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Peatland plant community succession as forced by water table changes – a long-term field study in southern Finland

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Peatlands are ecosystems having a thick waterlogged organic layer with anaerobic conditions that slow down decomposition below plant production. Plant communities are key to peatland ecosystem functioning as they determine production and losses. Water level and nutrient availability are the main drivers of plant communities characteristic of peatlands. Our objective was to quantify the response of peatland vegetation to altered ecohydrology. Experimental drainage has been widely used as a proxy for climate change in mires as water tables are predicted to decrease with increased evapotranspiration and precipitation regimes will be more extreme. We hypothesized that drainage will drive plant community succession towards a new equilibrium vegetation community assemblage.

To study vegetation succession following experimental drainage, we used field experiments on three peatland types in Juupajoki, Finland, which were maintained over 15 years allowing us to measure conditions approaching, or at, a new equilibrium. On each peatland type were three treatments: control, experimental drainage, and historical drainage. Successional changes were recorded by recording species cover on permanent sample plots established prior to treatment. Both bryophytes and vascular species were included. Analyses were completed using ordination and principal response curves.

Modified ecohydrology as studied by experimental drainage had a significant effect on peatland vegetation and drove succession from open peatland towards forest vegetation. Main gradients in vegetation composition – i.e. principal ordination axes – were nutrient status and time since treatment. The rate and degree of successional change depended on peatland type. Minerogenic peatlands underwent rapid changes where shrubs quickly dominate, then later recede as tree cover develops. Ombrogenic peatlands were slower to change and succession occurred to a lesser extent than on minerogenic systems. Vegetation in low topographical positions with high water tables was the most sensitive to changes regardless of site, whereas hummocks showed more resiliency, particularly in ombrogenic peatlands. This study provides a key foundation using long-term data for further work describing ecosystem functional changes resulting from plant community succession.