



Euro-FLOW: a European training and research network for environmental FLOW management in river basins. A MARIE SKŁODOWSKA-CURIE ACTIONS Innovative Training Network (ITN) funded under H2020-MSCA-ITN-2017

ESR 8: Testing the effect of hydrological alteration on stream ecosystem functioning

3 year fixed- term PhD position.

Host institute: University of Birmingham, UK

Supervisors: Dr Mark Ledger and Prof Alexander Milner

Project Description:

Flow is recognized as a master variable that shapes the structure, functioning and service provision of freshwater ecosystems. The modification of natural flow regimes, through activities such as abstraction, irrigation and dam construction, can lead to major alterations in flow regimes, including in the frequency, intensity, duration and timing of high and low flows, with profound implications for stream biota. The science of environmental flows has evolved as means to manage and mitigate the worst impacts of hydrological change in rivers and streams, but the flow-ecology relationships that underpin water resource management are still poorly understood. This research project seeks to understand how modifications in flow regimes influences stream ecosystem functioning, and specifically explores whether ecological thresholds – the points at which small changes in environmental conditions lead to large shifts - exist in the nature of the relationship between flow and ecosystem functioning in streams.

Flow-ecology relationships can be challenging to quantify in natural systems, especially where the focus is on extreme events – floods and droughts – that are, by definition, rare and unpredictable. Experiments have been advocated recently as useful alternatives to surveys that are often confounded by long-term change in unrelated environmental conditions, and will be used here discern causal relationships among the many underlying stressors associated with hydrological alteration. The student will conduct mesocosm experiments in the University of Birmingham ECOLAB, a new £1.1M stream mesocosm research facility on campus. Here, flow can be manipulated in artificial streams located outdoors, and sensor networks can be deployed to sense change in ecological responses among biota (algal biofilms, invertebrates and fish).



Figure 1: Mesocosm facility at UoB

This project also benefits from being closely linked to research by other postgraduate and postdoctoral researchers investigating low flow impacts on stream ecosystems. The successful candidate will also gain from being part of a large, interdisciplinary, water research team based at the University of Birmingham.

Objectives:

- (1) Use artificial streams in the Birmingham ECOLAB facility to replicate elements of natural flow regimes, and simulate gradients of low and high flow versus control flow regimes
- (2) Determine the mechanistic basis of low flow impacts, via factorial manipulation of habitat connectivity, habitat/sediment area, temperature and water quality
- (3) Monitor impacts on water quality and ecosystem processes using sensor networks
- (4) Determine impacts on metabolism, algal production, and invertebrate-fish feeding links.

Expected outcomes:

- (1) Reveal how key ecosystem processes are impacted by flow modification
- (2) Identify tipping points and non-linear responses along gradients e.g. of low flow stress
- (3) Identify key environmental stressors that modify ecosystem processes when flows are modified, to form the basis of mitigation strategies
- (4) Evaluate the utility of mesocosms for e-flow science

Secondments:

Centre for Ecology and Hydrology, UK for 3 months, in year 2 or 3 to undertake community invertebrate analysis

University of Leeds, 3 months, in year 2 or 3 to learn and undertake food web data analysis

Eligibility Criteria:

- * Applicants must not have resided or carried out their main activity in the UK for more than 12 months in the 3 years immediately prior to their recruitment¹.
- * Applicants must hold a first degree and/or Masters degree in an environmental science subject (hydrology, ecology, environmental management, etc) and be highly motivated to work in an international team including frequent travel between the Euro-FLOW beneficiaries and project partners.
- * Applicants must not have more than 4 years (full time equivalent) research experience at the date of their recruitment¹. This is counted from the date they obtain the degree that would let them start work on a doctorate. They must not have been awarded a doctoral degree.
- * Some experience of freshwater ecology is required. Skills in stream metabolism measurement, invertebrate or algal taxonomy, and/or statistical analysis using R would be advantageous.
- * Applicants must have excellent written and spoken English skills.

Other requirements: Full driving license (UK/EU)

¹Date of recruitment is defined as the first day of the applicant's employment i.e. the start date indicated in their employment contract.

EuroFLOW Information:

The regulation of river flows is one of the biggest stressors affecting river ecosystems across the world. In many countries, major legislative efforts are therefore underpinning the development of new approaches to mitigate the impacts of river flow regulation. These approaches are based on optimising the management of river flows to maintain services to humans (e.g. water supply, hydropower) whilst protecting and/or rejuvenating the aquatic environment with water of adequate quantity and quality in space and time (i.e. environmental flows). In this context, a field of applied aquatic science has developed to generate the evidence base for identifying the best ways to manage the quantity, quality and patterns of environmental flows to sustain river ecosystems, Euro-FLOW will train a new cohort of researchers to be future leaders in this field. Within Euro-FLOW, 15 early-stage researchers will develop new theoretical and empirical insights via ground-breaking experimental manipulations, large-scale field surveys and development of cutting-edge models to inform the management of water flows and aquatic ecosystems in river basins. Future research leaders will be developed through advanced training in: (i) river ecosystem science in relation to environmental flows; (ii) transferable scientific and life skills; (iii) collaborative working with international and inter-sectoral networking. Euro-FLOW will produce scientists with the ability to span subject boundaries, e.g. hydrology, geomorphology, geochemistry, ecology, microbiology, modelling and environmental management. The strong involvement of the non-academic sector will provide the PhD students with a holistic perspective on career opportunities.

Application details

The application should contain a cover letter that states your motivation, a CV and supporting documents about your education and studies (i.e. transcripts, certificates) and professional experience where applicable and two references. If you are applying for more than one EuroFLOW position, please rank your preferred projects.

Contact Dr Mark Ledger M.E.LEDGER@bham.ac.uk for information on how to apply

Closing date: 30 November 2017

Post start date: February 2018