

# Landslides and Debris Flow (Mudslide)



**L**andslides occur in all U.S. states and territories and occur when masses of rock, earth, or debris move down a slope. Landslides may be small or large, and can move at slow or very high speeds. They are activated by storms, earthquakes, volcanic eruptions, fires and by human modification of the land.

Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or “slurry.” They can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. They can also travel several miles from their source, growing in size as they pick

up trees, large boulders, cars, and other materials along the way.

Landslide, mudflow, and debris-flow problems are occasionally caused by land mismanagement. Improper land-use practices on ground of questionable stability, particularly in mountain, canyon, and coastal regions, can create and accelerate serious landslide problems. Land-use zoning, professional inspections, and proper design can minimize many landslide, mudflow, and debris flow problems.

## What to do before a landslide or debris flow

1. Contact your local emergency management office or American Red Cross chapter for information on local landslide and debris flow hazards.
2. Get a ground assessment of your property.
  - County or state geological experts, local planning department or departments of natural resources may have specific information on areas vulnerable to land slides. Consult an appropriate professional expert for advice on corrective measures you can take.
3. Minimize home hazards.
  - Plant ground cover on slopes and build retaining walls.
  - In mudflow areas, build channels or deflection walls to direct the flow around buildings.
  - Remember: If you build walls to divert debris flows and the flow lands on a neighbor’s property, you may be liable for damages. Explore a neighborhood or special district project.

- Install flexible pipe fittings to avoid gas or water leaks. Flexible fittings are more resistant to breakage.
4. Familiarize yourself with your surrounding area.
    - Small changes in your local landscape could alert you to the potential of greater future threat.
    - Observe the patterns of storm-water drainage on slopes and especially the places where runoff water converges.
    - Watch for any sign of land movement, such as small slides, flows, or progressively leaning trees, on the hillsides near your home.
  5. Be particularly observant of your surrounding area before and during intense storms that could heighten the possibility of landslide or debris flow from heavy rains. Many debris flow fatalities occur when people are sleeping.
  6. Talk to your insurance agent. Debris flow may be covered by flood insurance policies from the National Flood Insurance Program (NFIP).
  7. Learn to recognize landslide warning signs.
    - Doors or windows stick or jam for the first time.
    - New cracks appear in plaster, tile, brick, or foundations.
    - Outside walls, walks, or stairs begin pulling away from the building.
    - Slowly developing, widening cracks appear on the ground or on paved areas such as streets or driveways.
- Underground utility lines break.
  - Bulging ground appears at the base of a slope.
  - Water breaks through the ground surface in new locations.
  - Fences, retaining walls, utility poles, or trees tilt or move.
  - You hear a faint rumbling sound that increases in volume as the landslide nears.
  - The ground slopes downward in one specific direction and may begin shifting in that direction under your feet.

*Landslides and flows can provoke such dangers as broken electrical, water, gas, and sewage lines, and disrupted roadways and railways.*

### **What to do during a heightened threat (intense storm) of landslide or debris flow**

1. Listen to radio or television for warning of intense rainfall.

- Be prepared to evacuate if instructed by local authorities or if you feel threatened.

- Should you remain at home, move to a second story if possible to distance yourself from the direct path of debris flow and landslide debris.

2. Be alert when intense, short bursts of rain follow prolonged heavy rains or damp weather, which increase risks of debris flows.

3. 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.

4. If you are near a stream or channel, be alert for sudden increases or decreases in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream. Be prepared to move quickly.
5. Be especially alert when driving. Embankments along roadsides are particularly susceptible to landslides. Watch for collapsed pavement, mud, fallen rocks, and other indications of possible debris flows.
6. Evacuate when ordered by local authorities. See the “Evacuation” chapter for more information.
3. Help a neighbor who may require special assistance—large families, children, elderly people, and people with disabilities.
4. Listen to local radio or television stations for the latest emergency information.
5. Landslides and flows can provoke associated dangers such as broken electrical, water, gas, and sewage lines, and disrupt roadways and railways.
  - Look for and report broken utility lines to appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury.
  - Check the building foundation, chimney, and surrounding land for damage. Damage to foundations, chimneys, or surrounding land may help you assess the safety of the area.

### What to do during a landslide or debris flow

1. Quickly move away from the path of a landslide or debris flow.
2. Areas generally considered safe include:
  - Areas that have not moved in the past
  - Relatively flat-lying areas away from drastic changes in slope
  - Areas at the top of or along ridges set back from the tops of slopes.
3. If escape is not possible, curl into a tight ball and protect your head.
6. Watch for flooding, which may occur after a landslide or debris flow. Floods sometimes follow landslides and debris flows because they may both be started by the same event.
7. Replant damaged ground as soon as possible since erosion caused by loss of ground cover can lead to flash flooding and additional landslides in the near future.
8. Seek the advice of a geotechnical expert for evaluating landslide hazards or designing corrective techniques to reduce landslide risk. A professional will be able to advise you of the best ways to prevent or reduce landslide risk, without creating further hazard.

### What to do after a landslide or debris flow

1. Stay away from the slide area. There may be danger of additional slides.
2. Check for injured and trapped persons near the slide, without entering the direct slide area. Direct rescuers to their locations.
9. See the “Recovering From Disaster” chapter for more information.