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Oxidation rates of overbank POC deposition in an eroding peatland

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In actively eroding peatlands, particulate carbon losses can be very large, with the potential to shift peatland systems from carbon sinks to carbon sources. However, incorporation of these losses into Greenhouse gas budgets is problematic because of uncertainties about the fate of eroded peat (POC). POC is potentially processed to dissolved and gaseous forms either in-stream or by oxidation from depositional sites, such as floodplains. Such losses are potentially large, but direct measurements are required.

This paper will present data from a field experiment designed to assess the importance of floodplain environments in 'processing' POC derived from eroded blanket peatlands. 24 gas collars (six replicate collars of four different treatments) were installed on a floodplain in the highly eroded Upper North Grain research catchment in the South Pennines. CO_2 flux was measured at fortnightly intervals over a 12 month period. The four treatments are:
• Unmodified floodplain surface;
• Floodplain surface covered by a 20 mm particulate organic matter (POM) layer;
• 20 mm POM layer isolated from the soil surface by a plastic base-plate on the bottom of the gas collar; and
• 20 mm POM layer isolated from the soil surface by a plastic base-plate on the bottom of the gas collar, refreshed on a monthly basis to simulate fresh peat deposits.

Results show that deposition of POM on floodplains reduce carbon sequestration by two main mechanisms. Firstly through suppression of photosynthesis as the POM layer acts as a physical barrier, preventing sunlight from reaching the underlying vegetation. This suggests that the frequency of inundation may be significant in terms of covering the underlying vegetation. The second mechanism is oxidation of the POM itself which, although numbers seem small, may be significant over longer time periods. The flux data is also examined alongside water table, air and soil temperature, and radiation data to determine the environmental controls on carbon flux. This information is then used to produce an annual carbon loss budget using long-term data for the catchment.