Ecosystems

Do You Live In an Ecosystem?

Everything in our world is connected. To understand the connections in the natural world, we need to study both living and non-living components of our planet. Biotic, or living parts, and abiotic, or non-living parts, function together to form an ecosystem. The biotic components include organisms and the interactions they have with one another. The abiotic factors are things such as temperature, light, soil, and water. Both living and non-living factors work together to form a complex system of energy and resource transfers.

Ecosystems have no particular size. They can be as large as a lake or as small as a puddle. Every centimeter of the planet is part of an ecosystem, and every part works together to make a balanced system. Each species in an ecosystem has a function, or niche, that helps keep the system working smoothly, but that doesn't mean a healthy ecosystem never changes. A healthy ecosystem has high species diversity, which helps the system recover after a disturbance, such as damage caused by humans or by a natural disaster. For example, torrential rains can flood a forest, reducing the population of ground-dwelling birds, but water fowl in the area increase due to added suitable habitat. As the floods recede over time, the balance of ground-dwelling birds to water fowl will shift again. Therefore, the forest needs a diversity of birds to take advantage of the variety of environmental conditions that can occur over time.

Too much disturbance in an ecosystem will cause it to lose diversity. Today, human actions are having negative impacts on natural ecosystems all over the world. The building of roads and homes, recreational activities, and farming reduce the biodiversity of natural ecosystems. Contamination of the abiotic components is sending many ecosystems out of balance, too. As part of the living organisms inhabiting the global ecosystem, humans need to be aware of their role in the ecosystem and how they can minimize their negative impact.

Wading Deeper - River Ecosystems

The river ecosystem can be broken down into three zones: benthic, aquatic, and terrestrial.

The benthic zone consists of the streambed and the organisms that live in, under, or close to it. In the benthic zone, species are usually attached to or buried in the substrate and are accustomed to being submerged in the water. In slow moving rivers, organic material from dead and decaying organisms accumulates on the streambed. This material becomes the food for invertebrates that live in or on the substrate. The primary producers in the benthic zone are not true plants, but instead are green algae. The green, slippery slime in streambeds is most likely microscopic, filamentous algae.

The aquatic zone includes the flowing water in the river and the animals in it. Slow-moving streams have a high diversity of insects and other invertebrates. Many of the insects are in their larval or nymph stage when they live in the water, for example mosquitos and dragonflies. These immature insects are the food for many fish species. Other invertebrates, such as leeches, mussels, and worms, also live in the aquatic zone. Larger animals can also thrive in slow-moving rivers. Frogs, newts, and otters also may live in rivers where they can withstand the current.

The terrestrial or riparian zone consists of land adjacent to the river and the organisms that inhabit the land. This zone can be steep river banks with a narrow strip of vegetation or a wide shallow floodplain that includes wetlands. Both types of habitat along rivers are important to the river ecosystem because riparian vegetation is an important source of the organic matter in the benthic zone. Riparian vegetation can reduce the damage caused by floods by stabilizing the soil and riverbanks. Wetlands function as filters by reducing soil entering the river, trapping nutrients before they wash away, and providing habitat for organisms that utilize the river resources, such as beaver, raccoons, bats, and song birds.

Although the zones can be described separately, there are numerous connections and interactions among the benthic, aquatic, and terrestrial zones of a river.

For more river ecosystem information, visit our Web site for educational links: *www.biosurvey.ou.edu*

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Activity – Get to Know Your Schoolyard Ecosystem

Materials

- An outdoor area such as your schoolyard, park, or outdoor classroom.
- String
- Magnifying glass
- Thermometer
- Popsicle sticks
- Journal or paper for collecting observations and data
- Small gardening tools

Procedure

First, locate a small patch of land to examine. Choose any place that you find interesting and has at least a few plants.

Using popsicle sticks and string, partition an area for examination.

Record observations about organisms in your ecosystem:

- List the organisms you find. (Don't worry if you don't know the names. Give a descriptive name to your species, such as shiny green beetle or skinny leaved plant.)
- Which species is most abundant?
- What organisms are producers in your ecosystem?
- What organisms are consumers?

Tip -- Don't forget to look underground!

Describe the abiotic components of your ecosystem:

- Record the temperature of the air and soil
- Use your trowel to examine the soil. Describe its texture and moisture.
- Describe the terrain or form of the land. (For example, is it flat, hilly, rocky, or a depression?)
- Which way does it slope? Does that affect the organisms that live there?

Questions for Discussion

1. What are some of the interactions that you see in your ecosystem?
2. Does your ecosystem have a lot of biodiversity?
3. Are there many different species or do just a few dominate?
4. Think of other organisms that could survive in your ecosystem.
5. What enables organisms to live successfully in your ecosystem?
6. What are some organisms that would not survive in your ecosystem? Why could they not survive?

Pulling it all together

Write a paragraph describing your ecosystem using the information you gathered and thinking about how your ecosystem functions.

Activity – Sampling the Biotic Components of a Ecosystem

Materials

- 1x1 meter square with string tied to make a grid of 10x10 cm squares (pvc pipe is a good material to use to make the quadrat)
- 1 yellow, 3 green, 5 blue, and 10 purple pieces of 9x12 inch construction paper (representing different tree species)
- 20 index cards (representing cattail clumps)
- 20-30 objects smaller than index cards, such as large paper clips, binder clips, or checkers (representing fourpoint evening primrose)

Procedure

In an area of at least 4x4 meters (open classroom or gym would be appropriate), place at random the construction paper, index cards, and small objects.

- 1 yellow = Green Ash
- 3 green = Box Elder
- 5 blue = Willow
- 10 purple = Cottonwood
- 20 index cards = Cattail Clumps
- 20-30 objects smaller than index cards = Fourpoint Evening Primrose

Count the number of evening primrose (small objects) and calculate the total area covered by trees (construction paper) and clumps of cattails (index cards).

Have students collect data using both sampling methods described below and record their data. You may want to form several groups so that students have a greater opportunity to perform the data collection.

For the quadrat method, have students randomly place the quadrat within your artificial riparian area. Students should record the number of squares within quadrat that are covered at least 50% by each tree species (construction paper). Students should record the number of squares within quadrat that are covered at least 50% by clumps of cattails (index cards). They should count the number of individual evening primrose (small objects). They should repeat their data collection in two or three randomly chosen places in the study area.

For the point transect method, students should place one end of a tape measure randomly in the study area. The transect should run for 3 m in a randomly chosen direction. Students should record what is directly under the tape measure at every 25 cm.

Students should use the worksheet to determine the total percentage cover of tree, cattail, and evening primrose plant density for each method.

Questions for Discussion

1. Which method did you prefer? Why?
2. Compare sampling results to the true densities that your teacher calculated. Which method better represented the real composition of your artificial ecosystem?
3. What is the downside of taking samples rather than inventorying the whole system?
4. If one method is clearly better in this situation, can you think of reasons to use the other method?
5. Which method was better at representing the "rare" species?

Sampling the Biotic Components of the Ecosystem Worksheet

Quadrat Method

Quadrat Area = _____ Total number of squares in quadrat = _____

Trees	# of squares containing 50% or more tree coverage	% cover of tree species (# of squares containing species divided by total # of squares)
Green Ash		
Box Elder		
Willow		
Cottonwood		
	# of plants in quadrat	Plant density (# of plants divided by total quadrat area)
Cattail Clumps		
Evening Primrose		

Transect Method

Length of transect = _____ Total number of points sampled = _____

Width of measuring tape = _____ Total area sampled (# of points *times* width of tape) = _____

Trees	# of points directly over tree species	% cover of species (# of points of each tree species divided by total # of points)
Green Ash		
Box Elder		
Willow		
Cottonwood		
	# of points directly over plants	Plant density (# of points over plants divided by total area sampled)
Cattail Clumps		
Evening Primrose		

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