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Evaluating a functional hydromorphological restoration of a lateral channel of the Upper Rhine (France): first results and implications of the temporal trajectory to restoration

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Integrated in the RAMSAR area of the Upper Rhine, the Rohrschollen island exhibits a high biodiversity. This artificial island results from many engineering works which impacted typical habitats and biocenoses. The LIFE+ project "Restauration de la dynamique des habitats alluviaux râchon sur l’île du Rohrschollen", managed by the City of Strasbourg, plans to restore the hydromorphological and ecological functionality of the hydrosystem (dynamic floods, bedload channel mobility, surface water-groundwater exchanges, renewal of pioneer ecosystems...) making this project one of the most ambitious for the French side.

Study Area and restoration project

Fig 1 - Location of the Upper Rhine, the Rohrschollen island and the Bauerngrundwasser channel (adapted by Schmitt, 2010)

Engineering works of the Upper Rhine River

1840-1876: Correction
Reduction and stabilization of a single main channel. A flooding area is maintained between two dikes.

1932-1977: Canalization
Ten dams were built on a French lateral artificial canal. The former main channel became by-passed (Old Rhine).

The Rohrschollen island and the Bauerngrundwasser anastomosing channel

Surrounded by an upstream diversion dam and a downstream agricultural dam, the Rohrschollen island exhibits a high biodiversity. This artificial island results of many engineering works which impacted typical habitats and biocenoses. The LIFE+ Rohrschollen project aims to reconnect the island to the Rhine by a new upstream connection channel and to improve morphodynamics in the channel and dynamic floods in the island.

Principles of the restoration

The Bauerngrundwasser will be reconnected to the Rhine thanks a new upstream connection channel (800m; Fig 1). When the discharge of the Rhine is higher at 1500 m³/s a maximum of 80 m³/s feeds the Old Rhine. The Bauerngrundwasser anastomosing channel is extremely narrow (no lateral dynamics, deposition of fine sediments, standing water aquatic communities...).

Perspectives concerning the whole monitoring program

The Rhine palaeo-channel before correction has been gradually filled with sand and silt deposits (maximum thickness of 1.50m; Fig 4). Passega analysis reveals low energy during fine sediment deposition (Fig 5).

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Conclusion

Potential future lateral erosion (arrows; Fig 6) will mostly introduce into the channel the Bauerngrundwasser fine sediments which constitute a limiting factor for the development of aquatic biocenoses. Bedload transport and lateral mobility, which increase alluvial biodiversity will essentially occur along the new upstream channel. This study reveals the importance of taking into account past temporal trajectories (hydrosystems are palimpsests) in order to increase the efficiency and sustainability of restoration projects.

Perspectives concerning the whole monitoring program

Pre-and post-restoration scientific monitoring:
- interdisciplinary monitoring (vegetation, macroinvertebrates, water and sediment quality...);
- hydrological monitoring (hydrogeology, hydraulics, gauging, GW-SW exchanges...);
- geomorphological monitoring (PIN tags, erosion chains, transverse and longitudinal profile, laser scanning, high-resolution aerial photo....)
- hydraulic modeling incorporating bedload transport and morphological evolution in order to provide to the managers long-term management scenario;
- Development of a simplified but functional monitoring protocol for a long-term survey.

References


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