Unit Overview	
Content Area: Life Science	
Unit Title: Matter and Energy in Organisms and Ecosystems Interdependent Relationships in Ecosystems	**Unit:** 1
Target Course/Grade Level: 6	**Timeline:** 36 days

Unit Summary:

How and why do organisms interact with their environment and what are the effects of these interactions?

Students *analyze and interpret data, develop models, construct arguments*, and demonstrate a deeper understanding of the cycling of matter, the flow of energy, and resources in ecosystems. They are able to study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on populations. They also understand that the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. The crosscutting concepts of *matter and energy*, *systems and system models*, *patterns*, and *cause and effect* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in analyzing and interpret data, developing models, and constructing arguments. Students are also expected to use these practices to demonstrate understanding of the core ideas.

What happens to ecosystems when the environment changes?

Students build on their understandings of the transfer of matter and energy as they study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on a population. They construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. The crosscutting concept of stability and change provide a framework for understanding the disciplinary core ideas.

This unit includes a two-stage engineering design process. Students first evaluate different engineering ideas that have been proposed using a systematic method, such as a tradeoff matrix, to determine which solutions are most promising. They then test different solutions, and combine the best ideas into a new solution that may be better than any of the preliminary ideas. Students demonstrate grade appropriate proficiency in asking questions, designing solutions, engaging in argument from evidence, developing and using models, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Learning Targets	
NJSLS- Science	
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 and explanation that predicts patterns of interactions among organisms across multiple ecosystems
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- 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. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)
- 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. (MS-LS2-2)

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

- 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. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- 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. (MS-LS2-4)
- 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. (MS-LS2-5)

LS4.D: Biodiversity and Humans

- 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. (secondary to MS-LS2-5)

ETS1.B: Developing Possible Solutions

- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.*(secondary to MS-LS2-5)*

ETS1.A: Defining and Delimiting Engineering Problems

- 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 are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)

Science and Engineering Practices
Developing and Using Models: Develop a model to describe phenomena (MS-LS2-3)
Analyzing and Interpreting Data: Analyze and interpret data to provide evidence for phenomena (MS-LS2-1)
Constructing Explanations and Designing Solutions: Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena (MS-LS2-2)
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)
Asking Questions and Defining Problems: Define a design problem that can be solved through

the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

NJSLS Cooonections

Primary Interdisciplinary Connections:

English Language Arts/Literacy

- Cite specific, empirical, textual evidence to support analysis of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively (RST.6-8.1)
- Trace and evaluate the argument and specific claims in a text about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Distinguish claims that are supported by empirical evidence and scientific reasoning from claims that are not (RI.8.8)
- Write an argument focused on how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively (WHST.6-8.2)
- Distinguish among facts, reasoned judgment based on research findings, and speculation when reading text about maintaining biodiversity and ecosystem services. Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion.
- Trace and evaluate the argument and specific claims in a text about maintaining biodiversity and ecosystem services, distinguishing claims that are supported by reasons and evidence from claims that are not. Trace and evaluate the arguments about specific claims in a text and assess whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.
- Include multimedia components and visual displays as part of an argument about competing design solutions based on jointly developed and agreed-upon design criteria to clarify information. Include multimedia components and visual displays. The multimedia component and visual displays should clarify claims and findings and emphasize salient points in the presentation.

Mathematics

- Understand that a set of data collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, has a distribution which can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data)
- Summarize numerical data sets, collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, that have a distribution that can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data) in relation to their context.
- Model design solutions for maintaining biodiversity and ecosystem services with mathematics. Use ratio and rate reasoning to evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- Develop a model that generates data for the iterative testing of competing design solutions involving a proposed object, tool, or process that maintains biodiversity and ecosystem services, reasoning quantitatively (with amounts, numbers, sizes) and abstractly (with variables).
- Develop a probability and use it to find the probability that designed systems, including those representing inputs and outputs, will maintain biodiversity and ecosystem services. Compare probabilities from the model to observe frequencies. If the agreement is not good, explain possible sources of the discrepancy.

Unit Essential Questions	**Unit Understandings**
1. How do changes in the availability of matter and energy affect populations in an ecosystem? 2. How do relationships among organisms, in an ecosystem, affect populations? 3. How can you explain the stability of an ecosystem by tracing the flow of matter and energy? 4. How can a single change to an ecosystem disrupt the whole system? 5. What limits the number and variety of living things in an ecosystem?	• Organisms and populations of organisms are dependent on their environmental interactions with other living things. • Organisms and populations of organisms are dependent on their environmental interactions with non-living factors. • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources. • Access to food, water, oxygen, or other resources constrain organisms' growth and reproduction. • Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. • Mutually beneficial interactions may become so interdependent that each organism requires the other for survival. • The patterns of interactions of organisms with their environment, both its living and nonliving components, are shared. • Interactions within ecosystems have patterns that can be used to identify cause-and-effect relationships. • Patterns of interactions among organisms across multiple ecosystems can be predicted. • Patterns of interactions can be used to make predictions about the relationships among and between organisms and abiotic components of ecosystems. • Food webs are models that demonstrate how matter and energy are transferred among 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. • Decomposers recycle nutrients from dead plant or animal matter back 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. • The transfer of energy can be tracked as energy flows through an ecosystem. • Science assumes that objects and events in ecosystems occur in consistent patterns that are understandable through measurement and observation. • Ecosystems are dynamic in nature. • The characteristics of ecosystems can vary over time. • Disruptions to any physical or biological component of an ecosystem can lead to shifts in all the ecosystem's populations. • Small changes in one part of an ecosystem might cause large changes in another part. • Patterns in data about ecosystems can be recognized and used to make warranted inferences about changes in populations. Evaluating empirical evidence can be used to support arguments about changes to ecosystems. • 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. • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines. • Changes in biodiversity can influence ecosystem services that humans rely on. • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • A solution needs to be tested and then modified on the basis of the test results, in order to improve it. • Models of all kinds are important for testing solutions. • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. • Small changes in one part of a system might cause large changes in another part.

	Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.
Unit Learning Targets (Outcomes) – Formative Assessment *Students who understand the concepts are able to …*	
· Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	
· Use cause-and-effect relationships to predict the effect of resource availability on organisms and populations in natural systems	
· Construct an explanation about interactions within ecosystems	
· Include qualitative or quantitative relationships between variables as part of explanations about interactions within ecosystems	
· Make predictions about the impact within and across ecosystems of competitive, predatory, or mutually beneficial beneficial relationships as abiotic (e.g., floods, habitat loss) or biotic (e.g. predation) components change	
· Develop a model to describe the cycling of matter among living and nonliving parts of an ecosystem	
· Develop a model to describe the flow of energy among living and nonliving parts of ecosystem. Track the transfer of energy as energy flows through an ecosystem	
· Observe and measure patterns of objects and events in ecosystems	
• Construct an argument to support or refute an explanation for the changes to populations in an ecosystem caused by disruptions to a physical or biological component of that ecosystem. Empirical evidence and scientific reasoning must support the argument.	
• Use scientific rules for obtaining and evaluating empirical evidence.	
• Recognize patterns in data and make warranted inferences about changes in populations.	
• Evaluate empirical evidence supporting arguments about changes to ecosystems.	
• Construct a convincing argument that supports or refutes claims for solutions about the natural and designed world(s).	
• Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.	
• Create design criteria for design solutions for maintaining biodiversity and ecosystem services.	
• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	
Cross Cutting Concepts: **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)

Energy and Matter

- **The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)**

Stability and Change

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

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Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- **Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)**

Scientific Knowledge is Based on Empirical Evidence

- **Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)**

Science Addresses Questions About the Natural and Material World

- **Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (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)**

Integration of Technology:

Web-based textbook, interactive whiteboard, interactive texts, videos, digital board builder

Technology Resources:
Discovery Education website

Wetlands Institute Ecology pre and post activities

Opportunities for Differentiation:

Differentiation and support tips, which includes suggestions for ELL, struggling students, and accelerated students, are available below the instructional practice section of each model lesson.

Teacher Notes:

Career Ready Practices: *In this unit the following career ready practices are addressed* CRP1: Act as a reasonable and contributing citizen and employee CRP2: Apply appropriate academic and technical skills CRP3: Attend to personal health and financial well-being CRP4: Communicate clearly and effectively and with reason CRP5: Consider the environmental, social and economic impacts of decisions CRP6: Demonstrate creativity and innovation CRP7: Employ valid and reliable research strategies CRP8: Utilize critical thinking to make sense of problems and persevere in solving them CRP9: Model integrity, ethical leadership and effective management CRP10: Plan education and career paths aligned to personal goals CRP11: Use technology to enhance productivity CRP12: Work productively in teams while using cultural global competence
21st century themes:

Evidence of Learning
Summative Assessment

Biotic and Abiotic Factors

1. Using Board Builder or poster board, students will answer the Focus Question for the concept, “How do organisms detect, process, and use information about the environment?” Students will be assessed on the Disciplinary Core Idea LS2.A,Crosscutting Concept Cause and Effect, RST.6-8.7, WHST.6-8.1.
2. Review Sheet: Students may review the information in this section using the Biotic and Abiotic Factors Review Sheet.

Energy in Ecosystems

Students will be assessed on the Disciplinary Core Idea LS2.C and CCCS SL.8.5.

1. Review Sheet: Students can review using the concept review found under the Evaluate tab.
2. Using Board Builder or poster board, students will answer one of the following the Lesson Questions for the concept:
    1. How does energy flow through ecosystems?
    2. Why is food important for organisms?
    3. Why are all organisms connected to each other?
3. Using the Performance Task, students will be assessed on each dimension of NGSS, the Performance Expectation of NGSS.

Relationships Among Organisms

Students will be assessed on the Disciplinary Core Idea LS2.A, LS2,B, and CCCS RST.6-8.1

1. Using Board Builder, students will answer one of the following the Focus Questions for the concept:
    1. What kinds of relationships exist between organisms in a community?
    2. Why is the sun an important source of energy for all living things?
    3. How do different organisms in a community obtain energy from their environment?
2. Using the Performance Task, students will be assessed on each dimension of NGSS, the Performance Expectation of NGSS, and CCCS WHST.6-8.2, WHST.6-8.9).
3. Students may use the Review Sheet or read the Concept Review located under the Evaluate tab.

Equipment needed:
Whiteboard, laptops, headphones, and hands-on materials for lessons

Teacher Instructional Resources (Hyperlinks):
These links are from The New Jersey DOE Model Curriculum.

Matter and Energy in Organisms and Ecosystems
Habitable Planet Population Simulator:
This ecosystem interactive will allow the user to determine the producers and consumers (primary and secondary) in a simulated ecosystem.

Modeling Marine Food Webs and Human Impact:
In this two-part lesson, students develop food webs and investigate human impacts on marine ecosystems.

Interactive Interdependence:
This article describes an interactive lesson in which the complexity of food webs and ecosystems is explored.

Florida's Everglades:
The River of Grass utilizes a video clip of a visit to the Everglades, short articles for students to read, a series of slides and a suggested project for students to complete.

Interdependent Relationships in Ecosystems

In Exploring the "Systems" in Ecosystems,
students are introduced to the concept of an ecosystem, and explore how to analyze ecosystems using a systems thinking approach.

The Flow of Matter and Energy in Ecosystems SciPack explores the systemic interplay and flow of matter and energy throughout ecosystems, populations and organisms.

Resources
- **Annenberg Media's Teachers' Resources offer short video courses covering essential science content for teachers. http://www.learner.org/resources/series179.html**

- **National Invasive Species Information Center (NISIC) provides data and information regarding invasive species, including covering Federal, State, local, and international sources. This site supports the performance assessment associated with the CPI.**
http://www.invasivespeciesinfo.gov/

Modifications

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

· Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.

· Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

· Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

· Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

· Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

· Use project-based science learning to connect science with observable phenomena.

· Structure the learning around explaining or solving a social or community-based issue.

· Provide ELL students with multiple literacy strategies.

· Collaborate with after-school programs or clubs to extend learning opportunities.

· Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)

ACTIVITIES	**MATERIALS**
Techbook Course: Ecology **Unit: Ecosystems** **Concept: Biotic and Abiotic Factors**	
Session 1 & 2: Follow Model Lesson, Engage tab, Explore tab, Interactive Text	Scientific Explanation (SE) sheet
Session 3: Prep students for Wetlands Institute field trip. Field trip - date TBD	Field Trip activity packet
Session 4: Read "Sand Dune: Ecosystem at the Edge" Create chart that names the two sand dunes ecosystems.	Sand Dune article, SE sheet, chart paper
Session 5: Follow Model lesson, Read Interactive Test: "Biotic/abiotic factors", Cite and gather evidence, Discuss competition at birdfeeder	SE sheet, Interactive Text "Biotic and Abiotic Factors

Session 6: Follow Techbook model lesson, rewatch the videos and complete a Venn Diagram assignment. Class discussion to share and explain Venn diagrams and cite evidence for their choices. Add evidence to Scientific Explanation Sheet	SE sheet, Venn diagram graphic organizer or paper, Assignment: Competition for Biotic and Abiotic Factors, Interactive Text "Biotic and Abiotic Factors",
Session 7 & 8: Hands-on Investigation - "Ecological Interactions M&Ms Activity". Read the Teacher's Guide ahead of time for useful and important information about instructional and logistical strategies for this activity. May to review some terminology. Assign 3 students to a group and provide materials and instructions. Students will complete 3 rounds during the investigation then answer lab questions with their group.	"Ecological Interaction Activity": Per Group of 3: Package of M&Ms, 3 empty cups, 3 spoons, 3 notecard stacks, student worksheet
Session 9: Follow Techbook model lesson, assign reading passage: Plant Invasion and collect evidence as they read to answer the lesson questions at the end and then discuss as a class. Students will use the evidence that they collected thus far to complete page 2 of the Scientific Explanation activity sheet (sections "Claim" and "Explanation"), share their explanation with classmates, and revise or enhance their own explanations after sharing and exploring those of their classmates.	Reading passage: Plant Invasion, Scientific Explanation Sheet, Scoring Rubric, Teacher's Guide
Session 10 & 11: Follow Techbook model lesson plans - Explain that an important factor in the health of sea creatures with external skeletons (such as sea urchins and corals) is the pH, or acidity, of the water. Ask students if water pH is a biotic or an abiotic factor. Show students the video while thinking about and writing down how human activity is affecting many sea creatures. After the video, have students work in small groups to create concept maps that illustrate the potential effects of ocean acidification on ocean ecosystems. Students should describe if and how the claims are supported by evidence then allow students to share their concept maps, explanations and evidence with the class. Students use the Board Builder tool to create a board that shows what they know about the focus question and they will answer Constructed Response Item. Optional research projects are available.	video:American Museum of Natural History Science Bulletins: Acid Oceans (6:36) Biotic and Abiotic Factors (CR), Optional: Research Projects 1 and 2, Board Builder Tool or large construction paper
Concept: Energy in Ecosystems	
Session 1, 2, & 3: Follow Techbook model lesson plans - Activate prior knowledge - introduce ecosystem vocab word, view photos of examples of different ecosystems and watch ecosystem video, model how to complete the Vocab Chart. Divide 3 questions among class (ie 3 groups) Chart paper Carousel brainstorming activity with question at top. Each group will write prior	Engage video: What is energy?, Vocab chart or other graphic organizer,

knowledge about the question (timed response). Then in partner groups or as individuals, students will use laptops use interactive glossary to complete the Vocab Chart (or teacher discretion vocab list) for the other vocab terms Read articles, watch videos and gather evidence to answer lesson question on Scientific Explanation sheet	chart paper, SE sheet, Interactive Text section: How does energy flow through ecosystems?, video segment:The Energy Flow (2:09), reading passage:Getting to Know: Energy in Ecosystem,
Session 4 & 5: Follow Techbook model lesson plans - Read articles, watch videos and gather evidence to answer lesson question on Scientific Explanation sheet. (Scroll down to access text and video (Not Frog File). As students read text and view the "Converting Food to Energy" video). Lead class discussion. Hands-On Activity, "The 10% Rule" students will graph and analyze data that shows the amount the loss of energy between trophic levels. Allow them time to work in pairs to plot the data, and answer the questions. You may wish to have students use the Data/Graphing Tool to plot their data. Facilitate a class discussion in which students share their results and answers to the questions in the activity.	Interactive Text section: Why is food important for organisms?, video segment:Converting Food to Energy(5:37), reading passage:Spigot Science…, SE sheet, 10% Rule Activity: Graph paper or computer graphing tool, Student Investigation sheet
Session 6 & 7: Follow Techbook model lesson plans - Read articles, watch videos and gather evidence to answer lesson question on Scientific Explanation sheet. Facilitate class discussion. Follow Techbook model lesson plans - In the Hands-On Activity: Flex Flow, students investigate how humans impact the flow of energy through an ecosystem.	Interactive Text section: Why are all organisms connected to each other?, Video segment: Overview of Mammals, Carnivores…, Flex Flow activity: Index cards, markers
Session 8: Follow Techbook model lesson plans - Complete scientific explanations/catch-up day. Students will pair and share within groups and then pair and share with other groups.	SE sheet
Session 9 & 10: Follow Techbook model lesson plans - Watch video: "The Food Chain: Predator and Prey" and partners discuss flow of energy in predator-prey relationships, discuss conservation of energy, then students rewatch video and create an annotated diagram of a food chain or food web for the Serengeti similar to the one they saw in the video segment.	video segment:The Food Chain: Predators and Prey (2:40), blank paper for diagrams,

Optional research projects available.	Optional research projects
Session 11: Evaluate: Follow Techbook model lesson plans - Students use the Board Builder tool or large construction paper to create a board that shows what they know about one lesson question of their choice. Emphasis should be placed on the evidence they have collected to support their findings. Optional: formal assessment available.	Resources: Board Builder tool or large construction paper for poster, Optional: assessment
Techbook Course: Ecology **Unit: Populations and Communities** **Concept: Relationships Among Organisms**	
Session 1 & 2: Follow Techbook model lesson - Activate Prior Knowledge: think-pair-share over the following question: What is a predator? Teacher shows the video segment: Octopus (not in student version, must be logged in as teacher) Follow Techbook model lesson - Fill out part of Scientific Explanation sheet and use Interactive Glossary to define terms.	Video Segment: Octopus video, Interactive Glossary, Vocab Chart or List, SE sheet
Session 3 & 4: Follow Techbook model lesson plans - read articles, watch videos and gather evidence to answer lesson question	Interactive Text, video segment:Producers, Consumers and Decomposers(4:39), video segment:Producers and Consumers(3:34), Web Concept Map graphic, SE sheet
Session 5: Follow Techbook model lesson plans - Exploration lab: What's Eating You? in student partners Additional video and reading resources available as links at bottom of webpage	Virtual Pond Food Web activity, Student Worksheet
Session 6: Follow Techbook model lesson plans - Read articles, watch videos and gather evidence to answer lesson question on Scientific Explanation sheet and lead a class discussion. Potential HW assignment if time limited - World Wide Web article (Leveled readers available)	Interactive Text, video segment:Food Chains: Predator and Prey Relationships(2:38), video segment:Predator and Prey (6:05), video segment:Food Chains and Food

	Webs(2:22), SE sheet
Session 7: Already completed a Food Web activity	NA
Session 8: Follow Techbook model lesson plans - Read articles, watch videos and gather evidence to answer lesson question on Scientific Explanation sheet	Interactive Text, video segment:Introduction to the Flow of Matter and Energy (1:08), video segment:Warmth and Light: The Sun and Life on Earth (2:11), SE sheet, Optional: KWL
Session 9: Follow Techbook model lesson plans - Compile evidence and answer 3 key lesson questions on the Claim and Explanation page of the Scientific Explanation sheet, share with class, critique and revise as needed. Session 10 & 11: Follow Techbook model lesson plans - students watch video segments and diagram the carbon cycle and then study nitrogen cycle diagram and lead a discussion with the class on the relationship between the carbon cycle, nitrogen cycle, and food webs.	SE sheet, video segment:Plants: Essential Contributors to the Carbon Cycle, video segment:Requirements for Life: The Carbon Cycle, video segment:The Nitrogen Cycle
Session 12: Follow Techbook model lesson plans - Assessment - Brief constructed response activity. Optional: Board builder activity	Constructed response item, Optional resource: Boarder Builder tool or large poster paper