

## ***Interactive comment on “The mutually antagonistic effect of drought and sand burial enables the biocrust moss *Bryum argenteum* Hedw. to survive the two co-occurring stressors in an arid sandy desert” by Rongliang Jia et al.***

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Received and published: 2 January 2018

This paper presents research on the ability of biocrust mosses - in particular *Bryum argenteum* - to survive multiple stresses in dryland ecosystems. The concept is good and this research may ultimately support better land management and interventions, enabled by knowing the environmental controls on dryland biota. The novelty of the work is related to the simultaneous assessment of two stressors and their interactions: drought and burial. The experimental work appears to have been planned and carried out carefully with attention to detail, which gives me confidence in the results. The

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results are presented in quite a confusing way though, which made it difficult for this reader to draw own interpretation and conclusions. A few details of the method were also not clear enough for me to fully understand the results, for example I was not sure whether the moss is completely buried or whether it sticks through some of the burial treatments, which is very important. A similar problem of detail and clarity affected reading of the discussion but to a lesser extent, and the final parts of the discussion were much clearer.

My suggestion for this paper is that the language and content should be revised with the aim of achieving clarity and detail relating to the objectives set out, and this may involve changing the figures too. Focusing discussion more on the fitness and adaptations of the moss is likely to help, and replacing commonly used vague terminology like "positive" and "negative" effects with specific observations or interpretations like "reduced chlorophyll content" or "increased fitness" will help further. I think that the experimental work is well conceived and of good quality, but at present it is hard to be sure whether the conclusions are fully supported by the results.

Specific comments below should help the authors see examples in the manuscript relating to the above suggestions:

8 "highest" is suggestive of being superior. Perhaps "latest" would be better?

11 surely this is a very large niche, not small as stated

45 Again use of "highest" does not seem appropriate

58 is there a reference to support this?

63 is there a reference to support this (that *B. argenteum* is usually the pioneer)?

70 "buried" perhaps a better word than "submerged"

72-76 here setting out the importance of understanding how *B. argenteum* survives these multiple stressors as a main theme in the work - an interesting objective with

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practical applications.

85-90 it is stated that drought "protects" (benefit) and burial can "slow water loss" (benefit), so why are these then described as "mutually antagonistic" on line 87? In this context they are mutually beneficial. I think care is needed here (and earlier e.g. line 33) to note the difference between an apparently harsh environment (for humans) which is actually the niche for which certain biocrust organisms are adapted. Therefore, these harsh conditions are likely a requirement for life of the biocrust organisms being studied. Based on this one may reasonably assume that drought and burial are mutually beneficial for organisms adapted to live in this environment.

94-99 unnecessary precision of environmental parameters. The time period for which these data relate should be given.

126 the year should be given (and on line 133)

129 "below the ground surface" - where? In situ at the extraction place in the field, or somewhere else?

138 please explain the burial a bit more, and refer to this in the introduction and discussion too as appropriate. It is necessary to know whether the burial completely covers the moss, or whether it sticks up through the added sand. This has major implications for the interpretation and understanding of the work.

143 The experiment duration seems rather short but nothing can be done about that now. Perhaps the duration can be explained / justified?

147 Would deposited sand be naturally blown off in the field? The answer to this is of interest in relation to how the moss adapts to burial. If the deposit is never blown off then the moss needs to abandon the buried chlorophyll and invest in the tip, however if it might be blown off then it would make sense to retain the buried chlorophyll for a while in-case it will be exposed later.

152 A nice idea to minimise the edge effect.

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159 Not clear if "shoot elongation" is the same as "shoot upgrowth" on line 157 - if same then please use same terminology, if different then please explain.

166 Again nice attention to detail in the experimental method here (randomising positions)

185 I think the unit is wrong here

211 and throughout results section: It is not clear what negative and positive effects are. Instead, just state which measurements changed and how they changed (e.g. decrease or increase in chlorophyll content). In general I found the results section quite difficult to follow because of this. Furthermore in some cases the language used unclear phrases (e.g. "decrease in autumn being significantly lower" line 206). There is some interpretation in results which should instead be in discussion.

284-286 I'm not sure if the effects observed have explained the moss distribution as claimed. Perhaps more explanation of this needed, or remove.

288 The discussion here is interesting, effectively summarising findings for the most part but still a bit confusing in relation to what is a positive or negative, which seems to partly contradict the introductory section e.g. lines 85-90

370-374 this is a clear and useful outcome of the work. Probably best not to mention the un-published results though.

380 This section also presenting clear and useful findings

Table 1. The precision to 3dp seems excessive, making it less clear

Figures 2-5. These are quite complicated and can't be fully understood based on the legend. For instance what is Control, 0.5mm, 1mm etc written at the top? What are the units or scale of drought severity? These details may be elsewhere but it should be possible to interpret the figures alone. I think some work is needed to make these a bit clearer, or if not possible consider using them as supplementary figures and replace

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with something less detailed which is easier to interpret.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-402>, 2017.