Hydrologic drivers and controls of stream ecological processes

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MOTIVATION

Understanding the dynamics of river ecosystems linked to hydrology is one of the most important challenges of ecohydrology. Indeed streamflow plays a fundamental role in sustaining and regulating fluvial ecosystem integrity.

RESEARCH OBJECTIVE

Quantitative analysis, through modeling and field experiment, of relevant implications of hydrologic fluctuations on river ecosystem dynamics described on a food-web perspective.

RESEARCH OUTLINE

Probabilistic characterization of streamflow and water depth temporal variability

A stochastic approach is used to analyze streamflow and water depth temporal fluctuations. The main outcome provides the analytical definition of frequency of occurrence (i.e. probability distribution function) of streamflow and water depth, which will be used to quantify interrelations between hydrology and stream ecology.

Modeling of stream ecological processes

Stream ecological processes are modeled through a simple predator-prey model, which reproduces benthic algae and macro-invertebrates dynamics.

Algae biomass = growth - death loss - predation loss

Macro-invertebrate biomass = growth due to predation - death loss

Analysis of interrelations between hydrology and stream ecology

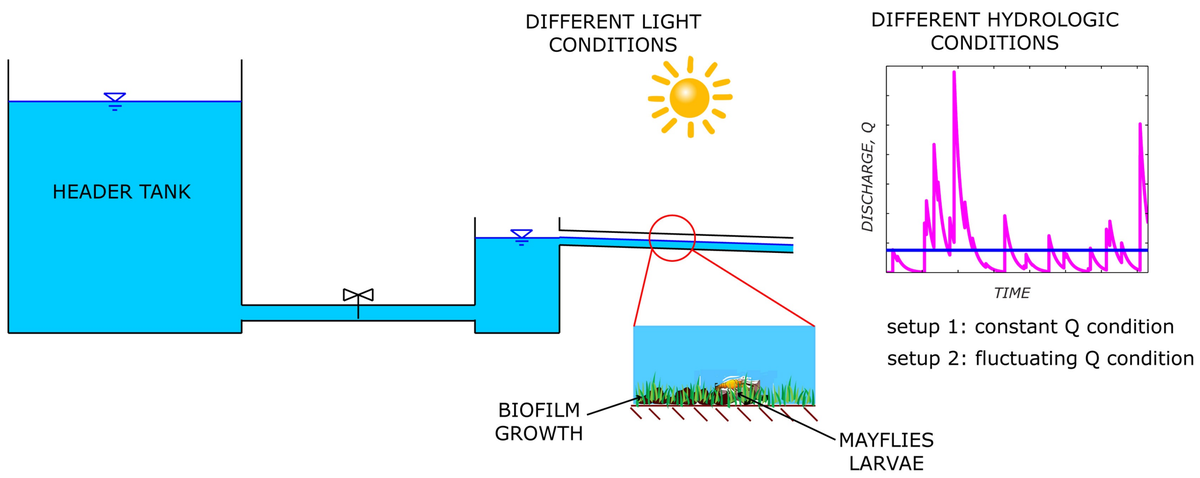
1. Ecohydrological model development

The following hydrologic influences on algae and macro-invertebrates dynamics will be introduced in the predator-prey model:

- at increasing flow velocity → high nutrient availability, algae erosion and macro-invertebrate drag
- at increasing water depth → reduced presence of algae due to light limitation

2. Experimental field campaign

The proposed model will be tested in a field experiment which will be conducted this summer at the Wasser Cluster Lunz, in Lunz am See (AU), with the collaboration of Prof. T. Battin, from University of Vienna.



Small flumes will be used to study biofilm, which is the main component of benthic algae, and macro-invertebrates dynamics under different ecohydrological conditions:

- six different light conditions will be tested to explore shading and water depth effects on algae growth,
- two different hydrologic conditions will be tested to verify the effects of constant and fluctuating discharge regimes on fluvial ecosystems.

REFERENCES

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