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Interactive comment on "Do successive climate extremes weaken the resistance of plant communities? An experimental study using plant assemblages" *by* F. E. Dreesen et al.

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We thank referee #2 for appreciating our experimental work and providing us with helpful comments. Here follow our answers to the raised comments.

Comment: Overall I think this paper examines an important topic that has received little attention in the ecological literature. The experiment is well designed, and the results are convincing. However I question the role of treatment intensity in the minimal effect of the first event on the second one. The authors used a 50-year return interval to define extremity and establish their heat and drought treatments. But using this approach, the authors state that the drought and drought + heat treatments were not

intense enough to bring the soil below the wilting point. I think this may be an important factor that could use attention in the discussion.

Answer: In our experiment, we chose to simulate 50-year extremes. The intensity of the 50-year extremes was determined using meteorological data, resulting in an amount of days without precipitation and maximum daily air temperatures, which were then applied to our plant assemblages. Despite the fact that our extreme manipulations were extreme based on climate statistics, we can not predict whether this will bring the soil below wilting point, resulting in a physiological extreme event. The latter will depend on several external factors such as the water use of the community, the soil type or the rooting ability of the plants. In this experiment, the meteorological extreme event did not induce an extreme ecological response and was thus not an 'extreme climatic event', as this would include extremeness in both the driver and the response (Smith, 2011). If this is what the referee means with discussing the role of treatment intensity used in our experiment, we will include this in the revised manuscript. Note that this issue is already partly discussed in the first paragraph of the Discussion (P 9162, L 1-16), were we compare our results to the results from De Boeck et al. (2011), were the same statistical extreme (50-year extreme) was used. In that study, however, the extreme treatment did bring the soil below the wilting point and did cause a strong reduction of the end-of-season biomass.

Specific Comments: Comment: Throughout the paper, especially in the figures, it was difficult to keep track of which scenario was which. Perhaps the authors could use a different and more intuitive way to label these timing treatments.

Answer: We understand that the variety of treatments and scenarios may sometimes be difficult to follow. Our motive for using the current labels was as follows: scenario I = only 1 extreme event; scenario II = 2 extreme events, with the shortest interval; scenario III = 2 events, with a mid-long interval and scenario IV = 2 events, with the longest interval. In figures 1 and 2, the timing of the extreme events in the different scenarios is indicated on the figure itself, so that the reader can quickly distinguish

between the different scenarios. We would like to keep our current labels for indicating the different scenarios, but for improved clarity, we will add in the revised manuscript the description of the different scenarios in the figure legends (or on the figure itself like figures 1 and 2). Also, readers can always refer to Table 1 which provides an overview of the different scenarios. However, if the referee or editor insists, we are willing to change the labels.

Comment: It's not clear to me how the authors assessed plant survival, but I assume this means the plant was entirely senesced aboveground. This seem problematic because above-ground senescence does not necessarily mean mortality as the authors point out later in the paper "regrowth or plants previously appearing dead". Perhaps a term like "whole plant senescence" would be more accurate

Answer: We indeed assessed complete senescence of aboveground parts and will change the term plant mortality to "whole plant senescence" throughout the revised manuscript.

Comment: Why is there such a large difference in plant survival in the DH treatments in scenario IV, with scenario II showing half the loss, and III showing none?

Answer: This difference in plant survival likely depends on the phenological stage of the plants, as mentioned briefly in the Discussion (P9163, lines 16-23). In the revised manuscript, we will more carefully discuss what could cause these differences.

Comment: I'm not convinced that the leaf color data needs to be included. The authors might be making a stretch to connect leaf color to chlorophyll content to nitrogen content to a mechanism by which dry soils and translocation increases plant nitrogen.

Answer: We included the leaf color data in the manuscript to demonstrate that plants undergoing the heat and drought + heat extremes were actually healthier than those undergoing the drought and control treatment, which was unexpected (especially in the drought + heat extreme). We, however, agree with the referee that leaf color is

not a strong evidence for higher nitrogen content in the leaves and enhanced nitrogen uptake from the soil and will delete the leaf color data from the revised manuscript.

Comment: There are several times in the results sections when the authors interpret their data: "findings suggest that, despite the greater leaf and/or plant morality, the remaining leaves in these treatments contained more chlorophyll

Answer: These parts will be deleted.

Comment: While I like the ideas in the last paragraph of the discussion, the content seems to come out of nowhere. Prior to this there was very little mention of community-ecosystem dynamics. I suggest either eliminating this paragraph, or discussing this earlier.

Answer: We agree with the referee and will delete or alter this paragraph in the revision.

Technical Corrections: - Table 1 is difficult to follow, adding vertical lines would make it easier to understand when the rows are connected.

Answer: This will be adapted.

Sincerely,

Freja Dreesen and co-authors

References

De Boeck, H. J., Dreesen, F. E., Janssens, I. A., and Nijs, I.: Whole-system responses of experimental plant communities to climate extremes imposed in different seasons, New Phytol., 189, 806-817, 2011.

Smith, M. D.: An ecological perspective on extreme climatic events: a synthetic definition and framework to guide future research, J. Ecol., 99, 656-663, 2011.

Interactive comment on Biogeosciences Discuss., 10, 9149, 2013.