TEACHER
ACTIVITY OUTLINE

wyland ocean challenge

AQUATIC ECOSYSTEMS

Activity No. FIVE

Title: WATERSHED MODELING

OBJECTIVES:
{students will be able to}

- Define the term "watershed" generally as an area of land that water travels through from the highest elevation to the lowest elevation
- Describe at least 3 types of pollutants and ways they might enter a watershed.
- Explain how human activities affect aquatic habitats and the ocean.
- Create a 3-D model of a watershed.
- Describe nature's ability to filter out a certain level of toxins
- Use paper mache to create a 3D representation of a watershed

SUMMARY:

Students will explore how water flows through a watershed by building a 3D model of a watershed. They will learn how water travels from the highest point to the lowest point, and how humans impact that flow of water, what goes into the water, and where that water ends up. Students will also learn the layers of the ground and how water is absorbed in those layers through a demonstration. They will discover earth's natural filtration process as well. Finally, students will explore how their local watersheds fit into larger watersheds that end up in the ocean.

TIME NEEDED:

3-5 sessions.

MATERIALS:

SCIENCE MATERIALS:
- Students' Field Notebook
- Eco-guide: What is a watershed?
- Student activity sheets
- Crayons, colored pencils, or markers in blue, red, brown, and green
- Plastic spray bottles
- Chocolate syrup
- Food coloring (yellow, green, & blue)
- Multi-colored cake sprinkles
- Large jar or 2 liter soda bottle
- Garden soil
- Sand
- Pebbles
- Small rocks
- Mineral kit or various types and densities of rock – if available
- Water

ART MATERIALS:
- Foil turkey pans or paint trays for the base of the model
- Misc. objects to build the landscape of the model such as: Newspaper, brown paper bags, cardboard, cups, toilet paper rolls, Styrofoam, and anything you can find that would help students build a landscape.
- Paper mache supplies
- Lots of newspaper
- Masking tape
- 1 bowl for every 3-4 students (ideally should be at least 3" deep and 6" wide)
- Scissors
- Flour
- Water
- White glue
- Acrylic Paints
- Washable tempera paint
- Some kind of paint trays (egg cartons, ice cube trays, small cups, etc..)
- Variety of paintbrushes
- Sponges
- Cups or plastic bottles for clean water to rinse brushes
- Plastic gloves if available

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PREPARATION:

- Read background: Watersheds, Message in the water, types of water pollution, dead zone
- Read Eco-guide: What is a watershed?
- Read student activity sheets
- Read How to use art in your classroom: Paper mache
- Copy student activity sheets
- You should decide ahead of time if you'd like students to create a model of the Mississippi watershed, a local watershed, the one they are studying, or design a generic watershed. If the students will be re-creating an actual watershed you should supply maps to help them with this process. The website www.usgs.gov (U.S. Geological Survey) has free maps on-line that you can print out. The EPA "Surf your watershed" website www.epa.gov/surf will give you names and maps of watersheds or you can do a Google image search for the watershed map you need.
- Put out art materials for creating the model

ACTIVITY INTRODUCTION:

1. Ask students what they remember about the water cycle. If you have not learned about the water cycle, review as needed. Tell students that you are going to take a closer look at what happens to water. Ask the students to share what happens to water after it rains (accept multiple answers - it evaporates, makes puddles, runs off, forms rivers or lakes). What determines where the rain goes once it reaches the ground? (Gravity forces it from high elevations to low elevations, the shape of the land, building structures, roads, etc.).
2. Tell them that there is a term for the area of land that water travels through from the highest spot to the lowest spot, which is usually the sea – it is called a "Watershed" because the water "sheds" from the high elevations, down to the low elevations. Your local watershed might be a part of a larger watershed, because ultimately the water goes to the sea. Everyone lives in a watershed and today they will investigate watersheds further.
3. Tell the students they will be working in groups to build a 3-D model of a watershed and see how human introduced items get into watersheds and what happens when they do.

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EXPLORATION:

1. Have the students turn to their Eco-Guides and read, "What is a Watershed?" Discuss the parts of the watershed again and the aquatic habitats that a watershed can contain.
2. Organize the students into groups and guide students through the building of their watershed model.
   - Give students instructions based on what watershed they will build. If they are creating a generic watershed, tell them they must include mountains, rivers, the ocean and at least one of the other aquatic habitats (lake, wetland, estuary). The lowest lying part of their model must be a larger body of water. Discuss what forms of topography might represent high elevations (mountains, hills, etc) and what might represent middle and lower elevations (valleys, rivers, canyons, etc) and what they might look like on their models.
   - Direct students to design their watershed model in their Field notebooks before they begin construction. Decide which materials they will use, and who will be responsible for each part.
   - Give each group of students a pan and the materials they can use to create the landscape of their watershed. They can crumple newspaper, stack items, build a framework out of cardboard, use wire (chicken wire) or balloons for support, etc. You will need to demonstrate how to support the paper mache and how to apply it for students.
   - Once they have their foundation ready, they will cover the entire project with a few layers of paper mache. Refer to "How to use art in your classroom: Paper mache" for more detailed instructions on how to use paper mache. Allow models to dry.
   - Once models are dry, have students paint them and allow to dry again. Make sure to use acrylic paints. Tempura paint will not hold up to the task. Any places that are not covered with paint might absorb the water. Although this seepage is OK in small amounts because it demonstrates how water becomes groundwater, the entire project should be mostly covered with paint to prevent the model from falling apart.
3. Once the watershed models are complete, pass out the student activity sheet 5A. Have students make a prediction about their watersheds (question 1 on their student Activity Sheet). Ask the students to spray their models with the water bottles to make it "rain" and make observations on their activity sheet as to what is now happening to the water (it is running downhill and into the ocean or low-lying water body).
4. Ask students if they think water just runs along the surface like this, or if it goes somewhere else. The ground is made of different minerals and materials and water can seep into it. Ask students to imagine what is underground. Have they ever dug into the earth? Does it all look the same? Tell students that there are many types of rock, minerals and materials in the ground. Their compositions have an effect on how water is absorbed into the ground. In the large jar, create different layers with the various soil, sand and rock materials. If you are using a 2 liter soda bottle, you can cut the bottle in half and set the top into the bottom with the neck of the bottle facing down. You can actually run water with different types of debris through the layers if you use this method. Talk about how some rocks are very dense and do not allow water to penetrate (granite), but other rocks are like sponges, which are very porous, and can become saturated with water (limestone, pumice). If you have access to rocks with various densities or a mineral kits (available online at various websites or $3-4) allow students to observe and feel them. For more information for teachers or students, visit http://ga.water.usgs.gov/edu/.

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{2 Liter plastic soda bottle} *{Cut bottle in half}* *{Invert top into bottom}*

AQUIFER: An underground bed or layer of earth, gravel, or porous stone that yields water.

ROCKS: Naturally formed mineral or petrified matter.

GRAVEL: An unconsolidated mixture of rock fragments.

PEBBLES: Small stones, especially worn by smooth erosion.

SAND: Small loose grains of worn or disintegrated rock.

SOIL: The top layer of the Earth's surface, consisting of rock and mineral particles mixed with organic matter.

EXPLORATION:
{continued}

5. Have students add items or symbols to their watershed model to represent some of the human elements discussed. Students may make create these elements out of paper, use small model objects, or paint symbols on their model.
6. Have students add items or symbols to their watershed model to represent some of the human elements discussed. Students may create these elements out of paper, plastic or aluminum foil, use small model objects, or paint symbols on their model if they are dry. If they use paint, you will need to add drying time to your session.
7. Ask students to consider the human elements they added. What types of things might these human elements put into the watershed? Accept all answers - pollutants from the cities, factories, and roads, etc, and address any misconceptions after they finish their experiment.
8. Ask the students to spray their models with the water bottles to make it "rain" and make observations on their activity sheet as to what is now happening to the different areas that were polluted (The "pollution" will run down the watershed and into the low-lying body of water).
9. In a class discussion, ask students what they think the water is like where the Mississippi River empties into the ocean – clean? Polluted? Inform them that every year a giant "dead zone" forms at that point in the ocean where nothing can live because of all the pollution that collects there. The dead zone varies in size, but can cover an area as large as the state of New Jersey and this isn't the only area that experiences dead zones. (For more detailed information on dead zones, visit: www. Smm.org/deadzone.)
10. Tell students to think about the jar with the rock layers. These layers provide a certain amount of natural filtration in the water. The earth can handle a certain amount of toxins and sediments through this process, but it can only handle so much. What happens to the rest? What happens when we develop areas and change the layers and watersheds? Changes can disrupt the earth's natural filtration process.
11. Pass out the student activity sheet map (5B) to the students and place one map on the overhead projector. Remind students that their local water shed can be a part of larger watersheds. The Mississippi watershed is an example of a large watershed that contains many smaller sections.
12. Ask the students to trace the Mississippi River with a blue colored pencil.
13. Next ask the students what they notice about the Missouri, Arkansas, and Ohio Rivers (they all end up in the Mississippi River). Have them use a red colored pencil to trace over these.
14. Point out the mountains to the students and ask them what these bumps represent (mountains). Explain that the mountains on the left near the Missouri and Arkansas Rivers are the Rocky Mountains and the mountains on the right near the Ohio River are the Appalachian Mountains. Have the students label the mountain chains and use a brown colored pencil to trace over the mountains.
15. Ask the students to think about why these rivers all flow into the Mississippi River? (the mountains and other rivers are at a higher elevation and water flows downhill, however, accept all answers at this point).
16. Finally have the students trace the dotted line around the watershed with green. Tell them this is the watershed boundary. All water flows from these outlying areas into the Mississippi River and into the ocean at the Gulf of Mexico.
17. Ask students to guess what percentage of the United States drains into the Mississippi watershed (it is about 40%). How many cities do they think are in this watershed? How many people live in those cities? (you aren't looking for an exact number here – just the impact that it is a lot).

EXPLORATION:
{continued}

18. Ask students how they think the people, cities, and towns affect the cleanliness of the water in the Mississippi watershed? What types of human introduced things might get into the water? How? What happens in the ocean where the Mississippi drains?
19. In a class discussion, ask students what they think the water is like where the Mississippi River empties into the ocean – clean? Polluted? Inform them that every year a giant "dead zone" forms at that point in the ocean where nothing can live because of all the pollution that collects there. The dead zone varies in size, but can cover an area as large as the state of New Jersey and this isn't the only area that experiences dead zones. (For more detailed information on dead zones, visit: www. Smm.org/deadzone.)

COMMUNICATION:
{and assessment}

1. Have students look at a map of the ecosystem they are studying and describe how water would enter and exit that ecosystem.
2. Students should answer the following questions in their field notebooks:
   a. In your own words, define the term "watershed".
   b. Name three pollutants and explain how they might enter a watershed. How could you help prevent this?
   c. Think about the ecosystem you are studying and what surrounds it. What type of pollutants do you think might be getting into that ecosystem? What effect could they have?
   d. Did building a three-dimensional model help you to understand watersheds? Explain why or why not and what you learned.
3. Art Challenge: Imagine yourself as a drop of water traveling through your watershed. What do you see? What do you hear? How far do you travel?

ADAPTATIONS:

For younger students:
Younger students can do most of this activity with assistance. We recommend leaving the map portion out of the activity for younger students.

For older students:
Have older students create a large collaborative 3D model of the watershed the ecosystem they are studying is in. Have them conduct demonstrations on the model for other classrooms. Have the students research what creates

STUDENT
ACTIVITY SHEET

Activity No. 5A

WATERSHED MODELING

Name:

Date:

What do you think will happen if it rains on your watershed? Where will the water go?

When you make it "rain" on your watershed model, describe the paths the water took.

Sketch your watershed model here and draw arrows to show the paths the water took.

Describe what happened to the pollutants when it "rained" on your watershed model.

STUDENT
ACTIVITY SHEET