

Pollution in My Backyard? No Way!

Students learn to distinguish between point and nonpoint source pollutants while they learn about real pollutants in Puget Sound. Through a demonstration exercise, students understand how stormwater runoff can carry nonpoint source pollution to Puget Sound. Students then determine how this pollution could be prevented.





Objectives

Students will:

- Differentiate between point and nonpoint source pollution
- Understand how nonpoint source pollution reaches Puget Sound through stormwater runoff
- Consider ways to prevent nonpoint source pollution

Inquiry/Critical Thinking Questions

- What pollutants are found in Puget Sound, and how do they relate to human activities in surrounding neighborhoods?
- How does nonpoint source pollution reach Puget Sound?
- How could students help to prevent nonpoint source pollution?

Subject Areas

- social studies (geography, civics)
- science (environmental)

Time Required

45 minutes

Key Concepts

point source pollution—harmful substances released from an identifiable source

nonpoint source pollution—harmful substances released from many different sources that cannot be individually identified

stormwater runoff—unfiltered water that reaches natural bodies of water by flowing over impervious surfaces

Washington State Science Standards Addressed

6-8 INQE: Models are used to represent objects, events, systems, and processes. Models can be used to test hypotheses and better understand phenomena, but they have limitations.

6-8 LS2E: Investigations of environmental issues should uncover factors causing the problem and relevant scientific concepts and findings that may inform an analysis of different ways to address the issue.

Washington State Social Studies Standards Addressed

(Grade 6) 3.2.1 Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

(Grade 7) 1.4.1 Understands the effectiveness of different forms of civic involvement.

(Grade 7) 3.2.1 Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.

(Grade 8) 3.2.1 Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.



Washington State Integrated Environmental and Sustainability Standards

Standard 1: Ecological, Social, and Economic Systems

Standard 2: The Natural and Built Environment

Standard 3: Sustainability and Civic Responsibility

Optional Background Reading

- Sandra Hines, “Spicy Puget Sound: Fish Swim in ‘Big, Dilute Latte,’ Research Shows,” *University Week*, December 4, 2008, <http://bit.ly/lRaiTI>—Spices detected in Puget Sound’s waters after Thanksgiving show how our activities directly impact the Sound.
- “Environmental Spices,” Aquatic Organic Geochemistry, University of Washington Keil Lab, <http://bit.ly/mNuGX1>—An explanation of the research methods performed by Rick Keil’s lab to measure spices found in the Sound.

Materials/Preparation

Handout: *Puget Sound Pollutants*, 1 per student pair

Large clear plastic bowl or other container, filled no more than $\frac{1}{4}$ full with water

Aluminum foil:

- Cover the surface of the large plastic bowl, and create a slight depression in the

surface by gently pinching the foil down along the inside rim of the bowl

- Cut a small hole in the center of the foil

Masking tape

- Tape the edges of the foil to the outside of the bowl, to keep the foil cover in place
- Trim any excess foil below the masking tape, to ensure a clear view through the bowl to the water

Simulated pollution materials

- Vegetable oil (motor oil)
- Green food coloring (pesticide)
- Red colored sugar (fertilizer)
- Chocolate sprinkles (pet waste)
- Small scraps of plastic and paper (litter)
- Soil and/or yard waste (erosion, sediment)

Rain simulator cup, made from a disposable plastic cup with holes poked in its bottom

- Other rain simulators might be a watering can, a dropper, or a squeeze bottle

Additional water for pouring in rain simulator cup





KEN MCCOWN

Activity

Introduction (15 minutes)

1. Ask students if they think that Puget Sound is pure and pristine, or if they think it is polluted in any way.
 2. Let students know that pollution can (and does) end up flowing into the Sound. Sometimes these pollutants, which include trash and toxic chemicals, are emptied directly into the Sound. Other times they travel over long distances and eventually end up washing into the Sound.
 3. Tell students that there are two types of pollutants: *point source* and *nonpoint source*. Write these words on the board.
 4. Group students into pairs. In a think-pair-share exercise, ask students to formulate possible definitions for the words *point* and *nonpoint*, where pollution is concerned. The words themselves (*point*, *nonpoint*) provide clues to their meanings.
 5. Have each group share their definitions. Write key words on the board as they call out their definitions.
 6. If no one deduced the correct meanings, share with them the correct definitions. Point source pollution comes from an identifiable source. (You can *point* to it because it comes from a single *point*.)
- Nonpoint source pollution comes from many different sources that cannot be individually identified. Usually runoff (rainfall that moves over land) is the culprit of nonpoint source pollution because it washes over many different pollutants from different places and carries them to nearby bodies of water.
7. Give each student pair a copy of the handout *Puget Sound Pollutants*, or use a projection device to display the images.
 8. Ask students to consider all of the images displayed. Tell them that you will be asking them to sort the images into two categories: point source and nonpoint source pollution.
 9. Have each pair sort the images, either by cutting them out and placing them into 2 groups, or by labeling each picture either *point source* or *nonpoint source*.
 10. On the board, create 2 columns. Label 1 column *point source pollutants* and the other column *nonpoint source pollutants*.
 11. Have each student pair list 1 pollutant under the heading where they think it belongs.
 12. If anyone disagrees with a pair's selection, allow students to voice their differences of opinion.
 13. Once all images/pollutants have been categorized, ask volunteers if they can think of other kinds of substances that



might be considered either point or nonpoint source pollution. Add these to the columns on the board. (*Point source pollution comes from factories/industrial discharges, ships, and sewage treatment plants. Most other pollutants will be categorized as nonpoint.*)

14. Let students know that nonpoint source pollution accounts for most of the pollution that reaches Puget Sound.

Demonstration (30 minutes)

1. Ask students how they think the pollutants categorized as “nonpoint source pollution” reach Puget Sound.
2. Let students know that you will be doing a demonstration of how pollutants enter waterways.
 - **Note:** You could do this as a whole-class demonstration, or you could have students carry out this exercise in small groups as a lab activity.
3. In a place where all students can see it, place your clear plastic bowl/container with water. It should be already covered with foil, according to the directions in the Materials/Preparation section.
4. Explain to students that this is a model. The foil represents a street or other ground surface that does not absorb
5. Ask students to think of different kinds of pollutants that might end up on an impervious surface such as a street, driveway, or sidewalk. (*For example, litter, motor oil, and pet waste.*)
6. As students call out each pollutant, have a student volunteer come up and place a small amount of that simulated pollutant on your foil surface.
7. Once your foil surface is sufficiently covered with common pollutants, tell students that it’s about to rain. Ask them to guess what is going to happen:
 - What will happen to the items they’ve placed on the foil surface?
 - What will happen to the waterway below?

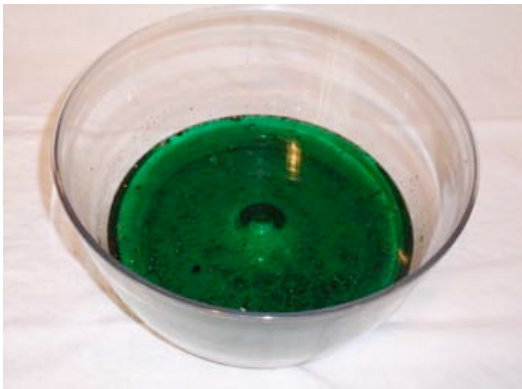




8. Ask a volunteer to come up and hold the rain simulator cup or watering can. While the student holds the cup, pour water into it so that it starts to rain. Ask the student to move the cup around so that the entire area receives some rain.



- **Option:** Allow students to come up one at a time to see what happened both on the ground and in the waterway.



9. Ask students how the pollutants got into the waterway. (*The rain washed them from the ground into the waterway, through the open storm drain.*)

- **Explanation:** This is what actually happens in our region. In some places, storm drains are not connected to the sewer system, meaning that water that enters storm drains does not get treated or cleaned. Instead, it flows directly to nearby waterways, which eventually enter Puget Sound. In other places, storm drains connect to sewer systems. Heavy rains can contribute more water than the sewer or wastewater treatment facility can handle, causing the water to empty directly into nearby waterways without being treated. Even when stormwater does get treated, not all toxins are removed by the process.

Stormwater runoff is the largest source of pollution to Puget Sound.

10. In a think-pair-share exercise, ask students to think of one way that this pollution could be prevented from entering the water.
11. Ask student pairs to share their ideas for stopping pollution from entering Puget Sound.



ALANA VINSTER

Discussion Questions

1. How does the health of the Sound affect your life? Your community or neighborhood?
2. What sources of nonpoint source pollution have you seen in your neighborhood? (*Pet waste, litter, and motor oil could all be carried away by runoff.*)
3. If many sources of pollution are already well-known, why do you think pollution still ends up in Puget Sound?
4. How would this simulation have been different if instead of the foil, which is an *impervious* surface, a different type of ground surface allowed the stormwater to be absorbed?
5. What could you do in your neighborhood to help prevent pollution from reaching Puget Sound through stormwater runoff?

Science Extension

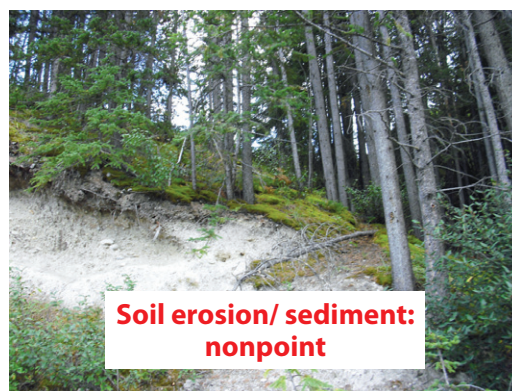
Why does water flow from freshwater streams and rivers to oceans and sounds? This phenomenon is caused by land elevation differences. Create a model of a region with several hills and valleys, using clay. Use a dropper to see how water flows from different elevations within the model.

Puget Sound Pollutants



FROM TOP LEFT HAND CORNER TO BOTTOM RIGHT: LAURA SKELTON, KILH49, R. KLISE, KARL VOELKER, AARON CARUANA, STOCKSNAPPER, KY KNOORD, NO CREDIT, JON ROSS

Teacher Master: Puget Sound Pollutants



FROM TOP LEFT CORNER TO BOTTOM RIGHT: LAURA SKELTON, KLH49, R. KLISE, KARL VOELKER, AARON CARUANA, STOCKSNAPPER, KY KNOORD, NO CREDIT, JON ROSS