

8thGrade Life Science

Ecosystems and Interrelationships

Big Idea When we try to pick out anything by itself we find it hitched to everything else in the Universe. (Quote by John Muir)

Teacher Background Information

Living things grow in systems that process energy and cycle the nutrients necessary for life. These communities of organisms and their non-living components are called ecosystems. Every ecosystem has food chains with plants and other photosynthetic life at the base. These organisms convert the energy of the sun into energy storing molecules that serve as the energy source for all living things. Food chains are joined into more complex interconnections called food webs. Energy is constantly lost from these systems and must be replenished. The atoms and molecules that make up the structure and nutrients of organisms are not lost, but constantly recycled between the living and non-living parts of the ecosystem. The history of these atoms is described in cycles such as the water, carbon, and nitrogen cycles. The study of ecology has shown that because of the complex connections and interconnections between living and nonliving parts of the ecosystem it is difficult to predict how even one small change in an ecosystem may affect the overall system.

Instructional Implications

Students understand ecosystems and the interactions between organisms and environments well enough by this stage to introduce ideas about nutrition and energy flow. If asked about common ecological concepts, such as community and competition between organisms, teachers are likely to hear responses based on everyday experiences rather than scientific explanations. Teachers should use the students' understanding as a basis to develop the scientific understanding.

As students build up a collection of cases based on their own investigations of organisms, and research, they should be guided from specific examples of the interdependency of organisms to a more systematic view of the kinds of interactions that take place among organisms. Prior knowledge of the relationships between organisms and the environment should be integrated with students' growing knowledge of earth and other sciences.

In the middle grades, the emphasis is on following matter through ecosystems. Students should trace food webs both on land and in the sea. The food webs that students investigate should first be local ones they can study directly. The study of food webs in other ecosystems can supplement their direct investigations but should not substitute for them. Most students see food webs and cycles as involving the creation and destruction of matter, rather than the breakdown and reassembly of invisible units.

Students' attention should be drawn to the transfer of energy that occurs as one organism eats another. It is important that students learn the differences between how plants and animals obtain food and from it the energy they need.

Essential Question

How does energy and matter flow through an ecosystem?

How do organisms in an ecosystem interact with and depend on one another?

AAAS Benchmarks/National and Science Education Standards

Flow of Energy and Matter, Food Webs

- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem. (NSES)
- Populations of organisms can be categorized by the function they serve in an ecosystem... Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem. (NSES)
- ...The entire earth can be considered a single global food web, and food webs can also be described for a particular environment...5D/M4** (BSL)
- For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs. (NSES)
- Energy can change from one form to another in living things. 5E/M3a
- Organisms get energy from oxidizing their food, releasing some of its energy as thermal energy. 5E/M3b*
- Plants use the energy from light to make sugars from carbon dioxide and water. 5E/M1bc
- ...matter is transferred from one organism to another repeatedly and between organisms and their physical environment...the total amount of matter remains constant, even though its form and location change. 5E/M2

Interrelationships

- The world contains a ... diversity of physical conditions, which creates a wide variety of environments... In any particular environment, the growth and survival of organisms depend on the physical conditions. 5D/M1b*
- The number of organisms an ecosystem can support depends on the resources available... Given adequate biotic and abiotic resources and no... (limiting factors)..., populations (including humans) increase at rapid rates.(NSES)
- In all environments, organisms with similar needs may compete with one another for limited resources,... 5D/M1a*
- Interactions between organisms may be for nourishment, reproduction, or protection and may benefit one of the organisms or both of them. 5D/M2*
- The global environment is affected by national and international policies and practices relating to energy use, waste disposal, ecological management, manufacturing, and population. 7G/M5*

Possible Student Misconceptions

Before students have an understanding of atoms, the notion of reusable building blocks common to plants and animals is quite mysterious. So following matter through ecosystems needs to be linked to their study of atoms.

Students may have difficulty understanding the conservation of energy as it passes from one trophic level to another.

Alaska GLE's

The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformations of matter and energy by

[6] **SC3.1** recognizing that organisms can cause physical and chemical changes (e.g., digestion, growth, respirations, photosynthesis) to matter and recognizing the importance of energy transfer in these changes

[6] **SC3.2** organizing a food web using familiar plants and animals

[7] **SC3.1** recognizing and explaining that organisms can cause physical and chemical changes (e.g., digestion, growth, respiration, photosynthesis) to matter and recognizing and explaining the importance of energy transfer in these changes

[7] **SC3.2** classifying organisms within a food web as producers, consumers, or decomposers

[8] **SC3.1** stating that energy flows and that matter cycles but is conserved within an ecosystem

[8] **SC3.2** organizing a food web that shows the cycling of matter

Materials/Resources

The Nature of Southeast (Richard Carstensen et al)
Alaska Wildlife Curricula-ADF&G
Discovery Southeast
eeelink.org
Journey North
Project Learning Tree
Aquatic Project Wild
Prentice Hall Environmental Science
Alaska Department of Fish & Game
U.S. Forest Service
U.S. Fish and Wildlife Service
National Marine Fisheries Service
NOAA
USGS
DIPAC hatchery
Southeast Alaska's Natural World, Armstrong and

Assessments

Uncovering Student Ideas in Science
Volume 2; Probe 19: **Habitat Change**
Volume 2; Probe 18: **Rotting Apple**

Science Notebooks

Connections to other content

Physical Science- Types of energy, chemical transformations
Link ecosystems to earth science.
Concepts of atoms and molecules are important to the transfer of matter
Evolution-How organisms adapt to changing ecosystems

Local Connections

Observation of stages of succession-glacial succession. forest succession
Wetlands:
 Bird migration
 Salmon nursery
Muskegs
Symbiotic relationships within the forest ecosystem
Freshwater and Marine ecosystems
Intertidal ecosystem