



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 11: Functional implications of river thermal response to flow dynamics

3 year fixed- term PhD position.

Host institute: Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany

Supervisors: Jörg Lewandowski, Gabriel Singer (IGB, Berlin, Germany), Guido Zolezzi (University of Trento, Italy), José Barquin (University of Cantabria, Spain)

Project Description:

The aim of this PhD project is to understand how natural and anthropogenically-impacted flow regimes (water level fluctuations) impact on the thermal conditions of the river water column and the river bed. Temporal variability and spatial heterogeneity of temperatures will be investigated with thermal infrared imaging (TIR), fibre-optic distributed temperature sensing (fo-DTS), temperature lances recording temperature depth profiles in the hyporheic zone and temperature loggers installed in wells. At the local scale, drivers and consequences of observed temperature patterns will be studied: Thermal sediment properties and subsurface flow patterns will be considered to understand the physical processes translating a flow regime into a thermal regime, whose ecological implications will be investigated by measuring microbially driven ecosystem functions. In a later phase of the project, the experimental findings shall be upscaled to understand riverscape patterns of thermal and microbial response to variable flow.

The project will be conducted at different study sites with different flow regimes. The perennial River Erpe in Berlin shows strong regular diurnal fluctuations of flow due to the outlet of a wastewater facility and the River Erpe is heavily impacted by nutrients, carbon and organic micropollutants. The ephemeral sand-bed Stream Demnitzer Mühlenfließ in Brandenburg shows intense flow variations and experiences usually some dry months during summer. Due to intense agriculture in the catchment the water quality is impaired by nutrients. The pristine braided River Tagliamento in Italy shows intense flow variations and its large gravel bed supports great microhabitat diversity including parts that are exposed to air for long periods of time. Consequently there is a huge span of temperature fluctuations in this river. Finally, the sand-bed stream Schlaube in Brandenburg experiences only very small water level fluctuations but the opportunity to cause small floods in this stream allows studying their impacts on subsurface flow patterns and biogeochemical processes.

Objectives:

- (1) Understand how natural and anthropogenically-impacted flow regimes (water level fluctuations) impact on the thermal conditions of the river water column and the river bed.
- (2) Test how variability temperature conditions influences microbially driven ecosystem functions at local habitat scale.

(3) Scale up findings to understand riverscape patterns of thermal and microbial response.

Expected outcomes:

(1) Identification of typical thermal patterns (regimes) of river water and river bed in response to variable flow and with a focus on within-habitat temperature stability versus across-habitat heterogeneity at the riverscape scale.

(2) Knowledge of how thermal regimes impact local ecosystem functions driven by temperature-sensitive microbes.

(3) A model-based linkage of flow-regime driven thermal patterns to riverscape ecosystem functioning.

Secondments:

A 2-month stay at University of Trento (Italy, host: Guido Zolezzi) in year 1 or 2 with the aim to conduct measurements at the Tagliamento.

A 4-month stay at the University of Cantabria (Spain, host: Jose Barquin) in year 2 with the purpose of modelling.