

Ecosystem Interactions

Teacher Guide

Grade Levels: 6 – 8

Program overview

The instructor will lead a discussion on the definition and components of ecosystems. The class will construct a food chain and discover the process of energy transfer and nutrient cycling. Students will then work in groups to assemble food chains using museum specimens. The class will collect data and each student will graph the results. The class will then discuss ecosystem structure.

Objectives/Student Learning Outcomes

After participating in this program, students will be able to:

- Identify and define the ecosystems and their components
- Discuss ecosystem structure and the roles and relationships different organisms can play in an ecosystem.
- Understand how ecosystems work, the natural balance of ecosystems, and why they are important.

Background

Everything we use everyday came from an **ecosystem**.

The water we drink, the food we eat, the paper and ink we read, the silicone in the processors of our computers- these things all came from an ecosystem. Living or nonliving, our resources come from nature.

Ecosystems are organized into levels and categories by the scientists who study them. A particular organism's scientific label has no more meaning or significance to it than the field guide where it is identified and labeled. Scientists assign species names and roles so that we may better understand the living thing, its role in the ecosystem, and the ecosystem itself.

The first level of organization in an ecosystem is **biotic** or living versus **abiotic** or non-living. Non-living things include water, soil, rocks and minerals, air, and the sun. Living things can further divided in several ways, the first of which is their classification. The five kingdoms are represented in almost every ecosystem, animals, plants, fungus, bacteria, and protists. These living things can also be divided into categories based on how they derive energy, autotroph versus heterotroph. **Autotrophs**, such as plants, get

P.A.S.S.

GRADE 6

Science Process – 1.3, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 5.4

Life Science – 3.2, 4.1, 4.2

GRADE 7

Science Process – 1.3, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 5.4

Life Science – 2.1, 3.1, 4.2

GRADE 8

Science Process – 1.3, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 5.4

Life Science – 3.2

energy from non-living sources, such as the sun. **Heterotrophs** must consume living (or once living) matter to obtain energy.

However, it may be better further divide living things by the way they obtain energy and/or what they eat.

Producers are living things that produce their own food using non-living sources of energy. Plants use sunlight, water, and air to create sugar, a form of stored energy. This stored energy is then available as food to **consumers**, or living things that can not create food, and therefore must consume other living things as food to get energy. A deer who eats tree leaves or a coyote who eats a deer are both consumers.

Decomposers are another form of living thing that can not create their own food, so are therefore **heterotrophs**, but decomposers generally prey upon dead matter. A fungus that decomposes dead tree leaves on the forest floor is a decomposer.

Consumers can be further divided, depending on what they consume. An animal that eats only plants is a **herbivore**, or plant eater. An animal that eats both plants and animals is an **omnivore**, or everything eater. An animal that eats only (or mostly) other animals is a **carnivore**. A sunflower is a producer; a butterfly who eats the sunflower nectar (or the leaves as a caterpillar) is a herbivore; a cardinal who eats both sunflower seeds and butterflies (or caterpillars) is an omnivore; a hawk who eats a cardinal is a carnivore.

Food chains are a simplified way of looking at one of many possible paths that energy and nutrients may travel

VOCABULARY

Autotroph – an organism that gets energy from non-living sources, such as the sun. Plants are autotrophs.

Carnivore – meat eater; any animal that eats only animal matter, a second or third-order consumer.

Community– any relationship in nature that involves plants and animals living together and interacting with one another in a particular environment. The biotic component of an ecosystem.

Consumer – any organism that depends directly or indirectly on food producing plants; any organism that consumes other organisms.

Decomposers – a living thing that obtains food by breaking down the remains of dead organisms.

Ecosystem– all of the biotic (living) and abiotic (non-living) things interacting in a particular area.

Environment – all the living and non-living factors that actually affect an individual organism at any point in its life cycle.

First-order consumer – an animal that eats producers or green plants directly (herbivore).

Food chain – transfer of energy through an ecosystem through the action of food producers, food consumers, and decomposers. Food chains interact to create a complex **food web**.

through an ecosystem. A grasshopper may eat little bluestem grass, then be eaten by a meadowlark who is then eaten by a hawk. That same grass could also be eaten by the meadowlark directly (in the form of seeds), a cotton rat, or a bison. The grasshopper may also be eaten by many other animals. Food chains can combine to form **food webs**, which are a more accurate way of looking at ecosystems. The term web is a more fitting metaphor. Ecosystems are complex, made up of many connections between many varieties of living things and the non-living environment. At first glance, it may be difficult to see how a coyote can be connected to a wild flower. Coyotes are carnivores, eating mostly animals (though they do eat some plant material). That coyote may eat a rabbit who ate the leaves of the plant, or eat a bird who ate a caterpillar that nibbled on the flower.

Life on earth continues because plants can use light energy from the sun and combine it with water and carbon dioxide to form sugar, a stored food resource available to the plant and anything that eats a plant. This basic ability, to transform light energy into sugar energy, is what drives most ecosystems (subterranean and deep sea ecosystems may be exceptions). All other living things depend on plants, either directly or indirectly.

Food web – the many different way that living things are connected in an ecosystem through energy or matter transfer. Many food chains make up a food web.

Herbivore – plant eater; an animal that eats only plants, a first-order consumer.

Heterotroph – an organism that must consume living (or once living) matter to obtain energy. Animals (including humans) are heterotrophs.

Niche – role or job of an organism in the environment; its activities and relationships in the community.

Omnivore – everything eater; an animal that eats both plants and animals, usually a second-order consumer.

Producer – any green plant that makes its own food using chlorophyll and light energy.

Second-order consumer – an animal that eats animals that eats producers or plants, (omnivore, carnivore).

Third-order consumers – an animal that eats second-order consumers (carnivore).

At the Museum

The Hall of Natural Wonders features four ecosystems: an upland stream, an oak-hickory forest, a limestone cave, and a mixed-grass prairie.

Discussion questions:

- Ask students to look for the biotic and abiotic members of the ecosystem. Then have students identify the types of living things.
- Which kinds of organisms are producers? Which are primary consumers, or herbivores? Which are secondary consumers, or omnivores? Which are tertiary consumers, or carnivores?
- What kinds of foods do these animals eat?
- Can you locate a decomposer in each ecosystem or habitat? How large or small is this organism?

Writing prompts:

- Choose one of the four different habitats in this gallery. Follow a food chain from the producers through the tertiary consumer. You may need to read the exhibit labels for more information about the organisms and their diets.
- Choose an animal in one of the exhibits. What do you think a day in this animal's life might be like? Where does it live? What does it eat? How does it avoid predators?
- Which ecosystem represented in this gallery is your favorite? Why?

Supplementary/Enrichment Activities

Science

1. **What kind of consumer are you?** Have the students look at their teeth in a mirror.
 - What kinds of teeth do they have?
 - What do they do with their front versus their back teeth?
 - Make a list of the types of food the students like to eat. Favorite foods, or typical lunch time meals. You can have the class make a favorites graph, say 10 pizza lovers, two hamburger fans, one pad thai eater, three spaghetti fans.
 - Look at the ingredients used to make these foods, or you can just pick the class favorite, pizza. Have the kids break down the whole food into its parts, crust, sauce, cheese, and toppings.
 - Write each ingredient for the crust on a separate small piece of paper, flour, sugar, yeast, water.
 - Write your ecosystem categories on several large pieces of paper: living and nonliving, then producer, consumer, decomposer.
 - Students should sort their ingredients to the correct category. Wheat is a plant, and should go in the producer category. For example: Yeast is a fungus and should go in the decomposer category. Cheese is made from cow milk, cows are herbivores, so cheese goes in the consumer category.

2. **Compost your lunch!** It's easy to make your own compost pile. You'll need a small area on your school grounds, or you can purchase (or get one donated to your school) a small compost bin.
 - Layer your compost. Alternate green and brown matter. Green matter is living stuff, such as left overs from lunch, grass clippings, weeds your class pulled from the outdoor classroom. Brown matter is dead stuff, such as tree leaves and coffee grounds. When adding food to the pile, make sure you cover it up with an inch or two of old compost so the smell will not attract animals.
 - Only vegetable matter. Compost piles are vegetarians! Meat and cheese will rot and stink up your compost. Healthy compost should not be stinky
 - Water your compost. Keep it from getting too dry. If it hasn't rained in a while, give your compost a drink to keep those bacteria and fungi hard at work, breaking down your scraps into natural fertilizer.
 - Try placing some small pieces of things in your compost pile, such as a plastic fork, a piece of paper, a soda can, an apple core, and orange peel. Come back to check on the condition of these items throughout the school year to see which things are decomposing and which things are not!

Language Arts

1. **Take a walk through an ecosystem.** Many famous writers have looked to nature for inspiration. You don't have to go to the woods to be a part of nature. Any natural area will do. Take a walk to a local park or open field or stand of woods near your school. If your school has one, you can use your outdoor classroom. Or you can just have your class sit on the grass on the playground. Nature is everywhere, but the degree of wildness may vary. Ask your students to write about their experience. You may let your students choose their poetry or prose style, or you may suggest a style. A paragraph or a short essay and very open ended. However, poetry is a great way to encourage both a better understanding of nature and the medium of poetry. There are many forms of poetry that work well for prompted writing: free verse, rhyming couplets, cinquain, and haiku.
2. **Outdoor writing prompts** you may use with your students:
 - Imagine you are a small member of this ecosystem. What are you? What does the world look like to you? What do you do each day? Where do you get food or find shelter?
 - Close your eyes and just listen for 1 or 2 minutes. What sounds did you hear? Which were human made and which were made by animals, plants, or wind or other non-human causes?
 - Imagine you lived in this ecosystem. How would you find the things you need to survive: air, water, food, and shelter? Look around you and think about how you might use the things you see around you to survive here.
3. **Choose your Habitat.** Ask students to choose (or assign) an ecosystem/habitat and write a one page report on it. Some habitats to choose: desert, grassland, temperate forest, temperate rain forest, tropical rainforest, tundra, wetland, coral reef, estuary.

Art

1. Create a critter!

- Students can work together or in small groups to create an imaginary animals that would live in a specific habitat. You may assign the habitat or the students may select one.
- Offer students a variety of art supplies, including colored paper or construction paper, scissors, glue, crayons or markers, popsicle sticks. Other great things to include: paper cups, tissue paper, colored feathers, interesting fabric scraps, old magazines with pictures, old wrapping paper, newspaper, egg cartons.
- Ask students to consider the following: where does the animal live, what does it eat, what eats it, how does it move, how does it avoid predators, what time of day is it active, what is it called?
- After completing their critters, have each group present their critter to the class. This can also be a great extension activity for the Choose Your Habitat report or the outdoor writing activities.