CERIS : Civil Engineering Research and Innovation for Sustainability

Mitigation of ecological effects of hydropower plants on rivers and their functions

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Summary

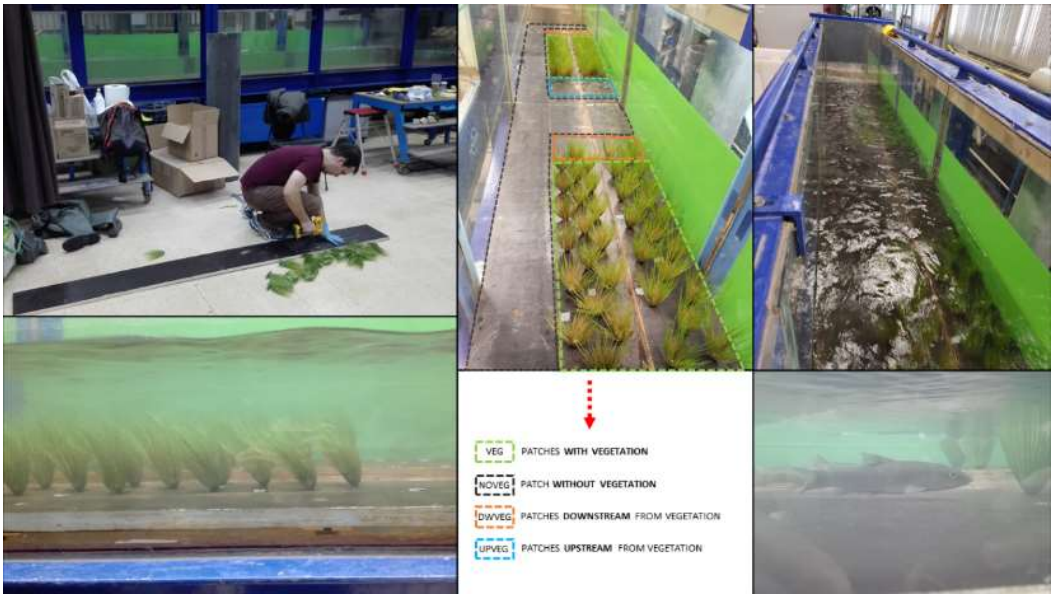
Plants constitute the bulk of the biomass at any cross-section of a stream or river and fulfil vital functions (e.g., biodiversity enhancement, water purification, sediment trapping) for fluvial ecosystems. Yet, the response of riverine plants to regulated flow has received only minor attention, and especially hydropeaking, a unique form of flow regulation, is overlooked. Hydropeaking, which refers to rising or falling discharges caused either by the turning on or off of hydro-turbines to generate electricity, allow responding to rapidly changing electrical demands. Given the increasing energy consumption expected for the next decades, along with the need to reduce hydrocarbon-based energy production, hydropeaking may become a significant source of pressure for rivers and their vegetation communities in the near future.

We hypothesize that some plants will be more vulnerable to specific hydropeaking scenarios, and that certain elements of hydropeaking are more disruptive to plant performance in general. Identifying resistant plants is of critical importance to determine which riparian communities might be vulnerable to hydropeaking operations, as well as to maintain environmental services that depend on riverine vegetation.

This thesis will contribute to the sustainable management of rivers subjected to hydropower production by providing ways to analyze the effects of hydropeaking in rivers from a functioning perspective, as well as by generating scientific knowledge to build benchmark models aimed at finding optimum peaking operation scenarios that minimize impacts on river functioning while maximizing hydroelectricity.

Keywords

Hydropeaking, plant traits, plant morphology, plant physiology.



Flow field properties and fish occupation of 1) patches with plants (VEG, green dotted rectangles); 2) patches upstream (UPVEG, blue dotted rectangle) and 3) downstream (DWVEG, orange dotted rectangles) from vegetation; and 4) patches without vegetation (NOVEG, black dotted area) were measured to assess sheltering behavior of L. bocagei and P. polylepis under baseflow and hydropeaking scenarios. Plants generated lower current velocity, lower hydrodynamic pressure and lower turbulence inside vegetated areas and downstream from plants, promoting hydraulically stable zones for fish to shelter.