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# *Interactive comment on* "Interactions between deforestation, landscape rejuvenation, and shallow landslides in the North Tanganyika – Kivu Rift region, Africa" *by* Arthur Depicker et al.

**Arthur Depicker et al.**

arthur.depicker@kuleuven.be

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Dear sir/madam,

Thank you for providing this constructive feedback on the research we present in this paper. While a more in-depth response and the updated manuscript will be provided upon receiving the comments of all reviewers, we can already address your main concerns briefly, and point-by-point;

1) Within this work, we opted to look only at shallow landslides, defined here as landslides of which the depth does not exceed more than a couple of meters. We exclude

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deep-seated landslides because they are less dependent on direct triggers such as rainfall and processes such as deforestation that are at play at the surface of the earth. We do not expect deforestation to have a (significant) impact on large deep-seated landslides with a rupture plane located deep in the bedrock or regolith of the earth surface. So in conclusion, we only include shallow ‘soil’ landslides; we exclude deep-seated soil landslides and deep-seated bedrock landslides (shallow bedrock landslides were not observed in the study area). We agree that this can be better highlighted in the text and that the inventory can be further illustrated with the corresponding size-distribution curves.

2) We agree that we used a bit of a shortcut in this part, though the mathematics check out, also for the example you provide; in this example, you describe a database consisting of 12 landslides, of which 3 occur in an area with an imagery range of 3 years, 4 in an area with an imagery range of 4 years, and 5 in an area of imagery range 5 years. To apply Eq. (6), we divide this area into 3 groups (index j); the first group has nj=rj=3, the second nj=rj=4, the third nj=rj=5, hence Eq. (6) gives

LS_F= 3/3+4/4+5/5=3 (assuming A=1).

Now, if we apply Eq. (7) we look at the individual landslides (i) and not the subareas (j). Applying the equation gives

LS_F=1/3+1/3+1/3+1/4+1/4+1/4+1/4+1/5+1/5+1/5+1/5+1/5=3,

the same result, but calculated without grouping the landslides first according to their imagery range (which would yield a very large number of groups in the real world where the imagery range of landslides has continuous values between 0 and 20 years). Perhaps the confusion arises from our switch from summation over subareas j (in Eq. (6)) to summation over individual landslides i (Eq. (7)). We will better describe this step in line 168.

3) In Figure 10 we look at the impact of slope on landslide activity (accounting for

deforestation and rejuvenation). We think that large differences in threshold slope between different areas could have a large impact on the trends observed in this figure; for example, a slope of 30° is expected to display more landslide activity in lithology with a lower threshold slope. Such low-threshold-slope-areas are only present in the rejuvenated landscape. Hence, their presence would have clouded our analysis in Fig. 10: the presence of low-threshold-slope lithology would be an extra factor that could explain the higher landslide rates for slopes in relict landscapes compared to equally steep slopes in rejuvenated landscapes. We will highlight this argument better, and consider moving some of the results towards the supplementary material, considering the comments of the other reviewers.

The classification of the lithology based on threshold slopes was done automatically by investigating whether or not there was a linear relationship between ksn and slope (if R2>0, a linear relationship existed). So while in figure 7a the software detected a positive linear relationship, this was not the case for figure 7f. We will specify this approach in the manuscript. (also note that both lithology a) and f) are excluded from further analysis, since we only focus on the ‘strong’ lithology).

4) A more thorough analysis of rainfall and seismicity would indeed strengthen this paper. Unfortunately, such an analysis is hampered by the data-scarcity in the region. Specifically, to investigate in-depth the impact of rain on landslides, we would need accurate rainfall data (high spatial and temporal resolution) and accurate timing of the landslides (as of now, we can only locate the timing of a landslide somewhere between the age of two Google Earth images). A detailed analysis of rainfall-landslide relationships in the region have been conducted by Monsieurs et al. (2020), yet in our case, it is impossible to obtain the necessary rainfall and landslide timing data to complete such an analysis. The same argument can be made for seismicity.

Another possibility is to investigate rainfall-landslide trends is to compare rainfall metrics (e.g. threshold exceedance/year) with landslide occurrence. Such a study would have merit but has already been conducted for the study area by Depicker et al. (2020).

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In that paper, a positive relationship between rainfall and landslides has been established. Similar work has been done for the relation between average seismicity (PGA) and landslides. We will better highlight this previous work and its results in our discussion.

Referenced works: Depicker et al. (2020) The added value of a regional landslide susceptibility analysis: The western branch of the East African Rift. Geomorphology 353 (2020) 106886. https://doi.org/10.1016/j.geomorph.2019.106886

Monsieurs et al. (2019) Towards a Transferable Antecedent Rainfall – Susceptibility Threshold Approach for Landsliding. Water, 11, 2202. https://doi:10.3390/w11112202

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