Land use effects on upland stream macroinvertebrate traits and functional diversity

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The use of multiple phenotypical traits as a biological monitoring tool has recently gained support across Europe (e.g. Statzner & Bêche, 2010) and North America (e.g. Poff et al., 2006) because species traits are affected similarly by environmental drivers or 'filters', regardless of biogeographical constraints on species identity. Despite the potential to use knowledge from European meta-datasets as a foundation of analyses (e.g. Statzner et al., 2007), the approach has not been widely used in the UK. The approach potentially offers an insight into stream community dynamics that might be missed by monitoring approaches that rely solely on taxonomic assessments, as well as offering a means of examining the fundamental processes by which ecological communities are assembled.

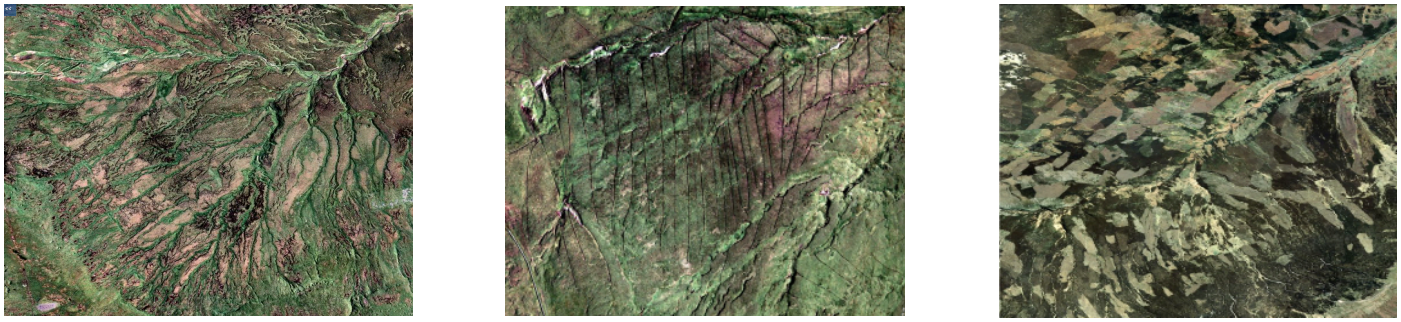
The search for general principles, or assembly rules, which determine how species combine to form communities, is a long-standing but continually debated field in ecology (e.g. MacArthur and Levins, 1967; Connor and Simberloff, 1979; Lawton, 1987; Weiher and Keddy, 1997; Belyea and Lancaster, 1999; Hubbell, 2001). Biological trait distributions can be used to gain an understanding of community assembly processes by comparing the observed functional diversity for a biological community against null (random or 'neutral' - Hubbell, 2001) models constructed from the regional species pool (Weiher and Keddy, 1997; Petchey et al., 2007). Significant departures from random may indicate either competitive exclusion or limiting similarity (values higher than expected by chance) or niche filtering (values lower than expected by chance) are important determinants of local assemblage structure (Cornwell et al., 2006; Holdaway and Sparrow, 2006; Petchey et al., 2007). These approaches to understanding community assembly can yield important insights into the effects of land management on ecological communities (e.g. Flynn et al., 2009).

Building on a series of existing studies which have been examining the effects of moorland management strategies (e.g. drainage, heather burning, afforestation; Ramchunder et al., 2009; in press), this study will firstly build upon existing European macroinvertebrate biological trait databases (e.g. Tachet et al., 2002) by undertaking a detailed review of published and grey literature to identify trait information for macroinvertebrates found in streams of the UK uplands. This database will subsequently be used to (i) develop an understanding of how stream macroinvertebrate biological traits respond to changes in upland land use and vary over time, and; (ii) examine assembly processes of stream macroinvertebrate communities in these environments. The project will run alongside the ongoing NERC funded EMBER project looking at moorland heather burning effects on stream ecosystems.

Benefits

The successful candidate will benefit from inter-disciplinary training in hydrology and stream ecology as part of the River Basin Processes and Management, and Ecology and Global Change research clusters in the

School of Geography. 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.



Aerial photographs showing different peatland management strategies (from L-R; intact peatland, drained peat, rotational heather burning). Macroinvertebrate datasets are available from two previous PhD studentships and a large NERC funded project (EMBER)

The nature of the project means that **the student will be trained in project specific research methods including macroinvertebrate sampling and identification, and applied statistics** for analysing biological data, both internally and at external workshops. **An additional important part of the training will be to attend national and international conferences (**e.g. FBA, BES, SEFS) 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 first class BSc and/or MSc distinction in an appropriate discipline, and have interests and experience in most, if not all, of the following topics: freshwater ecology, upland environments and hydrology. Strong applicants will be considered for funding 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 Lee Brown at l.brown@leeds.ac.uk. Further details about postgraduate research degrees at the School of Geography, University of Leeds can be found at http://www.geog.leeds.ac.uk/study/phd/apply.html

References

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