

Comment on the under-review manuscript “**Pioneer biocrust communities prevent soil erosion in temperate forests after disturbances**” by:

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Dear authors,

as part of the undergraduate course “Critical Thinking in Ecological and Environmental Sciences” at the University of Edinburgh we have read carefully the mentioned above manuscript and we would like to express here our thoughts. We have found this piece of work is, in overall, a timely and interesting manuscript and we hope that our thoughts will help the authors to improve the status of their under-review paper.

Overall Summary

This is a very interesting topic. The study is, in overall, well organized and executed. The manuscript is also in good order and there is clear presentation of results and appropriate use of English language. The ‘Introduction’ could be shorter with less detail; it should focus to attract more the interest of readers why this research must be done, and what are they key knowledge gaps that it addresses. Occasionally there is too technical terminology used which makes understanding challenging for the non-experts (see detailed comments below). It seems that some major gaps exist in terms of statistical analysis and how the authors have examined the role of environmental parameters in shaping the floral communities. There should be better use of references in ‘Materials and Methods’ and better elaboration in parts of the ‘Discussion (e.g., in parts of Section 3.1 - see detailed comments below). A final major point is that the authors really need to highlight the key findings of their study – currently it seems that their major finding about the superior role of biocrust communities in preventing erosion is already mentioned in the literature. The innovative aspects of the study need to be made clear early in the manuscript and in the ‘Abstract’.

Abstract

In overall it is well written. We suggest the authors make clearer why is it important to study what they have studied e.g. why is the succession so important? In addition, the final 2-3 sentences of the ‘Abstract’ need some modifications – making them simpler and easier to understand will increase their impact. It might be preferable to avoid use of “we” in the abstract and perhaps the detail of results could be reduced; authors might also be more clear in highlighting one main conclusion to express.

Introduction

Line 35: Please provide some examples why soil erosion will increase through climate change. Also are there any (numerical) projections about how much erosion will increase in years and decades to come?

Line 41-42: Is there a reason behind these relatively large shifts in erosion of forestlands?

Line 44: Please use more plain language in “showed that unsealed forest roads at the catchment scale” so that the reader can get a clearer understanding.

Lines 46-53: This numerical information provided is useful, but we feel it would be better to be used in the “Discussion”. Here in the “Introduction” make sure you present the bigger picture and why it is important for this research to be carried out. Lots of numerical information can distract the readers from the major messages.

The sentence on line 55 could be modified to summarise the point of referencing all of these studies and then group them together in the citation for reference

Line 61: Please explain where the term “cryptogamic” refers to. Also, what do you mean by “understory”?

Line 63: Perhaps replace “edaphic” by “floor”?

Line 68: We feel this should be “bryophyte-dominated”?

Lines 68-70: Please provide briefly some information on the direction of these effects by bryophytes e.g. increase/decrease in runoff etc.

Line 81: Please improve wording.

Line 86: The authors need to make clearer which is the research gap and especially to link it better with previous lines/sections.

Lines 92-94. It is welcome that authors make clear the objectives of their study. We feel though that it would be even better if they make some null hypotheses related to their points e.g., how do they expect that the underlying substrate, vegetation cover and track position will affect soil erosion?

Line 96: Please explain what you mean by “interrill”.

In the “Introduction” and especially towards the end of it the authors should make some clearer references on how their findings can be used in good practices for management. They can elaborate on that aspect in the Discussion.

Materials and Methods

Line 121 and further: Could abbreviate genus name in species scientific names for conciseness purposes (e.g. *P. sylvestris*)

Lines 140-146: Please provide references about the use of similar experimental set up in previous studies.

Lines 148-149: The authors need to provide more information about the particular selection of this rainfall intensity e.g., is similar intensities observed often in the studied area? Provide also relevant references.

Line 149- 153: The authors should provide more details about technical aspects mention in there e.g., measurements on surface run off. Please also provide references.

Line 154-155: For how long were the samples left to dry?

Line 156: Please mention what is exactly the aggregate size and which are the measurement units for this parameter.

Line 159-162: It is interesting that measurements on elements (C, N) were made. Please make sure that there are the relevant references made in the “Introduction” so the sections of the manuscript align better.

Line 173. Please improve the wording about nomenclature in Tables.

Lines 183-187. It seems that post-hoc tests were not carried out. Also, it seems that the role of environmental parameters in the flora structure / development has not been accounted/examined for. If this is the case, then it is regarded as a major gap and needs to be addressed.

More information on the number of replicates is needed.

A map showing where the research was carried out would be welcome.

Overall, we believe that the “Materials and Methods” section could have been written more succinctly to make it easier to read.

Results and Discussion

Line 191: ‘Section 3.1.1 – Biocrust species composition’. It seems that this title is not fully adequate as in the section 3.1.1 there are also results about temporal trends. This should be reflected in the Section 3.1.1 title.

Line 193: Please avoid using where possible abbreviations (e.g., ‘UF’) as it is difficult for the reader to follow them.

Line 196: Please clarify what is ‘protonema’.

Line 205 / Table 1: Could table 1 provide more information on composition, cover and richness? Do we need Author column?

Lines 222-223: This is just an assumption on the role of pH; there should be appropriate statistical analysis to explore the role of abiotic environmental parameters in shaping the communities.

Tables 1 and 2: The information shown here is interesting; however it seems that these Tables are a bit long – how about moving them to Supplementary Material?

Lines 227-230: These are major findings and should be moved earlier/up in the Results and Discussion section.

Lines 232: Please clarify the categories that the species belong to e.g. do they belong to ‘protonema’ or another category?

Line 234: “little importance”: Please provide numbers rather than terms like “little importance”.

Lines 227-242: This is a big chunk of results but discussion on them is absent.

Line 243: It would be better to start the section with the key result; discussion on it should follow.

Line 246: Please see comments above about stats regarding the role of environmental parameters.

Figure 1: Could be useful to have included a longer caption describing what photographs demonstrate to make the article more accessible for the readers that do preliminary paper skimming. A map of the area would have been highly beneficial for the readers to better visualise the studied site spatial distribution.

Line 271: It is not clear what the authors try to say here e.g. that there are similar trends between biocrust and total coverage trends? Or something else? Please clarify.

Figure 2 caption: Perhaps it would read better as “mean values and standard error are given”. Please also remind to the readers the number of replicates.

Line 282: The values of pH should be mentioned.

Lines 288-289: The authors should elaborate on their statements about contradictions between their findings and those from (Corbin and Thiet, 2020; Bergamini et al., 2001; Fojcik et al., 2019).

Lines 289-292: The authors should elaborate on the mechanisms driving positive correlations between vascular plants and moss growth.

Line 292: The statements/discussion on biocrust should be on a separate paragraph.

Lines 327 – 338: Please make sure that you provide p-values where needed. Also, it is not necessary to use extensively phrases such as “A was X times higher than B”. Providing the average values, standard error and the p-values would suffice.

Lines 339-341: See our comments above about examining the role of environmental parameters in shaping discharge / run off. For example, how much of the variability in discharge is explained by differences in the soil features?

Sections 3.2.1 and 3.2.2 should be merged. The independent and response variables should be subject to appropriate statistical analysis e.g. distance-based linear modelling (Clarke and Gorley 2015)

Clarke KR, Gorley RN (2015) PRIMER v7: User Manual/Tutorial PRIMER-E: Plymouth

Lines 398-401: Some of the lines mentioned here should had been included in the Materials and Methods. Also it is not clear where the term 'reduction' refers to – please clarify.

Figure 5: The box plots for biocrusts and vascular plants are very close (this is not necessarily bad) and some of the outliers for biocrusts may be regarded as outliers for vascular plants (and vice versa). It would be helpful to see the outliers for each of them with different colours. We feel that a sudden change in the colour scheme on this graph could confuse the readers that got used to seeing dark green as 'wheel track' and light green as 'central track' in previous 3 figures.

Line 425 Conclusions

Line 426 : it seems that null hypotheses were not made; it is suggested to adjust accordingly the text at the end of the "Introduction".

The conclusions section looks too lengthy; it should appear more succinct and with higher impact. Focus on your key findings and how they fill gaps in the literature. Avoid repeating results and numerical values.

Could include more discussion of direction and opportunities for future studies

Lines 450- 456: Would it be also of interest to study the factors that support higher growth rates for the biocrust communities?

Appendix

Figure A1. Please clarify in the image (using arrows) the wheel track and center track.

It seems that there is some inconsistency in editing/coloring of symbols across the figures e.g., see color code used Figures 3 and 4.