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Impacts of peatland restoration on fluvial carbon fluxes in the Peak District National Park, UK: a fingerprinting approach

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Peatlands represent major carbon stores. However, large areas of the UK's blanket peat are significantly degraded and actively eroding, impacting carbon storage through the physical export of particulate organic carbon (POC). The stability of peatlands is therefore important for the preservation this carbon store. The restoration of eroding peatlands has been a major conservation concern for several decades. However, little is known about the source and quality of sediment still entering the fluvial system in revegetated catchments. Understanding the physical process dynamics relating to revegetation and sediment flux is required in order to assess the efficacy of peatland restoration in reducing POC release.

Peat erosion is widespread in the Peak District National Park, UK. The Bleaklow Plateau has been a focus of restoration over the past decade, with attempts to stabilise the peat surface through revegetation. Three sites have been studied which represent different surface conditions in the area: (i) actively eroding, (ii) recently revegetated and, (iii) intact. Bleaklow lies in close proximity to the industrial cities of Manchester and Sheffield; consequently the near-surface layer of the peat is contaminated by high concentrations of anthropogenically derived atmospherically deposited lead. The contaminated nature of the near surface peat distinguishes POC mobilised from the peat surface from that eroded from gully walls. This has allowed a fingerprinting approach to be adopted which has not previously been used in organic systems. Lead concentration, organic carbon content, and the SIRM/ARM magnetic ratio were used to characterise and identify potential sources of sediment entering the fluvial system.

The composition of sediment at the three sites suggests all sources are active, regardless of surface condition. POC fluxes are greatly reduced following restoration to levels comparable to intact sites. However, the composition of suspended sediment produced in intact and restored sites differs. Post-restoration there is a larger contribution of POC from the deeper, older carbon store, relative to the intact sites.

Although traditional radiometric dating methods are often used for assessing the age of mobilised carbon in peatland fluvial systems, geochemical fingerprinting shows promise as a cheap and rapid alternative for evaluating the relative inputs of old and new carbon in such environments.