



Are landslides in the New Madrid Seismic Zone the result of the 1811–1812 earthquake sequence or multiple prehistoric earthquakes?

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Previous research indicates that deep translational and rotational landslides along the bluffs east of the Mississippi River in western Tennessee were triggered by the M7–8 1811–1812 New Madrid earthquake sequence. Analysis of recently acquired airborne LiDAR data suggests the possibility of multiple generations of landslides, possibly triggered by older, similar magnitude earthquake sequences, which paleoliquifaction studies show occurred circa 1450 and about 900 A.D. Using these LiDAR data, we have remapped recent landslides along two sections of the bluffs: a northern section near Reelfoot Lake and a southern section near Meeman-Shelby State Park (20 km north of Memphis, Tennessee). The bare-earth, digital-elevation models derived from these LiDAR data have a resolution of 0.5 m and reveal valuable details of topography given the region's dense forest canopy. Our mapping confirms much of the previous landslide mapping, refutes a few previously mapped landslides, and reveals new, undetected landslides. Importantly, we observe that the landslide deposits in the Reelfoot region are characterized by rotated blocks with sharp uphill-facing scarps and steep headwall scarps, indicating youthful, relatively recent movement. In comparison, landslide deposits near Meeman-Shelby are muted in appearance, with headwall scarps and rotated blocks that are extensively dissected by gullies, indicating they might be an older generation of landslides. Because of these differences in morphology, we hypothesize that the landslides near Reelfoot Lake were triggered by the 1811–1812 earthquake sequence and that landslides near Meeman-Shelby resulted from shaking associated with earlier earthquake sequences. To test this hypothesis, we will evaluate differences in bluff height, local geology, vegetation, and proximity to known seismic sources. Furthermore, planned fieldwork will help evaluate whether the observed landslide displacements occurred in single earthquakes or if they might result from episodic movements associated with a sequence of multiple prehistoric earthquake. This study highlights the value of high-resolution, bare-earth topographic data to investigate the secondary effects of groundshaking in stable continental regions, where primary tectonic deformation associated with large earthquakes is commonly obscure or subtle.