

Rivercity - flooding as a potential to rework urban planning

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Abstract. This paper offers an in-depth account of how sustainable initiatives are assembled and function in practice, using the city of Cesena in Northern Italy as a case study. Located along the Savio River, Cesena's cultural identity and urban development have long been shaped by its close relationship with the river and its surrounding biodiversity. This connection, however, has been increasingly tested by environmental crises, most notably the devastating flood that severely impacted the region in 2023. In response, the project aims to establish a collaborative public-private governance scheme that fosters closer cooperation between local residents, municipal authorities, and key stakeholders. Special attention is given to engaging the community in shaping the district's sustainable future, with an emphasis on resilience, inclusivity, and environmental awareness. The paper also investigates the often-overlooked dimensions of local sustainability efforts and evaluates their broader societal impact using the New European Bauhaus (NEB) Impact Model as a framework for assessment and reflection.

Keywords: Sustainable river management, Climate neutrality, Flooding resilience.

1 Introduction

Urban rivers represent critical ecological, social, and economic assets [1], yet they face increasing pressures from urbanisation, climate change, and unsustainable land-use practices [2, 3]. In river cities such as Cesena, located along the Savio River in Italy, the need for a sustainable urban vision, one which integrates river revitalisation with resilience against the threat of flooding, has become increasingly urgent [4]. Traditional approaches to river management often prioritize engineering solutions over ecological and social considerations, leading to fragmented landscapes with poor outdoor quality [5]. This often results in increasing vulnerability to extreme weather events, making the threat harder to handle through regular built environments. In river management gaps persist in effectively aligning sustainable water and land-use strategies with broader goals such as climate neutrality and participatory governance [6]. The lack of comprehensive (policy, revitalisation, participation and funding) frameworks that assess the multidimensional impacts of interventions hinders the transition toward resilient and inclusive river cities.

This study addresses these challenges by exploring how the NEB Impact Model (New European Bauhaus) can be applied to evaluate and enhance sustainable practices in Cesena's Savio River context. This research aims to contribute to a replicable and holistic sustainable urban vision development in river cities, ensuring long-term climate resilience, improved outdoor quality, and equitable stakeholder engagement [3, 5]. The findings will inform policymakers, planners, and communities in adopting integrated strategies for sustainable water and land-use in riparian environments.

1.1 Cesena & the Savio River

Cesena is a city in the Emilia-Romagna region of Northern Italy. Throughout history it's been linked to the Savio River, which flows through the region, enriching its landscape and biodiversity. Since 2013, the "Savio River Park" has become central to Cesena's ecological development strategy, though it faces significant challenges from climate change. Wide areas of the region are below sea level and consist of reclaimed wetlands that are unstable due to rising sea levels along the coast. What's more, human interventions in watercourses in Emilia-Romagna, particularly driven by economic interests such as seaside tourism, have been significant [7].

Recently in 2023, severe flooding had tremendous impact on the area. Addressing the regional vulnerabilities that became apparent as a result, requires sustainable action from both the community and decision-makers [8]. The area faces risks from storms, high surges and tidal levels, affecting residential zones and key infrastructure [9]). While natural areas are limited compared to urbanized zones, they are vital for environmental preservation and regional resilience [10]. To manage natural risks influencing coastal vulnerability, the EU Directive (2007/60/EC) was adopted in Italy through DLGS42/2010 [11], which highlights the need for good and effective Green and Blue Infrastructure (GBI) to support climate adaptation. Specifically, the EU Adaptation Strategy [12] urged the region to develop and strengthen the flood risk management for the Po Basin, including the Savio River, in 2021. While cities generally adopt different approaches to sustainability [13], success often depends on the level of collaboration between residents and authorities. In 2019, the municipality of Cesena initiated a participatory process to develop its new Urban General Plan (UGP). Aligned with Emilia-Romagna Region's planning law (LR 24/2017), the UGP serves as the city's primary tool for promoting sustainable and citizen-centered urban development. The ecosystem intervention needs for the Savio River fits into this overall vision and in particular tackles the following Strategic axis and specific objectives [4], namely addressing the climate and environmental challenge, making the city attractive, as well as Regenerating and valorizing the city. These objectives resonate with the New European Bauhaus aims and goals [14].

1.2 Local sustainability practices

The City of Cesena is aiming to reach climate neutrality and improve resilience with the Savio River Management System. The system will help overcome the risks of flooding and establish a sustainable energy system as well as healthy ecosystem around the river. The river's current landscape varies considerably, featuring three distinct sections: an upstream area near the Apennines, a central urbanized zone passing near Cesena's historic center, and a downstream agricultural plain. The 2023 flooding created a complex community response - fostering extraordinary solidarity through volunteer groups like the "Guys of Mud" while simultaneously generating fear and a disconnect from the waterscape [15]. This complicated and contradictory response highlights the need for strategies that address both physical reconstruction and an emotional reconnection to the river. The new Savio River Management System needs to address the multifaceted experiences in the river identity and culture.

1.3 Evaluating with the New European Bauhaus Impact Model (NEB Impact Model)

New European Bauhaus (NEB) is a policy and funding program, initiated by the European Commission and utilizing the green transition framework [11]. NEB looks at aspects of sustainability, inclusivity, and beauty - with the goal to assess the value and importance of (built and natural) places for society. The NEB Impact model stems from the NEB movement and consists of specific pillars which look at aspects such as governance, economic performance, social-cultural performance, healthy living, and environmental performance. The model refers to examples in dozens of cities and information gathered in interviews with collaborators in the cultural, artistic, and creative sectors, as well as with property owners and tenants, citizen, and communities.

Particularly of importance in the case of Cesena are aspects of climate neutrality and resilience, sustainable water & land use, outdoor quality, and participation.

1.4 Method of Analysis and results

Developing resilience in cities and addressing ecological and social threats to the future of human settlements have high urgency [16]. This brings local actors in new relation and collaboration with different stakeholders, each with unique and differing motives, power, and governance systems [17, 18]. Local work needs to begin by defining the conditions of professional agency in the human-city-river context. To create the general framing of professional agency, we found a partial synergy between the UGP plan for the Cesena region and the NEB Impact Model. First, we assessed the needs for Cesena, particularly related to the management of the river. We evaluated this via a simplified question: “does *this* exist for the Savio River in Cesena?” - listing

the sub-criteria of the NEB Impact Model that helps structure how local sustainable practices are organized, managed, and governed in a balanced manner. The aforementioned evaluation does not rate the quality of the local work, but rather serves to help analyse if the basic framework collaborates on all five pillars of the NEB Impact Model. This type of assessment serves as an important tool for cooperation and directing the (en)visioning phase for a project. This allows the local alliance to identify gaps and strengths, while potentially steering stakeholder mapping and work in the project to achieve a more sustainable collaboration. For the purpose of this paper, four fields of activities were evaluated. They are aligned with the topics of the UGP developed by the municipality and are major areas of action along the Savio River. The assessment was done on the levels of “**climate neutrality and resilience**” as the long-term vision, the “**sustainable water- and land-use**”, and the “**quality of the outdoor**” spaces, which will significantly determine the use and users, and last but not least “**participation**”. We tested the NEB Impact Model with this case, to elaborate on its potential as an assessing and informing tool. In order to inspire how the needs of this case could be tackled, we finally introduced examples in the last part of the paper. For this research, a qualitative approach was chosen. Hereby local activities were evaluated by local actors with the New European Bauhaus Impact Model. Instead of rating activities, the assessment aimed to understand the local framework and identify experiences upon which future activities can build. The dispositions, values, and identities coming together in such work provide professionals but also limit their scope of action [19]. They use methods to identify needs and communicate them comprehensively to a variety of actors in an increasingly uncertain context.

2 Results obtained in the case of Cesena

Overall, the citizens and municipality have accumulated substantial experience in addressing the challenges of the Savio River. This accumulated knowledge and expertise represents a significant strength, and future efforts will inevitably be shaped by these established practices. However, unifying diverse actors into a collective pathway and fostering a shared vision presents a considerable challenge, particularly due to limited overlaps in responsibilities, capacities, and prior experiences of collaboration among stakeholders. Introducing an innovative and inclusive Savio River Management System will be strongly dependent on the integration of natural landscapes and strengthening relationships between actors. It is imperative to address critical issues such as flooding risks, the growing demand for sustainable energy, and the preservation of a healthy ecosystem. As the highlighted detail aspects in the five categories illustrate, some ground-structures have been established, making it possible for the building-up of the management system to begin with the established structures.

2.1 Savio River management – discussion of findings

To improve the situation in Cesena, the city needs to define an innovative public-private river management scheme that considers the natural value of the river, its connection with the community and hydraulic safety. The previous incidents underline the need to increase the skills of volunteers and stewards of the ecosystem, to create a nature park along the entire length of the river, to enhance the river's role as a blue corridor, and to increase the quality of life through riverside development. To ensure that the local community is involved as active participants, the new management system must address economic deficiencies, focus on stakeholder engagement and citizen participation in both long-term river management and vision development, incorporate bottom-up practices, create river-focused events, and align interventions with nature conservation and hydraulic safety frameworks.

At present, the city works mainly top-down, excluding the rich experience of citizen initiatives. While local practices around the river demonstrate rich experience in climate adaptation, resource management, and outdoor quality, gaps remain in material circularity, indoor environmental quality, and cultural sustainability integration. Governance processes, often criticized for weak participatory quality, risk eroding trust over time. Economic challenges, including weak legal certainty and high societal costs, further hinder progress. The Water Management System needs to address these shortcomings, incorporating stakeholder engagement and citizen participation as central elements. Currently, Cesena's governance model is predominantly top-down, particularly in river maintenance and flood protection, which limits community involvement. Systemic

citizen empowerment is essential, as local communities have proven reliable in crisis situations and can play stronger roles in future scenarios. To sustain trust and momentum, the administration must carefully manage stakeholder expectations and create clear roles and opportunities for participation. In summary, strengthening stakeholder and citizen inclusion is the most pressing priority for achieving sustainable river management in Cesena. The management of the river needs to clarify following questions

- How can the river valorisation strategies balance ecological restoration with urban development while ensuring flooding resilience?
- What role does participation play in fostering socially inclusive and environmentally sound river management?
- How can cities like Cesena leverage the NEB Impact Model to measure and optimise sustainability outcomes across environmental, social, and economic dimensions?

2.2 Inspirational cases for governance and participation

The gap analysis with the NEB Impact Model delivers quick results on the needs of the city, which need to be considered in a sustainable management structure. This can help in significantly mapping inspiring cases and best practices in an effort to jumpstart the ideation process. To prepare exchanges, we selected three examples that can serve to illustrate how to deal with the main topics: (a) a governance model, (b) a mixed-use-lab can be combined with energy production and (c) an example of dealing with the environmental challenges posed by rivers. There might be the need for further examples and deeper investigations, but to start the process of matching challenges with solutions, these first three examples can be useful.

Urban Commons – Torino – governance scheme. The concept of urban commons in Torino [20], Italy, represents a transformative approach to managing shared urban resources through collective governance and citizen participation. In Torino, this concept has gained traction as a response to urban challenges such as social fragmentation, economic inequality, and environmental degradation [21]. The governing as commons, allows to balance the interests of various stakeholders, including local governments, private actors, and citizen groups requires robust frameworks for collaboration and conflict resolution.

Energy Lab – Copenhagen – cross-financing green areas management. The energy project integrates the care of green areas into the operational framework, which focuses on combining renewable energy production with urban green space management through IoT technology [22]. The project utilizes solar panels installed in parks and green rooftops to generate clean energy while preserving and enhancing the ecological value of these spaces. By integrating photovoltaic systems with green infrastructure, the project not only contributes to the city's ambitious goal of becoming carbon-neutral by 2025 but also promotes biodiversity and improves urban microclimates.

Rhine River basin management – cross-country – participative management of the Rhine River. The participative river management involves multiple stakeholders from Germany, France, Switzerland, and the Netherlands. This initiative emphasizes collaborative governance to restore and protect the Rhine River's ecological health. Local communities, NGOs, scientists, and policymakers work together to address challenges such as pollution, flood management, and biodiversity loss.

3 Conclusions for the use of the NEB Impact Model

The findings of this study underscore both the strengths and persistent challenges in Cesena's approach to sustainably managing the Savio River. The city and its citizens have developed substantial experiential knowledge in addressing river-related issues, forming a solid foundation for future initiatives. However, the transition toward a truly integrated, participatory, and climate-resilient river management system remains hindered by fragmented governance, limited stakeholder collaboration, and a predominantly top-down decision-making structure, which has not yet adequately respected the existent economic factor. Unifying

stakeholders under a shared vision remains one of the biggest challenges. The NEB Impact Model analysis highlights not only the gaps, but also underlines the need to include more actors to balance the interests and therefore strengthen the long-term benefits. Managing the balance between ecological and urban needs has to be based on a holistic perspective. The proposed innovative public-private management scheme must harmonize hydraulic safety, ecosystem preservation, and community connectivity to simultaneously mitigate flood risks and improve quality of life [5]; [23]. The NEB Impact Model can help to define the pillars of such a management system or framework. Enhancing and strengthening the river governance to be truly participatory is not only an ethical wish, but a must due to hydraulic challenges and risks. Systemic empowerment of local communities—through co-design processes, river-focused events, and clear participatory roles—is essential to build trust and ensure long-term sustainability [4]. The NEB Impact Model's emphasis on inclusivity and co-creation offers a viable framework for such engagement. While Cesena excels in climate adaptation and outdoor quality, gaps in circular material use, cultural sustainability, and equitable economic models require targeted interventions. Legal and financial mechanisms must be reinforced to support stakeholder collaboration and reduce societal costs [2, 6].

The restoration of the Savio River demands a paradigm shift—from reactive, sectoral interventions to proactive, holistic management. The NEB Impact Model can be utilised in a quick self-assessment to identify gaps and weaknesses, as well as strengths. Especially the communication between different departments and expertise can be handled in a productive and illustrative manner. But the self-assessment is only an indicator, if the described topics are taken care of – this is not an indicator for how well the aspects are handled, or how innovative the practices are. Therefore, this quick application of the NEB Impact Model is not a qualitative rating by any means. Taking this shortcoming into account, the model might be a useful tool to test and verify its use in other contexts and constellations.

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4.2 Disclosure of interests

In the interest of transparency, the authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper. Any potential conflicts of interest have been fully disclosed to ensure the integrity and credibility of the research findings. This disclosure aligns with ethical standards in academic publishing.

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