

## **Comment on soil-2021-76**

Anonymous Referee #2

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Referee comment on "The effect of natural infrastructure on water erosion mitigation in the Andes" by Veerle Vanacker et al., SOIL Discuss.,  
<https://doi.org/10.5194/soil-2021-76-RC2>, 2021

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The manuscript describes a systematic review of the effectiveness of Nature-based Solutions (natural infrastructure) to reduce soil erosion and runoff in the Andes. The study combines the results of 121 data sources (mainly peer-reviewed articles), from which a range of variables were recorded. A statistical procedure was applied to summarize the results and to show how the different interventions are able to mitigate soil erosion and runoff.

In general, the manuscript is very well written and is well-structured. The objective and research questions are well-defined, but could be better integrated into the Conclusions (see below). The methodology is clearly described and I'm happy that the authors included several supplements, which gives confidence in the robustness of the study.

The main critique I have is the way the different interventions are presented in the manuscript, which is often not very consistent. In the abstract (lines 20-21) and the Introduction (lines 76-81), the authors refer to three types of natural infrastructure, i.e. protective vegetation, soil and water conservation measures and adaptation measures that regulate flow and transport of water. The latter category seems to be related to reservoirs and other hydraulic structures, which is often referred to as gray infrastructure. It would be odd to include such interventions in this study given the focus on natural infrastructure. However, in the Material and Methods, a different classification is given (lines 154-156), which includes protection of natural vegetation, forestation and soil and water conservation measures. These are subsequently used throughout the rest of the manuscript. So at the end, no gray infrastructure is included in the analysis. Please revise the abstract and Introduction so that the same categories are used throughout the entire manuscript. Also please revise the terminology used for the different interventions, because there are some inconsistencies throughout the manuscript. And keep a clear difference between the control and intervention categories, sometimes all six categories are discussed as if they were they were all natural infrastructure or interventions.

The objective of the study is to quantify the effectiveness of natural infrastructure and in several instances a reference is made to the control-intervention design of the majority of the studies included in the systematic review. With this in mind, I do not understand why the authors present the results of the differences between two control types in Figure 5 (i.e. cropland vs. rangeland, cropland vs. bare soil and rangeland vs. bare soil). These results are not in line with the objective. For clarity and consistency, I suggest to remove those results or show them in a supplement, and focus the results on the difference between conventional agricultural practices and natural infrastructure.

The authors mainly focused on the 6 indicators as shown in the figures and tables. Apart from that, the authors recorded some other information regarding climate, soil type, land use, among others. It would be interesting to see how these variables affect the results. This means an additional analysis, but could explain some of the uncertainty. Since there are not many studies to perform such an analysis, the authors could aggregate all categories into two categories, i.e. natural infrastructure and control.

Regarding the discussion of the results. The interventions studied in the current study are, of course, not only being studied in the Andes, but also in other geographical areas. I suppose similar studies have been performed in other regions. It would be interesting to discuss how the effectiveness of these interventions in the Andes compare to similar interventions in other geographical regions.

Regarding the Conclusions. The authors have defined three research questions in the last paragraph of the Introduction. This is very convenient for the Conclusions, because you can just literally answer these questions here. However, I have the feeling that the Conclusions mainly focus on the second research question. The other two questions are somewhat discussed, but could get some more attention. I suggest to reduce the conclusions regarding the second research question, mainly focusing on the most relevant results, and answer the other research questions, at least more than has been done now, i.e. in lines 390-394 and 412-414.

Below I have provided specific comments to the text and the figures.

### **Specific comments**

Line 17: I suggest to first introduce the term "natural infrastructure" before using them in

these research questions.

Line 24: Do these two values (1.3 and 2.8) belong to, respectively, the two categories protective vegetation and soil and water conservation measures? Please clarify in the text.

Line 25: Again a range of values is provided, please be more precise about where this range is based on.

Line 73: Add "as" between "such" and "peatlands".

Lines 73-74: According to the website of the IUCN, natural infrastructure or natural water infrastructure is considered to be a Nature-based Solution (NbS). I suggest to introduce NbS here, because it is an emerging topic that most readers are familiar with.

Lines 74-76: This is actually how Cohen-Shacham et al. (2016) refers to NbS. See also previous comment.

Line 110: Please specify which search fields were used, e.g. Article title, Abstract, Keywords, etc.

Lines 129-132: The second criteria should explicitly suggest that modelling studies are included or excluded, now it is a bit unclear if modelling studies are considered or not.

Line 137: So from 813 studies the authors went to 190 studies based on the inclusion and exclusion criteria (lines 129-134), but how were the 53 studies excluded. Here it seems that these were excluded based on the same criteria. Please clarify in the text.

Line 145: Why is altitude not numbered?

Lines 151-152: The latter two categories overlap, i.e. large catchment (> 1000 km<sup>2</sup>) and landscape scale, which is not defined by a study area size. Please be more specific about the difference between these two classes.

Lines 154-157: These are the three natural infrastructure categories as defined earlier

(lines 94-96)? It seems that the previous three categories were defined differently, i.e. from the previous categories PRO and FOR would be included in category 1, SWC in category 2 and category 3 is not included here. Please clarify in the text.

Lines 182-183: Did the authors use specific software to extract the data from figures? I suppose that tables were also used.

Line 217: Please replace "both" with "all three of them", or similar.

Lines 217-220: The most southeast located study area doesn't seem to be located in the Andes. Please clarify why this study is nevertheless included. Or show in the map what area is considered to be the Andes.

Lines 243-244: Here the conventional/traditional agricultural practices are also included under natural infrastructure. To prevent confusion, please rewrite this sentence.

Lines 243-246: This sentence needs to be revised. I suppose the authors are referring to the results of the Kruskal-Wallis test, as shown in Figure 4, not in Table 1. Please be more specific about which results is discussed and especially refer to the statistical test.

Lines 261-262: Where is this results shown? Pastures and native grasslands are included in any of the categories? Please clarify in the text.

Lines 277: With natural vegetation the authors mean the protected areas (i.e. PRO)? Please be very consistent with using the names of the categories. To prevent confusion, I suggest to always use the same name and/or use the abbreviation.

Lines 279-280: Is there a separate statistical test performed on the differences between the intervention and control categories? I could not find this in the manuscript. Please clarify in the text.

Lines 304-305: But Figure 5 includes comparisons of 1 and 2 independent case studies. I suggest to indicate in Figure 5 which comparisons are considered and which not. For instance, the comparisons that are considered could be indicated with a darker color and the ones that are neglected with a lighter color (or with some level of transparency).

Line 326: Why are two values shown here, to what are these two values referring to. Please clarify in the text.

Line 329: Where are SWC compared to grasslands? In Figure 5 the categories are compared with either cropland or rangeland, not with grassland. Please clarify in the text.

Lines 300-343: In Figure 5 the comparison is made between the categories and cropland (upper) and rangeland (lower). This subsection is mainly focused on the differences with cropland and rangeland is only mentioned in one paragraph (lines 307-312). I was under the impression that the authors would compare the intervention categories (PRO, FOR, SWC) with the control categories (CROP, RANGE, BARE). Which is also much better in line with the objective of the study. So why did the authors compare, for instance, rangeland and bare soil with cropland? And why are the intervention categories not compared with bare soil, in a similar way as has been done with cropland and rangeland?

Line 369: With "both" the authors mean "simultaneously"?

Line 383: I think that this should be 43%, instead of 40%.

Lines 392-393: These two values (i.e. 85 and 125) are referring to the previous sentence? Please combine these two sentences into one sentence to know where the values are referring to.

Lines 403-407: The authors frequently indicate the effect size results as a range between the minimum and maximum value of the error bars in Figure 5. I think it would increase the readability if the authors would indicate the mean response ratio in the text, rather than the spread of the error. For instance, as has been done in the subsequent two sentences.

## **Figures and Tables**

Figures: Please increase the font size of the smallest font.

Figure 3: I suggest to include the names of the countries in the map, for those readers that are not too familiar with the topography of South America. Please, include a reference to the DEM used as background for the map.

Table 1: Please replace the last sentence with something like this: "The box-plots followed by a common letter are not significantly different by the Dunn's posthoc test at the 0.05 level of significance." See Piepho (2018) for an interesting discussion about the meaning of these letters and for suggestions on how to refer to them in table and figure captions.

## **Supplement**

Supplement C: I highly encourage to include the underlying data as a supplement to this study. However, it seems that some information is missing in this spread sheet. It would be useful to include a separate sheet where the different codes (e.g. for the ecosystem services, natural infrastructure and treatment) are explained. Also the actual data is missing, there are no values included on the right side of 5. Indicators. Please explain why these have not been included.

## **References**

Piepho, H.-P.: Letters in Mean Comparisons: What They Do and Don't Mean, *Agron. J.*, 110(2), 431–434, doi:10.2134/agronj2017.10.0580, 2018.