EcoDaLLi

Ecosystem-based governance with Danube lighthouse Living Lab for sustainable innovation processes

Nature-based Solutions Catalogue of Projects and Measures

NBS CATALOGUE

Funded by the European Union

T2.2 Apply the methodology developed within T2.1 in the 4 Danube units

The aim of this task was the application of the methodology developed within T2.1 for NBS assessment across the entire Danube river basin, including Danube Delta (divided in 4 Danube units), in order to showcase the best practices already implemented & financed.

Methodology for Mission relevant NBS assessment was developed by University of Novy Sad (see the deliverable T 2.1)

„Nature-based Solutions (NBS) are a novel, permanently evolving concept, which is a kind of upgrading of UNO Sustainable Development Goals and European Green Deal, stimulating "*solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience",* it is researched as a promising approach for reaching Mission and DRBMP defined targets.
In the line with previous, within the EcoDaLLi project WP2 is defined:
NBS & eco-system connectivity for the protection and restoration of freshwater ecosystems and biodiversity. (T 2.1).

Applied methodology

The methodology for survey and evaluation of existing applications of Nature based Solutions (NBS), projects, interventions and others, is based on the EcoDaLLi deliverable 2.1 (D 2.1):
Methodology for Mission Relevant NBS Assessment.

In this publication, kind of toolbox or manual for NBS applications, is elaborated this issue, based on wider sources, UNDP, IUNC, USA *etc*., but, the most relevant are applied the approaches and terminology used by European Commission publications and documents. This does not mean that other sources were, or should not be, neglected or treated as not applicable or less significant and of lower quality.

The most significant publications, used for development of D 2.1 were:

Dumitru, A., Wendling, L. (eds.). 2021b. Evaluating the impact of nature-based solutions, A handbook for practitioners. Publications Office of the European Union, Luxembourg.
Cardinali, M., Dumitru, A., Vandewoestijne, S., Wendling, L. 2021. Evaluating the impact of nature-based solutions, A summary for policy makers. Publications Office of the European Union, Luxembourg. doi:10.2777/521937.
Dumitru, A., Wendling, L. (eds.). 2021a. Evaluating the impact of nature-based solutions, Appendix of methods. Publications Office of the European Union, Luxembourg.

All three publication are based on outcomes of previous EU cofinanced projects, related to the restoration of urban and restoration of peri urban areas. However, in many cases, these include restoration of water bodies, and riverine flora and fauna. Almost all of them focus biodiversity enhancement.

Applied methodology

In D 2.1 kind of history of NBS, and diverse definitions of it is presented. As representative is selected following one, taken from previously mentioned publications:

Nature-based Solutions provide integrated, multifunctional solutions to critical societal challenges. They are "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and interventions. Nature-based Solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services" (European Commission).

This definition is not significantly different from these stated by other sources, e.g. IUCN.
It should be noted that the NBS, as an approach for restoration, is still under development, and its final stage is far from over. However, essential changes are not expected.

NBS concept

NBS concept umbrella, is presented in Fig. 1, from **Dumitru and Wendling** (2021b).
Very important, and seldom noticed, is that NBS is related to the nature restoration, and that the infrastructure of it should be, preferably, blue or green (Fig. 1). Pure grey infrastructure cannot be treated as NBS. Frequent is also application of hybrid one, combination of grey and one or both of previous ones. In review publications it was not found what represents the upper limit of grey share in the case of hybrid ones.

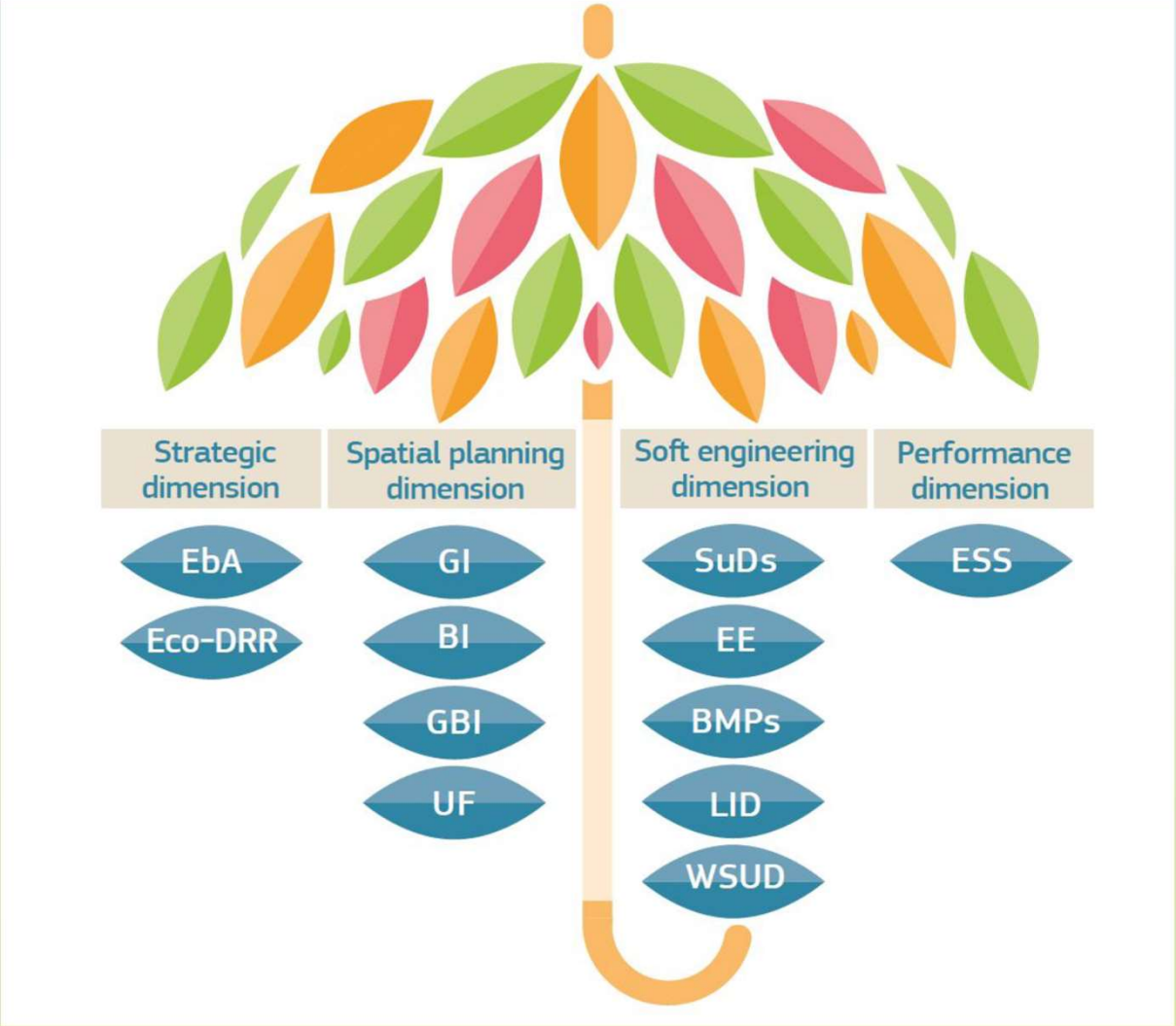


Fig.1 Nature-based solutions as an umbrella concept and the relation of NBS to key existing concepts. EbA = ecosystem based adaptation; Eco-DRR = ecosystem-based disaster risk reduction; GI = green infrastructure; BI = clue infrastructure; GBI = green-blue infrastructure; UF = urban forestry; SuDS = sustainable urban drainage systems; EE = ecological engineering; BMPs = best management practices; LID = low-impact design; WSUD = water-sensitive urban design; ESS = ecosystem services.

Mission Ocean related literature: *European Commission. 2023. Baseline study for the implementation of lighthouses of the Mission 'Restore our ocean and waters by 2030': Atlantic, Arctic, Danube and Mediterranean lighthouses, Final report. Publications Office of the European Union, Luxembourg.*

Societal Challenges Addressed

Societal challenges are a core part of NBS. In Fig. 1 is presented one of examples presented in **Dumitru and Wendling** (2021b). There is a list of all used for EU projects, and green highlighted ones are applied for this project.

In D 2.1, Chapter 4, are elaborated these issues. The list consists of, for urban restoration, selected societal challenges. Highly relevant for **Mission Ocean and Waters** and **EcoDaLLi**, are highlighted.

Climate Resilience
Water Management
Natural and Climate Hazards
Green Space Management
Biodiversity Enhancement
Air Quality
Place Regeneration
Knowledge and Social Capacity Building for Sustainable Urban Transformation
Participatory Planning and Governance
Social Justice and Social Cohesion
Health and Wellbeing
New Economic Opportunities and Green Jobs

Fig. 2 Example of societal challenges, project GROWGREEN

Societal Challenges Addressed

Depending on specificity of the planned project/intervention can be selected some other societal challenges, here listed or others. Example, Water Quality, relevant for biodiversity enhancement. This can be related to the macro and micro plastic litter. The seventh challenge could also be relevant, but with slightly modified title: Knowledge and Social Capacity Building for Sustainable Transformation.

Project developer could define other societal challenges or include some others from above list.

Major societal challenges have been thoroughly elaborated in D 2.1 Chapter 4. The example of Water Management is presented in Fig. 3.

NBS type: *Revitalize floodplains*

Challenge-orientation
- Reducing flood risks

Exemplary NBS actions
- Reconnect rivers and floodplains
- Allow for meandering

Ecosystem process utilization
- Natural water retention capacity
- Water (evapo-)transpiration

Practical viability examples
- Public funding
- Green bonds

Three exemplary co-benefits
- Biodiversity protection
- Recreation
- Drinking water provision

NBS type: *Protect and establish wet-lands*

Challenge-orientation
- Sequesting carbon

Exemplary NBS actions
- Enhance water retainment
- Initiate typical plant communities

Ecosystem process utilization
- Carbon sequestration in soils and vegetation

Practical viability examples
- Climate mitigation funding
- Mitigation banking

Three exemplary co-benefits
- Biodiversity protection
- Flood regulation
- Water quality protection

NBS type: *Site-specific land-use adaptation*

Challenge-orientation
- Soil erosion

Exemplary NBS actions
- Extensify agricultural land use
- Transform fields into grassland

Ecosystem process utilization
- Natural soil cover
- Natural soil fixation

Practical viability examples
- Payments for ecosystem services
- Cooperation with tourism sector

Three exemplary co-benefits
- Recreation
- Biodiversity protection
- Water retention

Fig. 3 NBS for water management, excerpt from Albert, S. et al. 2019. Addressing societal challenges through nature-based solutions: How can landscape planning and governance research contribute? Landscape and Urban Planning, 182, 12–21.

Project Phases

In Fig. 4, excerpt from D2.1, is presented one example of NBS project phases.
Simplified, project phases are:

I Preparatory Phase. NBS Assessment Phase
II Restoration Phase
III Followed by Operational Phase

Preparatory Phase consists of:
NBS project initiation.
Validation of the Project as **NBS Indicators, Baseline Data Collection**, **Theory of Change**, **Monitoring and Evaluation Plan**.
Creating NBS project **Conceptual Design.**
The **Restoration Phase** includes civil engineering and other activities relevant for the project and is performed using common procedures.
After this starts the **Operational Phase**, which includes **Monitoring and Evaluation**, but, also maintenance measures, and eventual reconstructions and adaptations.

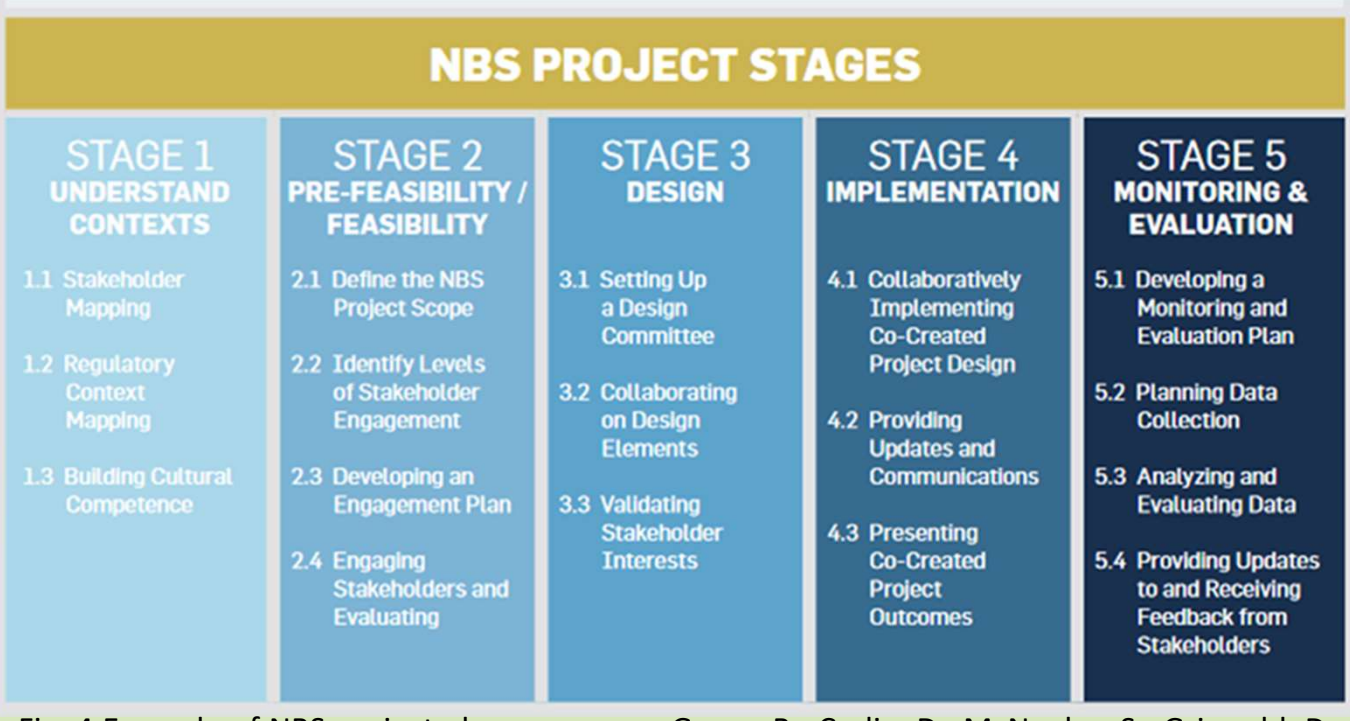


Fig. 4 Example of NBS project phases, source: Gregg, B., Carlin, D., McNeeley, S., Griswold, D. 2022. Stakeholder engagement guide for Nature-based Solutions. United Nations CEO Water Mandate and Pacific Institute. Oakland, California. www.ceowatermandate.org/nbs/engagementguide

This is comprehensively described in D 2.1.
The indictors, metric and nonmetric description of selected characteristics, are comprehensively elaborated in **Dumitru and Wendling** (2021a), **Dumitru and Wendling** (2021b) and in D 2.1, chapter 5.

MEANINGS

Baseline data collection
Current values of selected indicators, before restoration.

Theory of Change
Expected values, improvements, resulted after restoration during defined operational phase.

Monitoring and evaluation plan
This is procedure for performing observation of restoration results.

NBS Type

Here are mostly treated geographic types:

1. Local, realized in settlement, community, county…
2. National, realized on country level.
3. International, realized in two or more countries.

There are also other possible classifications, like pilot, research trial, demonstration (including educational), etc.

Project size and others

Until now, mostly are defined two sizes, big or large, and small. Among realized NBS are dominant big ones. In D2.1 is, in Chapter 2, this issue was discussed and proposed to include also mini size as a category. Mini size can be applied for research trials, demonstration and educational NBS projects.

It can be mentioned other activities are aimed at initiation, inducement, advocacy of application of NBS. There are numerous publications of this type. These are positive as support for introduction of NBS, creation of public interest and partiality. This is also in line with societal challenge **Knowledge and Social Capacity Building for Sustainable Transformation**, and engaging citizens.

NBS projects
on Upper/Middle/Lower Danube and the Delta

Accoring to the described methodology NBS related projects were chosen, characterized and showcased.

2-4 projects from each section are described in detail and a list of 27 projects are provided as well.

As the projects were implemented by various state organisations, companies, NGO-s from different sources and time scale, there are some difficulties to gather all the relevant data.

Type 3 NBS	• Trees and shrubs - Forests (including afforestation)

• Natural or semi-natural water storage and transport structures
- Floodplains, floodplain reconnection with rivers
- Restoration of degraded waterbodies
- Restoration of degraded waterways, including re-meandering of streams and river daylighting

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Germany
River, water body	Danube

Societal Challenges

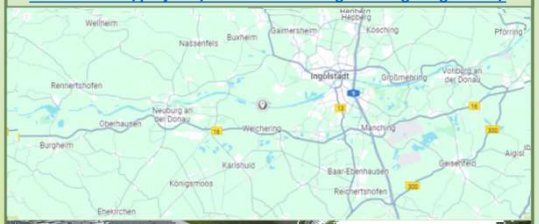
1	2	3	4	5	6
✓	✓		✓		

Other:

Stage	ME	Size	B
Geotype	N	IS	

Project WEBSITE

https://www.undekade-restoration.de/projekte/auenrenaturierung-neuburg---ingolstadt/



Project summary:

The Danube floodplain between Neuburg and Ingolstadt is with 2100 ha one of the largest remaining alluvial forests in Germany but has lost a lot of its natural dynamic in the 19th and 20th century due to river regulation measures. Thus, the project "Dynamisierung der Donauauen" aimed to improve river continuum and flood plain dynamics by implementing a package of different measures including but not limited to the construction of water outlets creating new habitats, improving longitudinal connection, and reconnecting the Danube to the adjacent alluvial forest.

Best practices and references

The project led to the founding of the "Auenzentrum" an initiative that serves research and knowledge exchange on the subject of floodplains of rivers and is dedicated to informing and engaging the public. A flyer containing detailed information on all activities is available in the German language:
Faltblatt_WWA_Dynamisierung_der_Donauauen.pdf

Environmental, socio-cultural, economic impacts

The Danube floodplains have a wide range of different habitats and are of national importance for the protection of species and biotopes. They are important for the long-term conservation of many species. In addition, the project has a positive effect on flood prevention due to the amount of water diverted.

Replication and scalability

The activities were of course targeted specifically at the part of the Danube between Neuburg and Ingolstadt and can therefore not be directly replicated. However, the project can serve as a best-practice example for how to approach renaturation and how to monitor its success.

Participation process

As early as 1997 a feasibility study was carried out by the Rastatt Floodplain Institute of the Worldwide Fund of Nature (WWF). Based on this study a project groups including of experts from water management and nature conservation, representatives of the city of Ingolstadt and the district of Neuburg-Schrobenhausen, E.on Wasserkraft and the largest property owner, the Wittelsbach Compensation Fund was formed to lay the foundations for implementation of the project.

Lessons learnt

• From the beginning of the project to the finalization of all construction it took 15 years showing that patience is key to a successful restoration project.
•The project is being continuously monitored since its beginnings to ensure and document the positive effects of the measures.

Type 3 NBS

Natural or semi-natural water storage and transport structures
Floodplains, floodplain reconnection with rivers
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	**Austria**
River, water body	**Danube**

Societal Challenges

1	2	3	4	5	6
✓	✓		✓		

Other:

Stage	**ME**	**Size**	**B**
Geotype	**I**	**IS**	

Project WEBSITE

https://www.undekade-restoration.de/projekte/auenrenaturierung-neuburg---ingolstadt/

Project summary:

"Spittelauer Arm" renaturalisation action has been planned, extends from Petronell to Hainburg, and it has already been part of several renaturation actions. Overall, the restoration goals were aligned towards the ambition of reestablishing the hydrological connection of this river stream with its floodplain and the Danube River. The "Spittelauer Arm"'s basic restoration principle is based on working with the existing stream flow and removing the traverse elements to enhance the floodplain connection. In the course of this, an overall understanding of the ecological elements and river ecosystems' landscape helped to define smart restoration strategies, such as the use of dismantled stones, which were reused from other projects' construction actions in the area.

Best practices and references

As a practical reference to nurture the implementation of these kinds of actions, a "guidance document for river engineering management on the Danube east of Vienna" was drafted ("Flussbauliches Managementleitbild für die Donau östlich von Wien"). In it, the objectives as well as the management principles and working methods required to achieve the objectives were agreed between business representatives and environmental organisations. The document is considered a strategic guideline for the further course of action in the catalogue of measures. The document is only available for download in German language.

Environmental, socio-cultural, economic impacts

Many positive impacts can be considered from the implementation of this project, such as biodiversity enhancement as well as socio-cultural and economic benefits to the residents. For instance, this especially applies to the area of 'Thurnhaufen', which is localised in the opposite front of the city of Hainburg, and turned into an alluvial forest that serves as a retreat for visitors and residents.
Overall, the LIFE project enhanced many opportunities to the communities for interacting with the natural environment and helped to maintain, restore, and increase the ecological value of along the tributaries, turning them into lifelines of the floodplain forests. Riparian forests deliver multiple benefits that can be monetised. In total, the Dynamic LIFE Lines project ecologically upgrades over 1500 hectares of riparian forests.

Replication and scalability

The replicability of this kind of restoration action is key in effective watershed restoration and the LIFE project allowed various small interventions along the Upper and Middle Danube region to help in improving the ecological state of this floodplain. A historical track on environmental assessment and monitoring of the watershed helps evaluate the benefits from the implementation of the restoration practices, to demonstrate the importance of replication and scalability for the achievement of our environmental goals. This project has been preceded by several other restoration measures in the area, such as the side-arm reconnection in Haslau Regelsbrunn, finished as early as 1998. The evaluation of the results from the implementation of the previous experiences shows us that the methods applied can be easily replicated and upscaled.

Participation process

All measures for the Danube east of Vienna are accompanied and supported by a stakeholder forum. Thereby, affected and interested parties have the possibility to be actively involved in the realisation of the measures and contribute to the way of implementation and evaluation within the given legal framework. Key element of the model is an advisory board, consisting of members of organisations and advocacy groups having a professional relation to the national park area.

Lessons learnt

As a main lesson, the LIFE project demonstrates that there are two essential elements for the achievement of the projects' goals, increasing biodiversity and hydrological dynamics and the regeneration of riparian buffers to transform the tributaries of the Danube into real lifelines. This translates into an important message given the importance of preserving last Europe-wide riparian forests on the Austrian Danube and showed that restoration of lifelines will significantly contribute to this aim.

Type 1 NBS

Monitoring
Regular monitoring of physical, chemical or biological indicators

Type 3 NBS

Natural or semi-natural water storage and transport structures
Restoration of degraded waterbodies

Country	Germany
River, water body	Danube

Societal Challenges

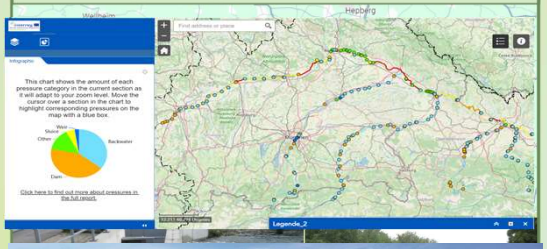
1	2	3	4	5	6
✓			✓		

Other:

Stage	REP ME	Size	B
Geotype	I	IS	

Project WEBSITE

https://www.interreg-danube.eu/approved-projects/danubesediment



Project summary:

DanubeSediment (Danube Sediment Management – Restoration of Sediment Balance in the Danube River) is a transnational initiative aimed at enhancing the morphology, sediment, and water management of the Danube River. Spanning across the entire river basin, this Interreg project took place between 2017 and 2019. Given the critical role of upstream areas in sediment transport, this factsheet emphasizes the efforts undertaken in the Upper Danube Region, with a particular focus on Austria and Germany.

Among the main outcomes of the project is the calculation of sediment balance throughout the Danube, coupled with an analysis of sediment flow regime, including sinks, sources, and sediment redistribution within the river. Key drivers and pressures causing sediment discontinuity were analysed to improve the impact assessment of sediment deficit and erosion.

Best practices and references

The DanubeSediment project has produced a variety of documents, plans and strategies aimed at the assessment of sediment transport across the river basin and to understand the Danube River morphology. For this purpose, the project has a strong monitoring component throughout the river, producing the Analysis of Sediment Data Collected. As well, the project has produced a Handbook on Good Practices in Sediment Monitoring with the purpose of refining methodologies to improve data on spatial and temporal variation of sediment transport, through suspended sediment and bedload monitoring, therefore fostering the understanding on the main ecological and hydraulic issues in the river. Interactive maps have been produced, showcasing the monitoring stations across the Danube River and the collected data. Additionally, the project analyses the different pressures that act on the sediment regime on the Danube River and its main tributaries, providing an overview through an interactive map. The following figure showcases the erosion and sedimentation levels, along with the main pressures on the river segment located in Germany and part of Austria.

Environmental, socio-cultural, economic impacts

The Danube Sediment Management Guidance acknowledges the level in which socio-economic development in the Danube region has altered the natural flow regime of the river. It identifies flood protection, hydropower, navigation, water supply, land use and commercial dredging as the main drivers of alterations in the sediment regimes in the river basin. DanubeSediment also has analysed the historical changes in terms of the river morphology, relating it to the different drivers. The project highlights the adoption of sediment management practices that aim to achieve a balanced sediment regime with a dynamic equilibrium between sedimentation and erosion. It proposes river basin restoration, including the revitalisation of the of river branches to improve water management and the morphology of the Danube River. The Sediment Manual for Stakeholders presents a compilation of best practices and measures for sediment management, including measures to reduce erosion at the catchment, sectional, and local scales.

Collecting data and assessing the sediment balance throughout the Danube River basin allows to improve sediment transport and mitigate environmental impacts related to alterations in the nutrient transfer, improvement in the flow regime, and flood mitigation.

Replication and scalability

The project results feed directly in the plans and strategies issued by the ICPDR, contributing to transnational water management and flood risk prevention, therefore broadening the scope of the project impact. DanubeSediment had International Training Workshops which supported knowledge transfer to key target groups in the Danube River Basin, thus communicating project results and engaging stakeholders beyond the project scope.

Additionally, the approach of analysing the processes and mechanisms of sediment transport at the river basin scale can be replicated in different areas.

Participation process

The project played a key role in the collaborative development of the Sediment Manual for Stakeholders. Furthermore, it facilitated participative processes that influenced the Danube River Management Plan (DRBMP) and the Danube Flood Risk Management Plan (DFRMP), incorporating valuable insights from stakeholders into these strategic plans.

Lessons learnt

The alteration of the sediment balance is a significant water management issue in the Danube River Basin, therefore it should be an integral part of the National River Basin and Flood Management Plans

- There is a need for the implementation of integrated river basin scale sediment management concept. Transboundary level approaches are required for the implementation of actions, specially focusing on upstream-downstream flow relations.
- Sediment management measures should be prepared in an inclusive way, connecting all relevant stakeholders, and must enhance the adoption of holistic approaches that consider both, sediment quantity and quality.

Type 1 NBS

Protection and conservation strategies
Establishment of protected areas or conservation zones
Ensuring of continuity of ecological networks (protection from fragmentation)
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 3 NBS

Natural or semi-natural water storage and transport structures
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Hungary
River, water body	Danube

Societal Challenges

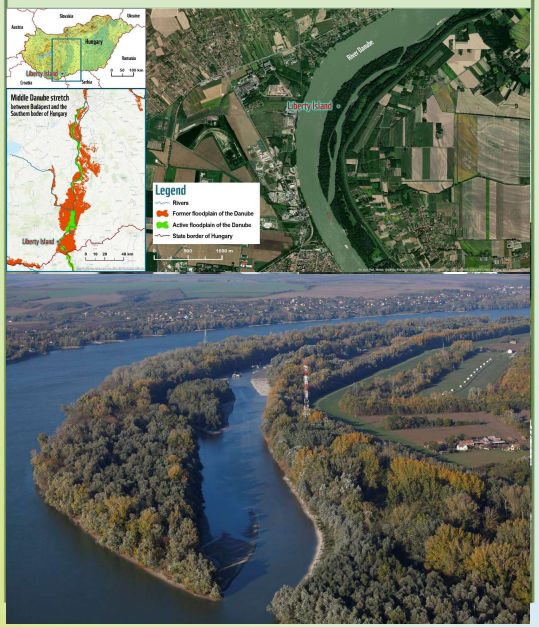
1	2	3	4	5	6
✓		✓	✓	✓	

Other:

Stage	ME	Size	B
Geotype	N	IS	

Project WEBSITE

http://www.szabadsagsziget.hu/



Project summary:

Conservation of alluvial habitats of community interest on the Szabadság Island and side channel in Béda-Karapancsa:
Island is covered by alluvial softwood forests with certain invasive (Fraxinus pennsylvanica, Acer negundo) pressure. Until 2009 commercial forestry was going on. The island was connected with the riverbank in 1982 by a rockfill dam, which carried large capacity water pipes. The dam was blocking the river flow in the side-branch, causing fast sedimentation, poor quality of stagnant water and degrading habitats. The forests on the island were cleared 80% from the seed-shedding individuas of the invasives, the 5 ha size poplar plantation was converted to a semi-natural alluvial forest. The waterpipes were relocated, and the rock-fill dam was opened, the large capacity waterpipes were relocated, and the side-branch was dredged along.

Best practices and references

The realized improvement of the longitudinal connectivity which brought additional advantages to the biodiversity improvement and recreational uses; the successful cooperation between the various sectors (as project partners: water directorate, waterworks, national park, local government) and stakeholders (foresty agencies, inhabitants of Mohács (closest city), fairway authorities, angler (other recreation) associations); a good monitoring design was established and the relevant biodiversity indicators are monitored. As a biodiversity-focused project brought also other advantages like improvement of improvement in climate regulation, local flood risk reduction, drought mitigation, is able for further filtration of the water thus improving water quality.

Environmental, socio-cultural, economic impacts

Biodiversity health indicators improved and this was one of the first multitaxa approach for quantifying after restoration changes in taxa composition in Hungary and biomonitoring was implemented during and after the restoration measures and no adverse consequences were identified. Improvement of recreational opportunities like rowing or angling is also characteristic, with change of invasives to native species carbon sequestration was increased and flood risk reduced.

Replication and scalability

Upscaling of the project includes more aspects like people are aware of the ecosystem services of wetlend ecosystems and have successfully worked out strategies and methods of such nature based solutions which can restore the natural dynamics of riverine ecosystems. These solutions are widely supported by goverments and business sectors as well.
Only such activities are allowed in floodplains and the river which are in line with natural processes and dynamics of such ecosystems.
NBS based restorations are commonly accepted and integratively planned restoration works are finished or in process.
Sediment balance is in better state (river management bodies' consider a jointly developed sediment management plan), more natural hydromorphological processes are ongoing.
Freshwater biodiversity is on a recovery track and people can use new opportunities from new economic modells based on natural river dynamics.

Participation process

Upscaling of the project includes more aspects like people are aware of the ecosystem services of wetlend ecosystems and have successfully worked out strategies and methods of such nature based solutions which can restore the natural dynamics of riverine ecosystems. These solutions are widely supported by goverments and business sectors as well.
Only such activities are allowed in floodplains and the river which are in line with natural processes and dynamics of such ecosystems.
NBS based restorations are commonly accepted and integratively planned restoration works are finished or in process.
Sediment balance is in better state (river management bodies' consider a jointly developed sediment management plan), more natural hydromorphological processes are ongoing.
Freshwater biodiversity is on a recovery track and people can use new opportunities from new economic modells based on natural river dynamics.

Lessons learnt

By planning monitoring of indicators of health & wellbeing were not included in the project, therefore only subjective follow up can be realized.
As for biodiversity improvement a general weakness is that invasive species require constant management otherwise it is not only a constraint for biodiversity but also for flood risk and other uses of the area.
Maintenance of the navigation route has impacts on the side-branch. The groynes cause sedimentation upstream of it, and this impact is still not mitigated and no safeguards on trade-offs were assessed during the project.
Perceived threats result from lack of further funding if unfavourable changes arise in ecosystem integrity (e.g. with the forefront of invasive species) and there is no intention to develop NbS strategy.
A balanced climate regulation is threatened by deepening of the main river channel, groine which enables an intensive sedimentation and expansion of the land on the cost of river channel. This process also threatens the flood and drought resilience of the area and hinders opportunities for health & wellbeing for especially local communities which visit usually the project site and its surrounding.

Type 1 NBS

Monitoring
Regular monitoring of physical, chemical or biological indicators

Type 2 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support biodiversity

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Hungary
River, water body	Danube

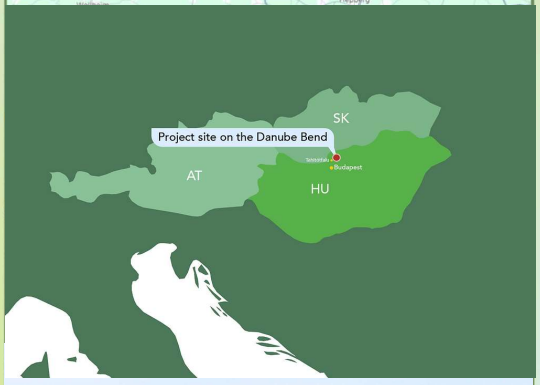
Societal Challenges

Other:

Stage	ME	Size	B
Geotype	N	IS	yes

Project WEBSITE

https://www.danube4allproject.eu/middle-danube



Project summary:

Project site is at Sződliget, 30 km north of Budapest along the Danube Bend. Work here will focus on the re-dynamization of the river section through ecological groyne optimization - the first implementation in the field in Hungary. River regulations resulted in loss of habitats and loss of side arms all along the Danube river. Danube has a channel character in many sections with low structural diversity. One of the typical situation is located at the 1675 Rkm. Two groynes have been built in the Danube right side littoral zone as a river regulation infrastructure. Between the groynes sedimentation and siltation have been found. Gravel littoral zone turned into slow flowing or standing water with mud. The dynamic character of the river has been totally lost in this 600 m long habitat.
Nevertheless, it is well known that navigation has a negative impact on ecology. The main impact is wave stress for aquatic species. Navigation impacts are significantly higher in channelized sections.

Best practices and references

1. Increasing biodiversity of the area (app. 50 ha) following by the increased structural diversity;
2. 10-20 cm/s velocity in littoral zone (nursery for reophilous species) even at low water level;
3. The island will provide a safe habitat against wave stress;
4. The island will be sustainable in the long term.
5. The restoration is compatible with both navigation and flood protection interests.

Environmental, socio-cultural, economic impacts

Richness of biodiversity and habitats increases while the section will be suitable as fish spawning area. Also it helps to maintain the fairway conditions.
This provides also more opportunities for anglers and less invasive species will be present. It will be a good example to be replicated representing an NBS for navigation and biodiversity as well. And the richer is the biodiversity the better it can mitigate also climate change effects.

Replication and scalability

Lots of old water regulation structures are along the Hungarian Danube stretch which could be revised and reshaped thus protecting siltation and riverbed narrowing and juvenile fish and macroinvertebrates from waves caused by heavy ship traffic..

Participation process

DANUBE4all will closely cooperate with the local communities, inhabitants, SMEs, and stakeholders to optimise the final design, strengthening participation before, during and after implementation of the measures e.g., by involving Citizen Science in monitoring programs

Lessons learnt

Project is ongoing, these can be concluded in a later stage.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)

Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 3 NBS

Natural or semi-natural water storage and transport structures
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Hungary
River, water body	Danube

Societal Challenges

1	2	3	4	5	6
✓				✓	

Other:

Stage	RF	Size	S
Geotype	L	IS	

Project WEBSITE

https://www.ddnp.hu/igazgatosag/hirek/vizpotlas_a_batai_holt-dunan

Project summary:

The aim of the intervention was restoring a relatively large oxbow on Danube's floodplain, which has been significantly silted up without open water surface. During the project certain section of the oxbow has been dredged creating app 900m x 100m large open water surface. Furthermore, a relatively large sluice has been constructed, it is used as a water retention artefact to improve the water level of the oxbow.

Best practices and references

The dredged materials were deposited in the close vicinity of the oxbow to reduce cost and environmental impact. For the construction of water retention artefact the existing railroad pillars has been used to decrease the amount of concrete used for building.

Environmental, socio-cultural, economic impacts

The restored oxbow is situated next to the village of Báta, locals can use the oxbow for recreation purpose (e.g. leisure angling) and the restored area improved the quality of the landscape, also.

Replication and scalability

The Danube-Drava National Park Directorate intend to restore the upper part of the oxbow by constructing small bottomweir and implementing small scale dredging.

Participation process

The project has been financed by the World Bank and the Hungarian state, the planning and implementation has been developed with the cooperation of South-Transdanubian Water Management Directorate and the Danube-Drava National park Directorate. The Municipality of Báta also supported the project by providing the place for water retention artefact.

Lessons learnt

The dredging within the floodplain can be very difficult because the heavy machineries can sink is soft soil. The water retention sluice have to be durable to resist the floods and the driftwoods. The driftwoods and other floating sediments has to be regularly remove from the artefact.

Type 1 NBS

Protection and conservation strategies
Establishment of protected areas or conservation zones
Ensuring of continuity of ecological networks (protection from fragmentation)
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 3 NBS

Natural or semi-natural water storage and transport structures
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Hungary
River, water body	Danube

Societal Challenges

1	2	3	4	5	6
✓				✓	

Other:

Stage	RF	Size	S
Geotype	L	IS	

Project WEBSITE

https://www.ddnp.hu/igazgatosag/hirek/vizpotlas_a_batai_holt-dunan

Project summary:

The aim of the project was improving the water discharge of Mocskos-Duna, which is an app. 4 km long oxbow on the Danube's floodplain. During the project a water retention sluice has been constructed into the mouth of the oxbow to retain the water after the floodwaves.

Best practices and references

Within the planning process we have focused on the principle to reach the largest benefit by the smallest intervention. So only a relatively small size artefact has been built, the other part of the oxbow remained untouched.

Environmental, socio-cultural, economic impacts

The certain section of the oxbow used for leisure angling by a local fishing association. The improved water also create more favourable condition for the fish communities.

Replication and scalability

The constructing of water retention artefact has been done in case of other restoration projects.

Participation process

The planning and implementation has been developed with the cooperation of South-Transdanubian Water Management Directorate and the Danube-Drava National park Directorate. The Gemenc state forest company- who is responsible for the management of nearby forest- was also involved in planning procedure.

Lessons learnt

The permanent riverbed erosion of river Danube resulted, that the level of the sluice calculated 15 years ago is a slightly high now and the sluice has to be operated more frequently than it was expected a decade ago.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 2, 3 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country Romania

River, water body Danube

Societal Challenges

1 2 3 4 5 6

Other:

Stage RF **Size** S

Geotype L **IS**

Project WEBSITE

Project summary:

The project tackled the urgent task of preserving two globally threatened bird species, the pygmy cormorant (Phalacrocorax pygmeus) and the ferruginous duck (Aythya nyroca), in the dynamic ecosystem of the lower Danube region. These species faced serious threats including habitat degradation, human activities, and insufficient cross-border cooperation in conservation. Despite being priority species for LIFE Nature funding in the EU, their populations in the wetlands of southern and southeastern Europe, particularly along the lower Danube, were declining. The project aimed to support cross-border cooperation between Romania and Bulgaria to implement coordinated conservation efforts across key Natura 2000 sites. It focused on restoring and enhancing important wetland habitats for breeding and feeding activities through initiatives like creating freshwater pools and managing reedbeds. These efforts were needed for the long-term survival of these species in the region.

Best practices and references

The NBS strategy prioritized habitat restoration and enhancement for Phalacrocorax pygmeus and Aythya nyroca. Wetland habitats along the lower Danube, like reedbeds and freshwater pools, were restored to create sanctuaries for these birds, supporting biodiversity. Sustainable land management practices were emphasized to address habitat degradation and promote ecosystem health, including controlling invasive species and reducing fragmentation. Stakeholder engagement focused on raising awareness about bird conservation and encouraging sustainable behaviors. Monitoring and adaptive management were key, allowing for assessment and adjustment of strategies based on real-time feedback. This approach optimized conservation efforts and ensured long-term sustainability.

Environmental, socio-cultural, economic impacts

The project successfully maintained breeding populations of P. pygmeus and A. nyroca along the lower Danube, with 1590 and 400 breeding pairs in Romania, and 770 and 155 breeding pairs in Bulgaria, respectively, meeting Favourable Reference Values. Moreover, it expanded their breeding and feeding areas by 1200 hectares each in both countries. A cross-border protected area of 44,297 hectares in Romania and Bulgaria demonstrated integrated conservation efforts, inspiring similar initiatives. Fisheries management was enhanced through seminars, workshops, and stakeholder engagement, benefiting targeted and other priority species. These efforts secured the favorable conservation status of the species in line with EU Birds Directive. The project advanced the Lower Danube Green Corridor Agreement by expanding Natura 2000 sites, restoring 1200 hectares of wetlands, and improving ecological coherence along the lower Danube.

Replication and scalability

The project demonstrates importance of cross-border cooperation in conservation efforts for species with transboundary habitats.
- Engagement of stakeholders through seminars, workshops, and outreach activities important for garnering support.
- There is an opportunity to scale up conservation efforts beyond the Lower Danube region and replicate initiatives in other areas facing similar challenges.

Participation process

Through seminars, workshops, and public events, stakeholders were informed about the benefits of NBS and encouraged to support conservation efforts.The project began by establishing necessary structures and financial frameworks for Natura 2000 site support. Efforts included understanding species' needs, engaging stakeholders, and developing strategies to address mortality issues. Progressing, the focus shifted to strengthening cross-border networks along the lower Danube, fortifying administrative and financial mechanisms, and preventing water pollution.

Lessons learnt

- Monitoring of bird populations and habitat conditions were essential to track effectiveness of interventions over time.
- Political instability, changes in government priorities, and socio-economic challenges pose risks to continuity of conservation efforts.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Maintenance or enhancement of natural wetlands
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 2,3 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Romania
River, water body	Argeș

Societal Challenges

1	2	3	4	5	6
✓	✓	✓			

Other:

Stage	RF	Size	B
Geotype	L	IS	

Project WEBSITE

Project summary:

The project aims to develop and implement a model for gravel extraction site restoration and community based conservation for the Fusea Natural Area.
Historically used as an extraction point for aggregates since 1970, the Fusea site located in the floodplain of the Arges river (Danube tributary, South of Romania), in the Dambovita County, is a mixed area of economical and natural value, covering 1 square km. While 88% of the site is included in the “Arges Middle Floodplain” Natura2000 site, there is also a functional gravel extraction point of Lafarge Group Romania and an area of community interest for the villages situated on its border.

Best practices and references

The project restored the gravel extraction site by reconnecting existing lakes and planting indigenous flora for biodiversity. Collaborative efforts with local communities managed human activities impacting the area. An interpretation trail and educational events promoted understanding of ecological significance. Online promotion amplified outreach, while the "Fusea Training Center" served as a hub for environmental education and best practices in conservation.

Environmental, socio-cultural, economic impacts

The project aimed to overcome key challenges in conserving Natura 2000 sites along the lower Danube. This included establishing administrative and financial structures for coordinated efforts between Romania and Bulgaria. Extensive research and stakeholder engagement were conducted to understand species status and requirements. Critical breeding habitats at sites like Blahnita, Olt-Danube, Belene, and Suhaia were restored and managed. Wetlands were maintained or restored to provide feeding grounds, minimizing disturbances and preventing deliberate killing of species. Strict management measures were implemented to prevent water pollution.
Environmental impact measures included soil erosion reduction and water quality improvement. Long-term sustainability was evaluated through monitoring protocols and institutional frameworks for continued management, ensuring lasting environmental and community impact.

Replication and scalability

The project has a good replication potential because of its effective implementation of conservation measures, habitat restoration, minimizing disturbances, preventing species killing, and managing water pollution to ensure the survival and ecological integrity of target species in key Natura 2000 sites along the lower Danube.The project primarily aimed at enhancing biodiversity by restoring a gravel extraction site, focusing on measures like reconnecting lakes and planting indigenous flora. Monitoring methodology can also be replicated: flora and fauna recovery monitoring in restored areas provided great information on indigenous species presence and ecological interactions. Facilitating wildlife movement through lake reconnection and strategic planting aimed to improve habitat connectivity, emphasising its impact on ecosystem resilience.

Participation process

This site is a good opportunity to show the value of ecological restoration of degraded floodplain and to ensure a community based system of managing the environmental services of the area with the direct involvement of the Lafarge team.
Community engagement, including local involvement in decision-making, aimed to promote ownership and stewardship.
Promotion activities tracked public engagement, showcasing effectiveness in raising awareness about ecological restoration.

Lessons learnt

Engaging with local communities early and consistently proved essential in building trust, understanding their needs, and ensuring their active participation.
Scaling up similar initiatives in other degraded areas offers the potential to maximize impact and address broader environmental challenges.
Building resilience into project designs and maintaining adaptive management practices can help mitigate environmental risks and ensure continued progress.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Maintenance or enhancement of natural wetlands

Type 2,3 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

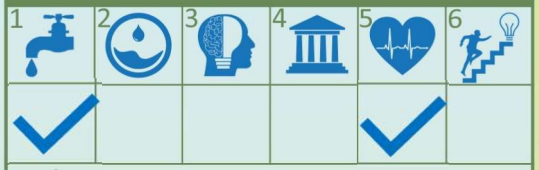
EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Bulgaria
River, water body	Rusenski Lom

Societal Challenges



Other:

Stage	ME	Size	M
Geotype	L	IS	yes

Project WEBSITE

https://restorerivers.eu/wiki/index.php?title=Case_study%3ARestoration_of_Rusenski_Lom_River_near_Ivanovo#Lessons_learnt

Project summary:

In the mid-20th century, the lower flow of the Rusenski Lom River underwent regulation with dykes, but this proved unsuccessful in some areas due to frequent flooding and high groundwater levels. Consequently, much of the reclaimed land was converted into fishponds, which were economically inefficient and often destroyed during periods of high water. As a result, many of these fishponds now lie abandoned. This situation is evident along the Rusenski Lom river near the Ivanovo rock monasteries, where an asphalt road and visitor infrastructure sit atop river protection dykes. Despite these measures, floods frequently inundate the area, damaging access roads and infrastructure. The flood of 2006 was particularly devastating, washing away bridges and alcoves on the island, and causing partial breaches in the dykes, leaving flooded land submerged for over a year.

Best practices and references

WWF started restoring the river and measures were completed in 2009. In this case, the water itself suggested the solution to the problem. The dike was further opened in three places.
It is the first example in Bulgaria for application of the principle "more space for the river – more safety for people", proven yet in mid-20th century.

Environmental, socio-cultural, economic impacts

Thanks to this approach, now during high water the river may spread out, settle down and go back into its bed without flooding the surrounding land.
At the same time, overflows in the floodplain terrace provide feeding places for the black stork, habitats for rare water plants and breeding places for a number of fish and amphibian species.

Replication and scalability

This project was implemented on a relatively small scale. Although there are some local specificities, the project is not uncommon and the techniques and approaches used are well established. In other words, there is great scope for replicating the good results and applying them elsewhere, including on a wider scale.

Participation process

The project was implemented in 2009 by the Rusenski Lom Nature Park Directorate, "Friends of Rusenski Lom" Club and WWF with the support of the Bulgarian Ministry of Culture, and was funded by WWF and the German Federal Ecological Foundation DBU.
Apart from the institutions and organisations mentioned, there were no other stakeholders actively involved. The project has gone through coordination procedures with the state administration and local authorities, but there has been no public consultation process.

Lessons learnt

This is a project that has been implemented on a small area and yet has a clear socio-economic and environmental positive service. Often small projects are questioned as to whether their implementation will have a measurable effect.
This is an example of a project that was not subject to public consultation and yet the lack of such consultation did not adversely affect the project.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Maintenance or enhancement of natural wetlands

Type 2,3 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Bulgaria
River, water body	Danube

Societal Challenges

1	2	3	4	5	6
✓	✓	✓	✓		✓

Other:

Stage	ME	Size	B
Geotype	L	IS	yes

Project WEBSITE

https://restorerivers.eu/wiki/images/5/50/WetlandsBrochure6.pdf

Project summary:

The Bulgarian Wetlands Restoration and Pollution Reduction Project, a pilot initiative under the GEF Black Sea/Danube Strategic Partnership, aims to control nutrient inflow to the Black Sea. The project focuses on wetlands restoration and nature protection, with Persina Nature Park and Kalimok/Brushlen Protected Site as key areas. It received funding from GEF, the World Bank, and other donors, totaling USD 13.28 million. By reconnecting wetlands to the Danube and promoting sustainable land use, the project aims to reduce trans-boundary nutrient loads and restore biodiversity.

Best practices and references

The project implements best practices in wetlands restoration and management, aligning with international conventions like the Ramsar Convention on Wetlands. It collaborates with local communities, government agencies and NGOs (Green Balkans, WWF and others). The initiative draws on successful experiences from other countries, such as Austria and Hungary, in wetlands restoration along the Danube River.

Environmental, socio-cultural, economic impacts

Restoring wetlands in Persina Nature Park and Kalimok/Brushlen Protected Site has significant environmental impacts, including biodiversity enrichment - new colonies of the Dalmatian Pelican were established at both project sites.
The nutrient reduction in the Danube River does not seem to be among the most significant contributions of this project .
Socio-culturally, the project fosters community engagement through mostly education and support for the traditional fishing practices.

Replication and scalability

The project serves as a model for other riparian sites facing similar challenges in biodiversity and wetlands degradation. Its success in Persina Nature Park demonstrates the feasibility of wetlands reconnection to the Danube linked with protected areas management. By sharing best practices and lessons learned, the project contributes to other efforts in the Danube basins to manage wetlands like Kalimok wetlands and Srebarna Lake.

Participation process

The consultative process in this project has taken place within a relatively limited range of stakeholders. These are state structures and local authorities. No private land or other property was affected in this project, which was a prerequisite for significantly more streamlined procedures. Communication with the local community proved to be very important in securing a positive attitude and support in ensuring the project outcomes.
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Lessons learnt

The establishment of a protected area (Persina Nature Park) and a state administration, which, among other things, is responsible for maintaining and developing the products of this restoration project, has proved to be the key to its successful implementation over the last more than 20 years.

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Maintenance or enhancement of natural wetlands
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 2,3 NBS

Sustainable management protocols
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Romania
River, water body	Danube Delta

Societal Challenges

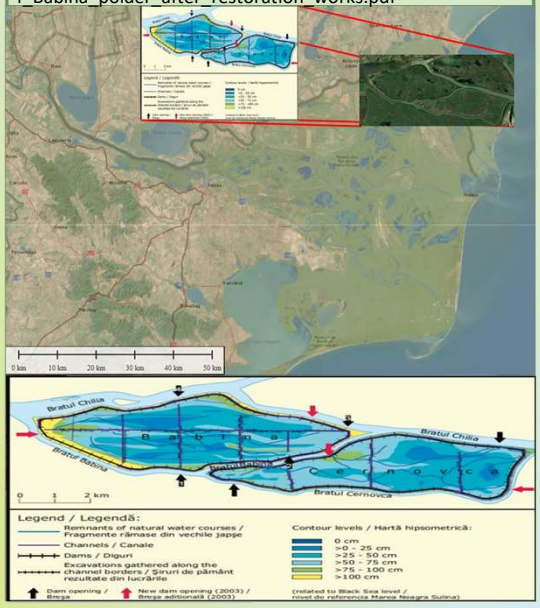
1	2	3	4	5	6
✓			✓	✓	

Other:

Stage	ME	Size	L
Geotype	L	IS	

Project WEBSITE

https://restorerivers.eu/wiki/images/b/b9/The_evolution_of_Babina_polder_after_restoration_works.pdf



Project summary:

The objective of ecological restoration in Babina and Cernovca Islets was to restore the natural, site-specific hydrological, biogeochemical and ecological functions, to ensure the redevelopment of the ecosystem and its functions and thus to promote the development of site-specific habitats and their biodiversity. More-over, the redevelopment of the natural resources should enable the local populations to proceed to their sustainable, traditional use.

Best practices and references

Babina and Cernovca Islets was the first projects in the Danube Delta where new paths were stroke, away from an intensive, site-unspecific use back to near-natural structures, exemplar for nature conservation with and for man. It caused a change of mind and offered new incentives to restore further flood prone areas that had been altered by man, in the Danube Delta but also in Fore-Delta.

Environmental, socio-cultural, economic impacts

Restored natural functions allow the redevelopment of natural resources and values that are to the benefit of the local populations and of major importance for the local, regional and national economy. Given their natural functions and values that are traditionally used with regard to sustainability, the restored wetlands also satisfy fundamental socio-economic functions. For the local populations of the Delta the restoration of abandoned agricultural polders and fish ponds is a good option as compared to the abandoned polders that could not be used as planned. Fish resources play a decisive role as they constitute the local populations' fundamentals of life. Reed cutting and use, especially with respect to the traditional construction methods in the Danube Delta, are among the major occupations of the people living in the Delta. Moreover, eco-tourism is of increasingly high importance. The landscape of the Delta, with its mosaic of waters and large reed areas, white willow gallery forests, dunes, the characteristic fauna of varying habitats and in particular its avifauna with large mixed, species rich colonies, benefits from a constantly growing interest. The areas comprised in the rehabilitation programme may thus also contribute to the development of an environmentally friendly sustainable eco-tourism.

Replication and scalability

The natural functions, once restored, develop certain existential values - natural and ideal resources - from which the local people can benefit, but also important for the local, regional and national economy. Through these traditionally and sustainably used resources and values, wetlands perform important socio-economic functions, providing the material basis for the local population. In this sense, ecological restoration is an alternative for abandoned agricultural and fish farms, which can no longer be used for the purpose for which they were intended.

Participation process

A management master plan that had been elaborated in a first phase for the Danube Delta Biosphere Reserve in 1992, comprised a number of areas to be restored, such as abandoned agricultural polders and unprofitable fish farms. Among these, the agricultural polders Babina (2100 ha) and Cemovca (1560 ha) were selected as pilot project areas for ecological restoration and were realized in a productive co-operation between the Danube Delta National Institute for Research and Development in Tulcea and the Institute for Floodplain Eco- logy of WWF Germany. Respective preparatory studies were conducted from 1992, allowing first restoration measures to be implemented already in 1994 in Polder Babina and in

Lessons learnt

The prerequisite for starting a restoration process is a concise planning and implementation of the necessary measures to be taken. In the spring of 1994, the Babina polder located in the northeastern part of the Danube Delta and previously used for agricultural purposes, was reconnected to the flood regime of the Danube River. In doing so, fresh ground was not only broken in terms of restoring the drained wetlands of the Danube Delta. Rather many crucial questions arose regarding the further development of the area. In terms of area development, how long would it take for the characteristic habitats to reappear? When will this wetland that was drained years ago be fully operational again and how long would it take Babina Island to return to its characteristic functions?

Type 1 NBS

Protection and conservation strategies
Ensuring of continuity of ecological networks (protection from fragmentation)
Maintenance or enhancement of natural wetlands
Monitoring: Regular monitoring of physical, chemical or biological indicators

Type 2,3 NBS

Sustainable management protocols
Integrated water resource management
Creation and preservation of habitats and shelters to support
Restoration of degraded waterbodies

EcoDaLLi

NBS CATALOGUE

Funded by the European Union

Country	Romania
River, water body	Danube Delta

Societal Challenges

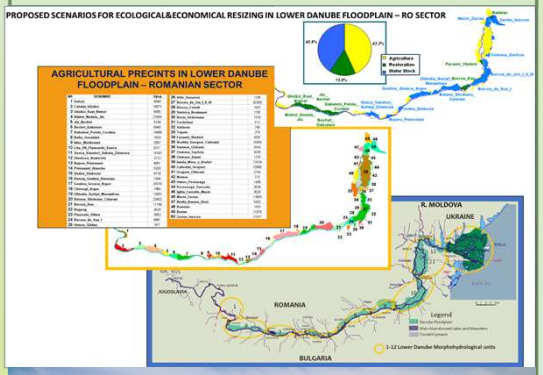
1 2 3 4 5 6

✓ ✓ ✓

Other:

Stage	IN	Size	L
Geotype	N	IS	

Project WEBSITE



Project summary:

The ecological and economical Program of re-evaluation the polders from Danube Floodplain and Delta was conceived and launch to give assistance to the Romanian Government in the process of strategically long-term planning for fulfilling the goals of the Water Framework Directive as well as for effective implementation of tasks regarding prevention, protection and mitigation of flooding effects, stipulated in the National Strategy for Flooding Risks Management.
The main objective of the program was to create the strategy of implementation of the integrated management concept (adaptative and ecosystemic) and sustainable development in Lower Danube Floodplain–Romanian Sector and also to elaborate priorities and criteria which show the ecologic, economic and social interests in order to evaluate the necessary and available resources, in order to increase the projects viability.

Best practices and references

Stipulated results: -defending localities against flooding;
-increasing touristic interest of the area and development of necessary infrastructure;
-benefits for local peoples referring to increasing of occupation level and developing of traditional activities as fishing, industrial fish processing, processing of reed, wood, osier etc.;
-Monitoring Integrating System in conditions of hydrologic risk;
-Rehabilitation and preservation of biological diversity specified for Lower floodplain of Danube River.

Environmental, socio-cultural, economic impacts

In the same time the program "Ecological and economical restoration of Lower Danube floodplain – Romanian sector" in order to implementing National Strategy of Management regarding Flooding Risk is in connection with European Union Directives (Water Framework Directive, Directives regarding Natural Habitat' Conservations, Wild Flora and fauna, Birds Conservations), and also the Objectives of Natural Strategy for Sustainable Development.
Danube River and its Valley in the Romanian Sector represented the subject of researchers for arrangement of the floodplain in order to its economical valorization, most of them stopped in 1970. With the view of implementing this Program, it insist on knowing at detailed level, the state of socio-economical and ecological systems, elaboration of digital model of the land and also hydraulic model, without can't be possible elaboration of the strategy against flooding.

Replication and scalability

The entire project, with the generated objectives and issues, contributes to:
•Uphold the shape, develop, integrate and consolidate an excellency network, recognized by the international norms.
•Growing the management system capacity for this field in Romania, to accumulate information, results and experience in highest scientifically and technical domains in order to spread them towards economical and social intern domain.
•An optimum focus and capitalize of the highest scientifically potential from Romania
•Harmonize to the EU Directives and requirements (Water Framework Directive, Floods Directive and Natura 2000)

Participation process

The diversity of the fields addressed through the imposed theme determined permanent meetings between partners to achieve a unique methodology in addressing these diverse topics, but also good information in the fields: remote sensing, soil quality, hydrology, economy and environmental protection.

Lessons learnt

1. Reconsidering the defense lines of localities against floods
2. Evaluation of the suitability of premises designed for economic activities in order to resize them as mixed premises (agricultural/polders for water storage)
3. Qualitative assessment of the environmental impact (regarding erosion, water balance, biodiversity conservation, etc.)
4. Calculation of the overall grade of each project and/or variant of the project.

Upper Danube NBS projects

NBS Type 1, 3

Country	Germany
River, water body	Danube

Societal Challenges

Stage	ME	Size	B
Geotype	I	IS	

Project website https://www.interreg-danube.eu/approved-projects/ides

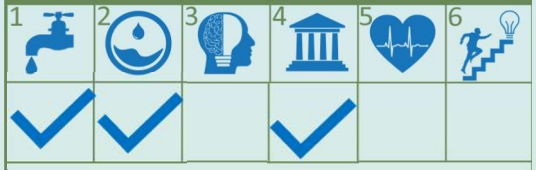
Project summary

The current DTP-Danube Floodplain Project (DFP) links attempts of improving flood retention and restoration, while water quality is not yet in focus. IDESproject aims to add water quality targets to this effort and improve water quality by developing an integrative floodplain management based on Ecosystem Services (ES). The transdiciplinary nature of the project links aspects related to the management of flood plains for both water retention (management) and improvement of water quality through the reduction of nutrients.

NBS Type 1, 2, 3

Country	Germany
River, water body	Danube

Societal Challenges



Stage	IN/RPE/ RF/ME	Size	B
Geotype	N	IS	

Project website https://rp.baden-wuerttemberg.de/themen/wasserboden/idp/

Project summary

The Integrated Danube Programme is a holistic concept that takes into account flood protection and ecology in equal measure. Measures for renaturation are used for flood protection and appropriately designed technical flood protection often improves ecology. Under the motto "Danube Habitat: Preserving-Developing" the IDP is intended to protect people from the floods of the Danube and develop the habitat of the Danube as a natural and cultural heritage. In the IDP, the Danube of Baden-Württemberg
Viewed as a whole. Individual projects such as flood protection measures, renaturation measures, the construction of fish ladders and bypass channels or the designation of nature reserves are seen in the context of an improvement of the entire Danube water system and listed in an overall view of the IDP.

NBS Type 1, 3

Country	Austria
River, water body	Danube

Societal Challenges

Stage	ME	Size	B
Geotype	N	IS	

Project website https://networknature.eu/case study/22570

Project summary

The Danube-Auen National Park in Vienna aims to multiple ecosystem services combine with trees with regulating services, such as water protection, retention, carbon sequestration, and micro, local, and regional climate regulation.

The National Park fosters an environment providing habitats and biodiversity for animal and plant species to enhance supporting ecosystem functions.

The National Park's blue and green infrastructure further aims to provide cultural functions by offering open spaces for recreational value, allowing urban dwellers to find aesthetic pleasure, a sense of place and inspiration.

NBS Type 3

Country	Austria
River, water body	Danube

Societal Challenges

Stage	REP	Size	B
Geotype	I	IS	

Project website https://project-merlin.eu/cs-portal/case-study-07a.html

Project summary

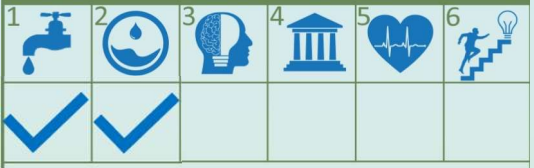
MERLIN "Mainstreaming Ecological Restoration of freshwater-related ecosy<stems in a landscape context: Innovation, upscaling and transformation" - Case study07 Restoration of the Danube floodplain in Austria

Upper Danube NBS projects

NBS Type 2, 3

Country	Austria
River, water body	Danube

Societal Challenges



Stage	REP	Size	B
Geotype	I	IS	

Project website https://life-iris.at/en/danube/

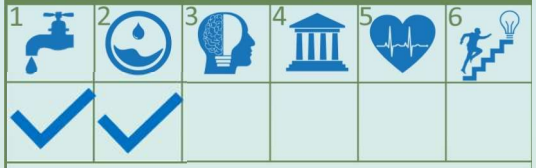
Project summary

In the area of tension between flood protection, hydropower use, shipping and nature conservation, the interests, responsibilities and planning framework conditions on the Danube in Upper Austria are particularly complex. For the first time in the history of the river, the project LIFE IRIS offers the opportunity to develop a joint action plan as result of a GE-RM planning process. Preparatory work for the planning process has been carried out and is now to be integrated – supplemented by further surveys and analyses – into a concept of measures, which is also coordinated and agreed with stakeholders.
Additionally a pilot measure with added value for flood protection and river ecology will be implemented. It is planned to create a gravel island and a side branch in the downstream section of the hydropower plant Ottensheim. By lowering the terrain, pioneer areas for gravel islands and floodplain forest sites will be created and the flood runoff will be improved.

NBS Type 1

Country	Austria
River, water body	Danube

Societal Challenges



Stage	RF	Size	B
Geotype	N	IS	

Project website https://www.life-netzwerk-donau.at/en-at

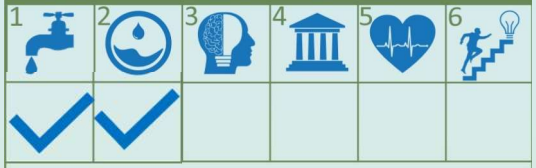
Project summary

3 fish passes, 4 locations, 5 measures: between 2016 and 2020, project manager VERBUND worked with partners to implement extensive improvements to waterbodies and species diversity on the Danube in Austria. The measures represent so-called “ecological stepping stones” and interconnect four Natura 2000 areas.

NBS Type 1, 2, 3

Country	Austria
River, water body	Traisen

Societal Challenges



Stage	ME	Size	B
Geotype	N	IS	

Project website https://www.life-netzwerk-donau.at/en-at

Project summary

Between 2009 and 2019, the LIFE+ Traisen project gave rise to a unique river landscape with a mosaic of existing and new habitats.
Many kinds of flora and fauna have already settled into the area. Many endangered kinds of flora and fauna have found a new home here. The river landscape will now continue to develop naturally and undisturbed.

A natural river course with densely vegetated banks: that’s what the area around the mouth of the Traisen looks like today. This was made possible by the LIFE+ Traisen project – Austria’s largest land restoration project to date.

Middle Danube NBS projects

NBS Type 1, 2

Country	Hungary
River, water body	Danube
Societal Challenges	1 ✓, 5 ✓
Stage	REP
Size	S
Geotype	N
IS	
Project website	https://wildisland.danubeparks.org/our-actions/current-progress/

Project summary

The Fertő-Hanság National Park Directorate carries out a project on one of the Danube islands and sidearms called Erebe.

The development, financed by the international Life Wild Island project, aims to increase the amount of water replacement, dredging of the sidearm and the creation of spawning grounds in order to restore the habitats of the island.

NBS Type 1

Country	Serbia
River, water body	Kolubara /Sava/
Societal Challenges	1 ✓, 4 ✓, 6 ✓
Stage	NBSa
Size	S
Geotype	N
IS	yes
Project website	www.reconect.eu

Project summary

RECONECT aims to rapidly enhance the European reference framework on Nature-Based Solutions (NBS) for hydro-meteorological risk reduction by demonstrating, referencing, upscaling and exploiting large-scale NBS in rural and natural areas.

NBS Type 4

Country	Serbia
River, water body	Danube
Societal Challenges	1 ✓, 4 ✓, 6 ✓
Stage	NBSa
Size	L
Geotype	N
IS	yes
Project website	https://doi.org/10.1007/s13280-020-01419-4

Project summary

NBS Type 3

Country	Austria
River, water body	Danube
Societal Challenges	1 ✓, 2 ✓, 4 ✓
Stage	REP
Size	B
Geotype	I
IS	
Project website	https://project-merlin.eu/cs-portal/case-study-07a.html

Project summary

MERLIN "Mainstreaming Ecological Restoration of freshwater-related ecosy<stems in a landscape context: Innovation, upscaling and transformation" - Case study07 Restoration of the Danube floodplain in Austria

Lower Danube NBS projects

NBS Type 1, 2

Country	Bulgaria
River, water body	Danube
Societal Challenges	1 ✓, 2 ✓, 3 ✓, 4, 5, 6
Stage	IN,RF,ME2
Size	M
Geotype	L
IS	yes
Project website	https://doi.org/10.1007/s40710-023-00659-2

Project summary

The Bulgarian Wetlands Restoration and Pollution Reduction Project, a pilot initiative under the GEF Black Sea/Danube Strategic Partnership, aims to control nutrient inflow to the Black Sea. The project focuses on wetlands restoration and nature protection, with Persina Nature Park and Kalimok/Brushlen Protected Site as key areas. It received funding from GEF, the World Bank, and other donors, totaling USD 13.28 million. By reconnecting wetlands to the Danube and promoting sustainable land use, the project aims to reduce trans-boundary nutrient loads and restore biodiversity.

NBS Type 1, 2,3

Country	Bulgaria
River, water body	Danube
Societal Challenges	1 ✓, 2 ✓, 3 ✓, 4 ✓, 5, 6 ✓
Stage	ME
Size	B
Geotype	I
IS	yes
Project website	https://persina.bg/проекти https://restorerivers.eu/wiki/images/5/50/WetlandsBroshure6.pdf

Project summary

WETLANDS RESTORATION AND POLLUTION REDUCTION PROJECT at Persina Nature Park

NBS Type 1, 3

Country	Bulgaria
River, water body	Rusenski lom
Societal Challenges	1 ✓, 2, 3, 4, 5 ✓, 6
Stage	ME
Size	M
Geotype	L
IS	yes
Project website	https://restorerivers.eu/wiki/index.php?title=Case_study%3ARestoration_of_Rusenski_Lom_River_near_Ivanovo#Lessons_Learnt

Project summary

The project was implemented in 2009 by the Russenski Lom Nature Park Directorate, Club „Friends of Russenski Lom" and WWF with the support of the Ministry of Culture and was funded by WWF and the German Federal Ecological Foundation DBU The main issues are the following: •In the mid 20th century most of the lower flow of Russenski Lom River was fully diverted;•High water floods the road;•When water overflows the dike it can no longer go back into the river;•The flood in 2006 washed away the bridge and the alcoves on the island once again;•In this case, the water itself suggested the solution to the problem;•It is the first example in Bulgaria for application of the principle "more space for the river – more safety for people", proven yet in mid 20th century.

NBS Type 3

Country	Bulgaria
River, water body	Danube
Societal Challenges	1 ✓, 2 ✓, 3, 4, 5, 6 ✓
Stage	RF
Size	B
Geotype	L
IS	
Project website	https://www.wwf.bg/what_we_do/rivers/kaikusha_marsh_restoration/ https://persina.bg/files/modules/183/attch-f-96bde-listovka-proekt-opos-persina-

Project summary

Restoration of Kaikusha Marsh in Persina Nature Park

Danube Delta NBS projects

NBS Type 1, 3

Country	Romania
River, water body	Danube

Societal Challenges

Stage	RF	Size	B
Geotype	L	IS	

Project website

Project summary

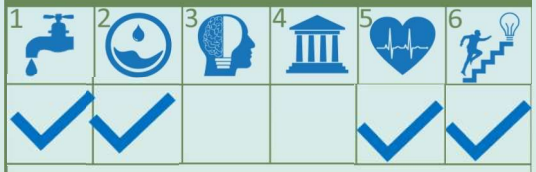
Carasuhat agricultural polder

Reconstrucţia ecologică a terenurilor aparţinând domeniului public al consiliului local Mahmudia în cadrul incintei agricole Carasuhat din delta Dunării

NBS Type 1, 2,3

Country	Romania
River, water body	Danube

Societal Challenges



Stage	RF	Size	B
Geotype	L	IS	

Project website

Project summary

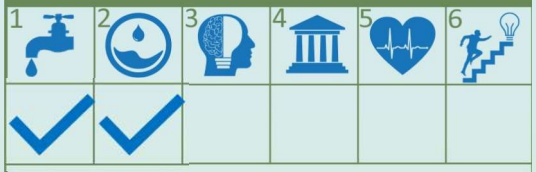
Gîrla Mare wetland

Imbunatatirea conditiilor ecologice ale zonelor umede de la Garla Mare

NBS Type 1, 2, 3

Country	Romania
River, water body	Danube

Societal Challenges



Stage	RF	Size	B
Geotype	L	IS	

Project website

Project summary

Babina and Cernovca agricultural polder

The objective of ecological restoration in Babina and Cernovca Islets was to restore the natural, site-specific hydrological, biogeochemical and ecological functions, to ensure the redevelopment of the ecosystem and its functions and thus to promote the development of site-specific habitats and their biodiversity. More-over, the redevelopment of the natural resources should enable the local populations to proceed to their sustainable, traditional use.

N B S CATALOGUE

Ecosystem-based governance with
Danube lighthouse Living Lab
for sustainable innovation processes

Nature-based Solutions Catalogue
of Projects and Measures

#EcoDaLLi #DanubeLighthouse
#EUmissions #HorizonEU #MissionOcean

EcoDaLLi Project

ecodalli.eu

Horizon Europe Project

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