Our Mississippi

Educational Activities

about the Upper Mississippi River

Grades 5–6

www.OurMississippi.org

St. Paul District
Rock Island District
St. Louis District

US Army Corps of Engineers ®

National Great Rivers Museum
P.O. Box 337
Alton, Illinois 62002

Background Information

In September 2004, the U.S. Army Corps of Engineers (Corps) distributed the Final Integrated Feasibility Report and Programmatic Environmental Impact Statement for the Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study.

The report described an integrated plan for modifications and operations changes to the Upper Mississippi River and the Illinois Waterway for navigation efficiency and ecosystem restoration. It also discussed the programmatic actions and the associated beneficial and adverse effects regarding navigation efficiency and ecosystem restoration needs.

To protect the known and unknown significant historic properties affected by the implementation of the navigation improvements, several government agencies signed a Programmatic Memorandum of Agreement. The signers included the Corps; U.S. Fish and Wildlife Service; Illinois, Iowa, Minnesota, Missouri, and Wisconsin Historic Preservation Officers; and the Advisory Council on Historic Preservation. It was decided that documenting the history and significance of the Upper Mississippi River and the Illinois Waterway would address some of these possible effects.

As part of that effort, the Corps held the first meeting of the Navigation and Ecosystem Sustainability Program (NESP) Cultural Resources and Stewardship Mitigation Team in La Crosse, Wisconsin, in June 2006. A second meeting was held in Alton, Illinois, in April 2008. In August 2009, the Corps contracted Formations of Portland, Oregon, to produce "Our Mississippi: Educational Activities about the Upper Mississippi River."

The production of the various drafts of the Teacher's Activity Guide was coordinated with the NESP Cultural Resources and Stewardship Mitigation Team through three workshops held between December 14-18, 2009 at Alton, Illinois; Pleasant Valley, Iowa; and St. Paul, Minnesota. All comments and responses were considered in various draft reviews.

Special Thanks to...

This Teacher's Activity Guide would not have been possible without the assistance and cooperation of many people. We would like to extend an earnest thank you to everyone who helped to develop this book, especially the workshop participants, draft reviewers, and content providers.

We would like to personally thank the following individuals for their extensive support and invaluable contributions: Brad Walker, The Izaak Walton League of America; Jeff Janvrin, Wisconsin Department of Natural Resources; and Paul Rohde, Waterways Council Incorporated.

Development Team

Thank you to the talented group of people with the U.S. Army Corps of Engineers for their assistance: Kimberly Rea, Mindy Cory, Erin Hilligoss-Volkmann, Angie Smith, Ron Deiss, Mark Cornish, and Ken Barr. Also, thank you to the capable and clever design team led by Formations: Corrie Greening, Marie Naughton, and Karen Adams.

Table of Contents

Welcome to Our Mississippi

Educational Activities about the Upper Mississippi River

Introduction

The U.S. Army Corps of Engineers is pleased to present this balanced, comprehensive guidebook to help teachers inform future decision-makers about this important natural resource.

Our Mississippi has been years in the making. In 1986, Congress designated the Upper Mississippi River System as both a nationally significant ecosystem and a nationally significant navigation system. Since then, the Corps has worked with multiple groups and agencies to improve the economic and environmental sustainability of the river.

This guidebook is a result of several different programs and partnerships that included other federal agencies, five states, and a wide variety of environmental, conservation, navigation, and industry groups to strike that ever-crucial balance of human and wildlife interests.

We embrace the Mississippi for different reasons and from different perspectives. It is a national resource shared for different purposes. The river is important to communities and individuals. We may have individual perspectives on the river, but successful management requires an integrated and collective effort.

Educational Approach

The main goal of Our Mississippi is to provide teachers with a mix of classroom, self-directed, and collaborative lessons and activities about the Upper Mississippi River that meet a wide range of national learning standards. They follow a multidisciplinary approach, weaving science, technology, and math with social science, language, and arts collaboratively to address complex, real-life resource management issues and multiple uses of the river.

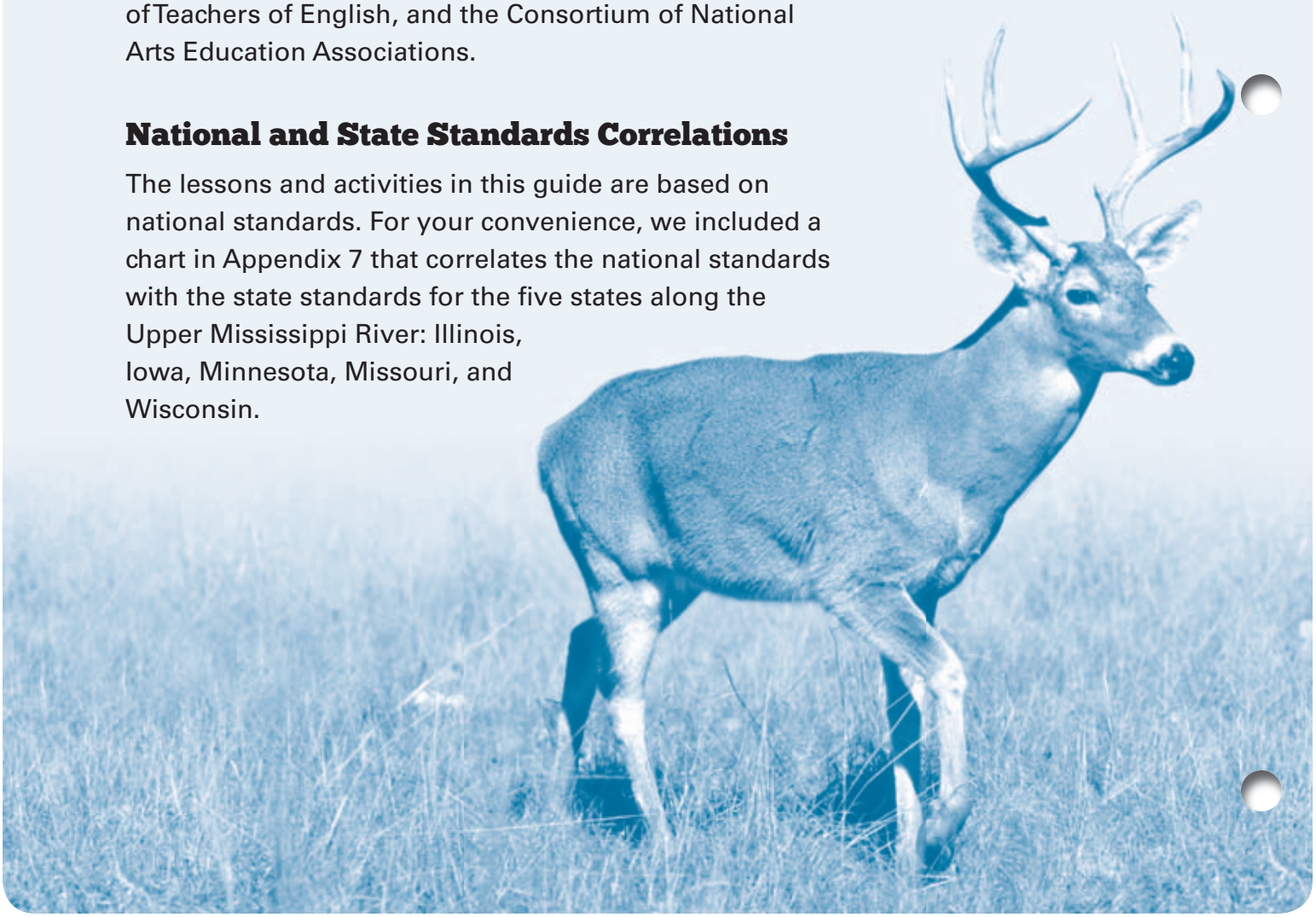
The lessons and activities chosen for the guidebook focus on concepts that can be investigated or demonstrated. Designed for grades 5 and 6, each unit includes activities or extension ideas for upper and lower grades as well.

National Standards

The lessons and activities in Our Mississippi were developed based on the national educational standards recommended by the National Research Council (for science standards), International Society for Technology in Education, National Council of Teachers of Mathematics, National Council for the Social Studies, National Council of Teachers of English, and the Consortium of National Arts Education Associations.

National and State Standards Correlations

The lessons and activities in this guide are based on national standards. For your convenience, we included a chart in Appendix 7 that correlates the national standards with the state standards for the five states along the Upper Mississippi River: Illinois, Iowa, Minnesota, Missouri, and Wisconsin.



How to Use this Guide

This guidebook was designed to provide teachers with a complete, cross-curricular approach to a wide range of subjects relating to the Upper Mississippi River, including earth science, physical science, social science, language arts, fine arts, and math in five interrelated units organized by subject area. Although each lesson can be used by itself as a stand-alone piece, the strength of this guidebook lies in the sequential manner in which the lessons and activities build on and complement one another.

Unit 1: Upper Mississippi River Watershed

The first unit presents a broad overview of the vast drainage basin of the Mississippi River, preparing students for an in-depth examination of the Upper Mississippi River by first placing it in the spatial context of its entire watershed. It introduces students to the river's geography, earth science, and physical science using a large wall map of the entire watershed that will serve as the conceptual thread that runs through all the units.

Unit 2: Upper Mississippi River Ecosystems

The second unit builds on the broad overview of the entire watershed to focus on the Upper Mississippi River itself. This unit explores the river's ecosystems and the life that depends on it through life science. Students investigate what a healthy river system is, how the river's health is measured and monitored, and what happens to the river—as well as people, plants, and animals—if the river is not healthy.

Unit 3: Upper Mississippi River History and Culture

The skills and knowledge learned in the first two units serve as the background information needed to examine human history, migration, and settlement through social science, language arts, and fine arts. The human history of the Upper Mississippi River is explored from the context of family or community traditions.

Unit 4: The Mississippi River at Work

This unit focuses on the river as a vital lifeline for human commerce. It uses the knowledge and skills presented in previous units to explore how humans rely on the river. Having learned how people used the river for transportation and trade in the past, students compare and contrast those uses with how people use the river today, including recreation and tourism.

Unit 5: A Shared Resource – Our Mississippi River

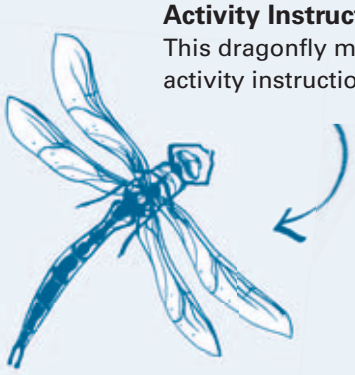
The knowledge and skills learned in the previous four units are applied in the final unit using higher-level skills, including communication, problem solving, and compromise. In this unit, students synthesize the earth science, physical science, and social science information to debate and problem-solve a variety of solutions for managing and conserving the Upper Mississippi River.

All pages in this guide are perforated and three-hole punched for your convenience. Copies of all lessons and activities can be found on the accompanying CD-ROM and companion website at www.OurMississippi.org. The website also includes additional information, activities, and up-to-date links for computer-based activities and extensions.

Primary Icons

Summary Sidebar
A river otter sits atop the summary sidebar that begins each lesson introduction and lesson to provide you with a quick overview of its purpose and focus.

Activity Instructions
This dragonfly marks all activity instructions.



Standards Correlation
The ruler provides you with a quick summary of the national and state standards addressed in a unit introduction or lesson.

Copy Me
This Viceroy butterfly identifies pages that can be reproduced on a copier.

Use of Icons

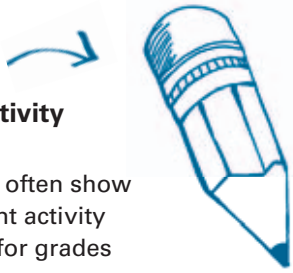
This guidebook includes icons to help you find what you need at a glance among the wealth of information, activities, and extension ideas. They serve as quick reference points for different types of information.

Secondary Icons

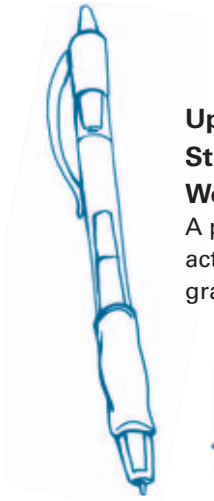
Helpful Hints
Post-It notes provide suggestions and tips.

Career Launch
The leaping frog identifies career ideas to share with students.

Answer Keys
A set of keys identifies the answers to pre- and post-assessments and activities.



Student Activity Worksheet
A pencil will often show up on student activity worksheets for grades 5–6 students.



Upper Grade Level Student Activity Worksheet
A pen marks student activity worksheets for grades 7–12 students.

Lower Grade Level Extensions
This duckling identifies extension ideas for grades K–4 students.

Unit Overview

Each unit is designed to give you everything you need to explore a given subject area in depth, including activities and extension ideas.

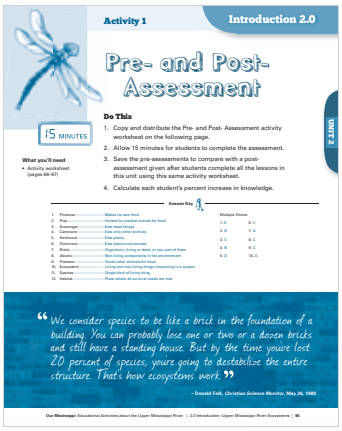
All units begin with a two-page overview that provides a brief summary of the unit and its lessons and activities.

Units contain:

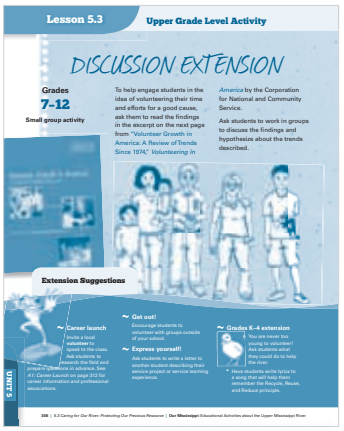
- Unit Goal
- Pre- and Post-Assessment
- Introduction
- Lessons
- Activities
- Extensions

Every unit contains four or five lessons that include one or two activities each.

Each unit includes a pre- and post-assessment designed to evaluate student knowledge before and after each unit. Answer key is included.



All units contain at least one upper and lower grade level extension activity.



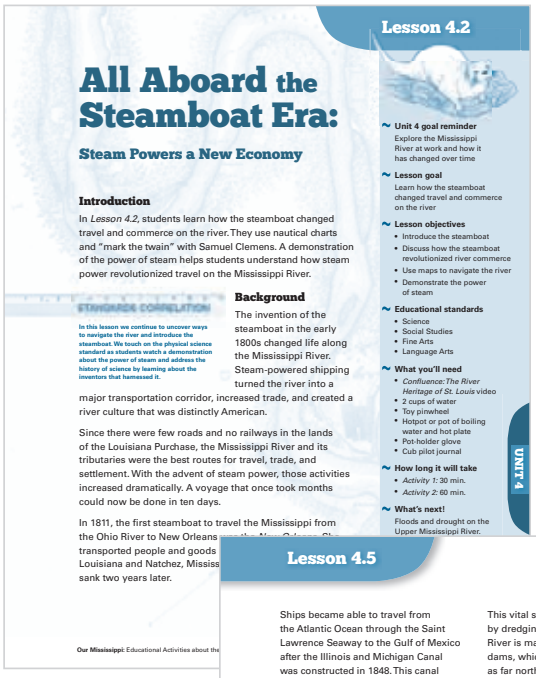
To help you choose and plan lessons and activities, we included a chart that provides all the pertinent information you need at a glance. It lists the goals, objectives, page numbers, standards, and activities for all the lessons in this guide in one place. This is located in the appendix section of the guide.

Lesson Overview

Each lesson provides all the information you need to explore a particular subject. Student activities are experiential hands-on activities or experiences. Highly adaptable, most can be used as either individual or small group activities or as classroom demonstrations, depending on the teacher's goals and resources.

Each lesson contains:

- Background information, key concepts, vocabulary, and/or interesting facts
- Discussion ideas and lesson instructions
- Student activity worksheets
- Related careers and quotes
- Extension ideas


Lesson 4.2

All Aboard the Steamboat Era:

Steam Powers a New Economy

Introduction

In *Lesson 4.2*, students learn how the steamboat changed travel and commerce on the river. They use nautical charts and "mark the twain" with Samuel Clemens. A demonstration of the power of steam helps students understand how steam power revolutionized travel on the Mississippi River.

STANDARDS CORRELATION

In this lesson we continue to uncover ways to navigate the river and introduce the steamboat. We touch on the physical science standard as students watch a demonstration about the power of steam and address the history of science by learning about the inventors that harnessed it.

Background

The invention of the steamboat in the early 1800s changed life along the Mississippi River. Steam-powered shipping turned the river into a major transportation corridor, increased trade, and created a river culture that was distinctly American.

Since there were few roads and no railways in the lands of the Louisiana Purchase, the Mississippi River and its tributaries were the best routes for travel, trade, and settlement. With the advent of steam power, those activities increased dramatically. A voyage that once took months could now be done in ten days.

In 1811, the first steamboat to travel the Mississippi from the Ohio River to New Orleans transported people and goods Louisiana and Natchez, Mississ sank two years later.

Unit 4 goal reminder
Explore the Mississippi River at work and how it has changed over time

Lesson goal
Learn how the steamboat changed travel and commerce on the river

Lesson objectives
- Introduce the steamboat
- Discuss how the steamboat revolutionized river commerce
- Use maps to navigate the river
- Demonstrate the power of steam

Educational standards
- Science
- Social Studies
- Fine Arts
- Language Arts

What you'll need
- *Confluence: The River Heritage of St. Louis* video
- 2 cups of water
- Toy pinwheel
- Hotpot or pot of boiling water and hot plate
- Pot-holder glove
- Cub pilot journal

How long it will take
- *Activity 1:* 30 min.
- *Activity 2:* 60 min.

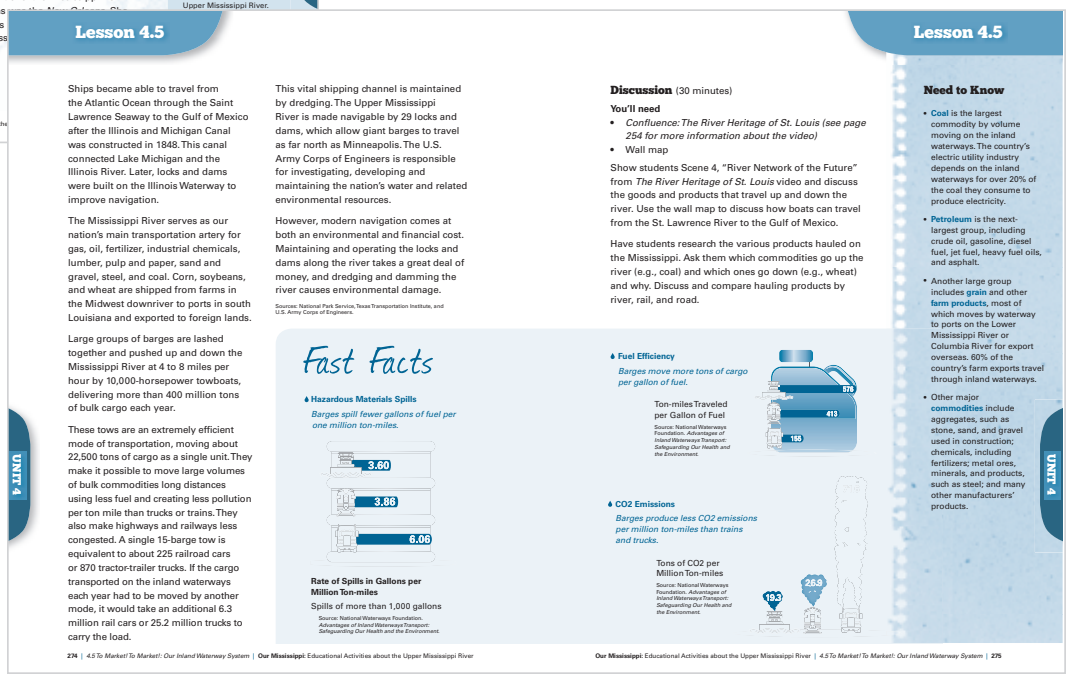
What's next!
Floods and drought on the Upper Mississippi River.

UNIT 4

Our Mississippi: Educational Activities about the

Each lesson includes a summary sidebar listing the unit goal, lesson goal, learning objectives, education standards, materials needed, time, and a preview of the next lesson.

To save teachers time and effort, we have provided background information to help teachers get up to speed on a topic, as well as engaging fast facts and ideas for leading structured discussions that will help prepare students for the activities and extensions.


Lesson 4.5

Ships became able to travel from the Atlantic Ocean through the Saint Lawrence Seaway to the Gulf of Mexico after the Illinois and Michigan Canal was constructed in 1848. This canal connected Lake Michigan and the Illinois River. Later, locks and dams were built on the Illinois Waterway to improve navigation.

The Mississippi River serves as our nation's main transportation artery for gas, oil, fertilizer, industrial chemicals, lumber, pulp and paper, sand and gravel, steel, and coal. Corn, soybeans, and wheat are shipped from farms in the Midwest downriver to ports in south Louisiana and exported to foreign lands.

Large groups of barges are lashed together and pushed up and down the Mississippi River at 4 to 8 miles per hour by 10,000-horsepower towboats, delivering more than 400 million tons of bulk cargo each year.

These tows are an extremely efficient mode of transportation, moving about 22,500 tons of cargo as a single unit. They make it possible to move large volumes of bulk commodities long distances using less fuel and creating less pollution per ton mile than trucks or trains. They also make highways and railways less congested. A single 15-barge tow is equivalent to about 225 railroad cars or 870 tractor-trailer trucks. If the cargo transported on the inland waterways each year had to be moved by another mode, it would take an additional 6.3 million rail cars or 25.2 million trucks to carry the load.

This vital shipping channel is maintained by dredging. The Upper Mississippi River is made navigable by 29 locks and dams, which allow giant barges to travel as far north as Minneapolis. The U.S. Army Corps of Engineers is responsible for investigating, developing and maintaining the nation's water and related environmental resources.

However, modern navigation comes at both an environmental and financial cost. Maintaining and operating the locks and dams along the river takes a great deal of money, and dredging and damming the river causes environmental damage.

Sources: National Park Service, Texas Transportation Institute, and U.S. Army Corps of Engineers.

Fast Facts

Hazardous Materials Spills
Barges spill fewer gallons of fuel per one million ton-miles.

Rate of Spills in Gallons per Million Ton-miles
Spills of more than 1,000 gallons

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*

Fuel Efficiency
Barges move more tons of cargo per gallon of fuel.

Ton-miles Traveled per Gallon of Fuel

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*

CO2 Emissions
Barges produce less CO2 emissions per million ton-miles than trains and trucks.

Tons of CO2 per Million Ton-miles

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*

Discussion (30 minutes)

You'll need
- *Confluence: The River Heritage of St. Louis (see page 254 for more information about the video)*
- Wall map

Show students Scene 4, "River Network of the Future" from *The River Heritage of St. Louis* video and discuss the goods and products that travel up and down the river. Use the wall map to discuss how boats can travel from the St. Lawrence River to the Gulf of Mexico.

Have students research the various products hauled on the Mississippi. Ask them which commodities go up the river (e.g., coal) and which ones go down (e.g., wheat) and why. Discuss and compare hauling products by river, rail, and road.

Need to Know

- Coal is the largest commodity by volume moving on the inland waterways. The country's electric utility industry depends on the inland waterways for over 20% of the coal they consume to produce electricity.
- Petroleum is the next-largest group, including crude oil, gasoline, diesel fuel, jet fuel, heavy fuel oils, and asphalt.
- Another large group includes grain and other farm products, most of which moves by waterway to ports on the Lower Mississippi River or Columbia River for export overseas. 60% of the country's farm exports travel through inland waterways.
- Other major commodities include aggregates, such as stone, sand, and gravel used in construction; chemicals, including fertilizers; metal ores, minerals, and products, such as steel; and many other manufacturers' products.

UNIT 4

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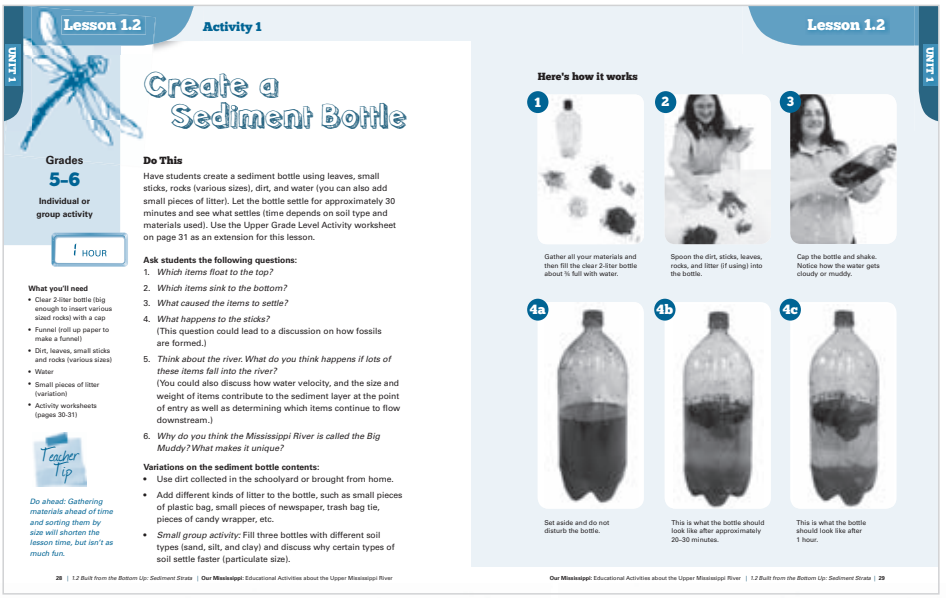
Our Mississippi: Educational Activities about the Upper Mississippi River | 4.5 To Market! To Market!: Our Inland Waterway System | 275

Each activity marked with a dragonfly lists information on grade level, time required, and materials. Some activities include photos of step-by-step instructions.



Lesson 1.2 Activity 1

UNIT 1

Create a Sediment Bottle

Grades 5–6

Individual or group activity

1 HOUR

What you'll need

- Clear 2-liter bottle (big enough to insert various sized rocks) with a cap
- Funnel (roll up paper to make a funnel)
- Dirt, leaves, small sticks and rocks (various sizes)
- Water
- Small pieces of litter (variation)
- Activity worksheets (pages 30-31)

Teacher Tip

Do ahead: Gathering materials ahead of time and sorting them by size will shorten the lesson time, but isn't as much fun.

Do This

Have students create a sediment bottle using leaves, small sticks, rocks (various sizes), dirt, and water (you can also add small pieces of litter). Let the bottle settle for approximately 30 minutes and see what settles (time depends on soil type and materials used). Use the Upper Grade Level Activity worksheet on page 31 as an extension for this lesson.

Ask students the following questions:

1. *Which items float to the top?*
2. *Which items sink to the bottom?*
3. *What caused the items to settle?*
4. *What happens to the sticks?* (This question could lead to a discussion on how fossils are formed.)
5. *Think about the river. What do you think happens if lots of these items fall into the river?* (You could also discuss how water velocity, and the size and weight of items contribute to the sediment layer at the point of entry as well as determining which items continue to flow downstream.)
6. *Why do you think the Mississippi River is called the Big Muddy? What makes it unique?*

Variations on the sediment bottle contents:

- Use dirt collected in the schoolyard or brought from home.
- Add different kinds of litter to the bottle, such as small pieces of plastic bag, small pieces of newspaper, trash bag tie, pieces of candy wrapper, etc.
- *Small group activity:* Fill three bottles with different soil types (sand, silt, and clay) and discuss why certain types of soil settle faster (particulate size).

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Lesson 1.2

UNIT 1

Here's how it works

1. Gather all your materials and then fill the clear 2-liter bottle about ¾ full with water.
2. Spoon the dirt, sticks, leaves, rocks, and litter (if using) into the bottle.
3. Cap the bottle and shake. Notice how the water gets cloudy or muddy.

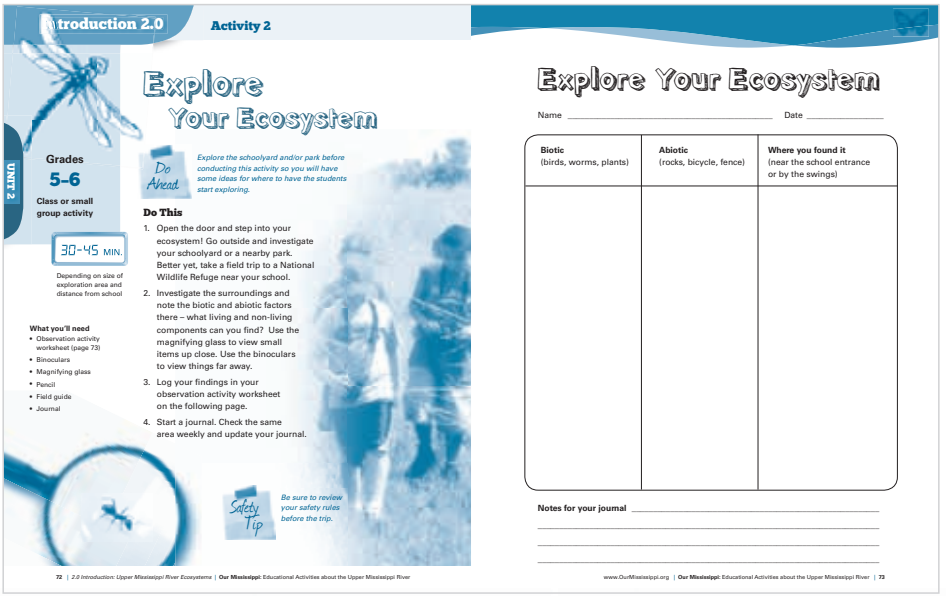
4a. Set aside and do not disturb the bottle.

4b. This is what the bottle should look like after approximately 20–30 minutes.

4c. This is what the bottle should look like after 1 hour.

Our Mississippi: Educational Activities about the Upper Mississippi River | *1.2 Built from the Bottom Up: Sediment Strata* | 29

Some activities include worksheets that can be copied and given to students to complete.



troduction 2.0 Activity 2

UNIT 2

Explore Your Ecosystem

Grades 5–6

Class or small group activity

30–45 MIN.

Depending on size of exploration area and distance from school

What you'll need

- Observation activity worksheet (page 73)
- Binoculars
- Magnifying glass
- Pencil
- Field guide
- Journal

Do Ahead

Explore the schoolyard and/or park before conducting this activity so you will have some ideas for where to have the students start exploring.

Do This

1. Open the door and step into your ecosystem! Go outside and investigate your schoolyard or a nearby park. Better yet, take a field trip to a National Wildlife Refuge near your school.
2. Investigate the surroundings and note the biotic and abiotic factors there – what living and non-living components can you find? Use the magnifying glass to view small items up close. Use the binoculars to view things far away.
3. Log your findings in your observation activity worksheet on the following page.
4. Start a journal. Check the same area weekly and update your journal.

Safety Tip

Be sure to review your safety rules before the trip.

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Explore Your Ecosystem

Name _____ Date _____

Biotic (birds, worms, plants)	Abiotic (rocks, bicycle, fence)	Where you found it (near the school entrance or by the swings)

Notes for your journal _____

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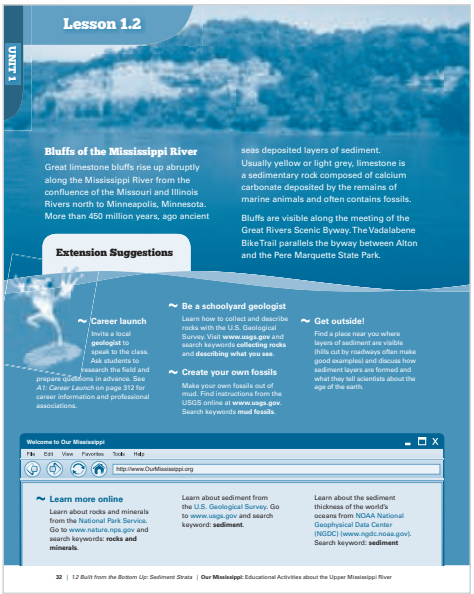
At the end of each lesson you will find ideas on how to extend the lesson. These provide additional depth to each lesson and include suggestions for outdoor and online activities for a variety of grade levels.



Lesson 1.2

UNIT 1

Bluffs of the Mississippi River

Great limestone bluffs rise up abruptly along the Mississippi River from the confluence of the Missouri and Illinois Rivers north to Minneapolis, Minnesota. More than 450 million years, ago ancient seas deposited layers of sediment. Usually yellow or light grey, limestone is a sedimentary rock composed of calcium carbonate deposited by the remains of marine animals and often contains fossils.

Bluffs are visible along the meeting of the Great Rivers Scenic Byway. The Vadalabene Bike Trail parallels the byway between Alton and the Pere Marquette State Park.

Extension Suggestions

Career launch

Invite a local **geologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Be a schoolyard geologist

Learn how to collect and describe rocks with the U.S. Geological Survey. Visit **www.usgs.gov** and search keywords **collecting rocks** and **describing what you see**.

Create your own fossils

Make your own fossils out of mud. Find instructions from the USGS online at **www.usgs.gov**. Search keywords **mud fossils**.

Get outside!

Find a place near you where layers of sediment are visible (hills cut by roadways often make good examples) and discuss how sediment layers are formed and what they tell scientists about the age of the earth.

Learn more online

Learn about rocks and minerals from the National Park Service. Go to www.nature.nps.gov and search keywords: **rocks and minerals**.

Learn about sediment from the U.S. Geological Survey. Go to www.usgs.gov and search keyword: **sediment**.

Learn about the sediment thickness of the world's oceans from NOAA National Geophysical Data Center (NGDC) (www.ngdc.noaa.gov). Search keyword: **sediment**

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Unit 1

Mississippi River Watershed

Unit 1: Mississippi River Watershed **presents a broad overview of the vast drainage basin of the Mississippi River. This unit prepares students for an in-depth examination of the Mississippi River by first placing it in the spatial context of its entire watershed and then introducing them to its geography, history, earth science, and physical science.**

A large wall map of the watershed places the Mississippi River in its larger geographic context. Used as a central teaching tool throughout this guide, the map acts as the main conceptual thread combining the different units, subjects, and activities.

1.0 Introduction to the Mississippi River Watershed: Pre- and Post-Assessments

Students use maps to locate their place in the watershed and learn basic facts that explain its national and global significance.

1.1 Movers and Scrapers: Upper Mississippi Glaciations

Explore how the Mississippi River Watershed was formed by the movement of glaciers millions of years ago.

1.2 Built from the Bottom Up: Sediment Strata

Investigate why the Mississippi River is constantly changing by learning how sediment is transported and by experimenting with different types of sediment.

1.3 Going with the Flow: The Ups and Downs of the Water Cycle

Learn the many ways the Mississippi River is impacted by the water cycle.

1.4 One Trunk with Many Branches: Mapping the Mississippi River Watershed

Discover the entire watershed by exploring the watershed's tributaries, identifying its states, and meeting its communities. Students focus first on the Mississippi River Valley and then widen their exploration to include the whole watershed in two different mapping activities.

UNIT 1

Introduction to the Mississippi River Watershed

Unit 1 goal

Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce.

Lesson goal

Learn why the Mississippi River Watershed is considered one of the world's greatest river systems.

Lesson objectives

- Introduce the Mississippi River Watershed
- Discover some interesting facts about the watershed
- Identify your state in the watershed

Educational standards

- Geography
- Earth Science
- Language Arts

What you'll need

- Double-sided wall map of the Mississippi River Watershed (included in this guide)
- Dry erase markers

How long it will take

- *Activity 1:* 15 min.
- *Activity 2:* 20 min.
- *Discussion:* 60 min.

What's next!

Learn how the Mississippi River Watershed was formed by glaciers

Introduction

The first lesson in Unit 1 provides the framework for an in-depth examination of the physical, chemical, and biological processes that shaped the Mississippi River system. It introduces students to the geography of the Mississippi River Watershed by using large wall maps of the continental United States. Students locate their place in the watershed and learn basic facts that explain its national and global significance.

STANDARDS CORRELATION

This lesson addresses geography standards by using basic map skills to organize information about the Mississippi River Watershed in a spatial context. It includes a pre- and post-assessment quiz for the entire unit.

Incorporating the Extension Suggestions adds an additional dimension to this lesson by including activities that incorporate language arts standards.

Pre- and Post-Assessment

15 MINUTES

What you'll need

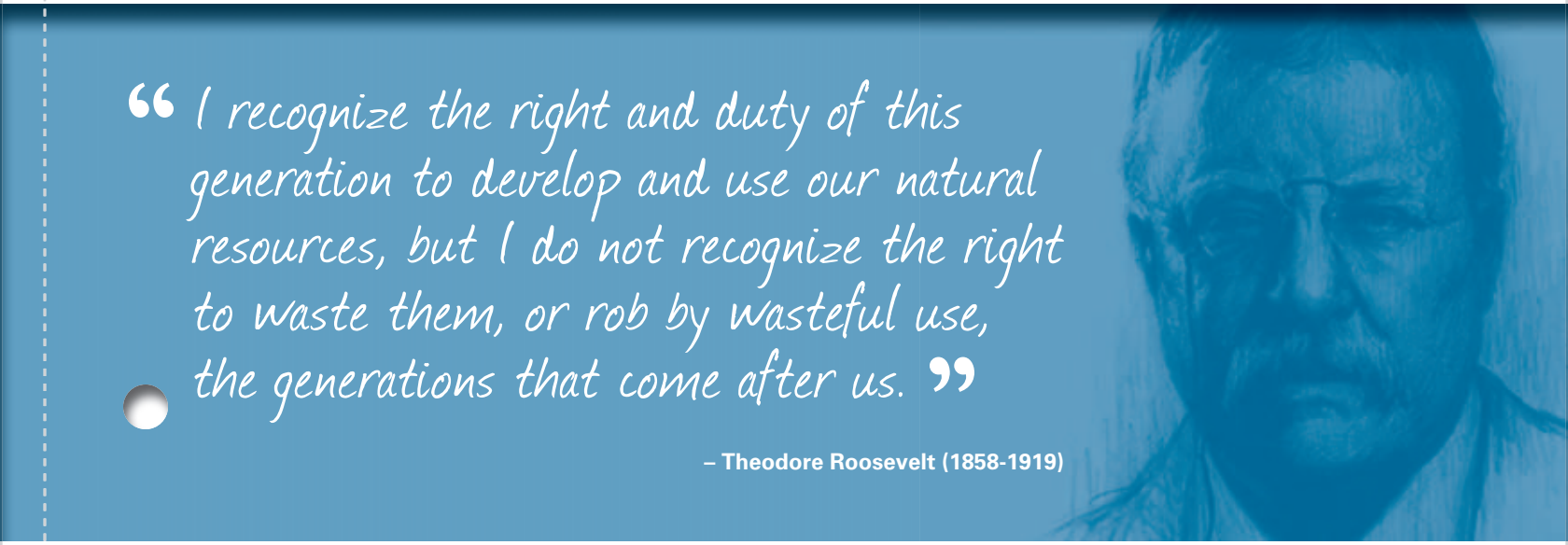
- Activity worksheet (pages 10–11)

Do This

1. Copy and distribute the Pre- and Post-Assessment activity worksheet on the following page.
2. Allow 15 minutes for students to complete the assessment.
3. Save the pre-assessments to compare with a post-assessment given after students complete all the lessons in this unit using this same activity worksheet.
4. Calculate each student's percent increase in knowledge.

Answer Key

1. Minnesota
2. Gulf of Mexico
3. Louisiana
4. Any four of the following: Arkansas, Illinios, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, Wisconsin
5. Answers may vary. Examples: birds, fish, mammals, reptiles, amphibians, insects
6. c
7. b
8. d
9. a
10. b
11. b
12. d
13. Ojibwe word for "great river" or "gathering of waters"
14. North to south



"I recognize the right and duty of this generation to develop and use our natural resources, but I do not recognize the right to waste them, or rob by wasteful use, the generations that come after us."

– Theodore Roosevelt (1858-1919)

Unit 1 Assessment

Name _____ Date _____

1. The Mississippi River starts in which northern state? _____
2. Into which large body of water does the Mississippi River flow? _____

   _____
3. In which state does the Mississippi River end? _____
4. Name four states that border the Mississippi River: _____

   _____

   _____
5. Name three kinds of wildlife found along the river: _____

   _____

   _____

   _____

Multiple choice

Circle the correct answer. There may be more than one correct answer.

6. The Mississippi River flows 2,340 miles from its source. How many kilometers is that?

   a. 1,170
   b. 2,340
   c. 3,765
   d. 4,680

7. The Mississippi River Watershed is:

   a. 5th largest in the world
   b. 3rd largest in the world
   c. 2nd largest in the world
   d. Largest in the world

8. The total area drained by a stream and its tributaries is called the:

   a. Hydrologic cycle
   b. Divide
   c. Tributary area
   d. Watershed or drainage basin

9. A tributary is:

   a. A stream or river that flows into and combines with another river or body of water
   b. Where the river enters into an ocean or other large body of water
   c. The location of the largest city on a river
   d. A place where three rivers meet

10. Headwaters are:

   a. Where a river empties into an ocean or other large body of water
   b. The place where a river or stream begins
   c. The deepest part of a river
   d. The widest part of a river

11. A mouth of a river is:

   a. The place where a river or stream begins
   b. Where a river enters the ocean or other large body of water
   c. The widest part of a river
   d. The area where two rivers meet

12. Which is NOT a tributary of the Mississippi River:

   a. Missouri River
   b. Ohio River
   c. Illinois River
   d. Colorado River

Bonus questions

13. From where does the word "Mississippi" originate?_____

    _____

    _____

14. Does the Mississippi River flow (in general): north to south, south to north, east to west, or west to east? _____

    _____

    _____

Introduction 1.0

Fast Facts

- 3rd-largest watershed (by area)
  - 1,837,000 square miles (4,757,800 square kilometers)
- 4th-longest river system
  - Mississippi River: 2,340 miles (3,765 kilometers)
  - Mississippi-Missouri system: 3,902 miles (6,275 kilometers)
- 10th-most powerful river in the world (average discharge)
  - 16,200 cubic meters per second

Need to Know

- **Headwaters**: The place where a river or stream begins.
- **River Mouth**: Where a river empties into an ocean or other large body of water.
- **Tributary**: A stream or river that flows into and combines with another river. The major tributaries of the Mississippi River include the Missouri, Illinois, Ohio, and Arkansas Rivers.
- **Ojibwe**: Group of Native American people from along the Mississippi River and the Great Lakes. Also spelled Ojibwey and Ojibwa. The name is sometimes anglicized as Chippewa.
- **Watershed**: A region or area of land where water from rain or snow drains downhill into a body of water, such as a river, lake, wetland, estuary, sea, or ocean. Also called a drainage basin.

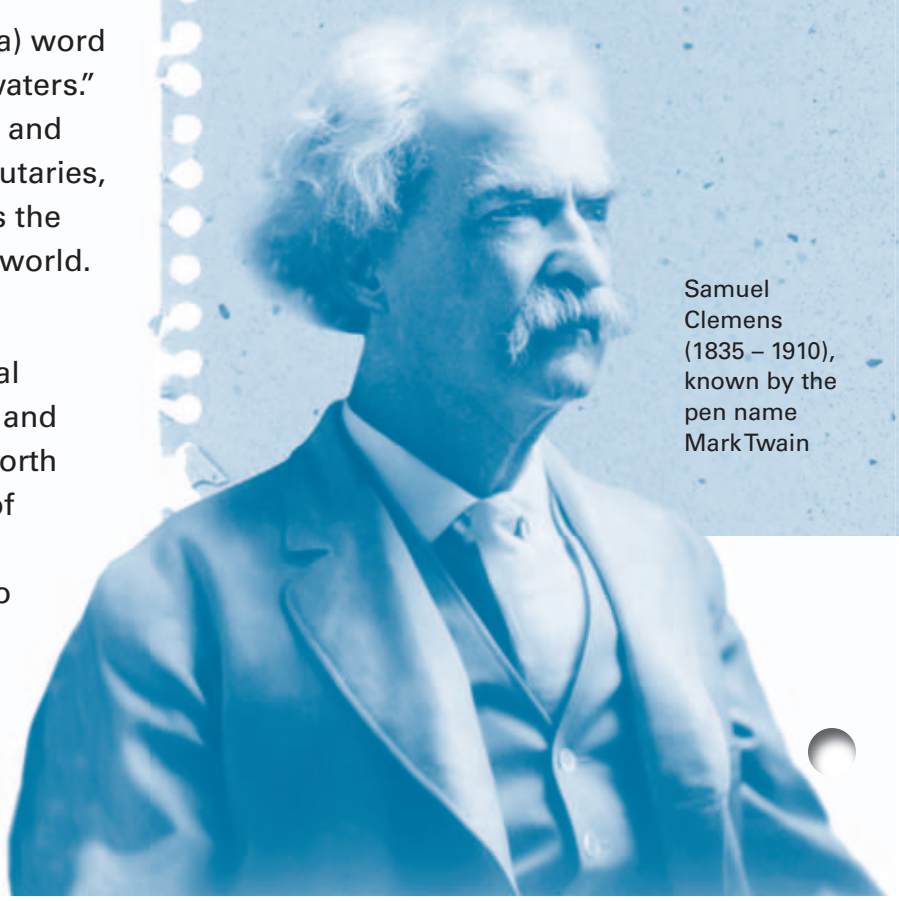
Background

As part of the longest river system in North America, the Mississippi River is one of the world's greatest rivers. It lives up to its many names – Mighty Mississippi, Father of Waters, Old Man River, American Treasure.

Mississippi is an Ojibwe (Chippewa) word for "great river" or "gathering of waters." When combined with the Missouri and Illinois Rivers, two of its major tributaries, the Mississippi River system forms the third-largest drainage basin in the world.

The Mississippi River's watershed covers about 40% of the continental United States and drains 31 states and two Canadian provinces. It flows north to south from Canada to the Gulf of Mexico and stretches east to west from the Appalachian Mountains to the Rocky Mountains. Only the watersheds of the Amazon and Congo Rivers are larger.

Sources: Environmental Protection Agency (EPA); Mississippi National River and Recreation Area; Upper Mississippi River Conservation Committee; U.S. Army Corps of Engineers, Mississippi Valley Division; U.S. Fish & Wildlife Service, Midwest Region; U.S. Geological Survey (USGS) Biological Resources Division.



Samuel Clemens (1835 – 1910), known by the pen name Mark Twain

Discussion (60 minutes)

Introduce students to the Mississippi River Watershed using the double-sided wall map. Start with the full-color satellite image side to introduce the watershed in relation to the topography of the landscape. Point out some of the geographic features that define the boundaries of the watershed, such as the Rocky and Appalachian Mountains. Ask students to help locate the following:

- Mississippi River
- Mouth of the Mississippi River
- Headwaters of the Mississippi River
- Major tributaries (Missouri and Illinois Rivers)
- Their state and city or town

Turn the map over to the black and white image of the watershed with unlabeled lines showing the Mississippi River, its main tributaries, and state outlines. Ask students to identify and count the number of states bordering the Mississippi River. On the map, label the Mississippi River and its major tributaries as well as the states bordering the river.

This map will be used in various activities throughout this guide. Laminate the wall map so it can be used with dry erase markers for activities. See the answer key on page 57.

Use the Word Search activity on page 14 to introduce students to concepts and vocabulary for this unit.

River View

"The Mississippi is well worth reading about. It is not a commonplace river, but on the contrary is in all ways remarkable... It seems safe to say that it is also the crookedest river in the world, since in one part of its journey it uses up one thousand three hundred miles to cover the same ground that the crow would fly over in six hundred and seventy-five. It discharges three times as much water as the St. Lawrence, twenty-five times as much as the Rhine, and three hundred and thirty-eight times as much as the Thames.

No other river has so vast a drainage-basin: it draws its water supply ... from Delaware, on the Atlantic seaboard, and from all the country between that and Idaho on the Pacific slope – a spread of forty-five degrees of longitude. The Mississippi receives and carries to the Gulf water from fifty-four subordinate rivers that are navigable by steamboats, and from some hundreds that are navigable by flats and keels. The area of its drainage-basin is as great as the combined areas of England, Wales, Scotland, Ireland, France, Spain, Portugal, Germany, Austria, Italy, and Turkey; and almost all this wide region is fertile; the Mississippi valley, proper, is exceptionally so."

– Samuel Clemens (Mark Twain), 1863

Word Search

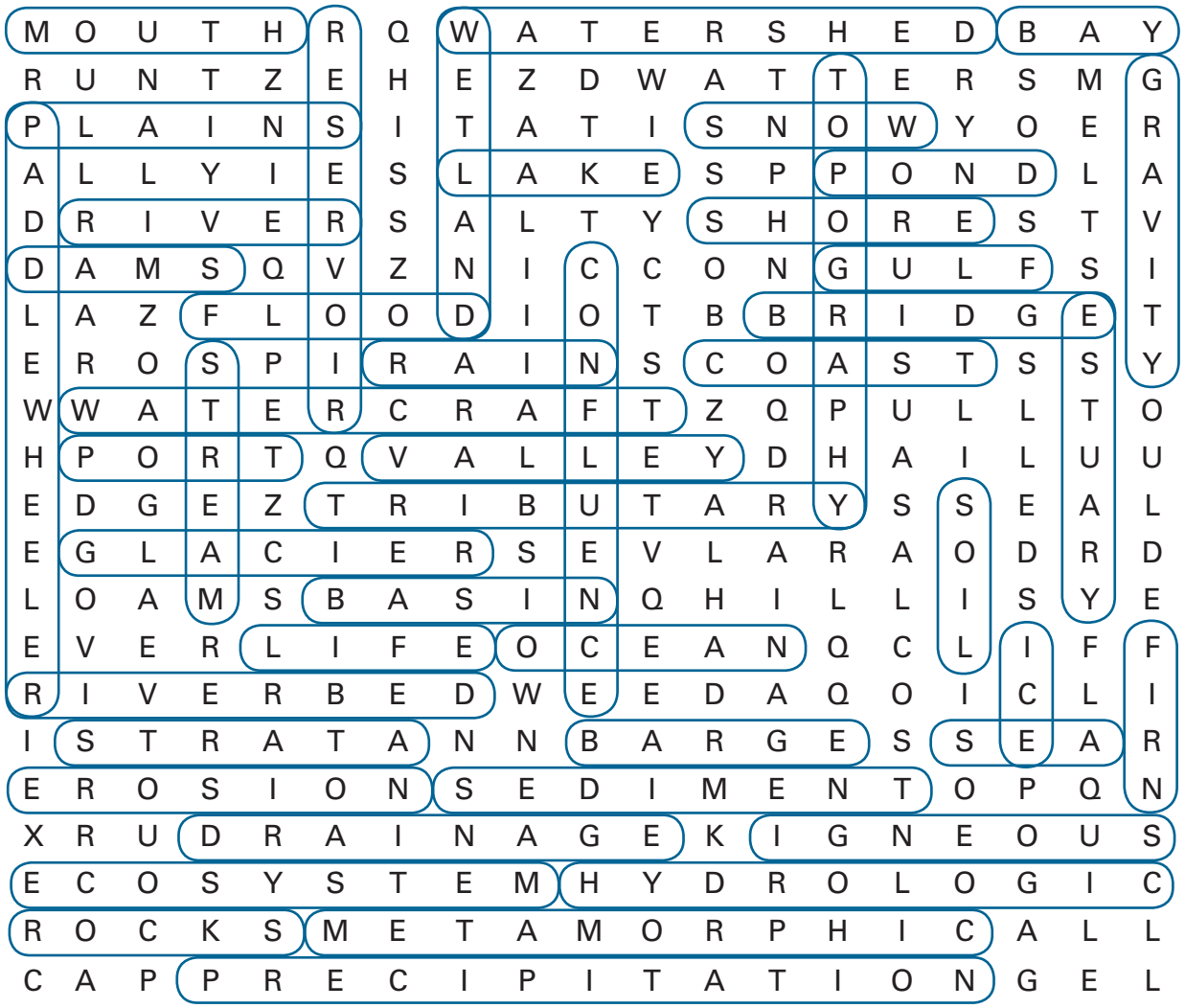
Name _____ Date _____

M O U T H R Q W A T E R S H E D B A Y
R U N T Z E H E Z D W A T T E R S M G
P L A I N S I T A T I S N O W Y O E R
A L L Y I E S L A K E S P P O N D L A
D R I V E R S A L T Y S H O R E S T V
D A M S Q V Z N I C C O N G U L F S I
L A Z F L O O D I O T B B R I D G E T
E R O S P I R A I N S C O A S T S S Y
W W A T E R C R A F T Z Q P U L L T O
H P O R T Q V A L L E Y D H A I L U U
E D G E Z T R I B U T A R Y S S E A L
E G L A C I E R S E V L A R A O D R D
L O A M S B A S I N Q H I L L I S Y E
E V E R L I F E O C E A N Q C L I F F
R I V E R B E D W E E D A Q O I C L I
I S T R A T A N N B A R G E S S E A R
E R O S I O N S E D I M E N T O P Q N
X R U D R A I N A G E K I G N E O U S
E C O S Y S T E M H Y D R O L O G I C
R O C K S M E T A M O R P H I C A L L
C A P P R E C I P I T A T I O N G E L

Words to find:

Barge
Basin
Bay
Bridge
Coast
Confluence
Dams
Drainage
Ecosystem
Erosion
Estuary
Firn
Flood
Glacier
Gravity
Gulf
Hydrologic
Ice
Igneous
Lake
Life
Melt
Metamorphic
Mouth
Ocean
Paddlewheeler
Plains
Precipitation
Pond
Port
Rain
Reservoir
River
Riverbed
Rocks
Salt
Sea
Sediment
Shore
Snow
Soil
Strata
Stream
Topography
Tributary
Valley
Watercraft
Watershed
Wetland

Word Search



Words to find:

Barge	Estuary	Life	Rain	Soil
Basin	Firn	Melt	Reservoir	Strata
Bay	Flood	Metamorphic	River	Stream
Bridge	Glacier	Mouth	Riverbed	Topography
Coast	Gravity	Ocean	Rocks	Tributary
Confluence	Gulf	Paddlewheeler	Salt	Valley
Dams	Hydrologic	Plains	Sea	Watercraft
Drainage	Ice	Precipitation	Sediment	Watershed
Ecosystem	Igneous	Pond	Shore	Wetland
Erosion	Lake	Port	Snow	

Introduction 1.0

Can you find where they stashed the cache?

Geocaching (pronounced geo-cashing) is a high-tech treasure hunt using a Global Positioning System (GPS) device to hide and seek a "cache", which is a hiding place used to conceal a container filled with a log book, and maybe a prize. The goal is to locate hidden containers called geocaches.

A geocacher places a geocache, usually a small waterproof container containing a logbook, and pinpoints its location using GPS technology. Anyone with a GPS device can locate the geocache and share their discovery online. To learn more, visit www.geocaching.com.

Extension Suggestions

Career launch

Invite a local **surveyor, cartographer (mapmaker)**, or **GIS (Geographic Information Systems) analyst** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

River systems of the world

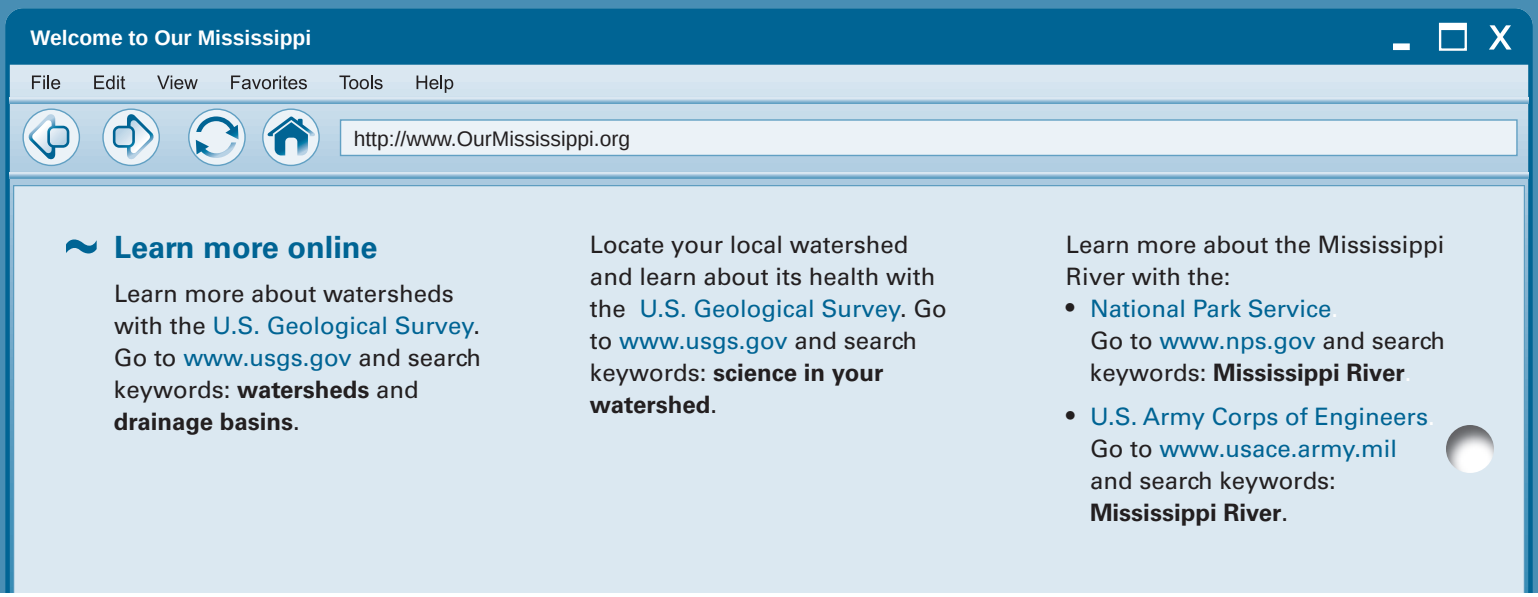
Compare the Mississippi River to other river systems around the world, such as the Yangtze River in China, Amazon River in South America, and the Nile River in Africa.

What's in a name?

Ask students to investigate how the Mississippi River got its name and write an essay about the possible origins of its name.

Mississippi Mystery Sleuths

Ask the students what river legends they have heard. Have the students work in teams to research the various legends and myths associated with the Mississippi and record their findings in a journal. Some suggestions: Piasa Bird, St. Anthony Falls legend, Sac and Fox story about Rock Island.



Learn more online

Learn more about watersheds with the U.S. Geological Survey. Go to www.usgs.gov and search keywords: **watersheds** and **drainage basins**.

Locate your local watershed and learn about its health with the U.S. Geological Survey. Go to www.usgs.gov and search keywords: **science in your watershed**.

Learn more about the Mississippi River with the:

- National Park Service. Go to www.nps.gov and search keywords: **Mississippi River**
- U.S. Army Corps of Engineers. Go to www.usace.army.mil and search keywords: **Mississippi River**.

Movers and Scrapers:

Upper Mississippi Glaciations

Introduction

In *Lesson 1.1 Movers and Scrapers: Upper Mississippi Glaciations*, students learn how the Mississippi River Watershed was formed by the movement of glaciers millions of years ago. They trace the pre- and late-Wisconsin glacial limits, and test how glacial ice and the force of gravity can carve river valleys.

Background

More than 12,000 years ago during the last Ice Age, glaciers covered parts of North America. They advanced and retreated in cycles, called glaciations, which were named after the regions they covered. During that time, the sea level was about 400 feet lower than it is today.

At that time, glaciers covered almost one-third of the land. During the Illinoian Glacial Stage, the Mississippi River was blocked and diverted to its current location near Rock Island. After the glacier melted, the Illinois River flowed into the abandoned channel left by the Mississippi River.

The Wisconsin Glacial Episode was the last major glacial advance at the end of the last Ice Age. It was a major force in shaping the Mississippi River. As this glacier shrank toward the north, it carved out parts of the Mississippi headwaters and the riverbed.

Great rivers of ice, glaciers sculpted mountains and carved out valleys. As glaciers grow and move, they pick up and carry gravel and boulders. As the glaciers melt, rivers flood and erode, and more rocks and soil are carried away. Glaciers continue to flow and shape the landscape today in many places throughout the world.

STANDARDS CORRELATION

This lesson addresses earth science and physical science standards, specifically, concentrating on the history of the earth and the physical processes that shaped it.

Unit 1 goal

Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce

Lesson goal

Learn how the Mississippi River Watershed was formed by the movement of glaciers

Lesson objectives

- Define geographic terms related to the formation of the Mississippi River
- Learn how the Mississippi River was formed
- Demonstrate glacial erosion

Educational standards

- Physical Science
- Earth Science
- Social Studies - Geography
- Language Arts

What you'll need

- Laminated wall map
- Dry erase markers
- Large clear plastic container
- Small clear plastic container
- Sand (1-2 lbs)
- Gravel and rocks
- Wood block (3 cm)
- Ruler
- Water
- Freezer
- Modeling clay (1-2 lbs)
- Hand towel
- Rolling pin or large dowel

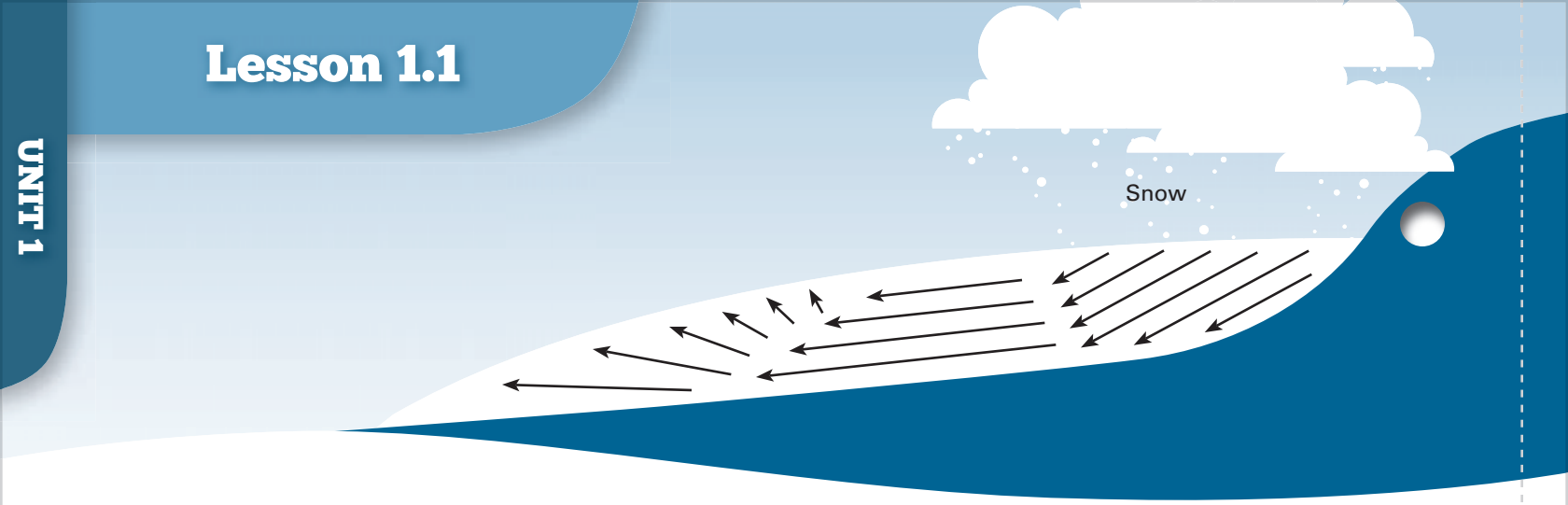
How long it will take

- Discussion: 45–60 min.
- Activity: 45–60 min.

What's next!

Learn about the rock cycle and sediment strata

Lesson 1.1



A glacier begins when winter snowfall exceeds summer melting. Newly fallen snow is about 80 percent air. After some melting, evaporation, and refreezing, the light, fluffy snow turns into small, round granules called firn. In about one year, it will reduce to 50 percent air.

Grinnell Glacier in Glacier National Park, Montana, has receded almost out of sight. Compare the two photographs, one taken in 1911 and the other in 2000. Scientists estimate that most of the 30 glaciers in the park will be gone by mid-21st century.

When additional snow, along with dust and other air-deposited substances, layer on top, the firn is compressed and changes into solid ice. This glacial ice is denser—composed of less than 20 percent air.

Years of compression gradually make the ice very dense. This compression forces out tiny air pockets between crystals. When glacier ice becomes extremely dense, the ice absorbs all other colors in the spectrum, making it look blue. When glacier ice is white, that usually means that there are many tiny air bubbles still in the ice.

As the ice sheet thickens, the force of gravity causes it to move. Ice moves by changing shape or by slipping and shifting along cracks in the ice sheets. Like water, ice seeks the lowest levels and flows downhill.

The ground beneath the glacier weakens due to the downward pressure of the ice and constant water saturation. This ground breaks off and moves with the flow of ice, lifting through periods of re-freezing and melting.

Sources: Environmental Protection Agency (EPA); Illinois State College of Education; Illinois State Museum; National Park Service; National Snow and Ice Data Center; Nature Conservancy; PBS NOVA; U.S. Geological Survey.

Discussion (45–60 minutes)

Use the wall map to show students areas of the United States that were covered by glaciers during the last Ice Age. At the end of the discussion, ask students to draw lines on the map to indicate pre-Wisconsin and late-Wisconsin glacial limits in different colors and label them.

Fast Facts

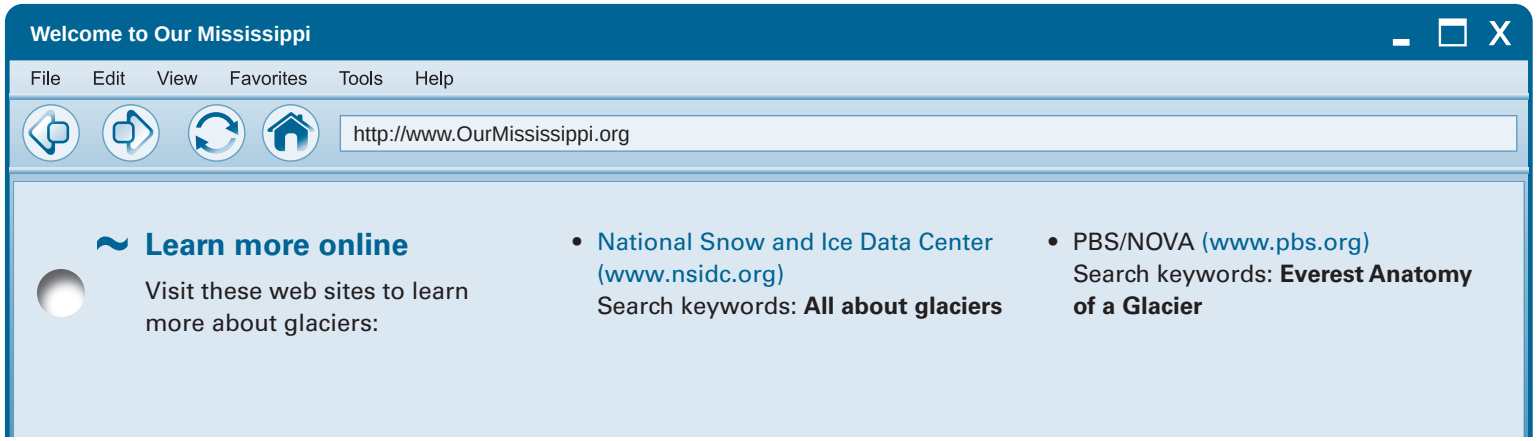
- Glaciers store about 70% of the world's freshwater.
- If all land ice melted the seas would rise about 230 feet (about 70 meters).
- During the last Ice Age the sea level was about 400 feet lower than it is today.
- North America's longest glacier is the Bering Glacier in Alaska, 127 miles (204 kilometers) long.
- Glacial ice can be very old—in some Canadian Arctic icecaps, ice at the base is over 100,000 years old.
- Antarctic ice shelves may calve (break off) icebergs that are nearly 50 miles (80 kilometers) long.

Show students images of Grinnell Glacier and explain how glaciers advance and retreat.

- A **glacier** is a huge collection of ice that moves slowly across the land. Glaciers form when more snow accumulates than melts. Glacier comes from the Latin word *glacies* meaning ice.

  Glaciers move, or flow, downhill due to **gravity**. Gravity is a force. Every time you jump, you experience gravity. It pulls you back down to the ground. Without gravity, you'd float off into the atmosphere.

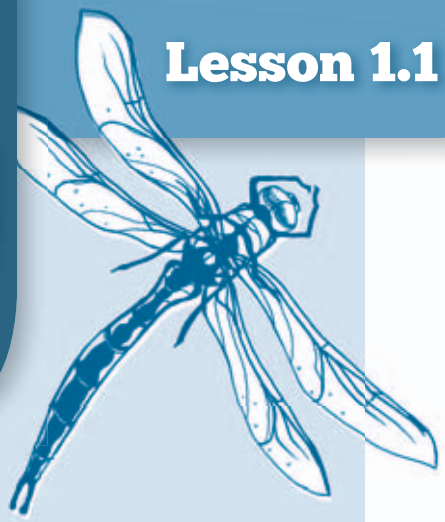
- **Erosion** occurs when rock or soil is loosened and carried off by glaciers, rivers, winds, or waves.
- **Firn** is a snowflake that has lost half of its air and did not completely melt during its first summer. Firn comes from German, meaning "of last year."
- A **current** is a "path" of water or ice that flows in a certain direction.



Learn more online

Visit these web sites to learn more about glaciers:

- National Snow and Ice Data Center (www.nsidc.org)
  Search keywords: **All about glaciers**
- PBS/NOVA (www.pbs.org)
  Search keywords: **Everest Anatomy of a Glacier**



Movers and Scrapers

Grades

5–6

Class or small group activity

1 HOUR

What you'll need

- Large clear plastic container (16" x 21" x 5")
- Small clear plastic container (5" x 8" x 4")
- Sand
- Gravel and rocks
- Ruler
- Water
- Freezer
- Modeling clay (1-2 lbs.)
- Hand towel
- Sand (1-2 lbs)
- Rolling pin or large dowel
- Student activity worksheet (pages 22–23)

Demonstrate the power of glacial erosion on two different types of surfaces, clay and sand.

Do This

1. The day before the activity, freeze the water, gravel, and rock mixture to make a glacier.
   - Put the gravel and rock mixture (use rocks of various sizes) in the bottom of the small plastic container.
   - Add just enough water to cover most of the gravel and rock mixture (several rock points should be exposed).
   - Freeze the container until the water is solid.
   - Remove the ice block from the container.
2. Demonstrate how a glacier erodes using two different surfaces (clay and sand). See step-by-step instructions on the opposite page.
3. Observe and record what happens:
   - Describe the effects of moving the ice block over clay and sand. How were they different?
   - Did any material from any surface become mixed with material from the ice block? Did the ice block deposit material on any surface?
   - What glacial land features are represented by the features of your clay model? Your sand model?
   - Based on your observations, predict the result of glacial erosion on rock.

Here's how it works

1

Using a rolling pin or large dowel, flatten the modeling clay into a rectangle approximately 20 x 10 x 1 cm.

2

Using the towel to safely grip the ice, place the block gravel-and-rock side down at one end of the clay.

3

Press down on the ice block and move it along the length of the flat clay surface. Sketch the pattern made in the clay by the ice block.

4

Next, press damp sand into the bottom of a shallow rectangle box. As in Step 2, move the ice block gravel-and-rock side down along the surface of the sand while pressing down lightly.

Teacher Tip

Do ahead: Freeze the water and gravel mixture the night before.

If you decide to let students work in groups to demonstrate glacial erosion, you will need one set of materials for each group.

Movers and Scrapers

Name _____ Date _____

Define

Firn _____

_____

Glacier _____

_____

Gravity _____

_____

Current _____

_____

Erosion _____

_____

Demonstrate the power of glacial erosion

The day before the activity, put the gravel and rock mixture (various sizes) in the bottom of the small plastic container. Add just enough water to cover most of the gravel and rock mixture (several rock points should be exposed). Freeze the container until the water is solid.

1. Using a rolling pin or large dowel, flatten the modeling clay into a rectangle approximately 20 x10 x 1 cm.
2. Using the towel to safely grip the ice, place the block gravel-and-rock side down at one end of the clay.
3. Press down on the ice block and move it along the length of the flat clay surface. Sketch the pattern made in the clay by the ice block.
4. Next, press damp sand into the bottom of a shallow rectangle box. As in Step 2, move the ice block gravel-and-rock side down along the surface of the sand while pressing down lightly.

Observe and record

1. Describe the effects of moving the ice block over clay and sand.

2. Did any material from any surface become mixed with material from the ice block? Did the ice block deposit material on any surface? _____

3. What glacial land features are represented by the features of your clay model? Your sand model? _____

4. Based on your observations, predict the result of glacial erosion on rock. _____

Lesson 1.1

Habitats and Climate Change

Habitat loss is one of the biggest threats to plant and animal species around the world. Global climate change is making that problem worse by altering the dynamic interactions within ecosystems. For example, climate change can decrease the flow or increase the temperature of lakes, rivers, and wetlands. Less snowfall in the mountains can result in decreased flow and increased temperature of streams, while drought and heat increase evaporation rates from the small ponds and wetlands. These changes in conditions often happen faster than plant and animal species can adapt.

Extension Suggestions

Career launch

Invite a local **geologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

What is Geologic Time?

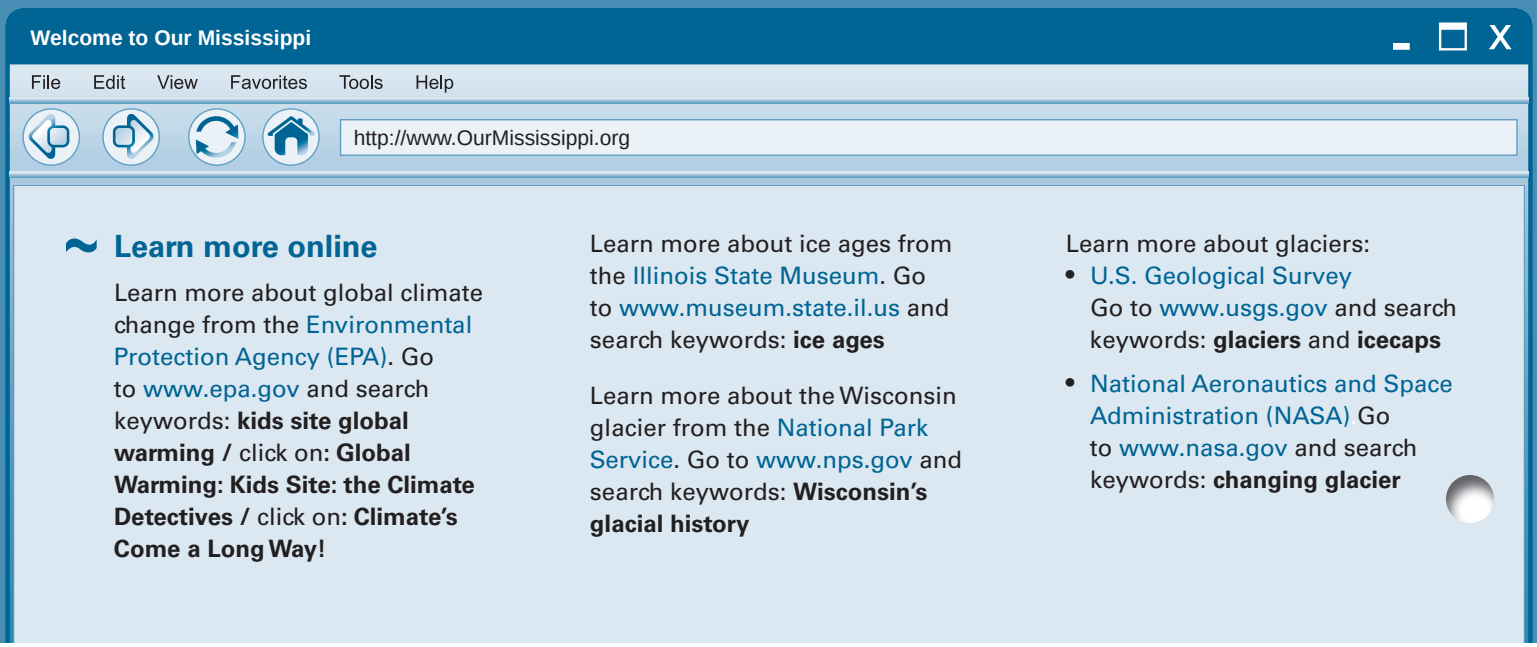
Introduce the concept of Geologic Time and discuss how scientists measure the past.

Design your own experiment

Ask students to design their own experiments to investigate how glaciers advance and retreat.

Global climate change

Discuss the melting of glaciers in the context of global warming. Have students research the implications of a one-, two-, and three-meter rise in sea levels.



Learn more online

Learn more about global climate change from the Environmental Protection Agency (EPA). Go to www.epa.gov and search keywords: **kids site global warming** / click on: **Global Warming: Kids Site: the Climate Detectives** / click on: **Climate's Come a Long Way!**

Learn more about ice ages from the Illinois State Museum. Go to www.museum.state.il.us and search keywords: **ice ages**

Learn more about the Wisconsin glacier from the National Park Service. Go to www.nps.gov and search keywords: **Wisconsin's glacial history**

Learn more about glaciers:

- U.S. Geological Survey Go to www.usgs.gov and search keywords: **glaciers** and **icecaps**
- National Aeronautics and Space Administration (NASA) Go to www.nasa.gov and search keywords: **changing glacier**

Built from the Bottom Up:

Sediment Strata

Introduction

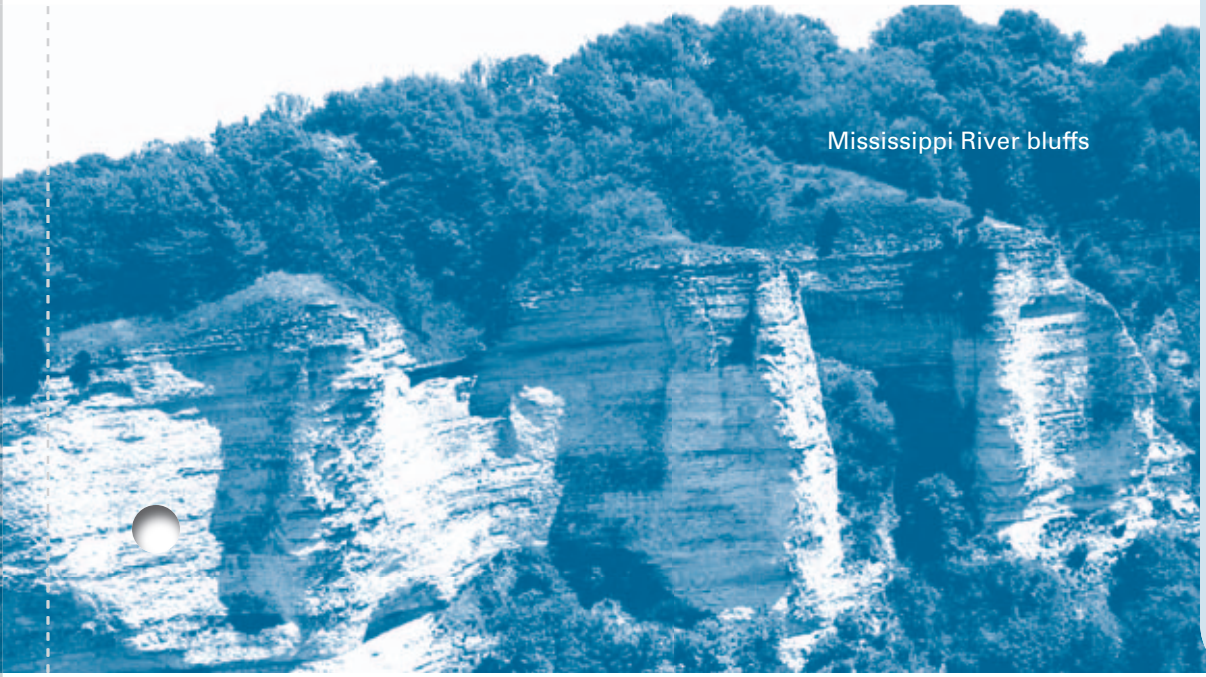
In *Lesson 1.2 Built from the Bottom Up: Sediment Strata*, students investigate why the Mississippi River is constantly changing and learn how sediment is transported. After learning about the rock cycle, stream flow, sediment, and strata, they experiment with different types of sediment to see how long it takes for them to settle.

Background

Rivers make their own beds

Drawn by the force of gravity, running water is the principal landscape modifier at work on the earth's surface.

A river carves its bed out of the surrounding landscape. How deep or how wide it makes its bed depends on the types of material in the land and the amount of water flowing through it.



Mississippi River bluffs

Unit 1 goal

Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce

Lesson goal

Learn why the Mississippi River is constantly changing

Lesson objectives

- Define geographic terms related to the formation of the Mississippi River
- Explain and discuss the rock cycle
- Identify the 3 types of rock
- Demonstrate how sediment is formed

Educational standards

- Earth Science
- Social Studies - Geography
- Language Arts

What you'll need

- Clear 2-liter bottle (big enough to insert various sized rocks) with cap
- Spoon
- Dirt, leaves, small sticks, and rocks (various sizes)
- Funnel (roll up paper to make a funnel)
- Water
- Small pieces of litter (variation)

How long it will take

- Discussion: 30–45 min.
- Activity 1: 60 min.
- Activity 2: 30 min.

What's next!

Learn how the water cycle plays a role in the day-to-day life of the river

Lesson 1.2

STANDARDS CORRELATION

This lesson addresses earth science and physical science standards, specifically, concentrating on the history of the earth and the physical processes that shaped it.

The land along the Mississippi River is mainly made up of sedimentary rock layers (strata). These strata are exposed in many places along the Mississippi River, especially along its high bluffs. Sediment constantly breaks away from the land and is deposited downstream by the river. Over time, a distinct drainage pattern develops, which often looks like branches on a tree.

Sediment transport
Prior to 1900, the Mississippi River transported an estimated 400 million metric tons of sediment per year from the interior of the United States to coastal Louisiana and the Gulf of Mexico. However, during the last two decades, the Mississippi River transported an average of just 145 million metric tons per year.

This reduction of sediment was the result of engineering modification of the Mississippi, Missouri, and Ohio Rivers and their tributaries by dams, meander cutoffs, river-training structures, bank revetments, and soil erosion control programs in the areas drained by them.

Sources: Environmental Protection Agency (EPA); U.S. Geological Survey (USGS).

Discussion (30–45 minutes)

Briefly explain the rock cycle and how rivers make their own beds. Use the following questions to spark a discussion.

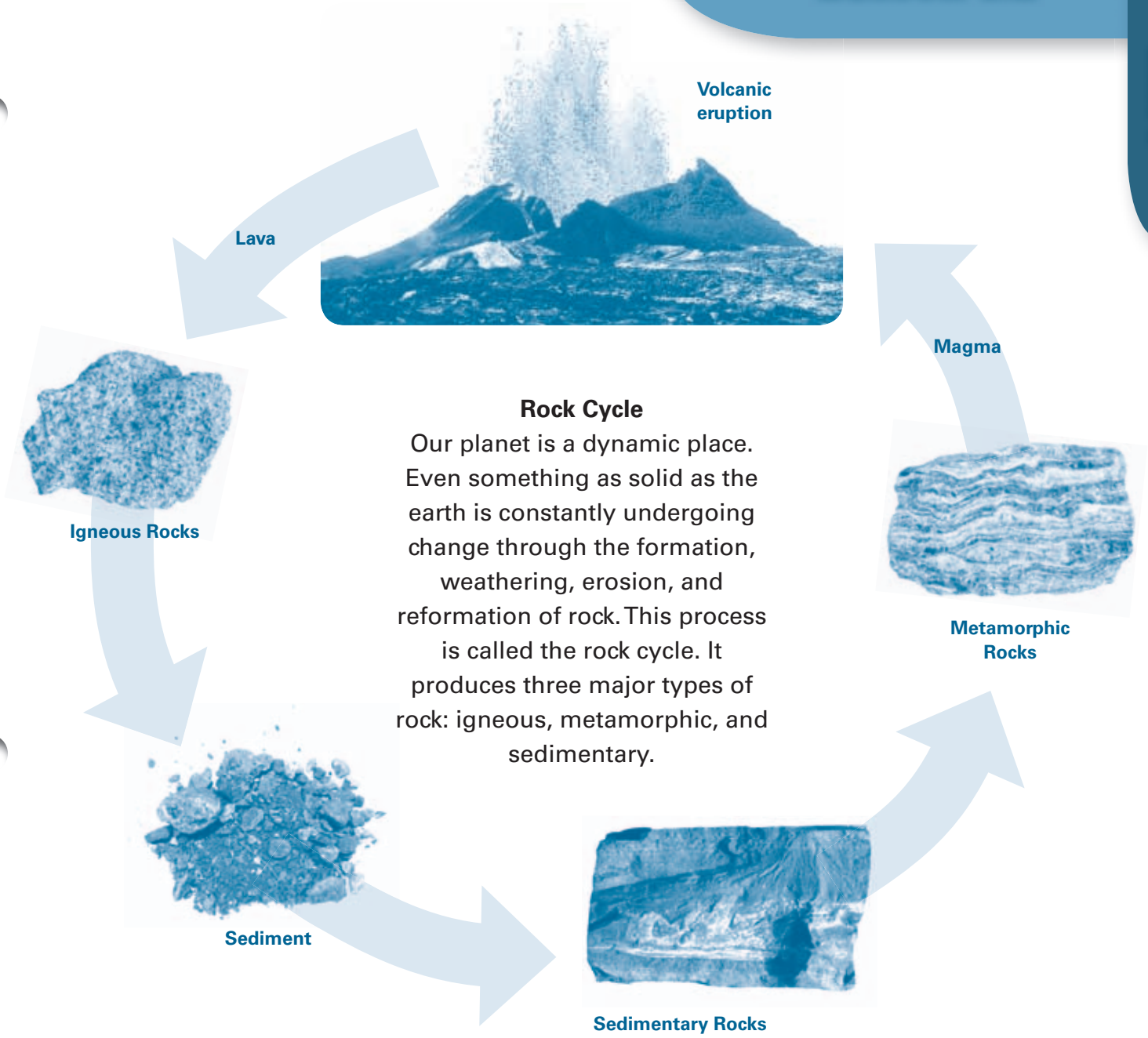
What is sediment?
Sediment is the matter that settles to the bottom of a liquid, usually sand, rock, or gravel. Sediment is a collection of solid material that gets dragged along with the flow of the river water, and then settles to the riverbed when the flow slows down.

What are strata?
Strata are distinct layers of sediment compressed over time. For example, sand eventually becomes sandstone because of pressure and cementing agents. Geologists read sedimentary strata the way biologists read tree rings. The thicknesses, composition, angles, fossils, and other characteristics tell us about the Earth's past.

What is stream flow?
Stream flow refers to the amount of water that moves through streams, rivers, and other water channels.

How is sediment transported?
Review the glacial erosion activity from Lesson 1.1 on pages 20–23 with students and explain sediment transport, then ask students,

What did you observe? Did we see erosion happening in the glacial erosion activity?



Rock Cycle

Our planet is a dynamic place. Even something as solid as the earth is constantly undergoing change through the formation, weathering, erosion, and reformation of rock. This process is called the rock cycle. It produces three major types of rock: igneous, metamorphic, and sedimentary.

Types of Rocks

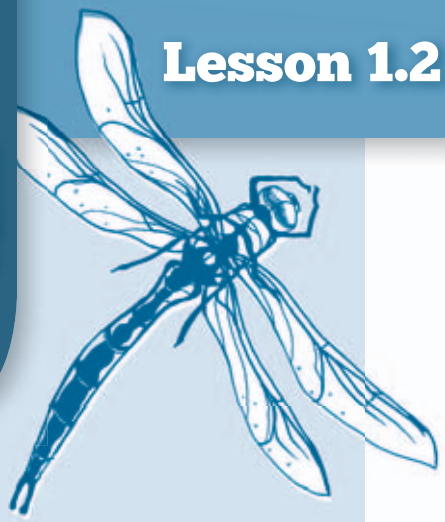
IGNEOUS ROCKS form when magma (molten rock deep within the earth) cools and hardens. When magma erupts onto the surface it is called lava. The chemical composition of the magma and its cooling rate determine the final igneous rock type. Basalt and obsidian are two common types of igneous rock.

SEDIMENTARY ROCKS are formed from pieces of pre-existing rocks worn away from weathering and erosion of once-living organisms. Called sediment, these small pieces may be transported and deposited elsewhere by rivers.

As the sediment deposits accumulate on the Earth's surface, they form distinctive layers. As these layers pile up and the pressure increases, they become lithified (cemented or otherwise consolidated into rock), forming sedimentary rock.

METAMORPHIC ROCKS are rocks that have been substantially changed from their original igneous, sedimentary, or earlier metamorphic form.

Metamorphic rocks form when rocks deep inside the earth are subjected to extreme heat and pressure, recrystallizing them into metamorphic rock. If the temperature and pressure become high enough, the metamorphic rock melts and becomes magma again, completing the rock cycle.



Create a Sediment Bottle

Grades

5–6

Individual or group activity

1 HOUR

What you'll need

- Clear 2-liter bottle (big enough to insert various sized rocks) with a cap
- Funnel (roll up paper to make a funnel)
- Dirt, leaves, small sticks and rocks (various sizes)
- Water
- Small pieces of litter (variation)
- Activity worksheets (pages 30-31)

Teacher Tip

Do ahead: Gathering materials ahead of time and sorting them by size will shorten the lesson time, but isn't as much fun.

Do This

Have students create a sediment bottle using leaves, small sticks, rocks (various sizes), dirt, and water (you can also add small pieces of litter). Let the bottle settle for approximately 30 minutes and see what settles (time depends on soil type and materials used). Use the Upper Grade Level Activity worksheet on page 31 as an extension for this lesson.

Ask students the following questions:

1. *Which items float to the top?*
2. *Which items sink to the bottom?*
3. *What caused the items to settle?*
4. *What happens to the sticks?*
   (This question could lead to a discussion on how fossils are formed.)
5. *Think about the river. What do you think happens if lots of these items fall into the river?*
   (You could also discuss how water velocity, and the size and weight of items contribute to the sediment layer at the point of entry as well as determining which items continue to flow downstream.)
6. *Why do you think the Mississippi River is called the Big Muddy? What makes it unique?*

Variations on the sediment bottle contents:

- Use dirt collected in the schoolyard or brought from home.
- Add different kinds of litter to the bottle, such as small pieces of plastic bag, small pieces of newspaper, trash bag tie, pieces of candy wrapper, etc.
- *Small group activity:* Fill three bottles with different soil types (sand, silt, and clay) and discuss why certain types of soil settle faster (particulate size).

Here's how it works

1

Gather all your materials and then fill the clear 2-liter bottle about ¾ full with water.

2

Spoon the dirt, sticks, leaves, rocks, and litter (if using) into the bottle.

3

Cap the bottle and shake. Notice how the water gets cloudy or muddy.

4a

Set aside and do not disturb the bottle.

4b

This is what the bottle should look like after approximately 20–30 minutes.

4c

This is what the bottle should look like after 1 hour.

Create a Sediment Bottle

Name _____ Date _____

Create a sediment bottle using leaves, sticks, rocks, dirt, and water

Materials needed: *clear 2-liter bottle with cap*, *spoon*, *dirt*, *leaves*, *small sticks*, *rocks of various sizes*, and *water*.

1. Fill a clear 2-liter bottle about ¾ full with water.
2. Spoon the dirt, sticks, leaves, and rocks, into the bottle.
3. Cap the bottle and shake. Notice how the water gets cloudy.
4. Set aside and do not disturb the bottle.
5. Observe contents after 1 min., 15 min., 30 min., 1 hour, 1 day.

Record Observations

1. Which items float to the top?

_____

2. Which items sink to the bottom?

_____

3. What caused the items to settle?

_____

4. What happened to the sticks?

_____

5. What do you think happens if lots of these items fall into the river?

_____

_____

6. Why do you think the Mississippi River is called the Big Muddy? What makes it unique?

_____

_____

_____

Built from the Bottom Up

Sediment Strata

Name _____ Date _____

Analyze and Hypothesize Extension

Review the observations you recorded for the *Movers & Scrapers: Glacial Erosion* activity. Now that you know more about sediment, develop hypotheses (proposed explanations for observable phenomena) based on the following questions:

1. *What did you observe about the sediment in the glacial erosion activity?*
2. *How many types of erosion are there? What type caused the rock erosion that happened in the glacial erosion activity?*

What did you observe? Did you see erosion happening?

Lesson 1.2

Bluffs of the Mississippi River

Great limestone bluffs rise up abruptly along the Mississippi River from the confluence of the Missouri and Illinois Rivers north to Minneapolis, Minnesota. More than 450 million years, ago ancient seas deposited layers of sediment. Usually yellow or light grey, limestone is a sedimentary rock composed of calcium carbonate deposited by the remains of marine animals and often contains fossils.

Bluffs are visible along the meeting of the Great Rivers Scenic Byway. The Vadalabene Bike Trail parallels the byway between Alton, Illinois and the Pere Marquette State Park.

Extension Suggestions

Career launch

Invite a local **geologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Be a schoolyard geologist

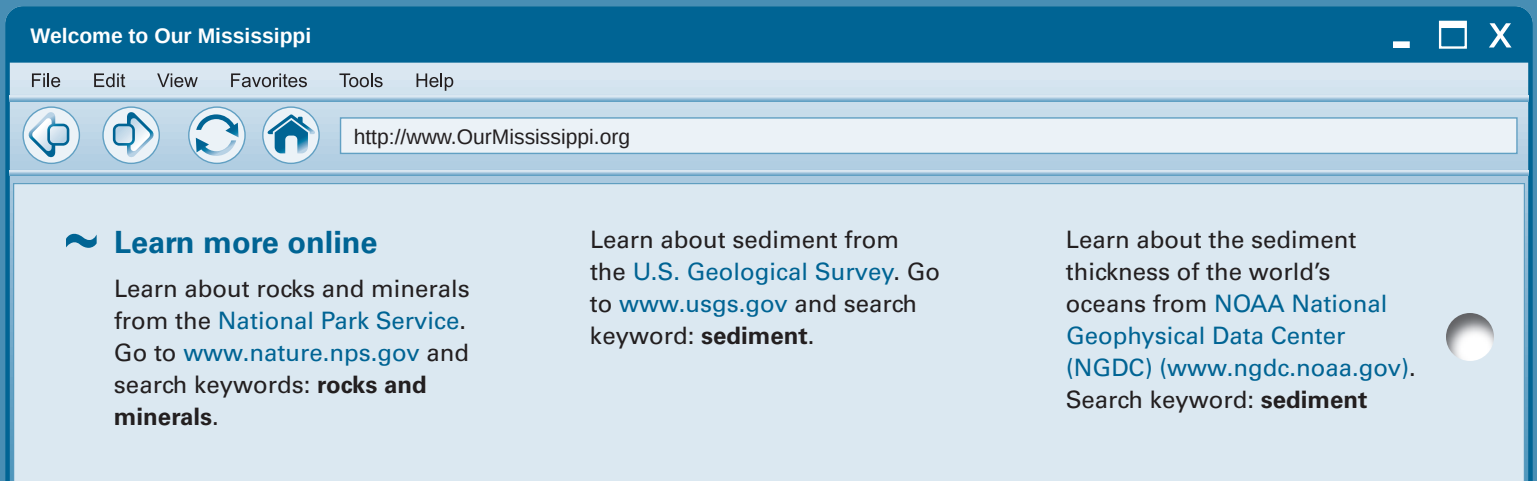
Learn how to collect and describe rocks with the U.S. Geological Survey. Visit **www.usgs.gov** and search keywords **collecting rocks** and **describing what you see**.

Create your own fossils

Make your own fossils out of mud. Find instructions from the USGS online at **www.usgs.gov**. Search keywords **mud fossils**.

Get outside!

Find a place near you where layers of sediment are visible (hills cut by roadways often make good examples) and discuss how sediment layers are formed and what they tell scientists about the age of the earth.



Learn more online

Learn about rocks and minerals from the National Park Service. Go to www.nature.nps.gov and search keywords: **rocks and minerals**.

Learn about sediment from the U.S. Geological Survey. Go to www.usgs.gov and search keyword: **sediment**.

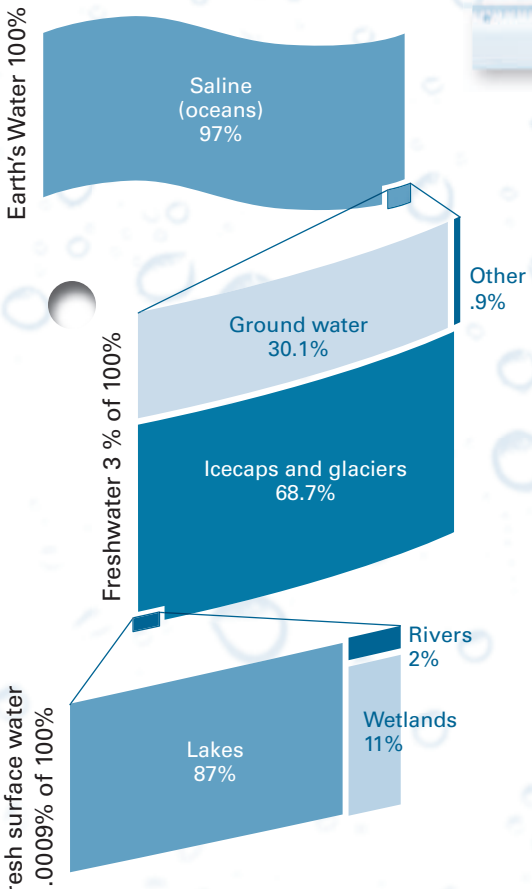
Learn about the sediment thickness of the world's oceans from NOAA National Geophysical Data Center (NGDC) (www.ngdc.noaa.gov). Search keyword: **sediment**

Going with the Flow:

The Ups and Downs of the Water Cycle

Introduction

In *Lesson 1.3 Going with the Flow: The Ups and Downs of the Water Cycle*, students study the properties of water and learn how the water cycle affects the Mississippi River. They also conduct an evaporation experiment and record their findings.



STANDARDS CORRELATION

This lesson addresses earth science and physical science standards, specifically, concentrating on the history of the earth and the physical processes that shaped it.

Background

Water power

Pure water is colorless, odorless, and tasteless. Although it seems like a very simple substance, water is vital for all life on Earth. It is everywhere: in our bodies, in the air as water vapor, and in the ground as soil moisture. Where there is water, there is life. Where water is scarce, life is a struggle.

Although 70% of the Earth's surface is covered in water, most of it—97%—is salt water. Of the remaining three percent of water that is fresh, most —70%—is locked in the polar ice caps and in glaciers. Less than one thousandth of one percent of the Earth's water is available on the surface in lakes and rivers.

Unit 1 goal

Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce

Lesson goal

Learn the many ways the water cycle affects the Mississippi River

Lesson objectives

- Define geographic terms related to the Mississippi River water cycle
- Discuss the water cycle
- Identify some of the impacts of the water cycle on the river

Educational standards

- Earth Science
- Physical Science
- Science in Personal and Social Perspectives
- Language Arts

What you'll need

- USGS Water Use poster
- 2 glasses (glass or plastic)
- Water
- Grease pencil (so you can erase with a cloth)

How long it will take

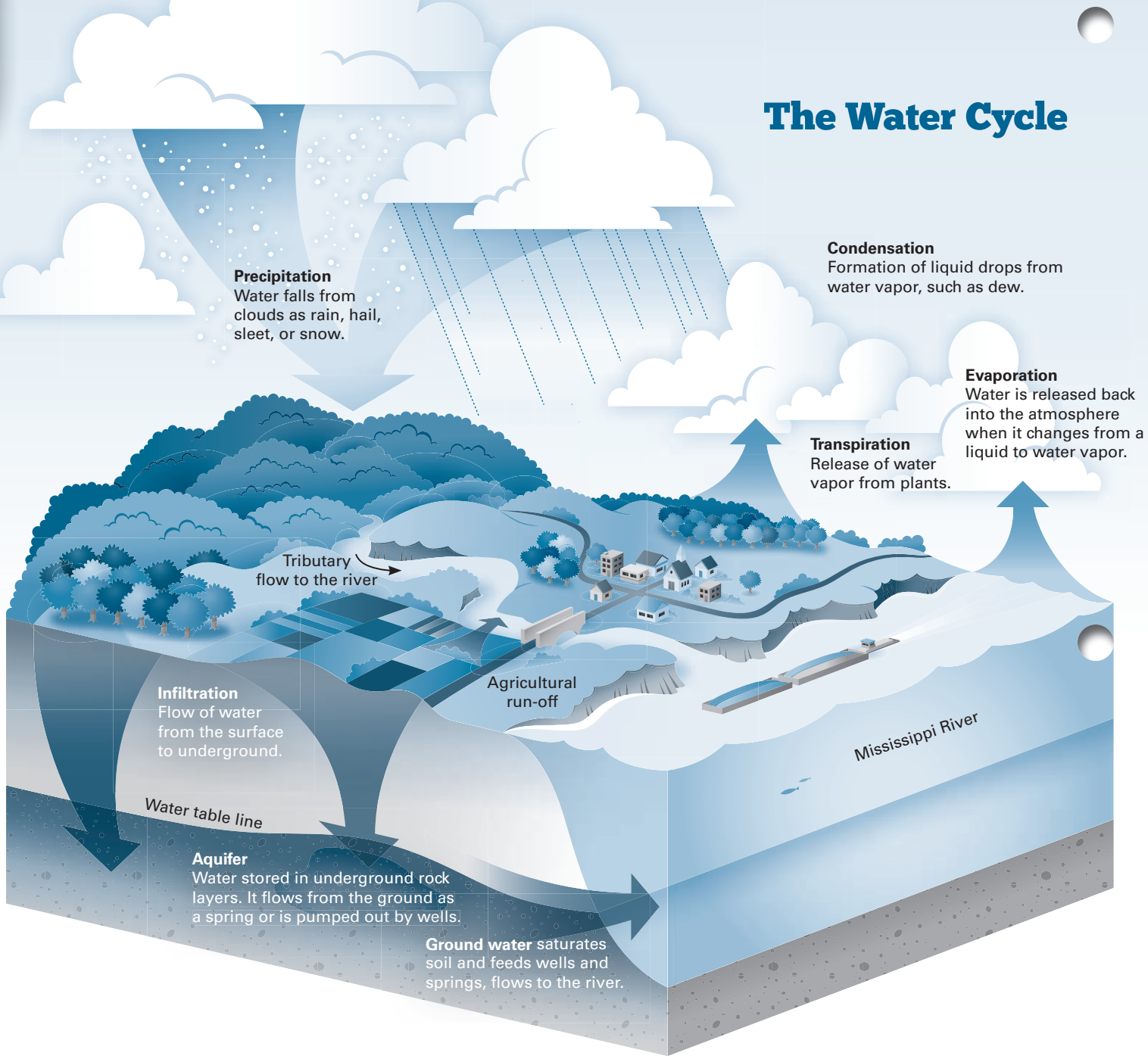
- Discussion: 30 min.
- Activity: 20 min. (plus 1 to 2 weeks for observation)

What's next!

Learn about the Mississippi River and its tributaries

Lesson 1.3

The Water Cycle



The Hydrologic Cycle

Water is found throughout the biosphere. The process of water moving through the environment is referred to as the water, or hydrologic, cycle. Water heats, rises into the atmosphere, forms clouds, falls as precipitation, and then returns to the ocean by way of rivers.

Thanks to the water cycle, our planet's water supply is constantly moving from one place to another and from one form to another. However, the water cycle is a closed system. The amount of water on Earth remains the same. The water in your body has been used and reused by organisms throughout history.

Although the amount and duration of water that falls as rain or snow varies depending on the season or the location, the water cycle is constant. We cannot make more water, which means there is a limited supply.

Sources: Environmental Protection Agency (EPA); U.S. Geological Survey (USGS).

It is possible that the water in your body was once inside of a *Tyrannosaurus rex*, George Washington, or Mark Twain.

Our bodies

Water is a major part of all living things. In fact, the most abundant substance in any organism is water. In some organisms, up to 90% of their body weight comes from water.

Our bodies need water to carry out many important and complex chemical reactions that all life must perform in order to survive. Water also circulates nutrients, carries waste away, and controls body temperature.

Although humans can survive for many weeks without eating food, we can only last a few days without drinking water. Each day humans must replace 2.4 liters of water, some through drinking and the rest from the water in the foods we eat.

- More than 60% of the human body is water
- Brain is composed of 70% water
- Lungs are nearly 90% water
- Lean muscle tissue contains about 75% water
- Body fat contains 10% water
- Bone has 22% water
- About 83% of our blood is water

Properties of water

Water can take three forms: liquid, solid, and gas. We drink its liquid form to sustain life. Because it is the universal solvent, we use its liquid form to wash dishes and ourselves. Massive sheets of ice, the solid form of water, cap our globe. Steam, the gaseous form of water, is powerful enough to move engines.

- Water freezes at 32° Fahrenheit (F) and boils at 212° F at sea level. At higher levels it boils at a lower temperature: 186.4° F at 14,000 feet.
- As a solid, water is less dense than its liquid form, which is why ice floats.
- Water can absorb a lot of heat before it begins to get hot. This is why water is valuable to industries and in your car's radiator as a coolant.
- Water has a very high surface tension. In other words, water is sticky and elastic, and tends to clump together in drops rather than spread out in a thin film.

Lesson 1.3

Need to Know

- **Water cycle**: The continuous movement of water on, above, and below the surface of the Earth. Water can change states among liquid, vapor, and ice at various places in the water cycle. Also called the hydrologic cycle.
- **Atmosphere**: The layer of gases that make up the air around Earth. The air includes gases that plants and animals need to breathe.
- **Humidity**: Amount of water vapor (moisture) in the air.

See the water cycle illustration on page 34 for more vocabulary words and concepts.

What can I do to SAVE water?

Ask students for ideas on conserving water, such as:

- Turn off the water while brushing your teeth
- Take shorter showers
- Water the plants/lawn in very early hours of the day before it gets hot

Visit the EPA's Water Sense Kids web site for more ideas, or ask students to research the site themselves: www.epa.gov/watersense/kids/index.html

Discussion (approximate lesson time 30 minutes)

Have students view the flash animation of the water cycle from the EPA's web site. Go to **www.epa.gov/safewater/kids/flash/flash_watercycle.html**

Note: flash software must be installed in order for this animation to work. Contact your school's Information Technology department if you have problems with the file.

Define and discuss the concepts and terms relating to the water cycle.

Introduce the idea of a balanced ecosystem and discuss natural and human processes that affect it, such as precipitation, floods, food chain, agriculture, and pollution.

Water supply and demand

Download and print the USGS Water Use poster from **www.usgs.gov.** Search keywords **water use poster** and choose the *Water Use Poster for Elementary School Students* (available in color and black and white).

Ask students to think about the small amount of fresh water on our planet and what it might be like to not have clean drinking water piped into our houses. Explain that some children in other countries spend hours each day helping their families carry water from streams and wells to their homes and then boil or treat the water (through chemical or solar processes) to make it safe to drink.

Earth's population grows by about 83 million people each year, which means the demand for water continues to grow. However, the amount of water on the planet does not change.

Create an Evaporation Experiment

Grades

5–6

Individual or group activity

20 MINUTES

Plus 1 to 2 weeks of observation

What you'll need

- 2 glasses (glass or plastic)
- 500 ml (17 ounces) of water
- Grease pencil (so you can erase with a cloth)
- Activity worksheets (pages 38-39)

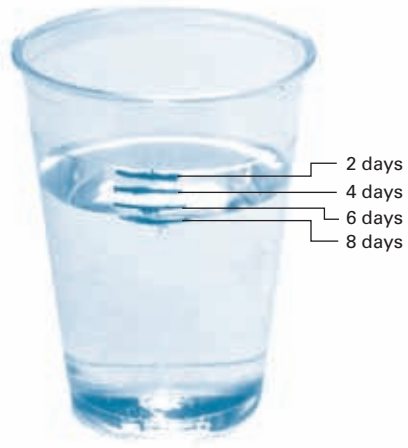
Teacher Tip

The sediment bottle from the previous lesson could be used for this lesson. However, it could take longer for the water to evaporate due to smaller neck. Do not use the bottle caps.

Prepare students for this activity by reviewing the properties of water and the evaporation definition. Explain that the rate of evaporation depends on heat, humidity (amount of water vapor in the air), and air movement.

Do This

1. Fill each glass with 250 ml (8.5 ounces) of water. Mark the water lines with the grease pencil. Write the date next to the line.
2. Place one glass in a warm, bright area. Place the other glass in a cool, dark area.
3. Visit the glasses every 48 hours for a period of one to two weeks, depending on how much evaporation you want students to observe and how many data points you want them to record.
4. At each visit, mark the water line on each glass and write the date next to the line.
5. At the end of the observation period, compare glasses.



This glass was set in the cool, dark area

This glass was set in the warm, bright area

Answer Key for Bonus question on page 39:

It is as old as the Earth itself. See the Background section of this lesson for more information.

The Ups and Downs of the Water Cycle

Name _____ Date _____

Define

Water cycle or hydrologic cycle _____

_____

_____

Atmosphere _____

_____

Precipitation _____

_____

Evaporation _____

_____

What are the positive and negative effects of precipitation on the river? Think about the river food chain, agriculture, and floods. Are there other things you should think about?

_____

_____

_____

_____

_____

_____

_____

Create an evaporation experiment

Materials needed: *2 glasses* (can be clear plastic), *500 ml* (17 ounces) *of water*, *grease pencil* (so you can erase with a cloth)

1. Fill each glass halfway with 250 ml (8.5 ounces) of water. Mark the water lines with the grease pencil. Write the date next to the line.
2. Place one glass in a warm, bright area. Place the other glass in a cool, dark area.
3. Visit the glasses every 48 hours for a period of one to two weeks, depending on how much evaporation you want to observe and how many data points you want to record.
4. At each visit, mark the water line on each glass and write the date next to the line.
5. At the end of the observation period, compare glasses.

1. Which one has more water? _____

_____

2. Did more water evaporate from the glass in the warm area? Why?

_____

_____

_____

3. What other factors influence the rate of evaporation? How?

_____

_____

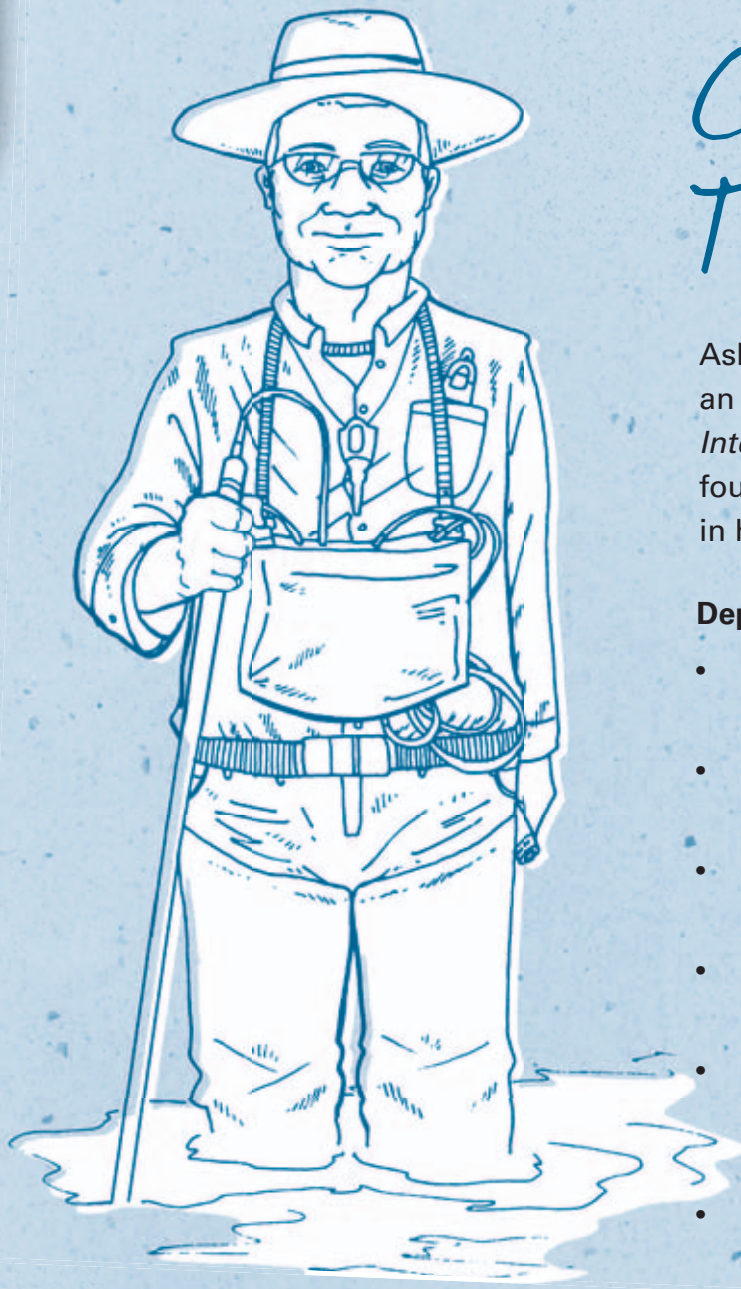
_____

Since you have used a grease pencil, you can take a cloth and wipe off the markings. Then you can redo the experiment and see if you get the same results.

Bonus Question!

Fill a glass half full with water and put it on the table in front of you. Take a good, long look at the water. Can you guess how old it is? _____

_____



CONSULT THE EXPERT

Ask students to read the abstract from an article in the scientific journal *Water International* and form groups of three or four to consider the opinion of an expert in hydrology.

Depending on grade level, have the students:

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to describe the relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and results.
- Use mathematics to quantify in all results of scientific inquiry.

Grades

7–12

Individual activity

Hydrologists study the movement, distribution, and quality of water by performing extensive field and laboratory research. They use a variety of instruments to measure water temperature, pH, dissolved oxygen, conductivity, turbidity, velocity, salinity, and other properties.

The Ups and Downs of the Water Cycle

Name _____ Date _____

Read, Analyze and Hypothesize

Read the abstract (short summary) from an article in the scientific journal *Water International* and form groups of three or four to analyze and discuss the hydrologic trends described.

Abstract

The Upper Mississippi River Basin has experienced considerable hydrologic change in the last two centuries as a result of removal of wetland areas, deforestation and subsequent reforestation, changes in agricultural practices, urbanization, navigation projects, and the construction of levees.

It is popularly accepted that the human-induced modifications to the river and its watersheds have increased the amount of flow in the Mississippi River, particularly during flooding events. Long-term stream gage records in the Upper Mississippi River Basin were analyzed to determine trends in stream flows and flooding. Over the 130 years of gaging there have been various periods in which the frequency and magnitude of floods have fluctuated. Trends in average flow and flooding are strongly correlated to coincident increases in average annual precipitation.

For many portions of the watershed, precipitation and stream flows over the last three decades have been higher than any earlier period on record. Outside of the dominant influence of climate variation, only one major change on Mississippi River flood discharges is observed. Flood control reservoirs in the Missouri River watershed appear to produce a 10 percent reduction in the average flood peak and average flood volume for the Mississippi River at St. Louis, Missouri.

Knapp, H. Vernon. "Hydrologic Trends in the Upper Mississippi River Basin." *Water International 19, no. 4* (December 1994); 199–206.

What hydrologic trends does the abstract describe?

_____

_____

_____

What hypotheses (proposed explanations for observable phenomena) can you make based on the information provided?

_____

_____

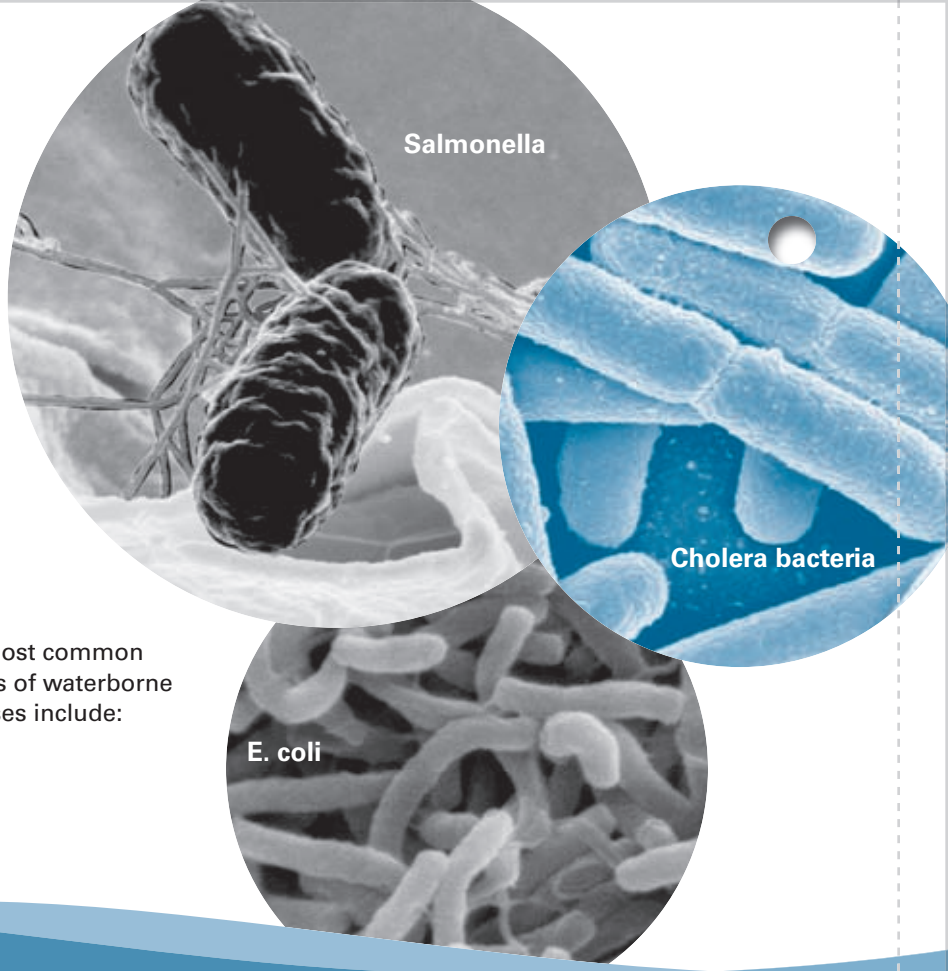
_____

_____

Lesson 1.3

Contaminated Water

The World Health Organization (WHO) estimates that 1.7 million people die each year from contaminated water, most of whom are children in developing nations. WHO is a specialized agency of the United Nations (UN) headquartered in Geneva, Switzerland.



The most common causes of waterborne diseases include:

Extension Suggestions

Career launch

Invite a local **hydrologist** or **climatologist** to speak to the class. Ask students to research these fields and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Water weight

Ask the students to figure how much one cup of water weighs. One gallon is 8.33 pounds (1 gallon = 4 quarts = 16 cups).

Grades 7–12 extension

Have students above 6th grade research climate change from primary sources, such as U.S. Geological Survey (www.usgs.gov) and Environmental Protection Agency (www.epa.gov).

Discuss climate change

Discuss climate change locally and globally and ask students to research evidence of climate change in their community. Have students begin their research at the EPA's Climate Change Kids Site at **www.epa.gov/climatechange/kids**

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

Learn more online

Learn about water from the U.S. Geological Survey Go to www.usgs.gov and search keywords: **water science for schools** and **learn more about water**

Learn about conserving water from the Environmental Protection Agency (EPA).Go to www.epa.gov and search keywords: **watersense kids**

Learn more about the Mississippi River and its major tributaries from the National Great Rivers Research & Education Center (www.ngrrec.org).

Learn about World Water Day (www.worldwaterday.org).

One Trunk with Many Branches:

Mapping the Mississippi River Watershed

Introduction

Lesson 1.4 One Trunk with Many Branches: Mapping the Mississippi River Watershed explores the entire watershed, focusing first on the Mississippi River Valley and its communities and then following the river's tributaries to learn about the watershed as a whole through classroom mapping activities. This lesson includes two mapping activities that build on one another: Tributaries of the Mississippi River and Basin Exploration.

The headwaters of the Mississippi River at Lake Itasca, Minnesota.

Unit 1 goal

Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce

Lesson goal

Learn the importance of the Mississippi River Watershed and the communities located along the Upper Mississippi River

Lesson objectives

- Define geographic terms related to the Mississippi River
- Identify states, tributaries, and major cities along the Upper Mississippi River
- Discuss the impact of the waterways on people and commerce

Educational standards

- Physical Science
- Life Science
- Math
- Geography
- Science in Personal and Social Perspectives
- Language Arts

What you'll need

- Laminated wall map
- Colored dry erase markers (including blue)
- Colored highlighters or pencils
- Paper

How long it will take

- *Activity 1*: 1 hour
- *Activity 2*: 1 hour

What's next!

Explore the ecosystems of the Upper Mississippi River

Lesson 1.4

Background

The Mississippi River flows 2,340 miles (3,705 kilometers) from its source in Minnesota to its mouth in the Gulf of Mexico. The headwaters of the Mississippi River is Lake Itasca in northwestern Minnesota. A small glacial lake, it sits 1,475 feet (450 meters) above sea level. The lake is fed by a number of smaller streams, sometimes considered the river's source.

U.S. states that border the Upper Mississippi River: Minnesota, Wisconsin, Iowa, Missouri, and Illinois.

Wisconsin

- *Nickname*: Badger State
- *Major industries*: Dairy Farming, Paper Production, Nonelectric Machinery Manufacturing (Engines, Turbines, Farm Machinery, etc.)

Minnesota

- *Nickname*: North Star State, Gopher State, Land of 10,000 Lakes
- *Major industries*: Farming, Finance, Technology

Illinois

- *Nickname*: Prairie State, Land of Lincoln
- *Major industries*: Coal Mining, Agriculture, Oil

Iowa

- *Nickname*: Hawkeye State
- *Major industries*: Corn, Soybeans, Livestock

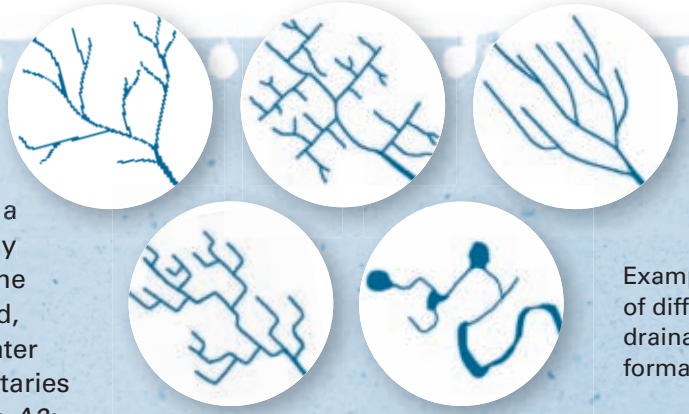
Missouri

- *Nickname*: Show-me State
- *Major industries*: Transportation Equipment (including Automobile Manufacturing and Auto Parts), Beer and Beverages, Defense, Agriculture, and Aerospace Technology

Mississippi River Watershed

The third largest drainage basin in the world, the Mississippi River Watershed covers about 40% of the continental United States and drains 31 states and two Canadian provinces before emptying into the Gulf of Mexico about 100 miles (160 km) downstream from New Orleans, Louisiana.

The upper and lower portions of the Mississippi are very different in hydrology and landscape. The communities along the upper and lower portions of the Mississippi experience different opportunities and challenges. Downstream of the confluence with the Missouri River at St. Louis, the Lower Mississippi River is a deeper, free-flowing river, making it easier for river travel and navigation. The Upper Mississippi River is shallower and subject to greater fluctuations in water flow, requiring locks and dams to maintain a navigable water channel.



Examples of different drainage basin formations.

Need to Know

- **Tributary**: A stream or river that flows into a main stem river rather than flowing directly into a sea, ocean, or lake. Tributaries and the main stem river drain the surrounding land, called the drainage basin, of its surface water and groundwater. Some of the major tributaries of the Upper Mississippi River include (see *A2: Major Tributaries of the Mississippi River* on page 314 for a complete list):
  - Arkansas River
  - Des Moines River
  - Illinois River
  - Kaskaskia River
  - Minnesota River
  - Missouri River
  - Ohio River
  - St. Croix River
  - Wisconsin River
- **Confluence**: The place where two or more bodies of water meet together, usually referring to one or more tributaries joining a main stem. Major cities are often located at a confluence.
- **Watershed**: A region or area of land where water from rain or snow drains downhill into body of water, such as a river, lake, wetland, sea, or ocean. It includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels. Also called a drainage basin.
  - The land in a drainage basin acts like a funnel, collecting all the water within the watershed and channeling it into a waterway. Watersheds are separated from adjacent basins by a drainage divide, usually a ridge, hill or mountain range.
  - The topography of the drainage basin, along with its shape, size, soil type, and land use, determine how much water reaches the river as well as how long it takes to get there.
  - Drainage basins have been historically important for determining territorial boundaries, including state lines, particularly in regions where trade by water has been important.
- **Watercraft**: A vehicle, vessel, or craft designed to move across (or through) water, including saltwater and freshwater, for pleasure, recreation, physical exercise, commerce, transport, and military missions. Professional types include barges, tugboats, towboats, paddle wheelers, and trawlers. Recreational boats include fishing boats, canoes, kayaks, and personal watercraft (PWC).
- **Bridge**: A structure built to span a valley, road, body of water, or other physical obstacle, for the purpose of providing passage over the obstacle. See *A3: Bridge Crossings of the Upper Mississippi River* on page 315.

Lesson 1.4

Key Communities

Twin Cities

Minnesota's two largest cities, Minneapolis and St. Paul, are often called the Twin Cities. Both cities developed along a series of stone bluffs at the confluence of the Mississippi, Minnesota, and St. Croix Rivers.

Early European settlers chose the area because it was the best place below St. Anthony Falls to unload boats. It was also one of the few places where the Mississippi River could be crossed by train, which helped fuel its growth.

The economy of the Twin Cities was—and continues to be—based on farming (corn, soybeans, sugar beets, wheat, dairy products), paper products, mining, and manufacturing. However, as these industries declined in the past few decades, it has transitioned to service, technology, and finance economies.

Several major corporations are headquartered in or near St. Paul including Ecolab, a chemical and cleaning product company; Securian Financial Group Inc.; Lawson Software; Gander Mountain, a retailer of sporting goods; and the 3M Company. Five Fortune 500 company headquarters are in Minneapolis: Target Corporation, U.S. Bancorp, Xcel Energy, Ameriprise Financial, and Thrivent Financial for Lutherans.

Prairie du Chien

Located near the confluence of the Wisconsin and Mississippi Rivers, Prairie du Chien was settled by French-Canadian fur trappers, who established a trading post there in 1685. It is one of Wisconsin's oldest communities.

Today, Prairie du Chien is one of Wisconsin's busiest ports. Two railroads and a small two-runway municipal airport make the city a shipping hub for the surrounding area.

Tourism, retail, service, and manufacturing employ most of Prairie du Chien's residents. State and local government, which include the courthouse and offices for Crawford County and a state penitentiary, are also major employers.

Quad Cities

The Quad Cities includes communities on both sides of the Mississippi River near its confluence with the Rock River: Davenport, Iowa and Rock Island, Moline, and East Moline, Illinois. The area was originally inhabited by Native Americans of the Sac and Fox tribes.

As river traffic grew, so did the Quad Cities, which became a crossroads for transport. The Rock Island Rapids made navigation by steamboats difficult, so travelers often had to wait in the area before continuing their journey, and trade goods had to be stored in warehouses. The first railroad bridge across the Mississippi River was built in the Quad Cities.

In 1848, John Deere founded the company that revolutionized the farming industry in Moline. The Quad Cities is also home to other large corporations, including International Harvester, Caterpillar, and Alcoa, the world's third-largest producer of aluminum.

Fast Facts

- Steamboat transport was a major industry, in terms of both passengers and freight, along the Mississippi River until the end of the first decade of the 20th century.
- The first bridge across the Mississippi River was built in 1855. It spanned the river in Minneapolis where the current Hennepin Avenue Bridge is located.
- The first railroad bridge across the Mississippi was built in 1856. It spanned the river between the Rock Island Arsenal and Davenport, Iowa.

Keokuk

Named for the Sac Chief, Keokuk, Iowa, is located at the confluence of the Des Moines and Mississippi Rivers. Early development of the area centered on the fur trade with the Native Americans. As steamboat traffic increased on the Mississippi more European settlers moved to the region.

When the Keokuk Lock and Dam began operation in August 1913, it was the largest single-powerhouse electric generating plant in the world. It was also the longest dam in the world, had the longest transmission line, and the highest voltage. The dam is still in use today.

St. Louis

Established just south of the confluence of the Missouri and Mississippi Rivers in 1764, St. Louis, Missouri, was built around the French fur trade. As steamboat traffic increased in the 1800s, St. Louis grew in size and prominence.

A major metropolitan city, St. Louis, Missouri, has many well-known U.S. corporations, including Fortune 500 companies such as Anheuser-Busch Breweries, Playtex, and Schick. St. Louis is also the world headquarters of Energizer, the battery and flashlight company, and Boeing Aircraft.

There are several large companies in the suburbs around St. Louis, including Hardee's and Enterprise Rent-A-Car's corporate headquarters. Charter Communications, the nation's fourth largest broadband communications company, is also headquartered in suburban St. Louis.

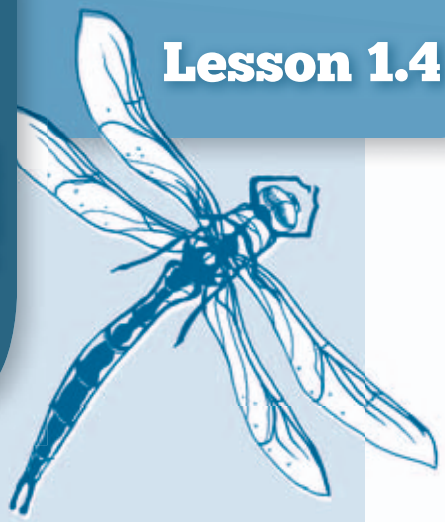
Across the Mississippi River from St. Louis are the cities of Alton and Grafton, which are also located at the confluence with the Illinois River. Developed as a river town in 1818, Alton was once a center for heavy industry and manufacturing. Today one of the main industries in Alton and nearby Grafton is tourism.

Cairo

Cairo, Illinois, was founded at the confluence of the Ohio and Mississippi Rivers and grew with the completion of the Illinois Central Railroad in the 1850s. It became such an important steamboat port in the 19th century that the government located a customs house there. However, as river trade began to decline so did Cairo's economy and population. As in other communities of the South, racial discrimination led to intense civil rights battles in the 1960s, including a 10-year-long boycott of white-owned businesses.

STANDARDS CORRELATION

This lesson incorporates a variety of standards, from physical and life science to math and geography. It also incorporates language arts. It uses the concepts and skills learned earlier in this unit to understand issues relating to the watershed from personal and social perspectives.



Tribute to the Mississippi River

Grades

5–6

Class or small group activity

1 HOUR

Students will create a legend and add the names of cities, tributaries, state parks, mountain ranges, wildlife, industry, and bridges. Legend will include icons and pictures.

Get Ready

Have students research the following states and communities along the Upper Mississippi River in preparation for this class activity:

- Five states along the Upper Mississippi (Minnesota, Wisconsin, Iowa, Missouri, and Illinois) to learn the state bird, tree, flower, mammal, and fish for each one. This information is located in *A4: Mississippi River Watershed States Chart* on page 317.
- Six communities along the Upper Mississippi River located at confluences: Twin Cities, Minnesota; Prairie du Chien, Wisconsin; Quad Cities, Iowa and Illinois; Keokuk, Iowa; St. Louis, Missouri; and Cairo, Illinois. Information on these communities is located in this lesson.

What you'll need

- Laminated wall map of the continental United States
- Student map activity worksheet (pages 50–51)
- Colored highlighters or pencils
- Colored dry erase markers (several colors including blue)
- Extra writing paper

Teacher Tip

Don't erase the map when you finish this activity. The labels will be needed again for the next one.

Do This

Step 1: Place the watershed in spatial context

- Use the satellite image side of the wall map to show students the Mississippi River and its watershed. Use the map to introduce key concepts and vocabulary in the *Need to Know* section on page 45. Discuss the following:
  - How waterways defined land areas and became state borders.
  - Importance of tributaries. How did they influence the movement of people, wildlife, and goods?
  - Importance of confluences. Why did people settle here?

Step 2: Identify the Mississippi River

- Turn the map over to the line map side and ask students to identify the Mississippi River. Ask students which direction the river flows and highlight it (or ask a student to) in blue using the blue dry erase marker.
- Ask students to name some of the types of watercraft seen on the river.
- Ask students to identify where the Mississippi River starts and highlight it with a blue dot at Lake Itasca.
- Start the map legend.
- Distribute the watershed map activity worksheet to students and have them do the same to their maps.

Step 3: Identify nine major tributaries

- Ask students to identify nine major tributaries of the Mississippi River (Minnesota, St. Croix, Wisconsin, Rock, Des Moines, Illinois, Missouri, Ohio, and Arkansas Rivers). Highlight and label each tributary on the map.
- Ask all students to highlight and label the tributaries on their individual maps.

Step 4: Identify the five states along the Upper Mississippi River

- Identify the five Upper Mississippi River states (Minnesota, Wisconsin, Iowa, Illinois, and Missouri) and label on wall map. Ask students to do the same to their maps.
- Ask students to identify state bird, tree, flower, animal, and fish for each of the five states and write them on the wall map (Please refer to *A4: Mississippi River Watershed States Chart* on page 317).
- Ask students to list these per state on a separate piece of paper.

Step 5: Identify and discuss six communities at confluences along the Upper Mississippi River.

- Ask students to identify where the following six communities are located along the Upper Mississippi River and label them on the wall map: Twin Cities, Minnesota; Prairie du Chien, Wisconsin; Quad Cities, Iowa and Illinois; Keokuk, Iowa; St. Louis, Missouri; and Cairo, Illinois. Ask students to do the same to their maps.
- Discuss these communities in the context of their location at major confluences:
  - **Twin Cities** (Minneapolis and St. Paul), Minnesota, near the confluence of the Minnesota and Mississippi Rivers
  - **Prairie du Chien**, Wisconsin, near the confluence of the Wisconsin and Mississippi Rivers
  - **Quad Cities** (Davenport, Iowa; and Rock Island, Moline, and East Moline, Illinois) near the confluence of the Rock and Mississippi Rivers
  - **Keokuk**, Iowa, near the confluence of the Des Moines and Mississippi Rivers
  - **St. Louis**, Missouri, near the confluence of the Missouri and Mississippi Rivers
  - **Cairo**, Illinois, at the confluence of the Ohio and Mississippi Rivers
- Identify major bridges and discuss their importance for the movement of people and goods. See *A3: Bridge Crossings on the Upper Mississippi River* on page 315.
- Discuss the similarities and differences among the six communities and identify two major industries (import/export) for each.

See page 57 for the answer key for the student worksheet for this activity.

One Trunk with Many Branches

Mapping the Mississippi River Watershed

Name _____ Date _____

Complete the map and create a legend:

1. Highlight the Mississippi River in blue and then label it on your map. Add a blue dot where the Mississippi River begins. Start your map legend by adding a blue line and labeling it Mississippi River.
2. Label the states along the Upper Mississippi River on your map.
3. Using a different color for each river, highlight and label the major tributaries of the Mississippi River and add them to the legend.
4. Label the major cities located at the confluences on your map.
5. What major tributary of the Mississippi River is your school closest to?

   _____

6. What is the importance of tributaries in terms of migration of people, wildlife, and goods? _____

   _____

   _____

   _____

   _____

   _____

   _____

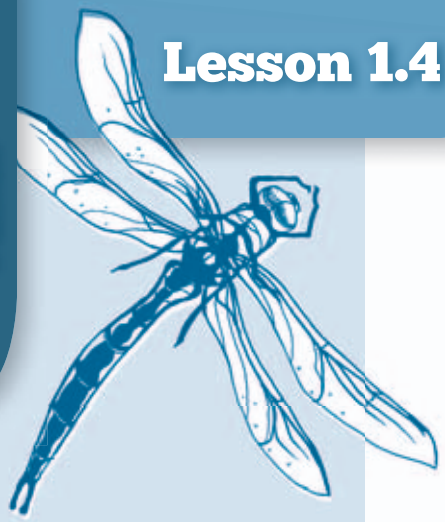
   _____

   _____

   _____

Follow the instructions on the front of this sheet to complete the map below.

Legend



Mississippi River Basin Exploration

Grades

5–6

Class activity

1 HOUR

This continuation of Activity 1 explains the importance and impact of the Mississippi River Watershed beyond the communities along its banks.

Students will create a legend and add the names of cities, tributaries, state parks, mountain ranges, wildlife, industry, and bridges. Legend will include icons and pictures.

Do This

Have students research the other 26 states in the entire Mississippi River Watershed in preparation for this class activity:

- Assign a state to each student in the class (if you have less than 26 students, have each student research two adjacent states) and learn the state bird, tree, flower, mammal, fish, and largest city for each one. See *A4: Mississippi River Watershed States Chart on page 317*.
- Review Activity 1 (page 48). The students will add to the wall map and their maps the six communities of the Upper Mississippi previously identified in Activity 1.

What you'll need

- Laminated wall map of the continental United States
- Student map activity worksheet (pages 54–55)
- Colored highlighters or pencils
- Colored dry erase markers (several colors including blue)

Teacher Tip

Use the line map again with the labels from the last activity still on it. Tell students that they will now be looking at the entire watershed.

Fast Facts

- Wisconsin has over 14,000 lakes and 7,446 streams and rivers. If you stuck them end to end they'd stretch nearly 27,000 miles—enough to circle the whole planet.

Step 1: Identify all the states in the watershed

- Ask the students to count how many states are in the watershed. How many states border the Mississippi River? Why are other states included in the Mississippi River Watershed?

- Identify the 31 states and two Canadian provinces in the watershed. Use postal abbreviations to add states to the wall map. Ask students to do the same to their maps.

  - Alabama (AL)
  - Arkansas (AR)
  - Colorado (CO)
  - Georgia (GA)
  - Illinois (IL)
  - Indiana (IN)
  - Iowa (IA)
  - Kansas (KS)
  - Kentucky (KY)
  - Louisiana (LA)
  - Maryland (MD)
  - Michigan (MI)
  - Minnesota (MN)
  - Mississippi (MS)
  - Missouri (MO)
  - Montana (MT)
  - Nebraska (NE)
  - New Mexico (NM)
  - New York (NY)
  - North Carolina (NC)
  - North Dakota (ND)
  - Ohio (OH)
  - Oklahoma (OK)
  - Pennsylvania (PA)
  - South Dakota (SD)
  - Tennessee (TN)
  - Texas (TX)
  - Virginia (VA)
  - West Virginia (WV)
  - Wisconsin (WI)
  - Wyoming (WY)
  - Alberta (Canada)
  - Saskatchewan (Canada)

Step 2: Learn about each state

- Identify and add state bird, tree, flower, mammal, fish, and largest city for the states included in the watershed to the wall map. See *A4: Mississippi River Watershed States Chart* on page 317.

- Identify the two major industries (import/export) in those states. What part did the waterway play in the development of those industries?

Step 3: Identify some of the communities in the watershed

- Identify a few of the major cities in the watershed and discuss why people may have settled at these locations. Possible cities: Pittsburgh, Pennsylvania; Memphis, Tennessee; Omaha, Nebraska; Kansas City, Kansas; New Orleans, Louisiana.

- Ask students to add the selected cities to the wall map.

See page 57 for the answer key for the student worksheet for this activity.

- Rochester, Minnesota, is the home of the internationally famous Mayo Clinic, known for its achievements in the field of medicine.
- The tallest man in the world, Robert Wadlow, was born in Alton, Illinois, in 1918. He weighed 491 pounds and stood 8 feet, 11 inches tall and wore a size 37 shoe.
- The shortest and steepest railroad in the U. S. is in Dubuque, Iowa. It is 296 feet long, and rises at an incline of 60 degrees to a height of 189 feet.
- Bagnell Dam impounds the Osage River in the Ozarks, Missouri. It creates one of the largest artificial lakes in the world, Lake of the Ozarks, covering 65,000 acres of surface area. The dam was completed in 1931.

Mississippi River Basin Exploration

Name _____

_____Date

1. Define what a **watershed** is. _____

_____

_____

_____

_____

2. Highlight or draw the boundaries of the Mississippi River watershed on the topography map on the back of this sheet.
3. Label all the states in the watershed on the map using the two-letter postal code abbreviation (IA = Iowa). How many are there? _____
4. How many states border the Mississippi River? _____
5. How have the tributaries in the Mississippi River watershed defined the land and the state borders? _____

_____

_____

_____

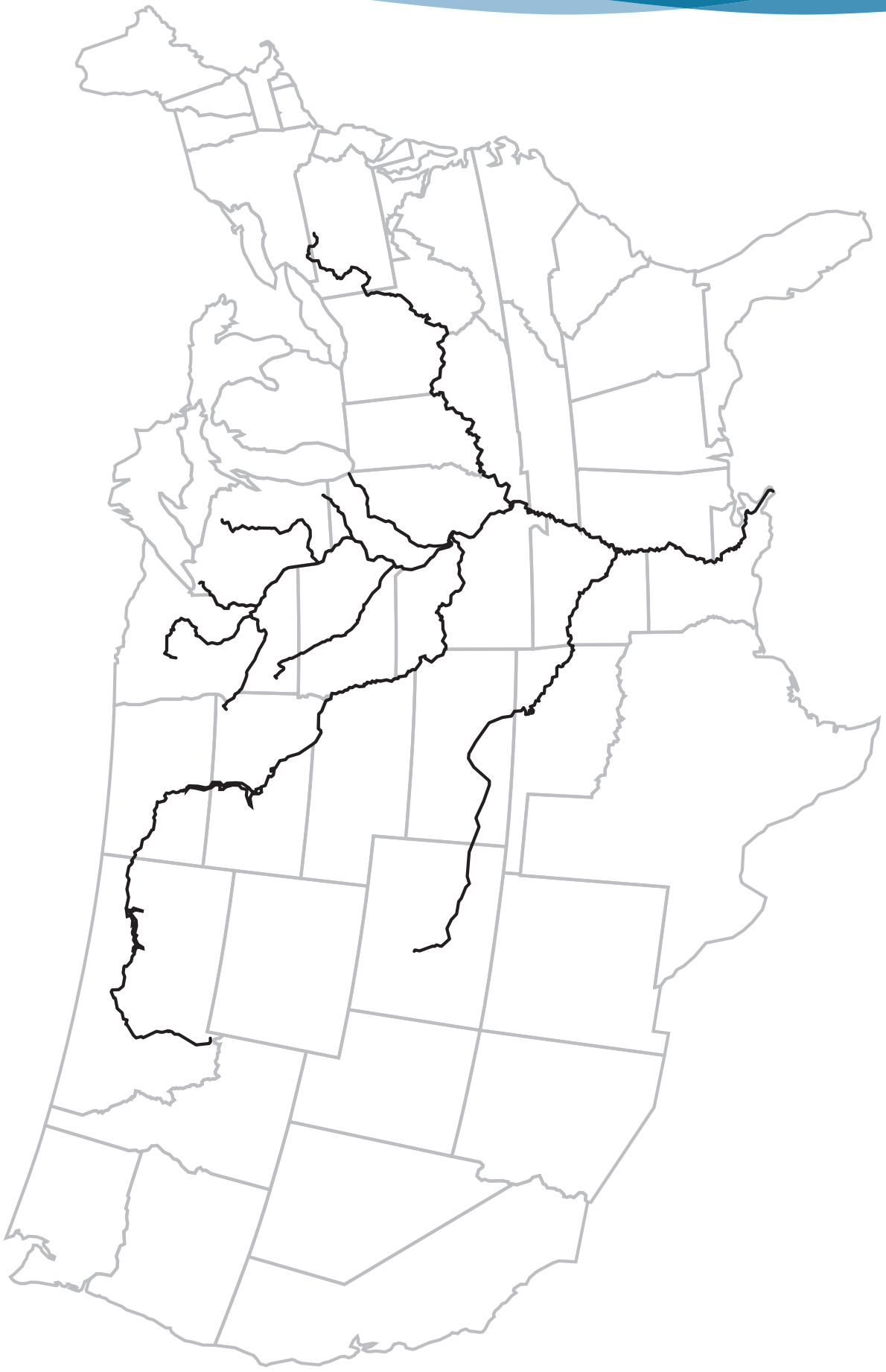
_____

_____

_____

_____

_____



Answers for Activity Sheets (pages 50–51, 54–55)

One Trunk with Many Branches

Mapping the Upper Mississippi Watershed

2. Label the states along the Upper Mississippi River on your map.
   See next page. (Minnesota, Wisconsin, Iowa, Illinois, and Missouri)

3. Using a different color for each river, highlight and label the major tributaries of the Mississippi River and add them to the legend.
   See next page

4. Label the major cities located at the confluences on your map.
   Twin Cities, Prairie du Chien, Quad Cities, Keokuk, St. Louis, and Cairo

5. What tributary (stream or river) of the Mississippi River is your school closest to?
   Answers will vary.

6. What is the importance of tributaries in terms of migration of people, wildlife, and goods?
   Answers will vary. Major cities are often located at the confluences of large rivers because they provide access to water for drinking and irrigation as well as a transportation corridor for people and products. Wildlife use rivers to travel between winter and summer habitat. The wetland and riparian (river) habitats provide food and shelter along their journey.

Mississippi River Basin Exploration

1. Define what a **watershed** is.
   A region or area of land where water from rain or snow drains downhill into a body of water, such as a river, lake, wetland, estuary, sea, or ocean. It includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels. Also called a drainage basin.

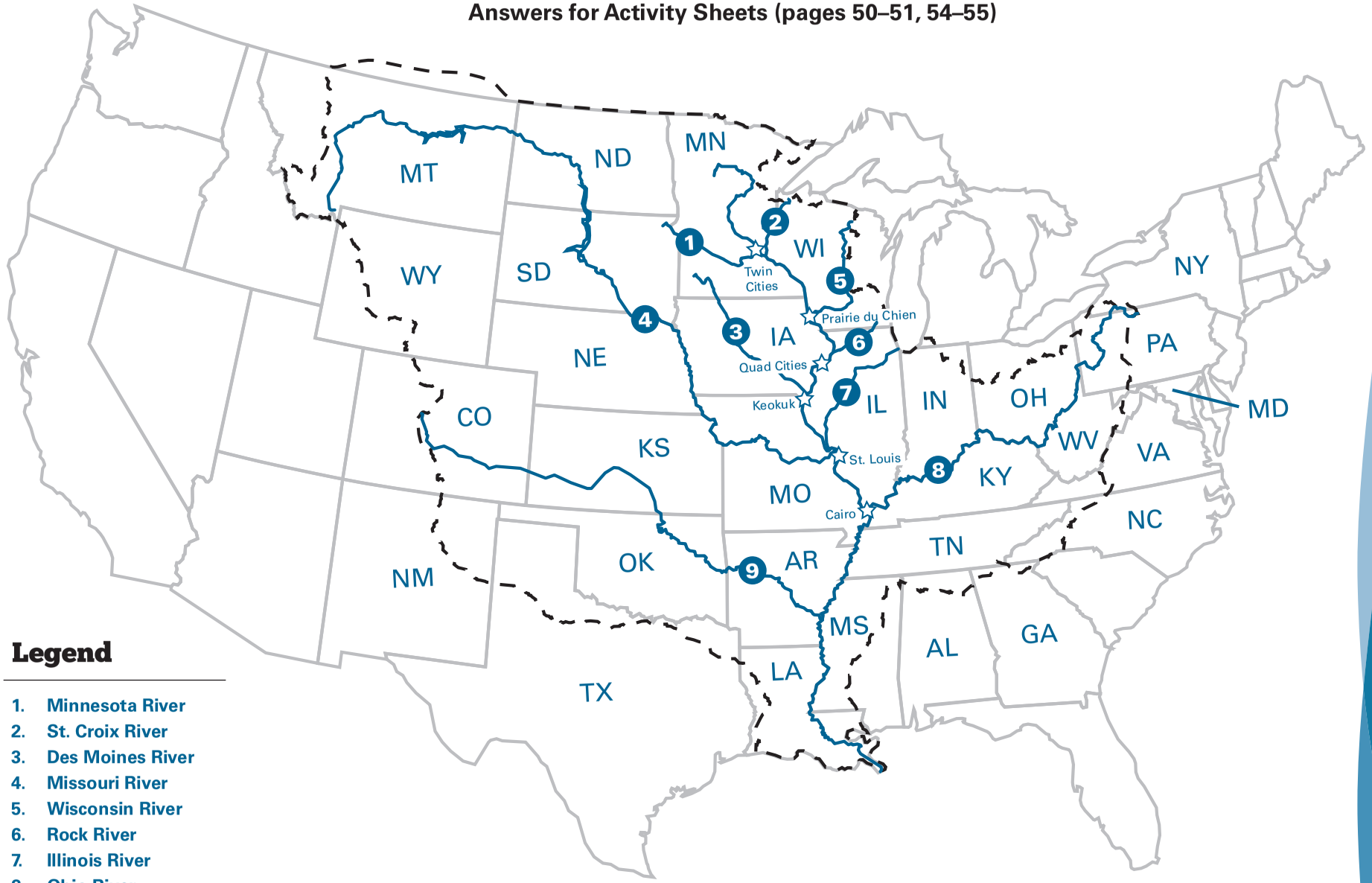
2. Highlight or draw the boundaries of the Mississippi River watershed on the map on the back of this sheet.
   See next page.

3. Label all the states in the watershed on the map using the two-letter postal code abbreviation (IA = Iowa). How many are there?
   There are 31 states. See next page.

4. How many states border the Mississippi River?
   10 states border the Mississippi River. (Minnesota, Wisconsin, Iowa, Illinois, Missouri, Kentucky, Tennessee, Arkansas, Louisiana, and Mississippi)

5. How have the tributaries in the Mississippi River watershed defined the land and the state borders?
   Answers will vary. Many state boundaries are defined by rivers because they provide natural borders between communities.

Answers for Activity Sheets (pages 50–51, 54–55)



Legend

1. Minnesota River
2. St. Croix River
3. Des Moines River
4. Missouri River
5. Wisconsin River
6. Rock River
7. Illinois River
8. Ohio River
9. Arkansas River

CHANGE OVER TIME
Yesterday, today, and tomorrow

Grades
7–12
Individual activity

Apply the skills and information learned in previous levels to analyze the past, present, and future of historic confluence cities on the Upper Mississippi River discussed in Activity 2 on page 52–53. Research and compare all six communities and then choose two of them to write a five-paragraph comparison/contrast essay.

Step 1: Research the following historic cities located at confluences on the Upper Mississippi River (Twin Cities, Minnesota; Prairie du Chien, Wisconsin; Quad Cities, Iowa and Illinois; Keokuk, Iowa; St. Louis, Missouri; and Cairo, Illinois) and answer the following questions:

- What year was each city founded?
- What is the history of each city's population and economic growth? Did it grow steadily since it was founded, or has its population and economy declined?
- What was each city's economic base when it was founded? What was its economic base in the mid-1800s and mid-1900s? What is it today?
- What are the past and present natural resources of each city? Are the same types of wildlife (animals, birds, fish) seen in each time period? If yes, why do you think that is? If no, why not?
- Why do you think some cities thrived and others did not? What makes each community unique?

Research Tip

Each state and most cities have web sites that provide basic information, often including its history and economy. Many cities also have chambers of commerce, which also have web sites. As informative as the Internet can be, keep in mind that the best place to start your research is in your school library.

Step 2: Complete the Comparison Table activity worksheet and use as a tool to compare and contrast the six cities.

- How are the cities similar?
- How are they different?
- What may be some reasons for the differences?

Step 3: Choose two of the cities and write a five-paragraph comparison/contrast essay based on the question, "What might the future bring for these cities along the river?"

Change Over Time

Yesterday, Today, and Tomorrow

Name _____ Date _____

	Twin Cities (MN) Minneapolis & St. Paul	Prairie du Chien (WI)	Quad Cities (IA and IL)	Keokuk (IA)	St. Louis (MO)	Cairo (IL)
Year of 1st Settlement What type of settlement?	1819: Zebulon Pike takes control of Minnesota and Mississippi Rivers, where Fort Snelling is eventually established				1786: Laclede set up a trading post	
1800s						
Commerce					Fur trading	
Ecosystem						
1900s						
Commerce						
Ecosystem						
2000s						
Commerce						
Ecosystem						

Lesson 1.4

> *"A watershed is that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."* – *John Wesley Powell*

Extension Suggestions

Career Launch

Invite a local **cartographer** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Grades K-4 Extension

Where in these 50 states do you live? Use the large map to find your home state. Do you have relatives living in other states? Find those states.

Surf your watershed

Find out more about the watershed your community depends on. Learn your watershed address at the Environmental Protection Agency's web site. Go to **www.epa.gov** and search keywords **surf your watershed.**

Get out!

Try a new high-tech treasure hunt called geocaching.

State capitals

Identify state capitals for the five states along the Upper Mississippi River and add them to the wall map and their individual maps.

Express yourself!

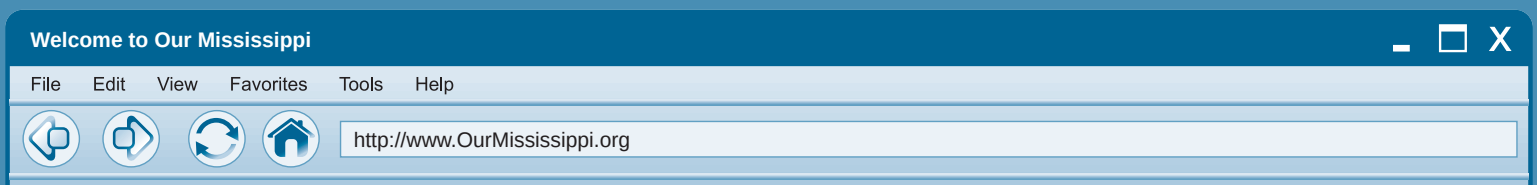
Journal and photograph your geocaching adventure.

Tributaries

Identify all the tributaries of the Mississippi River and some of the communities located at the confluences.

Grades 7–12 extension

Have students identify a historic figure from one of the communities identified in Activity 1 and write a biography.



Learn more online

Learn about watersheds with:

- U.S. Geological Survey Go to www.usgs.gov and search keywords: **watersheds**
- Environmental Protection Agency (EPA) Go to www.epa.gov and search keywords: **watershed**

Explore cities located at confluences along the Upper Mississippi River:

- Minneapolis, MN: www.ci.minneapolis.mn.us
- Saint Paul, MN: www.ci.stpaul.mn.us
- Prairie Du Chien, WI: www.prairieduchien-wi.gov
- Quad Cities (Davenport, Iowa; and Rock Island, Moline, and East Moline, IL) www.visitquadcities.com
- Keokuk, IA: www.keokukiowatourism.org
- St. Louis, MO: http://.stlouis.missouri.org
- Cairo, IL: cairo.mcma.siu.edu

Learn about states from the Drexel University's College of Information Science & Technology. Go to www.ipl.org, click on **For Kids** and then click **Stately Knowledge**

Learn about states bordering the Upper Mississippi River at:
www.illinois.gov
www.iowa.gov
www.minnesota.gov
www.missouri.gov
www.wisconsin.gov

Bonus Activity!

Go with Your Creative Flow!

Teacher Tip

Set a time limit for each step, if necessary.

Safety Tip

Review safety rules before starting and remind students not to pick up something sharp or dangerous.

Do This

1. Take students outdoors to an environment that sparks their imagination (schoolyard, park, nature center).
2. Divide students into partners or teams and ask them to find five objects that inspire them to create something. If students need help, suggest categories instead of specific items.
   - Something that floats on the wind or water (seedpod, leaf, feather, twig)
   - Something that sinks (pebble, rock)
   - Something old (discarded paper, can, or water bottle)
   - Something red, yellow, or blue
   - Something smooth, rough, prickly, or fuzzy
3. Ask each team to tell what they found and what they plan to do with one or more of the items—tell a story, paint a picture, sing a song, write a play, plan a trip, take apart or build or invent something.
4. If time allows, have students make (or start) their project. Schedule another class session to present their final product, if necessary.

Unit 2

Upper Mississippi River Ecosystems

Unit 2: Upper Mississippi River Ecosystems **builds on the broad overview provided in *Unit 1: Upper Mississippi River Watershed.* Students build on the knowledge and skills gained about the geography, history, earth science, and physical science of the entire watershed to focus on the river itself in Unit 2. The wall map introduced in Unit 1 is used again in Unit 2 as the main conceptual thread running throughout the guide.**

Unit 2 emphasizes life science and geography. In this unit, students explore what ecosystems are and how they are made up of living and non-living things. They investigate what a healthy river system is, how the river's health is measured and monitored, and what happens to the river—as well as people, plants, and animals—if the river is not healthy. This unit also includes an in-depth exploration of bird migration, which helps prepare students for lessons and activities on human history and migration in *Unit 3: Mississippi River History and Culture.*

2.0 Introduction to Upper Mississippi River Ecosystems: Pre- and Post-Assessments

Prepare students for learning about the Upper Mississippi River Ecosystems through pre-post assessments, key vocabulary, and outdoor exploration of their local ecosystems.

2.1 At Home in the River: Plants, Animals, and Habitats of the Upper Mississippi River

Learn how living things are connected to their environment by creating a food chain checkers game and raising tadpoles.

2.2 Just Passing Through: Bird Migration and the Mississippi River Flyway

Take a birdwatching field trip and recreate the Mississippi Flyway in the classroom or schoolyard.

2.3 Well River Checkup: Assessing the Health of the River

Investigate what happens to the river when you wash a car and test the effects of phosphates on pond water.

2.4 Life on the Brink: Endangered Species of the Upper Mississippi River

Research endangered species in your state and create a wildlife garden in the schoolyard.

2.5 Mississippi River Sustainability: How to Make a Positive Impact on Your Environment

Calculate your eco-footprint and read and learn the inspiring story of how one young person made a difference.

Introduction to Upper Mississippi River Ecosystems

UNIT 2

Unit 2 goal

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Introduce students to the ecosystems of the Mississippi River

Lesson objectives

- Define terms related to ecosystems of the Mississippi River
- Study the ecosystems of Upper Mississippi River floodplain
- Investigate biotic and abiotic components outdoors

Educational standards

- Life Science
- Science as Inquiry
- Science in Personal and Social Perspectives
- History and Nature of Science

What you'll need

- Binoculars
- Magnifying glass
- Pencil
- Field guide
- Journal

How long it will take

- *Activity 1:* 15 min.
- *Discussion:* 60-90 min.
- *Activity 2:* 30-45 min.

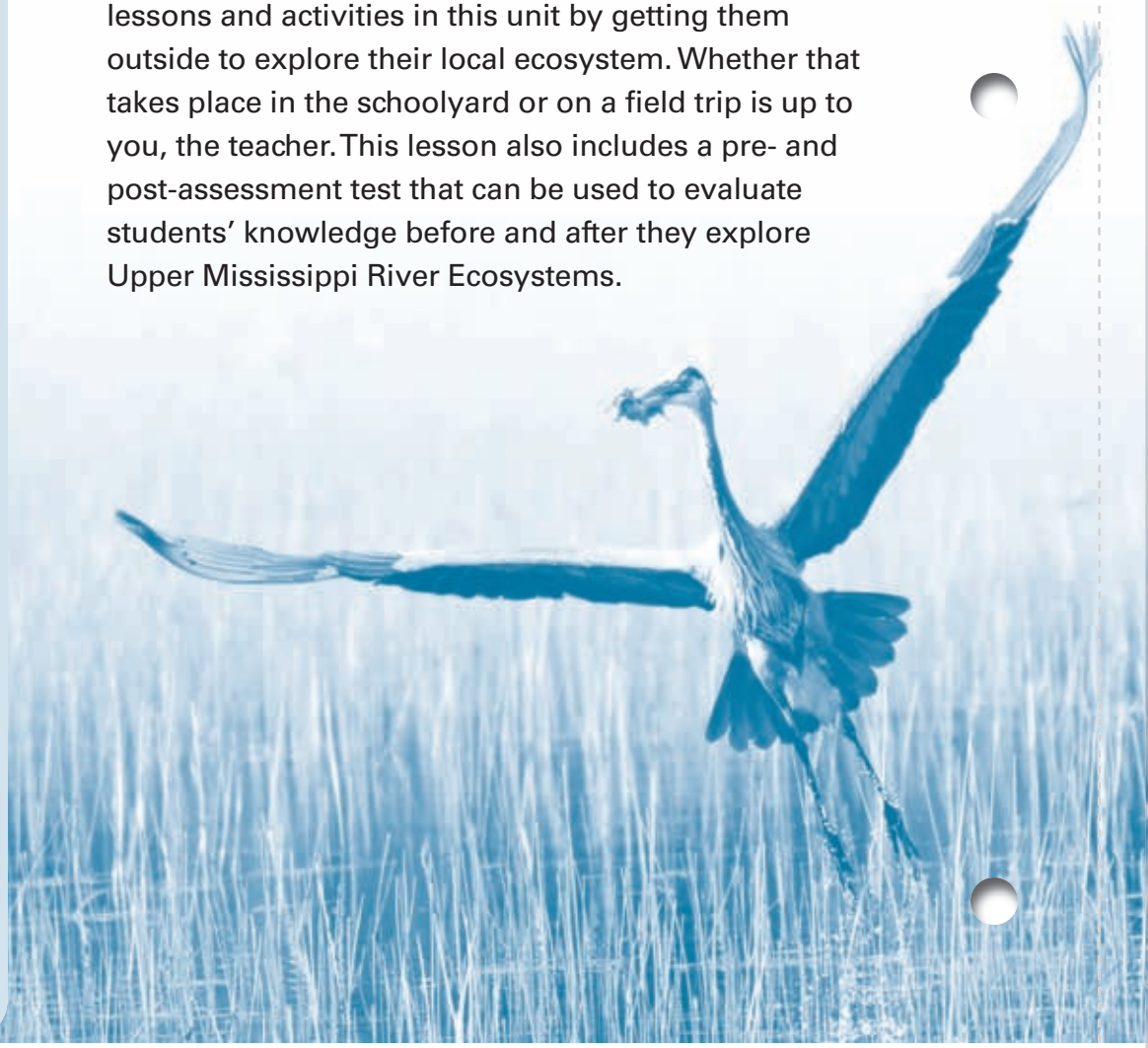
What's next!

Understanding how living things interact in an ecosystem

Introduction

In Unit 1 we examined how the Mississippi River made its mark on the country's ecosystems and commerce. In Unit 2 we will explore the ecosystems of the Mississippi River in more depth and learn how human activity has affected them. Students learn about the health of Upper Mississippi River ecosystems, habitats, and species through a variety of hands-on and outdoor activities that focus on life science and geography.

This introductory lesson prepares students for the lessons and activities in this unit by getting them outside to explore their local ecosystem. Whether that takes place in the schoolyard or on a field trip is up to you, the teacher. This lesson also includes a pre- and post-assessment test that can be used to evaluate students' knowledge before and after they explore Upper Mississippi River Ecosystems.



Pre- and Post-Assessment

15 MINUTES

What you'll need

- Activity worksheet (pages 66–67)

Do This

1. Copy and distribute the Pre- and Post- Assessment activity worksheet on the following page.
2. Allow 15 minutes for students to complete the assessment.
3. Save the pre-assessments to compare with a post-assessment given after students complete all the lessons in this unit using this same activity worksheet.
4. Calculate each student's percent increase in knowledge.

Answer Key

1. Producer ---------- Makes its own food
2. Prey ---------- Hunted by another animal for food
3. Scavenger ---------- Eats dead things
4. Carnivore ---------- Eats only other animals
5. Herbivore ---------- Eats plants
6. Omnivore ---------- Eats plants and animals
7. Biotic ---------- Organisms, living or dead, or any part of them
8. Abiotic ---------- Non-living components in the environment
9. Predator ---------- Hunts other animals for food
10. Ecosystem ---------- Living and non-living things interacting in a system
11. Species ---------- Single kind of living thing
12. Habitat ---------- Place where all survival needs are met

Multiple Choice

1. D
2. B
3. C
4. B
5. D
6. C
7. A
8. C
9. C
10. A

"We consider species to be like a brick in the foundation of a building. You can probably lose one or two or a dozen bricks and still have a standing house. But by the time you've lost 20 percent of species, you're going to destabilize the entire structure. That's how ecosystems work."

– Donald Falk, *Christian Science Monitor*, May 26, 1989

Unit 2 Assessment

Name _____ Date _____

Matching

Draw a line from the word on the left to the correct definition on the right.

1.	Producer	Organisms, living or dead, or any part of them
2.	Prey	Eats plants and animals
3.	Scavenger	Hunts other animals for food
4.	Carnivore	Non-living components in the environment
5.	Herbivore	Hunted by another animal for food
6.	Omnivore	Single kind of living thing
7.	Biotic	Living and non-living things interacting in a system
8.	Abiotic	Place where all survival needs are met
9.	Predator	Eats plants
10.	Ecosystem	Eats dead things
11.	Species	Eats only other animals
12.	Habitat	Makes its own food

Multiple choice

Circle the correct answer. There may be more than one correct answer.

1. Living things are connected to their environment because they:

   a. Live in the same ecosystem
   b. Interact with each other
   c. Are part of the habitat food web
   d. All of the above

2. Why is the Mississippi River called a flyway?

   a. Airplanes fly up and down the river
   b. Birds follow the river when migrating
   c. Golfers play on the river
   d. All of the above

3. Water that goes down the storm drain ends up:
   a. Back in the faucet
   b. In the backyard
   c. In the river
   d. At my neighbor's house

4. Which are ways we can help our local endangered species?
   a. Remove native plants
   b. Plant a garden to attract wildlife
   c. Use plastic instead of paper
   d. All of the above

5. How can you make a positive impact on your environment?
   a. Recycle instead of throwing things away
   b. Clean up after your dog
   c. Collect rainwater to reuse
   d. All of the above

Choose the BEST definition for the word.

6. Endangered
   a. Non-living thing
   b. Part of the food chain
   c. In danger of no longer existing

7. Photosynthesis
   a. Plants making food
   b. Camera taking photos
   c. Plants making oxygen

8. Species
   a. Abiotic factors
   b. Non-living thing
   c. Single kind of living thing

9. Riparian habitat
   a. City neighborhood
   b. Amusement park
   c. River bank

10. Conservation
    a. Preserving natural resources
    b. Renewing water
    c. Discovering fossil fuels

Background

We are all dependent on the life-support services that healthy ecosystems perform. Ecosystems provide food and habitat for diverse communities of people, plants, and animals. They also purify our air and water, recycle our waste, regulate climate, and moderate floods and drought.

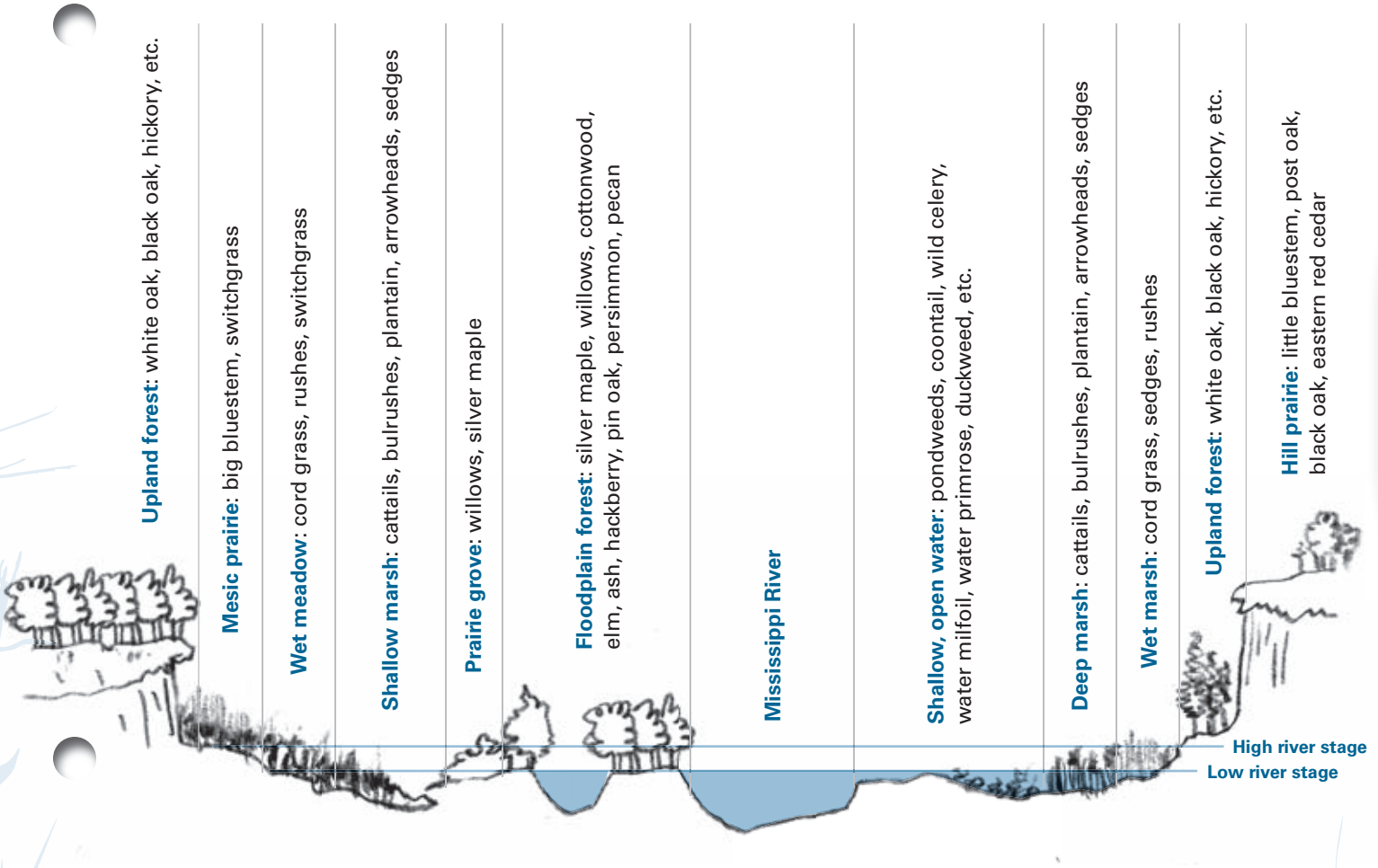
What is an ecosystem?
Many different definitions of ecosystem exist, from the very simple to the extremely complex. These definitions are open to debate because they have legal and political ramifications for international agreements protecting biodiversity.

Simply put, any group of living and non-living things interacting with each other can be considered an ecosystem. The abiotic, or non-living, components of an ecosystem are the physical factors of the environment, such as rocks, soil, sunlight, water, and air. The living, or biotic, components of an ecosystem include the organisms, both living and dead, such as plants and animals, that interact with and are dependent on abiotic factors. Together these components interact to create a stable, self-sustaining system.

An ecosystem can be as small as a puddle or as large as the Earth itself and can be temporary or permanent. The larger and more diverse in biotic and abiotic components, the more productive the ecosystem. Biodiversity is used as a measurement of ecosystem health.

The Convention on Biological Diversity defines an ecosystem as a "dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit. " The Convention on Biological Diversity is an international, legally binding treaty adopted in Rio de Janeiro in June 1992 and ratified by 192 countries. The United States was not one of them.

Different types of ecosystems are usually identified based on the types of native plant communities that occur in an area. Different ecosystems are found together in a geographical area called a biome that shares the same climatic conditions.



Ecosystems of the Upper Mississippi River Floodplain

Look at the cross-section of the Upper Mississippi River Floodplain. Low-elevation floodplain areas, which are usually inundated, support aquatic and wetland plants. Areas subject to frequent flooding support flood tolerant species. The least flood-tolerant plant species occur on well-drained, high elevation areas. Flooding is the major disturbance on low-elevation floodplains. Fire was once an influence on high-elevation floodplains, but fires have been suppressed and agriculture is currently the major influence.

Introduction 2.0

UNIT 2

This is a Landsat map of the Upper Mississippi River between Lock and Dam 8, near Genoa, Wisconsin, and Lock and Dam 7, near Dresbach, Minnesota. It was created using data collected by a Landsat satellite to map land cover and land use areas.

River floodplains create a dynamic mosaic of riverine, wetland, and grassland habitats that support a diverse variety of plant and wildlife species.

- **River channels**
- **Wetlands**
- **Grasslands**

Need to Know

- **Organism**: An individual living thing, such as a plant, animal, fungus, or bacteria.
- **Species**: A single kind of organism. All people are one species.
- **Population**: A group of the same species living in the same place at the same time.
- **Abiotic factors**: Non-living chemical and physical components in the environment, such as temperature, light, moisture, or air currents. Examples: rocks, soil, sunlight, water, air, and any items made by humans from non-living components, such as brick and cement.
- **Biotic factors**: The organic components in an environment that affect organisms. They consist of plant and animal organisms, both living and dead, as well as the results of their activities, including what they eat and defecate.
- **Biome**: A geographical area that shares the same climatic conditions.
- **Community**: Different populations of species that live and interact together. Several communities live together in an ecosystem.
- **Ecosystem**: Any group of living and nonliving things interacting with and dependent on each other to create a stable, self-sustaining system.
- **Biodiversity**: The number and variety of organisms in a given locality, community, or ecosystem.

Minnesota Dwarf Trout Lily *(Erythronium propullans)*

STANDARDS CORRELATION

Taken as a whole, this introductory lesson addresses several key science objectives. In addition to learning about populations and ecosystems (life science), students engage in hands-on scientific exploration, which helps them understand science as a human endeavor and gives them the foundation necessary to do scientific inquiry. They also begin to understand science from a personal and social perspective.

Incorporating the extension suggestions adds a new dimension to this lesson by including activities that feature fine arts and language arts standards.

Discussion (60 - 90 minutes)

Once students have completed the pre-assessment, begin the discussion by asking them to visualize their schoolyard or backyard. Prompt them by asking specific questions about key features, such as grassy and paved areas, paths, playground equipment, other children, flowers, and insects. Make a list of their answers.

Then ask students to think about their community, starting with their families and moving up to their street, neighborhood, town or city, and state.

Use these personal references as the context to define and discuss the key terms and concepts for this lesson to prepare students for the Explore Your Ecosystem activity. Emphasize biodiversity and discuss why it is important.

> *"The links between ecosystem and human health are many and obvious: the value in wetlands of filtering pollutants out of ground-water aquifers; the potential future medical use of different plants' genetic material; the human health effects of heavy metal accumulation in fish and shellfish. It is clear that healthy ecosystems provide the underpinnings for the long-term health of economies and societies."* – F. Henry Habicht, *EPA Journal*, September–October 1990

UNIT 2

Explore Your Ecosystem

Grades
5–6

Class or small group activity

30–45 MIN.

Depending on size of exploration area and distance from school

What you'll need

- Observation activity worksheet (page 73)
- Binoculars
- Magnifying glass
- Pencil
- Field guide
- Journal

Do Ahead

Explore the schoolyard and/or park before conducting this activity so you will have some ideas for where to have the students start exploring.

Do This

1. Open the door and step into your ecosystem! Go outside and investigate your schoolyard or a nearby park. Better yet, take a field trip to a National Wildlife Refuge near your school.
2. Investigate the surroundings and note the biotic and abiotic factors there – what living and non-living components can you find? Use the magnifying glass to view small items up close. Use the binoculars to view things far away.
3. Log your findings in your observation activity worksheet on the following page.
4. Start a journal. Check the same area weekly and update your journal.

Safety Tip

Be sure to review your safety rules before the trip.

Explore Your Ecosystem

Name _____ Date _____

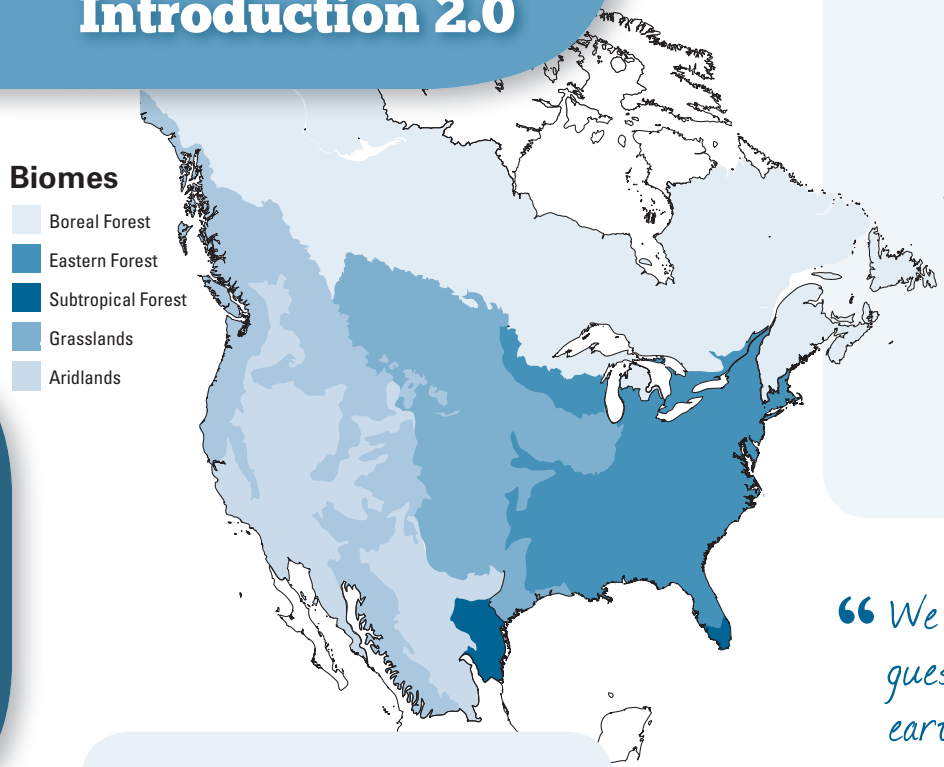
Biotic (birds, worms, plants)	**Abiotic** (rocks, bicycle, fence)	**Where you found it** (near the school entrance or by the swings)

Notes for your journal _____

_____

_____

_____



Fast Facts

- The U.S. Fish & Wildlife Service has identified and defined boundaries for 53 ecosystem units by grouping watersheds. To learn more, go to the U.S. Fish & Wildlife Service website (www.fws.gov) and search *Ecosystem Units*.

> "We have forgotten how to be good guests, how to walk lightly on the earth as its other creatures do."
>
> – Barbara Ward, *Only One Earth*, 1972

Extension Suggestions

~ Career launch

Invite a local **biologist**, **conservationist**, or **ecologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

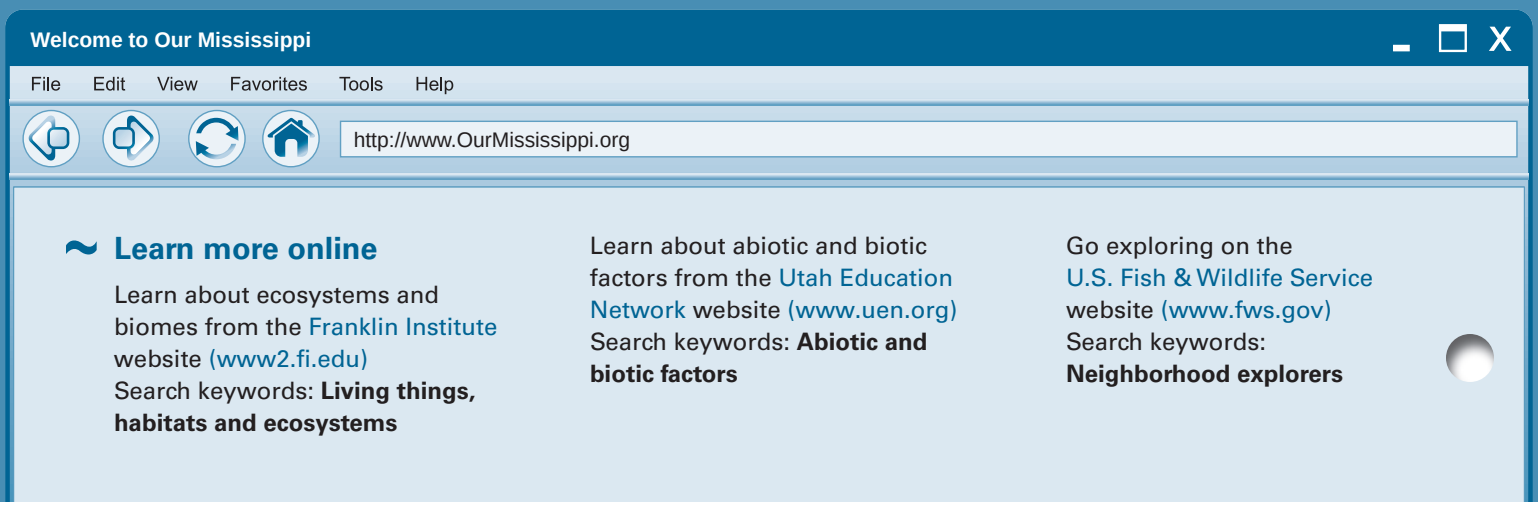
~ Get out!

- Take a field trip to a nature center or wildlife refuge and ask students to identify biotic and abiotic components or write in a journal. Call ahead for pre-visit materials for tips and ideas of other activities.
- Encourage students to ask their families to spend a day together at a nature center or wildlife refuge and present a report about what they learned to the class.

~ Express yourself!

Ask students to write a poem or paint a picture of their favorite spot outdoors that includes biotic and abiotic factors.

Consider doing a class photo journal on an aspect of water. Visit a park or a nature center to take photos and keep a diary of what you saw, heard, and felt. Write captions for your photos.



~ Learn more online

Learn about ecosystems and biomes from the Franklin Institute website (www2.fi.edu)
Search keywords: **Living things, habitats and ecosystems**

Learn about abiotic and biotic factors from the Utah Education Network website (www.uen.org)
Search keywords: **Abiotic and biotic factors**

Go exploring on the U.S. Fish & Wildlife Service website (www.fws.gov)
Search keywords: **Neighborhood explorers**

At Home in the River:

Plants, Animals, and Habitats of the Upper Mississippi River

Introduction

Lesson 2.1 At Home in the River: Plants, Animals, and Habitats of the Upper Mississippi River builds on the knowledge and skills learned in the last lesson about Upper Mississippi ecosystems to look at plant and animal communities at the habitat level. Students explore how living things are connected to their environment by creating a food chain checkers game and raising tadpoles.

Background

Home sweet home

A habitat is an organism's "home." It is the place where a population of plant or animal species naturally lives and grows. Habitats supply the basic needs for survival, such as food, water, shelter, and space, and vary in size depending on the species and the resources available. Many species may also have different habitat needs at different life stages and times of year.

All living things need energy to live, and they depend on each other for food. Food chains are more than just a collection of organisms that eat each other. They are also a conduit for the accumulation and transfer of energy. There are many habitats and food webs within an ecosystem.

Unit 2 goal reminder

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Understand how living things are connected to their environment

Lesson objectives

- Define terms related to ecosystems of the Mississippi River
- Research species connections in a food web
- Understand the importance of indicator species
- Care for tadpoles in an aquarium and record their development

Educational standards

- Life Science
- Science in Personal and Social Perspectives
- Fine Arts
- Language Arts

What you'll need

- 3 pieces of 20" x 20" poster board in 3 different light colors
- Pen or pencil
- Scissors
- Glue
- Checkerboard
- Frog eggs or tadpoles
- Aquarium or fish bowl with a screen top
- Pond, rain or conditioned water
- Fish food
- Sponge

How long it will take

- *Discussion/prep time:* 1 hr.
- *Activity 1 and 2:* 1 hr. each

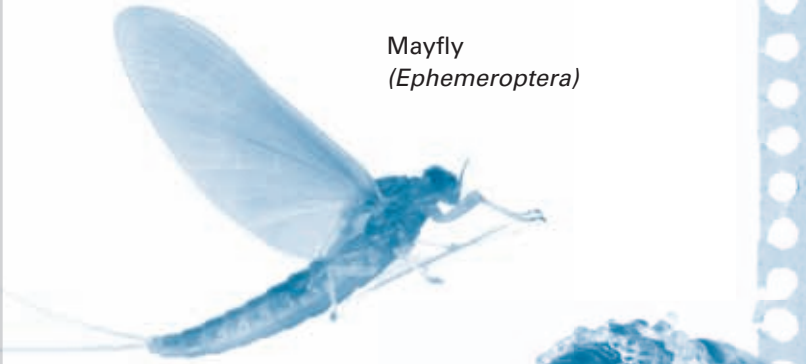
What's next!

Exploring why and how birds migrate

Indicator species

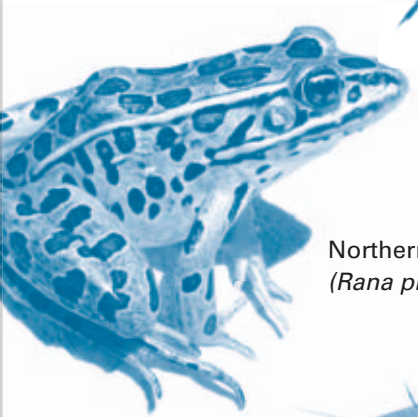
Some plant and animal species are especially sensitive to habitat changes, and are the first to show signs of stress when a habitat is unhealthy. Frog populations have been declining all over the world for years. Loss of habitat, water pollution, fungal disease, and predation by non-native species are a few of the causes.

Sources: Environmental Protection Agency (EPA); Mississippi National River and Recreation Area; Upper Mississippi River Conservation Committee; U.S. Fish & Wildlife Service, Midwest Region; U.S. Geological Survey (USGS) Upper Midwest Environmental Sciences Center; USGS Biological Resources Discipline; *The Facts on File Dictionary of Biology*, 3rd ed., by Robert Hine.



Mayfly
(Ephemeroptera)

Caddisfly Larvae
(Trichoptera)



Northern Leopard Frog
(Rana pipiens)

Flathead Catfish
(Pylodictis olivaris)

Need to Know

- **Predators**: Animals that kill and eat other animals.
- **Prey**: Animals that are killed and eaten by other animals.
- **Herbivores**: Animals that eat only plants.
- **Omnivores**: Animals that eat both plants and other animals.
- **Carnivores**: Animals that eat only other animals.
- **Invertebrates**: Animals without backbones, which includes about 95 percent of all animal species, such as insects, worms, spiders, crustaceans, and mollusks.
- **Crustaceans**: Large group of invertebrates that includes shrimp, crabs, and barnacles.
- **Mollusks**: Large group of invertebrates that includes snails, slugs, clams, and mussels.
- **Plankton**: Microscopic organisms that live in both salt and fresh water.
- **Phytoplankton**: Microscopic plants that live in or near the surface of the water.
- **Zooplankton**: Microscopic animals that eat other plankton, such as phytoplankton.
- **Habitat**: The place where a population of species makes its home and meets all of its needs for survival, including food, water, shelter, and space. Within each ecosystem, there are many different habitats that vary in size.
- **Riparian habitat**: The habitat along the bank of a river.
- **Food chain**: The relationships between organisms in a habitat arranged in order of predation (interactions between predators and prey).
- **Food web**: All the food chains in a particular habitat.
- **Photosynthesis**: The process though which plants make their own food from sunlight, water, and a gas called carbon dioxide.
- **Producers**: Organisms, such as plants and algae, that make their own food through photosynthesis.
- **Consumers**: Members of the food chain that eat other living things. There are four types, or trophic levels, of consumers:

  1. Primary consumers: Animals that only eat plants (herbivores), such as rabbits, deer, and elk. Many primary consumers are prey for consumers at higher trophic levels.

2. Secondary consumers: Animals that eat other animals, including both omnivores and carnivores.
3. Tertiary consumers: Carnivores that eat other carnivores.
4. Quaternary consumers (also called apex predators): Animals that are at the top of the food chain and have no predators within their ecosystem, such as the gray wolf, grizzly bear, bald eagle, osprey, great horned owl, coyote, lynx, and wolverines. Humans are also apex predators.

- **Scavengers:** Animals that eat dead things.
- **Detritus**: Small pieces of organic material from dead and decaying plants and animals.
- **Decomposers**: Living things that break down the cells of dead plants and animals into simpler parts, helping to return nutrients to the soil to be used by primary producers. Decomposers include fungi (mold), bacteria, and worms.
- **Bacteria**: Large group of single-celled organisms that live in soil, water, organic material, and the bodies of living plants and animals.
- **Recycling**: The act of using things again. When organisms die or produce waste, they become food for decomposers, which break down the organic matter into nutrients that can be used again by producers.
- **Indicator species:** A species whose presence, absence, or health tells us about the health of its habitat or ecosystem. Also called bioindicators. Fish, aquatic plants, and aquatic invertebrates are excellent indicator species because they:
  - live in the water for some or all of their life
  - differ in their tolerance to amount and types of pollution
  - live for several years

Sources: U.S. Fish & Wildlife Service, Midwest Region; U.S. Geological Survey (USGS) USGS Biological Resources Discipline; The Facts on File Dictionary of Biology, 3rd ed., by Robert Hine.

Discussion (about one hour)

Begin the **discussion about habitats** by asking students how their homes and communities provide them with the food and shelter they need to be healthy and safe. Use the context of their homes to introduce and discuss the key terms and concepts relating to species and habitats. Explain the difference between habitats and ecosystems. Once students understand the concept, move on to food chains.

Begin the **discussion about food chains** by asking students to log what they ate the day before and look up its nutritional information to determine where on the food chain their meals came from. Compare several different types of meals, from highly processed meals to whole foods, to get a wide range of foods from almost every trophic level. Use these personal references as the context to define and discuss the key terms and concepts.

STANDARDS CORRELATION

Used in its entirety, this lesson explores life science by examining populations and ecosystems in more detail. Students learn about the complex relationships between producers and the different levels of consumers. They see how energy is transferred through food chains and understand how organisms are categorized by their function in the ecosystem.

Students again engage in hands-on scientific exploration, which furthers their understanding of science as inquiry and as a human endeavor. Language arts and games are incorporated into this lesson to make the activities more engaging to a wide variety of learning styles. Extension suggestions offer ideas for deepening activities and incorporating personal and social perspectives.

Once students understand the complex relationships among species in a food chain, use another visual to show how many food chains create an ecosystem's food web.

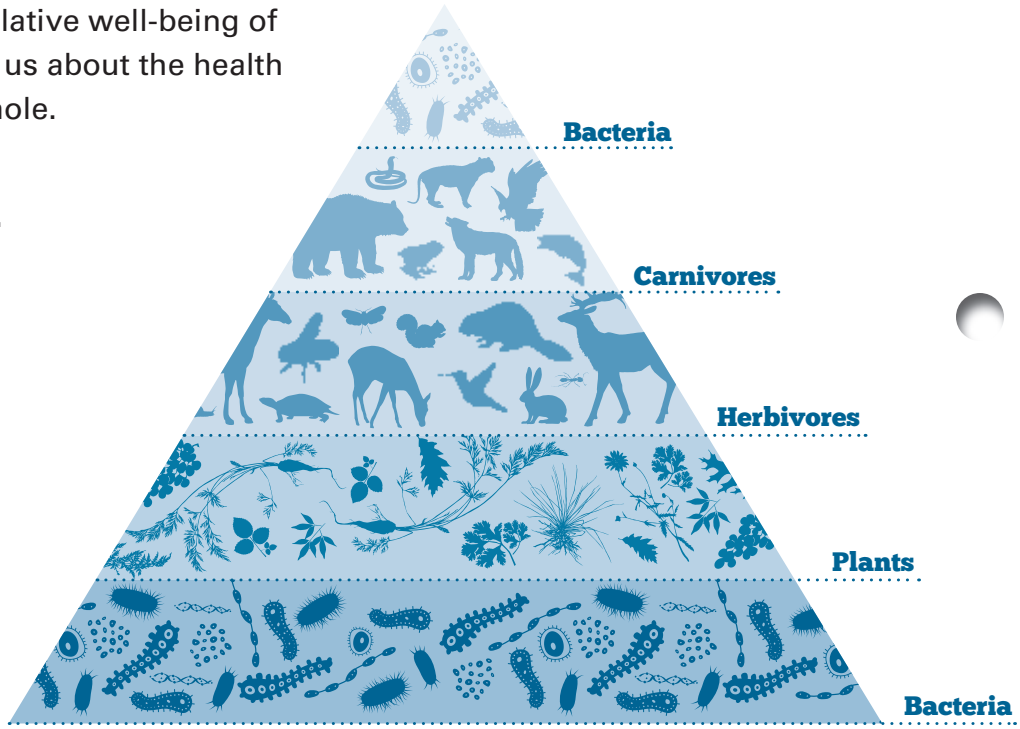
Finish the discussion by defining and discussing indicator species using the mayfly as an example. Mayflies are an excellent example of an invertebrate indicator species because of their varied tolerance for pollution and their role in the food chain as a major food source for fish. Discuss what the presence, absence, or relative well-being of mayfly populations tells us about the health of an ecosystem as a whole.

Teacher Tip

Use visuals to help students understand the complex interactions in food chains and food webs. The food chain table and the ecological pyramid will help students understand the relationships.

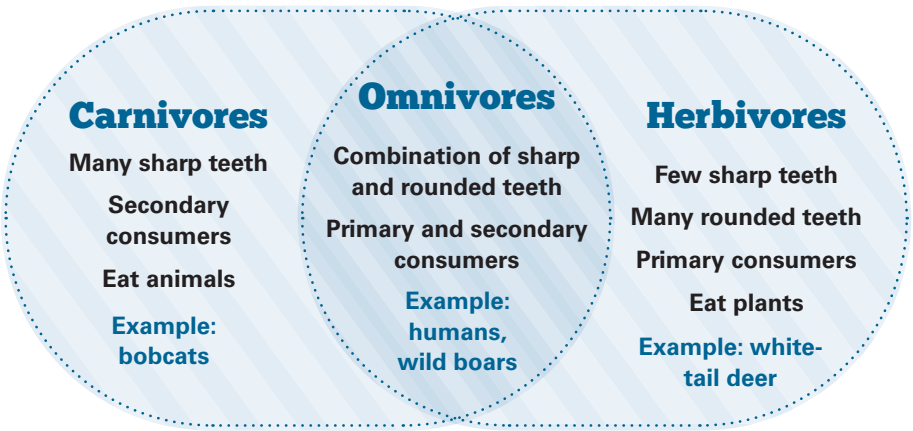
Ecological Pyramid

An ecological pyramid makes clear two important facts about food webs. It shows how the total number of organisms found in any one level decreases as you go up the pyramid, which means the amount of available energy decreases as well. For example, let's say an ecosystem that contains 10,000 lettuce plants can support 100 rabbits, but only 10 owls, and just 1 hawk.



Venn Diagram

Use a Venn Diagram to help students understand how the terms producers and consumers relate to herbivore, carnivore, and omnivore as well as the terms predator and prey. Describe and discuss their different roles.

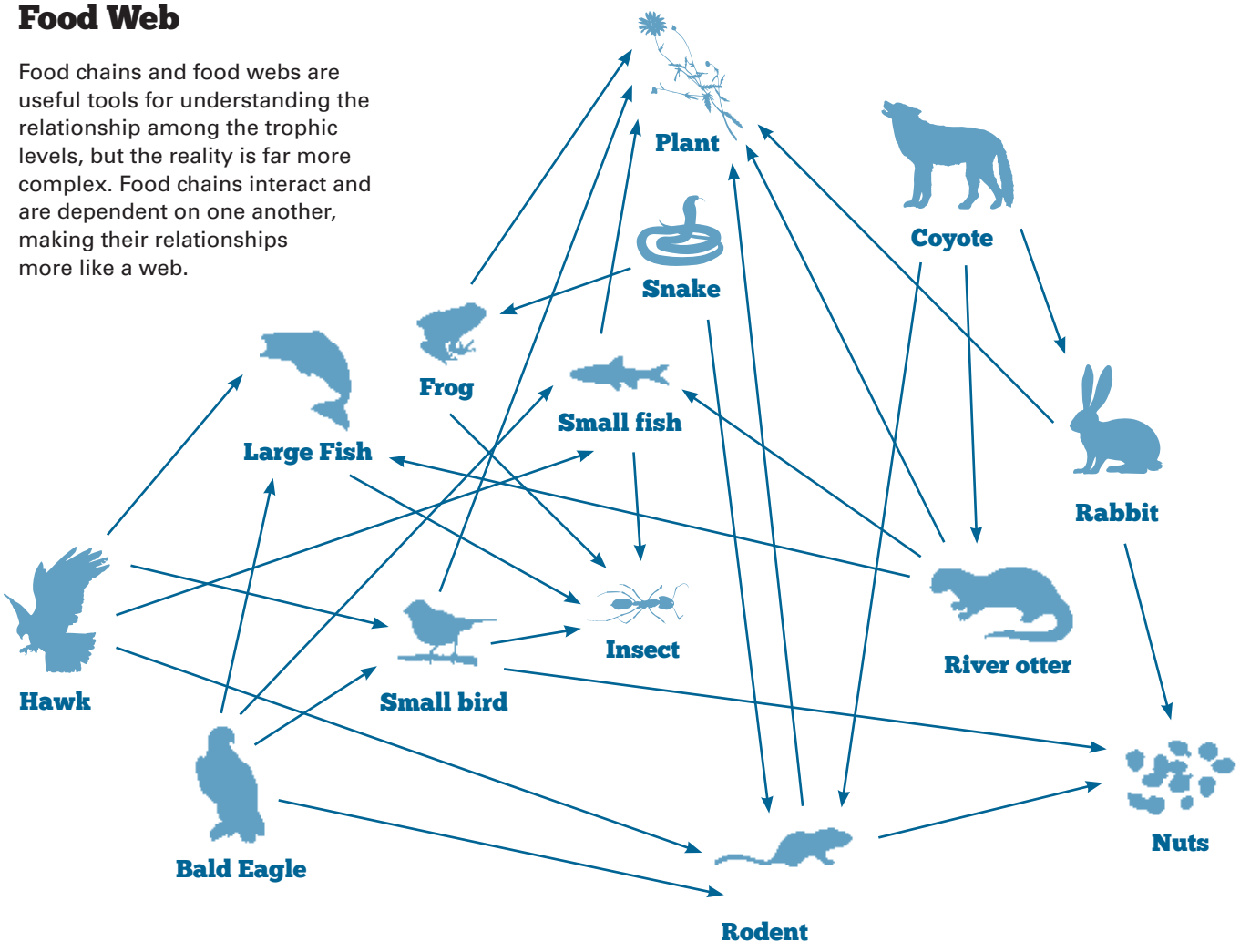


Trophic Level: The position of an organism in a food chain

Trophic Level	Grassland Ecosystem	Wetland Ecosystem	River Ecosystem
Decomposers	Worms	Fungi (mold)	Bacteria
Primary Producers	Grass	Algae and Aquatic Plants	Phytoplankton
Primary Consumers	Grasshopper	Mosquito Larva	Minnow
Secondary Consumers	Rat	Dragonfly Larva	Crayfish
Tertiary Consumers	Snake	Fish	Fish
Quaternary Consumers	Hawk	Raccoon	River Otter

Food Web

Food chains and food webs are useful tools for understanding the relationship among the trophic levels, but the reality is far more complex. Food chains interact and are dependent on one another, making their relationships more like a web.



Fast Facts

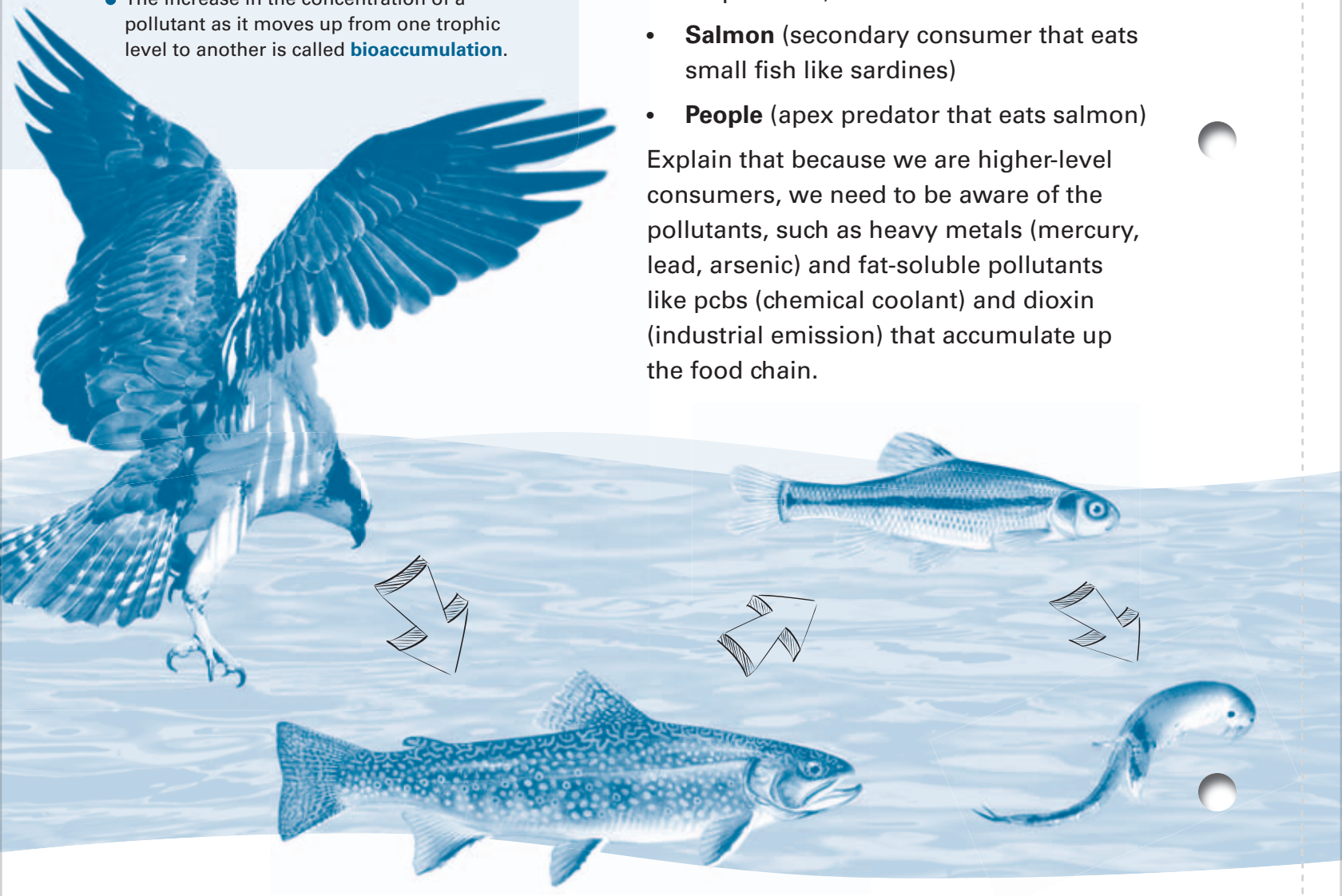
- Only 6% of the native habitats of the Upper Mississippi River floodplain remain today.
- The Upper Mississippi River floodplain is home to more than 50 species of mammals.
- At least 163 species of fish live in the Mississippi River.
- At least 45 species of amphibians and reptiles inhabit the Upper Mississippi River area.
- There are more than 50 documented species of mussels in the Upper Mississippi River.
- The increase in the concentration of a pollutant as it moves up from one trophic level to another is called **bioaccumulation**.

Bonus Round Discussion

If you have the time, build on the meal analysis discussion to explore the implications of eating higher or lower on the food chain. For example, describe the health benefits of omega 3 fatty acids, such as preventing disease (cancer and cardiovascular disease) and improving brain and immune system functioning. Then identify the different food sources of omega 3 and their place in the food chain:

- **Flaxseed oil** (primary producer)
- **Sardines** (primary consumer that feeds on plankton)
- **Salmon** (secondary consumer that eats small fish like sardines)
- **People** (apex predator that eats salmon)

Explain that because we are higher-level consumers, we need to be aware of the pollutants, such as heavy metals (mercury, lead, arsenic) and fat-soluble pollutants like pcbs (chemical coolant) and dioxin (industrial emission) that accumulate up the food chain.



Food Chain Checkers

Grades

5–6

Class or small group activity

1–3 CLASSES

depending on student research time

What you'll need

- 3 pieces of 20" x 20" poster board in 3 different colors, each light enough to write on
- Pen or pencil
- Scissors
- Glue
- Checkerboard
- Activity worksheets (page 83)

What's for Dinner?

Students learn about the connections among species in a food web by researching what local animals eat and creating a Food Chain Checkers game based on the trophic levels of the animals they choose.

Do This

Step A: Warm-up

1. Have each student research at least two local species to discover what they eat.
2. Discuss their findings and record them on the board.
   - You will need a minimum of 12 species for each student to make enough checkers to play a game.
   - Be sure to include humans.
   - Consider including pelican, sandpiper, least tern, sanderling, plover, bald eagle, and osprey in preparation for Lesson 2.2 on bird migration.

Step B: Complete the Food Chain Chart

1. Ask students to complete a food chain for each ecosystem in the *Who Eats Whom?* activity worksheet on page 83. Use the chart below to help students who have difficulty assigning species to the trophic levels for each ecosystem.
2. Ask students to pick 12 species from their Food Chain Chart to play checkers.

LEVEL	Grassland ecosystem	Wetland ecosystem	River ecosystem
Producers	1. Grass	1. Algae & aquatic plants	1. Phytoplankton
Primary consumers	2. Grasshopper	2. Mosquito larva	2. Minnow
Secondary consumers	3. Rat	3. Dragonfly larva	3. Crayfish
Tertiary consumers	4. Snake	4. Fish	4. Fish
Quaternary consumers	5. Hawk	5. Raccoon	5. River otter

Step C: Make the checkers

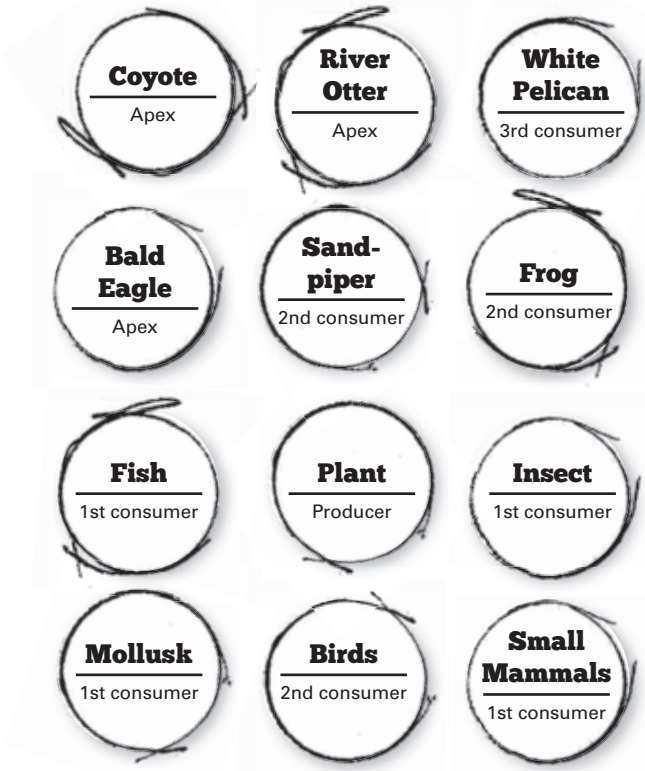
1. Have students work in teams of two to make and play one game of checkers.
2. Choose two colors to use to make the checkers.
   - Cut out 12 circles sized to fit in the size of the squares.
   - On one side write the name of each species and its trophic level (decomposer, primary producer, primary consumer, secondary consumer, tertiary consumer, or apex consumer).
   - The other side is left blank unless the checker reaches the opposite side of the board. If that happens, have students turn the checker over and write apex on the blank side.

Step D: Rules of the game

1. Place the highest-level consumers at the back of the board and the lowest level in front.
2. To play, move diagonally like checkers. Capture checkers by "eating" (i.e., diagonally jumping over) any species that are on a lower trophic level, which represents a legal move. Remove the jumped checker.
3. Checkers that reach the last row of the opposite side of the board become apex predators. Have students turn over that checker and write "apex" on the blank side. It can now legally jump any piece.
4. Game ends by capturing all of the opposing player's pieces, by leaving the opposing player with no legal moves, or with a draw.

Teacher Tip

If pressed for time, use the sample checkers below instead of asking students to make their own.



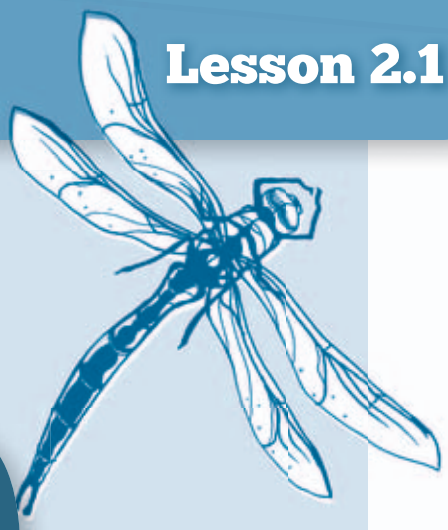
Who Eats Whom?

Name _____ Date _____

LEVEL	Grassland ecosystem	Wetland ecosystem	River ecosystem
Primary producers	1. Grass	1. Wetland plants	1. Phytoplankton
Primary consumers	2.	2.	2.
Secondary consumers	3.	3.	3.
Tertiary consumers	4.	4.	4.
Quaternary consumers	5.	5.	5.

Make food chains for three types of ecosystems (grassland, wetland, and river) by filling in the chart above with the appropriate species for each trophic level. Use species from the list below or research your own examples.

1. **Turtles** eat: snails, crayfish, insects, small fish, aquatic plants
2. **Muskrats** eat: a variety of plants
3. **Great blue herons** eat: fish, invertebrates, small mammals, reptiles, amphibians
4. **Crayfish** eat: detritus, small fish, plants, snails, plankton
5. **Frogs** eat: insects, invertebrates, plants
6. **Tadpoles** eat: phytoplankton
7. **Mosquitos** eat: plant nectar and blood
8. **Dragonflies** (adults) eat: mosquitoes, flies, bees, ants
9. **Zooplankton** eat: phytoplankton
10. **Largemouth bass** eat: zooplankton, crayfish, small fish, frogs
11. **Pond snails** eat: detritus and plants
12. **Bluegills** eat: insects, larvae, crustaceans, plants
13. **Raccoons** eat: plants, crayfish, frogs, fish
14. **Minnows** eat: small snails, zooplankton, insect larvae
15. **River otters** eat: crayfish, freshwater mussels, fish, frogs
16. **Bacteria** eat: detritus (dead or decaying organic matter)
17. **Bobcats** eat: rabbits, rodents, squirrels, birds, fish, insects
18. **Spiders** eat: flies, insects, other spiders
19. **Humans** eat: plants, mammals, birds, fish, crayfish
20. **Coyotes** eat: rabbits, rodents, squirrels, birds, fish, insects, snakes
21. **Owls** eat: small mammals, rodents, small occasional bird
22. **Horses** eat: grass, hay, grain
23. **White pelicans** eat: small fish, salamanders, crayfish
24. **Sandpipers** eat: insects, small crustaceans, mollusks
25. **Least terns** eat: small fishes, shrimp, invertebrates
27. **Plovers** eat: insects, larvae, marine worms
28. **Bald eagles** eat: fish, waterfowl, shorebirds, small mammals, turtles, carrion
29. **Ospreys** eat: fish, snakes, voles, squirrels, muskrats



UNIT 2

Raising Tadpoles

Grades
5–6

Class or small group activity

12 WEEKS

1 hour to start. Half day if combined with a field trip. Ongoing project lasting up to 12 weeks.

By caring for tadpoles and witnessing their metamorphosis into frogs or toads, students understand that some species may also have different habitat needs at different life stages and times of year. They also learn about the importance of clean water.

Teacher Tip

It usually takes between 6 and 12 weeks for some species to grow from egg to tadpole to frog.

What you'll need

- Frog eggs or tadpoles (about 2 or 3 tadpoles per quart of water)
- Aquarium or fish bowl (about 10 gallons) with a screen top
- Pond, rain, or conditioned water
- Fish food
- Sponge
- Gravel and aquatic plants (if desired, but not necessary)
- Activity worksheet (page 87)
- Be sure to get permission from property owner before collecting pond water or other items, and do not release non-native species into the environment

Do This

1. Set up tadpole aquarium. Depending on where you get the tadpoles and what kind of water you use, this may take several days.
   - Clean, chlorine-free water is essential for tadpoles. Rain or pond water is best.
   - If using tap water, condition it with chlorine removers from a pet store or leave it in the sunlight for two days to break down the chlorine.
2. Get frog eggs or tadpoles.
   - Buy frog eggs or tadpoles online or from a pet or a pond supply store. Ask for the scientific name and find out the specific habitat and food requirements for that species.

- If you are doing this lesson in early spring, consider taking the class on a field trip to gather frog eggs or tadpoles. Be sure to get permission from property owners before collecting pond water or other items.
  - Timing. It's best to gather eggs in early spring so they turn into frogs before school ends.
  - Get ready. Wear the right clothes for the weather and the place.
  - Know when and where to go. Listen for frog calls. That lets you know the time is right. Look in still ponds, puddles, and ditches near the water's edge. Frogs usually lay their eggs around tall grasses or submerged sticks or logs.
  - Know what to look for. The eggs are together in a large clump of jelly. Each egg has a dark center (the tadpole) and a jelly "egg" around it.
  - Scoop up a clump of eggs along with some pond water, mud, and plants.

3. Care and feeding.
   - The pond plants you collect provide plenty of food during the first days of hatching. After that, feed the tadpoles about twice per week. They will eat finely ground fish food or spinach and lettuce leaves that have been briefly boiled.
   - If the tank gets too dirty, replace with fresh pond or rainwater. If you have to use tap water, remember to condition it first.

There Was an Old Lady Who Swallowed a Fly

There was an old lady who swallowed a fly.
I don't know why she swallowed the fly,
I guess she'll die.

There was an old lady who swallowed a spider,
that wiggled and wiggled and tickled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
I guess she'll die.

There was an old lady who swallowed a bird.
How absurd to swallow a bird.
She swallowed the bird to catch the spider,
that wiggled and wiggled and tickled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
I guess she'll die.

There was an old lady who swallowed a cat.
Imagine that, she swallowed a cat.
She swallowed the cat to catch the bird.
She swallowed the bird to catch the spider,
that wiggled and wiggled and tickled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
I guess she'll die.

There was an old lady who swallowed a dog.
My what a hog, to swallow a dog.
She swallowed the dog to catch the cat.
She swallowed the cat, to catch the bird,
She swallowed the bird to catch the spider,
that wiggled and wiggled and tickled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
I guess she'll die.

There was an old lady who swallowed a cow.
I don't know how she swallowed a cow.
She swallowed the cow to catch the dog.
She swallowed the dog, to catch the cat.
She swallowed the cat to catch the bird.
She swallowed the bird to catch the spider,
that wiggled and wiggled and tickled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly
I guess she'll die.

I know an old lady who swallowed a horse...
She's dead of course!

—Rose Bonne

Teacher Tip

Ask students to find the flaw in this nursery rhyme's food chain.

- When the tadpoles start developing legs, they need some sort of perch so they can get out of the water. Floating water lily leaves and branches are ideal, but a sponge will work. Make sure to keep a screen across the top.

4. Have students observe the tadpoles daily and record their development in a journal, lab report, or online.

5. What to expect:
   - Back legs will develop first, then front legs.
   - Tails are resorbed after front legs emerge.
   - Once the tadpole's tail is gone, it is considered a frog.

6. If you gathered eggs or tadpoles from a local pond or stream, release your frogs back to where you found them. Be sure to get appropriate permissions before releasing the frogs. If you choose to keep the frogs, you need to begin to feed them insects and give them firm ground as well as lots of water. **However, if you purchased your eggs or tadpoles from a store, do not release them into the environment.** They may not be a native species, and many states have laws prohibiting the release of aquarium fish and amphibians for fear of introducing diseases or invasive species.

Raising Tadpoles

Journal Page

Name _____ Date _____

Lesson 2.1

> *Our challenge for the future is that we realize we are very much a part of the earth's ecosystem, and we must learn to respect and live according to the basic biological laws of nature.* – Jim Fowler

Extension Suggestions

~ Career launch

Invite a local ecologist, biologist or conservationist to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ You are what you eat

Ask students to talk to their parents about where in the food chain their meals come from and think about the health and environmental implications for the way they eat.

~ Get out!

Go on a tour of a local food processing plant.

~ Express yourself!

As a class activity, ask students to write a poem about food webs using cumulative verses similar to "There Was An Old Lady Who Swallowed A Fly." Each student adds a verse and then repeats the entire poem.

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

~ Learn more online

Contribute to the food web by helping decomposers do their thing both at home and at school. Learn about composting from the Environmental Protection Agency website (www.epa.gov) and search keywords: ***Backyard composting***

Learn more about the indicator species from the Environmental Protection Agency website (www.epa.gov) and search keywords: **Indicator Species**

~ Grades K–4 Extension

Recycle, reuse, reduce: what on earth can you do with an old jelly jar? Go to Environmental Protection Agency website (www.epa.gov) and search keywords: **EPA waste kids education**

~ Volunteer!

- Visit the Living Lands & Waters website (www.livinglandsandwaters.org) Click on **Get Involved.**

~ Get involved

- There are many opportunities to help protect and restore habitat along the Upper Mississippi River. Find out how at the Mississippi River Wild website (www.mississippiriverwild.com) Click on **volunteer.**
- Contact local, state, or federal agencies for volunteer opportunities.

Just Passing Through:

Bird Migration and the Mississippi River Flyway

Introduction

Lesson 2.2 Just Passing Through: Bird Migration and the Mississippi River Flyway uses the knowledge and skills learned in the last lesson about habitats and food chains to understand the habitat needs of migratory birds. In this lesson, students recreate the Mississippi Flyway in the classroom or schoolyard and take a birdwatching field trip.

Background

Bird migrations are among nature's most dramatic events. Birdwatching is the fastest growing outdoor activity in America. It is one of the best ways to connect students with nature and science.

Need To Know

- **Migration**: Migration is the movement of a species from one place to another, often following a change of season.
- **Migration route**: The paths taken during the course of migration by a single bird species.
- **Stopovers**: Places where birds stay for a brief time during their migration.
- **Breeding grounds**: The area where an animal mates and produces offspring.
- **Flyway**: General flight routes used by many migrating bird species between their wintering grounds and their breeding grounds. There are four major migratory flyways in North America: Atlantic, Mississippi, Central, and Pacific Flyways.
- **Wetlands**: An area of land where the soil is saturated with moisture some (seasonally) or all of the time.
- **Riparian habitat**: Riparian is the habitat along the bank of a river.

UNIT 2

Unit 2 goal reminder

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Understand why the Mississippi Flyway is a major migration route for birds

Lesson objectives

- Define terms related to ecosystems of the Mississippi River
- Research migration routes and identify stopovers
- Create a flyway in your classroom
- Prepare for a birdwatching field trip
- Go birdwatching

Educational standards

- Life Science
- Science in Personal and Social Perspectives
- Geography
- Fine Arts
- Language Arts

What you'll need

- Chairs, desk, or safety cones
- Paper and clipboard
- Tape
- Student journals
- Pencils and crayons
- Binoculars
- Hat
- Waterproof boots or shoes
- Field guide

How long it will take

- *Discussion:* 20 min.
- *Activity 1:* 60 min.
- *Activity 2:* Half-day field trip

What's next?

Assessing the health of the Mississippi River

Why do birds migrate?
The reasons are complex and not fully understood, but the simple answer is because they can. The ability to fly allows birds to seek out the best places to find food and safe places to breed and to escape harsh winter weather.

Migration is no easy feat, however. Migrating birds must endure storms, bad weather, exhaustion, and natural obstacles such as mountain ranges. They also encounter many human-made challenges and obstacles as well, including habitat destruction, pollution, and structures that disorient them, such as skyscrapers and lighthouses.

All kinds of birds migrate, from large cranes and geese to small songbirds and tiny hummingbirds. A few species fly non-stop, some for several days, covering great distances. But most birds stop along the way to rest and refuel. Finding habitat that will provide them with the food and shelter they need during their journey is vital to their survival.

Fast Facts

- 65% of all bird species migrate.
- About 326 bird species—60% of all North American birds—use the Mississippi River Basin as their migratory flyway.
- 40% of all North American migratory waterfowl use the Mississippi River corridor during their spring and fall migration.
- The Riverlands Migratory Bird Sanctuary (RMBS) is designated an Important Bird Area by the National Audubon Society.
- The Upper Mississippi River National Wildlife and Fish Refuge is designated a Globally Important Bird Area. Many species of birds stopover or nest along its 261 miles of Mississippi River floodplain from Wabasha, MN, to Rock Island, IL:
  - 50% of canvasback ducks
  - 20% of the eastern U.S. population of tundra swans
  - 167 active bald eagle nests in recent years
  - 2,700 bald eagles stop during spring migration
  - 5,000 herons and egrets nest in up to 15 colonies

STANDARDS CORRELATION

In this lesson, we continue to explore life sciences while developing research skills. Students use traditional library research methods as well as Internet technology to discover information about bird migrations and the Mississippi Flyway. They then apply life science and geographic knowledge and use their creativity in the Classroom Migration activity, which incorporates visual arts standards by asking students to draw, paint, or build dioramas of migration stopovers. By exploring the habitat requirements of migratory birds, students also gain insight into the balance needed between wetland protection and economic development, which aligns with science in personal and social perspectives standards.

How do they know when it's time to go?
The change in the length of daylight, which causes hormonal changes in birds, is the main cue that lets birds know it's time to migrate. As the time to migrate approaches, birds eat as much as they can to store energy for the trip.

How do birds find their way?
Scientists are still investigating all the possible ways birds navigate during long migrations, but many believe birds orientate themselves using the position of the sun during the day and the stars at night, just as humans have done for millennia. Studies also suggest birds use a combination of other abilities, including sensing the earth's magnetic fields and using visual landmarks such as coastlines, rivers, and mountains.

Mississippi Flyway
Birds follow the Mississippi Flyway to fly from central Canada to the Gulf of Mexico. Some use it to migrate from the Arctic Ocean to Patagonia in South America. They choose this route because of its north-south orientation, lack of large obstacles such as mountain ranges, and its abundance of habitat, including channels, backwaters, sloughs, wetlands, and adjacent uplands.

Going the distance
Several species make incredibly long migrations each year traveling from summer breeding grounds to winter feeding areas.

- **American avocets** prefer open water and marshy habitats as they migrate between southern wintering and northern breeding grounds.
- **American white pelicans** travel along the Mississippi River Flyway between their summer breeding grounds in central Canada and their wintering grounds in the southern United States and Central America.
- **Barn swallows** migrate more than 6,000 miles each year from the arctic to South America.
- **Sandhill cranes** depend on wetlands as places to rest and refuel on their spring and fall migrations from southern United States and Mexico to Canada.
- **Tundra swans** can fly as fast as 80 miles per hour and as high as 4,000 feet.

Fun Fact!

The **monarch** is the only butterfly that migrates north and south. No one individual can make the entire trip. It takes three or four generations to complete the migration from Mexico to Canada and back again. During the migration female monarchs lay their eggs along the way and their offspring finish the trip.

American avocets

American white pelican

Barn swallow

Sandhill crane

Tundra swan

Monarch butterfly

Something Told the Wild Geese

Something told the wild geese
It was time to go.
Though the fields lay golden
Something whispered, "Snow."
Leaves were green and stirring,
Berries, luster-glossed,
But beneath warm feathers
Something cautioned, "Frost."
All the sagging orchards
Steamed with amber spice,
But each wild breast stiffened
At remembered ice.
Something told the wild geese
It was time to fly—
Summer sun was on their wings,
Winter in their cry.

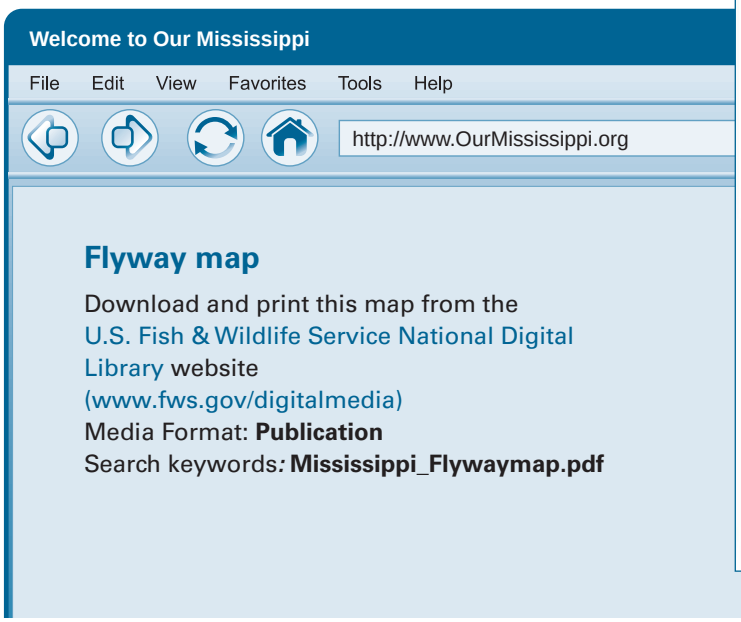
– Rachel Field

Discussion (about 20 minutes)

Begin the discussion about bird migration by asking students questions about how their families prepare for a long trip. Do they plan trips based on the seasons? How do they find their way? What do they eat? Where and how often do they stop to rest or sleep? Use this personal context to introduce students to vocabulary and key concepts about bird migration and center the discussion on the three main questions:

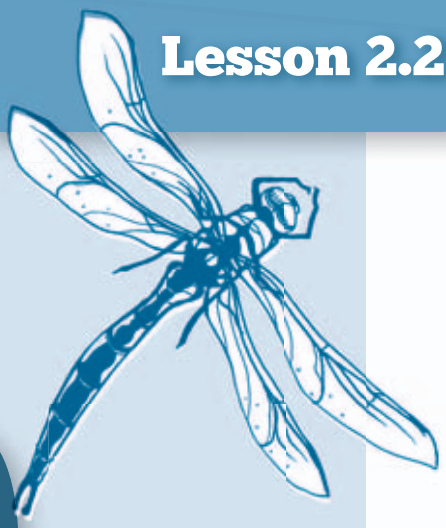
Why do birds migrate?
How do they know when it's time to go?
How do birds find their way?

Introduce the Mississippi Flyway as one of four important migratory flyways in North America using the flyway map and discuss the importance of wetlands to migrating birds.



Flyway map

Download and print this map from the U.S. Fish & Wildlife Service National Digital Library website (www.fws.gov/digitalmedia)
Media Format: **Publication**
Search keywords: **Mississippi_Flywaymap.pdf**



UNIT 2

Mississippi Flyway

Classroom Style

Grades

5–6

Class or small group activity

1 HOUR

Plus student research time

What you'll need

- Chairs, desks, or safety cones (if outside)
- Paper for drawing stopovers
- Paper for labeling stopovers and birds
- Student journals
- Tape
- Pencils
- Crayons
- Field guide
- Clipboard or other hard surface to write on
- Game cards (pages 96-97)

Create a classroom "Mississippi Flyway" and have the students migrate around the room as birds.

Do This

Step A: Warm-up

1. Identify a cast of migratory birds for students to choose from and write them on the board. The Mississippi Flyway is used by large numbers of ducks, geese, shorebirds, blackbirds, sparrows, warblers, and thrushes. Suggestions for species: lesser scaup (duck), ring-neck duck, wood duck, hummingbird, northern shoveler (duck), American golden plover (shorebird), sanderling (shorebird), killdeer (shorebird), lesser yellowlegs (shorebird), Lincoln's sparrow, Tennessee warbler, Swainson's thrush, peregrine falcon (raptor), osprey (raptor), great egret, Caspian tern, and American white pelican.
2. Ask individual students or small groups to select one or more species to research. They will become that species (as an individual or a flock) for the classroom flyway activity. They should find out:
   - What their species eats
   - Where their species rests
   - What are hazards their species may encounter

Teacher Tip

If possible, include more if you have the time and space. Adding local stopovers, such as community parks or farmers' fields, will add interest and relevance.

3. At a minimum, ask students to research the following Mississippi Flyway stopovers, noting the mix of ecosystems each contains (grassland, wetland, and riparian habitats).
   - Mississippi National River and Recreation Area
     - **www.nps.gov**, search keywords "Mississippi River facts"
   - Upper Mississippi River National Wildlife and Fish Refuge (along the river in four states)
     - **www.fws.gov**, search keywords "Upper Mississippi refuge"
   - Great River National Wildlife Refuge
     - **www.fws.gov**, search keywords "Great River refuge"
   - Delta National Wildlife Refuge
     - **www.fws.gov**, search keywords "Delta refuge profile"
   - Riverlands Migratory Bird Sanctuary
     - **www.mvs.usace.army.mil/rivers/RMBS.html**
4. Ask students to draw pictures of the ecosystems at each stopover.
5. Locate and label the flyway stopovers and the wall map.

Step B: Get ready

1. Rearrange the classroom to create at least five stopovers using chairs, desks, or safety cones (if outside or in the gym).
2. Designate each area as one of the flyway stopovers researched in class and mark with student drawings.
3. Print and cut out five sets of game cards. Each set includes Go, Stop, and Yield cards.
   - **GO** cards send students forward.
   - **YIELD** cards make students pause, perform a task, and continue their journey.
   - **STOP** cards mean that particular bird dies on the journey.
   - **GO BACK** cards make students encounter a hazard and go back to a previous rest stop.
4. Put a set of cards at each stopover.

Step C: Migrate!

1. Have students use the game cards included in the lesson to migrate their bird around the classroom "flyway," first north and then south with stops at the appropriate stopovers.
2. At each stopover station, students read the card aloud and move accordingly. If students pull a STOP card, they should die a dramatic death and return to their seats OR they may join another student as part of their flock. The joining student follows the main student and does whatever his/her card says, as in "follow the leader."
3. Ask students to log their journeys in a logbook or journal.

Game Cards

Copy this page 1-sided and cut each card out. *Students take a card and read it aloud, place that card on the bottom of the deck and follow the directions. Students who "die a dramatic death" may join another student as part of his/her flock, following the first student's lead.*

GO

Sunny day. Perfect day for flying. **Fly on to the next stopover.**

GO BACK

Wetland is GONE! Someone built an apartment building. **Go back 1 stopover to rest and eat.**

YIELD

POURING! Heavy rain. **Stay here until you count to 100. Then fly on to the next stopover.**

STOP

OH NO! Eaten by a predator. **Die a dramatic death. Log your death.**

GO

Catch a breeze! **Fly on to the next stopover.**

YIELD

OUCH! Diving for a fish, you get a hook in your wing. **Stay at this stopover until an Audubon volunteer removes it. Stretch your wings 5 times. Then fly on to the next stopover.**

YIELD

Caught! A scientist is banding your legs so your flight can be tracked. **Kick and flap your wings 10 times. Then fly on to the next stopover.**

STOP

Bright lights ahead! Whoa, the lighthouse beam confused you. You crashed into it. **Die a dramatic death. Log your death.**

GO

Ride'em…barge? Caught a ride on a barge. **Go to the next stopover.**

YIELD

Smell that! It's your favorite food. You stay to eat your fill. **Sing a happy song. Then fly on to the next stopover.**

GO BACK

Holy frozen fish! Pond stopover is still frozen. **Go back 1 stopover.**

STOP

Watch OUT. Airplane ahead. Oh No! You flew into it. **Die a dramatic death. Log your death.**

GO

Mmmm good! A farmer has planted your favorite berries. **Fly on to the next stopover.**

YIELD

BRRRRR Frost last night. **Flap your wings 10 times to warm yourself. Then fly on to the next stopover.**

YIELD

Whew! You have been flying all night and are very tired. **Count to 100 while you rest some more. Then fly on to the next stopover.**

STOP

OH NO! You flew into the side of a glass building. **Die a dramatic death. Log your death.**

Game Cards

Copy this page 1-sided and cut each card out. *Students take a card and read it aloud, place that card on the bottom of the deck and follow the directions. Students who "die a dramatic death" may join another student as part of his/her flock, following the first student's lead.*

GO

Flying high! You flew high enough to catch a fast tailwind. **Fly on to the next stopover.**

YIELD

Yuck! Someone sprayed the field with pesticide. **Roll on the floor and moan 6 times. Then fly on to the next stopover.**

YIELD

Tornado blew you off course. **Spell "migration" aloud 5 times. Then fly on to the next stopover.**

GO

Hooray! You made it to a National Wildlife Refuge! Your're protected here. **Fly on to the next stopover.**

GO

Do you hear birds singing! **Sing your favorite song. Then fly on to the next stopover.**

YIELD

You spotted a potential mate. Do a courtship dance! **Flap your arms and run in circles while you count to 50. Then fly on to the next stopover.**

GO

Yum. School kids planted some of your favorite food. Now you're all fueled up. **Fly on to the next stopover.**

STOP

OH NO! You got caught by someone's cat. **Die a dramatic death. Log your death.**

GO

Mayflies are hatching! Mayflies are hatching! **Eat up and fly on to the next stopover.**

YIELD

Holy Hurricane, Batman! Blown off course. **Circle the stopover 10 times. Then fly on to the next stopover.**

YIELD

Watch Out! Almost hit by a jet ski. **Lie down and count to 10. Then fly on to the next stopover.**

YIELD

Pea Soup? Fog? **Draw a picture of yourself as a bird as you wait for the fog to clear. Then fly on to the next stopover.**

STOP

OH NO! You perched on a faulty power line. **Die a dramatic death. Log your death.**

YIELD

Hold up! The youngsters need to rest. **Hop on 1 foot and recite the 4 times table. Then fly on to the next stopover.**

STOP

OH NO! You cannot find a safe place to stop! You become too tired to go on. **Die a dramatic death. Log your death.**

GO

Students created bird habitat in their schoolyard! It's the perfect place to eat and rest. **Fly on to the next stopover.**

Stopover Labels

Copy this page 1-sided and cut each label out. *To add your city park or another regional stopover, adjust your copier so that the light gray box description does not copy. Enlarge these labels on the copier as necessary. Then fill in your regional stopover. Suggestion: Have students draw, paint or build dioramas for each stopover.*

Canada

Upper Mississippi River NWFR, MN

Upper Mississippi River NWFR, WI

Upper Mississippi River NWFR, IL

Upper Mississippi River NWFR, IA

Two Rivers National Wildlife Refuge, IL

Riverlands Migratory Bird Sanctuary, MO

Great River National Wildlife Refuge, MO

Delta National Wildlife Refuge, LA

Central America

(Your City Park)

NWFR = National Wildlife and Fish Refuge

Bird Watching Field Trip

Grades

5–6

Class or small group activity

4 HOURS

1 half day field trip

What you'll need

- Observation sheet (pages 100-101) or a notebook journal
- Paper
- Pencil
- Clipboard
- Binoculars
- Hat
- Waterproof boots or shoes
- Field guide

During spring or fall, take students on a half-day field trip to a local birding hotspot or National Wildlife Refuge to watch birds. You can find a map of refuges on the U.S. Fish & Wildlife Service website: www.fws.gov/refuges.

Do This

1. Prior to the field trip, have each student research four common migratory bird species in your area, focusing on identifying features, habitat, food sources, and migration destination. See the list of birds in Activity 1 on page 94 for suggestions.
2. At the site, remind students they are guests in the birds' home. They should talk softly, walk slowly, and observe birds from a distance using binoculars so as not to disturb them, especially birds on nests.
3. Have students complete their observation sheets in the field and draw a picture of each bird.

Teacher Tip

*The American Museum of Natural History's book, **Birds of North America**, is an excellent reference about birds.*

Once threatened with extinction, the eastern bluebird has made a strong comeback, thanks to backyard birders who put up and monitored nesting boxes.

Activity Extension

~ Become a citizen scientist

Students can become citizen scientists by recording their sightings online at Cornell Lab of Ornithology's eBird website ***www.ebird.org***. Click **Submit Observations**.

Bird Watching

Observation Chart

Name _____ Date _____

EXAMPLE

Species: GREAT EGRET **Time of day:** 11:25 AM

Habitat: Wooded swamps and ponds	Where was the bird? Standing on a rock	What was the bird doing? Watching the water
Food source: Fish, snakes, frogs and other birds		
Migration: From U.S. to Mexico, Latin and South America	Drawing of the bird: 	
Size: 38" length and 51" wingspan		
Identifying features: - all white - yellow beak - dark legs and feet		

EXAMPLE

Species: KILLDEER **Time of day:** 1:25 PM

Habitat: Prefers open areas, especially around water	Where was the bird? On a sandbar	What was the bird doing? Resting
Food source: insects, earthworms, snails		
Migration: From Canada and Northern U.S. to Mexico	Drawing of the bird: 	
Size: 10" length and 24" wingspan		
Identifying features: - small bird with long slender legs - brown back and white breast - black collar and black band across breast		

Species: **Time of day:**

Habitat:	Where was the bird?	What was the bird doing?
Food source:		
Migration:	Drawing of the bird:	
Size:		
Identifying features:		

Species:	**Time of day:**	
Habitat:	Where was the bird?	What was the bird doing?
Food source:		
Migration:	Drawing of the bird:	
Size:		
Identifying features:		

Species:	**Time of day:**	
Habitat:	Where was the bird?	What was the bird doing?
Food source:		
Migration:	Drawing of the bird:	
Size:		
Identifying features:		

Species:	**Time of day:**	
Habitat:	Where was the bird?	What was the bird doing?
Food source:		
Migration:	Drawing of the bird:	
Size:		
Identifying features:		

Lesson 2.2

UNIT 2

Extension Suggestions

Career launch

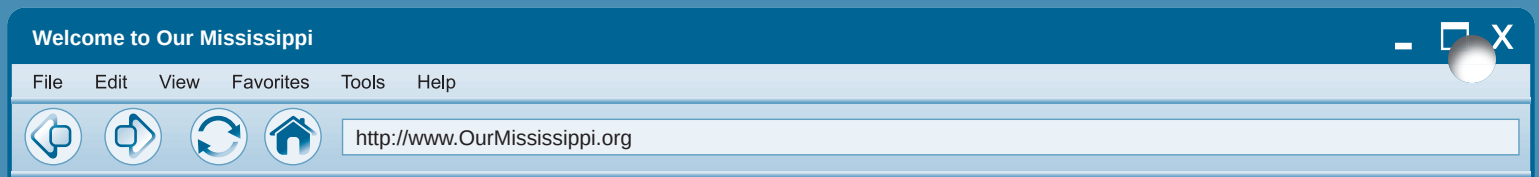
Invite a **birdwatcher**, **ornithologist** or **wildlife biologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Explore

- Celebrate **International Migratory Bird Day**. Learn more at **www.birdday.org**.
- **Build a bird feeder**. Visit the Audubon Society's web site for instructions on building birdfeeders from a variety of materials, including recycled milk cartons (**www.audubon.org**) Click on: **Education > Educators' lounge > Nature activities**

Get out!

Visit a **National Recreation Trail** operated by the U.S. Army Corps of Engineers along the Mississippi River. Go to **www.usace.army.mil** Keyword search: **National Recreation Trails**



Learn more online

Play an **online bird migration game** on the Smithsonian Migratory Bird Center website (nationalzoo.si.edu)
Keyword search: **Bird game**

Learn about **flyways** from the U.S. Fish & Wildlife Service website (www.flyways.us) or download the PDF at www.iptv.org/mississippi/lessonplans/ActivityPDFs/Science/Flyaways.pdf

Learn about **birds and other wildlife** and when and where to see them from the Upper Mississippi River National Wildlife Refuge website (www.fws.gov)
Keyword search: **Midwest Upper Mississippi River**
Click on: **Wildlife observation**

Visit the Mississippi National River and Recreation Area website (www.nps.gov/miss)
Keyword: **Animals**

Kids and Nature… a Match Made in the Outdoors. Go to www.usace.army.mil
Keyword search: **Kids and nature**

Learn about **birdwatching and bird migration** and see a **directory of bird watching clubs** by state at the U.S. Geological Society website (www.birdingguide.com)

Explore **bird migration** at the U.S. Geological Survey website (www.npwrc.usgs.gov/resource/birds/migratio/index.htm)

Find additional educational resources online on the Council for Environmental Education's Flying Wild website (www.flyingwild.org), the Cornell Lab of Ornithology's Education Program website (www.birds.cornell.edu/education), or the Smithsonian Migratory Bird Center website (www.nationalzoo.si.edu)
Keyword: **Migratory birds**

Additional places to learn about birds:

- Riverlands Migratory Bird Sanctuary (www.mvs.usace.army.mil/rivers)
- Audubon Society (www.audubon.org)
- Cornell Lab of Ornithology (www.birds.cornell.edu)

Well River Checkup:

Assessing the Health of the River

Introduction

In *Lesson 2.3 Well River Checkup: Assessing the Health of the River,* students learn how their actions become part of the water cycle and impact the health of the water supply. They trace how the everyday action of washing a car can impact the environment, and they test pond water for its phosphate content.

Background

A safe supply of water is the most important element of a healthy society, yet about 1/3 of the world's population doesn't have access to clean, safe drinking water. Drinking contaminated water is a major cause of disease and illness around the world.

Many people don't think about where their water comes from or where it goes. We trust the water that comes out of our pipes is safe and clean, and we don't think much about it after it goes down the drain.

In most homes, the water that goes down the sinks, showers, and toilets flows to the wastewater treatment plant, where it is treated before it is discharged into the Mississippi River. However, pollutants from yards and streets that flow into storm drains are not treated. They travel directly into our creeks, wetlands, lakes, and the Mississippi River and harm or even kill the plants and animals that live there.

Sources: Environmental Protection Agency (EPA); Stormwater SMART, Piedmont Triad Council of Governments; University of Minnesota, Department of Chemistry; Upper Mississippi River Basin Association; U.S. Geological Survey (USGS) Water Resources of the United States; Wilkes University Center for Environmental Quality, Environmental Engineering and Earth Sciences; Wisconsin Department of Natural Resources.

Unit 2 goal reminder

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Understand we all use and reuse the same water

Lesson objectives

- Understand point and non-point pollution
- Examine the effects of detergents and fertilizers on aquatic life
- Test for dissolved oxygen in water samples
- Determine the relationship between pollutants and dissolved oxygen in water
- Collect and interpret data

Educational standards

- Physical Science
- Life Science
- Science in Personal and Social Perspectives

What you'll need

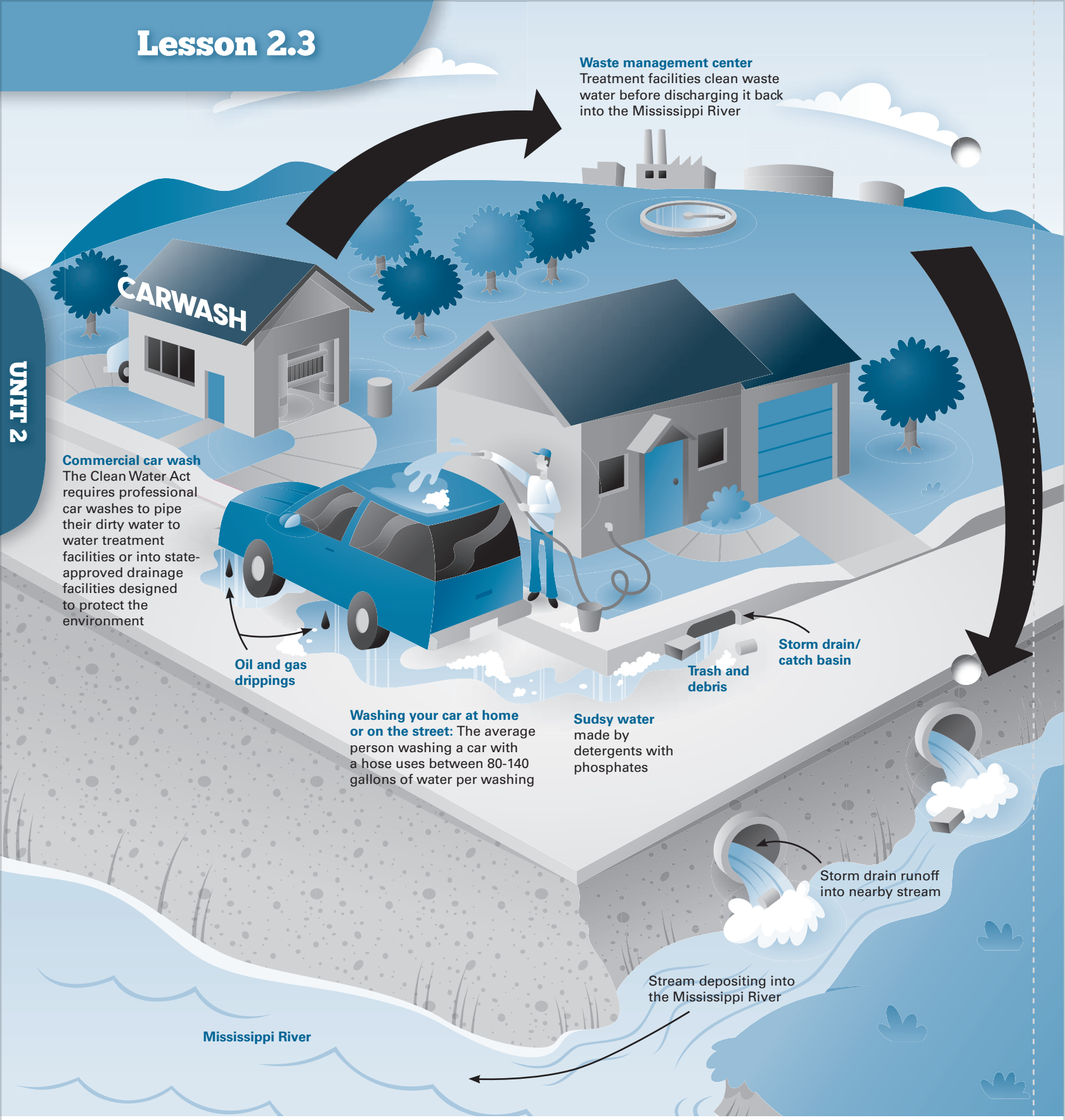
- Distilled water
- Mud or dirt
- Water plants and gravel
- Long-handled spoon or thin gardening trowel
- 3 half-gallon glass jars
- Masking tape/pens for labels
- Measuring spoons
- Fertilizer containing phosphates
- Dissolved oxygen test kit

How long it will take

- *Discussion:* 30 min.
- *Activity 1:* 15 min.
- *Activity 2:* 2 weeks

What's next?

Learn about the endangered species in your state and how you can help



Go Commercial

When it comes to washing your car, there's no home advantage. Taking it to a commercial car wash is an eco-friendly alternative. Washing your car at home wastes water and washes pollutants—including oil, gas, and phosphates from fertilizers and detergents—down the storm drain and directly into rivers and streams untreated.

Need to Know

- **Pollution**: The contamination of air, water, or soil by substances that are harmful to living organisms, usually caused by human activities. Pollution is divided into two main categories:
  - *Point source*: Pollution that can be traced back to a single origin or source, such as a sewage treatment plant discharge.
  - *Non-point source*: Pollution that cannot be traced back to a single origin or source, such as stormwater runoff, water runoff from urban areas, and failed septic systems.
- **Contaminants** enter the Mississippi River untreated from runoff and stormwater drains. Treated wastewater enters the river directly through discharge pipes from industry and wastewater treatment plants. Contaminants include:
  - *Pesticides and herbicides*: Substances, chemical or biological, used to prevent or destroy pests, such as unwanted rodents, insects, plants, and fungi.
  - *Petroleum*: A naturally occurring, flammable liquid consisting of a complex mixture of hydrocarbons and other organic compounds. Includes fuels (gasoline, diesel fuel, jet fuel) and lubricants (motor oil).
  - *Toxic metals*, such as mercury, lead, and arsenic.
  - *Nitrate*: A form of nitrogen, a plant nutrient used in fertilizer. Excess amounts can cause an overgrowth of bacteria and algae, which can deplete oxygen and kill fish.
  - *Phosphate*: A form of phosphorus, a plant nutrient used in fertilizers, detergents, matches, explosives, and pesticides. Like nitrogen, it can lead to an overgrowth of bacteria and algae, which can deplete oxygen and kill fish.
- The two most-common contaminants in the Mississippi River are **PCBs** and **mercury**. These chemicals often bioaccumulate in species as you move up the food chain from one trophic level to the next. See the definitions on page 80.
  - *PCBs* are human-made organic chemicals known as chlorinated hydrocarbons, used as a cooling agent for transformers, carbonless papers, cutting oils and hydraulic fluids. They were banned because of their toxicity in 1979. Very stable compounds, PCBs do not break down quickly or easily, which is why they are still a problem today.
  - *Mercury* is a naturally occurring element that is toxic at certain levels. Mercury was used in the making of paints, agricultural chemicals, and in mining and smelting. Today, mercury mainly enters the environment as air pollution from the burning of coal and falls from the air to accumulate in streams and oceans.

What can I do to SAVE water?

- Check faucets for leaks. Even a slow drip can waste 15 to 20 gallons every day.
- Take shorter showers and install a water-saving showerhead.
- Turn off the water while brushing your teeth.
- Use a shut-off nozzle to water your plants.
- Let the rain water your lawn
- Replace your old toilet to a low-flow model and save about 2 gallons per flush.

STANDARDS CORRELATION

The activities and discussions in this lesson focus on the content standards for life science (populations and ecosystems; diversity and adaptations of organisms) and physical science (properties) with an emphasis on inquiry and active learning. To make these activities and discussions relevant and personal, they are placed in the context of science in personal and social perspectives wherever possible.

Discussion (about 30 minutes)

In Unit 1 we learned about the water cycle, so we know that the amount of water on earth has always been the same. What does that tell us about the water we drink?

Fast Facts

- The Upper Mississippi River provides water to approximately 2.8 million people.
- More than 7 billion gallons of water are withdrawn from surface water sources each day.
- Approximately 278 facilities discharge wastewater into the Upper Mississippi River, including industrial facilities and municipal sewage treatment plants.
- Dumping 1 quart of motor oil down the storm drain can pollute 250,000 gallons of water.
- Water consumed washing cars:
  - At home: 80-140 gallons
  - At a professional car wash: 30-45 gallons

As water travels over or through the ground, it dissolves minerals and picks up substances left by people, pets, or wildlife. Untreated water can contain a variety of contaminants, including:

- Microscopic organisms from sewage or animals, such as bacteria
- Fuels (gasoline, diesel fuel, jet fuel) and lubricants (motor oil)
- Heavy metals, such as mercury and arsenic
- Industrial chemicals and detergents
- Fertilizers
- Pesticides

Where does water go after we use it? Usually one of two places: **storm drains** and **sewage systems**.

Storm drains collect water from outside our homes and businesses and carry it, untreated, directly to streams and rivers. Only rain should go into storm drains, not trash, oil, or other pollutants.

Sewers collect water from inside homes and businesses and carry it to treatment plants, where it is cleaned before it reaches streams and rivers.

Some communities have combined systems that collect wastewater and storm runoff together in one pipe. During heavy rainfall, this system can overflow, discharging untreated wastewater directly into streams and rivers.

> *"In every glass of water we drink, some of the water has already passed through fishes, trees, bacteria, worms in the soil, and many other organisms, including people... Living systems cleanse water and make it fit."*
>
> – Elliot A. Norse, Conservation Biologist, 1985

Virtual Car Wash

Grades

5–6

Class or small group activity

15 MINUTES

What you'll need

- Activity worksheet (pages 108–109)

Washing your car at home wastes water and washes pollutants in rivers and streams untreated. Most people keep their hoses running while they wash their cars. By the time they are through they can see the water draining down the driveway and into the street. The average person washing a car uses between 80-140 gallons of water per washing.

Do This

1. Ask students, where does used water go when you wash a car in your driveway? Have students use the graphic to trace its path on the activity worksheet.
2. What does it carry with it? Think about what may be on the car, on the driveway, in the street.
3. Instead of letting the water run, use a bucket and a hose with a shut-off nozzle and wash your car on the grass so the soapy water soaks into the ground. Better yet, take the car to the local car wash. At all car washes, the water will be treated before it is returned to the river.

Check out your local car wash!

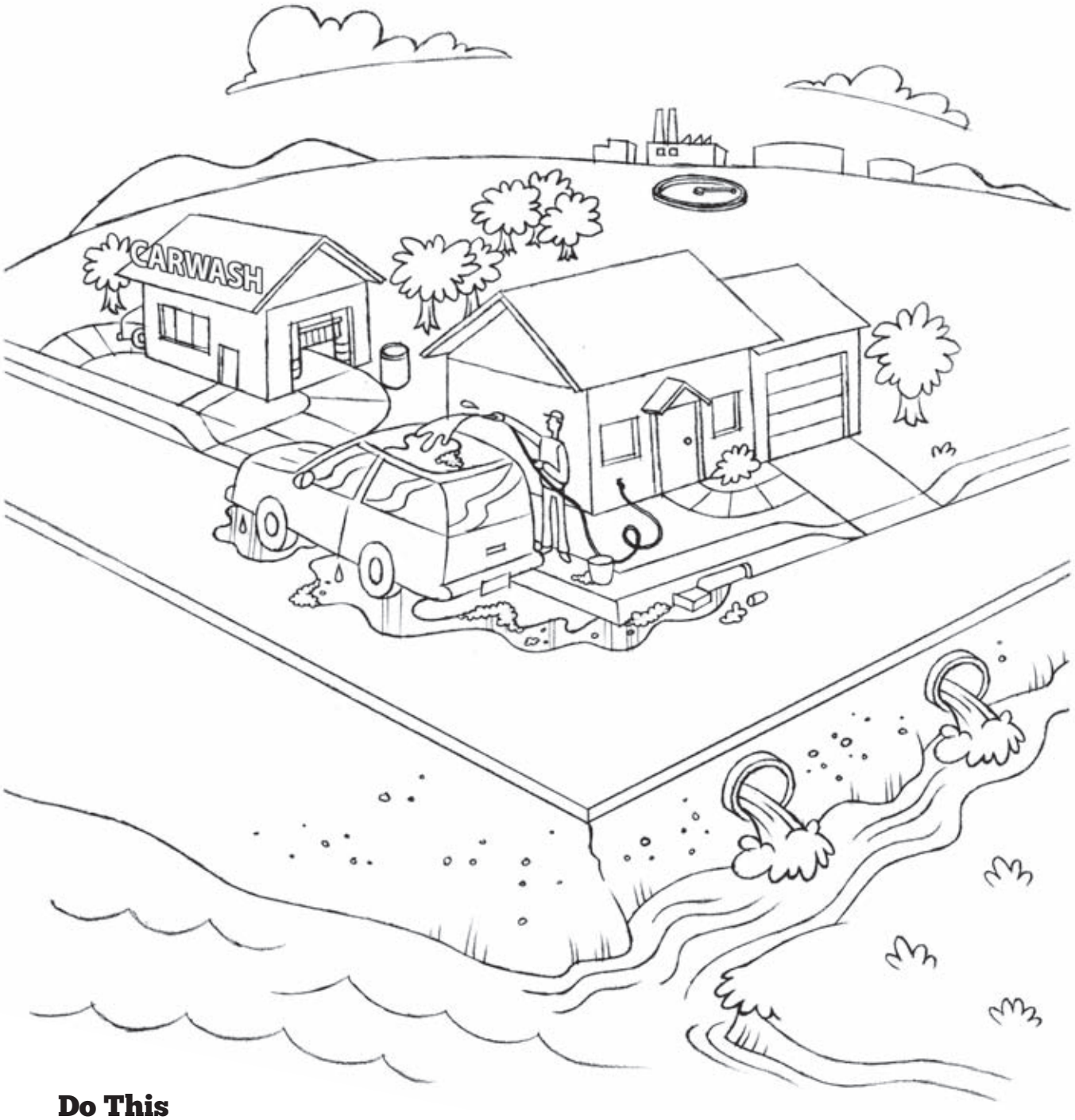
- Ask them how they dispose of their used water. Does it go to a treatment facility? Do they treat it on site and reuse it?
- How many cars do they wash in one week? How much water do they use per car? Figure out the total gallons of water they use in one week.

Answer Key

1. The water goes down into the driveway into the storm drain, which empties into the Mississippi River untreated directly or through a tributary.
2. Soapy water plus grease and grime on a car contains asphalt from the roads, asbestos from the brakes, oil and gasoline that has dripped from the car, rubber particles from the tires, toxic metals, and rust.
3. Instead of letting the water run, use a bucket and a hose with a shut-off nozzle and wash your car on the grass so the soapy water soaks into the ground. Better yet, take the car to the local car wash. At all car washes, the water will be treated before it is returned to the river.

Virtual Car Wash

Name _____ Date _____



Do This

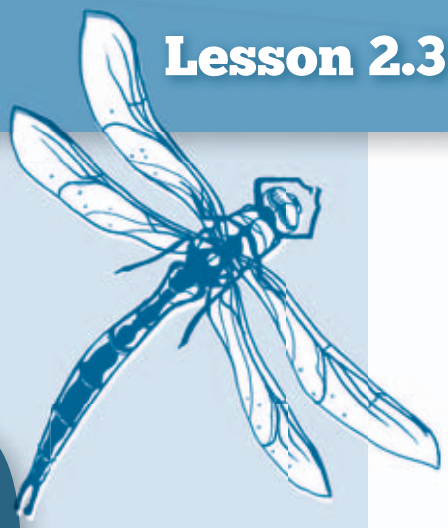
- Plan a virtual car wash. Write down what you need.
- Follow the water. Mark the path of the water used to wash your car on the drawing.

Answer the following questions

1. Where does used water go when you wash a car in your driveway?

2. What does it carry with it? Think about what may be on the car, on the driveway, in the street.

3. What can you do to protect the environment AND have a clean car?



UNIT 2

Phosphates in Your Water

Grades
5–6

Class or small group activity

2 WEEKS

What you'll need

- Water, plants (including roots), and mud from a pond
- Long-handled spoon or thin gardening trowel
- 3 half-gallon, glass canning jars
- Masking tape/pens for labels
- Measuring spoons
- Fertilizer containing phosphates
- Dissolved oxygen test kit (available at aquarium supply stores)
- Activity worksheet (pages 112-113)

Runoff from fertilizers and detergents containing phosphates can have adverse effects on waterways and aquatic life. They cause excess nutrient levels that can lead to an overgrowth of bacteria and algae, which can deplete oxygen and kill fish.

Do this

1. Collect water, plants (including roots), and mud from a pond. Be sure to get permission from property owner before collecting pond water or other items.
2. Plant equal amounts of water plants in three half-gallon, wide-mouth canning jars. Use a long-handled spoon to make sure the roots of the plants are securely in the mud mixture.
3. Slowly pour pond water into the jar. Try not to stir up the mud too much.
4. Label jars 1 through 3.
5. Place the appropriate amount of fertilizer in each jar using the amounts listed in the chart.
6. Measure the amount of dissolved oxygen in each jar according to the kit directions and record it on the activity sheet.
7. Put all the jars in a sunny location.
8. Observe daily for 2 weeks and record your observations.
9. On day 7 and day 14, measure the amount of dissolved oxygen in each jar again and record it on the activity sheet.
10. Record, analyze, and discuss your observations.

Analysis

At the end of the experiment, which jar had the most vigorously growing plants? Answer is Jar 3: 1 tsp fertilizer
Which one had the least dissolved oxygen? Answer should be Jar 3: 1 tsp fertilizer

Conclusions

What would happen in a stream that has an excess of phosphates, warm temperatures, and good sunlight? Answer: Phosphates stimulate the overgrowth of plants. As the plants die, decomposers grow rapidly and consume oxygen. This lowers the oxygen level, suffocating fish and other organisms that require oxygen.

Progress Samples

	Jar 1: Control (no fertilizer)	Jar 2: 1/2 tsp fertilizer	Jar 3: 1 tsp fertilizer
Day 1			
Dissolved oxygen	Varies	Varies	Varies
Day 7			
Dissolved oxygen	Varies	Varies	Varies
Day 14			
Dissolved oxygen	Varies	Varies	Varies

Teacher Tip

Dissolved oxygen (DO) levels vary with water temperature and altitude. Cold water holds more oxygen than warm water, and water holds less oxygen at higher altitudes. DO levels also fluctuate seasonally and over a 24-hour period. DO should average between 5.0 and 7.0 ppm. PPM (parts per million) is equal to milligrams of DO per liter of water.

Phosphates in Your Water

Name _____ Date _____

During the next two weeks, you will observe and record what happens to 3 jars of pond water when you add different amounts of detergent containing phosphates.

Materials

- Water, plants (including roots), and mud from a pond
- Long-handled spoon or thin gardening trowel
- 3 half-gallon, glass canning jars
- Masking tape/pens for labels
- Measuring spoons
- Fertilizer containing phosphates
- Dissolved oxygen test kit (available at aquarium supply stores)

Do This

1. Collect water, plants (including roots), and mud from a pond. Be sure to get permission from the property owner before collecting pond water or other items.
2. Plant equal amounts of water plants in three half-gallon, wide-mouth canning jars. Use a long-handled spoon to make sure the roots of the plants are securely in the mud mixture.
3. Slowly pour pond water into the jar. Try not to stir up the mud too much.
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7. Put all the jars in a sunny location.
8. Observe daily for 2 weeks and record your observations.
9. On day 7 and day 14, measure the amount of dissolved oxygen in each jar again and record it on the activity sheet.
10. Record, analyze, and discuss your observations.

	Jar 1: Control (no fertilizer)	Jar 2: 1/2 tsp fertilizer	Jar 3: 1 tsp fertilizer
Day 1			
Dissolved oxygen	_____	_____	_____
Day 7			
Dissolved oxygen	_____	_____	_____
Day 14			
Dissolved oxygen	_____	_____	_____

Analysis

At the end of the experiment, which jar had the most vigorously growing plants?

_____

Which one had the least dissolved oxygen?

_____

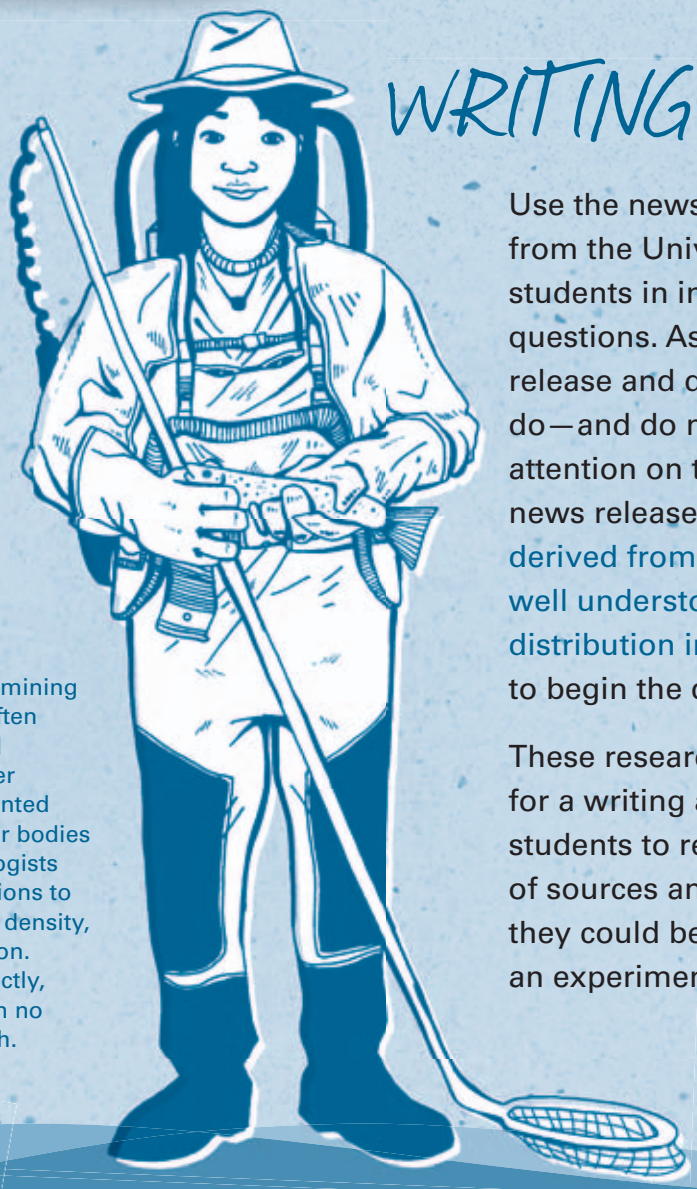
Conclusion

What would happen in a stream that has an excess of phosphates, warm temperatures, and good sunlight? _____

_____

_____

WRITING EXTENSION



Grades 9–12

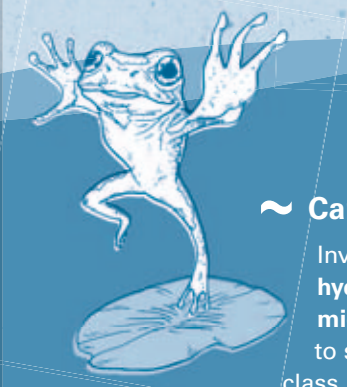
Individual activity

To stun fish before examining them, fish biologists often use backpack-mounted electrofishers in smaller streams and boat-mounted electrofishers in deeper bodies of water. It allows biologists to sample fish populations to determine abundance, density, and species composition. When performed correctly, electrofishing results in no permanent harm to fish.

Use the news release (on the next page) from the University of Minnesota to engage students in inquiry by developing research questions. Ask students to read the news release and discuss what the findings do—and do not—tell us. Focus students' attention on the final paragraph in the news release, "The toxicity of the dioxins derived from triclosan currently is not well understood, nor is the extent of their distribution in the environment at large," to begin the discussions.

These research questions can then be used for a writing assignment that requires students to research and access a variety of sources and communicate findings, or they could be used to design and conduct an experiment.

Extension Suggestions



~ Career launch

Invite a local **hydrologist** or **microbiologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Get out!

- Volunteer to monitor water quality in your state's lakes and rivers. Contact your state Department of Natural Resources for information.
- Visit the National Great Rivers Research and Education Center in Alton, Illinois, to learn more about the health of the Mississippi River. The Center's scholars and scientists study the ecology of the river and its tributaries, the watersheds that feed them, and the river communities that use them. Visit online at **www.ngrrec.org**

~ Stencil stormdrains

Stencil stormdrains to remind people not to pollute our watershed. Go to the Friends of the Mississippi River website, **www.fmr.org**, and search keyword: **stenciling**.

~ World Water Monitoring Day

Celebrate World Water Monitoring Day on September 18. Join in the effort to monitor water quality between March and December each year. Learn more at **www.worldwatermonitoringday.org.**

Well River Checkup

Assessing the Health of the River

Name _____ Date_____

Read, analyze, and hypothesize

1. Read the news release below from the University of Minnesota.
2. Think about what else you would want to know about the issue.
3. Develop three research questions that you could use to write a research paper or design an experiment.

Read Below

University of Minnesota News Release

University of Minnesota study finds rising levels of dioxins from common soap ingredient in Mississippi River sediments

Dioxins in general decreasing, but those derived from triclosan increasing

MINNEAPOLIS / ST. PAUL (05/18/2010) Specific dioxins derived from the antibacterial agent triclosan, used in many hand soaps, deodorants, dishwashing liquids, and other consumer products, account for an increasing proportion of total dioxins in Mississippi River sediments, according to University of Minnesota research. The study appears online in the May 18 issue of the journal *Environmental Science and Technology*.

The researchers, from the university's Institute of Technology (soon to be College of Science and Engineering), found that over the last 30 years, the levels of the four dioxins derived from triclosan have risen by 200 to 300 percent, while levels of all the other dioxins have dropped by 73 to 90 percent.

In April, the Food and Drug Administration announced it would study the safety of triclosan, which has been linked to disruptions of hormonal function and may also play a role in the evolution of bacterial resistance to antibiotics. In papers published in 2003 and 2009, university civil engineering professor William Arnold and his colleague Kristopher McNeill, a former professor in the university's Department of Chemistry, discovered that triclosan, when exposed to sunlight, generated a specific suite of four dioxins.

In the current study spearheaded by Jeff Buth, a recent Ph.D. graduate in chemistry (supervised by Arnold and McNeill), the researchers examined sediment core samples from Lake Pepin, an enlargement of the Mississippi River 120 miles downstream from the Minneapolis-St. Paul metro area. The sediment cores, containing a record of pollutant accumulation in the lake for the past 50 years, were analyzed for triclosan, the four dioxins derived from triclosan, and the entire family of dioxin chemicals. The study was a collaborative effort between researchers at the University of Minnesota, Pace Analytical (Minneapolis), the Science Museum of Minnesota, and Virginia Tech.

"These four dioxins only come from triclosan. They didn't exist in Lake Pepin before triclosan was introduced," Arnold said. "In the most current sediments, these triclosan-derived dioxins account for about 30 percent of the total dioxin mass."

Triclosan was first added to commercial liquid hand soap in 1987, and by 2001 about 76 percent of commercial liquid hand soaps contained it, researchers say. About 96 percent of triclosan from consumer products is disposed of in residential drains, leading to large loads of the chemical in water entering wastewater treatment plants.

Triclosan is incompletely removed during the wastewater treatment process, and when treated wastewater is released to the environment, sunlight converts some of the triclosan (and related compounds) into dioxins. Triclosan and the dioxins ended up in Lake Pepin sediments by sticking to organic particles in the river, which then sank when they reached the calmer waters of the lake.

The toxicity of the dioxins derived from triclosan currently is not well understood, nor is the extent of their distribution in the environment at large, Arnold says.

End of article

Research Questions

1. _____

2. _____

3. _____

Life on the Brink:

Endangered Species of the Upper Mississippi River

Karner Blue Butterfly
(Lycaeides melissa samuelis)

Introduction

Lesson 2.4 Life on the Brink: Endangered Species of the Upper Mississippi River builds on the knowledge and skills learned in lessons 2.1 and 2.2 to learn and share about local endangered species and create habitat for wildlife in the schoolyard.

Background

In the history of life on earth there have been at least five mass extinctions, each caused by natural disasters and processes. Using mathematical modeling, scientists estimate that of all the species that have lived on the Earth since life first appeared here three billion years ago, only about one in a thousand species is still living today. That means 99.9% of all species that have ever lived are now extinct.

Extinction is a natural process. It is a normal part of evolution. But the current extinction rate is anything but natural. We are now at the beginning of a new sixth extinction. It is unlike anything since the end of the dinosaurs. But this time the cause is different. It is the result of the spread of just one species—us.

Gray Wolf
(Canis lupus)

UNIT 2

Unit 2 goal reminder

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Learn how we can help endangered species that depend on the Upper Mississippi River

Lesson objectives

- Define terms related to ecosystems of the Mississippi River
- Identify endangered species in your local area
- Design and plant a school wildlife garden

Educational standards

- Physical Science
- Life Science
- Geography
- Science in Personal and Social Perspectives

What you'll need

- Nature magazines
- Access to the Internet
- Shovels
- Hoes
- Rakes
- Plants
- Plant seeds
- Water containers or hose

How long it will take

- *Discussion:* 30 min.
- *Activity 1:* 15 min.
- *Activity 2:* 3-4 days

What's next?

Learn how we can make a difference in our environment

Fast Facts

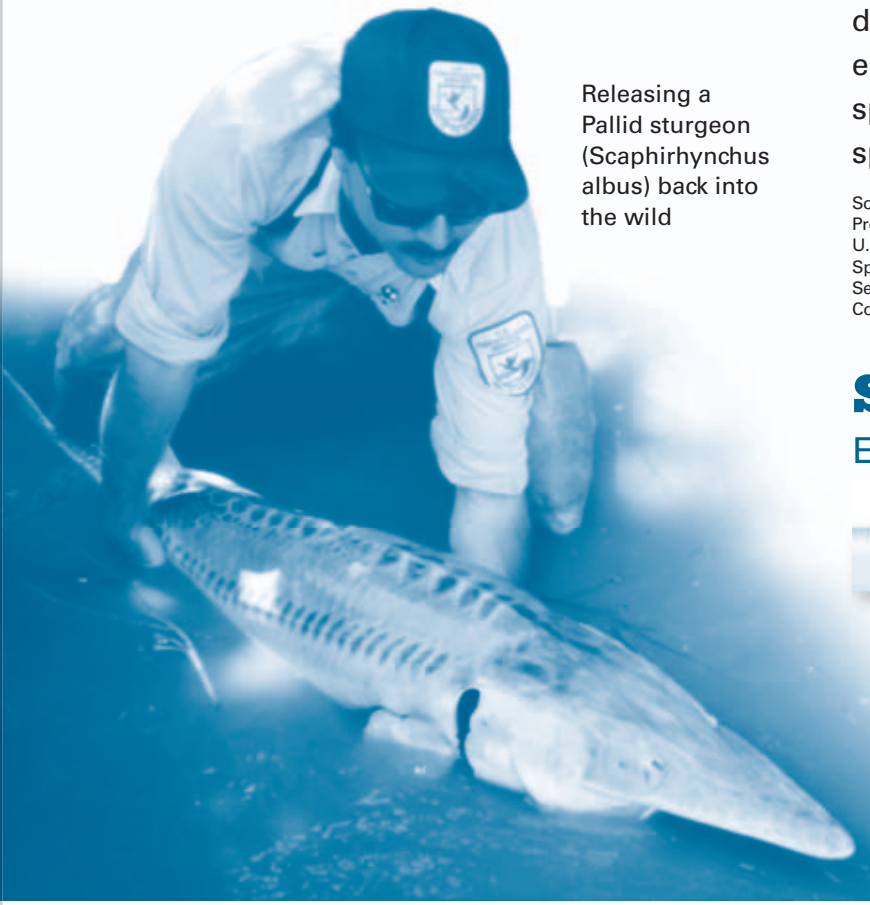
The United States has more ecosystems and habitat types than any other nation. They support species of plants and animals found nowhere else on earth.

The Upper Mississippi River Basin provides critically important habitat for 286 state-listed, 36 federal-listed, or candidate species of rare, threatened, or endangered plants and animals.

Number of endangered species that depend on the Upper Mississippi River by state:

- Illinois: 24 listings
- Iowa: 12 listings
- Minnesota: 12 listings
- Missouri: 27 listings
- Wisconsin: 15 listings

More than 500 species in North America have disappeared in less than 400 years. Scientists estimate that the natural extinction rate is approximately one species lost in every 100 years. As much as 20 percent of all living populations could become extinct by 2028.



Releasing a Pallid sturgeon (Scaphirhynchus albus) back into the wild

Why are more species going extinct today?

More species are going extinct today because we are altering the air, water, and land faster than species can adapt. Most species have the ability to adapt to a changing environment. But if the changes become too severe in their ecosystem, they cannot survive.

Endangered Species Act

In 1973, the U.S. Congress passed the Endangered Species Act. Its purpose is to conserve and protect threatened and endangered species and the ecosystems they depend on to survive. Because species are linked and dependent upon each other within their ecosystems, the loss of just one plant species can cause up to 30 other species to disappear with it.

Sources: Environmental Protection Agency (EPA) Endangered Species Protection Program; National Wildlife Federation; National Park Service; U.S. Army Corps of Engineers' Threatened, Endangered, and Sensitive Species Protection and Management System; U.S. Fish & Wildlife Service Endangered Species Program; U.S. Geological Survey; Wildlife Conservation Society; World Wildlife Fund.

So what's the good news?

Endangered means there is still time.

STANDARDS CORRELATION

The activities and discussions in this lesson focus on the content standards for life science (populations and ecosystems; diversity and adaptations of organisms). To make these activities and discussions relevant and personal, they are placed in the context of science in personal and social perspectives wherever possible.

Discussion (about 30 minutes)

Review the vocabulary from the previous lessons in this unit and introduce the words endangered and extinct. Ask students about animals that have become extinct (passenger pigeon) or nearly became extinct (bald eagle, peregrine falcon, bison, wolf, grizzly bear) in North America. Explain that biologists estimate that more than 500 species, subspecies, and varieties of North American plants and animals have become extinct since the Pilgrims landed at Plymouth Rock in 1620.

Review terms and concepts about ecosystems and habitats and ask students to think about what might cause extinction. Discuss why species become endangered and the impact of human behavior. Introduce the major threats to species using this acronym **HIPPO** as a memory aid:

- **H**abitat loss
- **I**ntroduced species
- **P**ollution
- **P**opulation growth (of humans)
- **O**ver-consumption

Habitat loss

The most common reason for extinction is habitat loss. An animal's habitat features all the necessities of life including access to food, water, shelter, and space. When people cut down forests, dig mines, build cities, or make roads, they destroy habitats. There is no place left for plants, fish, and wildlife.

Invasive species

Invasive species are the second-biggest threat to endangered species. An animal introduced to a new area competes with native species for resources. In some cases, an introduced species is more successful, and they outcompete or displace native species. Introduced species prey on them, eat their food, infect them, or otherwise disrupt them.

Pollution

Pollution affects animals both directly and indirectly. For example, acid rain destroys forests, oil spills kill coastal plants and animals, poisons wash into waterways, and plastic trash entangles wildlife. Oil spills kill seabirds, marine, and coastal life. Between 1993 and 2002, nearly 650,000 tons of oil spilled into the sea in 470 separate accidents. In 2010, one of the largest oil spills occurred in the Gulf of Mexico.

Human population

The second "P" represents the number of people on our planet. Currently, our planet houses over six billion people who compete for resources such as food, water, medicine, clothes, shelter, and fuel, which affects how much the animals have. With more than six billion people on the planet, we are crowding the earth and driving other species out.

Over-consumption

"O" stands for over-consumption. Many industrialized nations consume resources at a rate faster than the resources can be reproduced.

Brainstorm ways students can help prevent plants and animals from going extinct. The best thing that anyone can do to combat these threats is to educate themselves. Learn about the issues and decide how you can make a difference.

Lesson 2.4

"The most effective way to SAVE endangered species is to protect the places they need to live." – Lois Capps

Asian Carp

Several species of Asian carp were introduced to U.S. fish farms in the 1970s to help control algae. Some escaped into the Mississippi River in the 1970s and soon began displacing native fish. Efforts are underway to prevent the Asian carp from entering the Great Lakes, which are connected to the Mississippi River through the Illinois Waterway. These efforts include electric barriers and netting.

Faced with dwindling supplies of more popular fish, some fishermen are starting to sell Asian carp to fish markets. Popular in Asian American communities, many expect demand for this fish to grow, especially if its name is changed to something that sounds tastier, such as Rock Island sole.

Need to Know

- **Conservation**: The wise use of natural resources in order to ensure continued availability to future generations.
- **Non-renewable resources**: Non-living resources that do not regenerate themselves.
- **Niche**: The role played by an organism in a biological community.
- **Adaptation**: Biological characteristic that improves the chance of survival of an animal and its descendants.
- **Carrying capacity**: The maximum number of healthy individuals within a species that a habitat can sustain.
- **Extinct**: A plant or animal species that is no longer living on earth. Although extinction is a natural part of evolution, the rate at which species are becoming extinct is estimated at 1,000 times the average extinction rates in the evolutionary time scale.
- **Endangered**: A plant or animal species that is in immediate danger of becoming extinct and needs protection to survive.
- **Threatened**: An organism whose population is declining in numbers, but has not yet become endangered. A plant or animal species that is likely to become endangered if it is not protected.
- Most of the environmental changes that threaten endangered species are caused by human actions. Some scientists believe that if these changes continue at current rates, one-half of all species of life on earth will be extinct in 100 years. Threats to endangered species include:
  - *Habitat loss*: The depletion of natural environments due to human activity or natural disasters.
  - *Introduced or exotic species*: An organism that is not native to that area.
  - *Pollution*: Any substance that destroys the purity of land, air, or water.
  - *Human population*: As of May 2010, the population of humans was about 6.8 billion. The last 100 years have seen a rapid increase in human population due to medical advances and increases in agricultural productivity due to technological advances.
  - *Over-consumption*: The excessive use of an animal by humans that results in a decline in the wild population of that species.

Who is Endangered?

Grades

5–6

Class or small group activity

15 MINUTES

This activity asks students to select an endangered animal, identify its physical and behavioral characteristics, research major threats facing it, and discuss ways of improving its chances for survival.

Do This

1. Introduce the lesson by selecting an endangered animal to discuss as a class.
   - Identify its physical and behavioral characteristics.
   - Describe its role or purpose and its adaptations.
   - Discuss the factors that may have contributed to causing this animal to be designated as "endangered."

2. Allow the students to work individually or in groups to:
   - Research endangered species in your region and select an animal to teach the class about.
   - Identify its habitat and characteristics.
   - Discuss what factors have caused it to become endangered.

3. Ask students to focus on the following questions during their research:
   - A general description of your animal.
   - Is your animal extinct, highly endangered, endangered, or threatened? If so, why?
   - What type of environment does your animal need to survive?
   - What impact have humans had on your animal?
   - What measures are being taken to help the survival of your animal?
   - Find pictures of local endangered species.

4. Present findings to the class.
   - Put a picture of the species in an appropriate location on the laminated wall map (there may be several).
   - Explain why these species are endangered and what students might do to help.

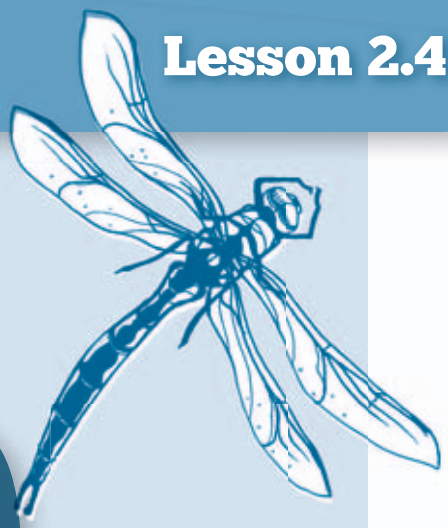
What you'll need

- Nature magazine for pictures
- Access to the Internet for pictures

Teacher Tip

See A5: Endangered Species by State on page 320. If students have not come up with these species on their own, assign species to individual students or groups.

- *Copperbelly water snake*
- *Interior least tern*
- *Map turtle*
- *Pallid sturgeon*
- *Peregrine falcon*
- *Piping plover*
- *Red-cockaded woodpeckers*
- *Whooping crane*



UNIT 2

Create a Wildlife Garden

Grades
5–6

Class or small group activity

3–4 DAYS

Total to plan and plant the garden. *30 minutes to prep students prior to visitor arrival. 1 day teacher pre-reading. 1-2 days for students to research how and what to plant in the garden.*

What you'll need

- Shovels
- Hoes
- Rakes
- Plants
- Plant seeds
- Water containers or hose

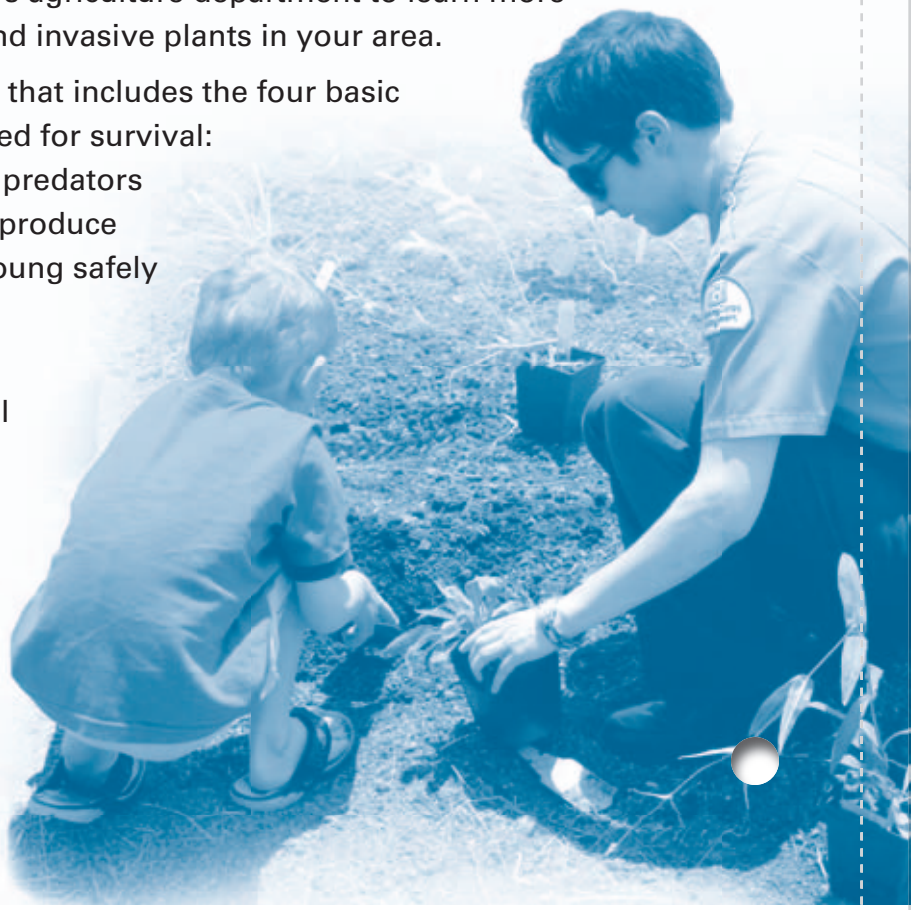
Teacher Tip

Research and develop habitat for a specific species in your area.

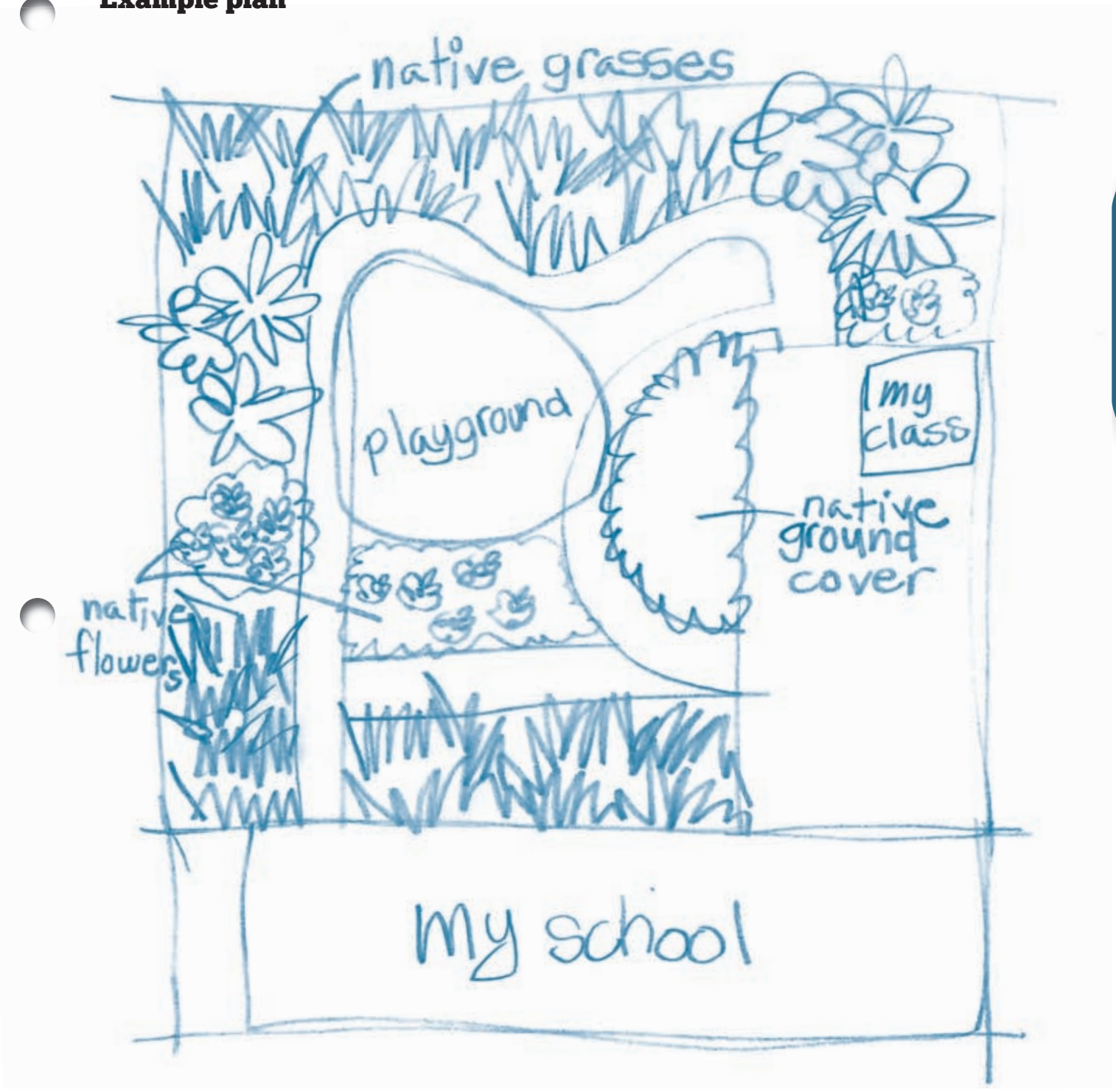
According to the National Wildlife Federation, setting aside just one tenth of an acre to create a schoolyard or backyard wildlife habitat would make a measurable impact on America's and the world's ecology. It could provide habitat for migratory birds, native plant species, butterflies, reptiles, amphibians, and beneficial insects.

Do This

1. Research the habitat needs of resident and migratory species in your area.
2. Identify habitat elements that already exist.
3. Identify native plants. You do not want to introduce invasive non-native plants into our schoolyard ecosystem. Check with your state's agriculture department to learn more about native and invasive plants in your area.
4. Develop a plan that includes the four basic elements needed for survival:
   - Cover from predators
   - Places to reproduce and raise young safely
   - Water
   - Food
5. Create the ideal wildlife habitat for your area!



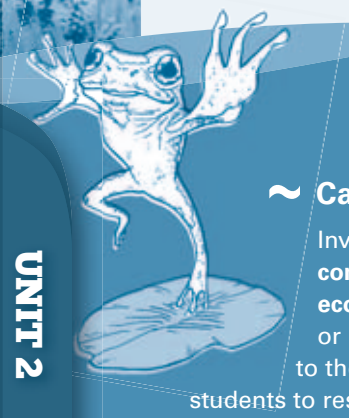
Example plan



"It's the little things that make the big things possible. Only close attention to the fine details of any operation makes the operation first class."

– J. Willard Marriott, founder of the Marriott Corporation

Extension Suggestions



~ Career launch

Invite a local **conservationist**, **ecologist, biologist,** or **botanist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Express yourself!

Next time you are outside, take a journal with you. Write down what you see, hear, smell, and touch. Illustrate your journal with drawings of what you observe.

~ Volunteer

Help with a conservation project at a local nature center, park, or wildlife refuge.

~ Get out!

Help restore and protect habitat in your own backyard and in your community:

- Build homes for birds.
- Plant native trees, shrubs, and flowers to attract wildlife, birds, and butterflies.
- Join a local clean-up effort to make these areas better places to live.
- Participate in community projects to plant riverbanks with native plants to protect soil and provide habitat.

~ Investigate

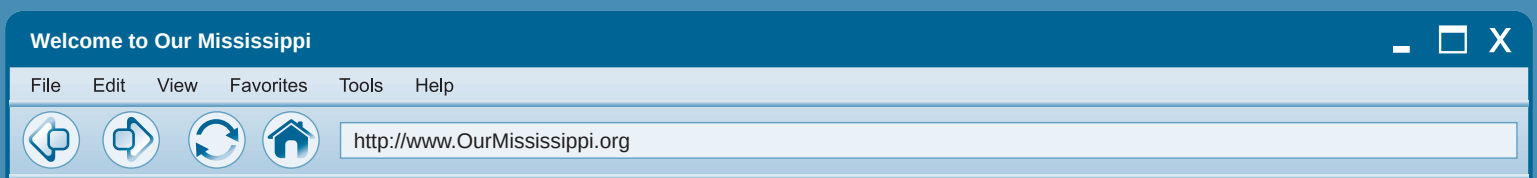
Research some of the invasive species threatening the Mississippi River, such as the Asian carp and zebra mussels, and teach others what they can do to help prevent their spread.

~ Adopt an endangered species

Adopt an endangered species native to your area by learning all you can about it and sharing that information with your family, friends, and classmates.

~ Create habitat for wildlife

Create habitat for wildlife in your schoolyard through the U.S. Fish & Wildlife Service's *Schoolyard Habitat Program*. Go to **www.fws.gov** and search keywords **schoolyard habitat**. You can also have your schoolyard habitat certified by the National Wildlife Federation. Learn more at **www.nwf.org.** Search keywords: **schoolyard habitat**



~ Learn more online

Join the National Wildlife Federation's Schoolyard Habitat program on the National Wildlife Federation website (www.nwf.org) and have your school's wildlife garden certified.

Play an online game. Build a wild version of yourself on the Wildlife Conservation Society website (www.buildyourwildself.com)

Learn about endangered and threatened species from the U.S. Fish & Wildlife Service website's Endangered Species Program (www.fws.gov) Search keywords: **Endangered Species Program**

Learn about wildlife from the Wildlife Conservation Society website (www.wcs.org), and the World Wildlife Fund website (www.worldwildlife.org)

Identify invasive and non-native plants with the help of the U.S. Fish & Wildlife Service and help remove them from your area. Go to www.fws.gov/midwest Search keyword: **invasive plants**

Mississippi River Sustainability

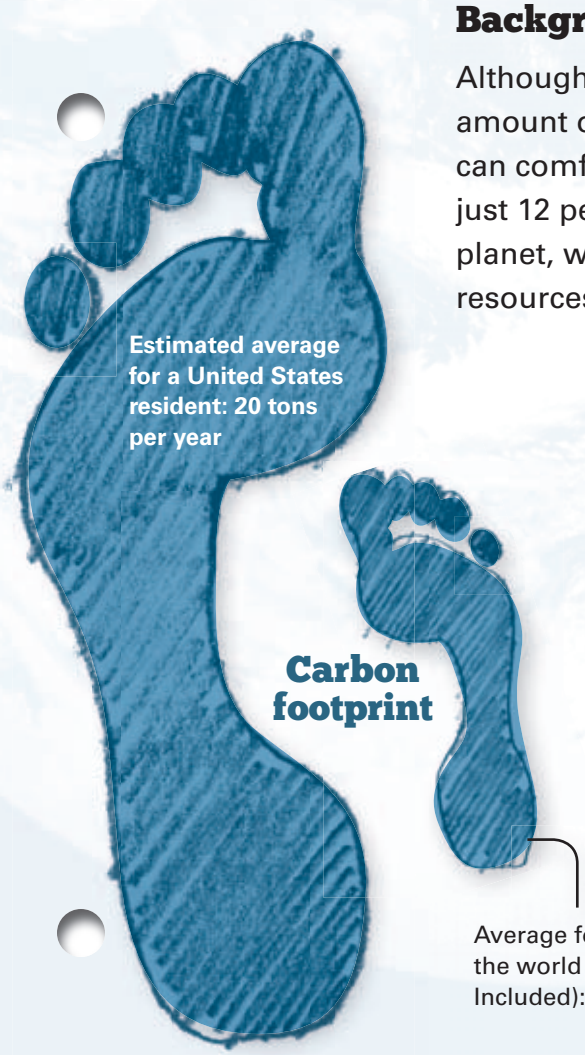
How to Make a Positive Impact on Your Environment

Introduction

Lesson 2.5 Mississippi River Sustainability: How to Make a Positive Impact on Your Environment focuses on actions students can take to conserve resources and live sustainably. They calculate their eco-footprint and read and discuss the inspiring story of how one person made a difference.

Background

Although the earth seems large, the amount of land surface where humans can comfortably live is relatively small—just 12 percent. To protect our home planet, we must learn how to conserve resources and live sustainable lifestyles.



The term "carbon footprint" has become a buzzword, but it is a complex and inexact measurement. Yet it is an apt metaphor for our impact on the planet. By exploring the concept of a carbon or eco-footprint, students learn that simple lifestyle choices have a meaningful impact on the planet.

UNIT 2

Unit 2 goal reminder

Explore the ecosystems of the Mississippi River and how humans affect them

Lesson goal

Learn how we can make a positive impact on our environment

Lesson objectives

- Define terms related to ecosystems of the Mississippi River
- Discuss the effect humans have on the environment
- Identify conservation ideas for school and home

Educational standards

- Physical Science
- Life Science
- Science in Personal and Social Perspectives

What you'll need

- Chad Pregracke activity worksheet
- Videotape of the Discovery Channel's *River Warriors*
- Television with a VCR or video player
- Access to the Internet

How long it will take

- *Discussion:* 1 hr.
- *Activity 1:* 1 hr.
- *Activity 2:* 1 class period

What's next?

Learn about history and culture along the Mississippi River

In essence, an eco-footprint is the negative impact that something has on the environment. Carbon footprint usually refers specifically to the amount of carbon emitted by something during a given period. It relates to the amount of greenhouse gases produced in our day-to-day lives through burning fossil fuels for electricity, heating, and transportation.

Our eco-footprint refers not only to our energy consumption, but to all the lifestyle choices we make that impact the earth, including what we buy, how we live, and what we throw away.

Discussion (about 1 hour)

Energy consumption

Introduce key terms and concepts by asking students if they engage in the following activities:

- Ride in a car
- Turn on a light
- Watch television
- Play a video game
- Microwave a meal
- Listen to a stereo
- Use the air conditioner
- Use a hair dryer
- Wash or dry clothes
- Use a dishwasher

Explain to students that many of our other daily habits and behaviors depend on energy, most of which cause pollution.

Need to Know

- **Eco-footprint**: The negative ecological impact that something has on the environment. Also called ecological footprint.
- **Carbon footprint**: The amount of carbon emitted by something during a given period. It relates to the amount of greenhouse gases produced when fossil fuels are burned.
- **Greenhouse gases**: Gases that trap heat in the atmosphere, much like a greenhouse. Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), and hydrofluorocarbons (HFCs).
- **Global warming**: An average increase in the Earth's temperature, which causes changes in climate.
- **Climate change**: Often used synonymously with the term global warming, it refers to the long-term changes in the climate of a region. A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans.
- **Sustainable**: If something is sustainable it can be kept going. Sustainable fishing means fishing in a way that does not reduce the number of fish and endanger them.
- **Biodegradable**: Something that can be broken down naturally and then becomes part of the soil, water, or air.

Because the use of energy is a part of our everyday lives, nearly every daily habit has a carbon cost. Discuss how these activities use sources of energy that is created by burning carbon-based fossil fuels, which release large amounts of greenhouse gases such as carbon dioxide.

The good news is there are many ways that students can reduce their eco-footprint. Ask students to brainstorm ways they can conserve energy at school and at home. Possible answers might include:

- Turn off lights when you leave a room
- Walk or bike instead of riding in a car
- Use less heating or air conditioning
- Buy locally grown food
- Buy products with less packaging

Explain to students that many of their answers are examples of conservation. Conservation is the quickest, most immediate way to save energy or other resources.

Conserving resources

Discuss the three R's of recycling: reduce, reuse, and recycle. Explain that recycling is not a new idea. In the 18th century, people called "rag-pickers" scavenged for bits of cloth to sell for use in paper production. They received money for their bundles of recycled cloth much like we do for recycling cans and bottles today. During the 1940s, recycling scrap metal and paper were part of the war effort.

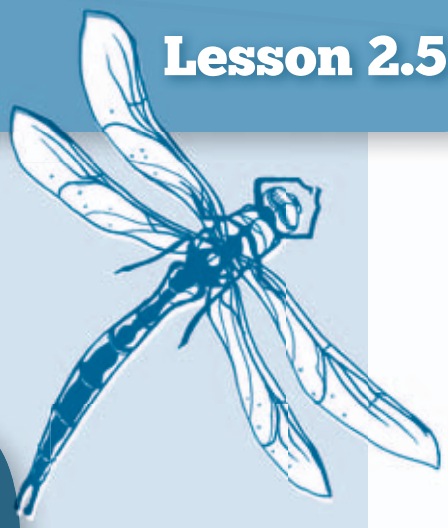
At the end of the discussion on recycling, add a 4th R—rethink. Challenge students to reconsider some of their energy consumption and buying habits.

Reducing waste

Ask students what happens when something can no longer be reused or recycled. What happens to all that garbage? It becomes part of the waste stream.

STANDARDS CORRELATION

The activities and discussions in this lesson apply the life science and physical science knowledge learned in the other lessons in this unit to explore ecosystem sustainability from personal and social perspectives.



Read and Comprehend

UNIT 2

Grades

5–6

Class or small group activity

1 HOUR

Plus essay homework

What you'll need

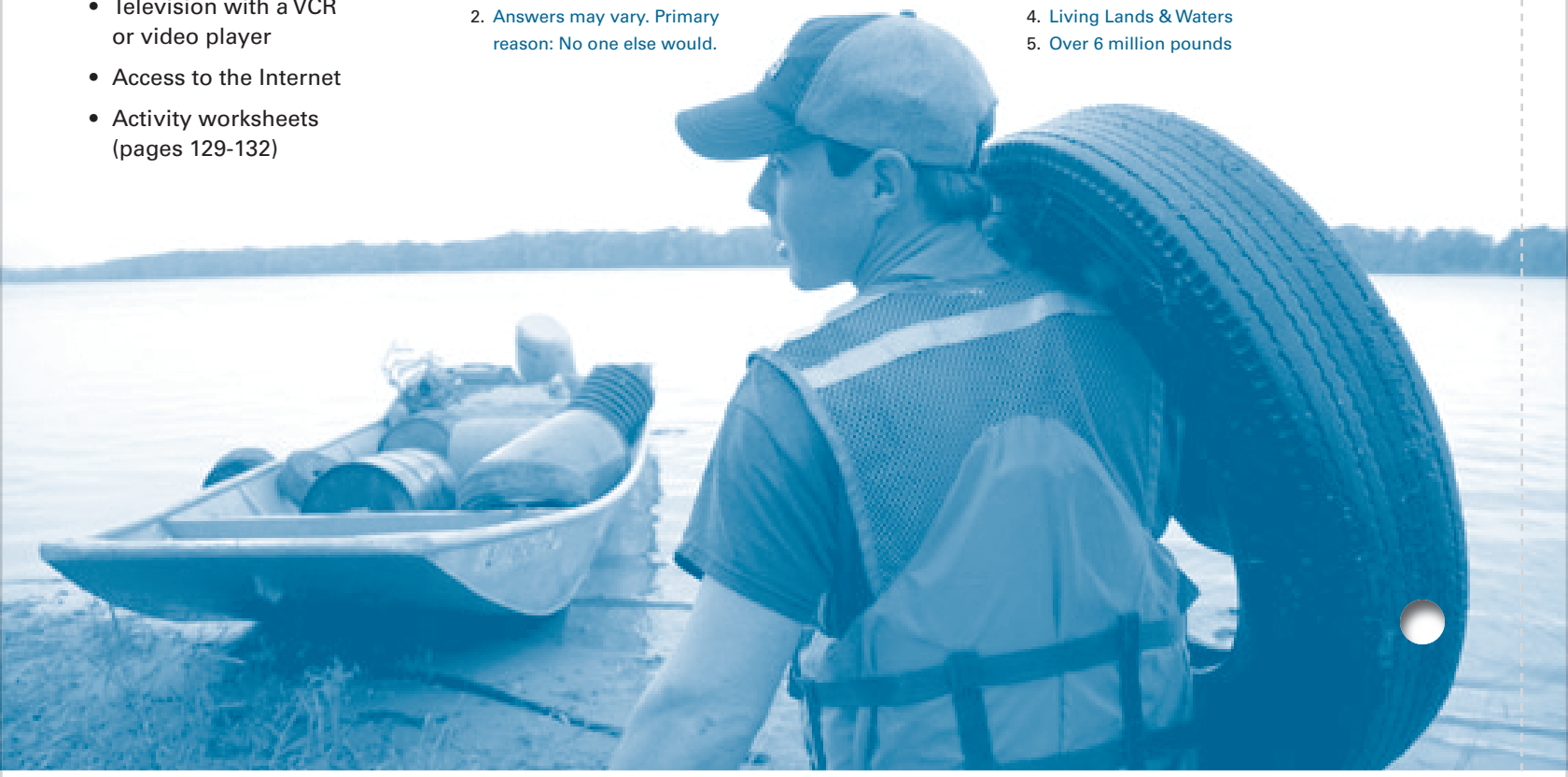
- Videotape of the Discovery Channel's *River Warriors*
- Television with a VCR or video player
- Access to the Internet
- Activity worksheets (pages 129-132)

Do This

1. Ask students to read Chad Pregracke's biography and write the answers to the questions on the student activity worksheet to test their reading comprehension.
2. Show the class the Discovery Channel Documentary, *River Warriors*, about Chad and his non-profit organization Living Lands and Waters.
3. Ask students to research Chad online and write an essay about his vision and accomplishments.

Answer Key

1. 15 miles from the Mississippi River outside of Hampton, Illinois.
2. Answers may vary. Primary reason: No one else would.
3. Commercial fisherman, shell diver, and barge hand
4. Living Lands & Waters
5. Over 6 million pounds



Read and Comprehend

Chad Pregracke: Mississippi River Hero

Name _____ Date _____

Today Chad Pregracke is a River Warrior. He is known all around the country for organizing massive river cleanups, filling large barges with garbage pulled from the Mississippi River. His hard work, charismatic leadership, and vision of a clean river have earned him many awards and honors over the years, including the prestigious National Jefferson Award for Public Service. His efforts have been written about in *Time*, *People*, and *National Geographic* magazines and shown on television on *CNN* and the *Discovery Channel*.

However, not that long ago he was a student just like you. Chad grew up just 15 miles from the Mississippi River outside of Hampton, Illinois. He and his older brother spent much of their time on, in, and around the Mississippi and Illinois Rivers. During summer breaks from high school and college, Chad worked on the river as a commercial fisherman, shell diver, and barge hand.

While working and playing on the river, Chad couldn't help but notice all the trash along the river. Believing someone in charge should take care of it, he started calling government agencies to notify them of the problem. He even sent photos of the large piles of garbage as proof. No one responded. Year after year passed by and the problem only worsened.

In 1997 Chad decided that, if no one else was going to clean up the river, then he would, one piece of garbage at a time. Working alone, Chad began pulling trash from the Mississippi River. That first year, he removed 45,000 pounds of garbage by himself. People began taking notice.

In 1998 at the age of 23, Chad founded *Living Lands & Waters*, a nonprofit organization based in East Moline, Illinois, dedicated to cleaning up and preserving our nation's rivers. With support from individuals and corporations, Chad raised enough money to hire a small cleanup crew and fleet of boats.

Today, the organization has grown to include 10 full-time employees and a fleet of 4 barges, a towboat, 6 workboats, 2 skid steers, 5 work trucks, and a large box truck. With this equipment, the crew is able to travel and work in an average of 9 states a year along the Mississippi, Illinois, Ohio, Missouri, and Potomac Rivers, as well as many of their tributaries.

Since the project's inception, Chad, his crew, and over 60,000 volunteers have collected over 6 million pounds of debris from our nation's greatest rivers. Most recently, Chad expanded the mission of the organization to include *Big River Educational Outreach*, *The MillionTrees Project*, and the *Adopt-a-River Mile* programs.

Answer the following questions about Chad Pregracke.

1. Where did Chad grow up? _____

2. Why did Chad decide to clean up the Mississippi River? _____

3. What jobs did Chad do on the river during summer breaks? _____

4. What is the name of the non-profit organization Chad started? _____

5. How many pounds of garbage have Chad and his organization pulled from U.S. rivers?

Your Eco-Footprint

Grades

5–6

Class or small group activity

1 CLASS PERIOD

What you'll need

- Activity worksheet (page 132)

In this lesson, students learn what their eco-footprint is over the course of a normal day.

Do This

1. Distribute the **Eco-Footprint Pledge** activity worksheet and guide students in completing the activity.
2. After students have completed their list of daily habits, divide them into small groups.
3. Working in groups, have students identify similarities in their habits and behaviors and then work together to come up with options for reducing their eco-footprints.
4. Ask students to reflect on some of the ways they can reduce their eco-footprint and choose three to commit to in everyday life. Have them write it as a pledge using "I" statements.

Possible answers:

Daily habits: Ride in a car, turn on a light, microwave a meal, watch television, play a video game, listen to music, use the heat or air conditioner, use a hair dryer, wash or dry clothes, or use a dishwasher

Reducing our eco-footprint:

- Turn off lights when you leave a room
- Walk or bike instead of riding in a car
- Use less heating or air conditioning
- Buy locally grown food
- Buy products with less packaging

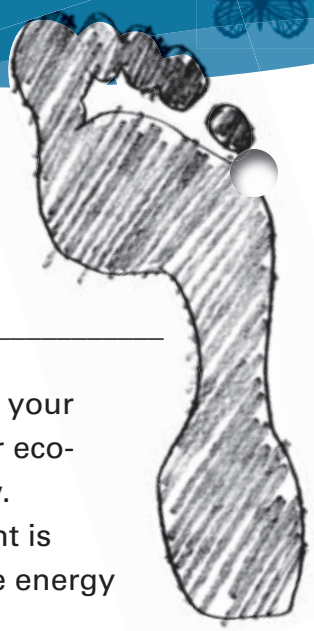
leave no trace
CENTER FOR OUTDOOR ETHICS

Outdoor Ethics

- Plan ahead and prepare
- Dispose of waste properly
- Leave what you find
- Respect wildlife
- Be considerate of other visitors

These excerpts from the *Leave No Trace Seven Principles* have been reprinted with permission from the Leave No Trace Center for Outdoor Ethics. For more information, visit www.LNT.org.

Eco-Footprint Pledge



Name _____ Date _____

Almost every daily habit or behavior contributes in some way to your eco-footprint. The good news is that there are lots of things we can do to reduce our impact on the planet.

First, think about the parts of your daily routine that add to your eco-footprint and list them below. Remember, your eco-footprint is increased every time you use energy that comes from fossil fuels.

_____

_____

_____

_____

_____

_____

Next, compare your lists and discuss which daily habits or behaviors are most common among your classmates. Once you've identified these, list the "**Top 5 things we can do to reduce our Eco-Footprint**."

1. _____

2. _____

3. _____

4. _____

5. _____

Finally, take a pledge to help the earth. Choose three items from the list and make it part of your everyday life. Write these down using "I statements." For example: I can _____less/more.

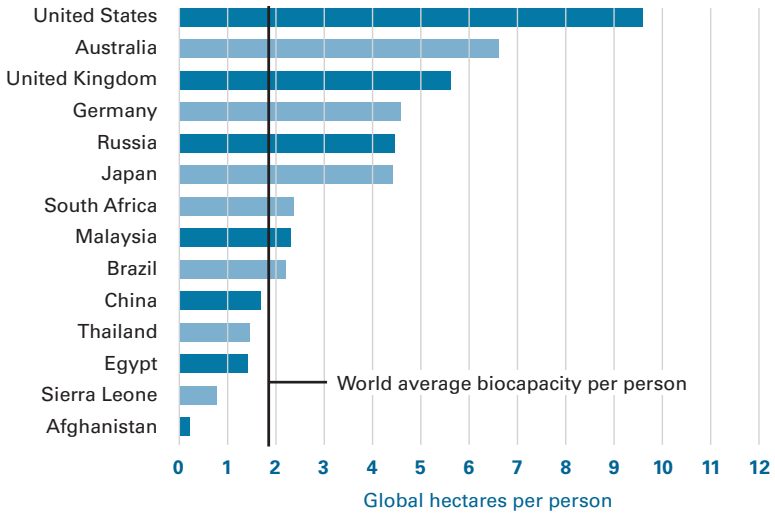
1. _____

2. _____

3. _____

On average, each person needs 2.2 global hectares, which is a measurement used to describe the biocapacity (amount of life) an area can support. The actual area of land a global hectare covers varies depending on the land type. For example, one global hectare of cropland takes less room than one global hectare of pastureland because more pasture is needed to provide the same biocapacity. In other words, pastureland is much less biologically productive than cropland.

Ecological Footprint per person by country (2003)



Extension Suggestions

Career launch

Invite a local **climatologist** or **ecologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

Volunteer for a river or park cleanup with a local conservation group or start your own.

Leave it cleaner than you found it! Go for a hike, a bike ride, or paddle around your local lake. Take a small trash bag and pick up litter along your route.

Express yourself!

Keep an eco-footprint journal. Use it to track how different actions and choices can help you change your footprint.

Trace the lifecycle of a piece of trash! Select a piece of trash and find out about its life: where and how did it start? What raw materials were used to create it? Where has it been? How it was used? Where it will end up?

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

Learn more online

Calculate your family's carbon footprint online at the Nature Conservancy website (www.nature.org)
Search keywords: **carbon footprint calculator**

Or use the EPA website (www.epa.gov)
Search keywords: **household emissions calculator**

Explore climate change on the EPA website (www.epa.gov)
Search keywords: **kids page climate change**

Examine trash and climate change on the EPA website (www.epa.gov)
Search keywords: **trash and climate change**

Learn about Community River Cleanups, Big River Educational Workshops, Million Trees Project, Riverbottom Forest Restoration, and Adopt-a-River Mile programs at Living Lands and Waters at www.livinglandsandwaters.org

Learn more about the Center for Outdoor Ethics: Leave No Trace at www.lnt.org

Unit 3

Mississippi River History and Culture

Unit 3: Mississippi River History and Culture **relies on the skills and knowledge students learned about life science in Unit 2 as the context for examining human history, migration, and settlement. The wall map is again used as a conceptual thread in this unit. Unit 3 emphasizes social sciences, language arts, and fine arts. Students are prompted to think about culture in the context of their own family traditions as a starting point for discussing human history on the Mississippi River.**

3.0 Introduction to Mississippi River History and Culture: Pre- and Post-Assessment

Introduce students to the key concepts and prepare them to explore history and culture along the Upper Mississippi River by asking students to investigate their own cultural identity and family origins.

3.1 Mississippi River's Ancient Civilizations

Learn about the original inhabitants of the Mississippi River and imagine what life was like for ancient Americans by watching a video and writing poetry.

3.2 Where Worlds Meet: Early European Exploration

Discover what happened when the old and new worlds converged on the Mississippi River by plotting the courses of early European explorers and researching the Native American tribes they encountered.

3.3 Louisiana Purchase: Gateway to the Western Frontier

Explore the role of the Mississippi River as a primary motivation for the Louisiana Purchase and plan a trip of your own on the Upper Mississippi River.

3.4 Rivers of Human Migration: Settlement, Transportation, and Trade

Learn about the European-American migration of settlers as they moved from East to West in search of new land and opportunity by analyzing 19th-century primary sources and evaluating the geographic characteristics that influenced migration and settlement.

3.5 Mississippi River: Pathway to Freedom

Learn about the Underground Railroad and plan your escape to freedom.

Introduction to Mississippi River History and Culture

UNIT 3

Unit 3 goal

Learn how communities and cultures develop to form civilizations

Lesson goal

Understand our own traditions and culture

Lesson objectives

- Discover your family culture
- Identify your family traditions
- Investigate how technology influences or changes traditions

Educational standards

- Social Science
- Language Arts

What you'll need

- Way to display family tree, timeline, or other visual aids

How long it will take

- *Activity 1:* 15 min.
- *Discussion:* 60 min.
- *Activity 2:* 45-90 min.

What's next!

Learn about the first civilizations along the Mississippi River.

Introduction

Unit 3 introduces the key concepts, facts, and vocabulary that students need in order to discover history and culture along the Upper Mississippi River. Students learn about abstract ideas such as culture, language, and social organization by exploring their own cultural identity and family origins.

STANDARDS CORRELATION

This introduction focuses on social studies and language arts standards, with an emphasis on how people create, learn, share, and adapt to culture. Students explore their own family or community culture to understand and identify cultural patterns, which prepares them for an in-depth examination of cultural continuity and change over time in the following lessons.

Serpent Mound in Adams County, Ohio

Pre- and Post-Assessment

15 MINUTES

What you'll need

- Activity worksheet (page 138–139)

Do This

1. Copy and distribute the Pre- and Post-Assessment activity worksheet on the following page.
2. Allow 15 minutes for students to complete the assessment.
3. Save the pre-assessments to compare with a post-assessment given after students complete all the lessons in this unit using this same activity worksheet.
4. Calculate each student's percent increase in knowledge.

Answer Key

Matching

1.	g	6.	i
2.	f	7.	e
3.	a	8.	c
4.	h	9.	d
5.	b		

Multiple Choice Questions

1. c
2. a
3. d
4. b
5. d

Definitions and Vocabulary

1. a
2. b
3. c
4. c
5. b

"To write history without putting any water in it is to leave out a large part of the story. Human experience has not been so dry as that."

– Donald Worster, *Rivers of Empire*, 1985

Unit 3 Assessment

Name _____ Date _____

Matching

Draw a line from the word on the left to the correct definition on the right.

1. Tradition
2. Historic
3. Written language
4. Archeology
5. Anthropology
6. CE
7. BCE
8. Culture
9. Social organization

a. A symbolic form of communication.

b. Study of the origins, physical and cultural development, and social customs and beliefs of people.

c. A set of shared attitudes, values, goals, and practices that characterizes a group of people.

d. Set of systems and institutions developed to meet basic needs, such as family, governments, languages, universities, hospitals, business corporations, and legal systems.

e. Before the Common Era.

f. Term used to describe the period of time known about through records, such as written documents or oral traditions.

g. Practice of handing down information, beliefs, or customs from one generation to another.

h. Study of past human culture by the recovery and examination of remaining material evidence, such as burial sites, buildings, tools, and pottery.

i. Common Era.

Multiple Choice

Circle the correct answer

1. Who was the first European to reach the Mississippi River?
   a. Christopher Columbus
   b. Juan Ponce de León
   c. Hernando de Soto
   d. Jacques Marquette

2. The Native American city of Cahokia was settled around:
   a. 750 CE
   b. 300 BCE
   c. 100 CE
   d. 600 CE

3. From which country did U.S. President Thomas Jefferson purchase the Louisiana Territory in 1803?
   a. Spain
   b. Mexico
   c. England
   d. France

4. The Corps of Discovery, commonly called the Lewis and Clark Expedition, departed from which place along the Mississippi River?
   a. St. Louis, Missouri
   b. Wood River, Illinois
   c. St. Paul, Minnesota
   d. Keokuk, Iowa

5. The Underground Railroad was:
   a. The first subway in Chicago.
   b. Secret organization of railway workers.
   c. Movement to end slavery in Europe.
   d. Secret routes and safe houses used by slaves to escape North.

Definitions and Vocabulary

Choose the BEST definition for the word

1. Migration
   a. The relocation of an individual or group to a new place, usually in search of resources or opportunity.
   b. The movement of trade items from one place to another.
   c. Term used to describe recent history.

2. Multicultural
   a. Someone who speaks many languages.
   b. Many cultures coexisting in a similar time and place.
   c. Large groups of people.

3. Mound builders
   a. People who lived in homes made of sod.
   b. People who built stone granaries to store corn.
   c. People who built mound-shaped earthen monuments for their dead.

4. Timeline
   a. Amount of time given to complete a task.
   b. Line dividing one historic era from another.
   c. Visual representation of the events of a certain era.

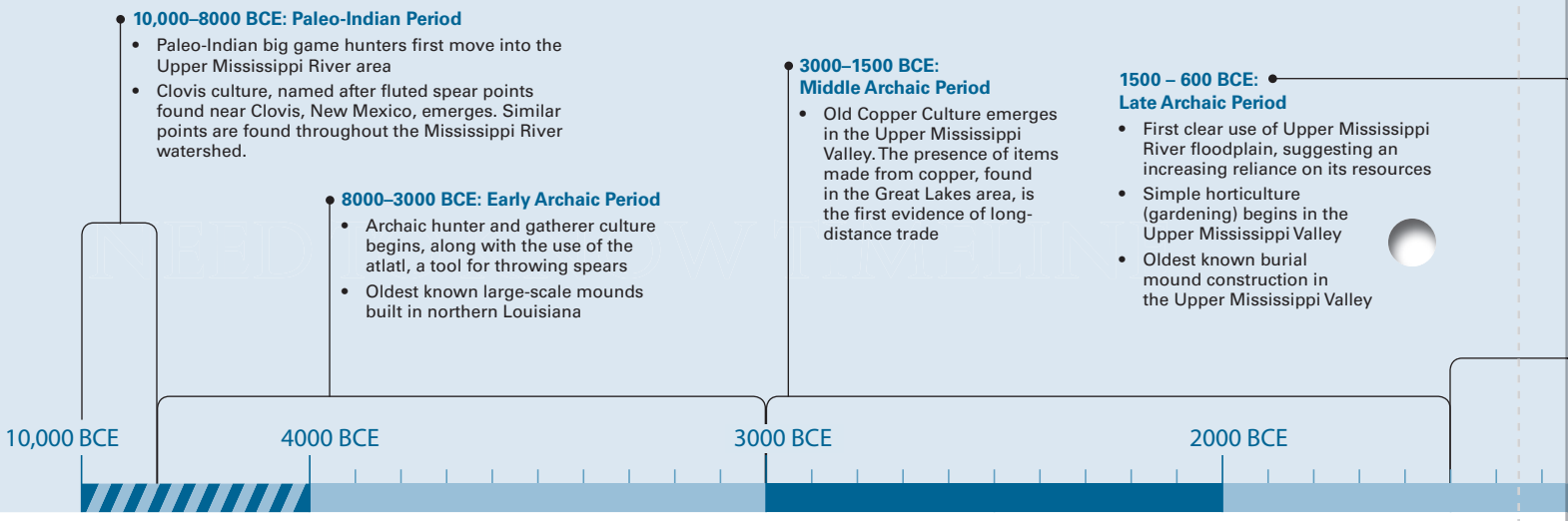
5. Chronology
   a. Device used to tell time.
   b. Organization of events in order of their occurrence.
   c. Tool used to determine the date of an object.

Moments in History

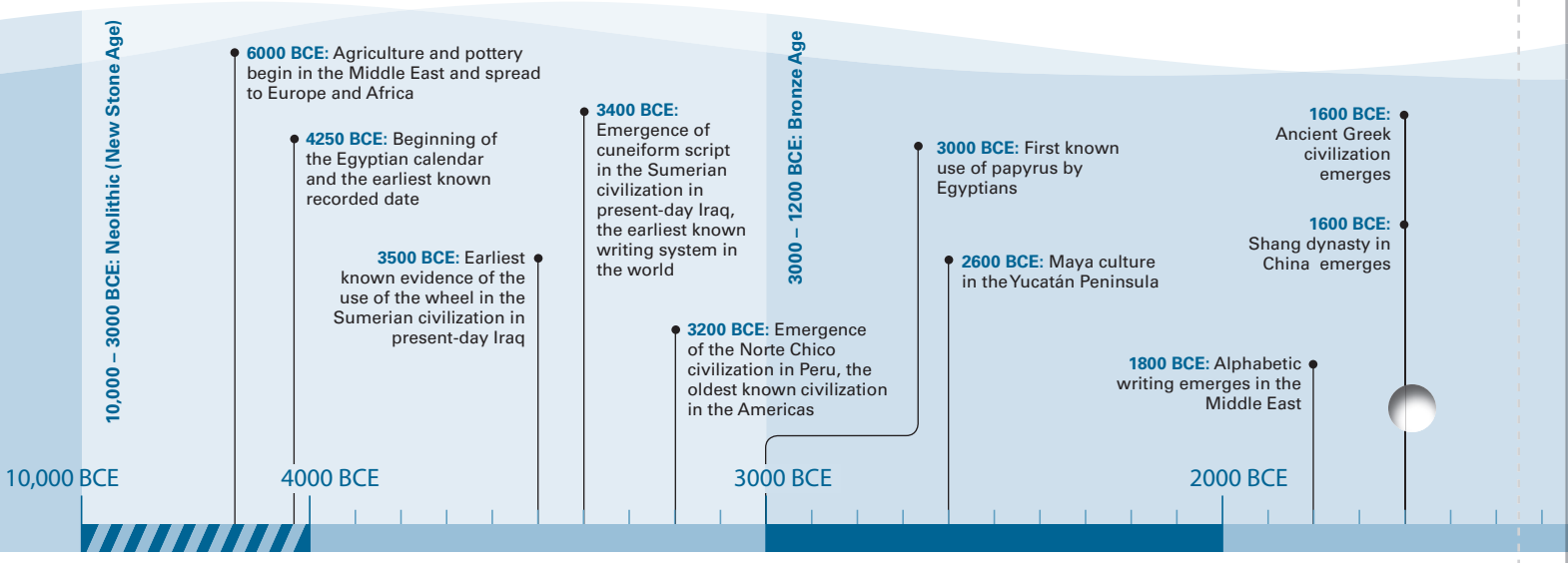
Archeologists divide history into developmental periods that describe times of continuity and change in cultural traditions. These periods varied from place to place, so all periods shown here are approximate.

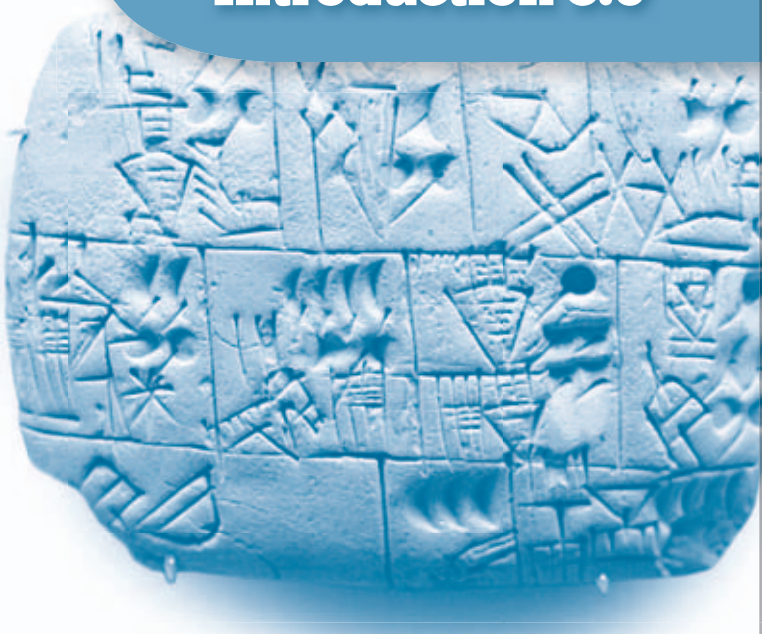
Timelines help us to understand events and trends and how they change over time. Comparing the cultural history of the Mississippi watershed with world history helps place the cultural changes in the Mississippi watershed in a larger context.

Our Mississippi Timeline



Our World Timeline

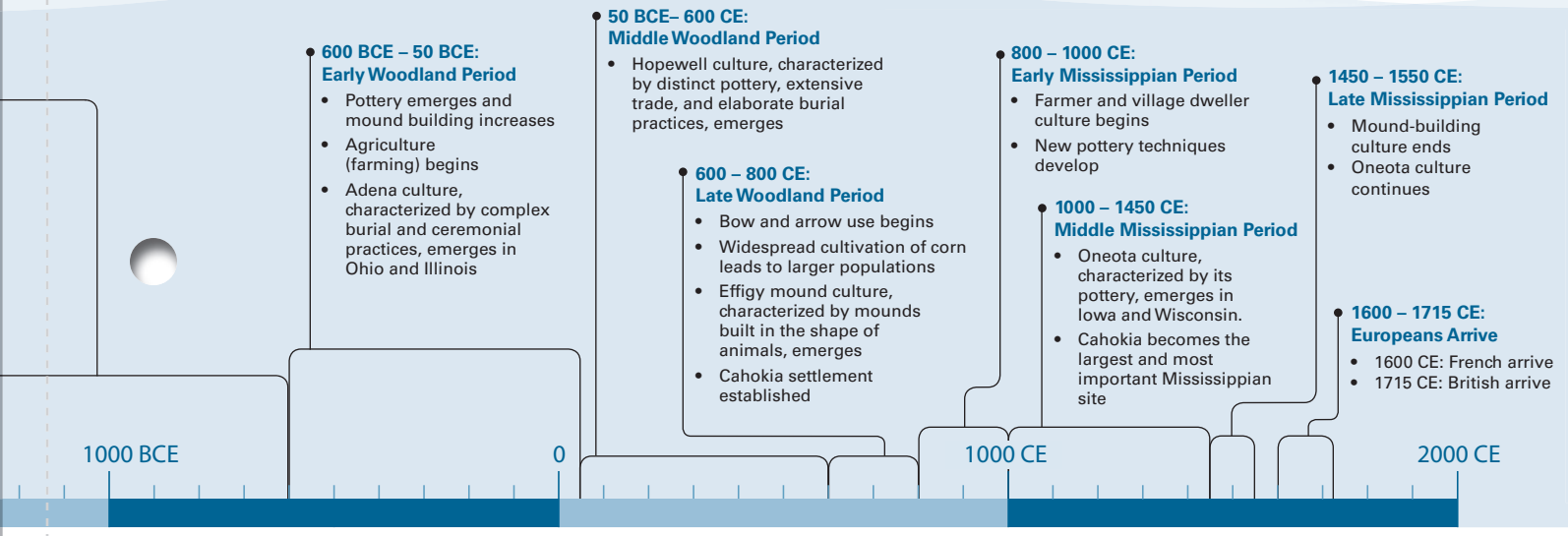


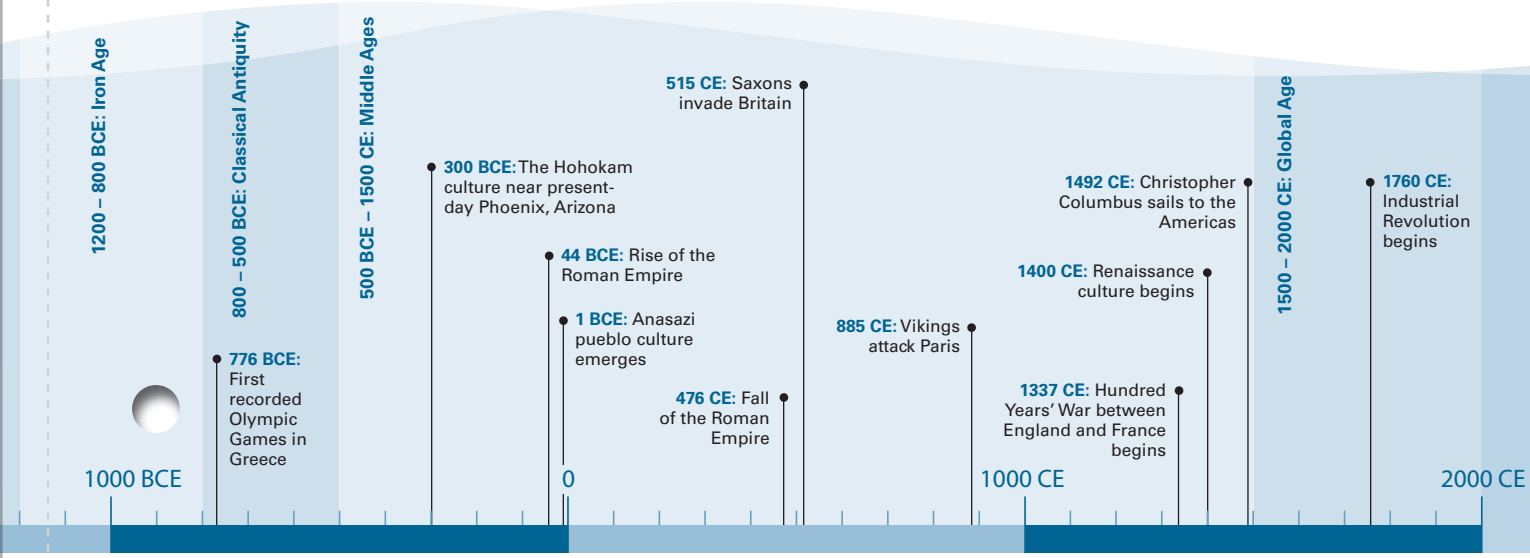


Cuneiform tablet believed to be from southern Iraq, circa 3100-3000 BCE.

Common Era

Common Era, abbreviated as CE or BCE (Before the Common Era), is one of the designations for the world's most commonly used year-numbering system. Identical to the numbering used with Anno Domini (BC/AD) notation, it has been in use since the 1700s.





Introduction 3.0

UNIT 3

Background

Who are we? Where do we come from? What makes us unique and yet similar? These are questions we explore through history, anthropology, and archeology.

The ability to create and transmit culture is what differentiates us from the rest of the animal world, but it's not that easy to find one definition that all anthropologists and archeologists agree on. In its broadest sense, culture can be defined as the thoughts, behaviors, languages, customs, and material items produced—along with the methods used to produce them—of a group of people.

Cultural formation and transmission

Cultures form when groups of people interact with their environment. Over time, they adapt their tools and methods to meet their basic needs to fit that environment. They also organize their society in ways that help each other meet basic needs, including families, governments, schools, occupations, medicine, legal systems, and come to share beliefs and symbols to understand and explain their world.

Culture is passed down from one generation to the next. It is dependent on the human ability to communicate. Language is a symbolic form of communication. The word *table*, for example, is nothing other than a symbol for the actual thing, a table.

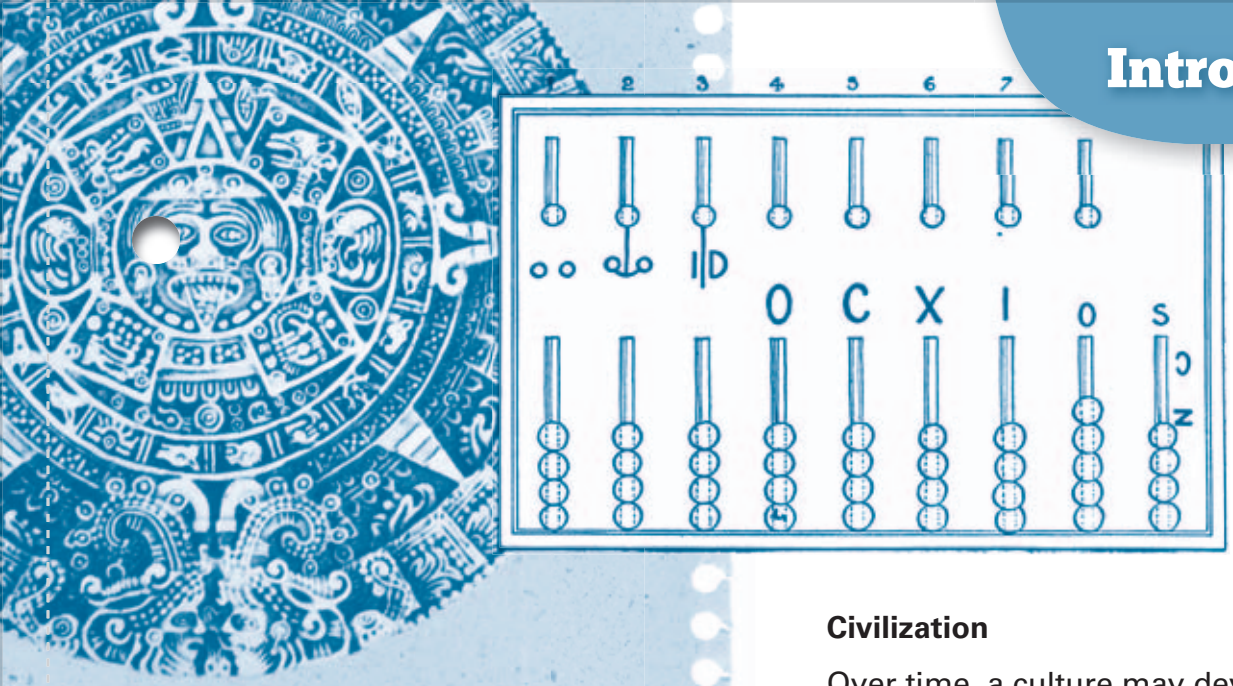
Outside influences such as trade can cause cultures to change. Where cultures intersect and interact with each other, they share ideas and technologies. For example, it is uncertain exactly when or where the wheel was first invented, but its use spread rapidly. Hence, other cultures did not have to reinvent the wheel.

Mayan calendar
The ancient Mayans invented a calendar of remarkable accuracy and complexity about 500 BCE.

Need to Know

- **Anthropology:** Study of the origins, physical and cultural development, and social customs and beliefs of people.
- **Archeology:** Study of past human culture by the recovery and examination of remaining material evidence, such as burial sites, buildings, tools, and pottery.
- **Chronology:** Organization of events in order of their occurrence.
- **Timeline:** Visual representation of the events of a certain era, used as a tool for studying history and culture.
- **Prehistoric:** Term used to describe the period before recorded history.
- **Historic:** Term used to describe the period of time known about through records, such as written or oral traditions.
- **Culture:** Shared set of attitudes, values, goals, and practices that characterizes an institution, organization or group. Culture is a term used to describe a people's whole way of life, including arts, beliefs, customs, inventions, language, technology, and traditions.
  - Cultural patterns emerge in response to basic needs, such as food, clothing, and shelter, as well as technology, language, arts (including music), education, religion, and recreation.
  - The term **multicultural** describes a group or a place with several coexisting cultures.

Introduction 3.0



Abacus
An instrument for making calculations by sliding counters along rods or in grooves, the abacus goes back to at least 2400 BCE. Many civilizations developed their own versions of the abacus.

- **Belief:** Feeling sure that something or someone exists or is true.
- **Value:** The idea that something, such as an object, goal, or belief, has worth.
- **Tradition:** The practice of handing down information, beliefs, or customs from one generation to another.
- **Civilization:** Similar to culture but commonly used to refer to a more complex or advanced form of organized life, including complex social, political, military, and religious values, goals, and practices.
- **Language:** A form of communication. Without language, people could not learn from one another across generations and culture could not be transmitted.
  - **Written language** is a symbolic form of communication.
- **Social organization:** Complex systems and institutions developed to meet basic needs, such as family, governments, languages, universities, hospitals, business corporations, and legal systems.

See the timelines on pages 140 – 141 for more terms and concepts.

Civilization

Over time, a culture may develop into a civilization, which is considered an advanced form of organized culture with more complex forms of social, political, military, and religious life. However, some people disagree about when a culture can be considered to have become a civilization. Also, *civilization* is a loaded term, one used to judge or contrast so-called civilized societies with so-called primitive ones. Although the term civilization is useful for describing a society's degree of complexity, it cannot be used to judge a society's beliefs, values, or quality of life.

Many of the world's greatest civilizations rose up on large rivers. The Shang Dynasty evolved along the Yellow River, the second-longest river in China after the Yangtze. It is considered the oldest continuous civilization in the world. The ancient Egyptian civilization that sprang up along the Nile River is older, but it was not continuous with modern Egyptian society.

Cahokia, a large city that flourished along the Mississippi across from St. Louis, Missouri, emerged during the Late Woodland culture. It is considered a civilization. Read more about Cahokia in the following lesson, *3.1: Mississippi River's Ancient Civilizations*.

Discussion (60 minutes)

Introduce the key concepts in the Need to Know section using individual family or local community customs and traditions as context, but be sensitive to the fact that not all students are living with blood relatives or intact homes. Explain that customs are our usual way of doing things that are handed down from one generation to another.

Use the questions in the student activity worksheet titled "My Culture" to guide a discussion to get students thinking about their own family culture. Begin by sharing information about the culture of your own community, family, or ethnic group to help students brainstorm and feel comfortable doing the same. Then discuss those practices and beliefs in relation to how cultural patterns emerge in response to basic needs, such as food, clothing, and shelter, as well as technology, language, arts (including music), education, religion, and recreation.

As American as....

Apple pie
Baseball
Red, white and blue
Rock 'n' roll
Chevrolet
Coca-Cola
Hollywood
Hot dogs
McDonald's
Cowboys
Football
Jazz
Route 66
Mickey Mouse
NASCAR
Statue of Liberty
Uncle Sam
Disneyland
Nike
Elvis Presley
Michael Jackson
Starbucks

My Culture

Students write a short essay about the culture of their community, family, or ethnic group, including its history, traditions, language, beliefs, and values and present it to the class. Essays should be accompanied by a timeline and diagram of their family tree.

Grades

5–6

Individual or group activity

40–90 MIN.

- 10–30 minutes for students to prepare timelines and family trees as visual aids.
- 30–60 minutes for students to read essays to the class

What you'll need

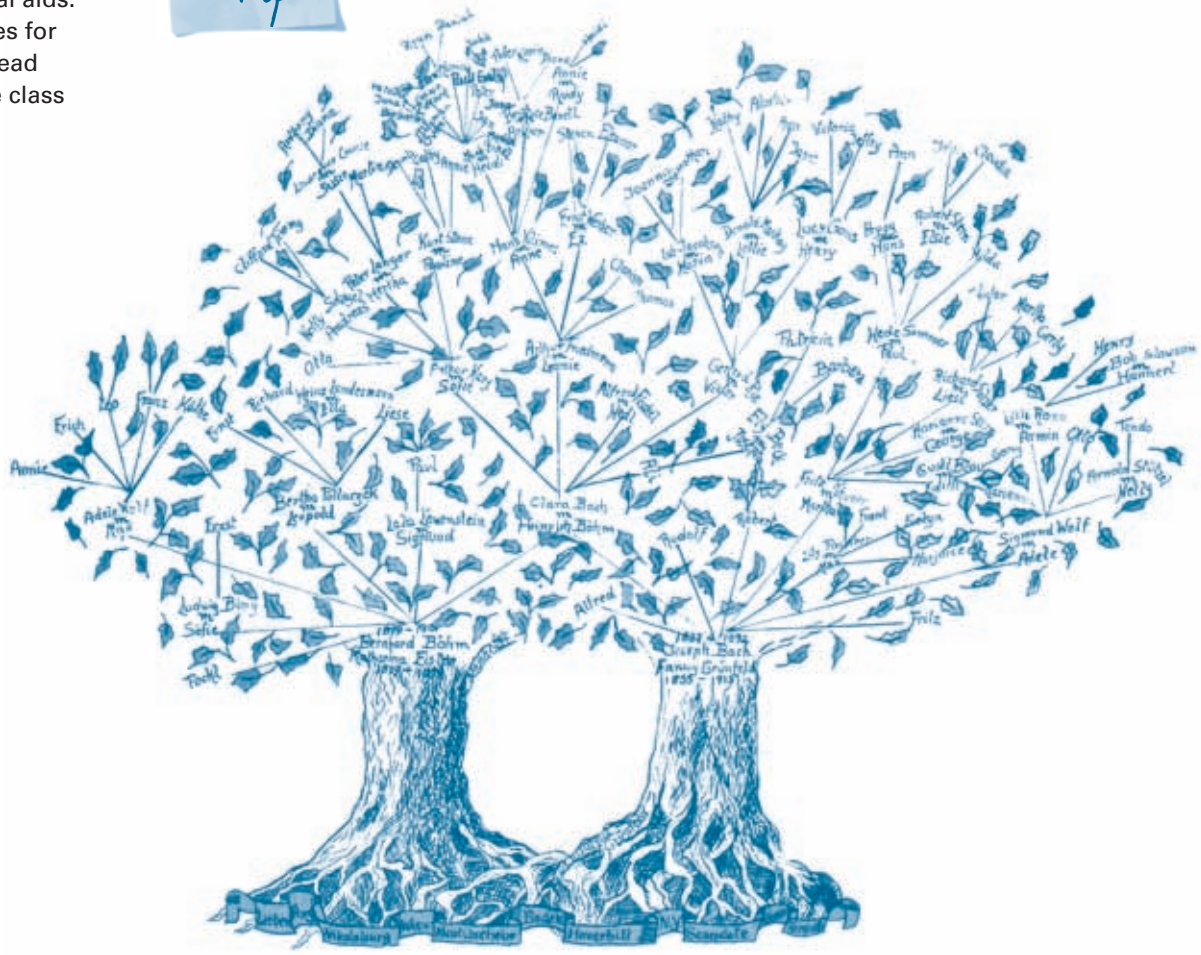
- Essay assignment activity worksheet (page 146–147)
- Way to display family tree, timeline, or other visual aids

Do This

1. Students present their essays and visual aids to the class.
2. Ask students to share their essays and visual aids with the class or post their materials online or on a bulletin board.

Teacher Tip

Similarities help students feel a sense of belonging. Help them understand that uniqueness makes them special and individual.



UNIT 3

Your Culture

Name _____ Date _____

Write an essay about your community, family, or ethnic group's culture, which you will present to the class. Include a timeline and family tree as visual aids for your presentation.

Your essay should include your culture's customs, traditions, beliefs, and values. You may need to interview your parents, grandparents, or neighbors to complete this assignment.

As part of your research, answer the following questions:

1. What part of the world do your ancestors (grandparents, great grandparents) come from? _____

2. What traditions are important to you? Do you do anything special for holidays such as Thanksgiving or New Year's? What other kinds of celebrations do you have? _____

3. What has your family or community taught you? What do you value most?_____

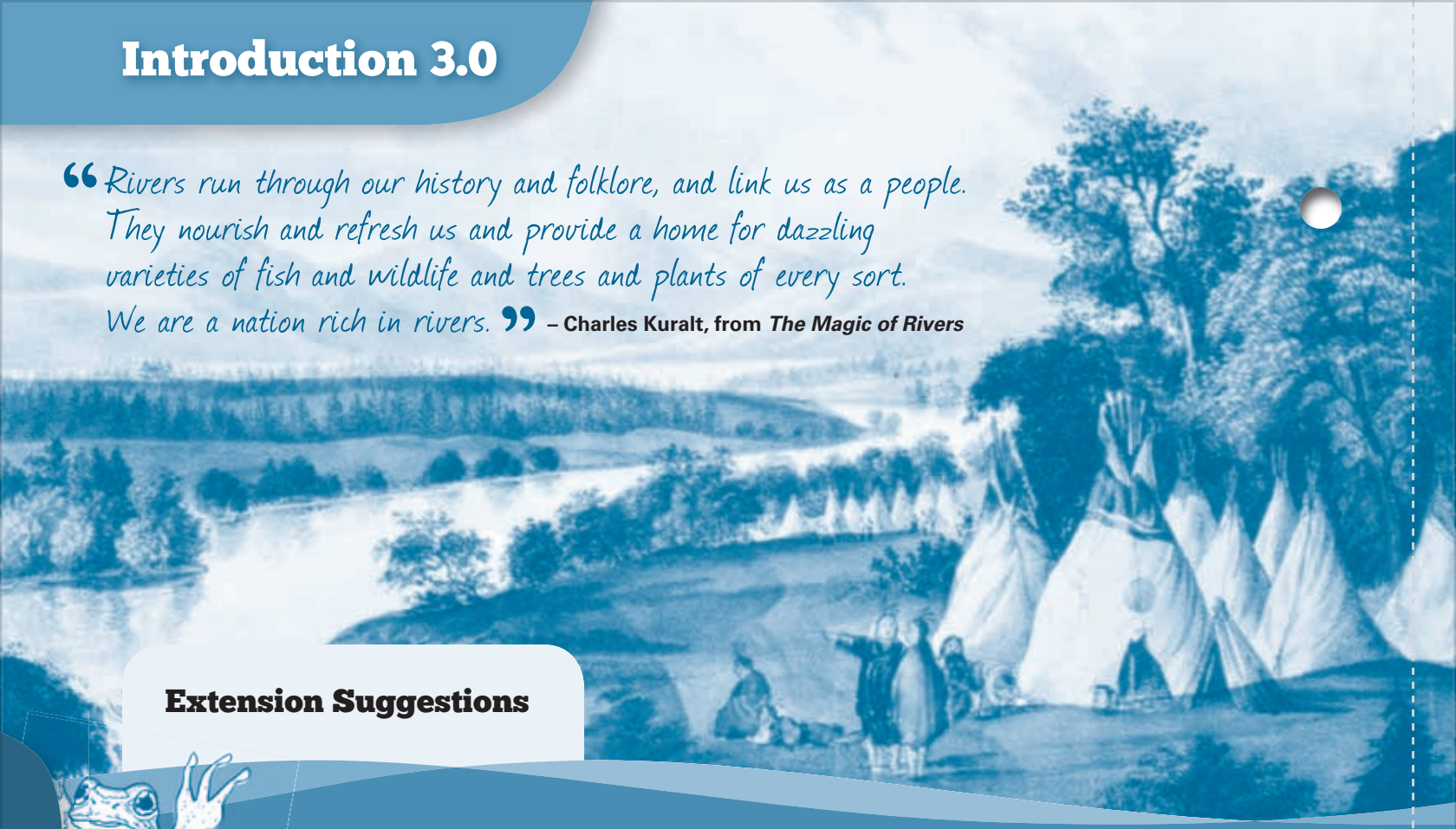
4. How do you communicate? Include languages spoken and technologies used to communicate with each other. _____

5. What do your parents do for a living? Your grandparents? _____

6. What technologies did your family or neighbors use when they were 10-12 years old? _____

7. Write an essay describing your culture using examples from your answers to the above questions.

Introduction 3.0



"Rivers run through our history and folklore, and link us as a people. They nourish and refresh us and provide a home for dazzling varieties of fish and wildlife and trees and plants of every sort. We are a nation rich in rivers." – **Charles Kuralt, from *The Magic of Rivers***

Extension Suggestions

UNIT 3

~ Career launch

Invite a local **anthropologist** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Go "old school"

Have students make slate tablets and imagine what it was like to do their homework on these mini chalkboards instead of paper in a frontier school. Simple tablets can be made using cardboard and spray-on chalk paint (best done outdoors).

~ Get out!

Visit a local historical site and participate in a living history event.

~ Express yourself!

- Write a letter to your grandparents and ask about their family traditions when they were growing up.
- Write a letter to your future grandchildren explaining what your life is like now.

~ Learn more online

Learn about culture from the New York State Education Department (www.nysed.gov)
Search keywords: **what is culture**

Learn about the process of archeology from the Mississippi Valley Archaeology Center at the University of Wisconsin—La Crosse (www.uwlax.edu/mvac)
Search keywords: **archeology process**

Learn about archeology for kids from the National Park Service (www.nps.gov)
Search keywords: **archeology for kids**

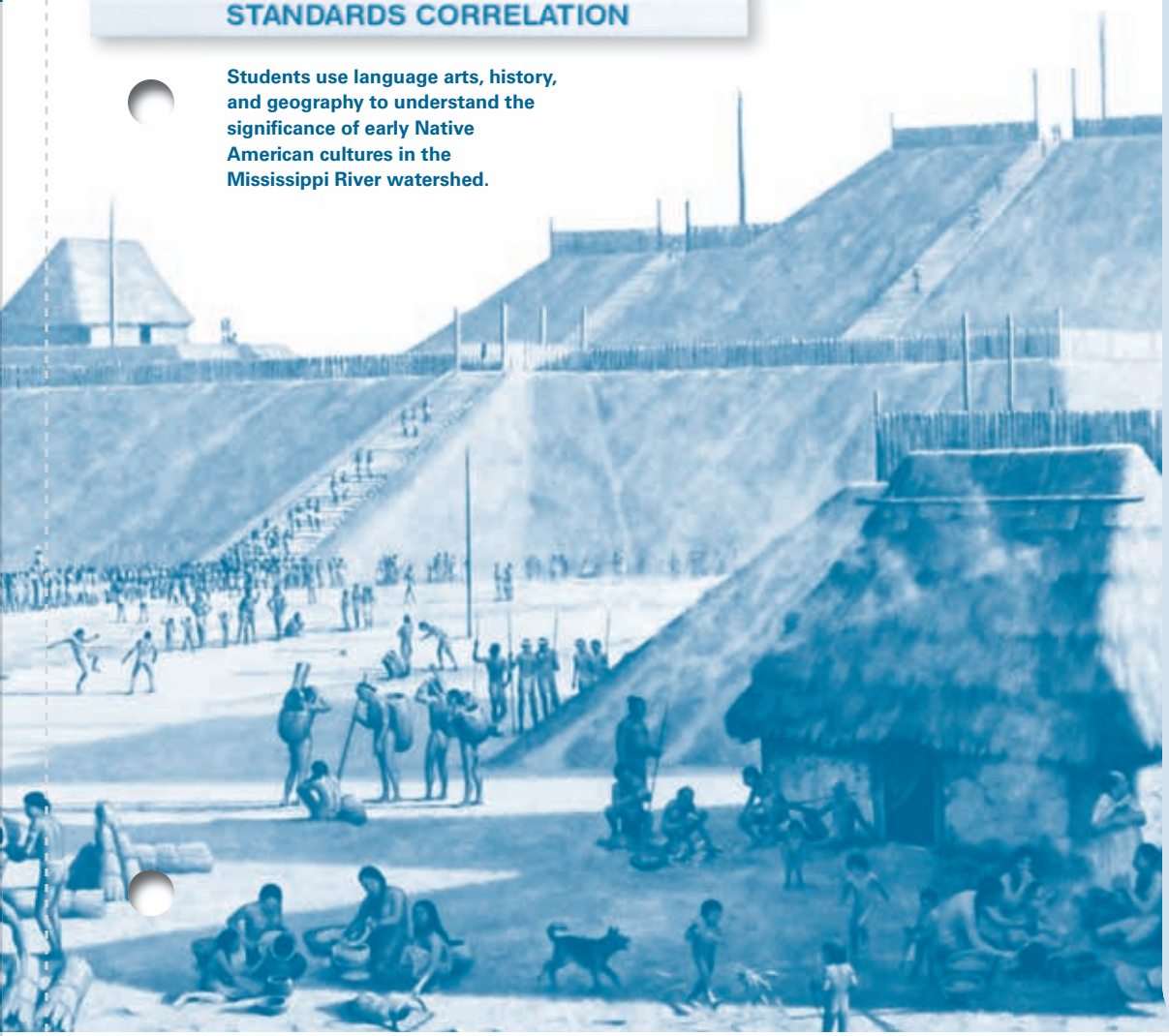
Mississippi River's Ancient Civilizations

Introduction

Lesson 3.1 introduces students to the original inhabitants of the Mississippi River and invites them to imagine what life was like for ancient Americans by writing poems. They learn about mound-building Mississippian Cultures by watching a video about the ancient city of Cahokia and explore oral tradition and archeology.

STANDARDS CORRELATION

Students use language arts, history, and geography to understand the significance of early Native American cultures in the Mississippi River watershed.



Unit 3 goal

Learn how communities and cultures develop to form civilizations

Lesson goal

Learn about ancient Americans living along the Mississippi

Lesson objectives

- Explore early American civilizations
- Discover their customs and cultures
- Compare their cultures to yours

Educational standards

- Social Science
- Fine Arts
- Language Arts

What you'll need

- Cahokia: City of the Sun online video
- Access to the Internet

How long it will take

- *Discussion:* 30 min.
- *Video:* 15 min.
- *Activity 1:* 45-60 min.

What's next!

Early European exploration and trade

Background

The Mississippi River is possibly the most historic waterway on the North American continent. Its rich history started with Paleo-Indians.

Paleo-Indian Period: 10,000–8000 BCE
Archeologists believe early humans first came to North America 15,000 to 20,000 years ago across the Bering land bridge that once connected Asia and North America during the Ice Age. They were big-game hunters who followed now-extinct woolly mammoths and mastodons. Artifacts such as projectile points and stone and bone tools suggest that these people came to the Upper Mississippi area about 12,000 years ago.

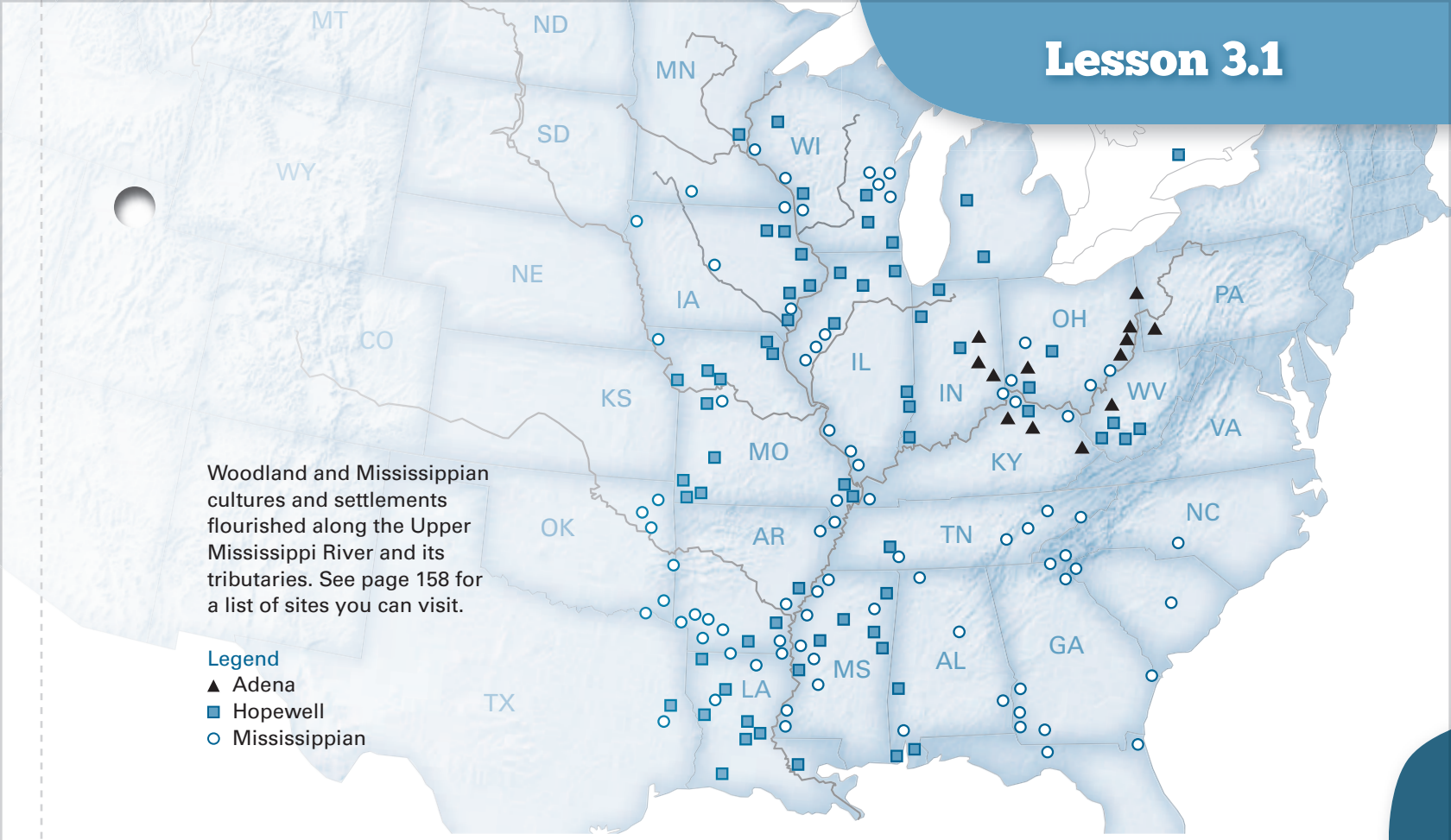
Archaic Period: 8000–600 BCE
When the Ice Age ended, a wider variety of plant and animal resources became available, and cultural traditions began to change. Projectile points evolved and the atlatl, a tool for throwing spears, came into use.

As Archaic hunters and gatherers began utilizing local resources more, including deer, bison, clams, fish, and plant materials, they became less nomadic. Toward the end of the Archaic period, some hunter-gatherers began practicing agriculture, making pottery, and building burial mounds.

Woodland Period: 600 BCE–800 CE
The Woodland period was a time of rapid change brought about by population growth and increased contact between groups through trade. The Woodland period is characterized by the development of agriculture and pottery, the building of burial and ceremonial mounds, and the introduction of the bow and arrow.

As people gathered food in larger quantities, their communities grew larger and more complex. Different traditions evolved based on shared

Monks Mound, located at the Cahokia Mounds UNESCO World Heritage Site near Collinsville, Illinois, is the largest Pre-Columbian earthwork in America north of Mesoamerica.



Woodland and Mississippian cultures and settlements flourished along the Upper Mississippi River and its tributaries. See page 158 for a list of sites you can visit.

practices, including burial, ceremonial, and artistic traditions. These include the Adena culture in Ohio and Illinois during the Early Woodland Period (600–50 BCE) and the Hopewell culture along the Ohio and Upper Mississippi Rivers during the Middle Woodland Period (50 BCE–600 CE).

Mississippian Period: 800–1550 CE

Between 800 and 1000 CE the Native American population exploded, which resulted in large towns and cities springing up along the Mississippi and its tributaries. This marked the beginning of the Mississippian period.

Cahokia

One of the largest ancient Mississippian cities was Cahokia. A bustling center of commerce and culture, it was larger than most European cities of its time, including London or Paris. This well planned city included 120 ceremonial and burial mounds, several plazas, and wooden palisade walls nearly two miles long. At its peak between approximately 1050–1150 CE, up to 20,000 people may have lived here.

Corn was the mainstay of their diet, which they grew in the rich bottomlands along the Mississippi River. This high-yielding crop could be stored for long periods. They also grew beans, squash, and other seed-bearing crops.

By the time the European explorers arrived, the Cahokia region was deserted. Archeologists continue to study Cahokia and other mound sites in hopes of finding evidence that will help explain what happened.

Please review the timeline on pages 140–141 for more information.

Sources: *It Happened on the Mississippi River* by James A Crutchfield; *Historic Resources Study of the Mississippi National River and Recreation Area* by the National Park Service.

Oral Tradition

Most of what we know about Native American culture before the arrival of Europeans comes from oral history and archeology.

Anishinabe-Ojibwe Migration Story

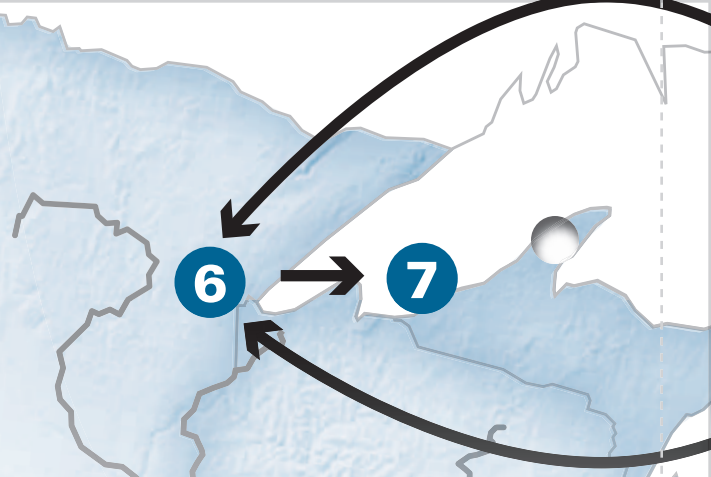
Oral tradition tells the story of the long migration of the Anishinabe-Ojibwe from the Atlantic Ocean to Spirit Island near Duluth, Minnesota. This epic journey lasted many generations and required a great deal of courage, determination, and faith. It probably began around 900 CE and took about 500 years.

In the Ojibwe language, "Anishinable" means "one of the people." It is what they call themselves. The Ojibwe are part of a large language group of Native Americans known as the Algonquin family. They are one of the largest and most widespread tribes in North America.

"Seven prophets came to the Anishinabe. They came at a time when the people were living a full and peaceful life on the North Eastern coast of North America. These prophets left the people with seven predictions of what the future would bring. Each of the prophecies was called a fire and each fire referred to a particular era of time that would come in the future. Thus, the teachings of the seven prophets are now called the Seven Fires." –William Commanda, Elder of the Algonquin Nation

Migration of the Anishinabe

When the seven prophets came to the Anishinabe, the nation was living on the shores of the Eastern Great Salt Water. The people were so many that you could not see the end of the Nation, even if you climbed to the top of the highest mountain and look in all directions. They had plentiful food from the land, the sea, and the rivers. It was a time and a place of great plenty.



1 The prophet of the First Fire informed the people "If you do not move, you will be destroyed."

He also told the people that the first of seven stopping places during the long migration would be a turtle-shaped mi-ni-si' (island). It was found in the St. Lawrence River near modern-day Montreal.

2 The second major stopping place was near the place of water and thunder the Ojibwe later called Kichi-ka-be-kong. It is now known as Niagara Falls. The Sacred Fire was moved here, and the people stayed here for a while.

3 The third major stopping place was near the Detroit River, which connects Lake St. Clair and Lake Huron to Lake Erie. Here they drove back an attack by the Iroquois and later smoked the pipe of peace with them. They rested and wandered, waiting for the next sign.

The prophesy of the Third Fire said a boy would be born that would show them the right path to where the Anishinabe would find "the food that grows on

The northern group of Anishinabe went to the western end of what is now called Lake Superior and found Spirit Island. The Sacred Shell rose up to the people here. Parts of the southern group came here, too.

water." Later a boy had a dream about stones leading across the water. The dream led the people to the islands that led across the great northern fresh water sea.

4 The Sacred Megis appeared on Manitoulin Island, the largest in a chain of islands in Lake Huron. This was the fourth major stopping place of the Anishinabe.

5 The fifth stopping place was Baw-wa-ting', near Sault Ste. Marie. This was a place of plentiful food and, later, trade with the light-skinned people. The migration split into two groups here, one following the northern shore of Lake Superior and the other the southern shore.

6 The prophesy was fulfilled at Spirit Island (near Duluth, Minnesota) where the Anishinabe found "the food that grows on water," or ma-no'-min (wild rice). It was the sacred gift from the chosen ground, and the sixth stopping place of the migration.

7 But the elders thought the journey wasn't quite over. An ancient prophesy spoke of a turtle-shaped island at the end of the journey. When the southern group of Anishinabe found Mo-ning-wun'-a-kawn-ing (Madeline Island), the Sacred Shell rose out of the water, and tobacco was placed on its shore... The Sacred Fire was carried here and continues to burn brightly.

Adapted from *The Mishomis Book: The Voice of the Ojibway* by Edward Benton-Banai (University of Minnesota Press, 1988) and "Ojibwe Migration Story" at www.ojibwe.org.

Discussion (45 minutes)

Discuss the role of oral traditions in Native American culture and read the Ojibwe Migration story with the class. Then read the *Pipe of Peace* story and the excerpt from the *Song of Hiawatha* by Henry Wadsworth Longfellow. Both poems refer to a sacred place where pipestone, a soft, red rock used to make pipes, is found.

Explain that *Song of Hiawatha* is a long, epic poem based on the oral tradition of the Ojibwe. Written in 1855, it is an example of the type of American Romantic literature that helped create the stereotype of the noble savage.

The poem's title character reveals a lack of understanding about Ojibwe history and culture. Longfellow mistook Hiawatha as another name for the Ojibwe cultural hero Manabozho. Instead, Hiawatha was a leader of the Iroquois, a traditional enemy of Ojibwe.

Ask students to consider the similarities and differences between the story and the poem. Point out the use of repetition in both. What might that tell us about the similarities between epic poetry and oral traditions? Would it help people memorize and transmit culture from one generation to the next?

The Pipe of Peace

"In the olden days, so they say, the Indians fought much. Always they followed the war trail. Then Gitche Manito, the Good Mystery, thought, 'This is not well. My children should not always follow the war trail.' Therefore he called a great council. He called all the tribes together. Now this was on the upper Mississippi."

"Gitche Manito stood on a great wall of red rock. On the green plain below him were the wigwams of his children. All the tribes were there. Gitche Manito broke off a piece of the red rock. He made a pipe out of it. He made a pipe by turning it in his hands. Then he smoked the pipe, and the smoke made a great cloud in the sky."

"He spoke in a loud voice. He said, 'See, my people, this stone is red. It is red because it is the flesh of all tribes. Therefore can it be used only for a pipe of peace when you cease to follow the war trail. Therefore it is the Place of Peace. To all the tribes it belongs.' Then the cloud grew larger and Gitche Manito vanished in it."

"Now therefore, because of the command of Gitche Manito, the Indians smoke the pipe of peace when they cease to follow the war trail. And because it is the Place of Peace, the tomahawk and the scalping knife are never lifted here."

"The Pipe of Peace" from *Myths and Legends of the Mississippi Valley and the Great Lakes*, edited by Katherine B. Judson and originally published in 1914.

Song of Hiawatha

On the Mountains of the Prairie,
On the great Red Pipe-stone Quarry,
Gitche Manito, the mighty,
He the Master of Life descending,
On the red crags of the quarry,
Stood erect and called the nations,
Called the tribes of men together.

"I am weary of your quarrels,
Weary of your wars and bloodshed,
Weary of your prayers for vengeance,
Of your wranglings and dissensions;

"Break the red stone from this quarry,
Mould and make it into Peace-pipes,
Take the reeds that grow beside you,
Deck them with your brightest feathers,
Smoke the calumet together."

- Henry Wadsworth Longfellow

Express Yourself Through Poetry

Grades

5–6

Class or small group activity

2 HOURS

- 30 min. for discussion
- 15 min. to watch video
- 30-45 minutes to write poem and create visual

What you'll need

- *Cahokia: City of the Sun* online video
- Access to the Internet
- Student activity worksheet (page 156)
- Teaching and Evaluating Haiku (page 157)

About the video

City of the Sun was produced by Donna Lawrence Productions, Inc. of Louisville, Kentucky. It won a Gold Medal Award at the 33rd Annual International Film and Television Festival of New York.

Get Ready

Read the Ojibwe story *Pipe of Peace* and the excerpt from the *Song of Hiawatha* by Henry Wadsworth Longfellow on page 154 to the class and discuss their similarities and differences. Explain that although the "Pipe of Peace" is said to be one of the original Native American stories Hiawatha was based on, it was published by someone who was not Native American. Ask students to think about the difference between listening to a story and reading one.

Do This

1. Watch the online video *Cahokia: City of the Sun*. Go to www.cahokiamounds.org and click on **Learn**. Then click on **Video Features**. You need Adobe Flash Player to view the video.
2. Discuss the video with students. Use the following questions to start the discussion.
   - Where does the name Cahokia come from? Answer: From the Iroquois who settled in the area after Cahokia was deserted. We don't know what these people called themselves.
   - What happened to them? Answer: No one knows for sure. They could have dispersed into smaller societies throughout the Midwest. Archeologists are studying the mounds to learn more.
   - What did they eat? Where did they get it? Answer: They grew corn, beans, and squash.
   - How did they build the mounds? Answer: They dug the earth with stone tools and carried it in baskets.
3. Ask students to write a Haiku poem about the Cahokia Mounds using the student activity worksheet on page 156. See Teaching and Evaluating Haiku on page 157 for more information.
4. Ask students to create a visual to go with the haiku, such as a photo, drawing, painting, or collage.

Express Yourself Through Poetry

Name _____ Date _____

1. **Write a Haiku poem about the Cahokia Mounds.**

2. **Create a visual to go with your poem.**

3. **Writing a Haiku poem**
   The haiku is a very structured poetry form. Initially introduced by the Japanese, it is a three-lined poem containing five syllables in the first line, seven in the second, and five in the third.

   The Cahokia
   were alive long, long ago
   on the river banks.

Evaluation Key for Activity Worksheet (page 156)

Express Yourself Through Poetry

Teaching and Evaluating Haiku

Short and imaginative, haiku are a great tool for combining natural history, social science, and language arts. Originating in Japan, haiku is a unique form poetry now popular across the world. It is a relaxing way to use reflection and creativity for self-expression.

Traditional haikus have 17 short sounds divided into three lines of a fixed five-seven-five pattern. However, we suggest allowing for some flexibility in the 5-7-5 syllable pattern in order to give students more freedom for self-expression and still achieve a concise, well-structured haiku. A general guideline requires that the poem be three lines with the middle line longer and totaling no more than 17 syllables.

Assess student haiku by the balance of their structure and the quality of the reflection.

Haiku examples

warm sun on my face
dragonfly on my finger
slow moving river

water falls from dam
framed by arch of busy bridge
rocks on river bank

on far river bank
gull tears into old fish flesh
two crows stand watching

precipitous bluffs
old shore of ancient river
memory remains

– excerpts from Michael Czarnecki's "Mississippi River Haiku"

Lesson 3.1

Pottery was a major innovation that spread during the Woodland period. Most was created using clay that was rolled and coiled into the shape of the pot. A rim was added to the top. The outside of the pot was often decorated with punctuated or cord-marked designs. The finished pieces were hardened in an open fire pit. Later, shells from the river were added to strengthen the clay, which also added different colors to the pottery.

Extension Suggestions

~ Career launch

Invite a local **archeologist**, **anthropologist**, or a **historian** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

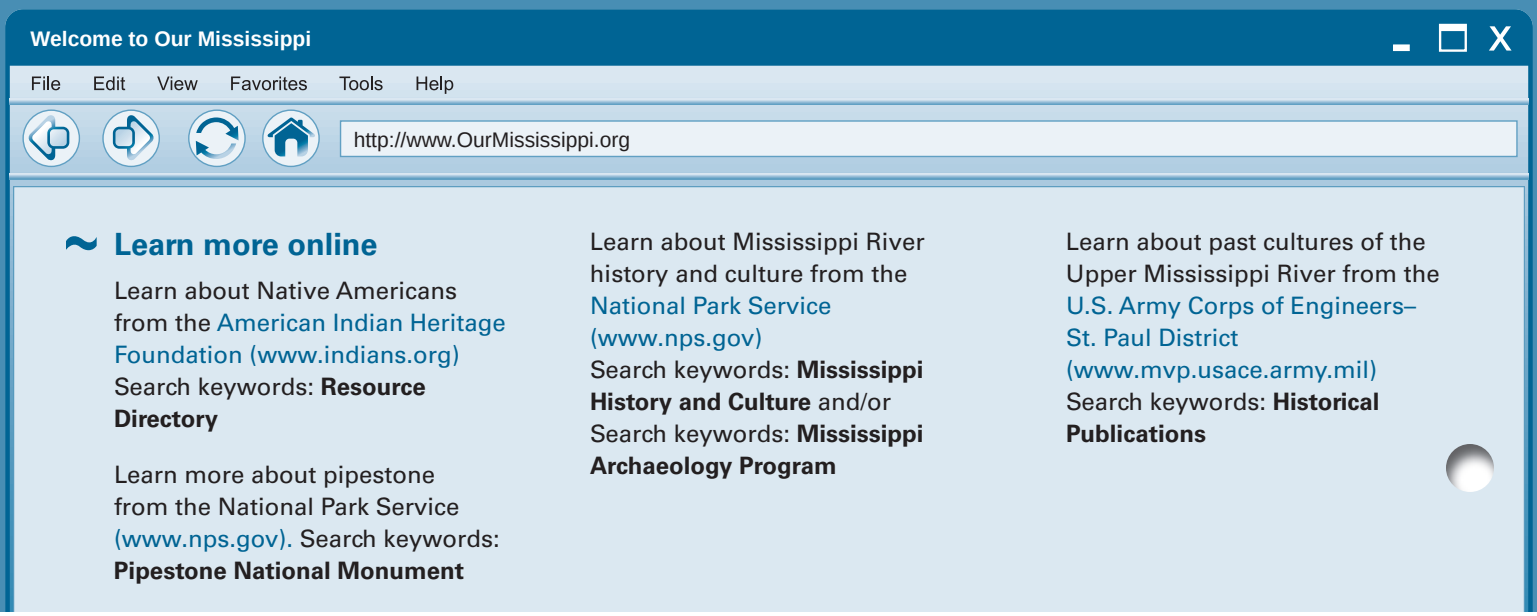
~ Get out!

Visit an ancient mound site near you:

- Aztalan State Park, Lake Mills, Wisconsin
- Cahokia Mounds State Historic Site, Collinsville, Illinois
- Effigy Mounds National Monument, Harpers Ferry, Iowa
- Gull Lake Recreation Center, Brainerd, Minnesota
- Osterhout Mound Park, Hannibal, Missouri
- Toolesboro Mounds National Historic Landmark, Wapello, Iowa

~ Express yourself!

- Design and build a diorama of the Cahokia mounds with dwellings
- Get some craft clay and make pottery using the coil method. Decorate it and fire it in the oven. Use it to hold a keepsake that means something special to you.
- Write a play about what life might have been like in Cahokia.
- Create a timeline for the tribal groups in your area.



~ Learn more online

Learn about Native Americans from the American Indian Heritage Foundation (www.indians.org) Search keywords: **Resource Directory**

Learn more about pipestone from the National Park Service (www.nps.gov). Search keywords: **Pipestone National Monument**

Learn about Mississippi River history and culture from the National Park Service (www.nps.gov) Search keywords: **Mississippi History and Culture** and/or Search keywords: **Mississippi Archaeology Program**

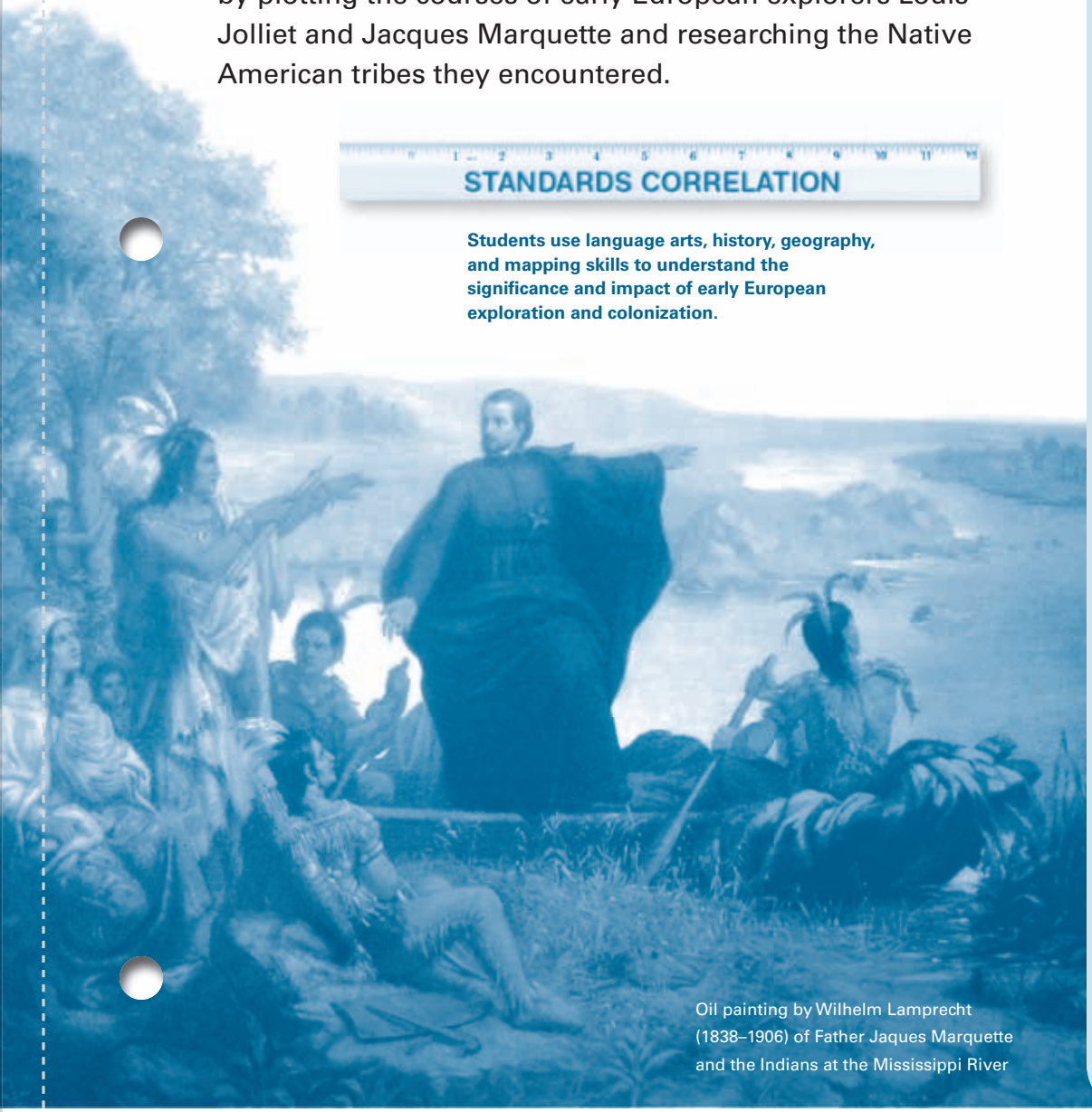
Learn about past cultures of the Upper Mississippi River from the U.S. Army Corps of Engineers–St. Paul District (www.mvp.usace.army.mil) Search keywords: **Historical Publications**

Where Worlds Meet:

Early European Exploration of the Mississippi River

Introduction

In lesson 3.2, students discover what happened when the old and new worlds converged on the Mississippi River by plotting the courses of early European explorers Louis Jolliet and Jacques Marquette and researching the Native American tribes they encountered.



Oil painting by Wilhelm Lamprecht (1838–1906) of Father Jaques Marquette and the Indians at the Mississippi River

STANDARDS CORRELATION

Students use language arts, history, geography, and mapping skills to understand the significance and impact of early European exploration and colonization.

Unit 3 goal

Learn how communities and cultures develop to form civilizations

Lesson Goal

Learn how new European settlements started along the Mississippi River

Lesson objectives

- Identify explorers of the Mississippi river and their sponsoring countries
- Discuss why many countries wanted to claim the Mississippi river
- Explain the importance of the Louisiana Purchase

Educational standards

- Social Science
- Fine Arts
- Language Arts

What you'll need

- Internet and library access
- Laminated wall map

How long it will take

- *Discussion:* several class sessions
- *Activity 1:* several class sessions

What's next!

Westward Ho!
The Louisiana Purchase

Lesson 3.2

> *As we were descending the river, we saw high rocks with hideous monsters painted on them and upon which the bravest Indian dare not look. They are as large as a calf, with claws and horns like a goat, their eyes are red, beard like a tiger's and a face like a man's. Their tails are so long that they pass over their bodies and between their legs under their bodies, ending like a fish's tail. They are painted red, green and black, and so well-drawn that I could not believe that they were drawn by the Indians, and for what purpose they were drawn seems to me a mystery.*
>
> – Father Jacques Marquette

Piasa Bird

Background

European Exploration

In the 1500s, Europeans were on the move. France, Britain, and Spain had developed a taste for spices, sugar, silks, and other exotic goods from the Far East, and they were looking for a new, easier route to the east that would make these trade items cheaper. As they explored North America looking for the fabled Northwest Passage, they noticed this new world was a land of riches for the country that could claim, explore, map, and control it.

European explorers and traders soon learned that the Mississippi River was a major water route in the middle of this large continent. Like the Native Americans that had lived there for centuries, European explorers began using the river as a major transportation route. In many ways, the Mississippi River is North America's first major highway.

Native Americans

North America was anything but new to the Native Americans who had lived here for millennia. The tribes that lived along the river in the 1600s included the Dakotas, Illinois, and the Ioway. Other tribes that lived in the area in the 1600s

Indian Tribe Territories circa 1600
(map to the left)

1. Santee Dakota
2. Menominee
3. Ioway
4. Ho-chunk
5. Illinois
6. Potawatomi
7. Sac
8. Mascouten
9. Fox
10. Miami
11. Kickapoo
12. Shawnee
13. Ojibwe
14. Ottawa
15. Petun
16. Neutral
17. Nipissing
18. Algonkin
19. Huron
20. Iroquois

were the Menominee, Ho-chunk, Fox, Kickapoo, Miami, Ojibwe, Potawatomi, Shawnee, Sac, Sioux, and Winnebago.

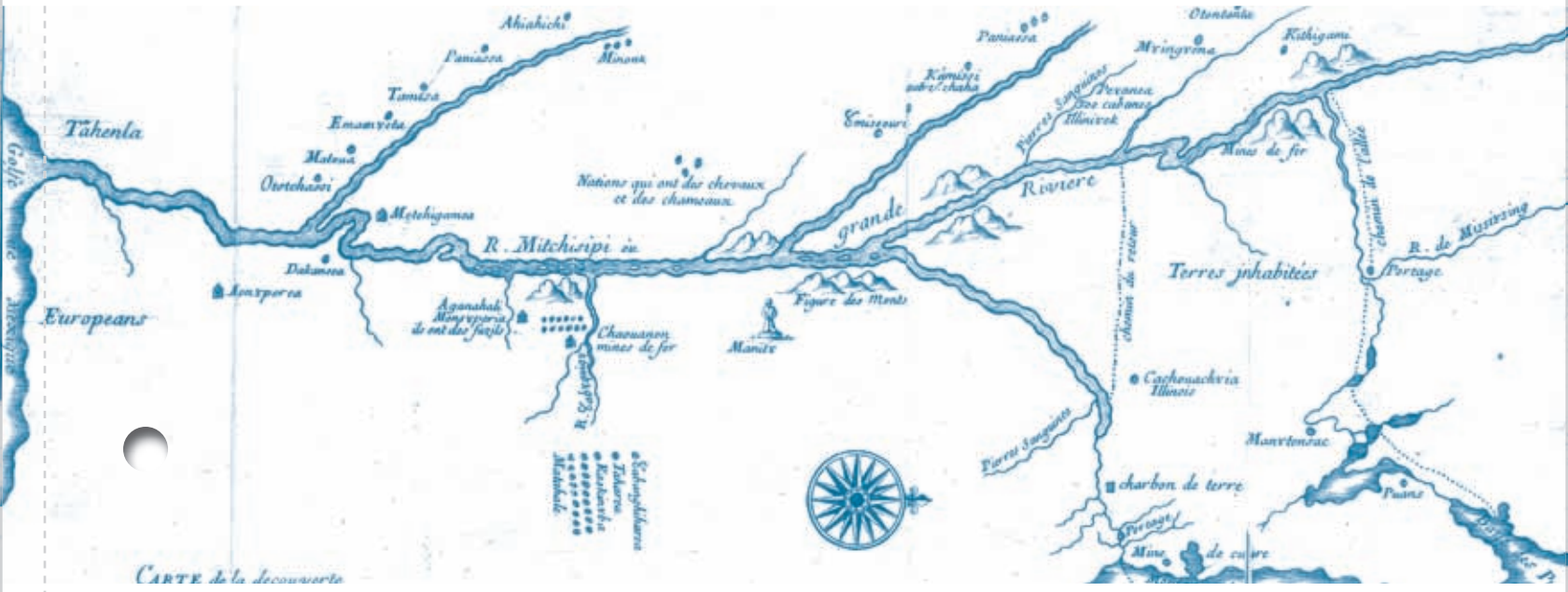
Europeans also noticed the many fur-bearing animals that inhabited the waterways of the upper Midwest, including beaver, otter, mink, bear, and deer. Many decided to settle in the Upper Mississippi River to invest in the rich fur trade, the success of which depended on Native American cooperation and assistance.

Jolliet and Marquette Expedition

The first Europeans to travel south on the Mississippi River were Louis Jolliet and Jacques Marquette. In 1673, they were searching for a water route that led to the Pacific Ocean, which would make the fur trade easier and more profitable.

Jolliet and Marquette travelled with five other men along Lake Michigan to Green Bay, canoed up the Fox River, and then went downstream on the Wisconsin River to the Mississippi River. They became the first non-natives to view the image of the Piasa bird on the bluffs near present-day Alton, Illinois. Marquette wrote about this Native American painting of a mythical spirit-being being in his journal, making it one of the earliest written accounts of Native American rock art in eastern North America.

Jolliet and Marquette traveled downstream to the confluence of the Arkansas River before turning around in fear of hostile Indians and Spanish explorers. They returned to Lake Michigan via the Illinois River. Jolliet's journal and his maps were lost when his canoe overturned on the rapids of the Montreal River. Marquette's diary is all that remains of their journey.



Hernando de Soto (c.1496/1497–1542) was a Spanish explorer and conquistador who led the first European expedition deep into the modern-day United States, including parts of Florida, Georgia, Mississippi, Alabama, Louisiana, Arkansas, and Oklahoma, while searching for a water route to the Pacific. De Soto died in 1542 on the banks of the Mississippi River near southern Arkansas or northern Louisiana.

Louis Jolliet (1645 –1700) was a French Canadian fur trader, guide and mapmaker born in Québec City. He explored the Canadian wilderness and the Great Lakes area. After the expedition, Jolliet continued his efforts to expand the fur trade westward and did extensive mapping.

Father Jacques Marquette (1637 – 1675) was a Jesuit priest from France who came to Canada as a missionary. He sailed to Quebec in 1666 and started a Chippewa (Ojibwe) mission at Chequamegon Bay at the western end of Lake Superior in 1671. He traveled with Louis Jolliet in the hopes of converting Native Americans to Catholicism. Marquette died of dysentery shortly after the expedition.

Robert de La Salle (1643 – 1687) was a French explorer who traveled extensively throughout the Great Lakes. His mission was to explore and establish fur-trade routes along the river. La Salle was the first European to sail down the length of the Mississippi River to its mouth. In 1682 he claimed the entire Mississippi basin for France, naming it Louisiana in honor of the King Louis XIV.

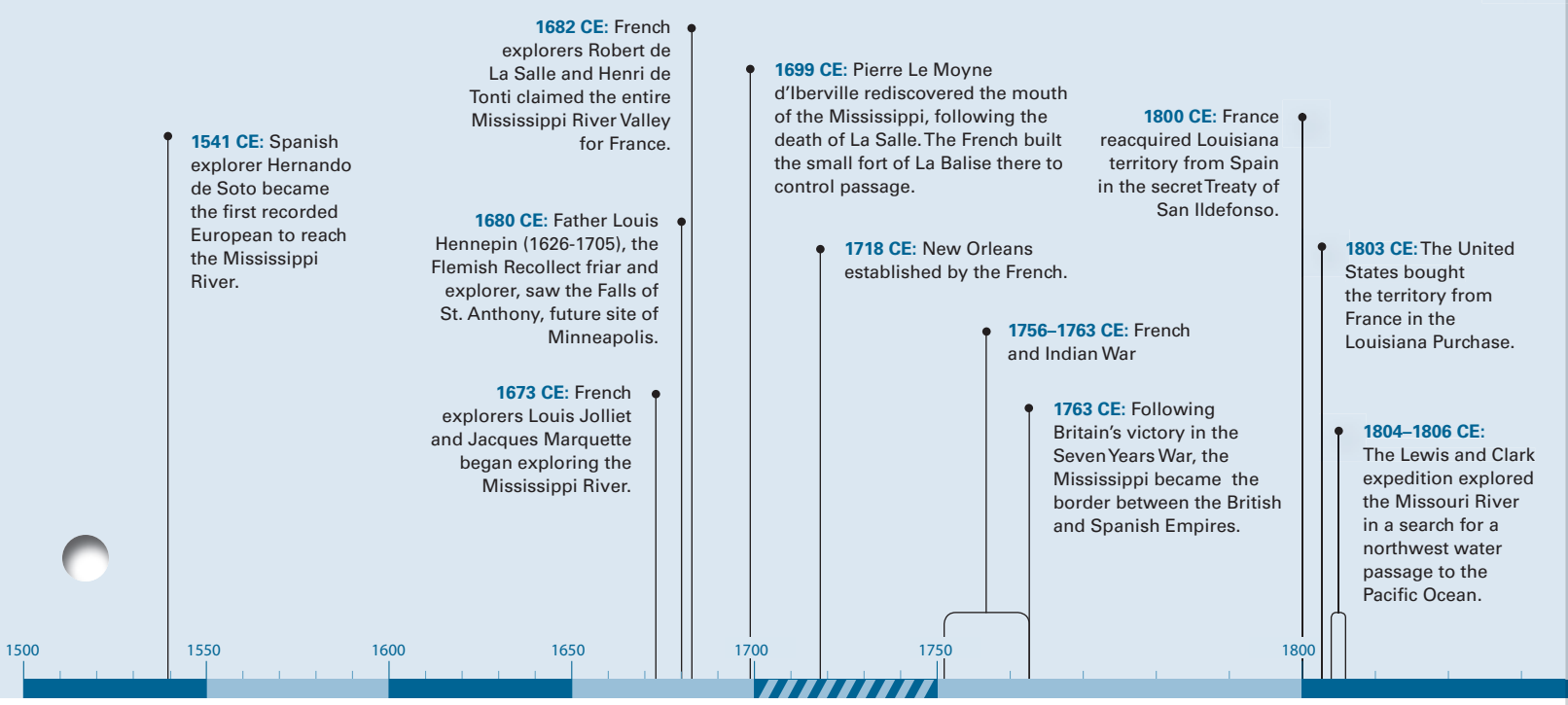
Discussion *(60-90 minutes)*

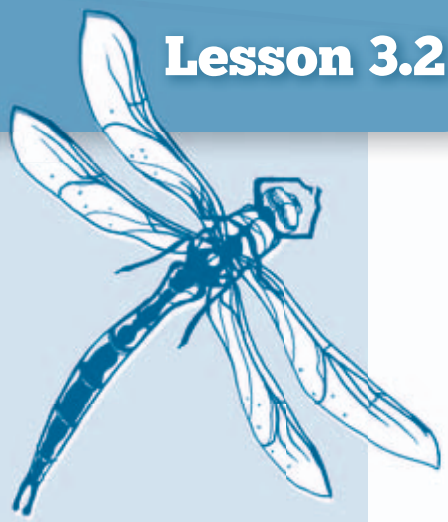
Introduce the timeline of European exploration. Discuss how many countries wanted to claim the Mississippi River and other parts of North America and why. Ask how the success of European expeditions depended on the cooperation and goodwill of the Native Americans they met along the way.

Who were the famous explorers of the Mississippi River? Where did they come from and what part of the Mississippi did they explore?

> "We were not long in preparing all our Equipment, although we were about to Begin a voyage, the duration of which Nie could not foresee. Indian Corn, with some smoked meat, constituted all our provisions; with these we Embarked – Monsieur Jollyet and myself, with 5 men in 2 Bark Canoes, fully resolved to do and suffer everything for so glorious an Undertaking. Accordingly, on The 17th day of may, 1673, we started from the Mission of St. Ignace at Michilimakinac, where I Then was. The joy that we felt at being selected for This Expedition animated our Courage, and rendered the labor of paddling from morning to night agreeable to us."
>
> –from the journal of Father Jacques Marquette

European Exploration and Trade Timeline





Explorers and Traders

Which Way Did They Go?

Grades
5–6

Class or small group activity

1 HOUR

In this activity, students plot the routes of early European explorers and research the Native American cultures they encountered on the Upper Mississippi River.

Research

In preparation for the class activity, ask students to work in groups to research the journeys of Hernando de Soto, Jacques Marquette and Louis Jolliet, and Robert de la Salle.

Do This

1. Plot the routes of the European explorers and traders on the wall map. See page 167.
2. Using the map on page 167, plot the general location of some of the Native American tribes Jolliet and Marquette encountered on the wall map.
   - Dakotas, Illinois, and the Ioway lived along the river.
   - Some other tribes present in the area at the time were Menominee, Ho-chunk, Fox, Kickapoo, Miami, Ojibwe, Potawatomi, Shawnee, Sac, Sioux, and Winnebago.
3. Assign students, either individually or in small groups, to research a specific Native American group and answer the following questions:
   - Identify some unique cultural aspects of each tribe.
   - How did the Native Americans and explorers interact?

What you'll need

- Laminated wall map
- Markers
- Pictures either drawn or found of Mississippi River Indian tribes
- Activity worksheet (pages 165-166)

"Amiskquew"
(a Menominie warrior)

"Shau-Hau-Napo-Tinia"
(An Ioway chief)

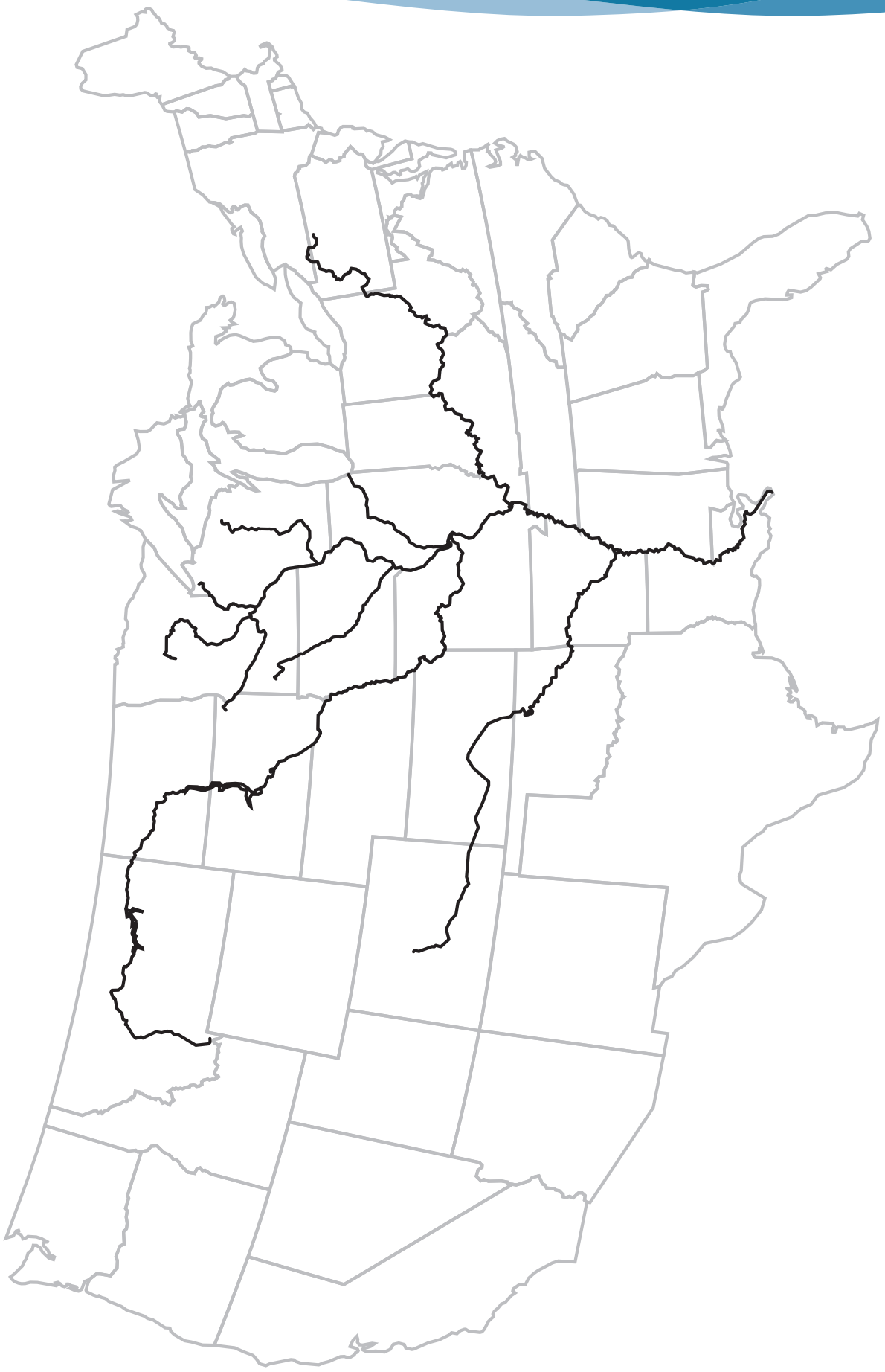
European Explorers and Traders

Which Way Did They Go?

Name _____ Date _____

1. Plot the routes of Hernando DeSoto, Robert de La Salle, and Jacques Marquette and Louis Joliet on the map on the other side of this sheet.
2. Research your assigned Native American tribe and plot its location on the map.
3. List three important cultural aspects of the tribe.

4. How did the tribe and explorers interact?

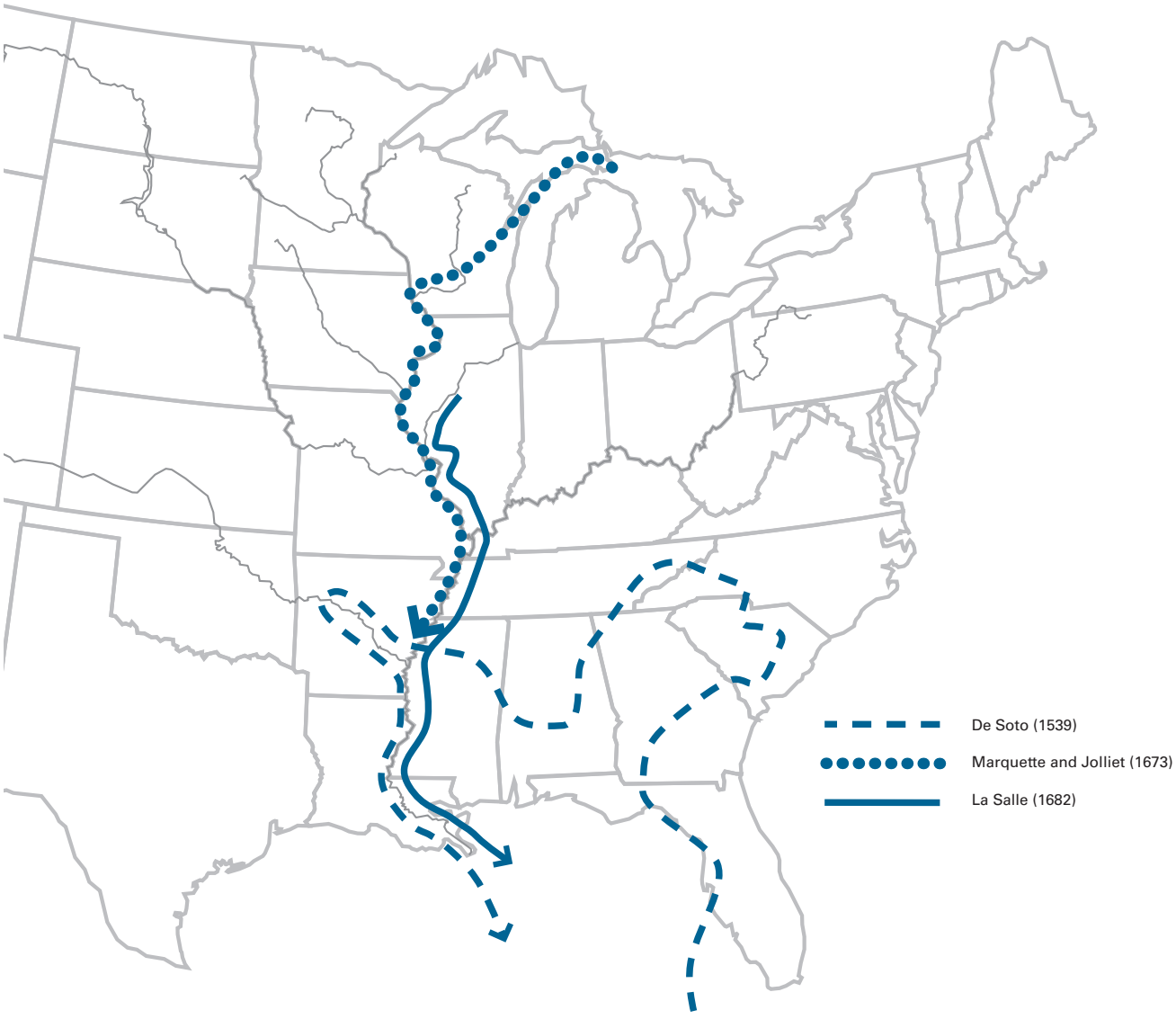


Answers for Activity Sheets (pages 165–166)

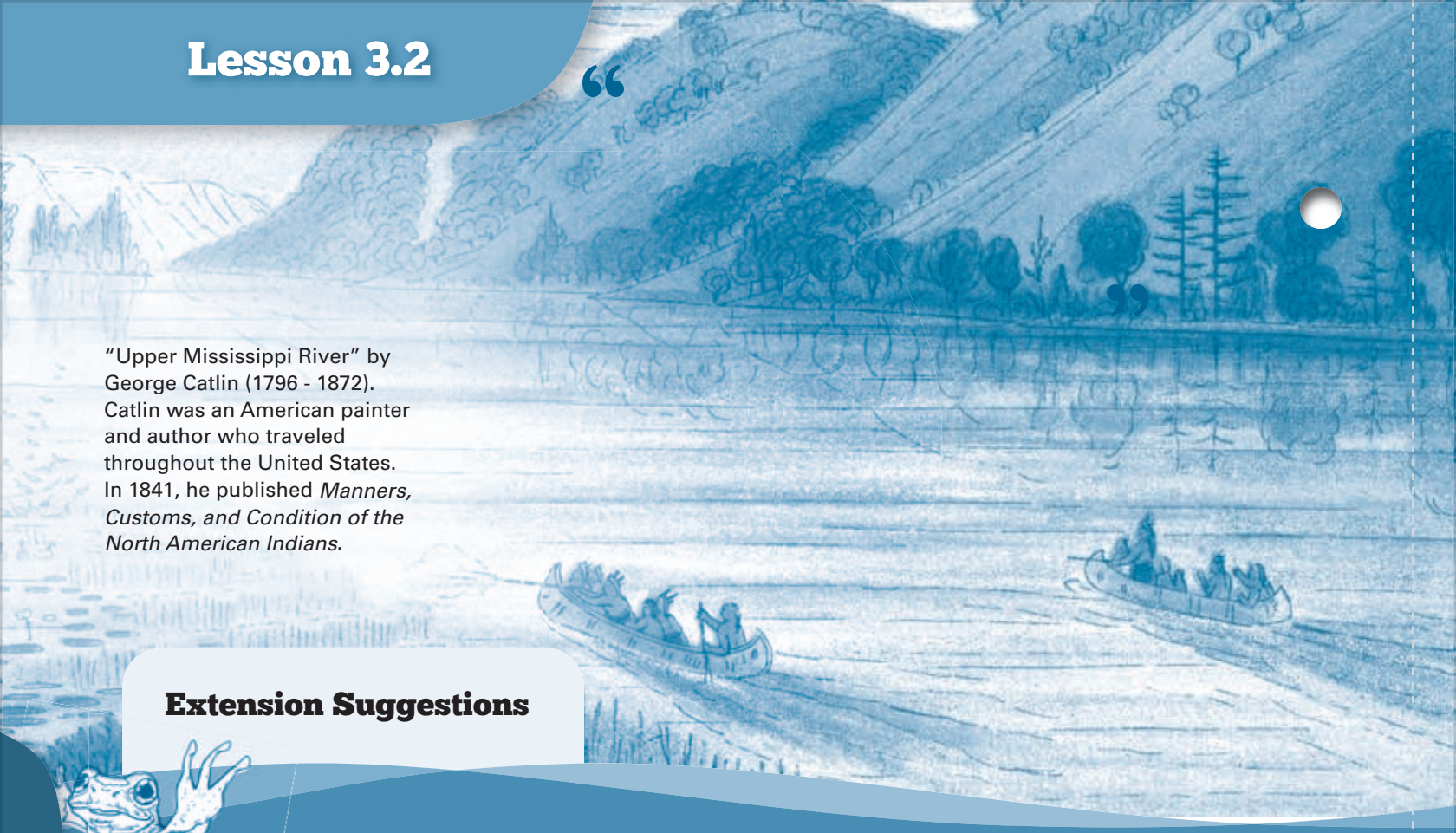
Which Way Did They Go?

3. List three important cultural aspects of the tribe.
   Answers will vary depending on the tribe students select. Cultural aspects should focus on responses to basic needs, such as food, clothing, and shelter, as well as technology, language, arts (including music), education, religion, or recreation. Interaction with traders should focus on either cooperation or conflict.

4. How did the tribe and the explorers interact?
   Answers will vary depending on the tribe students select.
   Interaction with traders should focus on either cooperation or conflict.



Lesson 3.2



"Upper Mississippi River" by George Catlin (1796 - 1872). Catlin was an American painter and author who traveled throughout the United States. In 1841, he published *Manners, Customs, and Condition of the North American Indians*.

Extension Suggestions

UNIT 3

~ Career launch

Invite a local **tribal spokesperson** to speak to the class. Ask students to research the tribe and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Get out!

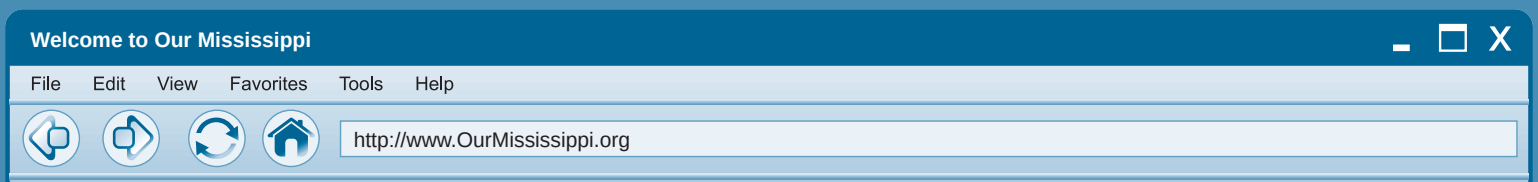
Visit your local historical society to learn more about European explorers and Native American tribes in your area.

~ Express yourself!

Research the culture of one of the tribes encountered by Jolliet and Marquette and perform a play, song, or dance based on that culture. Make a dream catcher or wampum bag.

~ Explore primary resources

Read the journal of Father Jacques Marquette to learn about the journey in his own words. Available online at www.americanjourneys.org. Click on Find a Document and scroll down to 1673. Choose "The Mississippi Voyage of Jolliet and Marquette.



~ Learn more online

Learn about what the United States was like before Lewis and Clark from the Library of Congress (www.loc.gov)
Click button: **exhibitions**
Search keywords: **before Lewis and Clark**

Learn more about Hernando de Soto at www.floridahistory.com.

Learn more about Marquette and Jolliet from the Wisconsin Historical Society. Go to www.wisconsinhistory.org and search **Marquette** and **Jolliet**.

~ Grades K-4 extension

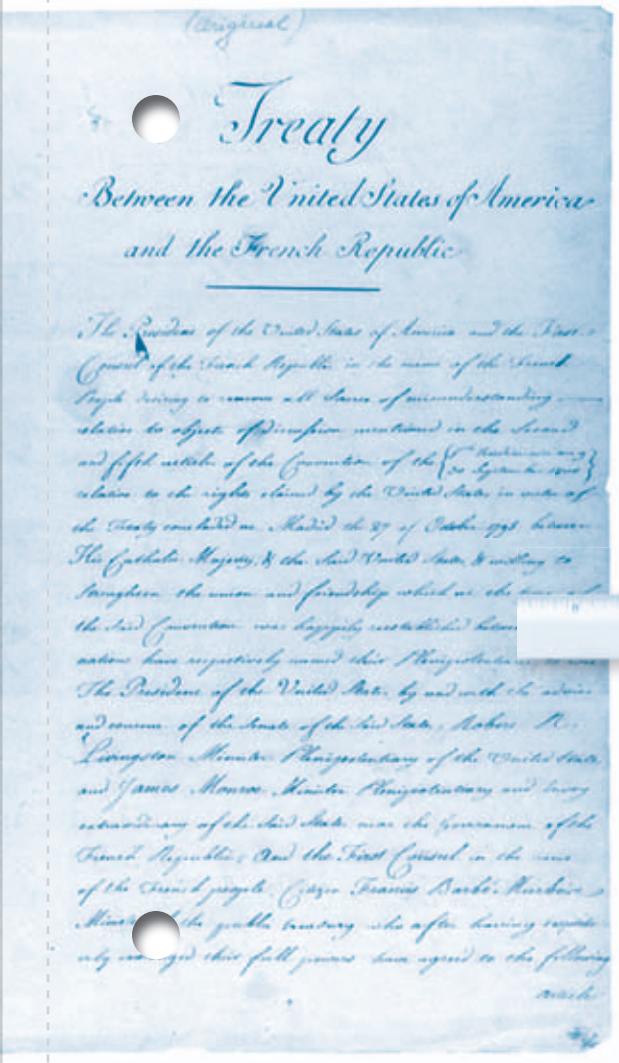
Play Native American children's games online. Go to Native Tech's website (www.nativetech.org)
Under Special Features, click button: **Games and Toys**

Louisiana Purchase:

Gateway to the Western Frontier

Introduction

Lesson 3.3 examines the role of the Mississippi River as a primary motivation for the Louisiana Purchase. It compares and contrasts the expeditions of Lewis and Clark and Zebulon Pike, and invites students to imagine the skill and courage required to plan and execute an expedition up the Upper Mississippi River by planning a trip of their own.


Treaty
Between the United States of America
and the French Republic

Background

The Louisiana Purchase was one of the most important events in American history. It gave the United States ownership and control of the Mississippi River and the vast western part of its watershed. A vital transportation route, the Mississippi River was key to the survival and expansion of a growing nation.

STANDARDS CORRELATION

This unit includes information and activities that address several key history and geography standards, including understanding U.S. territorial expansion in the early 1800s and the significance of the Louisiana Purchase. It also includes information on how the forces of cooperation and conflict among people influence the division and control of natural resources and trade routes, and how it affected relationships with Native Americans. Students also learn about the importance of maps and mapping skills for gathering information about people, places, and environments.

Unit 3 goal

Learn how communities and cultures develop to form civilizations

Lesson Goal

Understand the Mississippi River's role in the Louisiana Purchase

Lesson objectives

- Review the importance of the Louisiana Purchase
- Discuss the significance of Zebulon Pike's expedition on the Mississippi River
- Compare and contrast the Lewis and Clark and the Zebulon Pike expeditions.

Educational standards

- Social Science
  Math
- Fine Arts
- Language Arts

What you'll need

- Wall map
- Access to the Internet
- Journal for each student

How long it will take

- *Discussion:* 60-minutes
- *Activity 1:* Several 60-minute sessions over several days, plus trip time

What's next!

Rivers of human migration

UNIT 3

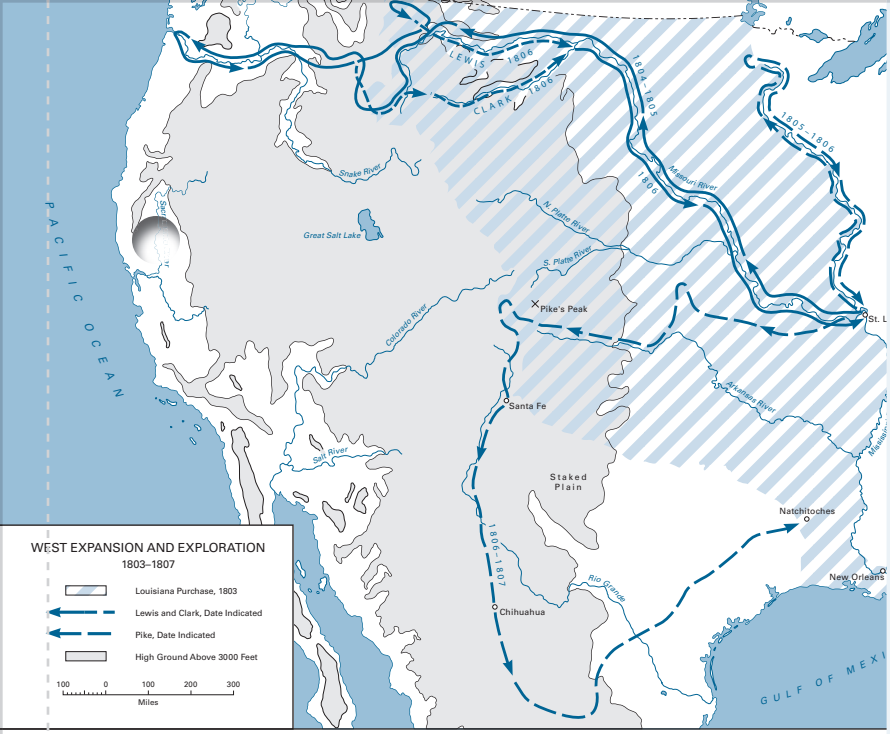
> "You are to proceed up the Mississippi River with all possible diligence. You will please to take the course of the river, and calculate distances by time, noting rivers, creeks, highlands, prairies, islands, rapids, shoals, mines, quarries, timber, water, soil, Indian villages, and settlements, in a diary... You will please to proceed to ascend the main branch of the river until you reach the source of it.... You will endeavor to ascertain the latitude of the most remarkable places in your route, with the extent of the navigation, and the direction of the different rivers which fall into the Mississippi."
>
> – Orders to Zebulon Pike from James Wilkinson, Commanding General of the U.S. Army, July 30, 1805.

In the 1800s, the Mississippi River was one of the most important geographic locations in North America. Whoever owned the Mississippi River controlled the movement of people and goods within the large expanse of land between the Appalachian and Rocky Mountains.

In 1802, farmers in Kentucky and the Mississippi Territory had sent more than a million and a half dollars' worth of produce through that channel, including over 1,000 hogsheads of tobacco (wooden barrels holding up to 1,000 pounds) and 100,000 barrels of flour, as well as large amounts of bacon, pork, lead, cordage, and apples. Of the 265 vessels that sailed from the Mississippi in 1802, more than half were American.

As Britain, France, and Spain squabbled over colonies in North America, the Louisiana Territory kept changing hands between France and Spain. In October 1802, Spain closed the mouth of the Mississippi to American vessels.

Petitions began to pour into Congress from the Western settlements for the defense of their commerce. Realizing the importance of the Mississippi River to farmers, trappers, and traders, U.S. President Thomas Jefferson negotiated with France to purchase the Louisiana Territory.



Fast Facts

- **The Lewis and Clark Expedition (1804–1806)** was the first overland expedition undertaken by the United States to the Pacific coast and back.
  - The expedition team was headed by the United States Army soldiers Meriwether Lewis and William Clark and assisted by Sacagawea and Toussaint Charbonneau.
  - The expedition's goal was to gain an accurate sense of the resources being acquired in the Louisiana Purchase.
  - The expedition laid much of the groundwork for the westward expansion of the United States.
  - The expedition began May 14, 1804 and finished Sept. 23, 1806.
  - The round-trip journey took two years, four months, and ten days.
  - It started from Camp Wood on Wood River (River Dubois) near Alton, Illinois.
  - It ended in St. Louis, Missouri.
  - It covered 8,000 miles and cost $38,722.
  - It included 33 people and one dog in the "Permanent Party."

UNIT 3

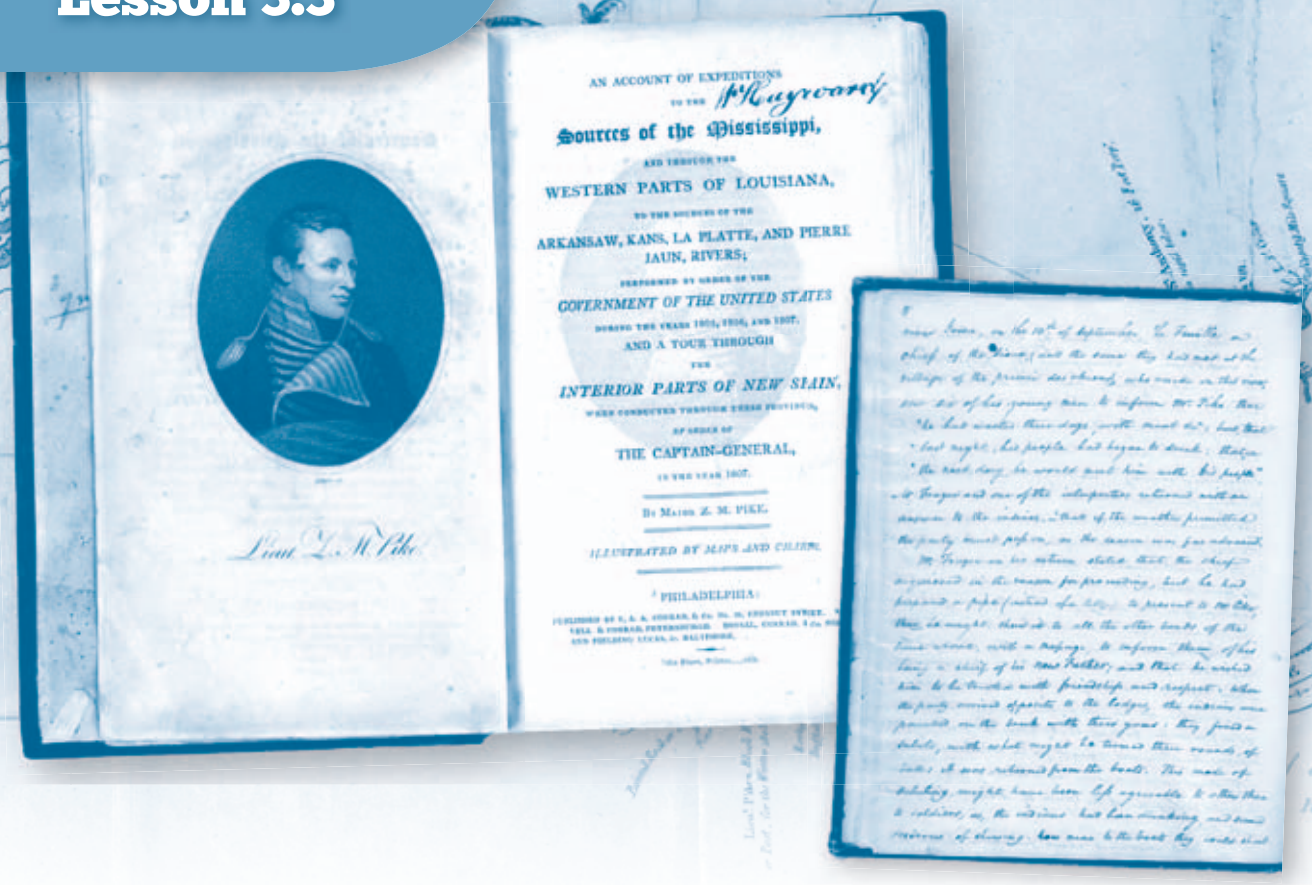
Venturing into Parts Unknown – the Lewis and Clark and Zebulon Pike Expeditions

The Louisiana Purchase was the best land deal in history. For the incredibly low price of just three cents an acre, the young United States bought all the lands drained by the Mississippi River, nearly doubling its size.

However, the Louisiana Purchase was unexplored territory. The only estimates of its actual size were based on the explorations of Robert LaSalle in 1682. The interior of North America was essentially a blank map. To settle the new territory and make use of its natural resources, the United States needed to map it and catalog its riches. It took about 50 years to complete the maps of the West as we know them today.

U.S. President Thomas Jefferson immediately began planning several missions to explore and chart the territory. The most famous of these was the Lewis and Clark Expedition of 1804–1806. Headed by the United States Army soldiers Meriwether Lewis and William Clark, it was the first overland expedition undertaken by the United States to the Pacific coast and back.

But Lewis and Clark were not the only explorers of the Louisiana Purchase. The young Army Lieutenant Zebulon Pike was chosen to explore the Mississippi River north of St. Louis, Missouri.



In 1810, Zebulon Pike published an account of his expeditions called *An Account of Expeditions to the Sources of the Mississippi, and Through the Western Parts of Louisiana, to the Sources of the Arkansaw, Kans, La Platte, and Pierre Jaun, Rivers*. It described the journeys he took at the request of the U.S. government between 1805 and 1807.

UNIT 3

Pike Expedition of the Upper Mississippi

Lewis and Clark were on their way back from the Pacific when Zebulon Pike left St. Louis, Missouri, on August 9, 1805 with twenty-three men to explore the Upper Mississippi River to present-day Minnesota. In their 70-foot keel boat they had supplies for four months, which they were expected to supplement by hunting.

Pike's orders were to locate the source of the Mississippi River, look for potential military post sites, inform people that the area now belonged to the United States, and notify British traders that their fur and trading operations were illegal. In addition, Pike was also expected to ask Native Americans for allegiance to the U.S. and make peace between the Ojibwe and Dakota Indians.

"From the Falls of St. Anthony to the Rum River, the Mississippi is almost one continued chain of rapids, with eddies formed by winding channels. The land on both sides consists of prairie, with scarcely any timber, excepting small groves of scrub oak. Rum river is about fifty yards wide at its mouth, and takes its source in Le Mille Lac, which is but thirty-five miles south of lower Red Cedar Lake. The small Indian canoes ascend this river quite to the lake, the ground in the neighborhood of which is considered one of the best hunting stations for some hundred of miles, and has long been a scene of contention between the hunting parties of the Sioux and Sauteaux [Ojibwe]."

–Zebulon Pike, Oct. 1, 1805.

This map of the Mississippi River from its source to the mouth of the Missouri River was drawn based on Zebulon Pike's notes from his journey.

Pike and his men constructed Fort Ripley, the first American fort west of the Mississippi River, on December 14, 1805. He also identified locations for a series of forts to protect the fur trade that were later constructed by the War Department between 1816 and 1819:

- Fort Madison, located at the head of the Des Moines River Rapids
- Fort Edward, located at the foot of the Des Moines River Rapids
- Fort Armstrong, located at the foot of the Rock Island Rapids
- Fort Crawford, located at Prairie du Chien, Wisconsin
- Fort Snelling, located at St. Paul-Minneapolis, Minnesota

Pike's expedition and the information he gathered strengthened the U.S. claim to the Louisiana Purchase and the fur trade. He published the most detailed account at the time of the cultures, animals, plants, waterways, settlements, and numerous other descriptions of the Upper Mississippi River. His book became required reading for all military explorers in the 19th century.

Discussion (60 minutes)

- Review the importance of the Louisiana Purchase.
- Outline the Louisiana Purchase on the wall map.
- Identify the current states that were part of the purchase.
- What was the purpose of the Lewis and Clark expedition? It was to find a practical, primarily water route across North America to the Pacific Ocean and to explore, map, and describe the people and the resources of the northwestern part of the Louisiana Purchase.
- What was the purpose of the Zebulon Pike expedition? It was to explore, map, and describe the people and the resources of the Upper Mississippi River to its headwaters.

Preparing for an Expedition

What Supplies Would You Need?

We don't know what supplies Zebulon Pike took with him on his nine-month journey on the Upper Mississippi River. However, we do know what Lewis and Clark took with them on their long, two-year journey.

Take a look at Meriwether Lewis' list of supplies. What would you take with you on such a long journey?

Mathematical Instruments

- surveyor's compass
- hand compass
- quadrants
- telescope
- thermometers
- 2 sextants
- set of plotting instruments
- chronometer (needed to calculate longitude)

Clothing

- 45 flannel shirts
- coats
- frocks
- shoes
- woolen pants
- blankets
- knapsacks
- stockings

Camp Supplies

- 150 yards of cloth to be oiled and sewn into tents and sheets
- pliers
- chisels
- 30 steels for striking to make fire
- handsaws
- hatchets
- whetstones
- iron corn mill
- two dozen tablespoons
- mosquito curtains
- 10 1/2 pounds of fishing hooks and fishing lines
- 12 pounds of soap
- 193 pounds of "portable soup" (a thick paste concocted by boiling down beef, eggs, and vegetables)
- three bushels of salt
- writing paper, ink, and crayons

Arms / Ammunition

- 15 prototype Model 1803 muzzle-loading .54 caliber rifles
- knives
- 500 rifle flints
- 420 pounds of sheet lead for bullets
- 176 pounds of gunpowder packed in 52 lead canisters
- 1 long-barreled rifle that fired its bullet with compressed air, rather than by flint, spark, and powder

Presents for Indians

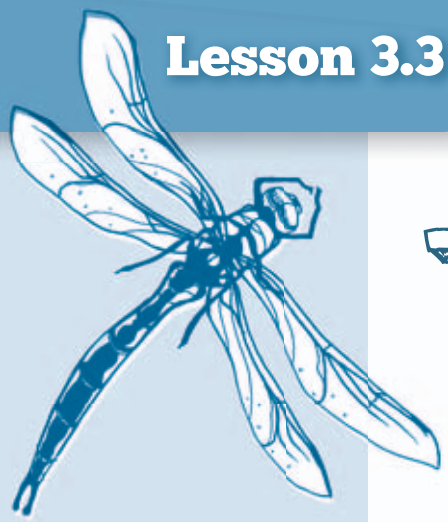
- 12 dozen pocket mirrors
- 4,600 sewing needles
- 144 small scissors
- 10 pounds of sewing thread
- silk ribbons
- ivory combs
- handkerchiefs
- yards of bright-colored cloth
- 130 rolls of tobacco
- tomahawks that doubled as pipes
- 288 knives
- 8 brass kettles
- vermilion face paint
- 33 pounds of tiny beads of assorted colors

Medicine / Medical Supplies

- 50 dozen Dr. Rush's patented "Rush's pills"
- lancets
- forceps
- syringes
- tourniquets
- 1,300 doses of physic
- 1,100 hundred doses of emetic
- 3,500 doses of diaphoretic (sweat inducer)
- other drugs for blistering, salivation, and increased kidney output

Traveling Library

- Barton's *Elements of Botany*
- Antoine Simon Le Page du Pratz's *History of Louisiana*
- Richard Kirwan's *Elements of Mineralogy*
- *A Practical Introduction to Spherics and Nautical Astronomy*
- *The Nautical Almanac and Astronomical Ephemeris*
- a four-volume dictionary
- a two-volume edition of Linnaeus (the founder of the Latin classification of plants)
- tables for finding longitude and latitude
- map of the Great Bend of the Missouri River



Trek Like Lewis and Clark

Grades

5–6

Class or small group activity

2 HOURS

Over several days, some may be homework assignments

What you'll need

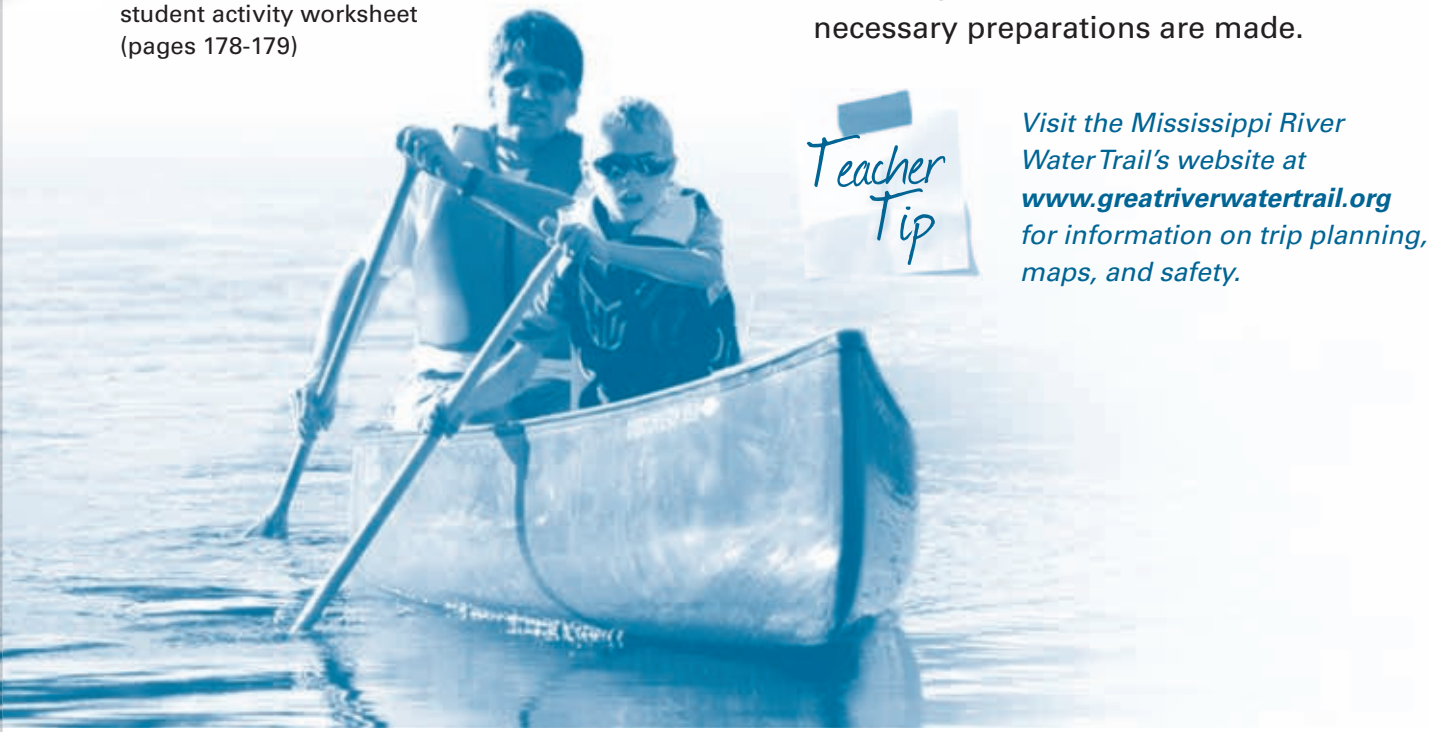
- Access to the Internet
- Preparing for an Expedition handout (page 174-175)
- Trek like Lewis and Clark student activity worksheet (pages 178-179)

Get Ready

Review the list of items Lewis and Clark took on their two-year expedition. Compare and contrast that with what you might take today on a one-week canoe trip. What items would be similar? What items would be very different?

Do This

1. Discuss how important it is to carefully plan a week-long canoe trip. Explain that it will require everyone's input and assistance. Then divide students into planning teams, such as food, transportation, equipment, and safety.
2. Ask each group to brainstorm all the supplies needed for their area of responsibility. Each team should produce a supply list.
3. Ask each team to select a team leader and assign roles to make sure all necessary preparations are made.



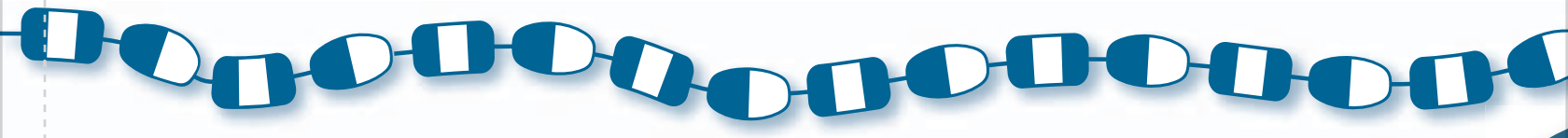
Teacher Tip

Visit the Mississippi River Water Trail's website at ***www.greatriverwatertrail.org*** *for information on trip planning, maps, and safety.*

After the class has started the planning process, invite a river guide to talk to the class and assist in the planning. Have students prepare questions beforehand and summarize the guide's advice afterwards.

To get the class thinking, some questions to ask the students:

- How will you get the people and supplies to the river?
- How will you pay for the trip?
- What items can be loaned or donated to the class?
- How should the class organize themselves to plan the trip?



Plan Your Expedition

Here are a few team suggestions along with their main responsibilities and some questions and lists of items to brainstorm with students.

- **Safety team: Think safety first!** Designate a safety team, but remind students that EVERYONE is on the safety team. This team is responsible for safety equipment and first aid supplies. *Don't forget first aid kits and life jackets.*
- **Itinerary team:** Gathers water trail maps, plans the route and the stopovers as well as activities. How far can the class travel in one day? Where should we stop over at night? What will we do during the day? At night? Suggestions could include bird watching, stargazing, storytelling.
- **Finance team:** Figures out the cost to buy or rent equipment and supplies and investigates loan and donation opportunities. How much will everything cost? How should the expense be shared?
- **Food team:** Determines menus and supplies for the whole class. How will they prepare the food? What about drinking water and cooking water? Supply list should include cooking and cleaning supplies needed, such as camping stoves, waterproof matches, cooking pots, dishes, eating utensils.
- **Supply team:** Determines supplies needed, including how many canoes, tents, sleeping bags, compasses, lanterns, as well as personal items that each person must bring, such as flashlights, whistles, all-weather clothing, backpack, jacket, rain gear, hiking shoes, socks, pants, shirts, underwear, toiletries (sunscreen, insect repellent, etc.), camera, journal.
- **Disposal team:** How will we dispose of waste, including human waste, and trash. What can be reused? What can be recycled? How do you properly dispose of waste?
- **Transportation team:** Figures out how to move people, equipment, and supplies to and from river. How many people per vehicle? Will they have to transport the canoes or will they be rented at the river entry point?

Trek Like Lewis and Clark

Name _____ Date _____

Plan a one-week trip on the Upper Mississippi River. Review the materials Lewis and Clark took on their two-year journey to help you brainstorm the supplies needed for your trip. Some items Lewis and Clark took:

- **Provisions:** rifles, writing books, dried and salted rations, fishing tackle, axes, clothes, medicine, cloth tent, mosquito netting, cooking pots, blacksmith's tools, lead for bullets
- **Trade goods:** glass beads, mirrors, blankets, needles, scissors, thread, knives, and trinkets

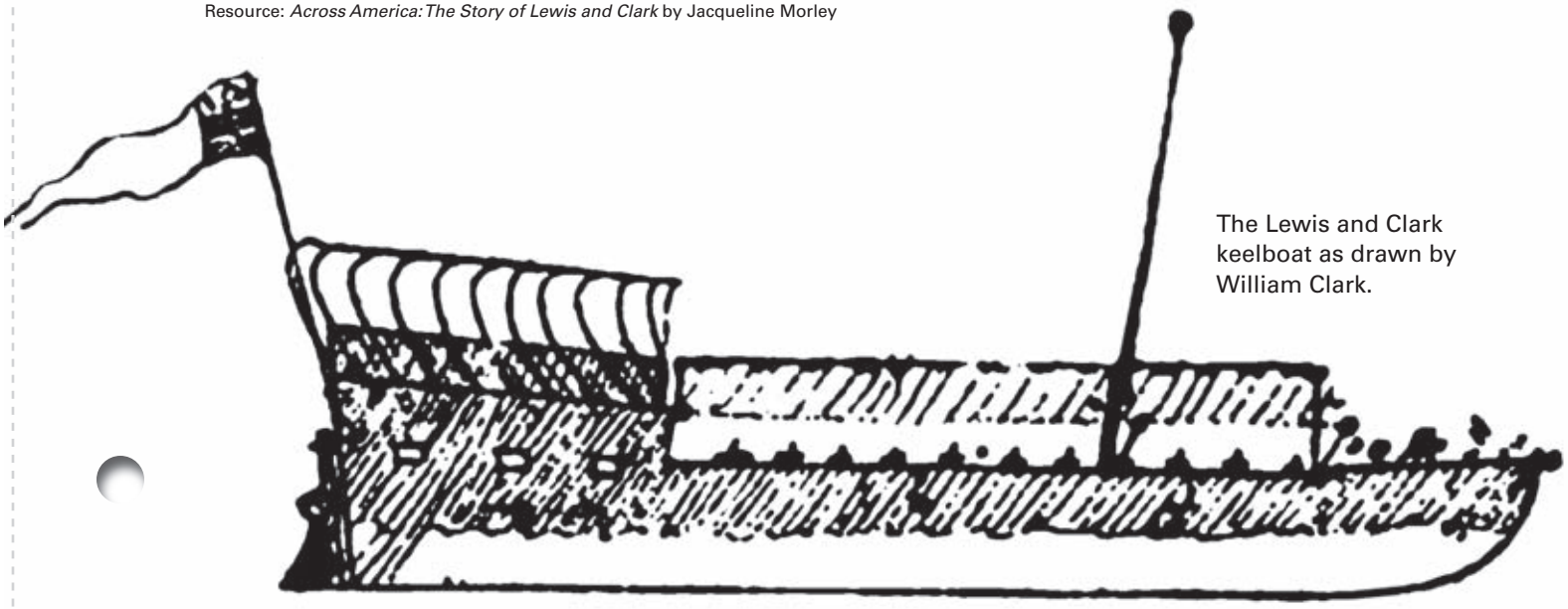
Where will YOU go and how will you get to the launch site?

What kind and how much food do you need to take? (Remember you need enough for the whole class and the chaperones.) How much will you carry? How will you get more on the trip?

What kinds of equipment do you need (for canoeing, cooking, sleeping, wearing etc.)? What other things should you take?

What will it cost? Remember Lewis and Clark started with $2,500 and ended up spending almost $39,000.

Resource: *Across America: The Story of Lewis and Clark* by Jacqueline Morley



The Lewis and Clark keelboat as drawn by William Clark.

Lesson 3.3

The Lewis and Clark keelboat as drawn by William Clark.

Extension Suggestions

~ Career launch

Career Launch: Invite a local **park ranger**, **river boat captain**, **river guide**, **boat designer/builder**, or **cartographer** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Express yourself!

Write Zebulon Pike, Meriwether Lewis, or William Clark a letter describing what you learned from their expedition and what else you would like to know.

~ Read all about it

- Read Zebulon Pike's book, *Exploratory Travels Through the Western Territories of North America*, published in 1811.
- Read the diaries of Meriwether Lewis and William Clark.

~ Get out!

- Map your route from home to school and from home to the grocery store.
- Take a canoe or kayak trip with friends or family. Don't know how to paddle? Take lessons!
- Take a driving trip to trace the path of Zebulon Pike from St. Louis to Leech Lake, which he thought was the source of the Mississippi River.

UNIT 3

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

~ Learn more online

Learn about Lewis and Clark Expedition from the National Park Service (www.nps.gov)
Search keywords: **Lewis and Clark Journey of Discovery**

Learn about Sacagawea from the National Park Service (www.nps.gov) and write a Haiku about her
Search keywords: **Corps of Discovery Sacagawea**

Learn about Mark Twain's Cave from the National Geographic Xpeditions (www.nationalgeographic.com)
Search keywords: **Mark Twain's Cave**

Was Zebulon Pike a failure? Read this article from the Morrison County Historical Society in Minnesota and decide. (www.morrisoncountyhistory.org/history) Search keywords: **Was Pike a failure?**

Learn about Zebulon Pike's expeditions (www.zebulonpike.org)

~ Consult an expert

Use Teaching with Documents: The Lewis and Clark Expedition from The National Archives and Records Administration (www.archives.gov)
Search keywords: ***education lessons Lewis and Clark***

Rivers of Human Migration:

Settlement, Transportation, and Trade

Introduction

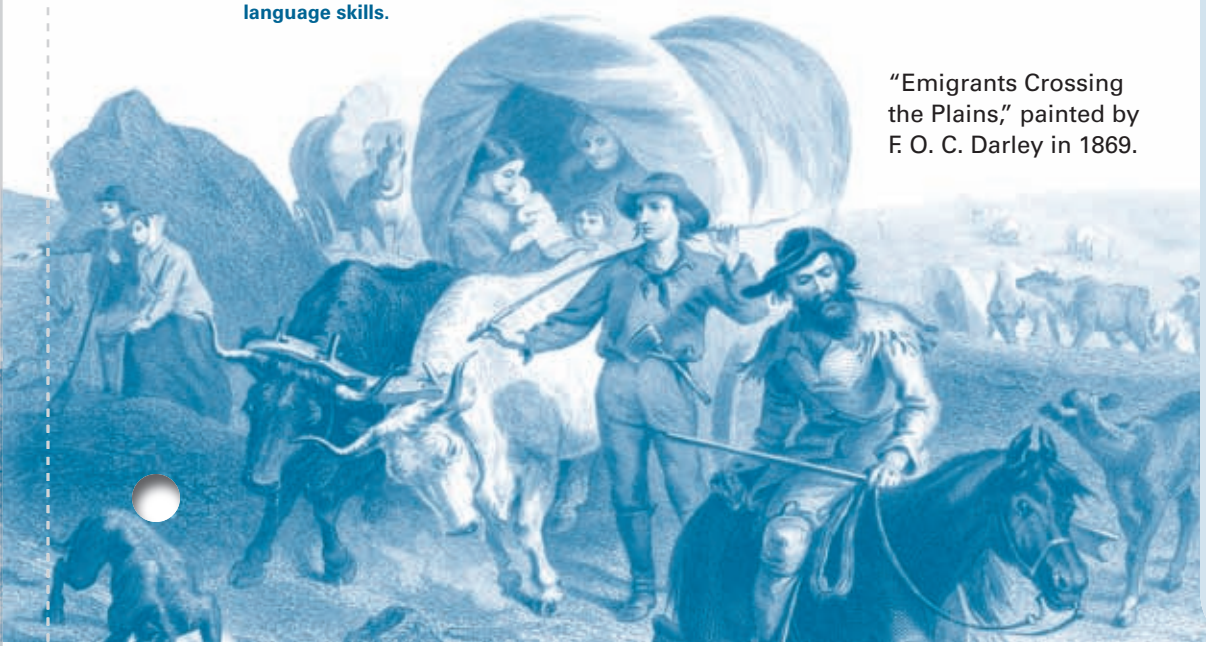
In Lesson 3.4, students learn about the European-American migration of settlers as they move from east to west in search of new land and opportunity. They analyze primary sources written in the 1800s and evaluate the geographic characteristics that influenced migration and settlement.

Background

The Mississippi River represents an ideal focal point for examining the geographic factors in United States history, as well as patterns of change over time, especially in the form of geographic expansion, as the United States enveloped the land on both sides of the river.

STANDARDS CORRELATION

This lesson uses language arts to explore state, regional, and national history. It addresses several key social science standards, especially geography and history, focusing on the eras of colonization and settlement through expansion and reform. Students read for perspective and multicultural understanding and apply language skills.



"Emigrants Crossing the Plains," painted by F. O. C. Darley in 1869.

Unit 3 goal
Learn how communities and cultures develop to form civilizations

Lesson Goal
Learn why people migrate and the river's role in migration

Lesson objectives
- Explore reasons for human migration
- Research your state
- Identify geographic characteristics that influenced migration and settlement

Educational standards
- Social Science
- Fine Arts
- Language Arts

What you'll need
- Local historian
- Internet and library access
- Wall map

How long it will take
- *Discussion:* 60-90 min.
- *Activity 1:* 30 min.
- *Activity 2:* 1 hr. 45 min.
- *Activity 3:* 1 hr. 30 min.

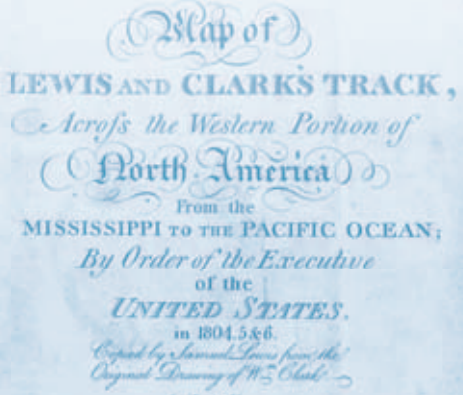
What's next!
The role of the Mississippi River in the Underground Railroad

America Expands

When the United States purchased the Louisiana Territory, it gave American farmers use of a vitally important waterway—the Mississippi River. Having free access to the river allowed American farmers and traders to move their goods to market much more quickly and easily. Between 1800 and 1850, the Mississippi River Valley went from being America's frontier to its heartland.

The Louisiana Territory opened up vast expanses of land west of the Mississippi to settlers, who—thanks to maps produced from the Lewis and Clark Expedition of 1804-1806—now had a better idea of the geography and natural resources west of the Mississippi River. However, this land was already occupied by Native American tribes. President Thomas Jefferson believed that Indians would eventually follow the example of European American settlers and adopt a settled, agrarian lifestyle.

"When they withdraw themselves to the culture of a small piece of land, they will perceive how useless to them are their extensive forests, and will be willing to pare them off from time to time in exchange for necessaries for their farms and families." –Thomas Jefferson, in a letter to Indiana Territory Governor William Harrison, 1803



Western Wagons

They went with axe and rifle,
when the trail was still to blaze,
They went with wife and children,
in the prairie-schooner days,
With banjo and with frying pan—
Suzanna, don't you cry!
For I'm off to California
to get rich out there or die!

We've broken land and cleared it,
but we're tired of where we are.
They say the wild Nebraska
is a better place by far.
There's gold in far Wyoming,
there's black earth in Ioway,
So pack up the kids and blankets,
for we're moving out today!

The cowards never started
and the weak died on the road,
And all across the continent
the endless campfires glowed,
We'd taken land and settled—
but a traveler passed by—
And we're going West tomorrow—
Lordy, never ask us why!

We're going West tomorrow,
where the promises can't fail.
O'er the hills in legions, boys,
and crowd the dusty trail!
We shall starve and freeze and suffer.
We shall die, and tame the lands.
But we're going West tomorrow,
with our fortune in our hands.

–Stephen Vincent Benét

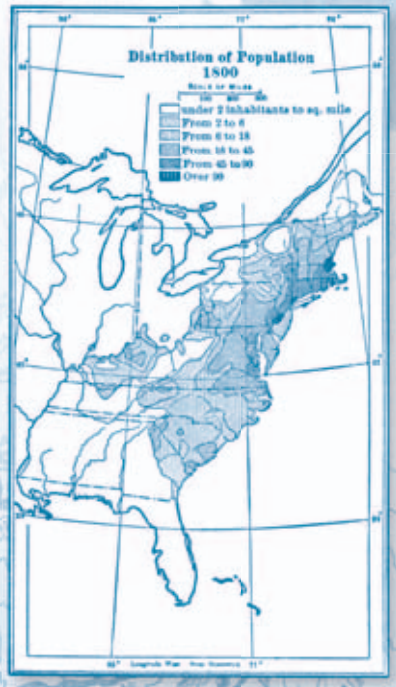
"The Pioneer's Home," by Currier & Ives, 1867

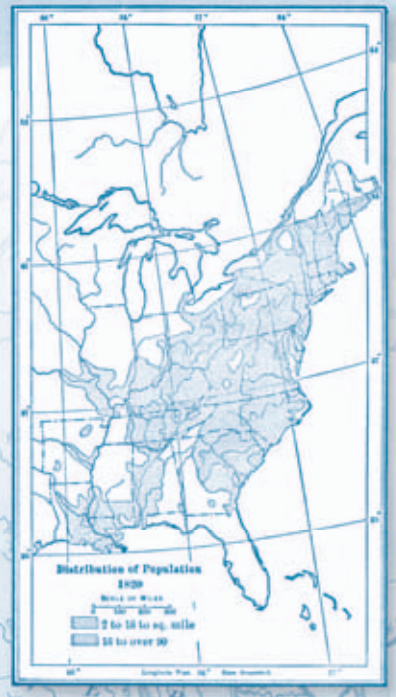
Need to Know

- **Migration:** Movement of people to new areas, usually in an attempt to find new opportunities or resources.
- **Settler:** Person who has migrated to an area and established residence there.
- **Settlement:** Permanent or temporary community in which people live.
- **Transportation:** Movement of people and goods from one location to another.
- **Trade:** Voluntary exchange of goods, services, or both. Trade is also called commerce. The original form of trade was barter, the direct exchange of goods and services without using money.

Settlement in the Mississippi River Valley

During the 1820s, pressure from a growing U.S. population pushed thousands of Americans westward in search of fertile land and a better life. Many people from Virginia, Kentucky, Ohio, and Pennsylvania settled in the Mississippi Valley. This influx of people, along with the advent of railroads and steamboats, made the Mississippi River Valley one of the nation's most complex cultural and commercial regions. In 1821 Missouri became a state. The following year, St. Louis was incorporated as a city.





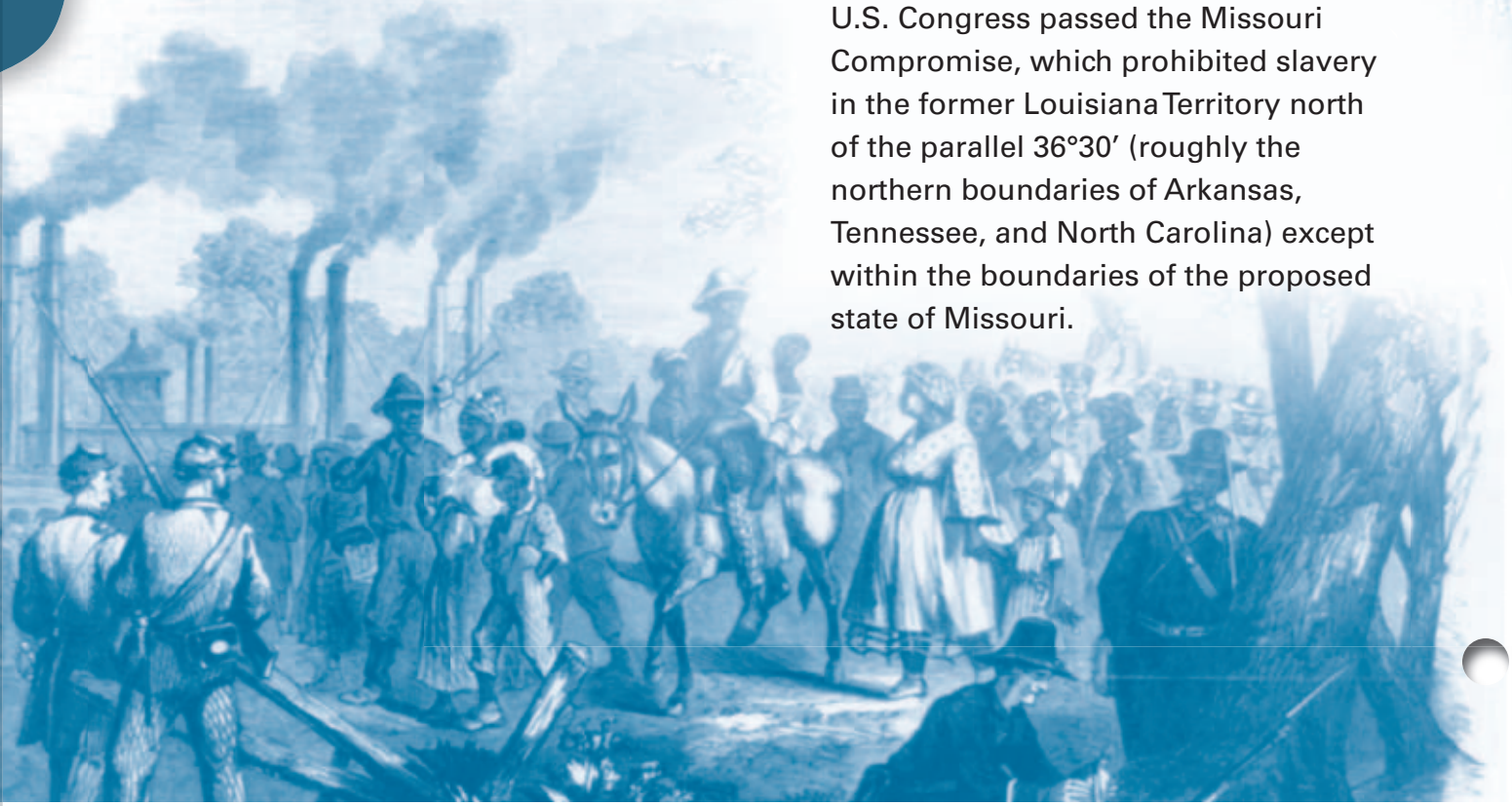
Lesson 3.4

UNIT 3

Crossroads of History

As the Mississippi River region became more crowded, settlers began to move even further west into what was now called the Missouri Territory. They followed Lewis and Clark's lead by starting their journey near St. Louis, Missouri, earning that city the title *Gateway to the West*.

Now the heart of a growing nation, the Mississippi River divided East from West. As tensions grew over slavery, it soon became divided North and South. Plantations along the Lower Mississippi River depended on slave labor to plant and harvest cotton and sugar cane as well as load it onto ships. In 1820, the U.S. Congress passed the Missouri Compromise, which prohibited slavery in the former Louisiana Territory north of the parallel 36°30′ (roughly the northern boundaries of Arkansas, Tennessee, and North Carolina) except within the boundaries of the proposed state of Missouri.



Trail of Tears

In 1830, Congress passed the Indian Removal Act, which forced all Indians living east of the Mississippi to move to barren land west of the Mississippi. Called the Trail of Tears, the forcible removal of many different Native American tribes included members of the Cherokee, Creek, Seminole, and Choctaw nations. Many Native Americans suffered from exposure, disease, and starvation during this long migration.

In all, Native American tribes signed 94 treaties, ceding thousands of square miles to the United States. In 1834, a special Indian territory was established in what is now the eastern part of Oklahoma.

Sources: *Complete Book of United States History, Encyclopedia of American History,* Northern Illinois University, U.S. State Department Bureau of International Information Programs.

Fast Facts

- Illinois comes from the Indian word "iliniwok," meaning "warriors."
- Iowa is named after the Iowa Indians. The Iowa tribal name "Ayuxwa" was spelled by the French as "Ayoua" and by the English as "Ioway." The Ioway spelled it "Baxoje."
- Minnesota is an Indian word for "cloudy water."
- Missouri means "town of the large canoes."
- Wisconsin means "grassy place" in the Ojibwe language.

Discussion (60–90 minutes)

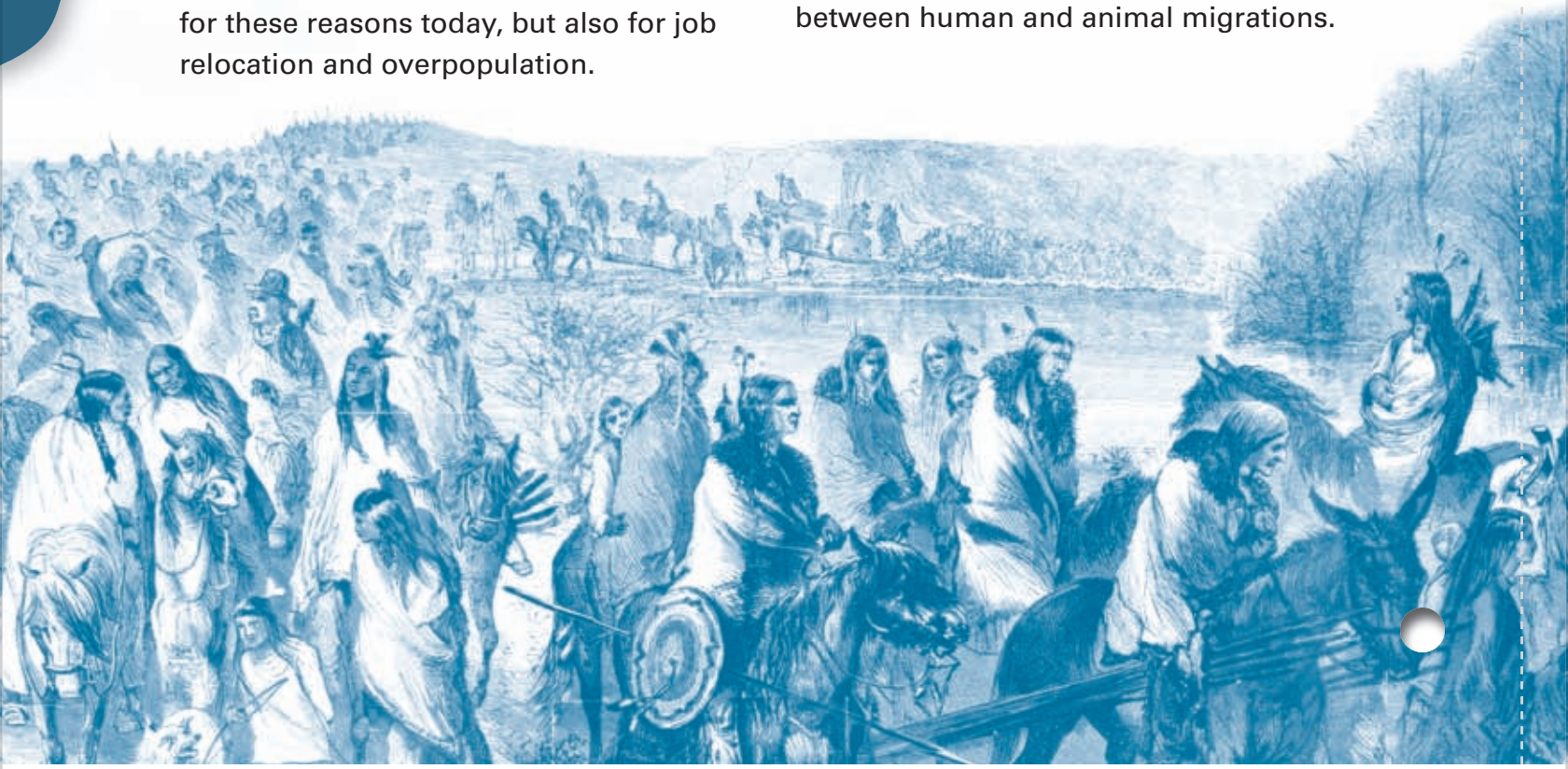
Begin a discussion about migration by asking students if they have ever lived somewhere else. How did they feel during and after their move to a new home (excited, sad, afraid, happy, bored)? Have students share the reason why their family moved to their current home.

Poll students and record the results. How many have lived in more than one place? How many have lived in a different city? State? Country? What were some of the reasons? How did students feel about leaving familiar places?

Explain that before recorded history, humans migrated across continents in search of food, shelter, safety, and hospitable climate. People still move for these reasons today, but also for job relocation and overpopulation.

Discuss the reasons why people move, focusing on the push/pull factors that lead to migration to and from different communities and regions. Relate migration patterns to economic, political, social, and environmental factors.

Ask students how they define migration, and record their answers. Students' answers may relate to the migration of birds, butterflies, or other animals. Discuss similarities and differences between human and animal migrations.



Views of the Valley of the Mississippi

Grades

5–6

Class or small group activity

30 MINUTES

30 minutes, plus reading and essay writing time

What you'll need

- *Reminiscences of Pioneer Life*, written in 1872 by J.W. Spencer about his experiences settling along the Mississippi in Illinois in the 1820s, on pages 188-189
- *View of the Valley of the Mississippi* written by clergyman Robert Baird in 1834, on pages 190-191

Students compare and contrast a mid-19th century source promoting settlement in the Mississippi Valley with an actual pioneer account of life there.

Do This

1. Ask students to read the excerpts from *View of the Valley of the Mississippi* and *Reminiscences of Pioneer Life* in class or as a homework assignment.
2. Discuss the similarities and differences between the two accounts with the class.
3. Write an essay comparing and contrasting the descriptions of emigrant life and opportunities in Illinois.

Teacher Tip

The archaic language and compound-complex sentences of many 19th-century authors may be difficult for students to comprehend, but it also presents an opportunity to discuss how language changes over time.

Activity Extension

~ The Indian village J.W. Spencer describes at Rock Island, Illinois, belonged to the Sac tribe. He also mentions Black Hawk, a famous Sac leader. Ask students to research and write a report about the Sac tribe or Black Hawk.

~ Discuss the 19th century style of these documents and how writing conventions and vocabulary change over time. Ask students to rewrite a section from one of the documents in a more modern style.

View of the Valley of the Mississippi

Read and Comprehend

Reminiscences of Pioneer Life

by J.W. Spencer

I was born in Vergennes, Addison County, Vermont, on the twenty-fifth of July, 1801, and after spending the early years of my life there, started, on the fourth of September, 1820, for Illinois, driving a two-horse team for a gentleman by the name of Brush.

Having an uncle in St. Louis county, Missouri, I went there, crossing the Mississippi River on the twenty-fifth of October, at St. Louis. This place had about five thousand inhabitants at that time. My uncle, and many more of the early settlers, were about leaving where they had settled, on account of Missouri becoming a slave state.

He and several of his neighbors had, early in the Fall of this year, visited the Illinois River country, and made some selections for farms, about thirty miles from the mouth of the river, at a settlement now called Bluffdale. In order to hold the lands they had selected, they were obliged[1] to make some improvement on them, which, having done, they returned to Missouri.

About the first of December, in company with my cousin, who was five or six years my senior, with his wife and two children, we started for the Illinois River, where my uncle and his party had made their claims the Fall before. On arriving there, we found on one of the claims a log cabin, about fourteen feet square, about half built; it lacked a roof, a floor, and a door, which we soon added.

About the year 1826, there was great excitement in regard to the lead mines of the upper Mississippi. In 1827 I thought I would try my luck one season at the mines. I passed Rock Island, on my way up the river, about the last of March, returning late in the summer. This practice of going up the river in the spring and coming down in the fall, was so generally observed by the first settlers of Illinois, that they were called "Suckers."

In the fall of 1828, I removed[2] to Morgan county, about twelve miles from Jacksonville, on the Beardstown road. Mr. Rinnah Wells, in passing from the mines to the southern part of the state, stopped with me over night. In the course of the evening he told me that the Indians had left their old village at Rock Island[3]. Having seen the country along the Rock Island rapids, in passing to and from the mines, and being much pleased with it, in less than a week, accompanied[4] by Loudon Case, Sr. I was on my way to ascertain[5] if the Indians had left.

When about ten miles from Rock River, we met a Mr. Prince, who had brought a load of corn from his farm near Peoria, to feed Judge Pence's team, who was just then moving to the old Indian village at Rock River. We reached Rock River on the 9th of December. The river seemed alive with ducks. I do not think I have ever seen as many at one time since.

Getting on the track of Judge Pence's wagons we crossed to the Big Island. Here we found Judge Pence looking for a place to ford, which we found about sundown, between the upper bridge and mill dam, on the main stream.

Here we found several wigwams[6], and took shelter in a large one for the night. Early in the morning Judge Pence started out, and returned about breakfast time, saying he would not unload his wagon here, as he had found a better wigwam, which proved to be Black Hawk's[7].

These wigwams are very much the shape of a New England barn, sixteen or eighteen feet wide, and from twenty to fifty or sixty feet long. The largest were calculated for from two to four families. They were built by setting posts in the ground, and siding with bark from elm trees. This bark, cut about seven feet long, varied in width from two to four feet, according to the size of the tree taken from. They had rafters, and on these were laid small poles, upon the poles was placed the bark, making a roof that turned rain very well. These wigwams made a very comfortable Summer house.

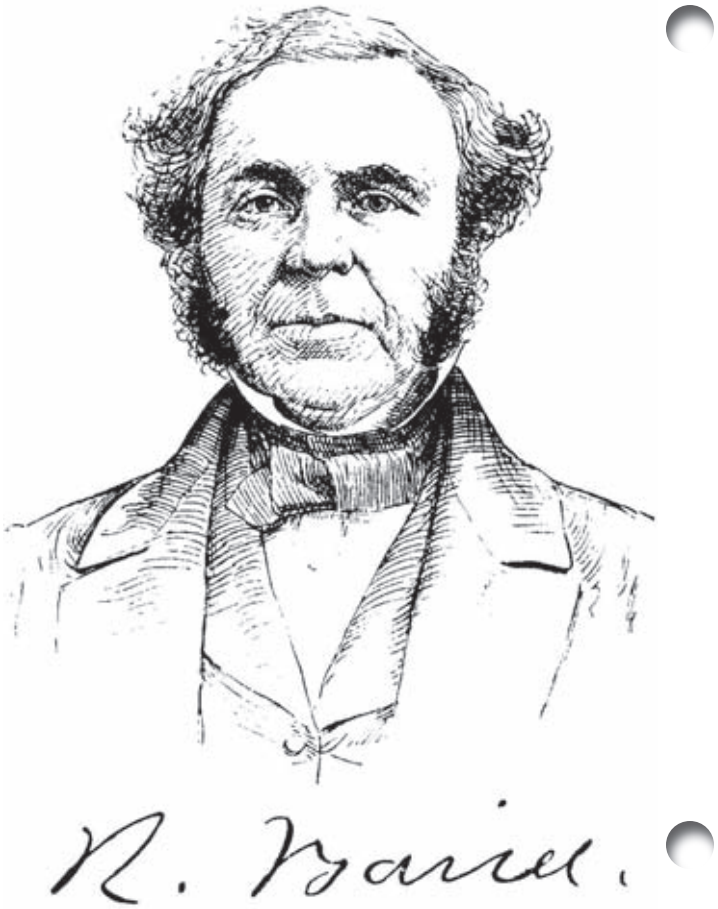
Their wigwams for Fall and Winter use were very different, being of flags woven into matting, which could be rolled up, and enough to cover a wigwam carried on one horse. They made a frame of small poles, one end sharpened and stuck in the ground, the other bent over so as to form a circle of ten or twelve feet. Then they placed the matting around and over the poles, leaving a small opening in the top for the smoke. A little fire in the center would keep the wigwam warm. The Indians say "the white man makes a great fire, and stands a great way off, the Indian makes a little fire, and gets very near it." On our arrival here we found no Indians, it being the season of the year when they were absent on their winter's hunt. The settlers, as well as the officers of the garrison[8], thought they would not return.

Spencer, J. W. *Reminiscences of Pioneer Life in the Mississippi Valley.* Davenport:, IA: Griggs, Watson and Day, 1872.

1. required; 2. moved; 3. Sac Indian village; 4. in the company of; 5. to find out; 6. dome-shaped Indian dwelling; 7. Sac Indian leader; 8. military post

View of the Valley of the Mississippi

by Robert Baird



Illinois

This state proffers[1] many inducements[2] to those who are emigrating to the West.

There are 28,237,859 acres of public land in this state to which the Indian title has been extinguished[3], yet to be sold; and 3,158,110 still belonging to the Indians, which will soon be in the market. For a treaty has very recently been proposed to the tribes in this state, by which they will probably sell their lands. The price of public land is $1.25 per acre. No credit is allowed.

Farms, considerably cultivated, may be purchased from the early settlers who desire to purchase government lands again, at prices varying from $2.50 to $8 per acre.

In no part of our country is it possible to convert an uncultivated piece of land into a good farm, sooner than in this state. Let an emigrant purchase, as he may do in thousands of places, a quarter of a section (160 acres) of land, or the half of it, or a section, if he is able, on the borders of a fertile prairie, so that one half of his purchase may be wood-land and the other half prairie, or whatever other proportion he chooses. And let him fence the larger part of his prairie land, and retain the wood-land to furnish timber, and in a short time he may have an excellent farm under cultivation. He may soon raise as many cattle, hogs, horses, etc. as he may desire, or has corn and hay to feed them with in the winter. And there need be no want of these things, if he has two or three hands to help him to cultivate his fields and mow his prairie. The prairie and woodland will afford range enough for his cattle, hogs, and horses in the spring, summer, fall, and early winter.

The larger prairies, which are sometimes several miles across, are like the lakes in New York and other parts of our country, public property; and all who live around their borders, have a common right to send as many cattle into them as they choose. The prairie, when turned into fields, is difficult, for two or three years, to subdue[4] completely. This is owing to

the unyielding grassy sward[5] with which they are covered; and to plough[6] which requires a strong team of horses or oxen.

The climate of Illinois is delightful, and unquestionably healthy. If emigrants will choose favourable situations, and be careful to have comfortable houses as soon as possible, and dress warmly when sudden changes from hot to cold weather are occurring, and not expose themselves to inclement[7] weather, they will have good health. The summers and autumns are generally dry and warm,—more so than in the Atlantic states.

The diseases which prevail are those which are common in the western states in the same parallels of latitude[8]. Bilious fever[9], in its various types, is the most noted. By timely attention, it is generally a manageable disease. It is far from being the case that even emigrants from the East, generally have a seasoning[10] of sickness before they become accustomed[11] to the climate.

Taken as a whole, this state is one of great fertility of soil, and capable of sustaining a vast population. It has the finest situation of all the western states. It is sufficiently remote from the mountains which bound each side of the Valley, to have a climate little affected by them. It has milder winters than those states which border the mountainous ranges. This is a country of vast and beautiful plains, with noble streams.

The eastern emigrant will find warm-hearted friends in every neighbourhood[12] in this state. The people of the West have much plain and blunt, but sincere hospitality. And any emigrant who comes among them with a disposition[13] to be pleased with the country and its inhabitants[14],—to partake of their hospitality cheerfully,—to make no invidious[15] comparisons,—to assume no airs of distinction[16]—and in a word, to feel at home in this region, where, of course, every thing is very different from what he has been accustomed to, will be truly welcome.

Baird, Robert. *View of the Valley of the Mississippi, or the Emigrant's and Traveller's Guide to the West. Containing a General Description of that Entire Country; and Also Notices of the Soil, Productions, Rivers, and Other Channels of Intercourse and Trade: and Likewise of the Cities and Towns, Progress of Education, and c., of Each State and Territory.* Philadelphia: H.S. Tanner, 1834.

1. offers
2. attractions
3. voided
4. conquer; bring under control
5. surface of land
6. plow
7. stormy
8. distance from the equator
9. illness that includes fever and nausea or vomiting
10. period of time lasting for one season (spring, summer, autumn, and winter)
11. used to
12. British spelling of neighborhood
13. tendency, mood, or inclination
14. people that live in a certain area
15. unpleasant or unkind
16. superior attitude

Get the Facts from the Expert

Grades
5–6

Class or small group activity

1.75 HOURS

- 30 minutes to prepare questions
- 1 hour for the talk
- 15 minutes to write thank you notes

UNIT 3

What you'll need

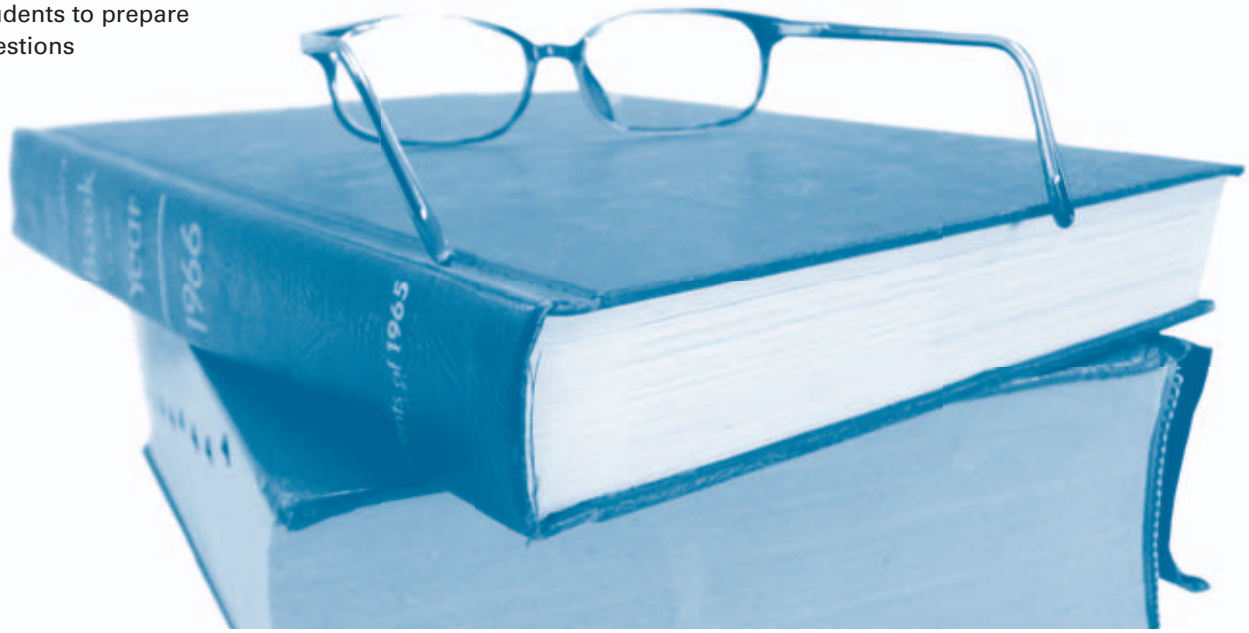
- Students complete activity 2 in preparation for activity 3
- Local historian
- Students to prepare questions

Do this

1. Invite a local historian to speak to the class for about an hour.
2. Have the students brainstorm questions to ask the historian, like:
   - Where did the first settlers come from?
   - When was the town settled?
   - What year was the town officially founded (recorded in record book) and by whom?
   - What part did the river play in the settlement of your town?
   - What did the settlers learn from the local Indians?

Teacher Tip

Be sure to have the students write thank-you notes and send them to the historian. They should mention at least one thing they liked or learned during their time together.



People on the Move

Teacher Tip

Refer to Unit 1 and the comparison of cities in Lesson 1.4

Trappers, Traders, Farmers, Sailors

Grades

5–6

Class or small group activity

1.5 HOURS

- 30 minute discussion to introduce activity
- 1 hour group session
- 1 hour to share findings with class

What you'll need

- Access to the Internet and school library
- Wall map
- *Trapper, Trader, Farmer, Sailor* activity worksheets (pages 194–197)

Warm-up Discussion

Ask students to think about a place they might like to move to when they are older. Have students brainstorm a list of reasons why they think they would like to move there. Then discuss why they chose that location. What would be the downside of moving? Create a chart on the board and have them record the pros and cons of moving to a new location.

Do This

1. Small group activity: Assign each group ONE of the five states along the upper Mississippi River.

2 Groups will research information on their assigned state and complete the Trapper, Trader, Farmer, Sailor table.

3. Individual activity: Write a letter to a family member living "back east" persuading them to come live with you. You may want to include a drawing showing the beauty of the area.

Trapper, Trader, Farmer, Sailor

Regional Analysis

Name _____ Date _____

Research the resources and opportunities available to settlers in your assigned state.

Circle your region: Minnesota Wisconsin Illinois Iowa Missouri

Geographic Conditions	Yes/No	Notes
Access to water		
Harbors		
Natural resources		
Fertile land		
Growing season		

1. Is this area better for a town site or a farm? Why?

_____

_____

_____

_____

2. What kinds of trades can be developed here?

_____

_____

_____

_____

3. What are the positive qualities of the area?

4. What are the negative qualities of the area?

5. Which natural resources were the most useful or helpful? Why?

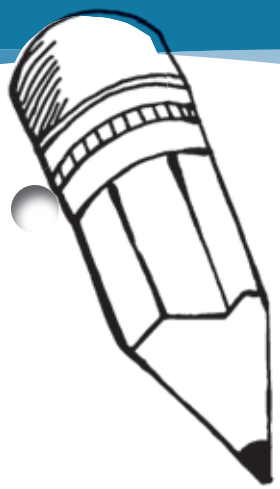
Trapper, Trader, Farmer, Sailor

Letter Assignment

Name _____ Date _____

Try to persuade a family member from "back east" to join you in your new home. Write a friendly letter telling about life in your region of the Louisiana Territory and why your family member would love it here.

Be sure to include specific reasons from your research and why you like it here. You may want to include a drawing showing the beauty of the area.



Draw your homestead below

Lesson 3.4

> "The American claim is by the right of our manifest destiny to overspread and to possess the whole of the continent which Providence has given us for the development of the great experiment of liberty and federative self-government entrusted to us. It is a right such as that of the tree to the space of air and earth suitable for the full expansion of its principle and destiny of growth."
>
> – John O'Sullivan, a New Yorker and editor of the *United States Magazine and Democratic Review*, 1845

John O'Sullivan coined the term Manifest Destiny, which came to mean the belief that the United States was destined to expand across North America from the Atlantic to the Pacific.

In 1872 John Gast painted the symbolic image of westward expansion. Called "Spirit of the Frontier," the painting shows settlers moving west. They are guided and protected by a goddess-like figure and aided by the new technologies, the telegraph and the railroad. Native Americans are shown being pushed aside to make room for the setters.

Extension Suggestions

UNIT 3

~ Career launch

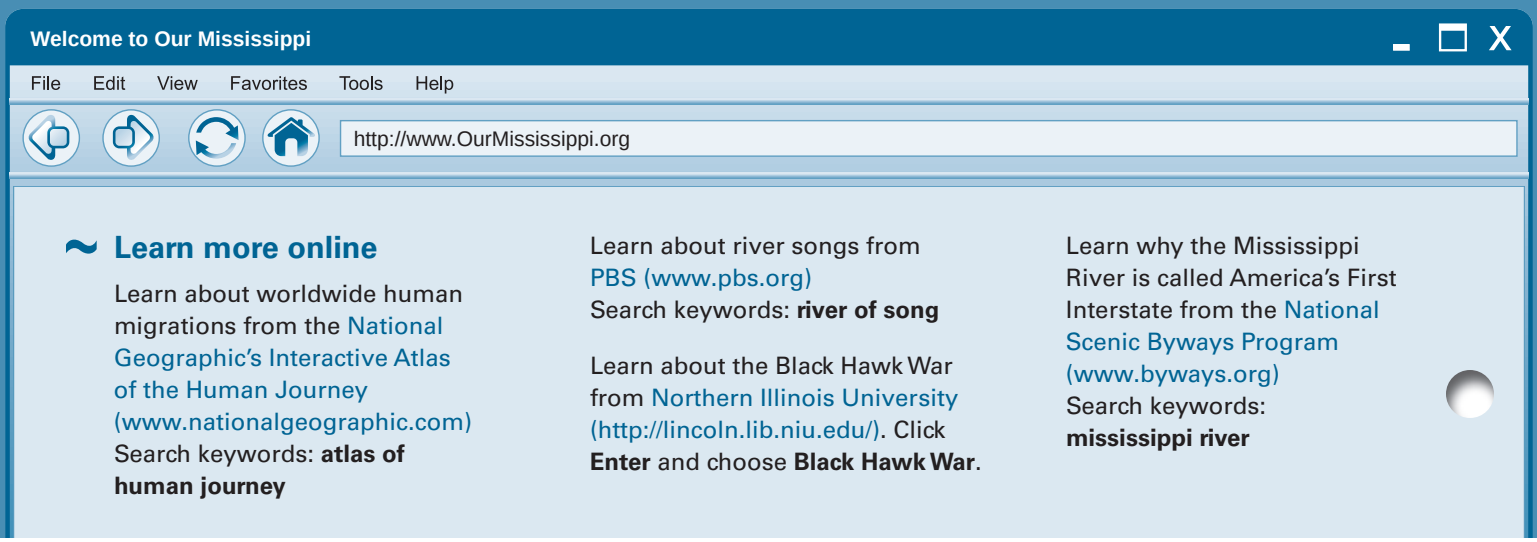
Invite a local **archeologist**, **anthropologist**, or **historian** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Get out!

- Visit your local historical society or library.
- Participate in a living history event.
- Plan a living history event at your school.
- Interview a person who migrated to the community and create a written report or oral presentation about their experience.

~ Express yourself!

- Write a "Guide for New Students" giving advice and recommendations about your school and community for students who have just moved to the area.
- Read a biography written by a settler in your state and write a letter to that person describing what you learned from reading about his or her life.



~ Learn more online

Learn about worldwide human migrations from the National Geographic's Interactive Atlas of the Human Journey (www.nationalgeographic.com)
Search keywords: **atlas of human journey**

Learn about river songs from PBS (www.pbs.org)
Search keywords: **river of song**

Learn about the Black Hawk War from Northern Illinois University (http://lincoln.lib.niu.edu/). Click **Enter** and choose **Black Hawk War**.

Learn why the Mississippi River is called America's First Interstate from the National Scenic Byways Program (www.byways.org)
Search keywords: **mississippi river**

Mississippi River:

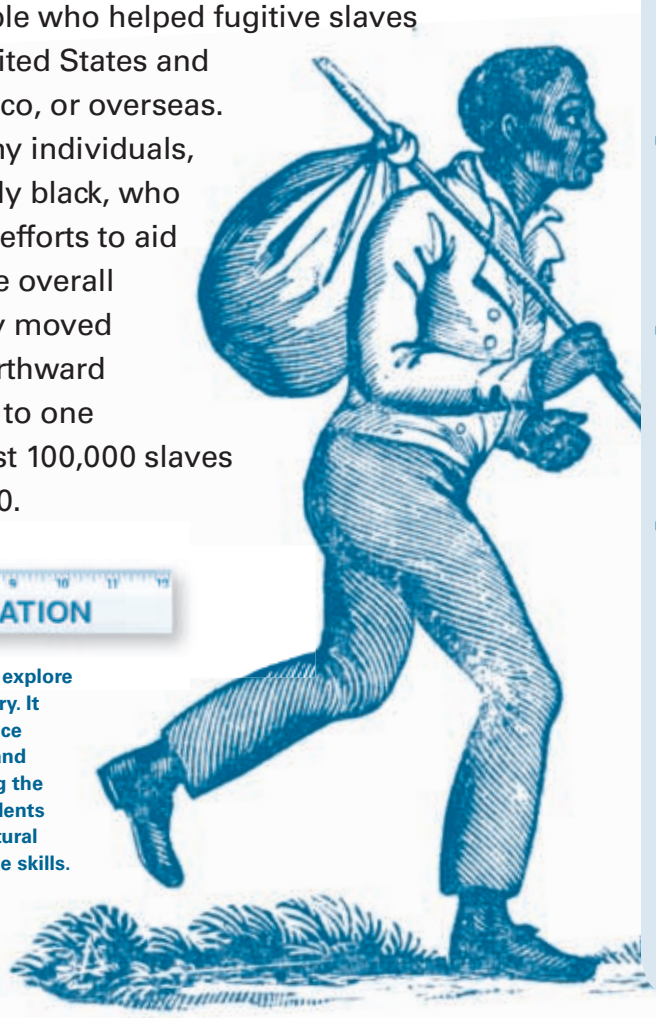
Pathway to Freedom

Introduction

In Lesson 3.5, students learn about the Underground Railroad and the efforts of abolitionists to free slaves. With groups of other students they plan routes of escape after researching safe house locations along the Mississippi River.

Background

The Underground Railroad was not an actual railroad or even a particular route to freedom. Instead, it was a codeword for a vast network of people who helped fugitive slaves escape to northern United States and Canada, south to Mexico, or overseas. It was made up of many individuals, some whites but mostly black, who knew only of the local efforts to aid fugitives and not of the overall operation. It effectively moved hundreds of slaves northward each year— according to one estimate, the South lost 100,000 slaves between 1810 and 1850.



STANDARDS CORRELATION

This lesson uses language arts to explore state, regional, and national history. It addresses several key social science standards, especially geography and history, focusing on slavery during the era of expansion and reform. Students read for perspective and multicultural understanding and apply language skills.

Unit 3 goal

Learn how communities and cultures develop to form civilizations

Lesson goal

Learn the role of the Mississippi River in the Underground Railroad

Lesson objectives

- Learn about key people in the Abolitionist Movement and the Underground Railroad
- Discover the routes of the Underground Railroad
- Become a railroad "rider"

Educational standards

- Social Science
- Fine Arts
- Language Arts

What you'll need

- Internet and library access
- Laminated wall map
- Journal for escape narrative
- Presentation materials

How long it will take

- *Discussion:* Two 60 minute sessions
- *Activity 1:* Two 60 minute sessions

What's next!

Unit 4: The River at Work

The system grew, and around 1831 it was dubbed "The Underground Railroad," after the then-emerging steam railroads. The system even used terms used in railroading: the homes and businesses where fugitives would rest and eat were called "stations" and "depots" and were run by "stationmasters," those who contributed money or goods were "stockholders," and the "conductor" was responsible for moving fugitives from one station to the next.

Sources: Friends of the Underground Railroad, Indiana University, Library of Congress, National Geographic, National Park Service, National Underground Railroad Freedom Center, PBS (Public Broadcasting Service).

Need to Know

- **Slavery:** System in which people are the property of others and can be bought and sold.
- **Underground Railroad:** Informal network of secret routes and safe houses used by 19th-century African-American slaves in the United States to escape to free states and Canada with the aid of abolitionists who were sympathetic to their cause. The term was coined sometime in the 1830s. Members of the Underground Railroad often used specific jargon, based on the metaphor of the railway. For example:
  - People who helped slaves find the railroad were "agents" (or "shepherds").
  - Guides were known as "conductors".
  - Hiding places were "stations".
  - Abolitionists would fix the "tracks".
  - "Stationmasters" hid slaves in their homes.
  - Escaped slaves were referred to as "passengers" or "cargo".
  - Slaves would obtain a "ticket".
  - Just as in common gospel lore, the "wheels would keep on turning".
  - Financial benefactors of the Railroad were known as "stockholders."
- **Safe houses:** A place that provides a safe haven. Locations of safe houses are kept secret from all but a limited number of people, for the safety of those hidden within them.
- **Abolitionist:** One who works toward the termination of slavery in the United States.
- **Abolitionism:** Movement to end the slave trade and set slaves free.
- **Spirituals:** Religious songs which were created by African-American slaves. Some people believe they were coded with information to help slaves escape.
- **Fugitive slave:** One who flees; a runaway.
- **Free states:** States that had prohibited the institution of slavery (as of 1836): Indiana, Illinois, Michigan, Ohio, Pennsylvania, Rhode Island, Connecticut, New Jersey, New York, Massachusetts, New Hampshire, Vermont, Maine.
- **Slave states:** Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Tennessee, Texas, Virginia, West Virginia, Delaware, and Maryland. Slavery was also legal in the District of Columbia.
- **Freed slave:** A free African American who had purchased freedom or was freed by his or her owner.
- **Free negro:** A person born to a free African-American woman (the rights of the child was determined by the rights of the mother); rights restricted by laws intended for slaves.

Reverend Robert T. Hickman

Born a slave in Missouri in 1831, Robert T. Hickman was allowed by his master to learn to read and write and became a slave preacher. In 1863, he led a group of more than 50 fellow slaves to freedom. With the help of the Underground Railroad, they fled up the Mississippi River to St. Paul, Minnesota. Accounts of their escape vary, but they reportedly began their journey on a raft they built in secret and were later smuggled aboard the steamboat *War Eagle*. Hickman founded Pilgrim Baptist Church in St. Paul in 1866. Modern songwriter Charlie Maguire composed a song about Rev. Hickman.

Frederick Douglass

Born a slave in Maryland circa 1818, Frederick Douglass learned to read on his own from white children and by observing the writings of the white men that he worked for. He then taught other slaves to read. He escaped to New York in 1838 and became a minister, author, and reformer and gave speeches around the country. In 1852, he was asked to speak at an event commemorating the signing of the Declaration of Independence.

> *"**What, to the American slave, is your 4th of July?** I answer; a day that reveals to him, more than all other days in the year, the gross injustice and cruelty to which he is the constant victim. To him, your celebration is a sham; your boasted liberty, an unholy license; your national greatness, swelling vanity; your sounds of rejoicing are empty and heartless; your denunciation of tyrants brass fronted impudence; your shouts of liberty and equality, hollow mockery; your prayers and hymns, your sermons and thanks-givings, with all your religious parade and solemnity, are to him, mere bombast, fraud, deception, impiety, and hypocrisy."* —Frederick Douglass

UNIT 3

Harriet Tubman

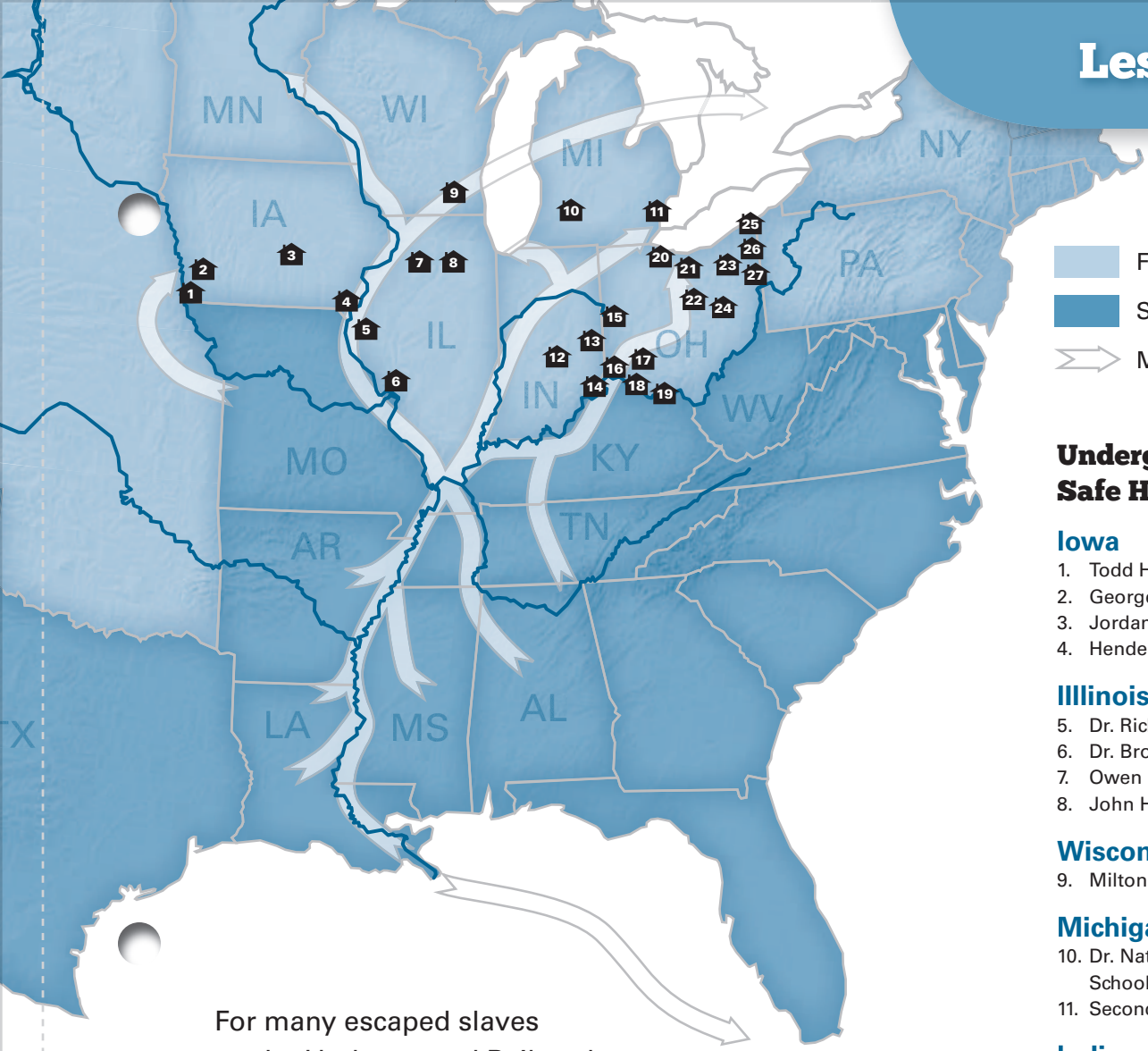
Harriet Tubman was born a slave in Maryland in 1820 or 1821. She became one of the most well known of all the Underground Railroad's "conductors," who, in her words, "never lost a single passenger."

As a child in Maryland, Tubman was beaten and whipped by her various masters. She escaped to Philadelphia in 1849. Less than a year after gaining her freedom, Tubman risked capture by returning to Maryland several times to rescue her family one group at a time. In ten years, she made 19 trips into the South and escorted dozens, perhaps hundreds, of slaves to freedom.

When the American Civil War began, Tubman worked for the Union Army, first as a cook and nurse, and then as an armed scout and spy. After the Civil War, she helped the struggle for women's suffrage. She died in 1913.

> *"I had crossed the line of which I had so long been dreaming. I was free; but there was no one to welcome me to the land of freedom, I was a stranger in a strange land, and my home after all was down in the old cabin quarter, with the old folks, and my brothers and sisters. But to this solemn resolution I came; I was free, and they should be free also; I would make a home for them in the North, and the Lord helping me, I would bring them all there."*
>
> – Harriet Tubman, quoted [without dialect] in *Harriet, The Moses of Her People* (1886) by Sarah H. Bradford

Harriet Tubman helped abolitionist John Brown recruit men for the raid on the arsenal at Harpers Ferry, West Virginia, on Oct. 16, 1859. John Brown and his 21 men, who included freed and fugitive slaves, wanted weapons to begin a slave uprising in the South.



For many escaped slaves on the Underground Railroad, the Mississippi River and its tributaries were the main route to freedom and a new life. Major rivers provided a natural route to freedom, helping runaway slaves find direction, take cover, and evade bounty hunters and slave catchers.

Most escapes were by individuals and small groups. Although fugitives sometimes traveled on real railways, the primary means of transportation were on foot or by wagon. They traveled by night and hid in swamps and abandoned fields during the day. If they were lucky, they would find a "station" or safe house where "agents" would hide them and provide them with food, shelter, and information along their journey.

Although safe houses and Underground Railroad operatives were located in both the North and the South, most were located along the borders between free and slave states. The Ohio River, one of the tributaries of the Mississippi River, formed the border between free and slave states, and therefore was a major Underground Railroad route.

Underground Railroad Safe Houses

Iowa
1. Todd House, Tabor
2. George B. Hitchcock House, Lewis
3. Jordan House, West Des Moines
4. Henderson Lewelling House, Salem

Illlinois
5. Dr. Richard Eells House, Quincy
6. Dr. Brown House, Alton
7. Owen Lovejoy House, Princeton
8. John Hossack House, Ottawa

Wisconsin
9. Milton House, Milton

Michigan
10. Dr. Nathan Thomas House, Schoolcraft
11. Second Baptist Church, Detroit

Indiana
12. Bethel AME Church, Indianapolis
13. Levi Coffin House, Fountain City
14. Eleutherian College, Lancaster

Ohio
15. James and Sophia Clemens Farmstead, Greenville
16. Harriet Beecher Stowe House, Cincinnati
17. Samuel and Sally Wilson House, Cincinnati
18. John P. Parker House, Ripley
19. John Rankin House, Ripley
20. Rush R. Sloane House, Sandusky
21. Wilson Bruce Evans House, Oberlin
22. Reuben Benedict House, Marengo
23. Spring Hill, Massillon
24. Putnam settlement, Zanesville
25. Col. William Hubbard House, Ashtabula
26. Daniel Howell Hise House, Salem
27. Village of Mt. Pleasant Historic District, Mt. Pleasant

Discussion (60-90 minutes)

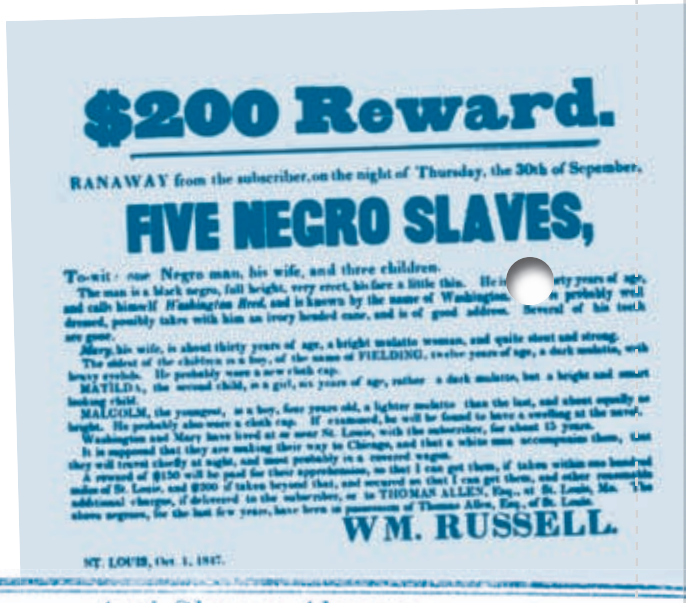
Begin the discussion by asking students to define what it means to be free. Then ask them to imagine what it would be like to be "owned" by another person.

Explain that runaway slaves often used rivers to find their way to freedom, including the Mississippi River and its tributaries, the Illinois and Ohio rivers. Ask students to think about how they would find their way north if they did not have a map. How would landscape features like rivers help them?

Introduce key concepts and vocabulary and explain that the Underground Railroad was not underground. Because escaping slaves and the people who helped them were technically breaking the law, they had to stay out of sight. They went "underground" in terms of concealing their actions.

Many clever and creative ideas helped slaves during their escape. When abolitionist John Fairfield needed to sneak 28 slaves over the roads near Cincinnati, he hired a hearse and disguised the group as a funeral procession. Henry "Box" Brown, a slave, had himself shipped from Richmond to Philadelphia in a box.

A reward poster for runaway slaves from 1847



$200 Reward.

RANAWAY from the subscriber, on the night of Thursday, the 30th of September,

FIVE NEGRO SLAVES,

To-wit: one Negro man, his wife, and three children.

The man is a black negro, full height, very erect, his face a little thin. He is [illegible] years of age, and calls himself Washington Reed, and is known by the name of Washington. He is probably well dressed, possibly takes with him an ivory headed cane, and is of good address. Several of his teeth are gone.

Mary, his wife, is about thirty years of age, a bright mulatto woman, and quite stout and strong. The eldest of the children is a boy, of the name of FIELDING, twelve years of age, a dark mulatto, with heavy eyelids. He probably wears a new cloth cap.

MATILDA, the second child, is a girl, six years of age, rather a dark mulatto, but a bright and smart looking child.

MALCOLM, the youngest, is a boy, four years old, a lighter mulatto than the last, and about equally as bright. He probably also wears a cloth cap. If examined, he will be found to have a swelling at the navel.

Washington and Mary have lived at or near St. Louis, with the subscriber, for about 15 years.

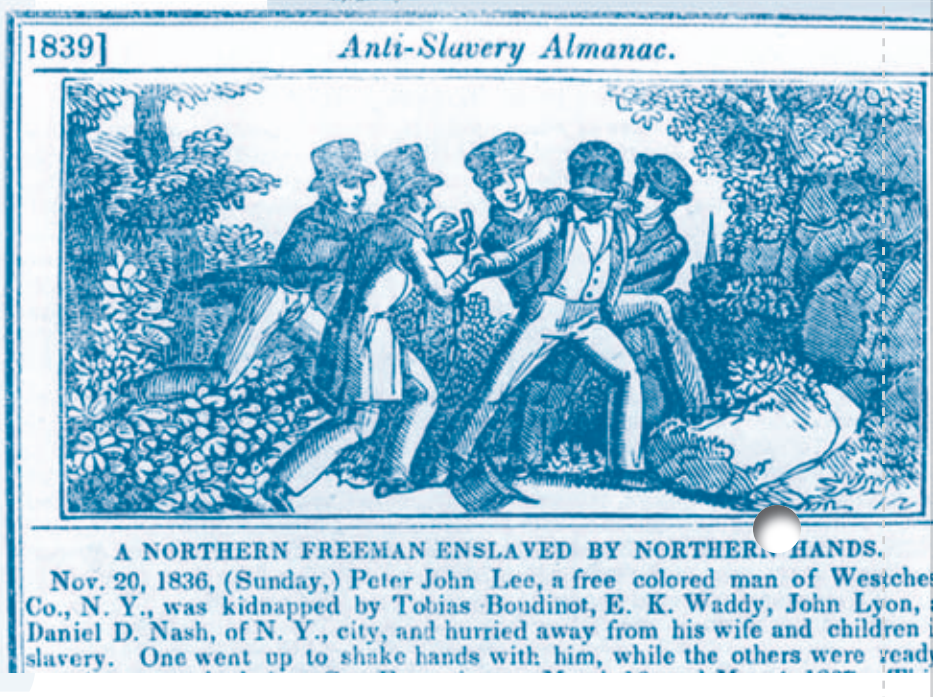
It is supposed that they are making their way to Chicago, and that a white man accompanies them. As they will travel chiefly at night, and most probably in a covered wagon.

A reward of $150 will be paid for their apprehension, so that I can get them, if taken within one hundred miles of St. Louis, and $200 if taken beyond that, and secured so that I can get them, and other reasonable additional charges, if delivered to the subscriber, or to THOMAS ALLEN, Esq., of St. Louis, Mo. The above negroes, for the last few years, have been in possession of Thomas Allen, Esq., of St. Louis.

WM. RUSSELL.

ST. LOUIS, Oct. 1, 1847.

A page from the Anti-Slavery Almanac



1839] Anti-Slavery Almanac.

A NORTHERN FREEMAN ENSLAVED BY NORTHERN HANDS.

Nov. 20, 1836, (Sunday,) Peter John Lee, a free colored man of Westches Co., N. Y., was kidnapped by Tobias Boudinot, E. K. Waddy, John Lyon, Daniel D. Nash, of N. Y., city, and hurried away from his wife and children slavery. One went up to shake hands with him, while the others were read

Fast Facts

- An estimated 100,000 African Americans escaped slavery between 1800 and 1860 using the Underground Railroad.
- Fugitive slave laws were passed by the United States Congress in 1793 and 1850 to provide for the return of slaves who escaped from one state into another or into a public territory.
- Slaves fled north to Canada and U.S. free states, south through Florida to the Caribbean Islands, and West through Texas to Mexico.
- Men in their early 20s were the most frequent travelers on the Underground Railroad.
- Fugitive slaves most often found help within the free black and Quaker communities.

Go Underground

Grades

5–6

Class or small group activity

2 HOURS

Get Ready: 60 minutes
Go Underground: 60 minutes

What you'll need

- Access to the Internet and school library
- Laminated wall map
- Blank map from lesson 1.4 (page 51)
- Activity worksheets (pages 206-207)

Do This

Step 1: Get Ready

1. Use the laminated wall map to draw a line between slave and free states.
2. Discuss and highlight major Underground Railroad routes.
3. Have students research underground railroad routes and safe house locations along the Mississippi River.
   - If students need help finding safe houses, direct them to the list of safe houses by state on the National Park Service's website. Go to www.nps.gov and search for "safe houses."
4. Plot the safe houses on the wall map.
5. Organize students in groups and assign them a slave state along the Mississippi River to escape from: Missouri, Arkansas, Louisiana, Mississippi, Tennessee, or Kentucky.

Step 2: Go Underground

1. Have students plan their route to Canada and plot it on their maps.
   - Record their journey in a journal.
   - Present their journey to the class or act it out as a play.

Teacher Tip

Other waterways, especially the Ohio River, were also major Underground Railroad routes, depending on where a slave started. Consider assigning groups a specific place along the Mississippi River as a starting point if you want them to use it as their main route.

Go Underground

Plan your escape route to Canada

Name _____ Date _____

Starting place (circle one):

Arkansas Kentucky Louisiana Mississippi Missouri Tennessee

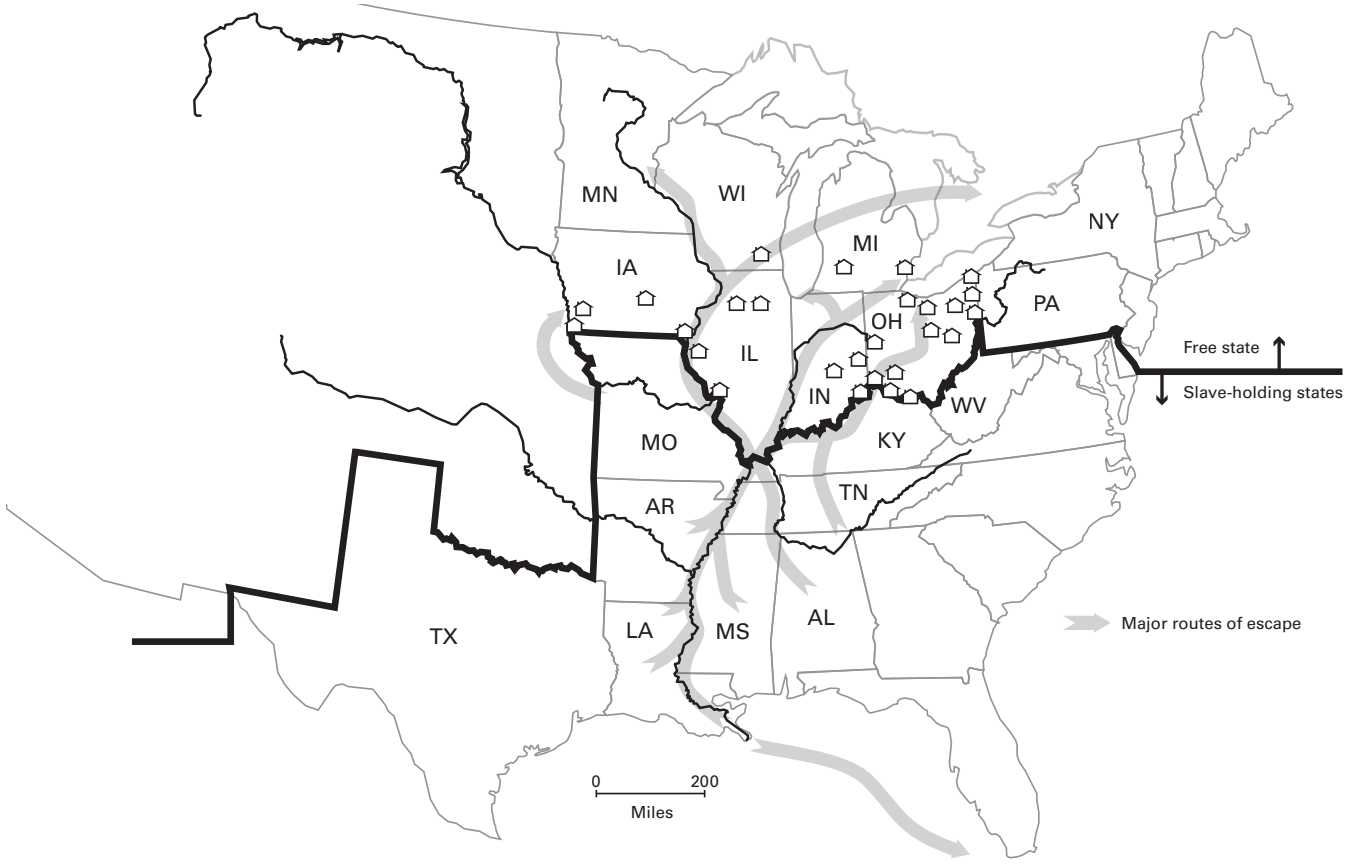
1. Pretend you and your classmates are a group of slaves escaping to free states in the north or Canada. How would you get there? What route would you take? Where would you sleep and eat?

_____

_____

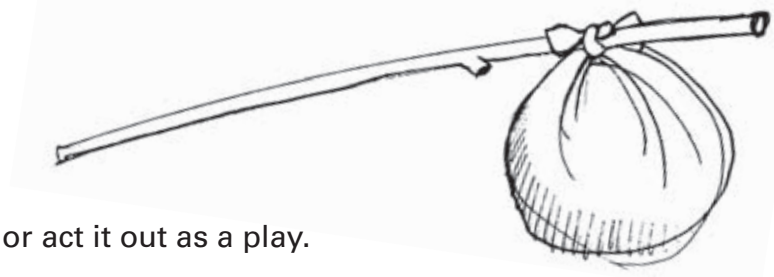
_____

2. Search for sources about the Underground Railroad at the library and online and plan your route on the map. Be sure to note where safe houses are located. Plot your route on the map.



3. Imagine what it would be like to take the journey and write a narrative describing it.

4. Draw a place you might pass or stay at along the way.



5. Present your journey to the class or act it out as a play.

Fact or Fiction?

Name _____ Date _____

Read, analyze, and hypothesize

Many people have long believed that African-American spirituals (religious songs created by slaves) were coded with instructions to be used to guide slaves on the Underground Railroad. Others, however, have recently disputed that claim, saying there is no historic evidence to support it.

What do YOU think? Read and decide for yourself. Write an essay supporting your position.

Read Below

Evidence to Ponder:

One famous Underground Railroad song is "Follow the Drinking Gourd":

Verse 1
When the Sun comes back
And the first quail calls
Follow the Drinking Gourd.
For the old man is a-waiting for
to carry you to freedom
If you follow the Drinking Gourd.

Verse 2
The riverbank makes a very good road.
The dead trees will show you the way.
Left foot, peg foot, traveling on,
Follow the Drinking Gourd.

Verse 3
The river ends between two hills
Follow the Drinking Gourd.
There's another river on the other side
Follow the Drinking Gourd.

VERSE 4
When the great big river meets the little river
Follow the Drinking Gourd.
For the old man is a-waiting for
to carry you to freedom
If you follow the Drinking Gourd.

Many versions of this song exist, but the first one was published by H.B. Parks in 1928. The publication date is used by some historians to prove that it could not have been used as a coded song for the Underground Railroad, because it was written so long after the fact. Others disagree and say that the song was passed down orally for decades before H.B. Parks wrote it down, and that there is enough documentation to show that these codes and signals were actually used at the time.

According to those that believe the song was used as a code, the drinking gourd is a reference to hollowed-out gourds used by slaves and other rural Americans as a water dipper. It is a code name for the Big Dipper star formation, which appears in the North Sky.

Verse 1 suggests escaping in the spring (when the sun comes back and the quail calls during spring breeding season) and heading North to freedom.

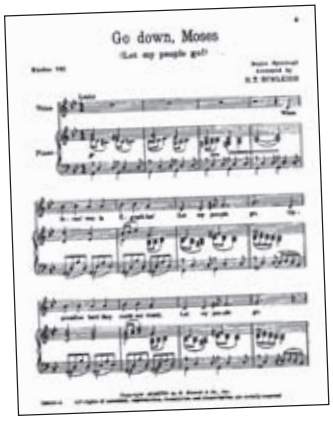
The term "old man" is nautical slang for "Captain." According to Parks, "peg foot" in Verse 2 refers to an Underground Railroad operative named Peg Leg Joe, who was formerly a sailor. Verse 3 gives directions to rivers that lead to the Mississippi River.

Verse 4 refers to where the Ohio runs into the Mississippi River at Cairo, Illinois. Here runaways would be met on the banks of the Ohio by the old sailor or other Underground Railroad conductor.

Article 1: In Support of Coded Underground Railroad Songs

Songs of freedom

City of Owen Sound, Ontario, Canada Website



The seemingly innocent spirituals, as the slave songs came to be known, were more than simple hymns of endurance and a belief in a better afterlife. As sung by slaves and their descendants, the spirituals allowed the slaves to communicate secret messages and information to each other about the Underground Railroad.

The spirituals and their lyrics were part of a sophisticated system that involved no incriminating evidence for plantation owners or overseers to find. Codes imbedded in the spirituals instructed slaves as to when, how and where to escape. They also included warning signals, such as the message of "Wade in the Water," informing slaves to travel along the riverbank so the dogs giving chase would be thrown off their scent.

Most slaves could not read or write; in fact, it was against the law to teach slaves to read or write. The spirituals provided a means of verbal, coded communication understood only by those in the Underground Railroad. Outsiders generally interpreted the spirituals on a literal level, while slaves knew the meaning of the messages hidden within the words and phrases. Through the words, the refrains, the "call and response" method of singing, and the rhythmic sounds produced by dancing feet, slaves could decipher these hidden meanings.

Songs were a part of the slaves' daily lives and were a survival tactic as well as a means of coded communication. Field slaves sang while they worked so the plantation overseer knew where they were, and could make sure that they were working.

Article 2: Disputes Coded Underground Railroad Songs

History's tangled threads

By Fergus M. Bordewich
New York Times, February 2, 2007

Few aspects of the American past have inspired more colorful mythology than the Underground Railroad. It's probably fair to say that most Americans view it as a thrilling tapestry of midnight flights, hairbreadth escapes, mysterious codes and strange hiding places.

Popular songs associated with the underground rarely withstand scrutiny, either. Recent research has revealed that the inspirational ballad ''Follow the Drinking Gourd"—perhaps the single best-known ''artifact" of the Underground Railroad—was first published in 1928, and that much of the text and music as we know it today was actually composed by Lee Hays of the Weavers in 1947. Nor do its ''directions" conform to any known underground route.

Such fictions rely for their plausibility on the premise that the operations of the Underground Railroad were so secret that the truth is essentially unknowable. In fact, there is abundant documentation of the underground's activities to be found in antebellum antislavery newspapers, narratives of escape written by former slaves, and the recollections of participants recorded after the Civil War, when there was no longer danger of reprisal.

Most successful fugitives were enterprising and well informed. The vast majority had little need for coded maps, since they came from the border states of Maryland, Virginia, and Kentucky, just a few days' or hours' walk from the nearest free state.

The Underground Railroad provided shelter, transportation, and guides, but through most of the North its work was hardly secret. Abolitionist newspapers reported news of fugitives in detail—their passage through town, the names of people who'd assisted them. In some places, activists distributed handbills announcing what they were doing and how many fugitives they had helped. Jermain Loguen, the African-American leader of the underground in Syracuse, advertised his address in local newspapers as an aid to freedom-seekers.

The larger importance of the Underground Railroad lies not in fanciful legends, but in the diverse history of the men and women, black and white, who made it work and in the far-reaching political and moral consequences of what they did. The Underground Railroad was the nation's first great movement of mass civil disobedience after the American Revolution, engaging thousands of citizens in the active subversion of federal law, as well as the first mass movement that asserted the principle of personal responsibility for others' human rights. It was also the nation's first interracial political movement, which from its beginning in the 1790s joined free blacks, abolitionist whites and sometimes slaves in a collaboration that shattered racial taboos.

Fergus M. Bordewich is the author of *Bound for Canaan: The Underground Railroad and the War for the Soul of America*.

Bordewich, Fergus M. "History's Tangled Threads." *New York Times*. 2 February 2007. Op-Ed.

Further Evidence to Ponder:

Here's another song that some historians believe contained coded messages to guide escaped slaves to freedom in the North.

"Go Down Moses" is a spiritual song that describes events in the Old Testament of the Bible. The first written mention of this song occurred in 1861, the year the Civil War started.

When Israel was in Egypt's land
Let my people go
Oppressed so hard they could not stand
Let my people go

Go down, Moses, way down in Egypt's land
Tell old Pharaoh, Let my people go

So Moses went to Egypt's land
Let my people go
To make old Pharaoh understand
Let my people go

Thus spake the Lord, bold Moses said,
"Let my people go,
If not, I'll strike your first born dead
"Let my people go"

In the song "Israel" represents the African-American slaves while "Egypt" and "Pharaoh" represent the slavemaster.

WRITING EXTENSION

Grades

7–12

Individual activity

Use the Fact or Fiction extension exercise starting on page 208 to help students realize that the study of history is not a static field. New information is discovered and established ideas are challenged regularly. By reading two accounts from reputable sources that disagree about the use of coded songs on the Underground Railroad, students learn that historians can sometimes disagree and it is up to the individual to decide what to believe after carefully considering the available evidence.

Harriet Beecher Stowe was an author and an abolitionist. Her novel *Uncle Tom's Cabin* described the horrors suffered by African Americans during slavery. Her influential book was considered an agent of social change.

Extension Suggestions

~ Career launch

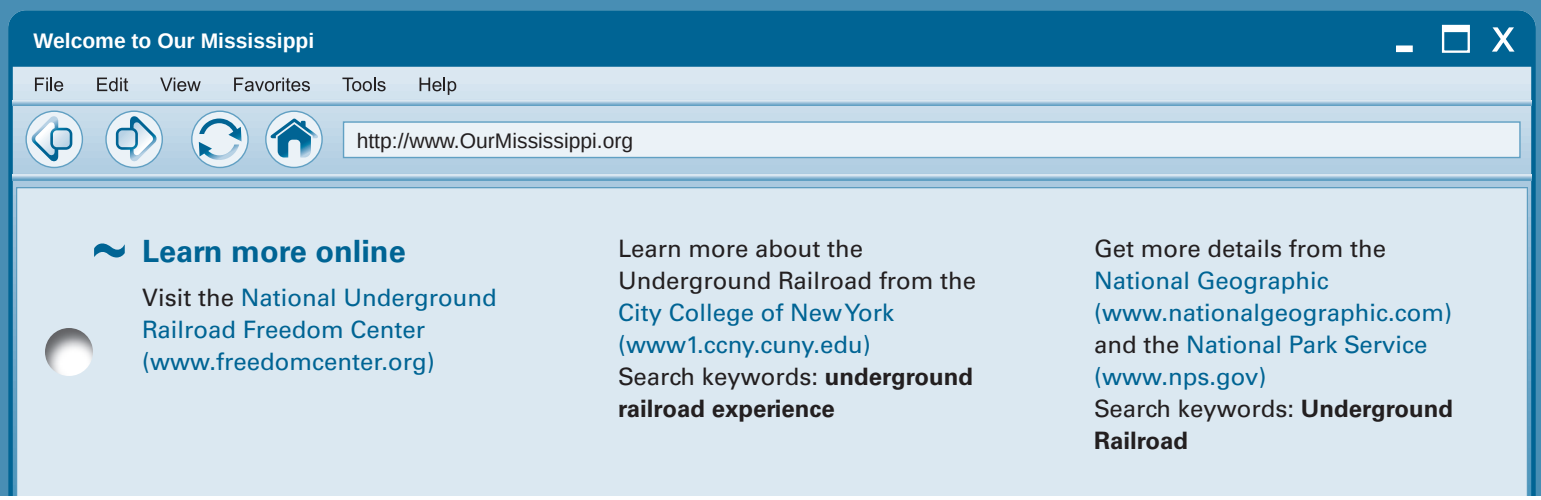
Invite a local **professor of African American studies** or **NAACP representative** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Express yourself!

- Learn a Spiritual song and perform it for other classes. Search online for "underground railroad songs," "antislavery songs," or "spirituals" to find your own or go to **www.osblackhistory.com** and click on "spirituals."
- Read a slave narrative and write a one-act play based on the story. Perform the play for your class.

~ Get out!

Travel to one of the Underground Railroad sites listed by states on the National Park Service website. Go to **www.nps.gov** and search for "safe houses."



~ Learn more online

Visit the National Underground Railroad Freedom Center (www.freedomcenter.org)

Learn more about the Underground Railroad from the City College of New York (www1.ccny.cuny.edu)
Search keywords: **underground railroad experience**

Get more details from the National Geographic (www.nationalgeographic.com) and the National Park Service (www.nps.gov)
Search keywords: **Underground Railroad**

Unit 4

Mississippi River at Work

Unit 4: Mississippi River at Work **builds on the knowledge and skills learned in Units 1, 2, and 3 to explore how humans rely on the river for more than just sustenance (food and water). This unit introduces students to human uses, beliefs, and values of the river and focuses on the river as a vital lifeline for human commerce and migration in the past, present, and future. The virtual river trip activity is used throughout this unit along with the wall map.**

Having learned about how people used the river for transportation and trade in the past in Unit 3, students compare and contrast those uses with how people use the river today, including recreation and tourism. This helps prepare students for the activities in Unit 5.

4.0 Introduction to the Mississippi River at Work: Pre- and Post-Assessments

Students research river-related occupations and gain an understanding of the many different industries that use the Mississippi River. They read biographies of workers and interview people about their current jobs and career paths.

4.1 Early Navigation: Powered by People

Explore what river navigation was like before the Steam Age. Students learn about different types of boats and understand the skill and strength needed to maneuver them up and down the river. They make a flatboat and imagine life on the river before the Age of Steam.

4.2 All Aboard the Steamboat Era: Steam Powers a New Economy

Learn how the steamboat changed travel and commerce on the river and mark the twain with Samuel Clemens. Experiment with the power of steam and understand how it revolutionized travel on the Mississippi River.

4.3 River Running Dry, River Running High: Major Floods on the Upper Mississippi River

Explore the changeable Upper Mississippi River as it alternates between flooding and drought. Students write their own newscast to inform their communities of the reasons for floods and droughts and what they can do to live in harmony with the Upper Mississippi River.

4.4 Controlling the River: Locks and Dams on the Upper Mississippi

Analyze how locks and dams made the Upper Mississippi River the ultimate travel corridor by creating your own lock system and playing the role of lockmaster.

4.5 To Market! To Market! Our Inland Waterway System

Explore the role of the Mississippi River as part of the Inland Waterway system and its role as a vital economic artery. Students read a navigation chart and plan a journey from the Atlantic Ocean through the St. Lawrence Seaway to the Gulf of Mexico.

Introduction to the Mississippi River at Work

Unit 4 goal

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Research river-related occupations on the Mississippi River

Lesson objectives

- Introduce the Mississippi River at work
- Identify river occupations
- Discuss the river's role in these occupations
- Write about an occupation of your choosing

Educational standards

- Social Sciences
- Fine Arts
- Language Arts

What you'll need

- *Confluence: The River Heritage of St. Louis* video

How long it will take

- *Activity 1:* 15 min.
- *Activity 2:* 2 hrs.

What's next!

Go back in time and learn about early navigation on the river

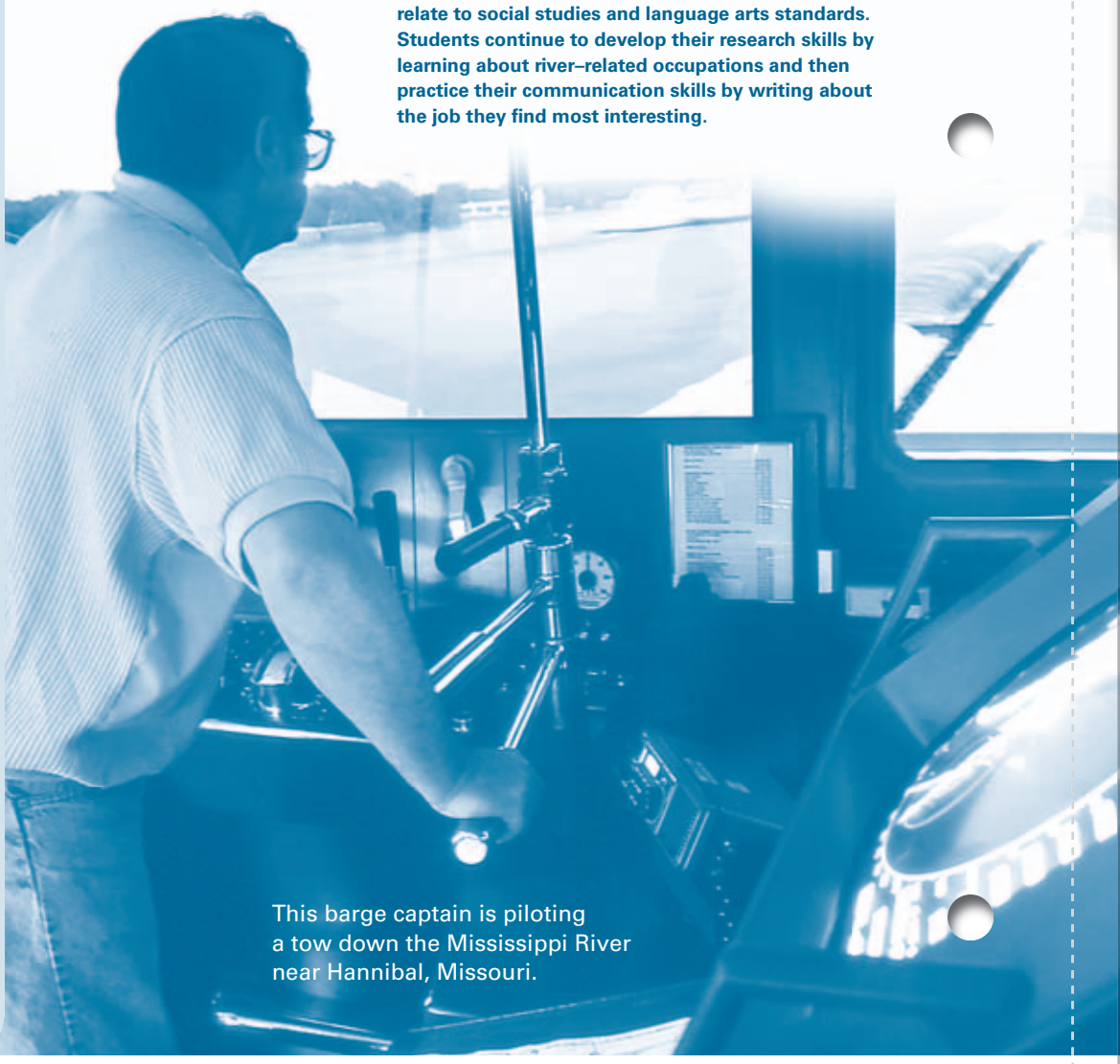
UNIT 4

Introduction

Students research river-related occupations on the Mississippi River and gain an understanding of the many industries that rely on the Mississippi River. They read biographies of workers and interview people about their current jobs and career paths.

STANDARDS CORRELATION

Most of the activities and discussions in Unit 4 relate to social studies and language arts standards. Students continue to develop their research skills by learning about river–related occupations and then practice their communication skills by writing about the job they find most interesting.



This barge captain is piloting a tow down the Mississippi River near Hannibal, Missouri.

Pre- and Post-Assessment

15 MINUTES

What you'll need

- Activity worksheet (page 216–217)

Instructions

1. Copy and distribute the Pre- and Post-Assessment activity worksheet on the following pages.
2. Allow 15 minutes for students to complete the assessment.
3. Save the pre-assessments to compare with a post-assessment given after students complete all the lessons in this unit using this same activity worksheet.
4. Calculate each student's percent increase in knowledge.

Answer Key

Multiple choice

1. B 2. A 3. C 4. B 5. D 6. C 7. D 8. C 9. B 10. False

Work Songs

Work songs were sung while conducting a task to direct physical labor and synchronize the timing.

(VERSE)
I hear dat bell a-ringing,
I see de Captain stand,
Boat done blow'd her whistle,
I know she's gwine to land.
I hear de mate a callin',
"Go git out the plank,
Rush out wid de headline,
An' tie her to de bank."

(CHORUS)
Roll out! heave dat cotton
Roll out! heave dat cotton
Roll out! heave dat cotton,
ain't got long to stay.

(VERSE)
It's early in de morning,
Before we see de sun,
"Roll aboard dat cotton,
An' get back in a run."
De Captain's in a hurry,
I know what he means,
Wants to beat de Sherlock,
Down to New Orleans.

(CHORUS)

(VERSE)
I heard dat mate a-shouting,
An' see him on de shore,
"Hurry boys! be lively,
Ain't but fifty more."
We ain't got time to tarry,
Here at dis cotton pile,
We gwine to git annoder,
Below here forty miles.

–William Shakespeare Hays
(1837 – 1907), American poet and lyricist

UNIT 4

Unit 4 Assessment

Name _____ Date _____

Multiple choice

Circle the correct answer.

1. Who invented the steamboat?

   a. Mark Twain
   b. John Fitch
   c. Daniel Grayson
   d. Zebulon Pike

2. How many cords of wood per day did the average steamboat use in the 1880s?

   a. 15-75 cords of wood a day (enough to build 15 houses)
   b. 5-10 cords of wood a day (enough to build 5 houses)
   c. 100-125 cords of wood a day (enough to build 20 houses)
   d. 130-150 cords of wood a day (enough to build 25 houses)

3. The first lock was built to deal with:

   a. floods
   b. sediment
   c. rapids
   d. fish

4. Besides being a writer, Mark Twain was also a:

   a. lock builder
   b. steamboat captain
   c. railroad engineer
   d. river guide

5. One 15-barge tow carrying dry goods on the river can replace:

   a. 2 trucks or 1 rail car
   b. 35 trucks or 8 rail cars
   c. 70 trucks or 16 rail cars
   d. 870 trucks or 225 rail cars

6. 9-foot channel:

   a. Minimum distance required between barges
   b. A subspecies of the channel catfish
   c. Depth of the river needed for barges to navigate the river
   d. Length of a channel boat

7. Which of these industries utilize the Mississippi River?

   a. Agriculture
   b. Transportation
   c. Tourism
   d. All of the above

8. What percentage of grain exported in the United States is shipped via the Mississippi River?

   a. 20%
   b. 40%
   c. 60%
   d. 80%

9. Approximately how many tons of goods were shipped via the Mississippi River in 2005?

   a. 100 million tons
   b. 500 million tons
   c. 750 million tons
   d. 250 million tons

10. There are 14 locks on the Mississippi River.

    a. True
    b. False

Introduction 4.0

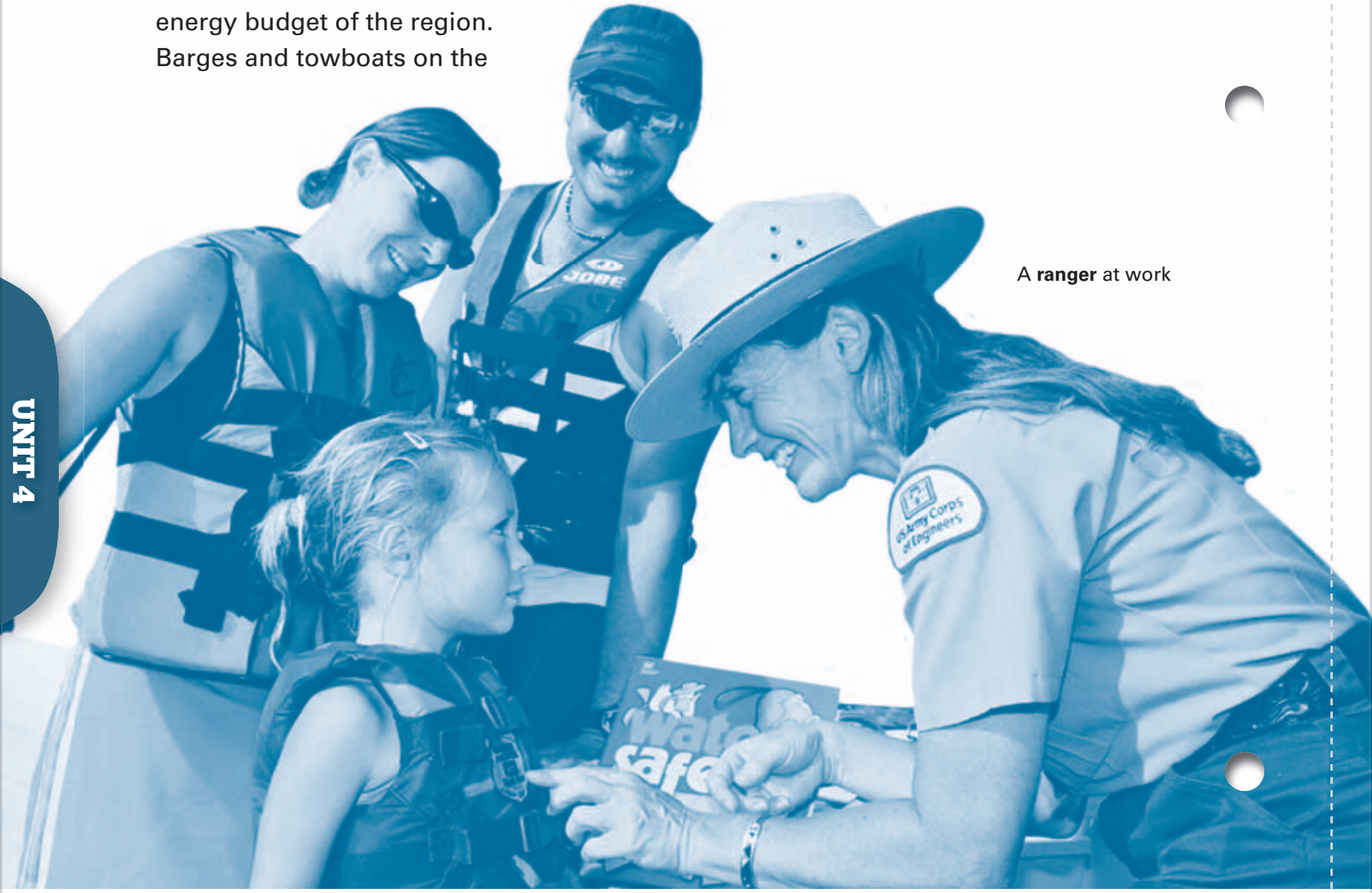
Background

No river has played a greater part in the development and expansion of America than the Mississippi. Our nation's chief navigable water route, it was – and still is – a vital factor in the physical and economic growth of this country. It is a place where people live, work, and play.

The Mississippi River Watershed includes some of our nation's most productive agricultural and industrial regions. Agriculture has been the primary user of the lands in the Mississippi River Watershed, continually altering the hydrologic cycle and energy budget of the region. Barges and towboats on the Mississippi River System carry 60% of the agricultural goods, industrial products, and raw materials transported on inland waterways.

Because of the Upper Mississippi River's slow current and relative depth, a series of locks and dams were built on the river in the 19th and 20th centuries to facilitate navigation for a steady stream of barge traffic. Most of the Mississippi River's big tributaries – the Missouri, Illinois, and Ohio Rivers – have also been developed for navigation.

Source: U.S. Army Corps of Engineers



A **ranger** at work

UNIT 4

A **farmer** at work

A **forester** at work

Fast Facts

- Nearly 500 U.S. grain transfer facilities are served by water transportation with the largest number, over 140 facilities, located on the Upper Mississippi River and the Illinois Waterway.
- Mississippi River Basin produces 92% of the nation's agricultural exports, 78% of the world's exports in feed grains and soybeans, and most of the livestock and hogs produced nationally.
- At least 40% of all North American migratory waterfowl depend on the Mississippi River Flyway during their spring and fall migrations.
- About 60% of all grain exported from the U.S. is shipped via the Mississippi River through the Port of New Orleans and the Port of South Louisiana.
- The Port of South Louisiana which stretches 54 miles along the Mississippi River is the largest tonnage port in the United States. It is comprised of facilities in St. Charles, St. John the Baptist, and St. James Parishes. Primary outbound cargoes include corn, animal feed, wheat, and soybean. (2009 information)
- Products shipped (partial list):
  - petroleum and petroleum products
  - iron and steel
  - grain including wheat, corn, and soybean
  - rubber
  - paper and wood
  - coffee
  - coal
  - chemicals

Commercial fishermen at work

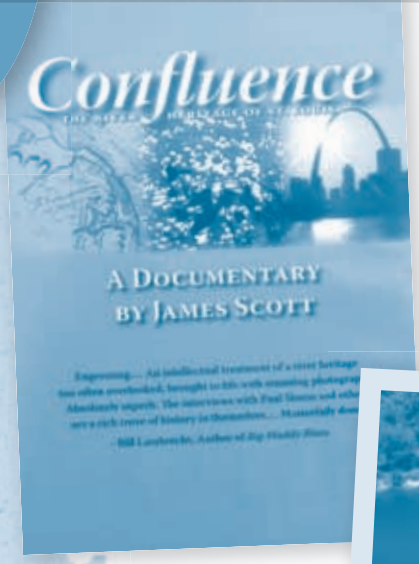
UNIT 4

Introduction 4.0

Career Launch

Careers and occupations related to the Mississippi River Watershed

- Agriculture: corn, wheat, rice, soybeans, chicken, hogs, beef and dairy cattle
- Biologists: fish and wildlife
- Forestry: logging, paper products
- Commercial fishing: operators, construction folks, facility engineers
- Commercial watercraft: captains and crew
- Conservation: public education, habitat protection and restoration
- Dock operators and crew
- Ecosystem monitoring
- Energy production and distribution
- Engineering
- Habitat restoration
- Lock and dam: facility operators, construction workers, engineers
- Manufacturing: food processing, machinery, transportation equipment, and chemicals
- Merchant mariners: operate and maintain tugboats, dredges, towboats, ferries, merchant ships, excursion vessels
- Mining: crushed stone, coal, sand and gravel, cement, and lime production
- Recreation and tourism: restaurants and hotels, river guides, recreation equipment, visitor centers, lifeguards
- Park rangers
- Wildlife managers



Produced and directed by Professor James Scott at St. Louis University, *Confluence: The River Heritage of St. Louis* is available for purchase from the National Great Rivers Museum gift shop and online at www.booksonstlouis.com.

Discussion (60–90 minutes)

Let's explore the river at work!

To spark student interest, watch the dynamic opening scene of the video *Confluence: The River Heritage of St. Louis*, which shows a variety of people working and recreating on the river.

Tell students that the Mississippi River is a working river and ask them what they think that means. Does the river have a job? Does the river earn money? Or does the river help us earn money by transporting our goods to market? Perhaps by providing us river jobs, like boat captain or river guide? Ask students what their parents do for a living. Do their occupations relate to the river?

Have students take 15 minutes to write down all the types of occupations they can think of that relate to the Mississippi River without using the Internet or books. Remind students that the Mississippi River Watershed encompasses 31 states (see Unit 1), so they should broaden their focus beyond jobs along the riverbank.

Mississippi River Watershed Occupations

Grades

5–6

Individual activity

2 HOURS

- 45 minutes to read and prepare lists
- 45 minutes to share and discuss
- 30 minutes to start essay (finish as homework)

What you'll need

- *Working on the Mississippi* Activity worksheets (pages 222-225)

Get Ready

Ask students to:

- Read the statements by six people who work on the river.
- Brainstorm other river-related occupations and write down as many occupations related to the river as they can.

Do This

1. Conduct the class discussion described above and write student responses on the board.
2. Select several occupations and ask:
   - What role does the river play with these occupations? (i.e., water for farming, transportation for logs, etc.)
   - How have these occupations changed in the last 100 years?
3. Have the students choose which job sounds the most interesting.
4. Have the students write to someone with that job to ask questions about their career and day-to-day job.
   - Using that information, have students prepare a report about that occupation. The report should include visuals such as charts and graphs.
   - Have students create a PowerPoint presentation and show it to the class.

Teacher Tip

Refer to Career Launch section on the previous page and A1: Career Launch on page 312 to familiarize yourself with the different occupations related to the Mississippi River Watershed.

Working on the Mississippi River

Name _____ Date _____

Meet some of the people who have river-related careers and read about their jobs. Choose which job sounds the most interesting to you and research that occupation. Based on your research, brainstorm at least three questions you would like to ask. As a class, send one letter to that person requesting additional information.

Read Below

Christine Favilla
Three Rivers Project Coordinator
Sierra Club, Illinois Chapter
223 Market Street
Alton, IL 62002
illinois.sierraclub.org

The Sierra Club is a non-profit, member-supported, public interest organization that seeks to practice and promote the responsible use of the earth's ecosystems and resources and to educate and enlist humanity to protect and restore the quality of the natural and human environment.

As the Three Rivers Project Coordinator, Christine Favilla helps to protect the region's big rivers, valuable wetlands, and tributaries. She reviews and comments on permits for development or the release of pollutants in the waterways. She is also active on several committees that work with landowners and government agencies to reach sustainable goals in their planning efforts.

"My vision for the upper Mississippi River is one that moves us from managing the river solely for our benefit to managing ourselves within the capacity of the river system. This strong sustainability goal includes a movement to local economies and local agriculture, resulting in less nutrient pollution, a smaller carbon footprint, and stronger communities. Working together, we can have healthier rivers, healthy economies, and healthier communities."

-Christine Favilla

Paul Rohde

Vice President

Waterways Council, Inc. (WCI)
225 South Meramec Avenue,
Suite 305
Saint Louis, MO 63105
www.waterwayscouncil.org

Waterways Council, Inc. (WCI) is the national public policy organization that advocates for a properly funded and well-maintained system of inland waterways and ports. As WCI Vice President, Paul Rohde seeks to educate decision-makers in the states and federal government, the news media and the general public about the critical importance of our nation's inland waterway system and the need to sustain and increase its reliability now and for our future.

The inland waterways industry was created for commerce back when Lewis and Clark set out on their exploration of the river system in the early 1800s. Today, our inland waterways transportation system offers the most fuel efficient, environmentally sustainable method of moving our nation's bulk commodities, at the lowest cost to shippers and, therefore, to everyone as consumers.

" I work closely with environmental, conservation and recreation groups, as well as many other advocates, to discover ways our organizations can work together to benefit both the environmental and economic concerns on river issues. Affecting river policy is all about building coalitions – finding where groups can work together, rolling our sleeves up, and working to change the status quo." - Paul Rohde

June Jeffries, PE

Project Manager

U.S. Army Corps of Engineers,
St. Louis District
Hydraulics Branch Engineering
and Construction Division
1222 Spruce St.
St. Louis, MO 63103
mvs-wc.mvs.usace.army.mil

June M. Jeffries, Professional Engineer, is the Chief of the Environmental Engineering Section at the St. Louis District, US Army Corps of Engineers. Her responsibilities include water quality, environmental services and lab analyses, industrial hygiene, HTRW (hazardous, toxic, or radioactive waste) activities, sanitary engineering.

She was formerly the project manager for the St. Louis District dike and revetment program and regulating works projects, which provided safe and dependable navigation channels on the Mississippi River, Kaskaskia River, and Illinois Waterway. She also managed programs to avoid and minimize impacts of navigation upon the environment.

June has 20 years engineering experience, with an undergraduate degree in mechanical engineering, and graduate degrees in civil/environmental engineering, ecology, and manufacturing engineering. While at the Corps of Engineers, June has worked as a water control manager and as a project manager for flood risk management projects.

" My job is a challenge that I enjoy meeting every day, and it is the best job I have ever had. My job allows me to work with people with a wide range of talents, for example with biologists, engineers, towboat pilots, and farmers. I very much enjoy opportunities to visit the river and see my projects in person." - June Jeffries

Michael F. Clark
Owner, River Guide and Outfitter
Big Muddy Adventures
539 Scranton Avenue
Riverview, MO 63137
www.2muddy.com

Michael Clark has over 10,000 miles of experience as a river guide and outfitter. He also teaches history, science, and computer science at St. Ann's of Normandy in St. Louis.

As the owner of Big Muddy Adventures, Michael's mission has been to connect people of all ages to rivers and facilitate a lifelong love of learning through exploration. Since 2001, he has guided groups on the Mississippi and Missouri Rivers and conducted live learning adventures for school children across the country.

Michael also lends his talents and equipment to numerous community service organizations to help clean the rivers. In 2009, Michael and his guides helped pull dozens of tires and barrels along with nearly a ton of plastic, aluminum, Styrofoam, metal, and cast iron from the rivers.

" The Mississippi River provides some of the best habitat in the world for a variety of species. Showing people some of the awesome places where nature remains intact and resilient is one of the keys to what we do."

- Michael F. Clark

Jeff Janvrin
Fisheries Biologist/ Mississippi River Habitat Specialist
Wisconsin Department of Natural Resources
3550 Mormon Coulee Road,
La Crosse, Wisconsin, 54601
dnr.wi.gov

As a fisheries biologist and habitat specialist with the Wisconsin Department of Natural Resources, Jeff Janvrin's mission is to protect and enhance the river environment and to promote responsible use of river resources. He thinks of the health of the river from a larger perspective: habitat loss, endangered species, and sedimentation.

Jeff Janvrin coordinates the identification, selection, planning, implementation, and evaluation of Mississippi River habitat restoration projects along the Wisconsin border. This involves a collaboration of efforts with other states, government agencies, organizations, and individuals.

An important part of Jeff's job is the collection of data both before and after a project. This helps determine if project goals were met and documents lessons learned that can be used to improve future projects.

" Restoration of an ecosystem is much more complex than grabbing the keys to a bulldozer and starting to push things back into place. Habitat restoration requires careful planning and patience. In some respects, it is much like trying to figure out how to put a puzzle back together, only you don't necessarily have, or know, where all of the pieces are and where they go." - Jeff Janvrin

Matthew E. Schramm
Resource Conservationist
Rock Island County Soil and Water Conservation District
3020 East 1st Ave.
Milan, IL 61264
www.aiswcd.org

Rock Island County Soil and Water Conservation District's mission is to promote conservation of natural resources (soil, water quality, air, vegetation, and wildlife habitat) through delivery of a variety of programs to local landowners, the public, and public agencies.

As a resource conservationist, Matthew Schramm works with landowners and public agencies to coordinate conservation efforts to improve water quality and reduce soil erosion. He also manages projects that restore ecosystems and prevent wildfires.

Since the local watersheds in his district all drain into the Mississippi River, everything his agency does has the potential to affect its health and water quality. The communities in his district are shaped by the Mississippi River and its history, including the decisions made today.

"One of the best parts of my job is working on collaborative efforts with other agencies, partners, and profession colleagues to advance local conservation of natural resources. Money, staff resources, and time are at a premium these days, but it is really neat to see what we can accomplish when we sit down together and work towards a set of common goals and objectives." - Matthew E. Schramm

Write down the three questions that your class would like to ask in the letter.

Introduction 4.0

The Mississippi River Water Trail is being developed by the U.S. Army Corps of Engineers and partnering organizations in response to public requests for a water trail on the Mississippi River within the St. Louis District boundary. The Corps has developed day use rest areas, primitive camping areas, watchable wildlife and interpretive opportunities on the Mississippi River.

The Mississippi River Water Trail was established through a partnership with the Mississippi River Water Trail Association, American Canoe Association, St. Louis Canoe and Kayak Club and numerous other partners to support and enhance the Mississippi River Water Trail and encourage community involvement. Visit www.greatriverwatertrail.org for more information.

Extension Suggestions

Career launch

Invite a local **career counselor** or **employment recruiter** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

- Just like in the old days, make a fishing pole from a long, sturdy stick, twine, and a hook. Go try it out. Learn which fish and size of fish you can keep, which you must throw back. Will you need a license to fish?
- **Job Shadow**: Students wrote an essay about an occupation they found interesting. Next they should try to job shadow someone doing that job.

Express yourself!

Create a Jeopardy-style game about river occupations and play as a class.

Grades K–4 Extension

What Floats, What Sinks? In the classroom or outside, have students experiment with various items, such as a leaf, pencil, pebble, or chalk, to see which ones float or sink in water.

UNIT 4

Learn more online

Learn about the U.S. Department of Labor (DOL). Go to www.dol.gov and read about occupations in the U.S. by searching keywords **list of SOC occupations**

Explore green jobs at the **U.S. Department of Labor (DOL)**. Go to **www.dol.gov** and search keywords **good jobs, safe jobs, green jobs**

Visit the U.S. Army Corps of Engineers (www.usace.army.mil) Search keywords: **Navigation, History, and Occupations**

Early Navigation:

Powered by People

Introduction

In *Lesson 4.1,* students learn about the types of boats used on the Upper Mississippi River before the Steam Age and how they were navigated. Students read about the exploits of the King of the Keel-boaters and understand the skill and strength needed to maneuver a Keelboat up and down the river. Students also make a flatboat and imagine life on the river before the Steam Age.

STANDARDS CORRELATION

Most of the activities and discussions in Unit 4 relate to social studies and language arts standards. Students continue to develop their research skills by learning about river–related occupations and then practice their communication skills by writing about the job that they find most interesting.

Mike Fink

King of the Keelboaters

Mike Fink (born 1770/1780? – died 1823) was a legendary boatman who exemplified the tough men who ran keelboats up and down the Ohio and Mississippi Rivers. The son of French Canadians, he was born in Fort Pitt, near Pittsburgh, PA. When he began his career in navigation he became notorious for both for his practical jokes and his willingness to fight anyone who was not amused. The muscles required to force a keelboat upstream would have made him a formidable opponent. Davy Crockett is supposed to have described him as "half horse and half alligator."

Unit 4 goal reminder

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Explore what river navigation was like before the Age of Steam

Lesson objectives

- Compare watercraft used before steamboats
- Understand how early watercraft were navigated
- Build a flatboat

Educational standards

- Social Studies
- Fine Arts
- Language Arts

What you'll need

- *Confluence: The River Heritage of St. Louis* video
- Pen and pager
- Metronome or other instrument to keep time
- 1 half-gallon milk or juice carton
- Ruler
- Scissors
- Tape
- Pipe cleaners
- Paper clips
- Water
- Toy people or animals, popcorn, and pennies

How long it will take

- *Discussion:* 60 min.
- *Activity 1:* 30 min.
- *Activity 2:* 60 min.

What's next!

Let's STEAM down the Mississippi River

Lesson 4.1

Lt. Robert E. Lee mapped the Rock Island rapids in 1837. He proposed cutting off the rock projections in the natural channel to make passage easier and less dangerous.

Background

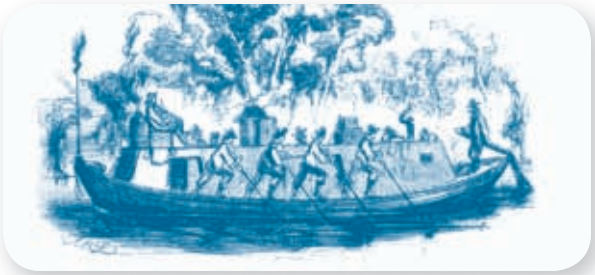
Before the locks and dams, the Upper Mississippi River was a natural, meandering river filled with shifting sand bars and shallow areas. Starting at Lake Itasca in north-central Minnesota, the Upper Mississippi flows more than 500 miles before it becomes navigable near St. Paul, Minnesota. From there, it flows 670 miles south to St. Louis. Along the way, the Upper Mississippi is fed by several rivers including the Minnesota, St. Croix, Chippewa, Wisconsin, Rock, Des Moines, and Illinois Rivers.

At places such as the Des Moines and Rock Island Rapids, the river's current could be dangerously swift and treacherous, depending on water levels. The depth of the Upper Mississippi averaged approximately three feet and, at certain seasons, amounted to as little as one foot in the 200 miles below St. Paul. During times of flooding, the Upper Mississippi was deep but turbulent. More frequently, long dry spells made the river too shallow to navigate. In addition, the river's uncharted shoals and sand bars presented a constant danger. Equally dangerous were the snags, debris, and trees that storms had washed from the river's banks into its waters.

Just above St. Louis the Mississippi River joins with the Missouri River, where it gains strength and volume. About 170 miles south of St. Louis at Cairo, Illinois, the Mississippi River meets with the Ohio River and doubles its volume. At this point, it becomes the Lower Mississippi, that "mile-wide tide, shining in the sun" described by Mark Twain.

Navigating the Upper Mississippi River
The Upper Mississippi was a challenge to all who traveled its waters. For hundreds of years before the Steam Age, small, light-draft craft plied the Upper Mississippi. Native Americans used boats that were adaptable to the river's shallow depth and variable conditions, such as canoes and pirogues, made out of hollowed-out logs. These could be either paddled or poled, depending on the depth of the water.

Whatever the craft, its success depended upon the river's ever-changing conditions, and the skill of its pilot. Early navigators were constrained by the natural routes and depths of the waterways they traveled. Where they met shallow water or rapids in rivers, they were forced to portage, or carry, their goods and boats around the obstruction before continuing their journey.



Flatboats and keelboats
Flatboat: A flatboat was a rectangular flat-bottomed boat used to transport freight and passengers on inland waterways. The flatboat is essentially a large, sturdy tub with a hull that displaces water and so floats in the water (which differentiates it from a raft, which floats on the water). Flatboats were rowed or pulled by horses that walked the river on a road called the towpath.

Loaded at an upstream point, they were floated downriver where their cargoes were unloaded. The flatboats were then dismantled and sold for lumber. Built for one trip only, they were cheap and often poorly constructed, but carried large quantities of merchandise at a time.

Keelboat: The most sophisticated craft on the Upper Mississippi prior to the arrival of the steamboat was the keelboat, which came into use sometime before 1800. Long, with narrow, graceful lines, the keelboat was the first queen of the river trade.

Two-way travelers, keelboats were built to survive many trips and could carry as much as 80 tons of freight. These shallow-draft, flat-bottom vessels were pointed at both ends, which allowed them to be poled or pulled upstream. Lieutenant Zebulon M. Pike and his men used a 70-foot keelboat during their exploration of the Upper Mississippi River Valley in 1805.

Sources: U.S. Army Corps of Engineers and the National Park Service

Lesson 4.1

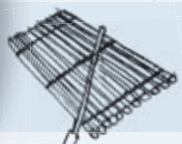
Discussion (60 minutes)

Show students the "The Primal River Network" scene from the video *Confluence: The River Heritage of St. Louis*. Discuss what was learned, focusing on how people used the river before the Steam Age (trade and migration). Produced and directed by Professor James Scott at St. Louis University, this video is available for purchase from the National Great Rivers Museum gift shop and online at www.booksonstlouis.com.

Describe the history of the different types of boats used on the river and how they were navigated. What types of watercraft did the Native Americans use? What role did the river play in the lives of Native Americans? What types of boats were used by the explorers and why? What kind did Lewis and Clark use?

Ask the students to think back to the last unit. What are the similarities among modern and historic boats? Prompt students to compare flatboats with today's barges.

What Kind of Boat Was Used?

	Type of Boat	Typical Cargo and Cargo Limits	Size and Crew	Direction and Power	When Used
	Canoe (birch bark or dugout)	Up to 2.5 tons: Food, furs, hides, travel supplies	About 18'x3'; Crew 1-13	Upstream: paddles Downstream: current	Prehistory to early 1800s
	Pirogue (Pee'row)	Up to 40 tons: Food, furs, hides, dry goods, cloth, blankets, military and travel supplies	Largest 50'x5'; Crew up to 30	Upstream: oars or poles Downstream: current	1660s – 1860s
	Bateau	Up to 40 tons: Passengers, dry goods, cloth, blankets, military and travel supplies	Larger than a pirogue; Crew of 18–30	Upstream: oars or poles Downstream: current	1750s – 1790s
	Log Raft	Lumber and logs, which was the log raft itself, sold at destination	About 600' long, 7–20' wide; Crew of 20	Downstream only: current	1830s – 1915
	Flatboat	Up to 100 tons: Settlers with livestock and household goods and supplies, agriculture (apples, potatoes, sugar), coal, general merchandise	Varied widely	Downstream only: current	1740s – 1870s
	Keelboat	15 – 100 tons: food, furs, military equipment, travel supplies, passengers, agriculture (apples, potatoes, sugar), coal, general merchandise	30–100 long, 7–20' wide; Crew of 10	Upstream: pushed by poles or pulled from shore, sometimes sail; Downstream: current	1770s – 1860s

UNIT 4

Row, Tow, or Pole Your Boat

Grades

5–6

Small group (3 students) activity

30 MINUTES

Some believe the song "Row, Row, RowYour Boat" is a work song. Rowing is a skillful, if tedious, practice that takes precision to power and steer a vessel. When a work song is sung as a group, it becomes a unifier, helping to keep the rowing of the oars in sync. Some have suggested the lyrics are a metaphor for life's difficult choices.

The most common modern version is:

Row, row, row your boat,
Gently down the stream.
Merrily, merrily, merrily, merrily,
Life is but a dream.

Sometimes people sing additional verses simply to extend the song, which is considered a form of children's street culture.

What you'll need

- Pen and paper
- Metronome or other instrument to keep time (if sung in class)

Do This

1. Ask students to add verses that relate to navigating the Upper Mississippi River or teaching someone how to paddle a canoe (see page 226). For example:

Row, row, row your boat
Gently down the stream
If you see a waterfall
Don't forget to scream

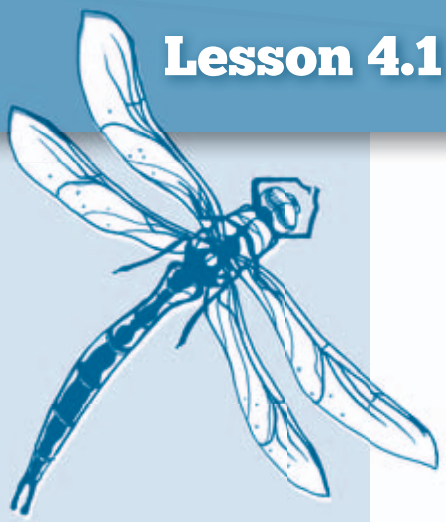
Row, row, row your boat
Gently down the lake
Don't stand up and rock the boat
That's a big mistake!

Rock, rock, rock your boat
Gently to and fro
Watch out, give a shout,
Into the water you go!

2. Have students sing their verses as a round in class. Use a metronome to emphasize the importance of timing.

Teacher Tip

A **round** *is a musical composition in which two or more voices sing exactly the same melody (and may continue repeating it indefinitely), but with each voice beginning at different times so that different parts of the melody coincide in the different voices, but nevertheless fit harmoniously together.*



Float Your Boat

Grades
5–6

Class or small group activity

60 MINUTES

Students build and test their flatboats, both when empty and filled with cargo, such as popcorn, pennies, or small toy animals and people.

Here's how it works:

What you'll need

- 1 half gallon milk or juice carton (per student)
- Ruler
- Scissors
- Tape
- Pipe cleaners
- Paper clips
- Water to float your boat in
- Things to put in your boat: toy people or animals, popcorn, pennies

Teacher Tip

Fill a plastic bin or tub with water and test the boats a few at a time or take students outside to try their boats in a nearby stream or pond.

1

Open the top of the carton and make sure it is clean inside. Lay the carton on its side.

2

Draw a straight horizontal line the length of the carton, dividing it in half. Extend the line across the bottom of the carton, and then along the entire length of the other side.

3

Cut along the line, splitting the carton in half.

4

Cut along the diagonal folds down to the top of the carton. You should have three flaps, a wide one in the center and a small one on each side.

UNIT 4

5

Fold the wide center flap upward to meet the sides. Cut off the center flap excess overlap.

6

Before you secure the flaps together with tape, this is what your flaps should look like. Secure each of the small flaps to the large one with tape.

7

Seal the edges of the flaps inside and out so your flatboat won't leak. You now have the hull of your flatboat.

8

Use the other carton half to make the cabin. Measure 3" from the bottom of the carton and draw a line across all four sides.

9

Cut off the bottom of the carton. You now have your cabin.

10

Cut small tabs (2 cuts ½" high and 1" apart) on all sides of the carton bottom.

11

Secure the cabin to the back of your flatboat with tape.

12

Paperclip a pipe cleaner to each side of the hull so that the crew will have something to propel the flatboat through the water.

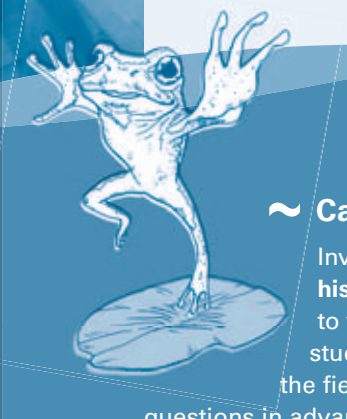
13

Fill your boat with crew members or cargo, such as popcorn kernels or pennies.

Fast Facts

- In 1705, the first recorded cargo was floated down the river from the Indian country around the Wabash, now the states of Indiana and Ohio. This was a load of 15,000 bear and deer hides brought downstream and out below Baton Rouge on its way to France.

Extension Suggestions



Career launch

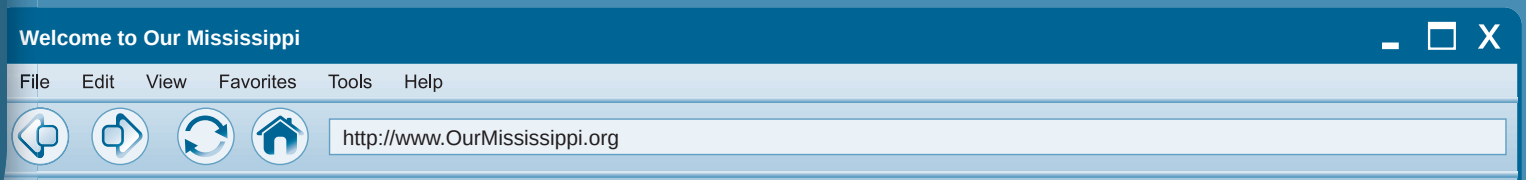
Invite a local **historian** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Express yourself!

- Write a play about traveling the Upper Mississippi River by canoe in the early 1800s.
- Read a Mark Twain book and write a book report to share with the class. Some books Twain wrote:
  - *Huckleberry Finn*
  - *Tom Sawyer*
  - *A Connecticut Yankee in King Arthur's Court*
  - *A Double Barrelled Detective Story*
  - *Captain Stormfield's Visit to Heaven*

Get out!

- Go float your boat that you made during Activity 1, pages 232–233.
- Visit a local marina and watch the watercraft in action.
- Take a hike at a nearby park and learn how to use a map and compass.
- Take safe canoeing lessons from the local parks and recreation department.



Learn more online

Learn about fur traders' keelboats at Steamboat Times (www.steamboattimes.com) Choose the button **Keelboat** in the menu.

Before bridges were constructed, ferry boats were the way to cross the river. Learn about riverboats and the early ferry operations on the **Illinois State Museum** website **(www.museum.state.il.us).** Enter keywords **first ferry** in the "Search ISM Site" box. Then click on **Early Technology; Riverboats and Ferry Operations**

Learn about ferry boats on the Middle Mississippi River today. Go to Greatriverroad.com and click the button **River Ferries**

All Aboard the Steamboat Era:

Steam Powers a New Economy

Introduction

In *Lesson 4.2*, students learn how the steamboat changed travel and commerce on the river. They use nautical charts and "mark the twain" with Samuel Clemens. A demonstration of the power of steam helps students understand how steam power revolutionized travel on the Mississippi River.

STANDARDS CORRELATION

In this lesson we continue to uncover ways to navigate the river and introduce the steamboat. We touch on the physical science standard as students watch a demonstration about the power of steam and address the history of science by learning about the inventors that harnessed it.

Background

The invention of the steamboat in the early 1800s changed life along the Mississippi River. Steam-powered shipping turned the river into a major transportation corridor, increased trade, and created a river culture that was distinctly American.

Since there were few roads and no railways in the lands of the Louisiana Purchase, the Mississippi River and its tributaries were the best routes for travel, trade, and settlement. With the advent of steam power, those activities increased dramatically. A voyage that once took months could now be done in ten days.

In 1811, the first steamboat to travel the Mississippi from the Ohio River to New Orleans was the *New Orleans*. She transported people and goods between New Orleans, Louisiana and Natchez, Mississippi until she hit a stump and sank two years later.

Unit 4 goal reminder

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Learn how the steamboat changed travel and commerce on the river

Lesson objectives

- Introduce the steamboat
- Discuss how the steamboat revolutionized river commerce
- Use maps to navigate the river
- Demonstrate the power of steam

Educational standards

- Science
- Social Studies
- Fine Arts
- Language Arts

What you'll need

- *Confluence: The River Heritage of St. Louis* video
- 2 cups of water
- Toy pinwheel
- Hotpot or pot of boiling water and hot plate
- Pot-holder glove
- Cub pilot journal

How long it will take

- *Activity 1:* 30 min.
- *Activity 2:* 60 min.

What's next!

Floods and drought on the Upper Mississippi River.

During the War of 1812, between the United States and Great Britain, Capt. Henry M. Shreve brought a cargo of supplies for Gen. Andrew Jackson's army from Pittsburgh to New Orleans in his side-wheeler, the *Enterprise*.

Although steamboats were in service between New Orleans and Natchez, they had not yet traveled far upriver. In 1817, the *Washington* made the round trip from Louisville to New Orleans in 41 days. Steamboat traffic increased rapidly soon after that. By 1833 more than 1,200 steamboats traveled the river.

Steamboats on the Upper Mississippi

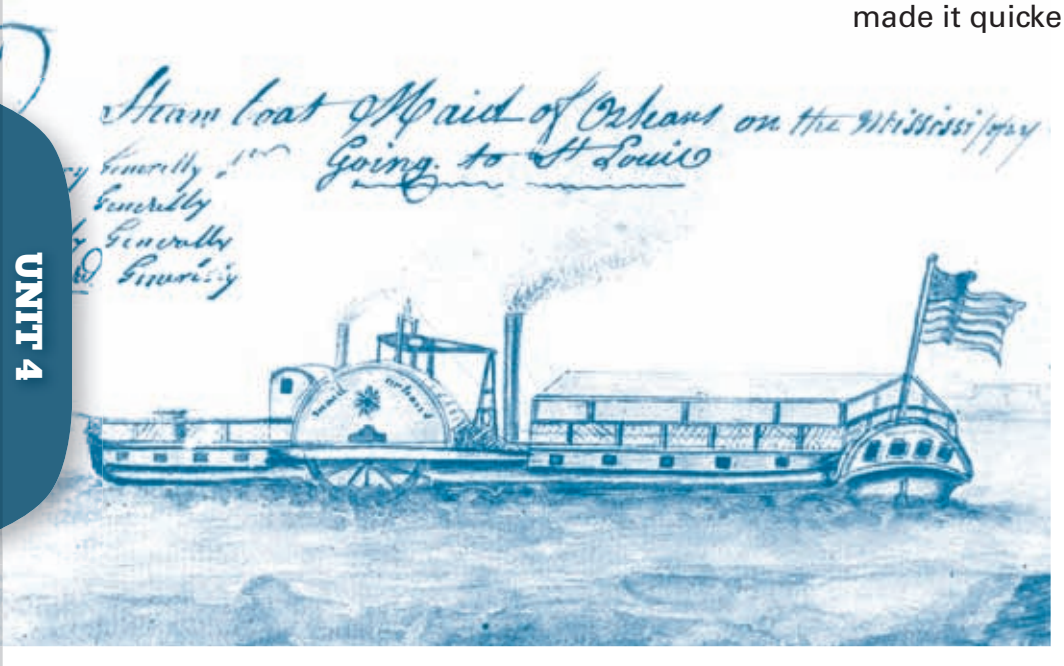
In August 1817, the *Zebulon M. Pike* became the first steamboat to reach St. Louis after a six-week trip from Louisville, Kentucky. In 1823, the *Virginia* was the first steamboat to travel from St. Louis, Missouri, to St. Paul, Minnesota. By 1840, there was heavy river commerce between St. Louis and the head of navigation at St. Anthony's Falls located near St. Paul.

The Grand Excursion

In 1854, the Chicago and Rock Island Railroad became the first to reach the Mississippi River from the East Coast. To celebrate the event, people traveled from Chicago to Rock Island, Illinois, by train, and then traveled upriver to St. Paul, Minnesota, by steamboat.

Full steam ahead

Traffic on the Mississippi River was dominated by steamboats for most of the 19th and early 20th centuries. The period between 1830 and 1850 was the golden age of steamboats. Steam power made it quicker and cheaper to



Designed for both sea and river navigation, *Maid of Orleans* was the first steamboat to reach St. Louis from an Atlantic port in 1820. The note on the drawing reads, "Steamboat Maid of Orleans on the Mississippi River going to St. Louis."

The steamboat *War Eagle* operated between Galena, Illinois, and St. Paul, Minnesota. It was later rebuilt as the *Cape Girardeau*.

UNIT 4

ship people and cargo, such as cotton, timber, coal, and produce, by river through New Orleans than to move them by land over the Appalachian Mountains. Because produce and products could be more easily transported to market, steamboats sparked the rapid growth of port cities, farming, trade, and prosperity along the river.

End of an era

The golden era of steamboats on the Mississippi River continued until the 1870s, when railroads began to surpass the river as the major commercial transportation mode for the central United States.

In 1856, the first railroad bridge was built across the Mississippi River between Davenport, Iowa, and the Rock Island

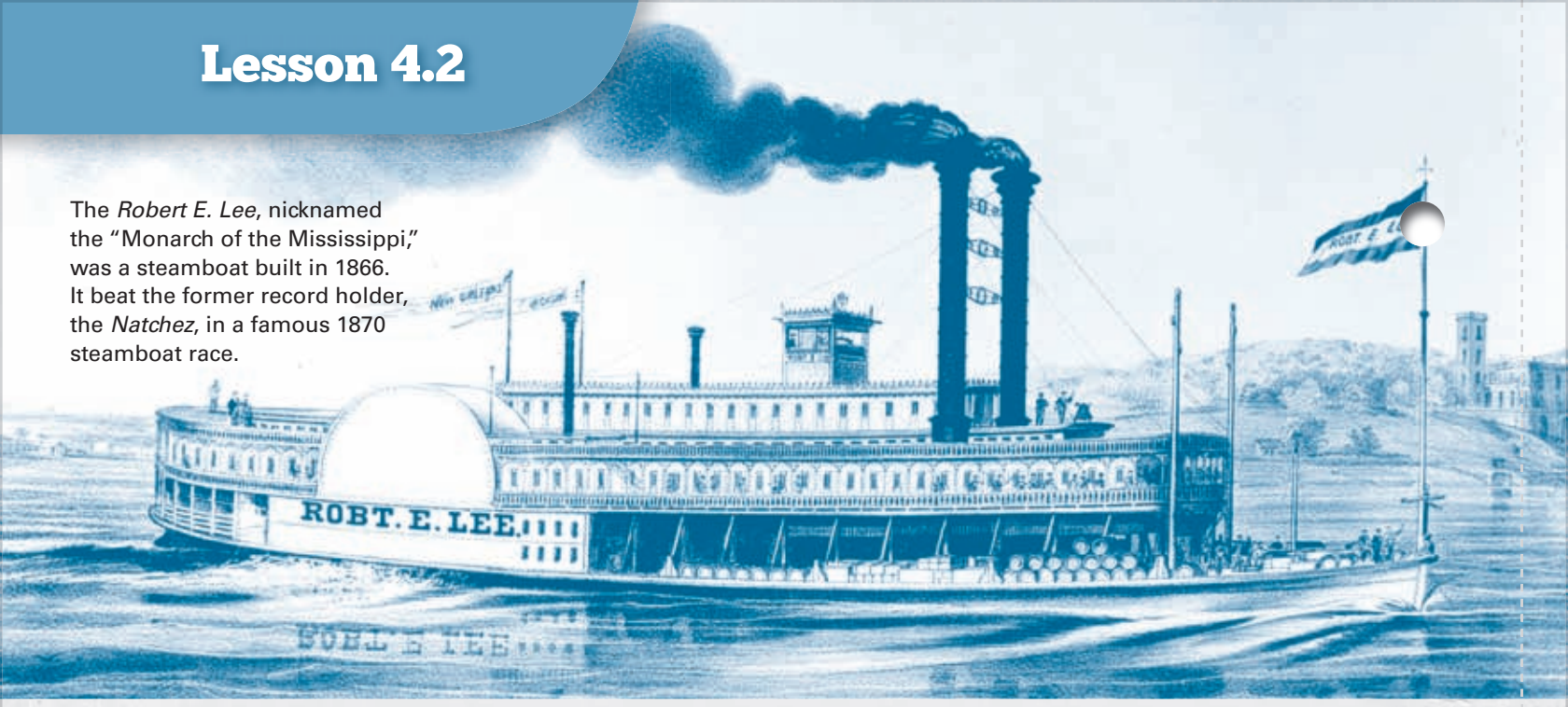
Fast Facts

- The first bridge across the Mississippi River was built in Minneapolis, Minnesota, in 1855.
- Steamboats did not always have steam whistles. Before steam whistles, bells had been used for passing signals and other communication between boats.

Steam boat bell from the *Belle of Louisville*

Steam whistle

The steamboat *Golden Era* operated on the Upper Mississippi and Red Rivers from 1852 to 1868 and saw service during the Civil War.



The *Robert E. Lee*, nicknamed the "Monarch of the Mississippi," was a steamboat built in 1866. It beat the former record holder, the *Natchez*, in a famous 1870 steamboat race.

Arsenal in Illinois. Two weeks after it was completed, the steamboat *Effie Afton* hit the bridge and set it afire. Steamboat captains declared the bridge a hazard. In the lawsuit that followed, Abraham Lincoln defended the railroad and won.

Steamboat transport remained a viable industry, in terms of both passengers and freight, until about 1920.

Sources: U.S. Army Corps of Engineers; Library of Congress; Augustana College; Upper Mississippi River History; www.steamboats.org

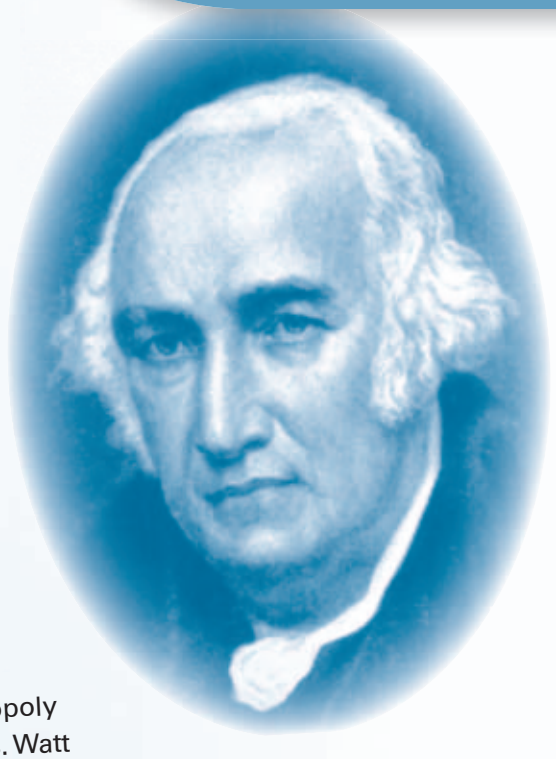
Cover of the original U.S. edition, 1883.

> "Ship channels are buoyed and lighted, and therefore it is a comparatively easy undertaking to learn to run them; clear-water rivers, with gravel bottoms, change their channels very gradually, and therefore one needs to learn them but once; but piloting becomes another matter when you apply it to vast streams like the Mississippi and the Missouri, whose alluvial banks cave and change constantly, whose snags are always hunting up new quarters, whose sand-bars are never at rest, whose channels are forever dodging and shirking, and whose obstructions must be confronted in all nights and all weathers without the aid of a single lighthouse or a single buoy; for there is neither light nor buoy to be found anywhere in all this three or four thousand miles of villainous river."

–Mark Twain, *Life on the Mississippi*

James Watt

Inventor of the steam engine



James Watt (1736 – 1819) was a Scottish inventor and engineer who redesigned the steam engine and helped usher in the Industrial Age.

Legend says that Watt got the idea for his steam engine when he saw steam pressure lift the kettle lid. Although steam power was already in use before Watt's time, he took the idea and improved it, making it available on a major scale.

In 1755, Watt took out a patent on his design. For the next 55 years, the Boulton & Watt Company had a monopoly over the production of steam engines. Watt calculated the power exerted by a horse and described his machines in comparison to a horse, so he also invented the term "horsepower."

John Fitch

Inventor of the steamboat

John Fitch (1743 – 1798) was an American inventor, clockmaker, and silversmith born in Windsor, Connecticut. He built the first recorded steam-powered boat in the United States in 1787.

Fitch began working on ideas for a steam-powered boat in 1785, 30 years after Watt's patent. The first successful trial run of his steamboat was made on the Delaware River in 1787. In 1790, he launched another boat powered by several stern-mounted oars.

Fitch was granted a patent on August 26, 1791, after a battle with James Rumsey, who also invented a steam-powered boat. Fitch's legal dispute with Rumsey and others helped bring about the enactment of the first Patent Act in 1790.

Samuel Clemens

Author and steamboat captain

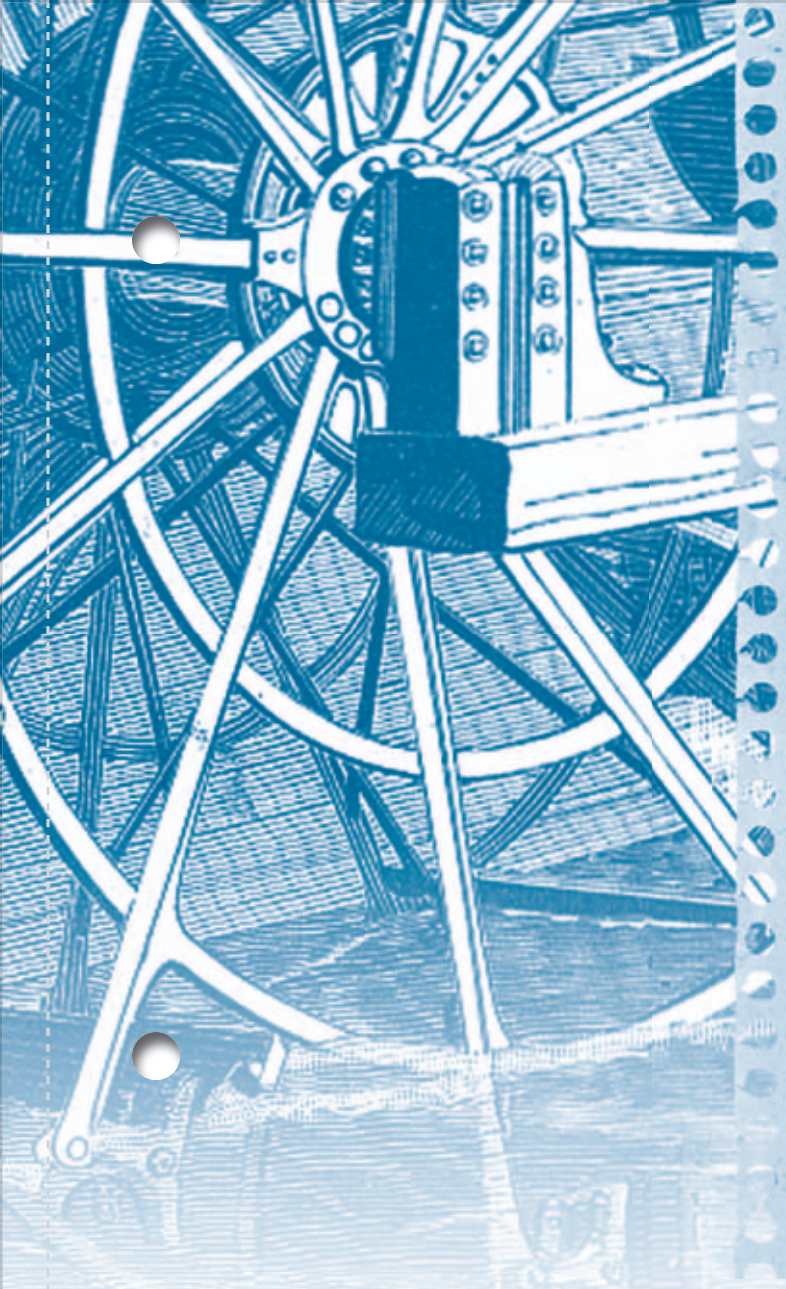
Samuel Langhorne Clemens (1835 – 1910) was an American author and humorist. His pen name was Mark Twain. He is best known for his novel, *Adventures of Huckleberry Finn* (1884), which has been called "the Great American Novel." Author William Faulkner called him the Father of American Literature.

Born in Missouri, he grew up in the port town of Hannibal on the Mississippi River. In 1859, at the age of 24, he realized a boyhood dream by becoming a steamboat pilot after serving as a cub pilot for two years under the tutelage of steamboat pilot Horace E. Bixby. Clemens chronicled his steamboat training and career in his book, *Life on the Mississippi*, written in 1883.

Blanche Leathers

First female steamboat captain

Blanche Douglass Leathers (1860 – 1940) was the first woman steamboat captain on the Mississippi River in the late 19th and early 20th centuries. Nicknamed "Angel of the Mississippi," she had wanted to captain a steamboat since she was a little girl. She married into the Leathers family, a prominent steamboat family from New Orleans. Seven of the *Natchez* steamboats were built for the Leathers family. She and her husband, Bowling S. Leathers, both piloted the steamboat *Natchez VII*. Her father-in-law Captain T. P. Leathers commanded the *Natchez* in its historic 1870 race with the *Robert E. Lee* from New Orleans to St. Louis.



Who's Who on a Steamboat?

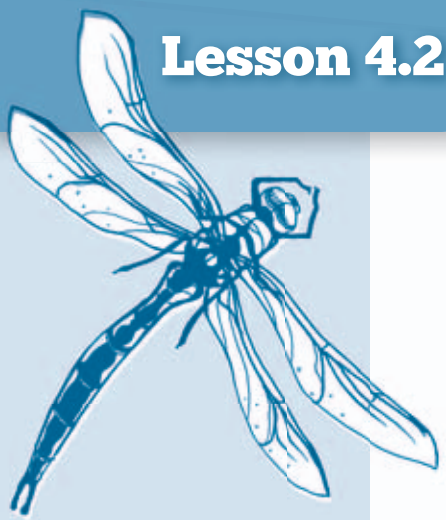
- **Captain**: Often the owner, the captain was in command of the steamboat. The captain was sometimes called the master.
- **Pilot**: The pilot steered the boat from the pilothouse on the top of the boat. Since there were no markers or buoys to operate by, pilots had to navigate the river largely from memory. An apprentice pilot was called a cub pilot.
- **Engineer**: The engineer started and stopped the boat's engines. Maintaining the appropriate water levels and steam pressure was very important because any sudden increase in pressure could lead to a catastrophic explosion.
- **First mate**: The first mate directed the handling of cargo and fuel, helped with landing and launching, and supervised the work of the deckhands.
- **Fireman**: Steamboats need a fireman to make sure there is enough fire to heat the water in the boilers to make steam and turn the paddlewheels.
- **Deckhands**: Also called stevedores or roustabouts, deckhands handled the freight and supplies carried aboard steamers. They also maintained and repaired the boat.

Discussion (60-90 minutes)

Show students scene 3, "The River Network Tamed," from the video *Confluence: The River Heritage of St. Louis* and a three-minute video clip on the history of the steam engine online at the History Channel's website. Go to www.history.com and search keywords **Modern Marvels Steam Engines Drive a Revolution**.

Remind students they learned about the types of boats that were powered by people (paddling, oaring, poling, pulling) in the last lesson. Help students see the similarities and differences between paddling a canoe and a steam-powered paddle wheel.

Introduce the students to the inventors of the steamboat: John Fitch made the first successful trial of a steamboat, and Robert Fulton made further innovations and invented the first successful commercial steamboat, the *Clermont*. Discuss the impact of the steamboat on trade, migration, settlements, and transport.



Create Your Own Steam Power

Grades
5–6

Teacher-led activity

30 MINUTES

Include time for water to boil

What you'll need

- 2 cups of water
- Toy pinwheel
- Hotpot or pot of boiling water
- Pot-holder glove

This activity can be a class demonstration or a group activity. If students are going to do this activity on their own, be sure to supervise them closely and remind them that steam can burn.

Steam is either mist (as seen from a kettle), or the gas phase of water (water vapor). Steam engines use the expansion of steam to drive a piston or turbine to perform mechanical work.

The steam engine is a heat engine. Heat energy from fuel is transferred to water in a boiler, making steam. Steam pressure is then converted to mechanical energy. Steam engines are classified as external combustion engines, because the fuel is burned under a boiler, and not inside the engine itself, as in gasoline and diesel engines.

Get Ready

1. Review the properties of water with students from lesson 1.3 in Unit 1.
2. Remind students that energy can change from one form to another.
3. Ask students to think about steam and explain the basic science of a steam engine.
   - Steam is the vapor state of water. The heat from burning fuel is absorbed by the liquid molecules in the water, exciting them. The water molecules begin to move faster and "break away" from the liquid surface, creating steam.
   - Like wind, steam has pressure. When it hits something, it can make it move, similar to how wind can turn a propeller. Pressure from the steam is used to create mechanical energy.

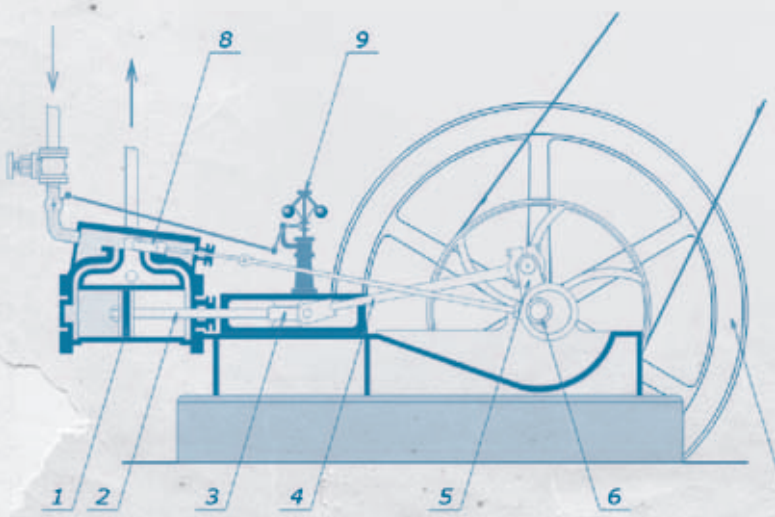
The Science of Steam Power

A steamboat is a ship that is powered by steam, which drives its paddlewheels. Steamboats with a paddlewheel mounted on the rear were called sternwheelers; those with paddlewheels on each side were side-wheelers.

A fire beneath the boilers in the engine room created enough heat to produce hot steam. The engine transformed the steam pressure to paddlewheel rotation. The higher the pressure, the faster the boat. Steamboats needed anywhere from 15 to 75 cords of wood a day – enough to build 15 houses – in the 1880s. People cut down the forests along the river's edge to power the steamboats until the supply was gone. Later steamboats were powered with coal.

Steam power could be dangerous because the high pressure could cause the boilers to burst. Many steamboats were destroyed and their passengers killed when their boilers exploded. If a boat was at a landing near a city or town when it happened, the explosion could also start a fire on land.

Sources: U.S. Army Corps of Engineers. Library of Congress; www.steamboats.com



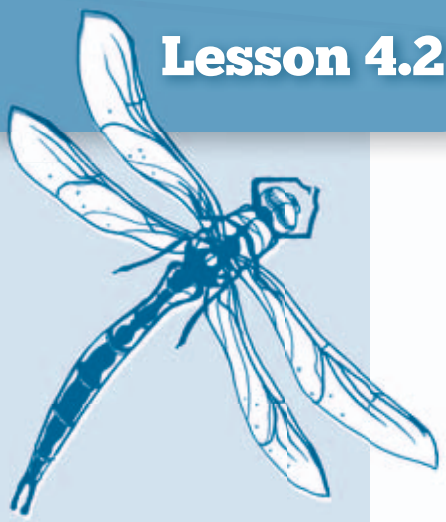
1 - Piston
2 - Piston rod
3 - Crosshead bearing
4 - Connecting rod
5 - Crank
6 - Eccentric valve motion
7 - Flywheel
8 - Sliding valve
9 - Centrifugal governor

Do This

1. Put the water in the pot and bring it to a boil.
2. Wearing an oven mitt or protective glove, hold a toy pinwheel over the steam of the boiling water.
3. Observe what happens to the pinwheel.
4. Move the pinwheel away from the steam and see what happens.
5. Ask students to explain in writing what happened.

What Should Happen

The heated water molecules from the steam move faster and farther apart. The steam becomes lighter and rises upward, creating an air current which moves the pinwheel.



Marking the Twain

Grades

5–6

Individual activity

1 HOUR

What you'll need

- Activity worksheet and map (pages 246–247)
- Cub pilot journal

Samuel Clemens (Mark Twain) received good advice from Horace Bixby, the river pilot who taught him how to read the river. The notebook Clemens used was ruled for use as a ledger and contains the cargo records of a steamboat clerk, suggesting that Clemens probably acquired it in some haste from that clerk. The dense texture of navigational directions on the pages displayed includes the young pilot's notes in the area of St. Louis.

When Clemens was learning how to pilot a steamboat, there were no buoys to guide him or locks and dams to help him navigate the changes in depth. He needed to know a hundred landmarks for every mile of the journey so he could know the shape of the river at night. Every point, stump, limb, ridge, rock, or snag had told him something about the river. He had to steer for the slack water, staying close first to one bank and then the other. To find slack water, he had to know the shape of the river so well he did not actually need to see the landmarks.

He also had to know the depth of the river in all places.

This depth was measured by the pilot's leadsmen who constantly monitored the amount of water under the bow and stern of the boat.

Get Ready

1. Read the quote attributed to Horace Bixby in *Life on the Mississippi* (on next page) and ask students to imagine the skills and knowledge required to be a steamboat pilot. Think about how writing things down helps you remember them.

"My boy, you must get a little memorandum-book, and every time I tell you a thing, put it down right away. There's only one way to be a pilot, and that is to get this entire river by heart. You have to know it just like A B C."

—Horace Bixby, from Mark Twain's *Life on the Mississippi*

2. Explain how pilots "read the river," a term used to describe the way pilots memorized the river's landmarks and characteristics and constantly monitored its current conditions.
   - Reading a constantly changing river meant understanding – and being on the lookout for – where the river was building sandbars by depositing silt and where it was moving obstructions such as logs or snags.
   - Pilots had to constantly monitor water levels and know where the water was deep enough to navigate.
   - They also had to know an area well enough to steer around, over, or through obstacles or hazards such as bridges and submerged rocks or other objects in any weather, day or night.
3. Explain how Samuel Clemens chose the pen name Mark Twain and what it means to "mark the twain."

Do This

1. Ask students to "mark the twain" on the map on page 247. The activity worksheet on page 246 explains the term and how it was used.
2. Using the twain measurements in the activity worksheet, they should note by highlighting or circling which areas on the map are above twain and below twain.
3. Ask students to also star any numbers that represent "mark twain" (safe water) or "no bottom."
4. Ask students to describe what it would be like to navigate this part of the river in their "cub pilot" journal.

Answer key for activity worksheets (page 246–247): **Students should find at least one example of each measurement listed on the activity worksheet on page 246. They should also star all measurements of 12 feet or more as representing safe water.**

Marking the Twain

Name _____ Date _____

Quarter less twain
Quarter less twain
Lawd, Lawd, no send me quarter less twain
Throw the lead line a little higher out.
I've gone low down, so mark twain,
Mark twain.
Come ahead, Mr. Pilot, a little bit strong.
I've done got over, and I believe we're gonna
Throw the leadline over—
No bottom here.

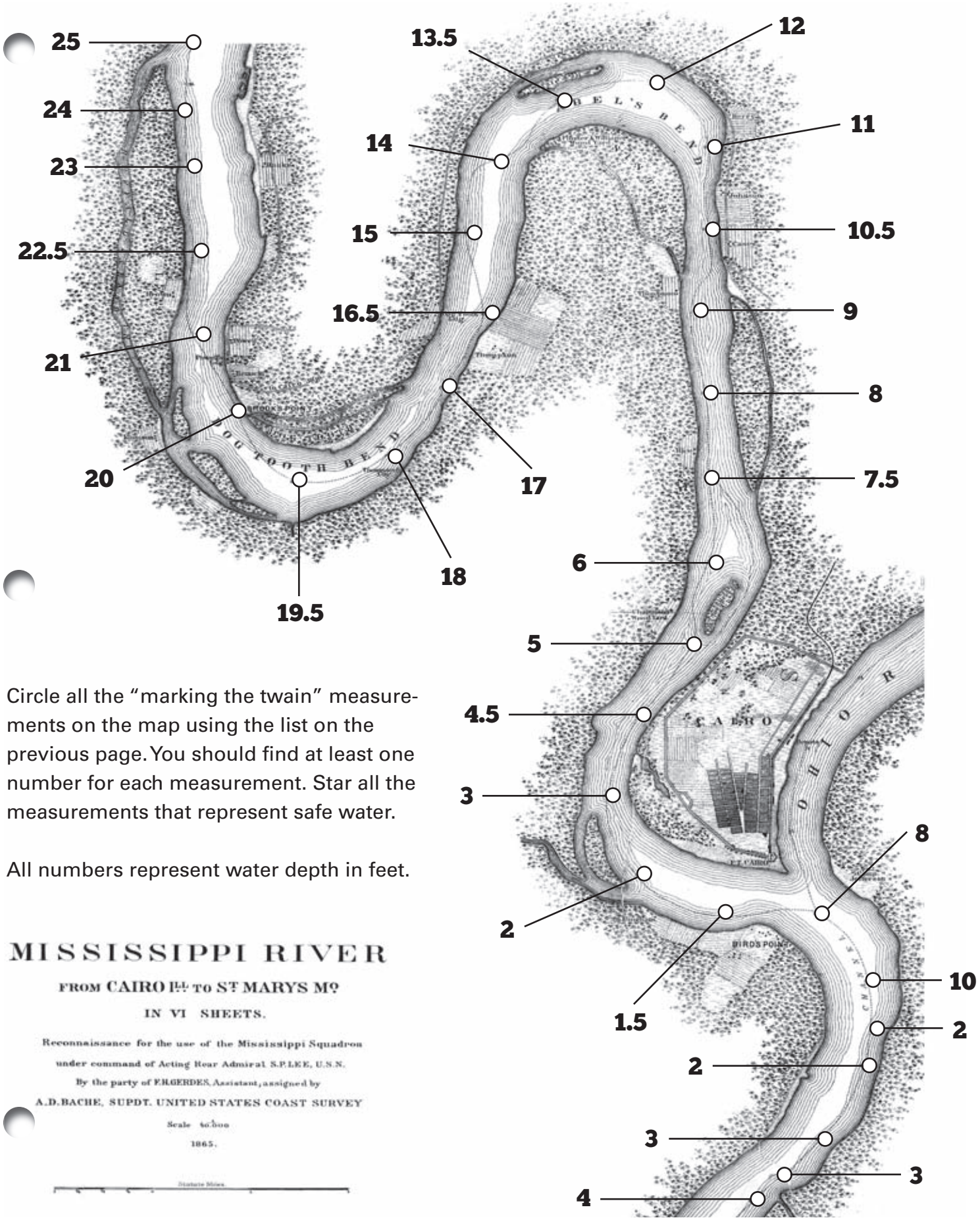
– from *Work Songs* by Ted Gioia

"Mark Twain," the pen name of American author Samuel Clemens, was the call the leadman made when the boat was in safe water. It meant the water was two fathoms (12 feet) deep.

A fathom was a unit of measurement the length of a man's outstretched arms (approximately 6 feet). Twain is an archaic term for the number two, so Mark Twain means "mark two."

A leadman determined the depth of the river using a leadline, which was a 30-foot-long weighted rope with incremental distances marked on it. He shouted these measurements to the pilot:

"Quarter"	1-1/2 feet (one quarter of a twain)
"Half"	3 feet (1/4 twain)
"Quarter Less"	4.5 feet (twain minus 1-1/2 feet)
"Mark One"	6 feet (1/2 twain)
"Quarter One"	7-1/2 feet
"Half One"	9 feet
"Quarter Less Twain"	10-1/2 feet
"Mark Twain" (safe water)	12 feet
"Quarter Twain"	13-1/2 feet
"Half Twain"	15 feet
"Quarter Less Three"	16-1/2
"Mark Three"	18 feet
"Quarter Three"	19-1/2 feet
"Half Three"	21 feet
"Quarter Less Four"	22-1/2 feet
"Mark Four"	24 feet
"No Bottom"	Any depth over 24 feet



Circle all the "marking the twain" measurements on the map using the list on the previous page. You should find at least one number for each measurement. Star all the measurements that represent safe water.

All numbers represent water depth in feet.

MISSISSIPPI RIVER

FROM CAIRO Ill. TO St MARYS Mo

IN VI SHEETS.

Reconnaissance for the use of the Mississippi Squadron under command of Acting Rear Admiral S.P.LEE, U.S.N.

By the party of F.R.GERDES, Assistant, assigned by A.D.BACHE, SUPDT. UNITED STATES COAST SURVEY

Scale 40,000

1865.

Lesson 4.2

Congress passed the first Federal Patent Act in 1790. The Constitution (Article 1, Section 8, Clause 8) gives Congress the power "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

John Fitch was granted his first United States patent for a steamboat on August 26, 1791.

Extension Suggestions

Career launch

Invite a local **captain** or **pilot** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

Go ride on a steamboat and keep a log of the journey.

Express yourself!

- Write a song about steamboats.
- Draw a steamboat.
- Write a play about working on a steamboat using as many steamboat terms as possible.

Read about it

Read "*Cooling Our Bottom on The Sand Bars": A Chronicle of a Low Water Trip* by Michael H. Marleau. This feature compares Samuel Clemens' journals with a letter to the *St. Louis Missouri Republican* believed to be written by Clemens. Ask students to read the letter and decide if they agree. Go to **www.twainquotes.com** and search for "cooling our bottom."

UNIT 4

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

Learn more online

Explore an interactive steamboat model online at www.steamboats.org
Click button: **History and Education**
Search keywords: **Interactive steamboat model**

Learn more about U.S. Patents from the United States Patent and Trademark Office's website www.uspto.gov.
Search keywords: **USPTO for kids**

Find steamboat news stories and pictures of past and present steamboats at www.steamboats.org

Download the works of Mark Twain at Project Gutenberg. Go to www.gutenberg.org and search keywords: **Mark Twain**

River Running Dry, River Running High

Major Floods on the Upper Mississippi River

Introduction

In *Lesson 4.3*, students learn about the changeable nature of the Upper Mississippi River and how it alternates between flooding and drought.

STANDARDS CORRELATION

This lesson combines history, social science, and language arts standards to help students understand the impact floods have on the lives of people. Students learn about the 1927 and the 1993 Mississippi River floods through multimedia sources, including documentaries, raw footage, amateur video, and newscasts. They use the knowledge and insight gained from studying these disasters to write their own newscasts to inform their communities about what causes floods and what they can do to protect themselves during the ups and downs of the Upper Mississippi River.

Unit 4 goal reminder

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Understand the natural cycles of flooding and drought on the Upper Mississippi River

Lesson objectives

- Discuss causes of flooding
- Identify major floods along the Mississippi River
- Research what kind of technology was used after each major flood
- Produce news article and broadcast

Educational standards

- Science
- Social Studies
- Fine Arts
- Language Arts

What you'll need

- U.S. Army Signal Corps historic footage of the 1927 flood
- PBS Nova online video *The Great Flood of 1993*
- Guest speaker
- Student journals
- Library and Internet access
- Digital video recorder
- Computer with DVD player and video editing software, such as iMovie

How long it will take

- Several one-hour sessions for students to research, prepare, and conduct the interviews
- Actual broadcast can be 15-30 minutes

What's next!

How locks and dams made the Upper Mississippi River the ultimate travel corridor

Background

Free-flowing river

People living along the Mississippi River were well aware of the flooding potential of the Mississippi River. Native American settlements were located on higher land. Hernando de Soto, the first European to explore the Mississippi, noticed how much the river flooded.

In its natural state, the Upper Mississippi River experienced cycles of high and low water levels. In wet years, river levels were high and turbulent. In dry years, water levels lowered to a trickle in some places. The plants and animals that lived along the Upper Mississippi River adapted to the river's larger range of water level fluctuations. In fact, they depended on these fluctuations. Steamboats, however, were not so adaptable. High, fast waters were difficult to navigate. During a drought, water levels were too low for navigation, and many steamboats became stranded on sandbars.

Major Floods on the Mississippi River

The history of the Mississippi River is one of frequent floods.

1927

The Great Mississippi Flood of 1927 was one of the most destructive floods in the history of the United States. The river crested at 56.60 feet at Natchez, Mississippi, on May 4, 1927, 8.60 feet above flood stage.

1965

The river crested at 24.85 feet in Clinton, Iowa, on April 28.

The young city of New Orleans near the mouth of the Mississippi began to build levees four to six feet in height to protect itself from floods. By 1812 levees had been built to protect land for more than 150 miles north of New Orleans.

Environmental impact of steamboats
Steamboat traffic had severe adverse environmental effects on the Mississippi River, especially between St. Louis and the confluence with the Ohio River.

Steamboats needed anywhere from 15 to 75 cords of wood a day, enough to build 15 houses in the 1880s. The steamboats consumed so much wood for fuel that the Mississippi River's floodplain soon became deforested. Without forests to anchor the soil, more sediment was released into the river. The Mississippi River became both wider and more shallow, making navigation more difficult and dangerous.

1993

The river crested at 49.47 feet in St. Louis, Missouri, 19 feet above flood stage.

2001

River crested at nearly 16.41 feet, in La Crosse, Wisconsin, four feet above flood stage.

2008

The river crested at 36.70 ft at Clarksville Lock and Dam in Missouri, 11.70 feet above flood stage on June 24, 2008.

Map of the flood of 1927

Containing the river

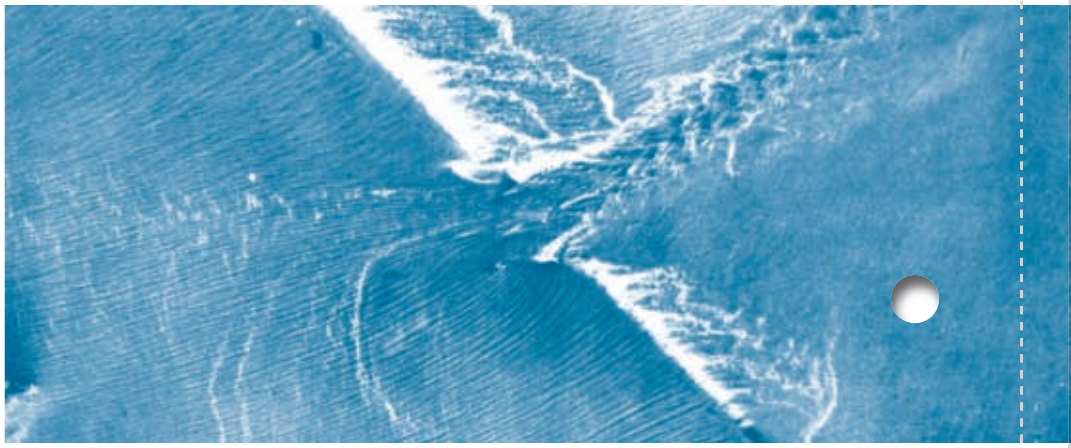
By the late 1800s, the importance of the Mississippi River as a transportation corridor was well established. Congress wanted to protect this vital resource, so they passed legislation to improve the river for navigation and protect communities against flooding. In 1879 Congress established the Mississippi River Commission to work with the U.S. Army Corps of Engineers to prevent destructive floods and deepen the river channel to make navigation safer and easier.

In 1917, Congress passed the country's first flood control act, authorizing the U.S. Army Corps of Engineers to work on levees from Illinois to Louisiana. By 1926, the Corps finished the construction of levees stretching from Cairo, Illinois to New Orleans, Louisiana.

Great Flood of 1927

The Great Mississippi Flood of 1927 was one of the most destructive floods in the history of the United States. In the summer and fall of 1926, violent storms dumped ten times the yearly average rainfall into tributaries throughout the Mississippi River watershed. On April 16 a 1,200-foot length of levee collapsed near Greenville, Mississippi, breaking with a force double that of Niagara Falls. It flooded an area 50 miles wide and more than 100 miles long, killing 246 people in seven states and causing over $400 million in damage.

Aerial view below shows the levee break at Mounds Landing, Mississippi, during the flood of 1927.



In response to the devastating flood of 1927, Congress passed the 1928 Flood Control Act authorizing the U.S. Army Corps of Engineers to design and construct projects for the control of floods on the Mississippi River and its tributaries.

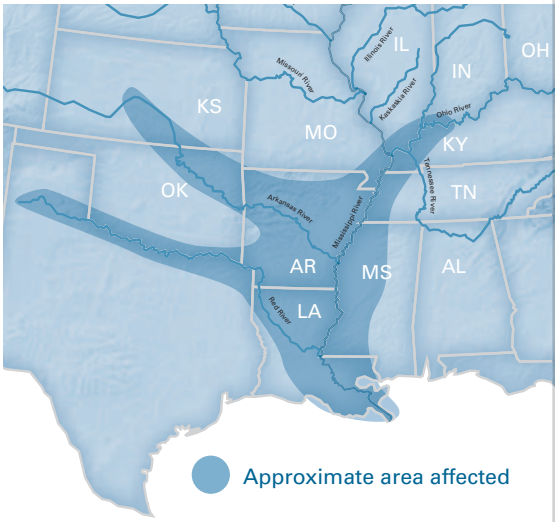
Great Flood of 1993

In 1993 another disastrous Mississippi River flood hit the Midwest, rivaling the devastation of the 1927 flood. Record precipitation again fell on the Mississippi watershed, starting in the fall of 1992, continuing as snow during the winter, followed by heavy spring rains.

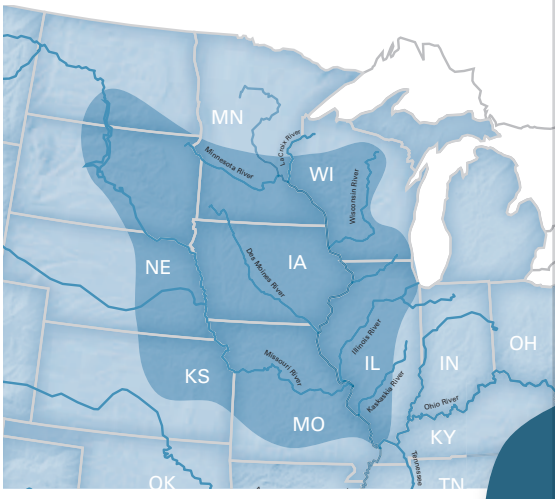
From May through September of 1993, major flooding occurred across North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, and Illinois. Near-record flows on the Mississippi River pushed the stage at St. Louis up to a new record high of 47 feet on July 20. Less than two weeks later, the river set another record crest of 49.47 feet at St. Louis on August 1.

In all, 92 locations set new record crests in 1993. Damage totaled $15 billion, 50 people died, hundreds of levees failed, and thousands of people were displaced for months.

Sources: U.S. Army Corps of Engineers, NOAA (National Oceanic and Atmospheric Administration), NASA (National Aeronautics and Space Administration).

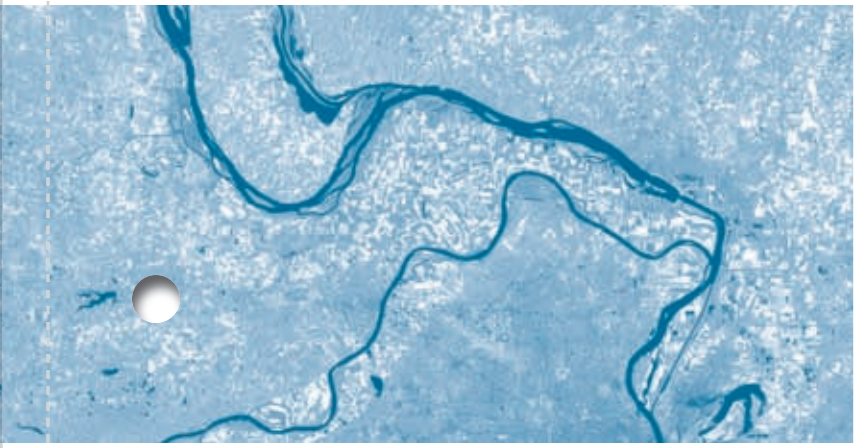


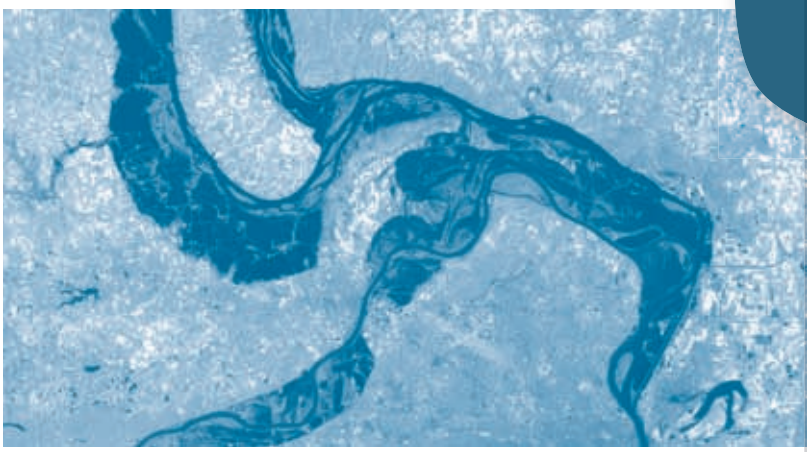
Extent of flooding in 1927



Extent of flooding in 1993

These two photos below compare the Mississippi River near St. Louis before and during the Great Flood of 1993. The photo on the left is from August 1991. The photo on the right is from August 1993, just after floodwaters had started to recede after the Flood of 1993.



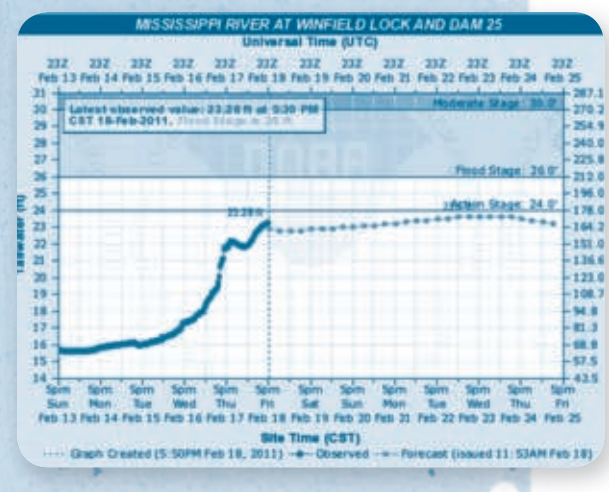


UNIT 4

Lesson 4.3

Need to Know

- **Weather:** The day-to-day state of the atmosphere, and its short-term (minutes to weeks) variation. Popularly, weather is thought of as the combination of temperature, humidity, precipitation, cloudiness, visibility, and wind.
- **Climate:** Statistical weather information that describes the variation of weather at a given place for a specified interval. It represents the synthesis of weather; more formally it is the weather of a locality averaged over some period (usually 30 years) plus statistics of weather extremes.
- **Crest:** A high point of an action or process.
- **Floodplain:** A flat or nearly flat land next to a stream or river that occasionally or periodically floods.
- **Flood stage:** An established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce.



Discussion (60 minutes)

Review key terms and concepts from *Lesson 1.3 Going with the Flow: The Ups and Downs of the Water Cycle* and introduce major Upper Mississippi River floods. Discuss them in the context of the river's natural cycle of droughts and floods and explain how climate and seasonal weather patterns impact the river. Have students watch the videos and write in their journals about their emotional reaction to the stories.

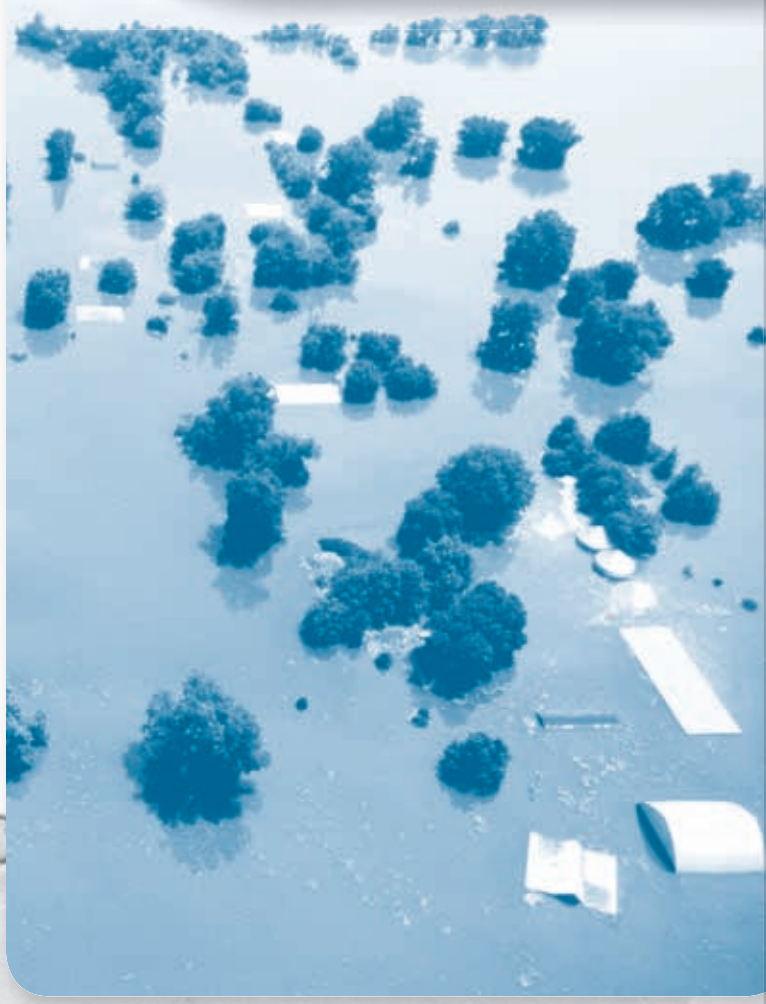
You'll need

- *Mississippi River Flood of 1927*, an 18-minute silent film of the actual flood. Available free for downloading in several formats and for viewing online at Internet Archive (registration required). Go to www.archive.org. After registering, search for "Mississippi River Flood of 1927."
- PBS Nova 5-minute video *The Great Flood of 1993*. Available free as a quicktime file at http://www.teachersdomain.org (registration required)
- Student journals

Synopsis for *Mississippi River Flood of 1927:* *(Rare, archival footage of the 1927 Mississippi River flood produced by the U.S. Army Signal Corps)*

This silent film captures one of the most dangerous floods in U.S. history in its historical context. Title cards interpret footage from Illinois, Mississippi, and Louisiana. Clips include floodwaters carrying houses and debris, marooned families and their livestock, levees being reinforced, biplanes searching for survivors, steamboats

UNIT 4



rescuing stranded residents, and Secretary of Commerce Herbert Hoover meeting with Red Cross officials.

Synopsis for *The Great Flood of 1993*

During a typical year, levees built along the banks of the Mississippi River keep the river in its channel and out of people's homes and fields. However, 1993 was anything but a typical summer. This video segment adapted from *NOVA* describes the meteorological conditions that created what was then the costliest flood in United States history.

When the Levee Breaks...

When the Levee Breaks is a Delta blues song written and first recorded by husband and wife Kansas Joe McCoy and Memphis Minnie in 1929. The song is in reaction to the upheaval caused by the Great Mississippi Flood of 1927.

If it keeps on rainin',
levee's goin' to break
And the water gonna come in,
have no place to stay

Well all last night
I sat on the levee and moan
Thinkin' 'bout my baby
and my happy home

If it keeps on rainin',
levee's goin' to break
And all these people
have no place to stay

Now look here mama
what am I to do
I ain't got nobody
to tell my troubles to

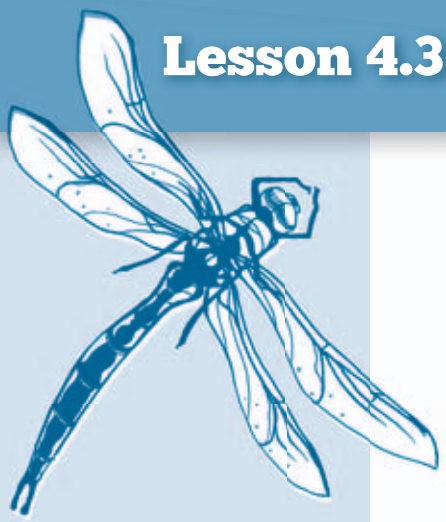
I works on the levee mama
both night and day
I ain't got nobody,
keep the water away

Oh cryin' won't help you,
prayin' won't do no good
When the levee breaks,
mama, you got to lose

I works on the levee,
mama both night and day
I works so hard,
to keep the water away

I had a woman,
she wouldn't do for me
I'm goin' back
to my used to be

It's a mean old levee,
cause me to weep and moan
Gonna leave my baby,
and my happy home



Breaking News! River Reports

Grades
5–6

Group activity

1/2 DAY

- Several one-hour sessions for students to research, prepare, conduct interviews, write and edit material as a group
- Actual broadcast can be 10-15 minutes for each group)

What You'll Need

- A guest speaker
- Library and Internet access
- Audiovisual script activity worksheet (pages 258–259)
- Digital video recorder
- Computer with DVD player and video editing software, such as iMovie

Ask students to work in teams to plan and produce a 10 to 15 minute broadcast news story about how their community prepared for—or recovered from—a recent flood.

Get Ready

1. Ask students to think about what they learned about Mississippi River floods from the videos and class discussions. Ask them if they had any questions about the floods that were not addressed.
2. Introduce the audiovisual script activity worksheet and explain that multimedia stories are planned and written in columns (one for visuals and one for the script)
3. Have students search www.youtube.com for past news coverage and raw footage of floods.
   - Suggest using search terms that include "Mississippi River flood" (in quotes) with the dates of major floods (1993, 2001, 2008).
   - Ask them to critically evaluate their sources for accuracy and credibility.
4. Invite a local reporter to talk to the class as part of their preparation.

Teacher Tip

If you lack resources to create a multimedia broadcast, such as a digital video recorder and DVD player, adapt the activity for radio broadcast with sound effects, a PowerPoint presentation with visuals, or a print story with photos and diagrams. If these are not available, have students make a report to the class.

Do This

1. Organize students into "newsroom" groups and let them assign themselves roles: writers, reporters, and producers.
2. Ask students to determine their "angle" or research question they will use to narrow their focus and plan their research and interviews accordingly.
3. Have students research history of flooding in their area at the library and on the Internet and determine individuals to interview for their stories.
4. Have students write up their interviews and text for the news reporters.
5. Use the final script and their video for assessment.

Breaking News!

River Reports

Name _____ Date _____

Use your investigative and communication skills to report on the most recent flood in your area. Work with your group to plan and produce a 10 to 15 minute broadcast news story about a local flood.

What's the story?
Determine your story's purpose or "angle." What does your audience need to know about the most recent flood? Write it as a research question and use it to guide your research and interviews.

1. What is your research question / angle?

_____

_____

_____

_____

2. Narrow down your topic. What specifically will your story cover? _____

_____

_____

_____

_____

3. Write your audiovisual script in columns as shown in the sample. _____

_____

_____

_____

_____

Sample audiovisual script

Video	Audio
Kids getting off the bus at a river restoration site. Close-up of student in tall boots holding a shovel in one gloved hand and a native plant in the other. Close-up of student planting a native plant.	Riverside Elementary school students are helping make the world a better place. After learning how the loss of wetlands increases the severity of floods, they decided to do something about it.
Wide shot of river showing birds, boats, and people on and along the river. Zoom in to a spot next to the river that is just bare rocks and dirt. Close-up of first student as she speaks. Wide shot of student's faces listening.	A long time ago this used to be a wetland full of lots of different kinds of plants and animals. Now, it's just a parking lot that few people use. Our class is going to help the city restore it by planting native plants.
Wide shot of City Parks Manager John Smith standing with the teacher Jane Doe and several students. Close-ups of John Smith and Jane Doe talking.	"The students are doing important work," says City Parks Manager John Smith. "Over time, this area will become a fully functional wetland. When the river floods, it will absorb some of the water, helping to prevent flooding downtown." "After learning about the importance of wetlands, the class wanted to find a project that would help restore one in their community," says Jane Doe.

Lesson 4.3

Extension Suggestions

Career launch

Invite a local **news reporter** or **TV anchor** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Express yourself!

- Write a news story for your school newspaper about the history of natural disasters in your area. Include information on disaster preparedness.
- Write a song about the 1927 or 1993 flood.

Get out!

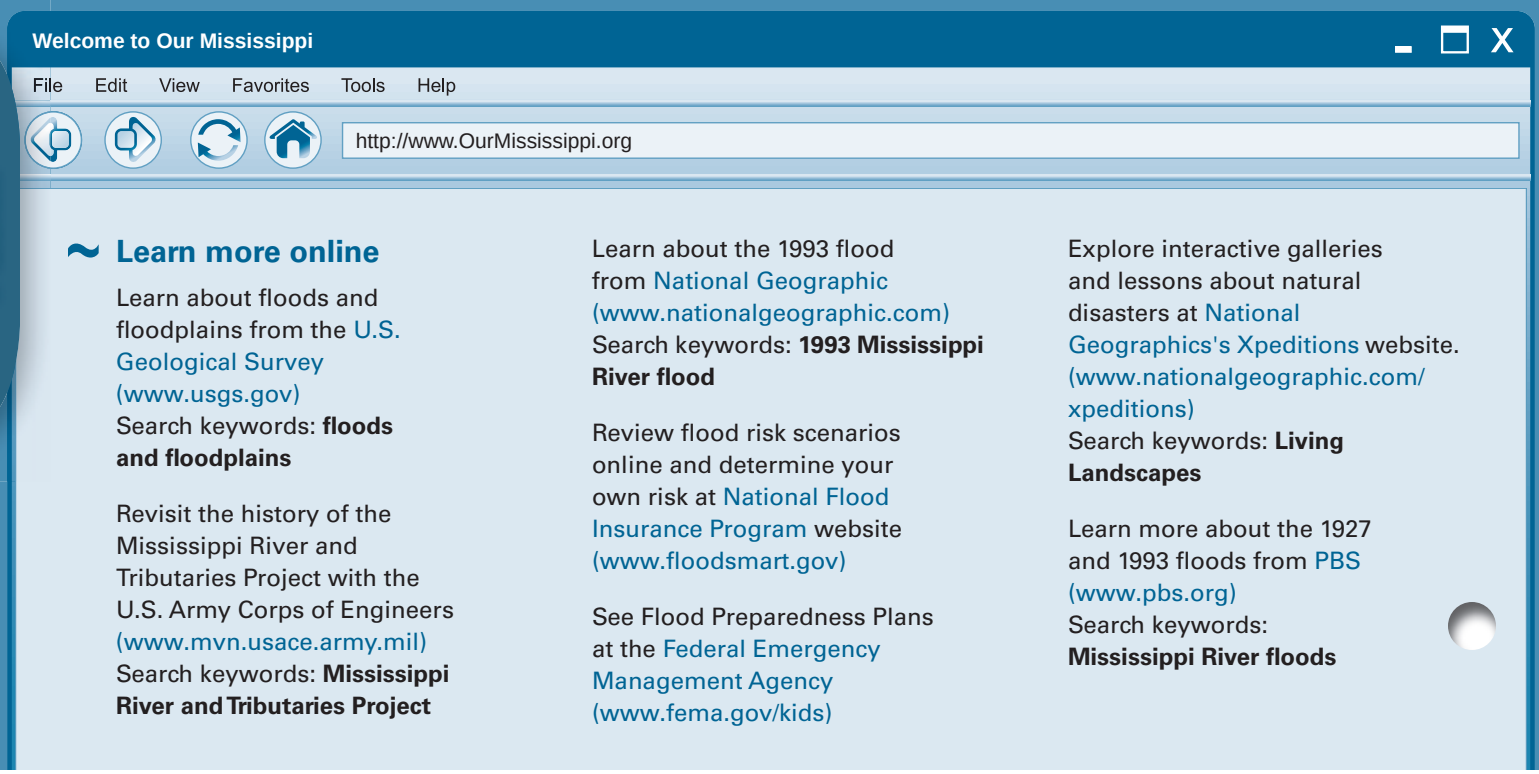
- Interview people in your community about floods and other natural disasters.
- Hike along the Mississippi River and look for evidence of flooding.
- Prepare a flood preparedness plan for your school, neighborhood, or family.

Think about it

- Analyze the historic floods of the Mississippi River in the context of the massive floods that occurred during the Pleistocene. Help students find primary sources that describe the archeological evidence for Ice Age floods. *Review 1.1 Movers and Scrapers: Upper Mississippi Glaciations* for background information.

Compare and contrast

- Compare and contrast the 1927 Mississippi River Flood with the 1931 Yangtze River Flood in China.
- Compare and contrast the 1927 and the 1993 floods. Investigate the aftermath of the 1927 flood as a major factor of the Great Migration of African Americans to northern cities, using maps and timelines, and compare this migration to the Underground Railroad (see *Lesson 3.5 Mississippi River: Pathway to Freedom*). Note similarities and differences in the routes, destination, and reasons for migration.



UNIT 4

Learn more online

Learn about floods and floodplains from the U.S. Geological Survey (www.usgs.gov)
Search keywords: **floods and floodplains**

Revisit the history of the Mississippi River and Tributaries Project with the U.S. Army Corps of Engineers (www.mvn.usace.army.mil)
Search keywords: **Mississippi River and Tributaries Project**

Learn about the 1993 flood from National Geographic (www.nationalgeographic.com)
Search keywords: **1993 Mississippi River flood**

Review flood risk scenarios online and determine your own risk at National Flood Insurance Program website (www.floodsmart.gov)

See Flood Preparedness Plans at the Federal Emergency Management Agency (www.fema.gov/kids)

Explore interactive galleries and lessons about natural disasters at National Geographics's Xpeditions website. (www.nationalgeographic.com/xpeditions)
Search keywords: **Living Landscapes**

Learn more about the 1927 and 1993 floods from PBS (www.pbs.org)
Search keywords: **Mississippi River floods**

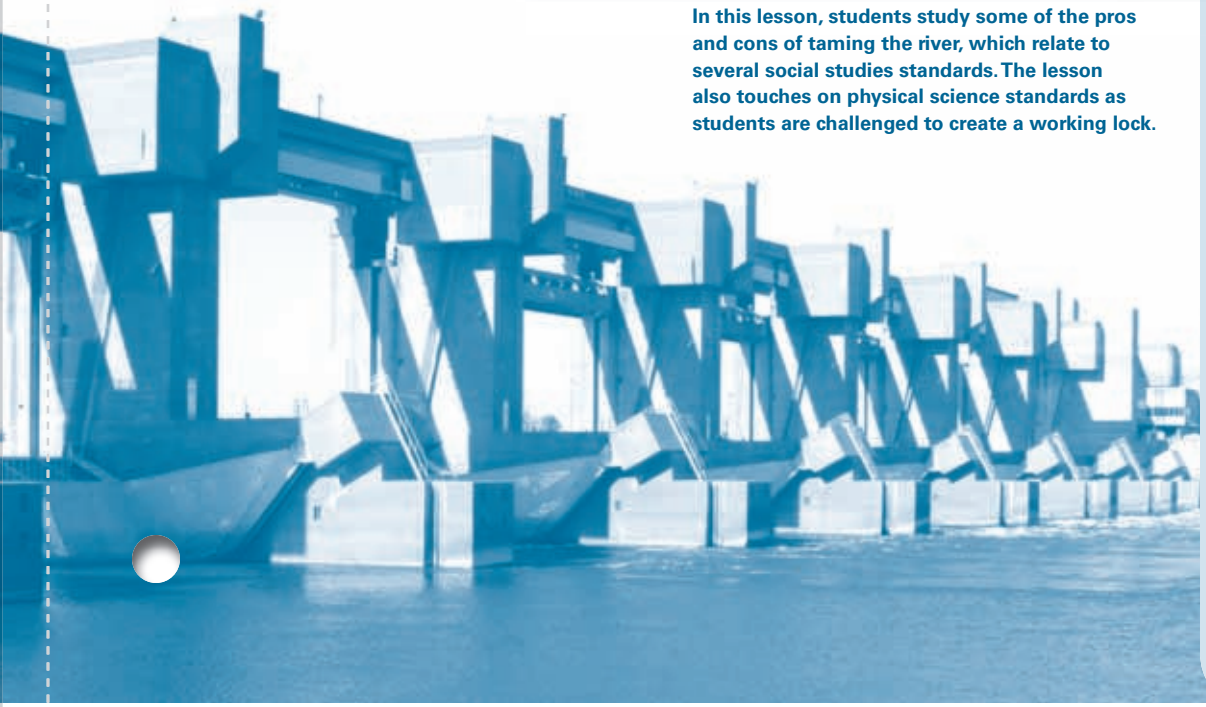
Controlling the River:

Locks and Dams on the Upper Mississippi River

Introduction

In *Lesson 4.4,* students learn how locks and dams make the Upper Mississippi River an important travel corridor. Students demonstrate how gravity raises or lowers water, which helps them understand how watercraft move from one lock to the next.

This lesson covers the history of the lock and dam system on the Upper Mississippi River, including why and how navigation is maintained on the river. Students understand why a clear channel is necessary to make the Upper Mississippi River a major transportation corridor.



STANDARDS CORRELATION

In this lesson, students study some of the pros and cons of taming the river, which relate to several social studies standards. The lesson also touches on physical science standards as students are challenged to create a working lock.

Unit 4 goal reminder

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Learn how locks and dams make it possible to navigate the Upper Mississippi River

Lesson objectives

- Explore how locks and dams changed the river
- Discuss the impact on wildlife
- Watch how a lock works
- Build a lock system

Educational standards

- Science
- Social Studies
- Fine Arts
- Math
- Language Arts

What you'll need

- Grease pencil or permanent marker
- 2 half-gallon milk or juice cartons
- Plastic container (about 18" x 24" x 6")
- Modeling clay
- Ruler (with centimeters)
- Scissors
- Water to fill plastic container 3 cc deep
- Pencil and paper

How long it will take

- Preparation: 1 hour
- Student Activity: 2 hours

What's next!

Going to market up and down the river

Background

The upper and lower Mississippi are very different rivers. On the Lower Mississippi River, there is no need for locks. Below the confluence of the Mississippi and Missouri Rivers, the Mississippi is deep enough and has minimal impediments for river travel, thanks to several major tributaries that feed into it.

Not so on the Upper Mississippi River. North of the Mississippi and Missouri confluence, numerous snags, sandbars, rapids, and other obstructions made river travel difficult. The waters of the Upper Mississippi River split and rejoined in countless side channels, producing a dynamic mosaic of islands, floodplains, wetlands, and river.

During the drought of 1864, the river was dry in so many places that there was no river traffic that year. It became clear if people were going to depend on the Upper Mississippi River for transportation and trade, a minimum level of depth needed to be maintained.

Based on gage data and engineering judgment, a low water mark was established. In 1878, Congress authorized the U.S. Army Corps of Engineers to establish a 4.5-foot deep channel. This eventually became the 9-foot channel we have today.

Early improvements of the Mississippi River above Cairo, Illinois, consisted mostly of removal of snags and closure of sloughs to confine low-water flows to

the main channel. Later, dredging and other channel improvements made the river navigable as far north as St. Paul and Minneapolis in Minnesota.

The Mississippi River became completely navigable from New Orleans to St. Paul with the opening of the Moline Lock that bypassed Illinois Rock Island Rapids in 1907.

In 1930, Congress authorized construction of a 9-foot channel between Minneapolis and the mouth of the Illinois River, just above St. Louis, providing for the construction of locks and dams. Dams were built on shallow rivers to hold back water and form deeper navigation pools with a constant minimum water depth of 9 feet in the channel for safe navigation. These dams make it necessary for river vessels to use a series of locks to "step" up or down the river from one water level to another.

Construction of these structures occurred mostly in the 1930s and 1940s and resulted in a total of 29 locks and dams. This system created what is commonly called a "Stairway of Water" as the Mississippi falls 420 feet from the Falls of St. Anthony in Minnesota to Locks #27 in Granite City, Illinois. The dams create slack-water pools for navigation during periods of low and medium flows. The locks pass river traffic from one pool to another, like a stairway of water.

River Management Timeline

1830s

Federal government authorizes removal of snags, shoals, and sand bars. Backwater is closed to keep more water in the main channel and rocks are dynamited and excavated to remove the rapids and deepen the water.

1878

Congress authorizes the maintenance of a 4.5-foot-deep channel, and several locks are built to bypass rapids. Cities built on flood plains build levees for protection against flooding.

1907

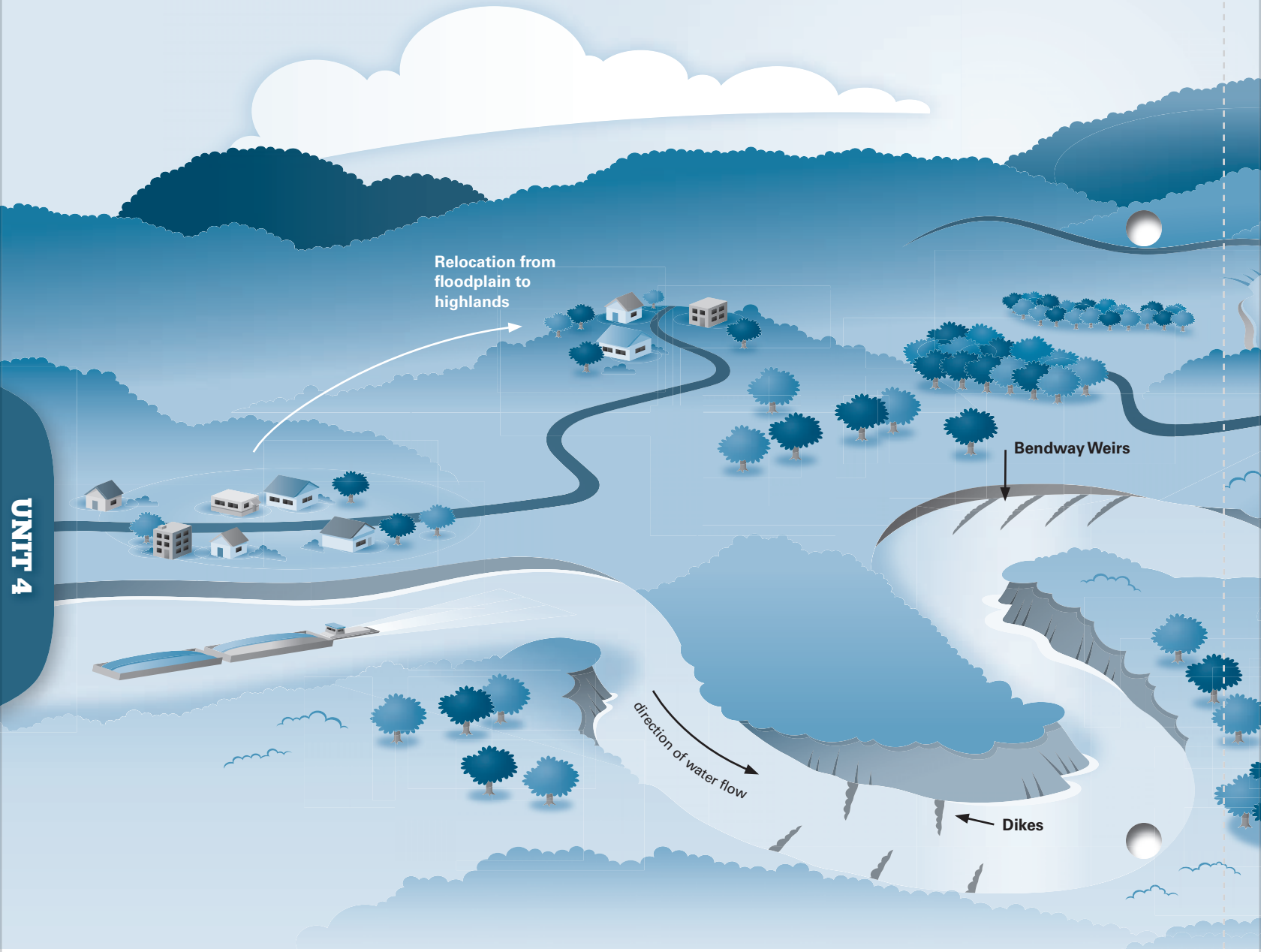
Congress authorizes a 6-foot-deep channel. Wing dams are built. These are essentially low dikes made of rocks and brush that extend from the river bank toward the channel. They force water into the central channel, which scours the channel deeper.

1930

Congress authorizes a 9-foot-deep, 300-foot-wide channel to accommodate large towboats and barges. The construction of a system of 29 locks and dams created a "staircase" of deep-water pools that helps maintain consistent channel depth and allows tugboats and barges to travel safely up and down the river.

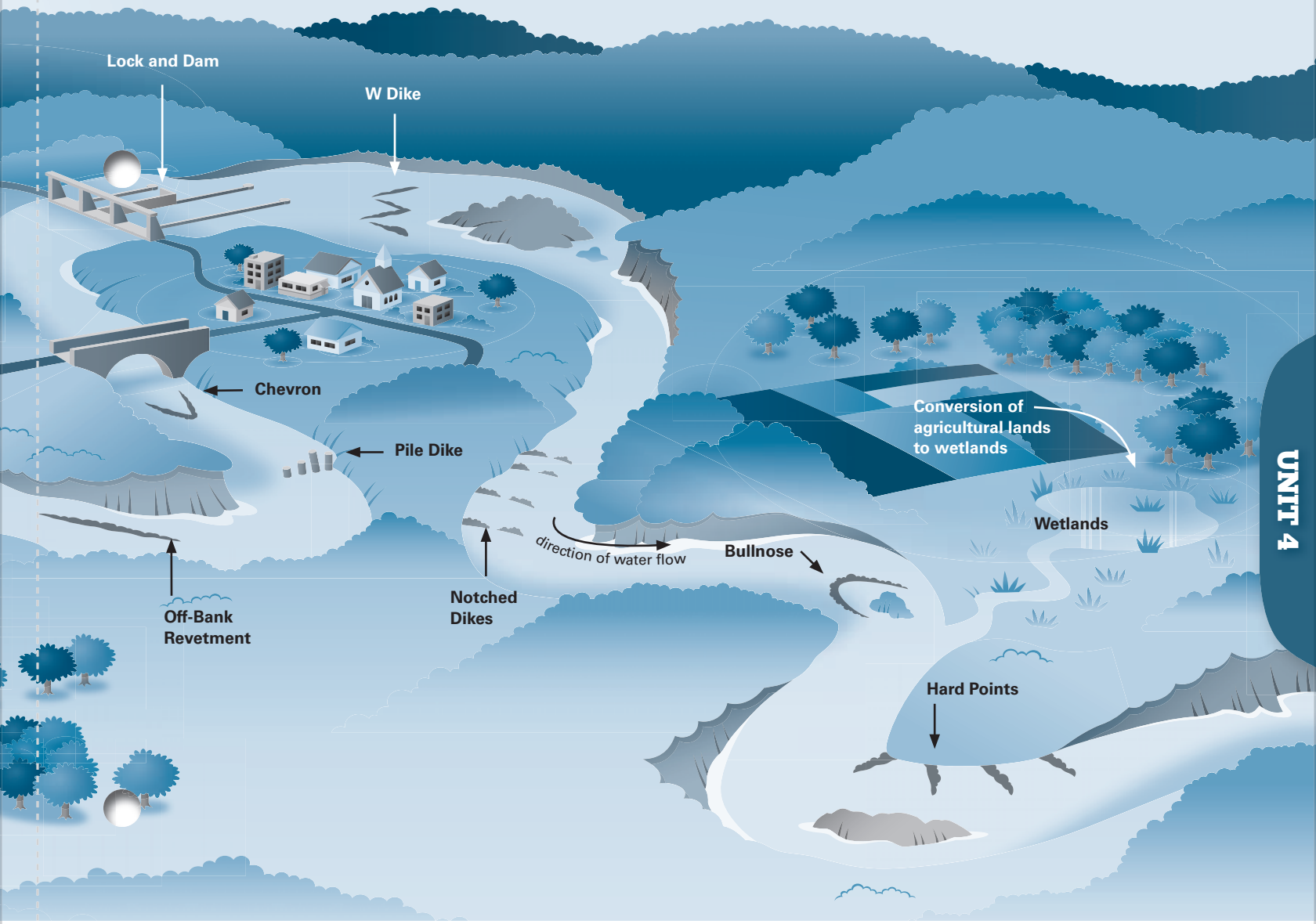
Managing the Upper Mississippi River

A variety of different river management techniques are used for both navigation and flood risk management. Some of these are natural, including preserving or restoring natural areas that help maintain functioning ecosystems and the benefits they provide. Others are structural, such as the locks and dams built by the U.S. Army Corps of Engineers. However, these structures come at an environmental cost. They interfere with natural river processes on the Upper Mississippi and Illinois Rivers, essentially changing free-flowing rivers into a string of reservoirs.



Water Management Structures and Techniques

- **Relocating** people to higher ground helps protect homes and businesses when large floods inundate the floodplain.
- **Dikes (aka Wing Dams)** are structures that direct the flow of water. There are several types of dikes on the Upper Mississippi River.
- **Bendway Weirs** are stone structures placed underwater in the deepest part of rive bends. They reduce the need for dredging and create river currents that are easier to navigate.
- **Off Bank Revetments** stabilize eroding riverbanks by placing rocks in the river parallel to the bank. This avoids the need to grade the bank and allows natural vegetation to grow.
- **Pile Dikes** are rows of wooden posts driven into the riverbed. As the river flows through them, it makes patterns in the riverbed and collects wooden debris, which create habitat for fish.
- **Chevron Dikes** are arch-shaped rock structures that point upstream. They work with the flow of the water to create fish habitat.
- **Locks and Dams** make the Upper Mississippi River navigable year-round by maintaining a channel of at least nine feet in depth.
- **W Dikes** help control sediment distribution and maintain navigable channel depths.
- **Notched Dikes** allow water and sediment to flow near riverbanks, which can create habitats for fish and wildlife, such as islands and sediment deposits.
- **Bullnoses** protect islands from erosion and create habitat for aquatic life.
- **Wetlands** absorb floodwaters like a sponge. Preserving or restoring wetlands helps prevent major floods.
- **Hard Points** are short rock structures that protect riverbanks from erosion and create fish habitat.



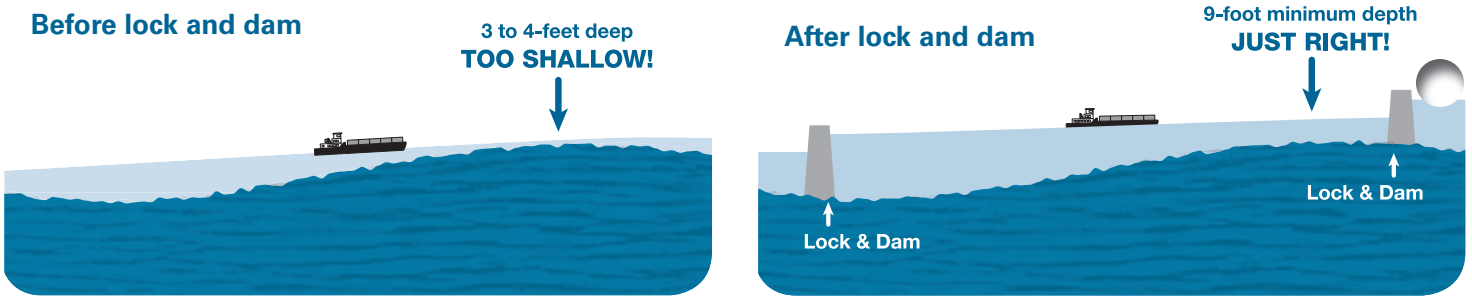
Discussion (60–90 minutes)

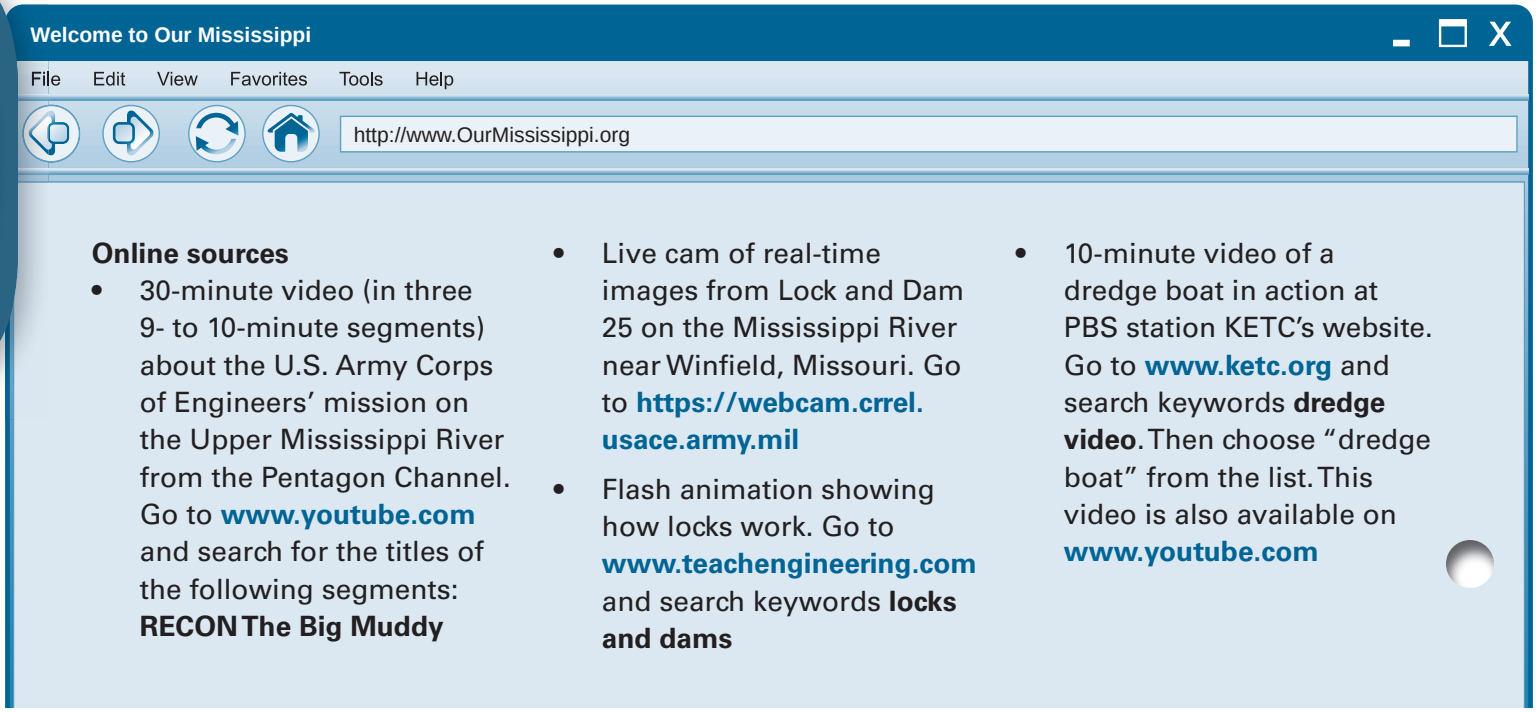
Remind students that earlier in this unit we talked about early navigation and how much human effort was required to get up and down the river. After the steamboat was invented, travel on the Upper Mississippi River was faster and easier, but travel was often delayed and even prevented by the unpredictable nature of the river and its changing water levels.

Ask students if they have heard the expression "water seeks its own level" and what they think it means. Explain how gravity allows water to flow downhill. Locks use gravity to raise or lower the water, much like filling and emptying a bathtub.

Use the online video and animations from the sources listed below to allow students to explore how locks and dams work in more detail.

Finally, discuss how locks changed navigation on the Upper Mississippi River, including their impact on wildlife and the environment.





Online sources

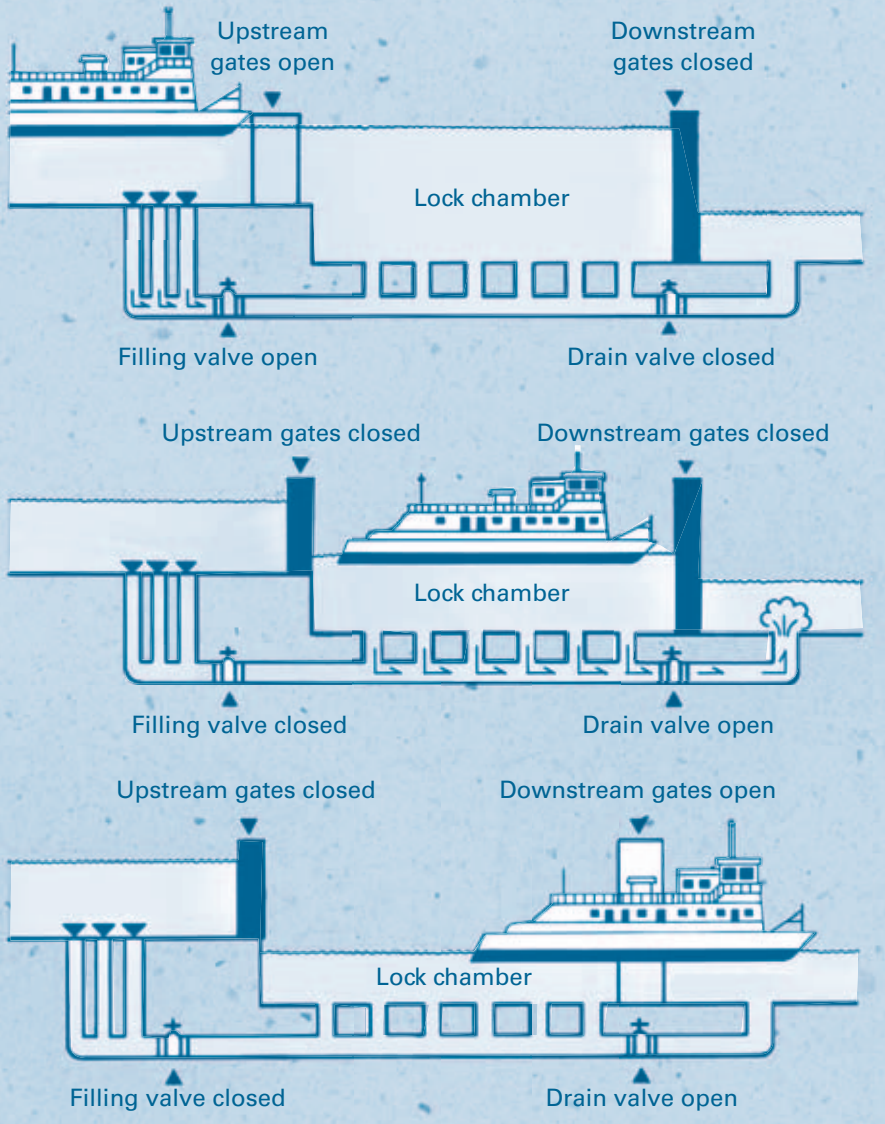
- 30-minute video (in three 9- to 10-minute segments) about the U.S. Army Corps of Engineers' mission on the Upper Mississippi River from the Pentagon Channel. Go to **www.youtube.com** and search for the titles of the following segments: **RECON The Big Muddy**
- Live cam of real-time images from Lock and Dam 25 on the Mississippi River near Winfield, Missouri. Go to **https://webcam.crrel.usace.army.mil**
- Flash animation showing how locks work. Go to **www.teachengineering.com** and search keywords **locks and dams**
- 10-minute video of a dredge boat in action at PBS station KETC's website. Go to **www.ketc.org** and search keywords **dredge video**. Then choose "dredge boat" from the list. This video is also available on **www.youtube.com**

Locking Through

The three steps in the "LOCKING THROUGH" process are shown below. Notice that the water flows moves by gravity, not pumps.

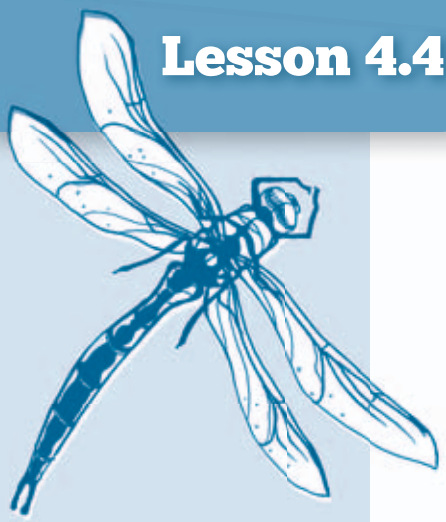
Teacher Tip

Use this diagram as the answer key for page 271 activity.



For a boat going downstream (towards the mouth of the river), the lock chamber is first filled by opening the filling valve. The drain valve and upstream and downstream gates are closed, so the level of the water in the chamber rises to the upstream level. The upstream gate opens and the boat moves in.

To lower the boat, the gates are closed behind it, the filling valve is closed, and the drain valve is opened. The higher water in the lock chamber drains to the downstream level within minutes. The downstream gate is then opened and the boat moves out on the lower water level. The process is reversed for a boat going upstream (towards the headwaters).



Leveling the Water

Grades

5–6

Group or individual activity

2 SESSIONS

- 15 min. for preparation
- 1 hour for student activity

What you'll need

- Grease pencil or permanent marker
- 2 half-gallon milk or juice cartons
- Plastic container (about 18" x 24" x 6")
- Modeling clay
- Ruler (with centimeters)
- Scissors
- Water to fill plastic container 3 cc deep
- Pencil and paper
- Activity worksheets (pages 270-271)

This activity allows students to demonstrate how gravity raises or lowers water using milk cartons and water. This activity will help students understand how water levels change without pumps, allowing watercraft to move from one lock to the next. Students also use math to measure volume and compare amounts at the start and end of the activity. Then they report their findings in an essay.

Do This

Part 1:

1. Have students work in pairs to do this activity.
2. After they complete step 5, have students calculate the volume in each carton and record their findings on the Student Activity Worksheet on page 270.
   - Measure the depth of each carton and calculate the volume in cubic centimeters (cc). Volume = length x width x depth.
   - Compare the difference in volume between cartons A and B.
3. Have the students explain the outcomes in a three-paragraph essay.

Part 2:

Ask students to put the images in order and complete the labels in the Student Activity Sheet on page 271.

Experiment with Water Levels

1

Cut the tops off the two milk cartons (Cartons A and B), about 12 centimeters (cm) from the top.

2

Poke one hole 1 cm from the bottom of each carton.

3

Cover the hole with clay.
a. Measure and draw a line inside 4 cm from the bottom of Carton A.
b. Measure and draw a line inside 12 cm from the bottom of Carton B.

4

Pour water into the container 5 cm deep.
a. Pour water up to the 4 cm line in Carton A.
b. Pour water up to the 12 cm line in Carton B.

5

Place both cartons inside the container.
a. Remove the clay from Carton A. Make sure the hole is open. Wait about 5 minutes and measure inside Carton A. Record water level.
b. Remove the clay from Carton B. Make sure the hole is open. Wait about 5 minutes and measure inside Carton B. Record water level.

Teacher Tip

Activity may be completed as a demonstration project, individually, or in collaborative pairs. For the assessment, students should draw their conclusions independently.

Be a Water Leveler

Name _____ Date _____

Once you have demonstrated how water seeks its own level, answer the following questions.

Record your water data

Beginning depth of water in carton A _____cm

Beginning volume in carton A _____cc

(volume = _____length x _____width x _____depth)

Beginning depth of water in carton B _____cc

Beginning volume in carton B _____cc

(volume = _____length x _____width x _____depth)

Difference in volume of water in carton A and B _____cc

Ending volume in carton A _____cc

Ending volume in carton B _____cc

Write a three-paragraph essay describing the outcome of your experiment. Use the data you gathered in your essay. You may need extra paper to complete this assignment.

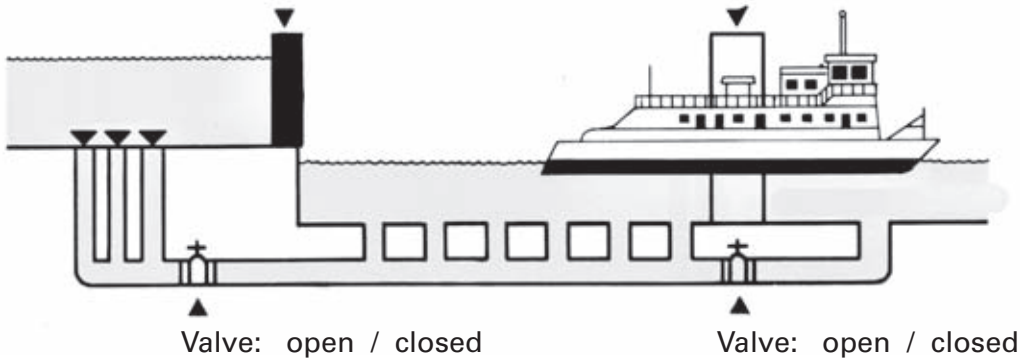
Get Ready

Have students play the virtual lock game with the U.S. Army Corps of Engineers' Bobber the Water Safety Dog. Go to **www.bobber.info** and choose **Lock Game**.

Number these illustrations in correct order and complete the labels by circling the words open or closed next to all gates and valves.

flow of river

#



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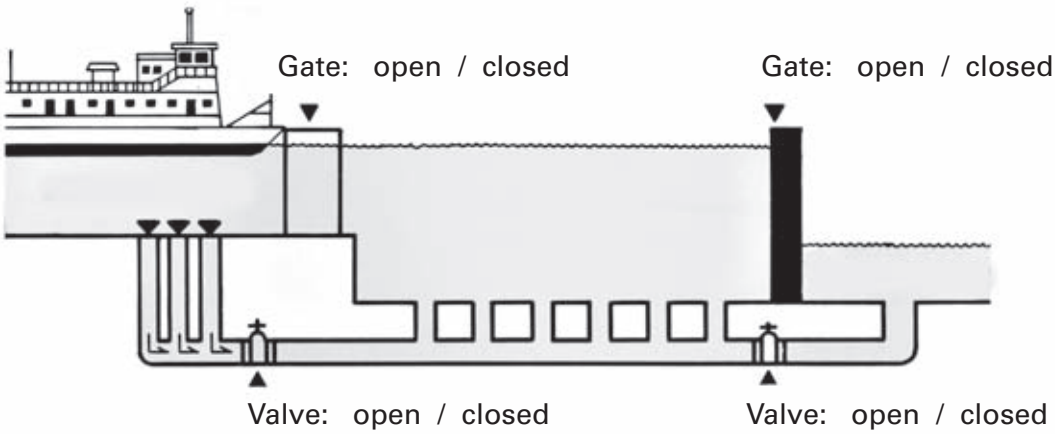

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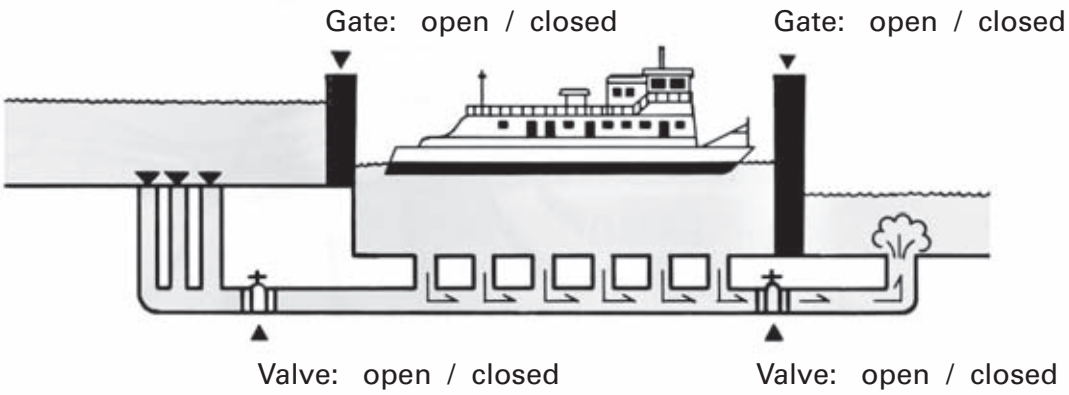


Fast Facts

Illinois Waterway

- The Mississippi River is not the only major river that was dammed during the New Deal.
- The Illinois Waterway features eight navigation locks and dams that were constructed during the 1930s.
- The Illinois River drains 30,000 square miles of the Upper Mississippi River watershed.

Melvin Price Locks and Dam

- Melvin Price Locks and Dam was the first replacement structure on the Upper Mississippi River nine-foot navigation project. It replaced Lock and Dam No. 26, which was demolished in 1990.
- It is named after Illinois Congressman Charles Melvin Price.
- Every year, more than 8,000 vessels and over 60 million tons of cargo pass through Melvin Price Locks and Dam.
- Although located on the Mississippi River, Melvin Price Locks and Dam controls the water level of the lower 80 miles of the Illinois River.

Extension Suggestions

Career launch

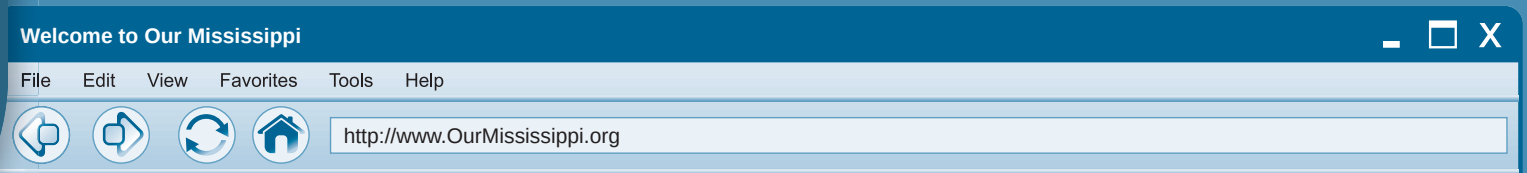
Invite a local **Lock Master** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

- Go watch a real lock at work.
- Tour a lock and dam facility.
- Get in a canoe or sailboat and go locking through (you should be an experienced paddler to go through by yourself).

Express yourself!

- Build your own lock and dam model or contact the U. S. Army Corps Engineers office near you to see if they have a model you can test.
- Make an engineering drawing of your lock and dam.



Learn more online

Visit the National Park Service (www.nps.gov)
Search keywords: **Locks and Dams**

The U.S. Army Corps of Engineers is responsible for operating and maintaining all locks and dams along the Mississippi River. Learn about Mississippi River Locks and Dams operated by the Corps at www.mvp.usace.army.mil
Search keywords: **Locks and Dams**

Study locks and dams at Teach Engineering (www.teachengineering.com)
Search keywords: **Dams**

To Market! To Market!

Our Inland Waterway System

Introduction

Lesson 4.5, explores the role of the Mississippi River as part of the Inland Waterway system and its role as a vital economic artery. Students read a navigation chart and plan a journey from the Atlantic Ocean through the Saint Lawrence Seaway to the Gulf of Mexico.

Background

STANDARDS CORRELATION

Students use what they learned about Mississippi River navigation and commerce in previous lessons to plan a virtual trip on the Inland Waterway System. This activity allows them to practice mapping, math, and computer skills as well as language arts.

The Mississippi River is the heart of a vast system of inland waterways that connects over 25,000 miles of navigable waters in the United States, including the Illinois Waterway, the navigable Missouri and Ohio Rivers, and the Intracoastal Waterway. It forms most of a waterway linking the Great Lakes-St. Lawrence Seaway with the Gulf of Mexico.

Unit 4 goal reminder

Explore the Mississippi River at work and how it has changed over time

Lesson goal

Understand the river's role as a vital economic interstate

Lesson objectives

- Learn which products go up the river and which go down
- Compare modes of transportation: river, rail, and road
- Create a virtual trip from the Atlantic Ocean through the St. Lawrence Seaway to the Gulf of Mexico
- Read a navigational chart

Educational standards

- Science
- Social Studies
- Math
- Fine Arts
- Language Arts

What you'll need

- *Confluence: The River Heritage of St. Louis* Video
- Highlighters
- Computers
- Access to the Internet
- Microsoft PowerPoint software
- Wall map

How long it will take

- Activity 1: 1 hour
- Activity 2: 2.5 hours

What's next!

What does it mean to share the Upper Mississippi River?

Ships became able to travel from the Atlantic Ocean through the Saint Lawrence Seaway to the Gulf of Mexico after the Illinois and Michigan Canal was constructed in 1848. This canal connected Lake Michigan and the Illinois River. Later, locks and dams were built on the Illinois Waterway to improve navigation.

The Mississippi River serves as our nation's main transportation artery for gas, oil, fertilizer, industrial chemicals, lumber, pulp and paper, sand and gravel, steel, and coal. Corn, soybeans, and wheat are shipped from farms in the Midwest downriver to ports in south Louisiana and exported to foreign lands.

Large groups of barges are lashed together and pushed up and down the Mississippi River at 4 to 8 miles per hour by 10,000-horsepower towboats, delivering more than 400 million tons of bulk cargo each year.

These tows are an extremely efficient mode of transportation, moving about 22,500 tons of cargo as a single unit. They make it possible to move large volumes of bulk commodities long distances using less fuel and creating less pollution per ton mile than trucks or trains. They also make highways and railways less congested. A single 15-barge tow is equivalent to about 225 railroad cars or 870 tractor-trailer trucks. If the cargo transported on the inland waterways each year had to be moved by another mode, it would take an additional 6.3 million rail cars or 25.2 million trucks to carry the load.

This vital shipping channel is maintained by dredging. The Upper Mississippi River is made navigable by 29 locks and dams, which allow giant barges to travel as far north as Minneapolis. The U.S. Army Corps of Engineers is responsible for investigating, developing and maintaining the nation's water and related environmental resources.

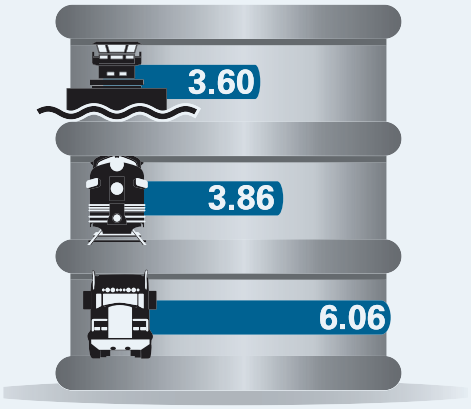
However, modern navigation comes at both an environmental and financial cost. Maintaining and operating the locks and dams along the river takes a great deal of money, and dredging and damming the river causes environmental damage.

Sources: National Park Service, Texas Transportation Institute, and U.S. Army Corps of Engineers.

Fast Facts

Hazardous Materials Spills

Barges spill fewer gallons of fuel per one million ton-miles.



Rate of Spills in Gallons per Million Ton-miles

Spills of more than 1,000 gallons

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*

UNIT 4

Discussion (30 minutes)

You'll need

- *Confluence: The River Heritage of St. Louis (see page 220 for more information about the video)*
- Wall map

Show students Scene 4, "River Network of the Future" from *The River Heritage of St. Louis* video and discuss the goods and products that travel up and down the river. Use the wall map to discuss how boats can travel from the St. Lawrence River to the Gulf of Mexico.

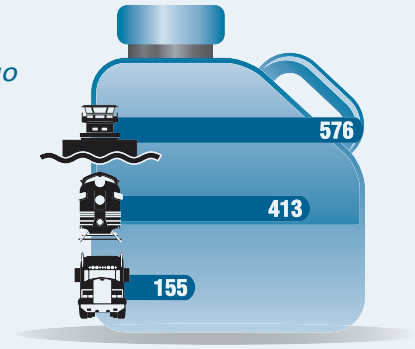
Have students research the various products hauled on the Mississippi. Ask them which commodities go up the river (e.g., coal) and which ones go down (e.g., wheat) and why. Discuss and compare hauling products by river, rail, and road.

Fuel Efficiency

Barges move more tons of cargo per gallon of fuel.

Ton-miles Traveled per Gallon of Fuel

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*

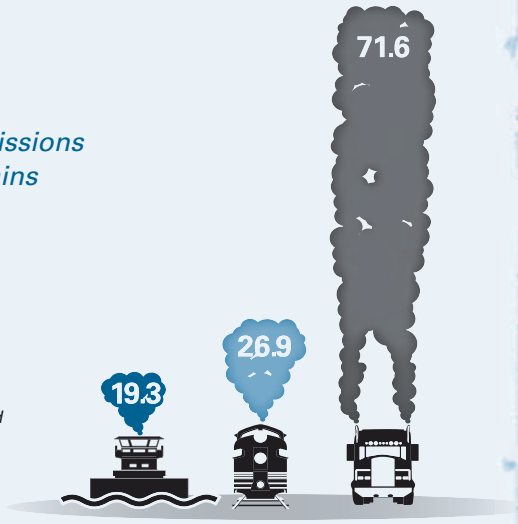


CO2 Emissions

Barges produce less CO2 emissions per million ton-miles than trains and trucks.

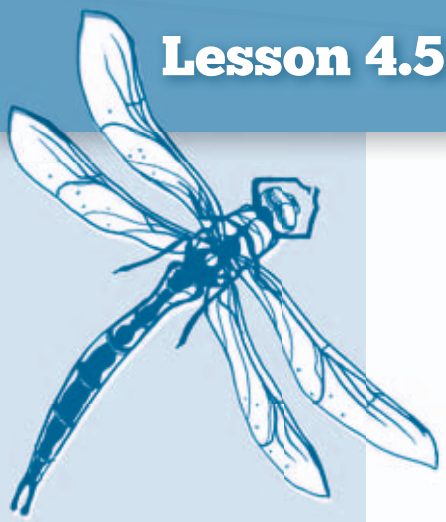
Tons of CO2 per Million Ton-miles

Source: National Waterways Foundation. *Advantages of Inland Waterways Transport: Safeguarding Our Health and the Environment.*



Need to Know

- **Coal** is the largest commodity by volume moving on the inland waterways. The country's electric utility industry depends on the inland waterways for over 20% of the coal they consume to produce electricity.
- **Petroleum** is the next-largest group, including crude oil, gasoline, diesel fuel, jet fuel, heavy fuel oils, and asphalt.
- Another large group includes **grain** and other **farm products**, most of which moves by waterway to ports on the Lower Mississippi River or Columbia River for export overseas. 60% of the country's farm exports travel through inland waterways.
- Other major **commodities** include aggregates, such as stone, sand, and gravel used in construction; chemicals, including fertilizers; metal ores, minerals, and products, such as steel; and many other manufacturers' products.



Plan a Virtual Trip on Inland Waterways

Grades

5–6

Individual or small group activity

2.5 HOURS

- 30 minutes to explain assignment and answer initial questions (longer if unfamiliar with the software).

What you'll need

- Computers
- Microsoft PowerPoint software
- Wall map
- Internet

Students create a PowerPoint presentation of a virtual trip on inland waterways from the Atlantic Ocean through the Saint Lawrence Seaway to the Gulf of Mexico.

Do This

1. The students will create a PowerPoint presentation that is a virtual field trip: Trace the path from the Atlantic Ocean through the St. Lawrence Seaway to the Gulf of Mexico.
2. Break students into groups and assign each group a section of the voyage (e.g., Chicago to St. Louis, St. Louis to New Orleans).
3. Presentations may include (they should use their imaginations):
   - Products
   - Various watercraft
   - Water safety signs
   - Wildlife seen along the way
   - Ports of call
4. Each group will produce a PowerPoint presentation (or part of one) with pictures and/or graphics plus narrative in the form of words or audio.
5. Each group will present their slideshow to the class.

Teacher Tip

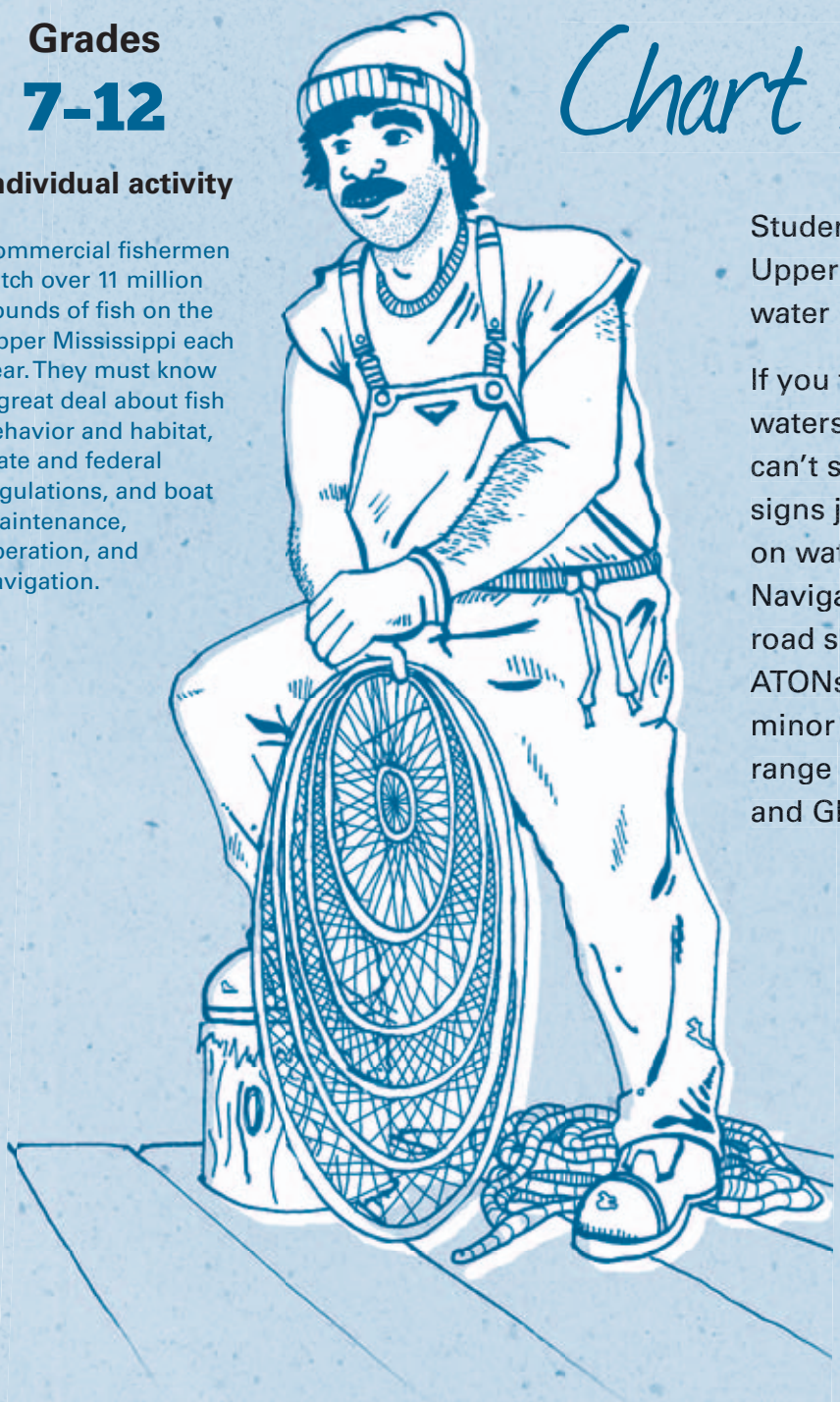
If PowerPoint is not an option, have students create a paper slide show using large index cards or half sheets of notebook paper.

Chart Safe Water

Grades
7–12

Individual activity

Commercial fishermen catch over 11 million pounds of fish on the Upper Mississippi each year. They must know a great deal about fish behavior and habitat, state and federal regulations, and boat maintenance, operation, and navigation.



Students use a navigation chart of the Upper Mississippi River to trace a safe water route.

If you travel by boat into unfamiliar waters or go out far enough that you can't see land, you must depend on signs just as you do on land. Signs on waterways are called Aids to Navigation (ATONs). These are the road signs of the water. Short-range ATONs include buoys, day beacons, minor lights, and lighthouses. Long-range aids include satellite beacons and GPS systems.

Have students use the navigation chart and legend on the next page (Map No. 57: River Mile 475 to 482) to determine the safest route past Horse Island. (Answer: They should draw a line between the red (shown in black) and green (white) buoys).

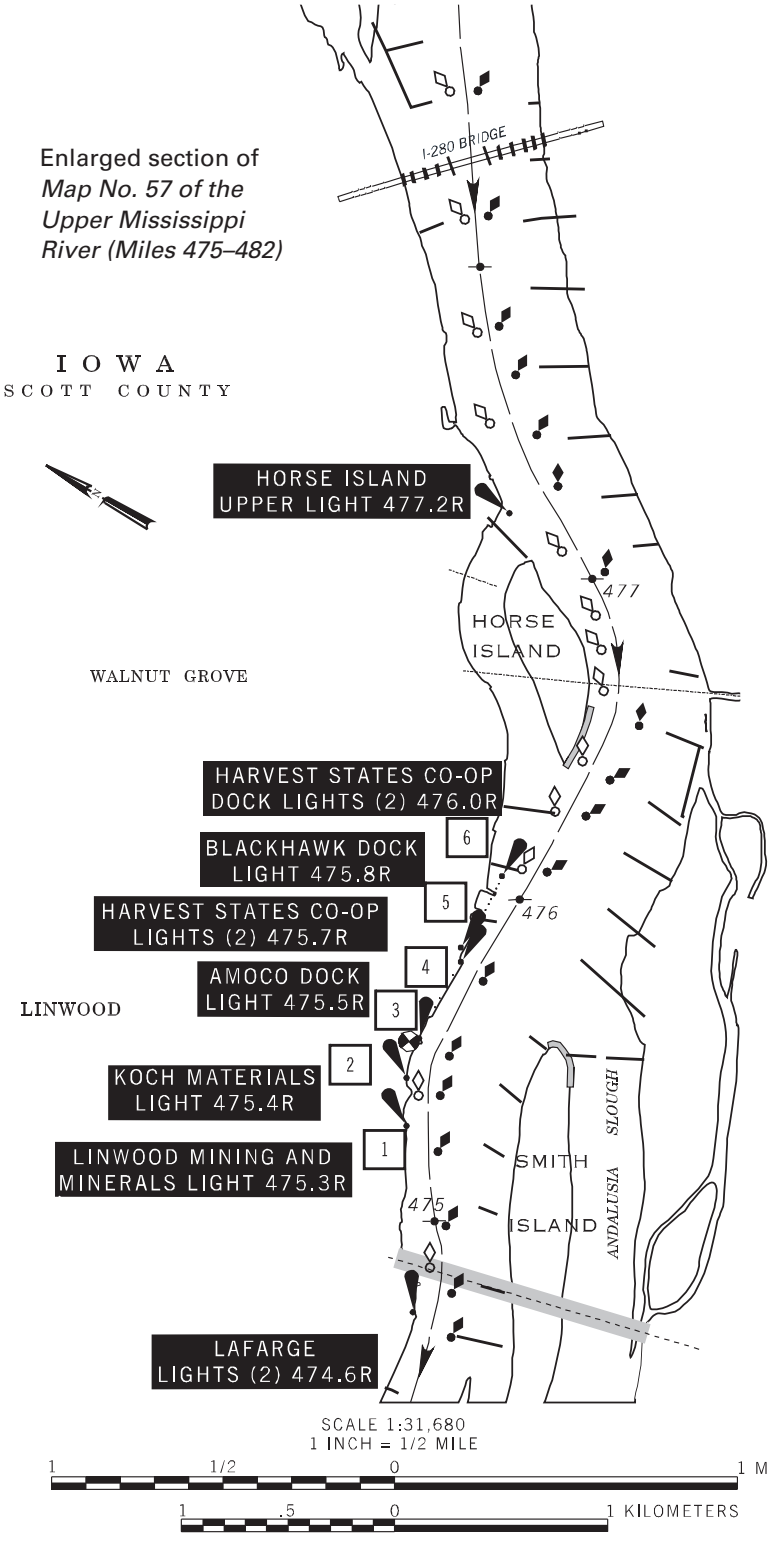
Then ask students to use the map and legend to answer the following questions on a separate piece of paper:

1. How many river miles between Lafarge Lights and Black Hawk Dock? Answer: 1.4 river miles
2. Which way should you go around Horse Island? Answer: Around its east side in between the red (shown in black) and green (white) buoys
3. Can you anchor at the dotted line at Horse Island? Answer: No

Navigate the Mississippi River

Name _____ Date _____

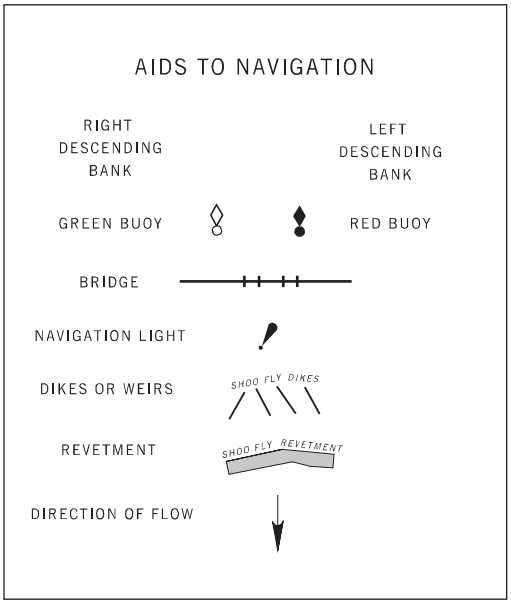
Enlarged section of *Map No. 57 of the Upper Mississippi River (Miles 475–482)*



Use this navigation chart and legend to determine the safest downstream route past Horse Island. Remember, lights and buoys are the traffic signs on rivers. Your course should take you between the green (shown in white) and red (shown in black) buoys.

Highlight your route with a pen or highlighter. Answer the following questions on a separate piece of paper:

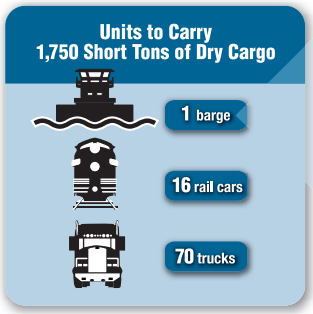
1. How many river miles between Lafarge Lights and Black Hawk Dock?
2. Which way should you go around Horse Island?
3. Can you anchor at the dotted line at Horse Island?



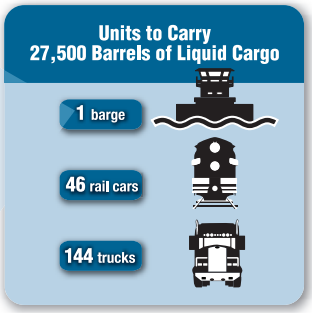
Grades

7–12

Individual activity



One loaded covered hopper barge carries 58,333 bushels of wheat, enough to make almost 2.5 million loaves of bread.



A loaded tank barge carries 27,500 barrels of gasoline, enough to keep about 2,500 automobiles running for an entire year.

How Much Does It Carry?

(Standard modal freight unit capacities)

What do the numbers tell us?

That depends on whose numbers you use. Research data on barge, rail, and truck comparisons to see how many different sets of statistics you can find. Try to locate sources with different points of view, such as industry groups versus environmental organizations. These sources below are a good place to start.

- Izaak Walton League of America (www.iwla.org)
- National Waterways Foundation (www.nationalwaterwaysfoundation.org)
- National Audubon Society (www.audubon.org)
- Nature Conservancy (www.nature.org)
- Sierra Club (www.sierraclub.org)
- Texas Transportation Institute, Texas A&M University (tti.tamu.edu)
- U.S. Army Corps of Engineers (www.usace.army.mil)
- U.S. Department of Transportation Maritime Administration (www.marad.dot.gov)
- U.S. Fish & Wildlife Service (www.fws.gov)
- Waterways Council, Inc. (www.waterwayscouncil.org)

Extension Suggestions

Career launch

Invite a local **towboat captain** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

- Take a real field trip up the Mississippi River.
- Go watch a working dock in action.

Express yourself!

Imagine what it would be like to take your virtual trip and write a fictional travelogue. Use Mark Twain's *Life on the Mississippi* as inspiration.

Welcome to Our Mississippi

File Edit View Favorites Tools Help

http://www.OurMississippi.org

Learn more online

Learn how navigational techniques change when people travel by land, sea, air, or space at the Teach Engineering website (www.teachengineering.org) Search keywords: ***navigation***

Learn about nautical charts on the National Oceanic and Atmospheric Administration (NOAA) website. Go to **www.noaa.gov** and search keywords: **nautical charts**

Go to the **Department of Commerce** website to learn more about commerce in the U.S.. Go to **www.commerce.gov**

Learn about the role of the **U.S. Coast Guard** (www.uscg.mil)

Unit 5

A Shared Resource – Our Mississippi River

Unit 5: A Shared Resource – Our Mississippi River **is a culmination of everything students have learned in the previous four units. In this unit, students synthesize the knowledge and skills learned to problem-solve a variety of solutions for managing and conserving the Upper Mississippi River while allowing for a variety of uses, from navigation to recreation. This unit requires several higher-level skills, including communication, problem solving, and compromise.**

5.0 Introduction to A Shared Resource – Our Mississippi River: Pre- and Post-Assessments

Prepare students for learning about what it means to share the Upper Mississippi River through pre- and post-assessments, key concepts and vocabulary, and an investigation of major uses and concerns about the river.

5.1 Sharing Our River: One River, Many Uses – Playing it Safe on the Mississippi

Students explore in more depth how different people use the river and teach younger grades about water safety.

5.2 Managing Our River for Everyone: Competing Views and Values

After working in groups to brainstorm how communities should rebuild after a devastating flood, students research, interview, and debate the issues from four key points of view.

5.3 Caring for Our River: Protecting Our Precious Resource

The final lesson encourages environmental stewardship by asking students to take an active part in caring for the river by engaging in a service project or designing a service learning opportunity of their own.

Introduction to
A Shared Resource – Our Mississippi River

Unit 5 goal
Explore what it means to safely share the Upper Mississippi River

Lesson objectives
- Define shared resource
- Investigate Mississippi River issues and concerns
- Discuss how we share this resource and the students' responsibilities in protecting it

Educational standards
- Life Science
- Science in Personal and Social Perspectives

What you'll need
- Internet access

How long it will take
- *Activity 1:* 15 min.
- *Discussion:* 1 hour
- *Activity 2:* 1 hour plus student research time

What's next?
Sharing and playing safely on the Mississippi River

Introduction

In this introduction to *Unit 5: A Shared Resource – Our Mississippi River*, students explore the larger issues involved in sharing a natural resource for diverse interests and uses. They will research primary sources, such as public meeting minutes and reports, to familiarize themselves with the river-related issues and decisions facing their communities. The knowledge gained from this research provides them with the context they need to discuss, collaborate, and compromise with different points of view. It also helps prepare them for the role-playing exercises in the following lessons.

STANDARDS CORRELATION

Unit 5 is the capstone for all the units. In this set of lessons students will demonstrate what they learned in previous lessons by teaching others and debating river-related issues. Multiple standards touched upon in this unit include Science, Language Arts, Fine Arts and Social Studies. In this lesson, Science in Personal and Social Perspectives and Language Arts standards are the focus. Students will investigate river-related issues and concerns so they can begin to formulate their perspective on how to manage and share the river.

UNIT 5

Pre- and Post-Assessment

15 MINUTES

What you'll need

- Activity worksheet (pages 284–285)

Do This

1. Copy and distribute the Pre- and Post-Assessment activity worksheet on the following pages.
2. Allow 15 minutes for students to complete the assessment.
3. Save the pre-assessments to compare with a post-assessment given after students complete all the lessons in this unit using this same activity worksheet.
4. Calculate each student's percent increase in knowledge.

Answer Key

Answers to the essay questions will vary. Information needed to complete the questions can be found in the previous units.

> "The life in us is like the water in the river. It may rise this year higher than man has ever known it, and flood the parched uplands; even this may be the eventful year, which will drown out all our muskrats. It was not always dry land where we dwell. I see far inland the banks where the stream anciently washed, before science began to record its freshets."
>
> – Henry David Thoreau (1817-1862), *Walden*, 1854

Need to Know

- **Shared resource:** An entity shared by many. At school, you share the playground with other students. The playground is a shared resource.
- The Upper Mississippi River is a shared resource. It supports diverse, interconnected uses:
  - Extensive navigation system (made up of 1,200 miles of nine-foot channel and 29 lock and dam sites).
  - Diverse ecosystem (2.7 million acres of habitat supporting hundreds of fish and wildlife species)
  - Floodplain agriculture
  - Recreation and tourism

Unit 5 Assessment

Name _____ Date _____

Essay questions

1. Describe the Mississippi River Watershed.

2. What can you do to help the river's ecosystem?

3. What historical event do you think had the biggest impact on the river? Explain why you think so.

4. What do you think can be done to reduce flood damage along the Mississippi River?

5. Choose an occupation, business developer or environmentalist, and describe the future you see for the Mississippi River.

Introduction 5.0

Background

The Mississippi River plays a large and complex role in the economy of the Upper Midwest states, both in rural and urban areas. Some economic uses, such as manufacturing, urban development, and tourism, benefit from a healthy river as well as attract people and jobs.

The Upper Mississippi River is losing its ecological vitality as parts of the fragile ecosystem disappear. The river's environment needs to be adequately monitored by observing indicator species and preventing habitat reduction, which could also pose risks to human health. Much of the harm done to the Upper Mississippi over the last 150 years can be traced to human activities. An early example appears in Unit 4 with the major forests harvested to supply wood for steamboats. Modern hazards include pollution from toxic chemicals, nutrients, and pathogens.

Progress has been made to improve the environment but many parts of the river system remain in need of help. The cumulative effects of these problems may further impact human use and enjoyment of the river.

Discussion (1 hour)

Begin the discussion by talking about sharing. We learn about sharing at an early age. However, we don't always share nicely because we think what we want is more important than what others want or need. Sometimes we need to put our own wants aside and help others.

Then have students watch the short (less than 2 minutes) video called The Great Rivers Partnership, available on www.youtube.com. Search keywords **Explore the Mississippi River by Nature Conservancy**.

Talk about why we must share the river in a way that meets the needs of all who depend on it in a sustainable way so that this vital resource will support people and wildlife for generations to come.

Review key concepts from Units 2 and 4 and discuss transportation, commerce, agriculture, recreation, and conservation:

- Who uses the river? How do they use the river?
  - Humans use it for work, agriculture, transportation, and play.
  - Plants and animals live there and use it for migration.
- Discuss how we share this resource and the students' responsibilities in protecting it.

Review previous lessons and activities:

- Car washing and drinking water – Units 1 and 2
- Wetlands and migration – Unit 2
- Locks and Dams – Unit 4
- Human Actions on the Mississippi – Units 1 through 4

Investigating the Mississippi River

Issues and Concerns

Grades

5–6

Individual activity

1 HOUR

Plus student research time

What you'll need

- Access to the Internet

Students explore primary and secondary sources to discover a broad range of opinions on a river-related topic and summarize the key concerns.

Do This

1. Ask students to research a river-related issue in their community and choose one that has the broadest range of opinions about the nature of the problem and its possible causes and solutions.
   - Look for notes or videos from public and city council meetings and public involvement reports from government agencies, such as the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers.
   - The list of government agencies and regional groups on page 288 are potential sources for this activity.
2. Ask students to summarize the variety of opinions they find and add their own to the end of their summary.

Option

Instead of asking students to do their own research, provide them with the following primary sources:

1. Public involvement report from U.S. Fish & Wildlife Service.
   - Go to www.fws.gov and search keywords **Upper Mississippi River National Wildlife and Fish Refuge Comprehensive Conservation Plan**.
   - Download and print **"Chapter 2: Consultation and Coordination with the Public and Others"** from **Upper Mississippi River National Wildlife and Fish Refuge's Comprehensive Conservation Plan**.
2. Public meeting minutes from the U.S. Army Corps of Engineers.

   Download and print **"St. Louis-Navigation Study Public Meeting Minutes from March 13, 2002."**
   - U.S. Army Corps of Engineers (Corps) public meeting minutes.
   - Go to http://www2.mvr.usace.army.mil/UMRS/NESP and click on Projects. Choose **Meeting Minutes**.
   - Navigate to **St. Louis-Navigation Study Public Meeting Minutes** from March 13, 2002. Download and print.
3. Video of a St. Paul, Minnesota, City Council meeting.
   - Go to www.stpaul.gov. Choose **City Council**, then **Meetings: Videos, Agendas, and Meetings**.
   - Search for **Mississippi River**.

Make this activity more dynamic by asking students to attend a city hall or other public meeting.

UNIT 5

Fast Facts

A variety of government agencies (state, regional, or federal) and non-governmental organizations (NGOs) are involved in making decisions about the Mississippi River.

- Federal Agencies
  - EPA (Environmental Protection Agency) and Research Program (LTMRP)
  - U.S. Dept. of Agriculture's Natural Resources Conservation Services (NRCS)
  - U.S. Army Corps of Engineers
- Regional Groups
  - United States Geological Survey's Long Term Monitoring and Research Program (LTMRP)
  - Upper Mississippi River Conservation Committee (UMRCC)
  - Upper Mississippi River Basin Association (UMRBA)
  - Ohio River Valley Water Sanitation Commission (ORSANCO)
  - Upper Mississippi River Basin Task Force
  - Lower Mississippi River Conservation Committee (LMRCC)
- State Agencies
  - State Water Quality Agencies

Source: *The Mississippi River in the Upper Midwest: Its Economy, Ecology, and Management*, from the McKnight Foundation, *Traveling Upstream: Improving Water Quality of the Mississippi River*, prepared for the McKnight Foundation (www.mcknight.org)

Extension Suggestions

~ Career launch

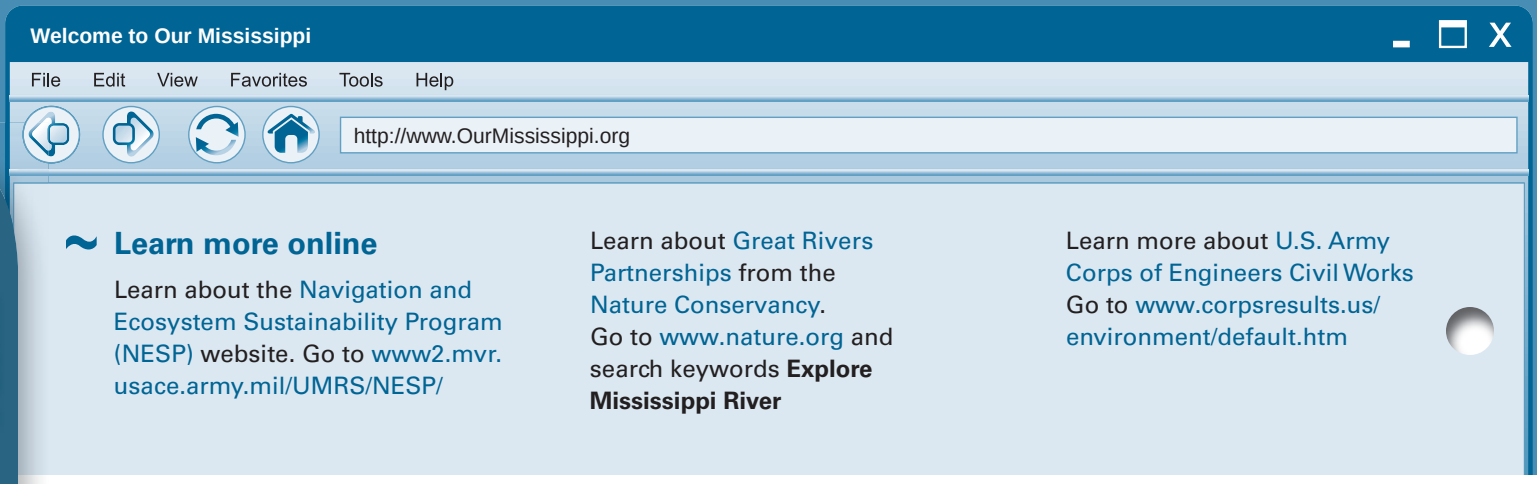
Invite a local **city council member**, **farmer**, **towboat operator**, or **fisherman** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Express yourself!

- Ask students to write a poem, draw a picture, or paint a painting of how they are connected to the Upper Mississippi River.
- Have students write letters to their city council or other local government official to share their concerns about how the Upper Mississippi River is managed for multiple uses.

~ Get out!

Arrange field trips to see different users of the Mississippi in action, such as riding on a barge, visiting a farmer's field, or helping U.S. Fish & Wildlife with environmental research and restoration projects.



~ Learn more online

Learn about the Navigation and Ecosystem Sustainability Program (NESP) website. Go to www2.mvr.usace.army.mil/UMRS/NESP/

Learn about Great Rivers Partnerships from the Nature Conservancy. Go to www.nature.org and search keywords **Explore Mississippi River**

Learn more about U.S. Army Corps of Engineers Civil Works Go to www.corpsresults.us/environment/default.htm

Sharing Our River:

One River, Many Uses – Playing it Safe on the Mississippi

Introduction

In this lesson, students explore how different people use the river in more depth, with an emphasis on safety. Students research water safety and prepare an activity to teach younger grades about water safety.

Background

The U.S. Army Corps of Engineers and the U.S. Coast Guard are the federal agencies most concerned with water safety. The Corps is the leading provider of water-based recreation on all federally managed public lands in the United States. Because most of that recreation occurs in and around water, the Corps is dedicated to water safety.

STANDARDS CORRELATION

In past lessons, students have learned about the river's ecosystem, its history, and its navigation challenges. They learned that the river has become a mainstay for wildlife and people either through occupation or recreation. This lesson focuses on how we can safely share the river and its resources, which relates to Science in Personal and Social Perspectives. Students will incorporate Language Arts and Fine Arts standards as they prepare to teach younger students about water safety.

Unit 5 goal reminder

Explore what it means to safely share our river

Lesson goal

Learn how to share the river safely

Lesson objectives

- Research the different types of water safety
- Identify key elements of water safety
- Teach younger kids in your school about water safety

Educational Standards

- Science in Personal and Social Perspectives
- Fine Arts
- Language Arts

What you'll need

- Access to the Internet
- Poster material
- Life jackets
- Safety cones
- Colored paper
- 8.5x11 white paper
- Markers and/or crayons
- Glue
- Tape

How long it will take

- *Discussion:* 30 min.
- *Activity 1:* Several hours to several days
- *Activity 2:* 30 min.

What's next?

Problem-solving solutions to manage the Mississippi River for a variety of uses and needs

Fast Facts

- Drowning is the 2nd leading cause of accidental injury or death for children ages 1-14.
- A child can drown in just 20 seconds, an adult in 60 seconds.
- Laws and regulations
  - Federal law requires all children under 13 to wear life jackets while on recreational boats, unless the state laws vary.
  - Recreational boats must carry one properly sized, U.S. Coast Guard-approved lifejacket (accessible and in good condition) for each person on board.
  - Life jackets should be tested for wear and buoyancy at least once each year. Waterlogged, faded, or leaky jackets should be discarded.
  - A snug-fitting flotation coat or deck-suit style life jacket can help you survive in cold water.

Life Jacket

Lifejackets come in different types that provide various levels of protection.

Type I: Off shore Life Jacket
Type II: Near Shore Buoyant Vest
Type III: Flotation Aid

"I've never pulled a dead body out of the Mississippi River that was wearing a life jacket."

– John Martin, U.S. Coast Guard

Discussion (30 minutes)

Can you have fun on the water? The best way to ensure a day of fun on the water is to make sure everyone is wearing a life jacket so they can return home safely. Too often people overestimate their swimming abilities on open waters so it is important to swim with a buddy, take swimming lessons and learn to swim well. Wearing a life jacket is always the best way to play it safe. Boaters should take a boater's education course and always be aware of weather and water conditions before they venture out for a day of fun on the water.

Begin by reviewing what students have learned about the many uses of the Mississippi River and its floodplain in previous units, including transportation, commerce, agriculture, recreation, and conservation. Discuss the importance of working and playing on the river safely.

Since animals can't read or understand the rules for boats and people, we need to be extra careful when around them on the water. When on or near the water, whether swimming or boating, we need to steer clear of animal and bird habitats, especially breeding areas.

Invite someone from the U.S. Army Corps of Engineers or U.S. Coast Guard to speak to the class. Ask students to prepare questions beforehand based on what they learned through online research. Let students know that they will be teaching younger children about what they learned.

Create a Water Safety Poster

Grades

5–6

Small group (3 students) activity

4 HOURS

Several hours or several days, depending on classroom time devoted to research. This activity could be assigned as homework.

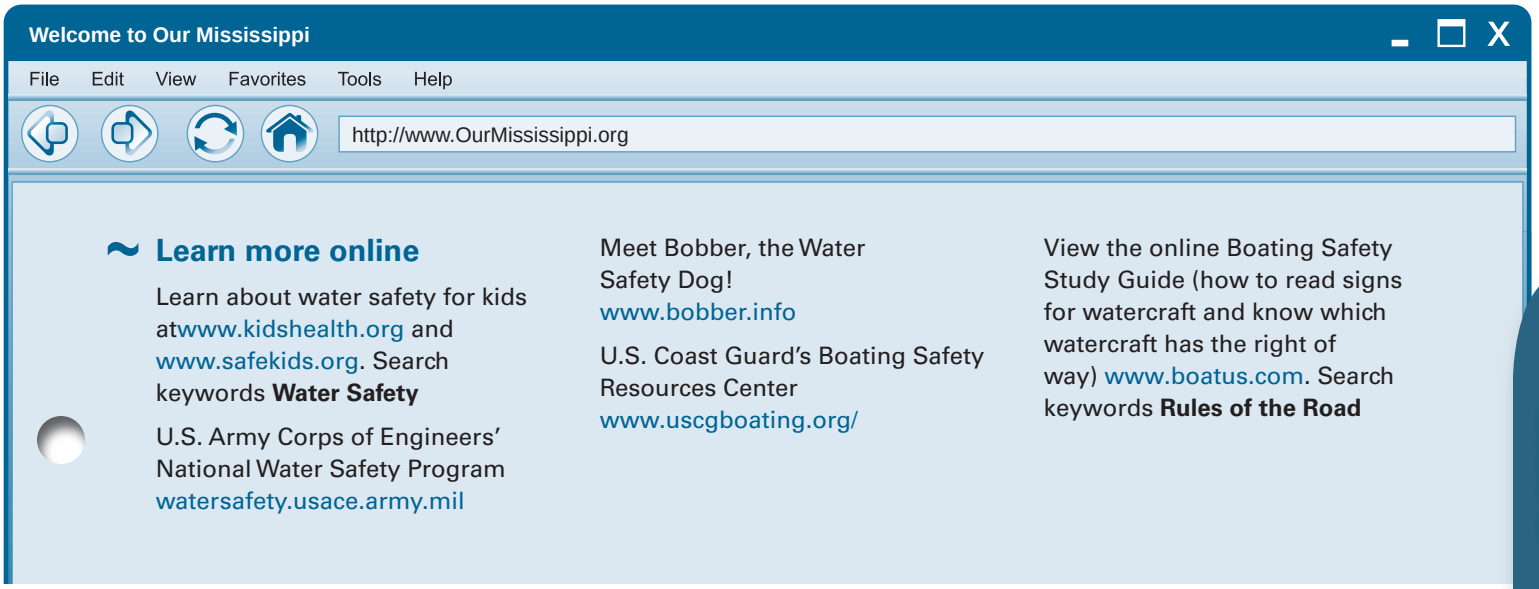
What you'll need

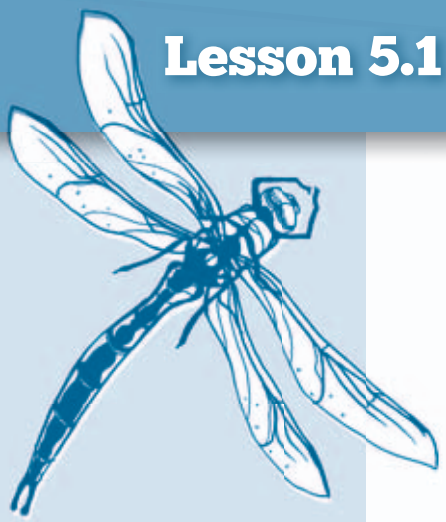
- Access to the Internet
- Poster material
- Markers and/or crayons

Ask students to research water safety with the intention of teaching younger school children how to be safe in the water.

Do This

1. Assign each group a water safety topic to research. Help them narrow the topic to a specific research question or statement. For example, life jacket safety can broken down into:
   - Why you should wear a life jacket
   - How to choose a life jacket
   - How your life jacket should fit
   - When to wear life jackets, and what rules apply on rivers and lakes
2. Once students have narrowed their safety topic, direct them to printed and online sources, such as the U.S. Army Corps of Engineers' National Water Safety Program and the U.S. Coast Guard Boating Safety Resource Center websites.
3. Ask students to create a water safety poster for younger school children.





Navigating the Rules of the Water "Road"

Grades

5–6

Class or small group activity

30 MINUTES

Students turn the schoolyard into a waterway and practice navigating marked channels safely. Older students help guide younger students through the course, helping them understand the rules of the waterway "road."

Do This

Based on what students learned from their research on boating safety, have them set up a watercourse in the schoolyard.

1. Invite someone from the U.S. Army Corps of Engineers or the U.S. Coast Guard to talk to the class about Navigational Aids and the Rules of the Road.
2. Prepare students for the discussion by talking about the similarities and differences between roads and waterways.
   - Explain that busy waterways have "lanes of travel" similar to the Interstate highway system.
   - Instead of meaning stop and go, red and green on waterways tell you which side you should be on depending on the direction you are traveling. When heading upstream (i.e., from the mouth of the river to the head of navigation), the red buoys are on the starboard (right) side of the channel and the green ones are on the port (left) side of the channel.
3. Give each student a life jacket to wear during the activity. Have students write and sign a safety pledge promising to wear their life jacket at all times when they are on the river.
4. Make 10 buoys, five red and five green, by wrapping playground cones with red and green construction paper.

What you'll need

- Life jackets (asks students to bring their own)
- Safety cones
- Colored paper
- 8.5x11 white paper
- Markers and/or crayons
- Glue
- Tape

Teacher Tip

If students don't have life jackets, use stickers or make string signs that say "life jacket."

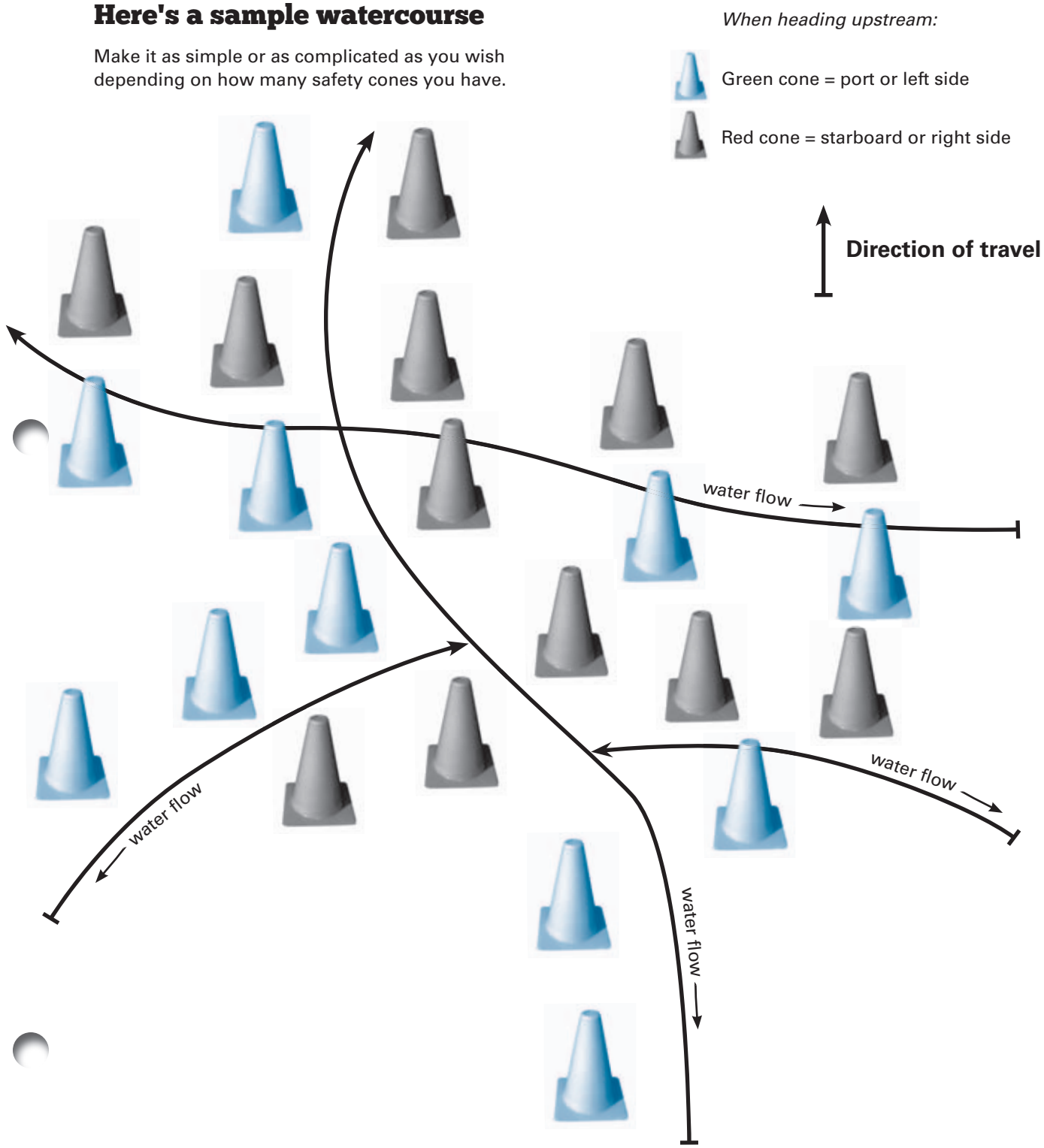
UNIT 5

5. Have students make paper boats and label them based on different types of watercraft to give to the younger children.

6. Ask the older students to guide the younger ones through the buoys using the Rules of the Road.

Here's a sample watercourse

Make it as simple or as complicated as you wish depending on how many safety cones you have.



Lesson 5.1

Teacher Tip

U.S. Army Corps of Engineers has a Safe Passage DVD and Water Safety K-6 Curriculum available. Go to ***watersafety.usace.army.mil*** *and click on Safe Passage.*

To help someone in trouble and keep yourself safe, learn these few simple safety rules:

Reach — To help someone in the water, reach first with a fishing pole, towel, boat oar, but don't get in the water yourself.

Throw — Scan your area for items such as an empty milk jug, cooler, or ring buoys that can be thrown to someone in the water.

Row — It's not safe to go near a swimmer with the boat motor running. Use the oars to bring the boat close enough to reach or throw.

Don't Go — Without expert training and experience in lifesaving techniques, you could put yourself in danger along with the person you are trying to help.

Extension Suggestions

Career launch

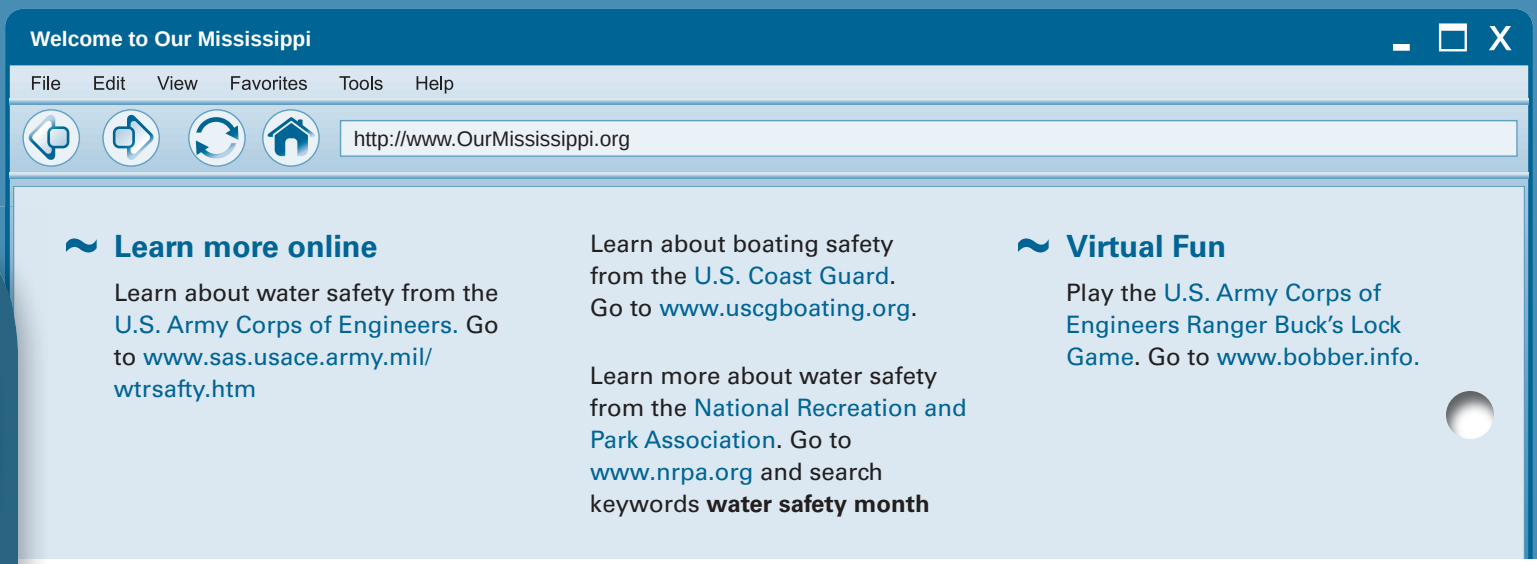
Invite a local U.S. **Coast Guard member** or **lock master** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

Get out!

- Take a lock tour at the National Great Rivers Museum in Alton, Illinois.
- Arrange a kayak or water boat field trip with a certified guide.
- Take a field trip to your local U.S. Coast Guard or U.S. Army Corps of Engineers office to learn about safe swimming and boating skills.

Express yourself!

- Ask students to create a water safety plan for their friends and families.
- Make your own safety flags.



Learn more online

Learn about water safety from the U.S. Army Corps of Engineers. Go to www.sas.usace.army.mil/wtrsafty.htm

Learn about boating safety from the U.S. Coast Guard. Go to www.uscgboating.org.

Learn more about water safety from the National Recreation and Park Association. Go to www.nrpa.org and search keywords **water safety month**

Virtual Fun

Play the U.S. Army Corps of Engineers Ranger Buck's Lock Game. Go to www.bobber.info.

UNIT 5

Managing Our River for Everyone:

Competing Views and Values

Introduction

In this lesson students actively engage in the many issues and decisions that communities in the flood plain of the Upper Mississippi must deal with on a regular basis. After working in groups to brainstorm how communities should rebuild after a devastating flood, they have the context they need to research, interview, and debate the issues from four key points of view.

Background

We depend on the Upper Mississippi River and its large floodplain—more than 2.5 million acres—for many things essential to our health and happiness. It is vital that future generations learn how to restore and maintain this living river.

Unit 5 goal reminder

Explore what it means to safely share our river

Lesson goal

Debate ideas for how to sustainably manage the river for multiple uses

Lesson objectives

- Identify issues facing communities
- Understand different points of view
- Brainstorm ideas
- Problem-solve solutions

Educational standards

- Life Science
- Science in Personal and Social Perspectives
- Social Science
- Fine Arts
- Language Arts

What you'll need

- Blackboard or flipchart for capturing ideas
- Markers
- Pen and paper
- Access to the Internet
- Guest speakers

How long it will take

- *Discussion:* 30 min.
- *Activity 1:* 45 min.
- *Activity 2:* 2 hrs.

What's next!

What is YOUR part in protecting the river?

STANDARDS CORRELATION

Students continue to conduct research and analyze data to formulate their arguments for the debating activity, which relates to Language Arts standard. Having learned about the importance of commerce of the river, students must think critically about how to balance business development with caring for the river's environment, which correlates to Science in Personal and Social Perspectives standard.

UNIT 5

What do the river and its floodplain do for us?

- **Human habitat**: More than 30 million people live in the Mississippi River basin. Nearly 80% of the population lives in urban areas such as Minneapolis-St. Paul, Minnesota; St. Louis, Missouri; Chicago, Illinois; the Quad Cities, Illinois and Iowa; Des Moines, Iowa; La Crosse, Wisconsin; and Peoria, Illinois.
- **Water supply**: About half of the residents in the Mississippi River Watershed rely on the Upper Mississippi River and its tributaries for their water.
- **Food supply**: Over 60% of the basin is cropland or pasture. Major cash crops include corn and soybeans.
- **Transportation and commerce**: About 850 miles of the Upper Mississippi River, extending from Minneapolis-St. Paul to the Ohio River, are commercially navigable.
- **Flood control and water quality**: Wetlands along the river help absorb flood water and filter pollutants.
- **Recreation**: The river generates over $6.6 billion dollars in revenue annually from people who hunt, fish, boat, or sightsee. Recreation and tourism employ 143,000 people.
- **Inspiration**: More than 1,300 river miles of diverse natural, rural, and urban open space are available for human exploration, education, spiritual renewal, and aesthetic enjoyment.

Discussion (30 minutes)

Begin the class discussion with the end goal: We must manage the river in a way that meets the needs of all who depend on it, in a sustainable way, to ensure that this vital resource will support people and wildlife for generations to come.

Ask students to imagine what they would do if they could build their communities from scratch. Where would they live? How would they get their basic needs met? Brainstorm ideas as a class for a few minutes before breaking students into groups for Activity 1. Once they have planned their ideal communities, they will be ready for the debate in Activity 2.

> *"The Upper Mississippi River System is the only waterbody in the nation that has been recognized by Congress as a nationally significant ecosystem and a nationally significant commercial navigation system."*
>
> – Water Resources Development Act, 1986. One of a series of acts about water resources enacted by Congress, it established cost-sharing formulas for the construction of harbors, inland waterway transportation, and flood control projects and created hundreds of projects, studies, and plans in almost every state in the nation.

Town Devastated by a Flood – Let's Rebuild!

Grades

5–6

Class or small group activity

45 MINUTES

What you'll need

- Blackboard or flipchart for capturing ideas
- Markers
- Pen and paper

Do This

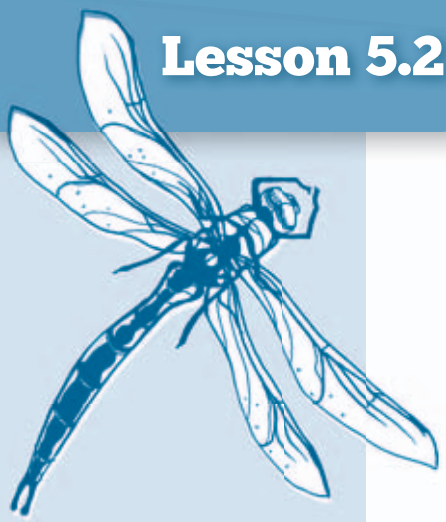
Your town has been wiped out by a catastrophic flood! Luckily, everyone made it to safety, but you must now rebuild from scratch.

1. Give the students 15 minutes to write their ideas or possibly make it a homework assignment.
2. Have students share the ideas with the class, capturing them on the board or flipchart.
3. Organize students into groups of four and present the scenario.

Student instructions

Answer the following questions to begin planning your new community:

1. Will you rebuild where you were (on a flood plain) or will you move to another location? Decide where to build your new town and describe why you chose that location.
2. How will you meet your basic needs for food and shelter?
3. What will be the economic base for your new town (business, agriculture, recreation, tourism)?
4. What services do you need to provide, such as power, water, garbage, sewage, transportation, education, etc.?
5. How will you protect the environment and ensure habitat for wildlife?
6. How will you interact with other communities on the river?
7. How will you sustain all of the above?



Town Hall Meeting

The Art of Dialogue and Compromise

Grades

5–6

Class or small group activity

2 HOURS

What you'll need

- Access to the Internet
- Guest speakers

After listening to and asking questions of experts, students prepare for and engage in a debate about the issues.

Do This

1. Invite local experts representing diverse points of view to help students prepare for a town hall debate. Points of view could include:
   - Agriculture (commercial fishing and farming)
   - Transportation and navigation (barge industry, civil engineer, U.S. Army Corps of Engineers)
   - Commerce and development (Chamber of Commerce, city planner)
   - Conservation and recreation (e.g., U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, Audubon Society, Sierra Club)
2. Organize students into groups of four and assign each group a point of view.
3. Have students prepare questions for each point of view, focusing on values and ideas for how best to manage the river for multiple uses.
4. Match up student groups for a class debate:
   - Assign a moderator and a time keeper
   - Students' arguments must be no more than 1-2 minutes per question with equal time for each point of view

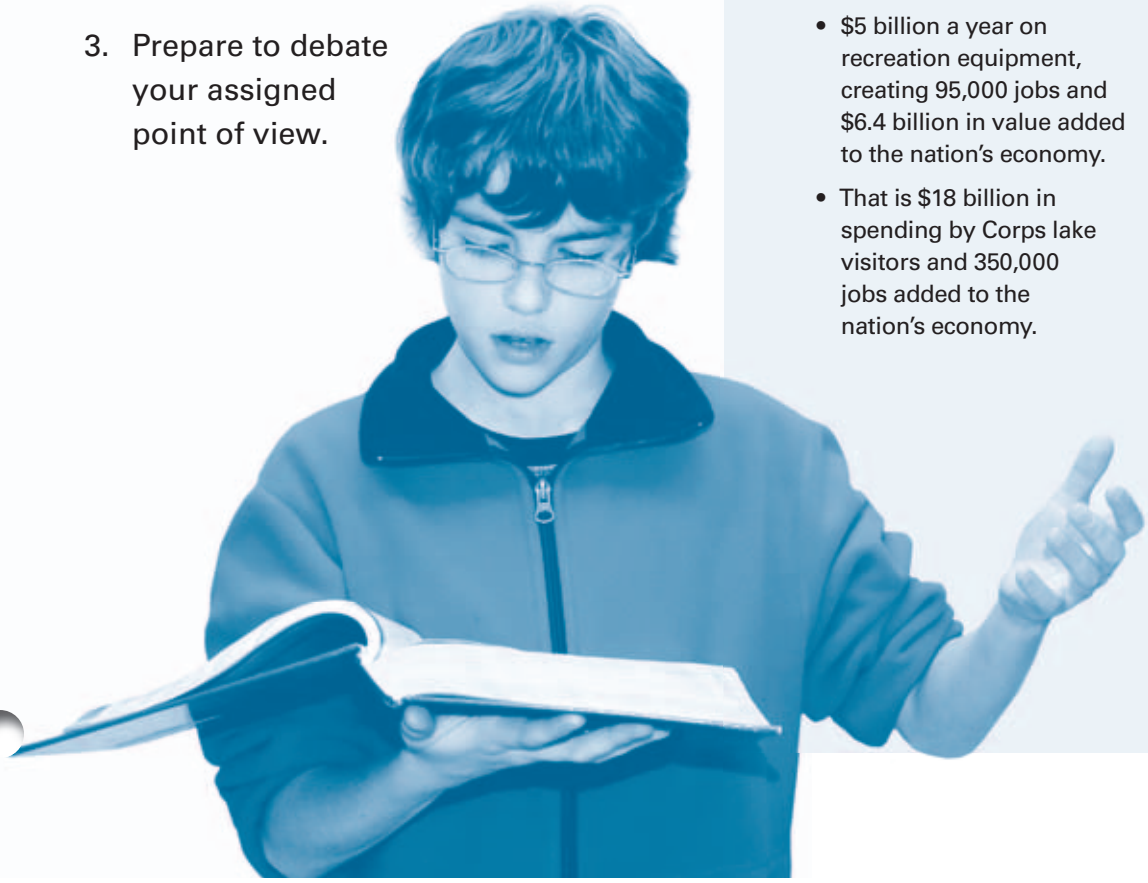
> *"Unfortunately, our rivers carry the waste into the bay like veins into a heart."*
>
> – Patrick Noonan, quoted in *Countryside*, Winter 1990

Student Instructions

1. Research different points of view on how to sustainably manage the river for multiple uses.

2. Prepare interview questions for local experts representing diverse points of view:
   - Agriculture (commercial fishing and farming)
   - Transportation and navigation (barge industry, civil engineer, U.S. Army Corps of Engineers)
   - Commerce and development (Chamber of Commerce, city planner)
   - Conservation and recreation (U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, Audubon Society, Sierra Club)

3. Prepare to debate your assigned point of view.



Fast Facts

The U.S. Army Corps of Engineers is the steward of 12 million acres of public lands and waters at more than 400 lake and river projects in 43 states. Nearly every outdoor recreation activity imaginable is waiting for you at one of the Corps' 2,500 recreation areas.

Recreational Facilities

- 420 lakes in 43 states hosting 33% of all freshwater lake fishing
- 56,000 miles of shoreline
- 90,000 campsites
- 3,500 boat launch ramps
- 200,000 fishing tournaments a year
- 4,300 miles of trails
- 12 million acres hosting 20% of visits on 2% of federal lands

Environmental Benefits

Recreation experiences increase motivation to learn more about the environment; understanding and awareness of environmental issues; and sensitivity to the environment.

Economic benefits

- $5 billion a year on recreation equipment, creating 95,000 jobs and $6.4 billion in value added to the nation's economy.
- That is $18 billion in spending by Corps lake visitors and 350,000 jobs added to the nation's economy.
- $13 billion a year on trip-related expenses such as gas, food, and lodging within and outside of the local communities surrounding Corps lakes, leading to 250,000 jobs and $16 billion in value added (includes wages and salaries, payroll benefits, profits, and rents and indirect business taxes) to the nation's economy.

This figure includes $8 billion spent in local communities, resulting in 100,000 jobs and $3.9 billion in value added to the local economies.

Mississippi Queen - River of Dreams

Drifting like a waltz is the river of dreams;
The moon high in the sky loves to touch it with beams.
We all sit by the fire voices singing;
Our paradise, the Mississippi queen.
Captains in the night know our river of dreams;
They guide beautiful sights like the old Delta Queen.
And time cannot erase music ringing;
Our paradise, the Mississippi queen.

– Janice B. Cassidy

Extension Suggestions

~ Career launch

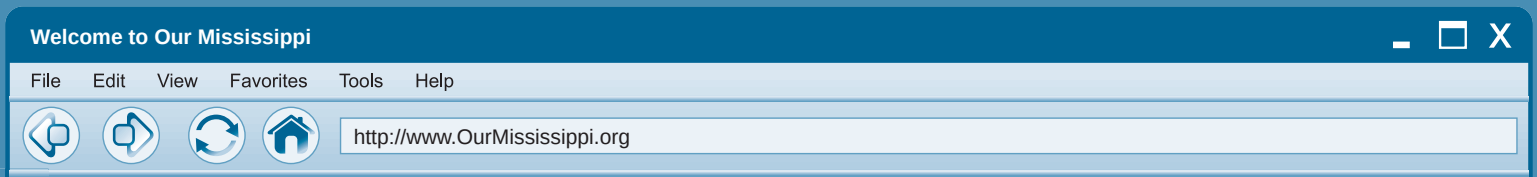
Invite a local **career planner** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Get out!

- Attend a local town hall meeting.
- Attend a local land-use hearing.
- Attend a legislative session at your state capitol building.
- What can your neighborhood do? Set up a meeting with your neighbors to discuss how you can protect your part of the river.

~ Express yourself!

- Ask students to write their state representative expressing their ideas or concerns about the Mississippi River.
- Form or join a debate team at your school.



~ Learn more online

Visit the American Planning Association: Kids and Community (www.planning.org)
Search keywords: **kids and community**

U.S. Army Corps of Engineers Civil Works environmental program has two major focus areas: protection and restoration, and stewardship. Go to www.corpsresults.us/environment/

Read Plotting a Future Course on the Mississippi River: Executive Summary from The McKnight Foundation. Go to www.mcknight.org/environment/env_eval.aspx

Caring for Our River:

Protecting Our Precious Resource

Introduction

The final lesson in this unit encourages environmental stewardship by asking students to take an active part in caring for the river through a service project or designing a service learning opportunity of their own.

STANDARDS CORRELATION

Caring for the river is everyone's responsibility. The Science in Personal and Social Perspectives is the main standard addressed in the activities in this lesson. Students are tasked with environmental stewardship and to "make a difference." They will research and either design or select a service learning project for the class, possibly the school.

Unit 5 goal reminder

Explore what it means to safely share our river

Lesson goal

Adopt a service project or design a service learning project

Lesson objectives

- Research service projects for your class and school
- Do a service project
- Design a science fair project on conservation

Educational standards

- Science in Personal and Social Perspectives
- Fine Arts
- Language Arts

What you'll need

- A guest speaker

How long will it take?

Depending on project selected

What's next!

This is it! Go make a difference!

Background

What is the difference between a service project and a service-learning project? According to the National Youth Leadership Council:

- **Picking up trash on a riverbank is SERVICE.**
- **Studying water samples under a microscope is LEARNING.**
- **When students collect and analyze water samples, document results, and present findings to the community—that's SERVICE LEARNING.**

Both service projects and service learning projects encourage a sense of environmental stewardship. Service learning engages students personally and requires higher-level skills.

According to Learn and Serve America, service learning is a hands-on approach to education that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities.

Service learning projects

Successful service learning projects have three distinct phases: preparation, action, and reflection.

Preparation includes:

- Identifying a genuine community need.
- Cultivating student interest in doing something about it.
- Researching opportunities, solutions and available resources.
- Making clear connections to the curriculum.

Action includes:

- Deciding on a project, which includes ensuring that all students have input into the decision and are willing to support and implement the project.
- Partnering with community organizations.
- Planning the project by developing a work plan.
- Doing the project.

Reflection includes:

- Asking the following questions at each phase of the project:
  - "WHAT" questions: "What are we doing, what have we accomplished, what have we learned?"
  - "SO WHAT" questions: "What difference does/did it make, why should we do it, how is it important, how do we feel about it?"

> "Eight trees will offset the amount of carbon a person releases by simply breathing during an average lifetime."
>
> — M. Sanjayan, lead scientist, Nature Conservancy

Why not plant a few for yourself?

- "NOW WHAT" questions: "What's next, where do we go from here, what has this prepared us for?"

- Engaging in reflective activities such as:

Doing

- Present a Service Fair.
- Make a video or slide show.
- Draw a picture.
- Paint a mural.
- Create a collage.
- Make a scrapbook.
- Perform a skit or play.

Writing

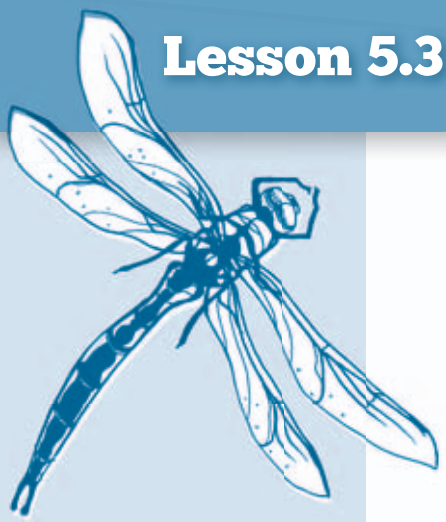
- Write a journal (group or individual).
- Write a news article for a local newspaper or the school newsletter.
- Write thank you notes to all who were involved in the project.
- Write letters to government officials.
- Write a paper about the community need that was addressed through the project.

Sharing

- Present findings to the community.
- Publish a website.
- Speak at community meetings.

Examples of Service Learning

- **Elementary children in Florida** studied the consequences of natural disasters. The class designed a kit for families to use to collect their important papers in case of evacuation with a checklist, tips about rescuing pets, and other advice to make a difficult situation easier, which students distributed to community members.
- **Girl Scouts in West Virginia** investigated the biological complexity and diversity of wetlands. They presented their findings to their Town Council to raise awareness of the issues concerning local wetlands.



Discussion Activity

Grades

5–6

Class or small group activity

2 HOURS

Broken into 30-minute segments over several days, plus time for student research and guest speaker

What you'll need

- A guest speaker

Do This

Ask students what they can do to help the Mississippi River. Depending on time, resources, and level of interest, ask students to choose from a list of service projects or develop a service learning project of their own.

For both service and service learning projects, brainstorm issues that affect the health of the river that students can get involved with. Have the students start with their homes and schools and expand the discussion to their community, state, and region.

Identify needs and opportunities

During the brainstorming session, ask students to identify needs within the community or opportunities to do something beneficial. Challenge them to think of as many ideas as possible. Encourage them to build on each other's ideas, to be spontaneous, to take risks, to think creatively. Then have them try to identify the causes behind each need, as well as some possible interventions.

Brainstorm solutions

Ask students to generate a list of workable solutions by focusing on what can realistically be done. Have each student share what they like about each proposed idea as well as their questions and concerns.

Identify resources

Before making a final decision on which project to do, have students research the resources available to help or support the project. This could include a grant proposal, a business or organization in the community, or parent volunteers. Invite an individual with expertise in the area of interest in order to provide relevant information before a final decision is made.

Decide on a project

Once the class has a list of possible needs and solutions, break them into groups to research the feasibility of their ideas. Have each group present the results to the class and ask them to vote on which project the class should do.

Ideas for projects:

- School or community recycling project
- School or community composting project
- Schoolyard or community garden
- Water quality monitoring
- Species counts
- River or park cleanups
- Schoolyard or park beautification
- Repairing picnic tables, benches, trails, or playground equipment
- Volunteer to make a difference on public lands:
  - Municipal parks
  - State parks
  - Federal parks

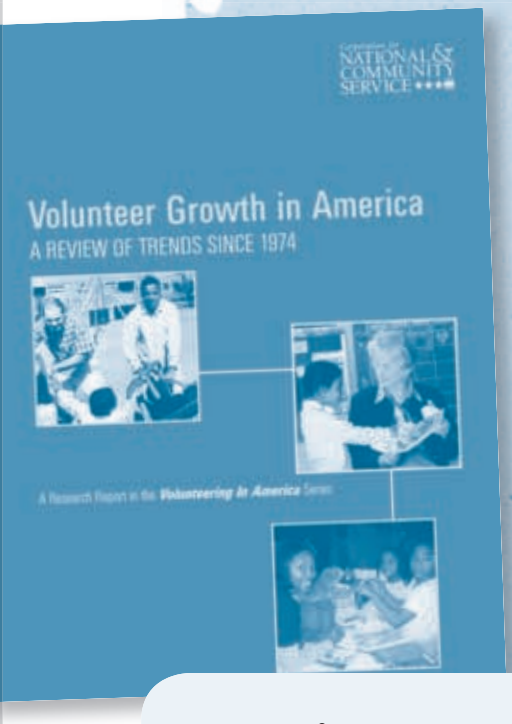
DISCUSSION EXTENSION

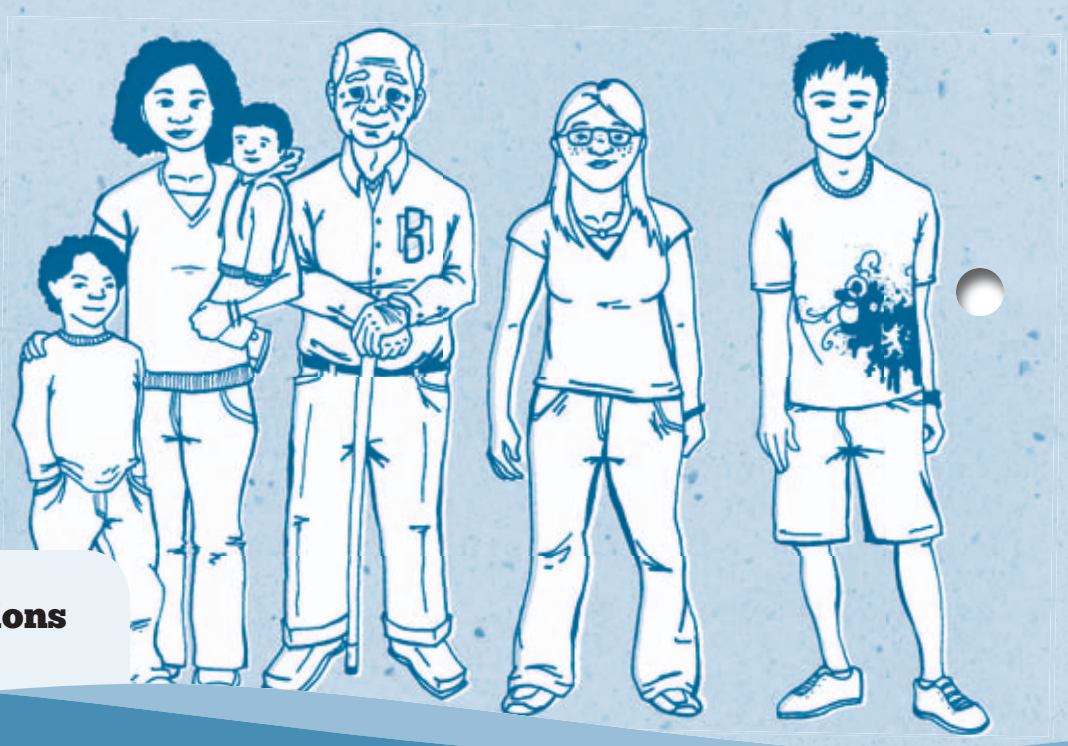
Grades
7–12

Small group activity

To help engage students in the idea of volunteering their time and efforts for a good cause, ask them to read the findings in the excerpt on the next page from "Volunteer Growth in America: A Review of Trends Since 1974," *Volunteering in America* by the Corporation for National and Community Service.

Ask students to work in groups to discuss the findings and hypothesize about the trends described.





Extension Suggestions

~ Career launch

Invite a local **volunteer** to speak to the class. Ask students to research the field and prepare questions in advance. See *A1: Career Launch* on page 312 for career information and professional associations.

~ Get out!

Encourage students to volunteer with groups outside of your school.

~ Express yourself!

Ask students to write a letter to another student describing their service project or service learning experience.

~ Grades K–4 extension

- You are never too young to volunteer! Ask students what they could do to help the river.
- Have students write lyrics to a song that will help them remember the Recycle, Reuse, and Reduce principle.

UNIT 5

Caring for the Upper Mississippi River:

Volunteering in America

Name _____ Date_____

Read, analyze, and hypothesize

1. Read the excerpt below from *"Volunteer Growth in America: A Review of Trends Since 1974," Volunteering in America* by the Corporation for National and Community Service.
2. Review and discuss the findings with your group.
3. Form a hypothesis about the volunteer trends described.

Read below

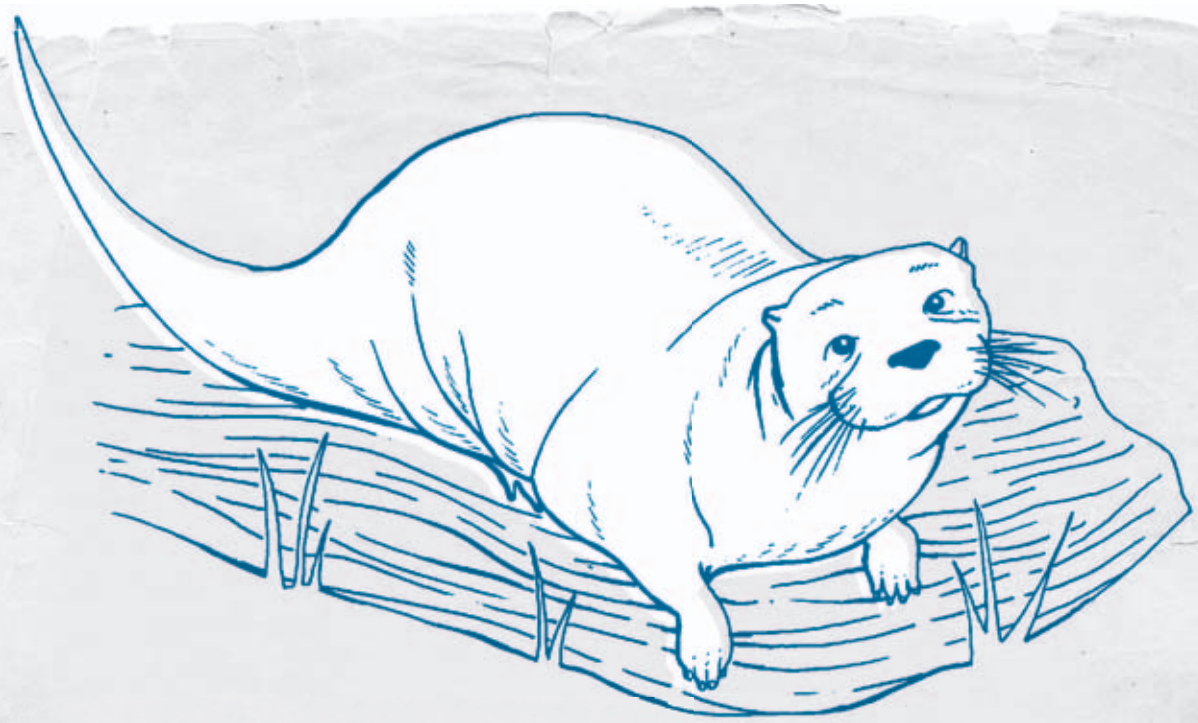
Throughout the history of the United States, Americans have valued an ethic of service. As Alexis de Tocqueville wrote over a century and a half ago, this ethic of service "prompts [Americans] to assist one another and inclines them willingly to sacrifice a portion of their time and property to the welfare of the state."

Today, the ethic remains strong as Americans of all ages donate their time to schools, churches, hospitals, and other local nonprofits in an effort to improve their communities. Every day, people across the country mentor students, beautify neighborhoods, help older Americans to live independently, restore homes after disasters, and much more.

- Volunteering is at a 30-year high.
  - The adult volunteer rate declined by 15% between 1974 and 1989 (23.6% to 20.4%, respectively) but rebounded to a new high today (27%). In fact, the adult volunteering rate increased by more than 32% since 1989.
  - The growth in volunteering has been driven primarily by three age groups: older teenagers (ages 16 to 19); mid-life adults (ages 45 to 64); and older adults (65 years old and over).
  - Volunteering that takes place through an educational or youth service organization had the largest increase between 1989 and today. While 15.1% of all volunteers served through or with an educational or youth service organization in 1989, 24.6% of all volunteers serve through or with an educational organization today, a 63% increase.
- Volunteering among teenagers (ages 16 to 19) has dramatically increased since 1989.
  - While volunteer rates among teenagers declined between 1974 and 1989 (20.9% and 13.4%, respectively), the percentage of teenagers who volunteer more than doubled between 1989 and 2005 (from 13.4% to 28.4%).
  - While the teenage volunteering rate has increased significantly over the last 30 years, teenagers continue to be primarily interested in episodic volunteering (contributing 99 or fewer hours a year). Today, 67.9% of teenagers are episodic volunteers.
  - Teenage volunteers are significantly more likely to serve with educational or youth service organizations today (34.7% in 2005 vs. 26.8% in 1989). In fact, volunteering with religious organizations (30.3% in 2005 vs. 34.4% in 1989) was the most common place that teenagers volunteered in 1989, but it is now the second most popular place for teenager volunteering, behind educational organizations.
  - More teenage volunteers are also serving with social and community service organizations today (12.9% in 2005 vs. 7% in 1989).

1. What volunteering trends does the study describe?

2. What hypotheses (proposed explanations for observable phenomena) can you make based on the information presented?



“True wisdom consists in not departing from nature and in molding our conduct according to her laws and model.”

—Seneca (4 B.C.-C.E. 65), *Moral Essays*

“It were happy if we studied nature more in natural things, and acted according to nature, whose rules are few, plain, and most reasonable.”

—William Penn (1644-1718), *Some Fruits of Solitude*, 1693

“Man has been empowered with reason, with the power to create, so that he can add to what he’s been given. But up to now he hasn’t been a creator, only a destroyer. Forests keep disappearing, rivers dry up, wildlife’s become extinct, the climate’s ruined and the land grows poorer and uglier every day.”

—Anton Chekov (1860-1904), *Uncle Vanya*, 1897

“Man’s unique reward, however, is that while animals survive by adjusting themselves to their background, man survives by adjusting his background to himself.”

—Ayn Rand (1895-1982), *For the New Intellectual*, 1961

“We shall never understand the natural environment until we can see it as a living organism.”

—Paul Brooks, *The Pursuit of Wilderness*, 1971

“For many of us, water simply flows from a faucet, and we think little about it beyond this point of contact. We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports.”

—Sandra Postel, *Last Oasis: Facing Water Scarcity*, 2003

Appendix

Supplemental Material

A1: Career Launch

To find a speaker for the classroom, contact your local chapter of the Professional Association. The rangers from the U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, or your State Department of Natural Resources would be able to speak on many of the topics. Visit the Department of Labor's website for a complete list of occupations at www.occupationalinfo.org.

Anthropologist
Description: Studies human beings and how they behave

Contact: American Anthropological Association (www.aaanet.org)

Archeologist
Description: Studies the past by looking for remains and artifacts left by people who lived long ago

Contact: Society for American Archaeology (www.saa.org)

Biologist
Description: Studies living organisms

Contact: American Institute of Biological Sciences (www.aibs.org)

Botanist
Description: Studies plants, flowers, and plant-like things such as moss and seaweed

Contact: Botanical Society of America (www.botany.org)

Business developer
Description: Identifies new business opportunities

Contact: The Society for Business Development Professionals (www.sbdp.org)

Career counselor
Description: Helps you find your career path

Contact: Your local high school career or guidance counselor

Cartographer
Description: Makes maps

Contact: North American Cartographic Information Society (www.nacis.org)

City planner
Description: Responsible for the city's general plan, zoning, municipal land decisions, and environmental studies

Contact: American Planning Association (www.planning.org)

Civic leader
Description: Leader in municipal affairs

Contact: City, county, or state offices

Climatologist
Description: Studies climate, specifically weather conditions over a period of time

Contact: American Association of State Climatologists (www.stateclimate.org)

Conservation officer or warden
Description: Protects and enforces conservation values and laws

Contact: State Department of Natural Resources

Conservationist
Description: Advocates for the protection of all the species in an ecosystem with a strong focus on the natural environment

Contact local: U.S. Fish & Wildlife Service (www.fws.gov), U.S. Army Corps of Engineers (www.usace.army.mil), or Nature Conservancy (www.nature.org)

Ecologist
Description: Studies living things, their environment, and their interactions

Contact local: U.S. Fish & Wildlife Service (www.fws.gov), U.S. Army Corps of Engineers (www.usace.army.mil), or Nature Conservancy (www.nature.org)

Economist

Description: Studies economic relationships and solution of problems arising from production and distribution of goods and services

Contact: National Association for Business Economics (www.nabe.com)

Employment coordinator

Description: Finds, screens, and interviews potential employees for their organization

Contact: Society for Human Resources Management local chapter (www.shrm.org)

Engineer

Description: Applies scientific knowledge, mathematics and ingenuity to develop solutions for technical problems. Engineers design materials, structures, machines and systems while considering the limitations imposed by practicality, safety and cost. e.g. Hydroelectric engineer

Contact: National Society of Professional Engineers (www.nspe.org)

Farmer

Description: Raises living organisms for food or raw materials

Contact: Local 4-H, FFA (Future Farmers of America), National Farmers Association (www.nfo.org)

Fisherman

Description: Captures fish and other animals from a body of water, or gathers shellfish

Contact local: Commercial Fishermen of America (www.cfafish.org)

Forester

Description: Makes sure that the forest and all the wildlife that lives there is healthy

Contact local: U.S. Fish & Wildlife Service (www.fws.gov), U.S. Army Corps of Engineers (www.usace.army.mil), or Nature Conservancy (www.nature.org)

Geologist

Description: Studies nonliving things the Earth is made of

Contact: Geological Society of America (www.geosociety.org)

Glaciologist

Description: Studies glaciers and their effects on the landscape and our climate

Contact: American Association for the Advancement of Science (www.aaas.org)

Historian

Description: Studies the passage of time and the events that happen within that passage

Contact: American Historical Association (www.historians.org)

Hydrogeologist

Description: Studies the ways that groundwater moves through the soil and rock of the earth

Contact: Geological Society of America (www.geosociety.org)

Hydrologist

Description: Studies the movement, distribution, and quality of water throughout the Earth

Contact: Geological Society of America (www.geosociety.org)

Lock master

Description: Manages canals, locks, and related property

Contact: U.S. Army Corps of Engineers (www.usace.army.mil)

Merchant mariner

Description: Operates and maintains numerous types of watercraft

Contact: National Mariners Association (www.nationalmariners.org)

Microbiologist

Description: Studies bacteria and other micro-organisms

Contact: The American Society For Microbiology (www.asm.org)

Mineralogist

Description: Examines, analyzes, and classifies minerals, gems, and precious stones

Contact: Geological Society of America (www.geosociety.org)

News reporter

Description: Collects and analyzes information about newsworthy events and writes news stories for publication or broadcast

Contact: Society of Professional Journalists (www.spj.org)

Ornithologist

Description: Studies birds

Contact: Ornithological Societies of North America (www.osnabirds.org)

Park ranger

Description: Enforces laws, protects resources, manages facilities, and provides education for visitors on public lands and waters managed by Federal and state governments

Contact local: U.S. Army Corps of Engineers (www.corpslakes.us) or U.S. Fish & Wildlife Service (www.fws.gov)

Sociologist

Description: Researches the structures that organize society, such as race, gender, and social classes

Contact: American Sociological Association (www.asanet.org)

Surveyor

Description: Measures and maps land or a building site to establish boundaries

Contact: National Society of Professional Surveyors (www.nspsmo.org)

Tourism occupations

Description: Information center staff, restaurant staff, hotel staff, recreation equipment, etc. For instance, guides that escort individuals or groups on sightseeing tours or through places of interest

Contact: The World Federation of Tourist Guide Associations (www.wftga.org)

Towboat captain

Description: Pushes water-going vessels (ship, barge, ferry, etc.) to transport passengers, freight, and other cargo

Contact: American Waterways Operators (www.americanwaterways.com)

Water safety specialists

Description: Provides professional open water, surf, and enclosed water rescue services.

Contact: Water Safety Specialist (www.watersafetyspecialists.com) or U.S. Coast Guard (www.uscg.mil)

U.S. Coast Guard member

Description: Protects our maritime economy and the environment, defends maritime borders, and saves those in peril

Contact: U.S. Coast Guard (www.uscg.mil)

Wildlife biologist

Description: Applies the principles of ecology to the conservation and management of wildlife and its habitats

Contact: The Wildlife Society (www.wildlife.org)

A2: Major Tributaries of the Mississippi River

Arkansas River in Arkansas
Big Black River in Mississippi
Big Muddy River in Illinois
Chippewa River in Wisconsin
Crow River in Minnesota
Des Moines River in Iowa
Illinois River in Illinois
Iowa River in Iowa
Kaskaskia River in Illinois
Maquoketa River in Iowa
Minnesota River in Minnesota
Missouri River in Missouri
Ohio River in Kentucky
Red River in Louisiana
Rock River in Illinois
Skunk River in Iowa
St. Croix River in Minnesota and Wisconsin
Wapsipinicon River in Iowa
White River in Arkansas
Wisconsin River in Wisconsin
Yazoo River in Mississippi

A3: Bridge Crossings on the Upper Mississippi River

Bridges over the Mississippi River that have notable engineering or landmark significance. Listed in order from the source of the river to its mouth.

Stone Arch Bridge

Former Great Northern Railway (now pedestrian) bridge at Saint Anthony Falls in downtown Minneapolis.

I-35W Mississippi River Bridge

This bridge collapsed catastrophically on August 1, 2007, killing 13 and injuring over 100. It was replaced by the I-35W Saint Anthony Falls Bridge, which opened in September 2008, ahead of schedule and on budget.

I-90 Mississippi River Bridge

Connects La Crosse, Wisconsin to Winona County, Minnesota, located just south of Lock and Dam No. 7.

La Crosse Rail Bridge

This bridge was one of the first 15 bridges built to cross the Mississippi River. Built in 1876, it is a swing bridge that spans the river between La Crescent, Minnesota, and La Crosse, Wisconsin, and carries Amtrak's Empire Builder train.

Mississippi River Bridge

Also known as the Big Blue Bridges, it is a combination of two individual bridges, the Cass Street and Cameron Avenue Bridges, that cross the east channel of the Mississippi River connecting downtown La Crosse, Wisconsin, to Barron Island.

Black Hawk Bridge

Connects Lansing in Allamakee County, Iowa, to rural Crawford County, Wisconsin, locally referred to as the Lansing Bridge and documented in the Historic American Engineering Record.

Julien Dubuque Bridge

Joins the cities of Dubuque, Iowa, and East Dubuque, Illinois and is listed in the National Register of Historic Places.

Savanna-Sabula Bridge

Truss bridge and causeway that connects the city of Savanna, Illinois with the island city of Sabula, Iowa. The bridge carries U.S. Highway 52 over the river. It is also the terminus of both Iowa Highway 64 and Illinois Route 64. Added to the National Register of Historic Places in 1999.

Fred Schwengel Memorial Bridge

Four-lane steel girder bridge that connects Le Claire, Iowa and Rapids City, Illinois. Completed in 1966.

I-74 Bridge

Originally known as the Iowa-Illinois Memorial Bridge, connects Bettendorf, Iowa and Moline, Illinois.

Government Bridge

Connects Rock Island, Illinois and Davenport, Iowa, adjacent to Lock and Dam No. 15. The fourth crossing in this vicinity, having been built in 1896.

Rock Island Centennial Bridge

A five-arched bridge connecting Rock Island, Illinois and Davenport, Iowa, opened in 1940.

Norbert F. Beckey Bridge

Connects Muscatine, Iowa to Rock Island County, Illinois, became the country's first bridge to use light-emitting diode lights to decoratively illuminate the facade of the bridge.

Great River Bridge

Cable-stayed bridge connecting Burlington, Iowa to Gulf Port, Illinois.

Fort Madison Toll Bridge

Also known as the Santa Fe Swing Span Bridge. At the time of its construction, it was the longest and heaviest electrified swing span on the river. It connects Fort Madison, Iowa and unincorporated Niota, Illinois. Listed in the National Register of Historic Places since 1999.

Bayview Bridge

Cable-stayed bridge bringing westbound U.S. Highway 24 over the river, connecting the cities of West Quincy, Missouri and Quincy, Illinois. Eastbound U.S. 24 is served by the older Quincy Memorial Bridge.

Clark Bridge

Also known as the Super Bridge as the result of an appearance on the PBS program, *Nova*. This cable-stayed bridge connects West Alton, Missouri and Alton, Illinois, was built in 1994, and carries U.S. Route 67 across the river. It is the northernmost river crossing in the St. Louis metropolitan area and replaces the Old Clark Bridge, a truss bridge built in 1928, named after explorer William Clark.

Old Chain of Rocks Bridge

Located on the northern edge of St. Louis, the old Chain of Rocks Bridge is notable for the 22-degree bend that occurs in the middle of the crossing, which was necessary for navigation on the river. This bridge was once part of U.S. Route 66, but is now used only by pedestrians and bicyclists. Vehicle traffic now travels across the river on nearby I-270.

McKinley Bridge

Named for William B. McKinley, CEO of Illinois Traction System Electric Railway. It connected St. Louis, Missouri, to Venice, Illinois, in 1910. In 1978, the railroad line was closed. The bridge closed to all traffic in 2001, but was reopened in 2007.

Martin Luther King Bridge

Formerly known as the Veterans Bridge, this cantilever truss bridge connects St. Louis, Missouri, with East St. Louis, Illinois. It was built in 1951 as a toll bridge. In 1967, the bridge fell into disrepair when the toll-free Poplar Street Bridge opened. In 1968, the bridge was renamed after Martin Luther King, Jr. In 1987, the toll was removed and repairs begun.

Eads Bridge

Combined road and railway bridge, connecting St. Louis, Missouri and East St. Louis, Illinois. When completed in 1874, it was the longest arch bridge in the world, with an overall length of 6,442 ft (1,964 m). The ribbed steel arch spans were considered daring, as was the use of steel as a primary structural material; it was the first such use of true steel in a major bridge project.

Poplar Street Bridge

Officially the Bernard R. Dickmann Bridge, the Poplar Street Bridge was completed in 1967, crossing the Mississippi River between East St. Louis, Illinois, and St. Louis, Missouri, just south of the Gateway Arch. The bridge is crossed by approximately 100,000 vehicles daily, making it the second most heavily used bridge on the river after the Dartmouth Bridge in Minneapolis, Minnesota.

Jefferson Barracks Bridge

Often called the J.B. Bridge, it is a pair of bridges that cross the Mississippi River from St. Louis, Missouri, to Columbia, Illinois. The 909-foot steel arch bridges were built nine years apart, with the first opening in 1983.

Chester Bridge

Truss bridge connecting Route 51 in Missouri with Illinois Route 150, between Perryville, Missouri and Chester, Illinois. The bridge can be seen in the beginning of the 1967 film, *In the Heat of the Night*. In the 1940s, the main span was destroyed by a tornado.

A4: Mississippi River Watershed States Chart

State	Tree	Flower	Mammal	Fish	Bird
Alabama	Longleaf Pine *Pinus palustris*	Camellia *Camellia sp.*	Black bear	Largemouth bass	Yellowhammer
Arkansas	Pine *Pinus echinata*	Apple blossom *Malus domestica*	White-tailed deer		Mockingbird
Colorado	Blue Spruce *Picea pungens*	Rocky Mountain Columbine *Aquilegia caerulea*	Rocky Mt bighorn sheep	Greenback cutthroat trout	Lark Bunting
Georgia	Live Oak *Quercus virginiana*	Cherokee rose *Rosa laevigata*	Marine mammal – right whale	Largemouth bass	Brown Thrasher
Illinois	White Oak *Quercus alba*	Native violet *Viola sororia.*	White-tailed deer	Bluegill	Cardinal
Indiana	Yellow Poplar *Liriodendron tulipifera*	Peony *Paeonia sp.*			Cardinal
Iowa	Oak *Quercus*	Wild rose *Rosa blanda*		(unofficial) Channel catfish	Eastern Goldfinch
Kansas	Cottonwood *Populus deltoides*	Native sunflower *Helianthus annuus*	American buffalo		Western Meadowlark
Kentucky	Yellow Poplar *Gymnocladus dioica*	Goldenrod *Solidago sp.*	Gray squirrel	Kentucky spotted bass	Cardinal
Louisiana	Bald Cypress *Taxodium distichum*	Magnolia *Magnolia grandiflora*	Black bear	White crappie	Eastern Brown Pelican

State	Tree	Flower	Mammal	Fish	Bird
Maryland	White Oak *Quercus alba*	Black eyed susan *Rudbeckia hirta*		Rockfish	Baltimore Oriole
Michigan	Eastern White Pine *Pinus strobus*	Apple blossom *Pyrus coronaria*	White-tailed deer	Brook trout	Robin
Minnesota	Red Pine *Pinus resinosa*	Lady slipper *Cypripedium reginae*		Walleye	Common Loon
Mississippi	Southern Magnolia *Magnolia grandiflora*	Magnolia *Magnolia grandiflora*	White-tailed deer	Largemouth bass	Mockingbird
Missouri	Flowering Dogwood *Cornus florida*	Hawthorn *Crataegus sp.*	Missouri mule	Channel catfish	Bluebird
Montana	Ponderosa Pine *Pinus ponderosa*	Bitterroot *Lewisia rediviva*	Grizzly bear	Blackspotted cutthroat trout	Western Meadowlark
Nebraska	Cottonwood *Populus deltoides*	Goldenrod *Solidago gigantea*	White-tailed deer	Channel catfish	Western Meadowlark
New Mexico	Pinyon *Pinus edulis*	Yucca *Yucca sp.*	Black bear	Cutthroat trout	Roadrunner
New York	Sugar Maple *Acer saccharum*	Rose *Rosa sp.*	Beaver	Brook trout	Bluebird
North Carolina	Pine *Pinus palustris*	Dogwood *Cornus florida*	Gray squirrel	Channel Bass	Cardinal
North Dakota	American Elm *Ulmus americana*	Wild prairie rose *Rosa carolina*	Nokota horse	Northern pike	Western Meadowlark
Ohio	Ohio Buckeye *Aesculus glabra*	Scarlet carnation *Dianthus caryophyllus*	White-tailed deer		Cardinal

State	Tree	Flower	Mammal	Fish	Bird
Oklahoma	Eastern Redbud *Cercis canadensis*	Mistletoe *Phordendron serotinum*	Buffalo	White Bass	Scissor-tailed Flycatcher
Pennsylvania	Eastern Hemlock *Tsuga canadensis*	Mountain laurel *Kalmia latifolia*	White-tailed deer	Brook trout	Ruffed Grouse
South Dakota	White Spruce *Picea glauca*	Pasque flower *Anemone pulsatilla*	Coyote	Walleye	Ring-necked Pheasant
Tennessee	Yellow Poplar *Liriodendron tulipifera*	Purple iris *Iridaceae sp.*	Raccoon	Channel catfish	Mockingbird
Texas	Pecan *Carya illinoinensis*	Bluebonnet *Lupinus subcarnosus*	Texas longhorn	Guadalupe bass	Mockingbird
Virginia	Flowering Dogwood *Cornus florida*	Dogwood *Cornus florida*		Brook trout	Cardinal
West Virginia	Sugar Maple *Acer saccharum*	Rhododendron *Rhododendron sp.*	Black bear	Brook trout	Cardinal
Wisconsin	Sugar Maple *Acer saccharum*	Wood violet *Viola sororia*	Badger	Muskellunge	Robin
Wyoming	Cottonwood *Populus sargentii*	Indian paint brush *Castilleja affinis*	Buffalo	Cutthroat trout	Western Meadowlark

A5: Endangered Species by State

Illinois

Animals	Endangered	Amphipod, Illinois cave (*Gammarus acherondytes*)
	Endangered	Bat, gray (*Myotis grisescens*)
	Endangered	Bat, Indiana (*Myotis sodalis*)
	Endangered	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
	Endangered	Clubshell Entire Range (*Pleurobema clava)*
	Endangered	Dragonfly, Hine's emerald (*Somatochlora hineana*)
	Endangered	Fanshell (*Cyprogenia stegaria*)
	Endangered	Higgins' eye pearlymussel (*Lampsilis higginsii*)
	Endangered	Pink mucket pearlymussel (*Lampsilis abrupta*)
	Endangered	Orangefoot pimpleback pearlymussel (*Plethobasus cooperianus*)
	Endangered	Plover, piping *(Charadrius melodus*)
	Endangered	Pocketbook, fat (*Potamilus capax*)
	Endangered	Snail, Iowa Pleistocene (*Discus macclintocki*)
	Endangered	Sturgeon, pallid (*Scaphirhynchus albus*)
	Endangered	Tern, least (*Sterna antillarum*)
Plants	Threatened	Aster, decurrent false (*Boltonia decurrens*)
	Threatened	Bush-clover, prairie (*Lespedeza leptostachya*)
	Threatened	Daisy, lakeside (*Hymenoxys herbacea*)
	Threatened	Milkweed, Mead's (*Asclepias meadii*)
	Threatened	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
	Threatened	Pogonia, small whorled (*Isotria medeoloides*)
	Threatened	Potato-bean, Price's (*Apios priceana*)
	Endangered	Prairie-clover, leafy (*Dalea foliosa*)
	Threatened	Thistle, Pitcher's (*Cirsium pitcheri*)
Fish	Threatened	Banded Killifish (*Fundulus diaphanus*)
	Endangered	Bigeye shiner (*Notropis boops*)
	Threatened	Blackchin shiner (*Notropis heterodon*)
	Endangered	Bluenose shiner (*Notropis welaka*)
	Endangered	Cypress minnow (*Hybognathus hayi*)
	Threatened	Gravel chub (*Erimystax x-punctatus*)
	Endangered	Greater redhorse (*Moxostoma valenciennesi*)
	Threatened	Iowa darter (*Etheostoma exile*)
	Endangered	Lake sturgeon (*Acipenser fulvescens*)
	Threatened	Longnose sucker (*Catostomus catostomus*)
	Endangered	Pallid shiner (*Hybopsis amnis*)
	Endangered	Pallid Sturgeon (*Notropis anogenus*)
	Endangered	Pugnose shiner (*Scaphirhynchus albus*)
	Threatened	River redhorse (*Moxostoma carinatum*)
	Threatened	Starhead topminnow (*Fundulus dispar*)
	Endangered	Sturgeon chub (*Macrhybopsis gelida*)
	Endangered	Weed shiner (*Notropis texanus*)
	Endangered	Western sand darter (*Ammocrypta clara*)

Iowa

Animals	Endangered	Bat, Indiana (*Myotis sodalis*)
	Endangered	Higgins' eye pearlymussel (*Lampsilis higginsii*)
	Threatened	Plover, piping (*Charadrius melodus*)
	Endangered	Shiner, Topeka (*Notropis topeka*)
	Endangered	Snail, Iowa Pleistocene (*Discus macclintocki*)
	Endangered	Sturgeon, pallid (*Scaphirhynchus albus*)
	Endangered	Tern, least (*Sterna antillarum*)
Plants	Threatened	Bush-clover, prairie (*Lespedeza leptostachya*)
	Threatened	Milkweed, Mead's (*Asclepias meadii*)
	Threatened	Monkshood, northern wild (*Aconitum noveboracense*)
	Threatened	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
	Threatened	Orchid, western prairie fringed (*Platanthera praeclara*)
Fish	Threatened	American Brook Lamprey (*American Brook Lamprey*)
	Threatened	Bluenose shiner (*Notropis welaka*)
	Threatened	Black redhorse (*Moxostoma duquesni*)
	Endangered	Bluntnose darter (*Etheostoma chlorosoma*)
	Threatened	Burbot (*Lota lota*)
	Threatened	Chestnut lamprey (*Ichthyomyzon castaneus*)
	Endangered	Freckled madtom (*Noturus nocturnus*)
	Threatened	Grass pickerel (*Esox americanus vermiculatus*)
	Endangered	Lake sturgeon (*Acipenser fulvescens*)
	Threatened	Orangethroat darter (*Etheostoma spectabile*)
	Endangered	Pallid Sturgeon (*Scaphirhynchus albus*)
	Endangered	Pearl Dace (*Margariscus margarita*)
	Endangered	Pugnose shiner (*Notropis anogenus*)
	Endangered	Weed shiner (*Notropis texanus*)
	Threatened	Western sand darter (*Ammocrypta clara*)

Minnesota

Animals	Endangered	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
	Endangered	Higgins' eye pearlymussel (*Lampsilis higginsii*)
	Threatened	Lynx, Canada (*Lynx canadensis*)
	Endangered	Mapleleaf, winged Entire (*Quadrula fragosa*)
	Threatened	Plover, piping (*Charadrius melodus*)
	Endangered	Shiner, Topeka (*Notropis topeka*)
	Threatened	Wolf, gray (*Canis lupus*)
Plants	Threatened	Bush-clover, prairie (*Lespedeza leptostachya*)
	Endangered	Lily, Minnesota dwarf trout (*Erythronium propullans*)
	Threatened	Orchid, western prairie fringed (*Platanthera praeclara*)
	Threatened	Roseroot, Leedy's (*Sedum integrifolium ssp. leedyi*)
Fish	Threatened	Paddlefish (*Polyodon spathula*)

Missouri

Animals	Endangered	Bat, gray (*Myotis grisescens*)
	Endangered	Bat, Indiana (*Myotis sodalis*)
	Endangered	Bat, Ozark big-eared (*Corynorhinus (=Plecotus) townsendii) ingens*)
	Endangered	Beetle, American burying (*Nicrophorus americanus*)
	Threatened	Cavefish, Ozark (*Amblyopsis rosae*)
	Endangered	Cavesnail, Tumbling Creek (*Antrobia culveri*)
	Threatened	Darter, Niangua (*Etheostoma nianguae*)
	Endangered	Higgins' eye pearlymussel (*Lampsilis higginsii*)
	Threatened	Madtom, Neosho (*Noturus placidus*)
	Endangered	Mapleleaf, winged Entire (*Quadrula fragosa*)
	Endangered	Pink mucket pearlymussel (*Lampsilis abrupta*)
	Endangered	Mussel, scaleshell (*Leptodea leptodon*)
	Endangered	Curtis pearlymussel (*Epioblasma florentina curtisi*)
	Threatened	Plover, piping (*Charadrius melodus*)
	Endangered	Pocketbook, fat (*Potamilus capax*)
	Endangered	Shiner, Topeka (*Notropis topeka*)
	Endangered	Sturgeon, pallid (*Scaphirhynchus albus*)
	Endangered	Tern, least (*Sterna antillarum*)
Plants	Threatened	Aster, decurrent false (*Boltonia decurrens*)
	Threatened	Bladderpod, Missouri (*Lesquerella filiformis*)
	Endangered	Clover, running buffalo (*Trifolium stoloniferum*)
	Threatened	Milkweed, Mead's (*Asclepias meadii*)
	Threatened	Geocarpon minimum (*No common name*)
	Threatened	Orchid, western prairie fringed (*Platanthera praeclara*)
	Threatened	Pogonia, small whorled (*Isotria medeoloides*)
	Endangered	Pondberry (*Lindera melissifolia*)
	Threatened	Sneezeweed, Virginia (*Helenium virginicum*)
Fish	Threatened	Central mudminnow (*Umbra limi*)
	Endangered	Crystal darter (*Crystallaria asprella*)
	Endangered	Flathead chub (*Platygobio gracilis*)
	Endangered	Lake sturgeon (*Acipenser fulvescens*)
	Endangered	Pallid Sturgeon (*Scaphirhynchus albus*)

Wisconsin

Animals	Endangered	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
	Endangered	Dragonfly, Hine's emerald (*Somatochlora hineana*)
	Endangered	Higgins' eye pearlymussel (*Lampsilis higginsii*)
	Threatened	Lynx, Canad (*Lynx canadensis*)
	Endangered	Mapleleaf, winged Entire (*Quadrula fragosa*)
	Endangered	Plover, piping (*Charadrius melodus*)
	Endangered	Wolf, gray (Lower 48 States) (*Canis lupus*)
Plants	Threatened	Bush-clover, prairie (*Lespedeza leptostachya*)
	Threatened	Iris, dwarf lake (*Iris lacustris*)
	Threatened	Locoweed, Fassett's (*Oxytropis campestris var. chartacea*)
	Threatened	Milkweed, Mead's (*Asclepias meadii*)
	Threatened	Monkshood, northern wild (*Aconitum noveboracense*)
	Threatened	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
	Threatened	Thistle, Pitcher's (*Cirsium pitcheri*)
Fish	Threatened	Black buffalo (*Ictiobus niger*)
	Threatened	Black redhorse (*Moxostoma duquesni*)
	Threatened	Blue sucker (*Cycleptus elongatus*)
	Endangered	Bluntnose darter (*Etheostoma chlorosoma*)
	Endangered	Crystal darter (*Crystallaria asprella*)
	Endangered	Goldeye (*Hiodon alosoides*)
	Endangered	Gravel chub (*Erimystax x-punctatus*)
	Threatened	Greater redhorse (*Moxostoma valenciennesi*)
	Threatened	Longear sunfish (*Lepomis megalotis*)
	Threatened	Ozark Minnow (*Notropis nubilus*)
	Threatened	Paddlefish (*Polyodon spathula*)
	Endangered	Pallid shiner (*Hybopsis amnis*)
	Threatened	Pugnose shiner (*Notropis anogenus*)
	Threatened	Redfin shiner (*Lythrurus umbratilis*)
	Threatened	River redhorse (*Moxostoma carinatum*)
	Endangered	Skipjack (*Alosa (Pomolobus) chrysochloris*)
	Endangered	Starhead topminnow (*Fundulus dispar*)
	Endangered	Striped shiner (*Luxilus coccogenis*)

Some species that were once listed as threatened or endangered have recovered enough to be removed from the list, including the bald eagle, peregrine falcon, and brown pelican.

A6: Glossary

Abiotic means non-living, or never having lived. Non-living chemical and physical components in the environment, such as temperature, light, moisture, or air currents. Examples: rocks, soil, sunlight, water, air, and any items made by humans from non-living components, such as brick and cement.

Abolitionism is the movement to end the slave trade and set slaves free.

Abolitionist is one who worked toward the termination of slavery in the United States.

Adaptation is the biological characteristic that improves the chance of survival of an animal and its descendants.

Anthropology is the study of the origins, physical and cultural development, and the social customs and beliefs of people.

Aquifer is a saturated underground rock layer with enough available water to be pumped out or flow from the ground as a spring.

Archeology, also spelled **Archaeology**, is the study of past human culture by the recovery and examination of remaining material evidence, such as burial sites, buildings, tools, and pottery.

Atmosphere is the layer of gases that make up the air around Earth. The air includes gases that plants and animals need to breathe.

BCE is known as Before Common Era.

Bacteria are a large group of single-celled organisms that live in soil, water, organic material, and the bodies of living plants and animals.

Belief is feeling sure that something or someone exists or is true.

Biotic means living or having lived. The organic components in an environment that affect organisms. They consist of plant and animal organisms, both living and dead, as well as the results of their activities, including what they eat and defecate.

Biodegradable is something that can be broken down naturally and then becomes part of the soil, water, or air.

Biodiversity is the number and variety of organisms in a given locality, community, or ecosystem.

Biome is a geographical area that shares the same climatic conditions.

Breeding grounds are the areas where an animal mates and produces offspring.

Bridge is a structure built to span a valley, road, body of water, or other physical obstacle, for the purpose of providing passage over the obstacle.

Carbon footprint is the amount of carbon emitted by something during a given period. It relates to the amount of greenhouse gases produced when fossil fuels are burned.

Carnivore is an animal that eat only other animals.

Carrying capacity is the maximum number of healthy individuals within a species that a habitat can sustain.

CE is known as the Common Era.

Channel is the bed where a natural stream of water flows.

Chronology is the organization of events in order of their occurrence.

Civilization is similar to culture but commonly used to refer to a more complex or advanced form of organized life, including complex social, political, military, and religious values, goals, and practices.

Climate is statistical weather information that describes the variation of weather at a given place for a specified interval. It represents the synthesis of weather; more formally it is the weather of a locality averaged over some period (usually 30 years) plus statistics of weather extremes.

Climate change is often used synonymously with the term global warming; it refers to the long-term changes in the climate of a region. A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans.

Community refers to different populations of species that live and interact together. Several communities live together in an ecosystem.

Confluence is where two or more bodies of water meet together, usually referring to tributaries.

Conservation is the wise use of natural resources in order to ensure continued availability to future generations.

Consumers are members of the food chain that eat other living things. There are four types, or tropic levels, of consumers.

Contaminants enter the Mississippi River untreated from runoff and stormwater drains. Contaminants may include: pesticides, petroleum, toxic metals, industrial chemicals, nitrate and phosphate.

Crest is a high point of an action or process.

Crustaceans are a large group of invertebrates that includes shrimp, crabs, and barnacles.

Culture is a shared set of attitudes, values, goals, and practices that characterizes an institution, organization or group.

Current is a "path" of water or ice that flows in a certain direction.

Decomposers are living things that break down the cells of dead plants and animals into simpler parts, helping to return nutrients to the soil to be used by the primary producers. Decomposers can include fungi (mold), bacteria, and worms.

Detritus are small pieces of organic material from dead and decaying plants and animals.

Drainage basin, also called a watershed, is a region or area of land where water from rain or snow drains downhill into a body of water, such as a river, lake, wetland, estuary, sea, or ocean.

Drainage divide, water divide, divide, or watershed is the line separating neighboring drainage basins (catchments).

Ecological footprint (eco-foot print) is the negative impact that something has on the environment.

Ecosystems are groups of living and nonliving things interacting with and dependent on each other to create a stable, self-sustaining system. They can be as small as a puddle or as large as the Earth itself.

Endangered refers to a plant or animal species that is in immediate danger of becoming extinct and needs protection to survive.

Erosion occurs when rock or soil is loosened and carried off by glaciers, rivers, winds, and waves.

Estuary is a partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. The mix of freshwater and marine environments creates very productive habitats.

Evaporation is the releasing of water back into the atmosphere when it changes from a liquid to water vapor.

Extinct refers to a plant or animal species that is no longer living on earth.

Firn is a snowflake that has lost half of its air and did not completely melt during its first summer. Firn comes from German meaning "of last year."

Flyway is a general flight route used by many migrating bird species between their wintering grounds and their breeding grounds. There are four major migratory flyways in North America: Atlantic, Mississippi, Central, and Pacific Flyways.

Floodplain is flat or nearly flat land next to a stream or river that occasionally or periodically floods.

Flood stage is the established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce.

Food chain is the relationships among organisms in a habitat arranged in order of predation (interactions between predators and prey).

Food web is all the food chains in a particular habitat.

Free negro is a person born to a free African-American woman (the rights of the child were determined by the rights of the mother); rights restricted by laws intended for slaves.

Free states are states that had prohibited the institution of slavery (as of 1836): Indiana, Illinois, Michigan, Ohio, Pennsylvania, Rhode Island, Connecticut, New Jersey, New York, Massachusetts, New Hampshire, Vermont, Maine.

Freed slave is a free African-American who has purchased freedom or was freed by his or her owner.

Fugitive slave is one who flees; a runaway.

Geopolitical boundaries are the political and geographic factors that influence boundaries. Drainage basins have been historically important for determining territorial boundaries, particularly in regions where trade by water has been important.

Glacier is a huge collection of ice that moves slowly across the land. Glaciers form when more snow accumulates than melts. Glacier comes from the Latin word *glacies* meaning ice.

Global warming is the average increase in the Earth's temperature, which causes changes in climate.

Gravity is a force. Every time you jump, you experience gravity. It pulls you back down to the ground. Without gravity, you'd float off into the atmosphere.

Greenhouse gases are gases that trap heat in the atmosphere, much like a greenhouse. Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), and hydrofluorocarbons (HFCs).

Groundwater is water located beneath the ground surface.

Habitat is the place where an animal makes its home and meets all of its needs for survival, including food, water, shelter, and space.

Headwaters or source of a river or stream is the place from which the water in the river or stream begins.

Herbivore is an animal that eat only plants.

Historic is the term used to describe the period of time known about through records, such as written or oral traditions.

Humidity is the amount of water vapor (moisture) in the air.

Igneous rocks form when magma solidifies. Magma is molten rock from deep within the Earth. The chemical composition of the magma and its cooling rate determine the final igneous rock type.

Indicator species is a species whose presence, absence, or relative well-being in a given environment tells us about the health of its ecosystem as a whole. Also called bioindicators.

Invertebrates are animals without backbones, which includes about 95% of all animal species, such as insects, worms, spiders, crustaceans, and mollusks.

Language is a form of communication. Without language, people could not learn from one another across generations and culture could not be transmitted.

Magma is deep within the Earth. It is so hot that some rocks slowly melt and become a thick flowing substance. Some of the magma pushes through vents and fissures in the Earth's surface until a volcanic eruption occurs. Magma that has erupted is called lava.

Metamorphic rocks are rocks that have been substantially changed from their original igneous, sedimentary, or earlier metamorphic form.

Migration is the movement of a species from one place to another, often following a change of season. Migration of people to new areas is usually an attempt to find new opportunities or resources.

Migration route is the path taken during the course of migration by a single bird species. There are four major migratory routes in North America: Atlantic, Mississippi, Central, and Pacific Flyways.

Mollusks are a large group of invertebrates that includes snails, slugs, clams, and mussels.

Niche is the functional role a particular organism plays in an ecosystem. If two species occupy the same niche then competition occurs until one has replaced the other.

Non-renewable resources are non-living resources that do not regenerate themselves.

Ocean is a major body of salt water. About 71% of the Earth's surface is covered by ocean, a continuous body of water that is customarily divided into several principal oceans and smaller seas.

Ojibwe is a group of Native American people from along the Mississippi River and the Great Lakes. Also spelled Ojibwey and Ojibwa. The name is sometimes anglicized as Chippewa.

Omnivore is an animal that eat both plants and other animals.

Organism is an individual living thing, such as a plant, animal, fungus, and bacteria.

Photosynthesis is the process through which green plants make their own food from sunlight, water, and a gas called carbon dioxide.

Phytoplankton are microscopic plants that live in or near the surface of the water.

Plankton are microscopic organisms that live in both salt and fresh water.

Pollution is the contamination of air, water, or soil by substances that are harmful to living organisms, usually caused by human activities.

Population is a group of the same species living in the same place at the same time.

Precipitation in general is the name for freshwater that falls from clouds as rain, hail, snow, or dew.

Predator is an animal that kills and eat other animals.

Prehistoric is a term used to describe the period before recorded history.

Prey are animals that are killed and eaten by other animals.

Producers are organisms, such as plants and algae, that make their own food through photosynthesis.

Recycling is reusing or making a substance available for reuse. For example, when organisms die or produce waste, they become food for decomposers, which break down the organic matter into nutrients that can be used again by producers.

Reservoir is an artificial lake used to store water. Reservoirs are often created by building a reinforced dam.

Riparian habitat is the habitat along the bank of a river.

River mouth is where a river empties into an ocean or other large body of water.

Safe house is a place that provides safe haven for people. Safe houses were part of the Underground Railroad. Their locations were kept secret from all but a limited number of people.

Scavengers are animals that eat dead things.

Sea generally refers to a large body of salt water and is commonly used as a synonym for ocean.

Sediment is the matter that settles to the bottom of a liquid, usually sand, rock, or gravel. Sediment refers to a collection of solid material that gets dragged along with the flow of the river water, and then settles to the riverbed when the flow slows down.

Sedimentary rocks are formed from pieces of pre-existing rocks worn away from weathering and erosion of once-living organisms. Called sediment, these small pieces may be transported and deposited elsewhere by rivers.

Shared resource means sharing an entity by many. At school, you share the playground with other students. The playground is a shared resource.

Settler is a person who has migrated to an area and established residence there.

Settlement is a permanent or temporary community in which people live.

Slavery is a system in which people are the property of others and can be bought and sold.

Slave states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Tennessee, Texas, Virginia, West Virginia, Delaware, Maryland. Slavery was also legal in the District of Columbia.

Social organization is a set of complex systems and institutions developed to meet basic needs, such as family, governments, languages, universities, hospitals, business corporations, and legal systems.

Species is a single kind of living thing. All people are one species. Two organisms of the same species can reproduce.

Spirituals are religious songs which were created by African American slaves. Some believe they were coded with information to help slaves escape.

Stopovers are places where birds stay for a brief time during their migration.

Strata are distinct layers of sediment compressed over time. For example, sand eventually becomes sandstone because of pressure and cementing agents.

Stream flow refers to the amount of water that moves through streams, rivers, and other water channels.

Sustainable means meeting the needs of the present without exceeding the needs of the future.

Threatened means an organism whose population is declining in numbers, but has not yet become endangered. A plant or animal species that is likely to become endangered if it is not protected.

Timeline is a visual representation of the events of a certain era, used as a tool for studying history and culture.

Topography is the study of the shape of physical features of the Earth, such as mountains, valleys, plains, peninsulas, cliffs, rivers, and lakes.

Trade is the voluntary exchange of goods, services, or both. Trade is also called commerce. The original form of trade was barter, the direct exchange of goods and services without using money.

Tradition is the practice of handing down information, beliefs, or customs from one generation to another.

Transportation is the movement of people and goods from one location to another.

Tributary is a stream or river which flows into a main stem river. A tributary does not flow directly into a sea, ocean, or lake. Tributaries and the main stem river serve to drain the surrounding drainage basin of its surface water and groundwater by leading the water out into an ocean or some other large body of water.

Trophic level is the position of an organism in a food chain.

Underground Railroad was an informal network of secret routes and safe houses used by 19th-century African American slaves in the U.S. to escape to free states and Canada with the aid of abolitionists who were sympathetic to their cause.

Value is the idea that something, such as an object, goal, or belief, is valuable or desirable.

Volcano refers to an opening or vent through which the molten rock and associated gases are expelled.

Water cycle is the continuous movement of water on, above, and below the surface of the Earth. Water can change states among liquid, vapor, and ice at various places in the water cycle. Also called the hydrologic cycle.

Watercraft is a vehicle, vessel or craft designed to move across (or through) water, including saltwater and freshwater, for pleasure, recreation, physical exercise, commerce, transport, and military missions.

Watershed is a region or area of land where water from rain or snow drains downhill into body of water, such as a river, lake, wetland, estuary, sea, or ocean. Also called a drainage basin.

Weather is the day-to-day state of the atmosphere, and its short-term (minutes to weeks) variation. Popularly, weather is thought of as the combination of temperature, humidity, precipitation, cloudiness, visibility, and wind.

Wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water.

Zooplankton are microscopic animals that eat other plankton, such as phytoplankton.

A7: Education Standards

The planning chart in Appendix 8 shows which activities and lessons are associated with which standard.

NATIONAL STANDARDS	ILLINOIS	IOWA
	http://www.isbe.state.il.us/ils/	http://www.corecurriculum.iowa.gov/Home.aspx
Science		
Science Standards *(Grades 5–8)* National Committee on Science Education Standards and Assessment • Science as inquiry • Physical science • Life science • Earth science • Science and technology • Science in personal and social perspectives • History and nature of science	**Science** *(Grades K-12)* • Inquiry and design • Concepts and principles • Science, technology and society	**Science** *(Grades 5-6)* • Science as inquiry • Physical science • Life science • Earth and space science
Math		
Math Standards *(Grades 6–8)* National Council of Teachers of Mathematics • Numbers and operations • Algebra • Geometry • Measurement • Data analysis and probability • Problem solving	**Math Standards** *(Grades K-12)* • Applications of learning • Solving problems • Communicating • Using technology • Working on teams • Making connections	**Math** *(Grades 5-6)* • Number and operations • Algebra • Geometry and measurement • Data analysis and probability
Social Science		
Social Science Standards *(Grades K-12)* National Council for the Social Studies • Civics • Economics • Geography • History	**Social Studies** *(Grades K-12)* • Political systems • Economics • History • Geography • Social systems	**Social Studies** *(Grades 5-6)* • Political science and civic literacy • Behavioral science • Economics • Geography • History

MINNESOTA	MISSOURI	WISCONSIN
http://education.state.mn.us/mde/Academic_Excellence/Academic_Standards/index.html	http://dese.mo.gov/standards/content.html	http://dpi.wi.gov/standards/applying.html
Science *(Grade 5)* • The nature of science and engineering • Physical science • Earth and space science • Life science *(Grade 6)* • The nature of science and engineering • Physical science	**Science** *(Grades K-12)* • Physcial science • Life science • Earth science • Scientific inquiry • Impact of science, technology and human activity on resources and the environment	**Science** *(Grades 5-6)* • Clarity and specificity • Advanced science content • Examples of science in Wisconsin • Connectedness • Continuity • Safety
Math *(Grades 5–6)* • Number and operation • Algebra • Geometry and measurement • Data analysis	**Math** *(Grades K-12)* • Numbers and operations • Geometric and trigonometry • Data analysis, probability and statistics • Mathematical systems • Discrete mathematics	**Math** *(Grades 5-6)* • Connections • Problem solving • Reasoning • Communication • Technology
Social Studies *(Grades 5-6)* • Government and citizenship • Economics • Geography • United States history • Minnesota history • World history • Historical skills	**Social Studies** *(Grades K-12)* • Civics • History of Missouri, the United States, and the world • Social science inquiry • Economic concepts and principles • Geography • Relationships of the individual and groups to institutions and cultural traditions	**Social Studies** *(Grades 5-6)* • Definition of social studies • Knowledge and skills • Connections in social studies

NATIONAL STANDARDS	ILLINOIS	IOWA
Fine Arts		
Fine Arts Standards *(Grades 5–8)* Consortium of National Arts Education Associations • Visual media • Music • Drama • Dance	**Fine Arts** *(Grades K-12)* • Language of the arts • Creating and performing • Arts and civilization	**Fine Arts** *(Grades 5-6)* NA
Language Arts		
Language Arts Standards *(Grades K–12)* National Council of Teachers of English • Reading for perspective • Understanding the human experience • Evaluation strategies • Communication skills • Communication strategies • Applying knowledge • Evaluating data • Developing research skills • Multicultural understanding • Participating in society • Applying language skills	**Language Arts** *(Grades K-12)* • Reading • Literature • Writing • Listening and speaking • Research	**Literacy** *(Grades 5-6)* • Reading • Writing • Speaking • Listening • Viewing essential concepts and skills

MINNESOTA	MISSOURI	WISCONSIN
The Arts *(Grades 5-6)* • Dance • Music • Theater • Visual arts	**Visual and Performed Arts** *(Grades K-12)* • The principles and elements of different art forms • Interrelationships of visual and performing arts and the relationships of the arts to other disciplines • Historical and cultural contexts	**Fine Arts** *(Grades 5-6)* NA
Language Arts *(Grade 5)* • Reading and literature • Writing • Speaking, listening and viewing *(Grade 6)* • Reading and literature • Writing • Speaking, listening and viewing	**Communication Arts** *(Grades K-12)* • Speaking and writing standard english • Reading and evaluating • Reading and evaluating nonfiction works and material • Writing formally and informally • Formal and informal presentations and discussions of issues and ideas	**Language Arts** *(Grades 5-6)* • Language arts: A developmental subject • Great authors and literary works • Connectedness

A8: Planning Chart

Unit 1 Goal:
Introduce students to the Mississippi River Watershed and explore how it made its mark on the country's ecosystems and commerce.

1.0 Introduction to the Mississippi River Watershed	Learn why the Mississippi River Watershed is considered one of the world's greatest river systems	• Introduce the Mississippi River Watershed • Discover some interesting facts about the watershed • Identify your state in the watershed	Page 6	• Geography • Earth Science • Language Arts	• Pre-assessment • Introduce wall map • Word search
1.1 Movers and Scrapers: Upper Mississippi Glaciations	Learn how the Mississippi River Watershed was formed by the movement of glaciers	• Define geographic terms related to the formation of the Mississippi River • Demonstrate how the Mississippi River was formed • Demonstrate glacial erosion	Page 17	• Physical Science • Earth Science • Social Studies-Geography • Language Arts	• Demonstrate glacial erosion
1.2 Built from the Bottom Up: Sediment Strata	Learn why the Mississippi River is constantly changing	• Define geographic terms related to the formation of the Mississippi River • Explain and discuss the rock cycle • Demonstrate how sediment is formed	Pages 25	• Social Studies-Geography • Earth Science • Language Arts	• Create sediment bottles
1.3 Going with the Flow: Ups and Downs of the Water Cycle	Learn the many ways the water cycle affects the Mississippi River	• Define geographic terms related to the Mississippi River water cycle • Discuss the water cycle • Identify some of the impacts of the water cycle on the river	Pages 33	• Earth Science • Physical Science • Science in Personal and Social Perspectives • Language Arts	• Do an evaporation experiment
1.4 One Trunk with Many Branches: Mapping the Mississippi River Watershed	Learn the importance of the Mississippi River Watershed and the communities located along the Upper Mississippi River	• Define geographic terms related to the Mississippi River • Identify states, tributaries, and major cities along the Upper Mississippi River • Discuss the impact of the waterways on people and commerce	Page 43	• Physical Science • Life Science • Math • Geography • Language Arts	• Map usage and legend creation

Unit 2 Goal: Explore the ecosystems of the Mississippi River and how humans affect them					
2.0 Introduction to Upper Mississippi River Ecosystems	Introduce students to the ecosystems of the Mississippi River	• Define terms related to ecosystems of the Mississippi River • Study the ecosystems of Upper Mississippi River floodplain • Investigate biotic and abiotic components outside	Page 62	• Science as Inquiry • Life Science • Science in Personal and Social Perspectives	• Pre-assessment • Explore Your Ecosystem - outside
2.1 At Home in the River: Plants, Animals, and Habitats of the Upper Mississippi River	Understand how living things are connected to their environment	• Define terms related to ecosystems of the Mississippi River • Research species connections in a food web • Understand the importance of indicator species • Care for tadpoles in an aquarium and record their development	Page 75	• Life Science • Science in Personal and Social Perspectives • Fine Arts • Language Arts	• Food Chain Checkers • Raising Tapoles
2.2 Just Passing Though: Bird Migration and the Mississippi River Flyway	Understand why the Mississippi Flyway is a major migration route for birds	• Define terms related to ecosystems of the Mississippi River • Research migration routes and identify stopovers • Create a flyway in your classroom • Prepare for a birdwatching field trip • Go birdwatching	Page 89	• Life Science • Science in Personal and Social Perspectives • Geography • Fine Arts • Language Arts	• Create a classroom flyway • Bird watching field trip
2.3 Well River Check-up: Assessing the Health of the River	Understand we all use and reuse the same water	• Understand point and non-point pollution • Examine the effects of detergents and fertilizers on aquatic life • Test for dissolved oxygen in water samples • Determine the relationship between pollutants and dissolved oxygen in water • Collect and interpret data	Page 103	• Physical Science • Life Science • Science in Personal and Social Perspectives	• Virtual car wash • Phosphates in your water
2.4 Life on the Brink: Endangered Species of the Upper Mississippi River	Learn how we can help endangered species that depend on the Upper Mississippi River	• Define terms related to ecosystems of the Mississippi River • Identify endangered species in your local area • Design and plant and school wildlife garden	Page 117	• Physical Science • Life Science • Science in Personal and Social Perspectives • Geography	• Identify endangered species • Create a wildlife garden
2.5 Mississippi River Sustainability: How to Make a Positive Impact on Your Environment	Learn how we can make a positive impact on their environment	• Define terms related to ecosystems of the Mississippi River • Discuss the effect humans have on the environment • Identify conservation ideas for school and home	Page 122	• Physical Science • Life Science • Science in Personal and Social Perspectives	• Read and comprehend • Calculate your eco-footprint

Unit 3 Goal: Learn how communities and cultures develop and evolve to form civilizations					
3.0 Introduction to Mississippi River History and Culture	Understand our own traditions and culture	• Discover your family culture • Identify your family traditions • Investigate how technology influences or changes traditions	Page 134	• Social Science • Language Arts	• Pre-assessment • Write about your culture
3.1 Mississippi River's Ancient Civilizations	Learn about ancient Americans living along the Mississippi	• Explore early American civilizations • Discover their customs and cultures • Compare their cultures to yours	Page 149	• Social Science • Fine Arts • Language Arts	• Express yourself through poetry
3.2 Where Worlds Meet: Early European Exploration	Learn how new European settlements started along the Mississippi River	• Identify explorers of the Mississippi River and their sponsoring countries • Discuss why many countries wanted to claim the Mississippi River • Explain the importance of the Louisiana Purchase	Page 159	• Social Science • Fine Arts • Language Arts	• Plot the routes of early European explorers
3.3 Louisiana Purchase: Gateway to the Western Frontier	Understand the Mississippi River's role in the Louisiana Purchase	• Review the importance of the Louisiana Purchase • Discuss the significance of Zebulon Pike's expedition on the Mississippi River • Compare and contrast the Lewis and Clark and the Zebulon Pike expeditions	Page 169	• Social Science • Math • Fine Arts • Language Arts	• Plan river trip like Zeb Pike
3.4 Rivers of Human Migration: Settlement, Transportation, and Trade	Learn why people migrate and the river's role in migration	• Explore reasons for human migration • Research your state • Identify geographic characteristics that influenced migration and settlement	Page 181	• Social Science • Fine Arts • Language Arts	• Views of the Valley of the Mississippi • Ask the Expert • Americans on the Move
3.5 Mississippi River: Pathway to Freedom	Learn the role of the Mississippi River in the Underground Railroad	• Learn about key people in the Abolitionist Movement and the Underground Railroad • Discover the routes of the Underground Railroad • Become a railroad "rider"	Page 199	• Social Science • Fine Arts • Language Arts	• Plan an Underground route

Unit 4 Goal: Explore the Mississippi River at work and how it has changed over time					
4.0 Introduction to the Mississippi River at Work	Research river-related occupations on the Mississippi River	• Introduce the Mississippi River at work • Identify river occupations • Discuss the river's role in these occupations • Write about an occupation of your choosing	Page 212	• Social Sciences • Fine Arts • Language Arts	• Pre-assessment • Research river-related occupations
4.1 Early Navigation: Powered by People	Explore what river navigation was like before the Age of Steam	• Compare watercrafts used before steamboats • Understand how early watercrafts were navigated • Build a flatboat	Page 227	• Social Science • Fine Arts • Language Arts	• Create new verses to Row, Row, Row your Boat • Make a flatboat
4.2 All Aboard the Steamboat Era: Steam Powers a New Economy	Learn how the steamboat changed travel and commerce on the river	• Introduce the steamboat • Discuss how the steamboat revolutionized river commerce • Use maps to navigate the river • Demonstrate the power of steam	Page 235	• Science • Social Science • Fine Arts • Language Arts	• Create steam power • Make the Twain
4.3 River Running Dry, River Running High: Major Floods on the Upper Mississippi River	Understand the natural cycles of flooding and drought on the Upper Mississippi River	• Discuss causes of flooding • Identify major floods along the Mississippi River • Research what kind of technology was used after each major flood • Produce news article and broadcast	Page 249	• Science • Social Studies • Fine Arts • Language Arts	• Produce a news broadcast
4.4 Controlling the River: Locks and Dams on the Upper Mississippi River	Learn how locks and dams make it possible to navigate the Upper Mississippi River	• Explore how locks and dams changed the river • Discuss the impact on wildlife • Watch how a lock works	Page 261	• Science • Social Studies • Fine Arts • Math • Language Arts	• Water equilibrium
4.5 To Market! To Market!: Our Inland Waterway System	Understand the river's role as a vital economic interstate	• Research which products go up the river and which ones down • Compare modes of transportation via river, rail, and road • Create a virtual trip from the Atlantic Ocean through the Saint Lawrence Seaway to the Gulf of Mexico • Read a navigational chart	Page 273	• Science • Social Studies • Math • Fine Arts • Language Arts	• Create a virtual trip on the river

Unit 5 Goal: Explore what it means to safely share the Upper Mississippi River					
5.0 Introduction to A Shared Resource - Our Mississippi River	Explore how to safely share this resource	• Define shared resource • Investigate Mississippi River issues and concerns • Discuss how we share this resource and the students' responsibilities in protecting it	Page 280	• Life Science • Science in Personal and Social Perspectives	• Pre-assessment • Investigate river issues & concerns
5.1 Sharing Our River: One River, Many Uses - Playing it Safe on the Mississippi	Learn how to share the river safely	• Research the different types of water safety • Identify keys elements of water safety • Teach younger kids in your school about water safety	Page 285	• Science in Personal and Social Perspectives • Fine Arts • Language Arts	• Create water safety poster • Teach younger students boating safety
5.2 Managing Our River for Everyone: Competing Views and Values	Discuss ideas for how to sustainably manage the river for multiple uses	• Identify issues facing communities • Understand different points of view • Brainstorm ideas • Problem-solve solutions	Page 295	• Life Science • Science in Personal and Social Perspectives • Social Science • Fine Arts • Language Arts	• Create a new town after a flood • Discuss at a mock town hall meeting
5.3 Caring for Our River: Protecting Our Precious Resource	Adopt a service project or design a service learning project	• Research service projects for your class and school • Do a service project • Design a science fair project on conservation	Page 301	• Science in Personal and Social Perspectives • Fine Arts • Language Arts	• Research service-learning projects and choose one

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