Unit 2: Ecosystems: Interactions, Energy and Dynamics

Content Area: **Science**
Course(s):
Time Period: **Trimester 2**
Length: **8-9 weeks**
Status: **Published**

Summary

Ecosystems are dynamic systems composed of living (biotic) and nonliving (abiotic) components that interact to cycles through the biosphere. This unit begins by introducing the levels of biological organization, from individ will then explore relationships among organisms, such as predator-prey, mutualism, and parasitism, and examin students will investigate how populations change over time and how factors like food, space, and climate influe will allow students to simulate real-world ecological phenomena. Students will also explore the carbon, nitroge data, and completing creative group projects, students will build a comprehensive understanding of how ecosyst importance of maintaining balance in nature.

Revision Date: July 2025

Essential Questions

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- What are the relationships among individuals, populations, communities, ecosystems and the biosphere?
- How do biotic and abiotic factors affect an organism's survival in their environment?
- In what ways do organisms interact within ecosystems that impact populations and the ecosystem itself?
- How does energy flow through an ecosystem?

Enduring Understandings

Ecosystems are composed of complex interactions between organisms and their environment, where relationships such as competition, predation, and symbiosis influence population dynamics.

Abiotic and biotic factors shape ecosystems by affecting the survival, growth, and reproduction of organisms. Energy flows through ecosystems in food chains and webs, with decreasing energy availability at higher trophic levels.

Ecosystems experience changes over time through ecological succession, leading to stable climax communities.

Nutrient cycles, such as the carbon and nitrogen cycles, are essential for maintaining life and recycling matter within ecosystems. Environmental changes, including climate change and invasive species, can disrupt ecological balance and alter population stability.

Objectives

Students Will Know:

- Within the biosphere, there are many different environments.
- That abiotic and biotic factors have an impact on organisms.
- Organisms are classified based on similar characteristics and DNA.
- Relationships exist between different organisms and their environment.
- Eventually, an environment can reach its carrying capacity.
- That less usable energy is available at the higher levels of the food web since much energy is used for life activities.
- When a community has reached the final stage of ecological succession, it is called a climax community.
- That competition for resources can affect the populations of organisms in a community.
- The effects of climate change on an ecosystem.
- The major types of symbiotic relationships: mutualism, parasitism, and commensalism.
- The carbon and nitrogen cycles are essential for maintaining life in ecosystems.

Students Will Be Skilled At:

- Interpreting food webs and identifying the flow of energy between organisms.
- Categorizing components of an ecosystem as biotic or abiotic.
- Organizing levels of ecological organization from organism to biosphere.
- Analyzing population data to identify trends such as predator/prey dynamics and carrying capacity.
- Modeling ecological succession and identifying pioneer and climax communities.
- Explaining nutrient cycling using labeled diagrams and visual models.
- Conducting simulations and labs that demonstrate extinction, succession, and the impact of environmental change.
- Constructing ecosystem models that show interactions, cycles, and limiting factors.

- Comparing the impact of invasive species through case studies like the Cane Toad video.
- Collaborating in groups to create visual representations of ecological processes and relationships.

Learning Plan

Introduction to Ecosystems

Discuss components of an ecosystem (biotic vs. abiotic). Students will study levels of biological organization: organism → population → community → ecosystem → biosphere. Students will take part in a group activity: Categorize classroom ecosystem items into biotic/abiotic.

Interactions in Communities

Discuss predator/prey, competition, mutualism, parasitism, and commensalism. View clips from the Cane Toad video and discuss its ecological impact as an invasive species. Conduct a graphic organizer on types of relationships in ecosystems.

Food Chains and Webs

Students will interpret food webs and understand that all organisms involved have an impact on other members of the community.

Population Changes

Conduct a graphing populations activity using data sets to show trends in predator/prey cycles. Discuss ecological changes, carrying capacity, and population growth curves.

Limiting Factors and Succession

Perform Kaibab Plateau Activity to simulate how predators, food, and hunting laws impact deer populations. Demonstrate succession lab showing changes from bare rock to a mature ecosystem (primary and secondary succession examples).

Nutrient Cycles

Relate carbon cycles using diagrams and videos. Group project: Create posters illustrating each cycle and explaining its importance in maintaining life.

Lab Investigation

Students will conduct a “Here Today, Gone Tomorrow” lab simulating extinction and environmental changes. Lab questions tie back to food webs, population data, and succession.

Synthesis and Reflection

Group discussion: How are all ecosystems connected? Students complete a formative assessment: Draw and label an ecosystem showing all interactions, cycles, and limiting factors.

Lab Safety will be reviewed before all Lab Activities

Assessment

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

Worksheets

Exit Tickets

Class Discussion

Quizzes:

Food Web/Food Chain quiz

Summative:

Unit Tests: Ecology Chapter

Ecosystem Project

Alternative :

Graphing Population Data

Food Chain Presentation/Research Project

Bench Marks:

Formal Lab Reports/Lab Write-ups

Demonstrating Succession Lab Work /Practicum

Materials

Elevate Science - Savvas - Life Science

Safety equipment

Computer(s)

Smartboard

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

Meter Sticks/ metric rulers.

Marine Food Web pictures

Colored pencils/scissors

Food Web Model

Models of the Nitrogen cycle and oxygen cycle.

Ecosystem images

Standards

9.2.8.CAP	Career Awareness and Planning
7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems
9.2.8.CAP.2	Develop a plan that includes information about career areas of interest.
TECH.K-12.1.1.c	use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
TECH.K-12.1.1.d	understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.
TECH.K-12.1.2.b	engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.
TECH.K-12.1.3	Knowledge Constructor
	Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.
TECH.K-12.1.3.c	curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
	Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
TECH.K-12.1.5.b	collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
W.AW.7.1	Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence.
W.AW.7.1.A	Introduce claim(s) about a topic or issue, acknowledge alternate or opposing claims, and organize the reasons and evidence logically.
W.AW.7.1.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.
W.AW.7.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among

	claim(s), reasons, and evidence.
W.AW.7.1.D	Establish and maintain a formal style/academic style, approach, and form.
W.AW.7.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
W.IW.7.2	Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
W.IW.7.2.A	Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aid in comprehension.
W.IW.7.2.F	Provide a concluding statement or section (e.g., sentence, part of a paragraph, paragraph, or multiple paragraphs) that follows the flow of ideas, reflects back on the topic, and supports the information or explanation presented.
SL.PE.7.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
MS-LS1-4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury. Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). Use 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.
LS1.B	Growth and Development of Organisms Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant

	seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.
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 organisms. Emphasis is on tracing movement of matter and flow of energy. Assessment does not include the biochemical mechanisms of photosynthesis.
LS1.C	Organization for Matter and Energy Flow in Organisms
PS3.D	Energy in Chemical Processes and Everyday Life
MS-LS2	Ecosystems: Interactions, Energy, and Dynamics
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. Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.
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. 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.
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial. Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.
LS2.A	Interdependent Relationships in Ecosystems 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-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.
LS2.B	Cycles 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.

	Energy and Matter
	The transfer of energy can be tracked as energy flows through a natural system.
MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
	Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.
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.
	Stability and Change
	Small changes in one part of a system might cause large changes in another part.
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
	Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.
LS2.C	Ecosystem Dynamics, Functioning, and Resilience
	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.
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.
	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
	Stability and Change
	Small changes in one part of a system might cause large changes in another part.

Modifications/ Accommodations

This link includes content specific accommodations and modifications for the populations listed below the link

https://docs.google.com/spreadsheets/d/1QL15CF_i_gwqtoPintFW-FmY85ALeKv4J1PQQxb-vbM/edit?usp=sharing