



## EnviroScape Water Pollution Lesson Plan

- I. What is Pollution?
  - A. Allow students to brainstorm different types of pollution.
  - B. Then tell them what pollution is: harmful substances deposited in the air, in the water, or on the land.
  - C. Today's lesson will focus on water pollution; what causes it and how we can help prevent pollution.
  
- II. Watershed
  - A. Explain that this model is a "watershed". A watershed is simply an area of land that drains into a particular body of water. The rainwater that falls on the land flows down hills and slopes and drains into a creek or river. Many watersheds make up a much larger "river basin" or "lake basin". For example, most of Genesee county is located within the Flint River Watershed, which is part of the Saginaw Bay Watershed, which is part of the Great Lakes Basin.
  - B. Point out the various areas in the watershed model: the construction area, farm, subdivision, industrial plant, riverbanks, and golf course.
  - C. Explain that everyone lives in a watershed and has a watershed address. Some students might know which body of water is nearest to their home or school. While most of Genesee County is located in the Flint River Watershed, a small section in the Southwestern area of the county lies in the Shiawassee River Watershed and small portion at the North of the county lies in the Cass River Watershed. The Flint River Watershed can be divided into 16 sub-watersheds. Make sure to know what local river and creeks are located around the school and know what sub-watershed your school is located within.
  
- III. The Two Types of Water Pollution
  - A. Point Source Pollution
    1. Point source pollution can be traced back to specific source.
    2. Some examples include:
      - a. Industrial Plant (point to building with pipe) we often refer to this as the "Pokemon Plant" which makes Pokeman cards, plastic toys, etc. You can refer to the plant as anything you would like-for older kids refer to the plant as an electronics plant.
      - b. Sewage Treatment Plant (building near the deforested area)

*Enviroscape Action: pour the cocoa/sludge mixture from the small bottle into both of these areas. For the Industrial Plant, squirt the mixture into the top of the plant and watch it flow through the pipe and into the*

*water/creek. For the Water Treatment Plant, squirt the mixture into the two round recessed areas in front of the plant. These represent the sewage tanks.*

3. Have students watch the results. The “pollutants” are discharged directly into the water.
4. Explain that industrial plants sometimes have accidental discharges into the water and the water treatment plants can sometimes malfunction (lightning strikes) and discharge sewage into the water.

#### B. Non Point Source Pollution

1. Non point source pollution originates from many sources. Each time it rains, run-off from the streets picks up litter, car lubricants, pet waste, excess fertilizers and pesticides, leaves, etc. These pollutants reach our waterways via wind, storm drains, and general run-off.
2. The EPA (Environmental Protection Agency) has determined that non point sources are the main cause of our nation’s water quality problems. Most people think that industry is responsible for the majority of our nation’s water quality problems, but that is not true.
3. Examples of non point source pollution include:
  - a. Loose Soil

*(Enviroscape Action: sprinkle cocoa on the following listed sites)*

1. Construction Site: Loose soil is often found where there is construction
2. Deforested Areas: A forested area has lots of trees and vegetation, a deforested area does not. Think of when new developments are being built. The land is cleared to build new buildings and as a result, there is new loose soil.
3. Shores of Rivers, Lakes, Creek Areas: Along the banks of water bodies, rainwater washing over the banks causes erosion.
4. Plowed Farm Field: Farmer’s plow their fields to prepare for planting a good crop. This can create loose soil

*(EnviroScape action: Using one of the water bottles, make it “rain” over the areas where you have sprinkled cocoa and over areas from the point source of pollution (i.e. the industrial plant and the water treatment plant.))*

Now discuss that when it rains, the rain water runs off our roof Tops and down the streets. While doing so, it picks up and carries pollutants with it. The rainwater travels either directly into a river/stream or travels down the storm drains where it then flows

into our rivers and streams. Point to the cocoa “dirt” that has now entered the big water body.

b. Fertilizer and Pesticides

Ask the students what fertilizers and pesticides are. You may need to prompt their answers. Fertilizers are nutrients that help plants grow nicely and help yards become greener. Pesticides are used to get rid of bugs and other pests.

*(Enviroscape Action: sprinkle gelatin powder on the listed sites. Use red for pesticides and green for fertilizer.)*

1. Farm Fields: The farmer wants his crop to stay free of pests and to grow well so that he has a crop to sell.
2. Homes: The homeowner would like their yard to look nice and green and to get rid of all the weeds and bugs.
3. Golf Course: Golf course owners want their golf courses to look attractive and green.

c. Car Lubricants and washing materials

Mention that cars, trucks, construction vehicles, etc. leak liquids (oil, antifreeze, grease, etc.) when not properly maintained. You often see dark spots on paved areas where this has happened. Ask students if they have ever seen a shiny multicolored layer on top of a rain puddle. Explain that this is oil. Some people also wash their cars at home in their driveways.

*(Enviroscape Action: Use cocoa and water mixture in “sludge bottle” and squirt on these areas as they are discussed)*

1. Driveways: Sometimes people wash their cars in their driveways. When they do this, all the dirt and grime on their car and the soap they use to wash their car runs off into the stormwater drains.
2. Roads and Bridges: When cars aren’t properly maintained, they can leak oil, transmission fluid, and antifreeze as they drive around.
3. Parking Lots: If cars are leaking, they will leak their liquids onto the blacktop where it will wash away into our rivers and lakes.

*(Enviroscape Action: using one of the water bottles, make it “rain” over the areas where you have sprinkled fertilizer and pesticide gelatin mix and the areas you squirted “slurry” representing lubricants.)*

Again, point out that the rainwater carries these pollutants directly into bodies of water. Look how dirty the water is becoming. Prompt the students to think of how this might affect our water quality and aquatic life.

d. Storm Drains

*(Enviroscape Action: using the cocoa/water “slurry” bottle, squirt some down the storm drain tubing (near the houses) and watch the mixture come out of the other end of the tubing near the water body.)*

Explain that storm drains are found on the curbing in neighborhoods and along all streets and are designed to allow rainwater to flow off of the pavement. Oftentimes people pour things directly down a storm drain (such as paint, motor oil, household chemicals, etc.). All storm drains lead straight to a body of water without first being treated. We should never pour anything down a storm drain. They are designed only for storm water.

e. Animal Waste/Fecal Matter

*(Enviroscape Action: using the cocoa/water “slurry” bottle, squirt on these areas as discussed.)*

1. Farm Animals and Geese: Oftentimes, farm animals walk directly in the creeks and deposit animal waste. This animal waste leaves bacteria (called fecal coliforms) in the water. Sometimes, the animals are further back from a stream, yet the bacteria from the waste get washed into the water in a heavy rain.
2. Pet Waste: We often walk our pets in our neighborhoods and even along stream banks. Using the dog figurine pretend to be walking the dog. Usually we do not pick up after our pets, but we must learn to do so. This would help prevent the build up of fecal coliform in the waters.
3. Septic Tanks Not Properly Maintained: (optional – better for older students) Point to the subdivision area and mention to the kids that older septic tanks may not function properly or that they have not been properly maintained from the beginning. This can result in human waste making its way to our water.

f. Litter and Trash

*(Enviroscape Action: Sprinkle the colored sprinkles at various places around the map to illustrate litter. Litter can be carried into the water by wind or rain.)*

*(Enviroscape Action: Using one of the water bottles, make it “rain” over the areas where you poured slurry representing animal waste, septic tanks, and make it “rain” over the litter.)*

IV. Why are these pollutants harmful to our rivers and streams?

A. These pollutants affect Water Quality and Aquatic Life

1. Fertilizer is a nutrient, it is food for plants – Fertilizers contain chemicals like nitrogen, phosphorous, and potassium that plants use to grow big. When these chemicals go into our lakes, they can also cause algae to grow. Remember, algae are plants that can use fertilizer to get bigger. Too much algae is a problem, though. When lots of algae die, they use up the oxygen in the water to decompose. This is a problem for fish because they need oxygen to breath. Too much algae at the surface of the water can also block sunlight from reaching other plant life at the bottom of lakes.
2. Pesticide is toxic. When pesticides enter our water bodies they can be transferred to organisms living in the water. For example, fish can absorb pesticides through their skin by swimming in the water. They also breathe in pesticides through their gills. Fish might also drink the pesticide-contaminated water or feed on other organisms that have eaten pesticides. Other animals eat fish, and thus the pesticide toxins travel up the food chain. When fish eat, drink or breathe pesticides, it can cause them to have trouble reproducing, to be more susceptible to diseases, and to have trouble escaping from predators.
3. Loose soil adds sediment to our water. Loose soil increases the cloudiness of the water, which increases the temperature, and decreases the amounts of oxygen in the water. The sediment also forms like a “slip-in-slide” on the lake floor and many organisms cannot lay eggs and reproduce. Sediment can also build up on the bottom of a river or stream, which affects the depth of the water. This could then cause a problem for boating and recreation.
4. Animal waste and septic sewage adds harmful bacteria to the water. This can cause people and animals to become ill. Excess sewage in a body of water can even cause officials to close portions of a lake for swimming and recreation.
5. Litter can injure people and animals and can even block storm drain pipes, which could lead to flooding.

V. What can we do?

- A. Ask students to brainstorm some things we can do to help prevent these pollutants from entering the rivers and streams. In the environmental field, we call them BMP’s (Best Management Practices).

B. Listed below are some things we can all do, you may want to mention a few that the students can relate to.

1. Household Activities
  - Do not litter (if you see litter, pick it up), dispose of waste in the trash
  - Do not pour anything down a storm drain (including grass clippings)
  - Be a smart shopper; read labels and try to buy items that are least toxic
  - Dispose of chemicals properly – there are special “drop-off” places and times in Genesee County for this
  - Pick up after pets
  - Maintain septic tanks
2. Lawns and Golf Courses
  - Use fertilizers and pesticides properly and do not overuse
  - Try not to fertilize right before a heavy rain
  - Plant trees, shrubs, and vegetation. This helps slow the rain runoff and absorb some of the pollutants
  - Consider using organic fertilizers (manure or compost)
  - Do not allow soil, leaves, grass clippings, etc. to accumulate on the driveway or on the street (compost them)
3. Construction Site
  - As temporary measures, the developer can use silt fencing and hay bales to help prevent loose soil from washing into the roads
  - For permanent measures: planting trees, shrubs, etc. will help prevent runoff
4. Driveways/Parking Lots and Roads
  - Keep cars tuned up to help prevent leaking lubricants( and reduce air pollution)
  - Anti-freeze is very toxic and has serious oxygen depleting characteristics. Motor oil can damage or kill underwater vegetation and aquatic life. Just one quart can contaminate 2 million gallons of drinking water.
5. Streambank, Lakeshore, and Forest
  - Mention (place felt strips) to represent vegetation. Planting trees, shrubs, etc. will limit runoff and help filter out pollutants and prevent erosion.
6. Farm
  - Place fencing around the farm animals to keep them out of the stream (they will need an alternate source of drinking water)
  - Berms (You can illustrate by rolling a small piece of clay and placing it across the plowed field where it enters the lake). This will help slow down the rainwater running off of the land.
  - Some farmers use manure containment (use clear plastic cap)
  - Some farmers use contour plowing, plowing across the field so the water runs away from the lake.

VI. Close Lesson

**Please follow the guidelines for cleaning the Enviroscape model and return it in CLEAN, DRY condition.**