

Ecosystems

Grade

7

Topic: Waste
Grade: 7
Duration: 2 x 45 minutes (and several weeks for creation of ecosystem)

The class will create a closed ecosystem to demonstrate the interdependence of living things. This ecosystem can be placed in the front of the school to demonstrate these principles to guests who visit the school. Posters describing the ecosystem should accompany the display.

Curriculum Expectations

- 7s1: Demonstrate an understanding of the interactions of plants, animals, fungi, and micro-organisms in an ecosystem
- 7s2: Investigate the interactions in an ecosystem, and identify factors that affect the balance among the components of an ecosystem
- 7s5: Identify populations of organisms within an ecosystem and the factors that contribute to their survival in that ecosystem
- 7s11: Investigate ways in which natural communities within ecosystems can change, and explain how such changes can affect animal and plant populations
- 7s13: Formulate questions about and identify the needs of various living things in an ecosystem, and explore possible answers to these questions and ways of meeting these needs
- 7s14: Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions
- 7s21: Describe the conditions in an ecosystem that are essential to the growth and reproduction of plants and micro-organisms, and show the connection between these conditions and various aspects of the food supply for humans
- 7e1: Communicate ideas and information for a variety of purposes (to outline an argument, to report on observations) and to specific audiences, using forms appropriate for their purpose and topic
- 7e5: Produce pieces of writing using a variety of forms (e.g., descriptive, narrative, and expository compositions), techniques and resources appropriate to the form and purpose, and materials from other media (e.g., diagrams, illustrations)
- 7e6: Produce media texts using writing and materials from other media
- 7e37: Plan a research project and carry out the research
- 7e48: Ask questions and discuss different aspects of ideas in order to clarify their thinking
- 7e55: Create a variety of media works
- 7a35: Produce two- and three-dimensional works of art that communicate a variety of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences, using appropriate art forms

Background Information

A closed ecosystem is one that has no matter (including nutrients) entering or leaving the ecosystem, as we find with the earth (except for the occasional meteorite). The earth ecosystem, of course, is open to energy transfers. Energy from the sun ultimately drives all processes in the ecosystem, including photosynthesis and all nutrient cycles. An open ecosystem, on the other hand, has inflows and outflows of matter as well as energy. Most ecosystems on the earth, such as ponds, rivers, forests, lakes, etc., are by themselves open ecosystems.

A characteristic of all systems is synergy. Synergy is the name given to the concept that the behaviour of a system cannot be predicted by understanding only the behaviours of the separate parts. Synergy implies that, for a system, the whole is more complex than just the sum of its parts. It is important to understand the way that the parts interact with one another to form the whole system. In many ecosystems not all the individual parts may be known, much less how they are interrelated to make up the whole.

Construction and observation of a classroom ecosystem can help develop many basic ecological concepts. It provides an understanding of the interrelationships that are taking place in food chains, food webs, nutrient cycles, and energy transformations. What are the basic requirements of living things? Why is sunlight so important? How is oxygen produced? These are some of the questions a classroom ecosystem can answer.

We depend upon the continued reuse of air, water, and land much the same as astronauts are required to reuse the limited resources they take along on space journeys. Apart from the sun's rays that supply life-giving energy for plant growth, nothing else has to enter or leave the earth's biosphere to sustain life. For this reason, the earth has been referred to as "Spaceship Earth". If life aboard our spaceship is to continue in a desirable fashion, we must pay more attention to the workings of the environment and the ecosystem in which we live.

By building a miniature classroom ecosystem, students can actually observe the workings of an interacting community relying only on the input of light energy for maintenance. The complexity of this system and the cyclical pattern of life will become apparent over a prolonged period of time. And, the beauty of it all is that once set up, no further work is required, just close observation.

Accountability

Student will understand how an ecosystem reflects their community.

Teacher Notes

1. Use this scenario as a possible starting point:

As your school moves towards creating a more environmentally friendly community, you realize that you need to be doing more to demonstrate these ideas to the many visitors that you have in the school. Many of the classes have created posters, developed charts and presented their work. You want to create a more permanent display to demonstrate the fragility and interdependence of all living things.

2. Discuss the concept of an ecosystem. What happens when one or more of the components of an ecosystem are altered?
3. Examine the concept food chains and nutrient cycles.
4. Construct a small class ecosystem. Refer to the information on "How to Create A Bottle Ecosystem" (attached).
5. There are several different types of closed ecosystems than can be created to demonstrate these principles. Encourage students to conduct research to find other examples.

6. Record the experiment using the scientific method and observe the ecosystem over time to record changes.
7. Changes to the ecosystem should be discussed to determine what is happening to cause these changes. Record these observations. Take pictures to add to the final display.
8. A further experiment would involve changing some aspect of the ecosystem and observing the result. Be careful, as this might damage the system depending on what is altered.
9. Students should make predictions about that would happen to the ecosystem if different factors were altered. Design an experiment to simulate some environmental condition that occurs in natural ecosystems due to human interference. A simulation of acid rain, ozone depletion, the greenhouse effect, fertilizer runoff, oil spills, or any other condition may be undertaken. Record the effect on the ecosystem.
10. Get them to extend this thinking to the natural world and discuss how changes that they are making in the EarthCARE program are similar to this experiment.
11. Put the ecosystems on display and include an explanation of what is happening within the environments. This can include a multi-media or web-based presentation using the pictures taken over the period of time when the ecosystem was evolving. This would make an excellent EarthCARE Fair activity.

Home Extension

Encourage students to create a smaller ecosystem at home and record the growth of the plants.

How to Create a Bottle Ecosystem

Purpose

To construct a bottle ecosystem and monitor its health over a period of time

Materials

- A large bottle
- Aquatic plants
- Bottom sediments
- Stopper or lid
- Rubber gloves
- Kitchen sieve
- Plastic bag and guppies (optional)
- Rubber boots

Method

1. Obtain as large a bottle as possible (preferably one with a lid, or one that can be stoppered).
2. Clean the bottle thoroughly.
3. Visit (with adult supervision) either a slow-flowing stream or, preferably, a pond or lakeshore. A site where aquatic plants are growing will probably yield a variety of aquatic life, both plant and animal.
4. Scoop approximately five to seven centimetres of bottom sediment into the bottle. If there are aquatic plants (especially algae) at the site, obtain a portion of these. (A kitchen sieve will act as a net to catch tiny aquatic organisms that might live amongst the aquatic plants.)
5. Fill the bottle three-quarters full with water obtained at the site. If chlorinated tap water is used let it stand in the jar with open top for at least 48 hours to dissipate the chlorine from the water.
6. Return the bottle to the classroom and place it on a window ledge (preferably a south-facing window) where sun will shine on it at some time in the day. Allow the contents to settle overnight.
7. If aquatic plants could not be obtained from the collection site, a visit to a local tropical fish store will be necessary. Purchase a few strands of an aquatic plant such as Canada Water

- Weed (Elodea). If you haven't obtained some snails in your original sample then it might be wise to purchase some of them as well. If you want fish in your ecosystem, three or four small guppies might be purchased. (Remember, the guppies will eat some of the other life.)
8. Carefully insert the aquatic plants into the bottle and secure them in the bottom sediment (if necessary by tying them to a weight such as a stone).
 9. If guppies are added to the system, they should first be placed in a plastic bag. The bag and contents should be placed in the ecosystem so that the water temperature in the bag has a chance to gradually become the same as the water in the ecosystem. This is necessary or the fish might suffer from temperature shock and die. After several hours, release the fish from the bag into the larger container.
 10. Place a lid on the bottle, but don't seal it.
 11. After a few weeks, when the system is functioning and appears to be in some sort of balance, the bottle can be sealed by melting some paraffin wax and applying it around the lid or stopper so that no air can enter or leave.
 12. If time is not a factor, (and it shouldn't be), allow the system to adjust to the light source for several weeks before adding guppies.

Observations and Results

1. Observe the growth of the plants and animals.
2. Compare your small closed ecosystem with those of other students.
3. Compare your small closed ecosystem with other natural ecosystems (e.g., a pond, river, or forest)
4. Record your findings.