

erosion

[Erosion](#) is the act in which [earth](#) is worn away, often by [water](#), [wind](#), or [ice](#). A similar process, [weathering](#), breaks down or [dissolves](#) [rock](#), weakening it or turning it into tiny fragments. No rock is hard enough to resist the forces of weathering and erosion. Together, they shaped the sharp [peaks](#) of the [Himalaya Mountains](#) in Asia and sculpted the [spectacular](#) forest of rock towers of [Bryce Canyon](#), in the U.S. state of Utah.

The process of erosion moves bits of rock or [soil](#) from one place to another. Most erosion is performed by water, wind, or ice (usually in the form of a [glacier](#)). These forces carry the rocks and soil from the places where they were weathered. If water is muddy, it is a sign that erosion is taking place. The brown color indicates that bits of rock and soil are [suspended](#) in the water and being transported from one place to another. This transported material is called [sediment](#).

When wind or water slows down, or ice melts, sediment is deposited in a new location. As the sediment builds up, it creates [fertile](#) land. River [deltas](#) are made almost entirely of sediment. Delta sediment is eroded from the banks and bed of the river.

Erosion by Water

Moving water is the major agent of erosion. Rain carries away bits of soil and slowly washes away rock fragments. Rushing streams and rivers wear away their banks, creating larger and larger [valleys](#). In a span of about 5 million years, the Colorado River cut deeper and deeper into the land in what is now the U.S. state of Arizona. It eventually formed the [Grand Canyon](#), which is more than 1,600 meters (1 mile) deep and as much as 29 kilometers (18 miles) wide in some places.

Erosion by water changes the shape of [coastlines](#). [Waves](#) constantly crash against [shores](#). They pound rocks into pebbles and [reduce](#) pebbles to sand. Water sometimes takes sand away from beaches. This moves the coastline farther inland.

The Cape Hatteras Lighthouse was built in 1870, on the [Outer Banks](#), a series of [islands](#) off the coast of the U.S. state of North Carolina. At the time, the [lighthouse](#) was nearly 1,000 meters (3,300 feet) from the ocean. Over time, however, the ocean [eroded](#) most of the beach near the lighthouse. By 1999, the surf [endangered](#) the structure. Many people thought it would collapse during a strong storm. The lighthouse was moved 880 meters (2,900 feet) inland.

The battering of ocean waves also erodes seaside [cliffs](#). It sometimes [bores](#) holes that form [caves](#). When water breaks through the back of the cave, it creates an [arch](#). The continual pounding of the waves can cause the top of the arch to fall, leaving nothing but rock columns. These are called [sea stacks](#). All of these features make rocky beaches beautiful, but also dangerous.

Erosion by Wind

Wind is also an agent of erosion. It carries [dust](#), [sand](#), and [volcanic ash](#) from one place to another. Wind can sometimes blow sand into towering dunes. Some [sand dunes](#) in the Badain Jaran area of the [Gobi Desert](#) in China reach more than 400 meters (1,300 feet) high.

In dry areas, windblown sand blasts against rock with [tremendous](#) force, slowly wearing away the soft rock. It also [polishes](#) rocks and cliffs until they are smooth.

Wind is responsible for the dramatic arches that give Arches National Park, in the U.S. state of Utah, its name. Wind can also erode material until nothing remains at all. Over millions of years, wind and water eroded an entire mountain range in central Australia. [Uluru](#), also known as Ayers Rock, is the only remnant of those mountains.

Erosion by Ice

Ice can erode the land. In frigid areas and on some mountaintops, glaciers move slowly downhill and across the land. As they move, they pick up everything in their path, from tiny grains of sand to huge [boulders](#).

The rocks carried by a glacier rub against the ground below, eroding both the ground and the rocks. Glaciers grind up rocks and scrape away the soil. Moving glaciers gouge out basins and form steep-sided mountain valleys.

Several times in Earth's history, [vast](#) glaciers covered parts of the Northern Hemisphere. These [glacial periods](#) are known as [ice ages](#). Glaciers carved much of the northern North American and European landscape. They [scoured](#) the ground to form the bottom of what are now the [Finger Lakes](#) in the U.S. state of New York. They also carved [fjords](#), deep [inlets](#) along the coast of [Scandinavia](#).

Today, in places such as Greenland and Antarctica, glaciers continue to erode the earth. These [ice sheets](#), sometimes more than a mile thick, carry rocks and other

[debris](#) downhill toward the sea. Eroded sediment is often visible on and around glaciers. This material is called [moraine](#).

Erosion and People

Erosion is a natural process, but human activity can make it happen more quickly. Trees and plants hold soil in place. When people cut down [forests](#) or plow up grasses for [agriculture](#) or [development](#), the soil washes away or blows away more easily. [Landslides](#) become more common. Water also rushes over exposed soil rather than soaking into it, causing flooding.

[Erosion control](#) is the process of reducing erosion by wind and water. [Farmers](#) and [engineers](#) must regularly practice erosion control. Sometimes, engineers simply install structures to physically prevent soil from being transported. [Gabions](#) are huge wire frames that hold boulders in place, for instance. Gabions are often placed near cliffs. These cliffs, often near the coast, have homes, businesses, and highways near them. When erosion by water or wind threatens to tumble the boulders toward buildings and cars, gabions protect landowners and drivers by holding the rocks in place.

Erosion control can also be done by physically changing the landscape. [Living shorelines](#), for example, are a form of erosion control for [wetland](#) areas. Living shorelines are constructed by placing native plants, stone, sand, and even living organisms such as [oysters](#) along wetland coasts. These plants help [anchor](#) the soil to the area, preventing erosion. By securing the land, living shorelines establish a natural [habitat](#). They protect coastlines from powerful [storm surges](#) as well as erosion.

[Global warming](#), the latest increase in [temperature](#) around the world, is speeding erosion. The change in [climate](#) has been linked to more [frequent](#) and more severe storms. Storm surges following [hurricanes](#) and [typhoons](#) threaten to erode miles of coastline and coastal habitat. These coastal areas have homes, businesses, and economically important industries, such as fisheries.

The rise in temperature is also quickly melting glaciers. This is causing the sea level to rise faster than organisms can [adapt](#) to it. The rising sea erodes beaches more quickly. In the Chesapeake Bay area in the eastern United States, it is estimated that a rise in sea level of 8 to 10 centimeters (3 to 4 inches) will cause enough erosion to threaten buildings, [sewer](#) systems, roads, and tunnels.