

Name: _____

Date: _____

Student Exploration: River Erosion

Vocabulary: cutbank, discharge, erosion, flood, floodplain, meander, meandering river, oxbow lake, point bar, river speed, riverbank, riverbed, sediments, slope, tributary, weathering



Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. The image above shows a raging mountain river in full **flood**. What do you think is making the water brown in color? _____
2. What impact do you think the flooding river will have on the surrounding landscape? _____


Gizmo Warm-up

If you stand by the bank of a river, it may seem that very little is happening. But over thousands and even millions of years, rivers can have a profound effect on the landscape. In the *River Erosion* Gizmo, you will see how rivers move materials and how they affect landscapes.



To begin, check that **Mountain river** and **Short-term erosion** are selected. The Gizmo shows a typical river that is moving through a hilly area.

1. The two movie cameras (🎥) allow you to observe different parts of the river up close. Click on the left movie camera. What do you see? _____
2. **Sediments** are small rock fragments such as sand or pebbles. What evidence do you see that sediments are being transported? _____
3. Now select the right movie camera to see the bank of the mountain river. What is happening to sediments on the bank? _____

<p>Activity A: Mountain rivers</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> • Check that Mountain river and Short-term erosion are selected. • If necessary, click outside the circle to close the zoomed-in view. 	
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Introduction: **Erosion** occurs when sediments and other materials are moved from one place to another. Along with **weathering**, which is the breakdown of large rocks into smaller sediments, erosion can have a profound impact on the landscape.

Question: How does river erosion affect landscapes in the mountains?

1. **Label:** First, get to know some of the different parts of a mountain river. Turn on **Show labels**. Label the image to the right, then fill in the word that goes with each description.



A small stream that flows into a larger river: _____

A place along a river where water drops straight down: _____

A letter that describes the shape of a typical mountain valley: _____

The side of a river: _____ The bottom of a river: _____

2. **Observe:** Turn off **Show labels**. Next to “Release barrel,” click **Play** (▶). Observe how fast the barrel moves as it floats down the river.

What happens when the barrel goes over the **waterfall**? _____

3. **Calculate:** The two red flags are 100 meters apart. The time at which the barrel passes the flag is shown. Remember, there are 60 seconds in a minute.

A. How many seconds did it take for the barrel to go 100 meters? _____

B. To find the barrel’s speed, use a calculator to divide the distance traveled (100 m) by the time it took the barrel to float 100 m. The units are meters per second (m/s).

What is the speed of the barrel? _____

(Activity A continued on next page)



Activity A (continued from previous page)

4. Record: Click **Reset** (↺). Turn on **Show data**.

A. The **slope** of the channel is how steep it is, or how many meters the riverbed drops for every horizontal kilometer. What is the slope of the river? _____

B. **River speed** is a measure of how fast water flows. What is the river speed? _____

C. How does the river speed compare to the speed of the barrel you calculated on the previous page? _____

D. **Discharge** is the water volume that flows past a given point every second, measured in cubic meters per second (m^3/s). What is the river's discharge? _____

E. What types of sediments are transported by this river? _____

Sediments are classified by size. The smallest sediments are clay particles, followed by silt, sand, and pebbles. Larger sediments include cobbles and boulders.

5. Observe: Turn off **Show data**. Next to **River flow**, select **Flood**. Look at the landscape, and then click on the movie cameras to see zoomed-in views. Describe what you notice below.


6. Calculate: Click **Play** to release the barrel. How many seconds does it take the barrel to get from one flag to the other? What is the speed of the barrel?

Time: _____

Speed: _____

7. Compare: Turn on **Show data**. During a flood, how do the river speed, discharge, and transported sediments compare to normal flow conditions?

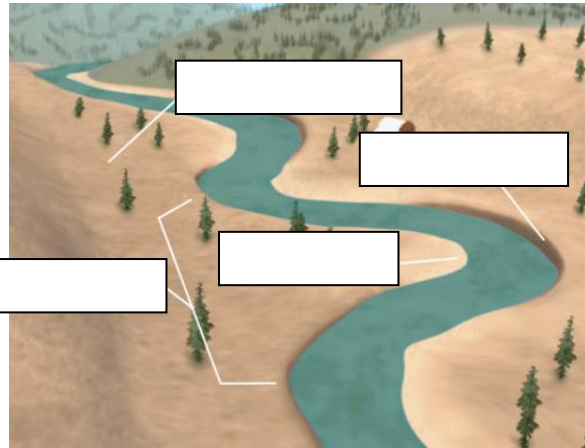


Activity B: Meandering rivers	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Select Meandering river. • Select Short-term erosion, Low vegetation, and Normal river flow. Turn off Show data. 	
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Introduction: **Meandering rivers** are found in flatter areas. Unlike the V-shaped mountain valleys, the valleys of meandering rivers have wide, flat bottoms called **floodplains**.

Question: How does river erosion affect landscapes in hilly or flat areas?

1. **Label:** Turn on **Show labels**. Label the image to the right, then fill in the word that goes with each description.



A large S-shaped bend in a river:

A flat area next to the river: _____

A steep riverbank on the outside of a bend in the river: _____

A gently sloping deposit of sediments on the inside of a bend in the river: _____

2. **Observe:** Turn off **Show labels**. Click **Play** to release the barrel. Observe the path of the barrel as it floats down the river. (The flags are 100 meters apart.)

A. How many seconds did it take for the barrel to go 100 meters? (Remember, there are 60 seconds in a minute.) _____

B. What is the speed of the barrel? _____

C. Turn on **Show path**. Did the barrel stay in the center of the river or go from side to side? _____

D. As the barrel went around each meander, did it stay closer to the **point bars** or the **cutbanks**? _____

In a meandering river, the water flows faster on the outside of a **meander**, near the cutbank, and moves more slowly near the point bar on the inside of the meander. The current carries the barrel toward the cutbanks and away from the point bars.

(Activity B continued on next page)

Activity B (continued from previous page)

3. Compare: Click **Reset**. Turn on **Show data**. List the slope, speed, discharge, and transported sediments of the meandering river. Then select **Mountain river** and fill in the remainder of the table. Change back to the **Meandering river** and compare the values.

	Meandering river	Mountain river
Slope		
Speed		
Discharge		
Transported sediments		

In what ways is a meandering river different from a mountain river?

4. Observe: Turn off **Show data**. Click the right movie camera to see the cutbank. Look at the sediments just above the water. What do you see? _____

Now select the left movie camera to see the point bar. Look at the sediments in the water.

What do you notice? _____

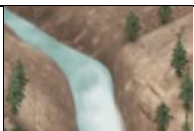
Erosion occurs at the cutbank, where water is moving faster. As a result, cutbanks are steep and often overhanging. Sediments are deposited in the slow-moving water near point bars.

5. Compare: Click in the simulation area to turn off the movie camera. Select **Flood**.
- A. The flat area surrounding the river is called a **floodplain**. Why do you think it has this name? _____
- B. Why might it be a bad idea to build a house in a floodplain? _____

- C. Turn on **Show data**. How do flood conditions differ from normal conditions? _____

- D. Look at the two close-up views. What do you notice? _____



Activity C: Long-term erosion	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Select Mountain river. • Select Long-term erosion and Low vegetation. 	
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Introduction: Both in the mountains and in flatter areas, river erosion can cause large changes to the landscape over time. In this activity, you will observe some of these changes.

Question: How do rivers change landscapes over long periods of time?

1. Predict: How do you think the mountain valley will change over time? _____

2. Observe: Click **Play**. Observe the valley for 200,000 simulated years. What do you notice?

3. Analyze: Click **Reset**. Turn on **Show data**. Record the slope, speed, and discharge of the river. Click **Play**, wait until the end of the simulation, and record the same data.

Year	Channel slope	River speed	Discharge
0			
200,000			

How does the river data change over time? _____

4. Observe: Click **Reset**. Click the movie camera to see a side view of the valley. Click **Play**.

Over time, does the valley erode downward or side to side? _____

5. Compare: Click **Reset**. Next to **Vegetation**, select **High**. Click **Play**. Compare the end result of 200,000 years of erosion with high vegetation to erosion with low vegetation.

Which landscape eroded more, and why do you think this is so? _____

(Activity C continued on next page)

Activity C (continued from previous page)

6. Predict: Click **Reset**. Select **Meandering river** and **Low** vegetation. How do you think the meandering river valley will change over time? _____

7. Observe: Click **Play**. Observe the valley for 2,000 simulated years. (The time frame is much shorter for the meandering river valley because changes occur faster there.)

A. What do you notice? _____

B. Over time, do the meanders grow wider or narrower? _____

C. How does the width of the floodplain change over time? _____

D. Turn on **Show labels**. What feature is formed when the river breaks through the narrowest part of the meander? _____

E. Click **Reset**. Turn on **Show data**. Click **Play** and observe the river data. How does the river data change over time? _____

8. Observe: Click **Reset**. Click the movie camera to see a side view of the valley.

A. What do you notice about the shape of the river channel? _____

B. Click **Play**. Does the channel erode downward or side to side? _____

Meandering rivers cause little downward erosion. Instead, the channel moves sideways as sediments are eroded from the cutbank and deposited on the point bar.

9. Compare: Click **Reset**. Next to **Vegetation**, select **High**. Click **Play**. Compare the end result of 2,000 years of erosion with high vegetation to erosion with low vegetation. Which landscape eroded more, and why do you think this is so?

