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New insights on controls of piping distribution in degraded blanket bog

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As part of the EU-funded MoorLIFE2020 project, which examines strategies to restore degraded blanket bog in the Peak District of northern England, we investigated natural soil pipes. These pipes are a cause of concern to peatland restoration practitioners who are unsure whether to block them to reduce erosion and flood risk when conducting restoration work. Soil pipes often occur in complex networks with varying channel sizes, undulating through the soil profile. Their prevalence is often linked to controls such as topographic location, slope, aspect, vegetation cover, climate, and properties of the surrounding soil. Such relationships are poorly understood for degraded blanket bog. A before-after-control treatment study was designed to examine the effects of pipe blocking on fluvial carbon removal and streamflow in Upper North Grain (UNG), a small headwater catchment located between 490 m and 541 m above sea level. The catchment has a blanket peat cover up to four meters thick at places, with a branching network of deep gullies that incise into the bedrock. This experimental design was envisaged to address the following hypotheses: (i) the severity of degradation of UNG is a dominant control on pipe density; (ii) blocking of pipe outlets impairs pipe-to-stream connectivity. Our results point towards a rejection of both hypotheses. An initial field survey used to locate and characterize pipe outlets, resulted in 353 individual outlet recordings with a density of 13.79 per km of surveyed gully bank. Southeast, south, southwest and west-facing gully banks accounted for more than 75% of identified pipe outlets. The experimental design compares water and aquatic carbon fluxes in two streams - in one catchment the active pipe outlets (n=25) were blocked by closing off the void behind the pipe outlet with peat and stones, wooden screens or plastic pilling, while in the other catchment the pipes were left open. Areas on the gully bank around original outlets were photographed every two weeks. This analysis showed that within the first month after blocking, all treated pipes had formed bypass routes around the block and initiated new pipe outlets. New outlets were found both above and below the original pipe outlet at distances up to 1 meter from the original pipe outlet regardless of bank aspect, suggesting the networks behind a pipe outlet to be a porous system that connects in both vertical and horizontal directions when issuing onto gully banks. Further results will be presented from the ongoing monitoring showing effects of pipe blocking on streamflow storm responses and the export of particulate and dissolved organic carbon from pipes and streams.