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Process-based river restoration for heavily modified sections of European large rivers: reference conditions, ecological deficits and target states

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Abstract

Although most European large rivers are declared as heavily modified water bodies, there are many constraints for their restoration, posed by current land and water uses. Besides, most river restoration actions are small and isolated, and ignore that current degradation is intimately tied to human-induced alterations of fluvial natural processes.

Therefore, this proposal aims at a more sustainable river restoration approach for heavily modified river sections of European large rivers, based on the recovery of natural processes while balancing current societal needs.

Results will bring some light on what processes have to be prioritized and what measures are the most successful in order to regain those processes. Moreover, expected outcomes but will enable to develop different restoration scenarios that might help in decision-making, especially for future river basin management plans.

Keywords: River restoration; fluvial processes; heavily modified large rivers; reference condition; ecological deficit; target state

Introduction, scope and main objectives

In the last decades, river restoration has gained increasing influence to reverse past degradation of freshwater ecosystems (Bernhardt and Palmer, 2011). In Europe, especially with the coming into force of the Water Framework Directive 2000/60/EC, restoration as a management measure for improving the ecological condition of rivers has grown considerably, as the achievement of water bodies' good status is a mandatory element of the WFD for EU Member States (Palmer *et al.*, 2013).

Restoration projects tend to address only some of the pressures at the local scale, leading restoration to a different trajectory than that of degradation (Verdonschot *et al.*, 2013). Therefore, there is a need to approach river restoration from the point of view of correcting anthropogenic disruptions to natural processes (erosion, sedimentation, channel migration, plant colonization and succession).

The present PhD concept aims to achieve an accurate comprehension of spatio-temporal dynamic patterns and processes of European large rivers at habitat and floodplain spatial scales occurring in ecological time (seasonal to centennial) scale (Ward *et al.* 2002). This understanding will proceed from the analysis of the pre-disturbance situation (reference conditions), the current deviation from the natural state (ecological deficit) and the existing boundary social constraints (Muhar *et al.* 2007).

Methodology/approach

The methodology is aimed to present a systematic approach to:

- Reference condition: based on historical data of the same river and on current situation of similar more natural rivers.
- Ecological deficit: impacts along history and consequent river response.
- Boundary conditions: critical factors and limitations for process-based restoration measures in large rivers.
- Selection of process-based river restoration/rehabilitation objectives (sustainable target state) and prioritizing measures, specifically for heavily modified sections of large rivers.

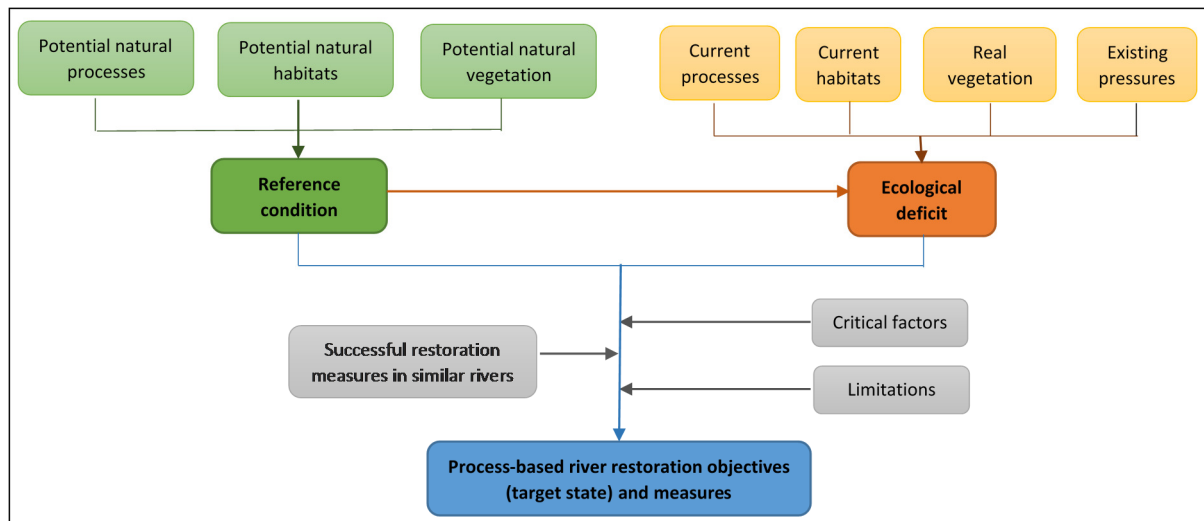


Fig. 1: Diagram with the proposed methodology

- Application to a case study: a 10 km length section of the Upper Rhine River in the border between Germany and France from downstream Iffezheim's dam until the mouth of the river Murg (tributary on the right).

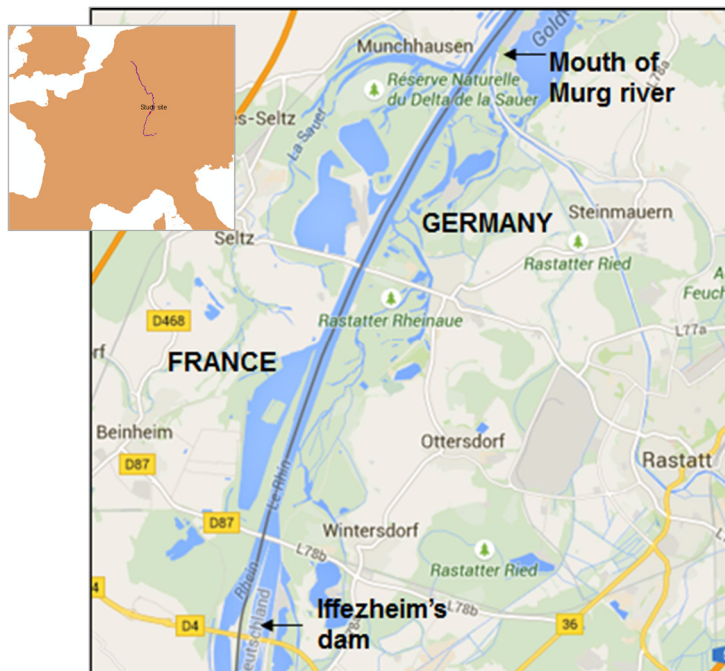


Fig. 2: Location of the case study

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References

Bernhardt ES. and Palmer MA. 2011. River restoration: the fuzzy logic of repairing reaches to reverse catchment scale degradation. *Ecological Applications*, 21(6): 1926-1931.

Palmer MA., Filoso S. and Fanelli RM. 2013. From ecosystems to ecosystem services: stream restoration as ecological engineering. *Ecological Engineering*, 65: 62-70.

Verdonschot PFM., Spears BM., Feld CK., Brucet S., Keizer-Vlek H., Borja A., Elliot M., Kernan M. and Johnson RK. 2013. A comparative review of recovery processes in rivers, lakes, estuarine and coastal waters. *Hydrobiologia*, 704(1): 453-474.

Muhar S., Jungwirth M., Wiesner C., Poppe M., and Schmutz S. 2007. Restoring riverine landscapes at the Drau River: successes and deficits in the context of ecological integrity. In *Gravel-Bed Rivers VI: From Process Understanding to River Restoration* (Vol. 11, pp. 779–803).

Ward JV., Tockner K., Arscott DB., and Claret C. 2002. Riverine landscape diversity. *Freshwater Biology*, 47(4): 517–539.