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The response of mire vegetation to water level drawdown

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Mires have a significant role in climate change mitigation due to their enormous carbon storage and due to the fluxes of greenhouse gases between ecosystem and the atmosphere. Mire vegetation is controlled by ecohydrology, climate and by the competition of plants on light and nutrients. The water logged conditions create a challenging environment for both vascular plants and bryophytes; therefore majority of plants growing in these habitats are highly specialized. Global warming is predicted to affect mire vegetation indirectly through increased evapotranspiration leading to decreased water table levels down to 14–22 centimeters. Water level drawdown is likely to affect the vegetation composition and consequently the ecosystem functioning of mires.

Previous studies covering the first years following water table level drawdown have shown that vascular plants benefit from a lower water table and hollow-specific Sphagnum species suffer. In addition to changes in plant abundances the diversity of plant communities decreases. The lawn and hollow communities of Sphagna and sedges are found to be the most sensitive plant groups.

It has been shown that surveys on vegetation changes can have different results depending on the time scale. The short and long term responses are likely vary in heterogenous mire vegetation; therefore predictions can be done more reliably with longer surveys.

We applied BACI (before-after-control-impact) experimental approach to study the responses of different functional mire plant groups to water level drawdown. There are 3 control plots, 3 treatment plots with moderate water level drawdown and 3 plots drained for forestry 40 years ago as a reference. The plots are located in meso-, oligo- and ombrotrophic sites in Lakkasuo (Orivesi, Finland). The vegetation was surveyed from permanent sampling points before ditching in 2000 and during the years 2001–2003 and 2009. The data was analyzed with NMDS (PC-Ord) and DCA (CANOCO).

Overall results show that the control and treatment plots were similar before the treatment which is crucial in studies conducted with BACI- experimental design. The vegetation composition in the varied between the years also in the control plots following variation in weather conditions, i.e. growing season temperature and precipitation. The year 2003 stood out with lowest water table levels and with highest coverage of the evergreen vascular plants in all plots. By 2009 there was a dramatic decrease in sedge species cover. There seems to be more changes in bryophyte cover in mesotrophic sites than in ombrotrophic ones. Especially lawn-specific Sphagnum responded to water level drawdown.

To quantify the impact of water level drawdown for different plant groups we used Principal Response Curves (CANOCO). Results show that all plant groups have a different short and long term response to water level drawdown. The first three years after ditching appeared to be a disturbance state. Only after that the vegetation started to adapt to the lowered water table conditions.