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 4: Linking environmental flows to changes in river ecosystem structure and functioning mediated by water chemistry and biotic interactions

3 year fixed- term PhD position.

Host institute: Norwegian Institute for Water Research, NO (NIVA)

Supervisors: Dr Nikolai Friberg (NIVA), Dr Asbjørn Vøllestad (University of Oslo, NO), Dr Hamish Moir (CBEC EcoEngineering, UK), Dr Mark Ledger (University of Birmingham, UK)

Project Description:

Norway produces approximately half of Europe's hydropower generated electricity and 70 % of Norway's rivers have consequently changed hydrological regimes. While direct effects on biota, in particular salmonids, are well documented, much less is known of how changed hydrological regimes indirectly influence biotic interactions and ecosystem functioning. Furthermore, water released from hydropower reservoirs will often differ in temperature regimes, gas saturation and water chemistry compared to unimpacted rivers. This, together with changes in sediment transport and geomorphic process rates, that are inherent features of changes to natural flow conditions, will significantly alter the environmental conditions at all levels of biological organization, and it has profound implications for ecosystem properties. In particular, we are interested in how this combined impact of hydropower influences interaction among autotrophic components in river ecosystems and the cascading effects further up in the food web. We are furthermore interested in quantifying changes in ecosystem functioning such as metabolic balance, primary and secondary production and rates of decomposition, and to link these changes to alterations in flow, temperature, geomorphological processes, gas saturation and water chemistry. We expect to translate changes in ecosystem functioning to the provision of key ecosystem services such as a sustainable recreative fishing that is a key source of rural income in many parts of Norway. We envisage a combination of using existing data sets, new field surveys and experiments to disentangle these complex abiotic and biotic interactions in relation to hydropower development. We expect that the PhD student will study component parts of this complex in more detail than other parts, depending on personal interest and competences, as well as logistic challenges. The successful candidate will be enrolled as a PhD candidate at the University of Oslo, Department of Biosciences, and linked to CEES (Centre for Ecological and Evolutionary Synthesis).

Objectives:

(1) To elucidate mechanisms by which changed hydrological regimes and environmental conditions influence interactions among autotrophic components;

(2) To investigate the direct and indirect (biotic) effects of reduced flow on benthic macroinvertebrates and fish;

(3) To investigate how overall ecosystem metabolism, primary and secondary production and organic matter decomposition are influenced directly and indirectly by changes in flow, related environmental conditions and biotic interactions.

Expected outcomes:

(1) Understanding of the main drivers of changes in the composition of autotrophic components and how flow can be managed to avoid direct negative impacts on cultural services from e.g. nuisance growth;

(2) Quantification of how autotrophic components can indirectly influence ecosystem structure and functioning, and the provisioning ecosystem services (biodiversity, nutrient-cycling, secondary production of fish);

(3) An ecosystem understanding of cascading effects arising from the interplay between flow conditions and biotic interactions that can conceptually be transferred to other systems.

Secondments:

University of Birmingham, UK for 3 months in Year 2 to undertake controlled mesocosm experiments

CBEC, UK for 3-6months in Years2/3 to undertake hydraulic modelling