MAPPING EUROPEAN PORT CITY TERRITORIES.

A COMPARATIVE SPATIAL ANALYSIS

Yvonne van Mil and Carola Hein

INTRODUCTION

Port cities have played a pivotal role in the development of Europe for centuries. They have evolved through a continual process of global and local exchanges along interconnected waterways, resulting in the emergence of shared spatial, economic, political, social, and cultural patterns. The stakeholders in each port city include a port authority – often very powerful and linked to national authorities that control planning and development – and various local actors and citizen groups that typically hold less political and economic power. Despite the similarities between ports and their transhipment activities, over time each port city has developed its own distinctive spatial strategies and stakeholder constellations.

Increasing awareness of the historical factors that shape port cities and their relationships with each other can empower stakeholders to develop strategies that benefit citizens across port city territories. Such strategies are crucial for addressing climate-induced challenges, including energy transitions, migration, and various water-related urgencies. Historically, ports have played major roles in local economies and in the spatial and socio-cultural development of nearby cities. However, with containerisation and technological advances, the historically close relationship between ports and port-related activities in neighbouring cities has weakened, as has the visibility of port activities within urban environments. At the same time, the expansion of ports beyond their traditional urban locations has amplified their regional impact, both in terms of economic prosperity and environmental issues such as noise, pollution, and other forms of environmental degradation (Hein and Van Mil 2019).

In line with the *Port City Atlas* (Hein et al. 2023), this chapter introduces the concept of 'port city territory' as a new approach to understanding the spatial and social impact of shipping, logistics, commodity flows, and other port-related activities on nearby maritime, urban, and rural areas. By adopting this perspective, diverse local and global stakeholders can gain a more comprehensive view of how these activities shape nearby regions. Policies and governance approaches such as port regionalisation and port clustering affect nearby cities and territories. By examining the networked effects of port flows on nearby areas, we can develop a deeper understanding of the spatial implications of these new interventions. Additionally, this exploration can lay the groundwork for achieving port city symbiosis (Jansen and Hein 2023) and establishing more inclusive and sustainable approaches that foster connections between

ports, cities, and territories. The concept of 'port city territory' refers to the spatial expanse influenced by port activities, encompassing the port's physical infrastructure as well as its connections to broader urban, industrial, and hinterland areas.

EXPLORING THE SPACES OF PORTS, CITIES, AND TERRITORIES

Port city territories around the world may appear similar at first glance, due to their shared waterside locations, global maritime connectivity, and infrastructure. However, they differ significantly in terms of scale, form, spatial characteristics, and political, social, and cultural structures. At the PULSE event in Genoa on 14–15 September 2023, Karel Van den Berghe emphasised this diversity during his presentation, noting: "There is no Any Port, but there are M-Any Ports". He was referring to the well-known *Anyport model*, developed by geographer James Bird (1963). Bird aimed to provide a basis for comparing port development by abstracting ports into standard morphological objects and combining them with a particular version of reality.

Scholars from a variety of disciplines, including transport geography, regional science, and economic geography, have examined port-city relations, port regionalisation, and port clusters (e.g. Notteboom and Rodrigue 2005; Notteboom et al. 2009; Ducruet and Notteboom 2020; de Langen 2021). However, the spatial impact of ports and port clusters on neighbouring cities and landscapes remains underexplored (Hein and Van Mil 2019; 2022; Hein et al. 2023; Moretti 2023). To understand the diverse nature of contemporary European port city territories, mapping is essential. Geospatial mapping helps us process, analyse, and display complex spatial data, as well as compare different qualitative and quantitative datasets at various scales. This facilitates the visualisation and analysis of data while maintaining context and detail (Harley and Woodward 1987; Dorling and Fairbairn 1997). However, the greatest challenge of mapping is to find a way to use data to create maps that provide new insights into our research questions.

Geospatial mapping allows for the development of new findings into the overlapping spatial needs and interests of ports, cities, and territories. It can be approached from different perspectives and disciplines, providing a basis for comparative analysis that goes beyond case studies limited to national contexts, selected languages,

or disciplines. This chapter presents a novel geospatial methodology outlined in the *Port City Atlas* that is designed to map and analyse the port city territories in Europe. It focuses on spatial morphological patterns and functional relationships, revealing the spatial interaction of ports and their neighbouring cities and surrounding environments at various geographic scales. This new mapping can facilitate a nuanced understanding of the spatial factors that affect regional development, agglomeration patterns, and the changing dynamics of the port-city relationship.

Since 2010, there has been an acceleration in the trend towards regionalisation of ports, resulting in the formation of port clusters (ESPO 2022). However, ports located in the same geographical or administrative region do not automatically form a port cluster. While geographical proximity is a fundamental element, it is the merging or clustering of multiple port facilities that defines a port cluster. These clusters have emerged or have been developed by national bodies in response to challenges such as the shift to renewable energy and an increased focus on sustainability, which require more land and better coordination with hinterland logistics hubs (Moretti 2023). According to ESPO's report on trends in port governance in 2022, half of European port managing bodies manage two or more ports – sometimes even across national borders.

Port clusters have novel impacts on neighbouring cities and territories. Increased collaboration among ports can create new logistic flows that affect citizens and spatial development. Geospatial analysis of port city territories can help assess the impact of ports and port clusters on diverse territories, considering their history and specific functions. For example, a port cluster may be located in a territory consisting of a large port and a metropolis like Barcelona, a large port and multiple small ports in a decentralised urban agglomeration like Rotterdam, or several small ports in a sparsely populated area like Las Palmas. These territories also differ in their maritime functions, such as container transport, bulk goods handling, or cruise ship operations, each of which has a distinct spatial impact. Additionally, governance structures within these territories vary, each having its own policies and tools for planning and development. Managing port city territories requires an understanding of the spatial impact beyond traditional case studies of waterfronts.

MAPPING PORT CITY TERRITORIES: A NEW GEOSPATIAL METHODOLOGY

The *Port City Atlas* uses a multi-scale mapping approach to study port city territories. The first scale is the European continent. This mapping illustrates the interconnectedness of port city territories through water and land. It also explores their relationship with the European trading network, taking into account geographical, topographical, and political contexts. It emphasises the significance of the oceans in European development. The second scale focuses on the maritime waters surrounding Europe – the Baltic Sea, North Sea, Atlantic Ocean, and Mediterranean Sea. This allows for an investigation of port city territories within the maritime environment. Historically, natural spatial conditions and international trade networks have shaped port cities more than political boundaries. The third and smallest scale examines port city territories, encompassing the port, city, and surrounding landscape influenced by port activities.

The *Port City Atlas* facilitates comparisons of port city territories in Europe, acknowledging their unique characteristics while addressing the shared challenges they face. To ensure consistency in scale, legend, and data sources, we developed a standardised mapping method and used harmonised datasets from the European Commission to study and compare port city territories systematically. National and regional datasets, while more detailed and accurate, are often inaccessible or inconsistent across regions. By selecting open-access spatial and statistical datasets, we avoided issues with incompatible definitions and criteria. To study the natural geography of port city territories, we selected geospatial layers depicting land and water morphology, landscape elevation, and sea depth contours. To explore interactions between natural and man-made features, we included morphological patterns of port, industrial, and urban areas, as well as Natura2000 protected area data. We overlaid these spatial layers with European, national, and regional transport networks to highlight connections between ports and their hinterlands and forelands. Local administrative boundaries were added to show urban and maritime areas in relation to local regulations and interests. The maps also include infrastructural, political, cultural, and social points of interest, signalling the degree of urbanisation and centralisation in each territory.

INSIGHT GAINED FROM THE MAPPING

The *Port City Atlas* includes analytical chapters; most importantly, it offers 124 maps, including 100 maps of port city territories that can serve as a foundation for future research and policy making. The wealth of data embedded in the maps and data pages raises important questions and enhances our understanding of port city territories. To illustrate the potential insights to be gained from these maps, the following section includes findings shared in the keynote presentation at the PULSE event in Genoa on 15 April 2024. It focuses on patterns in the natural geographical conditions at the edge of land and water, and some port statistics. These morphological patterns and quantitative data highlight the differences among European port city territories and allow us to predict some spatial planning challenges.

At the European level, some patterns can be observed. For example, due to the natural geography at the water-land interface and the position of the port in the global trade network, there are explainable differences between the four sea basins: a maritime perspective is more revealing than a national one. France, for example, has eight major ports spread over three sea basins. Almost all of those on the Atlantic coast (Le Havre, Nantes Saint-Nazaire, and Bordeaux but not La Rochelle) are located in an estuary or river, which may be due to the rougher conditions of the Atlantic and the presence of navigable rivers. In the Mediterranean, with calmer seas, fewer major rivers and deltas, but more mountains and an irregular coastline, the ports are located in natural embayments (Marseille and Toulon). Dunkirk and Calais are located on the relatively shallow North Sea, where there are several deltas and major rivers, but these ports are located in a (narrow) strait and have an artificial coastline, as there is no natural protection for the safe loading and unloading of ships.

Reading the maps together with the port statistics, it is clear that the natural geography of port city territories affects port performance as well as throughput. Of the fifteen largest European cargo ports, 11 are located in an estuary or a river, including the five largest cargo ports in Europe: Rotterdam, Hamburg, Antwerp, Amsterdam, and London. Here, the main river on which they are located serves as a transport link to the fore- and hinterland, giving them an advantage over ports not located on waterways. The next four largest cargo ports are located in natural embayments. In contrast, most of the top fifteen passenger ports are located in straits, on engineered coastlines, or are surrounded by islands. This also reveals that the

location in the natural geography of water and land is related to port functions: cargo ports tend to be located along rivers, while passenger ports are more likely to be located along artificial coastlines or in natural bays. These findings also illustrate the proximity of large coastal ports, which tend to be located around islands, in narrow straits (e.g. Helsingborg and Helsingør in the Baltic Sea), in natural embayments (e.g. Trieste, Monfalcone, and Koper in the North Adriatic Sea or La Coruna and Ferrol on the Atlantic coast), and in large river estuaries (e.g. Immingham and Hull in the Humber Estuary on the North Sea).

The maps of the 100 port city territories represent their spatial layout, complemented by data pages displaying statistics related to the four spatial entities that make up the port city territories: the waterbody that serves the port, the port, the city, and its territory. For example, the section on the port shows the spatial share of different port functions in the city's administrative area based on land cover data. This data may indicate port specialisation. However, it can be misleading since the size of transhipments does not always correspond to the spatial share in the total port area. Passenger port functions, for instance, occupy less space compared to containers or bulk cargo. In some cases, ports have relocated industrial or polluting activities outside city limits, meaning these port areas are no longer administratively part of the city, which in turn also provides some insight. The types of throughputs, shown in the infographic, also illustrate the port's specialisation, which in turn affects the city and territory. For example, oil ports such as Brunsbüttel, are associated with polluting industries, while container ports require large areas for storage and efficient transport links to the hinterland and inland distribution centres.

Other port data includes the number and percentage of vessels entering the port, categorised by type, both in absolute terms and relative to other ports in the Atlas. These ships have a significant effect on the port, city, or surrounding territory, although the effects vary by type. In Palermo, for example, cruise ships enter the port alongside regular passenger vessels such as ferries. Attracted by the cultural heritage of the port city territory, cruise ship tourism brings economic benefits, but also puts pressure on UNESCO World Heritage Sites and Natura2000 sites in the territory, highlighting conflicting interests.

CONCLUSION

The mapping methodology outlined in this chapter offers a robust tool for understanding the complexities of European port city territories and anticipating the impact of new governance and policy interventions such as port clustering. By employing a standardised, multi-scale approach, it enables systematic comparisons and deeper insights into the spatial, political, and cultural dynamics that shape these territories and the impact that future decisions may have. The integration of spatial data with statistical infographics allows for a comprehensive analysis of the relationship between ports, cities, and their surrounding territories. This method not only highlights the diversity within port city territories but also provides a flexible framework for further exploration, allowing users to customise the mapping based on specific themes, time periods, or geographical areas. Ultimately, this approach advances our understanding of the spatial impact of ports on cities and nearby territories. It can be a valuable resource for researchers, planners, and policymakers who wish to navigate and address the complexities of these unique spaces.

References

Bird, J. H. 1963. *The Major Seaports of the United Kingdom*. London: Hutchinson.

Dorling, D. and D. Fairbairn. 1997. *Mapping: Ways of Representing the World*. London: Routledge.

Ducruet, C. and T. E. Notteboom. 2020. "Revisiting Port Systems Delineation through an Analysis of Maritime Interdependencies among Seaports". *GeoJournal* (3): 1831–1859.

ESPO. 2022. *Trends in EU Port Governance*. https://www.espo.be/media/ESPO%20Trends%20in%20EU%20ports%20governance%202022.pdf (accessed 20 August 2024).

Harley, J. B. and D. Woodward (eds) 1987. *The History of Cartography, Volume 1*. Chicago: University of Chicago Press.

Hein, C. and Y. van Mil. 2019. "Towards a Comparative Spatial Analysis for Port City Regions Based on Historical Geo-spatial Mapping". *PORTUSplus* 8. https://portusplus.org/index.php/pp/article/view/189 (accessed 26 August 2024).

Hein, C. and Y. van Mil. 2020. "Mapping as Gap-Finder: Geddes, Tyrwhitt, and the Comparative Spatial Analysis of Port City Regions". *Urban Planning* 5 (2): 152–166.

Hein, C., Y. van Mil, and L. Ažman-Momirski. 2023. *Port City Atlas: Mapping European Port City Territories: From Understanding to Design*. Rotterdam: nai010 publishers.

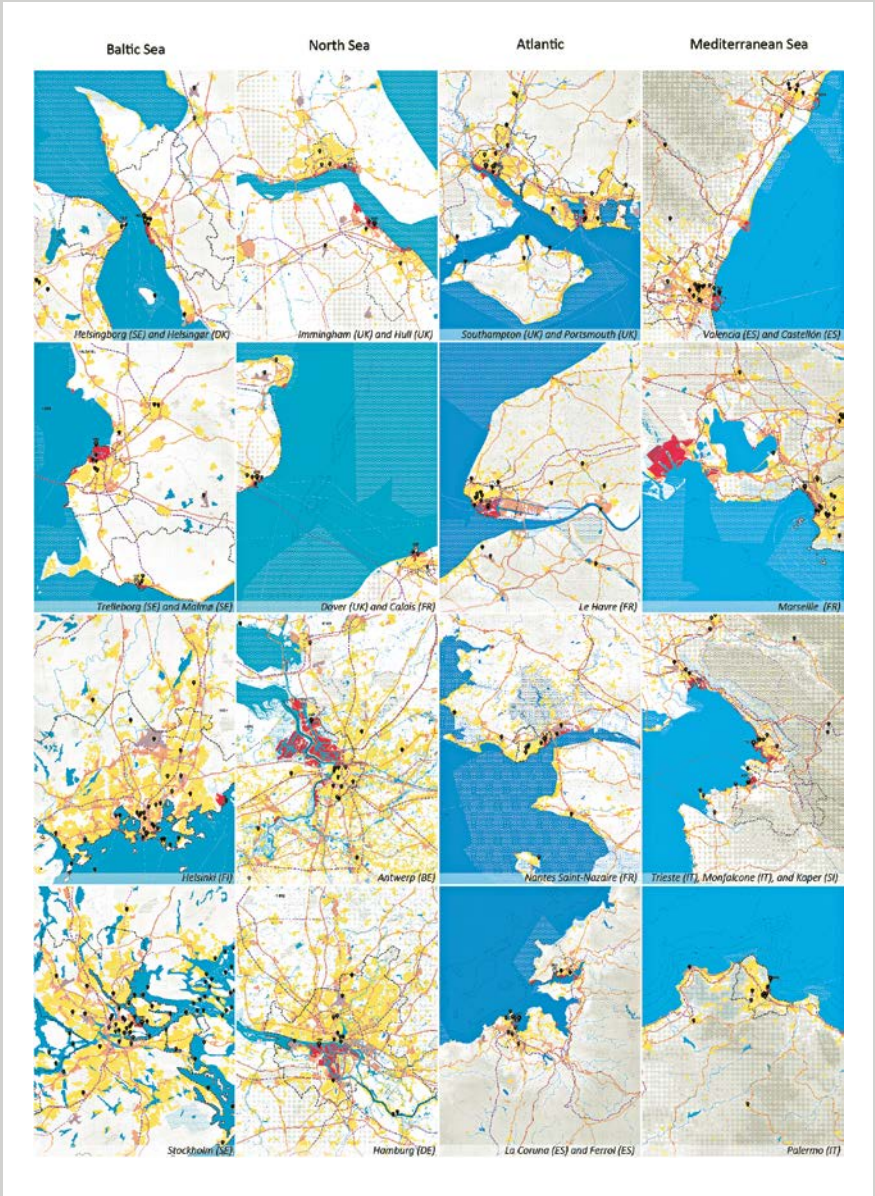
Jansen, M. and C. Hein. 2023. "Port City Symbiosis: Introduction to the Special Issue". *Maritime Economics and Logistics* 25: 211–229.

Langen, P. W. de. 2021. "Seaports as Clusters of Economic Activities". In *International Encyclopedia of Transportation, Freight Transport and Logistics*, Volume 3, edited by Roger Vickerman and Kevin P. B. Cullinane, 310–315. Amsterdam: Elsevier.

Notteboom, T. E. and J.-P. Rodrigue. 2005. "Port Regionalization: Towards a New Phase in Port Development". *Maritime Policy and Management* 32 (3): 297–313.

Notteboom, T. E., C. Ducruet, and P. W. de Langen (eds.). 2009. *Ports in Proximity: Competition and Coordination among Adjacent Seaports*. Aldershot: Ashgate.

Moretti, B. 2023. "The Port-clUster LandScapE: Developing a Spatial and Design Approach to Port Clusters". https://pulse.unige.it/research (accessed 20 August 2024).



Maps from the Port City Atlas. Mapping European Port City Territories: From Understanding to Design, Carola Hein, Yvonne van Mil, and Lucija Ažman-Momirski. 2023. Rotterdam. Source: Authors