**River Erosion Gizmo**

**Gizmo Warm-up**

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

1. The two movie cameras () allow you to observe different parts of the stream up close. Click on the left movie camera. What do you see?
2. Now select the right movie camera to see the bank of the mountain stream. What is happening to sediments on the bank?

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| **Activity A:** **Mountain streams** | Get the Gizmo ready: * Check that **Mountain stream** and **Short-term erosion** are selected.
* If necessary, click outside the circle to close the zoomed-in view.
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1. Calculate: The two red flags are 100 meters apart. Click play to release the barrel. The time at which the barrel passes the flag is shown. Remember, there are 60 seconds in a minute.
2. How many seconds did it take for the barrel to go 100 meters?

1. 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?

1. 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.

1. 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?

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| **Activity B:** **Meandering rivers** | Get the Gizmo ready: * Select **Meandering river**.
* Select **Short-term erosion**, **Low** vegetation, and **Normal** river flow. Turn off **Show data**.
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Time: Speed:

**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**.

1. 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.)
	1. How many seconds did it take for the barrel to go 100 meters? (Remember, there are 60 seconds in a minute.)
	2. What is the speed of the barrel?
	3. Turn on **Show path**. Did the barrel stay in the center of the river or go from side to side? Circle one.
	4. As the barrel went around each meander, did it stay closer to the **point bars** or the **cutbanks**? **Circle one**. 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.
2. Compare: Click **Reset**. Turn on **Show data**. List the slope, speed, discharge, and transported sediments of the meandering river. Then select **Mountain stream** and fill in the remainder of the table. Change back to the **Meandering river** and compare the values.

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|  | **Meandering river** | **Mountain stream** |
| Slope |  |  |
| Speed |  |  |
| Discharge |  |  |
| Transported sediments |  |  |

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

1. 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.

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

* 1. Turn on **Show data**. How do flood conditions differ from normal conditions?

* 1. Look at the two close-up views. What do you notice?

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| **Activity C:** **Long-term erosion** | Get the Gizmo ready: * Select **Mountain stream**.
* 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?

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

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

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| **Year** | **Channel slope** | **River speed** | **Discharge** |
| 0 |  |  |  |
| 200,000 |  |  |  |

How does the stream data change over time?

1. 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?

1. 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?

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

1. 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.)
	1. What do you notice?

* 1. Over time, do the meanders grow wider or narrower?
	2. How does the width of the floodplain change over time?
	3. Turn on **Show labels**. What feature is formed when the river breaks through the narrowest part of the meander?
	4. Click **Reset**. Turn on **Show data**. Click **Play** and observe the river data.

How does the river data change over time?

1. Observe: Click **Reset**. Click the movie camera to see a side view of the valley.
	1. What do you notice about the shape of the river channel?

* 1. 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.

1. 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?