

Steep Risks: Assessing Social Vulnerability to Landslides in Rural Puerto Rico



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Project Overview



Purpose

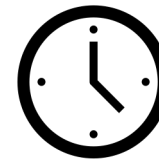
This study assesses the social vulnerability of landslide-prone communities in Puerto Rico, with the goal of understanding:

- the total population living in these areas,
- the relationship between social vulnerability and landslide susceptibility, and
- how communities experience and define their own vulnerability to landslides



Research Site

Utuaado, Puerto Rico
and surrounding areas

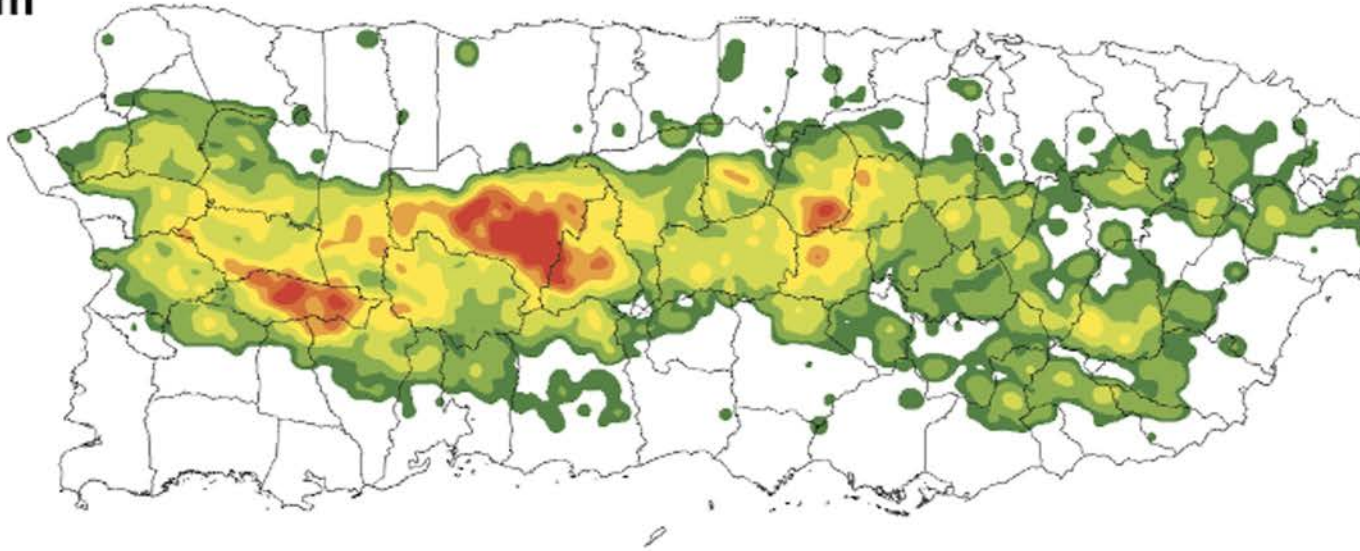
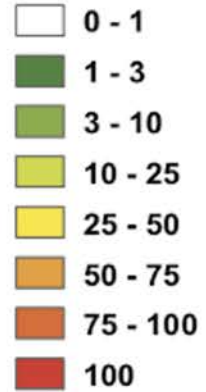


Timeline

Nov 2022-Jan 2023: Quantitative analysis
Jan-April 2023: Qualitative research

Hurricane María Landslide Density

per sq. km



Hurricane María hit Puerto Rico in September 2017. Rainfall triggered 70,000+ landslides.

Landslide scarps density map after Hurricane Maria, data from: Hughes et al, 2019.

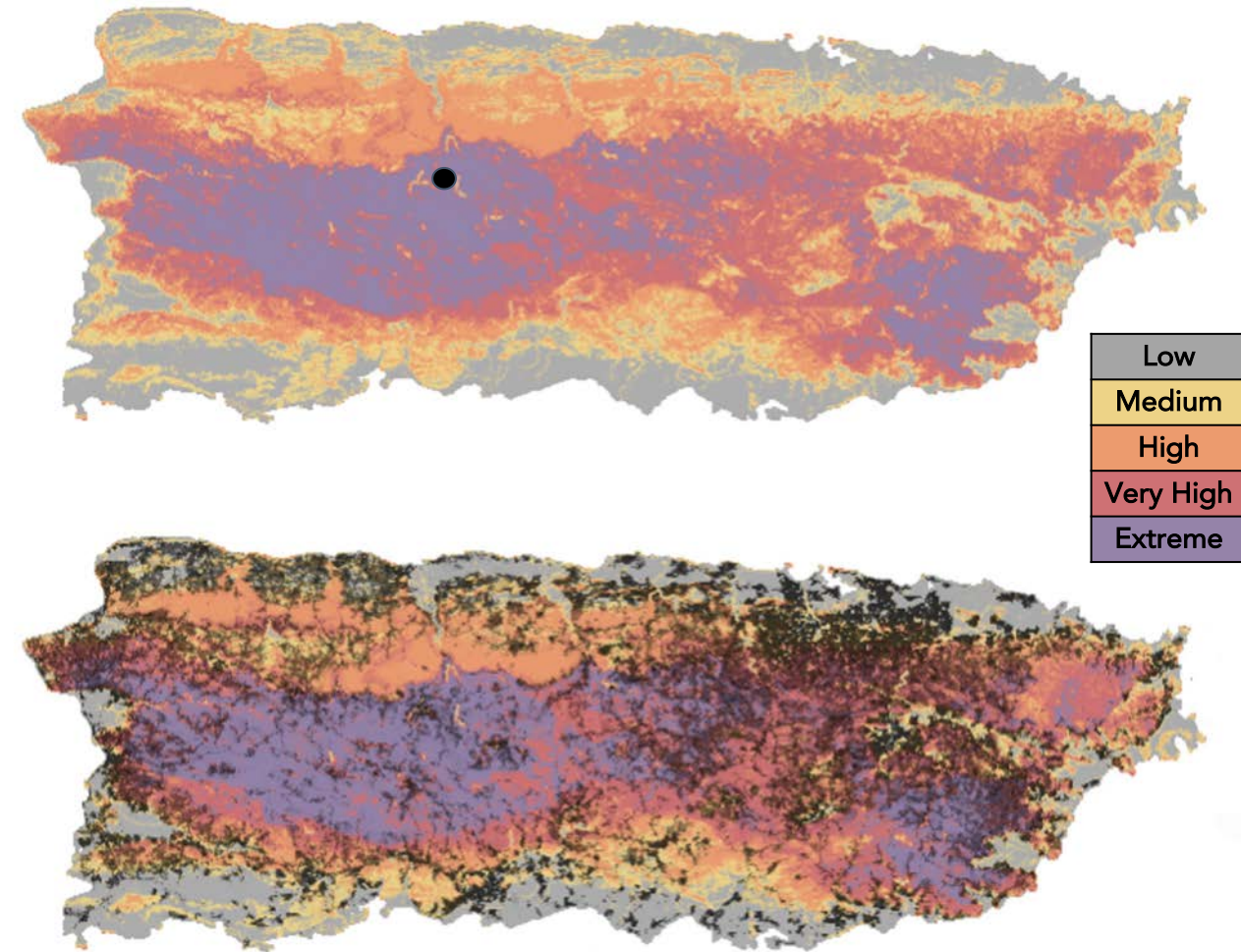


Photos by: Jonathan Godt, USGS, 2017

Methods

Mixed-methods research design

- 1) Quantitative geospatial analysis of the population exposed to different levels of landslide susceptibility (right)
 - **Data:** Landslide Susceptibility (Hughes & Schulz 2020); World Pop 100m gridded population data
- 2) Compared landslide susceptibility and social vulnerability (ASDTR/CDC SVI) at census tract scale.
- 3) Qualitative research in Utuado to contextualize the exposure analysis
 - 2 **focus groups**, 11 semi-structured **interviews**
33 total participants (residents & service providers)



Focus Groups

Focus Groups in Disaster Research



Peek, L., & Fothergill, A. (2009). Using focus groups: Lessons from studying daycare centers, 9/11, and Hurricane Katrina. *Qualitative Research*.

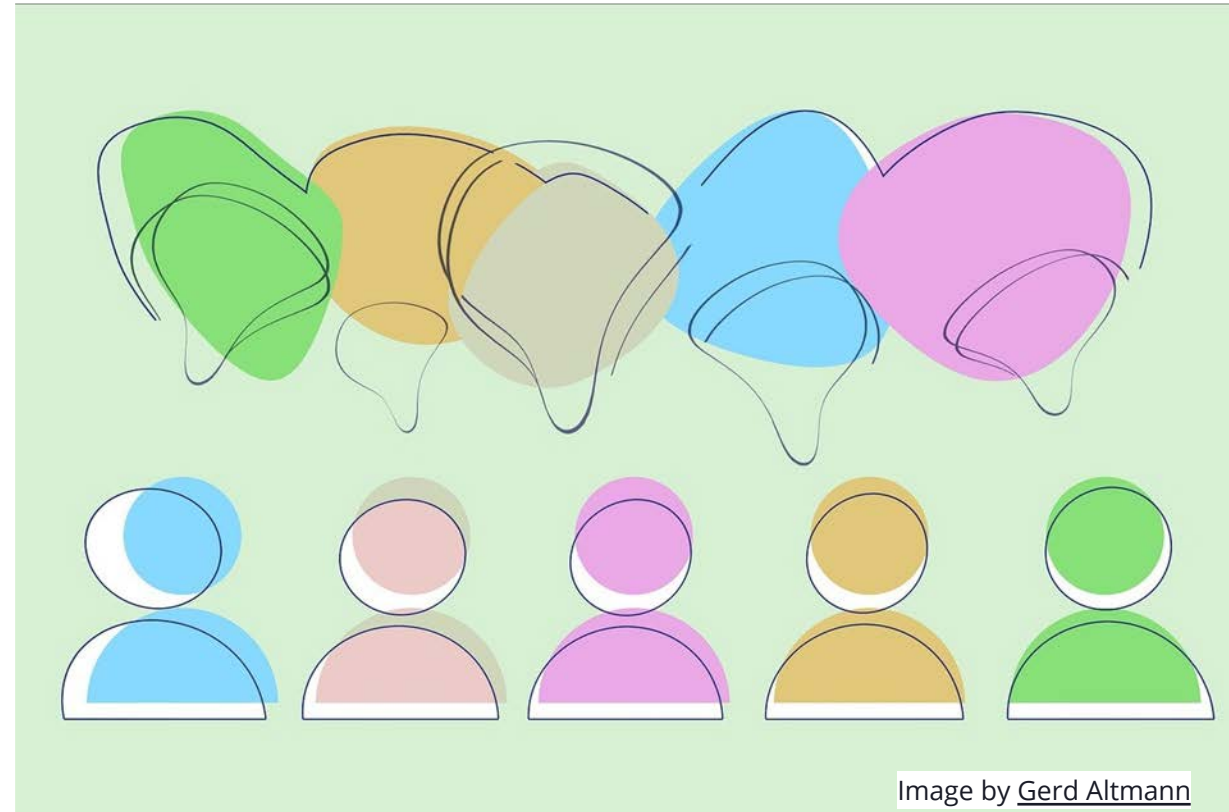


Image by [Gerd Altmann](#)

Preliminary Findings

Table: Population by Landslide Susceptibility Level in Puerto Rico

Susceptibility	Population	Percentage
Low - 1	1,079,297	37.73%
Medium - 2	701,896	24.53%
High - 3	526,533	18.40%
Very High - 4	364,745	12.75%
Extreme - 5	179,009	6.26%

6% of the population lives in the top 1% of area susceptible to landslides.

- One-third of the population of PR lives in areas of high to extreme landslide susceptibility.

Preliminary Findings

Qualitative Analysis

- Landslides are a chronic stressor for some rural residents
- There is inadequate government attention to landslide hazards
- Farmers and agricultural workers may be more “exposed” to landslide risk through impacts to their land and livelihoods
- Elderly populations and people with disabilities are more vulnerable when landslides disrupt the road network

The landslides have not been fixed; the roads have not been fixed. Here we are still, as if hurricane season passed last month. And two or three months from now the season will come again. And here there is no need for a hurricane; if it rains for 12 hours straight, the roads are gone and landslides are the order of the day... Because there is no planning, there is no maintenance of anything that exists.

Public Health Implications



1

Landslides exacerbate public health concerns during and after intense storms, especially those related to clean water and access to medical care.

2

Communities with the highest landslide susceptibility are also typically **medically underserved**.

3

Some communities have started to self-organize ahead of heavy rainfall that might lead to landslides and isolation. **Public health organizations could coordinate with these groups.**

Public Health Implication

1

Landslides exacerbate public health concerns related to heavy rainfall in Puerto Rico

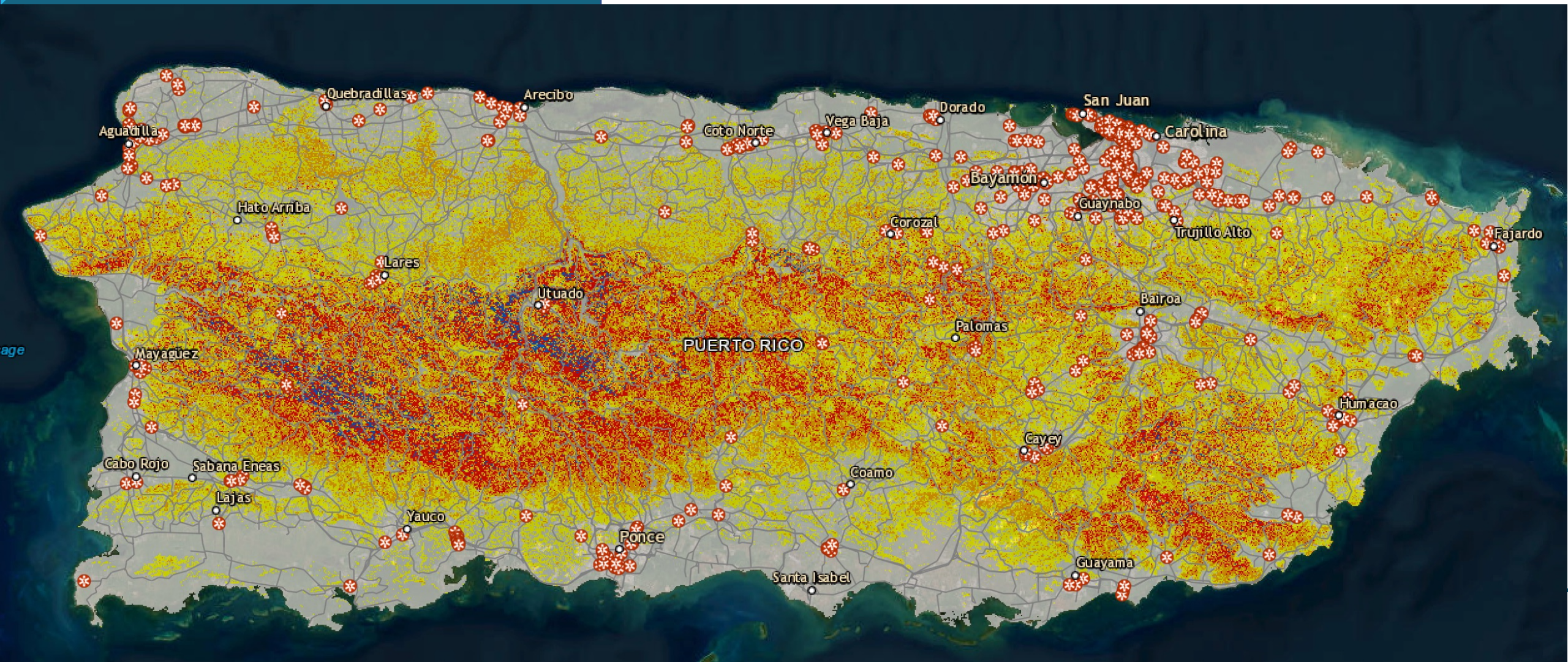
Recommendation: Supporting farmers' and landowners' erosion-control practices can reduce landslide susceptibility, benefit their livelihoods, and mitigate the public health impacts of landslides.



Public Health Implication

2

Communities with the highest landslide susceptibility are also typically **medically underserved**.



Public Health Implication

3

Some communities have started to self-organize ahead of landslides that could lead to isolation.

Public health organizations could coordinate with, support, and learn from these groups.



Future directions



Forthcoming research report on the Natural Hazards Center website



Continued outreach with research participants and the media



Continued analysis of qualitative data



Road network analysis to identify points where communities could become isolated due to landslides

Thank you!

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