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# Carbon and nitrogen dynamics in mesocosms of five different European peatlands

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Elevated nitrogen (N) deposition, a key growth limiting nutrient in ombrotrophic peatlands, can cause various shifts in peatland N cycling. Quantification of N transformation rates and fluxes within peatlands that are induced by long-term N deposition is crucial for understanding the mechanisms and robustness of N retention. Using a 15N labeled tracer under steady state conditions at two water table levels, we investigated the fate of N in mesocosms from five European peatlands, which have a history of differing long-term N load. Peat contained the largest N pool, followed by Sphagnum (0 - 5 cm), shrubs, graminoids and the dissolved pool. We found a decline of N recovery from the peat and an increase of N recovery from shrubs and the dissolved pool across the N deposition gradient. Sphagnum mosses not only intercepted large amounts of 15N in the mesocosms (0.2 – 0.35 mg g-1) but they also retained the tracer most effectively relative to their biomass. Polluted sites (Lille Vildmose, Frölichshaier Sattelmoor) contained the largest dissolved nitrogen pools and the highest nitrate concentrations. At the same time the recoveries of their Sphagnum pools were in the range of the recovery recorded for the Sphagnum layer from the ‘clean’ site (Degerö Stormyr). Our experiment shows that a decline in N retention at levels above ca. 1.5 g m-2 yr-1, as expressed by elevated near-surface peat N content and increased dissolved N concentrations, might not be an evidence for Sphagnum saturation. As long as N is required for the synthesis of biomass Sphagnum species can thrive even at strongly elevated long-term N loads.

A change in WT position from -28 to -8 cm influenced $CO_2$ fluxes from mesocosms only to a small degree, which implies that small changes in water table position may be less important in controlling $CO_2$ exchange with the atmosphere than often assumed. Although water table rise was a main driver for increase of methane emissions in all cores, short time lags (3–32 days) of methane reappearance were observed. The delays seemed to be more related to the soil physical characteristics and moisture conditions than to electron acceptor deposition. The N deposition gradient did not have a strong effect on C fluxes and we did not observe a decline in Sphagnum growth with increasing N deposition, which is in conflict with the results of fertilization experiments.