Susceptibility to Deep-Seated Landslides in California

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This map shows the relative likelihood of deep landsliding based on regional estimates of rock strength and steepness of slopes. On the most basic level, weak rocks and steep slopes are more likely to generate landslides. The map uses detailed information on the location of past landslides, the location and relative strength of rock units, and steepness of slope in a methodology developed by Wilson and Keefer (1985). The result shows the distribution of one very important component of landslide hazard. It is intended to provide infrastructure owners, emergency planners and the public with a general overview of where landslides may occur in the future. The maps show the relative likelihood of deep landsliding based on regional estimates of rock strength and steepness of slopes in a methodology developed by Wilson and Keefer (1985). The result shows the distribution of one very important component of landslide hazard. It is intended to provide infrastructure owners, emergency planners and the public with a general overview of where landslides may occur in the future.

How this map was prepared

Landslide inventory: All previously mapped deep-seated landslides were digitized from the Landslide Inventory Database, which is maintained by the State of California Department of Conservation. The database records all landslides that have occurred in California since 1900. The landslide inventory maps are only available for specific counties. Where in county, and may not reflect all of these counties.

Terrain: A digital elevation model was generated with data from the 2009 National Elevation Dataset (NED). Slope values were then calculated from the elevation data and combined according to the methodology of Wilson and Keefer (1985).

Rock strength: A relative rating of rock strength, a measure of resistance to deformation and fracturing, is shown in the map legend. The rock strength classes are placed in the highest rock strength unit, weakly cemented sandstones in an intermediate unit, and shale, claystone, pre-existing cemented sandstones in the lowest value of rock strength. Note that digital landslide susceptibility to deep-seated landslides in California can be triggered by rainfall, earthquake shaking, or other factors. Additionally, this map does not include susceptibility to debris flows, a very fluid, fast-moving form of landslide which typically is triggered by intense rainfall. A complete map of landslide potential would consider the increase in landslide hazard, including debris flow hazard, with higher potential rainfall and with higher potential earthquake shaking. Average annual rainfall is higher in the northern Coast Ranges and northern Sierra Nevada than in the rest of the state and potential earthquake shaking is higher in the coastal regions. Although we cannot currently combine these factors to produce a landslide potential map, the convergence of factors suggests higher landslide potential in the northern Coast Ranges than in other regions of the state.

Next steps, from landslide susceptibility to landslide potential: Landslides can be triggered by rainfall, earthquake shaking, or other factors. Additionally, this map does not include susceptibility to debris flows, a very fluid, fast-moving form of landslide which typically is triggered by intense rainfall. A complete map of landslide potential would consider the increase in landslide hazard, including debris flow hazard, with higher potential rainfall and with higher potential earthquake shaking. Average annual rainfall is higher in the northern Coast Ranges and northern Sierra Nevada than in the rest of the state and potential earthquake shaking is higher in the coastal regions. Although we cannot currently combine these factors to produce a landslide potential map, the convergence of factors suggests higher landslide potential in the northern Coast Ranges than in other regions of the state.

Landslide Susceptibility: Rock strength and slope are combined according to the methodology of Wilson and Keefer (1985) as implemented by Ponti et al (2008) to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks.