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Soil erosion in the uplands: impacts on the terrestrial carbon cycle

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Upland peat is an important reserve of terrestrial carbon in temperate, boreal and sub-arctic regions of the world. It is estimated that globally, peatlands may contain up to one third of the total terrestrial carbon pool [1]. Although the terrestrial-riverine carbon flux is relatively small in comparison to the terrestrial-atmospheric carbon flux, it is an important consideration in peatland ecosystems due to the extent of the carbon stock contained within a comparatively small area of the global terrestrial surface.

Terrestrial-riverine carbon fluxes from peatlands are dominated by the release of dissolved organic carbon (DOC) and particulate organic carbon (POC), with a relatively minor contribution from inorganic carbon [2]. Long term records of DOC in rivers draining UK upland catchments have indicated substantial increases in concentration in recent decades [3,4]. Rates of POC export have been less extensively studied over the long term but data from reservoir surveys confirm that this is also an important means of upland carbon erosion [5,6]. Although these records provide useful estimates of carbon budgets from upland catchments, they do not inform us of the underlying processes responsible for the mobilisation and transport of POC and DOC.

This research aims to examine the physical and biological processes which control the release of the different forms of organic carbon. It is the expectation that POC releases will be dominated by physical processes associated with erosion at the soil surface, for example wetting and drying, freeze/thaw cycles, wind and water erosion. In contrast, DOC release is more likely to be linked with vegetation cycles/physiology and soil biological activity as governed by climate and land use. *In situ* experiments will be carried out in the Trout Beck catchment, a headwater tributary of the River Tees that lies within Moor House NNR, North Pennines, UK. Differences in DOC and POC

export from intact and eroding peat sub-catchments will be determined. In addition, a more disruptive sampling regime will use bare, re-vegetating and vegetated soil to test the influence of soil biological activity on organic carbon production and release. Experimentation in the Earth Systems soil erosion laboratory at Lancaster University will use peat blocks excavated from Moor House to replicate measurements made in the field under controlled hydrological and temperature regimes.

With respect to climate change, this research hopes to indicate some of the changes which may occur in the carbon dynamics of upland peatland environments as a result of changes in the direct and indirect controls on peatland processes.

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