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Microbial activity and dissolved organic carbon production in drained and rewetted blanket peat

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Heightened levels of degradation in response to environmental change have resulted in an increased loss of dissolved organic carbon (DOC) in the drainage waters of many peatland catchments across Europe and North America. One significant threat to peatland sustainability has been the installation of artificial drainage ditches, and although recent restoration schemes have pursued drain blocking as a possible strategy for reducing degradation and fluvial carbon losses, little is known about how such processes influence the intimate biological systems operating within these soils. This paper investigates how disturbance, in the form of drainage and drain blocking, influences the rate of microbial activity within a peat soil, and the subsequent impact this has on DOC production potential. Peat samples were extracted from three treatment sites (intact peat, drained peat and drain-blocked peat) in an upland blanket peat catchment in the UK. Microbial activity was measured via laboratory experimentation that incorporated the use of an INT-Formazan dehydrogenase enzyme assay to assess the level of electron transport system (ETS) activity occurring within each treatment. Drainage significantly lowered the height of the water table relative to the intact peat, whilst drain blocking successfully rewetted the peat, having raised the height of the water table relative to the drained site. Mean microbial activity rates at the drained site were found to be 33 % greater than the undisturbed intact peat and almost double that of the restored, drain-blocked site. These results correspond well with previously published data observing significantly greater DOC concentrations in the pore waters of the drained site and significantly lower concentrations at the blocked site, relative to the intact peat. Data from the drain-blocked treatment also provides evidence contrary to the commonly quoted hypothesis that an enzyme-latch reaction may be sustained in drained peat, even once it has been rewetted following water table restoration. Data is also presented that demonstrates how earlier research using INT-Formazan to assess microbial activity in peat, which has not incorporated correction for the spectrophotometric interference incurred from coloured DOC compounds, should be treated with caution.