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Importance of mosses and vascular plants in peat soil carbon sequestration

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Nutrient rich peat soils have earlier been shown to loose carbon despite higher photosynthesis and litter production compared to nutrient poor soils, where instead carbon accumulated. To understand this phenomena data from two drained Finnish sites, nutrient poor Kalevansuo and nutrient rich Lettosuo, was combined with a process-oriented model (CoupModel). Uncertainty based calibrations were made using eddy-covariance data (hourly values of net ecosystem exchange) and tree growth data. The model design was three vegetation layers: trees, smaller vascular plants and a bottom layer with mosses, all with different LAI and degree of coverage. Adding a moss layer was a new approach, having a modified physiology compared to vascular plants. Soil organic carbon was described by two separate litter pools for vascular plants and mosses together with a common inert pool of decomposed organic matter. Over a period of 10 years the model showed similar photosynthesis rate for the two sites but higher biomass accumulation for the fertile stand. Moss biomass did not increase, instead mosses delivered high litter inputs with low turnover rates compared with litter from vascular plants. Both the soil organic carbon received from vascular plant litter and the old decomposed matter declined by time, while litter originating from mosses was accumulating by time. Large differences between the sites were obtained during dry spells where soil heterotrophic decomposition was enhanced in the vascular plants dominated site, due to a larger water depletion by roots. Important for carbon accumulation in the poor soil was the mosses, adding larger litter quantities with a resistant quality together with less water depletion in dry spells.

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