DEBRIS-FLOW LANDSLIDES

Of the wide realm of natural disasters, landslides receive little attention. This is precisely why they often seem so unexpected. A landslide is simply the sudden movement of terrestrial material: any combination of soil, rocks, mud, or water with gravity being the primary driving force. The material can move slowly and cause damage over a period of time, or move rapidly, destroying property and taking lives suddenly. Landslides are more common in mountainous terrain but can occur in relatively flat areas as well. Each year, it is estimated that landslides kill 25 to 50 people and result in about $2 billion of property damage. Landslides are not yet directly predictable but are easier to anticipate than other natural hazards such as tornadoes and lightning.

The term "landslide" covers a wide range of events. In the eastern part of the country, they are typically divided into three categories:

Debris flows are rapidly flowing mixtures of soil, rock particles, and water. Once they begin, debris flows can pick up entire trees, boulders, houses, and cars. The media, when referring to debris flows, often use the term "mudslide." The soil mass that initially moves is usually a rocky, silt-sand mixture that is not highly cohesive, allowing the soil to "liquefy" during heavy rains and move quickly, up to 30 mph downslope. Once movement begins, there is often insufficient time to reach safety. Debris flows often originate in hill slope depressions, or hollows, near the headwaters of mountain streams. When triggered by intense rainfall, debris flows typically follow mountain stream channels. Building homes or other structures at the base of steep hill slopes (>30 degrees), especially near stream channels, increases vulnerability to damaging debris flows. Land-disturbing activity on steep slopes can also increase the likelihood of debris flows.

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Rock slides (sometimes called avalanches or rock fall) usually occur along roadways but can take place on any rock slope. They can occur in conjunction with heavy rainfall but also can happen without notice. Freeze-thaw cycles and wedging by tree roots can loosen blocks of rock from a slope. A rolling and bouncing basketball-sized rock can easily go through a roof. Rocks slide or fall because of preexisting weaknesses within the rock mass.

Debris or earth slides move much slower than debris flows because not enough water is present to allow the soil to liquefy. They typically move inches to feet per day, often making them unnoticeable. During wet weather cycles, slides can be self-perpetuating. Initial movement opens tension cracks that provide pathways for water to infiltrate deeper into the slide mass, further decreasing the stability of the slope. Earth slides, although slow moving, can be dangerous because they are difficult to see.

A variety of events can cause a landslide: earthquakes, snow melt in the mountains, rapid freezing and thawing, or torrential rain. In the eastern United States the majority of landslides are caused by heavy rain because earthquakes are very rare. More specifically, intense rainfall onto already saturated ground from previous rains is often the culprit. Hurricanes and tropical storms are notorious for causing landslides in the Appalachian Mountains. During the active tropical season of 2004, more than 130 significant landslides were documented across the Carolinas. One event was especially devastating. Hurricane Ivan moved through western North Carolina about ten days after Hurricane Frances moved along a similar track. The rains caused a debris flow near Franklin, NC, that traveled more than two miles and leveled a housing community, killing four people and destroying 15 homes.

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In an attempt to prevent future losses from landslides, the United States Geological Survey and numerous state geological agencies are mapping high-risk landslide areas. The results of the risk-mapping will be made available to municipal planners and prospective property owners.

—Jonathan Lamb
Meteorologist

References

North Carolina Geological Survey. "Geologic Hazards in North Carolina – Landslides."

Before a landslide occurs...

Learn about landslide risk in your area.

Contact local officials, state geological surveys or departments of natural resources. Landslides occur where they have before, and in identifiable hazard locations. Ask for information on landslides in your area, specific information on areas vulnerable to landslides, and request a professional referral for a very detailed site analysis of your property, and corrective measures you can take.

If you live in a landslide-prone area:

Contact your insurance company to make sure your property is covered for landslides. Rock and earth slides are usually covered by home policies, but debris flows are often considered flooding and must be separately covered through the National Flood Insurance Program (NFIP).

Become familiar with the land around you to help assess your danger. Watch the patterns of storm-water drainage on slopes near your home, and especially the places where runoff water converges, increasing flow over soil-covered slopes. Watch the hillsides around your home for any signs of land movement, such as small landslides or earth slides. Progressively tilting trees or fences can indicate an ongoing earth slide. Watching small changes could alert you to the potential of a greater landslide threat.

Plant ground cover (low growing plants) on any bare slopes to resist slope movement. The roots hold the soil together which can reduce the chance of a landslide.

During a heavy rain event:

Stay alert and awake. Many debris-flow fatalities occur when people are sleeping. Listen to a NOAA Weather Radio or television for flood statements or warnings. Be aware that intense, short bursts of rain may be particularly dangerous, especially after longer periods of heavy rainfall and damp weather.

If you are in areas susceptible to landslides and debris flows, consider leaving if it is safe to do so. Remember that driving during an intense storm can be hazardous. If you remain at home, move to a second story if possible. Staying out of the path of a landslide or debris flow saves lives.

Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together. A trickle of flowing or falling mud or debris may precede larger landslides. Moving debris can flow quickly and sometimes without warning.

If you are near a stream or channel, be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly. Don't delay! Save yourself, not your belongings.

Be especially alert when driving. Embankments along roadsides are particularly susceptible to landslides. Watch the road for collapsed pavement, mud, fallen rocks, and other indications of possible debris flows.

What to Do if You Suspect Imminent Landslide Danger:

Contact your local fire, police, or public works department. Local officials are the best people to assess potential danger.

Inform affected neighbors. Your neighbors may not be aware of potential hazards. Advising them of a threat may help save lives. Help neighbors who may need assistance to evacuate.

Evacuate. Getting out of the path of a landslide or debris flow is your best protection.