Unit 4: Ecosystem Dynamics

Content Area: **Science**
Course(s): **Environmental Science**
Time Period: **3rd Marking Period**
Length: **8 Weeks**
Status: **Published**

Unit Overview

Ecosystems are complex, interactive systems that include both biological communities (biotic) and physical (abiotic) components of the environment. Ecosystems are dynamic, experiencing shifts in population composition and abundance and changes in the physical environment over time, which ultimately affects the stability and resilience of the entire system.

Transfer

Students will be able to independently use their learning to...

-What kinds of long term, independent accomplilshments are desired?

Understand the difference between living and nonliving factors in an ecosystem.

Analyze ecosystems and habitats and be able to identify the importance of protecting each.

Understand how evolution has influenced the natural world.

Explain why resistance is a product of overuse of pesticides and antibiotics.

Analyze the six kingdoms for differences in classification.

Identify relationshipd and interdependence in ecosystems.

Make a connection between the sun and all energy transfers on Earth.

Explain why larger predators require more food in comparison to prey animals, relating this information to energy pyramids.

Be aware of the cycling of materials and how pollution moves through the cycle.

Identify the role natural disturbance plays in succession.

Explain how latitude and altitude affect which biomes will be in an area.

Identify adaptations in each biome that allows organisms to thrive there.

Be aware of threats to each biome.

Describe the functions of wetlands and threats against them.

Identify the importance of estuaries.

Meaning

Understandings

Abiotic and Biotic factors are the specific makeup of an ecosystem.

Protecting habitats is more important than protecting singular organisms.

Using Pesticidces and Antibiotics are the reason that resistance is such a prevalent problem iin the environment today.

Kingdoms are broken up based on types of cells they possess and how they obtain their food.

All organisms within an environment rely on one another to maintain life and balance.

The sun is the ultijmate energy source ono Earth.

Larger predators are the top of the food chain and therefore require more food more often.

Following the law of matter conservation, materials cycle through Earths systems, and when one part is polluted the pollution can go through the entire cycle causing disruptions.

Biomes are classified by latitude, altitude, and organisms within, primarily plants.

Organisms in each biome are adapted to live in that biome.

Wetlands function as nurseries and water retention.

Essential Questions

How are ecosystems interconnected?

How do organisms live as populations of one species within a community?

In what ways do artificial and natural selection differ?

Why is natural selection the driving force behind evolution?

How has the use of antibiotics unintentionally selected for pests and bacteria that are resistant to pesticides and anitbiotics?

How are the kingdoms divided?

How does photosynthesis harvest energy that is used for all life on Earth?

What are three ways energy transfer can be followed?

What are humans doing that affects the cycling of materials in an ecosystem?

What is ecological succession and how does that affect the environment?

How are biomes classified?

What are the forest biomes and what are the greatest threats to them?

How are savannas and a deserts different?

How are aquatic ecosystems classified?

What functions do freshwater wetlands serve?

Why do coral reefs need clear shallow water? How does this affect the marine environment?

What are threats to the marine ecosystem? How can they be reduced?

Application of Knowledge and Skill

Students will know...

Abiotic and biotic factors makeup the distinct elements of an ecosystem.

Populations are a single species living in the same place at the same time.

It is better to protect whole habitats than single species.

Natural selection is the driving force behind evolution.

Adaptation gives each organisms its distinct traits and advantages.

Resistance is the ability of one or more organisms to tolerate a particular chemical designed to kill it.

The six kingdoms are defined by the organisms type of cells and how it obtains food.

Photosynthesis drives energy production around the world.

Energy transfer can be simple as in a food chain, or complex as in a food web.

Energy pyramids are representative of trophic levels.

Material in the carbon, phosphorous and nitrogen cycles is constantly being recycled.

Excess use of fertilizer can affect the nitrogen and phosphorous cycles.

Ecological succession is a gradual process of change and replacement of all or some of the species in a community.

Vegetation is used to name a biome.

Humans are the greatest threat to all the biomes.

Wetland organisms are determined by the salinity of the environment.

Wetlands function for water retention and as filters for pollution and toxins.

Nutrient traps are what make estuaries very productive ecosystems.

Students will be skilled at...

Identifying abiotic and biotic factors in an ecosystem.

Analyzing adaptations and how they affect the survival of an organism.

Classifying organisms into kingdoms.

Create a logical energy transfer from sun to predator.

Identify elements that affect the cycling of materials in the environment.

Describe a disturbance and accurately map the process of succession.

Identify and classify biomes by the vegetation that grows within them.

Analyze threats to biomes and describe a potential solution for each.

Differentiate between freshwater and marine aquatic ecosystems.

Identifying both needs of and threats to coral reefs.

Identifying their own impact on aquatic ecosystems.

Academic Vocabulary

Ecosystem

Biotic factor

Abiotic factor

Organism

Species

Population

Community

Habitat

Natural selection

Evolution

Adaptation

Artificial selection

Resistance

Archaebacteria

Eubacteria

Fungus

Protist

Gymnosperm

Angiosperm

Invertebrate

Vertebrate

Photosynthesis

Producer

Consumer

Decomposer

Cellular respiration

Food chain

Food web

Trophic level

Carbon cycle

Nitrogen-fixing bacteria

Nitrogen cycle

Phosphorous cycle

Ecological succession

Primary succession

Secondary succession

Pioneer species

Climax community

Biome

Climate

Latitude

Altitude

Tropical rain forest

Emergent layer

Canopy

Epiphyte

Understory

Temperate rain forest

Temperate deciduous forest

Taiga

Savanna

Temperate grassland

Chaparral

Desert

Tundra

Permafrost

Wetland

Plankton

Nekton

Benthos

Littoral zone

Benthic zone

Eutrophication

Estuary

Salt Marsh

Mangrove swamp

Barrier island

Coral reef

Learning Goal 1

In Ecosystems, the biotic (living) and abiotic (nonliving) components interact to form an interconnected system. Species adapt to their environment through the process of evolution by natural selection. The six kingdom system of organization helps scientists to classify organisms and study their differences.

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SCI.HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
SCI.HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
SCI.HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Target 1

SWBAT distinguish between abiot and biotic factors, describe how a population differs from a species and explain how habitats are important for organisms.

Target 2

SWBAT explain the process of evolution by natural selection, the concept of adaption and resistance.

Target 3

SWBAT name the six kingdoms of organisms, explain the importance of bacteria, fungi and protists and

explain why insects are so successful.

Learning Goal 2

Organisms need energy to stay alive. Some organisms, such as plants, can directly convert usable energy from the sun. The cycling of materials such as carbon, nitrogen and phosphorous is essential to keep nutrients balanced in ecosystems. Human activities can affect these cycles. Through ecological succession, ecosystems can change over time.

SCI.HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
SCI.HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Target 1

SWBAT describe how energy is transferred from the sun to producers and then to consumers, explain how energy transfer in a food web is more complex than energy transfer in a food chain and how energy pyramids represent trophic levels.

Target 2

SWBAT describe the short and long term processes of the carbon cycle and explain how excess use of fertilizer can affect the nitrogen and phosphorous cycles. Identify ways humans are affecting the cycling of materials.

Target 3

SWBAT list two types of ecologocal succession, explain pioneer species and describe how lichens contribute to primary succession.

Learning Goal 3

Biomes are described by their vegetation, temperature and precipitation. The terrestrial biomes of the world include tropical rain forest, temperate forest, taiga, temperate grassland, desert, tundra, chaparral and savanna. There are biome specific threats to each.

SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
SCI.HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Target 1

SWBAT describe why vegetation is used to name a biome and explain how latitude and altitude affect which plants grow in an area.

Target 2

SWBAT list 3 characteristics of tropical rainforests, temperate deciduous forest, and taiga and name two threats to the worlds forest biomes.

Target 3

SWBAT describe the difference between tropical and temperate grasslands, deserts and tundra. Describe a threat to each biome.

Learning Goal 4

Freshwater ecosystems are made up of lakes, rivers, and wetlands. Marine ecosystems include estuaries, coral reefs and oceans. Aquatic ecosystems perform many environmental functions and support many plant and animal species. Pollution, development and overuse threaten many of these ecosystems.

SCI.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
SCI.HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the

	cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Target 1

SWBAT describe the factors that determine where an organism lives in an aquatic ecosystem and describe two enviornmnetal functions of wetlands and a threat against it.

Target 2

SWBAT explain why an estuary is a very productive ecosystem, compare salt marshes and mangrove swamps and describe threats to coral reefs and ocean organisms.

Formative Assessment and Performance Opportunities

Class discussion

Paper and pencil tests

Science notebook

Student displays and presentations

Student experiments

Student wroksheets

Summative Assessment

All assessments are differentiated and aligned to the science standards and curriculum. ALternate assessments may include projects and presentations, or a common paper/pencil assessment or both. Common Assessment is administered through LinkIt.

Accommodations/Modifications

- Include additional resources for notebooks
- Make available diagrams of cycles
- Provide access to Albert.io online resource specific to interconnecting ecosystems

Unit Resources

- Environmental Science, Holt, Reinhart & Winston, 2008
- Interactive classroom and whiteboard activities
- Internet
- Supplemental textbooks and online textbook/teacher resources
- Videos and onlione videos

21st Century Life and Careers

CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
CAEP.9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.

Interdisciplinary Connections

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.WHST.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or

	trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
LA.WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.