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Bringing back the rare – biogeochemical constraints of peat moss establishment in restored cut-over bogs

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In rewetted cut-over bogs in north-western Germany and elsewhere almost no spontaneous recolonization of hummock peat mosses, such as Sphagnum magellanicum, S. papillosum or S. rubellum can be observed. However, to reach goals of climate protection every restoration of formerly mined peatlands should aim to enable the re-establishment of these rare but functionally important plant species. Besides aspects of biodiversity, peatlands dominated by mosses can be expected to emit less methane compared to sites dominated by graminoids.
To assess the hydrological and biogeochemical factors constraining the successful establishment of hummock Sphagnum mosses we conducted a field experiment by actively transferring hummock species into six existing restoration sites in the Vechtaer Moor, a large peatland complex with active peat harvesting and parallel restoration efforts. The mosses were transferred as intact sods in triplicate at the beginning of June 2016. Six weeks (mid-July) and 18 weeks later (beginning of October) pore water was sampled in two depths (5 and 20 cm) directly beneath the inoculated Sphagnum sods as well as in untreated control plots and analysed for phosphate, ferrous iron, ammonia, nitrate and total organic carbon (TOC). On the same occasions and additionally in December, the vitality of mosses was estimated. Furthermore, the increment of moss height between July and December was measured by using cranked wires and peat cores were taken for lab analyses of nutrients and major element inventories at the depths of pore water sampling.
Preliminary results indicate that vitality of mosses during the period of summer water level draw down was strongly negatively related to plant available phosphate in deeper layers of the residual peat. Furthermore, increment of moss height was strongly negatively related to TOC in the upper pore waters sampled in October. Concentration of ferrous iron in deeper pore waters was in general significantly higher beneath Sphagnum sods compared to control plots suggesting a direct impact of hummock mosses on microsite soil moisture conditions. However, with an increase of water levels towards winter season accompanied by increase of ferrous iron and concurrent increase of phosphate in pore waters of the upper peat layers the vitality was strongly positively related to plant available phosphate. This suggests that actively transferred hummock mosses suffering temporarily from desiccation during the dry summer season are able to recover also under relatively higher trophic conditions as long as water level and redox state favour an optimal supply of required water nutrients.