

# What controls physical vulnerability to geo-hydrological hazards? A contribution to quantitative assessment of landslide and flood risk in western Uganda

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## Abstract

Geo-hydrological hazards (landslides and floods) are often associated with significant damages on physical infrastructure like buildings and roads. Understanding the factors controlling the extent of damage is a prerequisite for quantitatively estimating risk and its spatial distribution, and advising on measures to reduce vulnerability. In this study we document the impact of 64 landslide and six flood events in four selected districts in western Uganda for the period May 2019 - March 2021 through extensive fieldwork. We quantify in economic value the physical damage of landslide and flood hazards on exposed buildings, roads and bridges. We then analyse the physical vulnerability based on damage ratios and determine the factors (building material, hazard characteristics and age of the building) that control the degree of damage using fractional logistic regression. Out of the 91 buildings affected by landslides, 54% were totally destroyed, and only 10% not or minorly damaged, for an average damage cost of 3,179 USD/building. For the 212 documented buildings affected by floods, 35% were totally destroyed, 28% had severe to moderate damage and the rest were minorly or not affected, with an average damage costs of 1,755 USD/building. The physical vulnerability of buildings to landslides depends on the size of the landslide, age of the building, type of building wall material and the steepness of the slope cut to establish an artificial foundation platform. On the other hand, the physical vulnerability of buildings to flood hazards is largely controlled by the flood depth, the distance from the river channel, slope, size of flooded area and type of floor material. The physical vulnerability functions developed in this study are being used as a new inputs into a regional quantitative model of geo-hydrological risks. Combining the hazard estimates with the most accurate information on exposure of physical infrastructure, will facilitate the identification of the types of events and the locations that require most attention for risk reduction.

**Publication:** EGU23, the 25th EGU General Assembly, held 23-28 April, 2023 in Vienna, Austria and Online. Online at <https://egu23.eu/>, id. EGU-4537

**Pub Date:** May 2023

**DOI:** [10.5194/egusphere-egu23-4537](https://doi.org/10.5194/egusphere-egu23-4537)

**Bibcode:** 2023EGUGA..25.4537S