

Topics

Science Process,
Ecosystem

Grades

6-12

Site

Outdoors, Aquarium

Duration

30 minutes (minimum)

Materials

- **Scientist Role Cards**
- Science notebooks
- Pencils
- Various tools for collecting data

Vocabulary

abiotic, biotic, ecosystem

National Science Education Standards

Science as Inquiry (K-4)
(5-8)

Abilities necessary to do scientific inquiry

Life Science (K-4)

Organisms and environments

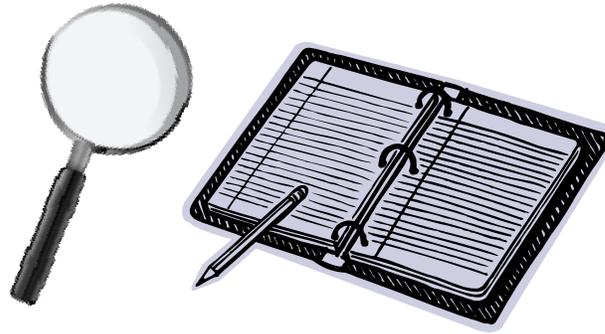
History and Nature of Science (K-4)(5-8)

Science as a human endeavor

Life Science (5-8)

Diversity and adaptations of organisms

Be a Scientist



Overview

What are the components of an ecosystem? Students find out by assuming the roles of scientists working in a variety of fields. Students experience the scientific process by making observations and collecting data about a specific ecosystem. Students then identify different components of the ecosystem and collaborate to produce a holistic view.

Objectives

Students will be able to:

- Describe fields of study for a variety of scientists.
- Use appropriate tools to collect and analyze data in the field.
- Identify relationships between abiotic and biotic components in an ecosystem.
- Understand the importance of scientific collaboration in the interpretation and evaluation of a field site.

Background

An **ecosystem** is the interactions of the **biotic** components (living things such as people, plants, animals and microorganisms) and **abiotic** components (nonliving things such as soil, water and air) in a geographic area and the natural cycles that sustain those components. An ecosystem can be large, like the ocean, or small, like the holdfast of a kelp plant.

There are many different fields of science that focus on different aspects of ecosystems. When scientists in multiple fields are able to share their data and perspectives, a more holistic and accurate view of an ecosystem is produced.

- Botanist - plants
- Ecologist - the way living things interact with their environment
- Ethologist - animal behavior
- Geneticist - how traits are inherited
- Geographer - physical, cultural and biological features of the Earth's surface
- Geologist - the history of the Earth and the materials of which it's made



VOCABULARY

Abiotic: nonliving

Biotic: living

Ecosystem: relationships between abiotic and biotic components in a specific area and the cycles that affect them

- Ichthyologist - fish
- Marine biologist - ocean plants and animals
- Microbiologist - microscopic plants and animals
- Ornithologist - birds
- Phycologist - algae
- Malacologist - molluscs, i.e., clams and snails
- Meteorologist - weather and climate
- Oceanographer - the physical ocean
- Paleontologist - fossils
- Zoologist - animals and their behaviors

Teacher Preparation

1. Decide which fields of science your students will study and print a role card for each student or student pair. If desired, make additional role cards using the scientific roles listed in the Background.
2. Assemble any necessary resource bags for the roles. (For example, a botanist may use a ruler, hand lens, botany field guide, tweezers and collection bag or jar. A hydrologist may use a Secchi disk, water monitoring kit or probe, and so on.) You may choose to have students bring a notebook to use for data collection.

Procedure

Part One: Introduction to a Scientific Investigation

1. **INTRODUCE THE ELEMENTS OF AN ECOSYSTEM INVESTIGATION.**
Explain that the class will be conducting an ecosystem investigation at a field site and that they will each play a specific scientific role in the investigation. Like scientists, they will observe, ask meaningful questions, conduct careful investigations, collect and analyze data and share their findings with others.
2. **STUDENTS RECEIVE BE A SCIENTIST ROLE CARDS.**
Either assign or let students, in pairs or individually, choose a **Be a Scientist Role Card**. Give students a corresponding resource bag for their role. Allow the students to discuss their roles, explore their resource bags and ask questions. Ensure that students understand any equipment use and protocols regarding data collection at the field site.

Part Two: At the Field Site

3. **BRIEF STUDENTS ON FIELD SITE EXPECTATIONS.**
Once at the field site, review the goals with students (*opportunity to understand an ecosystem through a scientist's eyes*). Set the physical boundaries and give safety reminders. Also, review any class rules or other guidelines students need to adhere to.
4. **STUDENTS EXPLORE THE FIELD SITE AND COLLECT DATA.**
Encourage students to collect data in response to the questions on their role cards while they explore the field site for a minimum of 30 minutes. Facilitate as necessary while students collect data and record it in their notebooks.

**THE MISSION OF THE
MONTEREY BAY
AQUARIUM
IS TO INSPIRE
CONSERVATION OF THE
OCEANS.**

Part Three: Analyze Collected Data

5. **IN SMALL GROUPS, STUDENTS WITH THE SAME ROLES DISCUSS THEIR FINDINGS.**
Group the students by scientific roles, e.g., oceanographers meet as a group, ecologists meet as a group, and so on. Give the groups 20 minutes to discuss findings and help each other fill in missing data.
6. **STUDENTS WITH DIFFERENT ROLES FORM GROUPS TO ANALYZE AND DISPLAY THEIR DATA.**
Ask the students to get together in “mixed groups.” Make sure that each group includes a variety of scientific roles, but only one representative for each role. Have students create a visual representation of all of the components of the system they observed. They should use data, samples, notes and drawings they collected at the site. Provide each group with a piece of poster paper or whiteboard and other drawing materials.
7. **GROUPS SHARE RESULTS WITH CLASS.**
Have the groups share their results with the rest of the class. Encourage students to ask questions and look for corroboration of their interpretation of the ecosystem components. Discussion questions may include:
 - How did your view of the ecosystem change once you met with other “scientists?”
 - Why is a holistic perspective of an ecosystem important?
 - What are implications for the management of an ecosystem?

Extensions

Create more role cards or challenge students to create role cards.

Resources

Website

National Geographic's Strange Days.

www.pbs.org/strangedays/educators/careers.html

Interviews with various scientists in the field are featured.

Books

Career Ideas: For Kids Who Like Science. Reeves, Diane Lindsey. Checkmark Books, 1998.

What is a Scientist? Lehn, Barbara. Millbrook Press, 1999.

Standards

California Science Standards

Grade 6: 1e, f; 2a, d; 4a; 5a ,b, d; 7b, g, h

Grade 7: 4a, c, f; 5a; 7a, c, d

Grade 8: 2b; 8c, d

Grades 9-12: Chemistry 2a, 4d, 5a, 5d; 7d

Biology 6b, 6d

Earth Sciences 5d, 5g, 6b, 8b, 9a, 9c

Investigation and Experimentation 1a-n



CONSERVATION TIPS

Making careful observations can be a hook for students to become better environmental stewards.

Becoming aware of intricate and delicate ecosystem interactions may lead students to take conservation actions such as carrying reusable water bottles and bags or participating in community cleanups to maintain a healthier environment.

Be a Scientist Role Cards

<p>Ecologist</p> <p>An ecologist studies the way living things interact with their environment.</p>	<ul style="list-style-type: none"> • Describe the biotic components of the ecosystem? • How are the biotic components of the ecosystem organized? • How do the biotic components of the ecosystem interact? • How do the biotic components interact with the abiotic components?
<p>Zoologist</p> <p>A zoologist studies animals and their behavior.</p>	<ul style="list-style-type: none"> • What kinds of animals do you see in the ecosystem? • How are the animals interacting with the other biotic components? • How are they interacting with the abiotic components? • What physical and behavioral adaptations do you observe? Describe.
<p>Phycologist</p> <p>A phycologist studies algae.</p>	<ul style="list-style-type: none"> • Describe the diversity and location of algae in the ecosystem. • What colors and sizes are the algae? • What are the algae attached to in the ecosystem? • How are organisms using the algae? • What evidence of sunlight is there in the ecosystem?
<p>Oceanographer</p> <p>An oceanographer studies the physical ocean.</p>	<ul style="list-style-type: none"> • Describe the biotic and abiotic components of the ocean ecosystem. • Are those components constant or do they vary on a daily, weekly or monthly basis? • Which of those components determine how many and what types of organisms the ocean can support? Explain.
<p>Botanist</p> <p>A botanist studies plants.</p>	<ul style="list-style-type: none"> • Describe the diversity and location of plants in the ecosystem. • Describe the main producers in the ecosystem. • What are the needs of the producers? • What role do those producers play?

Be a Scientist Role Cards

<p style="text-align: center;">Geologist</p> <p>A geologist studies the physical structure and processes of the Earth.</p>	<ul style="list-style-type: none"> • Describe the general geology of the ecosystem. • Is there evidence of major geologic events (earthquakes, volcanic eruptions, mountain building or eroding, or other evidence)? • Has water shaped the surface of this ecosystem? How? • Describe the rocks and soil, i.e., color, texture or hardness. • What impact does the soil have on the biological organisms that live on or in the soil?
<p style="text-align: center;">Hydrologist</p> <p>A hydrologist studies movement, distribution and quality of water.</p>	<ul style="list-style-type: none"> • Describe any water or evidence of water in the ecosystem. • Based on a visual survey, are there areas in this ecosystem that seem to receive more water than other areas? Why is this? • What is the role of rain or other precipitation in this ecosystem? • Describe water runoff and drainage in this ecosystem. • What do you predict the quality of water (past or present) to be in this ecosystem? Why?
<p style="text-align: center;">Anthropologist</p> <p>An anthropologist studies peoples and cultures.</p>	<ul style="list-style-type: none"> • Describe any signs of human influences on the ecosystem. • Can those influences be described as positive or negative? Explain. • How do you think the ecosystem is different today than three hundred years ago? Why? • Are there specific actions people can take to make human influences on the ecosystem more positive?