Watershed Activity 1

Region: Eastern Coastlines

Grade Level(s): 5-8

Time Required: One 45-minute class period

Learning Objectives:

- The students will be able to understand that all water that falls on a watershed drains into the same large waterway.

Materials:

- Dish basins or plastic shoe boxes, one for each team of four students
- A transparent rigid lid for each basin (should cover entire top of the basin, but does not need to be watertight)
- Duct tape to secure the lids
- Grease pencils or overhead markers – one per student team
- Oil-based modeling clay, enough to shape a landscape into each basin
- A source of water
- One watering can with a sprinkle opening or other water pouring container per student team
- Map outlining the Chesapeake Bay watershed

Background:

- Shaped for thousands of years by the crashing waves and weather of the Atlantic Ocean, the eastern coastline has developed wonderfully diverse landscapes set in equally varied climates. From warmer tropical ecosystems such as Florida's beaches, barrier islands, bays, estuaries, and tidal marshes, to the colder reaches and rocky coastline of Maine, each of these landscapes has its own set of plants and animals that call these places home. These varied landscapes have developed through a combination of processes. As the sea level continues to rise due to melting of continental glaciers left by the Ice Age and the effects of climate change, most of the eastern coastal region has experienced, and continues to experience, submergence. At the same time, rivers and streams deposit sediment surrounding their mouths as they open to the ocean. In addition, the harsh waves of the Atlantic Ocean, which are weakened by the wide continental shelf jutting out into the ocean, slow and deposit the sediment that they carry near the shoreline. Thus, as glaciers melt, the ocean rises, and sediments are deposited along the shoreline. These processes have been happening concurrently for thousands of years and have marked the eastern shoreline by thick deposits of sediment and sea level rise. Those who live along this coastline must cope with its unique environmental issues. Low-lying land juxtaposed with the vast Atlantic Ocean leads to issues of flooding and erosion. These issues are compounded by the

effects of climate change.

Procedures/Instructional Strategies:

1. In the bottom of each basin shape the clay to model a landscape. You may use a topographical map of your region to model your watershed or you can create a landscape which focuses on one or more features you would like the students to learn about. Create a land model with an ocean area using the clay.

2. To resemble the Chesapeake region, the landscape should include a "mountain" with one side which leads gradually down to a "beach" and one steep side similar to a river valley that will drain towards the beach. The beach side needs to be nearly flat, extending a long way into the water.

3. Tape the lid to the basin on one edge, so that it opens easily. Mark the inside wall of the basin in permanent marker in 1 cm increments from the bottom of the basin to the top. Each 1 cm will equal 68.28 m (224 ft) of elevation. (Based on the elevation of the highest mountain in Maryland, Backbone Mountain, which has an elevation of 3,360 feet, and the depth of an average shoe box is 15 cm)

4. Give each team of four students a model kit, a watering can, and a grease pencil.

5. Begin by telling the students to make it rain a little bit on their model by sprinkling water over the landscape. As the water runs over the landscape the students should observe the flow patterns. They should have about 1 cm of water in the bottom of the basin when they are finished (tell students to fill the basin to the first line marked on the inside of the basin).

6. Have the students write their observations on their data sheet.
    - The students should notice that the water runs downhill, that the valley becomes a basin for a river, and that all water eventually ends up in the Bay.

7. Have the students come up with a definition of a watershed.
    - Show them a picture or map of the Chesapeake Bay watershed, and discuss what makes it a watershed.
    - You can also discuss the various ways (that are not visible in their models) for a real watershed to hold water before it travels into the Bay, such as pervious rocks, soil, and plants.

8. Evaluate students with the following questions:
    - Describe the pattern of water flow over the landscape when it rains.
      (All water flows downhill. The water collects as streams and rivers in the valleys and continues to run downhill into the Bay.)
    - Define a watershed in your own words.
      (Answers will vary, but should include the idea that it is all of the water that flows from the mountains into a body of water, such as the Chesapeake Bay.)
    - How does the Chesapeake Bay watershed differ from your model?

(Answers will vary.)

- Describe the pathways of water shown in the Chesapeake Bay watershed from the mountains to the Bay.
  (The water flows from the mountains of Pennsylvania and other states that do not border the Bay, down streams and rivers through other states to the Bay.)

National Science Education Standards:

Earth Science

- Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
- Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.
- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

Science and Technology

- Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.
- Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.

Science in Personal and Social Perspectives

- When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.
- Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.
- Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.
- Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.

- Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.
- Students should understand the risks associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking).
- Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.
- Important personal and social decisions are made based on perceptions of benefits and risks.
- Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
- Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
- Science cannot answer all questions and technology cannot solve all human problems or meet all human needs. Students should understand the difference between scientific and other questions. They should appreciate what science and technology can reasonably contribute to society and what they cannot do. For example, new technologies often will decrease some risks and increase others.
- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.
- In areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered. Different scientists might publish conflicting experimental results or might draw different conclusions from the same data. Ideally, scientists acknowledge such conflict and work towards finding evidence that will resolve their disagreement.
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.

Additional Resources:

- Watershed Workbook
  http://www.nps.gov/anac/forteachers/upload/watershedkit.doc
- Wetland Education through Maps and Aerial Photography
  http://www.wetmaap.org/index.html
- Sea Level Rise Maps and GIS Data
  https://www.cresis.ku.edu/research/data/sea_level_rise/index.html
- Chesapeake Bay Seminar Series
  http://ian.umces.edu/seminarseries/
- "An Earth Day Perspective: NASA Satellites Aid in Chesapeake Bay Recovery", April 22, 2008
  http://www.nasa.gov/topics/earth/features/chesapeake.html