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Assessing the impacts of urban gullying in the Democratic Republic of Congo

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Urban gullies cause major infrastructural damages and often claim casualties in many tropical cities of the Global South. Nonetheless, our understanding of this hazard is currently limited to some case studies while the overall impacts remain poorly quantified. Here, we aim to bridge this gap by making a first quantification of the number of persons and buildings affected by urban gullies at the scale of the Democratic Republic of Congo (DRC). We used Google Earth imagery to identify and map urban gullies for cities in the DRC and evaluate their expansion rate and the resulting damages where possible. In total, more than one thousand urban gullies were mapped across 22 affected cities. Over 80% of these gullies were active and, by analyzing their expansion, we identified 1463 houses and 386 roads destroyed. Nonetheless, the actual impacts are likely much larger since the limited amount of imagery available does not allow to quantify all impacts.

We therefore also made an estimate of the total number of persons directly affected by urban gullies (i.e. displaced due to the destruction of their house). For this, we calculated the areal fraction of urban gullies in affected cities (which ranged from 0.12% to 4.66%) and combined these fractions with the urban population density. From this, we estimate that a total of 212 000 people have been affected. The problem is especially acute in the cities of Kinshasa, Mbujimayi, Tshikapa, Kananga, Kabinda, and Kikwit. Given that these gullies are linked to recent urban growth and typically less than 30 years old, we estimate that at least 7000 people/year lose their house as a result of urban gullies in DRC. This is likely an underestimation since (i) not all urban gullies are detectable; (ii) urban gullies may disappear and reappear over time; and (iii) many of these gullies are likely more recent than 30 years. Furthermore, this assessment does not take into account numerous other indirect impacts of urban gullies (e.g. impacts on traffic and sanitation, increased flood risks, real estate value loss and intangible impacts like fear or stress).

Overall, this research shows that urban gullying is a serious problem in DRC, but likely also in many other tropical countries. More research is needed to better understand this processes and,

ultimately, to prevent and mitigate its impacts. The results and the database of this study provide an important first step in this direction.