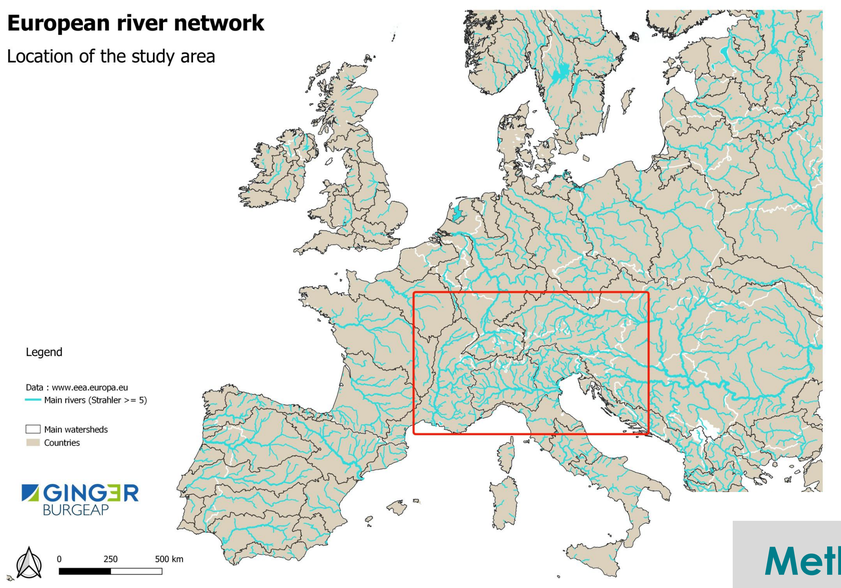
COARSED R&D Project

Integrated management of coarse sediments : a review in large developed rivers draining the Alps

First communication : project overview and methodology



Origin of the project

The Rhône river was the subject of a preliminary study prior to the definition of a Sediment Management Master Plan between Geneva and the Mediterranean (540 km). Despite significant gravel inputs from tributaries (150,000 m³/year), the functionality of coarse sediments is severely impaired along 87% of the river's length due to numerous dams (reducing the slope) and diversions (reducing flow rates). In order to determine the feasibility and benefits of innovative management and restoration measures, it should be helpful to analyze good practices on other rivers that are similar in terms of sediment load and engineering development.

Study area

The selection focused on large rivers with a wide sediment panel including gravel, high bedload transport (or capacity), heavily engineered (navigation, hydroelectricity, gravel mining, human activities), subject to management and restoration measures related to coarse sediments, and which have been diagnosed (sediment budgets).

Most of the large rivers that drain the Alpine mountain range meet these criteria. Ten rivers have been selected: French Rhône (two sectors), Swiss Rhône, Rhine, Isar, Inn, Danube, Drava, Po, and an additional river, the Meuse.

Other rivers could have been selected, such as: Ain, Durance, Aare, Salzach, Adige, Mur, etc.

First findings

The situations of the major rivers studied are not always comparable. There are wide varieties of sediment loads (natural, influenced) and types of engineering development (run-of-river, diversion or reservoir dams, navigation or not, gravel mining, etc.). These situations lead to a wide variety of morphological responses and sediment balances (incision, deposition, equilibrium). In addition, local governance and regulations vary from country to country. As a result, management and restoration measures are more or less ambitious and highly diverse.

However, morphological adjustment resulting from sediment transport disruption (excess or deficit) is indeed a common thread, and it remains at the center of ecological, safety, and socioeconomic concerns.

Context and objectives

Coarse sediment management is a key issue in sustainable river management, at the interface between natural processes in watersheds, flood risk management and development of water uses in valleys.

The overall objective of the COARSED project is to 1) identify and analyze good practices for coarse sediment management and process restoration in heavily engineered rivers, and 2) consolidate recommendations and operational tools in order to achieve good status in accordance with the WFD, while ensuring a sustainable balance between ecological, safety and socio-economic issues.

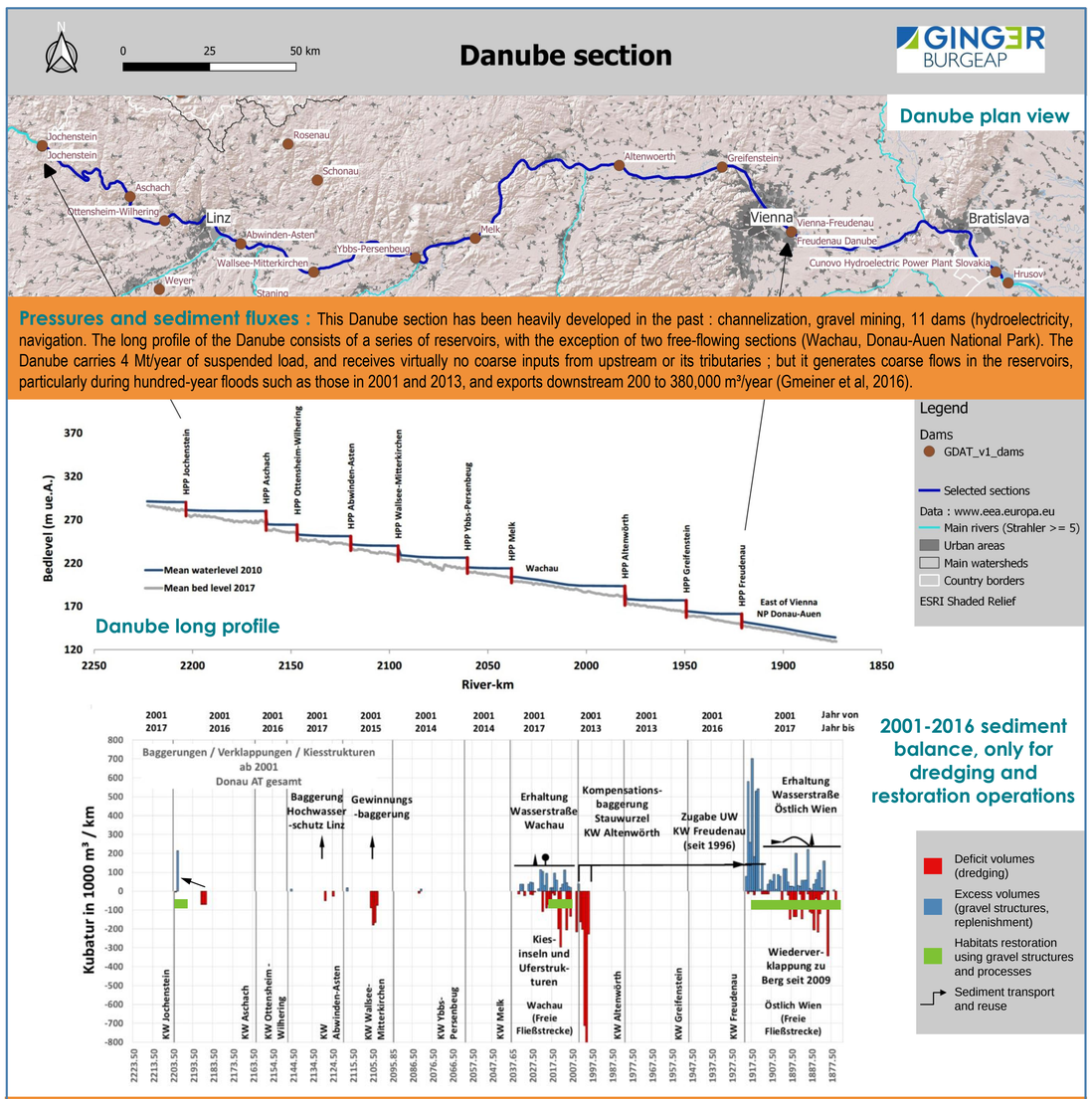
The analysis focuses in particular on coarse sediment altered balance, as identified in sediment budgets, and on all management steps aimed at correcting these situations: dredging, transport, replenishment, onshore management, and associated ecological restoration through forms or processes.

Methods

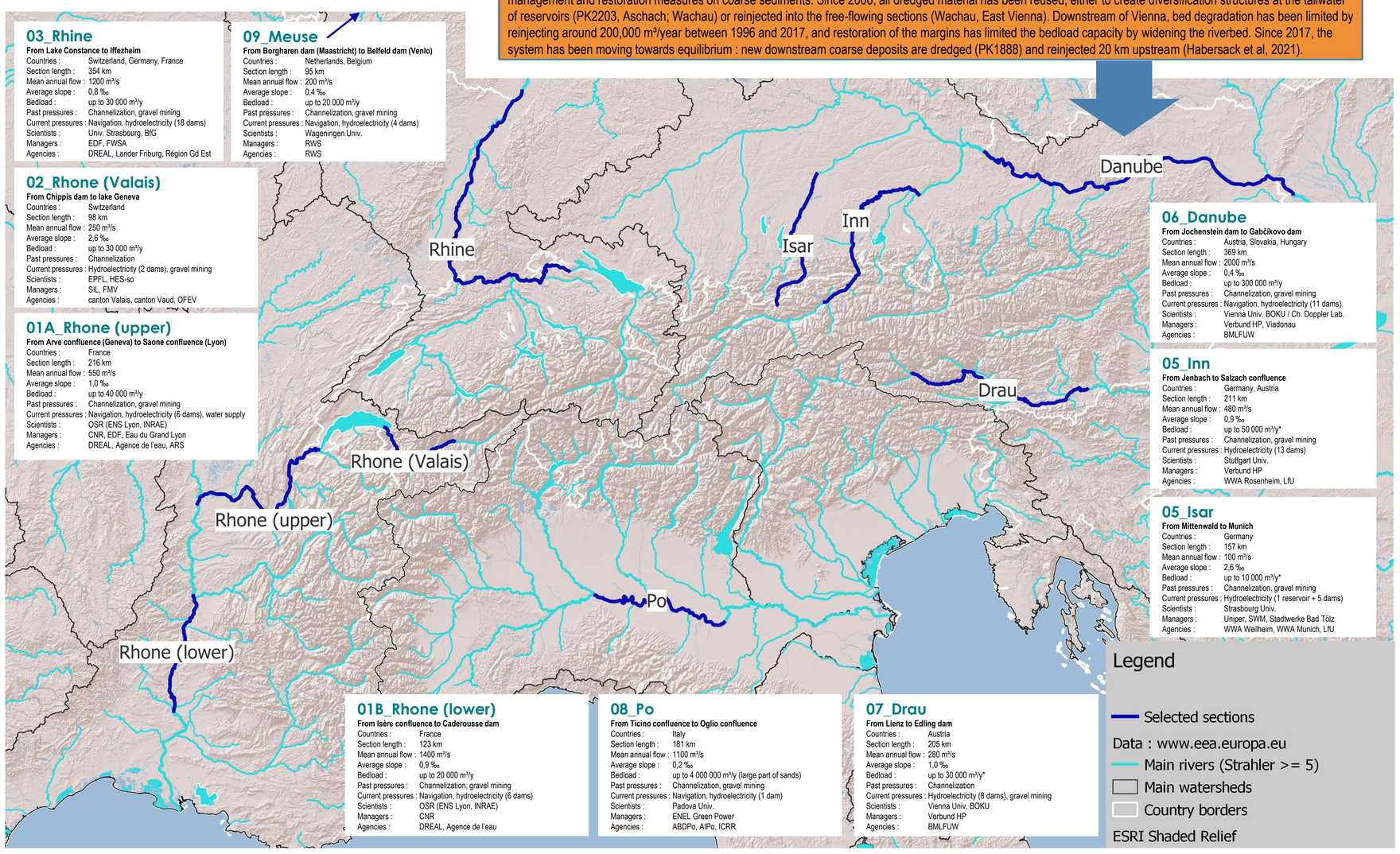
The review is based on existing literature, with data collected from three groups of stakeholders: scientists, managers, and government agencies.

The survey grid used as a framework includes the following categories of questions:

- What is the hydrosedimentary context of the river and its watershed?
- What actions (taken or planned) to restore the coarse sediment balance ?
- What are the targeted benefits of actions (ecological, security, water uses)?
- What are the constraints to implementing actions ?
- How can excess sediment be reused?
- What scientific monitoring is used to assess the benefits and impacts of management and restoration actions ?
- What perspective in the context of climate change ?
- Which of the projects is the most emblematic ?



Sediment management and processes : The 2001-2016 sediment balance highlight the sediment processes specific to the river and the effects of management and restoration measures on coarse sediments. Since 2006, all dredged material has been reused, either to create diversification structures at the tailwater of reservoirs (PK2203, Aschach; Wachau) or reinjected into the free-flowing sections (Wachau, East Vienna). Downstream of Vienna, bed degradation has been limited by reinjecting around 200,000 m³/year between 1996 and 2017, and restoration of the margins has limited the bedload capacity by widening the riverbed. Since 2017, the system has been moving towards equilibrium : new downstream coarse deposits are dredged (PK1888) and reinjected 20 km upstream (Habersack et al, 2021).



Selected rivers and sections

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