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Hydrological restoration of an upland peatland and its consequences for the microbial processing of dissolved organics

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Peatland restoration efforts are accelerating globally with a primary aim of restoring the carbon balance of these ecosystems. Degraded peatlands export carbon to the atmosphere but also to freshwater environments as dissolved organic compounds. Whilst hydrological restoration measures can effectively reduce emissions of CO2 from upland peatlands, the impact on carbon export to the aquatic environment is less apparent. In some cases, dissolved organic concentrations can even increase after restoration, without clear mechanisms that could drive such a response. We aim to determine whether the response of the peat microbial community to restoration measures can explain poorly understood trends in dissolved organics.

We investigated a severely degraded peatland in South Wales that has experienced historic drying to considerable depth, almost complete loss of surface vegetation, and a lowering of the peat surface. Restoration measures implemented over the past 16 years have involved hydrological intervention through gulley-blocking as well as efforts to stabilize the peat surface and re-establish plant communities. Porewater collected over the first 6 months of our investigation indicates, contrary to expectation, that DOC concentrations were lowest in the most severely degraded region of the bog and highest in the least disturbed regions. We will discuss the potential drivers behind this observed trend, focusing on the role played by the peatland microbiome in the processing of dissolved organics in the peatland. In addition, we draw on water-table monitoring and sampling results to consider how environmental and geochemical conditions moderate biotic processing of dissolved organics. Improvement of our understanding of the microbial community response to rewetting measures is required as this underpins the function and carbon balance of these systems and will ultimately inform management approaches.