

## Reflect

Have you ever seen a sculpture that has been outside for many years? If the sculpture is of a person, the nose and mouth might be worn down. The face might have cracks in some places. The way the sculpture looks now is probably not how it looked when the artist made it. Think of the famous Sphinx in Egypt. This sculpture was made more than 4,500 years ago. Over thousands of years, some parts of the Sphinx have worn away. Just like structures that humans build, Earth's **landforms** change over time. Take mountains, for example. Some mountains are tall with steep slopes.



**landforms:** features on Earth's surface, such as mountains, plains, hills, dunes, and valleys

They have sharp, jagged peaks. Over time, however, their slopes will become gentler. Their peaks will become more rounded and smooth, just like the face of the Sphinx. These changes happen when rocks break down and move to new places.

What forces in nature cause landforms to change? How do you think these changes happen? What causes weathering? One way that landforms change over time is by weathering. Weathering happens when forces in nature break down rocks into smaller pieces. Think of the tiny grains of sand on a beach. Those grains of sand used to be parts of larger rocks or shells. However, pieces of the larger rocks or shells broke off over time. The pieces became smaller and smaller. Now, they are just tiny grains.

Different things cause weathering. Wind is one way that weathering happens. Wind carries tiny particles of soil and rock called sediment. As wind blows against a mountain, the sediment grinds against it. This grinding action breaks off pieces of the mountain. Liquid water can also cause weathering. Rivers carry sediment that grinds against rocks in the riverbed. Over time, large formations such as canyons can form. Ice can also cause weathering.



Weathering from water, ice, and wind helped create these natural arches in Utah. Over many years, parts of the rocks were worn away, leaving empty spaces.

Remember that water expands when it freezes. If water seeps into cracks in rocks and then freezes, the ice pushes the cracks a little wider. After melting and refreezing many times, the ice will split the rock into pieces.

## What Do You Think?

The rocks at the edge of a waterfall tend to be rounded and smooth. Why do you think the rocks are this way? What caused the weathering? Where else might you see how weathering changes land?



## Look Out!

Changes to land happen at different speeds. A volcano or an earthquake can change landforms in minutes! Wind, water, and ice are just as powerful. For example, sudden waves called tsunamis can uproot trees and shift whole beaches. In most cases, though, wind, water, and ice take much longer to change Earth's surface. They may even take millions of years! Look at the tall, skinny towers of rock in the picture below. They formed from an area of rock that is 40 to 60 million years old. The rock is still changing today. Scientists predict that in another few million years, the rock towers will appear very different.



These towering rock formations are called **hoodoos**. Short, intense rainfalls are one agent that weathered and eroded the rock to form these structures.

### What causes erosion?

Weathering is not the only way that landforms change. When rocks break down into smaller pieces, those pieces often get moved. This movement of rock particles to a new place is called erosion.

Weathering and erosion work together to change Earth's surface. In fact, many things that cause weathering also cause erosion. Wind causes erosion by carrying away loose sediment from landforms such as cliffs or sand dunes. In fact, sand dunes are constantly shifting positions because of wind erosion.

**glacier:** a slow moving mass of ice

In a similar way, running water carries away loose rock particles in a riverbed. The Colorado River, for example, has carried away enough rock material to nearly fill the Grand Canyon! Rainwater from storms also causes erosion when it washes away soil from hillsides. Ice can cause erosion as well. As a **glacier** flows downhill, it breaks off pieces of rock. The glacier then carries the rock pieces with it.

## Look Out!

Eventually, wind, water, and ice put down the sediment they carry. This process is called deposition. (If you deposit something, you put it down.) Over time, this sediment can build up and form new landforms. For example, when wind stops blowing, the particles in the air fall to the ground. As more particles collect, they may build new beaches and sand dunes. Rivers may deposit sediment as they enter larger bodies of water because the water slows down. This sediment creates new land at the mouth of a river (called a delta). Glaciers also deposit rock and soil as they melt and retreat.

## Try Now

Take some time to observe weathering, erosion, and deposition in action.

1. To complete this activity, you will need the following materials:
  - A rectangular baking pan
  - Sand
  - Tap water
  - Two small wooden blocks
2. Place one wooden block under the edge of one side of the pan. The pan should be slightly tilted.
3. Add sand to the raised end of the pan. Make your sand like a mini beach. To do this, make sure your sand covers only about half of the pan (the higher part).
4. Pour water into the lowered end of the pan until it just reaches the edge of the beach. Do not let the water spill over the edge of the pan. If necessary, add more sand to the beach.
5. Dip the second wooden block in the water at the lowered end of the pan. Gently move it up and down to create waves.
6. Watch what happens to the sand. What signs of erosion and deposition do you see?



Sediment piles up at the mouth of this river to form a delta.

## Try Now

### **Looking to the Future: Threats to Forests**

Human actions can also change the land. In many cases, human actions lead to erosion. For example, humans have cut down many large forests in recent decades. People clear the land to build homes and businesses. When trees are cut down, their roots no longer hold the soil in place. As a result, the soil washes away more easily. This can be harmful for the environment. As soil erodes, nutrients that help plants grow also wash away. Fewer plants results in less food for the animals that live in the area, including humans! Also, loose soil can wash away suddenly in a landslide, which can harm other living things.

People in many areas want to make laws that protect forests. Some organizations are fighting companies around the world that are destroying forests. However, other laws are making it easier to cut down forests. For example, Brazil's government recently passed a law that allows farmers to clear some protected forests for farmland. The removal of forests continues to threaten the planet. Erosion can remove nutrients and important soil from areas that cannot get it back. How do you think we can prevent erosion from happening?

## What Do You Think?

Landforms on Earth change in different ways. Read the list of changes in the box below. Then decide whether each change is an example of weathering, erosion, or deposition. Finally, label the agent of change in each example (wind, water, or ice).

Changes to Land	
<ul style="list-style-type: none"><li>• After a sandstorm, sand falls from the air onto a sand dune.</li><li>• A creek moves sediment downstream.</li><li>• A breeze carries small rock particles away from a mountain.</li></ul>	<ul style="list-style-type: none"><li>• Water freezes and expands inside a rock, splitting the rock into pieces.</li><li>• A river leaves sand and soil along the coast as it enters the ocean.</li><li>• A glacier scrapes off some sediment as it moves along a cliff.</li></ul>

Weathering	Erosion	Deposition

## Connecting With Your Child

### Adaptations Close to Home

To help your child learn more about changes to land, go to a nearby park. If possible, choose a park with a variety of landforms and natural features, including rivers, waterfalls, hills, and boulders. Ask your child to identify as many landforms as possible.

Once your child has identified the landforms, ask him or her to hypothesize (guess) how these landforms might have changed or caused change over time. (Your child has learned that wind, water, and ice cause changes to land.) Have your child record hypotheses in a small notebook.

Next, have your child safely explore the landforms more closely to look for evidence of change. He or she has learned about three types of changes to land:

- weathering (rock breaking down into smaller particles)
- erosion (the movement of rock particles)
- deposition (the settling of rock particles)

For example, your child might note that the stones along a stream bed are rounded and smooth. This is because the water carries small particles that grind down the rocks and make them smoother. Your child should note whether his or her observations support or contradict hypotheses about the landforms.

When you return home, research online the different landforms that your child observed in the park. In particular, look for how they have changed or caused changes over time. Have your child compare his or her observations to the information found in the research.

Here are some questions to discuss with your child:

1. How have wind, water, and/or ice affected landforms in the park?
2. Did you see any signs of weathering, erosion or deposition? If so, what kinds?
3. What are some human activities that might change the landforms in the park? How would these changes affect the plants and animals that live in the area?