

Lesson 1

Ecosystem Exploration

INTRODUCTION

In this lesson, students will learn about the essential parts of an ecosystem and how a nature journal can be used to better understand the relationships between these parts. John Muir's journals of Yosemite National Park will be used as an example of how detailed observation can be used as a scientific tool to better understand ecosystems. Students will create their own nature journals and record observations about the components of their school yard ecosystem.

LESSON OVERVIEW

Grade Level & Subject: Grades K-4 Science and Art

Length: 1 class period

Objectives:

After completing this lesson, students will be able to:

- Understand how scientific study leads to the protection of natural areas.
- Identify John Muir and describe his work.
- Identify the components of an ecosystem.
- Describe the value of environmental observation.

Next Generation Science Standards Addressed:

This lesson addresses the following Next Generation Science Standards:

- **K-PS3-1.** Make observations to determine the effect of sunlight on Earth's surface.
- **K-LS1-1.** Use observations to describe patterns of what plants and animals (including humans) need to survive.
- **K-ESS3-1.** Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
- **2-LS4-1.** Make observations of plants and animals to compare the diversity of life in different habitats.
- **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment

Materials Needed:

- Excerpt from 'The Earthquake' by John Muir (see attached)
- ['Parts of an Ecosystem' Diagram](#) (see attached)
- Blank paper; one for each student
- Markers/color pencils/crayons/water colors etc.

Assessment:

Students will be assessed through the following activities:

- Participation in group discussions
- Completion of a nature journal entry

LESSON BACKGROUND**Relevant Vocabulary:**

- **Abiotic:** The non-living components of an ecosystem, like rocks, soil, temperature and weather.
- **Biotic:** The living components of an ecosystem, like plants, animal, bacteria and other organisms.
- **Ecosystem:** All of the living and non-living components of an environment that interact to function as a system.
- **Food web:** A series of organisms each dependent on others for food, including producers (plants), consumers (animals and insects) and decomposers (bacteria and worms).
- **Habitat:** The natural environment where a particular species or community of animals lives; the physical environment that surrounds and influences them.
- **John Muir (1838-1914):** An American naturalist, author, and environmental advocate. He founded the Sierra Club and fought to protect natural areas in the American West.
- **Naturalist:** One who studies natural history, specifically a botanist, zoologist or field biologist.
- **Nature journal:** A tool used in the field to record observations; typically a notebook format; also called a field journal.
- **Primary producer:** The organisms in an ecosystem that convert the sun's energy and inorganic material.

Background Information:

The Earth is covered in overlapping and interrelated **ecosystems**. The borders between ecosystems are often not particularly clear cut, but they are delineated by areas that share the same or similar plants, animals, and physical environments. They can be as small as the community of insects living in a single tree or as large as the entire planet. While ecosystems appear very different from one to another, they all contain biotic and abiotic components, including plants, animals, soil, water, and sun. Studying an ecosystem means understanding how each of the biotic and abiotic components impacts the others, either directly or indirectly.

Ecosystems receive their energy from the sun, and this energy works its way through **food chains** to other members of the system.

Primary producers, or plants, use the sun's energy and nutrients from the soil, air, and water to grow and produce food for others. Since all parts of an ecosystem depend upon the others, the physical aspects of the environment effect the growth of primary producers, which intern determines the characteristics of a particular ecosystem.. For instance, the thin soils and cold climate of high altitude areas limit growth and produce an ecosystem of relatively low productivity with plants and animals adapted to these conditions.

While it may be easy to recognize the differences between ecosystems in the amazon and those in the arctic, the subtle differences that may be found just over the next hill take careful observation to identify. One particularly valuable tool used by scientists called **naturalists** I identifying these differences is the **nature journal**. Nature journals, or field journals, are detailed records of specific natural conditions and events in a particular area. The information recorded in nature journals has been used, especially before advancements in scientific equipment, to identify ecologically significant or unique areas, as well as new species of plants and animals. Journals are a common tool for data collection both in the field and in the laboratory to record observations.

John Muir is an American naturalist who spent many years studying the complex workings of the Sierra Nevada Mountain ecosystem. Muir recorded over 7,000 pages of observations in his nature journals throughout his lifetime. He worked tirelessly to protect the natural places he studied, and eventually his work helped persuade the US Congress to create Yosemite Valley and Sequoia National Parks in California. His work earned him the title of the 'father of the national parks'.

Resources:

- Geography for Kids – Ecosystems
http://www.geography4kids.com/files/land_ecosystem.html
Basic discussion and definition of ecosystems
- NatureWorks.com – Ecosystems
<http://www.nhptv.org/natureworks/nwepecosystems.htm>
In depth discussion of ecosystems and ecosystem functioning.
- American Society of Naturalists
<http://www.amnat.org/home.html>
- National Park Service – Yosemite National Park
<http://www.nps.gov/yose/historyculture/muir.htm>
Biography of John Muir
- National Park Service and NatureBridge.com – Yosemite Field Journal
<http://www.naturebridge.org/sites/default/files/Field%20Journal%20YOSE.pdf>
Youth field journal designed specifically for Yosemite Nation Park

- The Sierra Club – The John Muir Exhibit

http://www.sierraclub.org/john_muir_exhibit/default.aspx

Access to some of Muir’s writing and sketches, as well as an extensive history

LESSON STEPS

Warm-up: Muir’s Journal

1. Introduce John Muir and explain that his work as a scientist is so important because of the detailed descriptions of environments he recorded in his *nature journals*.
2. Read Muir’s journal entry entitled ‘Earthquake’ which can be found at the end of this lesson.
 - a. Have the students listen for the ways in which the earthquake changed the environment.
3. To bridge Muir’s journal with the larger concept of an ecosystem, close with a brief discussion of what Muir observed. The following are possible discussion questions.
 - a. What trick did Muir use in the very beginning of the entry to more closely observe how the earthquake was moving the ground?
He placed a bucket of water on his table and watched how the water moved.
 - b. What are some of the ways that the earthquake changed the environment? It may be helpful to make a list.
 - c. What are the ‘actors’ in the story that Muir says this event tells? Put differently, what are the things the earthquake affected?
Boulders, streams, trees, mountains, lakes, etc.
 - d. Are there any ways that the boulders or other actors may have affected the animals in that area? *The boulders created pools and rapids in the streams; they changed the fishes’ habitat. Meadows were covered so that deer and other animals could no longer graze on them. The new rock piles expanded habitat for small animals that like to live in nooks and crannies.*

Activity One: Drawing out Ecosystems

1. Have the class close their eyes and picture their schoolyard (or a nearby natural area that they would all be familiar with). Ask them to visualize all of the different plants, animals, nonliving things, and different weather conditions that they can picture.
2. While their eyes are closed, make four columns on the board and label them plants, animals, non-living things, and weather conditions.
3. Ask the class to open their eyes and ask for suggestions for each column.

4. After each column has a reasonable number of suggestions, circle two items from different columns and connect them with a line. Ask students how these two might affect one another. Repeat this several more times until the connecting lines begin to look like a tangled web over the original columns.
5. Explain to the class that by identifying all of the characters and how they affect one another, they have just described the ecosystem. Draw a large circle around the columns and label it 'schoolyard ecosystem'.
 - a. Ask if anyone has heard the term ecosystem.
 - b. Given how they connected all the parts on the board, could they describe what it means?
6. Display the ecosystem graphic if necessary, and further explain ecosystems using the information in the background and vocabulary sections.

Activity Two: Exploring our Local Ecosystem

1. Ask students to think about what Muir was observing and describing in the journal entry.
 - a. Was it just about an earthquake?
 - b. How did Muir describe the ecosystem?
2. Explain that understanding an ecosystem requires careful observation. A nature journal is one tool that scientists like John Muir have used to record these observations. Journals create a detailed record of plants, animals, soils, and weather conditions through drawings and written descriptions.
3. Explain that students will now be going out into their schoolyard to observe the ecosystem around them. They will record their observations in a nature journal.
 - a. Ask students what kind of information they should include in their journal entry in order to document their ecosystem. Using the items and categories from the lists on the board will help.
 - b. Their entry should include (it may be helpful to write these on the board or have the students record them on their sheet of paper before going outside):
 - i. Date
 - ii. A description of the weather conditions (and drawing if possible).
 - iii. A description of the soil (color, texture, is it damp or dry?).
 - iv. A drawing of a plant with a brief description of where they found it (e.g., in the shade, in an open area, etc.), labeled with parts of the plant (stem, root, petal, etc).
 - v. A drawing of an animal or insect and description of its location and what it was doing, labeled appropriately.
4. Before going outside:
 - a. Give each student a blank sheet of paper on which to make their entry.

- b. Set clear boundaries on where they may explore.
 - c. Make sure everyone has a clipboard/notebook for use as a solid surface to draw on and that everyone has something to draw with. If students don't have their own colored pencils, consider having a 'coloring station' where a communal set may be used after they make their initial sketches.
5. Return to the classroom with 10 minutes remaining.

Wrap Up: Sharing Entries

1. After students have returned to their seats, ask for volunteers to share their entries.
 - a. What features, organisms, or plants did they observe?
 - i. How did (or might) these organisms, plants and features interact with each other?
 - ii. How did certain parts of the plants or animals make these interactions possible?
 - b. Would they have seen these if they hadn't been making close observations for their journals?
2. Ask the class if they are a part of the schoolyard ecosystem.
 - a. How do they interact with some of the actors they observed?
3. Ask students if they found these observations difficult or easy.
 - a. Could they imagine studying the outside world like John Muir did for many years?

Extensions:

- Repeat the outdoor journaling activity several times throughout the school. Students can log observations from the same location, recording how changes throughout the year.
- Have students expand their journals by adding more pages and a cover made out of cardboard or a recycled paper grocery bag. Decorate journals using recycled materials.
- Draw a large map of the area that students observed on a large sheet of paper. Have students add descriptions or drawing from their journal entries where they made their observations, creating a detailed map of how their schoolyard ecosystem varies across the area.

CONCLUSION

After completing this lesson, students will have an understanding of ecosystems and the parts that comprise them. They will also have developed a data collection skill based on detailed observations by undertaking a nature study of a local area. Students will also have gained an appreciation for a historical figure in American environmentalism, John Muir.

LESSON PLAN CREDITS

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Excerpt from “Earthquake” by John Muir

Our National Parks (1901)

“The rocks trembled more or less every day for over two months, and I kept a bucket of water on my table to learn what I could of the movements. The blunt thunder-tones in the depths of the mountains were usually followed by sudden jarring, horizontal thrusts from the northward, often followed by twisting, jolting movements. Judging by its effects, this earthquake was gentle as compared with the one that gave rise to the grand boulder system of the mountains. Nature, then created, as we have seen, a new set of features, simply by giving the mountains a shake – changing not only the high peaks and cliffs, but the streams. As soon as these rock avalanches fell every stream began to sing new songs; for in many places thousands of boulders were hurled into their channels, roughening and half damming them, forcing the waters to surge and roar in rapids where before they were flowing smoothly. Some of the streams were completely dammed by drift-wood, leaves, etc., filling the spaces between the boulders, thus giving rise to lakes and level pools; and these, again, after being gradually filled in, to smooth meadows, through which the streams now silently meander; while at the same time some of the boulders took the places of old meadows and groves. Thus rough places were made smooth, and smooth places rough. But on the whole, by what at first sight seemed pure confusion and ruin, the landscapes were enriched. All Nature’s wildness tells the same story.”

Retrieved from The Sierra Club: http://www.sierraclub.org/john_muir_exhibit/writings/the_earthquake.aspx

Stream and Forest Ecosystem

Retrieved from: <http://mamontoff.org/SCIENCE/ecosystem.jpeg>