

## Landslides in New Hampshire

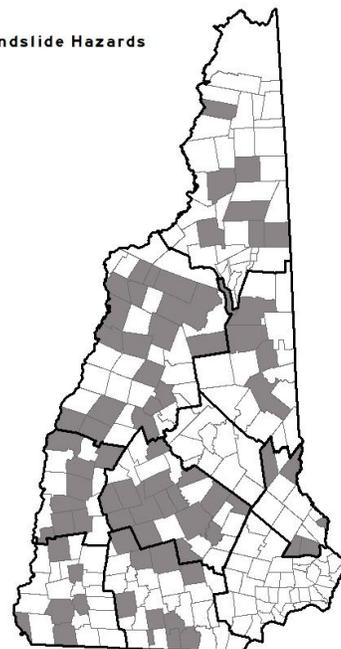
Landslide events in New Hampshire within the past 10 years have shown that such events can occur in the state. A “landslide” is a mass movement of rock and soil, such as rock avalanches, mud flows and slumps. While most landslides occur during or after heavy rain events, they can occur any place where steep slopes and unstable soils combine. Landslides may occur over a span of minutes or less, but they may also take days, months, or even years to develop.

Slope steepness is a key factor causing the earth surface mass movements. However, there are other factors, including erosion of a slope and soil moisture, among others. A period of heavy rains can saturate slope soils, so that the pressure of the water in the spaces between soil particles pushes the soil apart. This enables gravity to overcome resistance to downward soil movement, and when this occurs, a slide begins. Gravity is constant but the degree of resistance can and does vary within slopes.

Although the steepest slopes are found in northern and western New Hampshire, steep slopes occur elsewhere across the state. At right is a map of New Hampshire towns in which at least one landslide is noted in a town’s Local Hazard Mitigation Plan in 2018, showing that landslides are a concern throughout the state. New Hampshire’s two fatal landslides include the Willey Slide of 1826 that killed nine people and the 1885 Cherry Mountain slide that killed one person. Seven major landslides have occurred in Crawford Notch alone during the 20<sup>th</sup> century, with six of these causing damage to roadways. In Franconia Notch, centuries of such activity can be witnessed in the waters of Profile Lake, which are impounded behind thick landslide deposits that altered the course of the Pemigewasset River.

Landslide hazards in the Connecticut River Valley are possible given its unique glacial history. As the last glacier receded from the region at the end of the Pleistocene epoch about 15,000 years ago, a large glacial lake flooded the valley as a newly formed glacial ridge impounded drainage to the south in Connecticut. The thick silt and clay that underlies much of the Connecticut River Valley were deposited beneath the quiet waters of this lake. Much of the Seacoast region is underlain by glacial clay deposited in a marine setting after the glaciers retreated. Where this clay lies beneath steep slopes or riverbanks, small slumps and landslides may be a hazard.

New Hampshire -  
Towns with Identified Landslide Hazards





Two landslides occurred in New Hampshire during 2010 alone. In March 2010, a landslide occurred after heavy rain on a steep hillslope on the south side of High Street in Greenville (photo left). As the top of the slide was next to the High Street pavement, a crevasse formed in the ground surface next to the street. High Street was closed for a lengthy period of time, and extensive stabilization was required. There was water seeping out of the slope the day after the slide occurred, and it is possible that the slide occurred along a pre-existing slide plane caused by the water seepage, below which water could not infiltrate.

One week later, a landslide occurred on about 390 feet of a 30-foot high steep slope facing the Cocheco River in Rochester (photo right). The top of this slide was located close to several homes on Wilson Street. The slope was comprised of sand, which was underlain by a clay layer at the base. While the Cocheco River was not high at the time this landslide occurred, the river had been much higher during the preceding weeks.



Though these events did not cause loss of life or cause the loss of homes, they serve as reminders of the hazards posed by New Hampshire's land. As these two events illustrate, landslides and rain events are related, particularly with very heavy rainfalls, or where several heavy rainfalls have occurred in turn, causing saturated soils. Steep slopes adjacent to New Hampshire's rivers are also prone to landsliding, seen by one example from the Peabody River at Gorham (photo left).

Warning signs are often present prior to a large event. Ground cracks, bulging and slumping may form in the years prior to a slide event. Nearby home foundations may shift, forcing major repairs. Wetland surfaces may rise and fall. Where the local geology suggests that landslides are possible – steep slopes coupled with unstable substrates

– a trigger is needed. In addition to heavy rain and saturated soils, in seismically active regions, this event may take the form of an earthquake, a hazard for which New Hampshire is not immune. Also, earth moving, use of explosives, and construction can also act as a trigger.

### **Landslide Awareness**

If you are near a steep slope, either beside a river or not, you could see certain signs that may suggest an eventual landslide, however, it is not often possible to conclude when a landslide might occur. Signs to watch for include:

- Springs, seeps or areas of saturated ground that has not been seen before; the appearance of such seeps within the steep slope itself, and that is new, may be cause for concern.
- Cracks or sinking that appears in the ground surface, roads, sidewalks, or at the base of foundations; and/or, where soil is moving away from foundations.
- Trees on a steep slope that are tilting, particularly where multiple trees on a slope are involved.
- A bulge appears in the ground surface at the base of a slope.
- Tilting trees, telephone poles, fence posts, etc., beside the top of a steep slope.
- Shifting of doors, walls, windows; or, cracks appearing in buildings.
- Underground utility lines break.

### **Observing Signs and What to Do**

If you observe one or more of these signs at a steep slope (or if they are getting worse), and primarily when property is involved, the first step is to contact an environmental firm with geologists on staff who can evaluate the site and potential risks. If the geologist determines that there are risks to the property or infrastructure, they can provide advice on mitigation options. If that evaluation determines a risk to be present, a landowner should contact their local municipal official or Emergency Management Director, who can relay reports to the State through the New Hampshire Division of Homeland Security and Emergency Management.

If the site of concern affects several properties, or it is believed that a landslide will pose safety risks to the public, you should report your concern to your local municipal officials or Emergency Management Director as soon as possible.

The New Hampshire Geological Survey (NHGS) will receive site-specific situations, questions or concerns via the channels described above. However, if you have general questions about landslides, or data regarding them, you may contact Shane Csiki at [Shane.Csiki@des.nh.gov](mailto:Shane.Csiki@des.nh.gov) or (603) 271-2876).