Elements of Biology Ecosystems: Organisms and Their Environments Teacher's Guide

Grade Level: 9–12	**Curriculum Focus:** Life Science	**Lesson Duration:** Three class periods

Program Description

Learn how plants and animals compete and cooperate in their environment, creating a balance of nature within their ecosystem.

Lesson Plan Summary

Students watch the program to learn the elements of an ecosystem. As a class, they pick a local ecosystem to observe. Working with a partner, students observe one element of the ecosystem. During class, they pool their findings and create a food web that illustrates the interactions between the ecosystem's plants and animals.

Onscreen Questions

- How can overhunting affect the food web?
- How might recycling paper affect deforestation?
- In what way is a tree a kingdom?
- What are the positive effects of planting trees?

Lesson Plan

Student Objectives

- Demonstrate an understanding of the elements that make up an ecosystem.
- Observe one element of a local ecosystem.
- Create a class food web showing the interactions among elements of the ecosystem.

Materials

- *Elements of Biology: Ecosystems: Organisms and Their Environments* video
- Computer with Internet access
- Newsprint and markers

- Pencil and paper
- Colored pencils

Procedures

1. Ask students to watch the program *Elements of Biology: Ecosystems: Organisms and Their Environments.* Ask them to think about the following questions:
    - What is an ecosystem?
    - What elements make up an ecosystem?
    - How are the elements of an ecosystem related?
    - What is the relationship between predators and prey in an ecosystem?
    - What is the relationship between producers and consumers in an ecosystem?
    - What is a food web?
2. After watching the video, have the class choose a local ecosystem to study, such as a park, pond, or field near the school. Tell students they will work in pairs to study one element of the ecosystem. For homework, have students visit the ecosystem and observe its plants and animals. Ask them to keep a list and to focus on a couple of elements.
3. During the next class, make a list of the elements the students observed; it will probably include trees, shrubs, squirrels, birds, rabbits, and other small animals. Assign each student pair to one element. Then tell students to return to the ecosystem and be ready to answer the following questions:
    - Is the element an autotroph or a heterotroph?
    - If it is an animal, what does it eat?
    - Is the animal a primary or secondary consumer?
    - Is the animal predator or prey?
    - What abiotic, or nonliving things, are part of the ecosystem?
4. After students have completed the assignment, have them pool their observations to create the ecosystem's food web. Put up a sheet of newsprint and ask a volunteer to draw the food web. Make sure that the students include the sun, which provides the energy for plants to make food, in the middle of the food web, followed by plants and the animals that eat plants. Students should show how the animals that eat other animals are related to those that eat plants.
5. Give students time in class to work on the food web. Encourage them to be creative and make it look interesting and attractive.
6. Conclude the lesson by holding a discussion about ecosystems. What have students learned by observing an ecosystem? How are different elements of the ecosystem related to each other?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students demonstrated a clear understanding of an ecosystem and its elements; made careful, thorough observations of an element; and made significant contributions to the creation of a food web.
- **2 points:** Students demonstrated some understanding of an ecosystem and its elements; made adequate observations of an element; and made some contributions to the creation of a food web.
- **1 point:** Students demonstrated little understanding o of an ecosystem and its elements; did not complete observations of an element; and made no contributions to the creation of a food web.

Vocabulary

abiotic

Definition: The nonliving elements of an ecosystem

Context: Air and water are abiotic elements of an ecosystem.

autotroph

Definition: The elements in an ecosystem that produce their own food

Context: Plants are autotrophs and make their own food through a process called photosynthesis.

biotic

Definition: The living elements of an ecosystem

Context: Plants and animals are the biotic elements of an ecosystem.

ecosystem

Definition: A habitat in which plants, animals, and microorganisms interact with each other and their surroundings

Context: In the ocean ecosystem, algae produce food that is eaten by fish and other marine animals.

food web

Definition: The relationships of interacting food chains in an ecosystem

Context: A food web shows that an relationships between plants and animals are extremely complex.

heterotroph

Definition: The organisms in an ecosystem that cannot make their own food

Context: Heterotrophs, also known as consumers, are animals that eat plants or other animals.

predator

Definition: Animals that hunt other animals for food

Context: In many forests, the coyote is the major predator of deer.

primary consumer

Definition: An animal that eats only plants

Context: Giraffes are primary consumers in their ecosystem on the African plains.

prey

Definition: An animal that is eaten by other animals in an ecosystem

Context: A balance of predators and prey in an ecosystem shows that it is healthy.

secondary consumer

Definition: Animals that live off primary consumers

Context: Lions and tigers are secondary consumers because they eat zebras and other animals that eat plants.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit this Web site:

http://books.nap.edu/html/nses/html/overview.html#content.

This lesson plan addresses the following national standards:

- Life Science: Interdependence of organisms; Behavior of organisms

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education addresses 14 content areas. To view the standards and benchmarks, visit http://www.mcrel.org/compendium/browse.asp .

This lesson plan addresses the following national standards:

- Science: Life Sciences—Understands relationships among organisms and their physical environment
- Nature of Science—Understands the nature of scientific inquiry
- Language Arts: Viewing—Uses viewing skills and strategies to understand and interpret visual media

---

DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video—This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index—Here the video is divided into sections indicated by video thumbnail icons; brief descriptions are noted for each one. Watching all parts in sequence is similar to watching the video from start to finish. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

Curriculum Units—These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

Standards Link—Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources—This screen gives the technical support number and Web site address.

Video Index

I. Energy Transfer (8 min.)
Learn how energy gets transferred through an ecosystem. Plants use sunlight to make their food, and animals rely on the plants and on other animals.

II. Interacting Organisms (4 min.)
Examine the relationships between predators and prey and competing species in an ecosystem, and learn why species reduction may take place.

III. The Impact of Change (4 min.)
Investigate cycles of regeneration and other changes in the environment and discover the effect of human influences on ecosystems.

IV. In Celebration of Trees (32 min.)
Explore the complexity of the forest environment, including different forest ecosystems in North America.

Curriculum Units

1. Organisms and Energy
Pre-viewing question
Q: What is an ecosystem?
A: An ecosystem is a habitat in which plants, animals, and organisms interact with each other and their nonliving surroundings.

Post-viewing question
Q: Describe producers and consumers and give an example of each.
A: An ecosystem's producers, called autotrophs, make their own food. Examples are photosynthesizing plants and some microorganisms.

Consumers are called heterotrophs. Herbivores eat only plants, so they are called primary consumers, such as a deer. Lions and other carnivores are secondary consumers because they eat meat. Fungi and bacteria are decomposers because they consume dead or decaying organisms.

2. Relationships Among Organisms
Pre-viewing question
Q: What are examples of predators and their prey that you might see in a local ecosystem?
A: Answers will vary.

Post-viewing question
Q: What is competitive exclusion?
A: In this process the stronger of two species vying for the same food and resources in an ecosystem will drive out the weaker species. An example is coyotes that drive out foxes and wolves driving out coyotes.

3. Environmental Impact of Humans
Pre-viewing question
Q: How have people changed the environment where you live?
A: Answers will vary.

Post-viewing question
Q: What can people do to improve some harmful changes made to the environment?
A: Answers will vary.

4. The Bristlecone Pine
Pre-viewing question
Q: What tree species grow where you live?
A: Answers will vary.

Post-viewing question
Q: How old is the bristlecone pine?
A: One of the oldest known living things on Earth, bristlecone pines in isolated groves are more than 4,000 years old.

5. Old Growth Forests
Pre-viewing question
Q: What kinds of trees might live in a forest?
A: Answers will vary.

Post-viewing question
Q: What functions do trees provide in a forest ecosystem?
A: Forest trees help replenish our atmosphere; no other ecosystem in the world stores more carbon than the North American coniferous forest. Large forest trees are homes for many kinds of organisms, as well as being a source of energy. Downed logs return vital nutrients to the soil, and standing dead trees are a wildlife habitat.

6. Logging and Balance
Pre-viewing question
Q: What kinds of objects are commonly made of wood?
A: Answers will vary.

Post-viewing question
Q: What are some concerns about the practice of clear-cutting?
A: Clear-cutting is effective for new forest growth; the practice allows for new wood fiber that will grow very rapidly. However, clear-cutting can also contributes to the destruction a forest as habitat, watershed, and source of fresh air.

7. The Everglades
Pre-viewing question
Q: What kinds of plants and animals live in a wetlands ecosystem?
A: Answers will vary.

Post-viewing question
Q: What might be the most interesting aspect of the Everglades environment?
A: Answers will vary.

8. The Legacy of Forests
Pre-viewing question
Q: What are some benefits of a forest ecosystem to animals, including humans?
A: Answers will vary.

Post-viewing question
Q: About how much of North America's original forest areas are still standing?
A: Less than 6 percent of the continent's original forests survive.