Project title: Effects of an increased precipitation regime on soil fauna community dynamics in a subarctic peatbog

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Host: Frida Keuper, Postdoc, Umeå University, Dept. of Ecology and Environmental Science, Climate Impacts Research Centre, Sweden

1. Purpose of the visit

The aim of my visit to the Climate Impacts Research Centre in Abisko (Sweden) was to explore potential links between vegetation cover/precipitation increase and soil fauna community dynamics in a subarctic peatbog system. This visit was used to discuss vegetation data (host) and soil fauna data (applicant) obtained from a precipitation manipulation experiment carried out in a peatland the Stordalen nature area from 2007-2009, with the aim to initiate the writing of a joint paper.

3. Description of the project

Climate change is not only expected to increase temperatures but also to alter precipitation regimes significantly. To test if increased precipitation will affect vegetation dynamics in a subarctic peatbog, Frida Keuper in 2007 initiated a precipitation-simulation experiment in Abisko, Sweden. To get more understanding about why vegetation changes occur, however, it is also important to study the belowground foodweb, as they control nutrient dynamics and consequently the vegetation
To get a more complete image of belowground responses to precipitation increase the applicant was therefore invited (2009) to take soil fauna samples from these plots. Soil fauna, specifically springtails (Collembola) are known to play a large role in nutrient dynamics and are particularly sensitive to soil moisture conditions. However, they are equally known to be sensitive to vegetation and the presence of roots.
By combining our data we are able to compare responses of soil fauna to an increased precipitation regime and simultaneously we can assess the relative importance of vegetation on these responses.

2. Description of the visit

The short visit started with the exchange of detailed microclimatic and vegetation data of the plots that had been previously sampled. After multiple meetings discussing the details of the experimental setup and the observed (absence) response of the soil fauna community to the imposed treatments, a draft version of a manuscript has been made, which is currently in preparation to become a 'final version'.

4. Main results

Surprisingly, the springtail community did not show any response to a doubling of summer precipitation, neither in species composition nor density (Fig 1.) (PERMANOVA analyses/ ANOVA analysis). An earlier study of Keuper et al. 2011, showed a lack of response in growth rates of the vegetation. A further exploration of the data indicated that the vascular plant community (species' biomass) did not shift due to the precipitation treatments (PERMANOVA analysis).
Multiple Pearsons' correlations were made to check for (within plot) relationships between vegetation biomass and springtail (species) density, however again, there were no significant correlations.

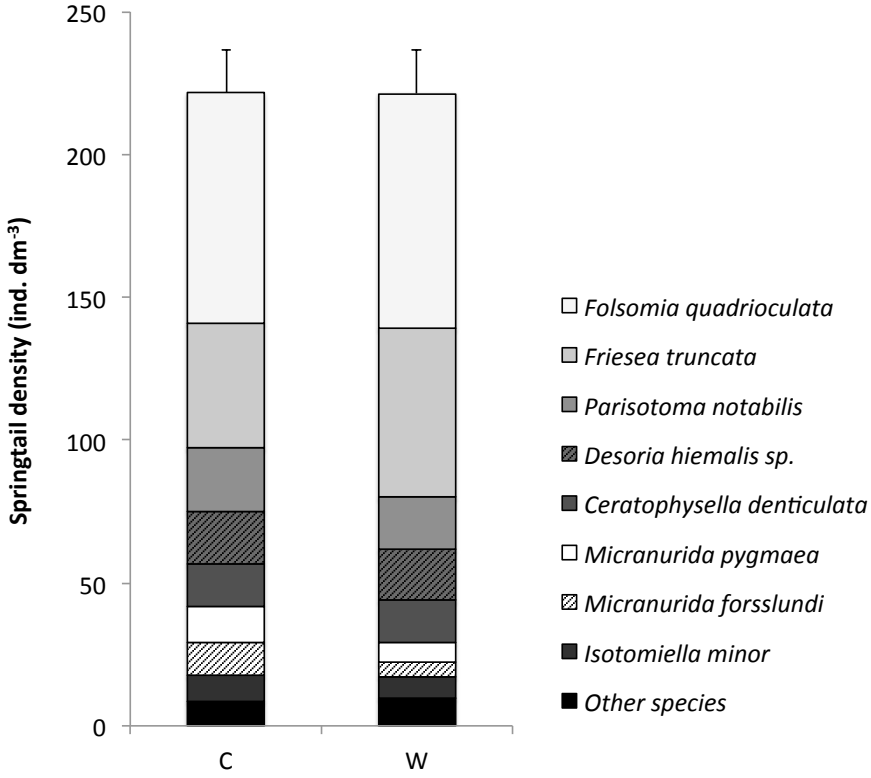

Fig 1. *Springtail species distribution and density in control plots (C) and experimental precipitation increase plots (W). Surface areas of different greyscales represent the abundance of the most abundant springtail species. Standard errors represent the variation in total springtail density. n = 8. Species composition did not significantly differ between treatments (PERMANOVA analysis, F= 0.25, p >0.8)*

Subtle, not significant, changes in species' relative abundances can in some cases lead to significant shifts in average community trait means (Bokhorst et al. 2011), which can have consequences for the functioning of the community. Therefore community weighted mean trait values (CWM) were calculated of three relevant functional traits, involved in springtail spatial patterning and functioning. The selected traits were: moisture preference, vertical stratification preference and maximum body size. For each trait we calculated CWMs for each of the communities undergoing the water addition treatment and the control. The trait values of each species were obtained from literature (Kuznetsova 2003, Fjellberg

1998, 2007), and springtail species' moisture preference and vertical stratification were assessed by subdividing them into classes. However, as could have been expected from the lack in springtail community response, precipitation increase did not alter CWMs (Fig 2)

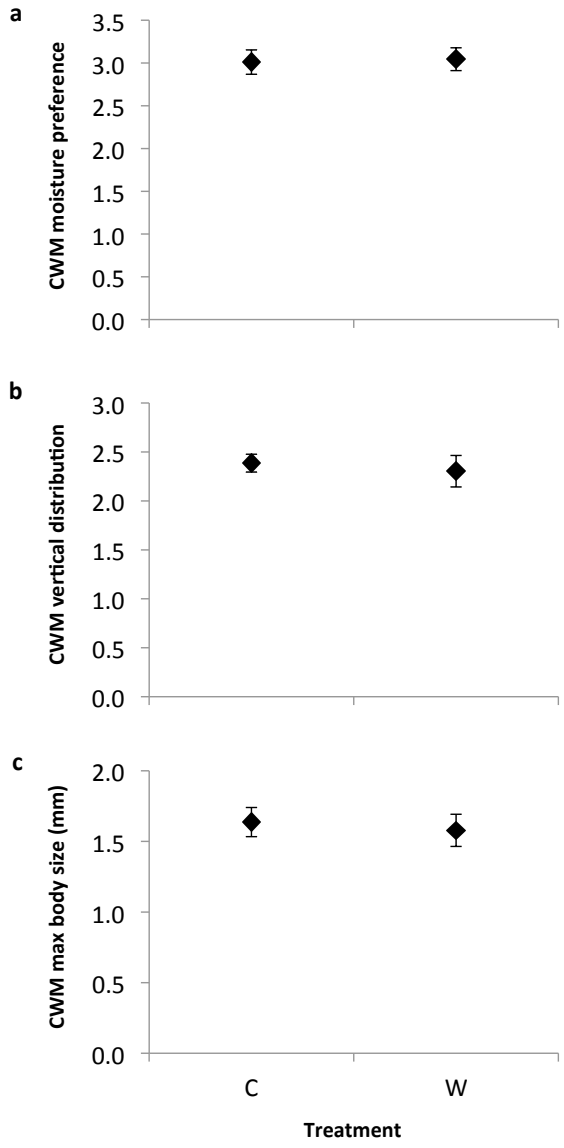

Fig 2. *Community weighted means of moisture preference (a), vertical distribution (b) and max. body size (c) for control springtail communities (C) and precipitation increase communities (W). Error bars are standard deviations. n = 8.*

A doubling of summer precipitation does not seem to have a significant effect on the species composition, density and trait averages of the springtail community.

Bokhorst, S., Phoenix, G.K., Bjerke, J.W., Callaghan, T.V., Huyer-Brugman, F. & Berg, M.P. (2012) Extreme winter warming events more negatively impact small rather than large soil fauna: shift in community composition explained by traits not taxa. *Global Change Biology,* **18,** 1152-1162.

Fjellberg, A. (1998) *The Collembola of Fennoscandia and Denmark, Part I:Poduramorpha*. Brill, Leiden, .

Fjellberg, A. (2007) *The Collembola of Fennoscandia and Denmark. Part II : Entomobryomorpha and Symphypleona*. Brill, Leiden.

Kuznetsova, N.A. (2003) Humidity and Distribution of Springtails. *Entomological review,* **83,** 230-238.

4. Future collaboration

Ms. Keuper and me will stay in contact during the write-up of this paper. Co-operative contacts between the institutes of the applicant and the host were strengthened by this collaboration and ideas for future collaboration have been discussed

5. Publications

A first draft of the manuscript with as preliminary title: "Springtail communities of a subarctic peatland do not respond to a prolonged period of frequent extreme precipitation events." is planned to be finalized by the end of January, to be submitted to Soil Biology and Biochemistry, Ambio or Oikos.