using Mathematics and Computational Thinking Analyzing and Interpreting Data Connections to Nature of Science: Scientific Knowledge Is Based on Empirical Evidence	Cause and Effect Patterns Stability and Change	Mathematics: 6.SP.B.5 Literacy/ELA: WHST.6-8.1
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.	MS-LS4.D MS-ETS1.A MS-ETS1.B MS-ESS3.C	Engaging in Argument from Evidence Using Mathematics and Computaional Thinking	Stability and Change Connections to Nature of Science: Science Addresses Questions About the Natural and Material World	Literacy/ELA: RI.8.8 WHST.6-8.1

ECOLOGY (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
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.	MS-LS2.A MS-LS2.C MS-LS4.D MS-ETS1.A MS-ETS1.B MS-ESS3.C	Obtaining, Evaluating, and Communicating Information	Cause and Effect Patterns Stability and Change	Literacy/ELA: RST.6-8.8 RI8.8 WHST.6-8.2 SL.8.5

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

ECOLOGY

ECOLOGY

Unit Issue: The environmental impacts of introduced species.

Anchoring Phenomenon: Introduced species are changing environments all around us. They can cause problems for people and affect biodiversity. Examples explored include Nile perch, zebra mussels, and local examples, such as starlings, kudzu, and others identified by students and teachers. Students generate and answer questions such as: How do introduced organisms interact with their environments, what are the effects of these interactions, and what can be done to prevent harmful interactions?

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline
People have introduced many kinds of species into new ecosystems either on purpose or accidentally, and they can cause problems for both people and the environment.	What are the effects of introduced species, and what can be done about them?	How have introduced Nile perch changed Lake Victoria? What are the trade-offs of introducing Nile perch into this environment? (Activity 1)	1, 2 (15, 16)	MS-LS2-4 MS-LS2-5 MS- ETS1.A MS- ETS1.B	Does this happen elsewhere?
		What effect can an introduced species have on an environment? What, if anything, can or should be done to control introduced species? (Activity 2)			Students research such a species, but in order to understand that research, they need to learn about Ecology.
There are different organisms and different numbers of organisms in different places.	Why are certain species more common than others, and why do some species become more common over time?	What patterns do you detect in the two locations, and how might the information in these patterns be useful to scientists? (Activity 3)	3, 4, 5, 6	MS-LS2-1 MS-LS2-2 MS-LS2-4	How can we look for and detect patterns in the living environment? Transects are one method.
		What patterns do you observe when you investigate your own environment, and what might be causing these patterns? (Activity 4)			These differences occur everywhere, including one's own backyard/school grounds, and we can use the transect method, too.
		How do the habitat requirements of individual organisms determine where a species will be found in nature? (Activity 5)			Populations are found in places that have the right kind of features in the environment.
		Do zebra mussel populations change or stay the same in their native range? (Activity 6)			Populations fluctuate in size, and determining the causes for those changes is an important question in ecology.

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

ECOLOGY (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline
A variety of species tend to be found together and linked through feeding relationships.	How do different species in the same ecosystem interact with each other and with the physical environment?	What is an owl's place and role in a food web? (Activity 7)	7, 8, 9, 10, 11, 12	MS-LS2-3 MS-LS2-1 MS-LS2-2	What an organism eats helps ecologists understand their role in an ecosystem.
		How do matter and energy move in an ecosystem? (Activity 8)			We can look at what all the organisms in an ecosystem eat and connect them through energy and matter relationships.
		How does the availability of food affect a population? (Activity 9)			When a population's prey increases in abundance, its size may grow; when its prey is scarce, its size may decrease.
		How do interactions with living or non- living factors in ecosystems affect populations? (Activity 10)			There are patterns to the ways organisms interact in an ecosystem, and these patterns occur in all ecosystems.
		What is the role of decomposers in the cycling of matter in an ecosystem? (Activity 11)			Decomposers break down dead organisms and return the matter to the environment.
		How does a new species affect the flow of energy and cycling of matter through an ecosystem? (Activity 12)			Ecologists can use models to try to predict the impact of an introduced species.

PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

ECOLOGY (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	PE	Storyline
Physical and biological factors can disrupt an ecosystem to a small or large degree.	What happens to organisms and relationships among them when an ecosystem is disrupted?	How can an abiotic disruption such as fire affect the flow of energy and cycling of matter in an ecosystem? (Activity 13)	13, 14	MS-LS2-4	Physical disruption can impact the flow of energy and cycling of matter in an ecosystem.
		What do the scientific data tell you about how the Hudson River changed after introduction of the zebra mussel? (Activity 14)			Ecologists have a large amount of data to examine the effects of Zebra Mussels; students will examine these same data.
People have introduced many kinds of species into new ecosystems either on purpose or accidentally, and they can cause problems for both people and the environment.	What are the effects of introduced species, and what can be done about them?	How can humans control or eliminate an invasive species? (Activity 15)	(1, 2) 15, 16	MS-LS2-5 MS-LS2-4 MS- ETS1.A MS- ETS1.B	How can we look for and detect patterns in the living environment? Transects are one method.
		What effect can certain introduced species have on an environment? What, if anything, can or should humans do to control these species? (Activity 16)			These differences occur everywhere, including one's own backyard/school grounds, and we can use the transect method, too.

NGSS CORRELATIONS

ECOLOGY

Crosscutting Concepts		Activity number
Patterns	Patterns can be used to identify cause and effect relationships.	3, 4, 5, 6, 10, 14, 16
Energy and Matter	The transfer of energy can be tracked as energy flows through a designed or natural system.	7, 8, 9, 11, 12, 13
Stability and Change	Small changes in one part of a system might cause large changes in another part.	1, 2, 5, 6, 13, 14, 15, 16
	Systems in dynamic equilibrium are stable due to a balance of feedback mechanisms.	12
Systems and System Models	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.	7, 8, 11, 12
Scale, Proportion, and Quantity	Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.	9
Connections to the Nature of Science	Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.	1, 2, 15
Cause and Effect	Cause and effect relationships may be used to predict phenomena in natural or designed systems.	1, 2, 3, 4, 5, 6, 9, 10, 14, 16
	Science assumes that objects and events in natural systems occur in consistent patterns and are understandable through measurement and observation.	8, 11, 12
Science and Engineering Practices		**Activity number**
Analyzing and Interpreting Data	Analyze and interpret data to provide evidence for phenomena.	3, 4, 6, 7, 9, 14
	Distinguish between causal and correlational relationships in data	4
Asking Questions and Defining Problems	Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	4
	Ask questions to determine relationships between independent and dependent variables and relationships in models.	14
	Ask questions that require sufficient and appropriate empirical evidence to answer.	4, 14
Constructing Explanations and Designing Solutions	Construct an explanation that includes qualitative or quantitative relationships between variables that predict or describe phenomena.	2, 7, 8, 10, 11, 13
Developing and Using Models	Develop a model to predict and/or describe phenomena.	7, 8, 11, 12

Science and Engineering Practices		Activity number
Engaging in Argument from Evidence	Construct and present oral and written arguments 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.	1, 5, 6
	Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.	14
	Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	15
	Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.	15
	Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.	15
Obtaining, Evaluating, and Communicating Information	Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.	16
	Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	2
Planning and Carrying Out Investigations	Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.	4, 5, 7, 9
	Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.	11
Using Mathematics and Computational Thinking	Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.	14
	Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.	15
Connections to the Nature of Science	Science disciplines share common rules of obtaining and evaluating empirical evidence.	3, 4, 5, 14
Disciplinary Core Ideas		**Activity number**
Information Processing (LS1.D)	Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	5

Disciplinary Core Ideas		Activity number
Interdependent Relationships in Ecosystems (LS2.A)	Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.	1, 2, 5, 6, 7, 8, 9, 14, 16
	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.	1, 5, 6, 7, 9, 12, 14, 16
	Growth of organisms and population increases are limited by access to resources.	6, 7, 9, 16
	Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	2, 6, 7, 10, 12, 16
Cycle of Matter and Energy Transfer in Ecosystems (LS2.B)	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.	7, 8, 11, 12, 13
Ecosystem Dynamics, Functioning, and Resilience (LS2.C)	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.	1, 2, 3, 4, 6, 12, 13, 14, 16
	Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	2, 3, 4, 5, 14, 15, 16
Adaptation (LS4.C)	Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	5
Biodiversity and Humans (LS4.D)	Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.	1, 2, 3, 4, 14, 15, 16

Disciplinary Core Ideas		Activity number
Adaptation (LS4.C)	Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	5
Biodiversity and Humans (LS4.D)	Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.	1, 2, 3, 4, 14, 15, 16
Human Impacts on Earth Systems (ESS3.C)	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.	13, 14, 16
	Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	15
Defining and Delimiting Engineering Problems (ETS1.A)	The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions.	15, 16
Developing Possible Solutions (ETS1.B)	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	2, 3, 15, 16
Performance Expectations		**Activity number**
Ecosystems: Interactions, Energy, and Dynamics (LS2)	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1)	9
	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2)	10
	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3)	12
	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4)	14
	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* (MS-LS2-5)	15

COMMON CORE STATE STANDARDS: CONNECTIONS AND CORRELATIONS

ECOLOGY

Making Connections in ELA

As with all SEPUP instructional materials, this unit introduces multiple opportunities for students to engage in a range of ELA practices and skills that are important grade-specific goals of the common core state standards and are also essential to the sensemaking students are doing throughout the unit. Specifically, students have multiple opportunities to develop arguments based on sound data sources related to why invasive species (such as the zebra mussel) negatively impact the environment, for example in activity 15 (RI.8.8). In activity 5, students also construct an evidence-based argument about a species' habitat requirements, and where it is likely to live, including both the behaviors and structures of the organism (WHST.6-8.1). Students engage in group research on how a variety of invasive species have impacted the environment in the past in activity 2. In doing so, they carefully use evidence from a variety of texts to support their understanding of the possible impacts on the ecosystem if an invasive species is introduced in the future (RST.6-8.1; WHST.6-8.9). In activity 16, students present their findings of this group research by communicating data to the class (through visuals) that support their findings (WHST.6-8.2; RST.6-8.8; SL.8.4; SL.8.5). In activity 3, students also carefully engage with a transect methodology to collect data on the environment, to better understand the living and nonliving components (RST.6-8.3). As students build on this understanding of the environment, they develop food web models, considering the percentage of energy lost at each level (RST.6-8.7). In addition, Appendix E: Literacy Strategies in the Student Book contains optional resources to support reading, writing and oral communication.

Common Core State Standards – English Language Arts		Activity number
Reading Informational Text (RI)	Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (RI.8.8)	15, 16
Reading in Science and Technical Subjects (RST)	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (RST.6-8.1)	1, 2
	Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks. (RST.6-8.3)	3, 4, 6, 7, 11
	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.6-8.7)	8
	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (RST.6-8.8)	2, 16

Common Core State Standards – English Language Arts		Activity number
Speaking and Listening (SL)	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound and valid reasoning, and well-chosen details: use appropriate eye contact, adequate volume, and clear pronunciation. (SL.8.4)	2, 16
	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (SL.8.5)	2, 16
Writing in History/ Social Studies, Science, and Technological Subjects (WHST)	Write arguments focused on discipline-specific content. (WHST.6-8.1)	1, 5, 9, 10, 12, 13, 14, 15
	Write informative/explanatory texts to examine and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (WHST.6-8.2)	16
	Draw evidence from informational texts to support analysis, reflection, and research. (WHST.6-8.9)	1, 2, 8

Making Connections in Mathematics

This unit introduces multiple opportunities for students to engage in math practices and skills that are important grade-specific goals of the common core state standards and are also essential to the sensemaking students are doing throughout the unit. At the beginning of the unit, in activity 1, students analyze graphs that show how the population of Nile Perch changed over time (6.EE.C.9). In activity 8, students develop food web models and engage in mathematical reasoning related to energy loss at each level (MP.4; MP.2). Students continue to use this reasoning in activity 7 as they calculate the number of prey an owl eats and determine effects to energy if certain organisms were removed from a food web (6.RP.A.3). Additionally, in activity 9, students analyze the relationship between the amount of food available and the number of Paramecium (6.RP.A.1). Later in the unit, in activity 14, students analyze data sets to determine the effect of an invasive species on a river ecosystem (6.SP.B.5).

Common Core State Standards – Mathematics		Activity number
Mathematical Practice (MP)	Reason abstractly and quantitatively. (MP.2)	6, 8, 9
	Model with mathematics. (MP.4)	8
Ratios and Proportional Reasoning (RP)	Understand the concept of a ratio, and use ratio language to describe a ratio between two quantities. (6.RP.A.1)	8, 9
	Use ratio and rate reasoning to solve real-world and mathematical problems. (6.RP.A.3)	7
Expressions and Equations (EE)	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 as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (6.EE.C.9)	1, 10
Statistics and Probability (SP)	Summarize numerical data sets in relation to their context. (6.SP.B.5)	3, 4, 5, 14