Watershed Moments

Objectives: Participants will learn what a watershed is and use maps and a tabletop watershed model to visualize the concept. Participants will learn about point- and non-point source pollution and manipulate representations of these on the tabletop model. Additional related activities can be found in the Additional Resources section.

Time needed: 15-25 minutes (more if using additional activities)

Target age: Appropriate for General Public; can be adjusted for different ages

Materials needed:
- pie chart(s) of where earth's water is found
- map of (local) watershed (to create one, see activity in Additional Resources)
- tabletop watershed model such as EnviroScape® (to make your own, see activity in Additional Resources)
- jar or clear vessel (size can vary) filled with water
- food coloring
- representations of pollution for use with the model (cocoa powder, unsweetened Kool-Aid powder in different colors, Styrofoam pieces, etc.)
- spray bottle(s) filled with water
- bucket of water
- empty bucket for "contaminated" water

Description: This lesson can be used to teach about watersheds in general or it can be tailored to teach watershed topics using a particular watershed. Adapting the activity for a local watershed is recommended because it allows participants to make personal connections that are more meaningful in the stewardship discussion. Discussion should begin with a review of the importance of water as a human resource. A brief look at a pie chart(s) for distribution of water in natural reservoirs (ocean, icecaps and glaciers, groundwater, etc.) is also useful. Discussion should include potential human use of water from these different sources and how the water moves and carries "stuff" from one source to another through the water cycle and through watersheds. 'Watershed' should be defined and discussed. For many, the term is familiar, but the grasp on the concept is weak. A map of a local watershed is useful in aiding comprehension. If using the Watershed Puzzle (http://dhp.disl.org/PDFs/NGI%20Watershed%20Puzzle.pdf), it would be appropriate here. The presenter should point out that watersheds cross political boundaries and discuss the implications. Once participants have a better understanding of what a watershed is, the tabletop model should be introduced with an explanation of what the different sites represent. Next, point- and non-point-source pollution should be discussed. The presenter should explain that the jar of water represents a body of water and then add a single drop of food coloring. When the food coloring is stirred or swirled, it is not very apparent, and it represents non-point source pollution (lawn fertilizer or pesticides, soapy water down the storm drain, etc.) contributed by an individual – the presenter. The jar should be passed, and each participant should add a drop - if someone declines to add a drop or if someone adds more than one, the group can discuss the fact that different individuals create different amounts of pollution. After each participant has added pollution, the jar should be shown to everyone so the cumulative effects of non-point source pollution can be noted (adapted from an activity on a USDA Forest and National Association of State Foresters poster). Then participants should apply the proxies (cocoa, etc.) to the tabletop model at appropriate sites (cocoa soil on a clear-cut logging site or construction site, red Kool-Aid

pesticide on a farm, green Kool-Aid fertilizer on a suburban lawn, etc.). Next, participants should "make it rain" with the spray bottles and make observations about what happens to the pollution and about how it would affect those living within the watershed. The presenter may also wish to discuss solid waste or marine debris. See http://dhp.disl.org/PDFs/NGI%20Sea%20of%20Debris.pdf for a marine debris activity, some or all of which can be added into the Watershed Moments lesson. After participants have made observations and discussed pollution in watersheds, there should be a discussion of methods of mitigating pollution. The model should be reset and the Best Management Practices applied, as discussed. After the BMPs (less fertilizer, less motor oil on roads, vegetated buffer zones, etc.) are implemented, participants should make it rain again and observe differences. Finally, the wrap-up should review the reasons why an understanding of the watershed concept is important to participants and a few BMPs that participants can implement at home.

Extensions:

- Discussion might move offshore a bit, turning to issues such as hypoxia and harmful algal blooms
- Discussion might include computer models, compared and contrasted with physical models, perhaps using inundation as a logical subject.
- Discussion can include the increased environmental pressures that result from population increases and the projections for population change in the watershed.
- Discussion could elaborate on transport, erosion, suspension, solution, deposition, etc.
- Bring math into the activity by doing a water use word problem

Standards:

National Science Education Standards:

Unifying Concepts and Processes – Systems, order, and organization

K-4

Science as Inquiry – Abilities necessary to do scientific inquiry
Physical Science – Properties of objects and materials; Position and motion of objects
Life Science – Organisms and environments
Earth and Space Science – Properties of earth materials; Changes in earth and sky
Science and Technology – Abilities to distinguish between natural objects and objects made by humans
Science in Personal and Social Perspectives – Personal health; Types of resources; Changes in environments; Science and technology in local challenges
History and Nature of Science – Science as a human endeavor

5-8

Science as Inquiry – Abilities necessary to do scientific inquiry
Physical Science – Properties and changes of properties in matter; Motions and forces
Life Science – Populations and ecosystems
Science in Personal and Social Perspectives – Personal health; Populations, resources, and environments; Risks and benefits; Science and technology in society
History and Nature of Science – Science as a human endeavor

9-12

Science as Inquiry – Abilities necessary to do scientific inquiry
Physical Science – Structure and properties of matter; Motions and forces
Earth and Space Science – Energy in the earth system; Geochemical cycles
Science in Personal and Social Perspectives – Personal and community health; Natural resources; Environmental quality; Natural and human-induced hazards; Science and technology in local, national, and global challenges
History and Nature of Science – Science as a human endeavor

Ocean Literacy: Essential Principles and Fundamental Concepts:

1. *The Earth has one big ocean with many features.* – g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean.; h. Although the ocean is large, it is finite and resources are limited.

2. *The ocean and life in the ocean shape the features of the Earth.* – c. Erosion – the wearing away of rock, soil and other biotic and abiotic earth materials – occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.; d. . . . Most beach sand is eroded from land sources and carried to the coast by rivers, but sand is also eroded from coastal sources by surf. Sand is redistributed by waves and coastal currents seasonally.
5. *The ocean supports a great diversity of life and ecosystems.* – f. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is "patchy". Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.; i. Estuaries provide important and productive nursery areas for many marine and aquatic organisms.
6. *The ocean and humans are inextricably interconnected.* – a. The ocean affects every human life. It supplies fresh water) most rain comes from the ocean and nearly all Earth's oxygen. It moderates the Earth's climate, influences our weather, and affects human health.; b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.; d. Much of the world's population lives in coastal areas.; e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollutions (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers) . . . ; g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.
7. *The ocean is largely unexplored.* – c. Over the last 40 years, use of ocean resources has increased \ significantly; therefore, the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.

Extensions Standards:

NSES:

Unifying Concepts and Processes – Evidence, models, and explanation

K-4

Life Science – Life cycles of organisms

Science and Technology – Understandings about science and technology

Science in Personal and Social Perspectives – Characteristics and changes in populations

5-8

Physical Science – Transfer of energy

Science and Technology – Understandings about science and technology

9-12

Physical Science – Chemical reactions; Interactions of energy and matter

Science and Technology – Understandings about science and technology

Science in Personal and Social Perspectives – Population growth

Additional Resources:

Content information on watersheds and pollution:

http://www.epa.gov/owow/watershed/whatis.html

http://oceanservice.noaa.gov/education/tutorial_pollution/welcome.html

Multiple watershed activities, including create your own watershed map and trace your watershed, create a tabletop watershed model, and more:

http://dhp.disl.org/newsite/downloads/PDFs/TeachersResor/NAAEE%2007%20-%20What%27s%20in%20a%20Watershed.pdf

Watershed Puzzle activity:

http://dhp.disl.org/PDFs/NGI%20Watershed%20Puzzle.pdf

Tabletop watersheds:

http://oceanservice.noaa.gov/education/for_fun/ItAllRunsDownhill.pdf

EnviroScape®

Marine Debris activities:

http://dhp.disl.org/PDFs/NGI%20Sea%20of%20Debris.pdf

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