Point by point response to Referee#1 comments

Dear Referee#1,

We would like to thank you for the insightful comments on our manuscript "**The effect of natural infrastructure on water erosion mitigation in the Andes » (**soil-2021-76). We are pleased to read that you appreciated the systematic review. We take your point that the study can be improved by better defining erosion/erodibility parameters like climate, vegetation, parent material; and by addressing how erosion rates are compared over a wide range of spatial scales. We take note of the references, and will include them in the revised paper.

Please find in the supplementary file a point-by-point response to all the concerns raised and how we will address them. Your original comments are copied below, and we have highlighted in blue color how we will revise the manuscript accordingly. We hope you find our response and changes to the manuscript satisfying and we are looking forward to hearing from you.

With kind regards,
Veerle Vanacker on behalf of all co-authors

Major comments

- Weak point: some information or references about sites/countries and rain characteristics are unclear or missing because the research of the studies is done by a specific selection of key words.
- Strong point: the overview of the references is well analysed.

We acknowledge that we could have included more information about the overall characteristics of the study sites, like rainfall amounts or intensities. We will provide a summary with an overview of site characteristics in the revised paper.

With some improvements, especially verifying the interest of specific references, in the definition of the erosion/erodibility parameters, and the conclusion-perspectives this paper could provide a relevant review for the research community working on different aspect of Andes mountains "ecology" (interaction soil, water, vegetation) and more generally for erosion processes studies.

Thank you for the suggestions. We are familiar with these studies, as they were part of the full papers that we assessed in this study. In the revised manuscript, we will add more information on the quantification of the erosion rates, and the erodibility parameters.

Specific comments

Line 54: a large research and applied project was conducted in Ecuador to protect Quito City, cf. *Perrin JL, Bouvier C, Janeau JL, Menez G, Cruz F. Rainfall/runoff processes in a small peri-urban catchment in the Andes mountains. The Rumihurcu Quebrada, Quito (Ecuador). Hydrological processes 2001; 15: 843-854.* I noted that you mentioned this study in the supplement D.

We thank the referee for this suggestion, and we agree that we can refer to this study in the introduction where we refer to studies analyzing the effect of land use on erosion processes.

Line 102 then line 110 to 115 and Supplement C:

I can understand that you selected studies due to absence of quantitative on-site or off-site soil erosion or soil quality measurements and I know that it is difficult to collect all the studies carried out on your topic, however it seems that some studies, are missing despite using your key words:

Buytaert W, Wyseure G, De Bievre B, Deckers J. The effect of **land-use** changes on the hydrological behaviour of Histic Andosols in south Ecuador. Hydrological processes 2005; 19: 3985-3997.

Janeau JL, Grellier S, Podwojewski P. Influence of rainfall interception by endemic plants versus short cycle crops on water **infiltration** in high altitude ecosystems of Ecuador. Hydrology Research 2015; 46: 1008-1018.

Poulenard J, Podwojewski P, Janeau JL, Collinet J. Runoff and **soil erosion** under rainfall simulation of Andisols from the Ecuadorian Paramo: effect of tillage and burning. Catena 2001; 45: 185-207.

We are aware of these studies, as they were part of the peer-reviewed studies that we initially retrieved from SCOPUS. The three studies are highly relevant for studying rainfall-runoff processes in the Andes. In the screening phase, we removed studies that did not contain quantitative data on soil erosion (soil erosion rates measured as $M/L^2/T$ or L/T). Thereby, the database was reduced to 121 studies.

Data base development – line 161 to 170: In this paragraph, I appreciated the definition of the soil indicators, but I suggest providing more explanation for the role of the rain (different intensities and duration depending on altitude…) and the role of the vegetal cover (throughfall/stemflow for infiltration, soil protection by different type of covers…), the broad range of bulk density (type of volcanic ashes). This complement of explanation could be useful to explain your result Line 284 to 291 in Results and Discussion and your Figure 4

We thank the referee for this suggestion, and will include more information on the factors controlling erodibility and erosivity, like vegetation cover, parent material and rainfall. Part of the variability in response ratios (shown in Figure 4) can be attributed to these factors, and we will further develop this in the discussion of the paper.

Results and Discussion : 3.4.1 Representation of natural variability in environmental conditions within the Andean region

The runoff and erosion processes decrease significatively (excepted exceptional events) with appropriate technique to protect the soil (cultural, terraces, etc.), with vegetal cover (natural or anthropized origin). This is not a surprise, and your review shows that what has already been studied on these "parameters". However, the rainfall characteristics (intensity, concentration of precipitation, etc.) seem little mentioned. Is it correct?

This is correct : there are few studies that have quantified the effect of rainfall intensity and duration on erosion rates. The few studies that analyzed this effect are based on plot measurements, and (often) simulated rainfall. We will mention this knowledge gap in the conclusion of the study.

3.4.2 Gap between plot-scale and catchment-scale erosion assessments, apparently, we have a "confusion" about erosion processes depending on the studied scale. Micro-plots (≤ 1 m^{-2} to 10 m^{-2}), generally the authors are studying Detachability and/or Erodibility expressed in gramme per $m^{-2.}$ Catchment scale the authors are interested by erosion expressed in tons per hectare. Due to this difference in scale, it is therefore very difficult to compare the studies with each other. Can you be more specific on how you compare these two spatial scales?

In soil erosion studies, different measures of soil erosion are reported: mass loss per surface area per time (M/L²/T), surface lowering per unit of time (L/T), or mass loss measured during rainfall simulations (M/L²). In order to have comparable datasets, we have converted all data to obtain erosion measures in t/km²/yr. We will provide more details on the conversions in the revised document.

Although there is a wealth of information on sediment production from plot studies on the one hand, and sediment yield from larger catchments on the other hand, it is not straightforward to make the link between the erosion processes in the sediment sources and the sediment throughput of larger catchments. We agree with the point made by the referee "it is difficult to compare the studies". This is also the point that we want to make in the discussion, i.e. that there is a gap in knowledge on the sediment cascade: sediment transfer, (temporary) storage and deposition.

Conclusion and perspectives.

It is a long conclusion about the contains of this review, maybe too long. On the other hand, the research perspectives look few and insufficiently precise. Could you add/suggest some specific studies should be done on the rainfall intensity thresholds corresponding to the effect of soil erosion parameter. (Which ones? How?)? Is it desirable to mention more studies related to climate change?

We will revise the conclusion, and include an outlook for future research. Climate variability and climate change is expected to have an impact on rainfall erosivity. Also, freshly exposed, deglaciated terrain is particularly prone to soil erosion.

Figure 3 : A small green circle is in Argentina but apparently far away of Andes mountains. Is it really related with your keywords and/or scientific questions?

We agree with the referee that this study comes from an area that is far from the other study sites (and might represent another environmental context). We have removed this site from the systematic analysis.