



What's Your Watershed Address?

Everyone lives in a watershed. Everything that happens on the land in a watershed affects the water body into which it drains.

Estimated Time

Three or four 50-minute class sessions

Technology Tools/Skills Used in Chapter

Topographic map reading

Safety Precautions/Concerns

None

Vocabulary

Channel
Erosion
Headwaters
Intermittent stream
Non-point pollution
Perennial stream
Physiographic
Point-source pollution
Sediment
Tributary
Watershed
Watershed address

Chapter Objectives

Students will be able to:

1. Define watershed and identify the watershed in which they live or attend school.
2. Explain the relationship between the watershed and the water body into which it drains.
3. Define point-source and non-point pollution. Compare and contrast them and support the answer using a specific example of each that is relevant to aquatic resources in Missouri.
4. Define erosion and sedimentation and analyze how human activity affects erosion and sedimentation. Describe the impact of erosion and sedimentation on aquatic resources in Missouri.
5. Identify Missouri's physiographic regions and explain how land type affects Missouri's aquatic resources.
6. Define water quality and support using a specific example of how humans affect water quality in a Missouri watershed.
7. Explain how a technological solution to a problem can have both benefits and drawbacks such as risks or unintended consequences, and support the explanation using a specific example of aquatic resources in Missouri.

Targeted Grade-Level Expectations

ES.3.A.6.b.

ES.3.A.6.c. Analyze the ways humans affect the erosion and deposition of soil and rock materials (e.g., clearing of land, planting vegetation, paving land, construction of new buildings, building or removal of dams)

IS.1.C.6.a.

IN.1.B.6.a.

IN.1.E.6.a. Communicate the procedures and results of investigations and explanations through:

- oral presentations
- drawings and **maps**
- data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
- graphs (bar, single line, pictograph)
- **writings**

Reference Material for Teacher Background

- Bryant Creek Watershed Project at watersheds.org
- MDC Watersheds page at mdc.mo.gov/fish/watershed/

- Missouri DNR Water Pollution Control page at dnr.mo.gov/env/wpp/wp-index.html
- Stream Team Middle School Activity Guide by Mark Van Patten at mostreamteam.org/activity_guide/contents.htm
- Streets to Streams Guide (E00428)
- Streets to Streams Video (E00447)
- Teaching with topos—for information about obtaining, reading and using topographic maps go to rockyweb.cr.usgs.gov/outreach/topoteach.html and interactive2.usgs.gov/learningweb/teachers/mapshow.htm
- Watershed Management Placemat (FIS273)
- Watershed Protection Practices (F00050)
- What Happened to the Stream in My Backyard? (STR238)

Safety Precautions/Concerns

None

Required Materials

- 1 square of aluminum foil for each student
- Squeeze bottle or pump sprayer containing water for each student or group
- Food coloring for each student or group
- Paper towels for spills
- Student Guide
- Notebook paper
- Pens or pencils
- Transparency of delineated watershed and notable features
- Transparency 3.1: Mississippi and Missouri Watersheds Map
- Transparency 3.2: Missouri's Watersheds Map
- Transparency 3.3: Missouri Counties Map
- Transparency 3.4: Missouri's Physiographic Regions Map
- Overhead projector (or other projection technology)
- Washable markers (enough for each student or group)
- USGS 7.5-minute quadrangle topographic map for each group (Obtain maps that include the area to which you will travel on your field study or your school. Laminate prior to use.)

Activity 3.1: Exploration of Students' Current Understanding of the Watershed Concept

This activity explores students' current understanding of the watershed concept.

Estimated Time

5 minutes

Required Materials

None

Procedure

1. Use a cooperative learning activity to explore the following questions:
 - Do you live in a watershed?
 - How does what happens on land in [name your area] affect the water in [name your local lake, stream or wetland]?
 - What makes water muddy? Is muddy water bad?
2. Explain to the class that this chapter will help them understand the relationship between what happens on the land and what happens in the water.

Activity 3.2: Student Investigation of Watershed Concept

This hands-on activity helps students visualize the concept of the watershed and helps them understand the relationship between a water body and its watershed.

Estimated Time

25 minutes

Be sure to have paper towels on hand!

Required Materials

- 1 square of aluminum foil for each student
- Squeeze bottle or pump sprayer containing water for each student or group
- Food coloring for each student or group
- Pens or pencils
- Paper towels for spills

Procedure

1. Tell students that they are going to make a watershed model. Explain that a watershed is all the land that drains water into a particular water body.
2. Distribute the squares of aluminum foil to each student or group. Instruct them to make a fist with one hand and place the foil over it using their other hand. Tell them to mold or smooth the foil around their fist, then to remove the foil and place it on the desk with the open side up like a cup. In some cases, it may be necessary to spread or flatten out the foil somewhat before proceeding.
3. Explain that the foil represents a watershed. The places where their knuckles were represent the low spots in the watershed. These will fill with water first, to become rivers, lakes and wetlands. Furrows where their fingers were represent valleys within the watershed. Explain that the edges of the foil are the highest points of the watershed. They represent ridgelines and mountaintops.
4. Direct the students to simulate rain in the watershed using the squeeze bottle or pump sprayer. Have students carefully observe the behavior of the water. Ask them to describe where the water went as it fell on their model watershed. (The water will run down from the high points through the valleys in streams until it reaches the low areas in the watershed, where it will collect.)
5. Invite the students to experiment by manipulating the contours of the foil and observing how the water changes paths when they spray on more water.
6. Suggest that students use a pencil to make one or two holes in the foil to simulate groundwater recharge in their model watersheds.
7. Ask students to place one or two drops of food coloring in locations around their watersheds, and simulate rain again. Explain that the food coloring represents pollution, and that the colored runoff represents non-point pollution—water pollution that comes from a broad area or a number of sources.
8. Lead class discussion of questions and observations. Be sure to emphasize that any pollutant on the land of a watershed will be carried by runoff into the waterbody of the watershed.
9. Have students clean up and dispose of used materials properly.

Activity 3.3: Student Investigation of Land Use and Pollution within a Watershed

This on-site activity helps students learn to make observations about watershed and land use conditions and develops understanding of non-point pollution.

Estimated Time

25 minutes

Required Materials

- Notebook paper
- Pens or pencils

Procedure

1. Take the class outside on the school grounds. (If that is not possible, the activity may be conducted from a suitable vantage point within the building.) Remind students that they are standing in a watershed and that everything around them is part of a watershed. Lead class discussion to help students understand that watersheds may include buildings, parking lots, athletic fields, lawns, homes, streets, farms, grasslands, forested areas, etc. Point out that when rain falls, water flows over all of the surfaces, picking up whatever contaminants may be present as it moves downhill. This is non-point pollution.
2. Have students explore the area to identify potential sources of pollution on the school grounds. Be sure to look for and point out signs of erosion. Ask students to identify land uses or features that may help reduce or contain pollution (for example, grassy swales or other planted areas between potential pollution sources and drainage areas). Ask students how non-point pollution gets in the watershed, and how people may prevent pollution or reduce its effects.
3. Have students record their thoughts and observations in their science notebooks.

Activity 3.4: Teacher Demonstration of Missouri Watersheds and Physiographic Regions

This demonstration helps students understand Missouri's watersheds, physiographic regions and the relationship between land types and aquatic resources. Students determine their watershed address.

Estimated Time

25 minutes

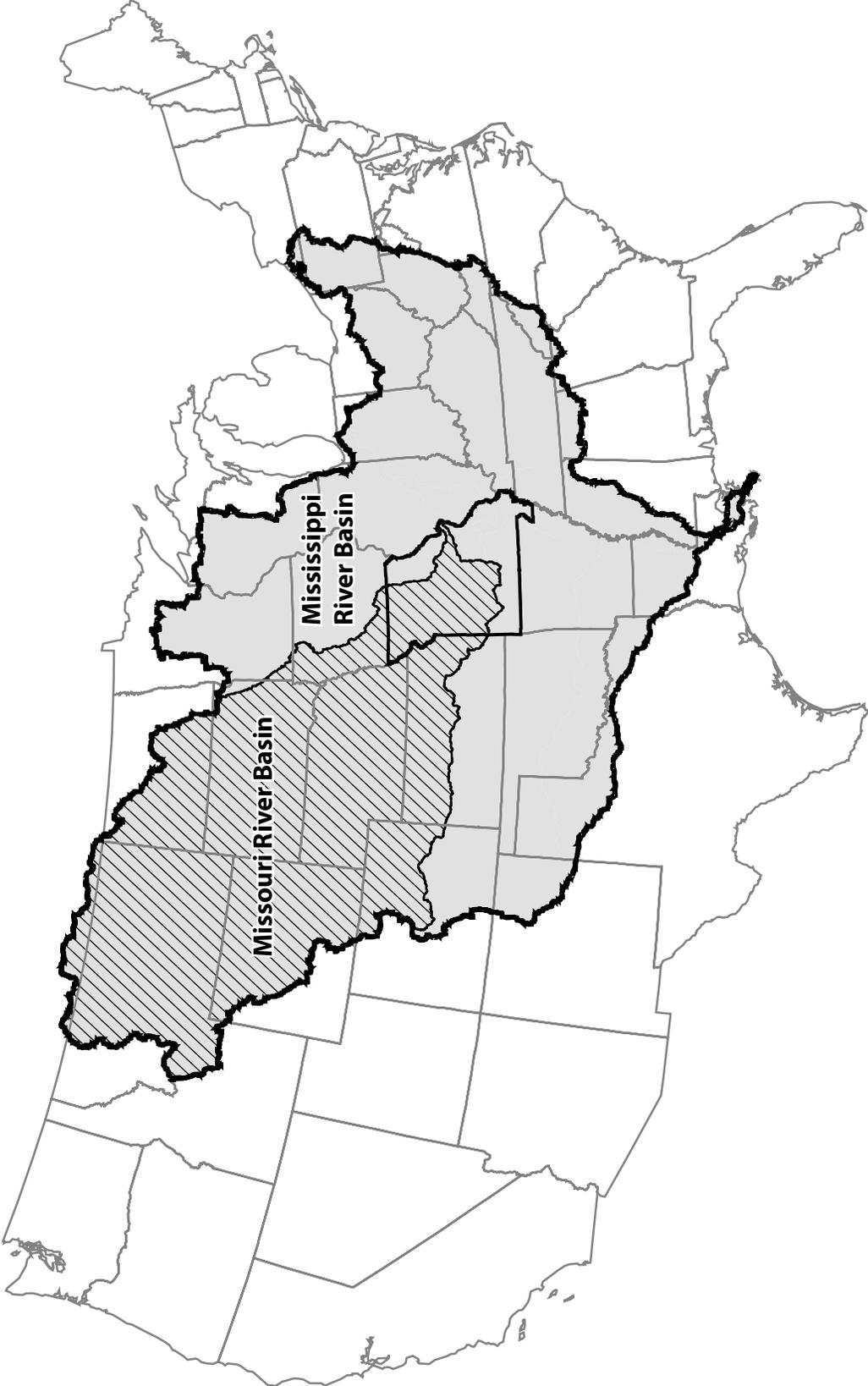
Required Materials

- Transparency 3.1: Mississippi and Missouri Watersheds Map
- Transparency 3.2: Missouri's Watersheds Map
- Transparency 3.3: Missouri Counties Map
- Transparency 3.4: Missouri's Physiographic Regions Map
- Overhead projector (or other projection technology)

Procedure

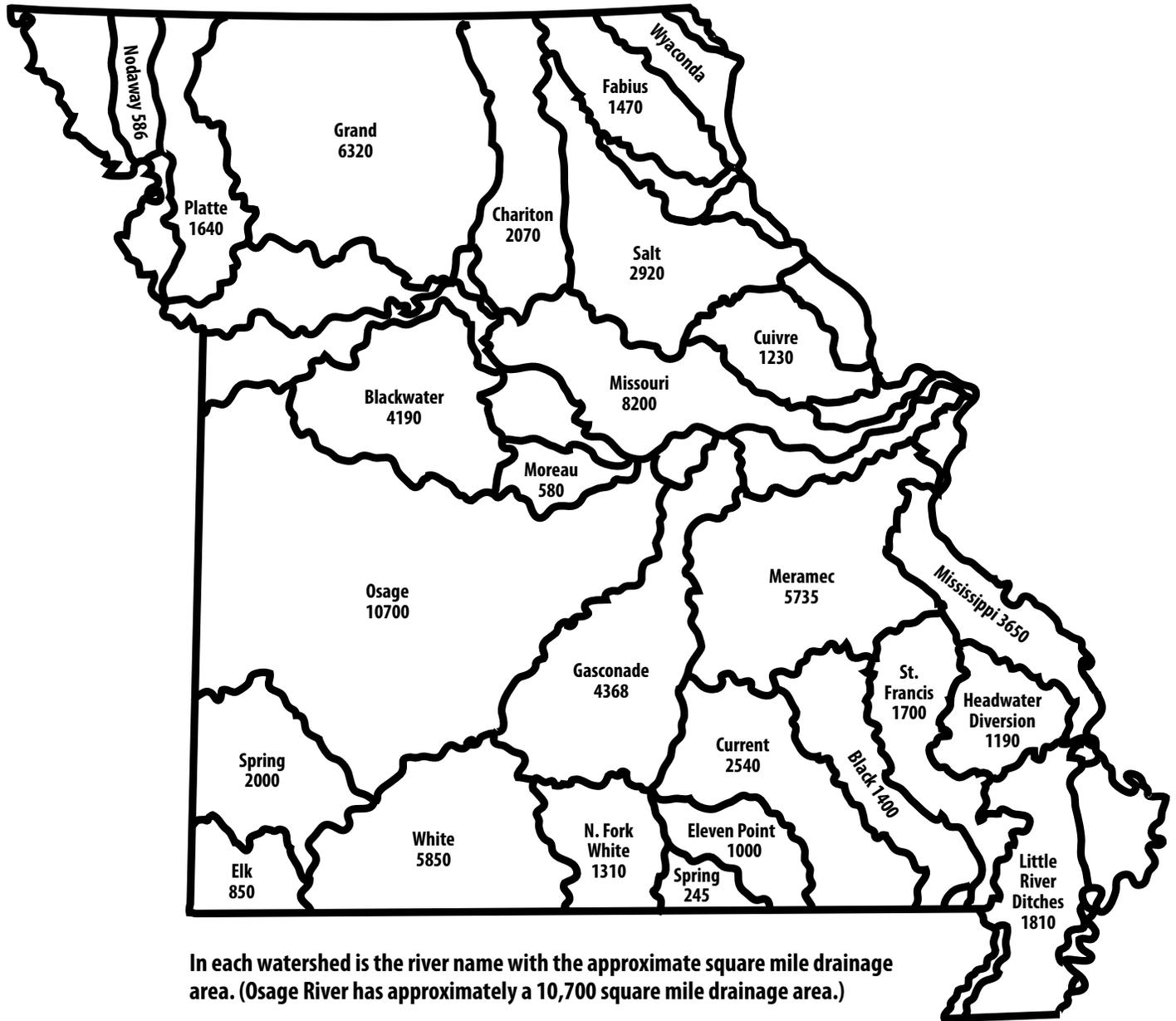
1. Display Transparency 3.1: Mississippi and Missouri Watersheds Map and discuss where Missouri fits into the United States and the Mississippi and Missouri watersheds. Point out that the state of Missouri lies entirely within the Mississippi watershed. Also point out that the Missouri watershed is part of the Mississippi watershed because the Missouri River flows into the Mississippi River. Explain that watershed boundaries frequently do not correspond to political boundaries. As an example, point out that a small part of the Missouri River watershed crosses the U.S. border into Canada.
2. Explain that, just as the Missouri watershed is a part of the Mississippi watershed, there are multiple smaller watersheds within every large watershed, and that Missouri has many watersheds within it. Put up Transparency 3.2: Missouri's Watersheds Map. Point out some of the significant watersheds in the state.
3. Place Transparency 3.3: Missouri Counties Map over the top of the watershed map. Carefully line up the state's borders. Draw the students' attention to your school's county. Ask students in which watershed the school is located. Lead class discussion to determine the school's watershed address. (For example, the watershed address of Summit Lakes Middle School in Lee's Summit is South Grand—Osage—Missouri—Mississippi.) Have students record the school's watershed address in their science notebooks. If any students live in other watersheds, help them determine their watershed address. Have students record in their science notebooks their home watershed address.
4. Using Transparency Master 3.4: Missouri's Physiographic Regions, briefly discuss the five major regions in Missouri. Be sure to identify and describe the physiographic region in which your school is located.

Transparency 3.1: Mississippi and Missouri Watersheds Map



Transparency 3.2: Missouri's Watersheds Map

Map courtesy of Missouri Stream Team

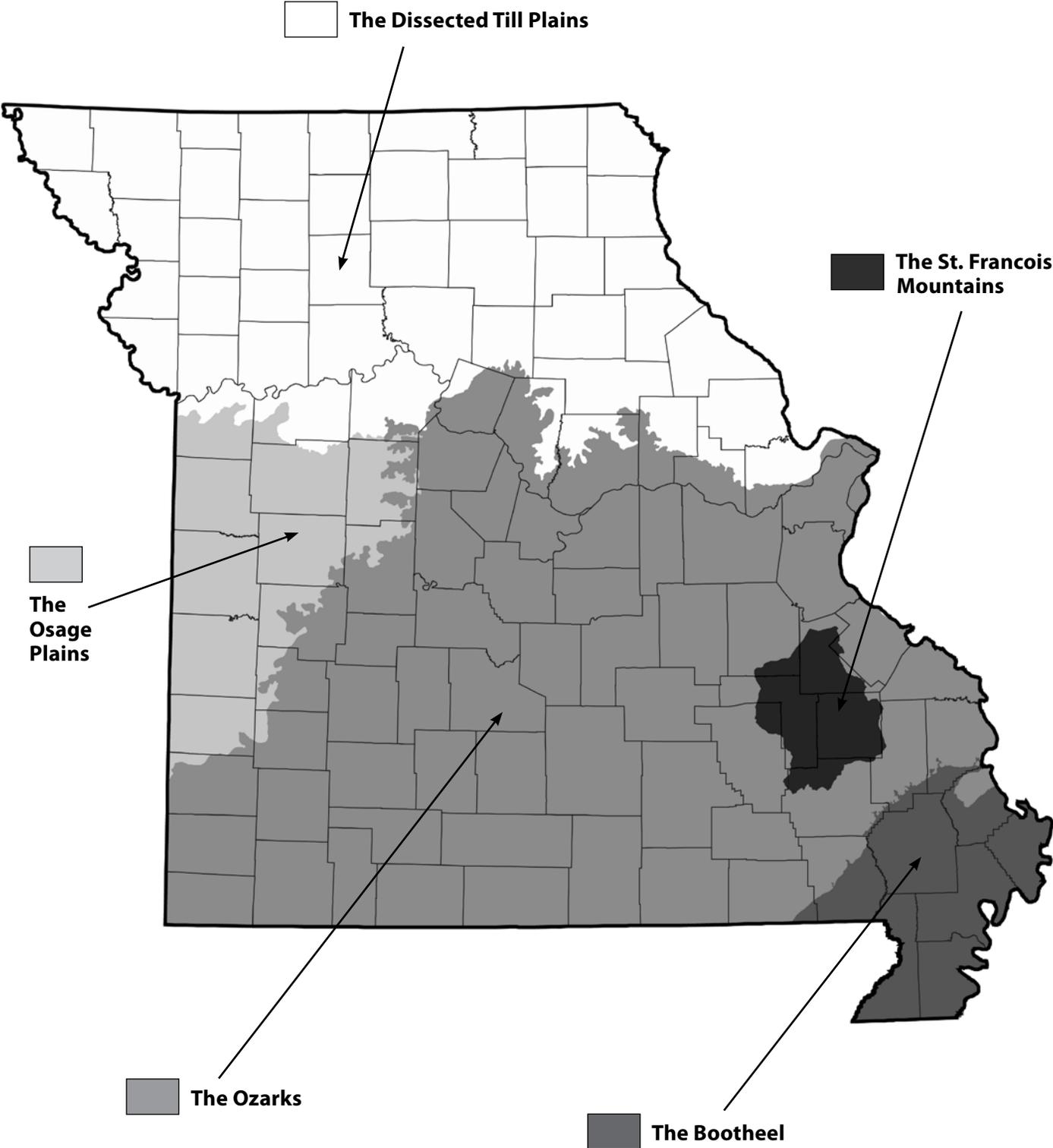


In each watershed is the river name with the approximate square mile drainage area. (Osage River has approximately a 10,700 square mile drainage area.)

Transparency 3.3: Missouri Counties Map



Transparency 3.4: Missouri's Physiographic Regions Map



Activity 3.5: Student Reading and Research

This activity provides students with definitions and explanations about the watershed concept and the relationship between the land of a watershed and the waterbody to which it drains.

Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

Required Materials

- Student Guide
- Notebook paper (optional)
- Pens or pencils (optional)

Procedure

1. Have students read Chapter 3: What's Your Watershed Address? Introduce vocabulary terms as needed.
2. Assign the **Questions to Consider** as homework or use them in a cooperative learning activity.
 1. What is a watershed? Which watershed do you live in?
A watershed is all the land that drains water into a particular body of water. Assess locally.
 2. How does the watershed affect the water body into which it drains? How do human activities affect the quality of water in a watershed?
What you do to the land, you do to the water. Everything that happens on the land in a watershed affects the water body into which it drains. A stream, pond or wetland can only be as healthy as its watershed. How we use the land affects the health of our aquatic resources. As water runs downhill, it picks up whatever is on the ground. When it flows through cities or across fields and pastures, water picks up sediment, pollutants and heat. These contaminants flow into a stream, wetland or lake you use to drink, swim in or fish from.
 3. What is point-source pollution? What is non-point pollution?
Point-source pollution is contamination that can be traced to a single source. Non-point pollution is water pollution that comes from a broad area or a number of sources.
 4. What is erosion? What causes it?
Erosion is the movement of solid material such as rock, soil or mud. It is a natural process caused by the forces of wind, water, ice, gravity and/or living things.
 5. What is sediment? Where does it come from?
Sediment is any bit of rock or soil that is suspended or carried in water. It comes from eroding rock, soil or mud.
 6. How does human activity affect erosion and sedimentation? What is the impact of erosion and sedimentation on aquatic resources?
Erosion can be accelerated by cutting down too many trees, overgrazing or disturbing land for construction. Planting trees and building terraces are two ways to slow erosion. Missouri farmers have switched to no-till planting and other conservation farming techniques to reduce the amount of soil and other sediment in Missouri streams. A certain amount of erosion and sediment is natural. However, too much of either can cause problems. Erosion can reduce soil fertility and water quality. Sediment that erodes from one place is carried away and settles out downstream. This can clog streams with gravel and fill reservoirs with sediment. Excess sediment blocks out light, killing aquatic plants or preventing their growth. Sediment covers up the nooks and crannies animals live in. It smothers aquatic animals by clogging their gills and by reducing the amount of oxygen in the water.
 7. What are Missouri's physiographic regions?
Missouri's physiographic regions are the Bootheel, the Ozarks, the Osage Plains, the St. Francois Mountains and the Dissected Till Plains.

Activity 3.6: Student Investigation of Watershed Mapping

This hands-on activity helps students understand the watershed concept. Students use topographic maps to delineate watershed boundaries and to identify potential impacts on the watershed and waterbody.

Estimated Time

25 to 50 minutes

Required Materials

- 1 laminated topographic map for each group
- Washable markers (enough for each student or group)
- Paper towels for erasing marks on maps
- Transparency of delineated watershed and notable features

Procedure

1. Students should work in groups. Distribute laminated topographic maps, washable markers and paper towels to groups.
2. Briefly explain the activity to the students and explain how to interpret a topographic map. Be sure to describe how to identify bodies of water, including perennial and intermittent streams, contour lines, uphill and downhill directions and high points.
3. Instruct students to place an X on the furthest point downstream (lowest elevation) that they will evaluate. All waterways upstream from this point are tributaries to this waterway, and all land uphill from this point is the watershed. Have students trace the waterbody and its tributaries with a marker.
4. Have students find the highest points around the X. These are the circles or closed loops of contour lines surrounding the X. Ask students to mark these with a dot. Then have them connect the dots with a smooth line following the highest contours. The area enclosed by this loop is the watershed. Be sure each group has produced a correct watershed outline.
5. Have students identify points of interest within the watershed. Potential sources of pollution may include dumps or landfills, farms or animal-feeding operations, golf courses and other places that may use fertilizer, sewage treatment plants and other known point sources, highways and mall parking lots, mines and other areas of land disturbance such as construction sites. Also note features that may have positive impacts, such as forested or other less-developed areas.
6. Lead class discussion of the features of the watershed and the potential impacts to water quality that they can identify within the watershed.

Prepare in advance

Familiarize yourself with the topographic map and symbols, and with the area you will be studying. Perform the activity yourself and determine the features of the watershed. Create a transparency by overlaying a transparency blank over the map and tracing the watershed features onto it or by photocopying the map with the watershed features delineated.

Activity 3.7: Student Investigation of Watershed and Land Use Conditions

Students apply what they have learned in the preceding activities to create science notebook pages to record observations of watershed and land use conditions in preparation for their field study day.

Estimated Time

25 minutes

Required Materials

- Notebook paper
- Pens or pencils

Procedure

1. Instruct students to work in groups to decide the best way to record observations of watershed and land use conditions as part of their field study day.
2. Have each group create a data table and have each student make a copy for his/her science notebook.

Chapter 3 Assessment

Directions

Select the best answer for each of the following multiple-choice questions.

1. What is non-point pollution?
 - a. A stream that empties into a particular body of water
 - b. Water pollution that comes from a broad area or a number of sources
 - c. The movement of solid material such as rock, soil or mud
 - d. Contamination that can be traced to a single source

2. What is erosion?
 - a. Any bit of rock or soil that is suspended or carried in water
 - b. Water pollution that comes from a broad area or a number of sources
 - c. The movement of solid material such as rock, soil or mud
 - d. All of the above

3. What is a watershed?
 - a. A stream that empties into a particular body of water
 - b. The area where precipitation first collects in tiny trickles too small to create a permanent channel
 - c. A stream that flows all year long
 - d. All the land that drains water into a particular body of water

4. What is point-source pollution?
 - a. A stream that empties into a particular body of water
 - b. Water pollution that comes from a broad area or a number of sources
 - c. The movement of solid material such as rock, soil or mud
 - d. Contamination that can be traced to a single source

5. What is sediment?
 - a. Any bit of rock or soil that is suspended or carried in water
 - b. Water pollution that comes from a broad area or a number of sources
 - c. The movement of solid material such as rock, soil or mud
 - d. None of the above

Chapter 3 Assessment

Directions

Write your own answer for each of the following questions.

1. What is the watershed address of your school?
2. Identify and describe the physiographic region in which your school is located.
3. How does human activity affect erosion and sedimentation? Justify your answer using an example relevant to Missouri's aquatic resources.
4. Describe the relationship between a watershed and the waterbody into which it drains. Support your answer with an example relevant to Missouri's aquatic resources.

Chapter 3 Assessment Answer Key

Multiple-choice questions

1. What is non-point pollution?
b. Water pollution that comes from a broad area or a number of sources
2. What is erosion?
c. The movement of solid material such as rock, soil or mud
3. What is a watershed?
d. All the land that drains water into a particular body of water
4. What is point-source pollution?
d. Contamination that can be traced to a single source
5. What is sediment?
a. Any bit of rock or soil that is suspended or carried in water

Write-in questions

1. What is the watershed address of your school?
Assess locally. Refer to Activity 3.3.
2. Identify and describe the physiographic region in which your school is located.
Assess locally. Refer to Activity 3.3.
3. How does human activity affect erosion and sedimentation? Justify your answer using an example relevant to Missouri's aquatic resources.

Answers should include at least one impact, one effect of human activity and one example. Some possibilities include the following:

Impacts:

- **Sediment can clog streams with gravel and fill reservoirs with sediment.**
- **Excess sediment blocks out light, killing aquatic plants or preventing their growth.**
- **Sediment covers up the nooks and crannies animals live in.**
- **Sediment smothers aquatic animals by clogging their gills and by reducing the amount of oxygen in the water.**

Effects of human activity:

- **Deforestation, overgrazing or construction speeds up the natural process of erosion.**
- **Planting trees and building terraces are two ways to slow erosion.**
- **Planting trees and other vegetation slows moving water down, and plant roots hold soil and rock in place.**

Examples:

- **Missouri farmers have switched to no-till planting, rotational grazing and other conservation farming techniques to reduce the amount of erosion and sedimentation in Missouri streams.**
- **Missouri developers use silt fences, buffer zones and other conservation techniques to reduce the amount of erosion and sedimentation in Missouri streams.**
- **Missouri Stream Teams plant trees along streams to protect them from erosion and to capture sediment.**

4. Describe the relationship between a watershed and the waterbody into which it drains. Support your answer with an example relevant to Missouri's aquatic resources.

Answers may include:

- **What you do to the land, you do to the water.**
- **Everything that happens on the land in a watershed affects the water body into which it drains.**
- **A stream, pond or wetland can only be as healthy as its watershed.**
- **How we use the land affects the health of our aquatic resources.**
- **As water runs downhill, it picks up whatever is on the ground.**

Examples:

- **When it flows through cities or across fields and pastures, water picks up sediment, pollutants and heat. These contaminants flow into a stream, wetland or lake, affecting the water you use to drink, swim in or fish from.**
- **When you flush your toilet, do the laundry, fertilize your lawn or dump used oil on the ground, you are affecting water quality in your watershed.**

Enrichments

Project WET:

- Branching Out!
- Just Passing Through
- Rainy-Day Hike
- Sum of the Parts

Project WILD Aquatic:

- Watershed
- Where Does Water Run?

Video clips:

- Mississippi River Maintenance Man
- Missouri River Relief

Demonstrations:

- Enviroscope model
- Stream Table

Service learning:

- Storm drain stenciling
- Litter pickup

Guest speaker:

- Stream Team volunteer. If invited for activities, the speaker may be able to assist with instruction as well as talk about volunteer opportunities and watershed issues.