Hydrological and thermal dynamics of peatlands in Denali National Park, Alaska, and influence on ecological communities.

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Abstract.

This project will investigate the hydrological and thermal behaviour of headwater wetlands in Denali National Park Alaska. A wetland classification scheme will be developed to select a number (4-5) of small wetlands for detailed instrumentation. The hydrological and thermal regime of these wetlands will be modelled to determine the sensitivity of these wetlands to climate change (e.g. winter precipitation; summer temperature), and the implications for ecosystem function. The latter will utilise available datasets on macro-invertebrate community distribution and abundance to provide a longer context for this investigation. The research will build upon close links with the US National Park Service, and where possible, site-specific results will be up-scaled to quantify the importance of these important landforms in the headwaters of a large continental river system (the Yukon).

Introduction.

Wetlands extend across ~50% of state of Alaska and have a fundamental role in the hydrological and biogeochemial cycles and perform a number of vital ecosystem services. Recent research has sought to quantify variations in wetland water sources (e.g. subarctic ponds; Rains, 2001), and model groundwater – wetland exchange (Reeve & Gracz, 2008). However, much of this work focuses on peatland systems in south-Central Alaska, and the degree to which these results might apply to sub-arctic catchments has still to be assessed. Such wetlands have been associated with elevated CH_4 concentrations, and thus influence GHG emissions (Umezawa et al., 2011). Their stable hydrological and thermal regime contributes to high biodiversity, and seepage from these wetlands represents an important source of DOC to fluvial systems, albeit highly vulnerable to changing climate (Hood et al., 2009).

A recent project at Birmingham has indicated the role of areas of upwelling groundwater on glacial floodplains as biological hotspots for ecological communities with valley-side wetlands an important variable driving community composition (Crossman et al., 2011). The proposed project will build-on the previous research and examine more widely the hydrological and thermal behaviour of these wetlands in headwater / glacerised catchments in Denali National Park Alaska. Where possible, the work will build upon an existing long-running ecological data-set to relate to indices of catchment hydrogeomorphology, and model the sensitivity of these systems to changing climate. This is an area of active interest in the international research community and will allow a scaling up of the role of these numerous, but little studied wetland systems in influencing catchment hydrochemistry and ecology.

The research student will benefit from designing a field programme and working in a multidisciplinary team and from participating in a large and active graduate research school within the School of Geography Earth and Environmental Sciences. The research programme will provide the student with training in hydrology; biogeochemistry; ecology; remote fieldwork and desk-based research methods; and analysis of environmental data.

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