

A Call for Participatory Convergence: Social Science Integration for Landslide Risk Reduction



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Natural Hazards Center



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To **reduce landslide risk**,
we must accelerate the integration of
the social and physical sciences,
engineering, public health, and other
relevant disciplines and ways of
knowing.

This will require a **convergent
approach** that is participatory,
interdisciplinary, problem-focused, and
solutions-based.



Photo by: Jonathan Godt, USGS, 2017

A photograph showing a landslide site. A paved road is cut off by a deep, exposed soil and rock mass. Several large, white, cylindrical pipes are visible, protruding horizontally from the landslide area. In the foreground, a person wearing a blue cap and a striped shirt is crouching down, looking at a smartphone. Another person in a dark shirt and khaki pants stands on the road, looking down at the landslide. A third person in a white shirt and hat stands further back on the left. The background shows a steep, green hillside under a blue sky with scattered clouds.

Landslide Risk Reduction is a *scientific endeavor* and inherently *social process* that involves people, organizations, institutions, and policy making bodies.

This process necessitates the deep integration of social science knowledge and approaches.

Photo by: Jonathan Godt, USGS, 2017

A soldier in a helmet and tactical gear is seated in the back of a vehicle, looking out over a landscape. The soldier is wearing a white helmet and a dark jacket. The landscape is a mix of green vegetation and brown, eroded soil. In the background, a small town or village is visible under a cloudy sky.

3 key points regarding the importance of social science integration and convergence

1. Social Science Questions are Central to Landslide Risk Reduction



Photo by: Jonathan Godt, USGS, 2017

1. Social Science Questions are Central to Landslide Risk Reduction

Social science integration and research leadership supports a human-centered approach to landslide risk reduction. Examples of the types of questions* social scientists might study include:

Risk, Risk Perception, and Warnings

- Who is most at risk to landslides? (*hazard exposure x physical vulnerability and social vulnerability / capacity*)
- How do people become exposed to landslides? How is exposure shaped by historical, social, political, and economic processes?
- How do different population groups understand landslide risk? How do people interpret landslide susceptibility maps?
- Who has access to landslide early warnings, and what are their further information needs?

Preparedness, Response, and Mitigation

- Are people prepared for landslides? What or who helps initiate preparedness in communities?
- How do diverse segments of the population act—both *immediately* (protective actions) and in the *long-term* (insurance, structural mitigation, relocation)—in response to the risks they face?

Impacts and Recovery

- What are the mental and physical health, educational, economic, political, and social impacts of landslides?
- What financial resources and other forms of social capital do people draw on to recover from landslides?
- What are the long-term consequences of landslides for families, schools, businesses, and communities?

Policy Evaluation

- What landslide risk reduction policies and programs are in effect at the local, state, tribal, and territorial levels? How effective are these programs at reducing risk?

*Jocelyn West, Sociology Ph.D. candidate at CU Boulder, is writing a dissertation that will tackle some of these key questions.

2. Social Scientists Are Leading Efforts That Can Support Your Work



Photo by: DeeDee
Bennett Gayle, 2019

2. Social Scientists Are Leading Efforts That Can Support Your Work

A few examples of existing social science programs that could be leveraged in the landslide hazard space (while also attending to the question of “What is unique about landslides?”).

ShakeAlert® Social Science Working Group, U.S. Geological Survey

- research on public awareness of earthquake hazard and available warning technology
- evidence-based guidance for emergency alert terminology
- *actionable* risk communication messaging
- *inclusive* alerts and warnings

Social Science Research Group for Wildfire, U.S. Forest Service

- organizational learning and continuous improvement

Social Science Extreme Events Research (SSEER) Network

- status of the social science workforce
- social science research coordination
- social science expertise

Natural Hazards Center

- Quick Response Research Award Program* (*funding from USGS for landslide hazard research!)
- public education and research to applications

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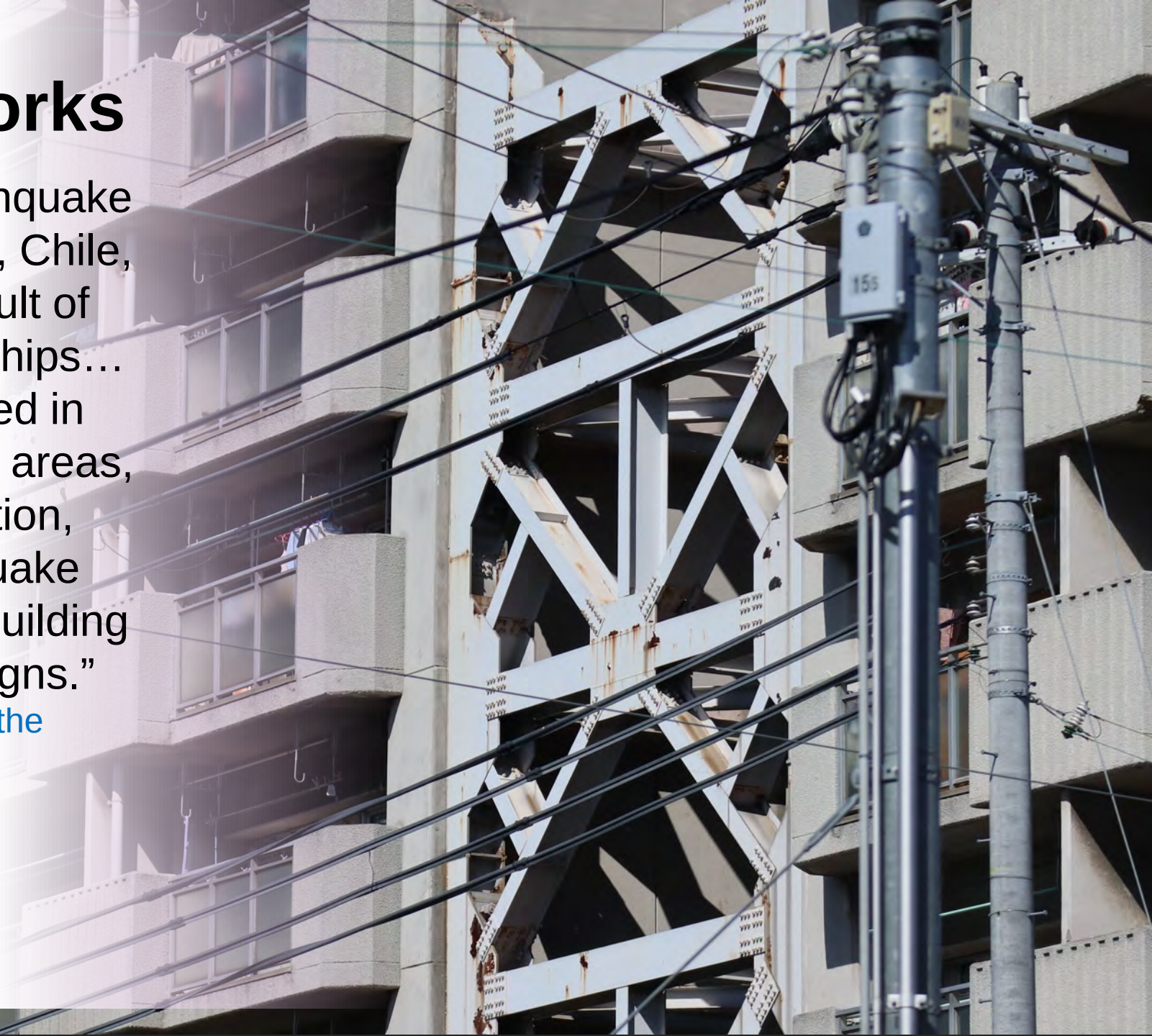
- training on the ethical collection of perishable data, reciprocity, social vulnerability, and much more
- multi-disciplinary research coordination and systematic data collection
- training and funding for data publication and sharing

3a. Convergence Works

“The remarkable reduction in earthquake fatalities in nations such as Japan, Chile, and the United States is the result of convergent-like research partnerships...

These partnerships have resulted in improved maps of earthquake risk areas, estimates of strong ground motion, engineering designs for earthquake resistant structures, and revised building codes compliant with those designs.”

-Dr. Marcia McNutt, “Convergence in the Geosciences,” *GeoHealth*, 2017



3b. *Participatory Convergence* Works Even Better

- Despite initial scientific breakthroughs, early applications of convergent research a) had little to no social science involvement and b) provided limited guidance for going beyond basic science and engineering to **reach impacted communities**.
- Yet, societal transformation requires that scientific innovations are **received, understood, and implemented** by practitioners, policy makers, and, most importantly, the communities and populations impacted by the serious problems to be addressed.
- **Participatory convergence** is a research approach that is *participatory* (community-centered, ethical, equitable, collaborative) and *convergent* (interdisciplinary, problem-focused, solutions-oriented)



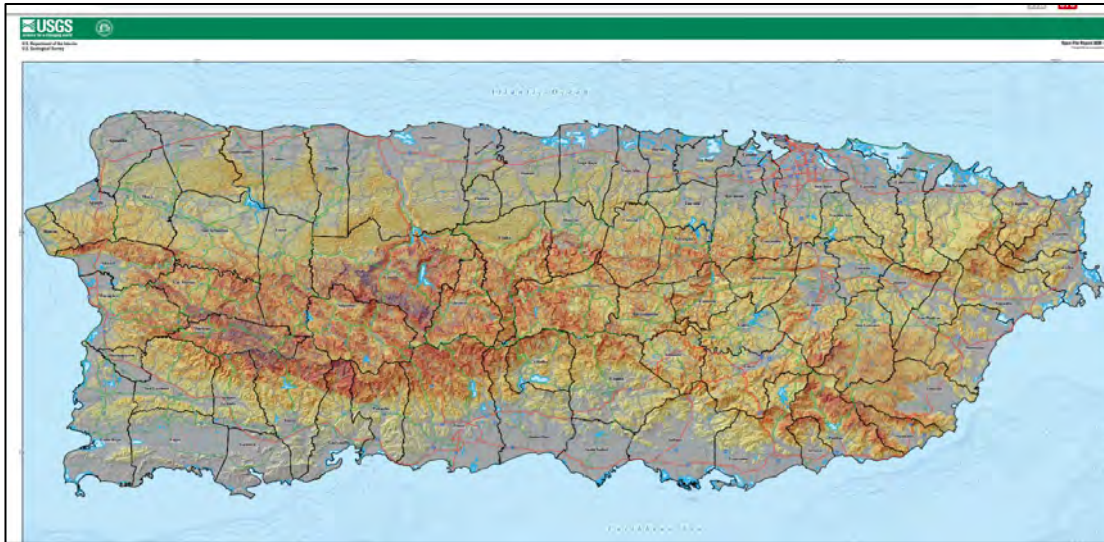
An aerial photograph showing a large landslide in a tropical area. A muddy, brown river flows through the center, surrounded by lush green vegetation. Several small houses and buildings are scattered throughout the landscape, some appearing to be in the path of the landslide. A road is visible on the right side, curving around the edge of the slide. The overall scene depicts the aftermath of a natural disaster.

Participatory Convergence In Action

- Hurricane Maria triggered more than **70,000 landslides** in Puerto Rico
- The USGS Landslide Hazard Program responded to Puerto Rico in the wake of Hurricane Maria and, **based on stakeholder requests**, identified the need to assist with the development of scientific products and education and outreach materials.

USGS + UPRM Partnership: Scientific Products

- Landslide inventory
- Landslide susceptibility map
- Products for hardest hit municipalities

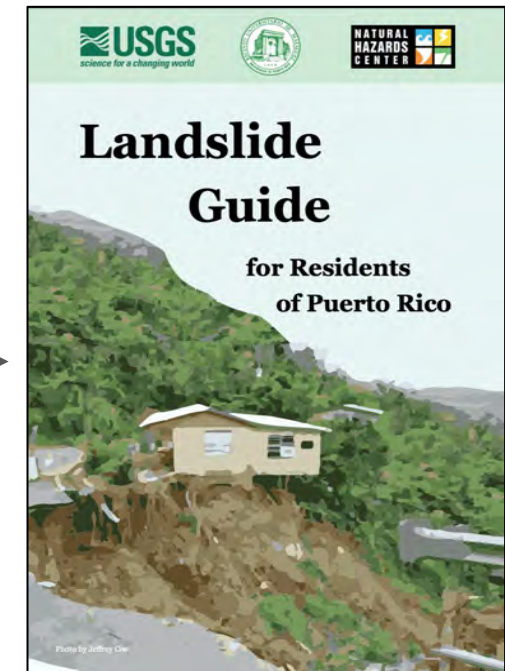
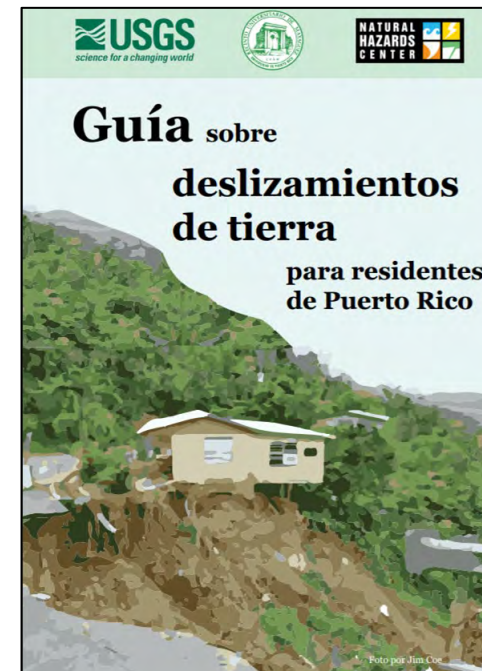


pubs.er.usgs.gov/publication/ofr20201022

Hughes and Schulz, 2020

USGS + NHC + UPRM Partnership: Education and Outreach Products

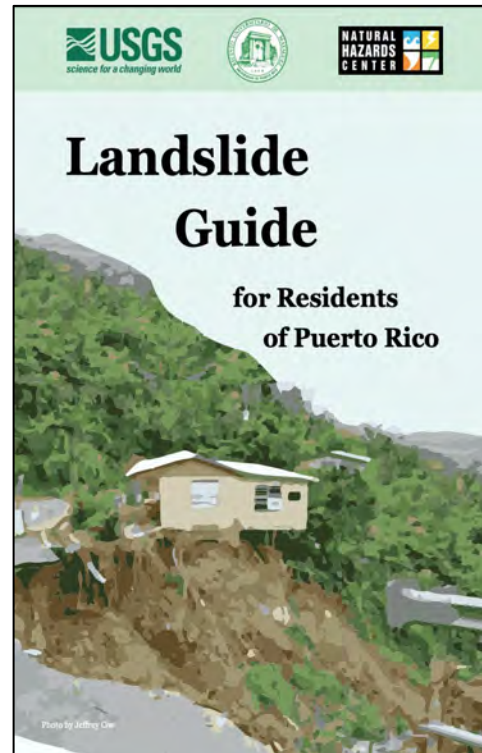
- Landslide guide (Spanish/English)
- Complementary products:
 - Trainings, radio scripts, infographics, & more



Download the Guides: hazards.colorado.edu/puertorico

Core Project Team: Lindsay Davis, Jocelyn West, (co-leads)
Godt, Hughes, Lugo Bendeزú, Álvarez, Peek

Why was the Landslide Guide created?



A: To **support the risk reduction objectives** of residents and professionals in Puerto Rico.

B: To **engage, inform, and raise awareness** about landslide risks in communities in Puerto Rico.

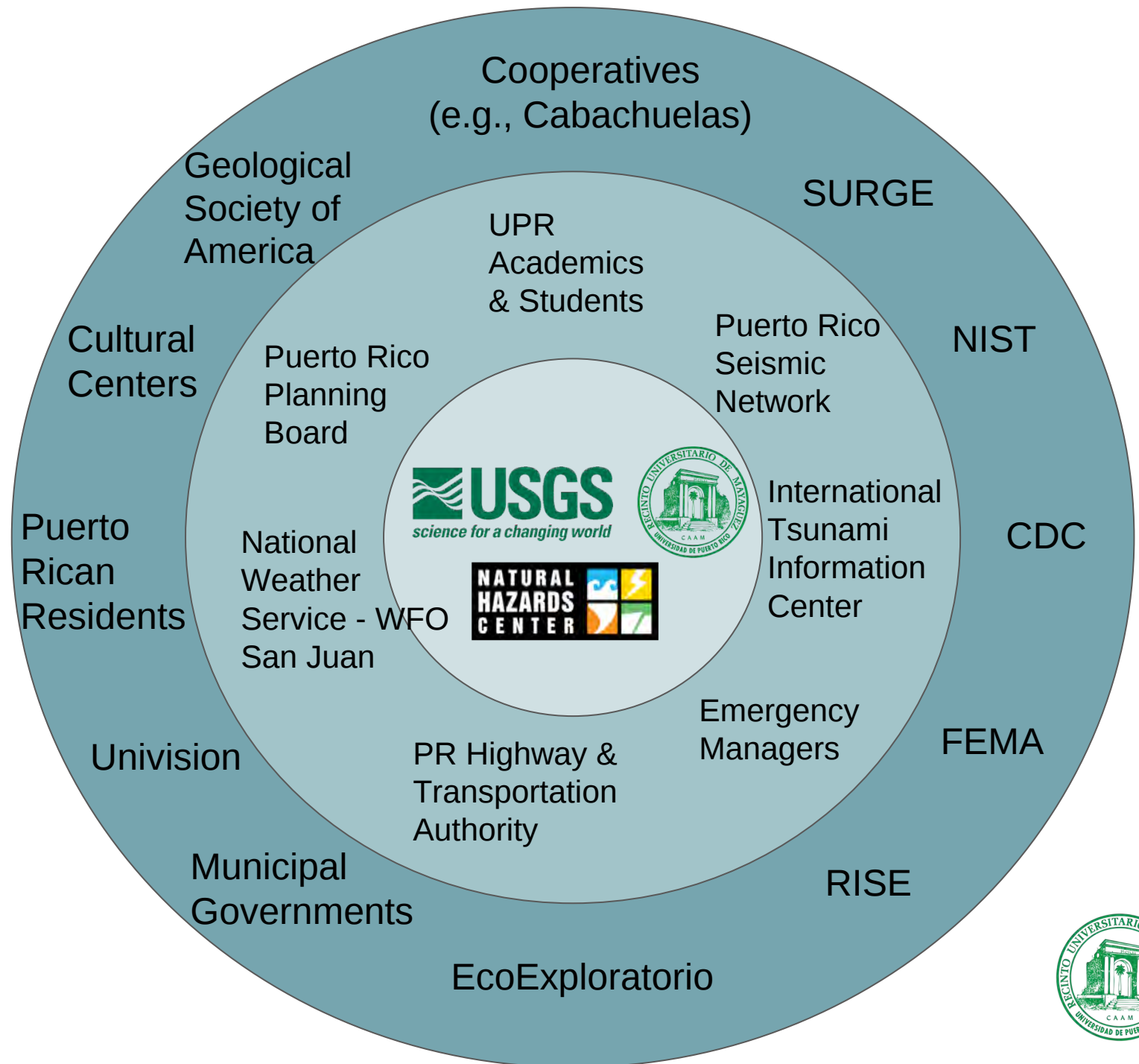
C: To **serve as a foundation for various additional modes of risk communication** including multimedia, workshops, and presentations.

*Participatory
convergence
requires *trusting
relationships* and
*long-term
collaboration**



Participatory convergence requires trusting relationships* and long-term collaboration

*Special thanks to ACL member Dr. Lorna Jaramillo Nieves!



Participatory Convergence Success Story

Puerto Rico's LandslideReady Program is getting these scientific and risk communication products into the hands of emergency managers, planners, and community members.

This was possible because of a social science-informed, participatory process that has supported municipalities. Some metrics of success:

- 15 municipalities currently participate in the program.
- More than 5,000 *Landslide Guides* have been distributed.
- Countless conversations and numerous preparedness and risk reduction actions have been initiated.



Photo by Karla Torres, 2026

An aerial photograph showing a steep, densely forested hillside. A prominent, light-colored, diagonal scar from a landslide runs down the center of the hill. In the foreground, a large, flat green field is visible. To the right of the field, a cluster of white buildings, identified as a school, is situated. The background shows more rolling hills under a blue sky with scattered clouds.

**What is
holding us
back?**

School

What is holding us back?

1. There is **no cohort of landslide social science researchers** akin to the generations of social scientists who've studied earthquakes, hurricanes, tornados, and wildfires.
 - Only **45 (2.5%)** of 1,836 Social Science Extreme Events Research (SSEER) members have studied a landslide event. (14 of these 45 landslide social science researchers are in the United States.)
 - There has been less federal/academic investment in building the capabilities of landslide social science researchers when compared to other hazards.
2. Landslides are one of the **least studied natural hazards** among social scientists.
 - Landslides often hit rural or geographically isolated populations. There is a tendency in the social sciences toward studying large-scale events that impact large numbers of people.
 - The Oso Landslide (2014) is the most studied landslide in our SSEER database, and still, **only 5 social scientists** reported studying that event.
3. Save for a few important examples of interdisciplinary, deeply integrated social-physical-engineering-health research, we have **few models of truly participatory convergent research** in the landslide hazard space.

**Change is
possible,
thanks to
the work you
are doing.**

School



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- Jonathan Godt and Jenny Riker
- Jocelyn West and Lindsay Davis
- Brigid Mark

THANK YOU



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hazards.colorado.edu
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Supplemental Slides for Reference

The Natural Hazards Center

Since 1976, we have served as the National Science Foundation-designated information clearinghouse for the **societal dimensions** of hazards and disasters.

Translating and
Sharing
Information

Building
Connections

Advancing New
Knowledge

Educating the Next
Generation

hazards.colorado.edu/



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Natural Hazards Center and CONVERGE

CONVERGE

Established in 2018, CONVERGE is the **social science led** shared-use facility that is part of the larger NSF-funded Natural Hazards Engineering Research Infrastructure. CONVERGE trains researchers, coordinates multi-disciplinary research teams, and advances convergent hazards and disaster research that is problem-focused and solutions based.



converge.colorado.edu



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Natural Hazards Center and CONVERGE

Training Modules

Since July 2019, our CONVERGE team and partners have released **12 Training Modules**

16,082

Training
Module
Registrants

21,043

Successfully
Completed
Modules

converge.colorado.edu/resources/training-modules/

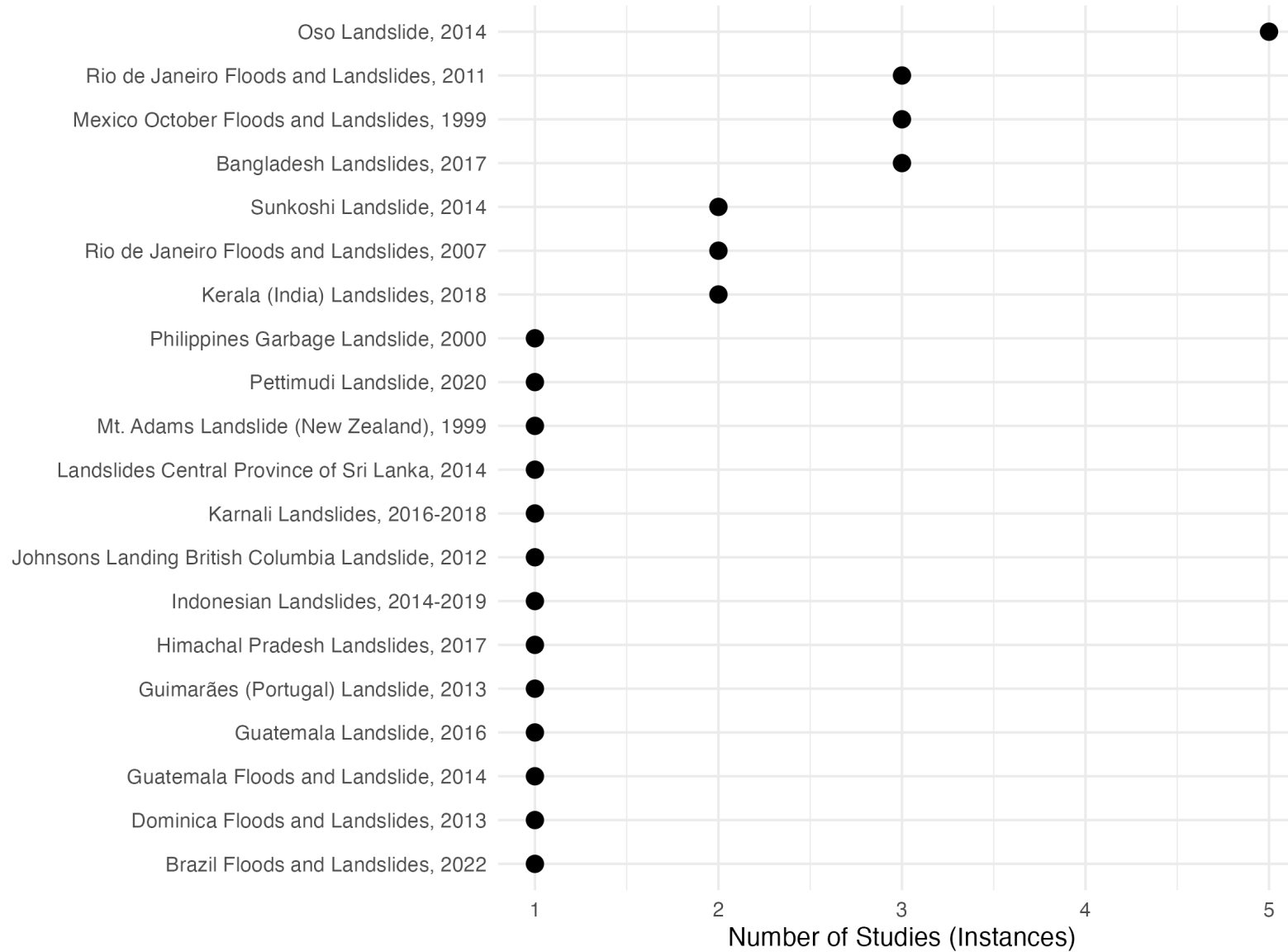


			
Broader Ethical Considerations	Collecting and Sharing Perishable Data	Cultural Competence	Disaster Mental Health
			
Emotionally Challenging Research	Gender-Based Violence in Fieldwork	Indigenous Sovereignty in Disasters	Institutional Review Board Procedures
			
Positionality	Public Health Implications	Reciprocity in Research	Social Vulnerability and Disasters

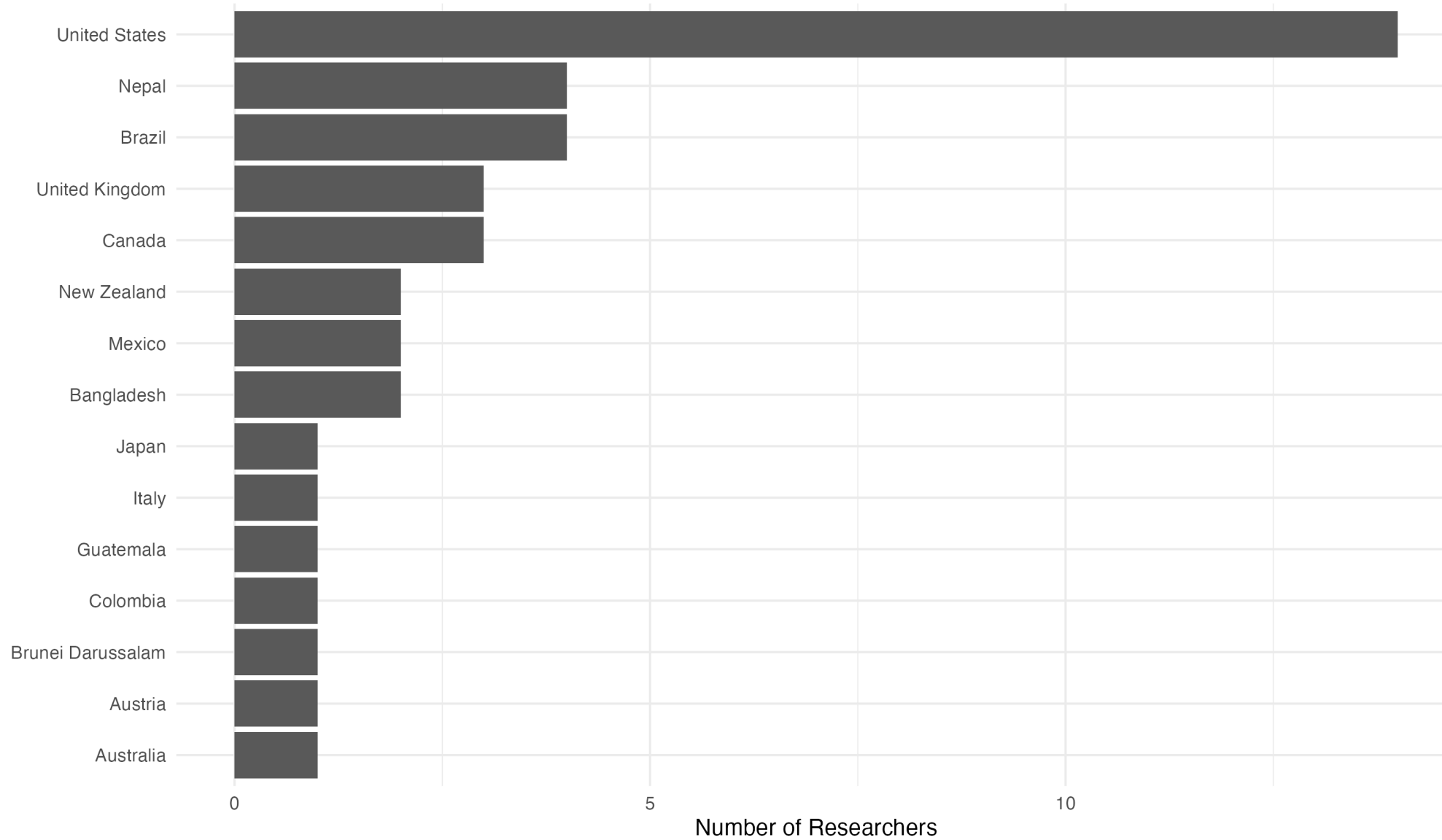


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Most-Studied Landslides (Top 20)



Where Landslide Researchers Are Based



Select Publications

Landslide Guide for Residents of Puerto Rico. University of Puerto Rico Mayagüez, U.S. Geological Survey, and Natural Hazards Center.
https://hazards.colorado.edu/puertorico.*

*Spanish Language Version, “*Guía Sobre Deslizamientos de Tierra Para Residentes de Puerto Rico*,” available at: <https://hazards.colorado.edu/research-projects/puerto-rico-landslide-hazard-mitigation-project>.

Austin, Jessica, Candace M. Evans, Jocelyn West, Heather Champeau, Lori Peek, and Rachel M. Adams. 2024. “Defining and Practicing Reciprocity in Disaster Research.” *International Journal of Qualitative Research* 23. <https://doi.org/10.1177/16094069241309279>

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<https://doi.org/10.3389/fbuil.2020.00110>

West, Jocelyn, Lindsay Davis, Raquel Lugo Bendezú, Yahaira D. Álvarez Gandía, K. Stephen Hughes, Jonathan Godt, and Lori Peek. 2021. “Principles for Collaborative Risk Communication: Reducing Landslide Losses in Puerto Rico.” *Journal of Emergency Management* 19(8): 41-61.
<https://doi.org/10.5055/jem.0547>

*Spanish Language Version, “*Principios de comunicación colaborativa de riesgos: Reducir las pérdidas por deslizamientos de tierra en Puerto Rico*.” <https://hazards.colorado.edu/research-projects/puerto-rico-landslide-hazard-mitigation-project>

Wu, Haorui, Lori Peek, Mason Clay Mathews, and Nicole Mattson. 2022. “Cultural Competence for Hazards and Disaster Researchers: Framework and Training Module.” *Natural Hazards Review* 23(1). [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000536](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000536)