

RESOURCE LIBRARY
ACTIVITY : 45 MINS

A River Puzzle

Students brainstorm how land is used along a river in their watershed. They arrange pieces representing places along a river from source to mouth, and discuss impacts "downstream" in a watershed.

GRADES

4 - 12+

SUBJECTS

Biology, Ecology, Earth Science, Engineering, Geography, Human Geography, Physical Geography, Social Studies, Civics, Economics

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OVERVIEW

Students brainstorm how land is used along a river in their watershed. They arrange pieces representing places along a river from source to mouth, and discuss impacts "downstream" in a watershed.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/river-puzzle/>

DIRECTIONS

1. Have students brainstorm human-environment interactions along a river.

To help students access prior knowledge, have them imagine different scenes they might see along a river. Ask: *What kinds of land and land use might you see along a river from beginning to end?* (Ideas may include cities, wilderness, farms, fishing areas, factories, and homes.) List

students' ideas on the board.

Next, help students see how humans and the environment are linked along rivers. Have students fold a sheet of paper to make three columns. Have them title the first column "Land Use by Rivers," the second "Impacts on Humans," and the third "Impacts on the Environment." In pairs or small groups, have students list 8-10 land use types from the board, then fill in the remaining columns with their ideas. Work through a couple of examples together as a class. For example, for "cities," the impact on humans might be "flooding of the river could cause damage" or "the river is a peaceful place to watch wildlife"; the impact on the environment might be that "trash and other pollution can be washed into the river." For "farms" the impact on humans might be "Water is available for crops"; an impact on the environment might be "fertilizers run off into the river."

2. Have students arrange the River Puzzle pieces.

Give each pair of students the River Puzzle handout, and have them cut along the lines to make the pieces. Looking at their brainstorming ideas, the notes you wrote on the board, and the puzzle pieces, have students add to their list any new ideas for land use along a river. Have each team place the "source" piece, the beginning of a river, near the top of a large sheet of construction paper and the "mouth" piece, the river's end, near the bottom. Each pair then arranges the remaining pieces to show how they imagine a typical river flows.

3. Have students share their rivers.

Have each pair join with another pair of students and have them compare their rivers, describing why they arranged them the way they did. Students can rearrange pieces if they'd like. Then, have a whole class discussion with volunteers sharing their river flow. Help students think about where rural, urban, and suburban land uses are typically located. Pairs can have one more opportunity to move the puzzle pieces around until they're satisfied. Ask students to tape the river to the construction paper.

4. Have students discuss impacts of human activity on a river.

Discuss as a class how different activities or land uses along a river could affect people, animals, and plants downstream—in the direction of, or closer to, the mouth. Write the following questions on the board as prompts:

- *In what ways do people use rivers?*
- *Which activities in a riverside town could affect the river?*
- *Where along a river would water be clean for swimming or fishing?*
- *How might farming affect the water in a river?*
- *How might building a dam or water treatment plant affect a river?*
- *What could happen to a river when a factory is nearby?*

5. Have students reflect on the path of a river from source to mouth.

Ask each student to complete his or her reflection on a piece of paper. You may want to collect students' reflections to assess their understanding of the topic.

Have younger students imagine being a drop of water moving along the river they created. Ask what the drop would experience on its journey. Prompt students to describe sights in and out of the water, smells, water temperature, and more. How would people's actions affect the drop of water?

Have older students envision a boat ride down the river from the source to the mouth, describing sights, sounds, smells, human impacts and modifications to the land, and other characteristics observed on the journey.

Tip

Consider cutting and laminating sets of puzzle pieces ahead of time so they can be used again.

Modification

If time permits, let students draw additional puzzle pieces for human impacts from their initial brainstorming.

Tip

Note that the diagram does not include tributaries to the river or represent activities in the entire watershed that could affect the health of the river.

Tip

This activity may lead to research by students to determine the purpose of water treatment and sewage treatment plants and how they work.

Informal Assessment

For the puzzle sequence, there is no one correct answer. Student answers will vary. The activity presents an opportunity for discussion about land use and how one activity can influence others. A typical sequence of land use along a river is as follows:

1. source
2. camping
3. fishing
4. dam
5. power plant
6. paper mill
7. trees
8. farming
9. farming with cows
10. water treatment plant
11. wetland with ducks
12. kids on playground
13. suburban housing

14. megalopolis
15. factory
16. sewage treatment
17. wetland
18. river extension
19. mouth

While there is no one right answer to this model, there are some incorrect ordering of pieces to consider in assessing student work. Inappropriate sequences can reveal a misunderstanding of the stream as a dynamic system. Reinforce this by asking which way the water is flowing—from a higher elevation to a lower elevation—and how you can tell.

Consider working with students to list criteria for a good river system model and then make that into a scoring guide. Key scoring points: The order of pieces should represent appropriate topography. There should not be mountains or fast-running brooks shown near the mouth of the river. Port facilities for large ships are found where the river widens and slows to meet the sea. Human use of the stream is influenced partly by the size of the stream and rate of flow, so whitewater rafting is upstream while fishing would typically be downstream or where the river becomes wide and flat because of a dam. Both discharging pollution and withdrawing water from the stream for drinking systems, industry, or irrigation affect downstream areas.

For the writing activities, students have the opportunity to individually explain their understanding of the exercise. Assess their work based on the degree to which they thoroughly explain the above concepts.

Extending the Learning

Have students use puzzle pieces, photos found online, and their own designed pieces to create river models for their own state.

Have students conduct research to determine how the different land uses—agriculture, industry, urbanization, and recreation/natural areas—can influence the quality of water in a river. How have people modified the land in their state, and what are the consequences of the modifications? Students can also think about how people can maintain and/or improve the health of the river.

Have older students consider choices they will make in their lives about where to live. They can select two puzzle pieces, one where they would most like to live, and one where they would least like to live. Have them explain their decisions, considering information about river flow and human impacts from the puzzle exercise.

OBJECTIVES

Subjects & Disciplines

Biology

- Ecology

Earth Science

- Engineering

Geography

- Human Geography
- Physical Geography

Social Studies

- Civics
- Economics

Learning Objectives

Students will:

- Brainstorm ways that humans interact with and affect local streams, rivers, and lakes in their watershed
- Arrange river puzzle pieces to form a realistic progression from source to mouth

- Describe how people have modified the environment along the river and the impacts and consequences, both positive and negative, of these changes

Teaching Approach

- Learning-for-use

Teaching Methods

- Discussions
- Hands-on learning

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Learning and Innovation Skills
 - Communication and Collaboration
- Critical Thinking Skills
 - Analyzing
 - Applying
 - Understanding
- Geographic Skills
 - Analyzing Geographic Information

National Standards, Principles, and Practices

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM
STANDARDS

- Theme 3:

People, Places, and Environments

NATIONAL GEOGRAPHY STANDARDS

- **Standard 14:**

How human actions modify the physical environment

- **Standard 15:**

How physical systems affect human systems

- **Standard 3:**

How to analyze the spatial organization of people, places, and environments on Earth's surface

- **Standard 4:**

The physical and human characteristics of places

NATIONAL SCIENCE EDUCATION STANDARDS

- **(5-8) Standard D-1:**

Structure of the earth system

- **(5-8) Standard F-2:**

Populations, resources, and environments

- **(5-8) Standard F-5:**

Science and technology in society

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **Reading Standards for Informational Text 6-12:**

Key Ideas and Details, RI.9-10.2

- **Reading Standards for Informational Text 6-12:**

Key Ideas and Details, RI.7.3

- **Reading Standards for Informational Text 6-12:**

Key Ideas and Details, RI.6.3

- **Reading Standards for Informational Text 6-12:**

Key Ideas and Details, RI.8.3

- **Reading Standards for Informational Text 6-12:**

Key Ideas and Details, RI.11-12.3

- **Reading Standards for Informational Text K-5:**

Key Ideas and Details, RI.5.3

- **Reading Standards for Informational Text K-5:**

Key Ideas and Details, RI.4.3

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Large sheets of construction paper
- Scissors
- Tape

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction

OTHER NOTES

This activity was originally developed for Geography Action 2001.

BACKGROUND & VOCABULARY

Background Information

Every river has a beginning and end, but a lot of different things go on in between a river's source and mouth. What humans do in a watershed—the area drained by a river—can affect the health of the river as well as the organisms that live in and around it.

River flow is directly related to the topography of the land. Mountains or fast-running brooks are typically near the source of the river. Port facilities for large ships are found where the river widens and slows to meet the sea. Human use of the stream is influenced partly by the size of the stream and rate of flow, so whitewater rafting is upstream while fishing would typically be downstream. Both discharging pollution and withdrawing water from the stream for drinking systems, industry, or irrigation affect downstream areas.

Prior Knowledge

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
megalopolis	<i>noun</i>	the union of two or more urban areas into a continuous metropolitan area. Also called a conurbation.
mouth	<i>noun</i>	place where a river empties its water. Usually rivers enter another body of water at their mouths.
rural	<i>adjective</i>	having to do with country life, or areas with few residents.
source	<i>noun</i>	beginning of a stream, river, or other flow of water.
suburban sprawl	<i>noun</i>	unplanned low-density development surrounding an urban area that often starts as rural land. Also called urban sprawl.
tributary	<i>noun</i>	stream that feeds, or flows, into a larger stream.
urban	<i>adjective</i>	having to do with city life.
watershed	<i>noun</i>	entire river system or an area drained by a river and its tributaries.
wetland	<i>noun</i>	area of land covered by shallow water or saturated by water.

For Further Exploration

Websites

- [Chesapeake Bay FieldScope 2.0](#)

FUNDER



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