Thermal performance of organisms viewed as a phenological trait: implications for biodiversity – ecosystem functioning research

Institute of microbiology (SUPSI), Stream Ecology group.

Supervisors: Dr. Thibaut Rota (thibaut.rota@supsi.ch) and Dr. Andreas Bruder (andreas.bruder@supsi.ch).

Duration: 1 year

Location : Principally campus Mendrisio, possibly short trips to field sites and collaborators in France or northern Switzerland

Keywords: Phenology; thermal performance curves (TPC); biodiversity – ecosystem functioning (BEF); temperature; functional traits; resource complementarity; ecological modelling.

Global changes are not only marked by ongoing and future temperature increases, but thermal regimes are also expected to be more variable, especially in streams. However, the consequences of those thermal regime shifts are still poorly acknowledged from an ecological point of view. Thermal performance curves (TPCs) describe the biological rates of an ectotherm organism along a temperature gradient. In short, an increase in temperature enhances the biological activity of ectotherms until it peaks at their thermal optimum. Then, their biological activity decreases because of temperature's deleterious effects. We believe viewing TPCs as phenological traits could improve our understanding of how complementarity in resource use arises between consumers in a variable thermal environment, how thermal traits relate to the life-cycle of species (periods of reproduction, time of emergence etc.), and how species are at risk given different thermal regime scenarios. Overall, viewing and using TPC as a phenological trait could advance biodiversity–ecosystem functioning (BEF) research, in unifying individual's biological rates, phenology and temperature regimes in a single ecological framework.

In this master project, under our guidance and given the candidate's affinity, creativity and skills, we aim at assessing the following goals:

1) Literature review and thinking, restitution of verbal arguments in the form of novel hypotheses and expectations in the topic of BEFs.

2) Sampling of detritivorous invertebrates and culture of aquatic hyphomycete fungi strains. TPC measurement by the mean of litter consumption assays of fungal and metazoan detritivores at different temperatures in the lab.

3) Testing correlates between TPCs and other phenological traits.

4) Modelling the implications of variability in TPC for BEF relationships in different thermal regimes and biodiversity loss scenarios using the statistical software R.

5) Testing empirically some of the mathematical predictions with a BEF microcosm experiment.

We expect: Strong curiosity for ecological concepts and theory, strong interest for aquatic organism ecology, creative thinking for synthesis and to translate information across specific topics, good English communication and writing skills, good knowledge of statistics, use of R software and basic mathematics, willingness to perform mathematical simulations, willingness for laboratory work, and a collaborative mind