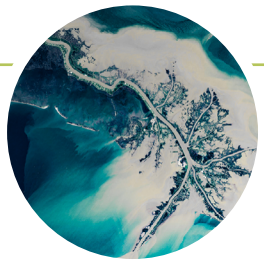
Modeling River Delta Formation

A Carolina Essentials™ Activity



Student Worksheet

Overview

You may have noticed creeks and rivers get muddy after a storm or even a hard rain. Scientists say the sediment load has increased. With a rain event, topsoil, plant debris, animal debris, and even trash makes its way into a river during what is considered a destructive process. With a larger volume of water and a faster flow rate, the river's sediment load can increase, removing and transporting more sediment mass. But what happens to the sediment when the volume of water and velocity of water return to normal? What happens to the sediment carried by the river once the river meets the sea? What happens is a constructive process that you will investigate in this lab.

Phenomenon

Look at the pictures of the Mississippi River delta and the Nile River delta. How can this natural phenomenon be explained?

SAFETY REQUIREMENTS

MATERIALS

Section of U-shaped or half-round gutter, 3 or 4 ft

Square aluminum pan, 8 or 9 in

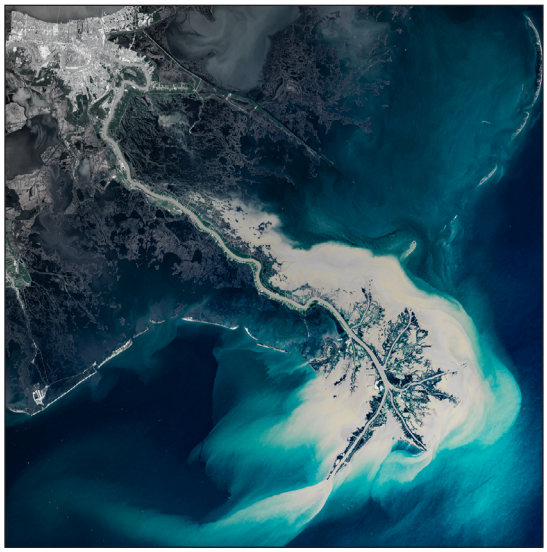
Polypropylene beaker with handle, 1,000 mL

Timer or smartphone

White sand (enough to cover the bottom and sides of the gutter)

Spoon

Tap water



Mississippi River

Nile River

Essential Question

What effects does moving water have on land surfaces?

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Activity Objectives

1. Determine how the sediment load and velocity of water affects the amount of sediment deposited by water.
2. Construct a model to explain what happens when moving water, carrying sediment, meets a large body of water.

Disposal

All sand should be returned to the designated container. The gutter, beaker, and aluminum pan should be wiped out with a paper towel. Do not flush sand down the sink drain.

Activity Procedures

Flow Rate

1. Line the gutter with sand. Cover the bottom and at least halfway up the sides. You may want to moisten the sand with a little water so it packs.
2. The gutter needs to drain into the aluminum pan. Place books or notebooks under the lower end of the gutter until it clears the side of the aluminum pan. With books or notebooks, raise the other end 3 to 4 inches so the gutter is sloped toward the pan.
3. Cover the bottom of the pan with about $^1/_4$ inch of water.
4. Fill the beaker with 1,000 mL of water.
5. Pour the 1,000 mL of water into the gutter over a 20 second interval.
6. Let the water and sand settle and sketch the results.
7. Pour the water out of the pan, leaving as much sand as possible. Do not pour sand down the sink drain.
8. Repeat the procedure from steps 3 to 7 with 1,000 mL of water but change the time to 10 seconds.
9. Repeat again but change the time to 5 seconds.

Sediment Load

1. Reline the gutter with sand by covering the bottom and at least halfway up the sides.
2. The gutter needs to drain into the square aluminum pan. Place books or notebooks under the lower end of the gutter until it clears the side of the aluminum pan. With books or notebooks, raise the other end 3 to 4 inches so the gutter is sloped toward the pan.
3. Cover the bottom of the pan with about $^1/_4$ inch of water.
4. Fill the beaker with 1,000 mL of water and stir in 100 mL of sand.
5. Pour the 1,000 mL of water and sand into the gutter over a 20 second interval.
6. Let the water and sand settle and sketch the results.
7. Pour the water out of the pan, leaving as much sand as possible. Do not pour sand down the sink drain.
8. Repeat the procedure from steps 3 to 7 with 1,000 mL of water and 100 mL of sand but change the time to 10 seconds.
9. Repeat again but change the time to 5 seconds.

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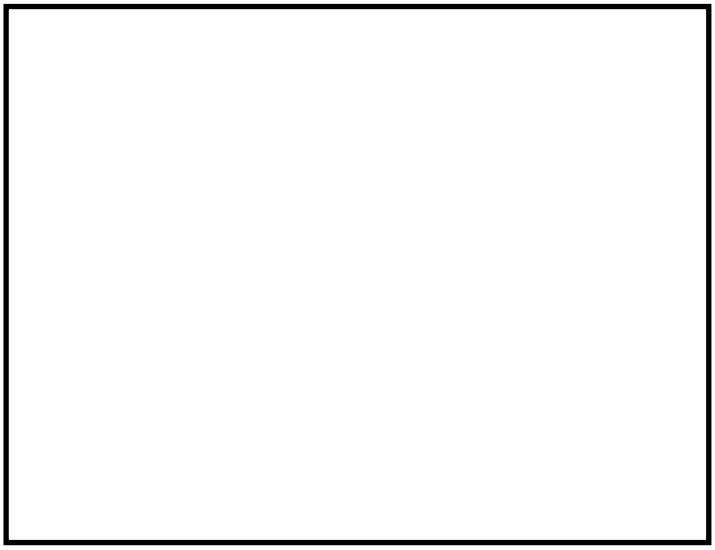
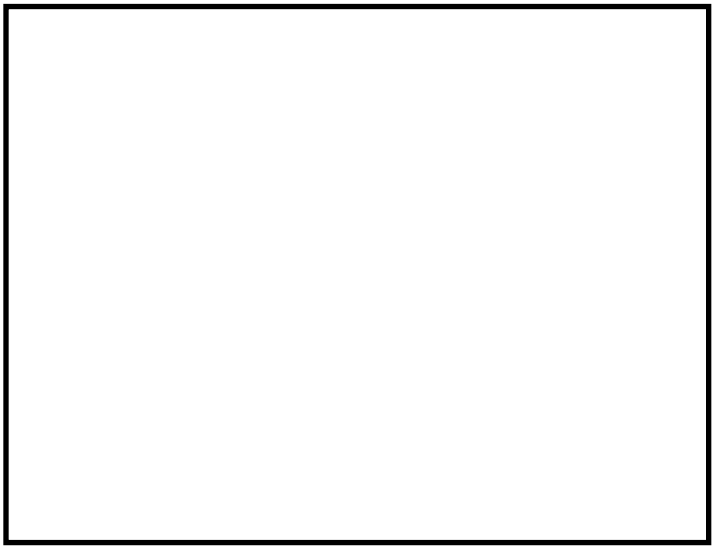
Data and Observations

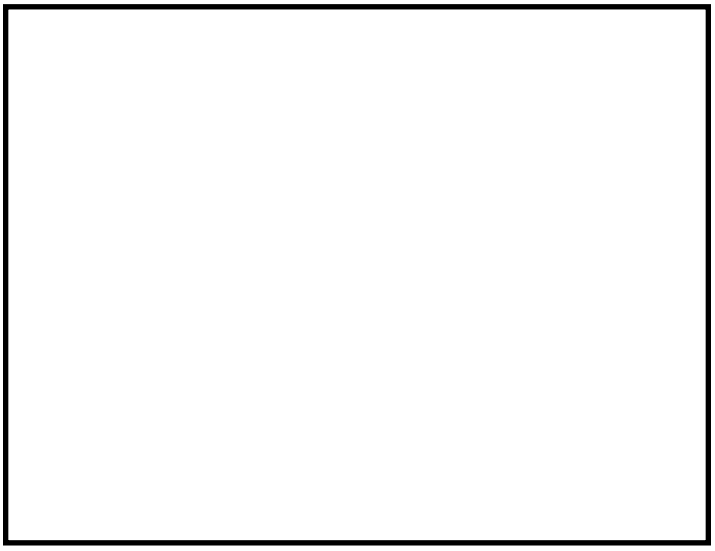
Sketch the result of each trial.

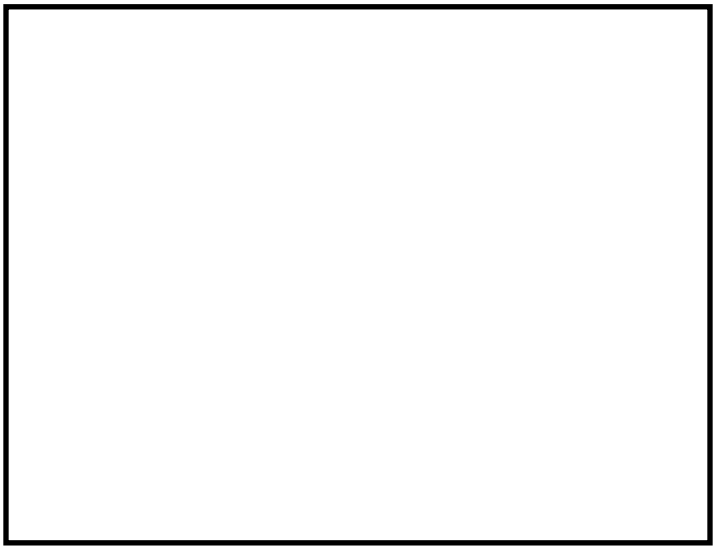
Flow Rate

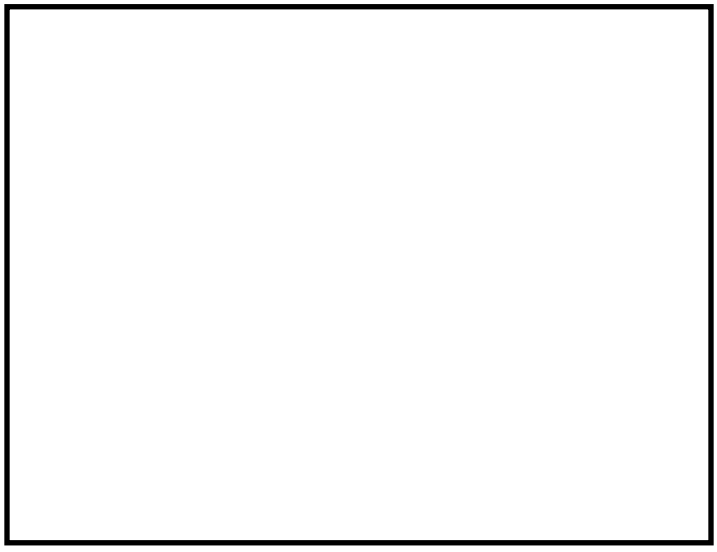


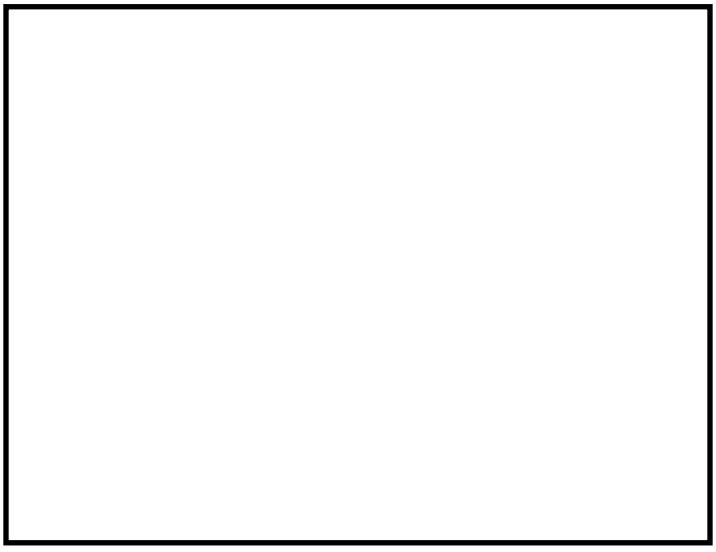
Sediment Load











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Analysis and Discussion

1. Calculate the volume of water per unit of time for the 6 trials. This is flow rate (mL/s).

2. Explain the destructive and constructive processes simulated in each trial.

3. Explain under what conditions the streambed remained unchanged and under what conditions it was most eroded.

4. Explain how the deposition of sediment in your investigation compared to the deltas of the Mississippi and Nile Rivers.

5. Create a model or flowchart for the development of a river delta over a long period of time.

6. Outline an investigation in which you could compare the materials stream channels are typically made from.