WASTE NOT, WANT NOT

OBJECTIVES

The student will do the following::

1. Simulate the uses and conservation of water.
2. List 3 to 5 ways to conserve water.
3. Recognize wasteful uses of water in their own environments.

SUBJECTS:
Math, Ecology, Science, Language Arts, Conservation

TIME:
45-90 minutes

MATERIALS:
two 2-gallon (8 L) buckets
2 measuring cups
"Water Use" cards (included)
student sheets (included
teacher sheet (included)
ruler
scissors
glue
crayons or markers
heavy construction paper
brass paper fasteners

BACKGROUND INFORMATION

At this very second, somewhere on the earth, water is falling as snow, rain or sleet. Nature provides us with so much water that if all the mountains and hills were leveled, water would completely cover the earth to a depth of nearly 2 miles (3.2 km). Despite this abundance, water does not fall evenly over the earth's surface. Where precipitation supplies too little water, the result can be desolation. Organisms in a dry environment must be specially adapted to minimize their need for water. Liquid water is the most important single substance for life on earth. Some bacteria live without oxygen, but all known life forms require water.

Water makes up more than 70 percent of all living things. It is found in almost everything we see and touch. The use of water is required by almost every kind of economic activity. It is indispensable to our lives. Water is a natural resource that must be used wisely.

Term

conservation: the act of keeping, protecting, or preserving our natural resources.

ADVANCE PREPARATION

A. Prepare ahead of time by bringing two 2-gallon buckets (or similar containers). Label one "Water Supply" and one "Water Used." Fill the bucket labeled "Water Supply" with water.

B. Duplicate and cut out the water use number and letter cards (teacher sheets).

C. Make photocopies of the water conservation quiz (one per student).

PROCEDURE

I. Setting the stage

A. Have the students discuss all the various ways they use water in a single day.

1. List them on the board and encourage them to include ways that water is used indirectly (e.g., farming, manufacturing, food processing).

2. Categorize the list by having the students decide if the usage is play, work, or home.

B. Assign two students to special positions: one will be a recorder and the other will measure the amount of water used (this person will be the "Quantity Control Officer").

C. Show the students the bucket labeled "Water Supply." Measure the depth of water in the bucket with a ruler and have the "recorder" write the results on the board. Tell the students that the bucket labeled "Water Supply" represents the amount of fresh water allowed per day for the group.

D. Explain that in this simulation, there will be a Group 1 and a Group 2. (NOTE: This simulation is designed for 24 students. The number of participants can be varied as needed. Make sure there is an equal number of conserver and nonconserver cards.)

II. Activity

A. Divide the class into 2 groups.

B. Pass out the "Water Use Number Cards" to Group 1 and the "Water Use Letter Cards" to Group 2. Explain that these cards represent how much water each person will use in a day.

1. Begin with Group 1.

2. As each student reads his demand on the water supply aloud, the "Quantity Control Officer" should remove that amount of water from the water supply bucket and place it in the bucket labeled "Water Used."

3. Ask the student who has card number 1 to read his/her demand and the amount of water needed. Continue with subsequent numbers.

4. This process should continue until all the number cards are used.

C. Measure the depth of water left in the "Water Supply" bucket. Have the recorder write the results on the board.

D. Subtract the amount of water left from the starting amount. Record the difference for Group 1.

E. Repeat the process for Group 2, beginning with the same amount of water as before. (NOTE: If none of the water has been spilled, dumping the used water back into the first bucket should be equal to the same amount.)

1. Ask the student who has card A to read his/her demand and the amount of water needed. Continue with subsequent letters.

2. This process should continue until all the letter cards in the group are used.

F. Measure the amount of water left in the "Water Supply" bucket and record as before.

G. Subtract the amount of water left from the starting amount. Record the difference for Group 2.

H. Discuss the noticeable difference between the amounts left and have the students formulate explanations.

I. Interject the "Water Trivia" teacher sheet; share selected facts with the students.

III. Follow-Up

A. Have the students state the difference in the groups; they should notice how one group carefully used its water supply and the other used it without concern for the amount available.

B. Help the students explain the differences in behaviors in the water use by each group.

C. Ask the students how group 1 could have conserved more.

D. What things do the students do that could conserve water in their daily uses?

E. Have the students list 3 to 5 ways to conserve water.

F. Have the students complete the student sheet, "Water Conservation Quiz." (Answers: 1.W, 2.W, 3.W, 4.S, 5.S, 6.S, 7.S, 8.S, 9.W, 10.W)

IV. Extensions

A. Give the students copies of the "Water Use Detective Badge and Citation" student sheet. Have them color and cut out the badge; they can pin or tape it to their shirts. Have the students become "Water Use Detectives" by finding as many ways as possible the school wastes water. Make a list of their findings and suggested solutions on the citation. Post these lists or send them to the principal.

B. Have the students complete a checklist of conservation improvements and practices in their individual homes as a homework assignment.

C. Have the students categorize the teacher sheet information (trivia) and student water use suggestions as to whether they are home, work, or play uses. Design circle, bar, or line graphs to show the results.

D. Have the students write a letter to the local newspaper explaining their concerns to the public.

RESOURCES

"The ABC's of Water Conservation," Channing L. Bete Company, New York, 1981.

Burch, Sandra K., "Be Water-Wise," Virginia Water Resource Center, Blacksburg, Virginia, 1983.

Leopold, L. and W. Langhein, A Primer On Water, U.S. Government Printing Office, Washington, DC, 1960.

"The Story of Drinking Water: Teacher's Guide Primary Level," American Water Works Association, Denver, Colorado, 1984.

WATER USE NUMBER CARDS

Group 1

#1 I have been working in the sun and am very thirsty. I would like some cold water to drink. 1 CUP (250 mL)	#2 I have been playing basketball and need to take a bath. 3 CUPS (750 mL)
#3 Mom asked me to wash the breakfast dishes, so I put them in the dishwasher and turned it on. 2 CUPS (500 mL)	#4 Mom said my tennis shoes need cleaning, so I ran them through the washing machine. 2 CUPS (500 mL)
#5 Since it's so hot outside, I want to fill up the wading pool. 2 CUPS (500 mL)	#6 It is time for lunch and I need to wash my hands with the faucet running. 1 CUP (250 mL)
#7 Mom wants me to wash her car tonight. 2 CUPS (500 mL)	#8 Flush the toilet, please. 1 CUP (250 mL)
#9 Dad and I are growing a garden. Since plants need water, turn the sprinkler on, please. 2 CUPS (500 mL)	#10 I just ate an ice cream cone. I need to brush my teeth with the faucet running. 1 CUP (250 mL)
#11 Our grass needs water to grow every day. 1 CUP (250 mL)	#12 I noticed the faucet leaking but it's nothing more than a drip. 1 CUP (250 mL)

WATER USE LETTER CARDS

Group 2

A. I have been working in the sun and am very thirsty. There is a cold bottle of water in the refrigerator. 1/2 CUP (125 mL)	B. I have been playing basketball and I need to take a short 5-minute shower. 1/2 CUP (125 mL)
C. Mom asked me to wash the breakfast dishes. I will wait until our dishwasher is full. 1/2 CUP (125 mL)	D. Mom said my tennis shoes need cleaning. I'll run them in the washing machine when it is full of old towels or cleaning rags. 1 CUP (250 mL)
E. Since it is so hot outside, I want to fill the wading pool, but I don't need to fill it to the top. 1 CUP (250 mL)	F. It is time for lunch and I need to wash my hands. I'll just fill the sink halfway and not run the faucet. 1/2 CUP (125 mL)
G. Mom wants me to wash her car, so I'll use the water I saved from the kitchen and bathroom sinks instead of letting the water run down the drain. 0 CUPS (0 mL)	H. Please flush the toilet. There is a plastic bottle filled with stones in the tank. 1 CUP (250 mL)
I. Dad and I are growing a garden. We use a soaker hose and mulch the plants. I'll also use rainwater we have saved. 1/2 CUP (125 mL)	J. I just ate an ice cream cone. I need to brush my teeth. I never leave the water running. 1/2 CUP (125 mL)
K. Our grass needs water to grow, but not every day. We use a soaker hose. 1/2 CUP (125 mL)	L. I noticed the faucet leaking so I told my dad and he fixed it. 0 CUPS (0 mL)

WATER TRIVIA

1. It takes 100,000 gallons (379,000 L) of water to manufacture one automobile.
2. 122 gallons (462 L) of water are needed to produce one loaf of bread.
3. It takes 50 glasses of water to grow 1 glass of orange juice.
4. 97 percent of all earth's water is salty; only 3 percent is fresh water.
5. 3/4 of the earth's surface is covered with water.
6. A 20-minute shower uses 16-20 gallons (60-75 L) of water.

   A 10-minute shower uses 8-10 gallons (30-38 L) of water.

   A 5-minute shower uses 4-5 gallons (15-19 L) of water.
7. It takes 3 gallons (11 L) of water to flush a toilet.
8. It takes 30-40 gallons (115-150 L) of water for a tub bath.
9. 10 gallons (38 L) of water is required to hand wash dishes.
10. It takes 20-30 gallons (75-115 L) of water to run a washing machine.
11. The average American home uses an average of 293 gallons (1,110 L) of water a day.
12. It takes 2,500 gallons (9,500 L) of water to produce one pound (2.2 kg) of beef.

WATER CONSERVATION QUIZ

Saving or Wasting

Print an "S" on the line before an action that saves water. Print a "W" on the line before an action that wastes water.

____ 1. Take long showers.

____ 2. Fill the bathtub full.

____ 3. Delay fixing a leaky faucet.

____ 4. Fix a leaky toilet.

____ 5. Wash only full loads in the washing machine or dishwasher.

____ 6. Fill the bathtub 1/4 full.

____ 7. Turn off water while brushing teeth.

____ 8. Fix leaky faucet.

____ 9. Wash a few clothes every day.

____ 10. Let water run while brushing teeth.

Water Waste *CITATION*



Location of water waste _____

_____

Description _____

_____

Suggested solution(s) _____

_____

_____

_____

_____

_____

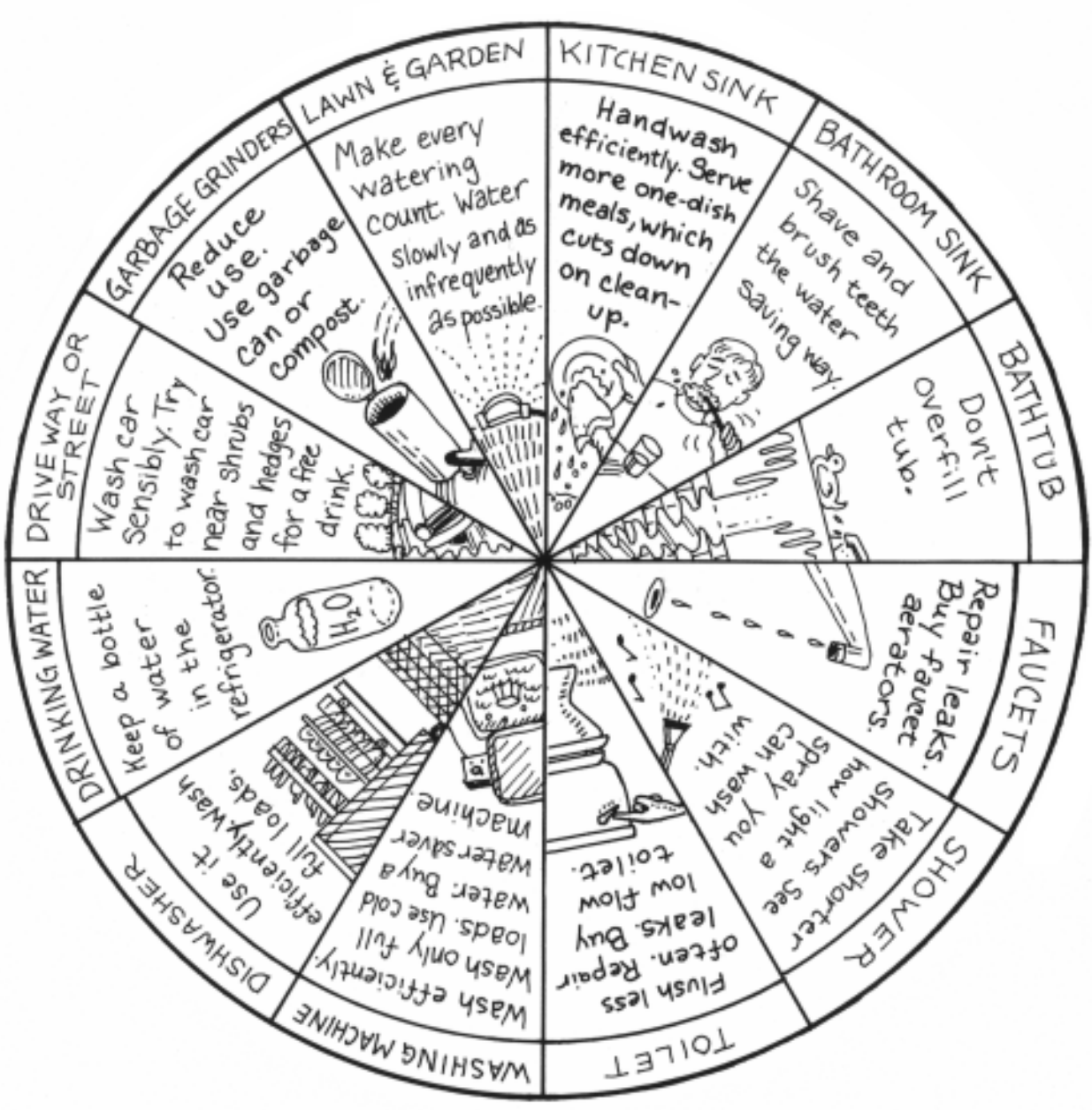
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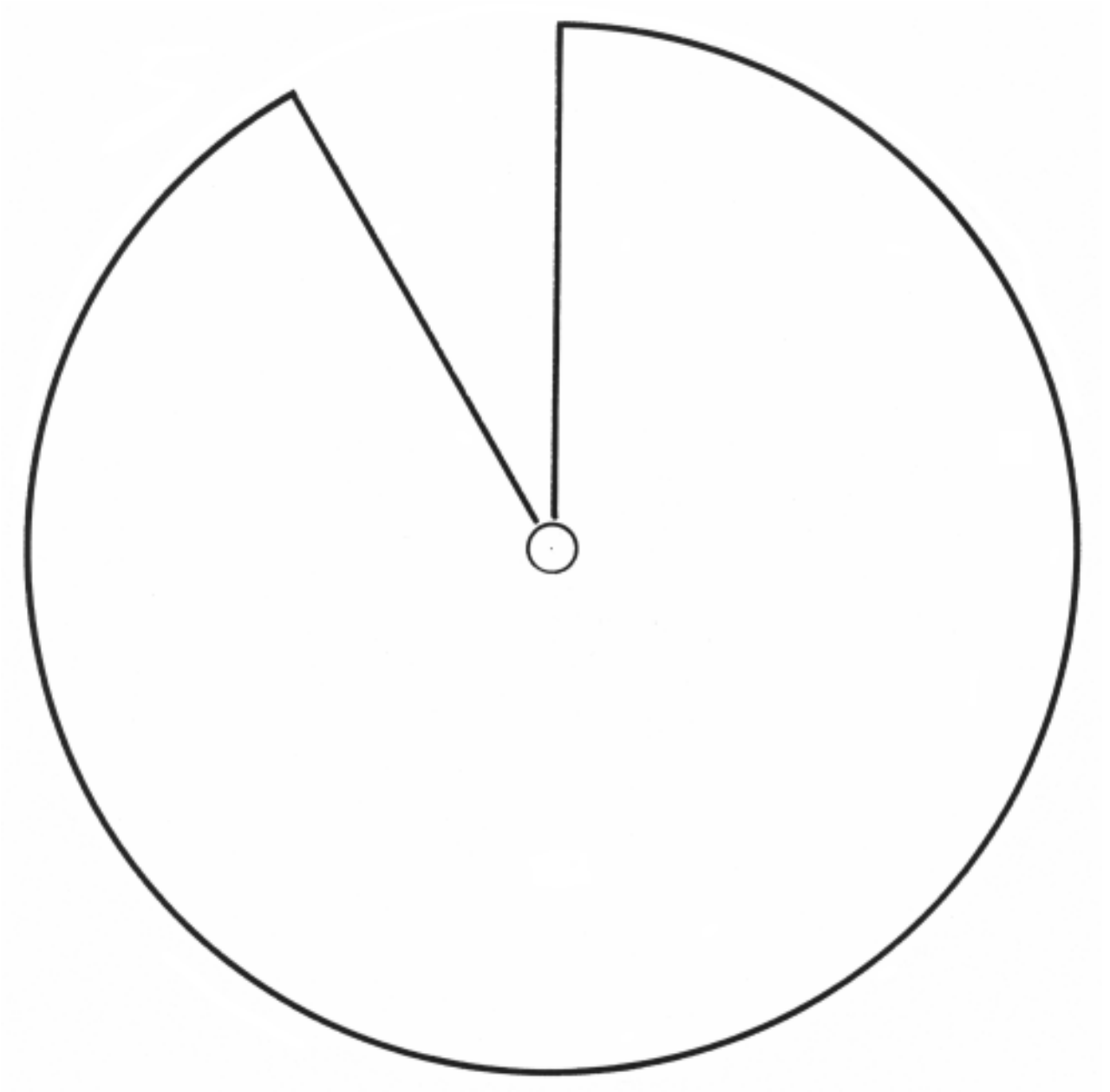
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MAKE A WATER CONSERVATION WHEEL!



MAKE A WATER CONSERVATION WHEEL!
(continued)



The Incredible Journey—Cube Pattern



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Just Passing Through

Plants and soils slow me down, and lakes, ponds and wetlands can hold me—but only for a while. Wherever I am, I'm just passing through. What am I?

- **Grade Level**
  Upper Elementary, Middle School
- **Subject Areas**
  Earth Science, Environmental Science, Ecology
- **Duration**
  Preparation time: Part I: 30 minutes; Part II: completed in Part I; Part III: 20 minutes
  Activity time: Part I: 20 minutes; Part II: 20 minutes; Part III: 30 minutes
- **Setting**
  Large space
- **Skills**
  Analyzing information (comparing and contrasting); Interpreting (relating, summarizing); Applying (designing)
- **Charting the Course**
  "The Thunderstorm" is included in Part I to begin the simulation. In "Get the Ground Water Picture," students are introduced to how water moves through soil. Students explore the role of their schoolyard in a watershed in "Rainy-Day Hike." In "Color Me a Watershed," students learn how changes to a watershed affect stream discharge. In "Sum of the Parts," students recognize how surface runoff and ground water can transport both point and nonpoint source pollutants.
- **Vocabulary**
  anaerobic, aerobic, organic, wetlands, erosion, sediment, Best Management Practices, vegetation, floodplain, delta, watershed manager, nonpoint source pollution, catch basin, riparian

Summary

In a whole-body activity, students investigate how vegetation affects the movement of water over land surfaces.

Objectives

Students will:

- compare the rates at which water flows down slopes with and without plant cover.
- identify Best Management Practices that can be used to reduce erosion.

Materials

Warm Up

- *Copies or overhead transparencies of* ***Slope Comparison*** *or*
- *Copies or overhead transparencies of photographs of hillsides with and without plant cover*

Part I

- *Yarn or rope* (the length of the playing field)

Part III

- *Tray of soil*
- *Container of water* (to be poured on tray of soil)
- *Planting pot containing only soil*
- *Container of water, including shredded paper*

Making Connections

Children have observed how water flows downhill and how it often transports litter or sediment. When watering plants, students have seen how soil and plant matter absorb and hold water. Understanding how vegetation affects water's movement across and through a site promotes student appreciation of the relationship between water quality and landscape.

Background

As it flows over and through soil, water filters through spaces among particles, and around plant roots and vegetative matter. This process slows the movement of water. Sediment (soil and other natural materials carried by water) may be removed from the water as it is captured and stored by vegetation, lakes, ponds and wetlands. Vegetation also helps to hold soil in place. When vegetation is removed (by human or natural causes), soil particles are more likely to be dislodged and carried away by water. This is called erosion.

Soil being carried by water is a natural, ongoing process. Erosion has occurred since water appeared on the planet. (Consider the formation of the Grand Canyon or the gradual leveling of the Appalachian Mountains.) When soil and organic matter are carried by water from one location to another, the destination site may be enriched and its surface area increased (e.g., the floodplain of a river or delta). However, the effects of erosion are not always desirable. Erosion of topsoil decreases the fertility of soil, and sediment build-up in streams and lakes can harm aquatic life.

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Ensuring that the condition of a land area does not promote deleterious erosion and other water resource problems involves the use of Best Management Practices (BMPs). Watershed managers rely on BMPs that reduce erosion and diffuse, or nonpoint source (NPS), pollution problems. (According to the U.S. Environmental Protection Agency [EPA], NPS pollution is "caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.") BMPs that prevent erosion include: landscaping areas to promote plant cover; replanting areas cleared by logging; monitoring water that enters and leaves cut areas; building terraces, catch basins, and natural filters to mitigate sediment deposition in lakes, streams, etc.; and leaving a green or planted zone in riparian areas.

Procedure

Warm Up

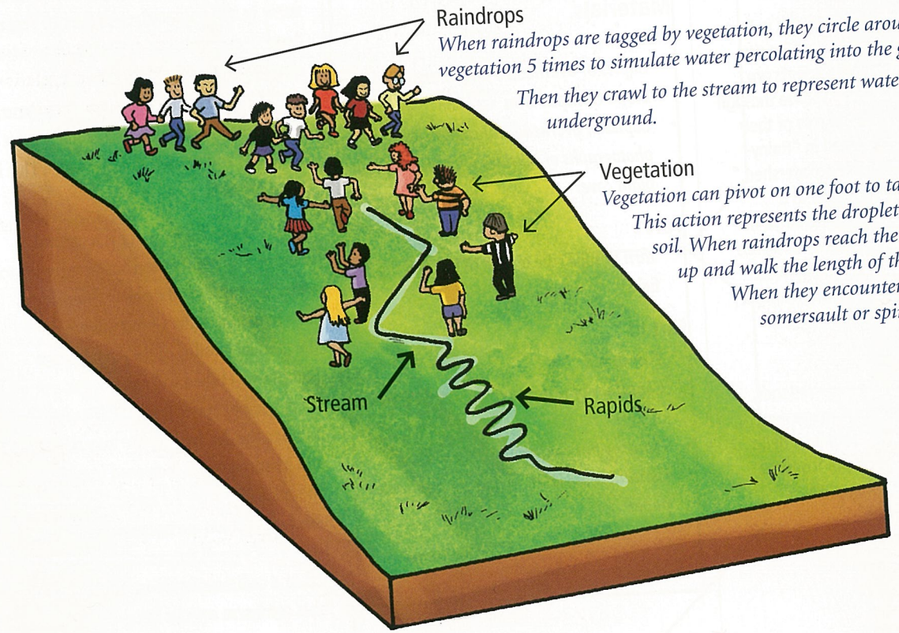
- Show students the pictures on ***Slope Comparison*** or other pictures of hillsides that are covered with vegetation. What do they think would happen to the water?
- Now, show photographs of hillsides with barren slopes. How would rainfall affect these areas, compared to the previous sites?

The Activity

Part I

1. **Inform students they are going to act out the role of water as it flows through a site (down a slope and into a stream). Arrange the playing field according to the diagram *Slope with Plant Cover*.** Lay yarn or a piece of rope down the middle portion of the field to indicate the stream. (A section of the yarn can be crumpled up to represent rapids.) Have half of the class assemble at one end of the playing field. These students represent "raindrops." The remaining students represent "vegetation" and should position themselves somewhere between the raindrops and the stream.
2. **To begin, have students participate in *Part I* of the activity, "The Thunderstorm." At the height of the storm, raindrops move into the site and take the most direct route to the stream (walking swiftly).** This represents water falling on and flowing over the land's surface.

Slope with Plant Cover



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Procedure

▼ *Warm Up*

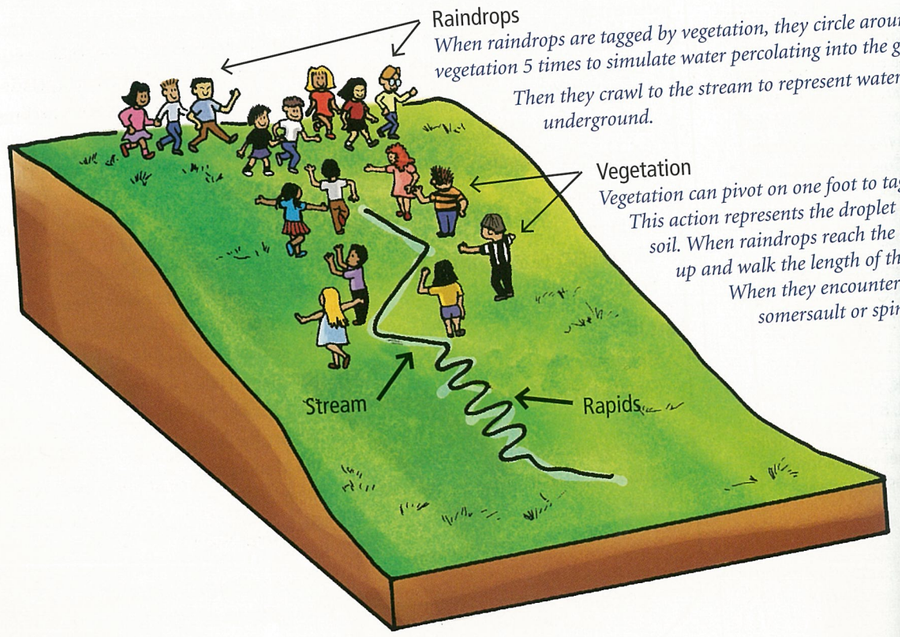
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▼ *The Activity*

Part I

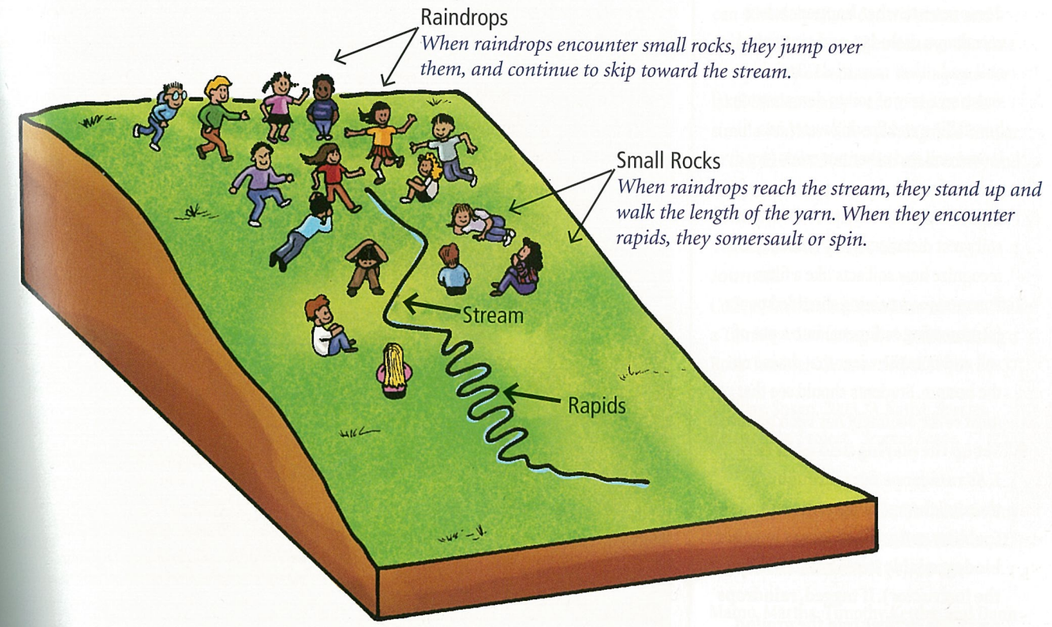
1. **Inform students they are going to act out the role of water as it flows through a site (down a slope and into a stream). Arrange the playing field according to the diagram *Slope with Plant Cover*.** Lay yarn or a piece of rope down the middle portion of the field to indicate the stream. (A section of the yarn can be crumpled up to represent rapids.) Have half of the class assemble at one end of the playing field. These students represent "raindrops." The remaining students represent "vegetation" and should position themselves somewhere between the raindrops and the stream.
2. **To begin, have students participate in *Part I* of the activity, "The Thunderstorm." At the height of the storm, raindrops move into the site and take the most direct route to the stream (walking swiftly).** This represents water falling on and flowing over the land's surface.

Slope with Plant Cover



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Barren Slope



3. Vegetation on the slope slows the flow of water. To show this, students representing vegetation try to tag the raindrops. Vegetation must keep one foot in place, but can pivot and stretch their arms (representing roots trapping water).
4. If a raindrop is tagged, the student simulates filtering into the ground by circling five times around the vegetation. To represent water moving underground toward the stream and passing through spaces among soil particles, raindrops should crawl toward the yarn. (In reality, this process can take many days, weeks or months, depending on rock material and gradient.) Raindrops cannot be tagged a second time.

5. **Once raindrops reach the stream, they stand up and walk the length of the yarn.** If they encounter rapids, they can spin about or do forward rolls to represent water spilling over rocks. At the end of the stream, they should wait for the rest of the raindrops.
6. **Record the time it takes all the raindrops to pass through the site.** Students can exchange roles and repeat the simulation.
7. **Discuss the results of the activity. Ask students to describe water's movement.** Help students to understand how vegetation slows the rate of flow, which allows time for water to percolate into the soil.

Part II

1. **Ask students how the results of the activity will differ when vegetation is removed. Have students perform the second version of the activity. (See diagram, *Barren Slope*.) Half of the class simulates raindrops and the other half represents "small rocks."** Students representing small rocks should sit or lie down, curling themselves into tight balls. When raindrops move near a rock, they can walk around or jump over it, continuing to flow down the slope.
2. **Compare the time required for raindrops to flow through sites with and without plant cover. Discuss the implications of water racing down a barren slope.**

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Just Passing Through—Slope Comparison

Compare these photos of slopes with and without plant cover.

Barren slopes.

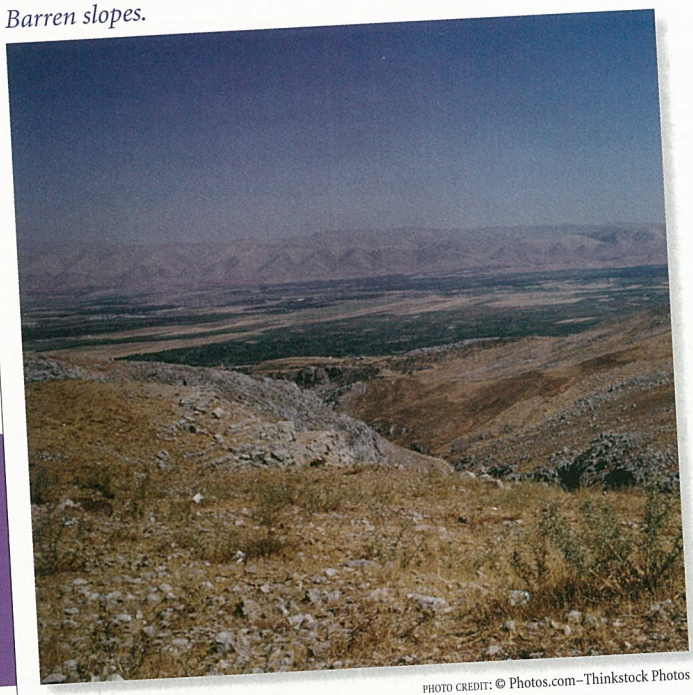


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Vegetated slopes.



PHOTO CREDIT: © iStockphoto–Thinkstock Photos



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Part III

1. **Prior to the third simulation, demonstrate what happens when raindrops dislodge and transport soil and other materials.** Sprinkle water on a tray of soil to demonstrate how falling and flowing water can loosen soil and other materials (e.g., pieces of wood, decaying matter and litter). Water can transport the loosened soil great distances. Help students to recognize how soil acts like a filter. Pour water containing shredded paper (representing sediment) into a pot of soil and note the water that drains out the bottom. Students should see that most of the sediment has been removed.
2. **Set up the playing field as in *Part I*. As raindrops flow through the site, they pick up sediment (pebbles, twigs, dead leaves or other biodegradable items scattered by the instructor). If tagged, raindrops percolate or filter into the ground. They drop all the tokens they have collected (symbolizing soil filtering raindrops and removing sediment).** Once raindrops are tagged, they circle five times around vegetation and crawl to the stream. (They do not pick up any more sediment.) Remind students about gravity; raindrops must keep moving as they bend down to collect materials.
3. **After raindrops make it through the site, have them count the number of items that they are still holding.**
4. **Arrange the activity as in *Part II* and have raindrops flow through the site, picking up sediment.** At the conclusion, students should find that a larger amount of sediment has been collected by the raindrops than in the previous simulation.
5. **Discuss problems associated with erosion and unchecked transport of sediment. Introduce Best Management Practices that can be used to control erosion.** Remind students that erosion is a natural process (necessary for adding minerals to streams and creating landscapes). However, because a large amount of sediment is being removed within a short period of time, this simulation (***Part III***, step 4) represents erosion that could be harmful.



PHOTO CREDIT: © Creatas–Thinks

Children running down a slope.

Wrap Up

Have students inventory their school grounds or community, looking for la areas that compare to those demonst the activity. During a rainfall, studen observe the area's runoff and the am sediment carried by the water. Stud plant trees or landscape a garden to an area that has erosion problems.

Project WET

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Storm Drain Watch

Grades: 3 – 4

Time Allotments:

Teacher preparation: 45 minutes
Lesson/activity: 30 – 45 minutes
Closure/assessment: 30 minutes

Content Objectives: After performing this activity students will be able to:

1) Describe what stormwater is;
2) Explain the purpose of a storm drain;
3) Define the term "nonpoint source pollution" and identify examples of it;
4) Suggest reasons why people create or contribute to nonpoint source pollution; and
5) Select strategies for reducing or preventing some forms of nonpoint source pollution.

Process Objectives: Students will:

1) Analyze real-life situations to determine concerns, problems and potential solutions;
2) Participate in group discussion and perform a task; and
3) Respond to questions from teacher.

Curricular Areas and Corresponding Core Curriculum Content Standards:

Consumer/Family/Life Skills	**9.2** (G4) A1 & 4
Social Studies:	**6.6** (G4) C1
Science:	**5.10** (G4) B1
	5.8 (G4) B 2 & C2
	5.4 (G4) A1 & C3
	5.1 (G4) A4
Language Arts:	**3.4** (G3) B2 (G4) A1-3, B3 & 4
	3.3 (G3) A1-3, B2, C3 (G4) A2, B4-6
	3.2 (G3) D1 (G4) D1
	3.1 (G3) D3, F5 & G8 (G4)

Vocabulary:

Nonpoint Source Pollution
Stormwater
Storm Drain

Materials Needed:

- An aquarium (non-leaking) with clear glass sides
- Water – should fill aquarium up halfway
- Cardboard box or box top – big enough to fit over top of aquarium
- Scissors – used to cut hole into box or boxtop
- Green and brown food coloring
- Two small bottles or baby food jars each filled halfway with water

- Three brown, dry twigs, each 2 – 3" in length
- A mix of soil, sand, leaves and pebbles – about 1 cup
- Vegetable oil – about ¼-cup
- Food scraps and food wrappers (about 1 cup)
- Yard waste - grass clippings, leaves, nuts and small sticks (about 1 cup)
- Paper waste – shredded newspaper, cardboard, tissues and paper (about 1 cup)
- One copy of storm drain illustration
- One copy of list of seven scenarios – these should be cut up into seven slips of paper
- A long stick or yard stick for stirring the watery mix
- Blank paper – one piece for each group of students
- Pencils – one pencil for each group of students

Anticipatory Set:

- Show the picture of the storm drain to the class and ask the following questions: "What is this called?" (Sewer or storm drain). "Where are these typically found?" (Alongside curbs or embedded in pavement, parking lots, bridges, etc.).
- Encourage stories regarding balls, toys or other items that have been accidentally dropped into storm drains or sewers by the students, their friends or family members. "Were you able to obtain these items? If not, where do you think the items went?"
- Ask: "What is the purpose of a storm drain and how does it relate to a storm?" (Flood control measure). "Where does water from snow or rain go after it enters a storm drain?" (In most cases water is carried by a pipe into a nearby waterway). Introduce the term "stormwater" to the group.
- Ask: "What other materials can enter storm drains with stormwater?" List suggestions on the board. Examples include litter, fertilizer, road salt, oil, sand, soil, leaves, twigs, animal waste and hazardous waste that has been dumped into drains or soil, etc.)
- Explain that the group will make a storm drain in the classroom in order to learn more about its purpose and the types of materials that can fall into it.

Guided and Independent Practice:

- Place the aquarium in an area where it is easy to view by all of the students.
- Fill the aquarium halfway with water. This water represents the river that the stormwater drains into after it has rained and the stormwater has traveled from a street through a storm drain and into the river.
- Cut a rectangular hole in the center of the box or box top that is large enough for someone's hand to fit through. Place the box or box top over the top opening of the aquarium – this cover represents the storm drain opening. Leave the aquarium's sides uncovered so students can view its contents.
- The eight scenarios on the separate worksheets provide realistic examples of the types of water pollution that enter storm drains in neighborhoods and communities. These sheets should be cut up into eight slips of paper and each slip should be placed on a table next to its corresponding type of "simulated pollution."
- Invite two student volunteers to introduce each scenario – one student should read it aloud to the class and the other student should drop the "simulated pollution" into the

storm drain (box opening on top of aquarium) when the reader is finished. After each scenario ask the class to draw conclusions regarding the concerns or problems that the scenario presents and ask them to take notes on these conclusions (as the information may be useful to them later.)

- Use the yardstick or stick to stir the contents of the aquarium when the scenarios have all been completed. Collect the slips of paper and save the scenarios for later use.

Closure:

- Ask students to examine the contents of the aquarium and describe how the quality of the water it contained changed during the activity. In a real-world setting, what do they think happens to these forms of water pollution? Review with them basic information about the water cycle and water movement, if needed, and tie these concepts into the classes' earlier discussion of stormwater.
- Discuss the definition of "nonpoint source pollution" and explain that the forms of pollution mentioned in the scenarios are all forms of nonpoint source pollution. Explain that nonpoint source pollution originates from the individual actions of residents and can occur anywhere – in small communities and neighborhoods as well as in cities and suburbs.
- Ask students: "Does this type of pollution harm the environment? If so, how?" Explain that the water quality of almost all of New Jersey's streams, rivers and lakes are effected in some way by nonpoint source pollution and it does factor into whether people can drink the water, swim in it or fish from it. It can also be harmful to the animals and plants that live in or near water.
- Ask students: "Do you think people in the scenarios wanted to damage the environment? Do you think they planned to pollute the water near them?" If so, have them explain why people might want to do these things. If not, have them guess why these people did what they did regarding their individual actions.
- Divide the class into small groups of 3 – 4 students and give each group one scenario (one slip of paper), a pencil and a piece of blank paper. Give them 5 – 10 minutes to address the problem in the scenario by answering the following questions:
  - What is the concern in this scenario?
  - Can the activity being conducted by people be reduced or prevented from happening? If so, how? OR
  - Can this form of nonpoint source pollution be reduced by amount or prevented from entering the water cycle? If so, how?

  Have representatives from each group share their problems and solutions with the rest of the class.

Assessment:

- Participation in group activity and discussion; and
- Responses to questions from the teacher.

Extension:

- Have students "invent" a method or mechanism that would remove unwanted chemicals, solid materials and/or floating objects from stormwater.

Source:

- ***Beneath the Shell…A Teacher's Guide to Nonpoint Source Pollution and Its Potential Impact on New Jersey Shellfish***. New Jersey Department of Environmental Protection. First Printing 1991; Revised 1993; Reprinted annually from 1997 – 2002 and 2004; adapted from "Storm Drain Watch"(pgs. 46 – 48).

Storm Drain Watch Worksheet: Eight Scenarios

Scenario #1: Mr. Fernandez has two small trees next to the house porch that he uses regularly. The trees attract wasps, mosquitoes and caterpillars. He sprayed the trees with a chemical to kill or drive away the insects. A storm occurs soon after he sprayed and most of the chemical was washed off the leaves and onto the sidewalk and driveway. From there it was washed with rainwater into the storm drain along the curb.

Simulated Pollution: *Mix 2-3 drops of green food coloring with the water in one of the bottles. Empty this green water into the opening on top of the aquarium.*

Scenario #2: A small stream winds through a popular golf course. During a heavy rain the stream is filled with fast flowing water. In certain places the sides of the stream are wearing away and tree roots are showing. During and after each rain soil, sand, leaves, pebbles and other natural debris are swept away with the heavy flow of water as the shores of the stream slowly collapse. This material is eventually carried by the stream into the river that it empties into.

Simulated Pollution: *Add the mix of soil, sand, leaves and pebbles into the opening on top of the aquarium.*

Scenario #3: Susan enjoys helping her father change the motor oil in the family automobile. She clumsily carries the huge pan of black, thick used motor oil to the storm drain in front of their apartment building, where she dumps it. It's gone! Eventually the oil will mix with the water of a nearby stream or river; and any motor oil that she spilled onto the ground will go into the soil and mix with water that is underground.

Simulated Pollution: *Empty the vegetable oil into the opening on top of the aquarium.*

Scenario #4: One snowy winter evening the Palmer family heard raccoons outside opening and turning over their garbage cans left out by the curb, but it was too dark and cold to go outside and chase them away. The next morning no one in the family had time to clean up the litter that was strewn all over the street. When the snow melted most of the trash floated with the water into the storm drain.

Simulated Pollution: *Add the paper waste through the opening on top of the aquarium.*

Scenario #5: One of Tyrone's jobs at home is to cut the lawn each week after school. When the grass catcher is full he dumps the grass clippings into the nearby ditch or sewer, whichever one happens to be closer to the lawnmower at the time. When in the ditch or drain the clippings turn yellow and begin to rot and smell until water from the next rainstorm carries the clippings away.

Simulated Pollution: *Add grass clippings through the opening on top of the aquarium.*

Scenario #6: Theresa enjoys walking the family dog, Jasper. When Jasper needs to go to the bathroom she is careful to make Jasper go on the paved road along the curb so that Jasper doesn't create a mess on the neighbors' tree lawn. She doesn't worry about this though because she knows that eventually the dog's waste will be washed with the rain into the nearby storm drain.

Simulated Pollution: *Put the three twigs through the opening on top of the aquarium.*

Scenario #7: The Martinez family enjoys stopping at a fast-food restaurant for dinner while on their way to the beach for the weekend. To save time, the family eats inside their mini-van that is parked in the restaurant parking lot. In order to keep the car clean, they leave their bags of food trash on the pavement in the parking lot for the workers to pick up, since there are no trashcans in the parking lot. This family may not realize that animals and wind will eventually open up the bags and spread this trash around. If it isn't picked up it can be carried by rainwater during the next storm into a nearby storm drain.

Simulated Pollution: *Add food scraps and food wrappers through the opening on top of the aquarium.*

Scenario #8: A maintenance worker employed by a resident's association for some townhouses must take on new summer duties for the landscaper while he is out sick. These duties include lawn care for each of the residences. The procedure of spreading weed killer takes about three days to complete and two days after he began an all-day rainstorm kept him indoors. The maintenance worker failed to realize that the downpour would wash away most of the weed killer that was already applied on the lawns. In fact, the chemicals would most likely be washed from plants and pavement into the nearby storm drains.

Simulated Pollution: *Mix 2-3 drops of brown food coloring with the water in one of the small bottles.. Empty this brown water into the opening on top of the aquarium.*
