Responses of fine root production to warming under different water-table level scenarios in sedge fens

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Introduction
In boreal sedge fen peatlands, carbon sequestration is largely mediated by sedge roots. Most of sedge biomass, in some cases more than 90%, is allocated belowground to the root systems (Sjörs 1991, Saarinen 1996). Thus, roots provide a direct input of organic matter to the peat, and their turnover is a major component of the C cycle. A small fraction of change in root production can thus affect the ecosystem C sink. Climate warming may affect the production patterns both per se and by shifting peatlands towards drier conditions. In order to predict the scale of impact of climate warming on fine root production (FRP), we examined the effect of warming under wet (ambient) and drier conditions on fine root production (FRP) and its depth distribution at two sedge fens in Finland: northern (Lompolojänkkä) and southern (Lakkasuo), using ingrowth cores. FRP was estimated by infrared spectroscopy using regression models. Wet represents C+W treatments estimated using ingrowth-dividing method (Bhuiyan et al. 2017). Warming was induced with open-top chambers (OTC) and drying treatments: C vs WWTD in 10-20 cm, 20-30 cm, 30-40 cm and WTD vs WWTD in 40-50 cm depth class. Only WTD and WWTD showed an increasing trend in FRP as compared to ambient. In addition, FRP was significantly different between W and WWTD in the northern fen (Fig. 1).

Results
In the southern fen, FRP under warming in wet conditions, W, showed an increasing trend, which was not significantly different from FRP under ambient conditions, however. In contrast, W resulted in lowering FRP trend compared to ambient in the northern fen (Fig. 1).

In the southern fen, warming showed greater FRP for each depth class compared to ambient, the difference being significant in the 30-40 cm depth class (Fig 2). In the northern fen, the depth classes below 10 cm showed several significant differences between treatments: C vs WWTD in 10-20 cm, 20-30 cm, 30-40 cm and WTD vs WWTD in 40-50 cm depth class. Only WTD and WWTD showed any FRP at 50-60 cm.

In both sites, sedge contribution to FRP was more than 70% under wet (ambient water-level) conditions. However, after drying (WTD) sedge contribution decreased in the 0-10 cm of the southern fen and in 10-60 cm layer of the northern fen, while those of shrubs and forbs increased (Fig 3).

Conclusions
Our results show that FRP can vary widely both between and within sites representing the same habitat type. They further suggest that the responses of FRP to climate change are in general minor. However, there may be changes in depth distribution and plant group composition that depend on the moisture regime. Such subtle changes in both the depth profile and decomposability of the organic matter inputs may yet affect the C cycle of sedge fens in the future.

References:

Experimental setup with OTCs and shallow ditches in Lompolojänkkä site

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