Watersheds

6-8

Science and Social Studies Standards Covered:

SC (6)- 2. Describe factors that cause changes to Earth's surface over time.

3. Describe water and carbon biogeochemical cycles and their effects on Earth.

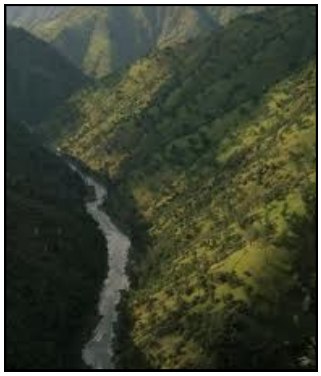
SS (7)- 3. Describe processes that shape the physical environment, including long-range effects of extreme weather phenomena and human activity.

8. Describe positive and negative environmental effects of human actions on the four basic components of Earth's physical systems: atmosphere, biosphere, lithosphere, and hydrosphere.

12. Describe problems involved in balancing the impact of human habitation on the environment and the need for natural resources essential for sustaining human life.

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

6-8

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

Suggested Post-Visit activities:

- Watershed Words
- A Poster is Worth A Thousand Words
- Guest Speakers
- Extra! Extra! Read All About It!

Books about Watersheds:

- *The Water Cycle* by Trudi Strain Trueit
- *Life in a River* by Valerie Rapp
- *River of Words: Images and Poetry in Praise of Water* by Pamela Michael and Robert Hass

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.

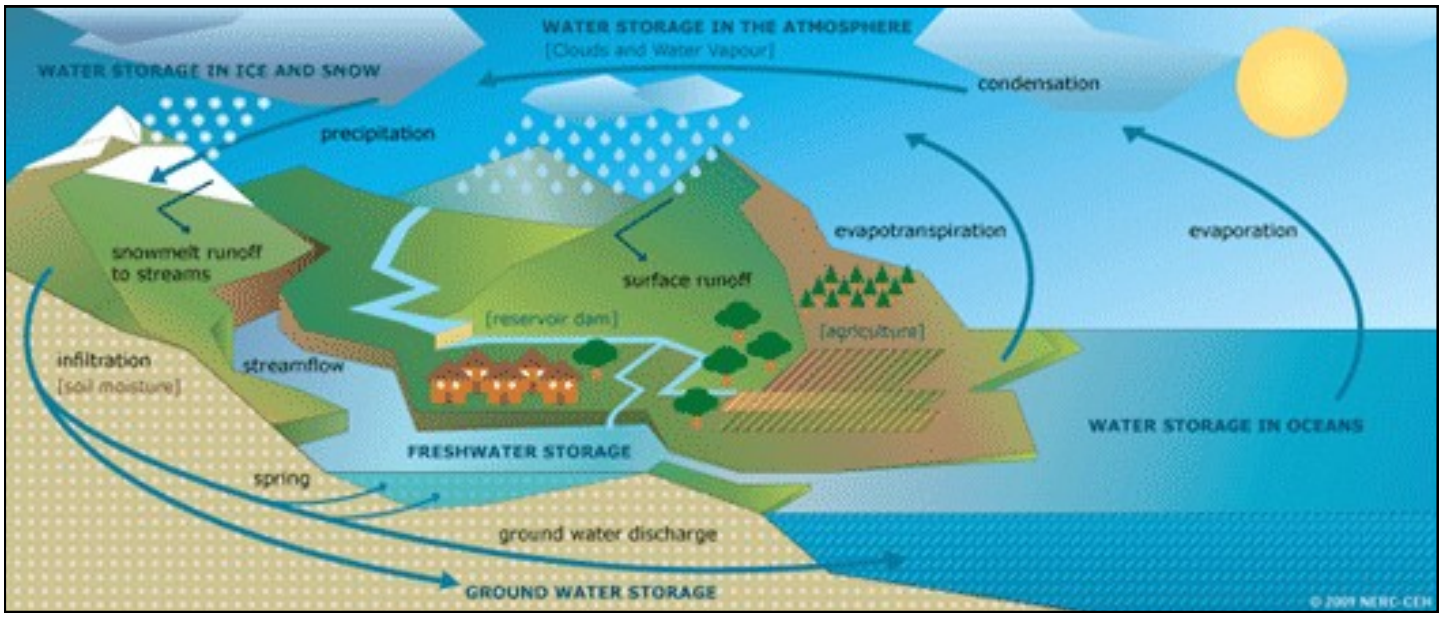
2.**Condensation**: Water vapor then collects in the atmosphere and changes from vapor to liquid. This is when, among other things such as fog, clouds are formed. Water continues to collect and form into these clouds until the water droplets become to heavy to stay in the cloud and fall to the ground.

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.

Name: _____ Date:_____

The Water Cycle



1. What are the phases of the water cycle? _____

_____

2. Name four ways which water can be stored. _____

_____

3. What is transpiration? _____

_____

4. Name three ways in which condensation can manifest. _____

_____

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

_____

6. Do you believe that all of the water on Earth today is the same water from the beginning of the Earth? Why or why not? _____

_____

7. Would it matter to someone who lived on the mountain if waste was dumped into the lake? Why or why not? _____

_____

8. Why is water pollution control important? _____

_____

_____

Answer Sheet to "The Water Cycle"

1. Evaporation, Condensation, Precipitation, Storage

2. Possible answers: water storage in atmosphere, oceans, freshwater storage like lakes and stream, storage in ice and snow, groundwater, plants and animals.

3. Transpiration is evaporation of the water in plants through plant leaves.

4. Possible answers: clouds, invisible water vapor in sky, fog, dew, 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. Yes, because 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. Yes, because the polluted water would eventually become some form of precipitation which would fall onto the mountain dweller.

8. 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 released from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types.

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

E. 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. 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 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?

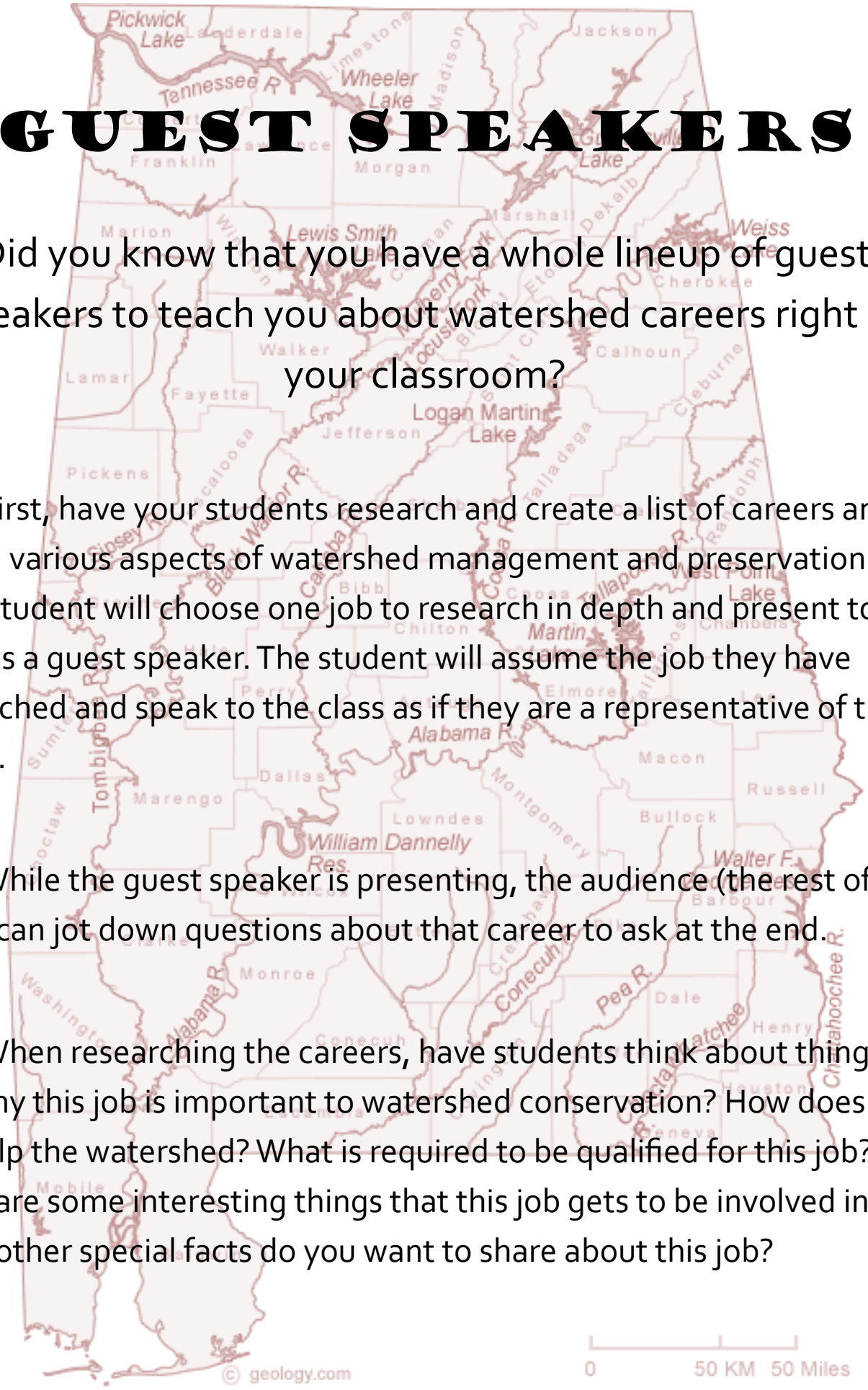
GUEST SPEAKERS

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?



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 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?

EXTRA! EXTRA! READ ALL ABOUT IT!

Create a class newspaper about your watershed.

Discovery Stage: Study newspapers to see how they are organized. Talk about the sections you find and the purpose of each one (local news, sports, business, etc.). Study the language reporters use when writing their articles. What types of topics are covered? How do reporters catch your interest with a headline? Discuss the pictures you see featured. What makes photos compelling?

Planning and Development Stage: On the board, write as many of these as you feel is appropriate, "Local News, National News, World News, Sports, Business, Editorial, Politics" with four or five slots beneath each one (or enough slots so that each student can be assigned to a section, as evenly distributed as possible). Have students decide what sections they would like to report on. Break into their section groups. When in groups, students should discuss story ideas for a watershed newspaper for their respective sections. If computers are available, students can begin researching their watershed for ideas. Each student in the group should be assigned to a story, be it individual or a partnered venture. Each group should produce four to five stories and a few pictures for a their section. Each group should also contribute one cartoon for the comics page which will be a collaboration from all groups.

Implementation Stage: A week or so later, students should have their stories written and edited, their pictures chosen, and cartoons at least at the beginning stages of development. Using a computer lab or classroom computers, have each group enter their articles into a digital format. You can use Microsoft Word, Microsoft Publisher, or other word processing program, to enter information into a newspaper template. You can also use http://paper.li/ to create an online newspaper which can be edited by all of your students. Cartoons can be scanned and added to the newspaper as image files.

Finalization: After all stories are entered, print out copies for each student if possible. If not, view your finished product together via projector or overhead. Have students explain why they chose their topics or pictures, and what they learned through the experience. Circulate your newspaper to other classes to show what you have learned about watersheds.

Possible watershed article ideas:

~Watershed conservation policies

~Events happening

~Politics and our watershed

~New factory or business being built

~History of our watershed

~Popular activities and attractions (lakes, rivers, etc.)

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.

_____

_____

_____

_____

<u>Complete the following statements:</u>

-A faster-moving stream will be able to carry _____ (more, less, the same amount of) sediments as/than a slower stream.

-A faster-moving stream will be able to carry _____ (larger, smaller, the same size) sediments as/than a slower stream.

How Can Farmers Reduce Erosion Caused by Rain?

Background

Water running across land being used for growing crops can carry away large amounts of topsoil. In this activity, you will investigate how different plowing techniques affect the rate of erosion.

Materials:

Each group will need- 2 paint roller trays, 2 collecting basins that are wider than the paint trays, 1 watering can, topsoil—enough to partially fill the roller trays, bricks or wooden blocks for supporting the roller trays, a water source, a meter stick, newspapers or plastic sheeting, rags, sponges, or towels or cleaning up spills.

Objective

-To demonstrate how mulching and contour farming practices can reduce erosion, and to measure the amount of erosion occurring on a model of a cultivated field

-Before starting this activity, a collection bucket for the water that contains soil particles should be set up. All groups must dispose of their sediment-containing water in this bucket.

Time Management

-This activity should only take about one class period to complete.

Procedure

-Spread out newspapers or plastic sheets to protect any surfaces that might be damaged by water or soil.

-Set up two models hillsides as follows: Fill the paint roller trays with soil. At the shallow end of each pan, the top of the soil should be just below the rim and have a minimum depth of about 2.5 cm. (The bottoms of these trays are uneven, so the maximum depth will vary.) The surface of the soil should be smooth and level, and parallel to the top edge of the tray.

-Make two stacks of bricks or wooden blocks to elevate each model hillside above the plastic basins. The lower end of the hillsides should hang over the plastic basins. The rims of the raised ends of the hillsides should be 6-7 cm above the rims of the lower end.

-The model hillsides can be used as models of fields plowed in different ways as follows:

-Using a pencil as you plow, make a series of parallel ditches about 2 cm deep in the soil of both hillsides. On one hillside, make the ditches go directly down the slope; on the other, make the ditches go across the slope. See the diagram on the next page.

-Fill the watering can. Simulate a rainstorm on each model hillside by sprinkling approximately 2 L of water on the upper end of each hillside from a height of 75 cm.

1. Describe how the water moves across the soil for the two different model hillsides. Which suffered more erosion? How can you tell?
2. Describe how a farmer in a hilly country should plow the land to reduce the amount of erosions that occurs when it rains.
3. Can you think of other ways that a farmer could reduce soil loss from the fields?

What is happening?

This activity simulates a technique used by many farmers to reduce erosions in plowed fields—contour plowing. In contour farming, one of the easiest and mostly widely accepted soil conservation practices, plowing is done across the slope of the land—that is, on the contour. When farmers plow on the contour in a hilly field, instead of plowing along the usual straight field boundaries and straits rows, they follow curved lines wherever necessary to stay at the same elevations.

Contour plowing alone will not stop erosion; the steepness and length of slope of fields affect the rate of erosion, as does the type of crop being grown and the condition of the soil. However, contour plowing can reduce soil erosions by as much as 50% on the wide range of soil and slope conditions. Contour farming is most effective at reducing erosions if it is combined with such practices as crop rotation and returning organic matter of the soil.

Preparation

-All of the topsoil used in this activity should be a similar type. If the soils are different, it will be difficult to know whether the differences in erosion are caused by differences in the soil or by the different directions of the ditches on the two model hillsides.

-Any similar-sized tray or baking pan can be substituted for the paint roller tray or the collecting basin.

Suggestions for further study

-If you do not have enough watering cans, you can make a sprinkler by using a small nail to punch holes in the bottom of a coffee can or other large can. The plastic top from the coffee can be used to stop the flow of water. You can also use a plastic soda or milk container with a cap. Punch holes near the top on one side and invert to use after the cap is replaced. You may wish to ask each group to provide its own watering device.

-Repeat the experiment after changing the slope by adding or subtracting supports. Be sure to use the same amount of water added at the same rate each time. How does slope affect erosion rate?

Answers

1. On the model hillside with ditches going straight down the slope, the water runs downhill very quickly, carrying a great deal of soil. As the “rain” continues to fall, the ditches get deeper and wider. The model hillside with ditches running across the slope suffers very little erosion. The upper ditches act as dams, holding back and slowing down the water, allowing much of it to sink into the soil.
2. In hilly country, plowing so that the ditches go across the slopes of the hillsides rather than straight up and down the hills can greatly reduce soil loss.
3. Mulching helps to reduce soil loss. After harvesting grain crops, farmers sometimes distribute the straw from the stems of the plants on the fields to serve as mulch. Planting grass or some other type of ground cover on fields after crops have been harvested also helps to prevent soil from washing away or being carried away by the wind.