Activity 3-6

Watershed Drainage and Sources of Pollution

Adapted from BTNEP/LSU AgCenter: *Nonpoint Source Water Pollution*

Focus/Overview

This activity draws a contrast between the relatively flat landscape of coastal Louisiana to more hillier terrain in the Tunica Hills region. This opens the discussion for how water moves through watersheds.

Learning Objectives

The learner will…

- make a model watershed using simple inexpensive materials.
- use the model watershed to investigate runoff, point source, and nonpoint source pollution.

Louisiana Grade Level Expectations (Science)

5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g. polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4).
7: GLE-39	Analyze the consequences of human activities on ecosystems (SE-M-A4).
8: GLE-50	Illustrate possible point and nonpoint source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem (SE-M-A3).

BTNEP Connection
Water Quality

Grade Level
5, 7, 8

Duration
2-3 class periods

Subject Area
science

Setting
classroom

Vocabulary
watershed, point source pollution, nonpoint source pollution.

Original Source
"Create Your Own Watershed" and "What is Runoff?" in BTNEP/LSU AgCenter: *Nonpoint Source Water Pollution*, Activities 2 & 3.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM
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Materials List

- large piece of plastic sheet
- powdered cocoa mix
- colored drink mix powder (red and green)
- watering can with sprinkler on spout or large water spray bottle
- water supply
- sponges or cloths for cleanup
- a variety of objects to place beneath plastic cloth to create contours
- toy tractors, trees, animals, cars, buildings
- map or aerial photograph of Barataria-Terrebonne watershed
- materials for simulating different landscapes (wetlands, residential areas, agricultural land)

Advance Preparation

1. Spread plastic cloth on a large, flat surface, either inside or outside. Have materials for mopping up water on hand and containers for holding water.
2. Fill spray bottle and/or watering can
3. Prepare the "pollutants."
   a. Cocoa powder can be soil
   b. Cocoa/water mixture in a spray bottle - can be used oil, point sources pollutants
   c. Cocoa paste can be cow manure
   d. Red drink mix powder can be pesticides; green drink mix powder can be fertilizers.
4. Collect props for the watershed, including:
   a. Industrial site
   b. Sewage treatment plant – a small bowl can represent the clarifier tanks.

Background

Water pollution is divided into two categories according to its source. Point source pollution, as its name suggests, come from a specific point, such as a pipe. We can trace the source of such pollution, and therefore it can be controlled. The Clean Water Act Amendments of 1972 have gone a long way to address point source pollution by imposing regulations on industries, sewage plants and other facilities that discharge wastes into water. There is a complex permitting and enforcement process overseen by the U.S. Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality.

If you choose to use an Enviroscape for this lesson, it will demonstrate three examples of point source pollution: a factory, a sewage treatment plant and a residential storm drain system. The latter receives nonpoint pollution - runoff from city streets – but the discharge from the drain itself may be classified as point source pollution.

Nonpoint source pollution comes from many widely scattered sources. These include our own lawns and streets, as well as farms, forests, construction sites, parking lots, and oil and gas extraction facilities. The sources of nonpoint source pollution are difficult to identify, making it much harder to control nonpoint source than point source pollution. The table outlines the causes and effects of nonpoint pollutants.

Nonpoint Source Pollutants

Source location	Pollutant	Potential Effects
Farms, residential lawns and gardens, parks, golf courses, school grounds	soil/sediment	turbidity in water, affecting aquatic life, clogging culverts and drainage ditches and carrying pollutants attached to soil particles.
	fertilizers	nutrient overload, which can cause excessive growth of aquatic vegetation (such as algae)
	pesticides	toxicity
	livestock, wildlife and pet wastes	nutrient overload, pathogens
Forestry operations, construction sites, roads, parking lots, driveways, gas stations, airports, industrial sites	soil/sediment	turbidity
	soil, grease, antifreeze, spilled fuel, solvents	accumulation of organic chemicals in water bodies, oil slicks on water surface, toxicity

Procedure

1. Let's review the definition of a watershed. (An area that is drained by a single body of water.) Let's look at the Barataria-Terrebonne Estuary again. *Display the Barataria-Terrebonne satellite image map.* Remember, Barataria-Terrebonne is made up of two watersheds or drainage basins. *Locate the two watersheds on the image.* We are going to make a watershed model. It doesn't have to be exactly like the Barataria or the Terrebonne watershed, but we can simulate how water drains from our watershed.
2. We have a large piece of plastic laid out on the floor (or ground). Now we need to make some topography, or changes in ground elevation. How can we use some of the objects I have here to change the elevation in the watershed? *Students suggest ways to create topography and put the objects under the plastic sheet to simulate the contours of part of the Barataria or Terrebonne watersheds.*
3. Before we add water to this watershed, where do you think the water will go? *If the water will run off the plastic, then assign students cleanup duty to take care of the spills. Using the water cans or spray bottles, rain on the watershed and have students notice whether predictions of where the water would travel were correct.*
4. Now we'll add other features to the landscape. We have collected cars, tractors, animals, trees and buildings, and we need to add them in appropriate places to complete our landscape. *Use thin sponges to represent marshes in appropriate locations.* What are the different uses we put the land to? A lot of the land is wetlands, but there are urban areas and agricultural areas. What can we add to the landscape to simulate these land-use types? *Other land-use types can be delineated by using permanent markers and coloring them in. Try to keep this simple, so the watershed effect will still work will still work when you add water.*

5. *At this point you may wish to review the water cycle or hydrologic cycle. See Project WET Curriculum Activity Guide, p. 161 and p. 201.*
6. *Spray/sprinkle water on the watershed.* Does all the water just run off the surface of the land and end up in the lake (or river, Gulf, etc.)? *Students suggest other destinations for the water: evaporation, percolating into the soil to become groundwater, being taken up by plants or becoming drinking water for humans (such as Bayou Lafourche).*

POINT SOURCE Water Pollution

7. We can also learn how pollutants move about in our watershed – where they come from and where they go. Two main kinds of pollution enter our watershed. The first is called point source water pollution and the second is called nonpoint source water pollution. Their names describe where they come from. **Point source water pollution** comes from a particular point such as a pipe or a drain. We can tell where the pollution is coming from, so we know what to do to treat and reduce point source pollution. The second kind, **nonpoint source water pollution**, is more difficult to pinpoint because it comes from many places. Often we don't know where it began.
8. Can you suggest any places on the model that could be a source of point source water pollution? *Students suggest point source locations such as an industrial plant, sewage plant and/or storm drain. Locate an industrial plant on the model. Hand a spray bottle that contains a cocoa powder and water mix and have them spray the mixture around the industrial plant.* What happens to the point source water pollution? Where did the "pollution" go? *Students observe that pollution enters the stream via the drainage ditches and/or pipes from the industrial plant.*
9. Industrial plants actually have to follow strict laws to keep the amount of pollution they release as low as possible. If they don't follow the rules, the watershed can become polluted. They also can be fined large sums of money by the Louisiana Department of Environmental Quality, which is charged with monitoring and keeping our water resources clean. To reduce the amount of pollution industrial plants release, the plants have water treatment facilities on site. Their wastewater is treated before being released. The pollutants are removed and often recycled in the factory. This also saves money and conserves resources.
10. Sewage plants can also be a point source for water pollution. What is the job of a sewage treatment plant? Sewage plants clean wastewater from the bathrooms and kitchens of homes, schools, businesses and other buildings in the community – and often stormwater that drains from streets. Sewage plants treat wastewater to remove solid material, pathogenic organisms and harmful chemicals. A sewage treatment plant provides "primary" and "secondary" treatment of wastewater. Water discharged from a sewage plant must meet point source discharge permit regulations as enforced by the Louisiana Department of Environmental Quality.
11. Sewage plants remove pollution from wastewater before it is discharged into the environment. In that way, it protects the health of you and me and reduces our risk of disease. It also protects the environment. *Ask for two volunteers – hand one the spray bottle filled with the cocoa/water mix and the other the water spray bottle. Have the first volunteer spray the mixture into the clarifier tanks of the sewage treatment plants until they are almost full. Have the second volunteer spray water into the clarifier tanks until they overflow.* What just happened? Because the clarifier tanks overflowed, untreated water entered the watershed. When could this happen in real life? This could happen during a heavy rainstorm when the plant can't handle all the water. Sometimes the sewage treatment process breaks down, too, causing improperly treated water to get into the watershed.
12. What problems can untreated or improperly treated sewage cause? Yes. It can make people sick. This is because sewage contains harmful bacteria and viruses as well as large amounts of nutrients that can cause problems in the environment. You definitely don't want to swim in or drink water polluted with improperly treated sewage.
13. Another source of point source pollution is from storm drains. What do storm drains do? Storm drains drain water off the streets during a heavy rainfall. Where does the storm water go? Most communities in Barataria-Terrebonne storm water goes into a ditch or canal and is pumped out into the nearest body of water. In smaller communities, and communities outside a hurricane protection levee, storm water may run directly into a roadside ditch and drain into a wetland or marsh nearby. [*Some communities do treat storm water. Check with your community public works or sewage department about this point.*]

14. Why is pollution in storm drains point source pollution? Because it is usually discharged from a pipe. *This point can get a little confusing and technical. Smaller communities may treat storm water runoff from streets as nonpoint source pollution. However, in larger cities, storm drain discharge may require a discharge permit from DEQ, making it point source pollution.*
15. Do people sometimes use the storm drain to dispose of things? What have you seen people putting in storm drains? Some people dispose of used motor oil, household chemicals, etc. Let's see what happens if we use the storm drain to get rid of our waste oil. Have a volunteer spray the cocoa/water mixture (representing oil pollution) into the streets of the town. Have another person spray additional water (representing rain). Where did all the pollution end up? It ended up in the lake/ocean.

NONPOINT SOURCE Water Pollution

16. Have you noticed how most parking spaces in a parking lot have oil spots in them? When it rains, what happens to that oil and grease? When it rains on our towns, our yards, on farms, forests, construction sites and golf courses, substances such a fertilizers, pesticides, oils, grease, trash, etc., that are on the ground, may get washed off into ditches, gullies, streams, bayous, rivers, canals – and eventually into the main receiving basin or waterbody.
17. Where can we find **loose soil** on our watershed model? Loose soil can be found on a plowed field, construction site, tree harvesting operation, stream bank erosion site, etc. *Have a student sprinkle cocoa powder in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the soil.*
18. Where might **pesticide** be applied on our landscape? Pesticide can be applied to golf courses, yards, farm fields, canal and stream banks, etc. *Have a student sprinkle the red drink mix powder in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the pesticide.*
19. Where would **fertilizer** be used in our landscape? Fertilizer can be applied to golf courses, yards, farm fields, canal and stream banks, etc. *Have a student sprinkle the green drink mix powder in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the fertilizer.*
20. Where do we find **oil and grease** on the ground? Oil and grease can be found in places such as parking lots, driveways, streets, and gutters. *Have a student spray the cocoa/water mix in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the oil and grease.*
21. Where might we find **animal droppings or manure**? Manure can be found in farm fields where there are cows, horses or other farm animals, or on residential lawns were there are pets. *Have a student spread the cocoa paste in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the manure.*
22. Where do people drop **litter**? Litter can be found on roadsides, parking lots, beaches, ball parks, etc. . *Have a student litter in one or several of the places suggested. Have another student make "rain" by spraying the watershed with water from a spray bottle. Have students note where the water takes the litter.*
23. What happened to all the various nonpoint source pollutants we added to our landscape (or watershed)? What does the lake look like now? Much of the pollution ended up in the lake and the lake looks very polluted, but some remained on the ground or in the ditches.
24. Is this what happens in real life? *Students suggest similarities and differences between the simulation and real life nonpoint source pollution.* What are the possible consequences of this nonpoint pollution in our environment? Students brainstorm concequences of nonpoint source pollution either as a whole class or in their groups. Each group can write the consequences and share with the whole class.

Blackline Master

none

Assessment

- none.

Resources

BTNEP Resources:

Portrait of an Estuary, publication by LSU AG and BTNEP

Websites:

Earthtrends, World Resources Institute, 2005, **Watersheds of the World: North and Central America - Mississippi Watershed**, accessed July 11, 2005, at http://earthtrends.wri.org/maps_spatial/maps_detail_static.cfm?map_select=390&theme=2.

Nice map of the Mississippi River watershed.

Terraserver Website, accessed July 13, 2005, at http://www.terraserver.com.

Excellent website to locate and download maps and aerial images of specific locations anywhere in the USA..

Topozone Website, accessed July 13, 2005, at http://www.topozone.com.

Excellent website to locate and download topographic maps anywhere in the USA..

References:

USGS Topographic Map website, April 28, 2005. Accessed July 13, 2005 at http://erg.usgs.gov/isb/pubs/booklets/symbols/.

Information on reading and interpreting topographic maps.

About.com website. 2005. **How to read a topographic map**, accessed July 13, 2005 at http://geography.about.com/library/howto/httopo.htm.

Simple steps to topographic map interpretation. Related links.