HUGK-12 Activity

Title: Build Your Own Watershed

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DCPS Standards: E.6.2, E.6.3, E.6.4, E.6.7, E.1.10, E.1.2

Goals:

1. Scholars will understand how water flows from higher elevations to lower elevations.
2. Scholars will understand how watersheds are interconnected.
3. Scholars will understand how the placement of buildings, roads, and parking lots can be important to watershed runoff.
4. Scholars will understand how careless use and disposal of harmful contaminants can have a serious effect on downstream watershed denizens.

Objectives:

1. Given materials that represent an impervious surface, buildings and soil, scholars will use their knowledge to build a watershed replica.
2. Given a specific direction of water flow, scholars will demonstrate how pollution of one area in a watershed can eventually affect other areas.

Prerequisite Knowledge:

Background

The land we live on is divided into watersheds. A watershed is a land area whose runoff drains into any river, stream, lake, or ocean. Small watersheds, such as the watershed for the creek behind your house, or the watershed for the pond down the road, drain into small bodies of water, and cover small land areas. The runoffs from small watersheds join together, and their combined areas become a new, larger watershed. Large watersheds, such as the Mississippi Basin and the Chesapeake Bay watershed, drain into large bodies of water, and cover immense land areas. Despite their differences in sizes, all watersheds share common properties. They all perform the same function of transporting water over the Earth's surface. The watersheds encompass suburban lawns, parking lots and city streets. Water seeps down through the soil to aquifers, which are underground formations in rock and soil that contain enough ground water to supply wells and springs.
Many human activities have an effect on watersheds. Construction projects like dams can limit the flow of water; construction of roads and buildings can divert and even increase the flow of water. Agricultural fertilizers can run off of crop fields and inadvertently fertilize harmful microorganisms in rivers and lakes, having an adverse effect on water quality and marine life. The irresponsible disposal of household and industrial chemicals can be harmful because these chemicals travel through the watershed, poisoning life and damaging natural ecosystems.

Watersheds can also have an effect on humans. Many communities use rivers, streams, and aquifers as their source of drinking water. Water treatment prepares 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 in a watershed. Homes built on flood plains, low lying areas adjacent to rivers, are susceptible to flooding conditions 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 become dry, causing water shortages for those who depend on their 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 that the ecosystems sustained by the watersheds are not destroyed, and to protect the health and safety of our communities.

Essential Questions:

1. How far does the watershed extend?
2. How do impervious surfaces affect the flow of water?
3. How do buildings affect the flow of water?
4. What feature of land dictates how fast and where water will flow?

Laboratory Materials:

For each team of five scholars:

1 large Tupperware container (about 1.5'W x 3'L x 1'H), 2 lbs. of modeling clay, 3 lbs. of sand, 2 lbs. of aquarium gravel, 1 roll of wax paper, 1/4 cup of cocoa mix (to represent chemicals), 1 spray bottle or bucket full of water.

Differentiating Instruction:

Thomas will present this activity to the group of Spanish speaking scholars in Spanish.

Rationale:

This activity is designed to have scholars attain a thorough understanding of watersheds, including the water cycle, the role of watersheds, delineation of watershed boundaries and effects and impacts of watersheds.

Research Activity:

1. Fill container to about 2 inches from the bottom with the gravel. Slope the gravel slightly so, that at one end (down slope), the gravel is only about ½ inch deep and, at the other end (upslope), the gravel is about 3 inches deep. This gravel layer will represent the aquifer.
2. Mix the clay and the sand. This mixture should allow water to run freely over it, but if left standing, the water should slowly permeate the surface. Add this

mixture to the container carefully, so as not to disturb the slope of the aquifer already placed. The slopes should be similar, with about 2 inches of sand/clay mix overlying the gravel already placed, and on the downhill end there should be about 3" of gravel left exposed.

3. Carve a channel in the middle of the clay/sand layer, about ½ inch deep and about 1 inch wide. This channel will represent the main river of the watershed. Near the top of the slope, split the channel into two or three separate channels to represent tributaries.
4. With some extra clay/sand mix, build little hills between the tributaries. These hills separate the smaller watersheds, but when looked at as a whole, the entire "river" system is one watershed. Buildings can be represented with bottle caps.
5. Along the main river, flatten out an area that is about 8 inches by 3 inches. Cut out a piece of wax paper to be about 4 inches by 3 inches in size. Stick this down onto the clay sand mix, sloping it slightly towards the river. This wax paper represents the impervious surface of a parking lot.
6. Fill the bottom of the aquarium up to about 2 inches from the bottom with water. The water should fill all of the aquarium gravel "aquifer" area, and should just reach up to the lowest extent of the clay/sand mixture.
7. Using the spray bottle, simulate rain over the flattened soil area and the parking lot.
8. Sprinkle some cocoa mix over the sides of one of the smaller watersheds. This represents pollution. Over one of the unpolluted "watersheds," cause some rain with the spray bottle. Now, make it rain over the polluted area. Note how the pollution travels down through the watershed, contaminating all downstream areas.

Evaluation and Assessment:

Answer the following questions:

1. What are some possible sources of watershed pollution in your community?
2. What other impervious surfaces besides parking lots can cause excessive runoff in a watershed?
3. What effect would there be if the entire watershed were paved?
4. What can be done to reduce our impact on watersheds and their environment?

Figure 1. Example watershed build from clay (google images)

Related Websites

National Geographic's interactive river system:
http://www.nationalgeographic.com/geographyaction/rivers/ga17.html

EPA's Surf Your Watershed:
http://www.epa.gov/surf/

RiverSmart:
http://www.riversmart.com/rivers101_watershed.cfm