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Does the composition of dissolved organic carbon (DOC) in peatland streams reflect the DOC leached from vegetation, litter and soil?

Pippa Chapman, Joseph Holden, Sheila Palmer, Lauren Parry, Zoe Wallage, and Hannah Wynne
water@leeds, School of Geography, University of Leeds, Leeds, United Kingdom (p.j.chapman@leeds.ac.uk, +44 113 343-3308)

Leaching of water-soluble compounds from fresh, senescent, and degraded plant biomass in contact with drainage water is an important process by which carbon, and other nutrients, are transferred from vegetation to soil and subsequently surface waters. Recent studies have shown that the quantity and quality of DOC leached from vegetation varies significantly with plant species. In blanket peatlands the dominant vegetation can vary from ericoid shrubs to sedges to acid grassland over quite short distances (meters). This variation in vegetation composition may be important in controlling the spatial variation observed in stream water DOC concentration and composition and therefore warrants further investigation, particularly in light of predicted changes in vegetation composition in response to climate change and/or changes in land management. This study (i) compared the amount and composition, in terms of its hydrophobicity, of DOC leached from a variety of plant and soil substrates from a blanket peatland in a laboratory experiment, and (ii) determined whether leachate DOC chemistry was reflected in the concentration and composition of DOC in soil waters, from patches of different vegetation types on the hillslope, and stream water from headwater catchments (< 40 ha).

There were significant differences in the amount and quality of DOC released from three major plant functional types (PFT) found in blanket peatlands. Leachates from Calluna and Eriophorum contained more DOC than those from Sphagnum, whereas the composition of the DOC was dependent on vegetation state (living foliage or litter) rather than PFT. Leachates from living vegetation contained the lowest proportion of hydrophobic (HPO) compounds (average = 30%) and leachates from the peat the highest proportion of HPO (average = 62%), with leachates from litter containing on average 49% HPO.

Although the amount of DOC in soil pore water reflected the results obtained from the leachate experiment, with larger concentrations observed in pore water beneath Eriophorum and Calluna compared to Sphagnum, the composition of DOC was similar beneath all vegetation types.

As reported in other studies, stream water DOC composition, at baseflow, was dominated by the HPO fraction (average = 67%), which is more similar to that observed in leachates from the peat than leachates of living foliage and litter.

The results show that while the quantity and quality of DOC leached from vegetation varied significantly with plant species, this was not reflected in soil water collected from beneath patches of different vegetation and streams draining catchments dominated by different vegetation. This suggests that microbial processes occurring within the peatland may be more important than the original source in determining the composition, in terms of hydrophobicity, of aquatic DOC.