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Shallow Landslides in the North Tanganyika-Kivu Rift Region: Interactions Between Deforestation and Landscape Rejuvenation

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Abstract Text:

Both the impact of deforestation and the impact landscape rejuvenation on shallow landslides are well understood, yet the way in which these two processes interact remains unclear. Deforestation alters the hydrological and geotechnical slope features and thus increases the likelihood of landslide occurrence, while this occurrence is also affected by landscape rejuvenation and its impacts on regolith thickness and slope steepness. In this study, we investigate how landslide erosion (m^2/km^2/year) in the North Tanganyika-Kivu Rift region (East-African Rift) responds to deforestation in different contexts of rifting-induced landscape evolution. We identify 673 non-stationary knickpoints to differentiate between the downstream rejuvenated landscape and upstream relict landscape. Subsequently, we find that landslide erosion rates are roughly 40% higher in rejuvenated landscapes than in the surrounding relict landscape. This difference is a result of the steeper relief in the rejuvenated landscape, which compensates its drier climate and lower regolith availability. Overall, deforestation initiates a landslide peak, increasing erosion with a factor 2-8. The effect of deforestation lasts approximately 15 years, after which it tapers out: the landslide peak depletes the most sensitive source areas and causes a depositional hardening of the slopes so that landslide erosion in formerly forested land eventually falls back to a level similar to forest conditions. Moreover, within relict zones, the relative impact of deforestation appears to be larger, probably due to the presence of a thicker regolith allowing for more landsliding once the tree cover is removed. In conclusion, the effect of deforestation should be studied with respect to the geomorphological context, as we observe that the impact of deforestation on shallow landslide erosion is different in relict and rejuvenated landscapes.

Session Selection:
EP035. The influence of landslides on sediment dynamics from source to sink

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