

## ***Interactive comment on “Disturbances of Biological Soil Crust by fossorial birds increase plant diversity in a Peruvian desert” by María Cristina Rengifo and Cesar Arana***

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We thank gratefully the comments given, which we found constructive and improved tremendously the quality of this manuscript. We agree with most of the comments. We have revised the manuscript in the light of the comments. Below the separated specific comments we indicate our responses and we attached a new version of the manuscript in the supplement.

Comments by G. Kidron

The MS describes the effect of biopedoturbation on species diversity and plant germi-

C1

nation in the Peruvian Desert. By disturbing the surface, fossorial birds create micro habitats that affect plant diversity and density. The increased diversity with increased heterogeneity is rather expected and the current MS adds additional information to a relatively large bulk of literature that exists on this topic. Nevertheless data from the Peruvian Desert is an important contribution. However, unfortunately, the MS is premature. While the authors describe the changes in seed bank and species diversity, no satisfactory explanation for this phenomenon is provided. This is a major obstacle once publication in a leading journal is sought. The MS suffers from additional drawbacks (lack of data, unclear Methodology), while the structure, flow and choice of citations also need major improvements.

Main points 1. The topic presented is not new and adds to many other publications on biopedoturbation, as thoroughly summarized by Whitford and Kay (1999). Whereas the authors try to link the findings to the presence of biological soil crusts (BSCs), the data presented are fragmentary and not convincing. The authors suggest that higher moisture availability at the mounds and lack of runoff there may explain the higher diversity and biomass at the mounds. Yet, the authors (1) present only three dates with moisture data throughout the entire growing period (2) the authors assume a linear increase in moisture from day 5 to day 60 (Fig. 2) although intensive fluctuation in moisture is expected due to the erratic nature of precipitation in deserts (3) no rain data are provided, which does not allow for a proper evaluation of the data (4) the values used for the moisture are not clear (gravimetric? volumetric? ratio of WHC?).

RE: We apologize for the mistake made regarding the values for the moisture content. We used the gravimetric moisture content, and the formula was added to the Method section. The Lomas of central coast of Peru have a well-marked seasonality, with very small amounts of precipitations in the form of fog, and we don't consider them to have an erratic nature of precipitation. We add a reference values of the precipitation to the area to make a better understanding of the climate. Since our objective was not to show changes in moisture through time but among treatments, and addressing a

C2

referee suggestion, we changed the moisture analysis and only used the data set of the last measurements, were the three surface were comparable.

2. The data should include a detailed account of the research site (general description of the geomorphology and/or dunes; the particle size distribution, i.e., the amount of sand, silt and clay; the main microorganisms within the BSC and possible their chlorophyll content in mg/m<sup>2</sup> as well as plant cover) and description of the disturbance (are the three birds mentioned have the same disturbance? What is the size of the mounds?). It should be accompanied by photographs that show the research site with the BSCs, the mounds created by the birds and photographs from the experimental design. Longterm precipitation at the site, including the possible contribution of fog and dew (approximate precipitation) should be added.

RE: We add a more extend description of the area, and remarked the gap in scientific literature on biological soil crust in the area. We add the description of the birds' disturbances and range areas of the sized, but not much has been reported about density or longevity. We add photographs of the area, the mounds, the plots and the biocrust.

In addition, clear hypotheses should be outlined and the rationale for measuring each of the variables should be thoroughly explained (for instance, what is the rationale of the chemical analysis of the crust? of measuring the calcium carbonate or EC?).

RE: We restructure the Introduction and state clearly the hypotheses. We also added a brief explanation of the chemical properties measure in the soil.

The Methodology should be thoroughly explained (statistics included). For instance, how do the authors define and differentiate between active and inactive mounds? Also, the methods or devices used for measuring each variable should be indicated, as well as the nutrient species. For instance: did the authors examine total or available P?

RE: Done. We explain thoroughly the methodology, add a graphic to visually help understand the experimental design for the moisture measurements and add a definition

C3

of active and inactive biopedturbations.

3. The Ms structure. Generally, the flow should be substantially improved. In essence the MS lacks Introduction. The Introduction should include general theories regarding the effects of disturbances on the ecosystem, with a specific emphasis on deserts and BSCs, especially on sand-covered BSCs.

RE: We restructure and improved the introduction.

The Discussion should focus on the findings, discussing the similarities/differences with previous publications and the implications for the ecosystem. For instance, it is generally assumed that water availability at the mounds is lower (Moorhead et al., 1985), in contrast to the authors' conclusion. This should be thoroughly discussed.

RE: We improved the discussion section and add the findings of Boeken and Shachak (1994) that also found mounds to be dryer than the biocrust.

Also, the analysis is not clear. For instance, there are two main variables that may negatively affect moisture: loss of water due to runoff or increased evaporation. Both possibilities should be discussed.

RE: We briefly address how both mechanisms could be possible regarding our findings.

4. The choice of references is unclear. The link between the mentioned topic and the references should be improved. Reports and abstracts should be avoided unless no other material exists. Book chapters and review papers should at best accompany peer review journal articles with empirical data (rather than being used as central references).

RE: We improved some of the references. Although information of the local environment is limited in scientific literature we still need to cite reports.

Grouping together many topics (6th and 7th line in the Introduction) cannot guide the reader. Citations that refer to trivial points should be eliminated.

C4

RE: We restructure the Introduction

5. Many of statements do not reflect the state-of-the-art knowledge and the picture that emerges is rather simplistic. For instance, do crusts necessarily promote plant survival (section 1 of Introduction)? Are BSCs necessarily hydrophobic (upper p. 6)? Will buried crust 'stop' infiltration (upper p. 6)? Do BSCs loose their water following the consumption of water by the microorganisms?

RE: We improved the discussion to address those issues.

Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2017-376/bg-2017-376-AC2-supplement.pdf>

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-376>, 2017.