The Amazon of Europe: Past and future of the Five-country Biosphere Reserve Mura-Drava-Danube

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Abstract

With its rich biodiversity, the world's first Five-country Biosphere Reserve Mura-Drava-Danube is not only Europe's largest protected river habitat, but also stands as an example of transboundary cooperation. Historically shielded during the Cold War, it is now a haven for biodiversity, serving as a critical habitat for more than 5,000 species, including the white-tailed eagle and black stork, playing a vital role in regional ecosystems and supporting the well-being of local communities.

In the face of challenges such as habitat destruction, the climate crisis and declining biodiversity, international projects aim to ensure the resilience of this unique habitat by promoting sustainable management and implementing restoration efforts.

Introduction

Stretching over 700 kilometres and covering 930,000 hectares across Austria, Slovenia, Hungary, Croatia and Serbia, the 'Amazon of Europe' is home to an extraordinary riverine landscape formed by the Mura, Drava and Danube rivers. This extensive, near-natural river area is home to a wide range of diverse and rare species and thus represents one of the most valuable contiguous river landscapes in Central Europe (Mohl et al. 2020).

In September 2021, this unique area received global recognition from UNESCO as the world's first five-country biosphere reserve, making it also the largest connected river-protected area in Europe. This landmark designation of the UNESCO Five-country Biosphere Reserve Mura-Drava-Danube (Transboundary biosphere reserve - TBR MDD) represents a significant accomplishment in transboundary river protection on a global scale. It serves as a model for international cooperation in environmental protection and highlights the significance of joint efforts between nations to safeguard our planet's invaluable ecosystems.

The story of the TBR MDD underscores the commitment of the countries involved to conserve their unique natural heritage and provides a guiding framework for similar conservation efforts for other riverine areas in the future.

The journey to unity

The Danube, along with its tributaries, has served as a significant historical trade corridor in Europe, connecting diverse cultural and natural realms. During the Cold War, its role as a commercial pathway diminished as it runs between the opposing blocs of the Warsaw Pact and NATO, with neutral Austria and Yugoslavia in the middle. This led to reduced human interference along its borders (Austria-Forum 2020). Unintentional neglect allowed segments of the Danube, Drava, and Mura rivers to develop naturally, creating a rich ecosystem of islands, steep clay and sandbanks, water channels and riparian forests that are home to a number of rare species (Mohl et al. 2009; Schneider-Jacoby 2012; Schneider-Jacoby & Mohl 2012).

The fall of the Iron Curtain in 1989 led to significant political changes in Europe, opening up previously closed areas along the Mura, Drava and Danube rivers. This increased access also brought increased threats and led to large-scale plans for river regulation, gravel extraction and new hydroelectric power plants. These transformations would have caused severe environmental damage by deepening the riverbed and cutting off wetlands and floodplain forests from the water supply and had the potential to further disrupt the natural habitats in the area (Mohl et al. 2009).

In the early 1990s a major effort began to preserve Europe's last unspoilt riverine landscapes. Initiated and coordinated by EuroNatur in 1993, this effort focused on bringing together stakeholders from Croatia, Austria, Serbia, Slovenia and Hungary, who launched the idea of a transboundary biosphere reserve (BR), as a counter-vision to the plans of building new hydropower dams on the Drava River (Koeck et al. 2022).

By 1997, the idea had developed into a concept for a transboundary Mura-Drava-Danube BR. International efforts to preserve the Mura-Drava-Danube corridor intensified from 2000 under the coordination of WWF. A major step forward came in 2009, when Croatia and Hungary agreed to establish the Mura-Drava-Danube BR to jointly protect their part of the ecosystem, leading to a five-country agreement in 2011. In 2012, UNESCO officially recognised the Croatian-Hungarian section. From there, one success followed another. In June 2017, the Serbian section of the Danube was recognised as a biosphere reserve, followed in the next two years by the Slovenian and Austrian sections of the Mura.

In September 2021, when the TBR MDD was officially recognized by the International Coordinating Council of UNESCO's Man and Biosphere Programme (UNESCO-MAB-ICC) (UNESCO 2021; Zollner & Wolf 2020), an idea born nearly 30 years earlier finally came to fruition.

This designation not only cemented the area's status as Europe's largest protected riverine habitat, but also underlined the critical role of collaborative stewardship in safeguarding the region's biodiversity against the backdrop of climate change and habitat loss.

The UNESCO Five-country Biosphere Reserve Mura-Drava-Danube

Ecosystems often extend beyond national borders and may be subject to differing or conflicting management and land use practices due to political rather than ecological factors. To address this issue, Transboundary Biosphere Reserves (TBRs) offer a collaborative management solution. A TBR is an official recognition at the international level of the political will by an UN institution to cooperate in the conservation and sustainable use of a shared ecosystem through joint management. Currently, there are 738 biosphere reserves in 134 countries that belong to the World Network of Biosphere Reserves, of which only 22 are transboundary, mostly bilateral.

Biosphere reserves serve three functions: conservation of ecosystems, sustainable socio-economic development, and the promotion of education, research, and monitoring.

The management of the region is based on three different zones (see *fig. 1*):

- the core areas, which are very sensitive, strictly protected;
- the buffer zone, where the landscape is protected and managed – together with the core zone of a size of 270,000 ha in the TBR MDD;
- the transition area, open to regional sustainable development – 660,000 ha of the TBR MDD.

The establishment of the TBR MDD is a good demonstration of UNESCO's intention to promote the establishment of TBRs, namely: the potential to resolve conflicts and strengthen trust between states (Ishwaran 2006; German UNESCO Commission 2007).

In addition to the TBR protection status, the region benefits from various additional levels of protection, such as the Natura 2000 network, which is an EU-wide ecological network of protected areas. There are a total of 17 Natura 2000 sites across all five countries and the Special Nature Reserve 'Gornje Podunavlje' in Serbia highlighting the ecological significance of these river environments. Additional examples of protected areas include the Mura-Drava Regional Park in Hungary, as well as the Kopacki Rit Nature Park and the Drava Mura Regional Park in Croatia.

These conservation efforts are supported by international and EU environmental legislation, including the Ramsar, Bern, and Bonn Conventions, as well as the EU's Habitats and Birds Directives (Schwarz & Mohl 2009).

A haven of biodiversity

The 'Amazon of Europe' is a biodiversity hotspot of global importance. Its vast floodplains and forests are home to more than 5,000 animal species and provide a vital corridor for migratory species. The reserve is home to the Danube Basin's largest coherent floodplain forest system and serves as a breeding ground for the highest density of white-tailed eagles *(Haliaeetus albicilla)* in continental Europe, with over 140 breeding pairs, and is a resting place for over a quarter of a million waterfowl.

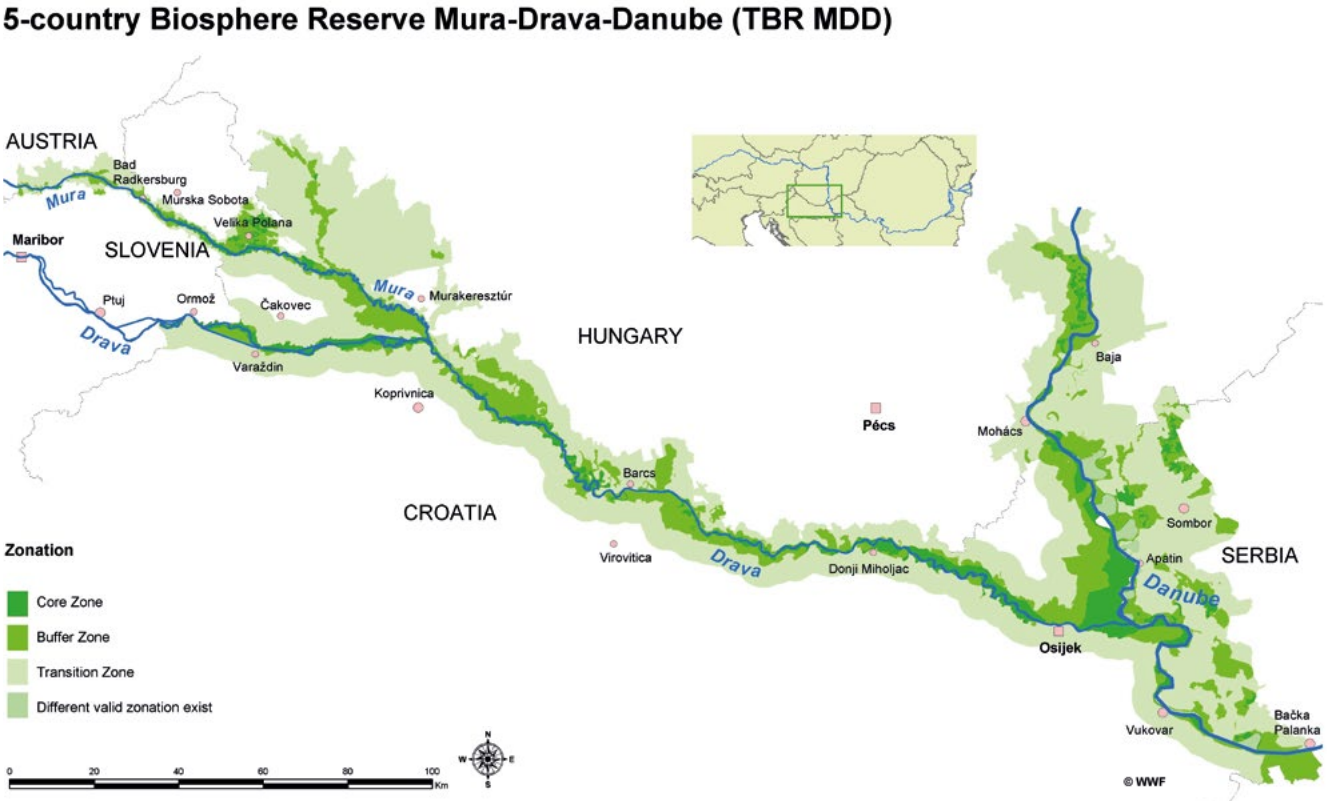

Figure 1. The TBR MDD and its core, buffer and transition zone. ©WWF

The extensive floodplains also provide the perfect habitat for a variety of a number of other endangered species. For example, in addition to the white-tailed eagle, black storks *(Ciconia nigra)* breed in the floodplain forests. Little ringed plovers *(Charadrius dubius)* nest on the gravel and sand banks of the rivers as well as the common sandpiper *(Actitis hypoleucos)* and the critically endangered little tern *(Sternula albifrons)*. Up to 7,000 breeding pairs of sand martins *(Riparia riparia)*, European bee-eaters *(Merops apiaster)* and common kingfishers *(Alcedo atthis)* nest in the natural steep river banks. The river system itself is home to rare fish species such as the sterlet *(Acipenser ruthenus)*, wild carp *(Cyprinus carpio carpio)* and huchen *(Hucho hucho)* (Schneider-Jacoby 1994; Mohl et al. 2009; WWF/EuroNatur 2009).

This rich tapestry of life is supported by a mosaic of habitats ranging from extensive floodplain forests, wet meadows, natural islands, gravel and sandbanks, steep banks, side channels, and oxbows that have remained relatively untouched by human development. This unspoilt nature owes much to the reserve's complex history as a borderland, which for decades limited human access and intervention, inadvertently fostering a refuge for wildlife.

In addition to their rich biodiversity, the rivers and floodplains play a vital role in the lives of local communities. The extensive floodplains ensure favourable groundwater conditions and provide self-purification of water, which is essential for the region´s drinking water supply. They also offer effective natural flood protection and are of great importance as a recreational area. Moreover, local fishers depend on the fish populations for their livelihoods. The beautiful landscape also has great potential for sustainable tourism, which is further supported by various local projects such as the 'Amazon of Europe Bike Trail' project, described later in this article (Stumberger et al. 2021).

The way forward

The TBR MDD includes a diverse array of ecological conditions and conservation statuses. The condition of the river banks across these rivers varies significantly: about 190 km (9%) remain in a natural state, 765 km (38%) are considered near-natural, and 1,081 km (53%) have been altered or impacted, primarily due to embankment constructions. Notably, the river Mura along the border between Austria and Slovenia sees up to 95% of its banks fixed with embankments, while some sections of the Mura, the Drava in Croatia and Hungary, and the Danube between Croatia and Serbia have less than 40% of their banks altered (WWF 2013).

Figure 2. Implementation of the DRAVA LIFE project in March 2024, showing the opening of a new initial channel at River Drava near the Croatian village of Novačka. ©Goran Šafarek

Figure 3. A section of the Mura River near the village of Petanjci. On the left side, in 2022, the river is very regulated and doesn't have much space. Only one year later, after the implementation of the measures of the Natura MURA project, in this case, the widening of the river bed, the river takes a more natural shape and has more space to form vital habitats such as sandbanks and gravel islands as shown in the photo on the right side. ©VGP, Simon Veberič

The total active floodplain area is reported at 132,341 hectares, accounting for 22% of its historical extent. The majority, or 78%, has been lost to flood protection measures like dikes, with the percentage of active floodplain loss ranging from 66% to 90% in different countries (WWF 2013). Despite these challenges, these floodplains continue to offer crucial ecosystem services, including flood risk mitigation, groundwater regulation, water purification, and supporting recreational and tourism activities.

In the face of ongoing threats such as habitat fragmentation, invasive species and climate change, the establishment of the TBR MDD marks the beginning, not the end, of conservation and restoration efforts. Already during the efforts to establish the TBR MDD, it was shown that repeated plans for new hydropower plants and river regulation 'fuelled' the work and message of national and international NGOs in the area. Another way to fuel and bring forward the message of the TBR was the implementation of cross-border initiatives and cooperation projects, such as those that involved EU funds.

Examples of these projects include the Danube Transnational Programme (DTP) 'coopMDD' project, which aimed to develop common management guidelines for the TBR MDD in cooperation with stakeholders from all five countries (Interreg 2017). This cooperation was continued by the Interreg DTP 'lifeline MDD' project, which aimed to develop a joint five-country restoration strategy and implementing it on a pilot basis (Interreg 2020). Finally, another project that has certainly contributed to establishing sustainable tourism in the TBR MDD is the Interreg project 'Amazon of Europe Bike Trail', a cross-border bike trail along the Mura, Drava and Danube rivers running through all five countries (Interreg 2018).

Other projects focus on the implementation of conservation measures, such as the 'DRAVA LIFE' project, which aims to improve the ecosystem of the Drava River in Croatia through river restoration measures. As part of this project, major restoration works were carried out in the last months, demonstrating the joint restoration efforts of water management, nature conservation and NGOs for the benefit of flood protection and nature conservation (DRAVA LIFE, 2016).

'WISE DRAVA LIFE' works to improve the conservation and resilience of valuable floodplain forests (WISE DRAVA LIFE 2021; *fig. 2*). Similar projects have also been set up along the Mura River, such as 'Natura MURA', which addresses the key challenges of nature conservation and provision of ecosystem services in the Mura floodplain (Natura MURA 2021; *fig. 3*). This list is not exhaustive, but aims to show the variety of projects and stakeholders involved in supporting the message of the TBR MDD and its conservation.

LIFE RESTORE for MDD

Following its designation in 2021, the TBR MDD Steering Committee (TBR MDD SC) agreed to develop a five-country LIFE restoration project to bring the TBR idea to life (*fig. 4*). The largest restoration project in the TBR MDD to date began in October 2023, involving 17 institutions and organisations in five countries, including public administrations for nature conservation, water, forest and regional management, as well as universities and NGOs, coordinated by WWF-Austria.

With a budget of € 20,024,000 co-funded by the European Union's LIFE programme, and with the involvement of the TBR MDD SC as an advisory body, the project aims to rehabilitate 29 sites along the rivers in the five countries. The aim is to create 2,472 hectares of more robust floodplain forests, reconnect 54,230 metres of river side channels and remobilise 966,000 m³ of sediment to create new gravel and sand banks. This goal will be accomplished by implementing a series of measures, including reconnecting river branches, widening river beds, restoring oxbows and meadows, purchasing valuable land, converting poplar plantations into more natural floodplain forests, and removing alien species in 17 Natura 2000 sites in the TBR MDD (see *fig. 4*). Additionally, large-scale plans for future restoration are being developed. These actions will not only provide valuable habitats for rare fish and bird species, but they will also restore healthier floodplain forests and increase their resilience to drying out.

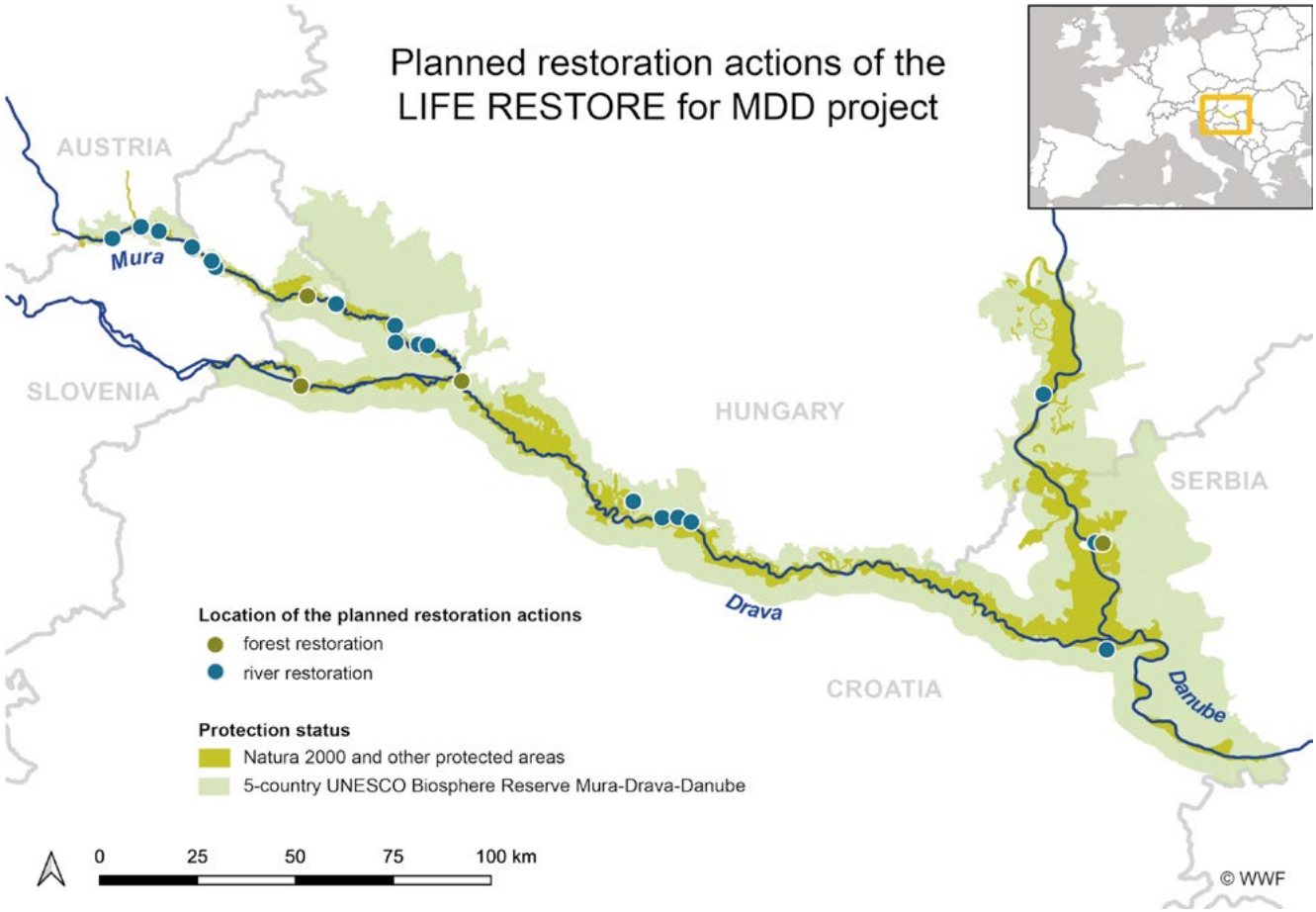

Figure 4. Planned restoration actions of the LIFE RESTORE for MDD project © WWF

These efforts are complemented by a strong emphasis on environmental education, public awareness and stakeholder engagement, as well as continuous monitoring, ensuring a holistic approach to conservation that involves and benefits local communities (WWF 2023).

Biodiversity extends beyond state borders (Batisse 1997). Therefore, promoting cooperation across political boundaries is crucial for nature conservation and concern for one's own habitat. The TBR MDD serves as an example of successful transboundary cooperation in environmental stewardship and is a significant milestone in global conservation efforts. However, declaring a biosphere reserve is only the initial step towards creating resilient natural areas in the face of mounting environmental pressures.

The effectiveness of transboundary cooperation in tackling global challenges, such as habitat destruction, the climate crisis, and the decline in biodiversity, is exemplified by projects like 'LIFE RESTORE for MDD', a cooperation, which benefits both nature and people in the Five-country Biosphere Reserve Mura-Drava-Danube.

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Islands as a Web of Life – Humans and Nonhumans in the Middle of the Danube

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When, in May 2020, I submitted an application to the Romanian National Research Agency (UEFISCDI) for a research project on the historical and social life of Lower Danube islands, many of my fellow anthropologists and historians raised an eyebrow. Indeed, islands are vital elements of the river ecosystem as they are playing important hydro-morphological and ecological functions. They contribute to water self-purification and the retention of sediments and nutrients, they provide important habitats for birds, animals, insects and fish reproduction and feeding, and support of a wide variety of vegetation and endemic species (Wyrick 2005; Schneider 2015; Krause 2016). It is hard to deny the river islands importance for the nonhuman life. Islands of the Lower Danube are not inhabited mostly because they are too small for this. For instance, around 1900, the average size of the 122 islands along the Lower Danube was 1.2 km^2, with a perimeter of 4,6 km. In 2022, the average size of the 81 Lower Danube islands were 1.8 km^2 with 5,5 km perimeter (Dorondel et al. 2023). With fex exceptions, most of the Lower Danube islands were never inhabited. One important exception is the Ada Kaleh Island inhabited by a handful of people since Medieval times (Dorondel & Ion under review). Few of them were temporarily inhabited or were used as places of refugee in the 19th century (Iancovici 1960). Besides, fluvial islands have a 'nomadic' character (Lahiri-Dutt & Samantha 2013): they move along the river, they modify their shape, they merge with one another or separate. They are highly volatile landscapes (Krause & Eriksen 2023). The social vacuity of Lower Danube islands is not an inherent quality of the river islands worldwide. In other parts of the world, for instance in Southeast Asia, the fluvial islands however volatile, are inhabited by people who find an alternative to the mainland (Lahiri-Dutt & Samantha 2013). Yet, to dismiss the social study of Danube islands would be a hasty assessment.

River islands stay in a sheer opposition with their maritime and ocean peers, which are larger, inhabited, more stable and thus more visible for historians and anthropologists (see for instance Patton 1996; Prokić & Šimkova 2024). For historians and anthropologists, European river islands suffer from a social vacuity that made them uninteresting as an object of study and rendered them invisible. So, the question is: Why study