From the Mountains to the Estuary: From the Schoolyard to the Bay

Meaningful Watershed Experiences for Grade 6 Students

Created by:

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Watershed Investigation

Part 1: Where's My Watershed?

Part 2: Runoff Race

Overview:

In Part 1, students will use topographic maps to determine their watershed address. In Part 2, students will build their own watershed model that has as little runoff, erosion, and pollution as possible.

Teacher Background: Watersheds

- A watershed is an area of land that allows water to flow over or under its surface to a particular body of water.
- The watershed of any large river, lake, or estuary can be divided into smaller local watersheds.
- Since water flows downhill, watersheds are defined by topography, contour lines on topographic maps indicate the direction of water flow.
- The water system transports water, organisms, nutrients and other materials within the system.

Teacher Background: Chesapeake Bay Watershed

- The Chesapeake Bay is the largest estuary in the U.S. and represents a complex and valuable ecosystem.
- The watershed (all the land from which water drains into the bay) extends from Cooperstown, N.Y. to its mouth at Norfolk, VA.
- The Chesapeake Bay watershed covers 64,000 square miles; approximately 37 percent of the watershed lies in Virginia.
- In Virginia, the rivers that drain into the bay include the Potomac, Rappahannock, York, and James. These waterways drain about 56 percent of Virginia's land.
- Nine river basins, or watersheds, occur in Virginia. These watersheds include the Potomac, Shenandoah, Rappahannock, York, James, Roanoke, New, Tennessee-Big Sandy, Chowan, and Coastal Rivers.
- The Chesapeake Bay ecosystem includes commercially valuable organisms such as crabs, oysters, striped bass, shad, and many others.
- A decline in the number of these organisms have resulted from diminished water quality, over-harvesting, reductions in habitats including submerged aquatic grasses, and spread of disease.
- In 1983 Virginia, Maryland, Pennsylvania, and the District of Columbia signed the Chesapeake Bay Agreement. This agreement deals with restoring water quality and habitat and has been refined over the years since it was first signed.
- Restoring the water quality of tributaries that feed the bay will lead to restoration of water quality, habitat and living resources of the Bay.

- The surface drainage of Virginia's river system can be divided into two drainage patterns: the land west of Roanoke (about one-fourth of state) drains into Gulf of Mexico; and the other three quarters of the state drains into the Atlantic Ocean.

Teacher Background: Human Activities

- The rivers of a watershed are constantly eroding the highlands that it contains.
- Human activities can accelerate this process. These activities include land clearing, dam building, farming and industrial development.
- Human activities can also decelerate the process. These activities include planting trees, installing barriers, protecting riparian buffers.
- Lateral movement of water is runoff.
- Runoff is the dominant way that water flows from one location to another. Many pollutants find their way into water through runoff. These pollutants are known as "non-point sources".
- Insecticides, fertilizers, animal wastes, oils, transmission fluids, and wastes are washed off by runoff into the streams, rivers and lakes.

Materials:

- Topographic maps of local watershed area
- Aerial photographs of local area
- Pans- 2 per student group, one with a black Sharpie line separating the bottom third
- Variety of substrates including pebbles, sand, soil, clay
- Sponges cut into 1" wide pieces
- Pieces of netting
- Assorted plastic plants
- 5- 1000 mL Graduated cylinders or beakers
- 5 pipettes
- Small wooden blocks (e.g. Jenga blocks)
- Cement blocks
- Two large containers for rinsing plastic pans
- Two large containers for rinsing hands

Part 1: Topographic Map Investigation

Setting the Stage:

Divide students into five groups. Welcome them into the watershed room. What watershed do we live in? *Chesapeake Bay*

Each table should have a copy of the Washington area topographic map. Ask students if they know what kind of map is on their table. Allow for answers. If students don't know tell them that it is a topographic map.

Acquisition of Learning:

1. Have students use magnifying glasses to investigate the topographic map.

   What do the small thin lines show? *Elevation the red lines are contour lines. Each line represents area with equal elevation. The contour lines never cross but curve instead.)*

2. Have students follow one contour line. They should find a number that shows elevation. *(how high above sea level)* Every point on that line has the same elevation.

3. What are the units on the map? *meters* The contour interval is 20 meters.

4. Have the students find their approximate location.

   Question: Can anyone find any other numbers on the contour lines? *(Allow for answers.)*

   Question: Can you find the Bull Run Mountains? What do you notice about the contour lines there? *(The lines are very close together; there is more of a difference in elevation.)*

5. Topographic maps show the general shape of the land. What does topography have to do with watersheds? *- the topography of the land determines how water will flow- water will flow from higher elevation to lower elevation. Water always flows downhill.*

6. Show poster with the aerial photo of the Chesapeake Bay watershed. The boundaries of the watershed are shown by the white line. Look at the boundary of Virginia in the West. What topographic feature is located there? *mountains*

7. When it rains on the eastern side of the mountains the water flows to the Chesapeake Bay; when it rains on the western side- where does it flow? *Mississippi and Gulf of Mexico*

8. Point out the Chesapeake Bay Watershed. Do a lot of people live here? *Yes, almost 17 million live in the watershed*

9. With all of those people, do you think the water in the Chesapeake is clean or polluted? *Unfortunately it is polluted*

<u>Part 2: Building their own Watershed</u>

10. Explain that students are going to make models of their own watersheds but they want the water running off into their watershed to be as clean as possible. Their challenge is to have the clearest runoff (i.e. the lowest turbidity).

11. In order to help students with the construction of the model, show them the soil profile. Explain the layers *(bedrock, rock, sand, soil, roots, plants)*

12. Go over the list of materials that are available for the students to use for to construct the watersheds. Show the rocks, sand, soil, plastic plants *(explain that there aren't any roots)*

    Sponges- these are like what habitat? *Wetlands*- they should be between the land and the water

    Netting- this is usually found around construction sites as well as at the Refuge. What is it for? *Around construction sites it helps prevent bare soil/sediments from getting washed into storm drains. At the Refuge, it helps prevent excess sediments getting into the water due to erosion; it holds the soil in place.*

    Blocks – these are the houses. Every team needs at least one house on their watershed.

13. Explain that one student is going to bring one container up to collect materials while the other student in the group take a few minutes to discuss the type of watershed they would like to build.
14. Tell the students that they will need to leave 1/3 of their container empty (below the black line). That is the Chesapeake Bay. The other two thirds should represent Virginia- mountains on one side sloping to the bay.

15. Each group should begin construction of their watershed using the materials provided. They should be reminded that watersheds go from higher elevation areas to lower.

16. The students can add items from the materials list above, but be sure that they use their container to get the materials.

17. Encourage the students but do not help them build their models! Be sure that they are leaving 1/3 of the container empty and clean.

18. After their watershed is complete, students should elevate one side of the pan by placing the cement block under the side of their watershed that has the mountains.

19. The students should then take 300 mL of water and begin to pour it onto the elevated side of the model watershed. If they want to simulate rain, they can put water in squirt bottles.

20. After the students have finished pouring the water, have them make observations about the amount of runoff and erosion.

21. Use 5 pipettes to collect a water sample from each container.

22. Ask students what is the measurement of how much sediment is in the water- *turbidity*

23. Compare the turbidity of the water that is collected from each group.

24. What is independent variable in this experiment? *Type of watershed model*

25. What is the dependent variable? *Turbidity of runoff*

26. What were the constants? *Type of container, amount of water, angle of watershed model*

- Allow about 10 minutes for students to clean up and put away materials.
- Put one student in charge of cleaning off the table with a sponge and have the other the students put the supplies away and clean put the containers.
- Have students put the materials back in the containers they got them from, when their container is almost empty, have them dump the rest of the sand and soil in the grass outside.
- Have them rinse their containers in the tubs outside.
- At the end, they should rinse their hands in the hand washing tubs outside.
- DO NOT HAVE THEM USE THE SINKS INSIDE….THEY WILL GET CLOGGED

Closure:

Have students sit back sown and report to the other groups about what they added and how it affected the runoff of the watershed. What factors increased erosion, what factors decreased erosion? What would they do differently if they did it again?