

# Be an Engineer!

Suppose your city wants to build a new housing development on a steep slope outside town. Design a model to test whether the land is safe from the types of landslides you read about in this book. What will your model include? What materials will you need? What conditions will you reproduce to test it?

Draw a sketch of your model and discuss it with classmates. Make changes to your plans as needed. Then construct your model. Conduct tests to see if the slope stays intact when natural events occur. Write about whether this would be a good place to build homes.

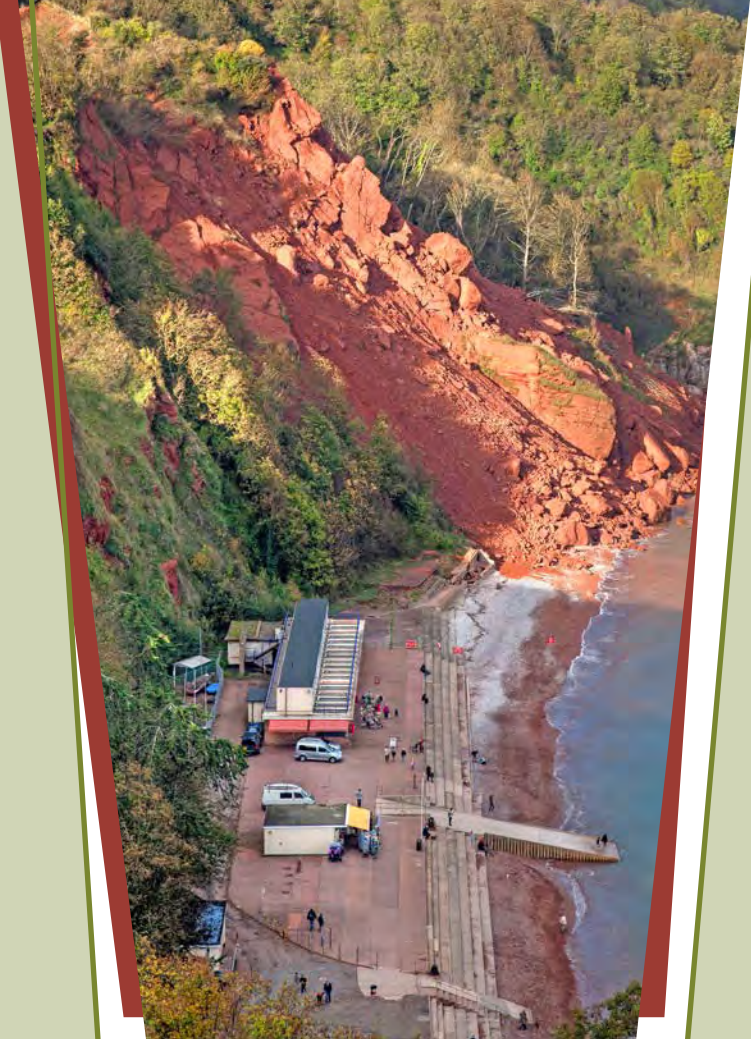


## Beyond the Book

Avalanches and landslides are very similar.  
Research avalanches and what causes them.

FOCUS Book

# Landslides



• Science A-Z 



## Notes

# Landslides



## FOCUS Question

How do landslides change  
Earth's surface?

Cause and Effect

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### Moving Earth

It's a rainy day in the mountains. The forest is quiet, except for the peaceful sound of raindrops.

Suddenly, there is a long, loud roar as the surface on one side of a hill breaks off and slides away. The soil tears apart, churning like a washing machine, while trees and rocks are swept away. The wall of debris finally comes to a stop on the flat ground below, burying a road.

This event is called a *landslide*. Landslides are natural disasters in which large masses of rock, mud, or soil suddenly collapse and move downhill.

Landslides can quickly change the landscape.

A landslide in Oso, Washington, buried a neighborhood in about 23 meters (75 ft.) of mud and debris.



## Read-Think-Write

Write your answers on separate paper. Use details from the text as evidence.

- 1 Where is a landslide more likely to take place—in an area with steep mountains or an area with rolling hills? Why?
- 2 What is the difference between a *slide* and a *fall*?
- 3 What are two ways that water can cause landslides?
- 4 How are wildfires related to landslides?
- 5 Why do landslides often happen at the same time as other natural disasters, such as tropical storms or earthquakes?



### FOCUS Question

How do landslides change Earth's surface? Imagine that a large landslide has just struck a steep mountain slope. Describe the type of landslide that occurred and what caused it. Also explain how the landslide changed the shape of the land.



Weathering wears away the side of a hill, and erosion carries bits of rocks, pebbles, and soil down to the bottom.

## Slow Versus Quick

The shape of land changes all the time. Through the processes of *weathering* and *erosion*, water and wind wear away Earth's surface. Sometimes flowing water and blowing wind move rocks and soil a bit at a time. Gravity can move rocks and soil downhill over centuries. Eventually, mountains wear down, rivers carve valleys, and plains grow smooth and flat.

However, landslides happen quickly. When a slope is very steep or the land becomes too loose or fragile, large masses of rock and soil can give way and fall all at once.

There are three main types of landslides: flows, slides, and falls.



## Flows

A flow happens when land acts more like a liquid than a solid. It oozes or rushes downhill, tumbling as it goes. It buries the land below like a flood. A flow can be strong enough to break off trees and pick up large rocks.

Flows almost always happen in soil made of small particles and usually take place when the soil is very wet. When soil becomes mud, a *mudflow* may form. The land easily flows away. A mudflow often occurs during periods of heavy rainfall.

But small, loose bits of soil like sand or gravel can also flow when they are dry. This is a *rockflow*.



## Living with Landslides

Landslides can be devastating for people living nearby. They can bury homes and roads. There may be no time to escape. Since water or sudden movement can cause landslides, they often happen along with other natural disasters. Floods, earthquakes, and volcanic eruptions can all cause landslides.

With careful planning, people can stay safe. Before building homes, bridges, or dams, engineers study the land. They check for layers of weak or loose rock. Then they can avoid building on or near slopes that could give way.

Controlling wildfires can help prevent landslides, too. Firefighters try to keep wildfires small so that some trees survive to hold the soil. Planting trees after fires can help keep slopes in place and prevent future landslides.

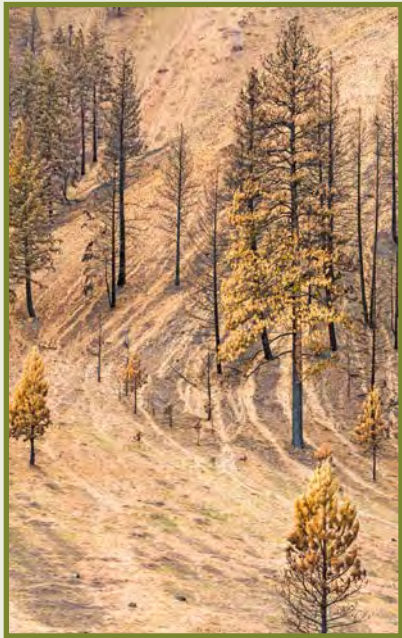


Engineers sometimes plant bushes and trees or place concrete on slopes to help hold up the structures on a hillside.

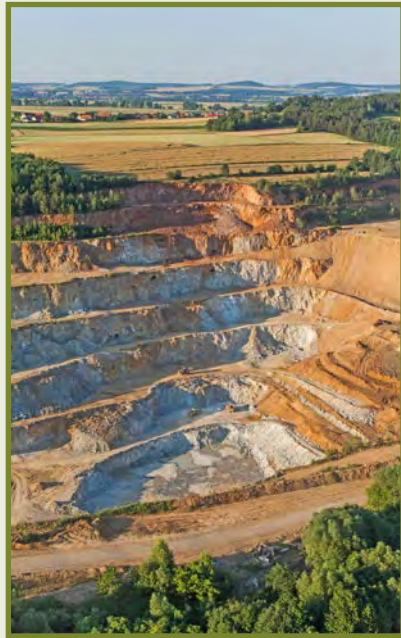
### Other Factors

Other conditions put slopes at risk for landslides. Plant roots can prevent landslides by holding soil in place. But if a wildfire kills the plants, the soil is exposed and rain can soak in, causing flows or slides. People can cause landslides in a similar way. Logging and building homes on slopes clear away plants and their roots.

Mining can dig away rock and soil, forming steep, unstable slopes. Building a dam can also cause a landslide. The water behind the dam can soak into the rock and soil, causing a collapse.



After a wildfire, the soil can easily wash away, leading to landslides.

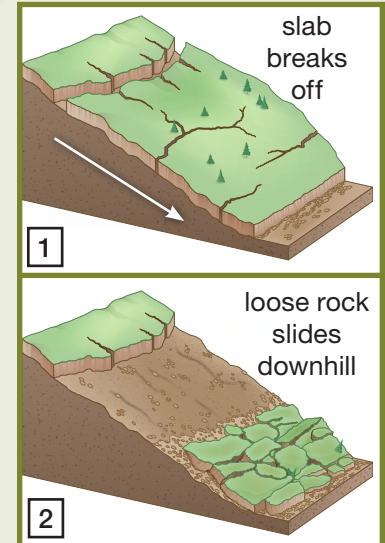


These steep, layered slopes are a result of mining.

## Slides and Falls

### HOW A SLIDE OCCURS

A *slide* happens when an entire slab of land breaks off and rushes downhill. Usually there is a layer of soft or loose rock underground. The weak layer can't support the ground above it, so the top layer gives way. Slides happen more often where water seeps into the rock and weakens it.



A *fall* happens when a chunk of rock breaks off all at once. These sudden crashes happen on very steep land, like cliffs, or places where the ground is hollow beneath the rock.



### Science in Your World

The Old Man of the Mountain was a popular cliff in New Hampshire that looked like a human face. In 2003, the rocks of the "face" broke off and fell into the valley below.



## What Causes Landslides?

All landslides ultimately occur for the same reason—gravity. Landslides happen on sloped land, such as mountains, hills, canyons, and cliffs. What makes some slopes suddenly give way while others remain intact?

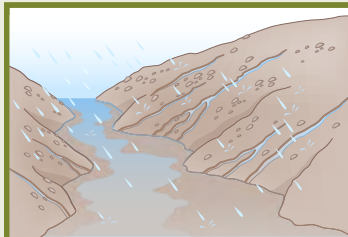
### Water

Water is the main cause of landslides. When it rains or snows more than normal, landslides are more likely to occur. Heavy rain or flooding can turn soil into slick mud, and rocks become slippery—both of which cause flows.

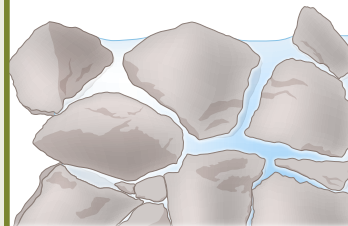
Gradual water erosion can also lead to a landslide. Waves create steep sea cliffs, and rivers carve out canyons. If a slope gets too steep, the land can suddenly give way.

Water can also trickle into cracks in rock over time. When the water freezes, it expands, breaking the rock apart and sending it tumbling.

### THREE WAYS WATER CAN WEAKEN A SLOPE



Water mixes with soil and forms mud.



Water between rocks freezes and expands.



Ocean waves wear away the land.

### Sudden Movement

Have you ever accidentally bumped a table? Did things topple over? This can happen to slopes when Earth's surface suddenly moves.

Earthquakes can shake big chunks of land into loose rock, causing slides or falls. They can also cause something called *soil liquefaction*. The shaking ground squeezes water up to the surface, and the soil becomes slick mud. If the mud is on a slope, it may become a mudflow.

Volcanic eruptions also move Earth's surface. Rising magma and gases can make a slope steeper and steeper until it collapses. Volcanic explosions can shake the land loose, starting a slide. Eruptions also pile up new rock, ash, and lava. This material can make a slope steep or heavy enough to collapse.



### Do You Know?

A *lahar* is a type of landslide specific to volcanoes. It occurs when volcanic ash mixes with water and quickly flows downhill.