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PLANNING PARALLELS BETWEEN FLOOD RISK MANAGEMENT AND ECOLOGICAL LANDSCAPE DESIGN
The Italian regulatory system and the Po River case study

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ABSTRACT
The growing instability of river ecosystems in terms of flooding danger requires risk management systems at the territorial level that can reconcile issues like territorial protection, environmental improvement and biodiversity management. This paper explores the need to propose models that relate to the dynamics of river ecosystems rather than forcing rigid, confining infrastructures on them. This paper will analyse the potential of ecological landscape design, nature-based solutions and a case study of the Po River to set out several theoretical assumptions needed to draw up large-scale planning and design strategies, where the use of said instruments takes account of the current climate adaptation and risk reduction needs and also allows enhancing the environmental, economic and cultural value of the territory and the landscape.

KEYWORDS
landscape architecture, ecological design, flood risk management, nature-based solutions, territorial resilience

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Climate change is altering the frequency, intensity and severity of environmental disturbances, resulting in negative effects on the landscape, abrupt changes to ecosystems (Turner et alii, 2020; Lewis and Maslin 2005; Poff, 2002) and serious repercussions on the economic level (Amadio, 2012). One of the most pressing issues is certainly linked to the management of water (Fig. 1). There is broad consensus that flooding risks are increasing in the face of an escalation in extreme events (Merz et alii, 2010; Ming et alii, 2021) and that the impact at territorial level is not insignificant (Meng, Dabrowski and Stead, 2020). Flood engineering is essential to territorial planning (Picon, 2005), but the increasingly obvious instability of man-made systems, linked as much to the intrinsic dynamism and speed of the inherent transformation processes as to the unpredictability of climate change (Maleksaeidi et alii, 2016) has made it clear that certain planning and design models are not capable of dealing with current environmental challenges (Turkelboom et alii, 2021; Picon, 2005). In managing flood risk in river environments, the operational limits of traditional approaches based exclusively on the advance definition of a preferential state of stability and its constant maintenance by adopting rigid engineering solutions (Figg. 2, 3) that employ static, constricting infrastructures (Rossano, 2015; Nobert, Krieger and Pappenberger, 2015) are becoming increasingly evident.

Rather than freezing the territory and its natural ability to change, (Mathur and Da Cunha, 2014), we should rethink planning practices in a way that encourages, instead of inhibiting, the ability to develop that is intrinsic to river ecosystems (Da Cunha, 2018; Michener and Haeuber, 1998). In order to transform a state of fragility into an opportunity (Grêt-Regamey et alii, 2015; Rossano, 2015), we have to reflect on the definition of the concept of risk, both in conceptual and regulatory terms. It is widely acknowledged that risk is the product of both a hazard and its consequences (Kron, 2005): far from being a simple exercise of definitions, understanding the concept of risk is of fundamental importance to understanding where and to what extent we can take action to best direct planning and design practices for areas exposed to the risk of river flooding.

In the specific case of man-made systems located in high-risk river environments, since it is impossible to take action to lessen the intensity of a hazardous event (unless indirectly through reduction of the causes behind climate change) and it is extremely difficult (from practical, financial and even social standpoints) to relocate well-established settlement or production systems like urban areas or agricultural production areas, it would seem apparent that the main way to reduce risk would be to take action to reduce the vulnerability of the system itself (Sharma and Ravindranath, 2019).

More specifically, the scientific definition of that concept makes it clear that the idea of vulnerability is exclusively caused by internal factors (sensitivity and the ability to adapt; IPCC, 2014). This shows how it is possible, at least theoretically, to reduce the risk by acting directly on the system and improving its capacity to evolve each time in response to external events (Sharma and Ravindranath, 2019). That is why the

Fig. 1 | The Po di Volano river flows through the first suburbs of Ferrara (credit: the Authors, 2022).

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Fig. 2 | Constrictive system, rigid embankment of the Lana River, Tirana (credit: the Authors, 2021).

Fig. 3 | Lamination basins along the Parco del Delta del Po, Sacca degli Scardovari (credit: the Authors, 2021).

goal of this paper is to define potential areas of work for the design and planning practices in order to encourage, in systems exposed to flooding risks, flood management and protection actions that foster the transformational and evolutive tendencies of the landscape. The sections below set out successful examples of landscape designs and plans with effects on the reduction of risk, there is an assessment of regulatory assumptions that guide design practices linked to river systems in an Italian context, and finally, these issues are applied to a case study of the river Po in the Emilia-Romagna region, underlining how this could be a pilot project at European level both for its landscape-environmental importance and its economic and social role.

Strategic and planning approaches for developing landscapes | Starting from the acknowledgement of the undeniably artificial nature of all landscapes and ecosystems (Hobbs et alii, 2006; Emanueli and Lobosco, 2016) and far from making yet another rhetorical proposal of the natural element as a planning instrument (Morton, 2009; Pasini, 2020), the interpretation of ecological landscape design (Van Der Ryn and Cowan, 2007) through Nature-based Solutions – NbS (European Commission Directorate-General for Research and Innovation, 2015) turns out to be an essential strategic assumption to create resilient landscapes that are continuously developing, i.e. that can adapt to the most unexpected need to change as dictated by extreme climate events. Even though there is a vast array of types and ranges of applications of NbS (EEA, 2017), for this paper, we would like to point out the great success that these

types of solutions have had in the area of river area flood risk management through the restoration of areas that previously formed part of the river and are returning to their initial function (i.e. hosting changeable, dynamic habitats) by reconsidering them through design and planning practices of landscape architecture. In this context, NbS contain an incredible variety of approaches to dealing with risk (World Bank and World Resources Institute, 2018; Sudmeier-Rieux et alii, 2021), and as opposed to traditional, rigid engineering solutions, prove to be extremely versatile instruments that can adapt to the specific morphological and typological characteristics of the various territorial environments and respond to the ever different and unpredictable environmental challenges in a more relevant, focused fashion (Schindler et alii, 2014; Albert et alii, 2019, 2021). Examples of reduction of flood risks through NbS incorporate both prompt actions being taken at the design stage along with systematic interventions as part of programmes that operate at the territorial level.

An example of the first category is the ecological-environmental-landscape restoration of the Shuicheng river (China 2009-12) from a Turenscape project that proposed the renovation of 90 hectares of wetlands devastated by decades of uncontrolled industrialisation through projects aimed at slowing down the flow of rainwater, improving water quality, and restoring native habitats (Fig. 4). The new ecological infrastructure entails the entire drainage basin of the Shuicheng river (Fig. 5). The water courses, wetlands and floodplains were integrated into rainwater management and purification system through the creation of a series of stormwater management ponds and wetlands. This approach both reduces floods to a minimum and increases the base flow to support the flow rate of the river after the rainy season. The concrete embankment of the artificially channelled river built in the 1970s was also removed and replaced by a natural riverbank comprising a vegetation terrace system that can be flooded to regulate the flow of water and revitalise the riparian ecology. This action returned the river to a state that could accommodate its dynamism, accommodate possible spatial changes and give back a significant public space to the community.

With regard to the second category, we would like to mention the Dutch Programme Ruimte voor de Rivier (Room for the River), developed by the Dutch Directorate-General for Public Works and Water Management (Rijkswaterstaat) from 2006 to 2015, which aimed to reduce the risk of flooding in areas close to the main rivers (Meuse, Rhine, Waal and the Ijssel), following the 1986 Ooievaar Plan ideas to improve the spatial quality of river areas (Fig. 6). Even though the Plan recognised the importance of maintaining the dyke system on which the substantive survival of the entire area of Holland had been based for centuries, it decided it was necessary to restore, where possible, the natural dynamic river processes through relocation of the existing dykes further upriver, lowering the levels of current flood plains, creating more buffer zones and expanding the existing riverbeds. All the actions identified aim to increase the outflow and storage capacity of the rivers and, where possible, give more room to environmental dynamics and public recreational activities.

Some of the actions taken under the Plan include the highly interesting Nijmegen-Lent case (2012-16), where relocation of the dyke north of the river and the creation of a secondary waterway help the expansion of the river during flooding events or intense rainfall (Figg. 7, 8). There is a bottleneck in the Waal River at Nijmegen due to its specific geometry which often caused flooding in its historical centre. After the floods of 1993 and 1995 and in view of an increase in the risk of flooding due to climate change, the municipality decided to give more ‘room for the river’, while protecting the surrounding natural habitats and providing recreational spaces. The city, therefore, began to adapt the river and its banks, relocating the main dyke 350 m inwards and excavating a large river channel parallel to the original one. Upon completion in 2016, the project had managed to reduce the height of the river water by 35 cm. When the river is high, a third of the total quantity of water is diverted towards the new ancillary channel. The actions taken under the plan also created an island which is now used as an urban river park.

Another interesting project was the Lower Danube Green Corridor Plan (Fig. 9). In 2000, the governments of Bulgaria, Moldova, Romania and Ukraine, under the general supervision of the WWF, entered into the Lower Danube Green Corridor Agreement to establish a green corridor along the common banks of the Danube. This agreement, which has currently resulted in actual interventions on the final 1000 km of the river basin, aims to restore river plains which had been heavily compromised by intense reclamation in the second half of the twentieth century, and more specifically to re-

Fig. 4 | The new Shuicheng river terraces, Liupanshui Minghu Wetland Park, designed by Turenscape (credit: Turenscape, 2013).

Fig. 5 | Park design interventions, Liupanshui Minghu Wetland Park, designed by Turenscape (credit: Turenscape, 2013).

store 224,000 hectares of natural floodplain as an alternative to the traditional dyke systems Ebert, Hulea and Strobel, 2009; Mansourian et alii, 2019; Fig. 10). The agreement also aimed to reconnect the river to its natural flooding areas, reducing the risks of major flooding in areas with human settlements and offering benefits both for local economies (e.g., through fisheries and tourism) and for the environment. The outcomes from the project show that restoration projects have provided many benefits, including improved natural capacity to retain and release floodwaters, enhanced biodiversity and strengthened local economies through diversification of livelihoods based on natural resources. The implemented measures increase the resilience of the river system and local companies in managing current climate variability and the likely impacts of further climate change.

Regardless of the type of NbS used in the above-mentioned projects and plans, we

Fig. 6 | Ruimte voor de River territorial plan, Rijkswaterstaat 2006-2015 (credit: Mijs cartografie, 2014).

believe it is important to emphasise the ability of the NbS to generate further benefits besides solely reducing flooding risks, as much in the environmental area as in the economic social, urban and cultural areas (Schindler et alii, 2014; Raymond et alii, 2017; Seddon et alii, 2020). They provide an opportunity to both drastically reduce flooding-related risks and also to improve the hydro-morphological features of water courses, increase riparian biodiversity and restore damaged ecosystems. Further issues are those linked to raising awareness on issues like the management of water resources, the creation of new spaces for the community and retrieval of the history and identity of places by adopting design solutions that are inspired by traditional local landscapes. The examples given show how the adoption of an approach based on ecological landscape design criteria and their interpretation, in design terms, through the use of NbS, can make it possible to identify and exploit flooding risk as an opportunity to incorporate (or restore) environmental and spatial values within the scope of landscape projects (Raymond et alii, 2017; Seddon et alii, 2020), but, in order to make this possible, a basic requirement from the start would be the need to connect complementary issues such as reducing flood risks, restoring and boosting ecosystems and urban development into a single strategic planning system.

Correspondence between risk management, planning guidelines and design actions in the context of Italy | The relevance of the issue of hydrogeological[1] security in Italy has formed the basis for a broad range of policies over past decades incorporated into national and regional plans. We can take one of the most important rivers in Europe as a reference, the Po River (Fig. 11); the following documents were identified as examples to analyse the relationship between risk management and project works imposed by the planning practices: the Hydrogeological Structure Plan (PAI), the Po Hydrographic District Management Plan (PdGPO) and the Flood Risk Management Plan (PGRA). Due to the complexity and extent of these instruments, for the purpose of this paper, we decided to focus on the design goals and guidelines shown by each of them. This analysis aims to examine whether there is room to manoeuvre within the scope of the regulations to propose transformation strategies for the river environment aimed at improving it in terms of environmental resilience.

The PAI, established by Italian Law 183/89, is the cognitive, regulatory and technical-operational instrument through which: 1) it recognises hazardous factors that exist in the territory and the definition of boundaries of the affected areas; 2) the actions and

Fig. 7 | New cycle/pedestrian crossing and new wetland ecosystems on the sideof the I-Lent Riverpark Nijmegen, designed by Lodewijk van Nieuwenhuijze and H+N+S landscape architects (credit: COAC, 2016).

Fig. 8 | The new river channel of the I-Lent Riverpark Nijmegen, designed by Lodewijk van Nieuwenhuijze and H+N+S landscape architects (credit: COAC, 2016).

Fig. 9 | Lower Danube Green Corridor territorial plan (credit: WWF, 2010).

measures to safeguard those areas are planned; 3) the conditions of use of the land are defined by the characteristics of the hydrographic systems and aimed at maintaining an adequate level of safety. Despite the stress put on the indispensable nature of maintaining and strengthening the engineering works currently in place to protect the territory, we should note how the Plan recognises, among its main objectives, the importance of restoring the function of the natural systems (including through reduction of the artificiality resulting from the defence works), the restoration, redevelopment and protection of the territorial environmental features, restoration of the river areas for recreational use, hypothesising strategic guidelines for interventions aimed at safeguarding and, where possible, expanding the natural flooding areas of the water courses, and in general, reducing manmade interference with the developing dynamics of the riverbeds and river systems.

The Management Plan for the hydrographic district of the river Po (Autorità di Bacino Distrettuale del Fiume Po, 2021a), drawn up by Directive 2000/60/EC (European Parliament and Council of the European Union, 2000) and transposed into Italian law through Italian Legislative Decree 152/06 (Repubblica Italiana, 2006), defines technical and operating instruments to optimise the use of water resources and achieve a good hydromorphological state of the rivers for both controlling potential impacts on human health and to guarantee the maintenance of biodiversity. More specifically, the Plan reiterated the need to encourage coordinated actions that aim to both protect and improve the state of aquatic ecosystems, terrestrial ecosystems and wetlands, while also helping to reduce the effects of flooding and drought.

Finally, in compliance with European Directive 2007/60/EC (European Parliament and Council of the European Union, 2007), and through Italian Legislative Decree 49/2010

(Repubblica Italiana, 2010), the Flood Risk Management Plan was prepared (Autorità di Bacino Distrettuale del Fiume Po, 2021b), an operating instrument conceived to identify and plan the actions needed to reduce the negative consequences of floods for human health, the territory, assets, the environment, the cultural heritage and economic and social activities. The five main goals identified by the Plan, which became strategies at the district level following the 2021 update, emphasise the wish to ensure more space for rivers. The lack of effectiveness (and non-sustainability) of the traditional technical-water approaches to ensure infallible and non-discriminatory protection against flooding is recognised in clear, unequivocal terms.

On the other hand, it reiterates the potential of solutions like revitalisation of the geomorphological and ecological functions of river systems, and the fact that implementation of green infrastructures mean both protection against flooding and the encouragement of informed, sustainable use of the land, the improvement of environmental conditions, the generation of habitat and landscape diversity, the storage and improvement of basic ecosystem services and the promotion of territorial development and resilient urban planning. It is also considered vital to operate in the entire catchment area upstream of metropolitan areas to ensure sustainable practices in land use which can help reduce flooding peaks, improve the retention and drainage capacity of the water in urban areas and provide for controlled flooding of designated areas in the case of serious flooding.

The guidelines set out in the above-mentioned Plans combine contemporary design practices and water management where rivers are recognised as dynamic systems to support even before than considering them as unpredictable systems to protect ourselves from. Even though they take different approaches, the documents analysed underline the need for coordinated intervention in the areas exposed to the river flooding risk, paying the necessary attention to plans related to the ecosystems and the transformational and adaptive ability that characterise them (Grêt-Regamey et alii, 2016). To that end, there has to be agreement on the strategic approaches to take[2] and planned actions and multi-disciplinary projects have to be defined since they have to be ap-

Fig. 10 | Topographical work in the Danube floodplain at Mahmudia, Romania (credit: Cristian Mititelu WWF Romania, 2010).

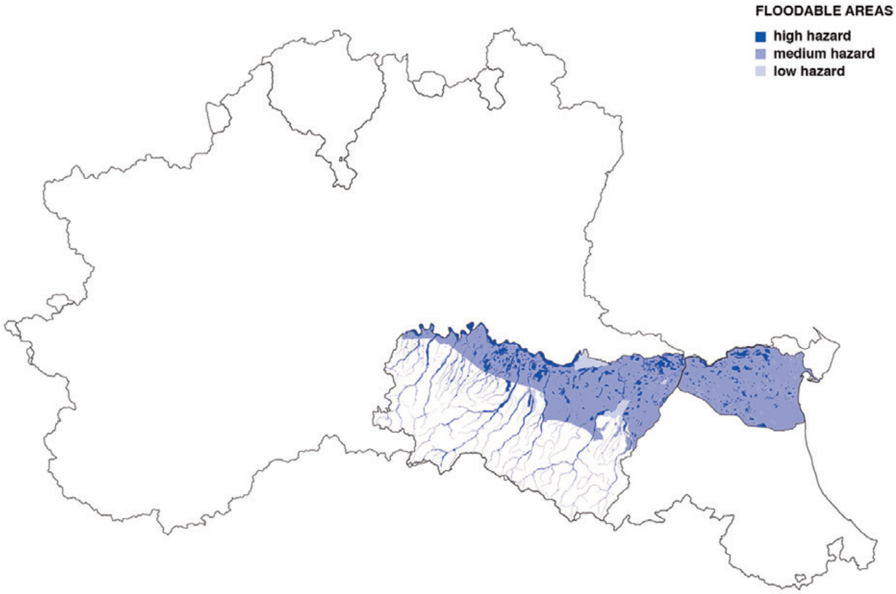

Fig. 11 | The Po River from above, note the complexity of the landscape traversed between urban, productive and agricultural systems (credit: apple maps, 2022).

Fig. 12 | Map of floodable areas within the management unit ITN008-Po in the Emilia-Romagna region (credit: G. Sartin, C. Mariani and Y. Nouira, reprocessed from National Geoportal and ABDPO data, 2022).

plied to transform the regulatory guidelines into reality, taking the positive aspects introduced and putting any operational or conceptual limits up for discussion.

Prospects for the Po River in the Emilia Romagna area | The vast size and environmental complexity of the hydrographic basin of the river Po exposes it to a diverse range of extraordinary flooding events (Domeneghetti et alii, 2015). Of these, those mapped between 2011 and 2020 in the entire management unit ITN008 – Po[3], 5 out of 8 are in the Emilia-Romagna territory. The exposure to risk in the area analysed, concerning the data set out above, is significant (Fig. 12). Most of the actions taken, that could be likened to the transformation of the landscape to reduce hydrogeological risk (embankments, water layouts, expansion banks), are purely of an engineering nature with no thought put towards issues of fundamental importance for river environments such as biodiversity. As shown by the examples analysed in the paragraphs above, some exceptions are distinguished by the greater care put into the design and references to broad-ranging strategies that include bigger areas of territory.

Starting from those assumptions and the input dictated by law, it would be possible to take action in a coordinated, widespread manner along the entire length of the river Po by reconsidering the typical aspects of the surrounding territory, i.e., its agricultural nature. Agricultural areas, which represent 46.6% of the entire regional territory in Emilia Romagna (Istituto Nazionale di Statistica, 2020), are sensitive areas for the management of water and flooding risk since there is a close connection with the territorial water system managed by the reclamation consortia. It should be possible to create a widespread system by selecting the agricultural areas that adjoin the irrigation infrastructure or the course of the river and subsequently transform them into wetlands for application of the NbS to create a more varied rural landscape that is environmentally richer. Acting as an ecological corridor as opposed to the current uniform countryside traversed by the Po River, the new wetlands would act as a quantitative and qualitative control instrument of the surface waters, ensuring adequate space for water storage where natural cycles of constructed wetlands could be created (Kadlec et alii, 2000).

Like surface water, similar issues arise with regard to aquifers, and underground water deposits that can help manage water and consequently reduce risk. The development of MAR systems – Managed Aquifer Recharge (Dillon et alii, 2019) to transform fields that consume water into accumulation and percolation recharge systems would allow for the creation of a series of water-connected systems that could manage rainwater in a constant, widespread and integrated way. A key role in this process could be carried out by the Forested Infiltration Areas (AFI – Aree di Infiltrazione Forestale; Fig. 13), i.e., woods with deep-rooted trees established for production purposes to enable water to permeate more quickly into the ground, preventing evapotranspiration (Mezzalira, Niceforo and Gusmaroli, 2014). According to the proposed template, instead of the current uniform scenario, the future agrarian countryside could evolve into a more varied system where the strictly productive agricultural areas could be interspersed with new wet ecosystems to reduce the risk of flooding and improve water management (Fig. 14). Even though theoretically, this should not be difficult, the strategic and planned position linked to the transformation of agricultural areas would incorporate complex issues such as the political and strategic interaction with specialist associations, the definition of criteria that could help select and transform the areas, a strategy for financially compensating the land owners (Felloni, Magagnoli and Tinti, 2019).

In accordance with Regional Law no. 24 of 2017 and through the Urban and Ecological-Environmental Quality Strategy which underlines how 'the new types and requirements thereby become those of resilience, i.e., the ability to adapt' (Regione Emilia Romagna, 2017), new integration possibilities have been introduced for territorial planning and landscape transformation actions. This opportunity will have to be grasped to renew planning and design methods to apply to contexts of high hydrogeological risk. Using a multi-disciplinary approach, preliminary processes could be initiated to improve the space and the environment, in addition to integrated risk management. The new financial assets allocated at European Union and national level are going in that direction: the Po River may obtain an overall allocation of about €360 million as part of the National Recovery and Resilience Plan commitments (Italian Government, 2021). The Italian Minister for Ecological Transition (MiTE) has agreed to a project to revitalise the Po area where wide-ranging action has to be taken for environmental and ecological restoration.

The project provides for improved management of hydrogeological risk with revitalisation action to be taken along the entire course of the river to reactivate the natural processes and encourage restoration through reforestation, the control of native plant species and the reduction of riverbed artificiality. If added to large-scale territorial plans, these strategic-design guidelines would allow for a reduction in hydrogeologi-

Fig. 13 | Bosco Limite, forest infiltration area in Carmignano di Brenta, Padua (credit: Bosco Limite, 2019).

Fig. 14 | Landscape transformation's scenario in the Po river area situated in the Province of Ferrara (source: Felloni, Magagnoli and Tinti, 2019).

cal risk, and more especially for the regeneration of a very widespread environmental network in the territory with positive, immediate impacts on the ecosystems involved (Keesstra et alii, 2018; Jakubínský et alii, 2021). The NbS-based adaptation and resilience approaches provide flexible, cost-effective alternatives that can be broadly applied to pre-empt climate change while simultaneously overcoming the many disadvantages of rigid infrastructures (Jones, Hole and Zavaleta, 2012) which now characterise the entire course of the Po River.

There is a widespread desire (or actually necessity) to establish a new reading of waterways that reinterprets the traditional static model of channelised rivers (Hartmann, Slavíková and McCarthy, 2009; Bengtsson et alii, 2003; Christensen, 1997). By overcoming this concept, we move closer towards the idea of systems in dynamic equilibrium, whose mobility and adaptability are factors that reduce water hazards, enrich habitats and enhance the value of the countryside. To that end, the agreed attempt to take a broader view to promote the restoration and revitalisation of river ecosystems through the definition of actions that deal with the issue of water management becomes clear (Werritty, 2006; Wesselink et alii, 2015).

Conclusions | The necessary awareness to deal with climate challenges must rapidly develop into integrated planning and design practices to complement the urbanisation processes and territorial transformation through a merger of theoretical and practical ideas. Converting the possible risk factors from potentially hazardous elements into design assumptions, going beyond the traditional segmentation typical of current rigid management models, and integrating approaches like the ecosystem-based approach and instruments such as nature-based solutions will enable a reduction in the territory's vulnerability to extreme water events.

As emerged from an analysis of the above-mentioned planning instruments, Italian planning already seems to incorporate the rudiments of the assumptions needed to implement the NbS on a territorial scale. Therefore, the challenge is to develop an approach that can keep design actions and territorial planning together in a single, consistent system through the definition of strategies that are both capable of avoiding or reducing the effects of a potential hazardous event and that can also promote the informed use of the areas impacted by the intervention. Therefore, the task of urban and territorial planning is to define the consistent use of space over the medium-long term (Ahern, 1999) which can help the development over time of the NbS and related benefits so that they do not become a further barrier – albeit green – to use of the space, but a reason to enhance the value of the river environment and its ecological-environmental components (Farina and Belgrano, 2004).

Two fundamental issues, summarised below, emerged when attempting to define the theoretical assumptions needed to draw up a large-scale strategy, where the use of the above-mentioned instruments will have to both respond to current needs for climate adaptation and risk reduction, and also allow enhancing the value and regenerating the environment, economy and culture of the territory and the countryside:

1) a reconceptualisation and reconsideration of the river environments as hybrid infrastructures; the river must be regarded as a highly dynamic environmental system, continuously developing, a landscape in transition that must be capable of being expressed in its coherent artificiality, also by better water management; leaving aside nostalgic and environmental trends, but respecting an environmental system for what it is or what it should be, we would like to confirm that the transformation (consistent and specific) of river environments and surrounding areas in accordance with Eda and NbS criteria is a priority to reduce the risk of flooding of river bodies;

2) the proposal of procedural and operating models that tend towards interdisciplinary planning processes based on mediation – rather than the abuse of power – between the individual interests and the needs in play right from the start and for the study of the project; to ensure the proper balance between water safety goals and landscape and environmental goals, control and coordination booths will have to be created, i.e. multidisciplinary commissions comprising town planners, ecologists, engineers and geographers, specifically aimed at monitoring the development of each plan and design from the formulation stage up to its completion, and ensuring that each action taken both reaches the necessary safety standards, and also generates spatial quality and promotes the cultural value of the countryside (Klijn et alii, 2013; Sijmons et alii, 2017).

In conclusion, we confirm that the Italian framework is a fertile one, both in terms of spatial preparation (its lack of uniformity makes it an open-air laboratory for design and planning issues) and in terms of regulatory conditions that seem to chart the right path to take in terms of operation. However, we need to experiment with these guidelines at a practical level, since we will only be able to validate the results or make critical corrections of the operational-methodological premises by directly applying them.

Notes

1) In Italy, 5.4% of the national territory is subject to a high probability of flooding, with 16,223.9 km^2 and 2,431,847 inhabitants involved; for more details, please see the 'Rapporto sulle Condizioni

di Pericolosità da Alluvione in Italia e Indicatori di Rischio Associati' (lit. Report on the Conditions of Hazard from Flooding in Italy and Associated Risk Indicators; ISPRA, 2021).

2) For the projects to work on an extensive territorial scale, all the parties involved will have to be willing to cooperate (territorial and local public entities, private entities, the civil protection authorities, management consortia and trade associations).

3) For the purposes of the Flooding Directive requirements 2007/60/EC, the hydrographic district of the Po River is divided into 5 management units; the biggest is the ITN008 – Po, with a territorial extension of 70,311 km^2.

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