



**Universität Stuttgart**



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**TOPIC: Laboratory tests to quantify the required bedload for a sustainable development of nature-like rivers**

#### **Advisor**

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#### **Keywords**

Gravel bed rivers, bedload transport, morphodynamic river system, physical model experiments

#### **Introduction and background**

Anthropogenic actions in rivers are often associated with altering the bed load regime. These disturbances result in most cases in changes in the morphodynamic system and hence, a significant impairment of native animals, plants, and their habitats.

To achieve good ecological status, in accordance with the water framework directive, the rehabilitation of the bed load regime of watercourses is required. However, so far, no in-depth knowledge is available on the required bed load to restore a channel form, a dynamic morphological system, and to ensure a heterogeneous substrate that is as close to nature as possible.

With the help of physical model tests, new insights will be gained in order to be able to determine the required bedload for future renaturation projects. Through a systematic approach, we will investigate which boundaries are necessary so that typical morphological structures and river dynamics develop. This new knowledge will not only result in approaches, which can be used in already altered systems, but also in new methods and formulae.



### **Research goals and Methods to be used**

First, the Ph.D. candidate shall review key and state-of-the-art literature on river morphology and dynamic river systems to become familiar with this research area. Simultaneously, a literature review on physical model experiments with moveable beds shall be conducted.

Based on the findings an artificial test bed will be elaborated at the hydraulic laboratory, and systematic experiments will be conducted. Here the boundaries, such as the slope of the initial channel, bed load supply and discharge will be altered. Additionally, conducted repetition experiments enables us to make robust and reliable conclusions. Data obtained by a laser scanner and distance sensors will provide the necessary data to elaborate an approach to quantify typical morphological structures. Here the use of machine learning and statistics is necessary.

In the final step, the transferability of the results will be investigated and an answer will be given to the question if the findings can be transferred to natural rivers with different boundaries (e.g., discharges, grain size distributions, etc.).

### **Research environment**

The PhD candidate will conduct experiments in the hydraulic laboratory at IWS. Besides, the student will become part of an interdisciplinary working group consisting of post-docs and doctoral students who conduct research on morphological processes in rivers.

### **Prerequisites**

Good knowledge in statistics, sediment transport and programming is required.

Knowledge in physical modelling and machine learning is welcome.

### **Contact for research questions**

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### **Contact for administrative questions (e.g., on the admission process)**

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