

## Extension Activities: Pollution Solution

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### Lesson Summary

Nonpoint source pollution (NPS) is a serious problem in urban areas. Students will learn about the causes of NPS pollution and perform an experiment to test how ground cover affects the amount of NPS pollution in runoff.

#### Materials

- 8 Small square plastic containers
- 8 Aluminum foil squares
- 8 Florist foam blocks
- 2 sets of sample materials including pet grass, gravel, black plasticine, and white crayola modeling clay
- Aerial photo of school or surrounding neighborhood
- 8 transparencies with grids

Per group:

- Small bottle of lemon juice
- 2 pH test strips
- pH color indicator chart
- 100 mL beaker
- Spray bottle of water

Per student:

- Copy of data sheet.

### Lesson Objectives

- Perform an experiment using the scientific method.
- Understand the difference between point source and nonpoint source pollution.
- Use a grid to estimate ground cover.
- Learn how to reduce stormwater runoff.

### Illinois Goals and Standards for Middle / Junior High, Early High School, and Late High School Science:

Goal 12:

Goal 13: B.3d, B.3f, B.4d, B.5c

### Vocabulary

Impermeable Surface  
Nonpoint Source Pollution  
Pollution  
Point Source Pollution  
Runoff

### Background Information

Pollution can come in many different forms. The most common types of pollution are air, water, and ground pollution. **Pollution** can be any substances in the air, water, or soil that cause a threat to human health or the environment.

Pollution can come from two sources, known as point source or nonpoint source pollution. **Point source** pollutants are pollutants that are discharged from any identifiable source, including pipes, sewers, smoke stacks, automobile exhausts, etc. **Nonpoint source** pollutants are pollutants that do not originate from one specific location. Instead, these pollutants accumulate in water as it flows over a widespread area.

Water, in the form of precipitation, collects on the ground and flows into lakes and streams. As the water, or **runoff**, flows it picks up debris and pollutants from the ground. These pollutants can include fertilizers from lawns, pesticides from agricultural fields, oil and salts from roadways and parking lots, and other trash and debris from sidewalks. All of these pollutants make their way into lakes and streams, contaminating the waterways.

Nonpoint source pollution is difficult to cleanup, but there are ways to prevent the pollution to begin with. One way is to

encourage people to properly dispose of harmful chemicals and wastes rather than dumping them on the ground. Another way to reduce nonpoint source pollution is to reduce the amount of impermeable surfaces. An **impermeable surface** is a hard surface that does not allow water to seep through to the ground, which leads to runoff. Increasing the amount of permeable surface area with ground cover such as grasses, native plants, or special pavers that allow water to seep through can reduce the amount of runoff, which will lead to less nonpoint source pollution in waterways.

### Initial Discussion

1. Tell the class that you have come to visit them to talk about pollution. Ask for a definition of pollution. If necessary ask for words that they think describes pollution.
2. Next, ask the students to list types of pollutants (air, water, noise, light, etc.) or examples of pollutants (garbage, chemicals, etc.). List the ideas in one column.
3. Now, ask the students to state where each of the pollutants comes from. Put these answers in an adjacent column. Some of the pollutants may have unknown or multiple sources. Next to these, write Nonpoint source pollution (NPS).
4. Begin a discussion about NPS. Start by reviewing the water cycle with students. Ask students what happens to rain as it falls to the ground. Define runoff and explain how contaminants are picked up by water as it flows towards streams and lakes (See Background Information).
5. Ask students how ground cover might affect the flow of runoff. Is it better to have more permeable surfaces, which allow water to flow into the ground, or to have more impermeable surfaces, where water runs off? Which type of ground cover would reduce NPS pollution?

### Hands-On Activity

6. Tell students they will setup an experiment that will examine how ground cover affects NPS pollution.
7. Begin by having students create a list of types of ground cover. As they read their lists aloud, keep track of their answers on the board. Be sure that the list contains the following: soil w/plants (grass), gravel, asphalt, and concrete.
8. Based on the list they created, ask students to make a hypothesis about which material will protect a water body the best from NPS pollution.
9. Arrange students in groups and give each group a plastic container, an aluminum foil square, and a data sheet. Have them create a basin that will hold water and place it on one side of the container. Assign each group a test material and have them fill the other side of their basin with their material according to the instructions on their data sheet.
10. Have one member from each group come to the front and get a 100mL beaker, a spray bottle of water, 2 pH test strips, and a small bottle of lemon juice.
11. Ask students to come up with a way to test how much pollution is in the water. What instruments or tools do scientists use to determine if water is polluted or not? Tell students they will measure the pH of the water in order to determine how polluted it is. The pH is a measure of how acidic or how basic the water is.

The pH of a non-polluted water body is between 6.5 and 8.2.

12. Have the students carefully follow the procedure on their data sheet. Make sure they record their data and complete all the questions.
13. When all the groups have finished, create a chart on the board and have each group record their results on the chart.

### **Relate Activity to Concept**

14. Ask students which material polluted the water the most? How about the least? How did the permeability of the material affect the amount of pollution that entered into the water?
15. Ask students to think about the ground cover that surrounds their school. What types of surfaces are permeable? What types of surfaces are impermeable? Have students estimate the amount of surface (percentage) that is permeable and impermeable.
16. Give students an aerial photograph of their school building and the surrounding landscape. Tell students they will use a grid-system to visually estimate how much impermeable surface surrounds the school.
17. Have students place the transparent grid system over the aerial photo. Have them count up all of the squares that are contained within the previously defined impermeable areas. Students can then calculate the percentage of impermeable surface area with the following equation: (number of squares of impermeable surface)/(total number of squares within the entire aerial photograph) X 100.
18. Have students discuss the results. Is there a body of water near the school?

(look at the aerial photo) If not, where is the runoff going?

19. Ask students to research the following:  
(1) Where does Chicago's stormwater runoff go? (2) What can students do to help reduce runoff in urban areas? (3) What can students do to reduce NPS pollution in urban areas?

### **Variations**

- Leave out the school ground cover assessment if time is short.

### **Assessment**

Collect and grade data sheets.

## Data Sheet

Name: \_\_\_\_\_

What is the **purpose** of the experiment?

What is your **hypothesis**?

What **materials** did you use?

Plastic square container  
Aluminum foil square = lake basin  
Foam block = underground  
Pipette  
Sample materials...? = surfaces

100 mL beaker full of water = lake water  
Spray bottle = rain producer  
Lemon juice = pollution on ground  
2 pH test strips

Ground cover sample \_\_\_\_\_

What is the **procedure** of the experiment?

1. Using the aluminum foil, create a basin in one-half of the plastic container that is capable of holding water.
2. Place the foam block in the empty side of the container. The sloped edge of the foam block should be facing the aluminum foil basin.
3. Smooth the inner wall of the foil basin along the sloped edge of the foam block. Make sure that the foil is not higher than the foam.
4. Take the sample material and place it on top of the foam block.
5. Fill the beaker with 100mL of water and pour it into the aluminum basin.
6. Using a pH indicator strip, test the pH of the water by dipping the strip into the water for 2 seconds. Compare the wet end of the strip with the color indicator chart. Record the pH in Table 1.

7. Fill the pipette with lemon juice. Sprinkle 20 drops of lemon juice evenly over the sample material.
8. Using the spray bottle, make it “rain” by gently spraying the sample material surface for 10 seconds.
9. Measure the pH of the water in the aluminum basin again. Record the results in Table 1

**Table 1**

	Before rain event	After rain event
<b>pH of water</b>		

What are the **results** of the experiment?

What is your **conclusion**?

