4. Watershed Detective

Skills:
Investigating, team-building, imagining, predicting, observing, evaluating

Purpose:
Students will be introduced to the concept of a watershed and how they function.

Time:
1 class period

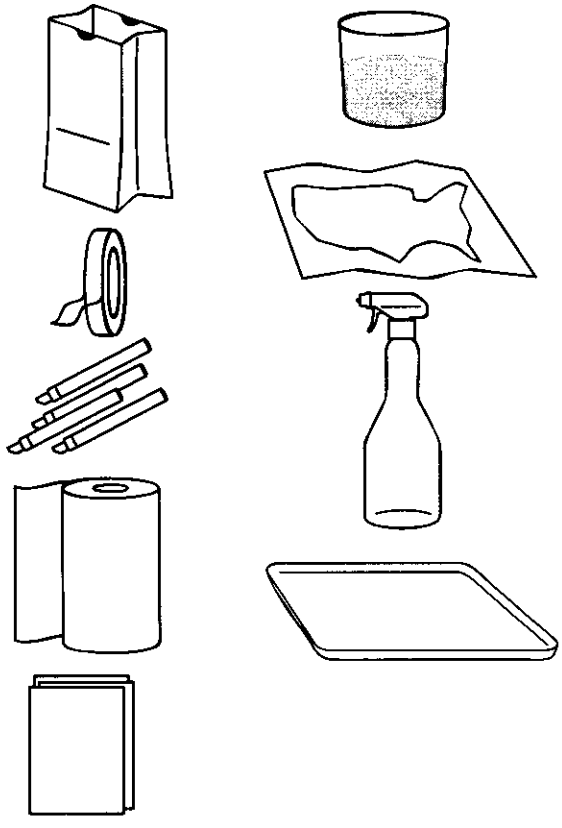
Setting:
Indoors

Materials:
- Student Activity Sheet
- Shallow pan
- Brown paper bag or large pieces of heavy-duty white or brown paper (3-ft. x 3-ft. piece for each group)
- Blue washable or soluble marker
- Red, brown, and green permanent markers
- Spray bottle of water
- Food coloring or a variety of colored powders (e.g., cocoa, fruit drinks) to represent pollution
- Small cup of sand and potting soil
- Clear cellophane tape
- Paper towels or sponges for clean-up
- Topographical map of the United States or Georgia (optional)

Background:
The land we live on is divided into watersheds. A watershed is a land area whose runoff water drains into any river, stream, lake, or ocean. Small watersheds, such as the watershed for the creek behind your school, or the watershed for the pond down the road, drain into small bodies of water and cover small land areas. The runoff from small watersheds joins together, and their combined areas become a new, larger watershed.

Despite their differences in sizes, all watersheds share common properties. They all perform the same function of transporting water over Earth's surface. The watersheds encompass suburban lawns, parking lots, and city streets. Water seeps down through the soil to aquifers, which are underground rivers that slowly move water below watersheds to outlet points at springs, rivers, lakes, and oceans.

Many human activities affect watersheds. Construction projects like dams can limit the flow of water. New roads and buildings can divert and even increase the flow of water. Agricultural fertilizers can run off crop fields and inadvertently fertilize harmful microorganisms in rivers and lakes, impairing water quality and marine life. The irresponsible disposal of household and industrial chemicals can be harmful because they travel through the watershed, poisoning life and damaging natural ecosystems.



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Watersheds can also affect humans. Many communities use rivers and streams as their sources of drinking water. Water treatment plants prepare this water for human consumption, but if the water is laden with chemicals and microorganisms, it can be difficult to treat effectively.

Floods are one of the major events that can occur in a watershed. Homes built on **floodplains** are susceptible to flooding when heavy precipitation exceeds the watershed's capacity to absorb water. Rivers, streams, and lakes overflow, threaten human lives, and damage or destroy roads, buildings, and flood control measures. Watersheds can also experience droughts, causing water shortages for those who depend on lakes and rivers for drinking water.

It is clear that humans have a close relationship with watersheds. The responsible planning of watershed use and development is important to ensure the ecosystems sustained by the watersheds are not destroyed, and to protect the health and safety of our communities.

Procedures:

1 Define and discuss: **watershed, tributary, major stream, pollution, catchment basin, drainage basin,** and **impervious surface**.

2 Optional: Have your students study a topographical map of the United States or Georgia. Ask one student to locate a major river on the map. With their finger have them trace the course of the river from its headwaters to its mouth. Now trace the land that forms around that river and drains into it. Choose another student to locate a large lake on the map. Have them determine what land area drains into it.

3 Divide your students into groups of 3 or 4. To prepare for the activity, provide each group with a large piece of paper. Have them crumple it up. Slightly unfold or partially smooth out the paper, so that it resembles the rough, irregular surface of a hilly landscape with dips and peaks. Students can make slight adjustments so that it resembles hilly or mountainous terrain. The idea is to be able to identify landscape elements that approximate tributaries, valleys, and ridges or watershed boundaries. (Ridges are the narrow, somewhat linear high points that separate adjacent valleys, in which streams might flow.)

4 Place the paper in a shallow pan.

5 Have your students imagine that a rainstorm is approaching. They need to decide where the water will flow. Each groups needs to assign one person to identify potential streams by having them draw lines with blue marker along their paths. Another student outlines the highest ridges that separate all the adjacent streams by drawing brown lines along their edges. The third student should draw houses and roads with the red marker. And the fourth student indicates green spaces (forests, fields, etc.) with the green marker.

6 After looking vertically down over the landscape that they have created, have the students draw a map view of the river system, including all the tributaries, on their student activity sheet. This map should also include the outline of the ridges in a different colored marker or pen, with arrows showing the direction of flow of their predicted streams and rivers.

7 At this point, stop the group and tell them that you think you hear a storm coming. Instruct them to leave their watersheds as-is, and push back their desks to create an open space or move to an open area for...

8 The THUNDERSTORM! (From *Project WET* 1996, "The Thunderstorm" p. 199.) When the entire class performs the actions in unison,

the effect is the sound of a thunderstorm as it builds, then dissipates. Ask students to stand in a semicircle in front of you. Explain that when you make eye contact and point to a student, he or she should imitate your motion. The student should continue making the motion until you make eye contact again and show a new motion. Continue the motion as you make eye contact and point again, showing a new motion. Start with a student on one end and begin with the first motion. Continue the motion as you make eye contact with each student down the line. Return to the first student and start the second motion. (This will create a crescendo as the sounds produced move from one end to the other. Using this strategy, lead students through the following series of motions:

- Rub your hands together
- Snap your fingers
- Clap your hands together in an irregular cadence
- Slap your hands on your legs (optional: at this time, a student flicks a light switch on and off to represent lightning, while another beats a drum to symbolize thunder)
- Stomp your feet
- Slap your hands on your legs and stomp your feet (represents height of storm)
- Stomp your feet
- Slap your hands on your legs
- Clap your hands together in an irregular cadence
- Snap your fingers
- Rub your hands together
- Open palms (quiet)

9 When all students are standing with open palms, have them remain silent for a minute to think about the exercise and to catch their breath. Now it's time to see the effect the storm has had on their watersheds and to see if their predictions were correct in identifying potential streams on their watershed models.

10 The ridges are high, the valleys are low, so which way do you think the water will flow? Students will now take turns spraying "rain" on the watershed with the spray bottle. Water should flow down the sides of the mountains and ridges. The water should follow the blue lines they used to define the tributaries. This is a watershed in action! Have them record their results.

11 Adhere a two-inch piece of cellophane tape to one of the ridges to represent a road or parking lot. Discuss impervious surfaces. Add a few drops of food coloring or small amounts of the colored powders to represent fertilizers, motor oil, pesticides, or other pollutants on the sides of hills adjacent to rivers. Discuss nonpoint and point source pollution. Place small amounts of sand and soil in the flatter areas. Have students predict what will happen to the pollutants when it "rains" on their watershed.

12 Again, using the spray bottle have them "rain" on their watershed at the highest elevation and note the pattern of river flow (in blue), contaminant flow (in red), and sand and mud slides that result. Have students show these locations on their maps they drew earlier, adding arrows that reflect the paths of movement of these materials.

13 Discuss each group's watershed map drawing. Have each group choose one important point from their map to share with the class: pollution source, erosion spot, etc. What happens to a watershed when pollution is present? Does the pollution remain contained in the watershed or can it flow via rivers or streams into another watershed? Can they name other types of pollutants (e.g., chemicals, grease, litter, animal scat)? How does vegetation (e.g., trees, shrubs, and other plants) help these watersheds? How does your watershed compare with watershed models made by your other classmates? Discuss ways students

can protect watersheds: *(no littering, staying on trails (preventing erosion), planting trees, participating in a Georgia Adopt-a-Stream river clean-up or monitoring program.)*

Extensions:

1. Have students prepare a presentation about watersheds and nonpoint source pollution and the steps we can take to decrease pollution in our environment. Have them demonstrate their model to another class.
2. Look at the various ways people have previously used water and currently use rivers in Georgia to earn a living and provide recreation. Note settlement patterns along the rivers of Georgia.

Answers to Student Activity Sheet:

1. **#1** Tributaries are usually smaller and their flow is faster than major streams.
2. **#2** Tributaries tend to make an acute angle where they join the major trunk streams, and this angle points in a downstream direction, which is the direction of flow.
3. **#3** These patterns are branch- or tree-like, and are called dendritic patterns.
4. **#6** Look for smaller areas where the water puddles up, overflows, and then runs into a larger lake or stream.
5. **#12** Ridges create the boundaries of a watershed. On one side of the ridge, the water may end up in one creek, stream, river, or lake; on the other side of the ridge, the runoff ends up in another creek, stream, river, or lake.

WATERSHED DETECTIVE

Detective's Name: _____ **Date:** _____

Looking vertically down over the landscape you have created with the crumpled paper, use a blue marker to draw a map view of the entire river system, including the tributaries. Draw the outline of the ridges in black. With a red marker draw arrows showing the direction the streams and rivers are flowing.

1. Tributaries are smaller streams that flow into major streams. Count the number of tributaries joining each of the larger streams.
   How many tributaries are there? _____
   How many major streams are there? _____
   How can you differentiate between a tributary and a major stream? _____
   _____

2. If your map did not have arrows, how could you tell which direction the streams and rivers were flowing?
   _____

3. Describe what the river system on your map looks like. What is this pattern called? (Hint: remember leaf veins) _____

4. Describe what happened the first time you sprayed clear water on your watershed model. _____
   _____

5. Did the flow of water go where you predicted with the lines drawn with the blue marker? Why or why not? _____

6. Does your watershed model contain any low spots or bottomlands that would fill up as ponds, lakes, or marshes over time? Why are these areas important? _____

7. After adding the pollutants and spraying the entire watershed note the pattern of river flow (in blue), contaminant flow, and sand and mud slides that result. Show the paths of movement of these materials on your map, drawing arrows with a green marker.

8. Describe what happened to the pollutants when you sprayed water again. How is this harmful to the watershed? _____

9. Provide 3 examples of what could be done to reduce the amount of pollutants affecting your watershed.
   1. _____
   2. _____
   3. _____

10. Describe what happened to the water as it was sprayed on the cellophane tape. What is the significance to the watershed of having too many roads and parking lots? _____

11. Does you watershed model contain mini-watersheds within the larger watershed? If so, how can you tell?

12. How can you tell where the watershed boundaries are located? _____

13. Now that you have observed your model, write a short description of a watershed and why it is important to protect it. Include the following terms: tributary, major stream, pollution, and impervious surface.