

# ***Interactive comment on “Development of bacterial communities in biological soil crusts along a revegetation chronosequence in the Tengger Desert, northwest China” by Lichao Liu et al.***

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Thank Referee #2 for the good suggestions to improve our manuscript and to add the depth. Now we discuss these questions one by one in the following. Introduction In the introduction, we split BSC composition and function into different paragraphs, and explained the roles of BSC both on the landscape scale and on the micro-scale. Also, we strengthened to explain the roles of BSC in succession in another paragraph. We separated the sentence ‘BSC constitute one of the most important landscapes and make up 40% of the living cover of desert ecosystems’ from ‘It is well known that BSC play critical roles in the structure and function of semi-arid and arid ecosystems’

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into two paragraphs. We think these two sentences play the role of up and down convergence in the two paragraphs, so it is not a repeat in such expression this time. According to the suggestions of Referee #2, we placed here the first paragraph of the discussion and adjusted the expression level of BSC roles from landscape scale to the micro-scale and succession. Combined with the full text of the expression, we deleted the hypothesis that bacteria play important roles in carbon (C) accumulation and soil improvement in early stages of BSC succession. Meanwhile, we added Section 4.4 for discussion the role of BSC to succession. Materials and Methods In our study, we selected BSC layer from the revegetation of different successional stages. Thus the depth of BSC was varied in these fixed-sand areas of different years (the depth was shown in Table S5). The whole BSC layer were selected with different depth in different sampling sites. In Line 89, 'plantation in floating sand' means 'plantation of the xerophilous shrubs in mobile sand'. But this meaning was expressed in the sentence 'The revegetation protection system for Bao–Lan railway in this area was established initially in 1956, and was expanded in 1964, 1973, 1981 and later through the plantation of the xerophilous shrubs'. So we decided to delete 'plantation in floating sand' in this sentence. Yes, in Section 2.2, there are some repeated descriptions, we have deleted and revised them. This section may be more clearly presented as a table. We think such statements can clearly demonstrate our sampling steps, so we didn't prepare a table in this section. Results In the results, the description of the key species of BSC was in paragraph 3, section 3.3. In Section 3.4 and 2.1, the BSC types were in unified terms as physical crusts, algal-dominated, lichen-dominated and moss-dominated crusts in the revised manuscript. Algae or algal crusts are mentioned and not cyanobacteria in the text. In the results of RDA, Both Referee #1 and Referee #2 put forward valuable opinions. The conclusion was revised as soil physicochemical factors are closely related (not determined) to bacterial diversity and function. The revised detail and answer to reviewer were in the revised manuscript and answer to Referee #1. Discussion We have move the first paragraph of the discussion with part introduction material to the Introduction. The first succession stage of BSC was

revised as algal crusts in the whole text, thus we continued use the expression 'algal crusts' in line 266. Due to the mixed components of each BSC samples, we can not refer to some names of the various organisms (e.g. which lichens and moss appear? Were cyano-lichens or chloro-lichens?). The importance of microbial biomass in terms of succession and their role in conversion rates of organic matter have been mentioned in Introduction, and discussed the results compared to other studies. We think Section 4.1 can not be separated into two paragraphs. Because this part concerns information of the whole bacterial community compositions, and comparisons with other studies of BSC and elaboration of their functions. Section 4.2 have been separated into two paragraphs. In Section 4.3, a slightly broader discussion on the correlations between soil properties and BSC was added according to suggestions of Referee #1. The predominant bacteria have the largest relative abundance, so they are the most likely major contributing microbes in soil physicochemical properties. The overall diversity of BSC has been added in the factors because it is a crucial factor as well as the influence of the revegetation (secondary succession) that would also provide stability. Finally, the last sentence has been revised as 'It would be good to understand more of the factors that together influenced the composition and function of BSC bacteria in long-term revegetation, including BSC, plant, soil biochemical properties and climate conditions, and the microorganisms in turn have the positive influence on soil improvement'. We added Section 4.4 for discussion the role of BSC to succession. Conclusion The conclusion have been rewritten and strengthened the contribution to the BSC succession process. Also, the support of our hypothesis and statements of key findings have been summarised in the first paragraph of the discussion. Minor corrections All minor corrections that suggested by Referee #2 have been revised in the revised manuscript.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/bg-2017-139/bg-2017-139-AC2-supplement.pdf>

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