

U.S. DEPARTMENT OF THE INTERIOR  
U.S. GEOLOGICAL SURVEY

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Plate 5 of 20

Digital Inventory of Landslides and Related Deposits  
Triggered by Hurricane Mitch,  
Villanueva Quadrangle (2661 IV), Honduras

Intense rainfall from Hurricane Mitch, 27-31 October 1998, exceeded 900 mm at places in Honduras and triggered more than 500,000 landslides throughout the country. According to estimates by the U.S. Army Corps of Engineers, landslides damaged 70% of the road network in Honduras. We estimate that nearly 1,000 fatalities resulted from landslides; however, official death tolls were not recorded in many areas of Honduras.

This landslide inventory map, prepared under the auspices of the U.S. Agency for International Development (USAID), shows one of 19 areas in Honduras that have ongoing landslide hazards and were the focus of landslide studies by the U.S. Geological Survey. The map shows the distribution of landslides triggered by Hurricane Mitch, including both source areas and deposits. This map and others of this series provide a basis for making informed decisions concerning possible relocation efforts and future land-use planning. In addition, estimates of sediment volume produced by landslides are derived for selected topographic quadrangles where landslide debris appears to be contributing significantly to the total sediment load of rivers, streams, and reservoirs.

Landslides shown on this and the other respective inventory maps were mapped by photo interpretation using 1:40,000-scale black-and-white airphotos taken by the U.S. Air Force in the months after Hurricane Mitch and from 1:40,000-scale black-and-white photos taken by a private contractor from Guatemala City in 2001. The landslide polygons were sketched onto 1:50,000-scale topographic maps of Honduras using the stereographic images produced by photo pairs to locate the landslides. The landslide boundaries were then manually digitized as input into a GIS database. We estimate the accuracy of locations to be within 100 m in terrain with low topographic relief and better than 50 m in terrain with high or distinctive topographic relief.

Debris flows accounted for more than 95% of the landslides and ranged in thickness from less than 1 m to 15 m and in length from a few meters to 7.5 km. Shallow thickness of debris flows (0.2 m-2.0 m) in the southern part of the country reflects the shallow, granular soils that exist in a tropical desert climate. Debris flows in central and northern Honduras are thicker (up to 15 m) due to the deeply weathered volcanic soils that result from higher annual rainfall within tropical valleys and cloud forests. Flow paths of debris flows in central and northern Honduras ranged in length from tens of meters to 7.5 km. The highest concentrations of debris flows in Honduras occurred in the mountains near the town of Choluteca where more than 900 mm of rain fell in three days.

Although landslides other than debris flows were few, several dozen deep-seated slump/earth flows occurred. The largest of these (6 million m<sup>3</sup>) was triggered in Tegucigalpa where the entirety of Colonia Soto was destroyed and the Río Choluteca dammed producing a large sewage lagoon upstream from the landslide dam.

The processes of flooding, landslide movement, and sediment transport were closely linked during Hurricane Mitch and continue to pose hazards. Numerous river systems have extreme sediment loads produced by landslide masses in the headwaters of these streams. As a result, many of these stream systems will continue to have localized

flooding and stream avulsion for many years to come due to the sediment produced by landslides that is being transported down the stream drainage network.

Descriptions of landslides in specific 1:50,000-scale quadrangles are found in the text of this report. The report also includes estimates of sediment volumes due to landslides in specific quadrangles.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

A PDF file for this map is available at  
<http://geology.cr.usgs.gov/greenwood-pubs.html>