

CURIOSITY AT HOME

BEACH EROSION



*How do beaches change over time? Where does sand come from? How do waves interact with the shores that they crash into? You can make a **model** of a beach and make your own waves to see what happens! You may even change the shoreline as the water moves particles of sand or rock away from their original position in a process called **erosion**.*

MATERIALS

- Sand (substitute dirt, or make your own moldable sand with 1 part vegetable oil and 8 parts flour mixed patiently (note: it can be a bit messy))
- Rocks or shells (optional)
- Water
- Rectangular container, such as a plastic tub, deep tray, casserole dish, or paint tray
- 1–2 inch tall object to prop up the container (such as a stack of magazines, deck of cards or short tupperware)
- Blue food coloring (optional)
- Empty plastic water bottle
- Stopwatch or other tool for timing
- Science notebook or piece of paper
- Something to write with

PROCEDURE

- Fill one side of the rectangular container with about 4–5 cups of sand. This will become your model of a beach.
- Place an object underneath the sandy side of the container to make a slope with the sand at the top. Push the sand uphill so it makes a gradual slope down to the empty side of the container. If you like, you could mold the sand into a cliff instead of a slope.
- Place some rocks or shells in the sand, if you are using them.
- Fill the plastic bottle with water and a few drops of blue food coloring. Shake well.



sand



rocks



shells



water



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- Pour the water from the bottle into the lower side of the container. Add more water until the water level overlaps slightly with your shore.
- Take the empty plastic water bottle and place it on top of the water. Start the timer and gently push up and down on the water bottle to make even waves for about 30 seconds.
- Observe how the water affects the sand. What do you notice? Write or draw your observations in your science notebook.
- Now make waves for 1 minute straight. How much has the beach eroded? Write down the time and your observations in your science notebook.
- Now make waves for another minute. How much more has the beach eroded? Write down the time and your observations in your science notebook.

EXPLORE MORE

- What do you think would happen if the waves moved faster? Slower? Try it out!
- Wind, rain, and big storms like hurricanes are all natural events that can cause erosion to beaches. How would rain change our model beach? What about wind? Write down your prediction in your science notebook then test it out! Make your own wind and rain and observe what happens.
- Are there any beaches, rivers, or lakes near you? Find a map of the shoreline near your community from a previous time period. Do you notice any changes from then to now? Check out [this interactive map](https://marine.usgs.gov/coastalchangehazardsportal/)¹ from the U.S. Geologic Survey that shows historic shorelines along the coast of Washington and the United States. Click on "Shoreline Change," then "Historical Shoreline Positions," and zoom in on the area you want to look at.

¹ <https://marine.usgs.gov/coastalchangehazardsportal/>



Diablo Lake, WA



Deception Pass, WA



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WHAT'S HAPPENING?

The sand in your tub and on beaches is made out of tiny pieces of rocks and shells. These rocks and shells, as well as the water in your tub and the water in the ocean, are made up of even tinier bits called molecules. The molecules moving around when you make waves in the water are like really fine sandpaper rubbing against the shore. The water molecules rub sand molecules off the shore and into the water. When the water molecules rub against rock molecules, they break tiny pieces of rock off and those pieces are new sand! The sand now in the water can help rub off more pieces of shore into the water.

You are also creating currents in the water with your waves. These currents pick up particles, like your sand, and carry them where the water goes.

DID YOU KNOW?

On coastal beaches, you may notice mounds of sand. These are called **dunes**. Dunes often have tall grass on top of them. The roots of the grasses help keep the sand in place and the dunes sturdy. The dune grass is also very important to the coastal ecology in Washington! Walking on dunes can weaken the structure and speed up erosion. We try to protect them by only walking on designated paths!

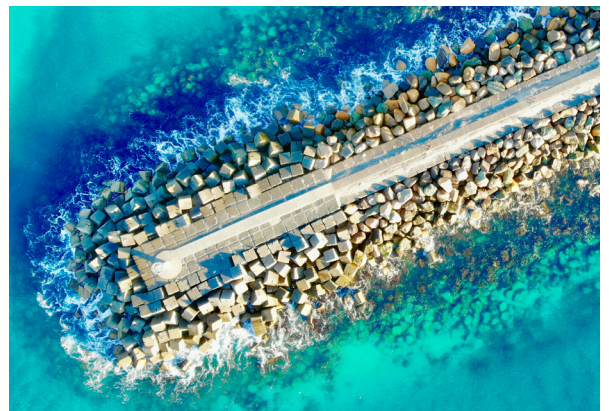
Seawalls and **jetties** are coastal structures that can help slow down erosion and protect the shoreline. Seawalls are built parallel to the shoreline to help protect against erosion and flooding that could damage buildings and roads that are close to the water's edge. Jetties are structures that are connected to the shore and stick out into the ocean. They help protect the coastline from currents and tides that could wash away beaches.



Dunes



Seawall



Jetty



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K-2 GRADE EXPLORATION

Here are some questions for you to explore together.

- What's an example of a liquid you used in your model? What about a solid? A gas?
- What do you think happens to the sand that gets eroded from the beach? Where might it go?
- How could you slow down beach erosion? Test out your idea on your model beach! After you build your idea, make waves for 1 minute again. How much erosion occurred? Was it different from your first experiment? Tell someone about your design and how it worked. What was successful? How could you redesign it?
- You tried this experiment with a small model of a beach. Do you think you would see results as fast on a full-sized beach? Why or why not?
- Some changes to the surface of the Earth happen quickly, and some happen slowly. Which of these do you think happen slowly?
 - Earthquake
 - River carves a canyon out of the stone
 - Volcanic eruption
 - Landslide
 - Mountain range forms



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3–5 GRADE EXPLORATION

Explore the following questions and write your observations in your science notebook.

- How could you help prevent or slow down beach erosion? Test out your idea on your model beach! After you've made your changes, use the stop watch to record how long you make the waves. How did your solution hold up after 30 seconds? After 1 minute? How much erosion occurred? Was it different from your first experiment? What was successful? How could you redesign it?
- In many places of the world, there are other land features right next to beaches, such as dunes, mountains, marshes, and rivers. How could these features change the rate of erosion at your beach? In your model, use the sand to build a mountain, or use water and a spoon to make a river. Now test what happens when it rains or there are heavy winds. Record your observations in your science notebook.
- The Dungeness Wildlife National Refuge Park in Sequim, WA has the longest natural sand spit in the United States. Sand spits are an extended stretch of beach that goes from the mainland out to sea. How do you think this affects erosion of the shoreline? Can you make one in your model?
- In this activity, we saw a model of one way the atmosphere (air) and hydrosphere (water) impact the geosphere (earth). Can you think of any other ways these systems might interact? Think about both large and small impacts, as well as fast and slow events. Draw an example of these interactions in your science notebook.
- How might plants, animals, and humans each affect how quickly a beach erodes away? Make a list or draw a picture of how these living things might slow down or speed up the rate of erosion.



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6–8 GRADE EXPLORATION

Explore the following questions and write your observations in your science notebook.

- How could you help prevent or slow down beach erosion? Test out your idea on your model beach! What things do you want to keep the same between the different tests in order to test as accurately as possible? How can you measure how eroded your beach is after each test? Write these down in a science notebook. What was successful? How could you redesign it?
- Imagine you are a city planner deciding if you should build a seawall to protect buildings built on top of a cliff near the sea. What could be some consequences of humans forcing beaches to stop natural erosion? Write a pros and cons list for building the seawall in your science notebook.
- In many places of the world, there are other land features right next to beaches, such as dunes, mountains, marshes, and rivers. How could these change the rate of erosion at your beach? In your model, use the sand to build a mountain, or use water and a spoon to make a river. Now test what happens when it rains or there are heavy winds. Record your observations in your science notebook.
- In this activity, we saw a model of one way the atmosphere (air) and hydrosphere (water) impact the geosphere (earth). Can you think of any other ways these systems might interact? Think about both large and small impacts, as well as fast and slow events. Draw an example of these interactions in your science notebook.
- What are some other ways that the atmosphere and hydrosphere affect the geosphere? Think of things across both short and long timescales, as well as large and small impacts. Draw an example of these impacts in your science notebook.

