The potential of Large Woody Debris for river restoration in lowland streams

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Large Woody Debris (LWD) has been successfully applied previously in river restoration practice of upland headwater streams in order to enhance riverine geomorphic and hydraulic heterogeneity and increase hydrological connectivity between river and floodplain [Reich et al., 2003; Kail & Hering, 2005; Munz et al., 2007]. However, the ecohydrological and biogeochemical consequences of LWD in lowland rivers are largely unknown.
In collaboration with UK regulators and river restoration partners, this project investigates to what extent the (re)introduction of LWD in sandy UK lowland rivers can improve their ecosystem services by enhancing macroinvertebrate habitat diversity and increasing streambed nutrient cycling, thus, supporting the achievement of the EU Water Framework Directive water quality targets.

Aims & Objectives: The project aims to provide scientific evidence of the impacts of LWD on exchange fluxes and residence time distributions (RTD) at the streambed interfaces where groundwater and surface water are mixing in sandy lowland rivers. It will identify the implications of exchange fluxes and RTD on streambed thermal patterns and associated microbial metabolic activity and biogeochemical cycling and analyse subsequent consequences of physic-chemical habitat structure for hyporheic and benthic invertebrates.
To achieve this, this project will pioneer the combination of novel distributed sensing networks and smart tracer technologies for quantification of microbial metabolic activity with innovative passive pore-water sampling approaches to identify spatial patterns and temporal dynamics of LWD-induced streambed fluxes, thermal patterns and residence times and analyse implications for the development of streambed biogeochemical hotspots of enhanced microbial metabolic activity. Aquatic invertebrates associated with LWD will be sampled at selected time points and will centre on identifying if faunal community structure and functioning differ in benthic and hyporheic habitats in association with physical and biogeochemical gradients.
To understand the temporal dynamics of these processes and process interactions as well as their evolution after LWD installation, cutting-edge technologies as Fibre-optic Distributed Temperature Sensing (FO-DTS) will be combined with streambed applications of metabolic microbial metabolic activity tracers (Resazurin) and micro-profiling of streambed pore-water chemistry by passive samplers in a nested experimental design at a succession of LWD installations in two representative UK chalk and limestone rivers.
Ecological data and associated environmental data will be analysed using a range of multivariate analysis techniques (e.g.,CCA or NMDS) to identify underlying gradient or drivers of invertebrate community change. Analyses will also include detailed examination of differences associated with variability in fluxes and residence times (e.g., ANOVA).

The project will be carried out in close collaboration with river restoration practitioners at the rivers Uck (Sussex) and Lathkill (Derbyshire) and be supported by key UK stakeholders including the Environment Agency and Dr Megan Klaar, River Restoration Council, Association of River Trusts, TrUck, SouthEast Water.
In addition to being integral part of the vital research environments at the Birmingham Water Sciences group and the Centre for Hydrological and Ecosystem Science at Loughborough University. The doctoral researcher will benefit from wide ranging additional international training opportunities and infrastructural support by the EU-FP7 funded INTERFACES Initial Training Network lead by the UoB supervisors Krause and Hannah.

Applicants should apply via
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