Landslides in a changing tropical environment: the North Tanganyika–Kivu rift region, Africa

Olivier Dewitte1, Arthur Depicker2, Jean-Claude Maki Mateso3,4, Charles Bielders4, Axel Deijns1,5, Stijn Dewaele6, Gerard Govers2, Liesbet Jacobs7, Violet Kanyiginya1,8,9, François Kervyn1, Matthieu Kervyn8, Désiré Kubwimana10,11, Toussaint Mugaruka Bibenyo1,6,12, Charles Nzolang12, Pascal Sibomana13,14, Ronald Twongyirwe15,16, Matthias Vanmaercke2, and Antoine Dille1,16

1Royal Museum for Central Africa, Department of Earth Sciences, Tervuren, Belgium (olivier.dewitte@africamuseum.be, axel.deijns@africamuseum.be, violet.kanyiginya@vub.ac.be, toussaint.mugarukabibenyo@UGent.be, francois.kervyn@africamuseum.be)
2KU Leuven, Department of Earth and Environmental Sciences, Leuven, Belgium (arthur.depicker@kuleuven.be, gerard.govers@kuleuven.be, matthias.vanmaercke@kuleuven.be)
3Centre de Recherche en Sciences Naturelles, Department of Geophysics, Lwiro, DR Congo (makigeo2013@gmail.com)
4Université catholique de Louvain, Earth and Life Institute, Louvain-la-Neuve, Belgium (Charles.Bielders@uclouvain.be)
5Vrije Universiteit Brussel, Department of Hydrology and Hydraulic Engineering, Brussels, Belgium
6Ghent University, Department of Geology, Ghent, Belgium (stijndg.dewaele@ugent.be)
7University of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, The Netherlands (l.h.jacobs@uva.nl)
8Vrije Universiteit Brussel, Department of Geography, Brussels, Belgium (Matthieu.Kervyn.De.Meerenre@vub.be)
9Mbarara University of Science and Technology, Department of Environment and Livelihoods Support Systems, Mbarara, Uganda (rtwongyirwe@must.ac.ug)
10University of Burundi, Department of Earth Sciences, Bujumbura, Burundi (desire.kubwimana@ub.edu.bi)
11Mohammed V University, Department of Earth Sciences, Rabat, Morocco
12Université Officielle de Bukavu, Department of Geology, Bukavu, DR Congo (nzolang@gmail.com)
13University of Liège, Department of Geography, Liège, Belgium (Pascal.Sibomana@student.uleige.be)
14INES-Ruhengeri, Department of Civil Engineering, Musanze, Rwanda
15University of Reading, School of Agriculture, Policy and Development, Reading, United Kingdom
16Royal Belgium Institute of Natural Sciences, Operational Directorate Natural Environment, Brussels, Belgium (adille@naturalsciences.be)

Tropical mountainous regions are commonly identified as landslide hotspots with particularly vulnerable populations. Anthropogenic factors are assumed to play a role in the occurrence and impact of landslides in these populated regions, yet the relative importance of these human-induced factors remains poorly documented. In this work, we explore the impact of forest cover dynamics, agricultural land management practices, urbanisation, roads, and mining/quarrying activities on the occurrence of landslides and their associated risk in the North Tanganyika–Kivu Rift, an area that stretches at the border of four countries in Africa. Using a holistic approach that combines extensive fieldwork, optical and SAR/InSAR satellite remote sensing, time-series analysis, UAS image acquisition, historical photograph processing, citizen science and geomorphic marker understanding, our study demonstrates the role of human activities on the frequency, size and deformation patterns of landslides in the region, in both rural and urban environments. The interaction between uplift associated with the continental rifting in the region, fluvial incision, and the (human-induced) landslides are also key elements that are considered in our analysis. Overall, we highlight the need to consider the human context when studying hillslope instabilities in regions under anthropogenic pressure.