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Exploring climatic controls on blanket bog litter decomposition across an altitudinal gradient

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The hydrological and ecological functioning of blanket bogs is strongly coupled, involving multiple ecohydrological feedbacks which can affect carbon cycling. Cool and wet conditions inhibit decomposition, and favour the growth of Sphagnum mosses which produce highly recalcitrant litter. A small but persistent imbalance between production and decomposition has led to blanket bogs in the UK accumulating large amounts of carbon. Additionally, healthy bogs provide a suite of other ecosystems services including water regulation and drinking water provision. However, there is concern that climate change could increase rates of litter decomposition and disrupt this carbon sink. Furthermore, it has been argued that the response of these ecosystems in the warmer south west and west of the UK may provide an early analogue for later changes in the more extensive northern peatlands.

In order to investigate the effects of climate change on blanket bog litter decomposition, we set-up a litter bag experiment across an altitudinal gradient spanning 200 m of elevation (including a transition from moorland to healthy blanket bog) on Dartmoor, an area of hitherto unstudied, climatically marginal blanket bog in the south west of the UK. At seven sites, water table depth and soil and surface temperature were recorded continuously. Litter bags filled with the litter of three vegetation species dominant on Dartmoor were incubated just below the bog surface and retrieved over a period of 12 months.

We found significant differences in the rate of decomposition between species. At all sites, decomposition progressed in the order Calluna vulgaris (dwarf shrub) > Molinia caerulea (graminoid) > Sphagnum (bryophyte). However, while soil temperature did decrease along the altitudinal gradient, being warmer in the lower altitudes, a hypothesised accompanying decrease in decomposition rates did not occur. This could be explained by greater N deposition at the higher elevation sites (estimated through measurements of N content in Sphagnum capitula), but this conclusion raises new questions over the reasons for, and the likely resilience of, the greater sink at the higher elevation sites relative to those at lower elevations. This talk disentangles the effects of temperature, moisture and N deposition on blanket bog litter decomposition, in order to make predictions about the future C balance of bogs in these areas that are climatically marginal in terms of peat bog formation.