Title

Mississippi River Watershed

Objectives

- Students understand that watersheds drain rainfall and melting snow into the nearest waterbody that lies at the lowest point of the watershed.
- Students can identify point and nonpoint sources of pollution on a model watershed.
- Students can propose and test methods for preventing pollution in a model watershed using everyday materials.
- Students understand that a body of water may be polluted by human activities within the watershed and responsible persons may be difficult or impossible to identify.

NGSS

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity

Materials (per group)

If creating your own watershed:

- Large sheet of foil or small tarp
- Large aluminum roasting pan
- "Pollutants" (described below) for watershed, including:
    - sludge squirter
    - pesticide shaker
    - fertilizer shaker
    - soil shaker
    - pieces of Styrofoam
- 2-3 aluminum cans
- Spray bottle filled with water
- Accessories for watershed: 1 house, 1 car, 1 bulldozer, 1 tractor, 2 trees, 1 cow
- Instructions on how to shape the watershed and place the accessories [available through LL &W?]

If using Enviroscape Model (best for groups of 16+):

*LL&W owns 4 Enviroscape models, allowing 10 students around each model.

- Spray bottle filled with water
- "Pollutants" for watershed, as listed above

Preparation/Class set-up

- If using the Enviroscape models, teachers should have the watershed model assembled and ready prior to the presentation. All cars, buildings, trees, bridges, cows, *etc*. should be placed on model.
- Projector should be turned on and PowerPoint presentation ready prior to class.
- Students should separate into equal-sized groups
- Supplies need to be pre-filled and/or mixed and ready:
    - The sludge mixture is in a 3-oz squeeze bottle. Fill 1/3 full of cocoa powder. Add enough water to fill. Shake until mixed.
    - Pesticide is in a 3-oz plastic bottle with a salt-shaker lid. Fill with contents from a red drink mix (e.g. Kool-Aid). Do not add water.
    - Fertilizer is in a 3-oz plastic bottle with a salt-shaker lid. Fill with contents from a green drink mix (e.g. Kool-Aid). Do not add water.
    - Soil is in a 3-oz plastic bottle with a salt-shaker lid. Fill with cocoa powder. Do not add water.
- Accessories and bottles should be placed in a separate container for each group

Activities

Part 1: Watershed Model

- Using the first slide of the PPT presentation, explain what a watershed is. After showing first slide, turn students' attention to the watershed model. The following is a script to follow:

Let's take a look at this model watershed. This watershed has many of the features we'd expect to find on rural and suburban landscapes throughout the Midwest. We have a construction zone and a golf course next to a residential area, a forest, a sewage treatment plant, an industrial factory, and a farm with a cow pasture and plowed fields. We also have ditches and streams that flow to a lake, which would be considered the waterbody of this watershed. Many of the features in this watershed produce either point sources or nonpoint sources of pollution that will affect the water quality of the lake. Notice the black dotted line signifies the boundaries of the watershed along the peaks of surrounding hills and mountains. That means any rain that falls on this side of the line drains this way, while all of the rain that falls on that side of the line drains that way. Each of you is now going to build a model watershed of your own.

- Pass out materials- map, instructions, shakers, bottles, aluminum sheets, pans, and cans, accessories
- Following the instructions on the handout step by step, build your watershed. We'll give you about 5 minutes to complete your watershed.
- Simulate rain by using a spray bottle set to mist

All the water travels along ditches and streams and eventually enters the waterbody, a lake (point to the lake).

- If your water does not all eventually flow to your lake, you may need adjust the shape of your watershed so that you have one main waterbody.
- Have students dry off the watershed at this point.

Now we will demonstrate how water pollution occurs in a watershed. Earlier, we learned about two types of pollution- point sources and nonpoint sources. What is the difference? (Students raise hands)

<u>Point sources of pollution</u> can be easily identified because they discharge pollution through a pipe. What sources in your watershed are point sources? (Students raise hands) Sewage treatment plant, industrial plant, and storm drain outfall. Pick up your sludge squirter and squirt sludge into the top of your industrial plant and notice how it discharges out the pipe into the river. Now put a few drops of sludge into your clarifier tanks of your sewage treatment plant. Finally squirt some sludge into your storm drain and notice it drain through the outfall pipe. Now spray your watershed with your water sprayer to simulate rain. What happens to the discharge from the storm drain outfall and the industrial plant (students raise hands). It flows downstream and is carried to the waterbody. What happens when rain falls on the clarifier tanks? (Students raise hands) Some of the sludge overflows and travels downstream to the waterbody. Now some overflow is normal, because most of the polluting material settles to the bottom of the clarifier tank, and the overflow water is treated and relatively clean. But during a very heavy rain event, the overflow will be untreated and polluting.

Let's move on <u>to nonpoint sources of pollution</u>. What do you see in your watershed model that could be a nonpoint source of pollution and why? (Students raise hands and the following are some possible answers, but only need to address 2-3 of these before moving on)

  - Construction area: soil erosion
  - Residential area: pesticides and fertilizers on lawns
  - Golf course: pesticides and fertilizers (this one is only on the Enviroscape model)
  - Farm (cow pasture): manure runoff and stream trampling
  - Farm (plowed field): soil erosion, pesticides, fertilizers
  - Clear cut forest: soil erosion
  - Roads, parking lots, driveways: oil, grease, antifreeze, litter
- (It is important to ensure that the watershed is dry before moving on. Otherwise the powders will become brightly visible as soon as they are sprinkled. It is better to see them suddenly appear when it rains)
- <u>To illustrate soil</u>, sprinkle ½ tsp cocoa on construction site, lakeshore, forest, plowed field on the farm.
- <u>To illustrate pesticides and fertilizer</u> sprinkle drink mixes on lawns, golf courses, and plowed field on the farm.

- To illustrate oil and grease, squirt a few drops of sludge mixture on roads, driveways, and parking lots.
- To illustrate manure and pet waste, mix cocoa and water to create a paste and place small amounts on pasture and residential yards.
- Make tiny bits of trash out of Styrofoam and put them on roads, ditches, parking lots, and other places throughout the watershed.
- Now spray each area using the spray bottle filled with water to simulate rain. Watch the rain as it runs off the streets, parking lots, and the land. You can see it pick up the soil and contaminants, carrying them to the waterbody. This flow is called runoff.

Now we will demonstrate how to slow down or prevent pollution of our water body.

- Add pieces of sponge or paper towel strips throughout the watershed in key areas to simulate wetlands and riparian buffer zones. Add more pollution just upstream of these barriers and spray water bottles over the pollution. Students should notice that the sponges soak up polluted water, preventing it from reaching the water body, and paper towel strips do the same.
- **Cleanup:** Empty sludge containers. If these are not emptied, they begin to smell like real sludge….

Part 2: Mapping your watershed

- Give each group a laminated map of the United States. Show the same picture on the screen (second slide of PPT).
- Explain that the Mississippi River Watershed is one of the biggest watersheds in the United States. Thirty-one states and two Canadian provinces comprise the watershed. Ask students to label the 31 states (give them about 3-5 minutes)
- The next slide shows the answers. Tell students to circle each state they got correct. Ask if any students got them all right. Find out who got the most.
- The next slide shows a physical map of the US, indicating that the Rockies and Appalachians create the western and eastern boundaries of the Mississippi River watershed. Ask students if they know the names of these mountains and why they are the boundaries.

Assessment

Show examples of best management practices currently set in place to protect waterways from point and non-point pollution.