TREMOR TACTICS

EARTHQUAKE VULNERABILITY IN PAPUA NEW GUINEA

CONTEXT

There is a growing trend amongst practitioners, researchers, and governments to better integrate disaster risk reduction (DRR) into tangible policies that improve resilience and reduce damage to social, economic, and physical capital. This topic has become even more relevant in recent years, as developing nations—particularly those exceptionally vulnerable to environmental hazards—seek to design innovative and effective policies that sustainably manage environmental degradation while protecting livelihoods and supporting resilient development.

A natural hazard does not necessarily cause a disaster, but a disaster can in part be instigated or exacerbated by a natural hazard. Disasters are caused due to a combination of social, economic, and physical factors. A risk index derived from these various factors and assigned to boundaries can generate a spatial analysis visualizing the populations most at risk.

Papua New Guinea is a developing island nation located north of Australia in the Coral Sea and south of the Indian Ocean. It is located on the "ring of fire", a region known for significant seismic and volcanic activity. Papua New Guinea's terrain is varied (islands, mountains, valleys, and floodplains to name a few), which creates isolated communities.

Many communities are cut off from basic health, sanitation, education, and communication services. There is an underdeveloped road network in the region, primarily servicing only the most population dense areas, and travel between coastal and highland provinces is limited to airplanes. Furthermore, there is no functioning early warning system for earthquake-induced hazards such as tsunamis, landslides, or flooding.

Damage from earthquake-induced mudslide, southern highlands, PNG, 2012. Photo: AusAID

SOURCES

Data: Natural Earth, UNISDR, PNG Nat'l Statistics Office, OurAiports.com, Open Street Map, OCHA ROAP
Projection: UTM WGS 1984 Zone 55S

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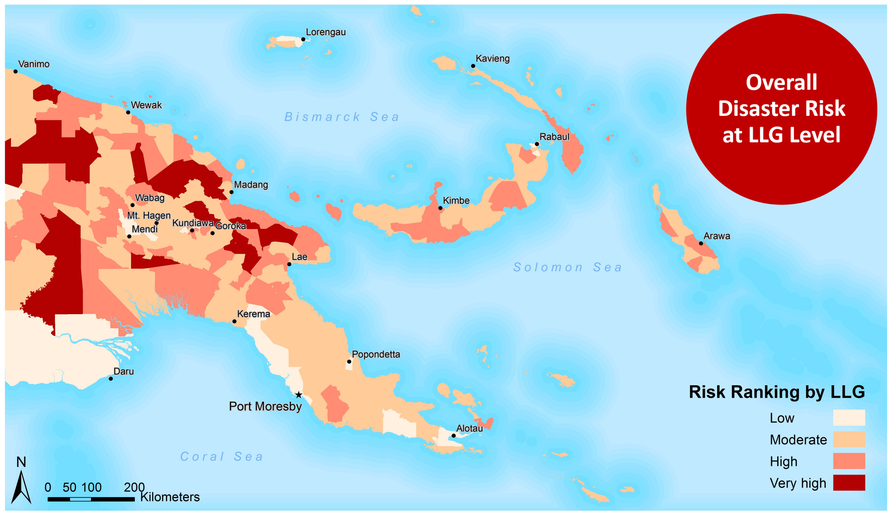
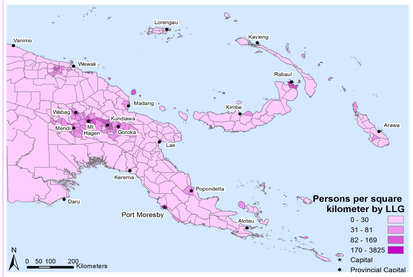
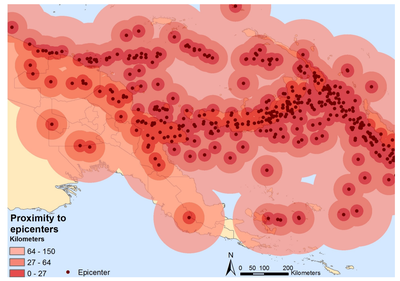


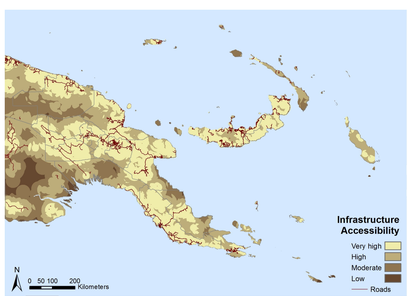
Exposure was defined as population density. It was calculated by dividing tabular census data of LLG population by the LLG area.

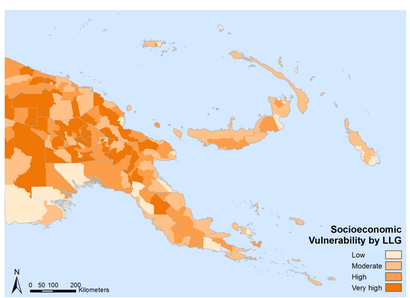


Hazard was calculated using the Euclidean distance tool to define distance to earthquake epicenters. Highly vulnerable areas are within 27 km.



Vulnerability is calculated by combining tabular socioeconomic characteristics and proximity to infrastructure (roads, airports, health and education facilities, and roads using Euclidean distance tool) at the LLG level. The most vulnerable LLGs are those with high population percentages that are illiterate and located far from infrastructure.





METHODOLOGY

This project calculates an overall disaster risk index at the local level government (LLG) level by combining the 3 determinants of disaster as defined by PreventionWeb, UNISDR's knowledge platform: hazard, vulnerability, and exposure. These 3 determinants were then combined using zonal statistics to generate an overall index ranging from low to very high risk. Earthquake data ranges from 1970 to 2017 and all vulnerability and exposure data came from the most recent 2011 census.

Hazard + Exposure + Vulnerability = Risk

RESULTS & LIMITATIONS

On average, LLG-level risk to disasters related to earthquakes is moderate. Nearly 30% of the country is categorized as high to very high risk. This is particularly concerning due to low levels of development and high dependency on subsistence agriculture. The majority of Papua New Guinean food consumption is produced in small gardens. Food security is therefore highly vulnerable to landslides and flooding caused by earthquakes. These circumstances can quickly escalate into famine.

The LLGs with the highest risk tend to be those located further from infrastructure, as illustrated by the Madang province, which had the highest count of highly at risk LLGs (30%). These regions are also vulnerable from a socioeconomic perspective.

There are several limitations to these results, namely the potential impact of external factors such as climate change and the spread of vector-borne disease. These are again dependent on access to infrastructure and baseline socioeconomic characteristics. Another limitation is the size of LLGs relative to population. Smaller LLGs are more densely populated, which may skew their vulnerability rankings.

A key takeaway from this analysis is the glaring need for the government to improve accessibility to vital services amongst rural populations in order to improve response speed and capacity in times of disaster.

Overall Risk Ranking at Provincial Level

Madang	7	Bougainville	6	East New Britain	6	Central	6
Sandaun	7	New Ireland	6	Gulf	6	Manus Island	6
Morobe	7	West New Britain	6	Milne Bay	6	National Capital District	5
Hela	7	Enga	6	Oro	6		
East Sepik	7	Chimbu	6	Western Highlands	6		
Eastern Highlands	6	Southern Highlands	6	Western	6		

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