replaced fodder legumes. Transport infrastructures were improved, and agricultural land ameliorated. Under the slogan of the 10th federal state, the Austrian administration initiated a systematic drainage of wetlands and bogs, which also affected the floodplains in connection with water regulation and flood protection (Ramsauer 1948).

As the Morava floodplains had been a border region between Austria and Slovakia since 1918, they were far less affected by these developments than most of the Austrian agricultural land. The proportion of arable land remained largely the same the investigated villages. However, their locations had shifted by 2020 (*fig. 4*). More than 20% of these areas were still forested in 1942, and 15% were ploughed as grassland. Grassland was converted into cereal fields, especially in the south of Marchegg. In contrast, the fields in the Slovakian floodplains almost entirely disappeared by 2020 (*fig. 5 and 6*).

The settlements in the analysed area grew from 56 to 68 ha between 1942 and 2020. The new areas mainly expanded around the historic centres. With a few exceptions, urban sprawl did not affect the Morava floodplains. Outside the floodplains, however, such processes did occur.

The most obvious change was the increase in forests in the second half of the 20th century. At around 1,730 ha, this land use type reached its most considerable extent since the 1820s. On the one hand, this expansion affected the area of today's WWF floodplain reserve, where the forest areas grew from 800 to 913 ha. However, this applied far more to the area outside the reserve, where the forests increased from 564 ha in 1942 to 818 ha in 2020, mainly on former grassland.

The two land use maps from 1942 and 2020 (*fig. 4 and 5*) show further developments in the second half of the 20th century: Single patches of forests as well as arable land and grassland were much larger due to rezoning plans following Austrian agricultural policy after the World War II. Pre-industrial plot divisions with small-scale utilisation structures were abandoned in favour of more efficient land cultivation with machines.

From 1970 onwards, most of the Morava floodplains studied here came under the care of the WWF. Since then, this area has been managed according to nature conservation principles as the Marchegg floodplain reserve (WWF 2022).

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The EU Mission 'Restore our Ocean and Waters' and its Danube & Black Sea Lighthouse coordinated by the EcoDaLLi Project

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Background

Around 75% of the Earth's surface is covered by oceans, seas and inland waters. They play a crucial role in the Earth's global ecosystem; their protection is fundamental to our future. Unfortunately, our oceans and waters are under serious threat from pollution, overfishing, unsustainable tourism and inappropriate land use. In addition, the consequences of the climate crisis, such as floods, droughts, rising temperatures, rising sea levels and heatwaves, are putting considerable pressure on water systems. One of the consequences of this is the loss of valuable biodiversity in water systems all over the world.

Restoration and full exploration of European marine and freshwater ecosystems by 2030

For this reason, the European Commission has launched a dedicated mission: The EU Mission 'Restore our Ocean and Waters by 2030'. It aims to contribute to the restoration, protection and full exploration of European marine and

freshwater ecosystems by 2030. Specifically, the objectives and three priorities of the Mission Ocean & Waters are: (1) protecting and restoring marine and freshwater ecosystems and their biodiversity, (2) preventing and reducing water pollution, and (3) creating a carbon-neutral and circular blue economy. The mission thus also supports the political goals of the Green Deal and is divided into two phases: Potential solutions demonstrated in a first phase (2021-2025) will be scaled up and replicated across the EU in the second phase (2026-2030). Implementation at regional, local and municipal levels is crucial to the success of the Mission; research and innovation also have an important contribution to make.

Lighthouses within the EU Mission 'Restore our Ocean and Waters'

In order to achieve the ambitious goals, four Lighthouse areas have been created in four large EU sea and river basins. These Lighthouses bundle the activities of the Mission and are sites for the piloting, demonstration, development and deployment of innovative solutions. Each area has been assigned one of the four main objectives of the Mission Ocean & Waters (*fig. 1*): Thus, the Mediterranean Sea Basin Lighthouse is dedicated to the prevention and reduction of water pollution; the Baltic & North Sea Basin Lighthouse to a sustainable blue economy that is climate neutral and circular. The protection and restoration of marine and freshwater ecosystems and biodiversity are central themes of the Danube River Basin Lighthouse with connections to the Black Sea and the Atlantic & Arctic Basin Lighthouse.

'If you would like to support the EU Mission Ocean & Waters and its Danube & Black Sea Lighthouse, you can submit actions that contribute to its objectives through the Mission Charter. By doing so, you send a clear message to European institutions about the important work being done in the Danube region. Mission Charter actions can take many forms, including supporting research and innovation, sharing knowledge, deploying solutions, providing education, or engaging citizens in ecosystem protection – ultimately contributing to a healthier Danube River Basin. Every contribution matters. Submit your actions here: https://ec.europa.eu/eusurvey/runner/MissionOceanWatersCharter.'

Elements for implementing the Mission objectives

Horizon Europe-funded projects are essential for achieving the Mission's objectives. Each of the four Lighthouses is coordinated by a Coordination and Support Action (CSA) project and is accompanied by Innovation Action (IA) and Research and Innovation Action (RIA) projects. In addition, there are also cross-lighthouse projects that contribute to the objectives of the Mission. The 'Digital Twin Ocean', a virtual representation of the ocean that combines ocean observations, artificial intelligence and advanced modeling on high-performance computers, and the 'Mission Charter' are also of great importance for the implementation of the Mission objectives. The Mission Charter unites stakeholders and provides tools, services, and best practices, while quantifying the Mission's impact and success.

Figure 1. Four Lighthouses of the EU Mission 'Restore our Ocean and Waters' and their assigned main objectives.

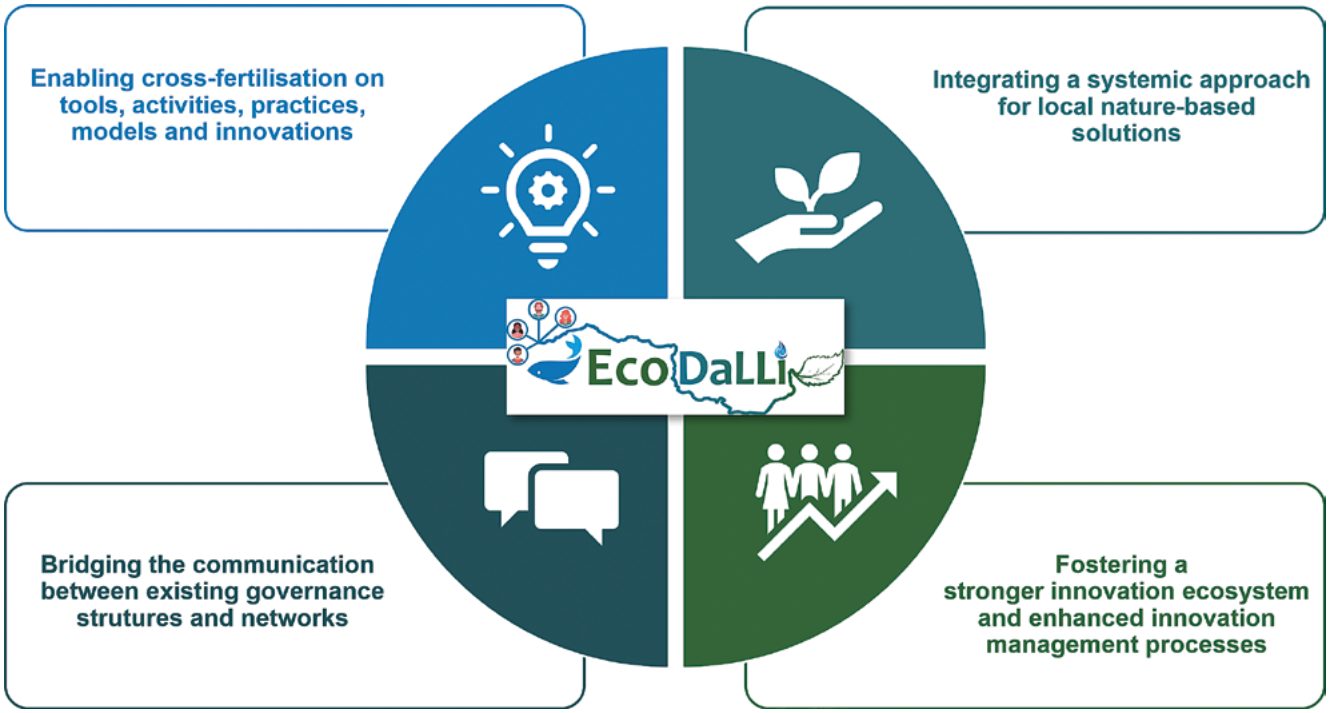

Figure 2. Main goals of the EcoDaLLi project as CSA of the Danube & Black Sea Lighthouse.

Projects within the Danube & Black Sea Lighthouse

The Danube & Black Sea Lighthouse is one of the four Lighthouses in the Mission Ocean & Waters. It currently comprises seven projects: EcoDaLLi as CSA and six IAs: DANUBE4all, DALIA, DaWetRest, Restore4Life, SUNDANSE and iNNO SED. While the DANUBE4all and DALIA projects are dedicated to the restoration of the Danube river, DaWetRest and Restore4Life are committed to the revitalization of climatically valuable wetlands. SUNDANSE and iNNO SED both focus on sediment management in the Danube & Black Sea basin. EcoDaLLi as a CSA works closely not only with the other Lighthouse areas and associated projects, but also with all key stakeholders and governance structures relevant to the Mission. The projects are funded by the EU with a total of 52.3 million euros under Horizon Europe.

Figure 3. Participants of the workshop 'Strengthening the Danube Innovation Ecosystem' in Ulm, Germany, organized by EcoDaLLi in cooperation with Priority Area 8, Competitiveness of Enterprises, of the EU Strategy for the Danube Region.

The EcoDaLLi project

EcoDaLLi (2023-2026) stands for 'ECOsystem-based governance with Danube lighthouse Living Lab for sustainable Innovation processes'. Coordinated by Steinbeis Europa Zentrum (SEZ) in Germany, the project brings together 17 partners and one associated partner from eleven countries. Through a network of Living Labs, EcoDaLLi strengthens collaboration between stakeholders, driving the development and implementation of innovative, sustainable solutions for the Danube and its delta. The project aims to build a robust innovation ecosystem, supporting the ecological restoration, protection and conservation of the Danube basin and its delta.

EcoDaLLi's concept and achievements

EcoDaLLi is built around four key objectives that guide its mission to support sustainable innovation in the Danube basin. These goals, illustrated in figure 2, focus on promoting collaboration, integrating nature-based solutions, and strengthening the region's governance and innovation ecosystem. Through these efforts, EcoDaLLi aims to enhance ecological restoration and support the long-term health of the Danube basin.

Key achievements of the project so far include the development of a nature-based solutions methodology and a best-practice catalog, which is designed to support the implementation of sustainable approaches across the Danube region. EcoDaLLi has also launched a Danube Innovation Community through stakeholder engagement workshops and Living Labs (*fig. 3*), facilitating collaboration among various stakeholders. Additionally, the project has established the EcoDaLLi portal, which serves as a repository for all project results (https://portal.ecodalli.eu/). A Danube & Black Sea Lighthouse Roadmap provides the framework for close cooperation between the Lighthouse projects to ensure effectiveness in working towards the shared goal: reaching the targets set by the Mission for the Danube & Black Sea Lighthouse.

Looking ahead to the project's completion in June 2026, EcoDaLLi will focus on capacity-building activities for stakeholders, offering targeted trainings to help scale up innovations demonstrated in the Danube & Black Sea Lighthouse. The project will also develop a Danube Innovation Action Plan, which will integrate its key outputs to ensure they are reflected in long-term governance policies. This plan will not only support entrepreneurship in the Danube basin but also foster cross-border cooperation, contribute to a healthier environment, and further strengthen the innovation ecosystem. Through these efforts, EcoDaLLi will facilitate shape strategies and policies that drive progress towards the overarching goals of the Mission Ocean & Waters.

Hands-On Science: IAD Summer School in the Danube Delta, 2024

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Abstract

By the end of August 2024, more than 20 student applicants nominated by IAD national representatives and 13 IAD expert group leaders and lecturers attended a one-week IAD Summer School in the Danube Delta. Ten students were from Romania and Austria, while another twelve came from Bulgaria, Hungary, Serbia, Ukraine and Slovakia. The summer school focused on microplastics, along with wetland biodiversity and nature conservation, reed management, and landscape development in the context of climate warming mitigation. Lecturers, who volunteered their time, represented many IAD countries and shared their expertise in diverse scientific fields, including microbiology, biota field surveys, reed management, wetland landscape planning, nature conservation, and climate research, as well as environmental education. This project was financed by the 'Executive Agency for Higher Education, Research, Development and Innovation Funding' Romania and IAD.

Excursion Details

Danube Delta Scientific Summer School aimed to create a friendly and open atmosphere for students and lecturers, sharing scientific practice in the floodplain and scientific discussions at 'round tables'. This was in line with the mission statement of IAD, to foster space for scientific collaboration and mutual exchange. IAD, as vital scientific network, is dedicated to a better understanding and protection of the Danube River and its catchment. By connecting with fellow participants and experts during IAD scientific summer school, we aimed to strengthen a better understanding of the many vital Danube Delta ecosystems, a unique area of 6,264.03 km² biosphere reserve established in 1998 under UNESCO's Programme on Man and the Biosphere and shared by Romania and Ukraine.

The lecturers have brought in their broad and deep expertise in aquatic sciences, while the students, many of whom are PhD candidates, also offered specialized knowledge backgrounds. This diverse mix of participants from various Danubian countries promises a rich learning experience. Thus, we had meaningful and stimulating discussions about former collaboration and joint projects and shared discoveries as we explored the fascinating world of the Danube Delta together. The photo figure 1 A shows the whole group of participants of this summer school in front of the small