Unit 4: Introduction to Ecology and Human Impacts

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 4**
Length: **8-10 Weeks**
Status: **Published**

Unit Overview

This unit answers the question, "How does a system of living and nonliving things operate to meet the needs of organisms in an ecosystem?" Students will apply understanding of how energy transfers through ecosystems through feeding relationships. Students will consider biotic and abiotic factors in an ecosystem and the effects these have on a population. They will evaluate competing design solutions for maintaining biodiversity or ecosystem services. This unit will also help students answer the question, "How do human activities affect Earth's systems?" and "How do we know our climate is changing?". Students will use many scientific practices to understand the significant and complex issues surrounding environmentalism.

Performance Expectations

MS-ESS3-1.2.1	Cause and effect relationships may be used to predict phenomena in natural or designed systems.
MS-ESS3-4.ESS3.C.1	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.
MS-ESS3-5.7.1	Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
SCI.MS-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
SCI.MS-LS4-6	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
SCI.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.
SCI.MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
SCI.MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
SCI.MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Three Dimensions

Science and Engineering Practices

SEP.1	Asking Questions and Defining Problems
SEP.2	Developing and Using Models
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.5	Using Mathematics and Computational Thinking
SEP.6	Constructing Explanations and Designing Solutions
SEP.7	Engaging in Argument from Evidence
SEP.8	Obtaining, Evaluating, and Communicating Information

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)

ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.(MS-ESS3-1)

ESS3.B: Natural Hazards

- Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.(MS-ESS3-2)

ESS3.C: Human Impacts on Earth Systems

- 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.(MS-ESS3-3)
- 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. (MSESS3-3),(MS-ESS3-4)

ESS3.D: Global Climate Change

- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

Crosscutting Concepts

	Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
CCC.2	Cause and effect: Mechanism and explanation.
CCC.3	Scale, proportion, and quantity.
	In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
	Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Knowledge, Skills, and Assessment

Essential Insights and Understandings/Guiding Questions	Critical Knowledge and Skills	A
How are ecosystems organized? All living things play a part in the health and operation of ecosystems.	An organism is an individual living thing (plant, animal, bacteria, fungi). A habitat is a place where living things live, grow, and reproduce. Organisms can interact with biotic and abiotic parts of a habitat. **Skill: SWBAT...** • **Differentiate between biotic and abiotic features of an ecosystem.** Ecosystems can be studied at different levels: Individual organism, populations, communities, and ecosystem. Populations can grow and shrink based on birth rate and death rate affected by resources availability. Populations may grow or shrink based on emigration or immigration affected by resource availability. Factors that can limit a population's growth are weather, space, food, and water. **Skill: SWBAT...** • **Read a population graph over time and predict trends or interpret changes in population sizes as related to resource availability.**	**Activi** depict biotic ecosy **Asses** popul studer future popul resou
Plants and animals of different species compete for limited resources and it guides their interactions.	A species has adaptations that help it exploit its ecosystem for resources to create a niche. Competition is the struggle between organisms for limited resources. When one species hunts, kills, and eats another it is known as predation or predator/prey interaction. Predators and prey have certain adaptations that help them kill/eat and/or survive. **Skill: SWBAT...** • **Interpret a graph based on the population sizes as predator and prey are introduced.** Symbiosis is any relationship in which two species interact on a	**Asses** predat Stude each p **Asses** comm prima

	predictable basis. When two species interact and both benefit, it is known as mutualism. When two species interact and one benefits and one remains unchanged, it is known as commensalism. When two species interact and one benefits and one is harmed, it is known as parasitism. **Skill: SWBAT...** • **Identify real life examples of each form of symbiosis.**	
	Communities are resilient and return to their prior form or create a new form after disruption. Primary succession occurs when soil forms on bare rock and a community is created. Secondary succession occurs when soil is formed and a disturbance occurs. **Skill: SWBAT...** • **Model how communities are created or return after a disturbance.**	
How does energy and matter get recycled and used in an ecosystem?	Living things can be classified as producers or consumers. Producers create food for an ecosystem through photosynthesis. Consumers obtain their energy through eating producers or each other. Decomposers break down dead producers and consumers and return nutrients back to the soil. **Skill: SWBAT...** • **Model the interactions of organisms eating relationships through a food web, food chain, and energy pyramid.**	**Activi** of ani ecosy Weav **Asses** questi Stude using produ **Revie** all ma identi a phot
How does human activity affect Earth's ecosystems?	Humans depend on biomes of Earth for many resources we need for survival and our lifestyle. Human actions have destroyed parts of the biosphere resulting in the extinction of species. The three major environmental issues are pollution, resource use, and human population growth. There are two types of pollution: point source and non-point source pollution. Point source is identifiable and comes from a specific place. Non-point source is widespread and difficult to determine a source. The human population grows exponentially and causes the demand for resources to rise. **Skills: SWBAT...**	**Activi** to red identi and de **Asses** argum increa consu systen

- **Differentiate between point and non-point pollution.**

Use of fossil fuels releases green house gases into the atmosphere resulting in a warming of the earth.

Skill: SWBAT...

- **Identify where greenhouse gases come from and the effect each has on global temperatures.**

Using alternative fuels and energy sources can help reduce use of fossil fuels. Alternative energy sources include solar, wind, geothermal, hydro and nuclear. Wind, hydro power, heat from nuclear reactions, or geothermal energy can be used to turn a turbine and generate electricity.

Skill: SWBAT...

- **Construct an argument that argues for or against increased funding devoted to use of alternative fuels and energy sources.**

Suggested Resources

CK12 Flexbook

Ecosystem Organization

- http://www.ck12.org/life-science/Ecosystems-in-Life-Science/
- http://www.ck12.org/life-science/Ecosystems-in-Life-Science/lesson/Ecosystems-MS-LS/?referrer=concept_details
- http://www.ck12.org/earth-science/Population-Size/

Competition

- http://www.ck12.org/biology/Competition/lesson/Competition-BIO/
- http://www.ck12.org/life-science/Habitat-and-Niche-in-Life-Science/lesson/Habitat-and-Niche-MS-LS/
- http://www.ck12.org/biology/Symbiosis/
- http://www.ck12.org/life-science/Succession-in-Life-Science/
- http://www.ck12.org/earth-science/Biological-Communities/

Food Webs:

- http://www.ck12.org/life-science/Food-Chains-and-Food-Webs-in-Life-Science/lesson/Food-Chains-and-Food-Webs-Basic/

Human Impacts:

- http://www.ck12.org/search/?q=pollution&referrer=top_nav&autoComplete=false
- http://www.ck12.org/biology/Human-Population/lesson/Human-Population-BIO/
- http://www.ck12.org/section/Natural-Resources-%3A%3Aof%3A%3A-Ecology-and-Human-Actions-%3A%3Aof%3A%3A-CK-12-Biology-I-Honors-CA-DTI3/
- http://www.ck12.org/earth-science/Reducing-Air-Pollution/

Technology Integration

CK12 Flexbook

iPad/smartphone iMovie intergration for demonstration of performance based goals.

Chromebooks for research on : food webs, biomes, ecosystems, ecological footprint reduction.

Differentiation

Differentiation for special education:

- General modifications may include:
  - Modifications & accommodations as listed in the student's IEP
  - Assign a peer to help keep student on task
  - Modified or reduced assignments
  - Reduce length of assignment for different mode of delivery
  - Increase one-to-one time
  - Working contract between you and student at risk
  - Prioritize tasks
  - Think in concrete terms and provide hands-on-tasks
  - Position student near helping peer or have quick access to teacher
  - Anticipate where needs will be
  - Break tests down in smaller increments
- Content specific modifications may include:
  - Provide hands on, manipulative model of food webs
  - Provide foldable to organize information on organization of ecosystems.
  - Provide notes on environmental issues.

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
  - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: organism, population, community, ecosystem, biome, symbiosis, mutualism, commensalism, predation, sustainability,

alternative fuels, nuclear, renewable resources, nonrenewable, habitat, predator, prey, decomposition, producer, consumer.

Differentiation to extend learning for gifted students may include:

- 7th Grade Class Blog: Find a topic relating to Ecology on D News, CrashCourse, CrashCourse Kids or Popular Science. Write a brief response and post on the class blog or site.

Exploration Topics:

- Mark and Recapture Lab: Use an online Mark and Recapture simulator or hands-on model to have students test the validity of the Mark Recapture technique.
- Animal Overpopulation: Explore techniques in New Jersey used to control animal overpopulation. Make a pros/cons list evaluating the techniques.
- Decomposers: Evaluate the effect of oxygen , moisture, temperature, or activity on a student designed compost chamber.
- Biogeography: Explain how movement of Earth's continents has affected how species are distributed on the planet.
- The Environmental Movement: In the beginnings of the Environmental Movement, people such as Rachel Carson used shocking facts, statements, and imagery. Create an art project (poster, poem, video) that captures the spirit of the environmental movement.

21st Century Skills

CAEP.9.2.8.B.1	Research careers within the 16 Career Clusters ® and determine attributes of career success.
CAEP.9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
CAEP.9.2.8.B.5	Analyze labor market trends using state and federal labor market information and other resources available online.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.