

Gravity, water -- two key triggers for landslides

James Urton, Santa Cruz Sentinel, 12-10-14

BIG SUR -- Gravity can be such a downer.

From swift and fluid mudslides to massive and lumbering landslides, gravity and water conspire to pull down the mountain peaks and green slopes that tectonic forces propped up.

“Gravity triggers landslides, and gravity doesn’t go away,” said Chris Wills, a supervising engineering geologist with the California Geological Survey.

Gravity is always ready to tear down what Mother Nature has propped up. But over the past two years water, its co-conspirator, has been an infrequent visitor.

Monterey County’s local geography, geology, and weather patterns influence the types of slides that can occur. As scientists have translated the details, California agencies and local communities have implemented practices to mitigate slide hazards.

Landslides come in all shapes and sizes. They form under a variety of conditions, which sows confusion among residents, government officials and even the scientists who study them.

“The problem is ‘landslide’ is such a general, catch-all term,” said Kevin Schmidt, a research geologist with the U.S. Geological Survey in Menlo Park.

The different types of landslides go by many different names. The most common in this area are smaller mudslides and larger landslides. Mudslides and debris flows occur when rains trigger fast-moving slurries of water, mud, dirt and debris. More massive, slow-moving landslides slip and slide their way down slopes often at the rate of inches or feet each year. But, sometimes even massive landslides move swiftly and without warning. Each type of slide occurs under its own unique geological and weather conditions.

“Rock and soil type really impart a fingerprint on how far and how fast it moves,” said Schmidt.

Mudslides and debris flows are arguably the most widespread landslide hazard across the county. If enough rain falls and saturates soil, they can plague nearly any water-laden slope or valley below.

“They happen along widely-scattered areas, typically after rainstorms,” said Wills. “They can be similar to a flood, but more hazardous because they move at the speed of water but have all this dirt and debris.”

Most mudslides and debris flows rush down the steepest drainage channels they can find, be it a natural channel or sewer line. Local planning commissions can mitigate risks to people and property by restricting building projects in these channels.

“It’s possible to build and avoid these channels,” said Wills. “It’s up to local agencies to investigate and avoid these.”

Wildfires can also leave areas prone to dangerous and swift-moving debris flows, noted Sherrie Collins with the Monterey County Office of Emergency Services.

“When soils get parched like that after a fire ... water just beads up and runs off,” she said.

Using grant money from the U.S. Department of Agriculture's Natural Resources Conservation Service, Monterey County OES has helped fortify six homes against debris flows that survived the Pfeiffer Ridge fire.

For larger landslides, all eyes in Monterey County are gazing southwest.

"Really, it's mostly the Big Sur coast that's our biggest worry," said Collins.

But, different sections of the coast are at vastly different risk for large landslides. The risks center around the local bedrock composition, position and angle.

"Geologic history governs what can happen there," said Wills.

Weaknesses in local bedrock can trigger larger landslides, which can range from a slow creep to a speedy slide. Sometimes, these slides move so slowly that buildings on the surface remain relatively intact. As with mudslides and debris flows, water and gravity work together to trigger the slide. But, with larger landslides, their conspiracy hatches over a longer period of time.

"For large landslides, you're much more likely to have them after several big storms saturate the ground," said Wills.

Even then, it can take weeks or months for water to penetrate a weak section of bedrock, soak it through, and let gravity do what it does best.

Large landslides need weak sections of bedrock to work best. For a region as geologically complex as Big Sur, divining the geologic history and landslide hazard for each section of coast is no easy task. Both USGS and the California Geological Survey have mapped bedrock composition and the rates of slow slides along the coast south of Carmel to help Caltrans and local communities understand landslide risks.

"The stage was set over millions of years for what we have now," said Schmidt.

Northern sections of the Big Sur coast contain stronger, crystalline bedrock that is more resistant to water inundation and larger landslides. Mudslides and debris flows are the primary slide-related hazards.

South of Hurricane Point, the bedrock mostly formed out of ancient deposits of small-grained sediments. The southern part of the Monterey County coast is dominated by marine sedimentary rocks that were lifted above sea level millions of years ago. They include layers of shale, which are especially prone to water inundation and land slides.

"It's a known problem child, and it's very expensive from a road maintenance standpoint," said Schmidt.

Caltrans has spent years coping with the effects of slides, large and small, along the Big Sur coast.

"When a storm is forecasted, we go on storm patrol 24/7. That includes landslides," said Susana Cruz, public information officer for Caltrans District 5, which includes Monterey County. Caltrans workers clear drainage paths and culverts before and after storms, secure slopes with netting and clear debris after mudslides and debris flows.

But after larger landslides, Caltrans has scrambled to rebuild highways and implement new landslide control policies. The last major slides in March and April 2011 washed sections of Highway 1 into the Pacific Ocean.

With the drought reducing rainfall, closures of the highway for landslides have been rare since 2012. More recently, Caltrans unveiled two major improvements to Highway 1 to bypass landslide hazards or reduce closure and repair times when they occur. The \$11 million Rocky Creek viaduct opened November 2013 and the \$29.5 million Pitkins Curve bridge and rock shed opened in January.

But, even Caltrans acknowledges that no infrastructure project will completely avoid or resist landslides.

“We live right by the ocean,” said Cruz. “They’re a part of life here.”

Landslides are a force of nature. Efforts to confront them, from new highways to improved drainage, are at best battles to mitigate risk. Eventually, Caltrans will need to replace more sections of coastal highway. USGS and the California Geological Survey will discover new landslide risks, alerting planning commissions and emergency responders. Residents will have to adjust.

It is a part of life locals in Monterey County know very well, especially along Big Sur.

“It’s the epitome of resiliency,” said Collins.