

The surface of the Earth constantly changes. The study of these changes is called geomorphology. Geomorphology includes both the gradual effects of rivers as well as rapid alterations caused by climatic events, such as floods, tsunamis, glacial movements, and mass movements on the surface. It also includes erosion, which is usually a gradual process, but can occur quickly as the result of severe weather.

When erosion happens on a large scale and all at once, it causes a landslide. A landslide is a mass movement of earth that is considered a natural disaster, much like earthquakes, volcanoes, wildfires, floods, and droughts. It can be a serious concern for people living near landslide hazards.

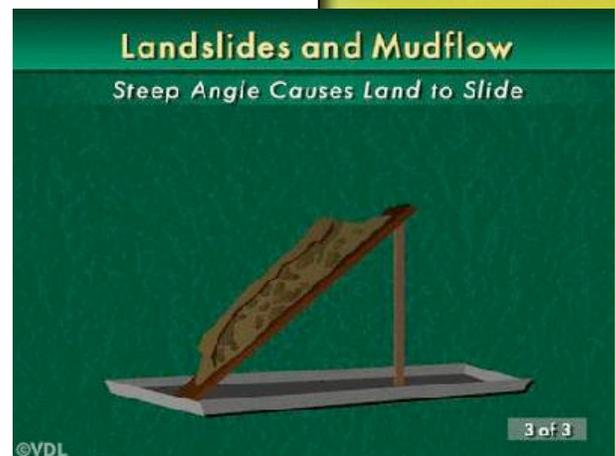
During the winter of 1982 in California's Santa Cruz Mountains, nearly a half-kilometer stretch of mountainside near Love Creek gave way after heavy rains made the soil on the slope unstable. The slide fell on an entire neighborhood, destroying homes and burying them with mud and rock. Ten people were killed at Love Creek. Some of the victims were never found. Afterwards, the geology of the area was studied closely. It was determined that the neighborhood should not be rebuilt in the same location.

Planning for Landslides

As at Love Creek, if a landslide occurs in a populated area, it can destroy buildings and take lives. Landslides are very common where there are mountains and frequent rainstorms. However, any area where weak or fractured materials rest on a steep slope can experience a landslide.

It is important to study landslides and understand their causes because they can be so destructive. Landslides cannot usually be prevented, but they can be anticipated. Good engineering and land management practices can reduce their impact. One way this is achieved is through land-use planning.

Land-use planning in urban areas is done with hazard maps. These maps assign a level of risk to each geographic area. Each area's risk of hazards, such as landslides, then determines the purposes for which the land may be used. Particularly dangerous areas are not used for human purposes, such as housing construction.



At a certain angle, a soil layer built on top of rock layers becomes unstable, as shown in this model.

Reducing Effects of Landslides

Because landslides cannot be prevented, communities located in landslide-prone areas must learn to adapt. Engineers work with fences and other systems to catch or divert landslides and falling rocks. When houses and buildings are destroyed by landslides, they will not typically be rebuilt in the same place. Instead, the new building will be located in a safer area. Hazard maps are also useful in the process of rebuilding after a landslide. The maps help property owners decide on a safer location for rebuilding.



A house destroyed by a landslide

Scientists have learned a lot in recent years about how to anticipate landslides. They are learning to identify the kinds of topography that are more prone to landslides. The study of rock mechanics has led to a better understanding about the strength of different rock layers. New technology is also increasing the ability to anticipate landslides. Satellite imagery and remote sensing data, as well as better weather prediction, has helped to reduce the number of lives lost to landslides.



A conglomerate rock, showing pieces of other rock inside it

Landslides in the Geologic Record

The Earth is a dynamic system. It is always changing. Some evidence suggests that changes to the surface of the Earth have been happening for a long time. When landslides occur, they leave a record. One type of evidence is found in rocks called breccias and conglomerates.

When a landslide occurs, it can break up the rock in the slope and carry pieces downhill. Over time, those pieces of rock are buried under new layers of sediment. The sediment solidifies, cementing the rock pieces together, forming the breccias or conglomerates. Finding such rocks at the base of a mountain can be an indication that landslides have occurred there in the past.

As the science of geomorphology progresses, people will be increasingly able to avoid the natural hazards posed by landslides.