



LESSON 4: What is a Watershed?

OVERVIEW

Students create a watershed to explore its functions and importance. By using a hands-on model, they will understand how pollutants and other contaminants, even when released from far away, can affect the health of our water.

Learning Targets

- Students will investigate models to define a watershed as a land area from which water drains into a receiving body of water.
- Students will investigate models to conclude that as rainwater moves down a watershed, it picks up natural and human-made pollutants and carries them downstream into bodies of water.
- Students will demonstrate how the choices we make as individuals affect others who live in the same watershed.

GLEs

See attachment

Materials Needed

- TV or computer with Internet access (optional)
- Plain scrap paper (8.5" X 11"), or sections of butcher paper
- Spray bottles with water
- Water-based markers
- Large piece of poster board or newsprint
- Paper clips

Background Information

What Is A Watershed?

A watershed is an area of land where all of the water that falls on it goes to a common outlet such as a river, lake, bayou, etc. In most other parts of the world, a watershed is known as a drainage basin. Watersheds are created by topographical features like ridges, hills, mountains, etc. that create a perimeter which forces water to flow to a common outlet.

A watershed contains all of the surface water, and all of the underlying ground water.



Watersheds Vary

Watersheds can be various sizes, which are defined by the common outlet you're observing. For example, rain falling on your home or school may drain into a storm drain – and you are part of that storm drain's watershed. However, that storm drain likely outflows into larger waterways and into the Gulf of Mexico. This makes you part of the Lower Mississippi watershed as well.

An analogy can be found in the U.S. Geological Survey, where watershed management is organized by Hydrologic Units. The largest unit is known as a region, and there are currently 22 of these. Inside these regions are smaller and smaller units of management. The smallest unit of management in this system is the sub-watershed, and there are over 160,000 of these!

Permeable Surface vs Impermeable Surface

When precipitation falls down, some of it will soak-in, or infiltrate the soil. Some of the water that has infiltrated the soil will gradually move downhill to an outlet point, while the rest will infiltrate even deeper to an aquifer. Even in an aquifer, the groundwater will eventually flow to an outlet. Water that does not infiltrate the soil will flow on its surface as runoff.

The type of soil, slope, soil saturation, and rate of precipitation all have an effect on how much precipitation will infiltrate vs. runoff. Another factor that greatly influences infiltration is the land cover. Some surfaces are "hard," and do not allow infiltration. These are called impermeable surfaces. Roofs, driveways, parking lots, and streets are examples of impermeable surfaces. Since water cannot infiltrate these surfaces, the precipitation moves quickly as runoff to the nearest outlet. This can contribute to flooding. The runoff can also "pick up" a variety of chemicals and materials that can affect water quality.

Pollution In Watersheds

As watersheds carry and hold water, they are often subjected to a variety of human activities that contribute to pollution of the water.

Point source pollution comes from a single identifiable source. For the purposes of water pollution, this often means a pipe coming from a factory or sewage treatment plant. Many older cities include storm-drain water with waste water to be sent to the sewage treatment plant. During large rain events, the capacity of the plants is exceeded, and the untreated rain-sewage mixture overflows directly into rivers or streams. Certain large-scale animal farms also produce point source pollution.

In contrast, *non-point source pollution* comes from a variety of different sources. Most occurs as a result of runoff. Some examples of non-point source pollution would be the oil that drips from cars, household pesticides, chemical detergents, trash and debris, and sediments from construction or farming. Non-point source pollution contributes more to total water pollution than point source, and is more difficult to control because it is generated from multiple locations.

The Gulf of Mexico Dead Zone

One of the striking consequences of pollution is the Gulf of Mexico dead zone. The dead zone is an area of hypoxic (low oxygen) water that appears each summer off the coast of Louisiana. It varies in size, but is influenced by the amount of nutrients (like nitrogen and phosphorous from farms and sewage discharge from municipalities) that is in the Mississippi River. The excess

nutrients create an overabundance of food for algae, which explode in population. Eventually the algae die. Bacteria consume oxygen from the water as they decompose the algae. Larger marine organisms that cannot escape the hypoxic conditions die, impacting the food web – including commercial fisheries.

Sources

- <https://water.usgs.gov/edu/impervious.html>
- <https://oceanservice.noaa.gov/education/kits/pollution/04nonpointsource.html>
- <https://oceanservice.noaa.gov/education/kits/pollution/03pointsource.html>
- <https://serc.carleton.edu/microbelife/topics/deadzone/index.html>

ACTIVITY (Suggested for grades 1 to 4)

Part I

1. Hand out the paper to each student or, if in groups, one piece of butcher paper.
2. Tell the students to crumple up the piece of paper and then smooth it back out most of the way. It should still be a bit crumpled, showing small ridges (high points) and valleys (low points).
3. Ask the students to imagine that this paper is a section of land, and to find the ridgelines (the tops of the fold-lines).
4. Have the students use a washable blue marker (not permanent) to color along the ridgelines on their “land.”
5. Explain to the students that they are going to make it rain on their watersheds. Ask them the following questions:
 - What do you think will happen to your land when it “rains?”
 - What will happen to the blue ridge lines you colored?
 - Where will the “rainwater” travel?

Part II – Crumpled Paper Watershed

1. Have the students use a spray bottle of water to create a “rainstorm” over their land. They should create gentle sprays of water. Have them observe what happens after every misting. Did this match their predictions?
2. As the “rainfall” accumulates, observe the pathways where the excess “rainfall” travels.
3. With their fingers, have the students trace their streams all the way back up to where they start at the top of the ridge. (This should be a path of blue ink.) When they reach the top, this is the edge of the watershed. Have students identify and compare the different bodies of water formed such as streams, bayous or lakes.
4. Have them trace the entire edge of the watershed with a finger, by following the ridgeline. This will be something like tracing the edge of a bowl. Explain to the kids that all of the inside, downward-sloping area they have just outlined is the watershed of a stream, bayou or lake. Explain to students the definition of a watershed, using their models to illustrate the concept.
5. Explain to students that they will now create some towns, farms and refineries in their landscape. Students will mark refineries with a red “x”, towns with a purple “#”, and farms with brown colored-in squares.

6. Have a short discussion with the students about what kinds of pollution the refineries, cities and farms may create.
7. Have the students make it rain again. Where did the pollution from the refineries, towns and farms go? Did it pollute their lakes or streams? Did any of their towns or farms get flooded? What happens if you build homes at the bottom of a watershed?

Part III – Digging Deeper

1. Using a blue marker, draw and color a river on poster board. Divide the river in half down the middle and crosswise into sections. Each section should include a bit of river and blank space to allow room for students' drawings. The number of sections should correspond with the number of students or groups of students working together. Number the sections on one side of the river in sequential order, placing numbers in the upper left-hand corners and repeat for the other side. Cut out the sections of stream. For durability, sections can be laminated.
2. Inform students that they have just inherited a piece of riverfront property and they've won the lottery. Have them brainstorm ways they could use the land and money.
3. Pass out the river sections. This is the students' property. Explain that the blue is water and the blank space is land they own. Since they've won the lottery, they can do whatever they wish with the land. Have students use the colored pencils to complete their drawings of their land.
4. When students have completed their drawings, have them look on the back of their property for a number and explain that each piece is actually part of a puzzle – of a bigger landscape. Starting with number one, direct the students to assemble their pieces.
5. Now that the watershed is complete, have the students explain what they did with their property. Have them identify how their development may have added pollution to the river. Have them place a paper clip (or any trinket) in the river to represent each way they pollute the stream.
6. Have the students grab their pollution trinkets and line up in the same order as their pieces of riverfront property. From the previous activity, ask them what is going to happen to the pollution when it rains (it's going downstream!). Have the first students begin to pass on their pollution to the next person in line, stating what kind of pollution it is. Do this with the second students in line, etc. By the end of the stream there should be quite a collection. How do the students downstream of the pollution feel about this? How can the property owners work together to resolve this conflict?
7. Have the students imagine that this "river" was in fact the Mississippi River (or another local river). Where is the end of the Mississippi River (or other local river)? What happens when rain carries pollution and trash down the river? Where does it end up? The U.S. Geological Service provides a service that students can use to trace the path that surface water takes in Louisiana. Go to <http://water.usgs.gov/streamer> to use this tool.

CALL TO ACTION

What can you do to prevent pollutants from ending up in our rivers? Brainstorm as a class an advocacy or educational awareness project to help your community understand runoff into the watershed.

OTHER RESOURCES

- **Keep Louisiana Beautiful** <http://keeplouisianabeautiful.org/>
- **Keep America Beautiful** <https://www.kab.org/>
- **What is a Watershed Video** <https://www.youtube.com/watch?v=QOrVotzBNto>
- **Electronic Fieldtrip to a Watershed** <https://www.ket.org/trips/watershed/>
- **Interactive Louisiana watershed map** <http://maps.lsuagcenter.com/watersheds/>
- **Show the students the following video from Bayou2Bay.com. This is a time-lapse video of the watershed from Byrd High School to Bayou Pierre toward the Atchafalaya Basin in the Gulf of Mexico. It will demonstrate to the students the path that water travels from the top of our state all the way to the bottom.** <https://youtu.be/imoAxC7JK7g>
- **Crumpled Paper Watershed activity taken from "Alice Ferguson Foundation, Hard Bargain Farm Environmental Center"**
- **Digging Deeper adapted from Project WET's "Sum of the Parts"**