

Getting to the Source

Grades: 5 – 8

Time Allotments:

Teacher preparation:	5 minutes
Lesson/activity:	30 – 45 minutes
Closure/assessment:	15 minutes

Content Objectives: After performing this activity students will be able to:

- 1) Define the term “nonpoint source pollution (NPS)”;
- 2) List examples or sources of nonpoint source pollution; and
- 3) Identify factors (such as population numbers and distribution, land use and natural factors) that aid in determining the types of NPS in a given area and how quickly they enter the water and travel.

Process Objectives: Students will:

- 1) Create a diagram for a type of “place” (rural, suburban and urban) that includes examples of land use in that given area;
- 2) Read and reference an information sheet; and
- 3) Perform a task while working in small groups.

Curricular Areas and Corresponding Core Curriculum Content Standards:

Consumer/Family/Life Skills	9.2 (G8) A 2 & 4, C1, 2 & 3, D3 & 4
Technology Education	8.2 (G8) C3
Computer/Info. Literacy	8.1 (G8) B6
Social Studies:	6.6 (G8) B6, C4 & 5
Science:	5.10 (G6) B1 5.8 (G6) B1 & 2
Language Arts Literacy:	3.4 (G7-8) A2 3.3 (G5-6) A2, 3 & 5, B6 (G7-8) A7, B3 & 4, C2 3.2 (G5-6) D1-2 (G7-8) D1 3.1 (G5) H1

Vocabulary:

Nonpoint Source Pollution
Point Sources (of Pollution)

Materials Needed:

- Copies of "Getting to the Source" Worksheet – one copy per student or per group of students
- Copies of “Examples of NPS" Information Sheet – one copy per student or per group of students
- Pencils – one per student or per group of students
- Mural paper – large piece(s) of drawing paper for each group of students

- Colored pencils, markers or crayons – enough for each group of students

Anticipatory Set:

- Ask students to brainstorm the types of pollution they are familiar with that occur in their own yards and neighborhoods. Write their examples on the chalkboard. Ask them if they think these types of pollution are effected in any way by rain or snow. Have them provide details and examples for their responses.

Guided and Independent Practice:

- Write the terms below on the chalkboard. Ask students their meanings and clarify the definitions of any terms they are not familiar with.

Pesticides	Animal Waste	Litter
Trash and Raw Sewage	Fertilizers	Dumped Oil
Pet Waste	Acidic Deposition	Sediment/Erosion
Stormwater Runoff	Grass Clippings/Sticks	

- Give each student (or group of students) one copy of the "Getting to the Source" Worksheet and a pencil.
- Have them work individually or in small groups to write the terms on the proper blank lines on the diagram that is on the worksheet.
- Before discussing correct answers, distribute copies of the "Examples of NPS" information sheets and give them time to review the information. Encourage them to check and discuss their answers. The correct answers are as follows:

1) Trash and Raw Sewage	5) Pet Waste	9) Acidic Deposition
2) Stormwater Runoff	6) Fertilizers	10) Pesticides
3) Dumped Oil	7) Grass Clippings/Sticks	11) Sediments/Erosion
4) Litter	8) Animal Waste	

- Discuss the definition of “nonpoint source pollution” and ask the following questions:
 - How does NPS move through the water cycle? (It moves with the water flow; the flow of water and pollution is greater after it rains or after snow melts.)
 - Where can these types of pollution collect? (It can collect in water bodies as well as in the ocean.)
- Explain that different types NPS that depend on such factors as the number of people, their distribution and the use of the land, impact watersheds in New Jersey. Have the students work in three groups to create three new water cycle drawings with the themes of "Rural," "Suburban" and "Urban."
- Give each group one piece of mural paper and one set of markers, crayons or colored pencils. They are to re-draw only the natural features from the diagram on the worksheet, such as the stream, the sky, the land and the estuary.
- Each new water cycle diagram should include drawings of NPS sources that would exist in their particular area. Sketches do not need to be drawn to scale. The students should use the "Examples of NPS" information sheets as a reference.
- Below are some things to consider:

Rural:

Horse farm/horses
 Agricultural farm/crops
 Irrigation ditches
 Septic systems/homes
 Orchards
 Roads/road salt

Suburban:

Housing development
 Condominiums
 Shopping mall
 Construction site
 Pets
 Some roadways
 Parking lots
 Small marina/geese
 Apartment complex

Urban:

Buildings
 Industrial sites
 Wastewater facility
 Construction site
 Parking lots
 Many roadways
 Pets
 Large shipyard

- Have them share and compare their drawings.

Closure:

- Discuss the following questions with the students:
 - What factors aid in determining the types of NPS sources in a given area? (Land use. Considerations include population, industry and business, geography, when the area was established and how quickly it was developed, etc.).
 - How could an increase in population in any of these areas affect NPS examples and amounts? (Additional types of development and land use would occur.)
 - What natural factors determine the rate that NPS pollutants mix with water and travel, or stay in one water body? (These factors include topography, water velocity, weather, soil and rock types, etc.).
 - Why do you think people knowingly or unknowingly contribute to NPS problems?
 - If you were the mayor of a town that had problems with NPS in nearby waterways, what would you do to address this problem?

Assessment:

- Completion of the worksheet;
- Contents of the drawing that reflects NPS sources in an assigned place;
- Performance in a small group; and
- Responses to questions from teacher.

Extension:

- Have students work individually or in small groups to research the status of nonpoint source pollution concerns and data either in New Jersey or in the region or watershed region where the school is located. (Many of the resources that are provided as part of this Web site should be helpful for this assignment.) Students should use print and non-print resources.

Source:

- *Beneath the Shell...A Teacher's Guide to Nonpoint Source Pollution and Its Potential Impact on New Jersey Shellfish*. New Jersey Department of Environmental Protection. First Printing 1991; Revised 1993; Reprinted annually from 1997 – 2002 and 2004; adapted from "Getting to the Source"(pgs. 40 - 42).

EXAMPLES OF NONPOINT SOURCE POLLUTION (NPS)

SEDIMENT: Sediment is tiny soil and rock particles carried by rain and snowmelt into streams, lakes and estuaries. It can carry chemical pollutants with it into the water. Sediment also increases the turbidity {cloudiness} of water, which reduces the penetration of sunlight. This slows the photosynthesis process in plants, which alters the amount of oxygen in the water and the availability of food for other aquatic organisms. Finally, sediment can accumulate along channels and bottoms, contributing significantly to flooding. Sedimentation can occur as the result of soil erosion, construction and other types of land disturbances in rural, urban and suburban areas.

EXCESSIVE NUTRIENTS: All plants require nutrients to survive and reproduce. Two naturally occurring nutrients, nitrogen and phosphorus, are commonly present in fertilizers. When an overabundance of fertilizer is used, excess nutrients are picked up by stormwater runoff and washed into nearby waterways. This excess causes increased algae and aquatic plant growth, resulting in a competition with each other, and with fish, for oxygen. This excessive growth lowers the amount of dissolved oxygen in the water, interferes with recreational use of the water, impairs potability and alters fish diversity and abundance. An oversupply of nitrogen in the water is usually the result of leaking septic systems or fertilizers and manure from farms or lawns that is carried into the waterway by stormwater runoff. An excessive amount of phosphates could indicate the presence of fertilizers, industrial waste, domestic sewage, car and laundry detergents, grass clippings and leaves.

ANIMAL WASTE: Pathogens are disease-causing microorganisms present in human and animal waste, or fecal matter. Diseases that can result from exposure to fecal matter include dysentery, hepatitis, food poisoning and parasitic infections. When pathogens are found beyond safe levels in New Jersey waters, beaches are closed and flows or sections of water are condemned for drinking and shellfish harvesting. Bacterial contamination is caused by the untreated waste of humans, pets, livestock and concentrated populations of wildlife. These materials are washed from the ground by stormwater runoff into local waterways. Contamination also occurs at marinas, docks and other areas frequented by large populations of waterfowl or by boaters discharging raw sewage overboard. Finally, improperly operating septic systems are a source of bacterial contamination from untreated human waste.

PESTICIDES: Pesticides, which include insecticides and herbicides, contain various substances that can negatively impact human health. These types of chemicals are used agriculturally and domestically. The use of "harder" pesticides, such as DOT, was banned because they can remain in the environment for years before decaying. The effects of currently-used pesticides on the aquatic environment depend on a number of factors, including the physical, chemical and biological properties of the pesticide, the amount, method and timing of the application, and the intensity of the first storm following application. Improper application and usage leads to pesticide-laden runoff and groundwater, and possible "kills" of aquatic vegetation, insects and fish.

TOXIC METALS: Metals such as copper, mercury, nickel, chromium, zinc and lead are considered to be toxic or poisonous because they can cause harmful health effects should concentrated amounts accumulate in the body. Their impact on human health can occur quickly or over a long period of time. Also, algae, shellfish and fish accumulate metals in their tissues, which can then be consumed by other animals and humans. Metals originate from cars, industrial waste and misused pesticides and are transported by rain and highway runoff.

ACIDIC DEPOSITION: Acid rain is the most common form of acidic deposition and is caused, in New Jersey, primarily by car emissions. It is also associated with the burning of coal and wood and other industrial emissions. It is defined as the settling of the aerial acid particles (sulfur

dioxide and nitrogen oxides) by means of precipitation. Acid rain not only removes certain nutrients from the soil and affects tree growth, but it also washes toxic metals from the soil into the waterways. Acidic deposition can lead to reproductive failure or death among aquatic animals.

MOTOR OIL: Improper disposal of used motor oil is as environmentally "offensive" as offshore drilling and tanker spills. Motor oil contains toxic substances, including lead and chemical additives, which seriously contaminate ground water and inland and coastal waterways. It stunts or kills algae and other vegetation, smothers aquatic animals and contaminates shellfish beds and drinking water supplies. The presence of oil in water is usually the result of used motor oil poured directly onto the ground or into storm drains and leakage from improperly maintained vehicles and equipment.

HOUSEHOLD HAZARDOUS WASTE: Toxic or poisonous substances in the home include oven cleaners, gasoline, turpentine, nail polish remover, antifreeze and paints, to name just a few. When they are improperly used or improperly disposed of onto the ground or down a storm drain, they enter nearby waterways or ground water without any type of treatment. When dumped into a sink, toilet or household drain, they can harm the bacteria used to treat the water, either in the septic system or at the wastewater treatment facility.

ROAD SALTS: Salt is used to de-ice highways every winter. Used in this way, however, it can contaminate ground water supplies and affect the lives of fish. It also retards the annual springtime mixing of surface and bottom waters in lakes and ponds by changing the salinity and density of the water, which decreases the amount of oxygen available for bottom dwelling animals. Road salts are presently used on highways, parking lots and other paved areas and are sometimes stored improperly adjacent to waterways.

LITTER: Roadside trash, overflowing garbage cans and dumpsters, unswept parking lots and alleys, illegally dumped tires and "junk" as well as piles of leaves, sticks and grass clippings piled along curbs or dumped into ditches, are all forms of litter. With time, wind, rain and melting snow aid in "breaking down" or decomposing some of these materials and carrying the lighter ones into nearby ditches, storm drains, streams and rivers. Not only does litter collect in piles and cause flooding, but during heavy rains it can travel far from its original location to eventually clutter the shorelines of rivers, bays and the ocean itself. Also, the contents of partially empty containers of hazardous materials, such as cleansing materials or paints, that become litter will eventually empty into a waterway and contribute to its contamination.