

Natural and artificial refugia in dynamic river widenings

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Introduction

River systems are heavily impacted by anthropogenic activities, channelization and their reduced morphological variability. One approach to mitigate these negative effects are **dynamic river widenings** (Fig. 1). Thereby, the natural **morphodynamic processes** of a river reach should be **revived**.



Fig. 1. Lower part of the 1700 m long dynamic river widening Schaffäuli along the Swiss Thur River in 2016. The channel with a former width of 50 m was initially widened in 2003 and has eroded 26000 m² of land until 2015 (Orthophoto and data: geotopo ag (Breitensteinstrasse 16, CH-8501 Frauenfeld, www.geotopo.ch)).

Variable sediment supply

Fig. 2 shows the adjustments to changes in discharge and sediment supply [1].

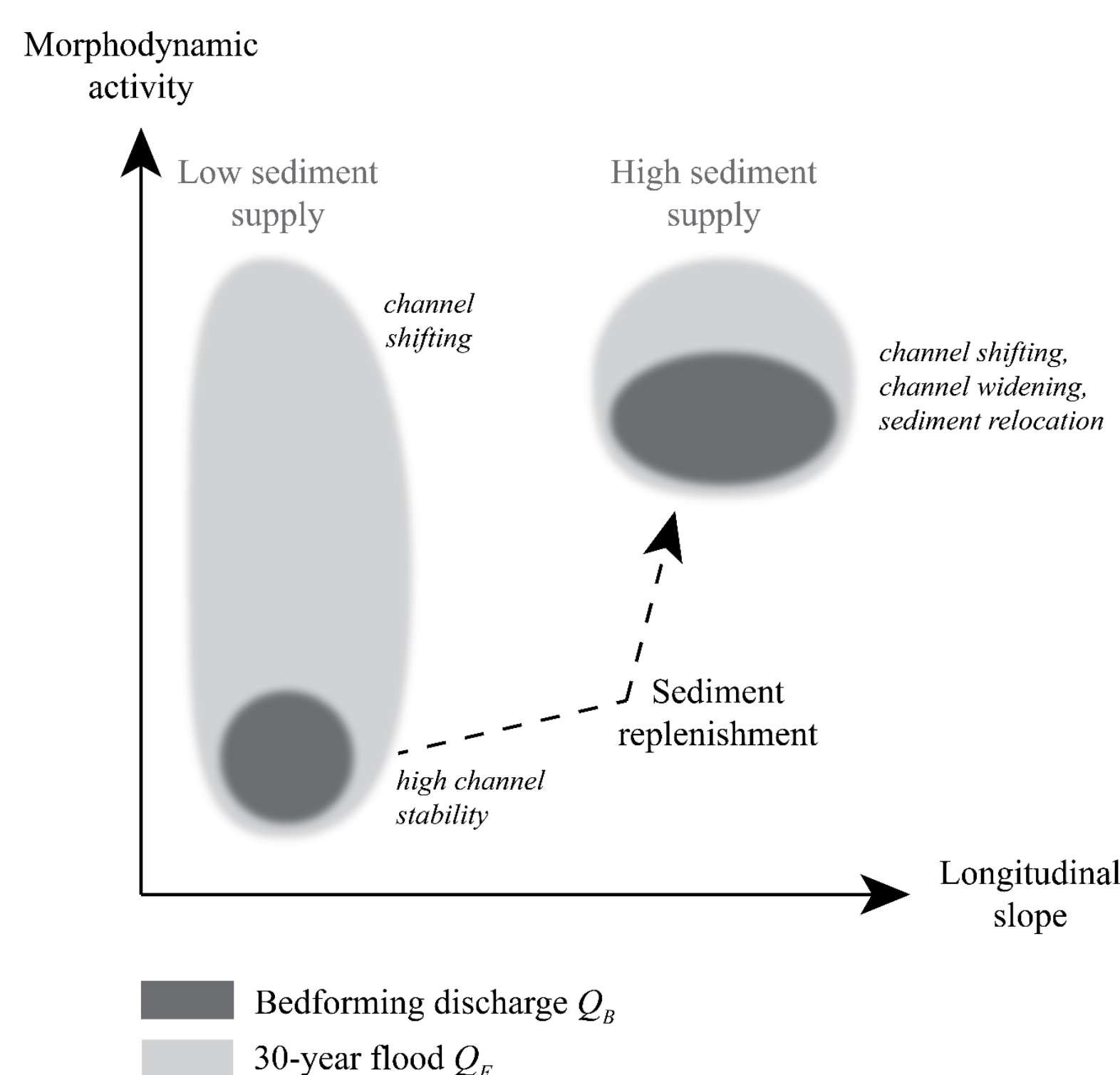


Fig. 2. Morphodynamic adjustments of reach scale river widenings in gravel-bed rivers with a longitudinal slope of approximately one percent due to different sediment supply rates. High sediment supply rate is close to channel transport capacity and low sediment supply is significantly lower.

The observed **channel response depends** on the **specific river system** and on its degrees of freedom (e.g. bank protection).

Common responses of active widenings:

- Steeper longitudinal slope
- Increasing bed and water surface elevation
- More heterogeneity
- Channel-floodplain connectivity

Research questions and experimental setup

To **extend** the **parameter range** further experiments with a longitudinal **slope** of approximately **0.2 percent** will be conducted. Based on the results from **flume experiments** at **VAW** (Fig. 3) and the numerical model (**BASEMENT**) the following statements should be discussed:

- **Morphological development** of one-sided dynamic river widenings with **low channel slope** as a function of **different sediment supply rates**
- **Comparison** of the effect of the implementation of local **flow deceleration measures** (e.g. ELJ, initial widening, ...) and **flow acceleration measures** (e.g. flow deflector, ...)
- **Availability** of **flood** and **drought refugia** in dynamic river widenings

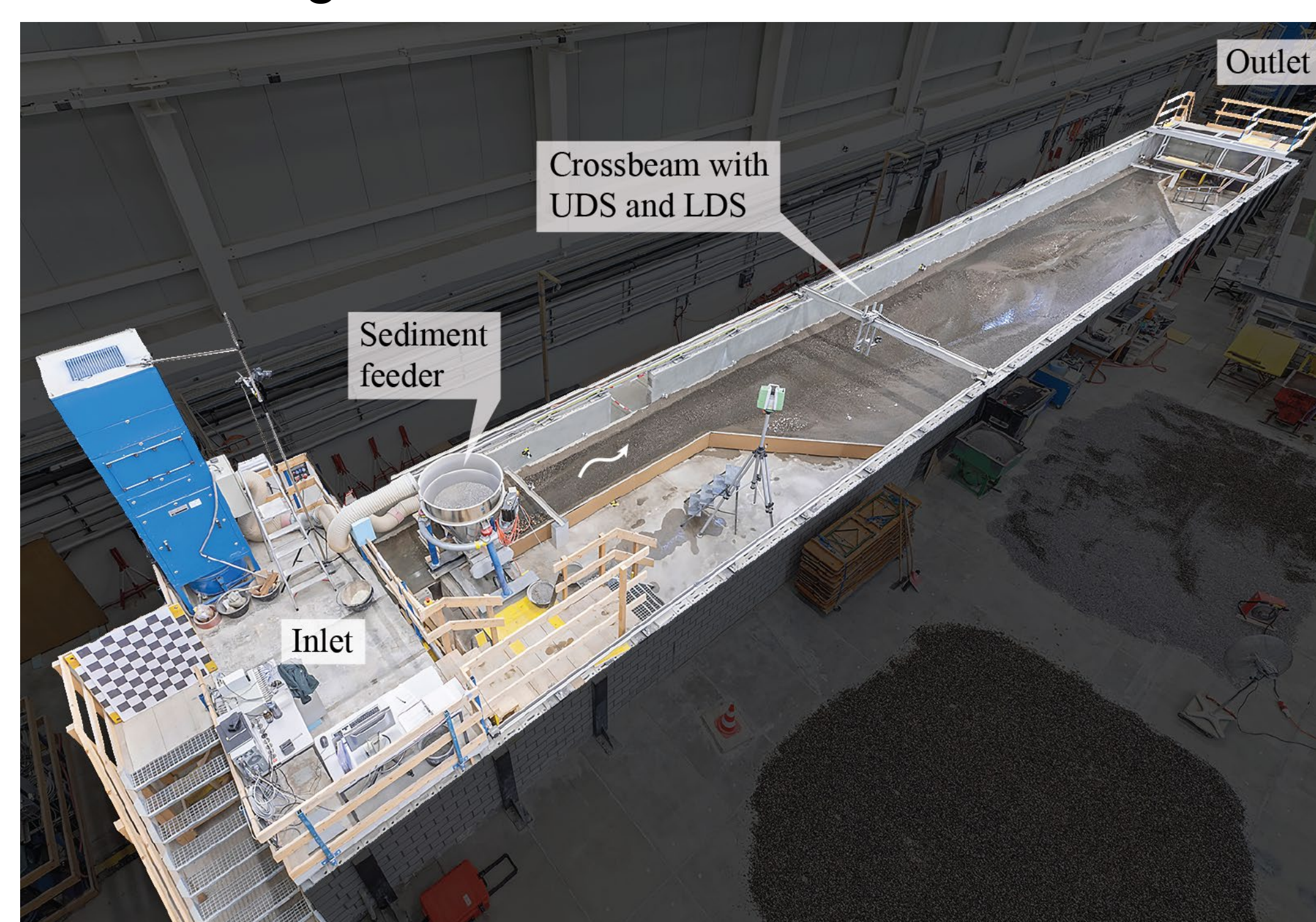


Fig. 3. Experimental flume at VAW with its main components (UDS = ultrasonic distance sensor, LDS = laser distance sensor)

Outlook

Dynamic river widenings show sustained morphodynamic activity and **potentially offer ecological benefits**. More research on the **comparability** of data from dynamic river widenings with **steeper** and **lower longitudinal slopes** is deemed necessary.

Reference

[1] Rachelly, C. (2021). Sediment Supply Control on River Widening Morphodynamics and Refugia Availability. VAW-Mitteilung 265 (R.M. Boes, ed.). Laboratory of Hydraulics, Hydrology and Glaciology, ETH Zurich, Switzerland. <https://doi.org/10.3929/ethz-b-000527231>