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The Po River and the UNESCO MaB network in northern Italy

Andrea Rolando
Alessandro Scandiffio

Abstract

This contribution, using a geographic approach, investigates the territorial relationships between the Po River and the UNESCO Man and the Biosphere (MaB) reserve network, which serve as areas designated for biodiversity conservation and sustainable development, to strengthen the relationships between humans and the environment. By applying a GIS-based mapping approach, the research shows that most of the MaB network in northern Italy is closely linked to the Po River and that these relationships vary across the territory. It can be distinguished the MaB reserves which overlap with the territories crossed by the Po River (Monviso, Collina Po, Po Grande e Delta del Po); the nearby MaB reserves which are closely linked to the main river (Ticino Valgrande Verbano and Appennino Tosco-Emiliano); the most distant MaB reserves, still framed by the Po district, that are directly linked to the Po River through its tributaries (Valle Camonica e Alto Sebino, Alpi Ledrensi e Judicaria). Nevertheless, there are some territories crossed by the Po River that lie 'in-between' the existing MaB reserves and could potentially ensure continuity of the MaB network along this extraordinary natural blue-green corridor. By exploring the territorial patterns and the spatial distribution of the so-called 'inner areas' localized along the Po River, the research seeks to outline a territorial vision aimed at enhancing natural and man-made assets through the MaB intangible network.

Keywords
Po River, UNESCO MaB, mapping, GIS, territorial Strategies.



Historical cartography representing the confluence between the Trebbia River and the Po River, in the proximity of Piacenza. Sheet 8, Brioschi Collection, 1821-1853.

ISBN 979128281040

Astolfo il suo destrier verso il palagio
che piú di trenta miglia intorno aggira,
a passo lento fa muovere ad agio,
e quinci e quindi il bel paese ammira;

Ludovico Ariosto, *Orlando Furioso*, XXXIV, 52.

Introduction

This research investigates the territorial relationships between the UNESCO network of Man and Biosphere (MaB) reserves and the Po River in northern Italy, by exploring their mutual roles within a territorial vision aimed at ensuring continuity in biodiversity conservation and sustainable development strategies along this extraordinary natural blue-green corridor, 650 km long. Within the UNESCO program, the World MaB network mainly focuses on the relationships between communities and their environments, promoting ecosystem safeguarding and sustainable economic development across large territorial portions. Since 1971, the MaB network has been established by UNESCO to ensure the shared use of resources in the biosphere, by promoting innovative, research-based approaches to their management and enhancement, as well as by encouraging the spread of environmental culture and education oriented toward sustainable development [UNESCO 2026].
Within this framework, the Po river, as a natural infrastructure, which crosses the whole northern Italy, from the western Alps to the Adriatic sea, crossing both urban settlements such as Torino, Piacenza, Cremona, Ferrara and many different environments, such as the alpine valleys, the hills, and the plain area, before modelling the delta [Jones 2022; Winder2025], is an unique example for analysing how the MaB network, which is interconnected to its path, can trigger positive territorial relationships with its surrounding context [Rolando 2024]. So, the research, with a map-based geographic approach, explores on the one hand the MaB network connected to the Po River at different levels, and on the other hand the 'in-between' territories, which are crossed by the Po River and are localized between the existing MaB reserves, framed within a territorial strategy which envisions the continuity of MaB reserves along the river.

The Po River and UNESCO MaB network in northern Italy

In 2026, Italy's UNESCO MaB network comprises 21 reserves spread across the country, established since 1977 [Commissione Nazionale Italiana per l'UNESCO 2026]. In northern Italy, the UNESCO MaB network includes 12 MaB biosphere reserves, 8 of which are located within the Po River district and are the ones the research refers to (fig. 1). The research is centered on this complex territorial system through a spatial analysis conducted from west to east.
The stretch of the Po River from its source on the western Alpine slopes of Monviso, in the Piedmont region, to the plain areas of Saluzzo and Racconigi and the first hilly landscapes of the Langhe—marking the northern boundary of the Province of Cuneo and extending for approximately 75 km—constitutes the territory of the Monviso MaB Reserve, designated in 2013. This transnational MaB Reserve, shared between Italy and France, is characterized by the coexistence of alpine and agricultural landscapes across a large and heterogeneous territory, where parks, natural reserves, and small human settlements preserve traditional knowledge and cultural practices.
Downstream, in the municipality of Carignano, the Monviso MaB Reserve interconnects with

the Po-Collina MaB Reserve, ensuring territorial continuity within the MaB network along the Po River. Established in 2016, the Po-Collina MaB Reserve encompasses large portions of the Turin metropolitan plain and the surrounding hilly areas. This territory, crossed by an approximately 90-km stretch of the Po River, is shaped by a strong interrelationship among the river system, the city of Turin, and the alpine valleys descending from the mountains along the French border.

Within this system, the Po River is reinforced by major left-bank tributaries, including the Chisone, Dora Riparia, Stura di Lanzo, and Dora Baltea, which join the Po upstream and downstream of the city. Originating in the Western Alps, these river corridors have historically constituted a fundamental hinterland for Turin's economic and industrial development, providing water resources, energy, and fertile territories that supported the city's emergence as one of Italy's main industrial centers. These include the areas of Pinerolo, Susa, and Ivrea, which form integral parts of the Turin metropolitan area, as well as the Aosta Valley, which, while administratively distinct, has long been historically and economically connected to Turin. This interdependence has shaped a complex landscape in which natural habitats, historic architectural heritage, and economic and cultural activities coexist.

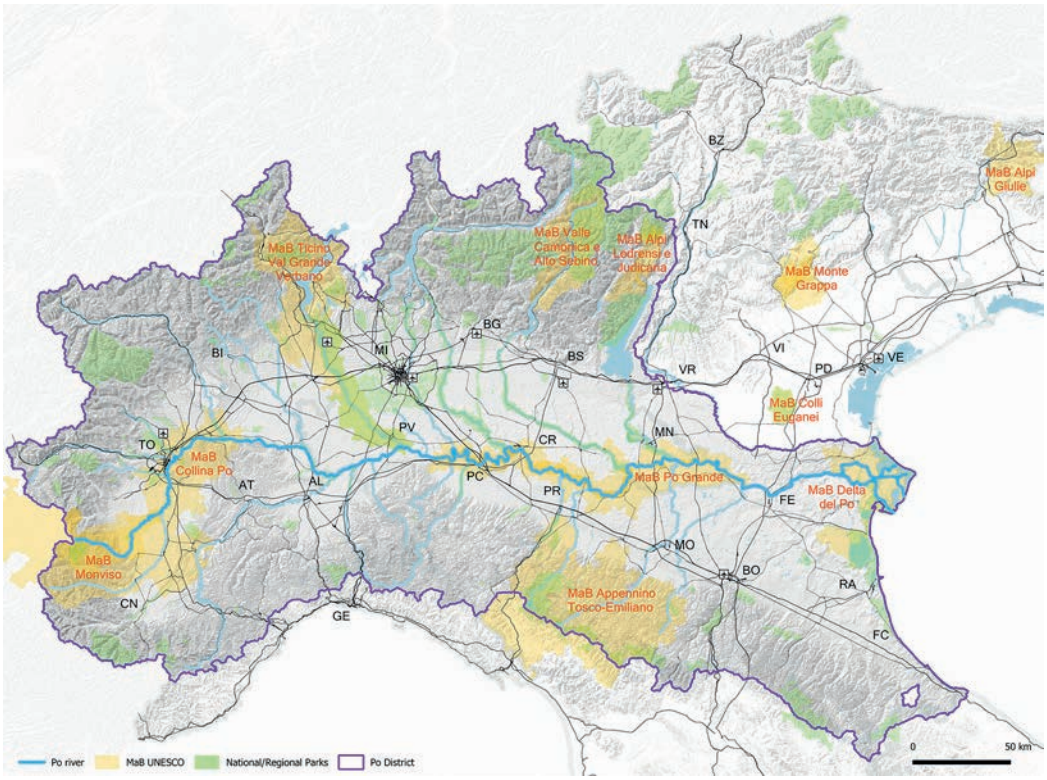

Fig. 1. Map of the UNESCO MaB network in northern Italy and its relationships with the Po River. Elaboration by authors.

The next stretch of the Po River, approximately 100 km long, which crosses Monferrato and Lomellina territories, between Piedmont and Lombardy, where are localized the towns of Casale Monferrato and Valenza, where the Po receives the Sesia, Tanaro, and Scrivia tributaries is characterized by extensive agricultural landscape related to paddy-rice cultivation (left hydrographic side) and heterogeneous agricultural landscapes, with arable lands and mosaics of small plots with different temporary e permanent crops (right hydrographic side). This area nowadays is not included in the MaB network.

Continuing downstream, the area of the confluence between the Po and the Ticino rivers has been included in the transregional MaB named 'Ticino Valgrande Verbano' (first designation 2002 and extension 2018), including the towns of Pavia and Varese, the Ticino regional park, and the area of Maggiore Lake with the National Park of Val Grande. It extends transversally to the Po River, along a northwest-southeast direction from the Alps to the Po, configuring itself as an ecological corridor in between the urbanized areas of Milan and Turin, ensuring the safeguard of the ecosystem's diversity and the preservation of agricultural landscapes' specificities.
Between the Ticino confluence and the 'Po Grande' MaB, there is a short stretch of the Po river, approximately 15 km long, where the Po river receives the Olona meridionale river from the north (S. Zenone Po), which is out of both MaB reserves, and deserves to be included in the MaB network, to ensure continuity to the MaB network.
The longest stretch of the Po River within the MaB network is the transregional one named 'Po Grande', designated in 2019, spanning from the confluence with the Trebbia River, in the Piacenza province, to the confluence with the Panaro River, in the Ferrara province, approximately 270 km long, crossing Emilia Romagna, Lombardy, and Veneto regions [Peraboni, 2020]. Along this stretch, the Po River flows through an extensive agricultural plain area, wet by numerous tributaries which reach the Po River both from the Alps (left hydrographic side: Lambro, Adda, Oglio, and Mincio rivers) and from the Apennine chain (right hydrographic side: Tidone, Trebbia, Taro, Parma, Secchia, and Panaro rivers). This MaB is significantly affected by agricultural and human activities, by the presence of small and medium-sized urban settlements, such as Piacenza and Cremona, and characterized by a great variety of ecosystems and specific environments, such as the floodplain areas, the wetlands, the fluvial islands, the riparian forests, and the land reclamation territories, which ensure a high degree of biodiversity along this corridor. Further extension of this MaB is related to the proximity of the 'Appenino Tosco-Emiliano' MaB reserve, whose area borders the surroundings of Parma and Reggio-Emilia cities, and that can improve its relationships with the Po River through the waterways network of the Taro and Parma rivers.
The stretch of the Po River, approximately 40 km long, which crosses the plain area between the Ferrara and Rovigo provinces, nowadays is not included in the MaB network, but it could ensure the continuity of the MaB network across its flat agricultural landscape, supported by a dense network of canals and waterways, and rural settlements that are tangible testimony of the relationship between humans and nature.
The last stretch of the Po River, approximately 50 km long, corresponds to the Po delta, where the river reaches the Adriatic Sea, the unique delta in Italy, which was designated by UNESCO as 'Po Delta' MaB in 2015. It is recognized for its distinctive landscape, shaped over time by river-borne alluvial deposits, small fluvial islands, floodplain areas, and wetlands, which support high biodiversity, with very few human activities, such as agriculture and fishing.

Spatial analysis of the MaB network across the Po River

The GIS-based spatialization of geoinformation for the MaB network along the Po River, using a map-based approach, enables the investigation of territorial relationships, even with the aim of revitalizing the country's inner areas [De Rossi, 2018]. By analyzing the spatial distribution of the MaB network within the Po district, as shown on the map (Fig. 1), three distinct spatial conditions emerge.
The first one concerns the presence of four MaB reserves perfectly centered on the Po River, overlapping with the territories through which the river flows. This condition concerns the one of 'Monviso', which is localized in the area of the source of the Po River; the one of 'Collina Po' across the plain metropolitan area of Turin and its surrounding hills, which ensures continuity to the Monviso one; the largest one which overlaps to the central tract of the river, named 'Po Grande'; and the ending one of the 'Po Delta'.
The second spatial condition concerns the MaB reserves, which are closely linked to the main river but not perfectly centered on it, and hold strong potential. This is the case of

'Ticino Valgrande Verbano' MaB, which overlaps the Po River around the Ticino confluence, but it mainly extends across the Ticino valley and the Maggiore Lake district. It can be assumed that it is strongly interconnected with the Po River and, at the same time, extends over a very large area along the Ticino valley. In this second group can also be inserted the 'Appennino Tosco-Emiliano' MaB, whose area, on the one hand, is largely distributed within the Po district, and on the other hand, extends northward toward the proximity of the 'Po Grande' MaB, through its rivers, Taro, Parma, Secchia, and Panaro, which are right tributaries of the Po River.
The third spatial condition concerns the MaB reserves, still framed by the Po district, that are far from the Po River but are directly linked to it through its tributaries, which serve as connectors in this network. This condition refers to two distinct MaB reserves in the north: the 'Valle Camonica e Alto Sebino' MaB and the 'Alpi Ledrensi e Judicaria' MaB. The first one is linked to the Po, through the Oglio River, which comes down from the Camonica alpine valley, through the Iseo Lake, till ending in the Po River; the second one is linked to the Po, through the Garda Lake and the Mincio River, which ends in the Po River.

The in-between territories as an opportunity to ensure continuity within the MaB network

A further spatial analysis of the MaB network along the Po River, has been undertaken to investigate, on the one hand, how Italy's inner areas (D, E, F classification according to SNAI 2021-2027) [Dipartimento politiche coesione 2026] are distributed across the territorial system of the Po River, and on the other hand, to understand how the in-between territories the existing MaB reserves are configured.
The map (fig. 2) highlights the widespread presence of inner areas across the two extreme regions of the Po River, the spring and the delta areas, as well as three distinct conditions across the Po River.
The section 'A', characterized by Monferrato and Lomellina territories, between the 'Collina Po' MaB and 'Ticino Valgrande Verbano' MaB, shows two small inner areas, classified as 'intermediate', localized in the Asti, Alessandria, and Pavia Provinces, which can benefit from a potential extension of the MaB network along the Po River.
The section 'B' includes the territories between 'Ticino' MaB and 'Po Grande' MaB. The area can be divided into two main parts: territories located along the Po River between Pavia and Piacenza, classified as 'intermediate' inner areas, and a broader southern portion extending toward the Apennine chain, where 'peripheral' and 'ultra-peripheral' territories prevail.
The section 'C' is a broad transversal strip extending from southern Brescia, passing through the 'Po Grande' MaB, to southern Ferrara. It is mainly characterized by inner territories classified as 'intermediate' with the small presence of some 'peripheral' areas.

Outcomes and Conclusions

In a synthetic spatial interpretation, after Piacenza, a clear contrast emerges between the territories on the left (northern) bank of the Po and those on the right (southern) bank. To the north, the landscape is shaped by the Alps and by urban systems that historically developed in close relationship with rivers, which served as sources of energy and resources. Cities such as Varese (along the Olona River), Como, Lecco (along the Adda River), and Monza (along the Lambro River), within Milan's northern productive area, exemplify this pattern. Further east, Bergamo and Brescia, historically connected to the Oglio River, are aligned along a strong infrastructural and economic corridor on the northern edge of the Po Valley, stretched out to Verona, Padova, and Venezia and crossed by the European Corridor V, which connects Lisbon to Kyiv.
On the southern side of the river, the urban structure is organized differently. A continuous sequence of cities aligned along the Via Emilia—including Parma, Reggio Emilia, Modena, and Bologna—is closely associated with the A1 motorway (Milan–Bologna–Rome) and the high-speed railway line. Beyond this linear urban system, the Apennines define a predominantly

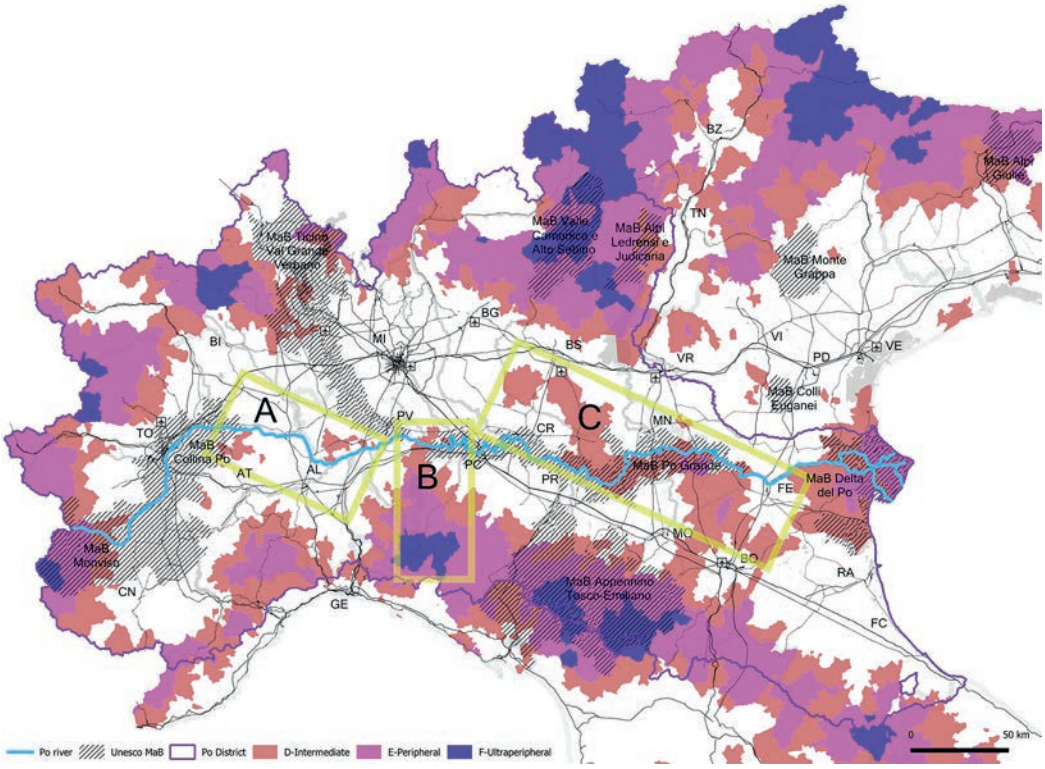

Fig.2. Italy's inner areas through the MaB network and the Po River. Elaboration by authors..

natural landscape that effectively "feeds" the river system. However, while the Alpine region produces longer, more stable rivers, the Apennines produce shorter, more irregular watercourses. As a result, downstream of Piacenza, the Po flows through a fundamentally asymmetrical territorial system, shaped by contrasting geomorphological, hydrological, and infrastructural conditions on its two banks. As a result, downstream of Piacenza, the Po flows between two major infrastructural corridors—the A4 Milan–Venice corridor to the north and the A1 corridor following the ancient Via Emilia, from Piacenza through Bologna to the Adriatic Sea to the south—a configuration that places the river and its adjacent territories in an intermediate position between two dominant axes of mobility and development. The map in fig. 3 uses schematic language to illustrate the locations of the MaB Reserves along the Po River and their geographic relationships to two major infrastructural corridors. The fragile territories in-between these corridors are particularly significant due to their relationship with the historical landscape and could place greater emphasis on the Po River as the backbone of an innovative territorial development, better related to nature and human activities.

In this perspective, the UNESCO MaB reserves could play a role not as autonomous entities but rather as components of a network interconnected by the Po River. Specifically, the research envisioned that the MaB network centered on the Po River could be further expanded to include both nearby territories and more distant areas whose MaB reserves are physically connected to the Po River through its tributaries, even considering the potential of MaB reserves as a driver for the revitalization of the inner areas of the country. In this sense, a better integration of the MaB reserves network, both as an intangible resource for the territories and as a catalyst for sustainable development actions, can foster synergies among local actors, enhance territorial cohesion, and support more coordinated environmental-based planning strategies at the supra-regional scale.

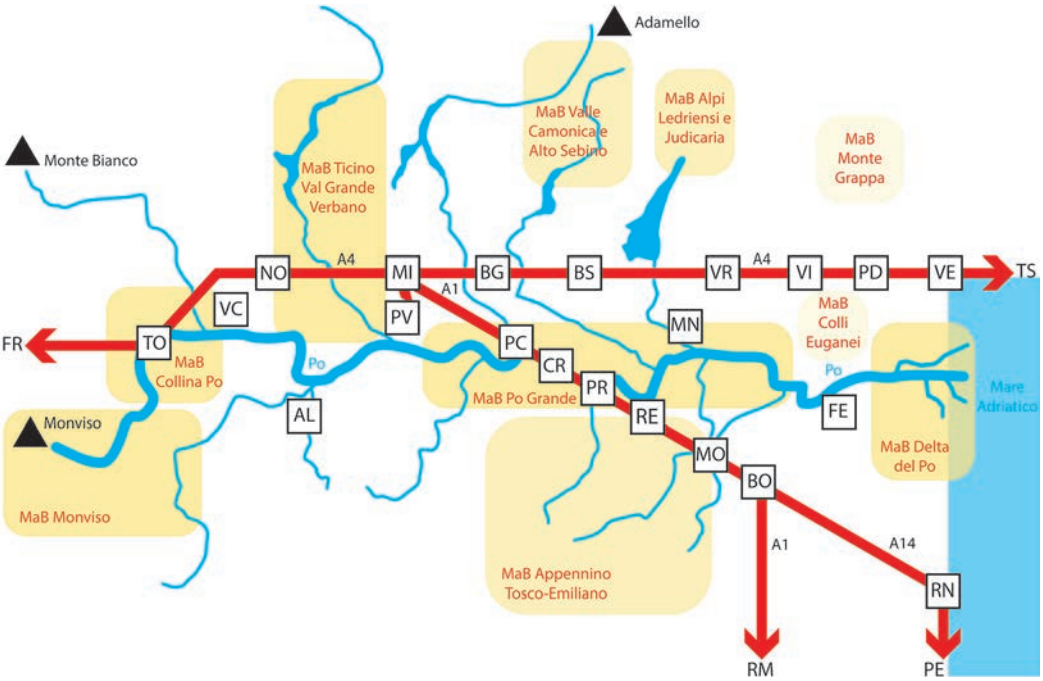

Fig.3. A schematic description of the Po River Valley interconnected through the MaB network. Elaboration by authors.

Credits

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All the authors shared the principles, and the research topics presented in the article. However, the paragraph titled 'Introduction' and 'The Po River and UNESCO MaB network in northern Italy'; was written by both authors, the paragraphs titled 'Spatial analysis of the MaB network across the Po River' and 'The in-between territories as an opportunity to ensure continuity within the MaB network' by A. Scandiffio, the paragraphs titled 'Discussion and Conclusion' were jointly written by both authors.

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