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Reply on RC1

Capucine Baubin et al.

Author comment on "The role of ecosystem engineers in shaping the diversity and function of arid soil bacterial communities" by Capucine Baubin et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-29-AC2, 2021

The MS represents a well-prepared experiment with clear questions and creative approach to soil microbiology. Everything is nicely described and presented but the discussion, which is not explaining the details of results well. I think that the authors should try to explain firstly why the patches have similar outcome while the effect of the two EEs are clearly different,

- *The patches have similar outcome because they have similar effects on the soil microbial community, i.e., changes in the water availability and physical conditions of the soil. However, it doesn't always mean that whenever the combination of EEs have the same effect is the sum of the singular effects. Rather, the combine effect implies change in the community though the contribution of each EE is not accumulative. We have mentioned that in the discussion but rewrote this part to make it clear: "The EE patches analysed in this study share the same habitat and resources but their impacts are distinct (Passarelli et al., 2014), and thus, their joint impact is non-additive. The behaviour of each EE is important as it becomes a feature of the combined impact of both EEs (Alba-Lynn and Detling, 2008). However, the effect of both EEs together cannot be inferred from their individual environmental impact or from their mutual interaction (Gilad et al., 2004)."*

secondly why the two individual EEs did not produce the effect to soil properties although they change the microbial community structure.

- *The two individual EEs change the physical conditions of the soil (evaporation, temperature, soil moisture retention) only during the wet season (Kidron, 2009). However, previous results have shown that the higher soil water content homogenize the microbial community (Baubin et al., 2019). Here, we were sampling in the dry season where differences between patches are pronounced (Baubin et al., 2019) as a result of the short-term effects on the soil properties during the wet season. we hypothesize that a long-term effect of the soil properties on the microbial community, which means that the observed differences in the dry season are directly linked to the changes in soil properties that happened in the wet season. To reiterate this point, we rewrote a section in the discussion: " The behaviour of each EE is important as it becomes a feature of the combined impact of both EEs (Alba-Lynn and Detling, 2008).*

However, the effect of both EEs together cannot be inferred from their individual environmental impact or from their mutual interaction (Gilad et al., 2004).[…] Therefore, the prolonged water availability and altered physical conditions from the wet season may hold lasting effects on the communities structure (Baubin et al., 2019), shaping the composition and functions observed here (Figure 2 and 3).”

Also, although there were not significant differences in the functional patterns between the two patches and the combination, it seems from the graphs that the variability was much lower for the combined patches. So, I would try to use a turnover for explaining why there is no effect on the soil properties in the individual patches and possibly resilience or resistance based on increased complexity, leading to stabilization of soil, or possibly reduced turnover for explaining the effect of combined EEs. Well, maybe you can find some other ways how to explain these patterns in more detail, but I think that the MS would benefit from more depth in those two issues. It can be just two, three sentences.

- *Thank you for your comments. The discussion has been modified as described above.*

More specific comments:

L59 Better introduce the sentence starting "The community's...

- *The sentence was changed to: “This taxonomical response to changes in the physico-chemical conditions is linked to the potential function of the community.”*

L145 Use other, more specific citation than the textbook.

- *The textbook citation was changed to Galloway et al., 2004.*

L230 Change to for metabolism-related and survival-related.

- *Corrected.*

L266-271 This part is not very useful, remove.

- *Removed.*

L271 The sentence starting "Here.." is a good beginning for the explanations. At this part you should continue to a greater detail of arguments.

- *Additional information was added to this part: “These conditions are the results of the collective dynamics of many individuals from two drastically different species, which cannot be predicted by the individual impact of each EE (Gilad et al., 2004). And while the soil parameters might be modified by the presence of both EEs, the microbial community might take a longer time to change, due to their slow turnover in the dry season.”*

L281 I would suggest not to include the third EE for explaining the discrepancies. There are no discrepancies, just results to be explained. This paragraph leads the MS to a rather weak conclusion but why to do that if the results are strong. Similarly, the conclusions should be more elaborated to connect this study to a broader picture of microbial functional distribution in dry habitats.

- *The part about the third EE was removed and the section rewritten: “In this study, we focused on two EEs only, but there are many EEs in one ecosystem and knowing their joint impact would help explain the nutrient turnover and the bacterial communities in this ecosystem.”*