

# AQUACROSS Case Study 3: Danube River Basin – harmonising inland, coastal and marine ecosystem management to achieve aquatic biodiversity targets

## Summary for Local Stakeholders

The interdisciplinary research project [AQUACROSS](#)<sup>1</sup> supports European efforts to protect biodiversity in Europe’s lakes, rivers, coasts and oceans. These aquatic ecosystems provide numerous economic and societal benefits to Europe – but they are at risk of irreversible damage from human activities. To counter this and to support achievement of the EU Biodiversity Strategy to 2020 targets, AQUACROSS has developed practical guidance on identifying threats to biodiversity, understanding links between ecosystems and the services they provide, data management, modelling and scenario development, and policy analysis, which fit together as parts of the integrated AQUACROSS Assessment Framework for ecosystem-based management of aquatic ecosystems<sup>2</sup>. We have developed, tested, and applied this research in eight case studies across Europe to solve local biodiversity challenges. This brief summarises our work in **Case Study 3**.

### The challenge

The Danube’s river biodiversity is threatened by changes to the hydrology and geomorphology (so-called hydro-morphological alterations), such as the disconnection of floodplains. Multiple human activities, including the construction of hydropower plants, expansion of agricultural use, and large-scale river regulation measures related to navigation and flood protection, are resulting in an ongoing loss of habitat and biodiversity.

Hydro-morphological restoration of river-floodplain systems is important basin-wide to conserve biodiversity (EU Biodiversity Strategy to 2020, EU Habitats and Birds Directive, HBD) and ensure that rivers stretches achieve “good ecological status” or “good ecological potential” according to the EU Water Framework Directive (WFD). Restoration also support other societal and policy objectives: flood protection relating to EU Flood Risk Directive (FD), pollution reduction to improve the Black Sea marine environment and climate change adaptation. Nevertheless, the complexity and heterogeneity of the environmental problems, lack of data, strong differences in socio-economic conditions as well as complexity and heterogeneity in national interests significantly hampers planning of restoration sites. Only few countries of the Danube region have already implemented or planned restoration activities, which are due by 2021.



Figure 1: Partially reconnected sidearm of the Danube. (Credit: Andrea Funk)

<sup>1</sup> AQUACROSS (Knowledge, Assessment, and Management for AQUatic Biodiversity and Ecosystem Services aCROSS EU policies), 2015-2018, has received funding from the European Union’s Horizon 2020 Programme for Research, Technological Development and Demonstration under Grant Agreement no. 642317. More information: [aquacross.eu](http://aquacross.eu)

<sup>2</sup> All AQUACROSS guidance and outputs are freely available online at <https://aquacross.eu/outputs>

## Objectives

Hydro-morphological pressures interact with the management goals of the Water Framework Directive and Nature Directives, resulting in potential synergies and conflicts between the various management goals. That is, pressures exerted by dominant uses often reduce the availability of some other ecosystem services, and may also significantly affect the implementation of policy goals. The implementation of sectoral policies on hydropower, navigation, and flood protection show significant synergies and antagonisms, too, and the interaction of their implementation significantly influences the actual combination and extent of pressures. For example, navigation projects might either have a synergistic effect on nature protection goals in already significantly altered river-floodplain sections (if ecological restoration is supported within the project), or potential antagonistic effects in intact river-floodplain sections where every intervention may create a conflict with nature protection goals. In conclusion, our approach, considering those multiple objectives related to biodiversity, ecosystem services and socio-economic benefits together could greatly facilitate the implementation of **ecosystem-based management (EBM)**.

## Applying the AQUACROSS assessment framework

We applied the AQUACROSS Assessment Framework, to identify how management of river-floodplain systems along the Danube can be supported to jointly conserve and restore biodiversity and secure the provision of ecosystem services. A prioritisation of the river-floodplain systems for restoration and conservation was conducted using a novel integrative modelling approach considering multiple targets related to biodiversity, ecosystem services and socio-economic benefits in line with EBM. This **EBM scenario** was evaluated against a Baseline scenario, restoration sites proposed within national programmes of measures developed in the context of the implementation of the WFD. Therefore we were using the following workflow:

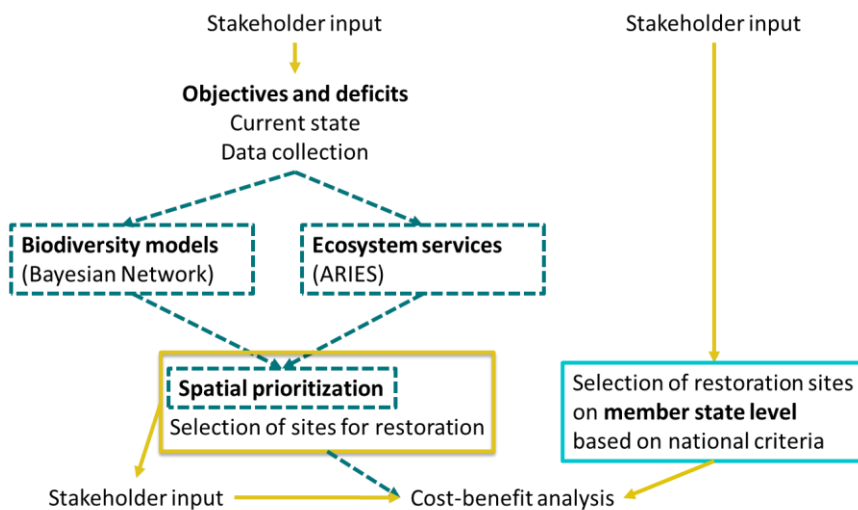


Figure 2: Workflow of model analysis (dark blue dashed) and scenario development (baseline in light blue, EBM scenarios in yellow) based on stakeholder input (yellow) for the Danube Case Study.

We modelled relationships between status indicators of biodiversity (HBD) and essential ecosystem services (flood retention, crop pollination, and

recreation), pressure indicators (hydro-morphological alteration) and indicators on underlying drivers including land-use, hydropower and navigation uses. We predicted biodiversity indicators within a Bayesian network approach and ecosystem services were quantified using the ARIES modelling platform. In a next step we calculated main factors relevant for conservation and restoration planning of river-floodplain systems, i.e. i) the remaining multi-functionality of the systems related to biodiversity and ecosystem services, ii) reversibility (potential to restore multi-functionality) related to multiple drivers and iii) the availability of remaining semi-natural land for restoration. Based on those criteria we make a spatial prioritisation based on trade-off analysis to identify important areas for biodiversity and ecosystem service conservation and restoration. We also evaluate modelling outcomes using a socio-economic cost-benefit analysis.

## Results and conclusions

Within the EBM approach river-floodplain sections are prioritized for conservation or restoration all along the Danube. A gap analysis showed that approx. 80% of the area we were prioritizing for conservation are already part of Natura 2000 sites. Some of the sites identified to have high restoration priorities are already designated as sites with high restoration potential or restoration is already ongoing (approx. 60% of baseline), and others were identified in areas where no sites are yet designated (adding approx. 3,000 km<sup>2</sup> of promising area). Our evaluation further suggests that a ecosystem-based management approach can be more cost-effective than the baseline scenario. It also represents a traceable and flexible approach as the different objectives related to floodplain restoration are balanced systematically. The proposed EBM approach can jointly support the selection of restoration sites including prioritisation of protected areas (HBD), site selection for the next River Basin Management Plans (WFD) or Flood Management Plans (FD).

In this sense, the approach fosters integrated management across objectives and policies, by considering the multi-functionality of river-floodplain systems related to biodiversity and ecosystem services aspects, but also cumulative impacts of multiple human activities.

The approach may also foster transboundary coordination and cooperation as it considers the whole navigable main stem of the River Danube (ecosystem scale) independent from jurisdictional, administrative and political boundaries (e.g. country scale) and therefore has potential to foster consensus on a shared vision for the future in the most international river basin.

**Literature:** Funk, A., Martínez-López, J., Borgwardt, F., Trauner, D., Bagstad, K.J., Balbi, S., Magrath, A., Villa, F., Hein, T., 2019. Identification of conservation and restoration priority areas in the Danube River based on the multi-functionality of river-floodplain systems. *Science of The Total Environment*. 654, 763-777.

## Stakeholder and AQUACROSS: Potential for take-off

Stakeholders were engaged at different steps: contributing data and information related to objectives and deficits. Further interactions as follow up after the project will focus on the potential for take-off of project results:

- AQUACROSS is invited for the 21th Ordinary Meeting of the ICPDR (December 10th-11th 2018) where the potential for take-off of project results will be presented.
- A practical example are the floodplain restoration plans led by viadonau, one of the key business stakeholders for the Danube case study, as it is leading different ongoing and planned integrative river restoration and engineering projects along the Danube. viadonau is interested in the integration of prioritisation results in a project proposal focusing on multiple floodplain sites along the upper and middle Danube to support the selection of relevant restoration sites.

## Final policy recommendations

Systematically linking data and knowledge from different disciplines within one approach can foster integrated planning across multiple policies by creating the opportunity to pursue different policy objectives simultaneously.

A further increase in integration and coordination across policies and across boundaries (e.g. countries or regions) including monitoring schemes as well as data acquisition and management will increase alignment, effectiveness and efficiency.

Want to learn more? A full case study report is [available online](#), or by contacting [andrea.funk@boku.ac.at](mailto:andrea.funk@boku.ac.at).