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Vegetation drives belowground biogeochemical gradients and C accumulation in an ombrotrophic bog

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Peat decomposition and C accumulation is determined by hydrology and climate and by concomitant changes in vegetation and changes in the quality of carbon inputs. Especially changes from moss dominated to vascular plant dominated vegetation affect belowground biogeochemistry and decomposition, as *Sphagnum* mosses provide refractory, nutrient poor litter, while vascular plants produce more labile litter and may have aerenchymatic rooting systems. In-site variability in moisture and vegetation, e.g. hummock-hollow structures, lawns, and medium scale surface topography, could thus cause large differences in decomposition and C accumulation within a site.

In order to understand within-site variability and to see how C accumulation, common decomposition indices, and major biogeochemical parameters in the pore waters are affected by site specific conditions and vegetation, we investigated a moisture-vegetation gradient along a 800 m transect in an oceanic, ombrotrophic bog in Southern Patagonia. Along the transect, conditions changed from wet, *Sphagnum* dominated (*S. magellanicum*), to intermediate drier and wetter with *Sphagnum*/shrubs mixtures, sedges and rushes to more wind exposed, dominated by cushion plants (mainly *Astelia pumila*). We hypothesized that under arenchymatic vascular plants, decomposition is enhanced and C accumulation is decreased. Vegetation development was elucidated by plant macrofossils and carbon accumulation was attributed to the respective vegetation.

The transect demonstrated a high variability of depth records within the bog. At the two most contrasting sites, the uppermost 1 meter persistently dominated by either *Sphagnum magellanicum* or *Astelia pumila* had accumulated over 2400 or 4200 years, respectively. Accordingly, the peat under cushion plants was much more decomposed, with C/N ratios of 20-50 compared to C/N ratios of 40-80 under *Sphagnum* patches. Mixed sites in between had C/N ratios of 30-90, depending on plant community, and intermediate C accumulation. Humification indices as obtained from FTIR spectra tended to be lower at the *Sphagnum* sites. All decomposition indices were clearly related to past vegetation changes. In the liquid phase, concentrations of DOC were higher under *Sphagnum* and also here, fluorescence spectra of DOC revealed higher contribution of protein-like fluorescence, which was close to zero at the cushion plant sites. Furthermore, the fluorescence index suggested higher contribution of microbially processed DOC at the cushion plant sites and higher contribution of plant derived DOC at the *Sphagnum* site.

Our study supports that peat decomposition processes are largely controlled by plant diversity. Presence of aerenchymatic cushion plants lead to a decrease in the concentration of labile carbon compounds in the pore water, to highly decomposed peat and less peat accumulation. For sites with gradients in hydrology and vegetation, spatio-temporal changes in carbon turnover and accumulation have thus to be considered.