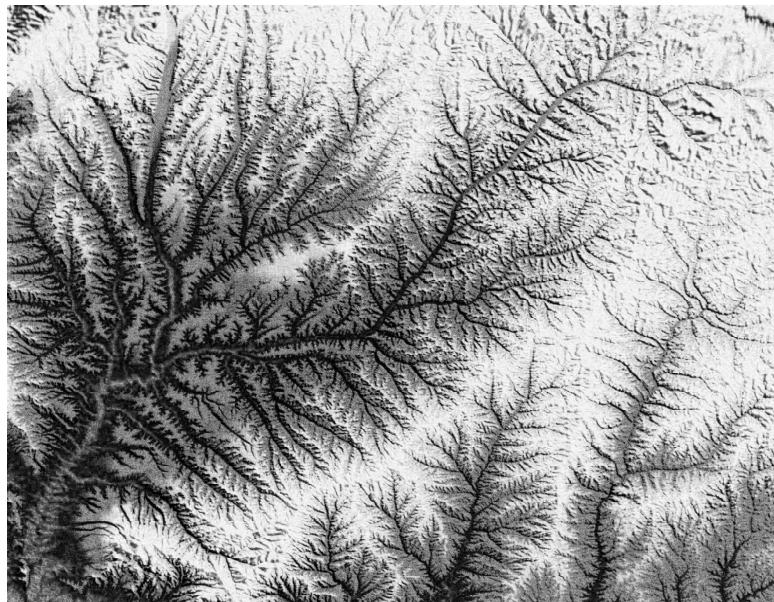


Fractal Rivers

Teacher's Intro

OVERVIEW

Students will learn about the branching fractal river networks that form watersheds. The structural similarity of the rivers to other natural fractals - particularly trees - is emphasized. Simple fraction problems are posed in the context of making water-use decisions for a hypothetical river in a community.



NM Math Standards:

K.G.4.2 Find and describe geometric shapes in nature or architecture.

(K,1,2).A.1.3 Recognize, reproduce, describe, extend, and create repeating patterns.

3.N.1.6 Demonstrate an understanding of fractions as parts of unit wholes, parts of a collection or set, and as locations on a number line.

4.N.1.3 Add and subtract fractions with common and uncommon denominators using a variety of strategies.

NM Science Standards:

Use numerical data in describing and comparing objects(3)

Know that Earth's features are constantly changed by a combination of slow and rapid processes that include the action of volcanoes, earthquakes, mountain building, biological changes, erosion, and weathering. (3)

Describe how human activity impacts the environment. (5)

Describe the contributions of science to understanding local or current issues (e.g., watershed and community decisions regarding water use). (5)

Understand how organisms interact with their physical environments to meet their needs (i.e., food, water, air) and how the water cycle is essential to most living systems. (6)

NM Social Studies Standards:

Understand maps and globes as representations of places and phenomena (1)

Use a variety of maps to locate specific places and regions (2)

Identify ways in which people depend on natural and man-made environments, including natural resources to meet basic needs (2)

Draw conclusions and make generalizations from geographic information and inquiry (4)

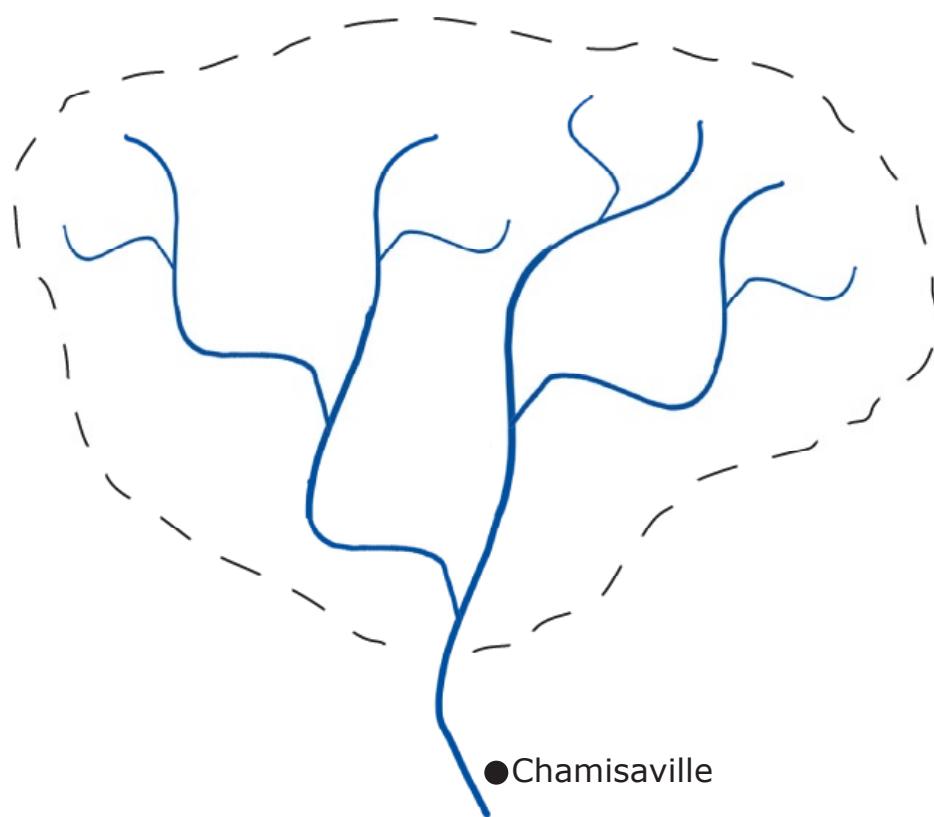
Demonstrate how different areas of the United States are organized and interconnected (5)

Fractal Rivers

Rivers are branching fractals that have been carved into the earth by rain that falls to the earth and then flows downhill - over many, many years. Two small streams join to form a bigger one, and then two bigger streams join to form a small river. Then 2 small rivers join to form a bigger river, and so on. A tiny arroyo or ditch is very similar to a giant canyon, only smaller.

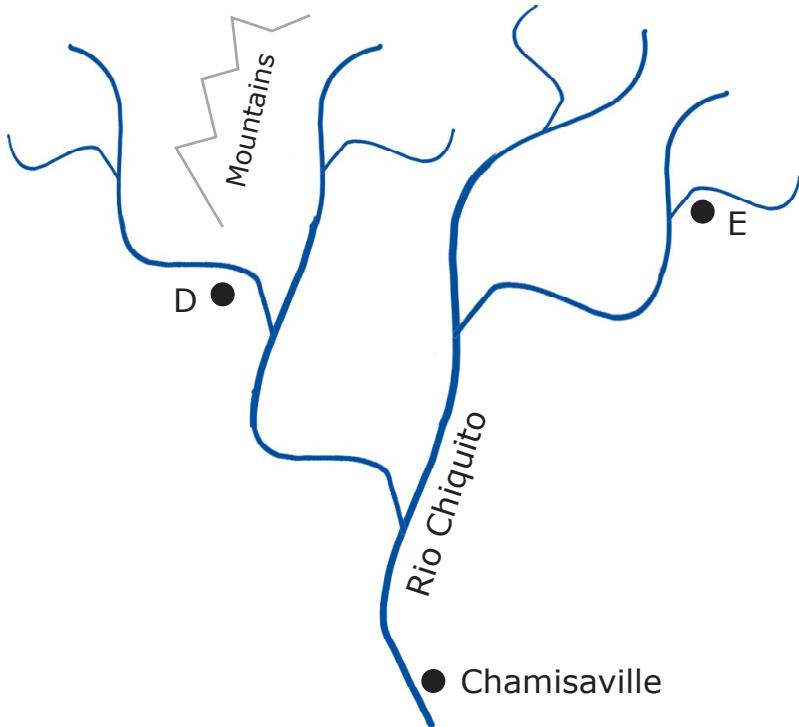
All of the rain that falls into an area of land that drains into the same river is called a watershed. The loop around the rivers and streams in the drawing below shows the watershed. In other words, any rain that falls inside the loop will flow past the town of Chamisaville on the map.

Most towns, villages and cities are built near a river, because water is so important for life. Water is used for drinking, growing crops, even for transport by boats.



Fractal Rivers

The Rio Chiquito is an imaginary river, but it behaves much like a real river. People have many uses for the river water, including farming and drinking. In order to flow, the river can stand to have no more than HALF of its water removed - otherwise it will run dry.



QUESTIONS:

Where could you place a dam in this river network to capture 1/2 of the water? Place a dot there, and label it "A".

Where could you place two dams that together would capture the same total amount, 1/2, of the river water? Place dots there, labeled "B" and "C".

If the farmers of Chamisaville decided to build a dam at point "D" to irrigate their crops, how much of the river's water would it use? (What fraction) _____

How much of the water would be left in the river? _____

How about if the people decided to build a dam at "E" for their drinking water - how much of the river's water would it capture? _____

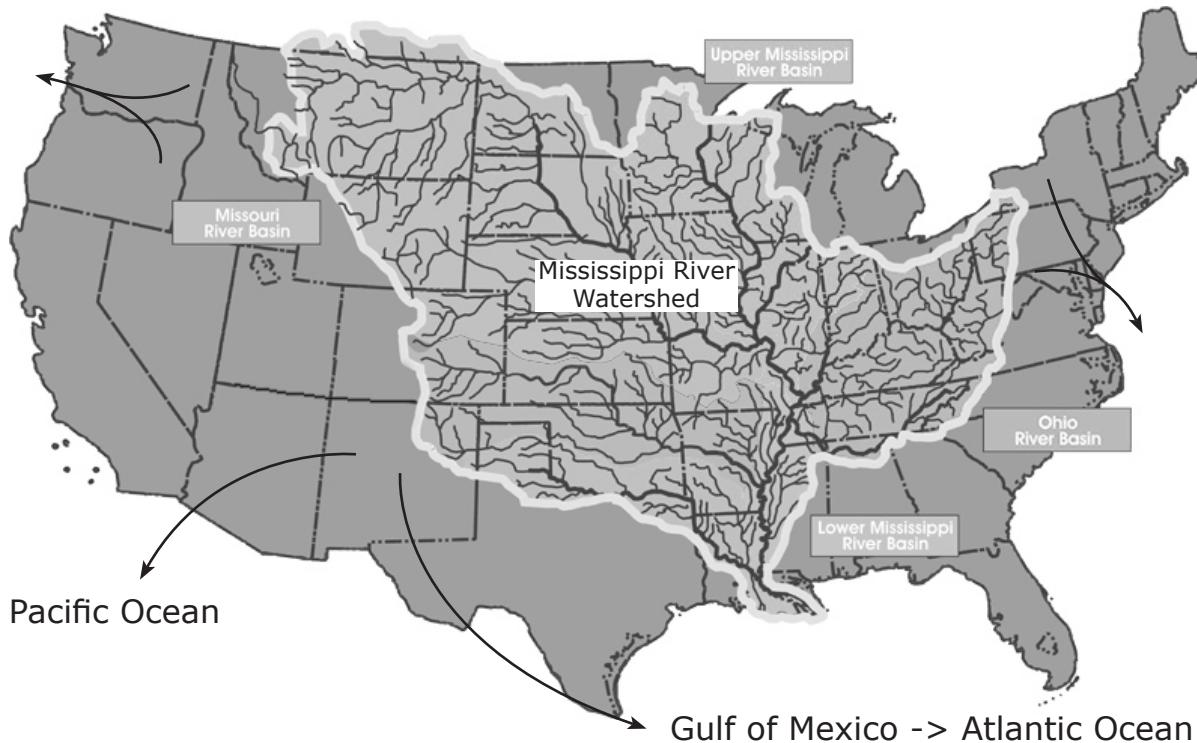
With dams at "D" and "E", how much of the river's water would be captured?

How much water would be left in the river? _____

Would this be enough to allow the river to flow? _____

Fractal Rivers

When rain falls in the United States, it drains into an ocean through a watershed. The biggest watershed in the US is the Mississippi River watershed, shown below. New Mexico belongs to 3 major watersheds. Rain that falls in the northeast part of the state drains into the Mississippi River. Rain that falls in the center of the state drains into the Rio Grande, and flows into the Gulf of Mexico. Rain that falls in the western part of the state enters the Colorado River watershed, and flows into the Pacific Ocean.



QUESTIONS:

About half of the state of Colorado is in the Colorado River watershed, and rain that falls in the west part drains into the Pacific Ocean. What watershed is the eastern half of Colorado in, and which ocean does rain that falls there drain into?

What is the *easternmost* state that is part of the Mississippi River Watershed?

What is the *westernmost* state that is part of the Mississippi River Watershed?

What other country, besides the US, is part of the Mississippi River Watershed?