Changing Hudson Project

The Changing Hudson Project curriculum was developed by scientists and educators at The Cary Institute, to help students understand how the Hudson River changes over time. By collaborating with teachers, scientists, and management agencies, the curriculum has grown to include a wide range of topics that engage students with visualizations, readings, investigations, and actual scientific data.

Watersheds http://www.caryinstitute.org/educators/teaching-materials/changing-hudson-project/hudson-river-ecosystem/day-3-watersheds

Objectives

1. Students will know how water flows around their school and be able to create a map of their local watershed.
2. Students will know what a watershed is and will be able to explain how permeability and pollution within a watershed will affect water quality.

Lesson Overview

1. Students discuss what they know about watersheds and create a drawing of their school's watershed after a walking tour

2. Students create a watershed model

3. They then view a PowerPoint explaining the importance of land cover in watersheds.

Time:
Two-three class periods
Setting:
Classroom
Materials

Per group:

- a plastic or metal tray
- spray bottle filled with water
- newspaper, paper towels
- plastic wrap
- food coloring or kool aid
- tennis ball
- tape measure
- local topographic map
- black sharpee marker

Per student:

- copies of Watersheds related reading
- copies of Runoff worksheet

Procedure

Preparation:

Students should read for homework the "Watersheds" related reading found below. Students should dress appropriately as the first part of this lesson takes place outside.

Engage:

Ask students where water goes when it rains. Answers may include the ground, gutters, sewers, streams, etc. Ask which direction water runs: The answer, of course, is downhill. Water always follows gravity. Ask students if they know what a watershed is? They should have read about watersheds for the previous night's homework and may remember the definition. Write the definition on the board and give further explanation of what a watershed is. Show pictures of the watershed where the school is or where most students live. Explain that we get our drinking and household water from a watershed.

Explore 1:

Students should brainstorm what sorts of land cover are permeable (forests, soil, fields, lawns, etc.) and which are impermeable (rooftops, cement, asphalt, some types of clay and rock formations)

Go for a walk with students around the outside of the school. Have them sketch on scrap paper the rough perimeter of the building and its viewable surroundings (roads, soccer fields, parking lots, etc.). Students should draw arrows indicating which direction water would flow in the case of a rainstorm or melting snow. Make sure they include the roof of the school, roads, etc. Students should use a tennis ball or other spherical object to indicate direction of the pull of gravity to help them determine which way water would run off of a surface. For the more ambitious students, use the 100 ft tape measure to make their drawings to scale.

Return to class. In groups of no more than four students each, have them sketch the school and its surroundings on large paper. Shade areas that are permeable in one color and areas that are impermeable in another. Use black arrows to indicate the direction of runoff of water. When students have finished their sketches have them use the topo map and their own drawings to answer the questions on the Runoff Worksheet.

Explore 2:

Instruct students to use the newspaper to create a landscape in their tray. Then cover their newspaper landscape with plastic wrap and spray with the water bottle. Have students make

observations about how the drops of water are moving. Have one member of each group report to the rest of the class the observations their group made.

Discuss the different landscapes made by the groups and the following questions: How do the water droplets move? (Downhill.) How and where are they collecting? What might these collections of water represent? (lakes, ponds, streams, rivers), how did the large rivers and lakes form? (from smaller streams feeding them). Ask students if they think the plastic wrap accurately represents the land in a watershed? Remind students that the plastic wrap is impermeable. Have students suggest types of land cover that are impermeable (rock, pavement, buildings, etc.). Ask what types of land cover are permeable? (soil and vegetation).

Tell students that the paper towels will represent permeable surfaces. Have each group add paper towels to their models. Instruct each group to use a different amount, one group to leave just the plastic wrap, and one group to cover the entire landscape. Now have students spray again and observe differences with the paper towels. Discuss the role vegetation plays in regulating the flow of water.

Distribute a new sheet of plastic wrap, paper towels, and a sharpee marker to each group. Instruct the students to lay out the plastic wrap on their landscape and with the sharpee, draw squares where they would want to build a community of homes, businesses, and public buildings. Then have them lay the paper towels in places that do not have buildings. As a class, brainstorm what types of pollutants are likely to be on the land. Make a class key of pollutant colors and types. Next, have students add pollution to their models using either the food coloring or different types of colored sugar and spray again. Have students make observations of how the rain affects the movement of the pollution and what this means for our water supply. Discuss the importance of not building our homes in areas that flood, but point out that we may also not want to build in the highest lands, if our city pollution runs down into the only water supplies!

Explore 3:

Ask students how permeability or impermeability of water may affect water quality. Get several suggestions. Using the PowerPoint presentation, review the effects of different land cover on runoff.

Explain:

A watershed is all the land uphill from the river or stream. You can think if it as a V-shaped land formation with smaller streams or rivers as well as lakes, ponds, wetlands and of course urban development. Everything that falls or is put on the Hudson's watershed feeds the river. Precipitation flows into small rivulets that flow into larger and larger streams that eventually flow into the Hudson. The Hudson River officially starts at Lake Tear of the Clouds in the High Peaks area of the Adirondacks, although many sources dispute the 'source' and name Henderson Lake, which is even further north. However, you may not even recognize the mighty Hudson where it begins, because it is a small stream that slowly gains in strength and size as it flows south. The river flows south for 315 miles to the Atlantic Ocean at New York City. The huge

watershed of the Hudson covers aprox. 13,390 square miles, which includes most of eastern New York, small parts of Vermont, New Jersey, and Massachusettes.

The northern part of the Hudson is surrounded by a largely forested landscape and ancient metamorphic rocks. Here, the river is clear and cold and is a favorite of fishermen and white-water rafters. After the water passes over the Troy dam, it enters the estuarine portion of the river, where it is subject to the ocean's tides and the mixing of salt water with fresh. From here to the mouth of the river, the Hudson is large and nearly flat. The tides have a large effect on this portion of the Hudson river, causing changes in its flow and its chemical composition. As you move south to New York City, the Hudson changes dramatically, becoming much more developed along its shoreline.

Extend:

Students can create more specific watershed models of the Hudson River valley. Divide students into several groups and assign each group a section of the watershed (north to south). Have them refer to topographic or relief maps of the valley in order to create their landscape. Have them draw in urban areas with their sharpees and put down paper towels approximately proportionate to the amount of green space or forest in between urban areas. Have students gather around as each section of the watershed model is sprayed, beginning with the northernmost portion of the Hudson River watershed. This area should have the most "vegetation," while the southernmost region should have the most urban area and exposed plastic wrap. Be sure to spray the same amount of water onto each portion of the watershed in order to be able to compare them more accurately. Ask for student observations and discuss them in the context of where you live, water quality, and flooding.

Evaluate:

Have students write a response to the prompt – Why is it important to protect watersheds from pollution and overdevelopment? You can also use their answers to the Runoff worksheet and their drawings as evaluation methods.

References:

The 'create a watershed' part of this lesson was adapted from Activity 3: What is a Watershed? from the NYSDEP (www.nyc.gov/dep).

Lesson Resources

- Runoff worksheet (pdf, 20 KB)
- Watersheds PPT (pdf, 3 MB)
- Watersheds PPT - teacher notes (pdf, 51 KB)

NYS Standards
MST 1 - Mathematical analysis, scientific inquiry, and engineering design
MST 2- Informational Systems/ Information Technology

MST 3- Mathematics in real-world settings
MST 4- Physical setting, living environment and nature of science
MST 5- Engineering and computer technology to satisfy societal needs
MST 6- Interconnectedness of mathematics, science, and technology (modeling, systems, scale, change, equilibrium, optimization)
MST 7- Problem solving using mathematics, science, and technology (working effectively, process and analyze information, presenting results)
Benchmarks for Science Literacy
5A Diversity of Life
5D Interdependence of Life
5E Flow of Matter and Energy
9B Symbolic Representation
9D Uncertainty
12B Computation and Estimation
12D Communication Skills
12E Critical-Response Skills

Related Reading

Watersheds