LABORATOIRE DE CONSTRUCTIONS HYDRAULIQUES

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Modeling interactions between river morphology and habitat dynamics in floodplains *(2015-2018)*

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Introduction

Switzerland's electricity production crucially depends on hydropower. With the energy strategy 2050, the government decided to shut-down nuclear power production (40% nowadays) thus increasing demands in hydropower. Hydropower installations in mountainous regions often cause the construction of dams, which cause negative impacts on rivers. Exemplary the diversion and storage of water, retention of sediments and interruption of the longitudinal connectivity **remove the natural behavior of rivers**. Fig. 1 shows the change in the Sarine floodplain after the construction of the dam in Rossens.

Figure 1 : The Sarine downstream of Rossens 1943 and 2012 (Swisstopo)

Objective

The objective is to derive tools to measure the impact of operational measures towards habitat conditions in the river corridor of hydropower affected rivers.

Research procedure

As a study site serves the Sarine River with a residual and hydropeaking reach and the Sense River as a natural comparison. Based on measured or simulated values such as flow velocity and depth, granulometry and discharge variation streams can be classified and compared. This allows to **quantitatively value the impact of a restoration or management measure** on the habitats. For this, the hydromorphological index of diversity (HMID), Eq. 1, is used and enhanced. Whereas *h* is the flow depth and *v* the flow velocity. These values are both measured in the field and also produced with **numerical simulations** in BASEMENT.

$$HMID_{site} = \left(1 + \frac{\sigma_v}{\mu_v}\right)^2 \left(1 + \frac{\sigma_h}{\mu_h}\right)^2 \quad (1)$$

Combined with ecological measures, it will be investigated to find a link between HMID and taxa in a river reach (Fig. 2).

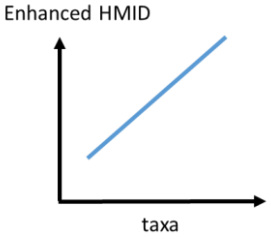

Figure 2 : Link between the enhanced HMID and taxa

Artificial flooding combined with an optimized configuration of multiple deposits of **sediment replenishment** was investigated in a field experiment in the Sarine. Ca. 500 grains in the deposits were equipped with **passive RFID tags**, allowing the determination of the travelled distance and the distribution in the river, which serve as base for further analyses. Fig. 3 gives an overview how the tags were found after the experiment.

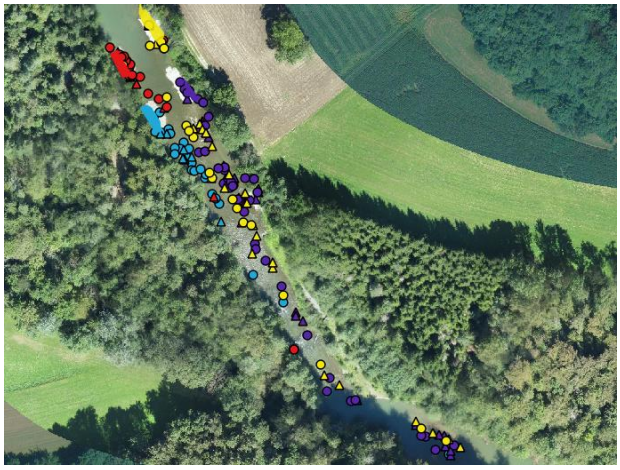

Figure 3 : Distribution of the RFID tagged sediments in the Sarine after the flood event