Understanding natural hazards in a changing landscape: A citizen science approach in Kigezi highlands, southwestern Uganda

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The Kigezi highlands, southwestern Uganda, is a mountainous tropical region with a high population density, intense rainfall, alternating wet and dry seasons and high weathering rates. As a result, the region is regularly affected by multiple natural hazards such as landslides, floods, heavy storms, and earthquakes. In addition, deforestation and land use changes are assumed to have an influence on the patterns of natural hazards and their impacts in the region. Landscape characteristics and dynamics controlling the occurrence and the spatio-temporal distribution of natural hazards in the region remain poorly understood. In this study, citizen science has been employed to document and understand the spatial and temporal occurrence of natural hazards that affect the Kigezi highlands in relation to the multi-decadal landscape change of the region. We present the methodological research framework involving three categories of participatory citizen scientists. First, a network of 15 geo-observers (i.e., citizens of local communities distributed across representative landscapes of the study area) was established in December 2019. The geo-observers were trained at using smartphones to collect information (processes and impacts) on eight different natural hazards occurring across their parishes. In a second phase, eight river watchers were selected at watershed level to monitor the stream flow characteristics. These watchers record stream water levels once daily and make flood observations. In both categories, validation and quality checks are done on the collected data for further analysis. Combining with high resolution rainfall monitoring using rain gauges installed in the watersheds, the data are expected to characterize catchment response to flash floods. Lastly, to reconstruct the historical landscape change and natural hazards occurrences in the region, 96 elderly citizens (>70 years of age) were engaged through interviews and focus group discussions to give an account of the evolution of their landscape over the past 60 years. We constructed a historical timeline for the region to complement the participatory mapping and in-depth interviews with the elderly citizens. During the first 24 months of the project, 240 natural hazard events with accurate timing information have been reported by the geo-observers. Conversion from natural tree species to exotic species, increased cultivation of hillslopes, road construction and abandonment of terraces and fallowing practices have accelerated natural hazards especially flash floods and landslides in

the region. Complementing with the region's historical photos of 1954 and satellite images, major landscape dynamics have been detected. The ongoing data collection involving detailed ground-based observations with citizens shows a promising trend in the generation of new knowledge about natural hazards in the region.