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Effect of long-term drainage of peatland on whole-profile microbial community structure

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Peatlands are crucial global carbon stores largely due to prevailing hydrological regime leading to higher rate of carbon input than loss. Like other changes in environmental conditions, alteration in peatland water table, which causes increased aeration in the upper layer, does not only cause a shift in this exchange rates, but leads to changes in plant species cover, litter quality as well as the niches of microbes, by affecting their functions and activities. Effects of changes in peatland hydrology are therefore complex, and play a key role in peat carbon cycles. Changed peat hydrology may especially affect the inter-play between methanogens and methanotrophs which are important members of the microbial community taking part in anaerobic/aerobic peatland carbon cycles. We provide more information on the effect of long-term (more than 33 years) changes in hydrology on the whole-peat-profile microbes, from top to bottom.

We studied drained and adjacent non-drained peatlands in Lakkasuo mire complex and Lammi area of Finland, which differed in vegetation cover and management history. We focused majorly on the phospholipid fatty acids (PLFA) analysis as an indicator of the overall microbial community structure, but also used DNA analysis to mainly compare the methane oxidizing bacteria (MOB) of the different peatland types with different vegetation.

Our PLFA results showed that peat mire complexes are more similar in their microbial community, within location and profiles than between locations irrespective of hydrological changes and types or vegetation covers. PLFA and DNA analysis also showed that MOB species belonging to type II were more dominant than those of type I in both locations studied. Our study also showed that long-term draining of peatlands does not change the biomass of soil microbial communities, but alters their structural or relative composition. The effect of long-term peatland drainage is mostly located at the surface. Depth gradient effects on peat microbial communities were reduced by long-term peatland drainage. Finally, our result showed that possibly due to differences in the accompanying changes in other biotic and abiotic environmental factors and conditions (e.g. vegetation cover), microbial shifts due to long-term peatland drainage are not unidirectional but vary from one peatland type or site to another.