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Urban gully erosion and the SDGs: a case study from the Koboko rural town of Uganda

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Urban gully erosion in developing regions has been addressed by the scientific community only recently, while it has been given much less attention in past decades. Nonetheless, recent examples show how relevant urban gully erosion in African towns of different sizes can be in terms of several Sustainable Development Goals, like goals 3 (good health and well being), 6 (clean water and sanitation) and 11 (sustainable cities and communities). The present work illustrate an example of gully erosion in the rapidly growing rural town of Koboko in NW Uganda close to the borders with Congo Democratic Republic and South Sudan. The research aims are (i) to develop a simple, low-cost methodology to quantify gully properties in data-scarce and resource-limited contexts, (ii) to quantify the main properties of and processes related to the urban gullies in the Koboko case study and (iii) to quantify the potential risk associated with urban gully erosion at the country scale in relation to rapid growth of urban centers in a sub-saharan African country. The methodology integrates collection of existing hydrological and land use data, rapid topographic surveys and related data processing, basic hydrological and hydro-morphological modeling, interviews to local inhabitants and stakeholders. Results indicate that Koboko may not represent an isolated hotspot of extensive urban gully development among rapidly growing small towns in Uganda, and, consequently, in countries with similar sustainable and human development challenges. Koboko, established two decades ago as a temporary war refugee camp, has been progressively established as a permanent urban settlement. The urban center is located on the top of an elongated hill and many of its recent neighbourhoods are expanding along the hill sides, where the local slope may reach considerable values, up to 10%. In the last ten years several gully systems with local depth up to 8 to 10 meters have been rapidly evolving especially following the construction of new roads and in the absence of a structured urban drainage plan. The deeper gullies are presently located in densely populated areas and present a variety of risks for people's livelihoods, including personal safety, risk of accidents for small vehicles (especially during night time), sanitation risk related with untreated domestic wastewater and uncontrolled garbage disposal into the deepest parts of the gullies. The methodology is easily repeatable and has the potential to quantify the fundamental properties of gully systems in contexts with scarce hydrological, soil and geomorphological local data availability and where the responsible agencies for urban planning and environmental protection are constrained by severe limitation in financial and human resources. For each gully system it allows to quantify total eroded volumes, length of the unstable gully reaches, time scale of development, drainage area and peak formative streamflow and also to provide process-based insight on the causes of gully development. The related knowledge base can be used to develop guidelines for urban growth aimed at minimizing the risk of gully erosion and related societal impacts.