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Comment on bg-2021-343

Bettina Weber (Referee)

Referee comment on "Pioneer biocrust communities prevent soil erosion in temperate forests after disturbances" by Corinna Gall et al., Biogeosciences Discuss.,
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Review of Pioneer biocrust communities prevent soil erosion in temperate forests after disturbances

by Corinna Gall, Martin Nebel, Dietmar Quandt, Thomas Scholten, and Steffen Seitz

The study of Gall and coauthors covers a very interesting and largely neglected topic, i.e. the role of cryptogams (and mainly bryophytes) in erosion prevention after disturbance by logging in temperate forests. The study was carefully designed, conducted on several different soil types and measurements were made several times after the disturbance had taken place. Thus, I think the study definitely should be published after the following suggestions have been considered.

First, I doubt that many of the bryophytes reported in this study fully meet the characteristics of biological soil crusts (biocrusts). The biocrust definition, as it was first brought forward by Belnap, Büdel and Lange (2003) in the first Ecological Studies volume on biocrusts, referred to communities of organisms that live within or only few centimeters on top of soil. A key characteristic is that the major part of the biomass is located within the soil and that it creates a hardened soil surface (an encrustation). I think both of these factors are not fully met by the communities reported here. In genera like *Atrichum*, *Rhytidiadelphus* and *Plagiomnium* the major part of the biomass grows above the soil surface and I also have not experienced a soil hardening effect in the vicinity of them. Thus, I think the term "biological soil crust" is irritating in this context, as the reader expects somewhat different properties. I think that biocrusts indeed could occur at the slopes next to a forest path with species like *Polytrichum piliferum* and it might be that in some parts of the investigated sites biocrust fragments could occur. But for the complete community I doubt the correctness of this term.

However, I do not see that as a deficit of this study at all. The authors could describe the studied communities as bryophyte or cryptogam communities and they could discuss the similarities and differences between biocrusts and their study objects. I think it also is relevant that not only biocrusts, but cryptogam communities in general are highly relevant for a variety of functional ecosystem processes and the present study shows this clearly once more.

Second, I think the illustrations in this manuscript could be improved. In section 3.1.1 the composition of bryophytes is explained, but the taxa are only listed in a table and the taxonomic composition is not graphically displayed. I think this is urgently needed and would clearly improve the comprehensibility of the results. In figures 2 and 3 the line diagram is not the correct way to illustrate the results, as there are no data available for the times between the measurements. For this type of data, box-whisker plots are correct, as they have also been used in the subsequent figures. In figure 3, the signatures are difficult to be separated from each other; I think this could be improved regarding form and color. In all plots where sampling was conducted at different times, the statistics should be added in order to illustrate which changes were statistically significant.

Third, the naming of the plots could be improved. The names of the different forests do not mean anything to the reader. I think it would be better to name the plots e.g. according to the parent material, soil type and/or texture or to just give them numbers. This would be particularly helpful, as you explain later that the substrate indeed had an effect on the observed vegetation.

Fourth, I think it might be irritating to name only the month of sampling. It would be clearer if you name them e.g. as Mar19, Jul19, Oct19, Feb20

Fifth and finally, the language needs to be carefully and thoroughly checked throughout the manuscript. Beyond minor mistakes, which are not a big issue, there are also sentences where the meaning remains unclear. Thus, careful and thorough language editing is urgently needed before final publication could be considered.

These language problems cause problems like the following one:

In line 143-145 it is written that "Four ROPs were placed in the WT and the CT in every skid trail (n = 32), and two ROPs in the undisturbed forest soil (UF) next to every skid trail site (n = 8)." This is not clear. Does it mean that on every skid trail four ROPs were installed? This would mean that there were 4 skid trails in total? Does it mean 4 skid trails each at WT and CT? This needs to be clarified. Also the rainfall simulation numbers given in the following sentence are not clear. I think a thorough language check will help to also clarify these issues.

Besides that, I observed the following minor issues:

Line 35-37: In this sentence there are several language style problems. I would suggest to reformulate it in the following way: The most prominent soil loss occurs in agricultural environments, and thus a considerable part of relevant research is conducted in these habitats.

Line 46-47: here I think you want to say "The most important reason for this is soil compaction and reduced infiltration rates **caused** by heavy machines used for timber harvesting"

Line 48: significantly

Line 55: exchange "which" by "that"

Line 60: "These" instead of "those"

Line 75: As most studies investigating the impact...

Line 80-81: This sentence is upside down. 'Pioneer biocrust communities could provide benefits' or 'the soil benefits from biocrusts'

Line 114: The skid trails show no geological formation, but the underlying rocks and soil do. Please adapt wording

Line 119: formed by extensive periglacial processes...

Line 125-127: There are several abbreviations that need to be explained: Ad-hoc-Ag Boden, Iuss Working Group Wrb, WRB Tool

Line 148: A rainfall intensity of 45 mm does not make sense. I think you speak of a rainfall intensity of 90 mm h⁻¹, applied over a duration of 30 minutes

Line 200-201: meaning of sentence unclear

...and many more not listed here.

Bettina Weber