

agement plans will secure the consideration of our project outcomes into sustainable measures aimed to restore the function of ecological corridors.

The Danube and its tributaries are key migration routes for sturgeons and other migratory fish, such as barbel and nase. These species are excellent bio-indicators of the effectiveness of ecological corridors due to their specific needs during their long lifecycles. This is especially true of sturgeons, which typically migrate long distances and are an important part of the natural heritage of the entire Danube Region. Their dramatic decline in the last few decades has become an issue of basin-wide importance, documented by the Danube countries and the European Commission.

### Training workshop on assessment of migratory fish habitat and behavior

The MEASURES project began with two important activities. The first one dedicated to the NGO environment and for specialists of academic and relevant institutions in the partner countries was the training workshop on assessment of migratory fish habitat and behavior.

Experts from seven Central and Eastern European countries gathered in Tulcea from 17 to 22 September, in the framework of a course supported by specialists from the Danube Delta National Institute for Research and Development. The purpose of the six days was to exchange experience(s) and share good practices along the Danube and its tributaries, in order to better study and understand sturgeons, the emblem species of this river. Discussions were focused on the identification of sturgeon species' habitats, ways to identify breeding, wintering or resting areas, behaviors of sturgeon species, and good practices and examples from all participating countries.



2. The participants of the Kick-Off Conference in Vienna (© R. Becsi)

### The Kick-off Conference took place this autumn in Vienna

On the first two days of October the Kick off Conference organized in Vienna officially launched the MEASURES project. Together with the project partners, also representatives from the relevant institutions for the conservation of sturgeons in Europe were present. Among them were: Gusztáv Csomor, Project Officer, Joint Secretariat – Danube Transnational Programme, Karl Schwaiger, Austrian Ministry for Sustainability and Tourism, Ivan Zavadsky, Executive Secretary, International Commission for the Protection of the Danube River and Jörn Gessner, Leibniz Institute of Freshwater Ecology and Inland Fisheries.

Important topics have been reached to achieve the project's objectives, a series of opinions have been set out to support work on the conservation of migratory fish in the Danube River Basin. And the solution is the synergy of all projects of the partner institutions and their work, the exchange of experience and expertise, the cooperation to maximize work for migratory fish of the Danube.

MEASURES is a project co-funded by the European Union (ERDF, IPA), [www.interreg-danube.eu/measures](http://www.interreg-danube.eu/measures)

## Strategies for restoration and conservation of aquatic biodiversity in the Danube River Basin – Findings from the H2020 AQUACROSS project

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### The AQUACROSS project in a nutshell

Knowledge, Assessment, and Management for AQUatic Biodiversity and Ecosystem Services aCROSS EU policies (AQUACROSS, <https://aquacross.eu>) is a Horizon 2020 project (June 2015 – November 2018) aiming to support EU efforts to protect aquatic biodiversity and ensure the provision of aquat-

ic ecosystem services. Besides water quality problems, hydro-morphological alterations, such as disconnection of floodplains, threaten riverine ecosystems and their biodiversity, and are a particular challenge along the Danube. Multiple human activities, including the construction of hydropower plants, expansion of agriculture, and large-scale river regulation measures related to navigation and flood protection are resulting in an ongoing loss of habitat and biodiversity. In the Danube River Basin case study, the AQUACROSS Assessment Framework (Gómez et al. 2016) thus was applied to identify how management of river-floodplain systems along the Danube can

be improved to jointly conserve and restore biodiversity and maximise provisioning of ecosystem services i.e., conserve or restore the high multi-functionality of the natural system.

### The importance of floodplain restoration to conserve biodiversity

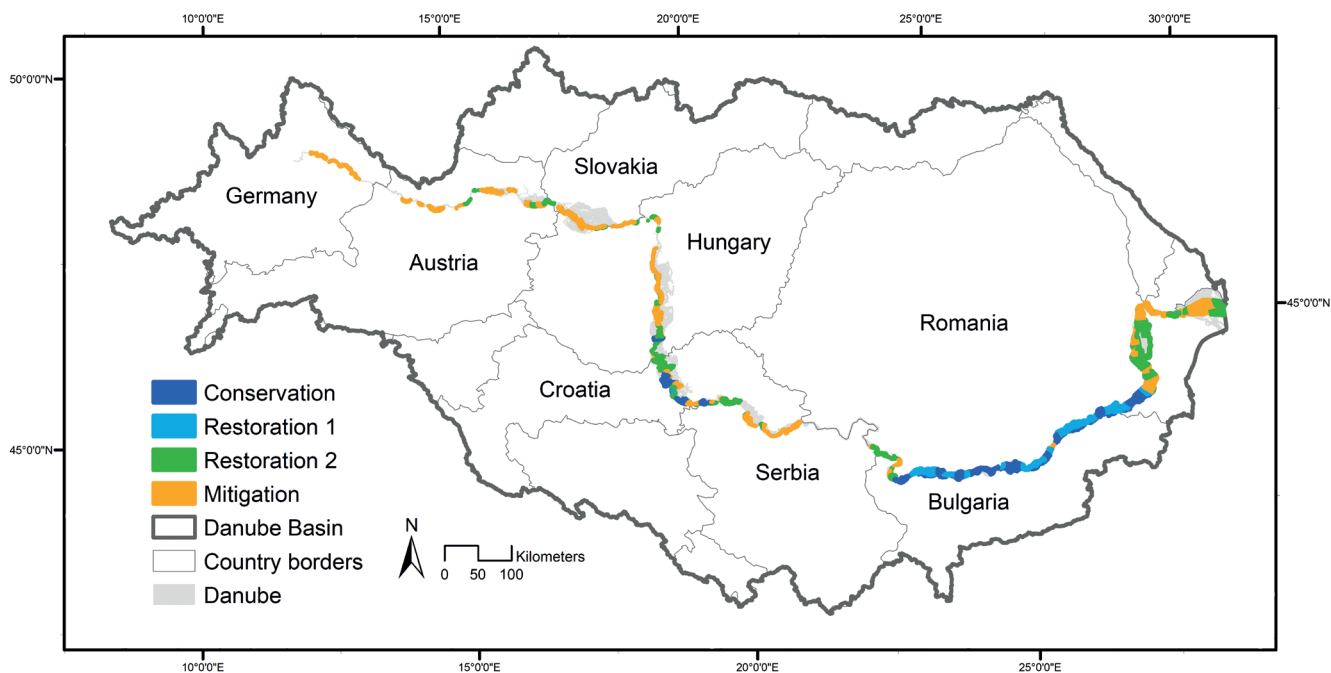
Throughout the basin, hydro-morphological restoration of river-floodplain systems is important to conserve biodiversity (in line with the EU Biodiversity Strategy to 2020 and the EU Habitats and Birds Directive/HBD) and ensure that river stretches achieve at least «good status» according to the EU Water Framework Directive (WFD). Restoration also supports other societal and policy objectives: flood protection, as called for by the EU Flood Risk Directive (FD), pollution reduction to improve the Black Sea marine environment under the EU Marine Strategy Framework Directive, and climate adaptation. However, the complexity and heterogeneity of the environmental problems, lack of data, strong differences in socio-economic conditions, as well as complexity and inconsistencies in legislation along the Danube significantly hampers planning of restoration sites. Only a few countries of the Danube region have already implemented or planned restoration activities, due by 2021. Thus, a prioritisation strategy of the river-floodplain systems for restoration and conservation was established by AQUACROSS (Funk et al., accepted), using a novel integrative modelling approach that considers multiple targets related to biodiversity, ecosystem services and socio-economic benefits, in line with Ecosystem-based management (EBM).

### Models and factors relevant for conservation and restoration planning of river-floodplain systems

Biodiversity models (Bayesian networks) and Ecosystem service models (ARIES - Artificial Intelligence for Ecosystem Services, <http://aries.integratedmodelling.org>) were jointly applied and resulted in a spatial prioritization to select sites for restoration and conservation. This selection was compared with the restoration prioritization at member state level and a cost-benefit analysis was conducted. To target restoration goals adequately, three main factors relevant for conservation and restoration planning of river-floodplain systems, i.e. i) the remaining multi-functionality of the systems, ii) reversibility (potential to restore multi-functionality) related to multiple drivers and iii) the availability of remaining semi-natural land for restoration versus agricultural area were calculated.

### Better performance of ecosystem-based management and multifunctionality of restoration measures

Unlike the current baseline, where each country selects their own restoration sites, the AQUACROSS method classified sites with conservation and restoration potential across the whole of the Danube based on their multi-functionality (i.e. restoration sites where habitats for multiple species as well as multiple ecosystem services can be enhanced, *fig. 1*). Additionally, it systematically prioritizes sites for floodplain restoration within different compromise scenarios based on the three main factors relevant for restoration planning. The AQUACROSS evaluation further suggests that the ecosystem-based management approach is more cost-effective than the baseline scenario.



**Figure 1.** Classification of river-floodplain areas along the navigable Danube. Conservation: high multi-functionality across species and ecosystem services and therefore defined as having the highest conservation potential. Restoration 1: high remaining potential for only a dominantly rheotopic/river community and therefore defined as requiring restoration. Restoration 2: remaining potential for only a dominantly stagnotopic/floodplain community as well as ecosystem services and therefore defined as requiring restoration. Mitigation: overall reduced biodiversity potential across all species and ecosystem services except for increased flood regulation potential and therefore defined as having potential for mitigation measures related to flood regulation and possibly parts of the species community. Adapted from Funk et al. (accepted).

AQUACROSS results thus can promote successful implementation of river-floodplain restoration. The proposed EBM approach supports the joint selection of restoration sites including prioritisation of protected areas (HBD), and site selection for the next River Basin Management Plans (WFD) or Flood Management Plans (FD).

With this, AQUACROSS links available multi-disciplinary information in an innovative way and creates a basis for a more integrated management and restoration planning of river-floodplain systems in the Danube River Basin, in line with the principles of EBM.

## News and Notes

### The most complete inventory of water plants along the Danube's entire course and of related water bodies in the Basin

***An attractive book for scientists as well as common readers interested in the aquatic plant life recorded in the «Most international Large River of the World».***

This book covers the topic of «Aquatic Macrophytes» in the Danube River, starting at the source-rivers in the Black Forest of Germany and leading the interested reader directly along the whole river course, to where it ends in the channels of the Danube Delta. Also covered are other rivers and human-made canals in the river basin, as well as some related topics with relevance to aquatic plant life, e.g. contributions from Slovenia, the Czech Republic and Slovakia.

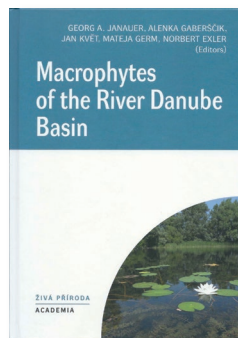
«Macrophytes of the River Danube Basin» has recently been published by ACADEMIA (Prague), with the support of the Academy of Sciences of the Czech Republic. The results reported in this book are based on the support of the Federal Ministry of Education, Science and Culture (Vienna, AT), the Austrian Committee of IAD (International Association for Danube Research), the Bavarian Government/Niederbayern, and the Provincial Authority for Environmental Protection and the Governmental Presidency of Baden-Württemberg.

Important contributions were provided by the Slovenian team, which took care of the first layout-structuring activities and the formidable graphic work on maps by Mateja Rihtaršič. Neither should one forget the outstanding support provided by regional and local organisations in the member countries that facilitated the essential work of the teams during the field campaigns a priori. Finally, more than 50 persons had been involved in different work phases of the whole project and 34 authors had prepared the 21 contributions of this book.

The Danube is one of the «Large Rivers of the World», ranking No.18 by length worldwide, and only second to the Volga River in Europe. The Danube is also the most 'international' river, as its basin reaches into 16 national states, and includes very small areas in another three countries (source: ICPDR maps).

## References

- Funk, A., Martínez-López, J., Bagstad, K.J., Pletterbauer, F., Trauner, D., Bagstad, K.J., Balbi, S., Magrach, A., Villa, F. & Hein, T. Identification of conservation and restoration priority areas in the Danube River. *Science of the Total Environment*. (accepted with minor revisions).
- Gómez, C.M., Jähnig, S., Langhans, S.D., Domisch, S., Hermoso, V., Piet, G., Martínez-López, J., Reichert, P., Schuwirth, N., Hein, T., Pletterbauer, F., Funk, A., Nogueira, A., Lillebo, A.I., Daam, M., Teixeira, H., Robinson, L., Culhane, F., Schlüter, M., Martin, R., Iglesias-Campos, A., Barbosa, A.L. & Arévalo-Torres, J. (2016). Developing the AQUACROSS Assessment Framework. Deliverable 3.2, AQUACROSS, European Union's Horizon 2020 Framework Programme for Research and Innovation Grant Agreement No. 642317.



Starting with earlier work of the Expert Group Macrophytes of IAD, and following a thorough Pilot Study period of two years, the main project lasted for five years until all reports had been delivered to the supporting authorities.

Regarding its content this book is quite unique, presenting a scale of detail never achieved previously in the documentation of the aquatic vegetation recorded in a large river. During the surveys along the whole length of the Danube, and with only a few exceptions (e.g. inaccessible reaches in the source-rivers), the 2850 kilometres in the main channel, and additional lengths in main river branches, were sampled for macrophytes, as well as for environmental parameters in the river and its corridor. Based on this dataset the individual contributions were composed to highlight different aspects of interest as seen by the authors of each chapter.

The source streams reflect the change in macrophyte composition from mountains, in which they start, towards the adjacent lowlands, where they merge to create the Danube. Its Upper, Middle and Lower Reach, and the Delta, clearly show the diverse character in macrophyte species composition along the whole Danube. This is also true for water bodies in other parts of the basin, which include e.g. karst-rivers, canal systems, and some types of impoundments, too. One contribution also deals with carnivorous aquatic plants, cultivated and studied in the Czech Republic.

This book also contains a complete species list of all macrophytes recorded during the surveys. Individual chapters show the plant names in the respective national language, too.