

¹Lauren Palermo (lpalermo@usgs.gov), ²Aleeza Wilkins (awilkins@usgs.gov)

¹U.S. Geological Survey, Geologic Hazards Science Center, ²U.S. Geological Survey, Office of Risk and Resilience

Landslide Loss Motivation

National Landslide Preparedness Act

Public Law 116-323: directs the Department of the Interior (DOI) to create a program to **reduce losses related to landslides**¹.



Landslide on SR 530 in Oso, Washington (2014) related to prolonged heavy precipitation.

Landslide in La Conchita, CA (2005) reactivated by intense rainfall.

Landslide in Thistle, Utah (1983) related to heavy precipitation plus rapid snowmelt.

43 fatalities, \$120 million spent to reconstruct SR 530, \$60 million in settlement payouts.

10 fatalities, \$5 million in settlement payouts.

No fatalities, roughly \$200 million in losses.

40 homes destroyed, dammed the North Fork Stillaguamish River.^{2,3}

13 homes destroyed, 23 severely damaged.^{4,5}

Flooded town of Thistle, damaged highways and rail lines, and formed a temporary lake.⁶

Landslide losses in the U.S. are severely underreported in space and time due to the absence of landslide insurance policies or programs, and the difficulty isolating landslide impacts from cascading hazard events. The widely cited \$1 billion/year loss estimate is based on limited data and has not been systematically updated⁷. To address this gap, the USGS compiled existing landslide loss reports into the National Landslide Damages and Losses (NLDL) database⁸ — and the Landslide Loss Interest Group was formed to advance the consistent, scalable, and operational collection of new landslide loss data going forward.

What is the NLHRR?

The National Landslide Hazard Risk Reduction (NLHRR) Working Group

is a USGS-supported interagency group focused on coordinating efforts to reduce losses from landslide hazards across the United States. Established under the National Landslide Preparedness Act (Public Law 116-323)¹, the NLHRR brings together federal agencies, state geological surveys, emergency management agencies, and academic institutions to advance landslide research, mapping, early warning, and risk communication.



Landslide Loss Interest Group

The **Landslide Loss Interest Group (LLIG)** is a subgroup of the NLHRR focused on better understanding, collecting, and conveying landslide loss data.

The overarching goals of this interest group are to collaboratively identify:

- (1) potential uses for and applications of landslide loss information,
- (2) best practices for the collection and management of these data
- (3) new avenues for data collection.

Our Members Include:

Kyle Tucker (Hawaii EMA)
Alice Pennaz (USGS)
Martha Kopper (Arkansas GS)
Jenny Riker (USGS)
Ben Mirus (USGS)
Stephen Slaughter (USGS)
Bill Burns (DOGAMI)
Scott Anderson (BGC Engineering)
Melanie Gall (ASU)
Curran Mohnhey (ODOT)

David Slayter (California GS)
Paul Burgess (California GS)
Kate Mickelson (Washington GS)
Eric Bilderback (USGS)
Sarah Hall (USGS/College of the Atlantic)
Zack Lifton (Idaho Geological Survey)
Oronde Drakes (USGS)
Nicholas Farny (FHWA)

Year One – Overview of Goals & Accomplishments

Task 1 – Identifying Potential Users of Landslide Loss Data

In Year One, the LLIG worked collaboratively to identify who uses landslide loss data and for what purposes, drawing on member expertise, guest presentations, and workshop discussions. This effort produced a working matrix of known and potential users and applications that will continue to be refined as the group's work advances.

Known Applications	Known Users	Potential Users
Mitigation Cost for Funding Requests (e.g., Benefit-cost analysis, indirect cost assessments, comparing mitigation options)	Counties, States	State EMAs, State DOTs, General Public
Metrics for Communicating Landslide Hazards Science Importance (e.g., Policy such as NLPAs referencing the Schuster 1978 estimate)	Congressional Audience, Grant Programs	
Communication of Hazard Consequences (public safety campaigns, cost savings of early intervention)	Federal, State, Local governments, non-profits, special interest groups	General Public, Policy Makers, Park Service, Educators, Real Estate Agents
Data-Informed Research	Federal Agencies (USGS), Academic researchers	
Land-Use Planning (e.g., disclosures for home buyers, discovery during land use assessments, exposure analysis of high-traffic areas)	State and Local Planning Boards	Real Estate Agents
Early Warning System Development	Academic researchers (i.e., University of Hawaii)	State & County EMAs
Hazard Mapping and Risk Assessments (e.g., vulnerability assessments, risk modeling)	State, County, City, Federal	Insurance
Emergency Response Planning (e.g., FEMA Preliminary Damage Assessments must estimate the cost of damage)	State/Local Emergency Management	State DOTs
Recovery Cost Estimates	Insurance, Federal Agencies (FEMA)	State EMAs, State DOTs

Task 2 – Defining Landslide Terms for Landslide Loss Tracking

Building on early discussions around shared terminology, the LLIG established working definitions for key terms including "landslide," "loss," and loss types to ensure consistent language across members and future guidance materials.

Term	Definition
Landslide	A gravity-driven downhill movement of earth materials [e.g. rock, mud, or dirt]. ¹⁰
Loss	The direct or indirect consequences of a landslide. <i>Direct losses</i> refer to directly quantifiable measures expressed in either monetary terms for damaged or destroyed physical assets (buildings, infrastructure and natural resources, etc.) or counts such as number of fatalities and injuries. <i>Indirect losses</i> refer to the subsequent or secondary results of the landslide, (such as declines in output or revenue and impact on wellbeing of people,) and generally arise from disruptions to the flow of goods and services as a result of a disaster. ¹¹
Repair Cost	Expenses to restore a damaged facility to its pre-disaster design, function, and capacity. ¹²
Replacement Cost	The cost of replacing the facility on the basis of its pre-disaster design (size and capacity) and function in accordance with applicable codes or standards. ¹²
Maintenance Cost	Routine/preventive maintenance activities that preserve the existing condition and extend useful life. ¹³

Year Two Proposed Activities

Thirty-five percent of the U.S. road network lies in areas with some level of landslide susceptibility,¹⁴ and State Transportation Departments are often bear the costs of repairing landslide-related damages to roads, therefore in Year 2, the LLIG is focused on improving landslide loss information in the transportation sector.

In our second year, the LLIG has proposed to:

- (1) Identify a State Department of Transportation (DOT) to work with for a landslide loss pilot;
- (2) Create a landslide loss pilot plan with the identified state (Washington);
- (3) Develop standardized guidance materials for landslide loss data collection, including a Landslide Classification Cheat Sheet tailored to DOT operations.

Building on insights from the 2025 Highway Geology Symposium workshop, Year Two will emphasize practical implementation — moving from defining and scoping landslide loss collection toward actively testing a replicable, scalable approach with a state partner. Results from the Washington pilot can later be tested for transferability to other State DOTs.

Do YOU have any landslide loss data? Or know where we could find it?

LEAVE A STICKY NOTE WITH DETAILS BELOW

(viable data will be incorporated into Version 2 of the NLDL (Palermo et al., 2026, in preparation))

Takeaways

- Documented applications and users of landslide loss data can inform how agencies prioritize and integrate loss reporting into existing programs.
- Shared loss terminology provides a foundation for more consistent reporting across jurisdictions and sectors. A State DOT pilot approach, if successfully developed, could serve as a replicable model for expanding loss tracking nationally

If you are interested in joining the NLHRR, please scan the QR code to the right.

NLHRR Homepage:



Landslide Hazard Program Webpage:



If you want to join the LLIG, please reach out to Lauren Palermo and/or Aleeza Wilkins for more information.

REFERENCES

1. U.S. Congress, 2021. National Landslide Preparedness Act.
2. The Seattle Times, 2024. Oso landslide timeline, 2014–2024.
3. Washington State Department of Natural Resources, 2015. Significant deep-seated landslides in Washington, 1984–2014.
4. Pacific Coast Business Times, 2008. La Conchita lawsuit settlement.
5. Sallent, 2008. La Conchita slide lawsuit settlement. Los Angeles Times.
6. University of Utah Bureau of Economic and Business Research, 1984. Flooding and landslides in Utah.
7. Fleming & Taylor, 1980. Estimating U.S. landslide damage costs. Environmental & Engineering Geoscience.
8. Palermo et al., 2025. National Landslide Damages and Losses Database. USGS data release.
9. U.S. Geological Survey, n.d. National Landslide Hazard Risk Reduction Working Group goals infographic.
10. U.S. Geological Survey, n.d. Landslide basics.
11. United Nations Office for Disaster Risk Reduction, n.d. Direct and indirect losses terminology.
12. Federal Emergency Management Agency, n.d. The 50% Rule: Repair vs. Replacement.
13. Federal Highway Administration, 2016. Guidance on highway preservation and maintenance.
14. Wood & Jones, 2025. Road exposure in landslide-susceptible areas. International Journal of Disaster Risk Reduction.