

## ***Interactive comment on “Bryophyte-dominated biological soil crusts mitigate soil erosion in an early successional Chinese subtropical forest” by Steffen Seitz et al.***

**Anonymous Referee #2**

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I have received your manuscript "Bryophyte-dominated biological soil crusts mitigate soil erosion in an early successional Chinese subtropical forest" for review. There are elements to like about this paper, especially the fact that this is one of the rare studies that addresses the influence and role of biological soil crusts on in early secondary succession after severe human impact. Before the manuscript can be considered for publication in Biogeosciences, the authors should nevertheless consider some general comments and rework parts of the manuscript. There is a general question as to how the soil crust in this studied can be referred to. In the introduction (first sentence) the authors refer to the importance of biocrusts in many ecosystems. By checking the reference and also other major biocrust research and literature it becomes obvious that

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the biocrust in this study is very special because it occurs in a forest. Such ecosystems are dominated by trees are their sheer occurrence indicates a high water availability. So, here it comes to a contradiction to the definition of a biocrust, which were recently defined to occur "in regions where water availability limits vascular plant cover" (Weber et al. 2016 - same reference as used by the authors). Almost every other biocrust study is taking place in drylands or at least areas where an arid element occurs. In the most recent review about biocrust distribution patterns by Bowker et al. 2016, the presence of biocrust is discussed as a function of effective precipitation within semiarid, arid and hyperarid ecosystems, certainly not in the humid forest with a mean precipitation of 1635 mm as in this case. This makes this study very special and requires that the authors explain very precisely why they discuss the topic in the biocrust background. It should be stated in the manuscript that biocrusts only contribute a minor ecological role in this ecosystem, certainly because of their low biomass and soil penetration depth, compared with trees and it should be taken into account that the trees are the major driver of this ecosystem. The presence of the mosses and algae may certainly have an effect as shown in this paper, but this should be seen in the bigger context and appropriately assigned. In the ongoing introduction, the authors explicitly describe the role of biocrusts in early succession, while the study site cannot be referred to as in early succession because of the existence of trees, that indicate quite a late successional stage. Nevertheless, the study site is special, because the trees were artificially planted, so the soil itself remains at an early successional stage (straight after disturbance) while the occurring vascular vegetation is at a later stage, due to human impact (at least the trees. What other vegetation occurs?). A more detailed explanation of the hypothetical background should be taken into consideration. Additionally, it should be clearly defined which ecological process is in the focus of this study. From the study background, the most reasonable is secondary succession after human disturbance. Within this, the biocrust may occur as one of the initial players, thus it will provide the basis for other plants but also disappear with ongoing succession. This should be stated. The hypotheses should come with explanations or at least theoretical background. In Hyp

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1 is the parameter tree growth or canopy cover or light intensity? Hyp 2, what is the exact expectation here? This sound very vague. Please be precise. In general, the introduction could benefit from more precise statements and direct explanations. In the moment many sections read like overall summaries rather than leading to explicit research questions for the study. Material and Methods 135: which were the determinants for the crust types Results 210: Please explain why the existence of vascular plants indicates any developmental stage of biocrust? Is this climax or are the plants taking over and the crust will disappear? If this is the case you should refer to the developmental stage of the vegetation in general and the crusts occur only for a little while. Discussion Overall the discussion could clearly benefit from more explicit arguments of the given results rather than summarising literature. Sections read like reviews and summaries of recent literature. Could you please discuss your own data and indicate what information these add to the existing knowledge? Here I strongly agree with the first reviewer how also stated that the discussion needs improvement. Please explain more detailed what your own findings mean and implement. Additionally, you might want to consider reading more about bryophytes and their growth in forest understories. Surely the discussion could benefit from some comparisons for growth rates and microenvironments. For the implication of the story, the authors should clearly underline, that this is a case study in a single, very special subtropical forest ecosystem and therefore findings cannot easily be extrapolated to other systems. In the first section of the discussion, statements are made, that do not refer to the presented data. 243: biocrusts were highly competitive 244: biocrusts prepared the upper soil layer 246: tree growth provides shade and protection from the wind, which then leads to advancement in biocrust development (Please explain that you use crown cover as a proxy for shading. Are there data about the wind?). Other 260: Replace competitive by coexisting. 261-265: The authors provide a very nice list of moss species for this study and assume here that species composition changes with decreasing light availability. It would be excellent to underline this finding by data. Can you provide data that show this shift of species? The statement could significantly gain importance if the change

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in species could be correlated to the decreasing light. As it stands now, it reads like an assumption. 279-280: Irrelevant for the study. Can be deleted. Additional minor comments: Some of the writing does not seem to be appropriate. Please reconsider 34: "Our" experimental forest ecosystem 36: Biocrust "covers" were still increasing 42: quickly colonise gaps in" higher vegetation layers" – what do you mean with layers? Which gaps are closed? 207: "traces of lichens" 210: organisms were found in minor numbers – is this fewer species, individuals or coverage? 243: early stage of the ecosystem 283: fasten themselves on the soil surface 329: They developed quickly to later-stages

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