

Towards an integrated model of nitrogen and carbon in streams across different spatial scales

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Background

Nitrogen is typically in low supply in upland ecosystems and consequently is tightly cycled such that streams draining undisturbed upland areas have low concentrations of nitrogen species. Atmospheric deposition of anthropogenic N threatens to upset the balance between biotic cycling, soil retention and stream loss, leading to N leaching and even eutrophication of inland waters. However, there is little information on the regional susceptibility and landscape scale control of N leaching, particularly with respect to the form of nitrogen being leached. Nitrogen may be present in streams as dissolved inorganic N (DIN) – mainly nitrate (NO_3^-) and ammonium (NH_4^+) – or as dissolved organic N (DON). The contribution of DIN and DON may vary between upland regions, yet DON is rarely considered in studies that aim to quantify regional patterns and controls on N leaching (Chapman et al., 2001). There is strong evidence that the concentration of both DON and NO_3^- in upland stream water is related to the concentration of dissolved organic carbon (DOC: Chapman et al., 2001; Evans et al., 2006), which in turn appears to be influenced in some catchments (but not all) by the size of soil carbon stores within the catchment, % peat cover, or depth of organic soil horizon (Aitkenhead et al., 1999; Chapman et al., 2001; Hope et al., 1997; Palmer et al., 2004) or soil C:N ratios (Aitkenhead & McDowell, 2000). However, these relationships do not hold for all upland regions or indeed all catchments, and it is likely that catchments size, land cover, and soil parent material also play a part in controlling/attenuating the concentration and speciation of N in upland catchments.

Project

This project will aim to integrate factors operating at different spatial scales into one integrated model of nitrogen (and carbon) in upland streams. The model will utilize existing data from streams across England, Scotland and Wales, supported by new data from the same catchments and/or additional catchments.

Training

The successful candidate will benefit from training in environmental monitoring and modelling, and soil and water quality 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 student will also 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: nitrogen cycling, upland soils, water quality, GIS, landscape/spatial modelling. 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 on our website (<http://www.geog.leeds.ac.uk/study/phd.html>).

References

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