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Do informal urban activities increase the likelihood of landslides?

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The combination of a rapid and unplanned urban development with likely future climate change could significantly affect landslide occurrences in the humid tropics, where rainfall events of high intensity and duration are the dominant trigger of landslides. The attention of current landslide hazard studies is largely focussed on natural slope processes, excluding the role of urbanisation on slope stability. The aim of our study is to understand the relative influence of urbanisation features on local slope stability where focused engineering actions can locally and effectively reduce landslide risk.
The study is set in Santa Lucia (Caribbean) characterised by a tropical climate and an ongoing informal urbanization sprawl. Field work coupled with expert knowledge allowed the definition of reasonable ranges of factors relevant for the evaluation of landslide risk.
In this way, instead of relying on existing records, which are generally lacking or very incomplete for landslides, ranges of plausible preparatory (such as slope, cohesion, friction angles), triggering (rainfall) and aggravating factors (deforestation, house density and water network) are defined and possible combination of these factors are sampled from. We then analysed individual slopes with the software CHASM, a physically based model which combines soil hydrology and slope stability assessment. The influence of the aggravating urban features on site hydrology and stability mechanisms are evaluated and then implemented in denser urban contexts, characteristic of unplanned settlements. The results of CHASMS can be generalised, defining critical thresholds which separate stable and unstable conditions considering both natural factors and the degree of urbanization. Once the triggers are understood, possible mitigation strategies can be evaluated. The ability to define local urban rainfall threshold for landslide slope stability helps the decision-making process to prioritize the areas of interest and locally define the main causes of instability, natural and/or urban. The independency of the method from the landslide records, coupled with a possible local adaptation, facilitates the transferability of the results to other urbanized or urbanising areas.