NATIONAL GEOGRAPHIC
Encyclopedic Entry

erosion

For the complete encyclopedic entry with media resources, visit:
http://education.nationalgeographic.org/encyclopedia/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.

Vocabulary

Term	Part of Speech	Definition
adapt	*verb*	to adjust to new surroundings or a new situation.
agriculture	*noun*	the art and science of cultivating the land for growing crops (farming) or raising livestock (ranching).

Term	Part of Speech	Definition
anchor	*verb*	to hold firmly in place.
arch	*noun*	shape that looks like an upside-down "U."
basin	*noun*	a dip or depression in the surface of the land or ocean floor.
batter	*verb*	to beat and cause damage.
bioerosion	*noun*	the process in which a living organism wears away at rock or another hard substance.
bore	*verb*	to drill or tunnel into something.
boulder	*noun*	large rock.
Bryce Canyon	*noun*	large rock formations (not a canyon) in the U.S. state of Utah.
cave	*noun*	underground chamber that opens to the surface. Cave entrances can be on land or in water.
Chesapeake Bay	*noun*	large, shallow estuary of the Susquehanna and other rivers that flow through the U.S. states of Maryland, Virginia, West Virginia, Delaware, Pennsylvania, and New York and the capital of Washington, D.C., before emptying in the Atlantic Ocean.
cliff	*noun*	steep wall of rock, earth, or ice.
climate	*noun*	all weather conditions for a given location over a period of time.
coastline	*noun*	outer boundary of a shore.
debris	*noun*	remains of something broken or destroyed; waste, or garbage.
delta	*noun*	the flat, low-lying plain that sometimes forms at the mouth of a river from deposits of sediments.
deposit	*verb*	to place or deliver an item in a different area than it originated.
development	*noun*	growth, or changing from one condition to another.
dissolve	*verb*	to break up or disintegrate.
dust	*noun*	tiny, dry particles of material solid enough for wind to carry.
earth	*noun*	soil or dirt.

Term	Part of Speech	Definition
economic	*adjective*	having to do with money.
endanger	*verb*	to put at risk.
engineer	*noun*	person who plans the building of things, such as structures (construction engineer) or substances (chemical engineer).
erode	*verb*	to wear away.
erosion	*noun*	act in which earth is worn away, often by water, wind, or ice.
erosion control	*noun*	process of preventing or reducing erosion by wind and water.
farmer	*noun*	person who cultivates land and raises crops.
fertile	*adjective*	able to produce crops or sustain agriculture.
Finger Lakes	*noun*	series of thin, deep lakes in the U.S. state of New York.
fishery	*noun*	industry or occupation of harvesting fish, either in the wild or through aquaculture.
fjord	*noun*	long, narrow ocean inlet between steep slopes.
flood	*noun*	overflow of a body of water onto land.
forest	*noun*	ecosystem filled with trees and underbrush.
frequent	*adjective*	often.
gabion	*noun*	wire frame filled with rock.
glacial period	*noun*	time of long-term lowering of temperatures on Earth. Also known as an ice age.
glacier	*noun*	mass of ice that moves slowly over land.
global warming	*noun*	increase in the average temperature of the Earth's air and oceans.
Gobi Desert	*noun*	large desert in China and Mongolia.
gouge	*noun*	hand tool with a partly curved blade, used for carving.

Term	Part of Speech	Definition
Grand Canyon	*noun*	large gorge made by the Colorado River in the U.S. state of Arizona.
habitat	*noun*	environment where an organism lives throughout the year or for shorter periods of time.
highway	*noun*	large public road.
Himalaya Mountains	*noun*	mountain range between India and Nepal.
hurricane	*noun*	tropical storm with wind speeds of at least 119 kilometers (74 miles) per hour. Hurricanes are the same thing as typhoons, but usually located in the Atlantic Ocean region.
ice	*noun*	water in its solid form.
ice age	*noun*	long period of cold climate where glaciers cover large parts of the Earth. The last ice age peaked about 20,000 years ago. Also called glacial age.
ice sheet	*noun*	thick layer of glacial ice that covers a large area of land.
indicate	*verb*	to display or show.
inlet	*noun*	small indentation in a shoreline.
island	*noun*	body of land surrounded by water.
landslide	*noun*	the fall of rocks, soil, and other materials from a mountain, hill, or slope.
lighthouse	*noun*	structure displaying large, bright lights to warn and help ships navigate coastal waters.
living shoreline	*noun*	method of creating coastal land by using stones and marine grasses to trap soil, sand, and mud.
moraine	*noun*	material, such as earth, sand, and gravel, transported by a glacier.
mountain range	*noun*	series or chain of mountains that are close together.
Northern Hemisphere	*noun*	half of the Earth between the North Pole and the Equator.

Term	Part of Speech	Definition
Outer Banks	*noun*	barrier islands off the coast of the U.S. state of North Carolina.
oyster	*noun*	type of marine animal (mollusk).
peak	*noun*	the very top.
plow	*noun, verb*	tool used for cutting, lifting, and turning the soil in preparation for planting.
polish	*verb*	to make smooth and shiny by rubbing.
reduce	*verb*	to lower or lessen.
remnant	*noun*	something that is left over.
rock	*noun*	natural substance composed of solid mineral matter.
sand	*noun*	small, loose grains of disintegrated rocks.
sand dune	*noun*	mound of sand created by the wind.
Scandinavia	*noun*	region and name for some countries in Northern Europe: Iceland, Norway, Sweden, Finland, and Denmark.
scour	*verb*	to rub harshly, often to polish.
sea level	*noun*	base level for measuring elevations. Sea level is determined by measurements taken over a 19-year cycle.
sea stack	*noun*	column-shaped rock formation created by waves eroding parts of coastal cliffs.
sediment	*noun*	solid material transported and deposited by water, ice, and wind.
sewer	*noun*	passageway or holding tank for liquid waste.
shore	*noun*	coast.
soil	*noun*	top layer of the Earth's surface where plants can grow.
spectacular	*adjective*	dramatic and impressive.
storm	*noun*	severe weather indicating a disturbed state of the atmosphere resulting from uplifted air.

Term	Part of Speech	Definition
storm surge	*noun*	abnormal rise in sea level accompanying a hurricane or other intense storm. Also called a storm tide.
stream	*noun*	body of flowing fluid.
surf	*noun*	waves as they break on the shore or reef.
suspend	*verb*	to temporarily stop an activity.
temperature	*noun*	degree of hotness or coldness measured by a thermometer with a numerical scale.
tremendous	*adjective*	very large or important.
typhoon	*noun*	tropical storm with wind speeds of at least 74 miles (119 kilometers) per hour. Typhoons are the same thing as hurricanes, but usually located in the Pacific or Indian Ocean region.
Uluru	*noun*	large sandstone rock formation in central Australia. Also called Ayers Rock.
valley	*noun*	depression in the Earth between hills.
vast	*adjective*	huge and spread out.
volcanic ash	*noun*	fragments of lava less than 2 millimeters across.
water	*noun*	chemical compound that is necessary for all forms of life.
wave	*noun*	moving swell on the surface of water.
weathering	*noun*	the breaking down or dissolving of the Earth's surface rocks and minerals.
wetland	*noun*	area of land covered by shallow water or saturated by water.
wind	*noun*	movement of air (from a high pressure zone to a low pressure zone) caused by the uneven heating of the Earth by the sun.

Articles & Profiles

- Association of Bay Area Governments: What You Can Do to Control Erosion and Protect Your Property

Audio & Video

- National Geographic Video: Alaska Coast Eroding Fast

Websites

- National Geographic Science: Erosion and Weathering