Understanding the effectiveness of measures aiming to stabilize urban gullies in Congolese cities: a systematic analysis based on field surveys

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Many cities of the D.R. Congo are strongly affected by urban mega gullies. There are currently hundreds of such gullies in Kinshasa, Kikwit and Bukavu, representing a cumulative length of >200 km. Many of these gullies (typically tens of meters wide and deep) continue to expand, causing major damage to houses and other infrastructure and often claim human casualties. To mitigate these impacts, numerous measures are being implemented. The type and scale of these measures varies widely: from large structural measures like retention ponds to local initiatives of stabilizing gully heads with waste material. Nonetheless, earlier work indicates that an estimated 50% of the existing urban gullies continue to expand, despite the implementation of such measures. As such, we currently have very limited insight into the effectiveness of these measures and the overall best strategies to prevent and mitigate urban gullies. One reason for this is that most initiatives to stabilize urban gullies happen on a rather isolated basis and are rarely evaluated afterwards.

This work aims to improve our understanding of this issue. For this, we constructed a large inventory of measures implemented to stabilize urban gullies in Kinshasa, Kikwit and Bukavu and statistically confronted these measures with observed vegetation recovery and long-term gully expansion rates (derived from high-resolution imagery over a period of >14 years). Our preliminary results (based on a dataset of > 900 urban gullies) shows that the most commonly applied measures are revegetation and reinforcement of gully heads with sandbags or household waste material (implemented in around 65% of the cases). Retention ponds in streets and infiltration pits on house parcels are also frequently implemented (around 25% of the cases). Overall, techniques relying on vegetation are used relatively more frequently in regions with clayey soil, while techniques involving digging (e.g. infiltration pits) and topographic remodeling (e.g. gully...
reshaping by creation of terraces) are used mainly in sandy or sandy-clay areas. Surprisingly, small-
scale local initiatives, such as stabilizing gully heads with household waste, often appear to have a
higher effectivity than some large-scale civil engineering initiatives. However, such small-scale
initiatives can come with important additional impacts (e.g. sanitation concerns). More research is
needed to confirm these findings. Furthermore, the stability of gullies seems to be strongly linked
to the degree of vegetation cover near the gully head. Nonetheless, it is not always clear if
vegetation is the cause or the result of this stability. Overall, this study provides one of the first
large scale assessments of the effectiveness of gully control measures in urban tropical
environments. With this study, we hope to contribute to a better prevention and mitigation of this
problem that affects many cities of the tropical Global South.