

MAIN SECTION

Introducing the Bauhaus of the Seas Sails Geospatial Platform: A Spatially Enabled Mapping Framework for Analyzing Complex Territories

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ABSTRACT

This paper introduces an early version and ongoing development of a geospatial platform, developed for the Bauhaus of the Seas Sails, one of six lighthouse projects from the 'New European Bauhaus' (EU policy and funding initiative). This platform is a tool designed to analyze the coastal regions such as port-city territories, aimed at supporting sustainable development. The platform integrates open-access geospatial data with sustainability, aesthetics, inclusivity data, and narratives from land-sea interactions, enabling data-driven decision-making. Two ongoing research introduced in this paper, showcases the platform's usability and versatility: one investigates health disparities in Rhine Watershed cities, leveraging its multi-scalar and cross-border capabilities; the other explores transnational spatial planning in the Flemish-Dutch Delta, fostering stakeholder collaboration. Through testing and development of the platform using different research approaches, the aim is to create a dialogue between spatial experts, for positioning the geospatial platform as a valuable resource for promoting sustainable development in coastal regions, through enhanced data visualization, analysis, and knowledge sharing. Since the Bauhaus of the Seas Sails geospatial platform is still a work in progress, this paper introduces the platform with the focus on refining and optimizing its capabilities. The aim is to effectively integrate and visualize diverse geospatial data, ensuring and building upon the interplay with local values, and support multi-scalar, cross-border, and transnational spatial planning.

KEYWORDS

Geospatial mapping; geospatial platform; cross-border regions; mapping framework; port-city territories.

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1. Introduction

Coastal regions, by nature of their location, face significant environmental threats, including rising sea levels, extreme weather events, and erosion. Tools like web-mapping applications increase the accessibility and usability of information technology. As a counterpart to top-down planning processes, such an open-source GIS platform can enable bottom-up decision making and participation through awareness creation and information, education and increased literacy, local knowledge-creation and therefore create possibilities to gather contributions from all communities and participants whose voices and ideas would otherwise be excluded.

The New European Bauhaus, as a movement¹ to achieve the goals of the European Green Deal,² provides the right opportunity to engage and collect the knowledge from local communities and citizens. The (old) Bauhaus,³ renowned for revolutionizing 20th-century design by bridging art, industry, and construction,⁴ has inspired the European Union to envision a 21st-century counterpart.⁵ The New European Bauhaus is committed to leading a movement aligned with the Green Deal, emphasizing sustainability and social inclusion.⁶ Responding to this vision, the Bauhaus of the Seas Sails project⁷ proposes a continental mobilization centered around the world's most fundamental natural resource: the sea. Initiated in response to the climate crisis, the Bauhaus of the Seas Sails project is an interdisciplinary, intergenerational, and interspecies movement addressing the complexity and scale of the problem. It posits that seas, oceans, and water bodies are the definitive global natural and shared space in the EU and the world. Established in 2022 with EU funding, the project consortium comprises 18 academic, cultural, and territorial partners across 7 pilots within 4 aquatic ecosystems. This project offers a valuable consortia and group of experts, to learn from the locally rooted activities, while exploring the EU's transition across various aquatic ecosystems.

1 EU. "New European Bauhaus." Accessed October 16, 2024. https://new-european-bauhaus.europa.eu/index_en

2 EU. "The European Green Deal." Accessed October 16, 2024. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

3 Bauhaus-Archiv. "1919–1933." Accessed October 16, 2024. https://www.bauhaus.de/en/das_bauhaus/48_1919_1933/

4 Rodrigo Hernández-Ramírez, Rodrigo Morais and Carlos Rosa. "Foundations, Research, and Transdisciplinarity: Re-shaping Education for the 21st Century at a School of Design and Technology in Portugal." in *Perspectives on Design and Digital Communication II: Research, Innovations and Best Practices* (Cham: Springer International Publishing, 2021), 259-272.

5 María Jesús Rosado-García et al. "A new European Bauhaus for a culture of transversality and sustainability." *Sustainability* 13, no. 21 (2021): 11844.

6 Kajetan Sadowski. "Implementation of the New European Bauhaus principles as a context for teaching sustainable architecture." *Sustainability* 13, no. 19 (2021): 10715.

7 EU. "Bauhaus of the Seas Sails." Accessed October 16, 2024. <https://cordis.europa.eu/project/id/101079995>



FIG. 1 The Bauhaus of the Seas Sails geospatial platform. Source: Bauhaus of the Seas Sails geospatial platform (<https://bauhaus-seas.app>)

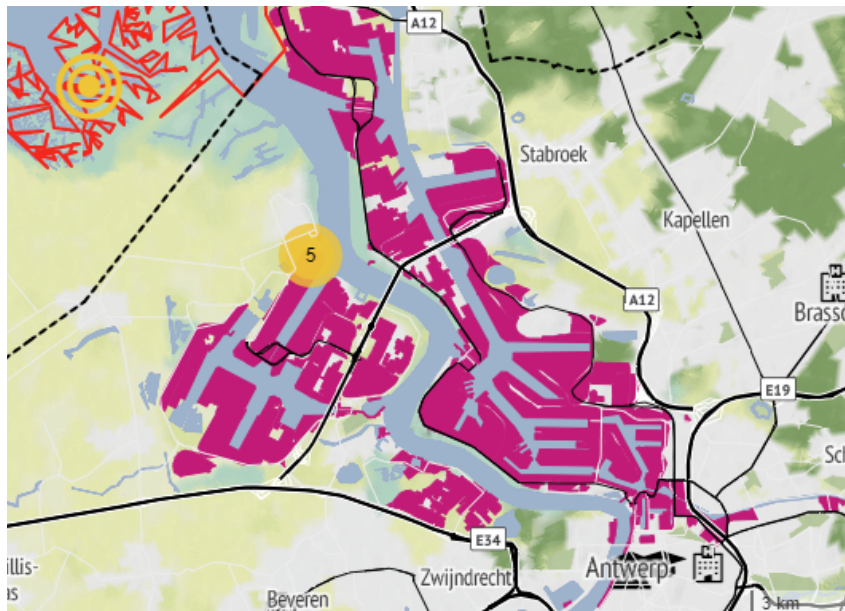


FIG. 2 A specific location zoomed at a local scale. Source: Bauhaus of the Seas Sails geospatial platform (<https://bauhaus-seas.app>)

With a focus on coastal regions and their relationship with the sea, the Bauhaus of the Seas Sails project aims to explore how we can engage with water bodies in a sensitive, conscious, and balanced manner. This encompasses climate regulation, preservation of ecosystems and biodiversity, and sustainable management of resources. Embracing the challenge of applying design to complex socio-ecological and more than anthropocentric issues, the project significantly impacts the UN's sustainable development goals and the EU's strategic priorities.

The Bauhaus of the Seas Sails geospatial platform⁸ is a developing online

8 EU. "Bauhaus of the Seas Sails geospatial platform" Accessed October 16, 2024. <https://bauhaus-seas.app>

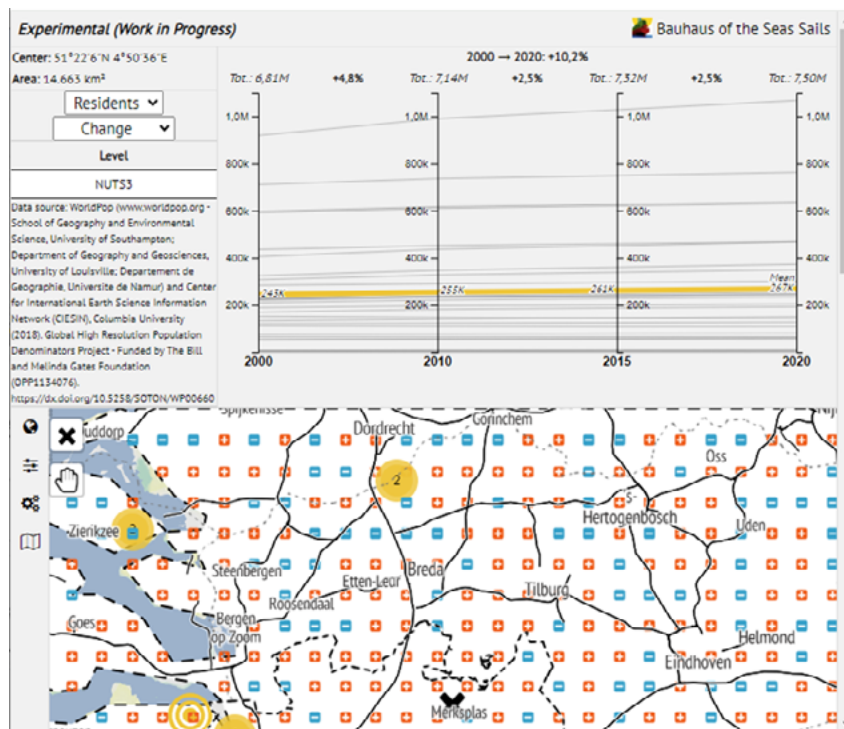


FIG. 3 Result of an analysis across the Delta region. Source: Bauhaus of the Seas Sails geospatial platform (<https://bauhaus-seas.app>)

system that combines open-access geospatial data, data on sustainability, aesthetics, and inclusiveness, as well as stories and narratives about the pilots participating in the project (Fig. 1).

This platform will enable efficient analysis, visualization, and sharing of open data and project-generated information within the project initiative and provide a foundation for living labs and the dissemination of findings by enabling the integration, visualization, and analysis of spatial data in real-time. Users of the platform will have the ability to engage with and gain insight from several layers of data based on the implementation of the drops (pilot actions). The first users are the consortium partners of the Bauhaus of the Sea Sails project who are testing the platform, while it is being developed. After the development of the platform, any individual can learn and engage with the platform. The platform already offers a variety of tools for creating captivating interactive map visualizations. With easy navigation and interaction options, users can explore and analyze inaccessible geospatial information in a user-friendly manner (Fig. 3).

The platform will serve to study the impact of the drops (pilot actions) and ripples (pilot demonstrators) in the diverse locations undergoing similar water-related transformations. Through its tools and functionality, the platform seeks to create a connection between science, technology, education, art, and culture, based on the ideals of the New European Bauhaus. The overarching goal of the platform is to: (1) engage users, (2) facilitate value-based discussions through interactive visualizations and (3) create a possibility for easier comparisons among the European coastal cities.

The geospatial platform is built on three core pillars. Firstly, the platform

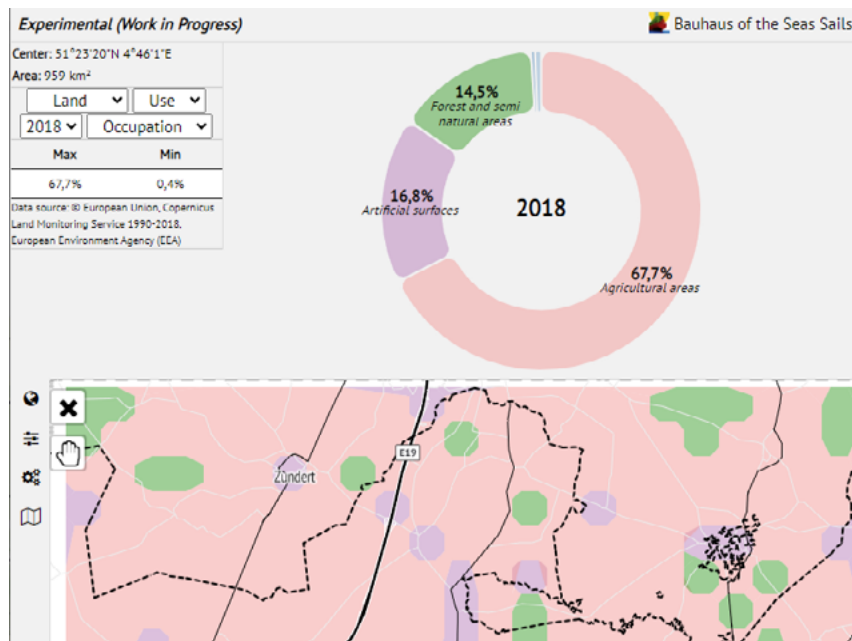


FIG. 4 A visualization of land use across the Delta region. Source: Bauhaus of the Seas Sails geospatial platform (<https://bauhaus-seas.app>)

allows users to create visually appealing and comprehensible maps, charts, graphs, and various additional graphical representations. These visualizations serve as the foundation for informed discussions and to contextualize the work done in the project across various locations. The visualization tools provided enable users to analyze patterns, relationships and trends within geospatial and statistical data (Fig. 4).

Secondly, the platform offers a comprehensive suite of analytical methods for performing complex spatial analysis. These powerful analytical tools enable users to gain valuable insights based on geographic patterns and relationships. Unlike proprietary software, geospatial platforms built with open-source software are free to use, significantly reducing costs. There are no recurring license fees, and the open-source nature allows for the flexibility to modify, extend, or customize the platform to suit specific needs. This adaptability ensures the Bauhaus of the Seas Sails platform can be tailored to various use cases without being constrained by predefined features. Lastly, through the narrative layer, the platform facilitates sharing of information generated within the Bauhaus of the Seas Sails project, serving as a repository and allowing consortium members to publicly share the effectiveness and impact of initiatives and their subsequent effects (Fig. 5).

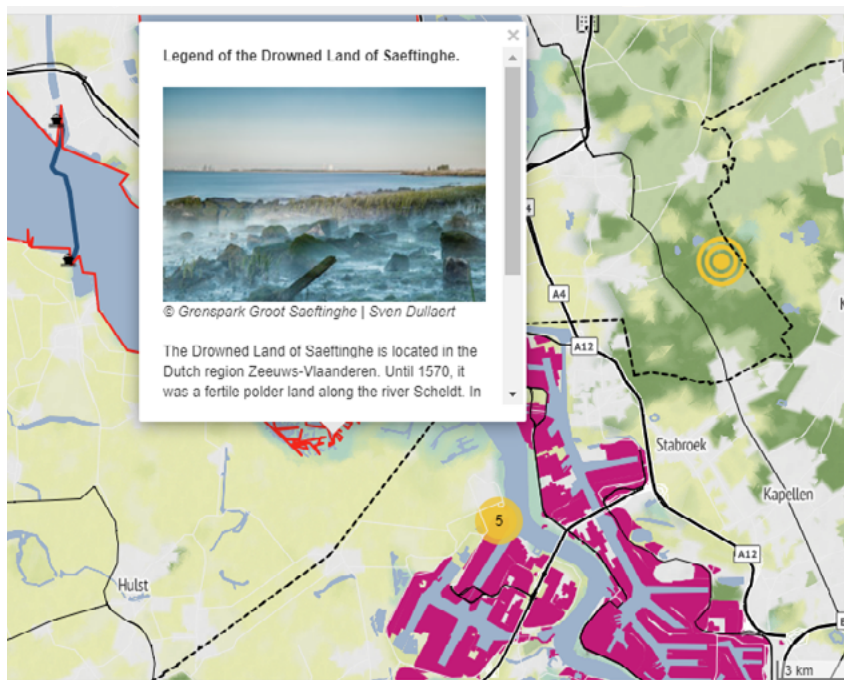


FIG. 5 Example of the narrative layer. Source: Bauhaus of the Seas Sails geospatial platform (<https://bauhaus-seas.app>)

The platform aims to establish a foundation for understanding and analyzing the crucial and intertwined socio-ecological challenges encountered in coastal regions. Examples of such complex and interrelated environments are port-city territories.⁹ They are distinguished by their multifaceted nature, interconnectivity, and operation across various scales,¹⁰ where the needs of natural environments overlap with human activities and influences, but also multiple stakes and interests interfere with each other and create wicked problems to be solved. Examples for this are the development and expansion of infrastructure to support the continuous global economic activities of ports, alongside catering to the needs of local urban functions within growing urban areas, that often result in conflicts¹¹ and imbalance which can lead to socio-spatial injustices,¹² economic exploitation and pollution,¹³ spatial and environmental conflicts,¹⁴ involvement in extractive industries,¹⁵ and increasing global material and

9 Carola Hein (ed.) *Port Cities: Dynamic Landscapes and Global Networks*. (London: Routledge, 2011).

10 Dirk Schubert, Cor Wagenaar and Carola Hein. "The Hoist of the Yellow Flag": Vulnerable Port Cities and Public Health." *Journal of Planning History* 21, no. 1 (2022): 56-78.

11 Carola Hein. "The Port Cityscape: Spatial and institutional approaches to port city relationships." *PORTUSplus* 8, no. Special Issue (2019).

12 Francesca Savoldi. "Contested port cities: A global geography of community conflicts". *PortCityFutures*. (2021, February 17).

13 Olaf Merk. "The competitiveness of global port-cities: synthesis report." *OECD Regional Development Working Papers* (2013).

14 Salvador del Saz-Salazar, Leandro García-Menéndez and Olaf Merk. "The Port and its environment: methodological approach for economic appraisal." *OECD Regional Development Working Papers* (2013).

15 Carola Hein, (ed.) *Oil Spaces: Exploring the Global Petroleumscape*. (London: Routledge, 2021).

resource consumption.¹⁶ A holistic lens and multiscale perspective facilitates a comprehensive understanding of the intricacies involved in the development and sustainability of complex territories.

2. Enabling a Data-Driven Mapping Framework for Complex Territories

The emergence and evolution of geospatial platforms have significantly transformed the field of geographic information systems (GIS), enabling a broad range of applications across various sectors. These platforms now go beyond traditional mapping and visualization, playing critical roles in areas such as disaster management, urban planning, and environmental monitoring.¹⁷

Geospatial platforms have advanced from the early days of GIS, which were primarily focused on static data representation, to sophisticated systems capable of real-time data processing and analysis. The incorporation of technologies such as cloud computing, mobile computing, and big data analytics has greatly expanded their capabilities, enabling more efficient data management and analysis.¹⁸ In parallel, the architecture of these platforms has evolved to emphasize user interactivity and integration with emerging technologies.¹⁹

Furthermore, the introduction of Web GIS has revolutionized access to and utilization of geospatial information. Research by Chen et al. highlights the significance of Web GIS in facilitating the sharing and collaboration of geographic data among users.²⁰ The interactive nature of these platforms encourages user engagement and enhances the overall value of geospatial data.²¹ Web GIS has also democratized access to geographic information, allowing users without formal GIS training to work with spatial data.²² Through the visual representation of intricate spatial data, mapping improves accessibility and understanding, enabling users to make well-informed decisions that contribute to sustainable development.²³ The geospatial platform effortlessly incorporates spatial data

16 James Corbett et al. "International maritime shipping: the impact of globalisation on activity levels." *Globalisation, Transport and the Environment* (2010): 58.

17 Kriswibowo et al. "Exploring the role of geospatial technology in disaster management of batu city: qualitative analysis using rqda method". *Journal of Information Technology and Computer Science*, 6, no.1 (2021): 80-95.

18 Elwakil et al. "New architecture for mobile GIS cloud computing". *Ijarccce*, 4, no.10 (2015): 1-7.

19 Ananda et al. "Towards a new methodology for web GIS development". *International Journal of Software Engineering & Applications*, 7, no.4 (2016): 47-66.

20 Chen et al. "The research of urban fundamental geographical information system based on webgis". *Applied Mechanics and Materials*, (2012): 170-173.

21 Noviansyah et al. "Web GIS of tourism: voyage and forecast". *International Journal of Engineering Technology and Natural Sciences*, 5, no.1 (2023): 1-9.

22 Zhang "Expanding library GIS instruction to web mapping in the age of neogeography". *Journal of Map & Geography Libraries* 16, no.3, (2020): 264-282.

23 Georgios Kouziokas. "Geospatial based information system development in public

from diverse sources, encompassing environmental, demographic, and socio-economic datasets. This comprehensive perspective on port-city dynamics is indispensable for making informed decisions.²⁴

The platform will offer a range of analytical maps that address diverse dimensions, such as air and water quality, energy consumption, and land-use patterns. This diverse thematic approach ensures that decision-makers can access pertinent information for specific planning and policy initiatives. The incorporation of interactive visualization techniques, such as heatmaps, overlays, and time-series animations, elevates the user experience and simplifies data exploration.²⁵ The interactive features enable users to delve into spatial relationships and patterns within the data, offering deeper insights.²⁶

The geospatial platform not only requires real-time data processing but also emphasizes real-time visualization capabilities. Handling data streams in real-time introduces additional challenges such as data synchronization and enabling near-instantaneous processing.²⁷ For the geospatial platform to deliver efficient performance and rapid response times, it must effectively handle large datasets and support high-performance processing. This capability becomes crucial when dealing with real-time complex spatial analyses or accommodating multiple concurrent users.²⁸ The platform achieves this by employing a custom-built geospatial indexing approach that partitions geographical space into highly regular cells. In order to enhance data query operations, a geographical search engine was developed.

A hierarchical grid system serves as a fundamental tool in many web-based applications for indexing and retrieving spatial data based on geographic location.²⁹ A grid structure systematically organizes geospatial data into a hierarchy of nested cells, with each level representing a distinct level of detail or granularity.³⁰ This hierarchical organization enhances the

administration for sustainable development and planning in urban environment." *European Journal of Sustainable Development* 5, no. 4 (2016): 347-347.

24 Benedetta Ettore et al. "Co-Planning Port-City 2030: The InterACT Approach as a Booster for Port-City Sustainable Development." *Sustainability* 15, no. 21 (2023): 15641.

25 Rufu Qin et al. "Web-based 3D visualization framework for time-varying and large-volume oceanic forecasting data using open-source technologies." *Environmental Modelling & Software* 135 (2021): 104908.

26 Jo Wood et al. "Interactive visual exploration of a large spatio-temporal dataset: Reflections on a geovisualization mashup." *IEEE transactions on visualization and computer graphics* 13, no. 6 (2007): 1176-1183.

27 Dominik Brunner et al. "Distributed geospatial data processing functionality to support collaborative and rapid emergency response." *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 2, no. 1 (2009): 33-46.

28 Michelle Hamilton et al. "Web-based geospatial multiple criteria decision analysis using open software and standards." *International journal of geographical information science* 30, no. 8 (2016): 1667-1686.

29 Cogan Shimizu et al. "A Pattern for Features on a Hierarchical Spatial Grid." in *Proceedings of the 10th International Joint Conference on Knowledge Graphs*, 108-114. (2021).

30 Mingke Li and Emmanuel Stefanakis. "Geospatial operations of discrete global grid systems—a comparison with traditional GIS." *Journal of Geovisualization and Spatial Analysis* 4

efficiency of spatial queries across various scales, enabling seamless exploration from country regions to localized areas.³¹ This data structure serves as a powerful mechanism for organizing and conducting efficient spatial queries on geospatial data. By partitioning geographic space into a hierarchical tessellation of highly regular cells, the method significantly accelerates spatial queries and effectively narrows down the search space.³² The hierarchical structure enables queries to swiftly identify and retrieve relevant data that are within the desired spatial area without the need to examine every single data point on the database. This optimization substantially reduces computational costs and greatly enhances query performance. Using a regular grid aids in providing smooth gradients and making it easier to measure differences between cells. It is important to choose the right kind of cell shape for the grid system. To ensure ease of use, polygons like triangles, squares, or hexagons are typically preferred since they tile easily. Taking performance into account, the platform employs square cells.

The grid-based approach within the platform plays a crucial role in efficiently organizing and querying geospatial data. It offers numerous optimizations for spatial queries, enabling fast and accurate retrieval of data. Additionally, the method facilitates zooming and Level-of-Detail (LOD) capabilities, allowing users to visualize and analyze data at varying levels of detail.³³ The grid-based method also supports aggregation and summarization operations on-the-fly, providing valuable insights from geospatial data in a concise manner. One of the key advantages of hierarchical grid systems is their ability to facilitate aggregation and summarization operations.³⁴ The structured hierarchy allows for efficient summarization of data by aggregating information at higher levels of the structure. Moreover, the hierarchical grid system enhances data compression and storage efficiency, thereby optimizing resource utilization on the server-side. Overall, this method is an essential component within the geospatial platform, effectively addressing scalability and performance concerns. By leveraging the hierarchical grid system in the platform, users gain the ability to efficiently retrieve and analyze geospatial data across different scales. From broad overviews to detailed analyses, this structure allows users to explore and summarize geospatial data in an organized and scalable manner within the platform.

(2020): 1-21.

31 Fei Hu et al. "A hierarchical indexing strategy for optimizing Apache Spark with HDFS to efficiently query big geospatial raster data." *International Journal of Digital Earth* (2018).

32 Terence Smith et al. "Requirements and principles for the implementation and construction of large-scale geographic information systems." *International Journal of Geographical Information System* 1, no. 1 (1987): 13-31.

33 Aaron Gardony, Dalit D. Hendel and Tad T. Brunye. "Identifying optimal graphical level of detail to support orienting with 3D geo-visualizations." *Spatial Cognition & Computation* 22, no. 1-2 (2022): 135-160.

34 Wei Wang, Jiong Yang and Richard Muntz. "STING: A statistical information grid approach to spatial data mining." in *Vldb*, vol. 97, 186-195. (1997).

The platform's grid-based approach facilitates visualization and analysis of geospatial data by enabling users to zoom and take advantage of LOD capabilities.³⁵ Without requiring extensive manual input, the platform automatically selects the appropriate level within the data hierarchy for analysis predicated on user interactions. This way the geospatial platform provides users with a streamlined visualization experience. Its custom-built geographical search engine seamlessly retrieves and displays data with varying levels of detail, dynamically adjusting resolution to match the user's chosen zoom level or area of interest.

3. The Platform's Versatility: Two Contrasting Research Proposals

The Bauhaus of the Seas Sails geospatial platform enables the comprehensive analysis of spatial data through an integrated approach. It embraces three complementary mapping approaches: 1) multi-scalar, 2) multidisciplinary, and 3) cross-border. These approaches enable the platform to handle data at various spatial scales, incorporate data from different disciplines, and integrate data from across international borders, respectively. As a result, the platform provides a powerful tool for analyzing spatial data and gaining insights into complex phenomena and allowing for diverse approaches in different research studies. In this paper, we introduce two different ongoing research to critically utilize and analyze the geospatial platform and provide refined inputs for further development. These research can also be seen as possibilities to contribute to the content of the platform.

3.1. Health and Wellbeing Research in Port Cities

One of the projects currently engaging with the development, testing and data acquiring of the Bauhaus of the Seas Sails geospatial platform seeks to leverage its capabilities for analyzing health and well-being in port-city territories along the transnational watershed of the Rhine river. This research project identifies the need for a conceptual advancement of existing localized city-centric views on health and wellbeing approaches and for a more holistic need-based research and planning framework for analyzing health and wellbeing that is able to scale up and across larger interrelated regions or 'Territories of Wellbeing'.³⁶

Watersheds, or river basins - as alternatives to coastal regions - in this case along the Rhine river, can be understood as natural planning regions,³⁷ delim-

35 Bo Huang, Bin Jiang and Hui Li. "An integration of GIS, virtual reality and the Internet for visualization, analysis and exploration of spatial data." *International Journal of Geographical Information Science* 15, no. 5 (2001): 439-456.

36 Lukas Höller. *From Healthy Cities to Territories of Wellbeing: Transforming second-tier port cities along the Rhine*. 2024(unpublished manuscript).

37 Jaqueline Tyrwhitt. "The Valley Section, Patrick Geddes' World Image." *Journal of the*

iting the territory of interest based on natural geographies that determine many of the anthropogenic and climate-related challenges on health and wellbeing unfolding on a territorial, cross-border scale. This links closely to the concept of bio-regionalism³⁸, which sees natural features as the underlying base for political, economic and cultural systems and thus accepts the principle that human societies and their habitats adapt to their surroundings and adhere to the inherent laws, capabilities, and constraints of the natural world. Such a territory can become a suitable environment to test the opportunities and limitations of an up- and cross-scales approach to health and wellbeing, particularly as a planning approach oriented to the sustainable, just and fair development of the region, because of three main reasons.

Firstly, port-city territories along the Rhine share complex natural and human-induced challenges through their common river geography. Secondly, those networks of non-primary cities entangled through for example port- and logistic-related flows of goods, people and innovation are an excellent example of polycentric and cooperative urban systems. Investigating them as an interconnected web of urban, non-urban and natural continuums, rather than isolated urban containers helps to avoid a first-city bias in sustainability research and strategy making. Thirdly, the high level of shared economic, spatial and administrative integration as well as cultural and historical proximity, the history of forward-looking cross-border and inter-metropolitan cooperation between ports, industries, medium-sized, non-primary cities, regional, national, and supra-national governments, based on institutions with a long track record of collaboration, can help develop to exploit existing capacities and emerge new and common policies to create healthier environments for all.³⁹

Yet, there is a need for operationalizing planning frameworks that can benchmark the current status of risks and challenges for health and wellbeing holistically, as well as identify existing and envision new capacities throughout the whole territorial scale in order to overcome them. The research focuses on Manfred Max-Neef's⁴⁰ Human Scale Development (HSD) model, which emphasizes a multidimensional understanding of time, space and needs satisfaction. The HSD model provides a conceptual framework and practical assessment tool that can guide the evaluation of health and wellbeing in large territories, such as the Rhine watershed since: 1) the systematic structure of nine universal human needs and sets of contingent satisfiers make the model fit for comparability and transferability; (2) the typological organization of satisfiers allows the definition of simultaneities, complementarities and trade-offs between needs; (3) the

Town Planning Institute 37, no. 3 (1951): 61–66.

38 Janis Birkeland and Cam Walker. "Bioregional Planning." in *Design for Sustainability*, 236–241. (London: Routledge, 2012).

39 Lukas Höller. *From Healthy Cities to Territories of Wellbeing*.

40 Max-Neef, M. A., Elizalde, A., & Martin Hopenhayn. *Human scale development: Conception, application and further reflections*. (New York: The Apex Press, 1991).

basis on existential categories of satisfiers and goods allow the investigation of spatial, institutional, personal and societal conditions of need satisfaction; and (4) the participatory and adaptive nature of the framework allows for community involvement during evaluation, planning and policy development.⁴¹

The geospatial platform can help to facilitate a mapping-approach that responds to the fuzziness of the multiple overlapping political, economic, cultural and ecological arenas. The port-city territories along the Rhine are not objective containers, but have to be defined as contingent, 'variable geometries',⁴² and are the "product of interrelations".⁴³

Firstly, such territories are continuously re-shaped through various functional, morphological and institutional dimensions, essential when looking at different urban and non-urban environments on different spatial and relational scales. Adopting a multi-scalar perspective is essential for the platform to adeptly navigate mentioned simultaneities, complementarities and trade-offs between needs and (dis)satisfaction across a large transnational watershed. Through the integration of data on diverse spatial levels, the platform can play a pivotal role in recognizing and addressing the underlying causes of health and wellbeing disparities within port-city territories. A geospatial platform allows for the implementation of dynamic and interactive graphics and maps and enables interaction by, e.g. selecting, filtering, overlaying, comparing and zooming.⁴⁴

Secondly, indicators of health and wellbeing (dis)satisfaction can be implemented, viewed and compared at different levels of detail (LoDs). Issues like air and water pollution frequently extend beyond international boundaries, necessitating collaboration and coordinated efforts among stakeholders across diverse jurisdictions.⁴⁵ Yet harmonized datasets are not always available for such a territorial scale and national and regional datasets don't always perfectly match. The platform can assist in tackling cross-border challenges related to data availability, differences in data collecting methodologies, comparability and transferability by disaggregating datasets from different administrative units or other boundaries, but also from different data providers and sources by re-aggregating them onto a scalable grid. This helps to analyze the whole watershed as well as to compare smaller single or multiple localities within the territory, fitting the idea of seeing such complex territories as relational, but also fits the

41 Manfred Gasper "Max-Neef's model of human needs understood as a practical toolkit for supporting societal transitions". *International Institute of Social Studies*. (2022).

42 Gordon Macleod and Martin Jones. "Territorial, scalar, networked, connected: In what sense a 'regional world'?" *Regional studies* 41, no. 9 (2007): 1177-1191.

43 Doreen Massey. *For Space*. (London: Sage 2005).

44 Rob Kitchin and Gavin McArdle. "Urban data and city dashboards: Six key issues." in *Data and the City*, 111-126. (London: Routledge, 2017).

45 Kyum Seung Kim et al. "Transboundary air pollution and cross-border cooperation: Insights from marine vessel emissions regulations in Hong Kong and Shenzhen." *Sustainable Cities and Society* 80 (2022): 103774.

idea of universal needs and contingent ways of satisfaction coming from Max-Neef's HSD model.

Thirdly, the variable geometry of such complex and relational territories is shaped by different theoretical lenses and practical aims, e.g. determined by certain frameworks, such as the HSD model. The nine universal human needs and the evaluation of need (dis)satisfaction includes insights from various professions such as geography, environmental science, and sociology. Adopting a multifaceted approach, the platform enables users to map individual health factors, analyze environmental determinants and spatial assets, evaluate socioeconomic and cultural factors, monitor health interventions, thus fitting the HSD approach of benchmarking various existential categories of health and wellbeing satisfiers, e.g. spatial, institutional, personal and societal conditions.

Lastly, empowering communities with access to health and wellbeing data and tools for analyzing their living environment allows them to actively participate in health planning and decision-making processes. This, in turn, promotes shared responsibility and community-driven solutions.⁴⁶ The platform can guide participatory sessions, such as Urban Labs, visualizing, filtering and combination data to create individual health and wellbeing stories in order to inform and explain the current state of health and wellbeing to a multitude of actors, to identify their current need (dis)satisfaction, raise awareness of development trajectories in cities, regions and countries and, in the long run, propose suitable strategies to altering those courses, guiding the formulation of effective policies that address the determinants of health and wellbeing in a just and participatory manner.⁴⁷

3.2. Transnational Spatial Planning in the Flemish-Dutch Scheldt Delta

Comprehensive data collection on cross-border regionalism in Europe is a complex endeavor.⁴⁸ The Flemish-Dutch Scheldt Delta constitutes an intricate and interconnected system that operates across various scales, requiring transnational spatial planning approaches. Spanning across multiple countries, this unique transnational estuary⁴⁹ holds immense significance (geographical, economic, environmental, sociocultural) for the

46 Muhammad Shakil Ahmad and Noraini Bt Abu Talib. "Empowering local communities: decentralization, empowerment and community driven development." *Quality & Quantity* 49 (2015): 827-838.

47 Ursula Von Rueden et al. "Socioeconomic determinants of health related quality of life in childhood and adolescence: results from a European study." *Journal of Epidemiology & Community Health* 60, no. 2 (2006): 130-135.

48 Jiannis Kaucic and Christophe Sohn. "Mapping the cross-border cooperation 'galaxy': An exploration of scalar arrangements in Europe." *European Planning Studies* 30, no. 12 (2022): 2373-2393.

49 Geopark Schelde Delta. "Geopark Schelde Delta." Accessed October 16, 2024. <https://www.scheldedelta.eu/en>

regions it traverses. From its origins to its extensive network of tributaries, the Scheldt Estuary not only shapes the physical landscape but also serves as a crucial economic and ecological artery. Situated between the two largest ports of Europe,⁵⁰ Rotterdam and Antwerp-Bruges, this region presents a unique opportunity for transnational cooperation in the pursuit of sustainable development.

As a part of Bauhaus of the Sea Sail, this Delta region (Grenspark Groot Saeftinghe) is being researched upon as one of the six pilots. Going deeper into the territorial values and planning, a supporting research concentrating in this transnational territory is developing at TU Delft and Erasmus University - "Integrative urbanism at a time of climate change". This is an attempt to compile and evaluate the planning strategies and instruments in search of synergy between the challenges and impact from different stakeholders (citizens as society, port and governance), learning about the values from their historical relationships with the territory. The transnational delta faces a multitude of challenges, from climate change to economic development, demanding a multidisciplinary approach.⁵¹ Climate change, particularly rising sea levels and extreme weather events, underscores the need for transnational cooperation.⁵² However, the historical dynamics of cooperation as well as competition between the ports of Rotterdam and Antwerp, coupled with administrative borders, complicate the decision-making process for spatial design and planning. Despite the historical success of economic and infrastructural cooperation, the citizens are facing challenges for communicating their values to economic and government stakeholders. EGTC Linieland van Waas and Hulst, promotes cross-border cooperation by offering structural solutions for border bottlenecks and promote social and economic cohesion in the region.⁵³ This is being done at the local scale. However, there exists a gap in considering socio-cultural values and acknowledging local initiatives within the decision-making process at the national policymaking processes. This research builds upon the insights of previous studies that highlight the tension between economic-driven port development and the broader interpretation of success by cities, encompassing citizen well-being and livability.⁵⁴ These factors underline the need for a comprehensive co-design framework for strategic collaboration for facilitating their interactions and harnessing the collective knowledge for future transnational

50 Eurostat. "Maritime freight and vessels statistics." Accessed October 16, 2024. <https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/6652.pdf>

51 Joost Hintjens, Thierry Vanelislander, Martijn Van der Horst, and Bart Kuipers. "Towards a bio-based economy in ports: The case of the Flemish-Dutch delta." *International Journal of Transport Economics* 42, no. 2 (2015): 229-247.

52 Åsa Persson and Adis Dzebo. "Exploring global and transnational governance of climate change adaptation." *International Environmental Agreements: Politics, Law and Economics* 19 (2019): 357-367.

53 EGTS. "EGTS Linieland." Accessed October 16, 2024. <https://www.egtslinieland.eu/>

54 Carola Hein, Ingrid Mulder and Hilde Sennema. "A Call for Value Literacy in Port City Transitions." *European Journal of Creative Practices in Cities and Landscapes* 4, no. 2 (2021): 108-129.

planning. The limited sharing of knowledge and data exchange across national boundaries presents significant challenges to the development of collaborative solutions and the sharing of best practices. This issue is multifaceted, encompassing legal, organizational, and technical barriers to cross-border data exchange and interoperability.

In this research, the transnational Flemish-Dutch delta is being hypothesized on key theoretical perspectives to frame the study within the context of non-standard geographies, particularly learning from the theories of Port Cityscape⁵⁵ and Transnational Urbanism.⁵⁶ Another new ESPON project,⁵⁷ for border regions establishes the relevance, value, and urgency of working in cross-border regions at the time of climate change is “Territorial Governance of Non-standard Geographies”. It aims to provide valuable policy advice on optimizing territorial governance mechanisms by integrating formal frameworks with soft spaces of governance. This suggests the necessity for cross-pollination of shared knowledge between spatial datasets and the societal values, to foster effective approaches to address transnational and cross-border regional issues.

In order to comprehend the intricacies spanning from local to transnational Delta scales, an analysis encompassing quantitative, qualitative, and spatial dimensions is being researched upon. The geospatial platform will be extensively used as a tool to bring the spatial and analytical implications of all the statistical data and their trends in conjunction with the stakeholder narratives and local values. The utilization of the platform within the Flemish-Dutch Delta region serves a crucial purpose for three main reasons. Firstly, it facilitates the collection of both local and national planning practices and instruments in cross-border regions, aiding in a comprehensive understanding of initiatives. Secondly, the platform enables the assessment of spatial data and stakeholders narratives related to planning and policy instruments, allowing for an in-depth analysis of land-sea interaction and transformations. Lastly, by testing the platform as a co-design tool to foster shared knowledge among users, it highlights gaps and enhances collaborative practices. This way, the research contributes to the platform's content, through the learnings and exchanges of the co-design processes, promoting shared knowledge among stakeholders and facilitating collaborative practices. By transcending national boundaries and pooling expertise from the Netherlands and Belgium, users can collaboratively tackle shared challenges. The geospatial platform stands out as a valuable tool for examining transnational planning in the Flemish-Dutch Delta.

55 Carola Hein. *The Port Cityscape: Spatial and institutional approaches to port city relationships*.

56 Michael Smith. “Transnational urbanism revisited.” *Journal of Ethnic and Migration Studies* 31, no. 2 (2005): 235-244.

57 ESPON. “Nostageo - Territorial Governance of Non-standard Geographies”. Accessed October 16, 2024. <https://www.espon.eu/espon-2030/thematic-actions-plans/governance-new-geographies/territorial-governance-non-standard>

This research aims to contribute to the advancement and refinement of the platform, enhancing its goal of empowering users to visualize and geolocate their activities, analyze relationships among diverse stakeholders. Overall, the geospatial platform is expected to be functioning as a tool for policymakers, planners, and stakeholders, providing a thorough understanding of the complex social-ecological system in the Flemish-Dutch Delta. This knowledge sharing platform lays the groundwork for formulating effective policies, interventions, and strategies to confront the region's challenges. The findings of the research will establish the geospatial platform as a strong tool for data analysis in similar regions, supporting transnational cooperation, tackling shared challenges, and fostering sustainable development.

4. Discussion

The intricate dynamics in coastal regions, specifically among port-city territories, are at the forefront of urban development challenges. These territories are strategically positioned along coastlines and waterbodies, often co-developing within or close to urban environments and function as hubs of trade, embodying a delicate balance between global economic needs, environmental stability and societal values. The continuous evolution of these complex territories necessitates innovative solutions that not only address their vulnerabilities but also leverage their unique characteristics for sustainable development. The Bauhaus of the Seas Sails geospatial platform provides a versatile toolset for comprehensive analysis of these complex territories.

The foundational understanding of port-city territories as dynamic and vulnerable urban environments underscores the significance of sustainable development. The geospatial platform represents a pioneering initiative that amalgamates open-access geospatial data, spatial information on port-city territories, and narratives about the pilots involved in the project. This platform offers an integrated approach, embracing visualization, analytics, and narrative sharing as its core pillars. It fosters a connection between science, technology, education, art, and culture, aligning with the ideals of the New European Bauhaus.

One of the distinctive features of the platform is its ability to facilitate the study of drops (pilot actions) and ripples (pilot demonstrators) in diverse locations undergoing water-related transformations. By enabling efficient analysis, visualization, and sharing of open data, the platform creates a foundation for living labs and the dissemination of findings. The platform, grounded in the New European Bauhaus vision, aims to engage users and foster value-based discussions through interactive visualizations. Visualizations not only serve as the bedrock for informed discussions but also contextualize project work across various locations. The analytical suite empowers users to perform complex spatial analyses, gaining

valuable insights into geographic patterns and relationships. The narrative layer acts as a repository, allowing consortium members to share information about the effectiveness and impact of initiatives.

An essential aspect of the geospatial platform is its emphasis on mapping, driven by a multi-scalar, multidisciplinary, and cross-border approach. This methodology enables the platform to handle data at various spatial scales, incorporate insights from different disciplines, and integrate data across international borders. In turn, this approach provides a powerful tool for analyzing spatial data, offering diverse perspectives and methodologies for different research proposals.

Two contrasting research proposals within the platform highlight its versatility. The health and well-being research in port-city territories takes advantage of the platform's multi-scalar and multidisciplinary approach. Recognizing the multifaceted nature of health disparities, the platform integrates data from diverse spatial levels, and acknowledges the importance of cross-border collaboration. This research proposal showcases how the platform can be instrumental in addressing complex urban health challenges, promoting equity, and contributing to sustainable development.

On the other hand, transnational planning in the Flemish-Dutch Delta demonstrates the platform's capability to handle intricate systems and diverse stakeholder dynamics. The platform aids in visualizing stakeholder locations, analyzing relationships, and assessing impacts. By revealing concentrations and distribution patterns, the platform enhances communication and coordination, guiding the development of sustainable practices. This research proposal exemplifies the platform's role in facilitating transnational cooperation and addressing challenges such as climate change through comprehensive spatial analysis.

The geospatial platform's innovative grid-based approach to data organization and retrieval stands out as a key for mapping. This approach not only optimizes performance and scalability but also supports real-time visualization capabilities. The hierarchical grid system enhances spatial queries, enables efficient summarization of data, and ensures resource efficiency on the server-side. This methodology is fundamental to the platform's ability to provide users with a streamlined visualization experience, dynamically adjusting resolution based on user interactions.

5. Conclusion

The Bauhaus of the Seas Sails geospatial platform emerges as a valuable tool. This open-access platform offers a comprehensive solution for analyzing complex territories. It integrates geospatial data, spatial information on port-city territories, and narratives, fostering collaboration through visualization, analytics, and knowledge sharing.

Aligning with the New European Bauhaus ideals, the mentioned functionalities and capabilities of the geospatial platform can help to bridge the communication between disciplines - science, technology, education, art, and culture - and users - citizens, politics, academia and practice, from various backgrounds. This fosters user engagement and value-based discussions. The platform's strength lies in its multi-scalar, multidisciplinary, and cross-border mapping capabilities. This allows researchers to analyze data across various scales, integrate diverse disciplines, and transcend international borders. This empowers users to conduct complex spatial analyzes, gaining valuable insights into geographical patterns and relationships. Additionally, a narrative layer facilitates knowledge sharing by allowing consortium members to share information about the effectiveness and impact of various initiatives.

The platform's versatility is demonstrably evident in the two showcased research proposals. One proposal focuses on health and well-being in port-city territories, while another tackles transnational planning in the Flemish-Dutch Delta. These diverse cases highlight the platform's adaptability in addressing complex urban challenges and fostering transnational cooperation. In essence, the geospatial platform is a transformative tool that not only addresses the challenges faced by port-city territories but also aligns with the vision of the New European Bauhaus, promoting sustainability, inclusivity, and innovation. As a dynamic and comprehensive platform, it lays the groundwork for informed decision-making, collaboration, and the pursuit of a resilient and sustainable future for complex territories.

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