Watersheds

9-12

Science and Social Studies Standards Covered:

SC (9-12)-

Aquascience– 4. Determine important properties and content of water as related to aquaculture.

Biology– 14. Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen.

Marine Biology– 11. Describe positive and negative effects of human influence on marine environments.

SS (9-12)-

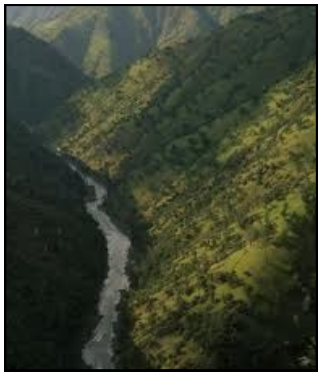
World Geography– 3. Identify components of Earth's physical systems.

5. Describe the consequences of deliberate and inadvertent human activities in altering the local and global environment.

6. Describe long-term management and policies aimed at protecting Earth's resources.

The Alabama Museum of Natural History (AMNH) is part of the University of Alabama Museums and is located on the UA campus in Smith Hall. Opened in 1910, it is the oldest natural history museum in Alabama, and one of the oldest natural history museums in the nation. AMNH's mission is to broaden the knowledge of natural sciences and human culture through collections and quality programs of research, instruction, and service.

Watersheds: Many people may not know that among the many things Alabama is known for is its extensive river systems. Alabama is ranked seventh in the states for its number of river miles and also has one of the largest watersheds in the nation, the Mobile River Basin. A watershed is defined as the total land area that drains surface water to a common point such as a river or an ocean. No matter where you live, you are in a watershed. Watersheds connect many people and environments who are all responsible for the well-being of our water supply. This watershed program teaches students about watersheds through interactive activities such as watershed mapping, environmental consciousness activities, water quality testing, watershed modeling, and other fun watershed related activities. This program can even be extended to a half day, in class "field trip"!



For more information or to schedule this program call **(205) 348-7550 or email **programs@ua.edu****

WATERSHEDS

ALABAMA
Museum of Natural History
THE UNIVERSITY OF ALABAMA

9-12

Did you know?

The Alabama Museum of Natural History is right on the University of Alabama campus? It is housed in Smith Hall near the Gorgas Library.

Did you know?

AMNH is a great destination for school field trips. Guided tours cost $2 per student. If you would like a hands-on component added, a tour and Discovery Lab is only $5 per student.

For information regarding field trips, you can call (205) 348-7550 or email programs@ua.edu.

For more info or to schedule this in-school program for your room, email programs@ua.edu

www.amnh.ua.edu

Suggested Pre-visit activities:

- The Water Cycle
- A Bird's Eye View
- A Poster is Worth a Thousand Words
- What is your Watershed Address?

Suggested Post-Visit activities:

- Watershed words
- Guest Speakers
- How Can Streams Move Mountains?
- A Town in Unrest

Books about Watersheds:

- *Headwaters: A Journey on Alabama Rivers* by Beth Maynor Young and John C. Hall
- *The Underground Water Resources of Alabama* by Dr. Eugene Allen Smith and

Videos and websites about Watersheds:

- *Discovering Alabama: Cahaba River Watershed*
- *Citizen's Guide to Alabama Rivers-Black Warrior and Cahaba, Tennessee River, Chattahoochee and Coastal Plain Streams, Alabama, Coosa, and Tallapoosa*
- *U.S. Fish and Wildlife Service: Appendix A.:Alabama*
- Clean Water Partnership

The Water Cycle

The Water Cycle is an important process for a watershed. Earth today has the same amount of water that is always has, which means the water in your watershed has been around for a while! The water in your lake was once in a cloud, the rain on your window could have come from the trees in your backyard, and the dew on your grass could have come from your local river. It all cycles around, and has done so for billions of years.

The Water Cycle starts with…

1.**Evaporation**: water turns to vapor after being heated from the Sun. The vapor rises into the atmosphere. This is also related to **transpiration**, which is when plants almost "sweat" from the heat of the Sun. It is evaporation of water from plants.

2.**Condensation**: Water vapor then collects in the atmosphere and changes from vapor to liquid. This is when, among other things such as fog, clouds are formed. Water continues to collect and form into these clouds until the water droplets become to heavy to stay in the cloud and fall to the ground.

3.Precipitation: This is the main channel for water to return to Earth. Water droplets who are too heavy to stay in clouds fall to the ground in the form of rain, hail, sleet, or snow. These fall into lakes, rivers, on top of mountain and hills, and even directly onto the ground.

4.Storage: Precipitation is stored as groundwater (water held under the surface), in rivers and lakes, and eventually in plants again. There it sits until it evaporates once again.

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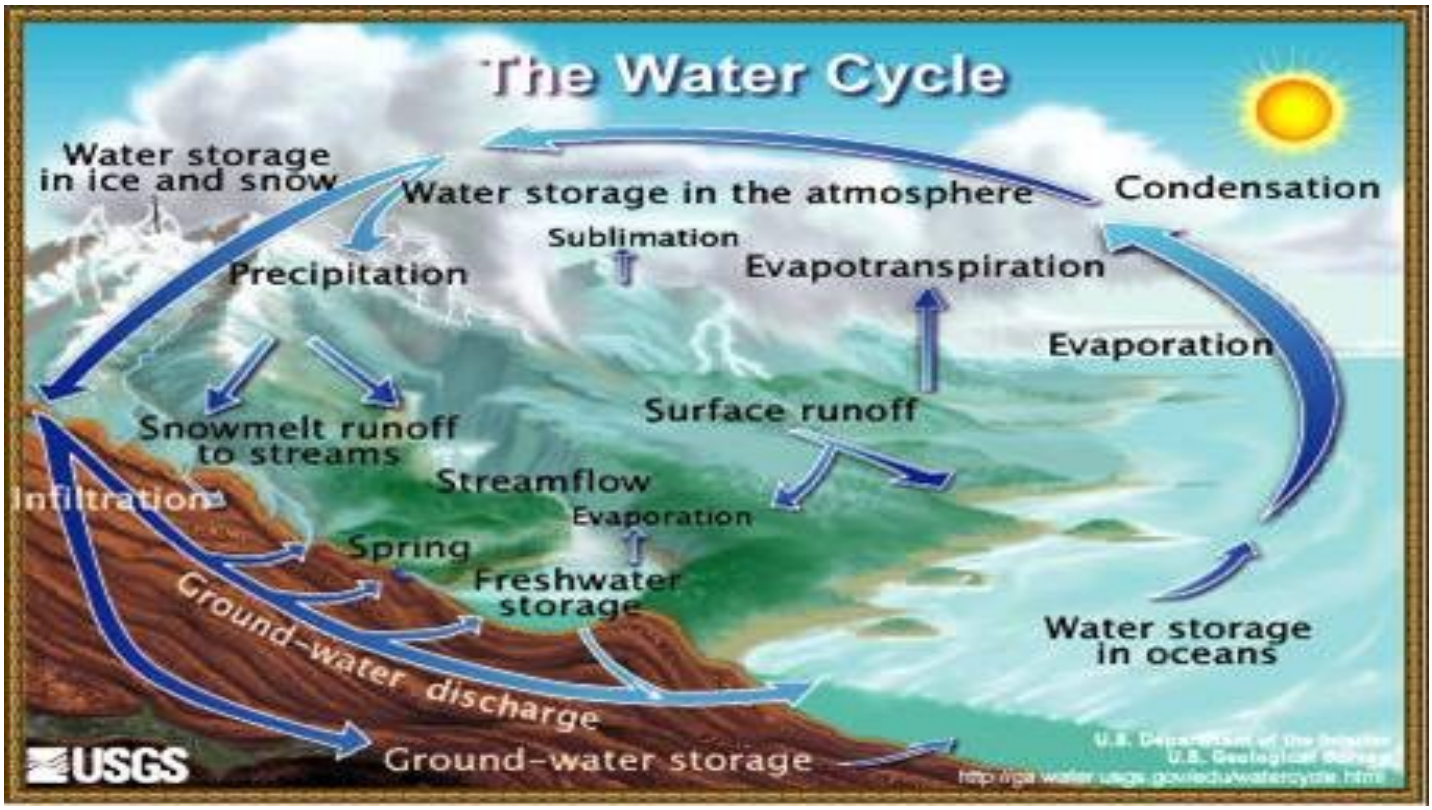


1. How does the water cycle work? _____

_____

2. Does the water cycle resemble any other processes on Earth? _____

_____

3. What is evapotranspiration? _____

_____

4. Can condensation manifest in other forms than just clouds? If so, how? _____

_____

5. How do mountains and hills affect watershed boundaries? _____

_____

6. How is it possible that all of the water found on Earth today is the same water as the beginning of time?

_____

_____

7. Why is water pollution control important? _____

_____

_____

Answer Sheet to "The Water Cycle"

1. Water that has been stored is heated by the sun and turned into vapor, which then evaporates into the atmosphere. There it condenses into a cloud, water vapor or other form. After becoming saturated, water is released in the form of precipitation which falls back to Earth and eventually ends up in storage again.

2. Possible answers: The law of conservation of energy (no energy is lost), carbon cycle, rock cycle, atmospheric cycle, etc.

3. Evapotranspiration is evaporation of the water in plants from the roots through plant leaves.

4. Yes, it can also be invisible water vapor in sky, fog, dew, or frost.

5. Mountains and hills define watershed boundaries because it is from them that watersheds receive their runoff water supply. Rivers and streams which are present on one side of a mountain or hill may not be present on the other side.

6. The water cycle shows us that all water is recycled and never leaves Earth's atmosphere. Therefore all water we use today has been recycled for billions of years.

7. Water pollution affects everyone. The polluted water is recycled through the water cycle and is eventually used or ingested by people, plants, and animals. If our water sources are polluted, we end up using contaminated water, spending more time and energy to try and clean it than we would have if we had controlled the pollution at the start.

Name: _____ Date:_____

WATERSHED WORDS

Match the watershed vocabulary words on the left to their definition on the right.

____ Watershed

____ Non-point source pollution

____ Impaired waters

____ Water quality

____ Tributary

____ Point source pollution

____ Biodiversity

____ Sediment

____ Stewardship

____ Water allocation

A. Rivers, streams, and lakes that do not meet minimal water quality standards.

B. A stream that contributes its water to another stream or body of water.

C. Pollutants discharged from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types.

D. The land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water, also called a drainage basin.

E. Fragmented organic or inorganic material derived from the weathering of soil, alluvial, and rock materials; removed by erosion and transported by water, wind, ice, and gravity.

F. Responsible for overseeing and protecting something considered worth caring for and preserving.

G. In a hydrologic system in which there are multiple uses or demands for water, the process of measuring a specific amount of water devoted to a given purpose.

H. Widespread overland runoff containing pollutants; the contamination does not originate from one specific location, and pollution discharges over a wide land area.

I. A measure of the distinct characteristics, qualities, or elements of plant and animal life in a defined area; a measure of biological differences.

J. The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

A Bird's Eye View

A watershed is a region that drains into a particular body of water. What is a major water source in your area? Use Google Earth to view your town and determine what water source defines your local watershed. Map out your watershed based on the rivers and lakes that affect your town.

About your watershed:

- What rivers and lakes make up your watershed?
- Find the source and the mouth of defining rivers in your local watershed.
- Find streams and tributaries which feed into these rivers.
- What geographical features are in your watershed?
- How many towns and cities are in your watershed? How many of these cities and towns also use the same water source as you?
- Where are you located in your watershed?

One Step Further:

Find the Mississippi River. Where is the source? Where is the mouth? How does the watershed surrounding the source of the Mississippi differ from the watershed at the mouth of the Mississippi?

A Poster Is Worth a Thousand Words

Have your class create watershed posters to show what they know. Posters could be done individually or in small groups.

Be creative! Use markers, collage techniques, finger paint, construction paper, tissue paper, glitter, or whatever you want to make your posters interesting. But make sure to make it informative and relevant.

Poster Subject Ideas:

- Create half of a poster before you learn about watersheds, and the other half after. The first half could be about what the student thought a watershed is and how it works, and the second half about what they learned. The two halves could be compared and discussed.
- After learning about watersheds, students could create a poster about what a watershed is and why it is important to be aware of them.
- Students could create a poster about problems that are unique to their own local watershed, such as pollution, run-off, non-point source pollution problems, etc.
- A poster could be created about ways to protect our watershed. What practices can be used to prevent run-off, non-point source pollution, point source pollution, and other processes which negatively affect our watershed?
- Students could create a poster about the businesses, farms, and towns which are included in their own local watershed. Where is their water source? What potential problems can be found? What proposals can be made to avoid or fix problems created by multiple users of the same water source?

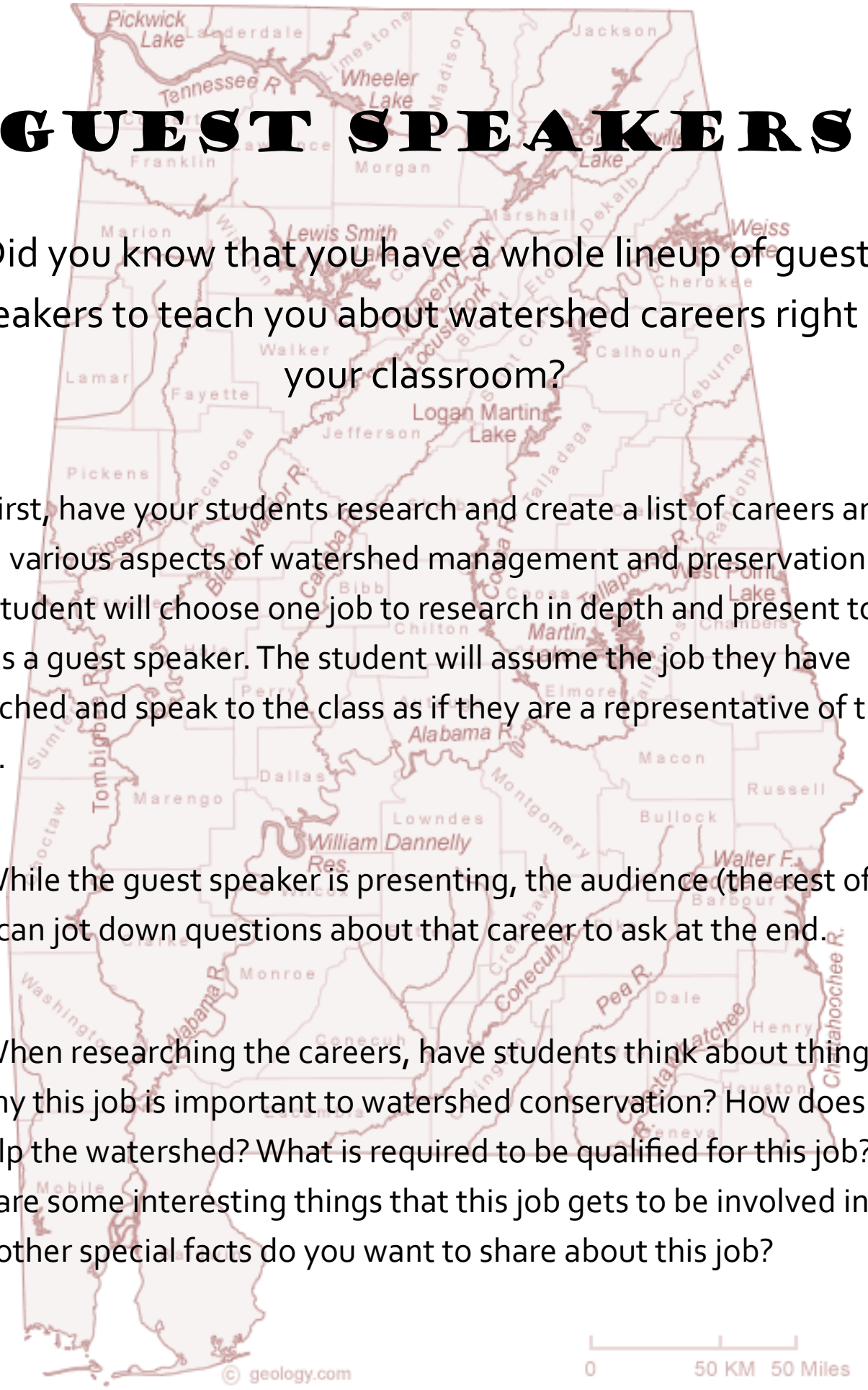
GUEST SPEAKERS

Did you know that you have a whole lineup of guest speakers to teach you about watershed careers right in your classroom?

First, have your students research and create a list of careers and jobs in various aspects of watershed management and preservation. Each student will choose one job to research in depth and present to the class as a guest speaker. The student will assume the job they have researched and speak to the class as if they are a representative of that career.

While the guest speaker is presenting, the audience (the rest of the class) can jot down questions about that career to ask at the end.

When researching the careers, have students think about things like why this job is important to watershed conservation? How does this job help the watershed? What is required to be qualified for this job? What are some interesting things that this job gets to be involved in? What other special facts do you want to share about this job?



How Can Streams Move Mountains?

Materials: Each group will need- the stream trough, collecting pan, 3.8 L jug, pencils, and supports used in Activity 7; sediments: (1) sand (2) round pebbles (3) flat pebbles (4) powdered clay (china clay, kaolin, or pottery clay) (5) ion mixture (a saturated solution of table salt and water); an eyedropper; a mixing jar (paper cup, baby food jar, etc.); a stirring rod (a pencil or a plastic straw will work); a clean glass microscope slide; a magnifying slide; a meter stick; water source; rags, paper towels, or sponges for cleaning up; NOTE: Your teacher will provide a bucket to collect all wed sediments. Do not dump sediments in a sink—they will clog the drain.

Vocabulary

Colloidal suspension: A method of sediment transport in which water turbulence (movement) supports the weight of the sediment particles, thereby keeping them from settling out or being deposited.

Saltation: The movement of sand or fine sediment by short jumps above the ground or streambed under the influence of a current too weak to keep it permanently suspended.

Background

In this activity, you will investigate how a stream carries its load of sediments. All streams carry sediments including sand, pebbles, dissolved minerals, and organic materials. Flowing water can quite literally "move a mountain" from an inland location to a river delta or into an ocean basin.

Objective

To explain how water contributes to the process of erosion and demonstrate four ways that streams carry sediments.

Procedure

-Set up the stream trough with the upper end elevated 5 cm above the table surface. Place the collecting pan at the lower end. Adjust the level of the jug supports so that the base of the jug will rest about 10 cm above the table (5 cm above the end of the trough). Place the pencils in the holes in the jug, fill it with water, and set it on the support.

-Allow the water to begin flowing from one hole of the jug. Drop a pinch of sand (no more than you can hold between two fingers) into the flowing water near the upper end of the trough and observe what happens. Describe the movement of the sand particles. _____

_____

-You may see particles of sand bouncing along in the flowing water. This type of movement is called saltation. Both wind and water move sand in this way.

-Imagine millions of grains of sand bouncing along in the water of a stream. How might the sand change the streambed?_____

-Would the grains of sand be changed by bouncing along? In what way? _____

_____

-Remove any sediment remaining in the trough after observing the motion of the sand. When necessary, empty your collecting pan and the sediments it contains into the class sediment bucket. Do not pour sediment into the sink—it will clog the drain.

-Refill the jug with water whenever necessary.

-Place four round and flour flat pebbles in the upper end of the trough. Allow the water to begin flowing over them.

-Describe how the pebbles move down the trough. Are there any differences in the way that round pebbles move compared to flat pebbles? How do you think the shape of the pebbles might change if they were moving down a stream for long distances? _____

_____

-Put a pinch or two of powdered clay in a mixing cup of water and stir vigorously until the mixture appears cloudy. This clay-and water mixture is called a colloidal suspension.

-Start the water flowing down the trough from one hole and pour the suspension of clay and water into the stream. How is the colloidal suspension transported by the stream? _____

_____

-Use the dropper to add a small amount of the salt solution to the upper end of the flowing stream of water.

-Can you observe the salt solution being carried by the stream? If so, describe how it is carried by the stream. _____

_____

-One way to tell whether or not a stream is carrying dissolved materials is to obtain a water sample and allow the water to evaporate. If salts are present in the water, they will crystalize as the water evaporates. Test for the presence of salt in the ion mixture s follows:

- Place two drops of the ion mixture on a clean microscope slide. Set the slide in a warm place and allow the water to evaporate. Use a hand magnifying lens (or microscope, if one is available) to observe what remains after the water evaporates. Sketch or describe your observations:

-List four methods by which streams move sediments.

_____

_____

_____

_____

What is Your Watershed Address?

This activity encourages students to recognize and explore their watershed by using state or regional road maps that cover enough area to incorporate many rivers and streams. Have students first identity their immediate location and then find and trace all streams (including creeks and rivers) that flow or lead directly into a larger body of water. Have them trace these streams as far back (upstream) as they can. Next have them trace the outer boundary that includes all of these streams. This outer boundary represents their watershed.

For example, in our locale (Baltimore, Maryland) we used a regional road map that included to following states: New York, Pennsylvania, New Jersey, Maryland, Delaware, Virginia, and West Virginia. Students marked Baltimore as their location and then, using a blue highlighter, traced all streams and rivers that flowed into the Chesapeake Bay. Using a green marker they then traced the outer boundary of the streams and rivers. The intent was to show them how the Chesapeake Bay receives water from all of the streams and rivers. The intent was to show them how the Chesapeake Bay receives water from all of these sources and thus is the major watershed of the area.

Driving Questions

1. What does it mean to be part of a watershed?
2. Based on where I live, how would my watershed be defined?

Materials

- State or regional road map
- Highlighters or dry erase markers (black, blue, green, and red; use only low– or non-VOC markers)

Procedure

Have students use the road maps and high-lighters or markers as follows:

1. Ask them to use black to mark on the map where they are located.
2. Ask them to use blue to trace all waters (rivers, streams, etc.) that flows into the main body of water.
3. Ask them to use green to trace the outer boundary of all water flowing into the bay.
4. Have a class discussion in which students compare their boundaries (green lines) to the boundary of the actual watershed.
5. If the actual watershed boundary is different from their boundaries, ask the students to use red to trace the correct boundary.

Think About

1. In what direction does water always flow?
2. What does the previous answer tell you about the elevation of river sources?
3. What are the main rivers flowing into your body of water?
4. What are the smaller rivers that flow into these larger ones?
5. What does the pattern of flowing rivers remind you of?
6. What is a watershed?
7. What is our watershed?
8. Where are we located in our watershed?

Activity found in Inside-Out: Environmental Science in the Classroom and the Field from the NSTA Press.

A Town in Unrest

Welcome to **Smithville**, a small town which is being faced with some very serious issues. As a lawmaker, towns person, business owner, and conservationist of Smithville, it is your turn to decide what should be done to resolve these issues with the good of Smithville in mind.

(Separate the class into groups, each one assuming the roll of one of the stakeholders of Smithville. Have each group come up with arguments which resolve the issue in a way which also protects their interest. See if an agreement and solid decision can be met.)

- A large toy manufacturer wants to install a factory just north of Smithville on the river that supplies water to the lake which Smithville gets its water from. What are the concerns? What are the advantages? How can the two come to an agreement about protecting the watershed?

- It has been an unusually dry summer. It is one of the worst droughts Smithville has seen in a generation. How do lawmakers allocate water for their residents? What needs should be met first? Should things like watering lawns, and filling pools be allowed? What emergency services can be taken advantage of if need be?

- It's a great day in Smithville! A brand new species of river snail has just been discovered in one of Smithville's streams. This species is not found anywhere else on Earth, and is an important discovery in the scientific community. What should be done about this? Should legislation be put into place to protect the snail? What about other aquatic life in the stream?

- There has been reports of acid rain in the area. How will Smithville react? What needs to be done to investigate and correct the problem? Who is responsible for the problem?