Navigating Urban Streams

For Students Grades 4–6

Studying streams and the effects of flowing water on the Earth's surface is an important part of understanding the water cycle and recognizing the connections humans have to scarce water resources. This field lab is designed to enrich teachers' classroom curricula and enhance students' understanding through field investigations of Deer Creek, an urban stream that flows through Litzsinger Road Ecology Center.

The visits in this field lab along with classroom and schoolyard activities will equip students to apply their knowledge of water and watersheds by performing a survey of their school grounds.

Students will benefit most from this field lab if they are familiar with the properties and characteristics of water and the water cycle. Suggested supplemental activities can be provided on these topics if needed.

Outcomes

Students will understand . . .

- How aspects of the water cycle shape our landscapes over time to form the watersheds that we all live in.
- The basic structure and function of a stream and its surrounding land.
- How stream ecosystems and their water resources are greatly impacted by humans in a number of different ways.

Learning Activities

This suggested sequence includes classroom and schoolyard preparatory activities, field experiences at the Litzsinger Road Ecology Center (LREC), and classroom follow-up activities. Background information is also provided. Teachers should note they are not required to cover all of this material with their students to participate in the Field Lab, but rather should feel free to select the aspects that seem best suited to fit in with their curricula and timeframes. A glossary of terms is provided in the back of this packet. Visit worksheets will be provided during your visits to LREC.

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Field Lab Overview

Unit 1: Watersheds

In the classroom: Introducing the Watershed Concept

Students will be introduced to the concept of a watershed by constructing simple watershed models in the classroom and by studying various relief maps.

Activity 1: What is a Watershed?

a. In this activity, students will construct a model watershed, identify features in the their model that go into making-up a watershed, and observe how these features drain water.

b. Students will then view maps of watersheds and take a closer look at the natural branching patterns of rivers and streams.

c. Finally, to demonstrate their understanding that larger watersheds are made up of many smaller watersheds, students will complete a worksheet entitled "Watersheds—Shapes and Sizes".

In the schoolyard: Applying the Watershed Concept on the Ground

Students will apply their newly acquired knowledge about watersheds and how water is drained by changes in elevation as they participate in an exploration of their school grounds.

Activity 2: Schoolyard Watershed Walk

To practice recording their observations in an outdoor setting and begin thinking about how water is drained by elevation changes of the land's surface, students will explore their schoolyard and look for physical features such as high and low places where water might flow downhill and collect.

Homework: Discovering Their Place in a Watershed

Where in the Watershed?

As a homework assignment, students will discover that we all live in a watershed by finding where they live (or where their school is located) on a watershed map.

Field Lab Overview *(continued)*

In the classroom: Introducing the Different Parts of a Watershed

Now that students have begun to generate an understanding about what a watershed is, they are ready to learn about the distinct components that go into making up a watershed.

Activity 3: Watershed Parts & Functions

Students will view the "Parts of a Watershed" diagram and discuss the roles that these different areas serve in a watershed as a class. Seeing this cross section view of a stream and its surrounding land will directly prepare students for exploring these features at the Ecology Center during their first visit.

Visit 1: At Litzsinger Road Ecology Center: Getting to Know The Parts of a Watershed

Through guided inquiry, students will become oriented to the site by making observations about the physical features of the creek and its surrounding land. Students will complete worksheets entitled "Parts of the Watershed" and "Let's Go Explore the Watershed" in which they will draw, describe, and label their visual observations about particular stream and riparian components.

In the classroom: Processing Field Observations

Students will share their field observations by participating in a class discussion and talking more about the functions of the various parts of a watershed. As a class, students will generate a list about the roles that each of these areas play. Knowing the names and functions of watershed features will prepare students for exploring how these features influence the way water flows, as well as how flowing water shapes these landforms. Students can also fill in the provided crossword puzzle to test their knowledge about the parts of a watershed.

Unit 2: Runoff and Erosion

In the classroom: Runoff & Erosion

Developing an understanding of precipitation and runoff is an important part of understanding the water cycle, how streams and watersheds are formed over time, and how flowing water affects both living and non-living parts of a stream ecosystem.

Activity 4: Runoff & Erosion Experiment

At their school, students will explore what happens to water after it rains. Teaching materials will be provided that will help demonstrate the concepts of infiltration, runoff, and erosion. Students will measure and compare the different amounts and rates of water runoff among different land surfaces: bare soil, soil covered in vegetation, and impervious surfaces.

Field Lab Overview *(continued)*

Visit 2: At Litzsinger Road Ecology Center: Stream Table & Scavenger Hunt

1. Students will work with a stream table to examine how four important parts of a stream (water, energy, sediment, and vegetation) interact with each other to maintain a balanced ecosystem. Students will have the opportunity to predict, manipulate, and analyze how a stream functions differently when one of these four variables is changed.

2. Students will revisit Deer Creek to look for specific stream features and phenomena demonstrated by the stream table. During the "Deer Creek Scavenger Hunt," students will find their way around using a site map and record observations.

3. "Follow a Water Drop" Students are to determine the pathway of a raindrop by locating the highest point on the property and following its path of travel. Students are encouraged to use watershed terminology, such as upland, floodplain, water table, and riparian corridor.

Unit 3: Water Quality

In the schoolyard: Vegetation and Water Movement (Optional)

Optional Activity 5. "Just Passing Through" *Project Wet* activity on school grounds

This activity will reinforce and build upon the concept of how vegetation affects the movement of water over land surfaces. It also prepares students for understanding that water moving over the surface of the land has the potential to pick up and carry other materials along with it on its way to a steam or other water bodies.

Visit 3: At Litzsinger Road Ecology Center: Enviroscape Model & Water Quality

During their third visit, students will look for human made objects in and along the creek. Students will be asked questions like, "How did all of these objects get here?" , "Where did they come from?", and "How far have they traveled?" Students will also:

- Collect and examine some water from the creek
- Talk about different types of pollution and observe an Enviroscape model that demonstrates point and non-point source pollution.
- Realize things we do can result in pollution of our waterways.
- Discover what types of actions can reduce pollution and help to maintain healthy stream and riparian areas.

Assessment

School Ground Survey: Students conduct a survey of how water drains on their school grounds. They will determine areas of good water infiltration, sources of water runoff, storm drains, and streams where the water drains to, They will also identify things that water might be carrying with it when it leaves their school grounds.

Extensions

Action Project: Students brainstorm as a class things that could be done to reduce the amount of runoff and water pollution on their school grounds before it drains into a nearby stream. Students can organize a schoolyard clean up or a stream clean up project at a nearby stream.

Missouri Grade-Level Expectations Addressed

The field experiences your students will participate in support growth in the following Missouri state curriculum standards. Program staff can work with you to highlight the standards most relevant to your curriculum goals.

- The Earth's crust is composed of various materials including soil, minerals, and rocks with characteristics properties. (Standard 5.1.A)
- The hydrosphere is composed of water (a material with unique properties) and other materials. (Standard 5.1.B)
- The Earth's materials and surface features are changed through a variety of external processes. (Standard 5.2.A)
- Changes in the form of water as it moves through Earth's systems are described as the water cycle. (Standard 5.2.E)
- Earth's materials are limited natural resources that are affected by human activity. (Standard 5.3.A)
- Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation (Standard 7.1.A)
- Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations. (Standard 7.1.B)
- Evidence is used to formulate explanations. (Standard 7.1.C)
- Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings). (Standard 7.1.D)
- The nature of science relies upon communication of results and justification of explanations. (Standard 7.1.E)

Activity 1
What is a Watershed?

Objectives:

Students will . . .

- ➤ Learn what a watershed is.
- ➤ Predict where water flows to and from in a watershed.
- ➤ Explore the natural drainage patterns of water with the use of maps.
- ➤ Discover that everyone lives in a watershed.

Materials:

1. Shallow baking pans made of glass, aluminum, or other materials
2. Assortment of blocks, small cups, or other small objects
3. Aluminum foil
4. Cups or small watering can
5. Overhead transparecies of provided watershed maps
6. Copies of student worksheet "Watersheds: Shapes & Sizes"

Background

A *watershed* is an area of land that drains or "sheds" water into a common water body, such as, a stream, river, lake, or wetland. This water eventually makes its way to one of the oceans. For example, the Mississippi River watershed is an enormous watershed, whereby rain water that falls on over a third of the land in the United States is drained into the Gulf of Mexico.

Watersheds come in all shapes and sizes. In the St. Louis vicinity, the River des Peres is a small river draining a relatively small amount of land. Small watersheds are usually part of larger watersheds. The Deer Creek watershed, where the Litzsinger Road Ecology Center is located, is a sub-watershed of the River des Peres. A number of small streams in the Deer Creek watershed, feed into the River des Peres watershed, which eventually feeds into the Mississippi River. All of the small streams, flowing into small rivers, larger rivers, and eventually into the ocean, from an interconnecting network of waterways.

Not only does water run into streams and rivers from the surface of a watershed, but water also filters through the soil and into the ground water system. Some of this water may eventually come in contact with the surface of the earth again and recharge a stream or river with additional water.

Procedure

1. Divide the class into groups of 3 to 4 students. Give each group a set of the above materials.
2. At one end of the baking pan, have students place the small blocks and other small items.
3. Explain that the blocks and other items will serve as hills and mountains, and the aluminum foil represents the surface of the Earth. Crinkle the aluminum foil,

Activity 1
What is a Watershed? *(continued)*

covering the blocks and forming a pool at the end of the baking pan without the blocks.

4. Prop the end of the pan with the blocks on a book or other support. The "Pool" end of the pan should be the low end.

5. Have the students identify the hills, mountains, streams, rivers, and lakes on their models.

6. Have the students carefully pour a cup of water on the high end.

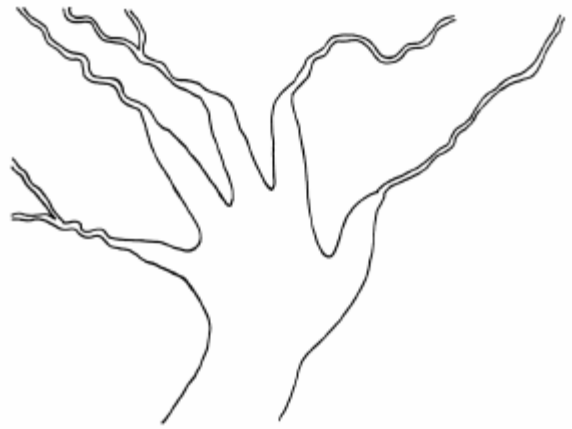
7. Ask the students:

   a. Where did the water run to? Possible Answer: Downhill to the lake.

   b. Is this what happens of Earth? Possible Answer: Yes, on Earth most of the water that falls as rain or other forms of precipitation drains off the surface of the Earth or through the soil into streams and rivers, and eventually into large bodies of water such as lakes, seas, and the oceans.

8. Introduce the term *watershed*. A watershed is an area of land that drains or "sheds" water into a common water body, such as, a stream, river, lake, or wetland.

9. To help students understand the concept of watershed, trace your hand, wrist and part of your lower arm on the board (see diagram at right). Color the spaces in between your fingers and label your arm the "Blue River." Explain that this is a model of a watershed and that your fingers represent smaller rivers feeding into the larger "Blue River." The spaces between your fingers is land. Explain that a watershed is usually named for the main stream or river, so what would this watershed be called? Answer: The Blue River watershed.



10. Watersheds come in all shapes and sizes. They can be very large like the Mississippi River watershed or they can be as small as the area of land that drains into a mud puddle. There isn't anywhere on Earth that is not part of a watershed. Reference the student's watershed models to explain how high points in elevation (like a mountain or hill top) determines the boundary of a watershed and influences which way water will flow. Use your hand once again to demonstrate this by making a "mountain" with your fist. Explain how water that hits one side of the mountain (your knuckle) will drain one way into a watershed and how water falling on the other side of the mountain will drain the opposite way into a

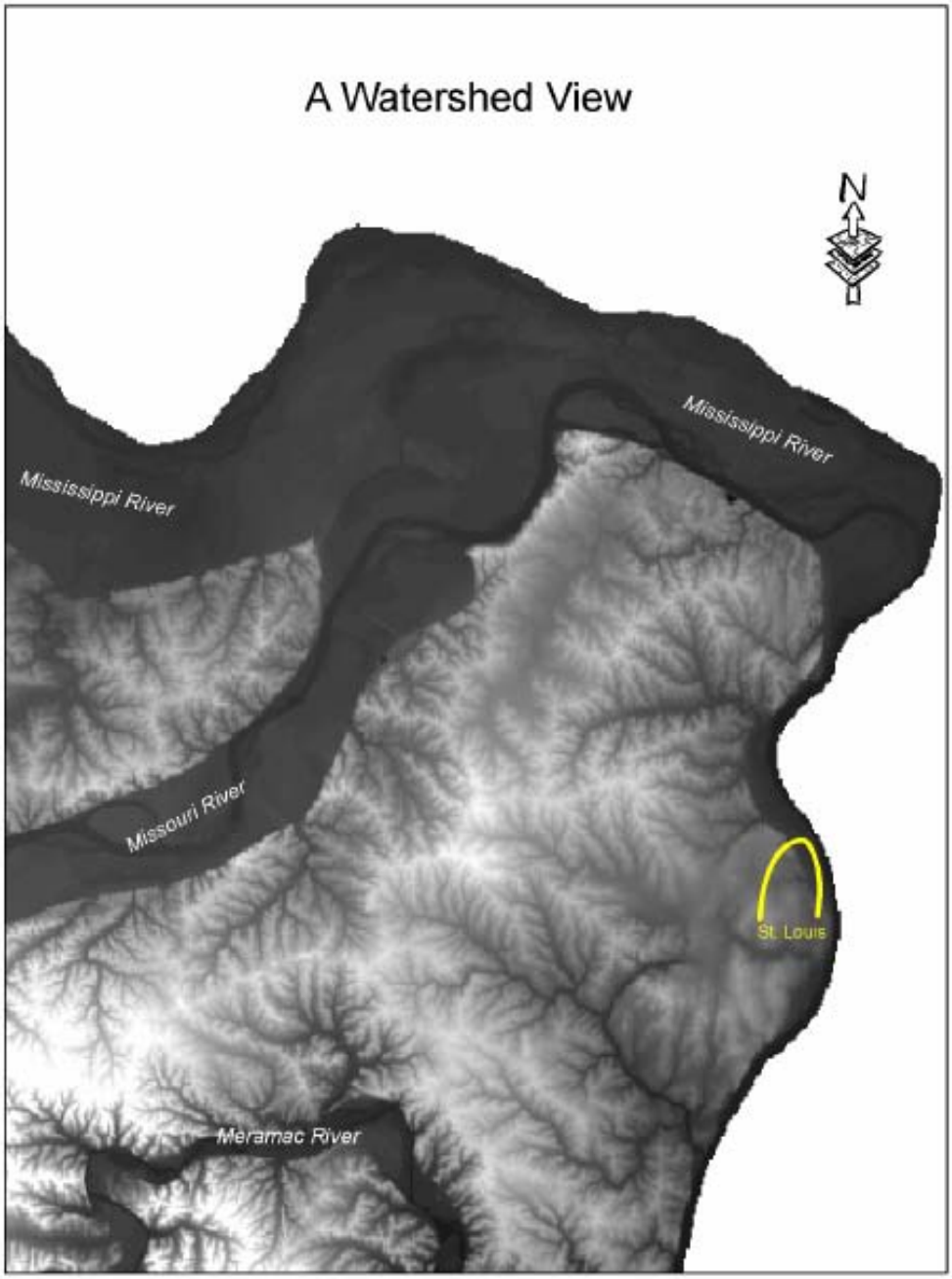
Activity 1
What is a Watershed? *(continued)*

different watershed. The most extreme example of this is the Great Continental Divide in the Rocky Mountains whereby water that falls on the west side of the divide all drains to the Pacific Ocean and water that falls on the east side drains to the Atlantic Ocean in the Gulf of Mexico.

11. Use the series of watershed maps provided to display to the students on an overhead projector as you discuss these concepts.

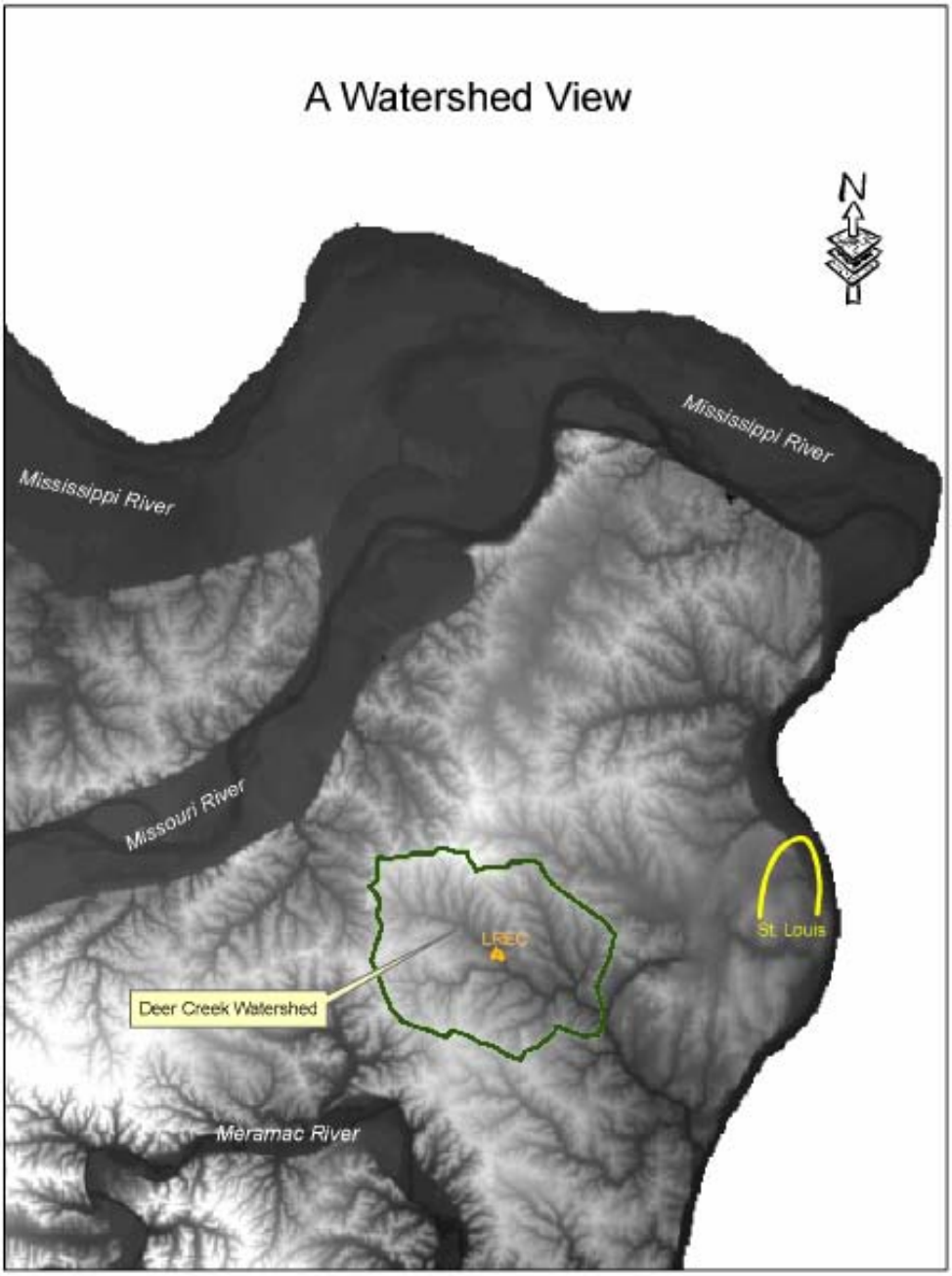
12. To reinforce for the students that large watersheds include many small watersheds, give each student a copy of the accompanying map titled "Watersheds—Shapes & Sizes". Ask them to circle the Black Creek watershed in yellow, the Deer Creek watershed in green, and the River des Peres watershed in red. Check to make sure that all the students have correctly identified the watersheds before cleaning up.

This is a representation of the first Watershed Map overhead transparency included in this packet. The transparency is in color. The descriptive text below is not included on the overhead transparency.



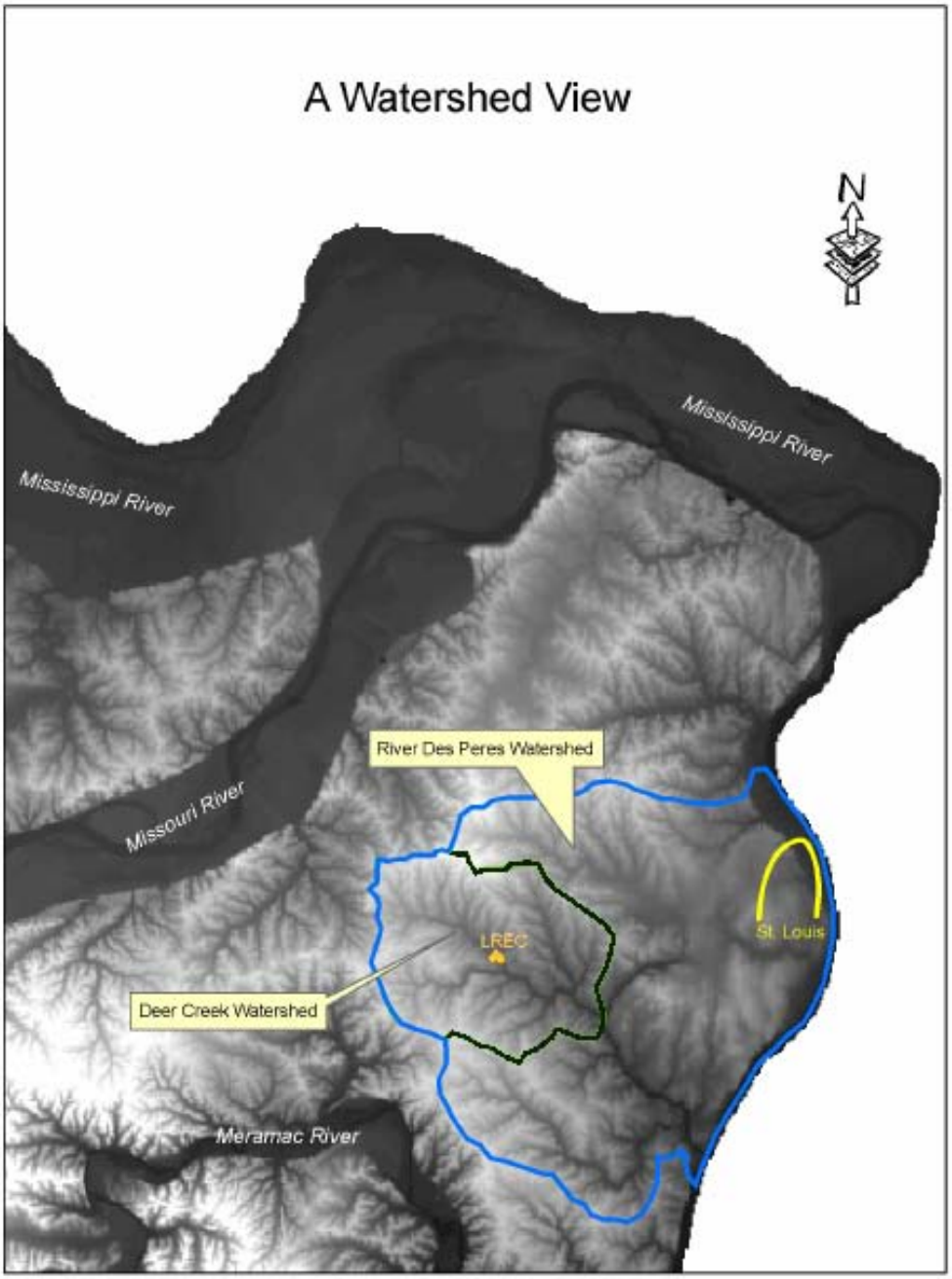
This is a relief map of the St. Louis region. It depicts drainage patterns on the Earth's surface. The lighter colored areas are higher elevations from which water drains away and the darker areas are lower elevations where water concentrates. Notice the natural branching pattern that results from smaller, tributary streams feeding into larger streams and rivers. Other branching patterns that the students may relate to include that of trees or of a human's central nervous system.

This is a representation of the second Watershed Map overhead transparency included in this packet. The transparency is in color. The descriptive text below is not included on the overhead transparency.



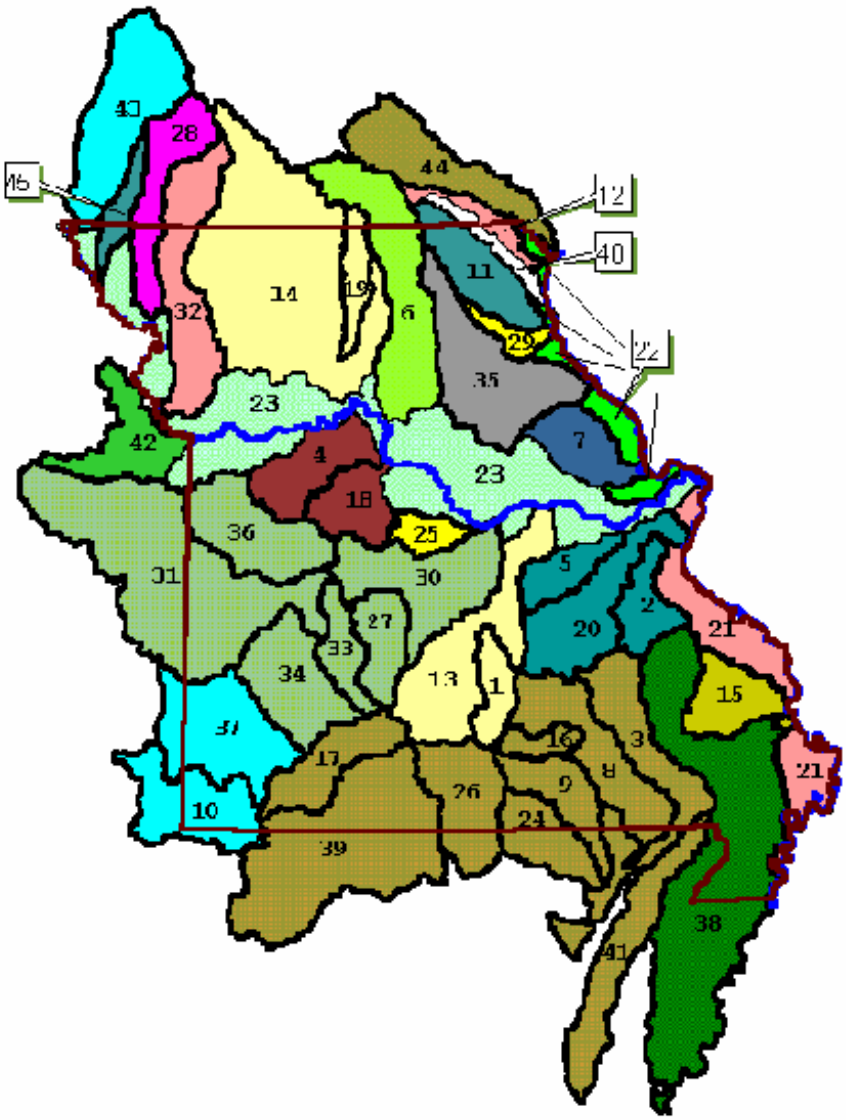
This is the same relief map of the St. Louis region except this map shows the boundary of the Deer Creek Watershed, where the Litzsinger Road Ecology Center (LREC) is located. Point out how water that falls inside the green boundary line drains into the Deer Creek watershed and how the water that falls outside the green line drains into a different watershed.

This is a representation of the third Watershed Map overhead transparency included in this packet. The transparency is in color. The descriptive text below is not included on the overhead transparency.



This map shows how the Deer Creek watershed (bordered in green) is actually a smaller, sub-watershed, of the larger River des Peres watershed (bordered in blue.) If necessary, trace and follow the paths of both Deer Creek and the River des Peres to find where they intersect. Point out the confluence of the two rivers, the point where they join together, for the students to see. The confluence is shown on this map in red and located in the Maplewood area. Point out that the River des Peres eventually flows into the Mississippi River, making it part of the even larger Mississippi Watershed.

This is a representation of A Watershed View of Missouri overhead transparency included in this packet. The transparency is in color. The descriptive text below is not included on the overhead transparency.

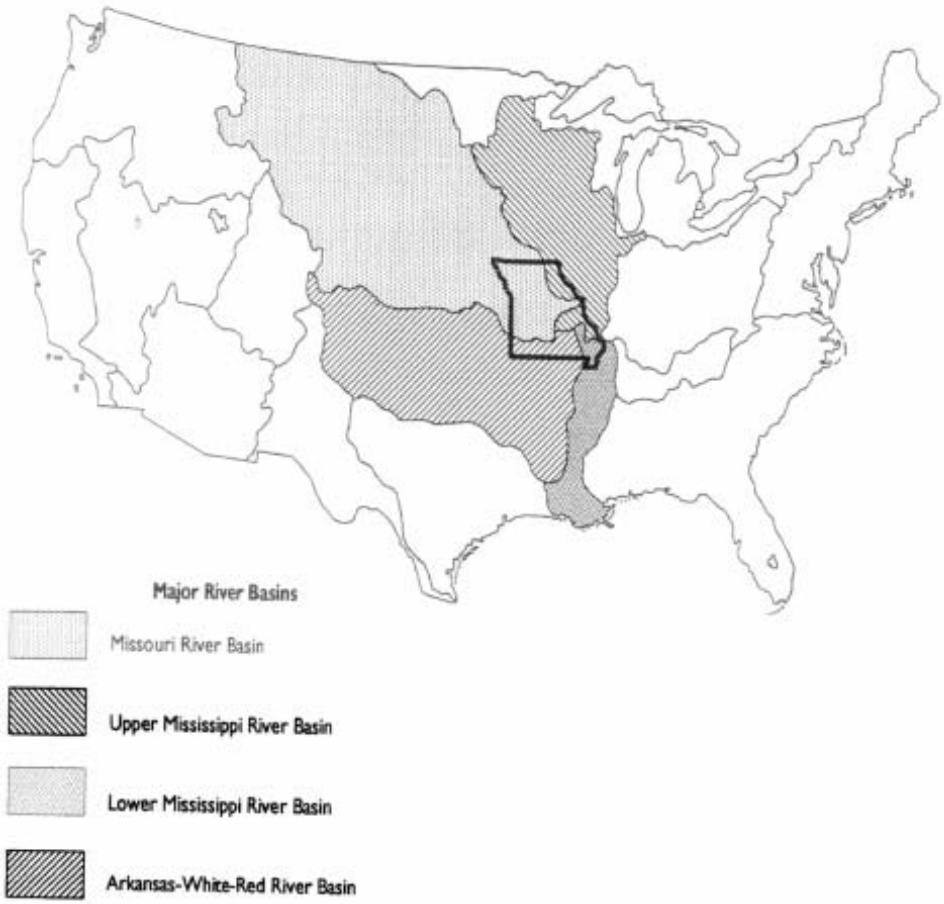


1. BIG PINEY RIVER
2. BIG RIVER
3. BLACK RIVER
4. BLACKWATER RIVER
5. BOURBEUSE RIVER
6. CHARITON RIVER
7. CUIVRE RIVER
8. CURRENT RIVER
9. ELEVEN POINT RIVER
10. ELK RIVER
11. FABIUS RIVER
12. FOX RIVER
13. GASCONADE RIVER
14. GRAND RIVER
15. HEADWATER DIVERSION
16. JACKS FORK RIVER
17. JAMES RIVER
18. LAMINE RIVER
19. LOCUST CREEK
20. MERAMEC RIVER
21. MISSISSIPPI RIVER, LOWER
22. MISSISSIPPI RIVER, UPPER
23. MISSOURI RIVER
23A. CROOKED RIVER
23B. BLUE RIVER
24. SPRING RIVER
25. MOREAU RIVER
26. NORTH FORK WHITE RIVER
27. NIANGUA RIVER
28. NODAWAY
29. NORTH RIVER
30. OSAGE RIVER, EAST
31. OSAGE RIVER, WEST
32. PLATTE RIVER
33. POMME de TERRE RIVER
34. SAC RIVER
35. SALT RIVER
36. SOUTH GRAND RIVER
37. SPRING RIVER
38. ST. FRANCIS RIVER
39. WHITE RIVER
40. WYACONDA RIVER
41. CACHE RIVER
42. LOWER KANSAS RIVER
43. NISHNABOTNA RIVER
44. LOWER DES MOINES RIVER
45. TARKIO RIVER

This map was produced by the Missouri Department of Conservation and adapted from the website: http://www.conservation.state.mo.us/fish/watershed/mdc40.htm. Watersheds grouped by color represent the larger watersheds to which they belong. Notice how the watersheds do not coincide with the state's political boundaries shown in red.

This is a representation of the USA/Missouri Basin Map overhead transparency included in this packet. The descriptive text below is not included on the overhead transparency.

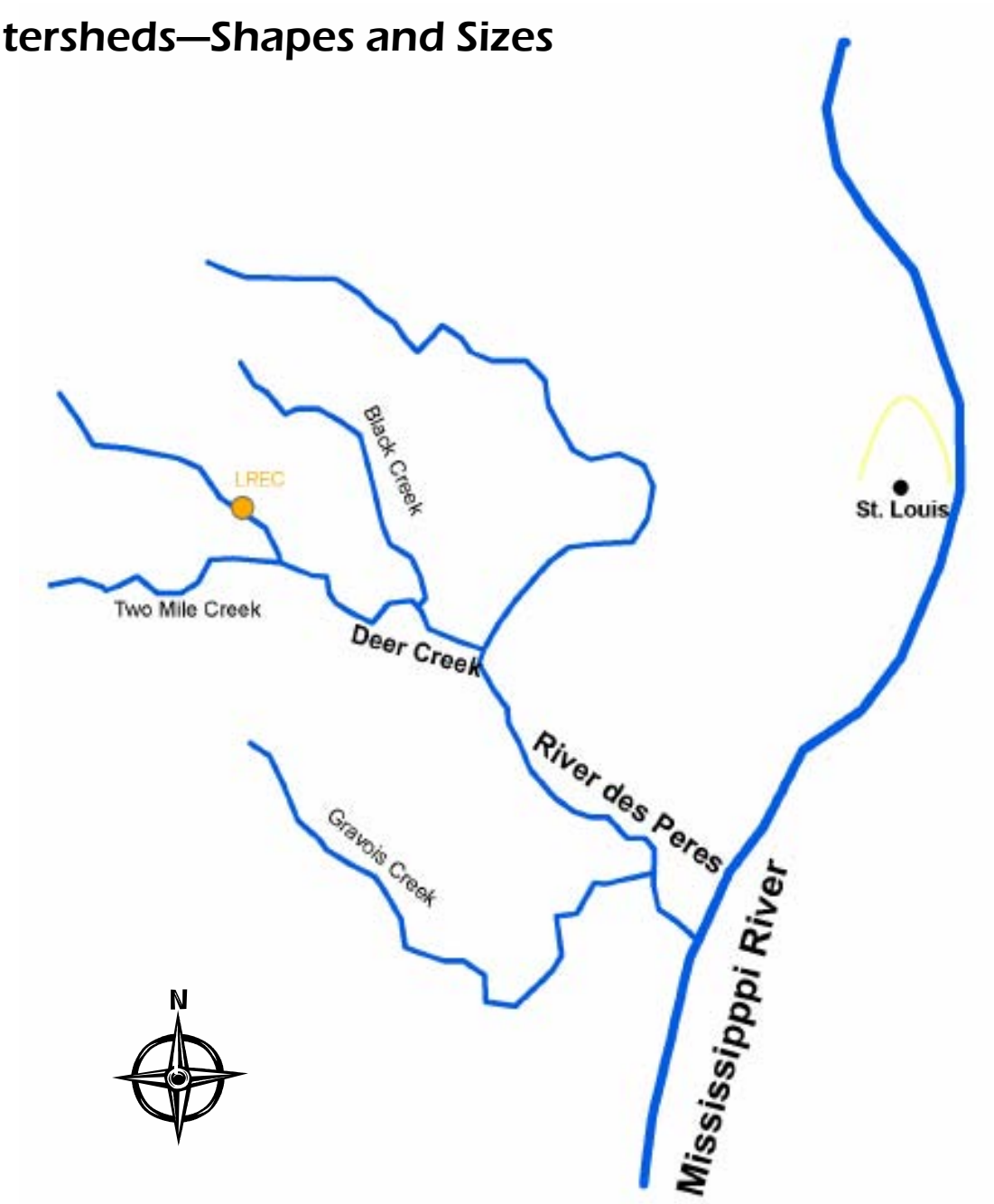
USA/Missouri Basin Map



Source: *Missouri Water Atlas*, 1986, Missouri Department of Natural Resources, Division of Geology and Land Survey

The watersheds in the St. Louis region and all of Missouri are part of the larger Mississippi watershed, which encompasses 31 states, two Canadian Providences and covers more than one third of the country. The headwaters of the Mississippi River start along the Missouri River in Montana and its mouth empties into the Gulf of Mexico.

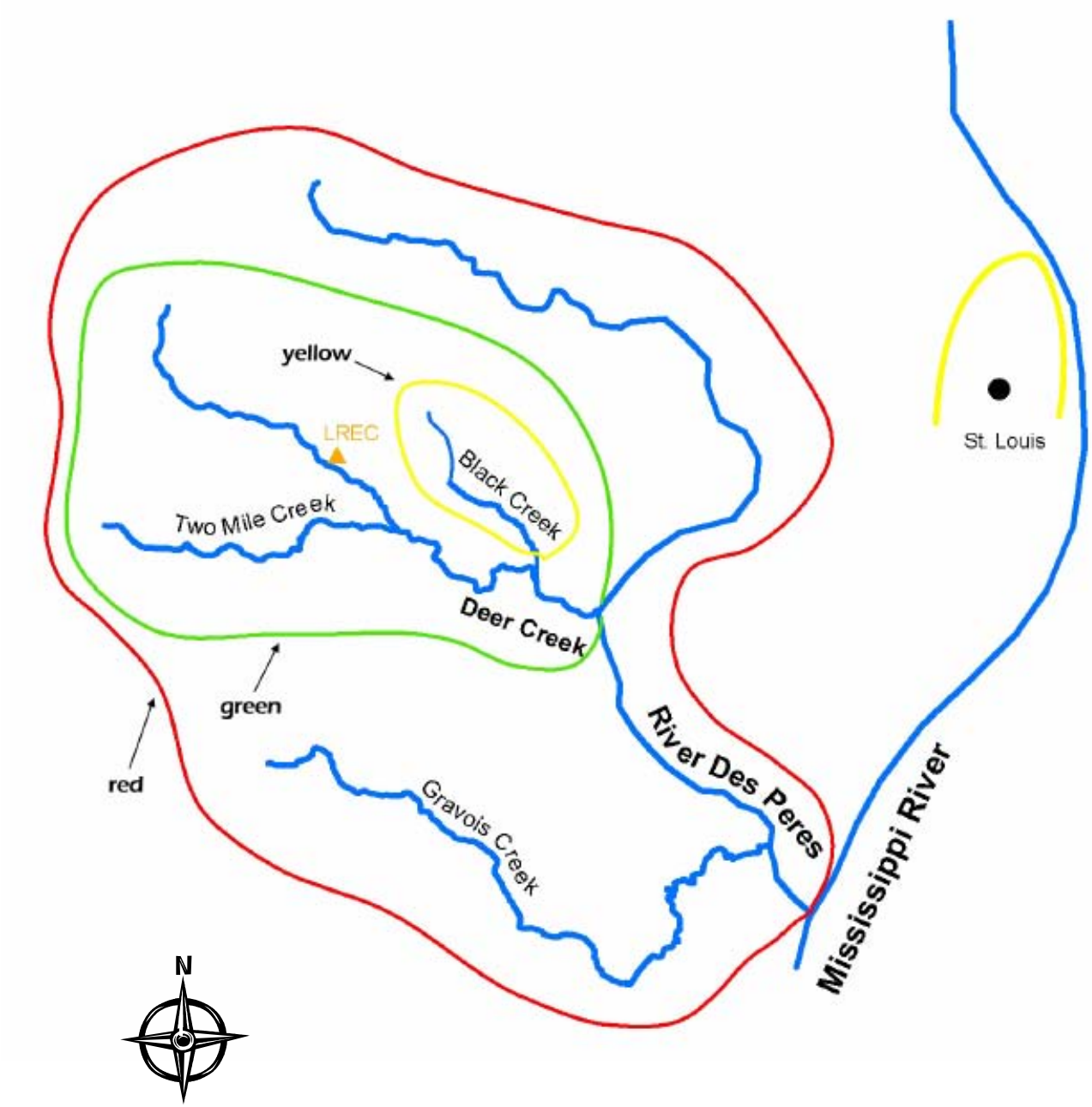
Student Worksheet
Watersheds—Shapes and Sizes



On the map above:

- circle the Black Creek watershed in yellow,
- circle the Deer Creek watershed in green, and
- circle the River des Peres watershed in red.

Answer Key
Watersheds—Shapes & Sizes



Activity 2
Schoolyard Watershed Walk

Objective:

Students will . . .

- ➤ Record observations in an outdoor setting.
- ➤ Apply concepts in a place that has significance in their lives.
- ➤ Demonstrate how water is drained by changes of the land's elevation.
- ➤ Develop map reading and orientation skills.
- ➤ Discover that their schoolyard is part of a watershed.

Materials:

1. "Template" or "base" map of the school grounds (made by teacher)
2. Clipboards
3. Pencils and/or colored pencils
4. Compasses (optional)

Overview

To practice recording their observations in an outdoor setting and begin thinking about how water is drained by elevation changes of the lands surface, students will explore their schoolyards to look for physical features such as high and low places where water might flow downhill and collect to form features like puddles.

Preparing for the Lesson

1. Teachers should prepare a base map of the school grounds for students to draw and record their observations on. Make sure to include features that can be used as reference points such as buildings, parking lots, sports fields, playground equipment, fences, walkways, trees, etc. Don't forget to mark which way is north on the map so that students can practice orienting themselves and their maps. Compasses would be useful for this activity, but they are not essential, especially if a lot of time is going to be spent trying to teach the students how to use them. Simply noting the locations of some of the larger distinguishable landmarks on the map should be sufficient.

2. Leave room for the students to draw on the maps and if possible provide a section where students can write answers to a few questions and record any observations. Here are a few suggested questions to include on the base maps:

   - ➤ Where is the highest point? Possible answer: rooftop, hilltop
   - ➤ Where is the lowest point? Possible answer: in a ditch, at the bottom of the hill, where that puddle has formed
   - ➤ Where did you or where might you find puddles? Possible answer: at the lowest places, where there are depressions in the ground.

Activity 2
Schoolyard Watershed Walk *(continued)*

- ➤ Which way does the water flow? Possible answer: downhill; from a high to a low.
- ➤ Draw some arrows on the map, indicating which way water would flow.

3. Walk the school grounds while keeping these questions in mind so that you know the best places to take the students.
4. Make enough copies of the map for all students.

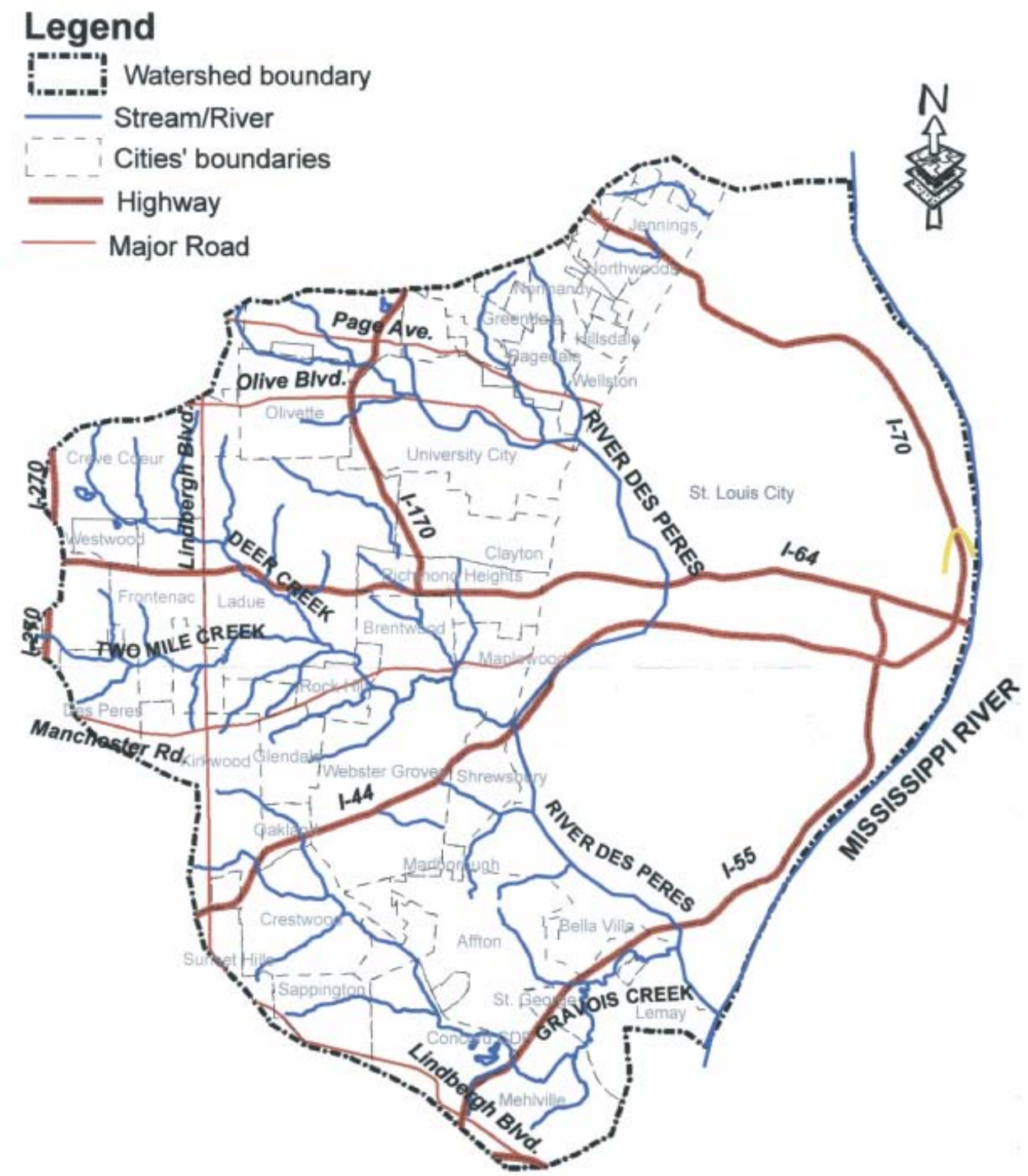
Note: This activity would also be great if planned for a rainy day and if appropriate rain gear was available. Seeing the schoolyard in the rain may help students conceptualize the drainage and movement of water. Another possibility might be to let a hose run on a section of the school grounds for a time until things like surface flow or puddle formations can be observed.

Procedure

1. Organize students into manageable working group sizes before venturing out onto the school grounds.
2. Discuss with students the idea of an "outdoor classroom" and how this activity is preparing them for their field visit to the ecology center, by sharpening their observation skills.
3. If possible, assign groups to different sections of the schoolyard to avoid traffic jams.
4. Have the group leader help the students orient their maps so that they are all facing the same direction.
5. Assign students the task of determining where the water that falls on their school grounds drains and collects.
6. Have students draw in any water features present on the school grounds.
7. Have students draw arrows indicating the direction and path that water may flow on their school grounds. Arrows should point away from areas the water drains off of (high points) and towards areas that it drains to (low points).
8. Make sure students take the time to write down the answers to some of the questions asked about the drainage of water on their school grounds.
9. If there is time have students share their findings with the other groups.
10. Wrap-up by discussing how the schoolyard is part of a watershed.
11. Assign the homework "Where in the Watershed."

Homework
Where in the Watershed?

Can you find where your school or home is located in the watershed? Mark their locations on the map. Then answer the questions on the other side of this page.



Homework
Where in the Watershed? *(continued)*

Questions:

Do you live in a watershed?

_____

_____

_____

What is the name of the watershed you live in?

_____

_____

What is the closest tributary, creek, or river to your house? Circle it on your map.

Activity 3
Watershed Parts and Functions

Objectives:

Students will . . .

- Gain familiarity with watershed components and their functions.
- Learn watershed terms.

Materials:

1. Overhead transparency: "Parts of a Watershed"

Introduction

The material presented here is meant to better prepare students for exploring the different parts of a watershed connected to the stream during their field visits. The introduction of terms and a brief description of the unique roles that they serve is meant to coincide with the overhead and worksheet "Parts of a Watershed," which shows a cross-section view of a stream and its surrounding land.

Students should view the cross-section and associated terminology on an overhead transparency before their first site visit so that they are somewhat familiar with the terms and their functions. Providing students with this initial exposure in the classroom, prior to the first site visit will help lay the foundation for exploring these areas, their functions, and how they interact in more detail throughout the entire field lab.

Below you will find a definition of the term and a few bullet points about why this area is important. Do not feel like you have to cover all of the material with the students before the first visit. The main thing is to introduce the terminology and a few of the key functions, which have been bolded for you. More discussion and exploration of these parts of the watershed is expected to happen during the site visits and as part of follow-up discussions in the classroom. At this point in time students should have already completed activities that have initiated their understanding of watersheds. Here, it is suggested to begin introducing these specific components of a watershed by starting with the stream channel and then expanding outwards until coming full circle with the watershed term. The terms listed below have been presented in this manner.

Activity 3
Watershed Parts and Functions *(continued)*

Terms

Channel: The area located between two streambanks where water concentrates and flows downstream.

Functions/Importance:

- **Collects water and carries it away** (eventually reaching an ocean or lake).
- **Provides a place for aquatic life to live.**
- **Acts as a travel way for wildlife** (birds especially).
- **Source of freshwater for humans and wildlife.**
- **Fun place for recreation!**

Riparian Corridor: The strip of land bordering the stream channel on each side that is made up of special "water-loving" vegetation. (The riparian zone is also a part of the floodplain).

Functions/Importance:

- The roots of this vegetation **help to stabilize the streambanks** by holding the soil in place and thus, reducing erosion.
- Slows water flow.
- Increases infiltration (water's ability to soak into the ground) and reduces runoff.
- Filters sediments and pollutants out of water.
- **Provides important wildlife habitat** and travel corridor.
- Provides shade to the stream.
- Provides important organic matter inputs (dead leaves, snags or fallen logs, etc.), which are the basis for many of the aquatic food chains.

Activity 3
Watershed Parts and Functions *(continued)*

Floodplain: The flat area of land that extends out from the sides of the streambanks and is flooded with water that spills over from the channel during times of heavy precipitation. The floodplain is bound by points of higher elevation such as the slope of a mountain, hill, or bluff.

Functions/Importance:

- **Carries excess water that the stream cannot handle.** During a flood, the flood plain becomes an additional part of the stream and does extra work for the channel.
- **Allows flood waters to spread out,** thus slowing the water and causing:
  a. Small soil particles that were suspended in the water to drop out and deposit in the floodplain itself. This action helps to "build" soil over time. Because of this rich soil found in floodplains, these areas are often some of the best agricultural lands in the world.
  b. A reduction in damage to the stream channel downstream. (If the floodplain is not allowed to work properly, the channel is forced to handle more of the flow and the channel will become eroded).
- **Supports wetland habitat,** which are important wildlife areas. (Missouri has lost more than 90% of it wetland habitat due to channelization, draining, and development).
- Vegetation in the floodplains helps to filter (clean) the water before returning it to the stream.
- Helps to capture, store, and slowly release water back into the stream because water able to soak into the soil and enter into the ground water system.

Ground Water: The supply of freshwater that is underneath the earth's surface, either in the soil itself or an aquifer (permeable rock layer that can hold large bodies of water underground).

Water Table: The depth at which underground water is first encountered, below this level the ground is completely saturated with water. The level of a water table can fluctuate up and down depending on how much water is soaking into the ground or how much water is being taken out from the groundwater supply by things like wells. When the water table intersects with the ground surface, it creates springs or areas where freshwater recharges a stream.

Functions/Importance:

- **Stores water**
- **"Recharges" streams with water**

Background Information
Watershed Parts and Functions *(continued)*

- Supports water-loving types of vegetation
- **Fresh water source for humans** (wells, springs, etc.)

Uplands: Land that is situated at a high elevation in the watershed, such as on a hill or mountain.

Functions/Importance:

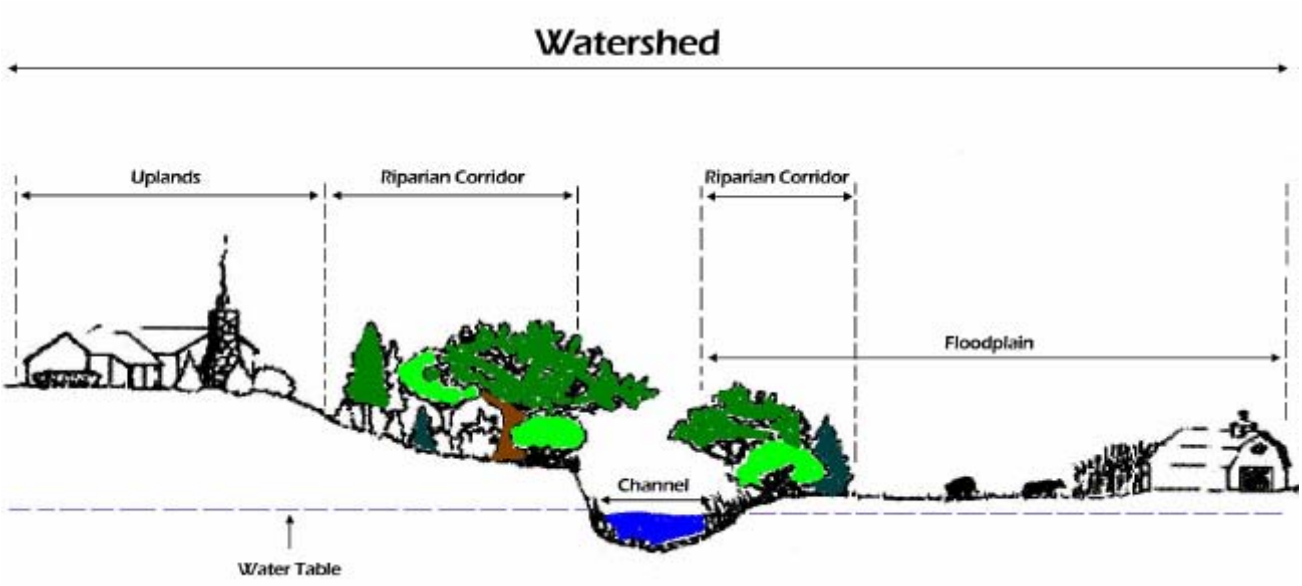
- **Provides the slope for the *energy* of the stream system**; determines the type of stream system (the steeper the slope the faster and narrower the stream is, as in a mountain stream; the more gradual the slope is, the slower and wider a stream is, as in a valley stream like the Mississippi).
- Provides water inputs into the stream system from overland flow/runoff and infiltration (water that soaks into the ground).
- Provides the first sediment/nutrients inputs into the stream
- Vegetation in the uplands provides filtration of water.

Watershed: An area of land that drains or "sheds" water into a common water body, such as a stream, river, lake, or wetland.

Functions/Importance:

- **Encompasses all of the above listed terms.**
- **Drains water from the land.**
- **Forms our rivers, lakes, and streams.**
- **We all live in a watershed!**

This is a representation of the Parts of a Watershed overhead transparency included in this packet.



Source: *Volunteer Stream Monitoring: A Methods Manual*, Environmental Protection Agency

Visit Worksheet
Exploring Parts of the Watershed

1. Locate the stream channel of Deer Creek. Spend some time in this place. Record some observations about what you see, hear, smell, and feel.

2. Draw and label some of the physical features of the *stream channel*. Make sure you include things like the streambanks, streambed, substrate type, and vegetation. Don't forget to describe what the water is like and any evidence of wildlife that you find!

3. What is the strip of vegetation bordering the stream channel called? Label it on your "Parts of the Watershed" worksheet.

Visit Worksheet
Exploring Parts of the Watershed *(continued)*

4. What types of plants do you find growing in this area? Can you identify and list a few of them? What do these plants do for the stream?

5. Can you find out how far this area extends out away from the creek? What other important role does this area play?

6. Do you notice a change in the landscape as you walk farther away from the stream? Describe what you discover.

7. Can you find where the beginning and end of the floodplain are? What function does the floodplain serve?

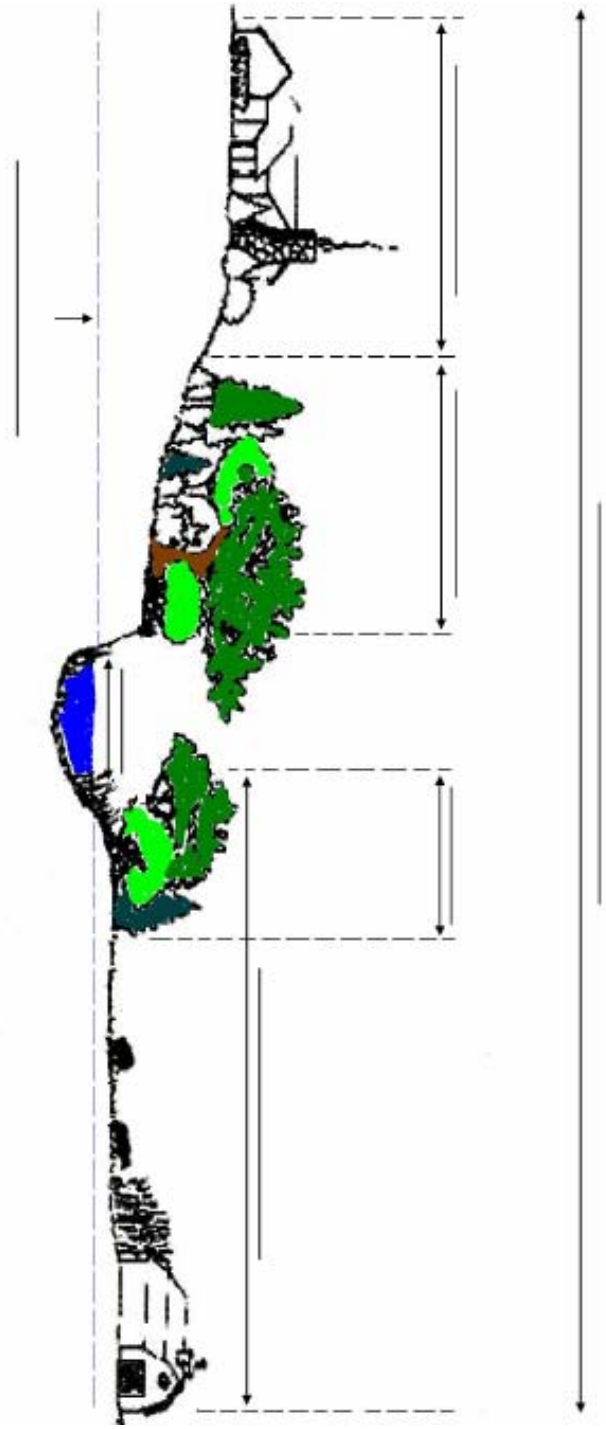
8. What other type of plant community did you discover in the floodplain? What is your favorite thing that you learned about this place?

9. What is the area above the floodplain known as? Don't forget to label this area on your "Parts of the Watershed" worksheet, too!

Visit Worksheet
Parts of a Watershed

Using the terms listed below, label the different areas that make up a watershed. The same term may be used more than once.

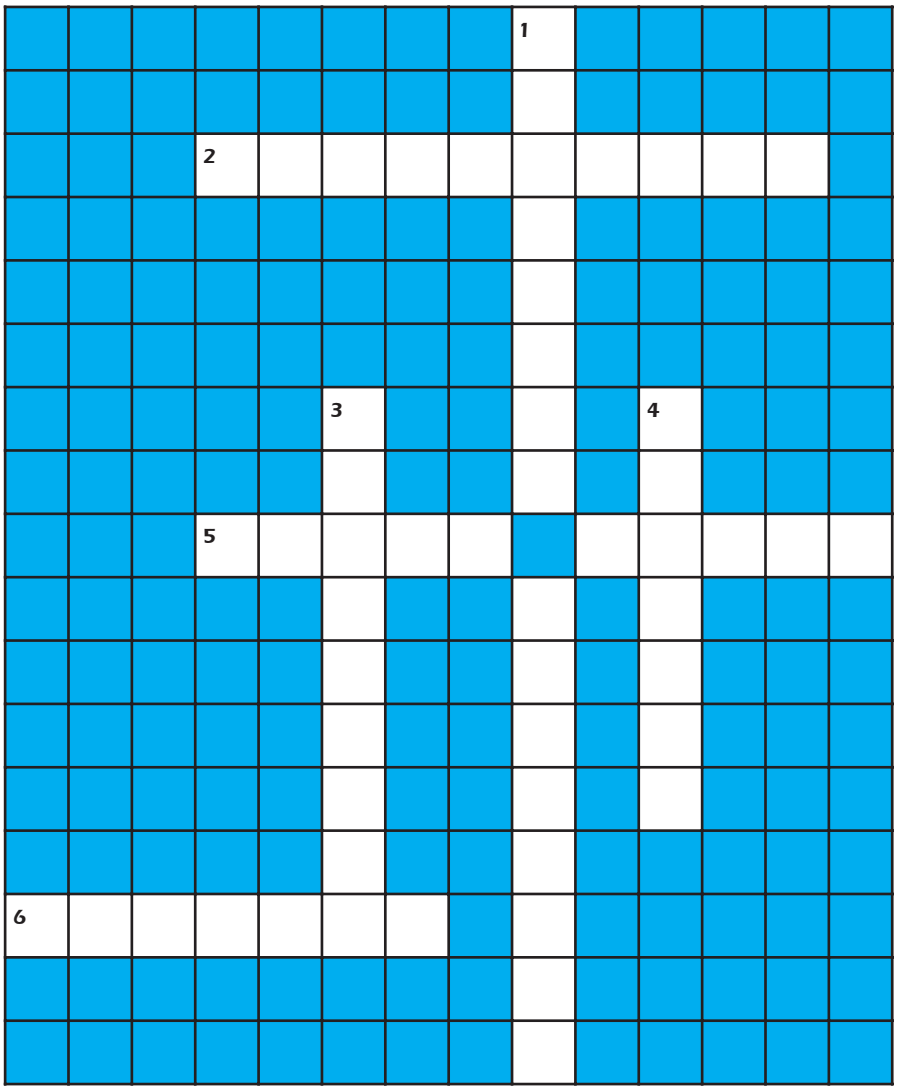
- ☐ Water Table
- ☐ Watershed
- ☐ Uplands
- ☐ Riparian Corridor
- ☐ Channel
- ☐ Floodplain



Notes: Define a few of the terms using your own words.

Source: *Volunteer Stream Monitoring: A Methods Manual,* Environmental Protection Agency

Student Worksheet
Watershed Parts Crossword



Complete the puzzle using your watershed knowledge.

Down

1. A strip of water loving vegetation that borders a stream. (2 words—include space in puzzle.)
3. A place where you live that drains water into a stream.
4. A place located between two banks where water flows.

Across

2. Helps do extra work for the channel in times of heavy rain; wetlands may be found here!
5. A part of the ground water system. (2 words—include space in puzzle)
6. A high place.

Watershed Parts Crossword
Answer Key

								R					
								I					
			F	L	O	O	D	P	L	A	I	N	
								A					
								R					
								I					
					W			A		C			
					A			N		H			
			W	A	T	E	R		T	A	B	L	E
					E			C		N			
					R			O		N			
					S			R		E			
					H			R		L			
					E			I					
U	P	L	A	N	D	S		D					
								O					
								R					

Complete the puzzle using your watershed knowledge.

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1. A strip of water loving vegetation that borders a stream. (2 words—include space in puzzle.)
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2. Helps do extra work for the channel in times of heavy rain; wetlands may be found here!
5. A part of the ground water system. (2 words—include space in puzzle)
6. A high place.

Activity 4
Runoff and Erosion Experiment

Objectives:

Students will . . .

- ➤ Discover what happens to precipitation after it falls on the land by investigating the processes of surface runoff, infiltration, and erosion.
- ➤ Learn how different types of land uses or land surfaces can alter water's movement across the Earth's surface.
- ➤ Record data and use it to attain an answer to a question.

Materials:

1. "Runoff and Erosion Demonstration Tool Kit"
2. Experiment Instruction Sheet
3. Student worksheets

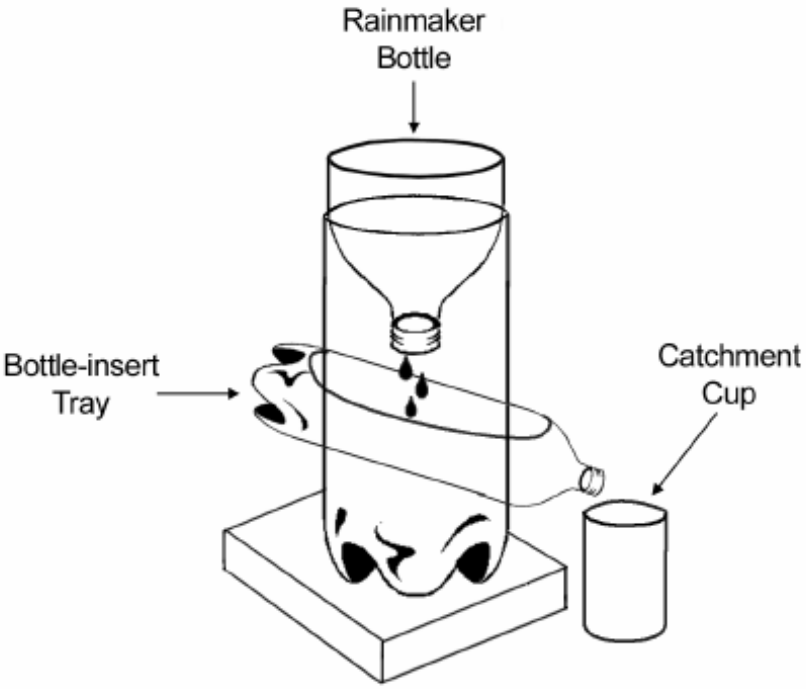
This demonstration is adapted from: *Watersheds: We All Live Downstream*. Produced by the Missouri Department of Conservation in cooperation with Southwest Missouri State University; St. James, MO (2002).

Overview

This activity is intended to happen in the classroom prior to students' second field visit to the Ecology Center. The experiment can either be demonstrated by the teacher or worked through in small groups. Additional help may be needed to facilitate group activity and ensure comprehensive understanding. There are enough materials provided for up to five groups.

Preparing for the Activity

1. Make a copy of the student worksheet for each student.
2. Gather the materials together from the "Runoff & Erosion Demonstration Tool Kit" and begin assembly as shown in the diagram below.



Activity 6
Runoff and Erosion *(continued)*

3. Three 24-oz. plastic bottle-insert trays will need to be prepared for every 2-liter rainmaker bottle. Prepare the 24-oz. plastic bottle-insert trays in the following manner:

   a. Fill bottle-insert tray #1 with nothing but soil. This will represent bare soil.

   b. Fill bottle-insert tray #2 with sponges (representing roots), soil, and then a leaf mulch layer. This will represent soil with vegetation present.

   c. Fill bottle-insert tray #3 with soil and then cover it with the fitted plastic impervious surface slip. This will represent impervious surfaces such as roads, parking lots, and rooftops.

Procedure

1. Introduce or review the following terms:

   ➤ **Runoff:** When water from precipitation flows over the surface of the ground and eventually makes its way to a stream or river. Runoff can pick up soil and pollutants from the land and carry them to a body of water such as a stream, lake, or ocean.

   ➤ **Erosion:** The wearing away of the land's surface by wind or water; a loss of soil.

   ➤ **Infiltration:** An important process when water soaks into the ground. Once in the ground, this water can be used by the roots of plants or stored in the groundwater system.

   ➤ **Impervious surface:** A surface that does not allow water to soak into or pass through it.

2. Organize the students into manageable working groups (enough materials are provided for up to five groups).

3. Pass out the instruction cards, student worksheets, and demonstration materials to each group, making sure that each student has his or her own worksheet.

4. Run the experiment, following the instruction sheet, for all three different land surface types.

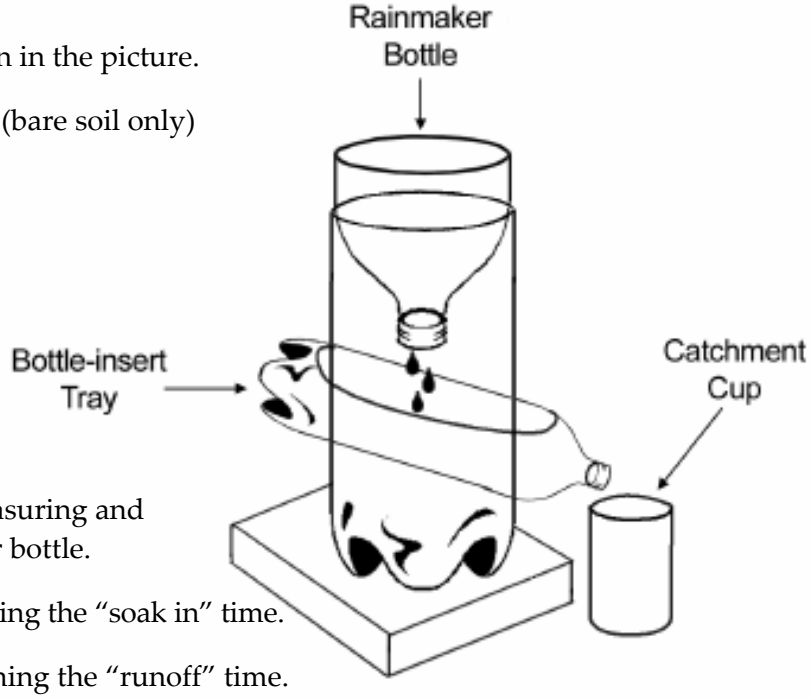
5. Allow some time at the end of the experiment for students to complete the processing questions on their worksheets.

6. If you had multiple groups, have students compare their answers graphically as a class and or calculate the average infiltration times.

7. Discuss the students' findings and have them relate how the experiment is similar to what happens in a watershed. The rainmaker represents *precipitation*, the bottle-inserts represent the earth's surface and how water can either *infiltrate* or *runoff*, and the catchment cup represents the stream.

Runoff and Erosion Experiment Instruction Sheet

*** Read through all of the directions before running the experiment.**



1. Put together the experiment as shown in the picture.
2. Insert the plastic bottle-insert tray #1 (bare soil only) into the side of the rainmaker bottle.
3. Measure out 250 milliliters of water with the measuring cup provided. This will be what you will pour into the rainmaker bottle. Record this amount in your data table.
4. Assign tasks to group members:
   - ➤ Rain simulator—in charge of measuring and pouring water into the rainmaker bottle.
   - ➤ Stop watcher #1—in charge of timing the "soak in" time.
   - ➤ Stop watcher #2—in charge of timing the "runoff" time.
   - ➤ Other group members can pair up with the stop watchers and help tell them when to start and stop their watches.

   How do you know when to start and stop the timers?

   Time to soak in: Start the timer as soon as water starts to fall onto the surface of the bottle-insert tray. Stop the timer once water starts to run out of the bottle-insert and into the catchment cup.

   Time to runoff: Start the timer when water first starts to run out of the bottle-insert and into the catchment cup. Stop the timer when water no longer flows into the catchment cup, but starts to drip.
5. Once everyone has a clear idea about what they will be doing, run the experiment by pouring the water into the top of the rainmaker bottle and begin timing what happens next.
6. Record the times in the appropriate places in the data table.
7. Measure and record the amount of water that is present in the catchment cup.
8. Determine the amount of soil erosion by examining the water in the catchment cup.
9. Slide the bottle-insert tray out of the side of the rainmaker bottle and replace it with the next bottle-insert tray.
10. Repeat the steps for the remaining two surface types.

This is a representation of the Demonstration Data Sheet overhead transparency included in this packet.

Land Surface Type

Data	Bare Soil	Soil with Vegetation	Impervious Surface
Water input (mL)			
Soak in time (sec)			
Runoff time (sec)			
Water output (mL)			
Soil Erosion (none, a little, a lot)			

Student Worksheet
Runoff and Erosion Experiment

Directions: Record your measurements in the data table provided and then use your data to answer the questions.

	Land Surface Type		
Data	Bare Soil	Soil with Vegetation	Impervious Surface
Water Input (mL)			
Time to soak in (sec.)			
Time to runoff (sec.)			
Water Output (mL)			
Soil Erosion (none, a little, a lot)			

1. Which of these surfaces had the most amount of erosion? Describe how you know.

2. Figure out how much water each of the surfaces held. (Hint: compare how much water you put in to how much water came out.) Fill in the table below and circle which one held the most water.

Bare Soil	Soil with Vegetation	Impervious Surface

3. Which of these surfaces held the least amount of water?

For the next 2 questions, calculate the runoff rate (volume of water per 1 second) and enter it in the table below. The runoff rate is the water output divided by the time of runoff. Units are mL/sec.

Bare Soil	Soil with Vegetation	Impervious Surface

4. Which of these surfaces had the fastest runoff rate (most volume of water/second)?

5. Which of the three surfaces had the slowest runoff rate (least volume of water/second)?

Visit Worksheet
Deer Creek Scavenger Hunt

Write down what feature you found at each flag location. List a few of your observations about that particular spot.

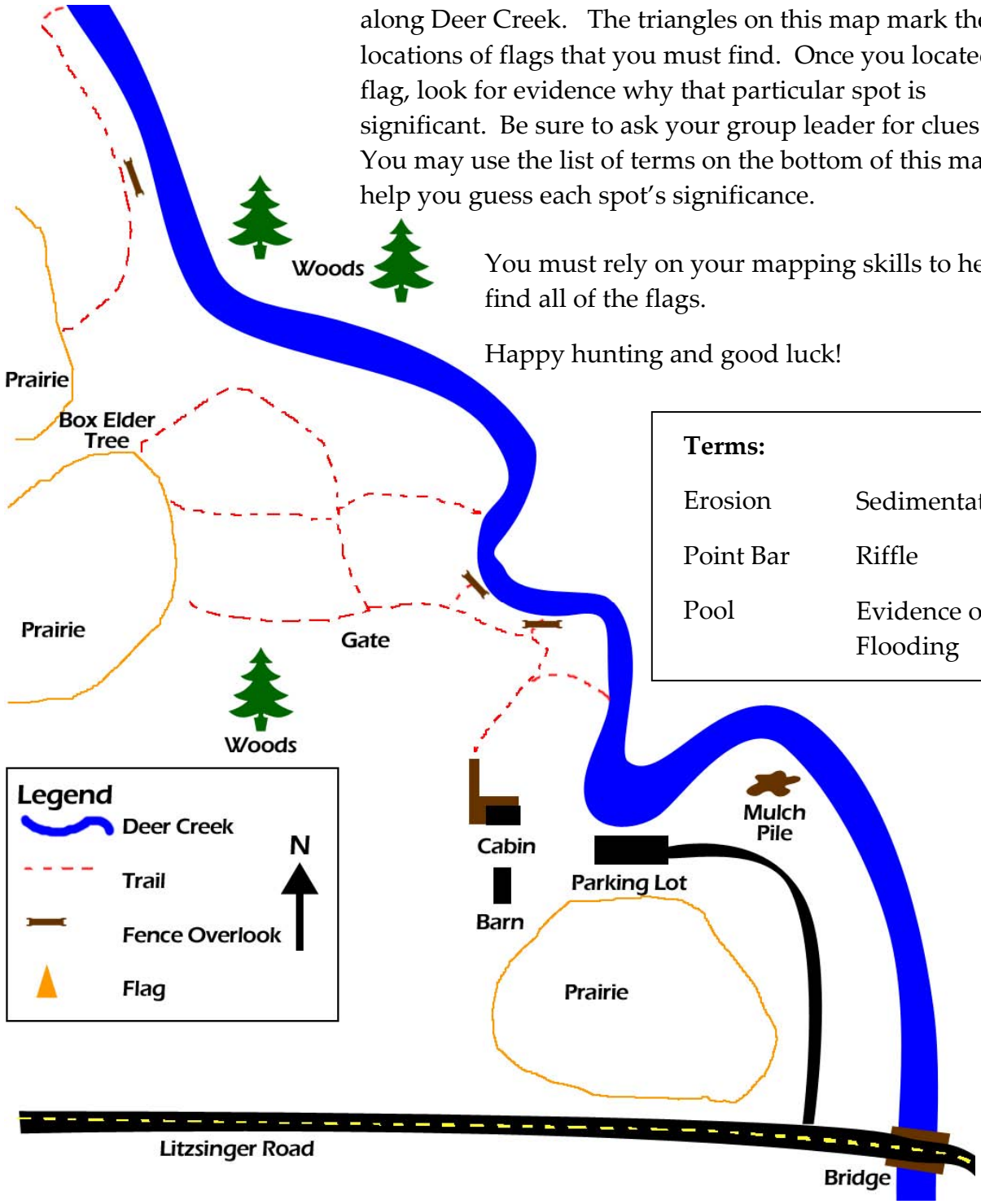
Flag #1:
Flag #2:
Flag #3:
Flag #4:
Flag #5:
Flag #6:

Visit Worksheet
Deer Creek Scavenger Hunt

Flags have been placed at particular points of interest along Deer Creek. The triangles on this map mark the locations of flags that you must find. Once you located a flag, look for evidence why that particular spot is significant. Be sure to ask your group leader for clues! You may use the list of terms on the bottom of this map to help you guess each spot's significance.

You must rely on your mapping skills to help find all of the flags.

Happy hunting and good luck!



Terms:

Erosion	Sedimentation
Point Bar	Riffle
Pool	Evidence of Flooding

Leader's Guide
Scavenger Hunt Clues

Erosion:

- The exposed roots of trees growing along the banks are a clue.
- The slopes of the banks may be steep because of this process.
- There has been a loss of something here.

Evidence of Flooding:

- Some of the vegetation here may be "pointing" out the answer.
- You may find certain objects like trash or debris that provide evidence of this event.
- Looking for the high water mark may be telling of this event.

Point bar:

- This is a place where the stream drops its load.
- These features are always located on the inside of a stream meander.
- This place is gravely or sandy under foot.

Pool:

- These places are usually found on the outside of a stream meander.
- This place would be a good place for a fish to hang out and relax.
- The water in this place is deep and slow.

Riffle:

- This thing is rocky and shallow.
- Water here flows quickly and mixes with the air.
- This would be a good place for tiny stream critters (macroinvertebrates) to live and hide.
- A fish would like to lay its eggs here.

Sedimentation:

- A "dirty" word.
- The evidence of this may be tiny, but there is lots of it.
- This often happens to a stream if a lot of erosion has occurred upstream.
- This thing may make it hard for stream critters to breathe.

Leader's Guide
Interpreting the Stream Table

Begin by asking the question; what makes a stream a stream?

Many answers are acceptable here, but the important concepts to get across are:

1. Stream systems are ***flowing water*** bodies that are dynamic or ever changing.

2. Streams are a product of a ***watershed*** *(An area of land that drains (sheds) water into a* common water body, such as, as stream, river, lake, or wetland)

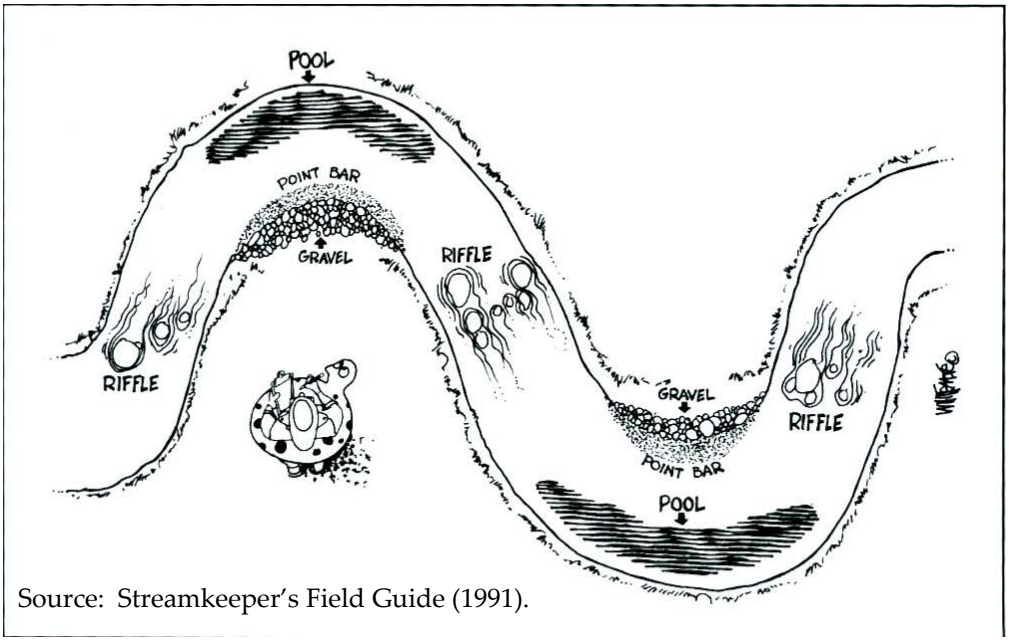
Review the Parts of a Watershed
Uplands
Floodplain
Riparian Corridor
Stream channel
Water table/Ground water

The Four Parts of a Healthy Stream

	Function	Relating it to the Stream Table
Water	Water falls on the land as *precipitation* (rain, snow, sleet, hail, etc) and is drained by the *watershed into* small channels, which in turn, flows into a larger channels and this continues downstream all the way to the ocean.	Draw attention to how water enters in at the top of the table (headwaters) and then *meanders* through the valley floor before emptying into a larger body of water, such as a larger river or the ocean. The outlet point of the stream is referred to as the stream or rivers *mouth.*
Energy	The stream gets its energy from gravity, so the steeper the slope of the stream the more energy our system is going to have. The more energy it has, the faster the water will move and the greater its ability to *erode* (ie; its ability to pick-up soil and sand and	The steeper the table is (ie: the stream gradient) the more energy our stream is going to have.
Sediment	The material (soil and sand) transported and deposited by the stream. Too much *sediment* can smother aquatic habitats. This process is referred to as *sedimentation.*	The granulated plastic simulates the soil in our watershed and represents the sediment of the stream.
Vegetation	Vegetation is needed to anchor the soil in place and prevent *erosion* along the stream banks. Vegetative cover is also important throughout the watershed because it increases the ability of water to soak into the soil (*infiltrate*) and reduces *runoff*.	Juniper cuttings will represent the vegetation along the stream banks preventing erosion.

Leader's Guide
Interpreting the Stream Table *(continued)*

Stream Meander Systems & In-Stream Habitat



Source: Streamkeeper's Field Guide (1991).

Meander: A term used to describe the natural pathway that water travels as it winds and bends across the landscape.

Erosion: The loss of soil or the wearing away of the land's surface; a natural process that can be exacerbated by the removal of vegetation or other land use changes in the watershed.

Habitat: The specific environment in which an organism lives and on which it depends for food, water, shelter, and growing space.

Point Bars: A place located on the inside of a stream bend where sediment, like sand or gravel, gets deposited by flowing water and as it builds up it forms features like sandbars or gravel bars.

Pools: An area of relatively deep, slow water usually located on the outside of a stream bend. These pools are great places for fish and other aquatic animals to rest.

Riffles: Shallow areas of fast moving water that flows over rocks, creating a "riffle" affect on the water's surface. Riffles tend to have well-oxygenated water and offer good habitat for macroinvertebrates and spawning fish.

Flooding: When the water in the stream rises up out of its banks after a heavy rain event.

Sedimentation: When excessive fine-soil particles (sediment) are deposited in the stream and smother aquatic habitat.

Leader's Guide
Interpreting the Stream Table *(continued)*

Impacts of Land Use Changes in the Watershed

Changing any one of the "four parts of a healthy stream" will cause the stream to function differently and bring about changes to the stream's meander system and in-stream habitats.

A. Urbanization – Altering the water variable

Scenario: Let's pretend that there has been a major change in the watershed and there will now be a lot more water entering our stream system at a faster rate, such as after a large rain event. This often happens when forested or prairie areas become developed, which decreases the amount of vegetative cover that allows water to soak into the ground and increases the amount of *impervious* surface in the watershed, such as parking lots, roads, roof tops, etc.

Table action:

- Remove some of the vegetation in the watershed to clear the way for development. The stream table will function better if you leave some vegetation in the headwaters.
- Have the students help to develop the watershed with some practicing "smart" development by placing houses and roads out of the floodplain and others developing in floodplain.
- Increase the amount of water moving through the stream table.
- Watch the increase in sediment movement and erosion taking place, perhaps in an area downstream where there is no vegetation along the streambanks.
- Notice where there are still trees near the headwaters how the stream is narrow, deep, and there is good fish habitat; where there is no vegetation the channel is wide, shallow, and has poor fish habitat.
- Riffles and other important in-stream habitat may start to become buried with sediment (*sedimentation).*
- Flooding may increase as stream flows become "flashier"; Development in the floodplain becomes threatened.
- Turn down the flow after the rain event. In dry periods with little rain, certain parts of the stream may dry up completely because the groundwater system is not getting recharged with water.
- The watershed is no longer acting like a "sponge" and storing water; instead all of the water is now running off due to the increased impervious surface.

Leader's Guide
Interpreting the Stream Table *(continued)*

B. Channelization & Stream Bank Armoring — Altering the energy variable

Scenario: Let's pretend that some people decide to straighten the stream and harden the banks to try and solve some erosion and flooding problems resulting from the increase in impervious surface. This would result in the *channelization* of the stream. A straight channel has faster flowing water and thus, greater ability to erode its soil.

Table action:

- Take out one of the meanders of the stream by "dredging" the sediment and placing it to the side to build a levee.
- Place blocks along the banks of the channel to represent streambank hardening.
- Notice how much this speeds up the flow because the water now has a shorter distance to travel.
- Observe the increased erosion and flooding problems.
- Point out the loss of in-stream habitat.

Optional Activity 5
Just Passing Through

Just Passing Through

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 (comparing and contrasting); Interpreting (relating, summarizing); Applying (designing)

Charting the Course
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" and "Capture, Store, and Release," students learn how changes to a watershed affect stream discharge.

Vocabulary
erosion, sediment, Best Management Practices

Who am I? Plants and soil slow me down, but I pass on through. I may be stored in a lake, but I will be released; I'm just passing through! Who am I?

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
- *Copies or overhead transparencies of photographs of hillsides with and without plant cover*
- *Yarn or rope* (the length of the playing field)
- *Tray of soil*
- *Container of water* (to be poured on tray of soil)
- *Planting pot containing only soil*
- *Container of water including shredded paper*
- *Biodegradable items* (such as peanuts) (optional)

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 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.

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 nonpoint source pollution problems. 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.

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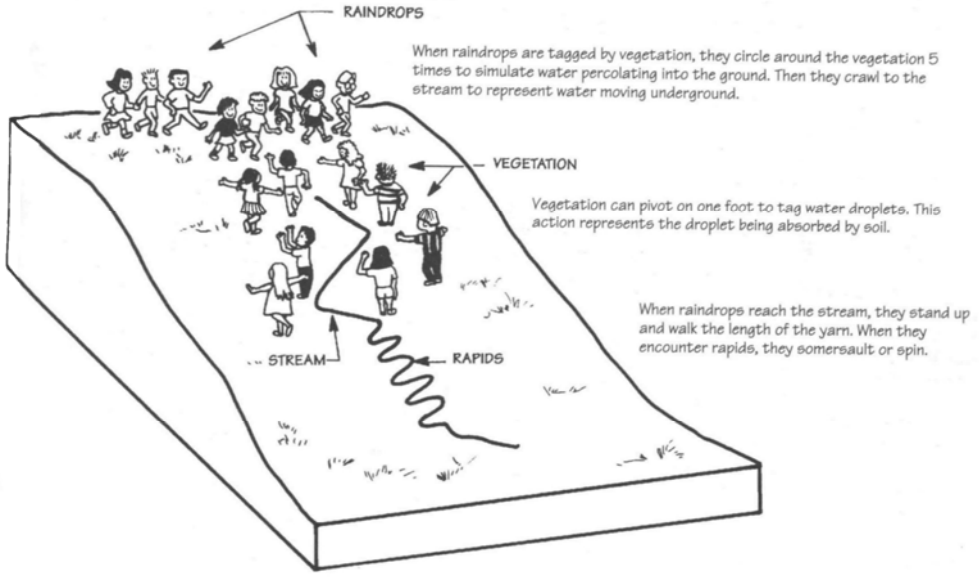
This activity is taken from The Project Wet Curriculum & Activity Guide, *The Watercourse and the Council for Environmental Education, 1995.*

Optional Activity 5
Just Passing Through *(continued)*

Slope With Plant Cover



Procedure

▼ *Warm Up*

Show students pictures of hillsides that are covered with vegetation. Ask them to imagine a gentle rain falling on these slopes. 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.

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

Optional Activity 5
Just Passing Through *(continued)*

stream, they should wait for the rest of the raindrops.

6. **Record the time it takes all the raindrops to pass through the site.** If they want, 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.**

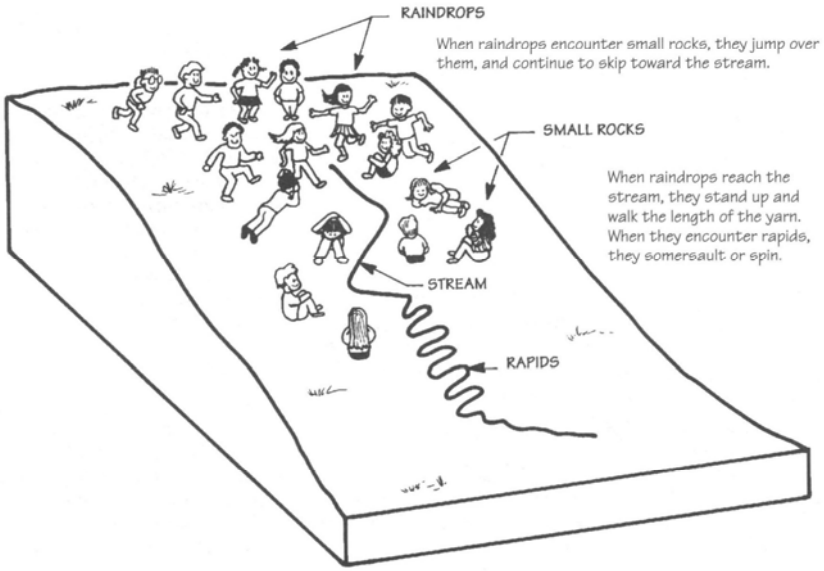
Part III

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 biodegradable items, such as peanuts, 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**

Barren Slope



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Optional Activity 5
Just Passing Through *(continued)*

number of items that they are still holding.

4. **Arrange the playing 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.

▼ *Wrap Up and Action*

Have students inventory their school grounds or community, looking for land areas that compare to those demonstrated in the activity. During a rainfall, students can observe the area's runoff and the amount of sediment carried by the water. Students can plant trees or landscape a garden to improve an area that has erosion problems.

Assessment

Have students:

- demonstrate how water flows down a slope and into a stream (***Part I***).
- compare water's movement through sites that have and that lack plant cover (***Part II***, step 2 and ***Part III***, steps 4 and 5).
- inventory their school grounds or community to assess areas likely to have erosion problems (***Wrap Up***).
- design a landscape using BMPs to control erosion (***Wrap Up***).

Extensions

How does a lake affect the movement of water through a site? Make the playing field similar to that in ***Part I***, but add a lake (a large circle of yarn or rope at the end of the stream). Have raindrops move through the playing field. When a student enters the lake, he or she cannot leave until four more raindrops enter the area. (They can stand in line and make a "wave," moving their arms up and down in a waving motion.) How did the lake affect the rate of water movement? Students may respond that after moving quickly through the stream, they were slowed by the lake.

To introduce how lakes can be affected by surrounding areas with and without plant cover, try the following. Show students a clear glass of water and pour in some sand or soil. Note how materials begin to settle out. Explain that this happens when water is standing in a lake as well. Arrange the playing field as in ***Part II*** and have raindrops pick up sediment as they move toward the stream. When a student enters the lake, he or she waits for the fifth student to enter. Raindrops discard their sediment before leaving the lake. Discuss how a lake could be affected by an accumulation of sediment. (If stream sediment continues to be deposited in the lake, over time the lake could become shallow or even fill. High levels of sediment can adversely affect aquatic plants and animals.) What could be done to decrease the quantity of sediment flowing into the lake? Students may want to repeat this simulation, but with a playing field similar to that in ***Part I*** (site with plant cover) and compare sediment levels.

Resources

Huff, Barbara A. 1990. *Greening the City Streets: The Story of Community Gardens*. St. Louis, Mo.: Clarion Publishing Co.

Miller, G. Tyler, Jr. 1990. *Resource Conservation and Management*. Belmont, Calif.: Wadsworth Publishing Company.

National Arbor Day Foundation. Contact: 100 Arbor Avenue, Nebraska City, NE 68410. (402) 474-5655.

Society of Municipal Arborists. Contact: 7000 Olive Boulevard., University City, MO 63130. (314) 862-1711.

Notes ▼

Leader's Guide
Concepts & Terms Introduced with the Enviroscape Model

Concepts:

The Enviroscape model demonstrates the following concepts:

- A watershed and the concept that activities that occur on the land can have an impact on our waterways. Good water quality and healthy water bodies starts on the land!
- Both point source pollution and non-point source pollution.
- Two important components of the water cycle: precipitation and runoff.

Definitions of Terms

Watershed: An area of land that drains or "sheds" water into a common water body, such as a stream, river, lake, or wetland.

Point Source Pollution: Contaminants that are discharged from a clearly identifiable source such as a pipe that dumps straight into stream or river.

Non-Point Source Pollution: Contaminants that result from many different human activities over a widespread area and not from a single location. Non-point source pollution occurs when rain or melting snow picks up things that may be on the ground, such as fertilizers, oil, litter, pet wastes, or bare soil and carries them to a body of water.

Precipitation: Moisture that falls from the atmosphere (rain, snow, etc).

Runoff: When water from precipitation flows over the surface of the ground and eventually makes its way to a stream or river. Runoff can pick up soil and pollutants from the land and carry them to a body of water such as a stream, lake, or ocean.

Leader's Guide
Demonstrating the Enviroscape Model

1. Begin by asking students what a watershed is.

➤ Discuss how the land in a watershed can be used for a number of different things. Talk about a few of the land uses depicted on the model (development/construction, residential, golf course, forested area, industry, agricultural, roadways, etc.)

2. Ask students what they think of when they hear the word pollution.

➤ See if they can brainstorm any types of pollution that could come from some of the different types of land uses shown on the model. Most of the students will probably come up with point source examples.

3. Demonstrate an example of point source pollution.

➤ Demonstrate point source pollution. This can be demonstrated without simulating precipitation.

Examples of point source pollution to demonstrate:

a. Dumping motor oil (soy sauce) into storm drain.

b. Discharge of waste products (coco mixture) from an industrial factory.

4. Demonstrate examples of non-point source pollution.

➤ Sprinkle contaminants around in their associated land uses while discussing with the students. After selecting a few of the non-point source contaminants to demonstrate, simulate rain with the spray bottle and watch the pollutants make their way to the bodies of water.

Examples of non-point source pollution to demonstrate:

a. Lawn and golf course chemicals such as fertilizers or pesticides (kool-aid mixture).

b. Animal waste (salt & pepper) from pets or farm animals.

c. Exposed soil (coco) from plowed agricultural field or construction site.

d. Oil (soy sauce) from leaky cars on streets and parking lot areas.

e. Trash or litter (pieces of paper) sprinkled around the watershed.

5. Clean up the enviroscape model for the next group.

➤ Pull the stopper out of the lake and let the water drain into the base of the model. Wipe and dry the surface of the model with paper towel. Refill the water in the lake by pouring clean water into it.

Glossary

Channel: The area located between two streambanks where water concentrates and flows downstream.

Confluence: The point where two flowing bodies of water come together.

Erosion: The wearing away of the land's surface by wind or water; a loss of soil.

Floodplain: The flat area of land that extends out from the sides of the streambanks and is flooded with water that spills over from the channel during times of heavy precipitation. The floodplain is bound by points of higher elevation such as the slope of a mountain, hill, or bluff.

Ground Water: The supply of freshwater that is underneath the earth's surface, either in the soil itself or an aquifer (permeable rock layer that can hold large bodies of water underground).

Habitat: The specific environment in which an organism lives and on which it depends for food, water, shelter, and growing space.

Headwaters: Where a stream's water originates, usually at a relatively high elevation in the watershed.

Infiltration: An important process where water soaks into the ground. Once in the ground this water can be used by the roots of plants or stored in the groundwater system.

Impervious Surface: A surface that does not allow water to soak into or pass through it.

Macroinvertebrate: Small animals without backbones that live in the bottom of the stream. These organisms are good indicators of stream health.

Meander: A term used to describe the natural pathway that water travels as it winds and bends across the landscape.

Glossary *(continued)*

Mouth: Where a river empties into a larger body of water.

Non-Point Source Pollution: Contaminants that result from many different human activities over a widespread area and not from a single location. Non-point pollution occurs when rain or melting snow picks up things that may be on the ground, such as, fertilizers, oil, litter, pet wastes or bare soil and carries them to a body of water.

Point bar (also known as a gravel bar or a sand bar): A place located on the inside of a stream bend where sediment, like sand or gravel, gets deposited by flowing water. As the point bar builds up it forms features like sand bars or gravel bars.

Point Source Pollution: Contaminants that are discharged from a clearly identifiable source such as a pipe that dumps straight into stream or river.

Pool: An area of relatively deep, slow water usually located on the outside of a stream bend.

Precipitation: Moisture that falls from the atmosphere (ie; rain, snow, etc).

Riffle: Shallow areas of fast moving water that flows over rocks, creating a "riffle" effect on the water's surface. Riffles tend to have well-oxygenated water and offer good habitat for macroinvertebrates and spawning fish.

Riparian Corridor: The strip of land bordering the stream channel on each side that is made-up of special "water loving" vegetation. (The riparian zone is also a part of the floodplain).

Run: A stretch of fast deep flowing water with a smooth current.

Runoff: When water from precipitation flows over the surface of the ground and eventually makes its way to a stream or river. Runoff can pick up soil and pollutants from the land and carry them to a body of water such as a stream, lake, or ocean.

Glossary *(continued)*

Sediment: Fine soil particles that are transported by water and deposited in the stream. Too much sediment can smother aquatic habitat. This is known as *Sedimentation.*

Storm Sewer: Man-made inlet through which rainwater runoff passes from an urban land surface into a receiving waterway. Typically gutters, curbs, and storm sewer drains are designed to channel runoff away from roads or a person's property as quickly as possible. This runoff is then dumped straight into streams, often without treatment.

Stream banks: The slope of land adjoining a body of water, such as a river or stream. The stream banks make-up the boundaries of the channel.

Streambed: The bottom of the stream.

Substrate: The material that makes up the streambed (the bottom layer of the stream) such as silt, sand, gravel, cobble, or bedrock.

Tributary: A name given to a smaller stream that feeds into a larger stream.

Uplands: Land that is situated at a high elevation in the watershed, such as on a hill or mountain.

Water Table: The depth at which underground water is first encountered, below this level the ground is completely saturated with water. The level of a water table can fluctuate up and down depending on how much water is soaking into the ground or how much water is being taken out from the groundwater supply from things like wells. When the water table intersects with the grounds surface it creates springs or areas where freshwater recharges a stream.

Watershed: An area of land that drains or "sheds" water into a common water body, such as, a stream, river, lake, or wetland.