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The flux of organic matter through a peatland ecosystem – a molecular budget of C in peatlands

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Carbon budgets of peatlands are now common and studies have considered nitrogen, oxygen and energy budgets, but no study has considered the whole composition of the organic matter as it transfers through a peatland. Organic matter samples were taken from each organic matter reservoir and fluvial transfer pathway and analysed the samples by 13C nuclear magnetic resonance (NMR) and thermogravimetric analysis. The samples analysed were: aboveground, belowground, heather, mosses and sedges, litter layer, a peat core, and monthly samples of particulate and dissolved organic matter. All organic matter samples were taken from a 100% peat catchment within Moor House National Nature Reserve in the North Pennines, UK, and collected samples were compared to standards of lignin, cellulose, humic acid and plant protein.
Results showed that the thermogravimetric trace of the sampled organic matter were distinctive with the DOM traces being marked out by very low thermal stability relative other organic matter types. The peat profile shows a significant trend with depth from vegetation- to lignin-like composition. A principal component analysis (PCA) of the NMR data shows that the DOM was a mixture of plant and peat compositions reacting to form a highly evolved composition that perhaps represents autochthonous stream processes. When all traces are weighted according to the observed dry matter and carbon budgets for the catchment then it is possible to judge what has been lost in the transition through and into the ecosystem. By plotting this “lost” trace it possible to assess its composition which is either 97% cellulose and 3% humic acid or 92% and 8% lignin. The “lost” composition shows that peatland processes preferentially remove carbohydrates and retaining lignin compounds reflected. Similarly the NMR traces show that while O-alkyl functional groups were selectively lost in the transition while alkyl groups were selectively enriched.