



Just Around the Bend Lesson Plan

Overview

In this lesson, students use satellite images of the Missouri River to think about agriculture, irrigation, and pollution. Students will decipher landforms on a map and corresponding satellite imagery as they ponder the impact that pollution might have on agriculture, irrigation, ground water and river water. Students are given the opportunity to view photos of recent environmental disasters involving oil spills, and to think about possible sources of pollution in the water systems in their own communities. This lesson sets the stage for the subsequent lesson entitled [The Pollution Patrol](#), in which students will use mathematical tools (number lines, scales, distances and directions) as they work on a hypothetical story in which they try to prevent a possible source of pollution from contaminating the Missouri River.

Suggested Lesson Sequence	Please see the Maps and More and Earth Systems and Humans module descriptions.
Lesson Level	Intermediate
Science Connections	<ul style="list-style-type: none"> Students investigate the water cycle and possible sources of water pollution. Students investigate how land is cultivated for agriculture.
Math Connections	<ul style="list-style-type: none"> Students will explore pattern recognition and representation using maps and images. Students will develop spatial sense using maps and images.
Technology Connections	<ul style="list-style-type: none"> Students will examine and interpret satellite imagery of the Earth. Students will use a computer to compare a satellite image with a map.
Human Connections	<ul style="list-style-type: none"> Students will investigate the importance of irrigation to the farmer's way of life. Students will recognize the role humans play in keeping our environment free from contamination.
Lesson Assessment	<ul style="list-style-type: none"> Assessment and Standards Table (Word) Assessment Activity Description Authentic Assessment

Materials

Powerpoint Reader ([Windows](#) / [Mac](#)) and [Adobe Reader](#)

Riverbend Map ([Acrobat](#)) - also used in the lesson [Pollution Patrol](#)

Riverbend Image ([Acrobat](#))

Just Around the Bend activity sheet ([Word](#))

Water Pollution photo essay ([Powerpoint](#)) to be viewed and read together as a class

Vocabulary

Note: Students may be unfamiliar with vocabulary words that occur throughout the activity sheet of this lesson. This is done intentionally, to spur additional conversations and discussion about these words and their meanings. Encourage your students to ask about words that may be new to them.

Irrigation: watering a large field of crops or grasses using an underground or surface water source. Irrigation allows for crops to be grown that need more water than what comes from rainfall. A field under irrigation is called an *irrigated* field.

Agriculture: the science or art of cultivating, or working, soil to produce crops or raise livestock. In this lesson, the agricultural fields shown are used to produce crops for humans and animals to eat.

Kilometer: a metric unit of distance that is shorter than a mile. In fact, 5 kilometers equals approximately 3 miles. A kilometer is one thousand meters long. Kilometer can be abbreviated using the letters "km".

Pollution: contamination of the environment with a human-made product or waste. Pollution can affect the air, water, plants, animals, and humans because all of these things are connected together.

Peninsula: a portion of land that is nearly surrounded by water.

Sheen: a thin layer of oil usually found floating on the surface of water.

Boom: a floating "wall" on the surface of the water that is designed to act as a barrier to oil.

Procedure

I. Assessing Prior Knowledge

Teachers should introduce this lesson by telling the class that they are going to spend the next few days (i.e., a series of lessons) on an imaginary camping trip at the Riverbend Campsite, situated next to the Missouri River. At this campground, there are many things to explore -- nature walks, river activities, and large agricultural fields nearby, many of which are watered every day by enormous rotating sprinklers in the center. This lesson focuses in particular on ground water irrigation. The following questions will prepare students for the ideas that will be explored during the lesson.

- Where is the Missouri River located?
- Do any of the students have small rotating sprinklers at home that they use to water the lawn? How do they work? What is the shape of the area of the grass that the rotating sprinklers water?
- Have students ever seen large agricultural fields? Perhaps from the window of an airplane?
- How might larger rotating sprinklers be used to water (irrigate) farm crops?
- How do you think pollution impacts the Earth and farming? Why might water pollution be bad?

II. Contextual Preparation

Distribute the [Riverbend Image](#), or display the image on a computer screen or with a computer projection device. This image captures a stretch of the Missouri River as it flows through an agricultural region. After allowing the students time to study this beautiful image, lead a discussion around the following question:

- What kinds of landforms can you see on the surface of the Earth?

Allow students time to simply explore the image, noting in particular all the different kinds of landforms they see. This might include the river itself, agricultural fields, tributaries and other small streams, sandbars under the surface of the water, rough sections of the shoreline, etc. Teachers should review the words in the vocabulary list.

III. Student Activities

1. Teachers should now distribute the Just Around the Bend [activity sheet](#), as well as the [Riverbend Map](#). The maps and images can be viewed on the computer or printed in hard copy. The activity sheet is designed to lead students through a careful examination of the image and map - one a human creation, and the other an actual image taken from space. It is important to help students understand the differences between these two maps, particularly the way that Riverbend Map is a replication of the actual landforms captured in Riverbend Image. The Riverbend Map will be used again in the lesson [Pollution Patrol](#).

In order to complete the questions on the activity sheet, students will also need to view the [Water Pollution Photo Essay](#). You may choose to show the photo essay at the beginning or end of the activity sheet. This provocative series of photographs and commentary helps students recognize the dangers of water pollution. The photo essay and the Riverbend Map will be used again in the following lesson, [Pollution Patrol](#).

Responses and background information for the activity sheet:

- Question #1: help students note the river itself, agricultural fields, colors of plants on the ground, tributaries and other small streams, sandbars under the surface of the water, rough

sections of the shoreline, etc.

- Question #2: Emphasize the different shapes of the fields, as this will become more important in subsequent questions - circular fields vs. rectangular fields. You may pause to ask students to hypothesize why the fields are different in shape. They will visit this topic specifically in the coming questions. The unlabeled agricultural plots are primarily circular, and they sit between the s-curve of the river.
- Question #3: Answers may vary. Unfarmed. The land looks rough, not uniform in color or shape. If it were farmed it would be bright green or brown, circular or rectangular in shape.
- Question #4: Answers will vary. There are approximately thirty-eight circular fields. The circular fields are closest to the river. Encourage students to think critically about the fields relative to their proximity to the river.
- Question #5: Students should make the connection that much of the ground water in the area comes from river water that has been drawn from the river itself into the water table.
- Question #6: Hopefully students will realize that the quantities of ground water will be much greater the closer one is to a large source of water like the Missouri. In these more remote (relative to the river) pieces of ground, there are not adequate sources of ground water to irrigate. Fields of crops in these areas depend on rainfall as the primary source of water.
- Questions 7-8: Hopefully students are recognizing the connection between pollution and irrigation and, ultimately, crop growth and consumption. That is, polluted river water infiltrates the ground water, which is then used to irrigate. Plants then absorb this contaminated water through their root systems, thereby also contaminating food products.
- Question #9: Encourage students to think deeply about natural water sources in their communities, or natural water sources that *might* have been there years ago before the area was developed. In particular, help them identify possible sources of pollution in the area, and ways that they might contribute to keeping the water system in the area free from pollutants. This discussion might lead nicely into one of the extension activities described below.
- Question #10: Answers will vary. However, students should be informed of the dangers of swimming or rafting in polluted waters. The plant and animal life will not be as abundant or healthy near polluted waters and the sights, sounds, and smells of polluted water will negatively affect the quality of the environment.

IV. Assessment

The following task might be used to assess students' understandings of the objectives of this lesson.

- Draw a diagram, along with an accompanying description, that traces how a source of pollution

(e.g., industrial waste products, gasoline, pesticides, etc.) could eventually end up in a food source to be consumed by animals (including humans).

Lesson Extensions for Authentic Assessment

- There are numerous websites on the Internet that contain very useful and interesting information about the impact of pollution on the water cycle. One such website can be accessed through the following URL: <http://response.restoration.noaa.gov/index.html>. As a class, explore the images and information contained within this site. In addition to being an excellent source of information (and background) for this lesson, there are additional lesson plans within the site that could also be pursued independently of the ESC curriculum (either as a class, or by individual students).
- Explore a natural water source in your community. This could be a small creek, lake, river, etc. Encourage the students to think about where the water originated (what are the sources that feed this water), as well as where this water will eventually go. As part of the experience, students could bring trash bags and collect garbage near the water that could contaminate the water source.
- Discuss with students the different ways that crops are cultivated. The discussion might revolve around the following questions: What tools do farmers use when cultivating crops? What chemicals do farmers use when cultivating crops? Why are some crops irrigated while other crops get water only from rain? What crops are grown in your state? Are there any crops that are grown in your county? Your backyard? Ask students to show one food item from their lunch sack. Where did that food item come from? What crops were grown to produce that food item? It may be fun to open a U.S. or World map and point out where the crops for the various lunch foods were produced.