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Investigating the potential of coppice wood bundle installation to enhance biogeochemical cycling in low-land rivers

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Anthropologically elevated nitrogen (N) concentrations are observed in surface waters globally, with well documented negative implications. The attenuation of N has therefore become a priority in river restoration and management programmes. Previous research has focused on understanding the variation in biogeochemical cycling between rivers. However, there has been little research to inform river managers of how to enhance biogeochemical cycling.

A strategy employed in river restoration schemes is the installation of coppice wood bundles (CWB) into river banks, primarily to control bank erosion. The potential of CWB installation to fulfil other management objectives has been realised, including silt trapping, habitat creation, carbon (C) sequestration and N attenuation. CWB are expected to enhance biogeochemical cycling similarly to naturally occurring large woody debris.

By manipulating channel geomorphology CWB installation alters streamflow characteristics, for example reducing flow velocity, creating pool and riffle sequences, and fostering upwelling and downwelling. These changes are expected to facilitate an increase in stream water residence time in the hyporheic zone and therefore increase N removal by denitrification. Furthermore, CWB provide a source of C which will persist for several years. By increasing the availability of dissolved organic C and the ratio of C:N the rate of denitrification may be increased.

Here I present how I intend to investigate these processes primarily using 3 experimental designs. (1) An incubation mesocosm experiment will assess the potential of CWB as a C source and their impact on denitrification rates and methanogenesis. (2) A recirculating flume experiment will assess how the position of CWB in the channel and in the sediment effects flow characteristics and stream metabolism. (3) A reach-scale tracer experiment will assess the in-situ impact of designed CWB structures compared to natural log-jams in a low-land river in the West Midlands, UK.

Results will inform river managers and policy makers on the suitability of CWB installation in river restoration and management programmes that focus on enhancing biogeochemical cycling.