



Delft University of Technology

Presenting Small ports, Big challenges

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Presenting Small ports, Big challenges

20 Dec 2024

Yvonne van Mil, Mila Avellar Montezuma, Marlies Augustijn, Beate Begon, Jean-Paul Corten, Fangfei Schutte-Liu, Matteo D'Agostino, Paolo De Martino, Mattia De Lotto, Carola Hein, John Hanna, Lukas Höller, Elena Marie Ensenado, Lea Kayrouz, Alankrita Sarkar, and Francesca Savoldi



Figure 1: Map of the port city territory of Rotterdam, taken from Hein, van Mil and Ažman-Momirski, 2023.

Large ports such as Rotterdam, Shanghai, or Los Angeles are always in the foreground; they are in the press, the subject of many academic studies, and key players in political decision-making, but what about all small and medium-sized ports in the same territory? If we look at the map of the port city territory of Rotterdam (Hein et al., 2023), we see several red spots indicating the ports of Scheveningen, Schiedam, Dordrecht, and Moerdijk, among others. These ports facilitate access to water and land, effectively support local industries, connect communities, and cooperate with larger maritime hubs (Figure 1). Together, these small ports form an important spatial, social, and economic grouping that is under-researched (Carella et al., 2024) and in need of comprehensive planning and policy advice. This blog presents different perspectives on the challenges and opportunities of small ports by presenting five ongoing projects by PortCityFutures members that address key issues in small ports. These projects were presented during the poster presentation at the symposium [\(RE-\) CONNECTING MARITIME-URBAN ECOSYSTEMS](#) on 16-17 September, 2024.

In today's rapidly changing landscape and at a time of rising sea levels, port city territories or other water-bound areas face complex challenges—balancing security, sustainability, and economic development. Addressing these issues requires a comprehensive and inclusive approach that values the insights and innovations of smaller port communities in building a resilient and sustainable future. However, the important role of smaller ports is often overlooked (Carella et al., 2024). Small ports are located along coastlines, rivers, lakes, or other bodies of water, and generally operate with smaller vessels and limited capacity, handling less than 10 million tonnes of goods annually (Bernacki & Lis, 2021). They tend to have a smaller physical size and footprint, less extensive infrastructure, and fewer facilities than larger ports.

Small ports can be defined not only by their volume of cargo handled, but also in relation to other ports within the same ecosystem, territory, or network. Smaller ports can play a crucial role in the resilience of the territory, contributing to economic, social, and environmental sustainability. Unlike large ports, which are often resistant to change, smaller ports such as Scheveningen, Schiedam, and Nijmegen offer opportunities for experimentation and innovation. Their deep-rooted links to the local maritime heritage make them ideal places to test new ideas, foster collaboration, and build a resilient future. In addition, these ports need targeted policies, planning, and support to meet contemporary challenges and maintain their position or even survival, especially in terms of long-term development and their relationship with the regional or territorial context.

Small coastal ports along the North Sea

The *Living with Water* project underscores the importance of small ports in the Dutch Delta, showing how studying these adaptable hubs can drive structural, cultural, and environmental changes across the region, especially in more complex ports like Rotterdam. By focusing on small coastal ports, the project aligns with broader strategic themes explored by the *NXR-2024 Designing for Extremes* initiative, where port resilience and heritage strategies are at the forefront of adapting to climate challenges. Both projects converge on the critical goal of preparing Dutch coastal cities to withstand rising sea levels through innovative strategies that blend cultural heritage with traditional-contemporary-innovative adaptation measures. This holistic approach not only alleviates pressures on larger port hubs but also strengthens the connection between communities, ports, and the urban-maritime territories that surround them, forming a roadmap for future resilient port-city relations and contributing insights toward global adaptation strategies and public policies.

Living with water: Exploring the role of small ports of the Dutch Delta (figure 2) explores how studying small ports can inspire structural, cultural, and environmental changes in larger ports like Rotterdam. The Dutch Delta, known for its innovative water management and maritime infrastructure, faces increasing challenges due to climate change, urbanization, and evolving economic demands (Meyer, 2012). The project aims to define what makes a small port unique within the global network and to explore the relationship between ports and cities. It will gather insights from key actors and stakeholders to examine current trends and imagine future scenarios, which will culminate in a conference, bringing together experts to share knowledge and shape the future of small ports. By adopting a holistic approach, it aims to co-create resilient, sustainable futures for the Delta region's small ports. Engaging citizens in the process will help generate implementable solutions that improve the relationship between cities, ports, and water. A comprehensive “Catalog of best practices” will capture the narratives of different small port cities, offering insights through data, spatial analysis, expert opinions, and innovative student projects. This will serve as a roadmap for future port-city relations.

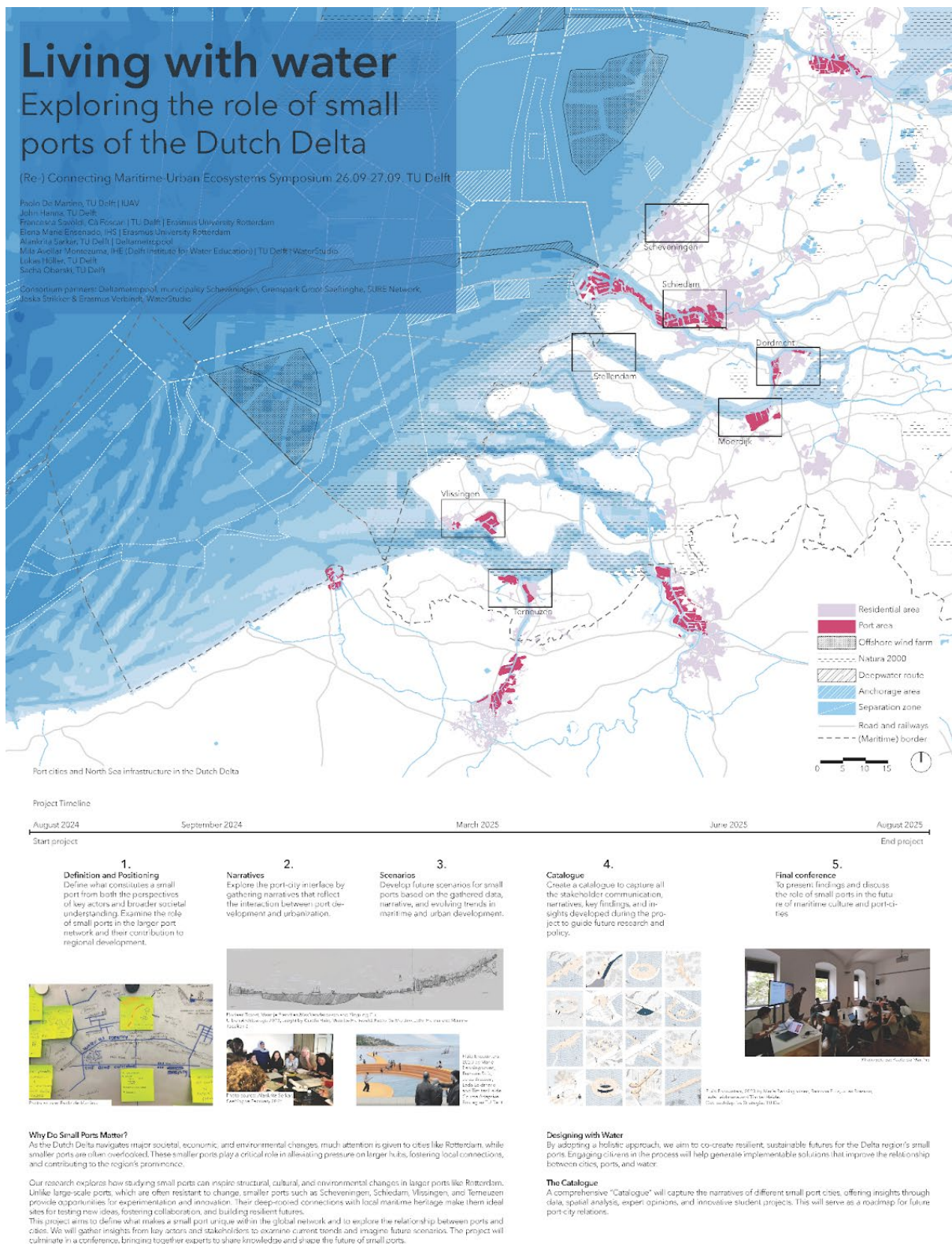


Figure 2: Poster of “Living with Water”, a project coordinated by Paolo De Martino and John Hanna together with Alankrita Sarkar and Mila Avellar Montezuma, Francesca Savoldi, Elena Marie Ensenado, and Lukas Höller.

The [Netherlands Exchanges Recife](#) *NXR-2024 Designing for Extremes: Heritage Strategies to Sea Level Rise Adaptation* (figure 3) project raised the question of how we can adapt and protect our coastal port cities from rising sea levels. The Hague, the political capital of the Netherlands and a known climate hotspot, is threatened by rising sea levels. The project initiated an event with the aim of finding ways to protect the capital from permanent flooding. The focus is on the port city of Scheveningen, its vulnerability to climate change, the impact on its water systems and cultural heritage, and the port terminal's climate adaptation strategies. Historically, water management in the Netherlands has mainly emphasized “protection” technologies; at this moment of cooperation between more than five continents, our strategy was to develop protection, adaptation, and mitigation to combat the adverse climate impacts projected for The Hague, thereby adapting and securing the port city against the encroachment of the North Sea. NXR-2024 builds on a 12-year partnership between the Netherlands and Brazil that has generated valuable insights and strategies for both countries. It brought together a global network of experts and activists for five intensive days in The Hague. This interdisciplinary workshop generated more than 60 innovative ideas on protection and adaptation (“living with waters”) to address pressing water challenges, culminating in a public debate with key authorities. Rethinking heritage through the lens of a 3.8 billion-year-old natural system in constant flux, the workshop proposed multi-scale interventions to protect and adapt The Hague, its port of Scheveningen, and coastal areas against rising sea levels. Among many follow-up activities, these shared ideas will shape public policies on climate adaptation in both the Netherlands and Brazil and contribute to the agenda of the 30th UN Conference of the Parties (COP30) in Brazil in 2025.

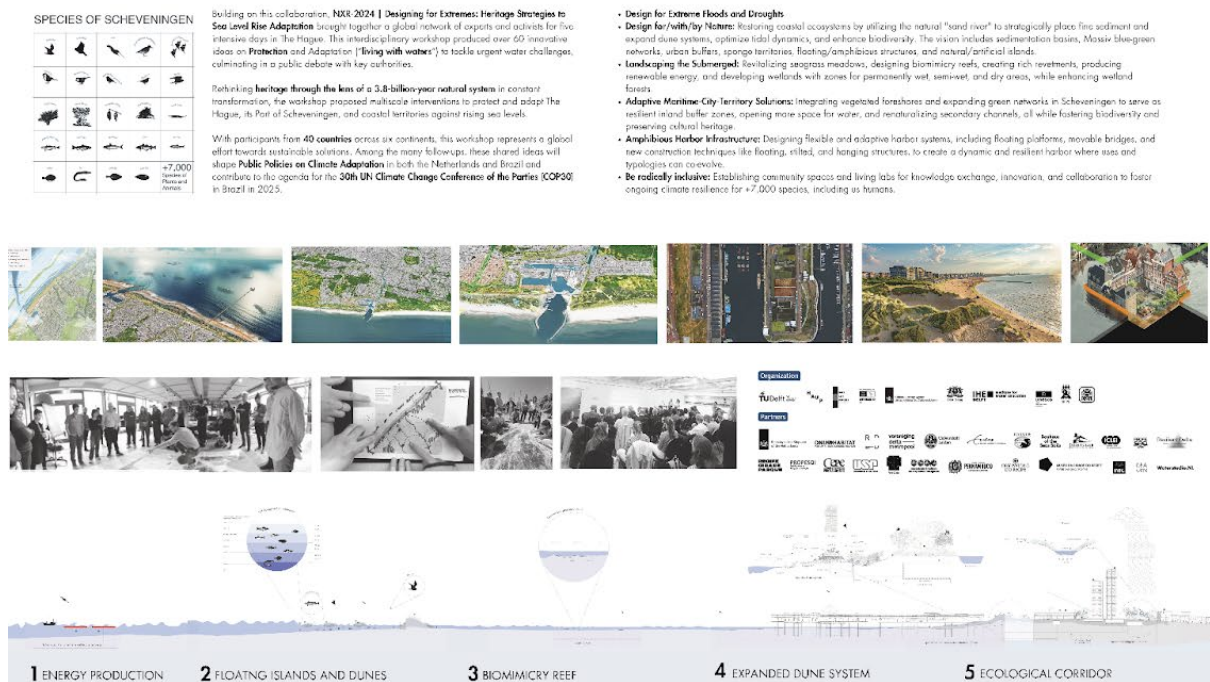


Figure 3: Poster of “NXR-2024 Designing for Extremes”, a project coordinated by Mila Avellar Montezuma, Carola Hein, Jean-Paul Corten (The Netherlands Cultural Heritage Agency - Ministry of Science, Culture and Education of the Kingdom of the Netherlands), Beate Begon (Policy advisor urban development, municipality of The Hague), Fangfei Schutte-Liu (Advisor Urban Planning, municipality

of The Hague), and Marlies Augustijn (Advisor Sustainable Living Environment, municipality of The Hague).

Small European port cities as part of river networks

Academic research has largely focused on maritime seaports (Bird, 1963; Hein, 2011; Hein, 2023), while river and inland ports have received comparatively little attention. This research gap reflects the general academic neglect of small and medium-sized ports, as most European river ports fall into these categories. Despite their size, river ports are essential as they serve as key hubs connecting large and small coastal ports to waterborne hinterland networks. Inland ports, in turn, rely on their strategic location within networks linking major coastal ports or urban centers. For example, Nijmegen is the largest inland port in the Netherlands and benefits from its location on the Rotterdam-Ruhr link. The next three projects deal with these river or inland ports, all from a different perspective and at various scale levels. They focus on ports as well as the surrounding cities, which might be large (such as Paris and Cologne) as well as small settlements (such as Dordrecht or Nijmegen). The study on river port cities examines the relationship between European ports within river networks and between the port, the city, and the surrounding landscape to better understand the complexity of these territories within their catchment areas. This research is part of a comparative study entitled *River Port City Atlas*, which will culminate in the publication of an atlas exploring the spatial challenges and potentials of river port city territories in Europe. The PhD project *From Healthy Cities to Territories of Wellbeing* examines the small and medium-sized river port cities in the Rhine basin as a subject for research on regional health and well-being. While the *Navigating Challenges* project zooms in on the case study of Nijmegen and the use of the river by the local community. All three projects show that everything is connected, from water safety and sustainability to economic interests and social concerns.

The poster of the forthcoming *River Port City Atlas* (figure 4) presents a holistic geospatial mapping approach to understand the complexity of river port city territories within European river basins. Similar to smaller coastal ports, river ports can play a key role in sustainable development, with opportunities to address water-related risks and contribute to the Sustainable Development Goals. However, they are often overlooked and understudied, especially in relation to their territory and water network. Given the interconnectedness of these areas through water systems, their design, planning, and policy have become an interdisciplinary challenge that requires a thorough knowledge of the different processes and interrelationships between functional, political, and environmental aspects. The proposed new GIS-based mapping methodology addresses these medium or small river port areas by providing a framework for analyzing the overlapping arenas—morphological, functional, and institutional—that shape port city territories. By integrating geospatial datasets, it serves as a tool to better understand the complex relationships between river, port, city and territory, and the role of river port cities within their territories and water networks, supporting a holistic view of their operations and impacts. This provides valuable insights for planners and policy makers and fosters strategic dialogue between academia and government to improve collaborative planning for sustainable urban development in shared river basins. Having tested the methodology for the Rhine basin, which has provided insight into the different categories of river port city territories and the logic of their position in the network, future research will extend this approach by studying other European river basins and port areas, with the aim of producing a follow-up volume to the *Port City Atlas* (Hein et al., 2023). This further research will refine the methodology and contribute to a more comprehensive understanding of European river port cities, identifying key challenges and questions for future research.

River Port City Atlas - Everything Everywhere All at Once

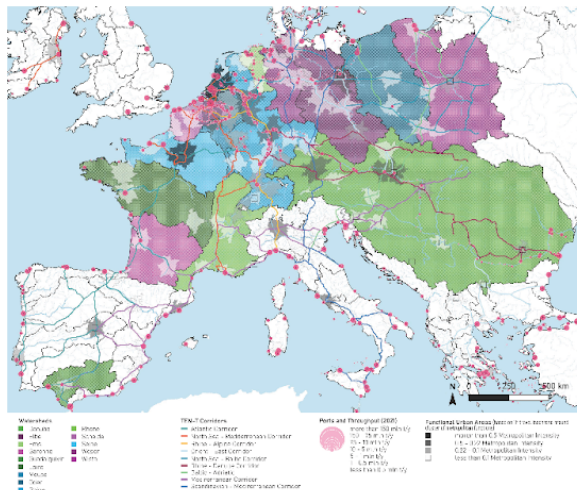
A holistic geospatial mapping approach to understand the complexity of River port city Territories within European watersheds



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Purpose

This poster presents the first steps towards a detailed yet comprehensible geospatial mapping of the complex interrelationships of European river port cities. These areas can play a key role in formulating sustainable development strategies and mitigating anthropogenic risks. However, they are often overlooked and insufficiently studied, both individually and in relation to their network and territory. By using a GIS-based approach to study, define and categorise European river city areas within their catchment areas, and by integrating different geospatial datasets, our mapping methodology enables the representation of complexities and logics in space and governance, and a better understanding of the interrelationships between river, port, city and territory in general, and between different inland port areas as a whole.

Originality/value

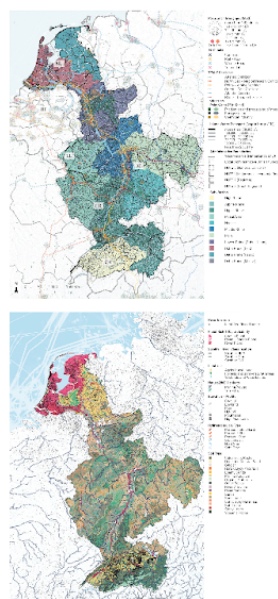
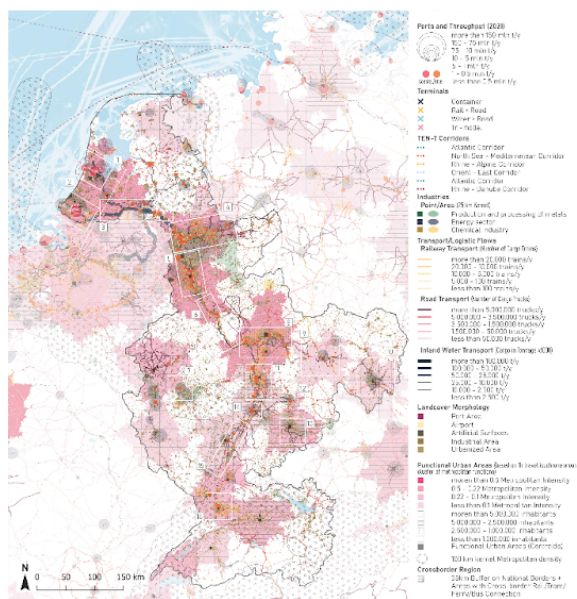
Such findings can prove valuable to planners and policy makers and enhance strategic dialogues, not only within the academic field, but also between stakeholders, planners, decision makers and policy makers. This will ultimately contribute to integrative understanding and collaborative planning for future sustainable development trajectories of urbanised port areas in shared watersheds.

Methodology

The methodology uses a sequence of steps, starting with the definition and selection of scales of analysis, through to the study of watersheds using a combination of functional, morphological and institutional spatial indicators, highlighting the need for a multidisciplinary understanding of such complex geographies. Having identified the Rhine basin as the watershed where most spatial challenges converge, we used this geography as a case study area to test our mapping methodology.

Findings

Although the methodology is still under development and comparisons with other river basins and European river port city areas are needed for a more complete understanding, the GIS mapping methodology already provides a better understanding of the interrelationships between rivers, ports, cities and territories, between inland port areas in general and within their network. This is an important and essential step towards sustainable development.



Morphological, functional and institutional dimensions are used to spatially define and categorise the river port city territory within the river basin.

Morphological

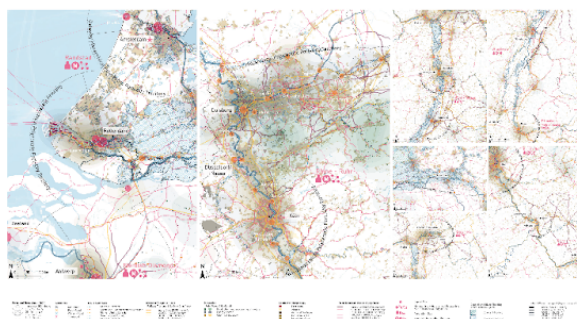
The morphological dimension is the spatial synthesis and outcome of long-term decision-making, planning and institutional negotiations, and helps to spatially define port city territories and better understand their complexity and underlying spatial relationships. This includes land cover, as well as flood plan areas, elevation, Natura 2000 sites and river barriers.

Functional

The functional dimension defines the territory on the basis of flows of goods and people or information, either from the (urban) core to the periphery or between different cores. They are visible through the transport and logistics links between the different urban and non-urban regions, the different industrial activities and their (re)distribution throughout the territory, and finally the different specialised urban/metropolitan functions and the accessibility of these services.

Administrative

In order to identify the responsible institutions and stakeholders involved, as well as to gain a more nuanced understanding of decision-making processes across different scales and administrative units, we mapped the boundaries of the river basin and its sub-basins, the administrative units at different NUTS levels, and finally the local administrative units, including the metropolitan areas and cities.



Next Steps

River port cities can play a key role in formulating sustainable development strategies and mitigating anthropogenic risks. Given the interconnectedness of these territories, their design, planning and policy has become an interdisciplinary challenge that requires a thorough knowledge of the different processes and interrelationships between functional, political and environmental aspects. The main contribution of the methodology presented here is that it outlines a basic framework of the morphological, functional and institutional logics of the multiple overlapping 'arenas' that make up different port cities. This methodology can be used as a tool to help us define and better understand river port cities, their function within the territories affected by port activities, and their position within the water network of which they are a part. It is a first step towards unravelling 'everything, everywhere, all at once'.

As a next step, this methodology will be further explored by studying and comparing other European river basins and river port areas. This is essential if definitive conclusions are to be drawn. In doing so, we aim to produce a follow-up volume to the *Port City Atlas* (by Hein, Van Mil and Azman-Momirski, 2023) on inland port cities, with the intention of providing an integrated systematic research methodology for studying and comparing European river port city territories, and to generate a more robust overall knowledge of these areas and identify future questions/challenges.

Figure 4: Project poster of “River Port City Atlas. Everything Everywhere All at Once”, which presents the first efforts for an atlas of River Port City Territories, by Lukas Höller and Yvonne van Mil.

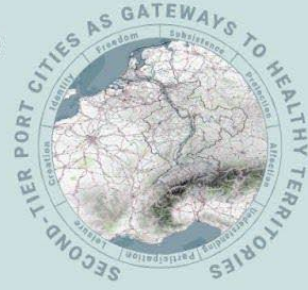
The Project “*From Healthy Cities to Territories of Wellbeing: Transforming second-tier port cities along the Rhine*” (figure 5) focuses on small and medium-sized river port cities along the Rhine and sees them vital to research regional health and wellbeing, as they form a unique polycentric network rooted in historical merchant trade and economic independence from national or monarchical forces and interdependence between each other. Today, facing shared challenges like flooding, drought, and industrial pollution, these cities can benefit from collaborative approaches, as seen in initiatives like the International Commission for the Protection of the Rhine. Yet, expanding these corporations beyond current environmental and economic management activities could foster even better and more territorial-based integrated planning for health and wellbeing across scales and borders, leveraging the region's adaptive capacities and historical interconnectedness through small and medium-sized river port cities.

From Healthy Cities to "Territories of Wellbeing"

Transforming second-tier port cities along the Rhine

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Abstract

This project presents both a critique and a conceptual advancement of city-focused health and wellbeing approaches, such as the Healthy City Movement initiated by the World Health Organization. It also outlines the initial steps towards operationalizing a research and planning framework for health and wellbeing on a broader territorial scale.

First, the project critiques the limitations of focusing solely on individual cities, even when organized in network structures, as viable alternatives to globally driven, economy-focused planning and governance frameworks. Localized improvements, though important, often fail to impact the larger system, especially in addressing territorial crises that transcend city boundaries. Furthermore, an emphasis on large, primary cities overlooks the innovative potential of medium-sized, second-tier cities. These cities, especially in Europe, are central to an interconnected urbanization model, yet are often neglected in health and wellbeing-driven planning approaches.

The project proposes that scaling research and planning for health and wellbeing across these medium-sized second-tier cities—particularly those in historically integrated port cities within the Rhine watershed—can unlock new opportunities for collaboration, shared capacities, and innovative development strategies. These cities serve as key nodes in polycentric, cooperative urban networks, offering a pathway towards "Territories of Wellbeing."

Finally, the project argues that simply expanding city-based frameworks is insufficient. Instead, it proposes an alternative approach by adopting Manfred Max-Neef's Fundamental Human Needs (FHN) framework. The holistic and nuanced nature of the FHN framework, with its focus on the relationship between needs and satisfiers, non-hierarchical need structures, and the integration of individual, social, and political dimensions, can offer a more comprehensive approach to addressing territorial wellbeing. This approach also emphasizes adaptation and active participation as essential components for satisfying human needs in spatial planning and governance.

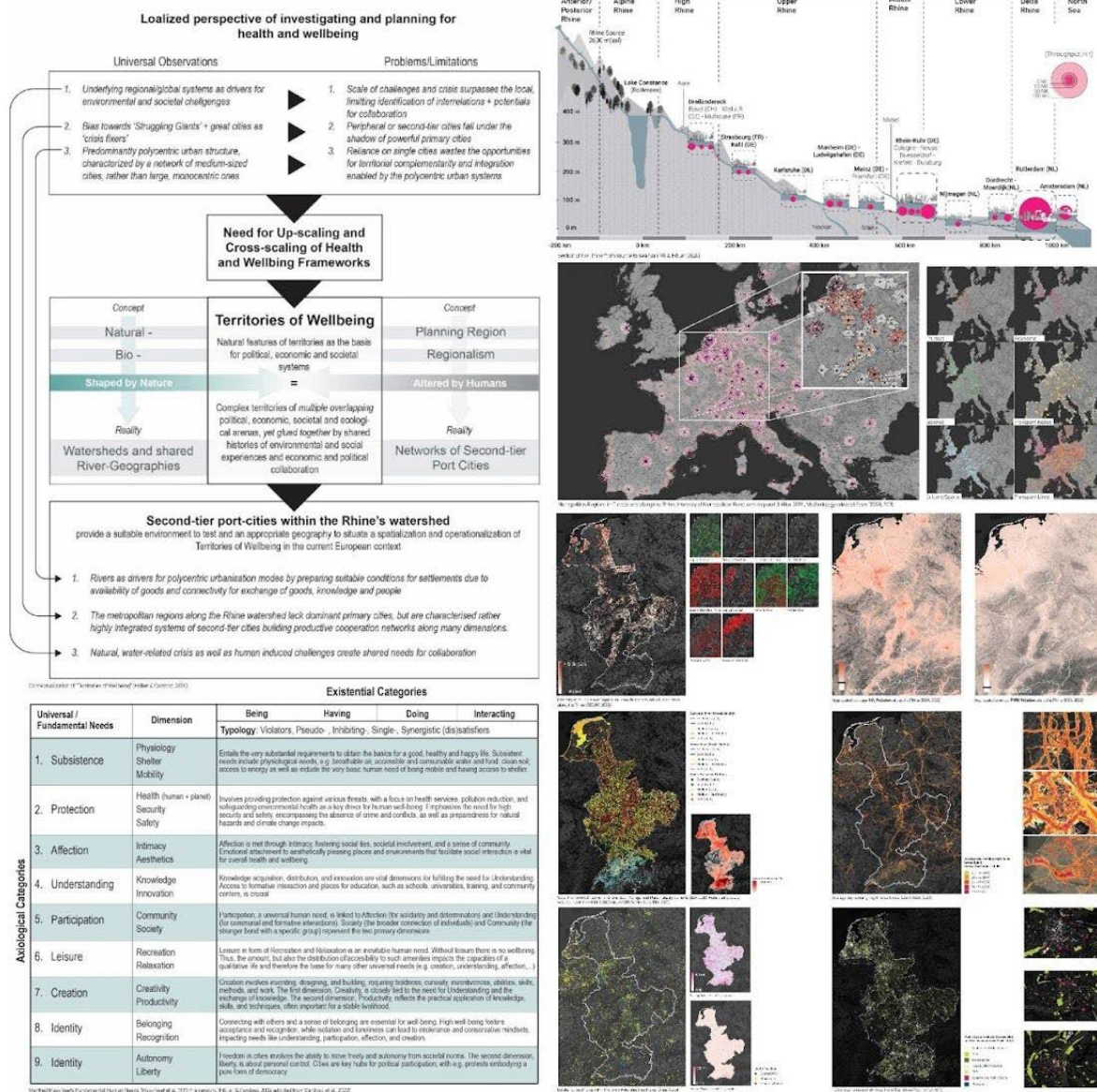


Figure 5: Poster of the PhD-project "From Healthy Cities to Territories of Wellbeing: Transforming second-tier port cities along the Rhine", by Lukas Höller.

The project *Navigating Challenges: Small Port Cities and Water User Conflicts* (figure 6) reflects on the socio-spatial analysis of the Nijmegen Waal/Spiegelwaal. It shows that urban small ports continue to play an essential role in the city economy while clashing with communities' changing needs and requests for leisure and public spaces. To meet increased demands for water safety, port authorities, city planners, and different government bodies need to work with local communities to avoid conflict and address how residents inhabit newly created spaces. In response to the devastating floods of the 1990s, the Dutch government launched the "Room for the River" program in the early 2000s, with 34 sites implemented between 2007 and 2015. A key project was the redevelopment of the River Waal near the city of Nijmegen, which included the creation of a side channel (the Spiegelwaal) and an island (Veur-Lent), the relocation of dikes, the development of waterfronts, and the construction of three new bridges. These newly created spaces have made Nijmegen internationally popular and are a source of pride for many Nijmegeners. At the same time, local residents and tourists began to inhabit the river park and its bridges in unexpected ways, creating alarm in public authorities concerning water safety. The number of new water users engaging in a variety of leisure activities vastly exceeds what was planned and are taking over spaces on the river Waal that are primarily used for industrial shipping and recreational cruising. This created a number of potential hazards, ranging from swimming in polluted waters to the danger of drowning and boating accidents.

The project developed as a multidisciplinary effort to assist municipal and Rijkswaterstaat employees in pursuing a better understanding of different stakeholders' choices, changing preferences, and values to raise awareness towards a safe shared use of the Waal and the Spiegelwaal. In line with the value case approach (D'Agostino & Hein, 2024) developed through the creation of the professional education course [Water System Design](#), the team engaged in three levels of analysis: historical, spatial, and social. The combination of the three levels carried out through a mixed method approach that integrated ethnography with analytical mapping generated valuable insights regarding changing definitions and perceptions of water safety both from the governance and the residents' perspectives, uncovering implicit values guiding the different stakeholders' choices and actions in their socio-spatial practices. This resulted in design proposals and policy recommendations hinting at a long-term, multi-scale approach to better integrate diverse publics and resolve conflicts, arguing that ongoing and multisectorial engagements, rather than a project-based approach, are needed to address changing values and stakeholder dynamics.

Navigating Challenges: Small Port Cities and Water User Conflicts

A socio-spatial analysis of the Nijmeegse Waal/Spiegelwaal

New spatial adjustments modify the way in which people engage with water, creating new practices and behaviors that planners need to think ahead about. Small ports have the challenge of having more users sharing the same space and the need for more collaboration to avoid conflicting uses. Small ports also offer a smaller stakeholder community which might be easier to get to and involve. However, community engagement and participation can be difficult to achieve, while planners are facing challenges that were unexpected. In Nijmegen, the municipality and Rijkswaterstaat are experimenting with agile design and short-cycled experiments to engage actors and address current challenges. Our role was to analyze spatial and social practices to understand new users' interests, values and behavioral patterns.



Figure 1: Two images of the Waal river area and after the 'Room for the River' project. Source: aerial images from Google Earth and a map from Rijkswaterstaat.

After the devastating floodings of the 1990s the national government and Rijkswaterstaat initiated the Room for the River program in 2000 and implemented it in 2007 in 34 different locations in the Netherlands. One of the most challenging was the redesign of the Waal in the Nijmegen area.

The project covered an area of more than 120 hectares, and included the construction of a side canal with inlet, along with dike relocations, waterfronts and nature development, and the construction of three new bridges over the Waal. The construction of the side canal, resulted in the formation of an elongated island in the Waal, called Vuur-Lent. The island and the diversion canal collectively constitute a river park, a floodplain part of a comprehensive landscape plan with the objective of integrating key locations on both banks.

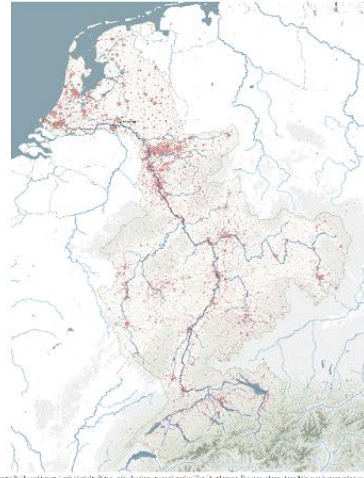


Figure 2: Map of the Netherlands showing the location of Nijmegen. Source: Rijkswaterstaat, 2023. See also the map on the left side of the poster.

Nijmegen is one of the largest inland port cities in the Netherlands and benefits from its strategic location on the transnational transport route between the Dutch gateway port of Rotterdam in the west and the German Ruhr area in the east, including Europe's largest inland port of Duisburg. In addition to economic opportunities, this riverside location and connection to a transnational water networks of the Rhine and Maas basins brings complex challenges such as flooding and water pollution.



Figure 3: Map showing the distribution of spatial layers along the river. Source: Rijkswaterstaat, 2023.

This set of maps shows our own observations of the area and the results of interviews with several people involved in the 'Room for the River' project, representing different stakeholders that are involved in the area.

The comprehensive dataset derived from the interviews was translated into a number of spatial layers, each representing primary factors influencing the design process, the aspirations of the designers and the intended use of the designated spaces (left side). This mapping process culminates in what can be termed a post-process masterplan, which narrates the project as some authors have experienced it after its completion. The second map (right side) has been drafted using the same methodology to illustrate the actual outcome of the project and the different uses by different groups of stakeholders, illustrating the variety of spatial activities that take place in the area and suggesting the multiplicity of factors that come into play. The juxtaposition of these sets of intangible layers would demonstrate a mismatch between the planned use and actual use of the area, particularly in terms of places for gathering/recreation and places for access to the water.

The quantity of new water users together with the prominent role of the river port is creating new challenges: if the city is now safe from flooding water safety has shifted towards safe use of waterways, awareness of possible hazards, water quality and presence of waterborne diseases with a general attention to human health and biodiversity.

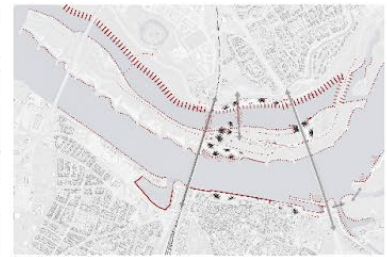


Figure 4: Map showing the distribution of spatial layers along the river. Source: Rijkswaterstaat, 2023.

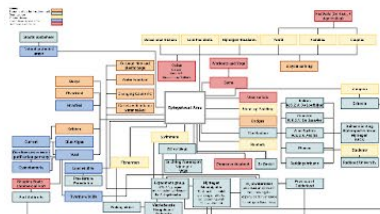


Figure 5: The network of stakeholders and other relevant actors surrounding the Spiegelwaal area, including various actors. Source: Lea Kayrouz and Matteo D'Agostino, 2023.

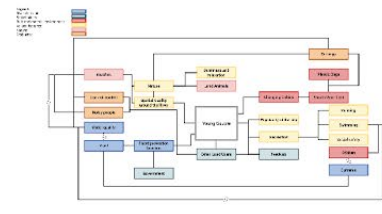


Figure 6: Network of stakeholders and other relevant actors surrounding the Spiegelwaal area. Source: Lea Kayrouz and Matteo D'Agostino, 2023.

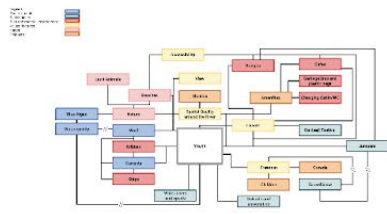


Figure 7: Network of stakeholders and other relevant actors surrounding the Spiegelwaal area. Source: Lea Kayrouz and Matteo D'Agostino, 2023.

Different types of agents – organizations, private citizens, non-human actors, and activities-commercial, public, individual – interact with the natural ecosystem and the built environment of the Spiegelwaal and Vuur-Lent. Each of these agents has a different relationship to water, and this depends on their respective values. Figure 6 illustrates the current network of human and non-human actors surrounding the Spiegelwaal.

Different stakeholders have diverse expectations and claims about the Spiegelwaal. Institutions aim to reduce accidents and establish safe water practices, ensure water quality and maintain the Spiegelwaal flood prevention function. Other stakeholders have other priorities and claims.

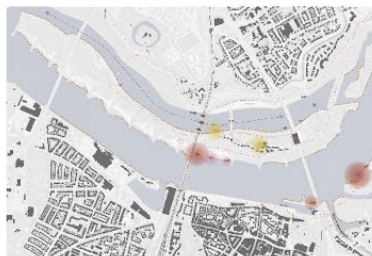


Figure 8: Map showing the distribution of spatial layers along the river. Source: Rijkswaterstaat, 2023.

The overarching insight that emerges from this analysis is that everything is connected to everything – and to each other. The Waal connects many and different types of users and stakeholders, locally, but also nationally and trans-nationally. In addition, water-related challenges such as water security, water quality and biodiversity are intertwined. The analysis suggests that we need longer-term, multi-scalar analysis to facilitate broader understanding, to integrate diverse publics, and to resolve conflicts around shared spaces. The socio-spatial analysis suggests that value changes have occurred in the past and that conflicts between different stakeholders shift, calling for an approach that is continuous and not just focused on projects. Interventions such as the Room for the River project are dialogical, they require continuous understanding of the spaces and adaptations. Such an approach needs institutions that can facilitate an ecosystem of care and conservation.

Rather than addressing the theme of water security separately as part of different institutional or disciplinary frameworks with one being prioritized at the expense of the other, we need new approaches that facilitate engagement among different groups. The value case approach aims to provide a methodology on how to facilitate interaction and give room for engagement among different stakeholders.



Figure 9: Aerial view of the Spiegelwaal area. Source: Rijkswaterstaat, 2023.

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Figure 6: Project poster of “Navigating Challenges: Small Port Cities and Water User Conflicts. A Social Spatial analysis” by Carola Hein, Yvonne van Mil, Matteo D’Agostino, Lea Kayrouz, and Mattia De Lotto, carried out in the first half of 2024 on behalf of Rijkswaterstaat, as part of the [Interreg North Sea Connected River project](#).

Taken together, these projects illustrate the urgency of small ports and, in their own way, explore their potential and challenges and contribute to putting small ports on the agenda as one of the [research themes of PortCityFutures](#). The posters attracted a lot of attention and stimulated interesting conversations (figure 7).



Figure 7: Photo taken by Mila Avellar Montezuma during the symposium (RE-) CONNECTING MARITIME-URBAN ECOSYSTEMS on 16 September.

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