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# Effect of drought on the carbon dynamics of grassland ecosystems at different altitudes

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Climate change will probably result in an increasing frequency of hot and dry summers in Central Europe within the next decades. This can have major impacts on ecosystems, because both temperature and moisture control essential ecosystem processes such as photosynthetic carbon fixation and mineralisation of organic residues. In this field study, conducted at three grassland sites between 400 and 2000 m above sea level in Switzerland, we simulated an artificial drought during early summer, and measured biomass production, soil respiration and dissolved organic carbon leaching during up to three vegetation periods.

Mean aboveground production at the alpine site (2000 m) was reduced by drought by about one third in 2006 and 2007. At the lowland site (400 m), drought did not significantly affect aboveground biomass production in 2005 and 2006, but reduced it for some harvests in 2007. At the intermediate altitude, which was in general the wettest of the three sites, no effect of drought on biomass production was observed over three years. Belowground biomass production was generally not significantly affected by drought.

Soil respiration was reduced by about 40% during the drought period. The $CO_2$ flux originating from root respiration and SOM decomposition was less affected by drought than the $CO_2$ flux from decomposition of fresh litter. As soon as the simulated drought period was terminated, soil respiration rates exceeded those in the control, but did not fully compensate the drought-induced reduction of $CO_2$ efflux within the same vegetation period.

We provide a synthesis of the results by combining the results from biomass production and soil efflux with preliminary data from laboratory incubations of biomass grown during the drought period.

Thus, our results indicate that increasing frequency of droughts might lead to pronounced changes in the carbon dynamics of grasslands in the short-term. However, uncertainty about the acclimation of both plant and soil microbial species to such new climatic conditions precludes long-term predictions based on our data.