

Mechanisms of dissolved organic carbon retention-release in organo-mineral soils within the Upper Nidd catchment

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Background

Organic soils, particularly peats, are a major source of dissolved organic carbon (DOC), and hence colour, to surface waters. Over the last 20 years, concentrations of DOC have increased in freshwaters draining catchments containing organic soils across large areas of Europe and North America (Monteith et al., 2007). The potential environmental implications of this trend in DOC are wide ranging, from local effects on water transparency, acidity and metal toxicity through to effects on drinking water quality, and possible destabilisation of terrestrial carbon stores. A range of hypotheses have been put forward as potential driving mechanisms (Evans et al., 2006), many of which are linked to climate change, such as increased production of DOC and changes in the hydrological export of DOC. Others have suggested that changes in the chemistry of atmospheric deposition may be the key driver, while some believe that land use change is a major factor. The exact driver(s) and mechanisms that can quantitatively explain the observed increase in DOC concentrations remain open to debate and are in need of further research.

Recent research within sub-catchments of the upper River Nidd, one of the largest water-gathering grounds in Yorkshire, has shown that mean annual water colour has increased between 1986 and 2006 in all sub-catchments. However, there was considerable variation in the increase, which ranged from 11 to 135%, with the catchments that had the smaller mean annual water colour values in 1986 showing the largest increase. These catchments are also the largest catchments where a greater contribution of flow originates from depth, as indicated by the larger silicon concentrations and pH values. Consequently, we hypothesise that: the increase in water colour and DOC concentration:

1. Water colour or DOC concentration in streams is related to the catchment soil properties, such as the depth and spatial distribution of the organic horizon (e.g. Palmer et al., 2005) or the mineralogy of the mineral soil
2. Mechanisms of retention/release of DOC within the mineral horizons of the soil have altered in recent years such that the capacity of soils to retain DOC has been compromised

Project and aims

The overall aim of this project is to: i) investigate the adsorption capacities of soil at different depths in the soil profile under varying pH and ionic strength; and ii) investigate the role of the spatial distribution of soil characteristics (type, depth) on DOC concentrations in streams.

Training

The successful candidate will benefit from training in soil science, solute chemistry and biogeochemistry as part of the River Basin Processes and Management research cluster in the School of Geography, recently rated in the top six research departments in the 'Geography and Environmental Studies' category (RAE 2008). Training at Leeds deals fully with the elements described in the Joint Research Centre statement on skills training for research students. PhD students take modules provided by the staff development unit (e.g. starting your PhD, small group teaching) and a 15-week faculty-training course (covering elements such as planning, critical reading and writing, oral presentations, writing research papers). Students present results and receive constructive feedback from peers in a Research Support Group, from colleagues in the River Basins research group, and at a university postgraduate research day.

The School of Geography at Leeds has excellent laboratory facilities and is well equipped to carry out the required research. The nature of the project means that the student will be trained in project specific research methods including experimental design, field sampling, chemical analysis, statistical analysis, and data interpretation and presentation. An additional important part of the training will be to attend national and international conferences (e.g. EGU, AGU) to present results and gain feedback. The student will be encouraged to submit papers for publication during the project.

Applications

The prospective student should have (or expect to receive) a minimum of a first class or high 2i BSc degree in an appropriate discipline, and have interests and experience in most, if not all, of the following topics: soils, environmental management, and the UK uplands. Successful applicants will be considered for full-time funding for 3.5 years duration from a range of sources including NERC, departmental and university sources. Self funded students are also welcome to apply for the project. Informal enquiries should be directed to Sheila Palmer at s.m.palmer@leeds.ac.uk. Further details about postgraduate research degrees at the School of Geography, University of Leeds can be found [here](#)

References

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- Palmer, S.J., Wellington B.I., Johnson, C.E. and Driscoll, C.T. (2005) Landscape influences on aluminium and dissolved organic carbon draining the Hubbard Brook valley, New Hampshire, USA. *Hydrological Processes* 19:1751-1769.