

## Factors Affecting an Aquatic Ecosystem

Aquatic ecosystems, such as ponds, lakes, and rivers, are extremely valuable. Unfortunately, aquatic ecosystems are threatened by human activities. For example, salt spread on highways and fertilizer spread on fields can be washed into nearby waterways, damaging aquatic ecosystems. Acid precipitation impacts aquatic ecosystems because excess acid upsets the chemical balance. In this activity you will consider these effects by building a small model ecosystem and altering the abiotic environment.

### SKILLS MENU

- Questioning
- Hypothesizing
- Predicting
- Planning
- Controlling Variables
- Performing
- Observing
- Analyzing
- Evaluating
- Communicating

### Purpose

To investigate some effects of altering abiotic features in an aquatic ecosystem.

### Equipment and Materials

- eye protection
- lab apron
- large spoon or stirring rod
- 1-L beaker
- funnel
- hand lens
- graduated cylinder
- electronic balance
- eye dropper and Petri dish
- four 2-L plastic pop bottles
- marker
- 4 L of pond water containing assorted aquatic organisms
- liquid plant fertilizer (any general houseplant liquid fertilizer like 10:10:10)
- dropper bottle of dilute sulfuric acid
- weighing papers
- table salt

### Procedure



1. You will work as part of a team to examine the influence of three abiotic factors on aquatic organisms. You will build small aquatic ecosystems and alter one abiotic factor in each. You will compare the community of organisms in the natural pond water (the control) with those in which acid, salt, or nutrient content has been altered (the treatments).

Your team will need to decide how to alter each variable. You will have to determine how much acid, salt, and fertilizer you will add to each of the three ecosystems. Base your decisions on what you think might occur in a real ecosystem. In your notebook, draw a table similar to Table 1 below and record how much material you will add to each treatment.

Table 1

Treatment	Contents	
	Starting material	Added material
control	1 L of pond water	none
plant fertilizer	1 L of pond water	___ mL liquid plant fertilizer
acid rain	1 L of pond water	___ mL dilute sulfuric acid
salt pollution	1 L of pond water	___ g salt



Always wear eye protection and a lab apron when working with chemicals.

2. Your team will also need to design a sampling method to estimate abundance of the organisms. How will you compare the variety and numbers of different organisms in your ecosystems? You may want to consider using ranking scales to compare the four ecosystems.
  3. Have your teacher approve your design before you proceed. **T/I**
  4. Put on your eye protection and lab apron.
  5. Label four 2-L bottles as control, plant fertilizer treatment, acid rain treatment, and salt pollution treatment.
  6. Stir the pond water so that organisms are evenly distributed in the water.
  7. Using the beaker and funnel, measure 1 L of pond water into each 2-L bottle.
  8. Using a hand lens, examine each ecosystem. Make sure that they have approximately equal numbers of organisms. If they seem uneven, add more organisms so that they appear to have approximately equal quantities.
  9. In your notebook, describe or draw each type of organism you see and estimate its abundance. **C**
  10. Using a graduated cylinder, measure the plant fertilizer and add it to the appropriate ecosystem.
  11. Using a graduated cylinder, measure the sulfuric acid and add it to the appropriate ecosystem.
  12. Using an electronic balance, measure the salt and add it to the appropriate ecosystem.
  13. Design a table to collect your data. Every two or three days, for at least three weeks, record the type of organisms and their abundances in each bottle. **T/I**
  14. Plan how to present your findings. You may want to use summary tables and graphs to present them. **C**
  15. You may want to consider using digital images to record and present your findings. **C**
- (c) Which ecosystem had the lowest number of organisms by the end of the experiment? Which had the lowest variety of organisms? **T/I**
  - (d) Account for any changes you observed in each ecosystem. Remember to compare your three test treatments with the control. **T/I**
  - (e) How did your results compare with those of other teams in the class? Were there any patterns among the quantity of fertilizer, acid, and salt added and their impacts? **T/I**

## Apply and Extend

- (f) Assuming there was always a supply of water, which of your ecosystems, if any, do you think could sustain life over long periods of time? Explain your answer. **T/I C**
- (g) Why would a scientist use small model ecosystems instead of investigating more complex natural ecosystems? **T/I**
- (h) Based on your observations, what effect do fertilizer, acid rain, and road salt have on the sustainability of aquatic ecosystems? **A**
- (i) Human activity can impact large water sources in unhealthy ways. The release of fertilizers or toxins into surface or groundwater can pollute water supplies and harm ecosystems. Road salt and deforestation can also affect water quality. Select a human activity and use the Internet and other sources to answer the following: **T/I A C**
  - (i) What purpose is served by the activity itself? For example, what is the benefit of using salt on roads?
  - (ii) Describe the specific nature of the problem. In what way(s) does this human activity threaten water quality and the sustainability of aquatic ecosystems?
  - (iii) What possible alternatives or technological solutions might solve or reduce the problem?
  - (iv) Does your research support what you observed in your model ecosystems?

## Analyze and Evaluate SKILLS HANDBOOK 3.B.7., 3.B.8.

- (a) Which ecosystem demonstrated the greatest algae growth? **T/I**
- (b) Which ecosystem maintained the greatest number of organisms? Which ecosystems had the most types of organisms? **T/I**



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