



Energy Use in an Ecosystem

Students survey different environments and investigate how sunlight, soil moisture, temperature, and wind affect living elements—plants and animals—in an ecosystem.

Grade Level: 5–8

Subject Areas: English Language Arts, Mathematics, Science

Setting: Outdoor study site such as the school yard or a park

Time:

Preparation time: 50 minutes

Class time: Three 50-minute periods

Vocabulary: Abiotic, Biotic, Ecosystem, Food chain, Temperature

Major Concept Areas:

- Energy flow in nonliving systems
- Energy flow in systems

Getting Ready: Find three study sites that are somewhat different from each other in terms of sunlight, air temperature, soil moisture, wind, and number and types of plants and animals living there. If possible, select one site that is open, like a field or lawn; one that has trees; and one that contains water.

Possible study sites include a school lawn; a park, playground, or any other area with many trees; a flowerbed or vegetable garden; a vacant lot; a pond, stream, or marsh; an open field; and a forest.

Plan to visit the sites on the same day or on different days (at about the same time each day). Obtain any necessary permission to take students to visit the sites you have chosen. Check the sites beforehand to identify and possibly remove any safety hazards.

Objectives

Students will be able to:

- identify ways that nonliving (abiotic) components of an ecosystem affect the living (biotic) components;
- relate living and nonliving components of an ecosystem to energy; and
- analyze how energy flow through an ecosystem influences the abiotic and biotic conditions of the ecosystem.

Rationale

Having students look closely at their surrounding environment heightens their observation skills and increases their appreciation of the qualities of their surroundings. By comparing different environments, students will begin to consider how the amount of energy (sunlight) an ecosystem receives greatly influences what can live there.

Materials

- Copies of the following pages:
 - *Survey of Energy Use in an Ecosystem*
 - *Comparing Energy Flow*
 - *Results and Analysis* chart
- Find additional resources related to this activity on keepprogram.org > Curriculum & Resources

Background

An ecosystem consists of species in a biological community (the living component) interacting with each other and with the physical and chemical factors that make up their environment (the nonliving component). An ecosystem can be as small and obscure as a blade of grass, a vernal pond, or rotting log. It can also be as large and magnificent as the Florida Everglades or the Amazon Rainforest. Some scientists even classify Earth as a working ecosystem.

Interactions among species include relationships like pollination, mutualism, predation, and decomposition. Plants and

animals in an environment interact with each other in various ways. For example, plants may depend on insects or birds to pollinate flowers and on earthworms to aerate the soil; animals may depend on plants for food or shelter.

Examples of how plants and animals interact with the nonliving elements of their environment include life-sustaining processes such as photosynthesis, water purification, evaporation, and respiration. Physical factors such as sunlight, moisture, temperature, and wind influence the suitability of an area for particular organisms.

The interaction of living and nonliving components affects the qualities and characteristics of an ecosystem. These interactions can influence the climate within the area (often called a micro-climate). For example, in a forest tall trees block the sunlight; this results in a shady moist understory where only certain plants can live. Energy is evident in all living and nonliving components of an ecosystem and in the interactions between the components.

- Sunlight and wind are energy resources.
- Potential energy in plant and animal matter.
- Temperature is related to thermal energy, and moisture content in soil and air is influenced by temperature.

Therefore, energy influences which types of plants and animals live in an ecosystem.

Procedure

Orientation

Take the class on a brief tour of the school grounds or have them think of various locations around the school. Ask them to identify different natural areas (not human-built) and list similarities and differences among the sites. Ask students what they think influences what a site looks like. Note their responses. Help students to identify the following elements that characterize an ecosystem:

- Soil (type and moisture)
- Sunlight
- Wind
- Temperature
- Plants
- Animals

Steps

1. Explain that students will investigate ecosystems at three different study sites to find out how living and nonliving elements affect each other. Hand out and review copies of *Survey of Energy Use in*

an Ecosystem. Demonstrate or explain each of the instructions to investigate the elements of an ecosystem.

2. Point out and describe the parameters for the three different study sites. Provide any rules or restrictions as needed.
3. Divide the class into six teams and assign each team one element to investigate (like soil moisture). An alternative is to divide the class into three groups and have each group investigate a site. Students within the groups should be responsible for conducting the survey of one element within the study site.
4. Hand out copies of the *Results and Analysis* chart. Tell students to record the measurements or observations for their investigations on the chart (and that they will get the information for the rest of the chart from their classmates after the investigations are complete).
5. After teams have had sufficient time to investigate each location, have them all come together to present their findings and share what they have learned. Students should compile their observations in the Results and Analysis Chart.

Closure

Hand out copies of *Comparing Energy Flow*. Have students work in teams to answer the questions. They should refer to the *Results and Analysis* chart and visit the site or talk to other students who studied the site. Discuss student responses.

Assessment

Formative

- How thoughtfully did students conduct the investigations and report their observations?
- To what extent did student presentations of their findings indicate they had conducted a thorough investigation?
- Did students listen carefully to each others' reports?
- Were students able to synthesize the results to answer the questions in *Comparing Energy Flow*?

Summative

Give pairs or teams of students a large sheet of paper. Have students write the names of each of the six elements studied (sunlight, soil moisture, wind,

temperature, plants, animals) in a large circle around the edge of the paper. They should draw lines showing connections they observed between elements. On each line, have students briefly describe the relationship. For example, students might draw a line between sunlight and soil and then write, “When there is more sunlight, the soil is drier.”

Extensions

Visit each site again at a different time of year and repeat your investigations. Compare your results: How has the soil changed? The temperature? The wind? The plants and animals? What factors influenced each change?

Revisit each location to look for ways humans have affected it. Students might look for things such as litter, damaged plants, new animal arrivals, polluted or cleaner waters, or an improved path.

Related KEEP Activities

The activity “Taking Temperatures” orients students on how to use and read a thermometer. Have students participate in “Food Chain Game” to further investigate energy flow through living systems. Older students can follow this activity with “Puzzling Wisconsin’s Biological Communities.”

Credit

Adapted from American Forest Foundation. “*Field, Forest, and Stream*” pp. 156–159 in *Project Learning Tree: Pre K–8 Activity Guide*. Washington, D.C.: American Forest Foundation, 1993.

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Survey of Energy Use in an Ecosystem

Team Members: _____

Date: _____

Purpose

To survey different energy-related elements (sunlight, soil moisture, temperature, and wind) to investigate how they affect the living elements—plants and animals—in an ecosystem.

Today's Weather

Temperature: _____

Humidity: _____

Cloud cover: _____

Wind speed and direction: _____

Other: _____

Team Responsibility

Check which strategy your class is using to survey the elements within the study sites.

- As a team, we are investigating all the elements in one study site.
- We have been assigned to survey one element in all the study sites.

Which element you are responsible for? _____

Other strategy (describe):

Materials

- Trowel or stick
- Lux meter or photosensitive paper
- Thermometer
- Small strip of paper
- Compass or handheld weather meter
- Notebook

Map

Use [Google Earth](#) or sketch (at right) a bird's-eye view of your school grounds and mark it with the location of the sites (label them 1, 2, and 3). If your team is only looking at one study site, circle which one is yours.

Survey of Energy Use in an Ecosystem

Elements and Survey Instructions

Use the **Results and Analysis** chart to record your observations.

Soil Moisture

Use a trowel or stick to scrape the surface of the ground and to obtain a small sample of soil from underneath the surface. By feeling the soil, you should be able to tell whether it is wet, moist, or dry. (Moist soil will stick together.) Examine the soil for other characteristics such as texture, color, and smell, and also note plant material or organisms in the soil.

Sunlight

Determine how much sunlight penetrates the ground at each study site. Determine light intensity at each site by using a lux meter or photosensitive paper. If these items are not available use relative terms such as shady, dark, medium light, or bright.

Wind

Use the small strip of paper to determine the wind movement at each site. Have one team member hold the paper away from his or her body, while the others observe whether it hangs straight down or blows at an angle. (Optional: Estimate the angle between 0 and 90 degrees). Use a compass or a handheld weather meter to determine from which direction the wind seems to be blowing.

Temperature

Measure each site's temperature at one inch (2.5 cm) deep in the soil, one inch (2.5 cm) above the soil, and at one yard (.9 m) above ground. If one site is a pond, stream, or lake, measure the temperature at just above the water, at one inch (2.5 cm) deep, and at one yard (.9 m) above.

Plants

Observe the various kinds of plants at each site (large trees, small trees, shrubs, small plants, and grasses—no need to identify species). Record the most common types of plants found and how many different species there are. Estimate, in percent, the amount of ground area that is covered or shaded by plants. You can do this by using [Google Earth](https://www.google.com/earth/), or by imagining you are looking down at the site from above. How much bare ground do you?

Animals

Note the various kinds of animals at each site (insects, spiders, worms, birds, reptiles, fish, frogs). You may move things around a bit (such as lifting up rocks or logs) but always leave things the way you found them. Try not to disturb anything you find. If you cannot find anything, look for evidence of animals such as scat, tracks, burrows, or leaves that have been chewed. Try to determine if the animal is a primary consumer, a secondary consumer, or a decomposer. Record the most common type of animal living in or visiting the site and how many different species there are.

Comparing Energy Flow

Variations among the Elements at Each Site

Answer the following questions based on your team's observations, class discussion, or both.

1. Describe what happens to sunshine as it enters each of the sites.

Things to consider in your description:

- Does sunshine fall mainly on plants or the ground?
- How might the amount of sunshine falling on the ground affect soil moisture?
- Is there a relation between the amount of sunlight received and temperature?

Site 1:

Site 2:

Site 3:

2. Describe a possible food chain for each of the sites. If possible, develop the chain into a food web.

Site 1:

Site 2:

Site 3:

3. What relationships do you see between the number and species of plants and the number and species of animals?

4. Describe what happens to wind as it flows through each of the sites.

Things to consider in your description:

- How might the amount of wind affect the plants and animals in each of the sites?
- Might the wind affect soil moisture?
- How could it affect temperature?

Site 1:

Site 2:

Site 3:

Comparing Energy Flow

5. Describe how each of the following might influence the plants and animals in each of the study sites.

- Sunlight:

- Soil moisture:

- Temperature:

6. Do you think any of these elements has the most influence? Why?

Write a statement comparing the energy flow through each of the study sites, using the elements investigated to emphasize the similarities and differences.

Results and Analysis

Study Sites

Elements	Site 1	Site 2	Site 3
Soil Moisture			
Wet, moist or dry			
Other characteristics			
Sunlight			
Wind			
Position of paper			
Direction wind comes from			
Temperature			
1 inch (2.5 cm) below soil			
1 inch (2.5 cm) above soil			
1 yard (.9 m) above ground			
Plants			
Most common species (describe or write name if known)			
Number of different species			
Ground cover (estimate what percent of the ground is covered by plants)			
Animals			
Observed (list the animal and if it is a primary consumer, secondary consumer or decomposer)			
Evidence (describe tracks, eaten material, scat, list name if known)			
Most common species			
Number of different species			