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Is the blocking of drainage channels in upland peats an effective means of reducing DOC loss at the catchment scale?

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Only 3% of the earths land surface is covered by peatland yet boreal and subarctic peatlands store approximately 15-30% of the World's soil carbon as peat (Limpens et al. 2008). In comparison British bogs store carbon equivalent to 20 years worth of national emissions. The loss of carbon from these areas in the form of dissolved organic carbon (DOC) is increasing and it is expected to have grown by up to 40% by 2018. Extensive drainage of UK peatlands has been associated with dehydration of the peat, an increase in water colour and a loss of carbon storage. It has been considered that the blocking of these drainage channels represents a means of peat restoration and a way of reducing DOC loss. This study aims to assess the effectiveness of this drain blocking at both an individual drain scale and at a larger catchment scale. Gibson et al. (2009) considered the effects of blocking at a solely individual drain scale finding that a 20% drop in DOC export was recorded post blocking however this decrease was due to a reduction in water yield rather than a reduction in DOC concentration with the concentration record showing no significant reduction.

The effect of external parameters become more pronounced as the DOC record is examined at larger scales. The catchment is an open system and water chemistry will be influence by mixing with water from other sources. Also it is likely that at some point the drains will cut across slope leading to the flow of any highly coloured water down slope, bypassing the blockages, and entering the surface waters downstream. Degradation of DOC will occur naturally downstream due to the effects of light and microbial activity. There is, consequently, a need to examine the wider effects of drain blocking at a catchment scale to ensure that what is observed for one drain transfers to the whole catchment.

A series of blocked and unblocked catchments were studied in Upper Teesdale, Northern England. Drain water samples were taken at least daily at nine localities. These sites were located such that individual drains could be monitored in the context of a larger catchment. Water table depth, flow and weather parameters were recorded along with the collection of runoff and soil water samples. A detailed sampling programme was undertaken in which a series of drains were studied in the 12 months prior to and post blocking. This approach has allowed the effects of blocking on the carbon budget, water balance and flow pathways to be considered.

Results indicate that the blocking of zero order drainage channels leads to a decrease in DOC export on an individual drain scale. However, this is due to a reduction in water yield rather than concentration. Concentrations are seen to rise by a small yet statistically significant amount in blocked zero order streams. The effect at a larger scale is more complex. Annual export values in the unblocked control catchment show a rise from zero to first order streams indicating that water is being added to the system at this scale from external spatially variable sources. This pattern is also recognised in the blocked catchment. The DOC concentration record in blocked drains at this larger scale however indicated a reduction relative to the unblocked catchment. This reduction points to a change in flow pathways post blocking as highly coloured water re-navigates its way downstream.

References:

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