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Identifying factors leading to hurricane induced landslide dam flood risk in Dominica

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Landslide dams occur when the debris from a landslide blocks, fully or partially, a river channel or floodplain. The landslide event often occurs during periods of heavy, intense rainfall, for example during hurricanes and tropical storms. This means that the blocked river is usually at high flow when the dam occurs, resulting in large volumes of water building up behind the dam. Due to the unconsolidated nature of the material blocking the river and large volumes of water behind it, it often does not take long for the dam to fail, releasing an enormous pulse of flood water down the river system. This flood pulse can cause enormous damage and modelling estimates show it can result in a flood peak from a catchment in the order of 3 to 4 times the flood peak that might be expected from the catchment under none-landside conditions. The island of Dominica in the Caribbean has suffered recently from two major catastrophic events, 2015 Tropical Storm Erica and 2017 Hurricane Maria. During these events there were many such landslide dam burst that brought significant damage to infrastructure such as bridges, housing as well as loss of lives.

We report on current research into understanding landslide dam risk on the island, funded by the World Bank as part of efforts to increase resilience of the islands infrastructure to hurricane induced hazards. The island has over one hundred main river systems, all of which are relatively steep due to the volcanic nature of the island and have therefore have significant landslide risk. We are aiming to answer the following questions with our research: (i) Which river catchments are most at risk from these dam-burst events and why; (ii) What evidence is available for landslides that blocked rivers during the last two major events; (iii) What are the scale of these events. We are carrying out geospatial analysis using a combination of landslide susceptibility mapping, river proximity analysis and LiDAR data recently collected for the island as well as landslide inventories for validation.

We will be using the understanding gained from this research to identify catchments most at risk, what infrastructure is exposed to this risk, what mitigation might be effective in reducing the risk, and finally what design changes to the infrastructure could be made to make it more resilient to these hazards.