FACT SHEET:
WHAT ARE LANDSLIDES?

WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES

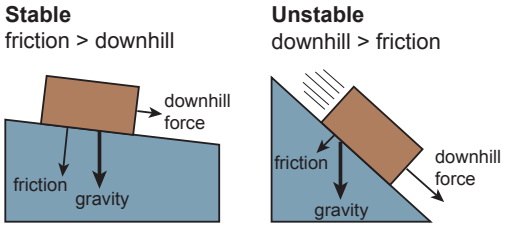
What Are Landslides And How Do They Occur?

A landslide generally refers to the downhill movement of rock, soil, or debris. The term landslide can also refer to the deposit that is created by a landslide event. This fact sheet is meant to provide general information only; real landslides have many variables.

THE ROLE OF GRAVITY

Landslides nearly always move down a slope. This is because the force of gravity—which acts to move material downhill—is usually counteracted by two things: (1) the internal strength of the material, and (2) the friction of the material on the slope. A landslide occurs because the force of gravity becomes greater than either friction or the internal strength of the rock, soil, or sediment.

Steeper slopes have a greater proportion of downhill force



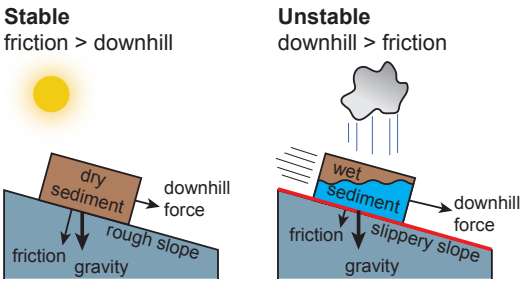
THE ROLE OF WATER

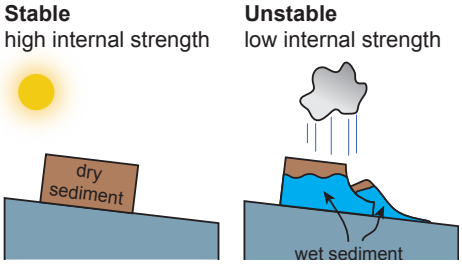
The addition of water to material on a slope can make landslides more common. This is because water adds significant weight to the slope as it seeps into the ground, becoming groundwater, and adding to the gravitational force. Water also lowers the strength of the material which can make it less able to withstand the force of gravity. Water also reduces friction (see *The Role of Friction*), making it easier to move material downhill. These processes help to explain why landslides are much more common during the rainy season, and especially common during or right after large storms.

THE ROLE OF FRICTION

The amount of friction between a deposit of rock or soil and the slope that it rests on plays a large role in when landslides happen. Imagine trying to slide a large rock along a flat surface—it's very difficult because of the friction between the rock and the surface. Pushing the rock is easier if the surface slopes downhill or is slippery. The same is true for landslides—steeper slopes have less friction, making landslides more common. Any change to the Earth's surface that increases the slope (for example, river incision or the removal of material at the base of a slope by humans) or that reduces the friction of a slope (such as the addition of water) can increase the likelihood of a landslide.

The addition of water increases weight and reduces friction





The addition of water can decrease strength and promotes landslides

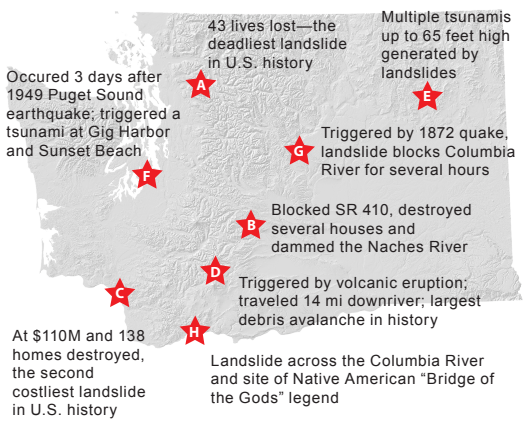
REPORT LANDSLIDES

Report landslides to your county Emergency Manager:

mil.wa.gov/other-links/emd-contact-us

SOME HISTORIC LANDSLIDES IN WASHINGTON STATE

Slide or area name	Date
(A) SR 530 (aka Oso or Hazel)	Mar. 2014,
(B) Nile	Oct. 2009
(C) Aldercrest–Banyon	Feb.–Oct. 1998
(D) Mount St. Helens	May 1980
(E) Lake Roosevelt	1944–1953
(F) Tacoma Narrows	Apr. 1949
(G) Ribbon Cliffs	Dec. 1872
(H) Bonneville	mid-1400s



WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

Division of Geology and Earth Resources
David K. Norman - State Geologist

TWO MAJOR CATEGORIES OF LANDSLIDES

In general, landslides can be categorized as shallow or deep-seated and this difference can determine their speed and size. Landslides typically occur during the winter months in western Washington and during the summer months in eastern Washington, but are possible at any time. Many of the landslide areas in Washington are a mixture of different slide types.

SHALLOW LANDSLIDES

Shallow landslides are rooted in the soil layer and often form slumps along roadways or fast-moving debris flows down valleys. These types of landslides are often called 'mudslides' by the news media. Shallow landslides also occur as flows, slides, or rockfalls and topples.

DEEP-SEATED LANDSLIDES

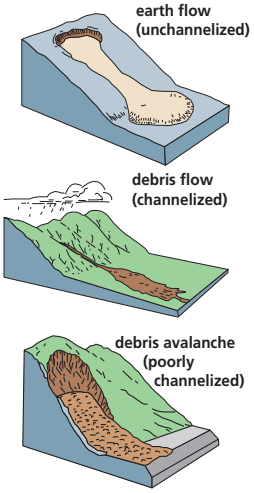
Deep-seated landslides are rooted in bedrock, are often slow moving, and can cover large areas and devastate infrastructure and housing developments. Deep-seated landslides usually occur as translational slides, rotational slides, or large block slides. Deep-seated landslides are typically much larger than shallow landslides.

TYPES OF LANDSLIDES

Landslides can occur as flows, slides, or rockfalls and topples. A major difference between the three types is the amount of water—flows have the most and rockfalls usually have the least.

FLOWS

Flows are generally a slurry mixture of water, soil, rock and (or) debris that moves rapidly downslope. Flows may or may not be confined to a channel.

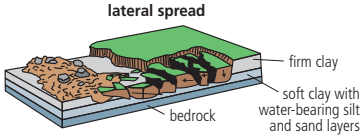


Earthflows have a characteristic 'hourglass' shape. The slope material liquefies and runs out, forming a bowl or depression at the head. Flows usually occur in fine-grained material on moderate, water-saturated slopes.

Debris flows usually occur in steep gullies and contain more coarse material than a mudflow. They move very rapidly and can travel for many miles. Slopes where vegetation has been removed by fire or humans are at greater risk for debris flows.

Debris avalanches are unchannelized debris flows that move very rapidly. They typically do not mobilize far and sometimes move like a snow avalanche.

Lahars are debris flows that originate on volcanoes. A volcanic eruption can rapidly melt snow and ice, causing a deluge of rock, soil, ash, and water that accelerates down the slopes of a volcano, devastating anything in its path. They can travel great distances and damage structures in flat areas far from their source. Communities near rivers draining Mount Rainier and Glacier Peak are at greatest risk.

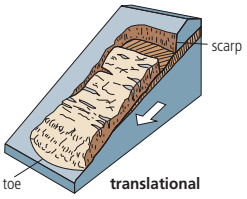


Lateral spreads occur on very low-angle slopes toward a free face such as a cliff or embankment. Movement is accompanied by cracking of the ground. Failure is caused by liquefaction (when soil is transformed from a solid to a liquid), usually because of an earthquake.

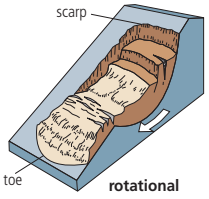
Soil creep is the very slow (inches/year), steady, downward movement of soil or rock. Creep is indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences, and small soil ripples or ridges.

SLIDES

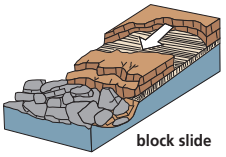
Slides are the downslope movements of soil or rock along a surface and can be deep-seated or shallow. The initiation of slides, like flows or rockfalls, is sensitive to steep slopes, the additional weight of water or other loads, and friction along their base.



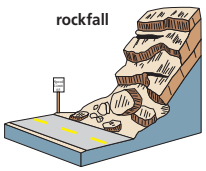
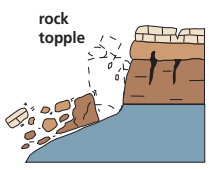
Translational slides usually fail along geologic discontinuities such as faults, joints, bedding surfaces, or the contact between two rock types. They move out or down along a planar surface with little tilting, and can travel great distances. Translational slides can contain loose sediments or large slabs of bedrock.



Rotational slides (slumps) are landslides that occur along a curved or spoon-shaped surface. Backtilting may occur near the scarp of the landslide and there is often a toe of displaced material. Rotational slides often occur because the internal strength of the material is overcome by its own weight. They are usually composed of relatively loose or unconsolidated material.



Block slides are a particular type of translational slide that occur when large and relatively intact slabs of rock or earth are rapidly transported downslope. These type of landslides can be large and damaging and occur where alternating layers of strong and weak rock slope downhill.

ROCKFALLS AND TOPPLES

Rockfalls and topples are usually rapid, downward movement of large pieces of rock. Sometimes this is enough rock to cover a road or bury a stream or river. Rockfalls and topples are common in Washington's mountain passes.