Biogeosciences Discuss., 10, C6895–C6898, 2013
www.biogeosciences-discuss.net/10/C6895/2013/

Biogeosciences Discussions
Open Access

Interactive comment on "Recovery dynamics and invasibility of herbaceous plant communities after exposure to fifty-year climate extremes in different seasons" *by* F. E. Dreesen et al.

Anonymous Referee #1

Received and published: 29 November 2013

This paper, which is quite well-written and clear, reports the results from experimental climate extremes imposed on artificial plant communities. The climate extremes were carefully chosen to reflect events with an average return time of 50 years and consisted of heat and/or drought in three parts of the growing season: spring, summer and autumn. Understanding the direct effects of extreme events on communities, as well as the long-term consequences in terms of functional community composition, is very important. As such, this paper is clearly suitable for Biogeosciences. However, the response of the plant communities to these events has already been reported elsewhere (De Boeck et al 2011). Here, the authors focus on the recovery dynamics in the first two years after the events. These recovery dynamics are not restricted to the

resident plant species, but also to naturally colonizing species, which were allowed to establish for two years. This approach is potentially interesting, because it may shed light on the long-term effects of extreme events on the functional composition of natural communities, which may have consequences for ecosystem functioning. However, the approach is also a bit tricky, because it depends on the available species pool. In this case, the experiment has been performed on the campus of the university, which raises the question whether the species pool present accurately reflects the pool of potential colonizers of the natural communities the experiment is mimicking. Another problem of natural colonization, particularly in small pots and over short timespans, is the potentially high variability of colonization: the species that eventually establish in the experiment may be greatly affected by the chance that its seeds actually reach a pot. This is clearly illustrated in Table S1, which shows several examples of species being highly successful in a particular pot, but absent from most others (e.g. Trifolium pratense, Lotus corniculatus, Achillea millefolium). Most probably, this is due to a relative low density in the local seed rain, making the chance that it reaches a pot rather small (as the authors acknowledge). Again, can this be considered to reflect what would happen in natural communities? Probably not. To avoid this problem, one could actively add seeds to each pot. I think the authors should briefly mention why they did not do this, and also discuss how this alternative approach may have changed their results. An additional problem of the high variability in colonization is that it makes it difficult to reach clear conclusions. If there are no effects of extreme events on community composition after colonization, is this due to inherently high variability in invasion probability among species or does it mean that extreme events have little impact on community composition? This problem is illustrated by the conclusions of the authors. For example, in the abstract, they first conclude that the observed change in composition was independent of the extreme event (l19-20), but later, they conclude that extreme events modified species composition (l22). This should be improved.

Specific comments The introduction is clear and well structured. Perhaps the part about recurring events (l26) can be removed because the experiment does not include

BGD
10, C6895–C6898, 2013

recurring events.

The methods are clear, and sufficiently complete to repeat the experiment. However, for a description of an experiment that has already been published (paragraph 2.1), I think it is too extensive. Hence, I would encourage to substantially shorten this paragraph and refer to De Boeck et al 2011 for details such as the soil composition, the design consisting of 6 boxes (which was not used in the colonization phase, if I understand correctly?), the determination of the length of the extremes, and the detailed data about soil water content (just mentioning if wilting point was reached may be sufficient here). Other point: I think the three resident species were included in the species composition analyses, but this is not very clear. Please clarify.

The results are clearly presented, but I think the number of tables and figs can be shortened. For example, Table 1 does not provide a lot of information and can be moved to the supplementary material. Fig 1 may also be omitted. A general description of the two years (in terms of drought-like circumstances, deviations from average climate) may be sufficient. Fig 3c basically shows the same effect as 3a (and 3b) and can be omitted too. Fig 4 puzzled me a bit, see also my previous question about whether the three resident species were also included in the composition data. Fig 4a shows 2009, which is before natural colonization has occurred. Hence, we are actually looking at shifts in abundance of the three experimental species, right? If correct, than this actually repeats the results shown in Fig 2b, which shows strong decline of T. repens in the DH treatment. To what extent does this decline also drive the observed effect in 2010 (Fig 4b)? I think it would be more interesting if you could show that the invader community (rather than the combination of residents and invaders) was different in terms of composition in response to the treatments. In general, I think there is a discrepancy here: for species richness, only invaders are considered (if I understood correctly?), but for composition, the residents were also included. I would only focus on the invaders. In addition, you may want to analyse the response of (a) particular invading species that did actually reach most pots. For example, Holcus lanatus seems to be

BGD
10, C6895–C6898, 2013

have reached most pots and become dominant in most treatments (table S1). Personally, I would prefer to have S1 in the main paper, especially because it also contains the biomass of the three resident species in 2010 and 2011, which is lacking from the paper's main figs!

The discussion is concise and clear, and is supported by the data. However, as mentioned earlier, I do not think it clearly reflects that the relatively minor effects of extreme events on invasibility and community composition in the long term are probably to a large extent due to the large variability in the species reaching the different pots.

Interactive comment on Biogeosciences Discuss., 10, 15851, 2013.