Chapter 2

Urban Waterscapes

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Urban Waterscapes

Introduction

The theme of urban waterscapes brings attention to the visual qualities of urban waterfronts but also acknowledge the broader interdisciplinary knowledge bases required to fully understand both the waterscapes above ground that may be directly affected by consequences of climate change, but also the underground urban water management of water in dynamic situations with risk of flooding affecting citizens and urban infrastructures.

The texts included in the section address some key challenges related to how to design solutions to address climate challenges in urban spaces across Europe.

In contemplating the urban configurations of tomorrow, particularly those situated at the intersection of land and water, exemplified in urban waterscapes, it becomes imperative to glean insights from diverse viewpoints. Delving into historical, social, and economic analyses and comprehending the intricacies of this multifaceted environment will aid in discerning the prospective needs that cities must address in light of climate change.

Drawing from past experiences is also essential when considering solutions. Urban waterfronts have historically played a pivotal role in city development (Konvitz 1978, 2019). Examining this history offers valuable insights into how these areas evolved, providing lessons that can shape resilient and sustainable urban waterscapes in the face of climate change (Giovinazzi, Moretti 2010, Nyka et al., 2022). Strategies derived from these experiences honour the traditions and cultures of these places. Certain texts in this chapter strongly relate past ideas to the vision for future urban waterscapes.

Additionally, the social aspect is a crucial consideration in understanding public spaces. This chapter emphasizes creating public awareness and engaging the community in a participatory manner. Incorporating tradition and culture into future urban waterfronts is closely linked to fostering a conscious society adaptable to change and cognizant of cities' transitional needs. Active community engagement through participatory design is pivotal in the transformative processes of cities (UNCED 1992, IPCC 2018, Few et al., 2007, Ayers, Forsyth 2009). Considering the social aspect when formulating solutions for climate change risks in cities is of utmost importance. Citizens' narratives of urban spaces should be integral when conceptualizing urban spaces in harmony with water and nature.

Examining water spaces across diverse cities and employing analytical frameworks to explore historical practices, social dynamics, and economic circumstances offers profound insights into their evolution. This understanding becomes instrumental in devising strategies to fortify upcoming urban waterfronts against climate change. This involves crafting inventive urban and landscape visions that integrate historical and social perspectives, drawing from lessons derived from the development and comprehension of urban waterscapes.

The research experiences from the European Horizon 2020 project SOS Climate Waterfront shed light on different paths for rethinking cities as laboratories for innovative strategies to address climate change, placing urban waterfronts at the forefront of adaptation schemes. They reveal how concepts and approaches such as sponge city, porous city, or water-sensitive urban design could be translated into specific design solutions and how cross-visions between cities contribute to rethinking urban territories. It also becomes evident that urban transformation has always been based on interdisciplinary approaches, with new ideas emerging from the exchange of expertise integrating various fields of knowledge, such as geography, social sciences, and the environment. For instance, enhanced by Nature-based Solutions (NbS), urban green-blue spaces, like parks, rain gardens, and greenways, go beyond their role in stormwater abatement to address both the restoration of ecosystems and the promotion of human health and well-being. Similarly, rethinking land-water boundaries to manage changing water storage capacity and sustain natural riverine ecosystems calls for inter-sectoral collaboration.

Often, modifications of the land-water interface aim to create innovative waterfront public spaces. These spaces emerge within fluid and expansive transition zones between land and water, often replacing the rigid lines of embankments. Waterfront public spaces can take various forms, including promenades, water squares, floating terraces, artificial islands, buffering parks, or passages through wetlands. To adapt to unpredictable weather events, their outlines are designed to change with different water levels. Intertwined with urban greenery systems, these spaces not only enhance biodiversity but also contribute to the aesthetic appeal of cities, engraving urban landscapes with natural elements, offering recreational opportunities, and fostering community engagement. Drawing from various disciplines, such as urban planning, environmental science, public health, or psychology, contributes to a comprehensive understanding of the importance of water-related public spaces and their key role in promoting resilient and harmonious urban communities.

Overview of the Thematic Chapter.
Based on experiences from the SOS Climate Waterfront Research Project, this chapter aims to enhance understanding of how different scales of urban and landscape planning, architectural design, heritage perspectives, and environmental engineering technology link together in water-related strategies and how they impact each other in defining preventive action plans. The findings allow for a better understanding of the impacts of climate change on urban territories and indicate paths for further research based on the integration of environmental, technological, and urban design perspectives. By posing new challenges, they also foster the pursuit of innovations in climate-resilient urban and landscape design and planning.

The text about sustainable drainage systems, written by Brattgård, raises relevant questions about how consequences of climate change in terms of risk for flooding in cities and how drainage systems need to be designed to manage transporting large volumes of water. Tracing stormwater management back to the end of the 1900s and learning from different models in US and Europe, the author is stressing the need for strategies for managing situations of flooding in the urban context. Thereby, extending the discussion of climate change beyond the topic of sea level rise to addressing strategies for extreme events of flooding in cities like Stockholm. Although Scandinavia has historically experienced land-rise (due to pressures from thick cover of ice) modern cities will nevertheless need to prepare for flooding appearing as a consequence of climate change. One strategy is to continue learning from different models of water management for a resilient system of underground solutions are also a part of the urban waterscape, even if hidden below the city.

The analysis of River Contracts in Abruzzo, written by Angrilli and Ciuffreda, draws on experiences from Italy and discusses possibilities of the model of river contracts for strategies that could potentially integrate water policies with land-use planning. However, experiences from the 17 river contracts also point to the complex nature of stakeholder interaction of blue spaces in cities. One important component is raising awareness of citizens of the neighbouring villages near the river basins and particular challenges with upgrading blue-green spaces including river banks.

The examination of a Hybrid Urban Culture in Stockholm, written by André Augusto Prevedello, takes departure in hybridization between natural and cultural landscapes. Applied to the area of Hornsbergs strand and the area of Frihamnen in Stockholm, the authors are discussing Nestor Canclini's concepts of

deterritorialization and reterritorialization. The waterfront area is designed and constructed as a revitalization project with a waterfront area enjoyed by citizens for swimming, picnics and kayaking. Solutions that can mitigate effects of floods are discussed, with the ambition of allowing for movement of both people and cars, but also the growth of fungi and grass. These types of suggestions with a blue-green hybrid zone require extensive citizen dialogues, involving construction companies, municipality planning department, and park management authorities to be a practical reality of the future. Waterfronts have a strong visual character, and frequently, the analysis of urban waterscapes evokes strong opinions of different interest groups.

Documents such as the 2030 Agenda for Sustainable Development, adopted in 2015, the Paris Agreement, and the impactful report *The Future of our Past*, explicitly acknowledge that culture and heritage can guide choices towards building the resilience of cities by revealing "climate-resilient development pathways" (TFOUP Report, p. 7). Following this trajectory, Giulia Luciani explores Beyond Green and Blue: Ecohistorical Infrastructures for Water Landscapes and demonstrates that water landscapes are exceptionally rich in natural and cultural layers where biological landscape systems and the history of the place intertwine. From this perspective, heritage in waterfront territories should not only be perceived as a subject of protection but also as an active tool for strengthening the resilience and identity of urban spaces. This infrastructural approach becomes a tool to transcend the boundaries of various disciplines that often treat water, ecological processes, and heritage as separate entities, leaving their interconnections and potential synergies largely unexplored. Luciani proposes ecohistorical infrastructures as devices to deepen the relationship between the natural and cultural aspects of water landscapes, highlighting their synergistic potential.

Examining the territory from a socio-ecological perspective, Anahita Azadgar presents design proposals aimed at the revitalisation of the neglected spaces surrounding Goharrud River in Rasht, Iran. The socio-ecological approach integrates diverse elements such as native vegetation, wildlife habitats, riverfronts, ecosystem services, resilience, and social considerations. Despite the advantages of socio-ecological urbanism in revitalizing riverfronts, there remains a noticeable scarcity of research that explores this approach through diverse case studies and design projects. The study places significant emphasis on benefits of integrating ecological and social considerations into urban planning and design.

The urban waterfront areas and city waterscapes will be affected by consequences of climate change — today and tomorrow. With new solutions emerging with inspiration from nature-based solutions (UN 2020) and arguing that design-solutions need to embrace the expected flooding with buildings that can change and adapt with the landscape around them and also engage in dialogues with citizens in new ways with different senses (Dethlefsen 2023). Other studies are focusing on the visual character of urban waterfronts in cities across the world (Luo et al., 2022), we see a highly interdisciplinary scholarship emerging drawing on empirical cases. The empirical knowledge, combining understandings of water systems in cities and willingness to share experiences from different types of urban waterfronts, is required to face the consequences of climate change we see today including flooding, extreme weather events, sea level rise, and heatwaves accelerating in urban spaces. Furthermore, by acknowledging the wide range of future expected (and unexpected) severe consequences from climate change on the horizon, the development and reshaping of urban waterscapes can contribute to more resilient future urban spaces.

In conclusion, this comprehensive exploration of urban waterscapes presents a multifaceted understanding of their significance, offering insights from historical, social, and environmental perspectives. It emphasizes the critical role of traditions, citizen engagement, and interdisciplinary collaborations in crafting resilient urban landscapes in response to climate change. By delving into various case studies and approaches, the essays in the chapter underscore the imperative for inclusive dialogue, adaptive designs, and innovative strategies in shaping sustainable and adaptable urban waterscapes for the future.

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Nils Brattgård.

Local Handling of Stormwater in Stockholm
Lessons from Sustainable Drainage Systems

Introduction

Stormwater management (SWM), or urban drainage as it is also called, has been a concern since at least 3000 BC (Fletcher et al., 2015; Kirby, 2005). The way the topic has been framed has varied over time, however. In the beginning, drainage was concerned with the transporting of large volumes of rainwater out of the city to reduce the risk of flooding (Fletcher et al., 2015) and protect public health (Vollaers et al., 2021). This meant a focus on the shape of the urban environment, and, in more recent times, the use of technical infrastructure to convey the water, primarily through the cities, sewer systems (Vollaers et al., 2021). As the global temperature rises due to climate change, cities expect changes in yearly rain volumes and rainfall intensities (Ballard et al., 2015; Stockholms stad, 2013). The challenges posed by these increasing volumes are further elevated through increasing densification and hardening of urban areas, allowing more water to run off the cities, surfaces (Kirby, 2005).

The nordics have already experienced what lack of preparedness means. In 2021, Gävle, a city in the northern part of Sweden, experienced 161.6 mm of rainfall in 24 hours which resulted in major damage to infrastructure, and costs in the millions (Gävle kommun, 2023). Copenhagen, meanwhile, has experienced multiple large rainfall events. The largest one in 2011 caused 5-6 billion DKK in damages (City of Copenhagen, 2012). But improper SWM also affects the environment. Fast water flowing into lakes from pipes can harm coastlines, and contaminated stormwater or combined sewer overflows can impact water quality in the receiving water bodies (Ballard et al., 2015).

These new circumstances led to the realization that existing drainage systems cannot handle the flows at a reasonable cost, if at all (Stockholms stad, 2013). Many places started using various types of natural structures (often called (Blue-)Green Infrastructure (GI) (e.g. Suleiman, 2021; Fletcher et al., 2015)) to improve SWM, whether that be the quality of stormwater, the quantity conveyed or both (Fletcher et al., 2015).

1.1 The Creation of New Terms and Concepts

New terms used to indicate the changes in SWM practice thus started appearing towards the end of the 1900s (Fletcher et al., 2015). In the US, Best Management Practices and Low Impact Development took a foothold and later spread throughout the world (Fletcher et al., 2015), while Water Sensitive Urban Design (WSUD), Sponge Cities and other similar terms developed in various countries across the world (Deletic et al., 2020). Some countries in the European Union (EU) have adopted these terms, either outright or by translating them into the native language, while others developed their own terms and concepts (Fletcher et al., 2015). Two of these are Sustainable Drainage Systems (also known as Sustainable Urban Drainage Systems) originating in the United Kingdom (UK) (Ballard et al., 2015; Fletcher et al., 2015) and *Lokalt Omhändertagande av Dagvatten* (LOD, local handling of stormwater in English) in Sweden (Fletcher et al., 2015). The terms and concepts are in large part interchangeable, but each term may provide its own set of guidance and tools (e.g. *The BMP Database* and *The SUDS Manual* (Fletcher et al., 2015)).

1.2 THE ROLE OF COMPARISON

Comparisons can play an important role in the development of knowledge (Boroditsky, 2007), and are used in a variety of fields of study. In SWM, comparisons are frequently made between different types of GI (e.g. Bastien et al., 2010), and different management approaches (e.g. Zhang et al., 2017; Bastien et al., 2010). Similarly, comparisons can be made between different countries' policy and the resulting practice.

The act of comparing two things against each other can emphasize similarities, but crucially, also bring differences into light. Boroditsky (2007) found that two similar items will often appear more similar to each other when compared, while two differing items will often appear more dissimilar. At the same time, they also conclude that searching for differences may uncover similarities because the most meaningful differences are found in structural similarities (ibid.).

1.3 ESTABLISHING A BASIS FOR COMPARISON

LOD appears in a lot of research in Swedish, but most importantly in local policy and planning documents, including Stockholm (Fletcher et al., 2015, Stockholms stad, 2013). In broad strokes, LOD refers to source or site control (Berggren et al., 1991; Fletcher et al., 2015; Stockholms stad, 2013). The term first took shape during

the 1970s (Berggren et al., 1991). At first it meant using gravel-filled soakaways to infiltrate water, but it has since come to include several GI building blocks that can be combined with each other and more conventional technical solutions (*Svenska vatten- och avloppsverksföreningen*, 1983). Since the beginning of the 1990s, there has seemingly been relatively little development. Today, Swedish municipalities describe LOD as management of runoff on each individual plot of land (*Täby kommun*, 2022) to allow for attenuation, infiltration (*Lidingö stad*, 2020), and treatment (*Värmdö kommun*, n.d.). While there is — to the author's best knowledge — no national policy document for LOD, there are advisory documents published by *Svenskt Vatten* (Swedish Water in English) — the trade organization for the public waterworks companies — on specific solutions and more general guidelines on various SWM topics (Svenskt Vatten, 2022).

Figure 60: Collage of tree planting methods in urban areas.

(Photo credits: author)

SUDS shares many similarities to LOD. SUDS was developed during the 1990s in Scotland (Fletcher et al., 2015; Kirby, 2005), where it has been used since. Guidance for the concept has developed over time, from 'similar, but separate' guides for different parts of the UK (Fletcher et al., 2015, p. 5), to the general guidelines for SUDS provided by *The SUDS Manual* (Ballard et al., 2015). SUDS guiding principle is the maximization of the benefits and minimization of negative impacts of runoff by mimicking the natural state of the ground (Ballard et al., 2015). Further, SUDS should — much like LOD solutions — not be seen as a single component but as an 'interconnected system, designed to manage, treat and make the best use of water' (Ballard et al., 2015, p. 27). The wide range of components, and flexible nature of SUDS, means that the concept can be applied anywhere (Ballard et al., 2015).

2 Stormwater Management using Sustainable Drainage Systems

SUDS are used in all parts of the UK, though it was created in Scotland, where it has been used to a much greater extent than in England and Wales (Kirby, 2005). The SUDS methodology has been used in both new developments and in the refurbishment of existing environments (Ballard et al., 2015; Vollaers et al., 2021).

2.1 SUDS GUIDING PRINCIPLES

The guiding principle of SUDS is to mimic the natural drainage processes an area exhibits before development (Kirby, 2005). It makes sense, then, that SUDS performance is evaluated against a baseline set by the natural hydrology of the site (Ballard et al., 2015). The performance is proposed to be evaluated based on four design criteria (Ballard et al., 2015), extending the commonly cited urban drainage triangle (quantity, quality, amenity) (Fletcher et al., 2015, Kirby, 2005) with biodiversity.

It should come as no surprise that water quantity and quality are likely to be the driving factors behind the design of a SUDS (Ballard et al., 2015). EU legislation has focused and clarified the requirements for water quality through the Water Framework Directive (WFD) (Directive 2000/60/EC) and flood risk (Directive 2007/60/EC), guaranteeing at least two topics to be covered. The following analysis of SUDS practice will be focused primarily on these factors, as well as the institutional framework around SUDS usage.

2.2 THE SUDS MANAGEMENT TRAIN

The SUDS Management train is argued to be a leading factor behind the success of a SUDS system (Ballard et al., 2015; Kirby, 2005). At

its core, the Management train only implies the usage of multiple different types of SUDS devices/measures (Ballard et al., 2015). The chaining of multiple measures has shown to improve, above all, the treatment performance of the SUDS system (Bastien et al., 2010). Following SUDS principles, these measures are meant to be dispersed throughout the development, but many SUDS systems nonetheless choose to use a single end-of-pipe solution (Bastien et al., 2010). The management train concept can be extended further by adding spatial boundaries within system design (Kirby, 2005):

- Source control, where water is dealt with on each landowners' lot.
- Site control, where multiple buildings may share a larger SUDS installation.
- Regional control, involving a few large-scale treatment steps.

The idea is that runoff should be utilized, infiltrated, or stored as locally as possible, with the increasing spatial scale indicating the ability to handle larger rain events (Bastien et al., 2010; Kirby, 2005). *The SUDS Manual* (Ballard et al., 2015) recommends complete interception for relatively small rain volumes (5 mm), covering commonly occurring small rain events, or the first flush of larger rainfalls. The recommendations for flood prevention cover larger rainfalls. Rain up to at least a 30-year return period should not lead to any flooding on site, and the built environment should withstand rainfalls up to a 100-year return period (or 200 years in Scotland) (Ballard et al., 2015).

2.3 REGIONAL DIFFERENCES IN SUDS IMPLEMENTATION

Implementation of SUDS is not equal. The success of projects varies greatly due to different approaches (Bastien et al., 2010, Vollaers et al., 2021), but also varying levels of knowledge, potentially leading to failures in the SUDS scheme (Vollaers et al., 2021). There are, however, also differences between implementation within the UK, in large part due to differing planning systems and institutional arrangements (Kirby, 2005; Potter & Vilcan, 2020).

Implementation of SUDS in England and Wales has been hamstrung by the legislation phrased around the older way of working with technical infrastructure (Kirby, 2005). Interest in SUDS implementation exists among planners in England, but they are limited by a lack of legislative backing, the neoliberal planning system giving power to developers, and a lack of resources (Potter & Vilcan, 2020). Additionally, the responsibility of planning drainage systems falling on local government while the agenda can be set by the

national government does not provide the best opportunities for creating good SUDS (ibid.). The result is the utilization of 'bog standard' SUDS solutions (ibid., p. 15) and at least one planner in England looking enviously at Swedish SWM (ibid., pp. 15, 16).

Up to the end of the 1990s, Scotland had many of the same issues as England and Wales, though the formation of the SUDS Scottish Working Party (SUDSWP) allowed these issues to be overcome to a large extent (Kirby, 2005). The creation of a common design manual, agreements concerning the responsibilities of SUDS, and clear guidelines for SUDS requirements in planning were particularly important accomplishments (ibid.). Since then, research has been conducted on a broad scale, gathering qualitative data for SUDS implementations to further SUDS development in Scotland (ibid.). Today, SUDS are required for all new developments and are commonplace in Scotland (ibid.), though large and visionary projects can still have problems finding funding (McLean, 2016).

2.4 CAUSES OF FAILURES

Vollaers et al., 2021 found that SUDS systems may fail at any stage in their life-cycle. Further, they found that many failures occurred due to lack of experience and knowledge of the planners. The use of SUDS sets new demands on the people in charge, requiring new sets of knowledge (ibid.). There is also a need for policies, guidelines, and standards supporting these new planning paradigms (Vollaers et al., 2021, Kirby, 2005).

It's easy to see that the conclusions of Kirby (2005) are true even today. The role the SUDSWP had in elevating Scottish SUDS practice can't be understated. Their work in creating

Figure 61: Rain garden on a street in Amsterdam, showing different outcomes using the same stormwater management measure. (Photo credits: author)

comprehensive manuals and studying SUDS performance was especially important in bridging the knowledge gap leading to system failure. In the time since 2005, *The SUDS Manual* was written to provide comprehensive guidance for England and Wales as well.

3 Stormwater Management in Stockholm

Stockholm started working with stormwater using LOD concepts in 1994 to reduce pollution in the city's waters caused by the duplicate drainage system (Stockholms stad, 2013). The first stormwater strategy was created following this line of thinking, to later be replaced by the current version (ibid.). SWM practice has since expanded to also include challenges related to flooding, amenity and biodiversity. Water quality is still a focus, likely fuelled by the need to reach good water status as defined by the WFD (Directive 2000/60/EC), a goal which is seemingly still far away (VISS, n.d.).

GI solutions are meant to be simple and small in scale, located both on individual lots and on public land. The strategy highlights a priority system—starting by reducing the amount of pollution runoff pick-ups, secondly reducing the amount of runoff on site, and only if this isn't enough, including larger scale tools within the catchment area. Supporting these goals, an action level (*Stockholms stad*, 2016a) has been created as a standard, requiring attenuation and treatment of at minimum 20 mm of rainwater to allow for a 70% reduction of pollutants. Though there has been criticism that this standard is too rigid, and possibly sets too high a requirement (Eliasson & Gidlöf, 2020).

Meanwhile, the requirements on flooding are relatively vague, with the stormwater strategy highlighting the need for setting a reasonable level of protection (*Stockholms stad*, 2013). The strategy highlights the need for reduction of volume through infiltration, decreasing peak flows through attenuation, as well as protecting infrastructure against damages caused by flooding.

3.1 SUSTAINABLE STORMWATER MANAGEMENT PRACTICE

Since the stormwater strategy and action level are implemented only for new development and significant redevelopments (Stockholms stad, 2013, 2016a) allowing for existing environments to remain as is. Gaining insights into current drainage practice thus involves analysing these newly developed areas.

Norra Djurgårdsstaden is one of the latest projects in Stockholm where sustainability is highlighted as a key development criteria (Stockholms stad, 2022). A comprehensive stormwater strategy has been developed specifically for the area (Olsson et al., 2011),

setting a mandatory minimum level for all development in the area. GI are to be utilized and should be able to intercept a two-year rain event, while the whole system should be able to handle at least a 10-year event without surface water pooling (ibid.).

Suleiman (2021) analysed three areas, with a focus on the planning process behind their creation:

- *Hammarby Sjöstad* acted as a test bed for new and innovative management methods (Suleiman, 2021). The area utilizes a large central canal to which rainwater is led from buildings and roads, a staircase shaped wetland combined with sedimentation basins, and a more standard wetland paired with three sedimentation basins (ibid.).
- *Årstafältet* is now on its second design after development plans were redrawn, consisting of a large-scale pond system towards the areas centre merged into a single water course (Suleiman, 2021) with local measures for rainwater reuse, treatment, and attenuation (Rydberg, 2009).
- In the *Hornsgatan* project, a new tree planting method was developed (Suleiman et al, 2020), which later came to be known as the Stockholm Model. Following this, a comprehensive guide was written concerning plant beds using trees (Stockholms stad, 2017), and the usage of trees has been added into legislation (Suleiman, 2021).

3.2 OPEN ISSUES

Suleiman (2021) found that the result of the recent developments in *Hammarby sjöstad*, *Årstafältet* and *Hornsgatan* are promising — and in large part successful — but are still inadequate in creating a suitable framework for sustainable SWM implementations (ibid.). Planners seemingly understand what sustainable SWM entails. However, they do not have the tools and adequate planning legislation framework to support their work (ibid.).

A large problem exists in communication and role distribution, both in planning and maintenance (Suleiman, 2021). While Stockholm municipality had interest in funding and creating successful schemes, the different actors in the city had different visions for the drainage systems (ibid.). In later stages, maintenance responsibilities were divided based on the type of infrastructure, which is problematic, since many GI have multiple uses and thus multiple maintenance needs (ibid.).

Finally, learning experiences from implementations have been limited in part due to maintenance being outsourced to external companies with lacking interest in tracking performance over time (Suleiman, 2021).

4 Analysis and Conclusion

The challenges faced by stormwater management aren't unique to any one city, as is evidenced by shared international legislation in the EU. But each location will have a specific set of circumstances. In the coming years, Stockholm will have to deal with its dense inner city, continue to manage the water levels of lake *Mälaren* to avoid flooding, improve the water quality of water bodies to meet EU guidelines, manage the flood risk in built environments, and many other issues. Looking past the Swedish border to see how others have solved similar issues can help in forging a path forwards.

4.1 INSTITUTIONAL FRAMEWORK

As Suleiman (2021) highlights, there is a need for reorganization of the institutional framework for stormwater management in Stockholm. Much like in England and Wales, planners are not opposed to sustainable drainage practice, and might even be keen to work with it more, but are limited by unclear legislation and complicated frameworks in the municipality.

The work in Scotland during the 1990s could be seen as a model to follow. Working with a group similar to the SUDS Working Party would be a first important step in the development of a framework for the distribution of responsibilities, both in maintenance and planning, as well as work towards the other challenges remaining for Stockholm's drainage practice. But pressure also needs to be put on the national government to adapt relevant legislation to new drainage practices. A Swedish Government Official Report concerning water in planning processes, to be completed in 2023, may be one step in this direction (Regeringskansliet, 2021).

4.2 DRAINAGE POLICY

The largest criticism that can be levelled at Stockholm's drainage policy is the apparent lack of any direct guidance on flood protection. There are only vague requirements to prevent damage caused by the water. Exact implementations are decided during planning stages for developments, but even then, exact numbers may be unclear. In comparison, SUDS in the UK has a standard up to which damage to buildings has to be prevented—a 100-year return period in general, and 200-year in Scotland. To highlight the importance of water quantity next to quality, Stockholm could set a similar standard.

One of the large challenges in Stockholm is the ability to implement sustainable stormwater management in existing environments. A large portion of the dense urban centre utilizes a

combined sewer (Stockholms stad, 2013), leading to risks of combined sewage overflows in the case of large rainfalls. At the same time, this environment creates the largest challenges when constructing stormwater management solutions due to a lack of space, and the need to demolish and reconstruct infrastructure.

Meanwhile, it's also possible that the action level might be set prohibitively high. Intercepting 20 mm of rainwater requires a large amount of space that may not be available. While it may not be a legally binding document, there is a risk that not achieving this goal leads to a lack of investment, even though small improvements may still be worthwhile. In such circumstances the 5 mm interception recommended by *The SUDS Manual* may be more reasonable. Having a split requirement could be one path towards faster implementation of stormwater management in existing environments by allowing the city to work in steps instead of all at once.

4.3 LEARNING FROM PAST EXPERIENCE

Another key factor in successful stormwater management implementation is experience (e.g. Kirby, 2005; Suleiman, 2021; Vollaers et al., 2021), which can be gathered by a sequence of practice/research, evaluation, and documentation.

Stormwater management occurs hands-on through practice, but also through more theoretical research and tests. The number of projects implementing stormwater management concepts is growing rapidly, as are the research projects Stockholm has participated in or conducted. Stockholm municipality has highlighted a number of water-related research projects it is participating in, many of which concern stormwater management (Stockholms stad, 2023a).

Not only the final result, but also the process leading up to it is important, as has been shown by Suleiman (2021). When evaluating a project, method, or tool, it's also important to note down institutional arrangements facilitating its success, or more importantly, failure (Navidi et al., 2017). Evaluating existing developments or ongoing developments is one possibility. Since many large-scale developments in Stockholm are ongoing, there are still enough opportunities for gathering data. Though that requires Stockholm municipality to take over maintenance. This may be one reason why the *International BMP Database* relies on volunteers providing data (Submit Data, n.d.). Similarly, the guides published by *Svenskt Vatten* are created by a large variety of institutions.

Finally, documentation is essential to organizational learning, improving the quality of work and preventing the repetition of past mistakes (Navidi et al., 2017). *The SUDS Manual* is the prime

example of documentation within SUDS. The Stockholm Water company, meanwhile, has created concise technical documents for a number of different drainage measures (e.g. rain gardens, Stockholm Vatten och Avfall, n.d.), highlighting key aspects, but not going as in depth as the document created for structural soil (Stockholms stad, 2017) or *The SUDS Manual*. Further, there is a broad technical handbook (Stockholms stad, 2023b) for all manner of constructions on public land, as well as stormwater management guidelines for three common typologies (Stockholms stad, 2016b, 2016c, 2021). Creating guidance for a large variety of measures could help particularly in the early conceptual design of projects (Navidi et al., 2017), potentially leading to a wider range of measures used.

4.4 The Future

Stormwater management in Stockholm has taken great leaps forward since the adoption of the Stormwater strategy. Nonetheless, a comparison with SUDS implementation in other countries, and Scotland in particular, shows room for improvement. The knowledge collected by *Svenskt Vatten* mimics work done for SUDS and could possibly be expanded further to discuss a large variety of SWM issues similar to the SUDS Working Party, possibly improving institutional arrangements around stormwater management. The work on the national level should directly help in improving SWM locally as well. The most immediate need for improvement in Stockholm is the management of flood risk, where a concrete interception volume is currently missing in adopted policy. This issue, as well as the need for continued improvement of water quality in the city's water bodies, could be helped through a wider range of measures, possibly fuelled by improved documentation.

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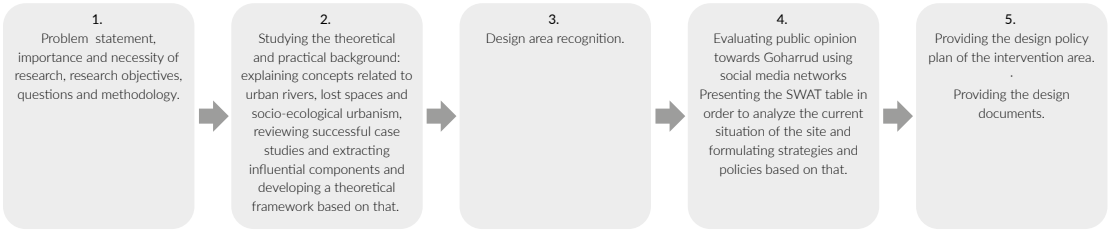
Revitalizing the lost spaces around Goharrud river in Rasht with a socio-ecological approach

Introduction

Rivers play a vital role in the natural landscape, providing several ecosystem services (Böck, Kerstin & Polt, 2018; Acuña, 2013). Despite this though, currently, they are often trapped within concrete walls, rendering them invisible from human sight (Blau, Marie-Luise & Luz, 2018; Clivaz & Reynard, 2018; Pareira et al., 2014). This situation has led to the creation of neglected spaces that serve as hotspots for social issues while accelerating their environmental degradation (Mandal & Das, 2018). But restoring and transforming urban river corridors into vibrant public spaces can help preserve urban ecosystems to a certain degree and create opportunities for recreational activities in urban areas, all while producing an appealing landscape (Everard & Moggridge, 2012; Guimarães et al., 2021). In recent years, adopting a sustainable approach has become the prevailing and customary practice for designing and revitalizing urban spaces. Despite its great value though, this approach is unable to provide comprehensive solutions for riverfronts due to the fact that it mainly focuses on the category of green design and pays little attention to social components (Graves, 2019). Hence, it is evident that the socio-ecological approach holds considerable appeal for the revitalization of riverbanks, given its emphasis on vital factors such as native vegetation, wildlife habitats, riverfronts, ecosystem services, resilience, and social considerations (Heymans, 2016; Dyson & Yocom, 2015; Sameeh, Gabr & Aly, 2019; Aalto, Marcus & Torsvall, 2018). However, despite the clear advantages of socio-ecological urbanism in riverfront revitalization, there is a scarcity of research exploring this approach through case studies and diverse projects (Barthel et al., 2013). This research gap underscores the need for further examination of the socio-ecological approach and its practical implementation in revitalizing riverfronts, thereby transforming neglected spaces into vibrant urban environments.

Goharrud River, once a key factor in the establishment of Rasht City, is plagued by the mentioned issues, including the dumping of waste, industrial and domestic sewage, and construction in its immediate vicinity. These problems starkly contrast with the recreational activities that used to thrive in the past, as today, people rarely engage in such initiatives in or around this river (Rezaei, Tajdari & Fatehi, 2017). Recognizing the urgency of revitalizing these

lost spaces along rivers and the dearth of urban planning studies with a socio-ecological approach, this paper presents Goharrud river (the area between Kargar St. and Azade St. in Rasht) as a model case study, aiming at improving its socio-ecological status through developing design strategies for its revitalization and transforming it into a vibrant collection of public spaces.



Methods

The research methods vary according to the nature of the subject and research objectives. This research can be considered of the applied type based on its goal and, in terms of time, it is cross-sectional, aiming to provide solutions to present issues. Applied research utilizes the knowledge and information obtained through foundational research to address human needs, and enhance and optimize tools, methods, and models. Its focus lies in the development of well-being, comfort, and the advancement of human living standards (Hafeznia, 2016). According to the objectives of this research, the appropriate research method is descriptive-analytical. Exploring social networks was also utilized

Figure 62: Research Structure (credits: author).

Figure 63: Aerial photos obtained from Google Earth on 9.10.2022 demonstrating the city of Rasht (top, left), the vicinity area (bottom, left) and the study area (right) (credits: author).

to gather public opinions about the river. Based on the site evaluation and public sentiment, a SWOT matrix was developed, leading to the formulation of strategies and policies. The study concludes with the creation of a 3D model using SketchUp software, providing different design views for better understanding the solutions.

Theoretical Framework:

Urban river revitalization refers to the restoration of waterways that have lost their ecological and social functions (Palmer & Allan, 2006; Nissen et al., 2012; Heikkila, 2011; Neruda, Tichonova & Kramer, 2012; Lee, Ma & Cheung, 20121). These revitalization efforts often target urban lost spaces, which are undefined areas lacking specific boundaries and functions (Trancik, 1986; Memarian, 2014; Hamelin, 2016; Khalid, Hilal & Marzukhi, 2018). In the context of cities as socio-ecological systems, the integration of humans and nature is a fundamental aspect (Plessis, 2008; Escalera-Reyes, 2020; Frank, Delano & Caniglia, 2017). The concept of socio-ecological systems recognizes the intricate and interconnected nature of urban environments, where humans are an integral part of the larger ecological framework (Resilience Alliance Organization, 2006). The application of this approach in urban planning gained momentum with the publication of *Social Ecological Urban Development*, which showcased the implementation of the model in a real case study in 2013 (Barthel et al., 2013). This integration of socio-ecological principles in urban design and planning serves as a practical entry point for fostering sustainable and resilient urban environments.

After conducting a review of the relevant literature, the present study identified several critical elements that should be considered when undertaking a design based on a socio-ecological approach. These key elements are organized into five main aspects, as outlined below:

Figure 64: Criteria for revitalizing the lost riverside spaces with a socio-ecological approach (credits: authors)

Exploring Social Medias:
Based on the review of people's opinions about Goharrud on social networks, several important tips emerge. These include people's distrust towards city officials, the collective memory of Goharrud's past, the improper state of landfill and sewage, the presence of popular campaigns for revival, people's positive sentiments towards the designed riverfront areas, the role of citizens in waste production and pollution, suggestions for improving the waterfront's current state, occurrences of anomalies such as crimes and vandalism on the river's edge, and the recognition of the river's tourism potential, with a comparison to tourism management in Western countries.

SWOT Analysis:
The main goals of this research in accordance with its theoretical framework are: providing a sustainable, balanced, law-abiding, complete and competitive physical environment; organizing the river's landscape; and considering human needs throughout the design process.

STRENGTH	OPPORTUNITY	WEAKNESS	THREAT
Presence of river's natural landscape	Possibility of creating active grounds due to physical differences	Lack of recreational, cultural and sports spaces on the riverside	Possibility of underground water contamination in the region due to the infiltration of part of the sewage in the ground and also the release of waste in the water flow path
The existence of a highway network around the area which provides suitable access for all citizens	The possibility of strengthening the perception of the area through strengthening the visual and auditory senses, the element of the river, greenness and increasing the sensory richness	Lack of tangible economic activities and public attractions in the surrounding area	Possibility of vitality and legibility reduction in the area due to physical problems and the lack of collective spaces
	Possibility of strengthening behavioral settings to increase the social relations of residents	Turning the river into a channel and destroying its natural landscape	
		Lack of safety and safeness	

Figure 65: Criteria for revitalizing the lost riverside spaces with a socio-ecological approach - SWOT Analysis model (credits: author)

Strategies:
After establishing the main goals and conducting a SWOT analysis, several strategies have been identified to guide the revitalization efforts. The most prominent strategies include removing visual obstacles to the river, establishing dedicated and suitable paths for active modes of transportation while ensuring proper access to both sides of the river corridor. Additionally, there is a focus

on developing green spaces, promoting tourism and leisure activities along the riverbanks, and creating a cohesive network while eliminating incompatible uses. To protect the environment, measures will be implemented to control water and soil pollutants, preventing further degradation. Enhancing the urban space's vitality and attractiveness is another key aspect of the strategy, along with eliminating secluded areas and promoting inclusive public spaces. Finally, the creation of employment-generating land use is considered a crucial element in the revitalization plan.

Results:

In the last part of this study, after laying over all the information provided by recognition and analysis of the site, major policies for different points in hopes of turning this lost space into an efficient and functioning public space as a whole were proposed and located. In order to reach a detailed design, firstly we need to categorize the spaces on macro scale. Due to the adoption of a socio-ecological approach in this research, some of the proposed activities will align with the cultural system of the area while also considering recreational and service land use. To achieve this, a spacious central zone dedicated to cultural activities forms the focal point of the site. Additionally, strategically placed fishing platforms serve a dual purpose as observation points, contributing to the revival of collective memory and cultural engagement. Complementing the cultural zone, the site features additional spaces such as a library and an open amphitheater.

The site features dispersed wooden booths and a local products market as micro-spaces within the commercial-service zone. Leisure-sports activities are defined by a children's playground, bicycle path, and fishing platforms. Adjacent to the playground is an urban agricultural spot that supports cultural and recreational activities, ensuring proper supervision and safety for children's activities near the community gardens.

Organic lines were chosen to connect design elements, as they complement the site better than broken lines. Particularly in the western part, curved lines align harmoniously with the site's form. These meandering lines, resembling springs and rivers, feature deep curves that create a soft and undulating effect. They are well-suited for paths, plant bed lines, and river beds. By guiding viewers around corners and revealing new views and spaces, these winding lines add a sense of freshness and mystery, stimulating viewers' curiosity and enhancing the garden's and green space's overall atmosphere (Hansen, 2016).

Conclusion:

Overall, the socio-ecological regeneration of the Goharrud River presents an opportunity for reviving neglected urban river corridors into active public areas. The emphasis of this study is on the incorporation of ecological and social considerations into urban planning and design. The removal of visual obstructions, creation of active transportation modes, formation of green spaces, promotion of tourism and leisure activities, environmental protection, improvement of urban vitality, and creation of job possibilities are only a few of the suggested strategies. The design's incorporation of organic lines improves the site's aesthetics and connection to the river's natural form. Cities may revitalize their rivers, design inviting public areas, and add to the overall resilience and sustainability of the urban landscape by embracing the socio-ecological urbanism framework.

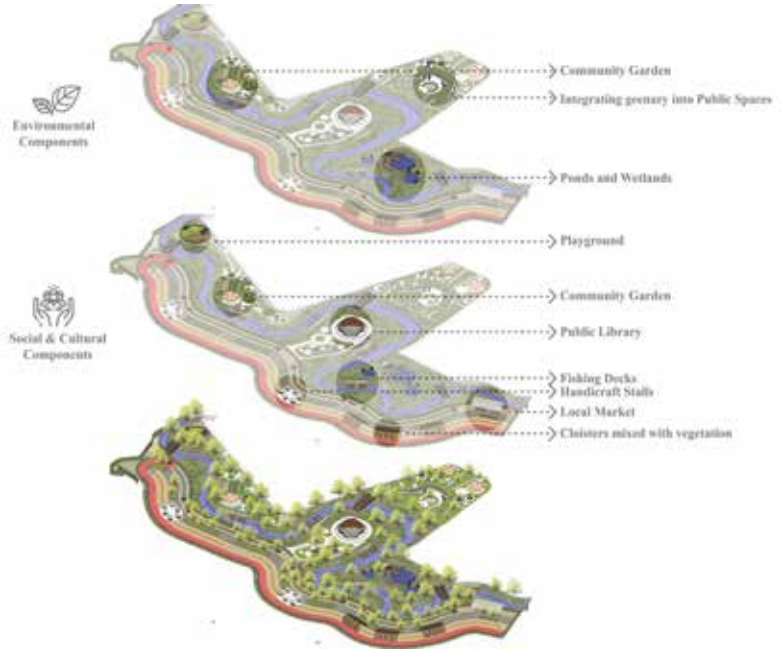


Figure 66: Diagram depicting environmental, social & cultural components of the design. (Credits: author)

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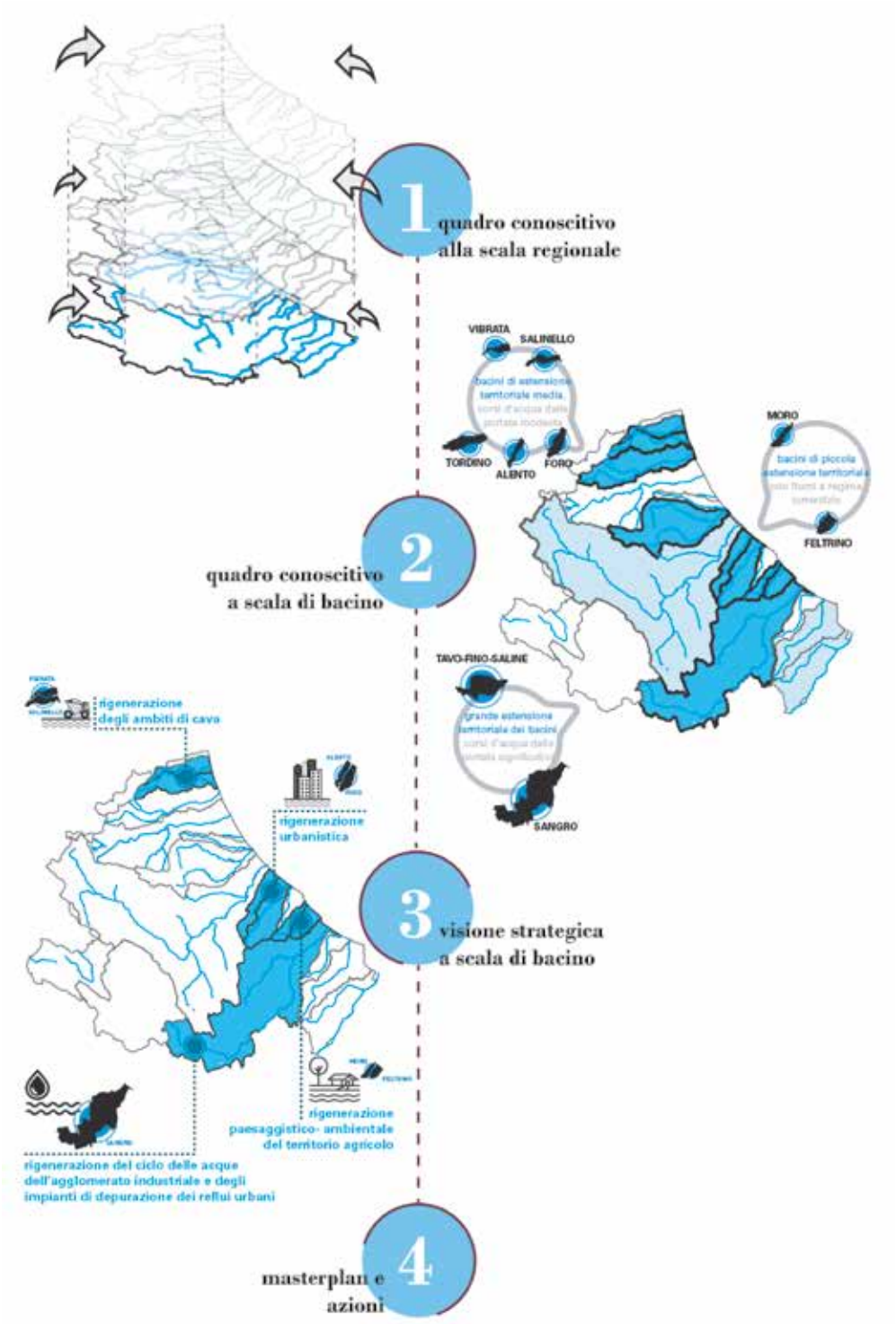
River Contracts Atlas in Abruzzo


1
quadro conoscitivo
alla scala regionale
VIBRATA
SALINELLO
TORDINO
ALENTO
FORO
MORO
FELTRINO
2
quadro conoscitivo
a scala di bacino
TAVO-FINO-SALINE
SANGRO
rigenerazione
degli ambiti di cava
rigenerazione
urbanistica
3
visione strategica
a scala di bacino
rigenerazione
paesaggistico- ambientale
del territorio agricolo
rigenerazione del ciclo delle acque
dell'agglomerato industriale e degli
impianti di depurazione dei reflui urbani
4
masterplan e
azioni

Premise

This contribution aims to provide an updated overview of the Abruzzo region's experience with river contracts, referring to the outcomes of the research 'River Contracts Atlas in Abruzzo' carried out with the aim of defining a document of an organic collection of maps and regional guidelines.

In the last years the context has changed, first as a result of new national acts, in particular with the recognition of river contracts at the legislative level, which took place with the *Collegato Ambientale*[1], and with the National Strategy for Adaptation to Climate Change, and then following the publication of the National Recovery and Resilience Plan (NRRP) calls, with the planning excitement that resulted from it.

At the time of the signing of the protocol between the Abruzzo Region and our Department of Architecture[2], the regional context in Abruzzo was characterized by the sudden proliferation of initiatives aimed at establishing river contracts, often in the absence of previous negotiated planning (important for sedimenting on the territory a habit of cooperation) and in which the delay in the establishment of a regional steering committee contributed to the confusion and extemporaneity of the attempts at self-organization of the different local contexts.

The research attempted to define a methodology useful for setting up a river contract process and recognizing the degree of criticality for each river basin with respect to the various indicators that characterized its state of health [Figure 68]. This was with the aim of comparing the quality of river basins with each other with respect to the different forms of pressure they experience.

To arrive to this result, the research work had been organized in several stages: from the critical reconstruction of ongoing actions at the regional level to the reconstruction of the system of knowledge available at the regional scale [Figure 69]. From the identification of pilot cases representative of the different regional watersheds (and construction of the relevant knowledge frameworks) to the construction of strategic visions and action plans on the pilot contexts [Figure 70]. It finally led to the methodological definition of a priority matrix and the construction of methodological guidelines.

Figure 67: Outline of the atlas methodology through the stages of:

1) cognitive framework at regional scale;
2) cognitive framework at basin scale;
3) strategic vision at basin scale;
4) master plan and actions.
(Credits: authors).

The research methodology

The research team proposed a vision of river contracts as processes capable of interpreting a two-fold innovation, the first pertaining to the opportunity to proactively integrate water policies with land use planning, especially in view of a land use government capable of averting the further depletion of water resources; the second concerning the active role of citizens, involved in inclusive processes aimed at participation in choices inherent to river basins. All this was by no means a foregone conclusion; it was first necessary to unhinge the sectoral and technocratic vision that connoted (and perhaps still connotes) public action on water in Abruzzo, as moreover in many other Italian regions. There was also a need to overcome the strongly hierarchical approach with which action is taken on common goods of primary importance such as water bodies; there was also a need to rebuild citizens' attention to public water, an attention that at the moment is still represented by a form of utilitarian interest, which leads citizens to conceive the common good river as a resource to be appropriated indiscriminately, especially when there is a persistent difficulty in the attribution of the status of ownership of the areas, as well as of the competencies over the management of its waters.

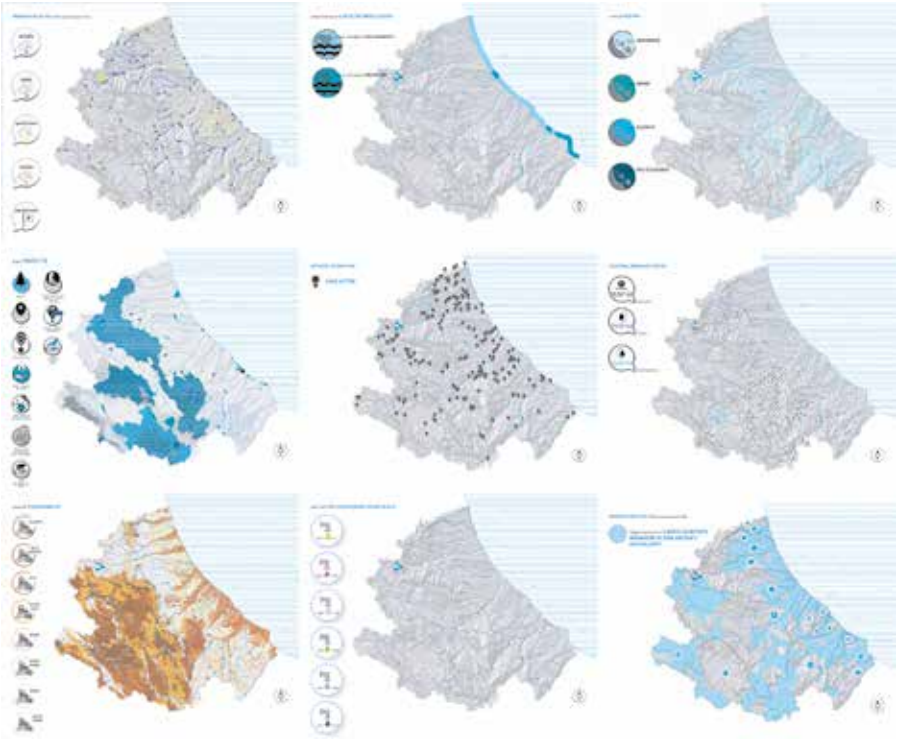
These starting conditions still hinder the effectiveness of the actions put in place by regional governance, on the other hand, even at the national level it should be noted that the results achieved by the Water Framework Directive (WFD), with regard to the objectives of improving the quality status of rivers, are not satisfactory, and there are many regions that have asked for an extension to 2027 of the deadline for achieving the environmental class good for their rivers.

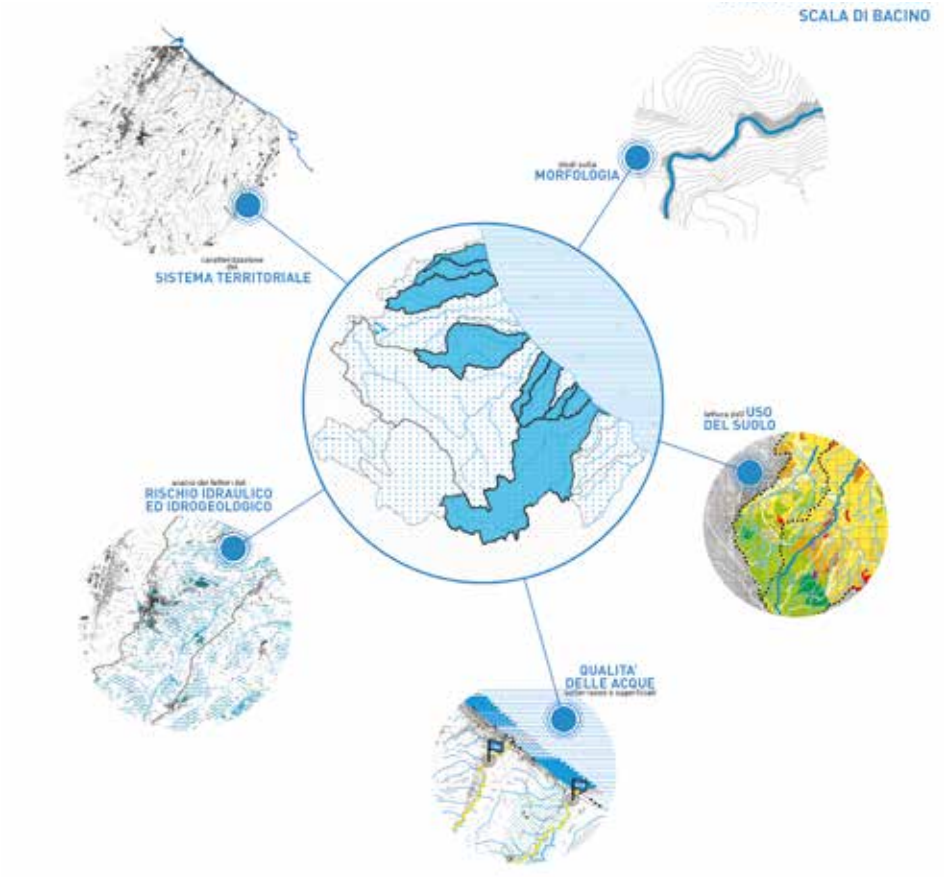
It was also stated that the solution to the critical issues of rivers and basins requires a strong degree of integration between urban planning policies, management of water uses, land maintenance, development of integrated water service and cognitive systems. An integration that in many regions, and among them Abruzzo, would have required a new culture of collaboration between institutional actors and, above all, the activation of participatory processes from below, linking the explicit and technical knowledge, proper to expert knowledge, with the 'tacit knowing' (Polanyi, 1979), represented by that implicit knowledge, elaborated by the community of local actors on the basis of cognitive and experiential knowledge, valuable in the activation of development processes.

On the basis of these premises, the picture emerging from the initial analyses was not encouraging: despite the large number of

Figure 68: Cognitive framework at the regional scale: mosaic of regional analysis maps. (Credits: authors).

Figure 69: Stages of the cognitive framework at the basin scale: land system characterization, morphology studies, land use studies, groundwater and surface water quality, hydraulic and hydrogeological risk factor analysis. (Credits: authors).




SCALA DI BACINO
MORFOLOGIA
SISTEMA TERRITORIALE
USO DEL SUOLO
RISCHIO IDRAULICO ED IDROGEOLOGICO
QUALITA' DELLE ACQUE

initiatives still no contract had reached the launch phase of the strategic plan and most were still quite far from that result. Not only that, often the river contracts insisted on the same basin involving it in different parts and in the absence of an overview; this fragmentation reflected the tendency of municipalities to form aggregations on the basis of administrative management opportunities (and political homogeneity), which have little to do with the scale of the problems of river ecosystems. The same fragmentation of the basins was also the cause of a lack of systemic capacity to resolve the deterioration phenomena, which, as we know, act on the scale of the entire basin.

The research highlighted the crucial importance of horizontal and vertical coordination between institutional and non-institutional actors, in a context of fragmented institutional and territorial competences like a water basin involving several municipalities, and possibly superior institutions such as parks and provinces. In many regions, including Abruzzo, these skills are absent, and collaboration between different administrations and civil society is still in its infancy. Moreover, there is a need to promote the principle of subsidiarity between institutions of different levels.

River contracts are regulated by the principle that a synergic and strong action of all stakeholders, public and private, is necessary for the regeneration of river basins and the pursuit of environmental, landscape, social, and economic objectives. To achieve success, a strong political intentionality and identification of the territory with an institutional subject of a supra-local nature are also required. This subject should hold the most important administrative functions in water governance, and the recognition of its coordinating role is more probable if it is close to the territorial realities.

The research on river contracts conducted an experimental phase for drafting the Atlas, which involved selecting different pilot contexts from Abruzzo's various basins. This allowed for the identification of scenarios that highlighted environmental and urban planning issues representative of the basins. The Alento and Foro water basins were a distinctive example of a case study that combined two different basins with similar and correlated identity characteristics. The analysis was conducted considering the two rivers as a single entity, both during the analysis phase and the definition of the river contract program.

The pilot application

The first part of the pilot application is entirely focused on the critical reading of the territorial, morphological, land use, hydraulic

and hydrogeological risk characters [Figure 71], which is crucial for the implementation of the second part, in which the river contract is outlined both through the setting up of a site specific form of governance as well as through the indication of good practices and the formulation of a proposal for the urban and environmental regeneration of the Alento river mouth, the latter exemplified by a project with defined and replicable aspects, aimed at mitigating the hydrogeological risk caused by the channelization of the riverbed.

The two rivers flow through diverse territorial and landscape contexts, including the natural environment of the Maiella National Park, industrial settlements, rural areas, and small to medium-sized urban agglomerations. An analysis of land use over time, based on data from the Corine Land Cover project spanning from 1990 to 2012, reveals a significant increase in industrial and commercial settlements near watercourses and a corresponding loss of wooded areas. While soils in close proximity to watercourses are predominantly agricultural, anthropogenic loads associated with civil and industrial uses have had the greatest impact on water quality. Furthermore, the continuity of the river course is disrupted in some places by small commercial settlements and a few sporadic urban agglomerations.

The difference between the environmental conditions of the springs and mouths is evident. The high degree of naturalness of the springs, sublimated by the presence of the Maiella National Park, contrasts with the chaotic condition of the mouths, typical of the coastal conurbation of the middle Adriatic. There are also built-up areas that fall within hydraulic risk restriction zones, with two types of urban agglomerations: sprawled houses mixed with agricultural land and urban settlements. The history of flooding events and the risk map show a clear correlation between flooding phenomena and the characteristics of the built fabric. Channelization of the watercourse causes considerable damage when rainfall is intense. The area most exposed to hydraulic risk in the case of the Alento river is the heavily urbanized mouth, while the inland area characterized by predominantly agricultural land use is the concentration of areas vulnerable to hydraulic risk in the case of the Foro river.

Scenarios and project

We moved from territorial analysis to constructing strategic scenarios, with the Province of Chieti as the hypothetical lead partner, assisted by a steering committee made up of representatives from participating municipalities and decision-making bodies within the basins. The governance proposal's innovative character lies in the organizational structure of the

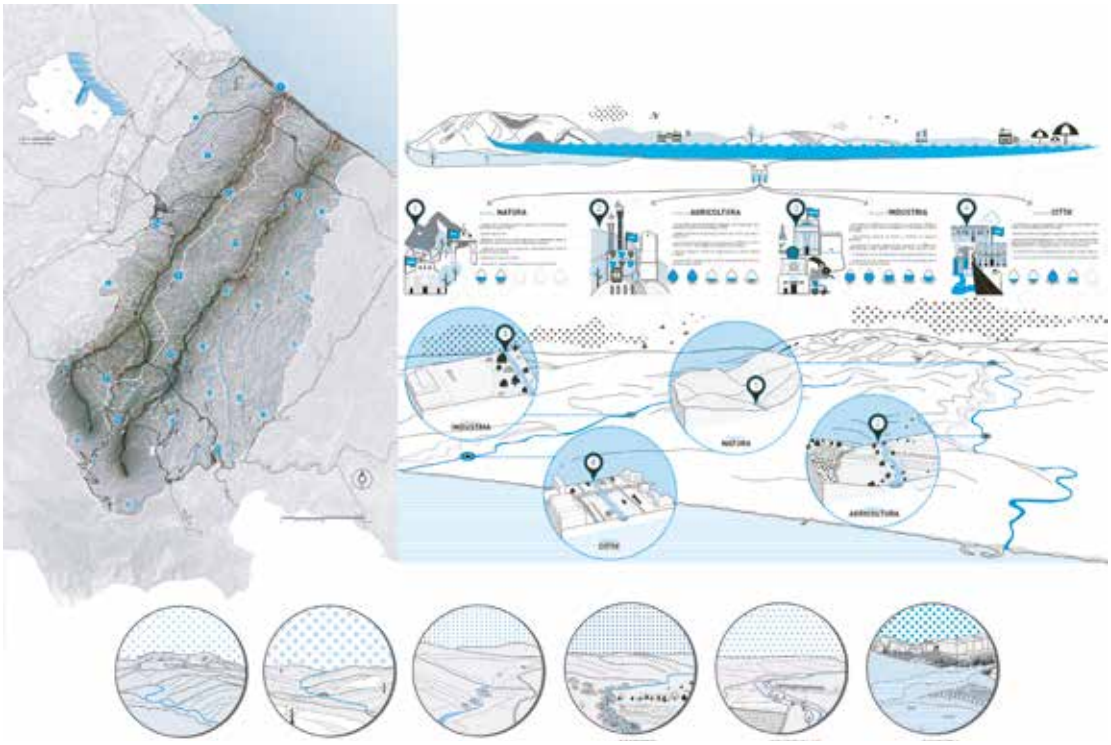
technical support secretariat of the steering committee, divided into three contexts: the Maiella National Park and its surrounding territory, a rural area with agricultural cultivation and small urban settlements, and an urban context with a high density of built-up areas and numerous productive activities.

The three contexts were identified based on spatial characteristics, water quality, and criticalities. For each context, priority lines of action were identified to address specific needs. The strategic vision includes qualitative protection interventions, rebalancing the hydrological regime of the watercourse, safeguarding the river corridor and ecosystem, rehabilitating the geomorphologic structure, preventing further artificialisation, and removing environmental and landscape deterioration. Other proposals include regenerating connections between villages and the river course, creating an agricultural park, upgrading the path network, recovering and protecting sheep-tracks, protecting parks and **SCI**, and enhancing tourist-recreational activities. From the general objectives of the river contract, we moved on to the definition of specific objectives, also determining the actors to be involved in the planning phase, as well as in the management and control phases and the expected timetable for activation and implementation. The strategic vision gives rise to the masterplan and the action plan, the latter articulated according to three priority policies: mobility; green system; routes and connections [Figure 72]. The planned actions cover a time span of between two and five years, with activation times set at three years by the river contract, taking into account the time required to carry out the works and the degree of priority assigned to each action with respect to the context in which it falls.

In consideration of the analyses carried out on critical issues and of the actions contained in the action plan, it is evident that the weakest context is the urban one, in need of particular attention in the planning of interventions: the most relevant issue is that of hydraulic risk, due to the proximity of the riverbed to built-up areas. It was therefore chosen to refer to Directive 2007/60/EC[3], which stipulates that member states shall, on the basis of a preliminary risk assessment, identify, for each river basin district or management unit, the areas in which there is a potential significant flood risk.

For the areas thus identified, Article 7 of the directive provides for the drawing up of a specific Flood Risk Management Plan coordinated at the level of the river basin district or management unit. The general objectives of the plan are to reduce the negative consequences of floods with respect to: human health, territory, environmental assets, cultural heritage and economic and social activities.

Figure 70: Basin-scale studies. The case of the Alento and Foro rivers. (Credits: authors).


NATURA
AGRICOLTURA
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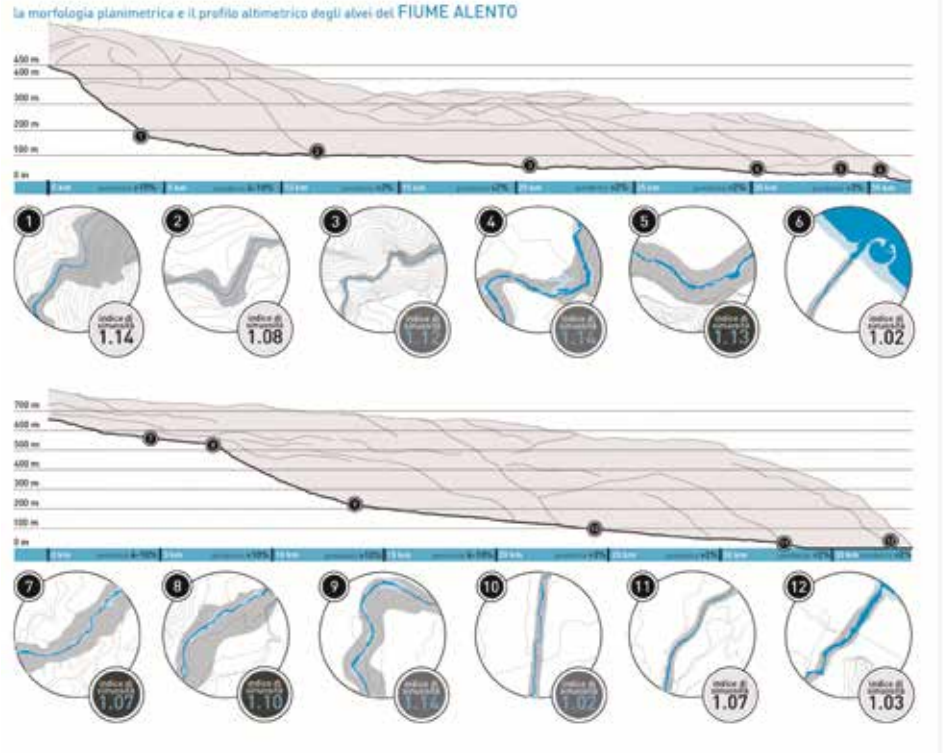
CITTÀ


la morfologia planimetrica e il profilo altimetrico degli alvei del FIUME ALENTO
1.14
1.08
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Starting from this very article of the directive, which states that 'Flood risk management plans may also include the promotion of sustainable land use practices, the improvement of water retention as well as the controlled flooding of certain areas in the event of a flooding phenomenon', the pilot project involving the mouth of the Alento river was established.

The project is articulated in four progressive steps, in accordance with the objectives of the river contract: the removal of the concrete banks; the restoration of the original geomorphologic structure; the re-naturalisation of the river banks and the creation of a river park open for the community.

The new river park therefore links the existing agricultural landscape and riparian vegetation with the new corridor, shaped in steps starting from the natural slope of the site, while respecting the existing flood areas. The morphology of the new river corridor also allows for an increase in the sinuosity index and the restitution of a totally permeable riparian area which, together with the enlargement of the section of the wetland area that can be flooded inside the riverbed, partially solves the problem of the hydraulic risk to which the area is subject.

Recent developments

A few years after the conclusion of the research, the advent of a new regional government seems to have given, in the framework of the green and digital transition program, a renewed impetus to water policies, perhaps also propitiated by the organization of the 2020 assembly of the Italian National Board of River Contracts (*Tavolo Nazionale dei Contratti di Fiume*) in Pescara, which was attended by a qualified representation of the regional authority, with the presidents of the Regional Council, the Councilor for Town and Territory Planning, and the head of the Territorial Government and Environmental Policies Department.

The main actions implemented so far by the new regional government have been the reorganization of the offices and, above all, the provision of a resolution by the regional council that, in addition to make the point of the situation of ongoing contracts, sets the objectives to be achieved, the reference methodology and the operational steps to be observed.

In detail, the establishment of a task force within the regional service is foreseen to assist local authorities in the implementation of the processes, verifying their correspondence with the regional guidelines. The task force will provide support for the organisation of consultation activities as well as participation in regional and

Figure 71: Basin-scale studies. The case of the Alento and Foro rivers. (Credits: authors).

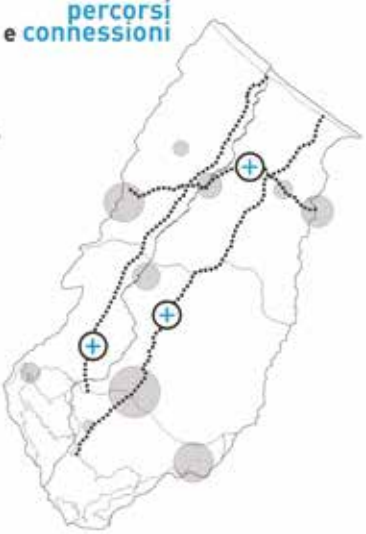
la mobilità

individuazione del reticolo della mobilità carrabile e dei punti in cui esso entra in diretto contatto con i corpi idrici. Tutte le **infrastrutture esistenti**, con particolare attenzione ai punti in prossimità dei fiumi, dovranno essere oggetto di costante **controllo** e **manutenzione**

il sistema del verde

evidenziazione del sistema del **verde esistente**, insieme ai nuovi interventi di rinaturalizzazione delle fasce ripariali, per la ricostituzione della rete ecologica e la **valorizzazione paesaggistica**. Anche i tratturi sono stati considerati come futuri elementi per la rete

percorsi e connessioni



la presenza dei borghi e dei centri abitati considerati come risorse per la rigenerazione urbanistica, ha portato a tracciare il sistema dei percorsi, che includeranno, oltre ai tratturi e alla **rete sentieristica esistente**, il **tracciato dei fiumi**, ed un **nuovo collegamento** trasversale Chieti- Tollo

la ripartizione delle azioni nei contesti pilota

national thematic sessions and meetings of the National Observatory of river contracts.

The draft resolution is then accompanied by the Strategic Document and Action Plan models that the local authorities, each in its own specific executive and management needs, may use as reference. The Region also provides a list of eligibility criteria together with a synoptic table setting out the model actions to be contained in the action plan.

Finally, it is worth mentioning the programming within the *Proposta d'Abruzzo*, drawn up for the use of NRRP resources, of 80 million euro for financing river contracts, together with other substantial resources for upgrading purification plants and sewage networks and the renewal of the aqueduct network.

Conclusions

The picture that is emerging in Abruzzo seems to be encouraging for those who see the river contract as a strategic tool to restore focus on policies that prioritize water resources in the region. River contracts are instruments that aim to prioritize the health and management of river systems and it appears that this approach is gaining momentum in Abruzzo. The river contracts are at this stage of the process bringing hope for different local decision makers by providing targeted lines of action to mitigate the impact of climate change on rivers and flooding, as well as by establishing a site-specific governance structure that includes representatives from participating municipalities and bodies with decision-making powers.

In order to give a further impulse to this process the region should start planning on pilot cases with the aim of giving concrete spatial arrangements to the objectives of improving water quality, which very often take vague and technicist forms, far from the common feeling of citizens. This research envisaged the formulation of strategic visions for each basin identified as a case study, to be understood as 'delegated and deferred' projects, to be implemented progressively through the convergence of the actions of several actors, guided by the guidelines associated with the strategic vision. Projects that did not, however, give up on the possibility of arriving at a final formal configuration, considered as a sort of anticipation of a future that is not univocally established, capable of acting as a figure on which the individual actions of the various parties involved in the river contract could continually collide, possibly correcting them. For this reason, the vision played an important role, aimed at bringing together everyone's commitments and responsibilities in achieving the objectives of recovery of the watershed, a recovery to be

considered as preparatory to the relaunch of territorial economies, of which the restored river landscape could be a strategic factor.

It is a hypothesis that wanted to flank the current model of watershed management, which favors top-down action, typical of the model of protection exercised through regulation, with the opposite and complementary model, which appeals to everyone's sense of responsibility, that of participatory governance.

The research's empirical major contribution is the production of an *Atlas*. As defined, the Atlas has primarily a documentary value, offering a comprehensive overview of Abruzzo's watersheds at the analysis phase. It systematizes data that is currently fragmented across various sources and generates original images and maps that will become useful over time for comparative assessments. The transformation of data into a schematic and organic collection constitutes a methodology that can be applied and repeated in any river context, nationally and internationally. At the same time, the design and experimental phase, applied on the selected pilot basins, is useful for the definition of best practices and methodologies useful for the development of strategies on the territory and the evaluation of the advances and transformations that have occurred.

Furthermore, by outlining the methodological guidelines in the research, the aim was to have a practical impact on those responsible for managing the river system in Abruzzo. It is noteworthy that two prominent regional officials, who currently oversee the river contract processes, are acquainted with this research and have played a role in its development/publication.

The research has had another impact on a national scale, particularly within the scientific community. This is due to the publication of the research as a book, which has made the findings accessible to a wider audience and has contributed to the advancement of research on river management and land governance. The book has also been recognized with an award from the National Table of River Contracts and the National Institute of Urban Planning (**INU**).

Notes

This paper is the result of a shared elaboration of the author. The drafting of the various paragraphs can be attributed as follows: Massimo Angrilli (Premise; The research methodology; Recent developments; Conclusions); Valentina Ciuffreda (The pilot application; Scenarios and projects; Conclusions).

1. Law No. 221 of 28 December 2015: 'Provisions on environmental matters to promote green economy measures and to curb the excessive use of natural resources'.

2. Department of Architecture, University G. d'Annunzio Chieti-Pescara (It).

3. The directive 2007/60/EC, know as "Flood Directive", entered into force on 26 November 2007. This Directive established a framework on the assessment and management of flood risk, aiming at the reduction of the adverse consequences of floods for human health, environment, cultural heritage and economic activities.

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Giulia Luciani[1].

Beyond Green and Blue: Ecohistorical Infrastructures for Water Landscapes

Urban waterscapes and their life histories

Imagining the future of contemporary water landscapes often turns out to be a hard task. Threats of the most diverse kinds contribute to making their path uncertain, ranging from changes in the climate and environmental degradation to urban transformation and geopolitical shifts and unbalances. The intrinsic instability of water-land systems is thus increased by the combined effects of often unpredictable forces and processes, while rapid population growth, soil consumption, polluting activities, and large infrastructures add to their risk conditions.

On the other hand, the formative and destructive power of waters and the many uses water has had in time have made these landscapes exceptionally rich in natural and cultural heritage. Port structures, historical transport roads, defence systems, industrial heritage, agricultural structures, or historical canalizations are only some of the many examples of water-related heritage that can be found in cities on water and their surroundings [Figure 73 and Figure 76]. In fact, the strategic presence of water and the richness of the natural environment themselves have made these places particularly favourable for human settlements, so that layers of sediments have accumulated in time. The contemporary urban waterscapes are thus permeated and infra-structured by ecological processes and sedimented heritage webs we are barely aware of. They have life histories in which the evolution of the biological landscape systems and the history of the place inscribed in its heritage are inextricably tied in a way that is too often unrecognized.

While growing attention is being given to the ecology of urban water landscapes as a source of wellbeing for the urban population, the approach to heritage, especially in coastal areas, mostly envisions it as an endangered object, focusing on protection. However paramount the issue of protection can be, heritage can be at the same time an active tool for strengthening the resilience of these territories. In fact, it has been stressed that an engagement of cultural heritage into adaptation strategies is needed to raise awareness, provide local knowledge and tools, increase social resilience by binding people to places, conveying identity values, stimulating participation (ICOMOS, 2019). There is limited understanding, however, both of water's value as heritage and of heritage as an active player in the future-making of the urban waterscapes (Hein et al., 2020). Different disciplines tend to approach water, the ecological processes, and heritage separately, so that their interrelationships and potential synergies remain underexplored.

An infrastructural mindset

The approach to contemporary urban waterscapes has to deal with managing urbanization beyond the city. It is not only a difference in scale that I am pointing out, but one of kind. The regionalization of the urban systems, rather than corresponding to a bare expansion of the city, springs from a suppression of the traditional urban features and leads to the dissolution of both the urban and its opposite the rural, fostered by a planning and design approach which considers only one scale — the broad scale of the infrastructural networks (Choay, 2008). These networks are the driver, support, and even purpose of the urban regions that are growing especially in the globally connected coastal areas.

If a structural difference exists between the traditional and the contemporary urban form, a different method is needed to work within the urban environment today. And if infrastructures are the core of these new landscapes, it comes to no surprise that among the most promising propositions is an infrastructural approach. Infrastructures have become a method to interpret and transform the (post)urban landscapes, a way to work at a large scale for which traditional methods such as land use planning turn out obsolete, and within overbuilt environments where the only possible strategy is to work with what is already there. The shift is double-sided: on one side, it affects the way infrastructures are conceived, not anymore as the realm of one single discipline but as a multifunctional and participative field — stressing the migration of infrastructures from sectoral engineering disciplines to the holistic framework of landscape (Bélanger, 2009); on the other side, the change deals with how landscape is conceived, "as an operative field that defines and sustains the urban development" (Nijhuis and Jauslin 2015, p. 18) — defining landscape itself as infrastructure. Such an approach aims to address the contemporary conditions arising from complexity, uncertainty, and multiplicity, and to manage an environment of fluxes rather than static components.

Two decades ago, Stan Allen described with seven propositions the characters of the emergent mindset he named "infrastructural urbanism":

1. "Infrastructure works not so much to propose specific buildings or given sites, but to construct the site itself".
2. "Infrastructures are flexible and anticipatory".
3. "Infrastructural work recognizes the collective nature of the city and allows for the participation of multiple actors".
4. "Infrastructures accommodate contingency while maintaining overall continuity".

5. “Infrastructures organize and manage complex systems of flow, movement, and exchange”.
6. “Infrastructural systems work like artificial ecologies”.
7. “Infrastructures allow detailed design of typical elements or repetitive structures, facilitating an architectural approach to urbanism” (Allen 1999, pp. 54-57).

The fields in which such landscape infrastructures[2] find increasing application include transport systems, green networks, and water management (Nijhuis and Jauslin, 2015). Green and blue infrastructures, in particular, have gained momentum since their introduction in the nineties as a development of the concept of ecological corridors and networks. Still conceived as linear structures, while the corridors mainly focused on continuity for the conservation of the biodiversity, the stress on multifunctionality within the green infrastructure concept aimed at broadening the goals these structures could achieve. The idea was to integrate different natural and anthropic systems in networks — the ecological network, the hydraulic protection network, that of the green spaces for recreation, the soft mobility network, and so on — with the aim of bestowing positive environmental, social, and economic effects on landscapes and communities, enhancing the wellbeing of both people and ecosystems (Acierno, 2018). With a shift in the conceptual framing, I propose to develop the concept into that of ecohistorical infrastructures.

Life histories made infrastructures

Reconceptualizing green-blue infrastructures in the frame of ecohistorical infrastructures aims, at first instance, at stressing the tight relationship between natural and cultural heritage in water landscapes and emphasize their synergic potential in providing benefits to the urbanized landscape. It also encompasses, however, a different understanding of human beings and how they relate to the environment. Anthropologist Tim Ingold marks a distinction between, on one side, a dominant view of human beings as substantially detached from the rest of the world, which is at the basis of both the anthropocentric and ecocentric attitudes, and, on the other side, a view of human beings as constitutively immersed in the world no less than its other non-human components (Ingold, 2000). This dwelling perspective, rooted in Heidegger’s and von Uexküll’s reflections, is close to the perspective of geographer Augustin Berque who proposes the notion of “ecumene” (Berque, 2016) to indicate the human environment and home (recovering the original domestic meaning of the Greek word oikos). While it

overcomes the false distinction between the human and the non-human, it also overcomes the conventional distinction between the "natural" and the "built" environment[3]: both are constructed during time to be dwelt-in, have ongoing and never completed life histories of unfolding relations to one another.

The "ecohistorical" concept embraces the dwelling perspective, acknowledging a circular relationship between action, perception, and memory. To perceive the environment means to engage perceptually with it through the body and its movement, so that action and perception overlap. Moreover, since the environment, or better landscape[4], continuously incorporates action collapsing into a form, to perceive it also means to engage with an ongoing past. Temporality belongs to the landscape and at the same time to its perception, as it takes place in the act of moving along certain paths. In fact, time, body, and movement are interwoven in this process. As Ingold puts it, "the same movement is embodied, on the side of the people, in their 'muscular consciousness', and on the side of the landscape, in its network of paths and tracks. In this network is sedimented the activity of an entire community, over many generations" (ibidem, p. 204). The heritage infrastructuring this landscape, being part of both the conventional realms of the human and the non-human, can be the mediator, the enabler of an attunement to the environment through the narration of its life histories.

Ecohistorical infrastructures, then, can be conceived as devices through which the urban landscape is crossed, perceived, and constructed, and through which people are "experienced" in turn — in the double sense that they gain experience while the environment "senses" them. These infrastructures have nodes and connections. The nodes will be parts of the landscape (places) with higher significance or capacity to enable an attunement, because meanings coagulate there, while the web of relations gets thicker. They allow new relations to be established, creating the conditions for them to unroll. They are naturally multifunctional because the human–environment relationship unfolds through them, so they develop along slow paths and tracks, the ones where the body is involved, and accommodate material as well as symbolical interaction with the environment. In the case of waterscapes, movement through and along water, experience of the historic waterscape and its participation or latency in the present, water management, *et cetera*, will be sustained by such an infrastructural network.

Ecohistorical infrastructures as an approach to urban waterscapes

As Allen underlined, infrastructures rather than design a specific site create the conditions for it to develop. This way, ecohistorical infrastructures make new synergies possible, by bringing together on the same ground the human being and his own environment — which is to be distinguished from the environment. The environment as a single entity is in fact a product of that same detached, global perspective which is at the root of the dominant dysfunctional approach (Olwig 2011, Barca 2020), featuring a view from outside as opposed to the view from within, which we are pursuing in order to recover a nonconflictual approach to the environment.

As an approach to urban water landscapes, ecohistorical infrastructures display, enhance, and manage the continuous exchanges which shape the natural and cultural ecology of the territory. In this respect, they mix in innovative unexpected ways valorisation, nature-based intervention, common goods re-appropriation, heritage reactivation, etc. Recovering the function of old canals and structures, creating new ecosystems inspired by previous landscape patterns, reusing abandoned structures for the storage of water, or allowing the formation of temporary water landscapes changing with tides or heavy rainfalls, can at the same time build resilience to climate change and weather events and enhance the perception of the structures and traces of the past. Vice versa, the dialogue with heritage can stress the meanings and increase the engagement and identification with the newly created water landscapes. Thus, ecohistorical infrastructures allow water-related heritage to recover, and often reinterpret or actualise its function, reconnecting the built environment and the ecology of the landscape.

As an approach to heritage, the strategy is coherent with a shift from an object-based approach to a landscape-based, systemic view. While the concept of heritage is getting close to that of landscape, as both are understood more as processes and complex sets of elements rather than single static objects (Fairclough, 2016), the urban space itself has been re-conceptualized as a landscape, as the understanding of the urban environment has moved its focus from a static view of structures to an ever-changing experience gained through walking and wandering (Nyka, 2017). Through the practice of wandering, nature and the built environment are perceived as inseparable parts of the same urban experience, and the open space reclaims an equal, if not preeminent role, to the built space. Connecting, mending, sewing emerge as key actions

for intervening in the urban landscape. Routes, itineraries, and corridors become key figures for assuring continuity of movement and experience in the urban planning as well as the heritage or cultural landscape management fields. In coastal areas and urban waterscapes in general, often characterised by ecological and perceptual fragmentation, ecohistorical infrastructures will easily grow on waterlines, stressing their reciprocally enhancing roles as paths, ecological structures, and heritage agglutinators [Figure 73].

Moreover, acknowledging the collective nature of the urban landscape and the intrinsic multiplicity of water as its structuring element, ecohistorical infrastructures require more than any other kind of infrastructure new collaborations between many artificially separated fields and disciplines, fostering synergic rather than conflicting strategies, and leading to dismantle long-running conflicts such as that between preservation and development. At the same time, they enable real participation by assuming the attunement and reconnection of people with their own environment as their primary aim. Compared to green infrastructures, indeed, they are aimed not just at bestowing services but rather at creating new ecologies of dwelling.

For an attunement to the environment to be reached, links and connections are displayed and explained through multiple stories and narratives. Narratives relate at the same time to history and imagination, for the infrastructure allows a variety of narrative paths to arise from the interpretation of the past and branch out into the figuration of future itineraries, through which coherent and "attuned" interventions can be designed and implemented. The idea of a narrative path is somehow present in figures related to heritage management such as cultural routes or heritage corridors. However, sticking to a past-looking, preservation-focused, and tourism-oriented conception, they lack an infrastructural grasp to make them active participants in the transformation of the territory.

Telling a history for the future

Ecohistorical infrastructures, in conclusion, are devices which integrate constructed, natural, and historical (in one word: environmental) features and facilities in a web of nodes and connections, where nodes correspond to "deep places" which, because of their special ecohistorical significance, are able to trigger and represent people's identification and connection with their environment. Using a traditional sectoral language, they feature high ecological and/or cultural values. Participation will be crucial in the identification and reactivation of these places.

Connections between the nodes, on the other side, correspond to paths where people, through movement, engage mentally and physically with an environment that is pregnant with the past. However, it is not only about tracing an itinerary through significant places: it is about putting them into value as nodes of a system of interactions and exchanges, points of contact and action with and within the environment. Thus, they are not meant as museum itineraries but as living infrastructures connecting horizontally — through space — and vertically — through time — people, places, stories. They are future-oriented as they catalyse projectuality towards the creative renewal of the ecologies of dwelling. Operationally close to green infrastructures, they differ in their conceptual foundation as well as in the equal and synergic importance of the ecosystemic and cultural dimensions. Ecohistorical infrastructures, in fact, assume that cultural heritage, beyond simply adding cultural values to green networks, is part and parcel of a continuously transforming environment where "nature" and "culture" cannot be considered separately, and therefore plays a key role in mediating perception and action when engaging with the landscape. Rather than working with stratifications of ultimately independent networks, they approach the oikos holistically, in such a way that elements taking part into the infrastructure are not simply summed but multiplied.

For the concept to be transposed into practice, a framework for heritage management is needed that could allow a reactivation beyond the logic of musealization within rigid constraints, and at the same time prevent improper interventions that may betray or exploit the sense and material value of heritage. Contractual instruments could be envisaged to deal with cultural heritage and the environment as common goods. Technology may help providing collaborative frameworks for the active participation of different stakeholders. Such a framework, however, should be object of future research to gain consistency and be fruitfully applied.

Valorisation and re-activation of cultural and natural heritage in lines and networks, within the concept of ecohistorical infrastructures, will then stand as an operative methodology for the implementation of a soft infrastructure system serving as a backbone for resilient urban development and/or regeneration within complex and rich contemporary water landscapes.

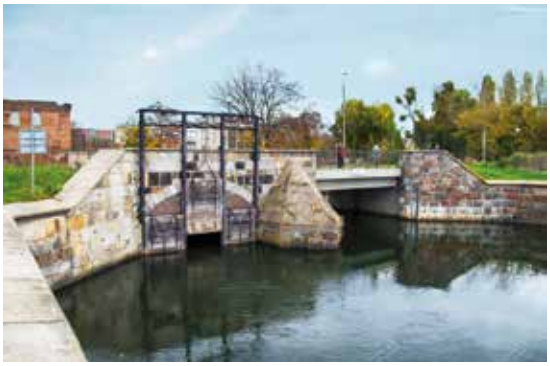

Figure 72: Abul Phoenician trading post in the Sado estuary, Portugal.

Figure 73: Bastion Wilk, Gdańsk (Poland).

Figure 74: Wisłoujście Fortress. along river Motława, Gdańsk (Poland).

Figure 75: Paola tower facing the Tyrrhenian sea, Latina (Italy).

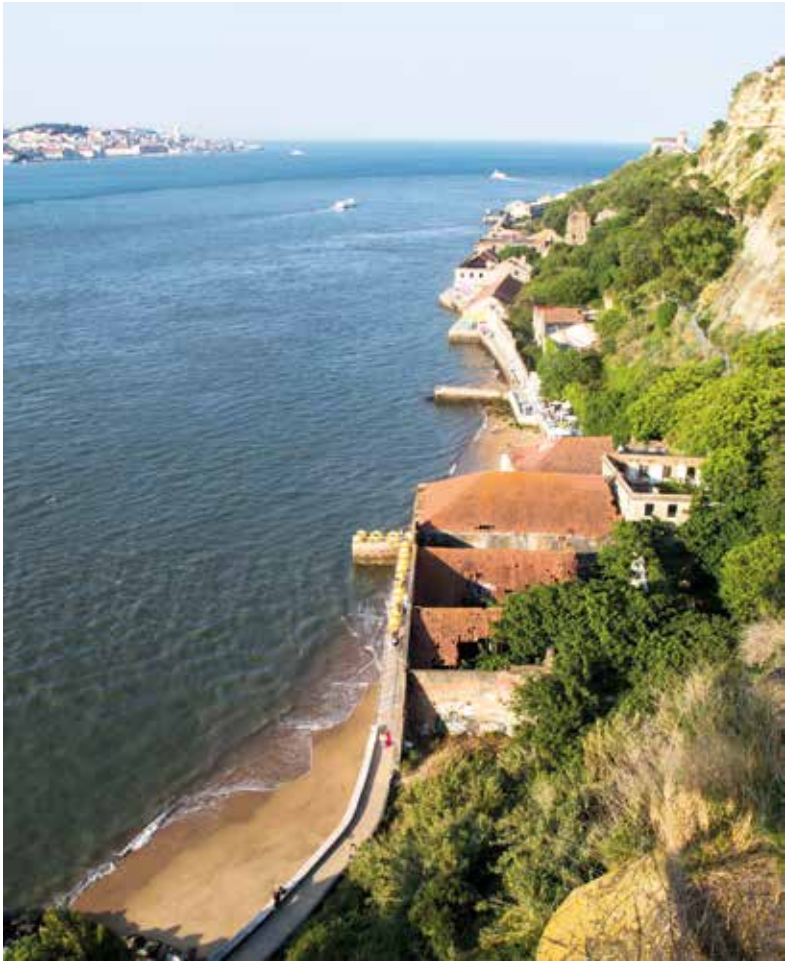

Figure 76: Decommissioned structures along the South bank of river Tagus, Portugal.

Figure 77: The Museum of the Second World War, located in a symbolic place of memory facing the Motława river, Gdańsk (Poland).

Notes

1. Sapienza University of Rome, DICEA.

2. With this expression I refer to the wide range of infrastructures framed within the "infrastructural mindset", which aim at supporting urban development from a multisectoral and integrative perspective.

3. The nature/culture dichotomy persists despite the many attempts at integration. For instance, "cultural values" are considered a plus for the multiple uses of green infrastructures, just as an added layer. Similarly, when it comes to other figures more focused on the culture realm, such as the heritage corridors, "ecological values" are integrated as a secondary object of protection. Even when a complementary integration is pursued, one remains stuck to a dualist terminology — "biocultural" is an example — which still presupposes the existence of separated fields which can in some cases be treated together. The term "ecohistorical", conversely, expresses an attempt to approach the environment as a whole, joining the notions of environment, place, history, and evolution. Here, *eco* is not just a contraction of ecological, but recalls the dwelt-in environment, the concept of *home*, while the historicity abandons the narrow meaning referred to the human matters only, to incorporate the (biological) notion of *evolution*.

4. For Ingold, organism and environment relate to one another as body to landscape. While the first pair refers to the process, the second draws attention to the form.

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André Prevedello.

For a Hybrid Urban Culture in Stockholm: The Application of Nestor Canclini's Concept in Two Areas of the Waterfront

KEYWORDS:
Stockholm, Hybrid, Waterfront, Climate Change, Society

Introduction

Stockholm's urbanized seafronts compose a human ecology featured by a landscape normally anthropized and loaded with cultural references. The presence of natural sites is restricted even if the city has a quantity of green area per inhabitant higher than several cities in Europe[1]. Waterfront lines are suffering local major impacts from global climate change. It is in the relationship between urbanized areas on waterfronts and the natural environment that we envision vital actions to mitigate problems arising from climate change, which should take place from a hybrid thinking.

It is possible to perceive another urban form that starts from the hybridization between natural and cultural landscapes. It is suggested here the effort to apply the thought of Nestor Canclini, who defends the city as a space in constant deterritorialization and reterritorialization (Canclini, 2006)[2]. When implementing a new urban design in the city that better mitigates the impacts of climate change, a disconnection between culturally established society and the place itself occurs naturally, since the city as a culture is always understood as a constructed artifact.

The intention here is to contribute with another understanding of the waterfront redevelopment phenomena in two sites of Stockholm: *Värtahamnen* waterfront located northeast of the city and *Hornsbergs Strandpark* waterfront, west of the city.

The City and The Waterfronts: Relations in Stockholm.

The city of Stockholm, the capital of Sweden, is a hub of people that concentrates more than 20% of the country's entire population[3]. The city is immersed in water with several lakes such as Mälaren, located in the center of Stockholm, Lötsjön, and lake Hjälmaren, among others. An analysis, without scientific commitments of maps and aerial photographs, about the urban evolution of the city, easily reveals this strong relationship between the city and water. The international fair of 1930 revealed, through advertising images, the modernism of a city immersed in a natural environment. This native habitat was then supposedly dominated by geometrized waterfronts that revealed the anthropization of nature. This relationship with water is so strong that it is also expressed in architecture, being visible in projects such as St. Mark's Church in Bjorkhagen, 1960, by architect Sigurd Lewerentz.

In the contemporary city, the Stockholm Sustainable Development Plan (2021) states that the city's bodies of water, Lake Mälaren, and the Baltic Sea are heavily burdened by human activity[4].

Since the end of the 19th century, several areas of the city have had a gradual development of port and industrial activities. The original core of the city, located on the island of Gamla stan[5], reveals the occupation of an island that had, in the past, the function of protection against invaders, precisely because it uses the natural environment, mainly the water. This symbology of being protected and at the same time islanded, came to the contemporary city in a very peculiar way, in which the relationship with water went from protection and isolation to contact and resilience.

In the current city, set in the context of climate change, the contact between city and water is essential to create environments not completely artificial nor natural, with ample spaces of vegetation, biodiversity, noise attenuation and other characteristics that promote quality of life. At the same time, the waterfronts can act as belts to promote flood control, soil erosion, soil permeability, and the protection of the cities themselves. These boundaries between water and city, act as a social and political infrastructure, in which 'the resilience and even language of ecological systems, in their multiple forms and manifestations, forms the basis for a new set of flexible, receptive and adaptable design practices' (Reed, 2014)[6], in other words, hybrid. In the case of Stockholm, surrounded by waterfronts, these can behave as a continuous green belt of great size and impact on urban life.

In this proper context, even with abundant green areas[7], the confrontation of climate change passes through the understanding of the relationship between the city and water. Among the 17 objectives and 169 sub-objectives to achieve the goals of the UN Agenda 2030, gains prominence the goal 14: 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. In the ecological landscape of Stockholm, where the presence of the natural water environment is part of the urban public space, this objective gains great relevance.

Methodology: The Hybrid of Nestor Canclini applied to the Landscape.

The methodology used here is based on the appropriation of Nestor Canclini's hybrid concept and its transposition to the urban environment. Since the author uses the theory in cultural relations, this methodology of action is based on the ontological understanding of the city as a cultural expression, primarily.

Moreover, culture is understood without the classic opposition between man and nature. It does so, because it argues here that all nature acts with social and aesthetic meaning for each society, thus creating identities. This happens geographically in the context of Stockholm city, with emphasis on the areas under study (Värtahamnen and Hornsbergs Strandpark).

Debating about the city's environment means not an indeterminacy, but an understanding of specific and merging knowledge. This is because this environment consists of a natural part (water), another undefined part (lawns, planted trees, plant beds) and yet another anthropic part (sidewalks, streets, decks, buildings). As Hagan (2014)[8] defends 'if nature is culture, then the time has come for culture to become nature, it must be reciprocal'. Canclini states that this understanding 'requires hybrid methodologies' (2004)[9].

Applying the concepts of Hagan and Canclini to the landscape design, we characterize the hybrid from three evolutionary stages. First: the use of clearly defined boundaries, which results in a landscape of little hybridization, great archetypal definition, typical of the early western 19th century rationalist. Second: the use of fluid boundaries, characteristic of an organicist design, continuous, of medium hybridization, typical of the late western 19th century romantism. This second design option is present in the 'Program for Sustainable Development, 2021', of Stockholm municipality[10]. Third: complete absence of limits, which results in the 'dematerialization of form'[11], with the non-identification of defining lines, thus generating diffuse and continuous territorialities.

Branzi (2014)[12], by contesting the urbanizing and universal modernism advocated in the Athens Charter[13], recommends that the cultural landscape, especially the city, should 'create thresholds between the city and the countryside through hybrid, half urban and half rural territories... conditions of discontinuous and flexible housing according to the seasons and climates'. Thus, we speak of an undefinition between the built and the free space, the physical and the virtual, the human and the animal, the built and the flora, and the geometric and the biotic. In movies depicting dystopic futures such as Stalker (1979) by director Andrei Tarkovsky (1932-1986), it is common a negative reference to the city taken by vegetation in the midst of constructions. However, this is precisely the image of a hybrid landscape, not in the sense of destruction, but of the natural merging with the anthropic environment, which is exactly Canclini's concept of materialization, when applied to architecture, landscaping, and urban design. It is in this sense that Di Felice (2009)[14] claims: '... the environment and the surrounding

territory are recognized, by some minority aspects of thought, no longer as a thing, nor as a lower way of life, but as something of a living, as a complex entity, agent and communicative'.

Värtahamnen Waterfront: The Future.

The Värtahamnen port area is located northeast of the city and was the site of studies of the SOS Waterfront June/July 2022[15]. The operations of the wharf were gradually developed during the early 1900s, with the construction of new piers and the gradual deepening of the channel level for vessels access. The site became a bulk cargo port for handling goods. Ferry traffic to Finland was started in 1966 with a flow that developed until the late 1980s. The Värtahamnen area is currently a strategic urban development site in Stockholm. Thus, several urban studies have been being developed by the municipality since 2011. The plans seek to transform the area into a part connected to the rest of the city. Studies predict that the region will hold around 10,000 new residential units, as well as offices, shopping malls and leisure spaces. Currently, the area is characterized with large parking areas, lack of green spaces, sparse vegetation, and public spaces, being characterized as a port area. The waterfront is geometrized with concrete floors for mooring boats [Figure 79].

The area highlighted as well as a future possibility for the insertion of resilient urban experiences, which positively impact the urban fabric, and act head-on against climate change. The city of Stockholm decided in 2009 that the area should have an environmental profile, functionally mixed use, with high architectural quality and public space alive and accessible to all. As stated more than

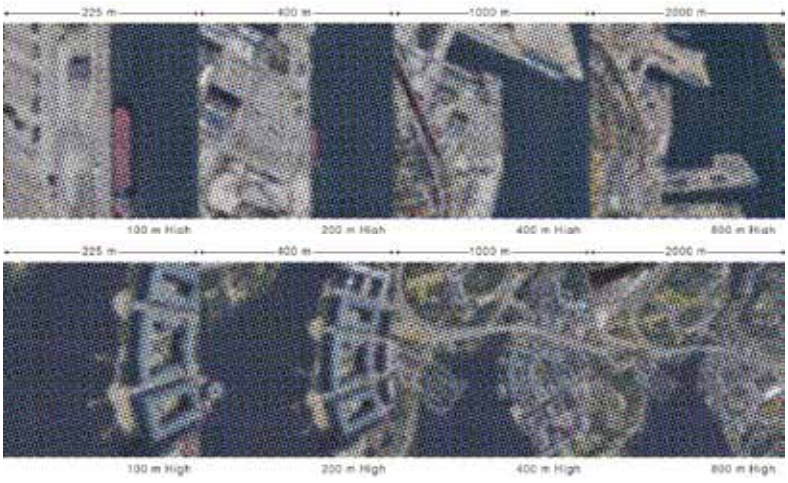


Figure 78: Actual hybridization in Värtahamnen (first) and Hornsbergs Strandpark waterfront (second). Maps. 0,5x0,5 mm pixelation. (Credits: author, 2023).

40 years ago 'the strategy for dealing with the two key problems, development and the environment, should be conceived as being just one' (Meadows, 1972)[16]. Thus, the future potential of the area must respond to urban development, but with a strong emphasis on the ecological development of the city.

Hornsbergs Strandpark Waterfront: The Past.
The Hornsbergs area is located to the west of the city. Much of this area (Stadshagen) has a history of acting as a leisure space for the central area of Stockholm (Norrmalm). The waterfront called Hornsbergs Strandpark connects Kristineberg with Stadshagen, and currently undergoes a process of urban regeneration, transformed it from a former industrial area.

The area underwent extensive urban revitalization in 2012, with redesign of its waterfront of almost 1000 meters and insertion of public space, vegetation, decks, sidewalks, and small squares. The project implemented an organic urban design with well-defined drawing lines, creating green spaces and direct contact with water, with level variations of up to 2.50 m high. Three long floating piers advance into the water creating leisure spaces in the middle of Ulvsundasjön bay. Several direct water accesses characterize this waterfront as a natural swimming pool easily accessible for use during summer.

In the 2012 project, the extensive use of concrete floors, well-defined organic lines and the arrangement of stones and benches in a clearly organized manner, end up strongly delimiting the separation between nature and built landscape. The authors of the project defend the need to clearly express that the waterfront was planned and built as an anthropic beach park, in which nature is not understood as culture. The larger vegetation is also arranged in a rational and organized way, which reaffirm the concept of the architects. Only accesses and small concrete stairs have some direct relationship with the rest of the streets that reach the waterfront. The only green area that starts on the waterfront and enters the city, takes place on the avenue Lindhagensgatan, with a symmetrical and organized sequence of trees arranged in a central flowerbed. In the rest of the site, the density of buildings acts clearly delimiting the natural landscape [Figure 79].

The waterfront is characterized as an anthropized and organicist landscape, with low hybridization. Much of the area is currently an embankment over the Ulvsundasjön bay, which eliminated the original shoreline, erasing all marks of the original waterfront.

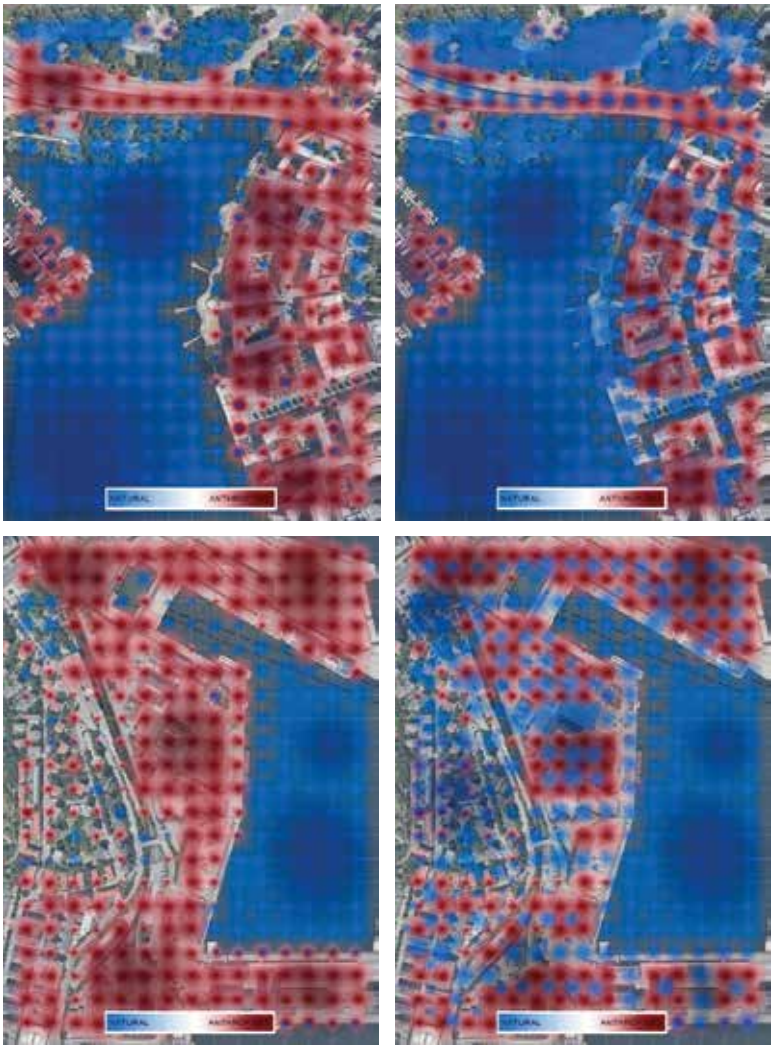
Hybridism Applied to The Areas

The relevance of the two waterfronts and the local impacts generated by worldwide climate change, empower the acceptance that actions in waterfronts must occur from a hybrid character between nature and city. It is suggested here the effort of application of the cultural thought of Nestor García Canclini applied to the urban space. This thought argues that the city is a space in constant deterritorialization and reterritorialization with a frequent loss of the natural relationship between culture and social territories (Canclini, 2006)[17]. The strategy of hybridizing the natural (water and vegetation) with the anthropized environment (traditional city) is part of the objective to create a progressive transition between these territories, to maintain and increase the social relations of society with waterfronts environments. This ecological urbanism acts in a resilient way, enabling to mitigate the effects of floods, increase soil permeability, increase green areas and vegetation, expand unbuilt limits, among others.

In the Hornsbergs Strandpark waterfront, there is the possibility of physically expanding the 30 m wide waterfront into the city and the Ulvsundasjön bay and eliminate the boundaries between city and vegetation that today are clearly defined. This is possible by mixing floors with vegetation and stones that allow the movement of people and cars, but also the growth of fungi and grasses. Stimulating the dissemination of natural substrates and the passage of microfauna and yet human occupation. Using floors with natural materials that decompose over time and could be recycled and replaced. With this actions, it is possible to create a dynamic landscape, without limits between nature and the city [Figure 80].

In the Värtahamnen waterfront, the possibilities are much greater. With a waterfront ranging from 100 to 700 m wide, there is the real possibility (because it is not yet urbanized) of predicting a deeper hybridization, crossing the built environment, and reaching the Gärdet Cricket Ground, located southeast of Värtahamnen. Elevated floors and streets could allow the expansion of the natural flora and fauna. The vegetation can naturally be restored without major landscape interventions. The fauna would also be recovered, not as in the original way, but in line with the medium density occupation [Figure 81].

These boundaries should work as transitional urban ecosystems which can exhibit characteristics of different stages of urban evolution and show increased variability in ecosystem structure, functions, and services, before shifting to a more stable urban regime. It is a matter of infiltrating the natural environment within the



anthropic environment as a strategy against climate change. In this sense, the occupation of this part of the city, could occur within the logic of Di Felice (2009)[18]: 'could be configured as the transient and fluid hybridization of bodies, technologies and landscapes with the advent of a new ecology of ecosystems, neither organic, nor inorganic, nor delimited, but informative and immaterial'.

Figure 79: Hybridization map of Hornsbergs Strandpark waterfront. Reality (left) and possibility (right). (Credits: author).

Figure 80: Hybridization map of Värtahamnen waterfront. Reality (left) and possibility (right). (Credits: author).

Discussion

Canclini states that 'the surveillance of political correctness sometimes asphyxiates linguistic creativity and aesthetic innovation' (2015)[19]. Despite the urban quality of the site, the revitalization of the currently built Hornsbergs Strandpark

leaves the natural environment clearly delimited. This territorial demarcation leaves little space for an informal ecology to be established although the project has inserted green areas and contact with water, which is already of great relevance because it acts to alleviating the problems caused by climate change such as the increase in water level. Otherwise, a greater hybridization in Hornsbergs Strandpark would allow the settlement of a new cultural image for the society, in which the boundaries between the natural and the urban environment would no longer be defined.

A hybrid design acts not only horizontally but also vertically, which is very clear in Värtahamnen waterfront. According to the memorandum *Guidelines on design values for sea levels in development projects*, from 2015, new constructions facing waterfronts must have a minimum height of 2.25 meters, according to the RH2000[20]. This recommendation aims to mitigate the impacts of rising sea levels due to climate change, for the next 100 years. In Värtahamnen, this height of 2.25 m can be diluted on the large plateau, generating a hybrid design of vegetation penetrating the urban environment that can reduce the vertical distance between the community and water, and maintaining Stockholm's historical cultural landscape and its relationship with aquatic environments.

Since the two areas are represented by the Stockholm City Plan, 2018, as areas of continuous use between land and water, it is possible to conclude that hybridization in these places can behave as a positive cycle that seeks to balance urban growth. The hybridization acts as a 'resilience urbanism which appeals to a certain back to basics attitude' (Adams, 2016)[21], where nature is no longer seen as something to be domesticated, but as an integral part of society. The concept defended, and culturally conceptualized by Canclini, is nothing more than the updating of part of the values expressed in the early 18th century, in the picturesque style.

Both areas are subject to the insertion of some guidelines for further hybridization such as: use of permeable floors that allows the growth of grasses; flexibility for the natural growth of vegetation; insertion of larger amounts of natural green areas in assorted sizes entering urban space; use of natural building materials and furniture that decompose in nature; allow vegetation to grow through the walls and floors of buildings, creating a vertical and horizontal natural connection [Figure 82].

The discussion here intended is part of the cultural acceptance of the landscape as a hybrid environment, simultaneously understood as an ecosystem and a cultural system (McHarg)[22]. As stated Di Felice (2009)[23] 'the natural environment, human and

social structures, instead of contrasting, should integrate into a symbiotic dynamism that would have allowed the improvement of living conditions'. Facing the global calamity of climate change, this symbiosis, which is a form of hybridization of the city with the natural, is a powerful tool for protecting human heritage.

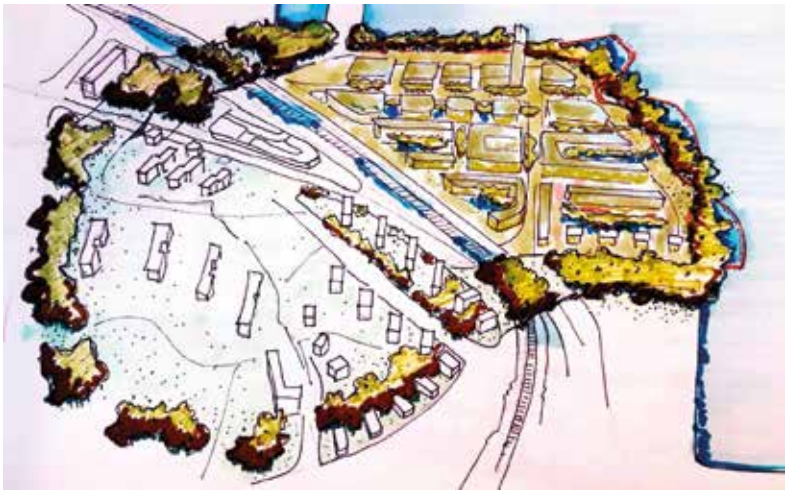


Figure 81: Hybridization in Värtahamnen waterfront. (Credits: author).

Notes

1. The World Health Organization (WHO) recommends 12 m² of green area per inhabitant.

2. N. G. Canclini, 'Hybrid Cultures: Strategies for Entering and Leaving Modernity', University of Minnesota Press, January 5, 2006, p. 288.

3. Population of 2,231,000 in 2015.

4. The main ecological problems reported in the Stockholm Sustainable Development Plan (2021) are eutrophication, toxins in water and land, and impact on the physical environment.

5. Gamla stan, until 1980, was officially named as "Staden mellan broarna".

6. Cris. Reed, 'The ecological agency'. In 'Ecological Urbanism', Org. Mohsen Mostafavi and Gareth Doherty (Editors). Lars Muller, 2016, p. 329.

7. The available public green in European cities is Stockholm at 41.61 m² per inhabitant, Dublin at 33.99 m², Copenhagen at 25.34 m², Berlin at 22.73 m2, and Prague at 25.71 m². Source: Maes et al., 2019 https://publications.jrc.ec.europa.eu/repository/handle/JRC115375

8. S. Hagan, 'Performalism: environmental measures and urbanism'. In 'Ecological Urbanism'. Org. Mohsen Mostafavi and Gareth Doherty (Editors). Lars Muller, 2016, p. 458.

9. N. G. Canclini. 'Diferentes, desiguales y desconectados: Mapas de la interculturalidad (Spanish Edition)', Gedisa Editorial, 2004, p. 189.

10. Program for Sustainable Development, Stockholm city. The Exploitation Office. Production: Blomquist Communication, 2021, p. 25.

11. The concept is defined by Prevedello, A. 2021, and presented in https://vitruvius.com.br/revistas/read/arquitextos/22.255/8229

12. A. Branzi, 'For post environmentalism: seven recommendations for a New Athens Charter'. In 'Ecological Urbanism', Org. Mohsen Mostafavi and Gareth Doherty (Editors), Lars Muller, 2016, p. 111.

13. The Charter of Athens was written in 1933. Among the various criticisms appears: "The evil is universal, expressed, in the cities, by a congestion that corners them in disorder and, in the countryside, by the abandonment of numerous lands".

14. M. Di Felice, 'Paisagens Pós-urbanas. O fim da experiencia Urbana e as Formas Comunicativas do Habitar'. São Paulo: Annablume, 2009, p. 38.

15. Project SOS Waterfront 2022. http://sosclimatewaterfront.eu/sos/news/urban-design-workshop-stockholm

16. D. L. Meadows, 'The Limits to Growth', Ed. Perspectiva S.A, 1973, p. 188.

17. N. G. Canclini, 'Hybrid Cultures: Strategies for Entering and Leaving Modernity', University of Minnesota Press, January 5, 2006, p. 288.

18. M. Di Felice, 'Paisagens Pós-urbanas. O fim da experiencia Urbana e as Formas Comunicativas do Habitar'. São Paulo: Annablume, 2009, p. 229.

19. N. G. Canclini. 'Diferentes, desiguales y desconectados: Mapas de la interculturalidad (Spanish Edition)', Gedisa Editorial, 2004, p. 26.

20. The Swedish national height system RH 2000 is the official national height. Formally adopted in 2005.

21. R. E. Adams, 'Climates: Architecture and the Planetary Imaginary. An Ecology of Bodies'. Columbia Books on Architecture and the City. Lars Müller Publisher, 2016, p. 189.

22. R. E. Adams, 'Climates: Architecture and the Planetary Imaginary. An Ecology of Bodies'. Columbia Books on Architecture and the City. Lars Müller Publisher, 2016, p. 189.

23. M. Di Felice, 'Paisagens Pós-urbanas. O fim da experiencia Urbana e as Formas Comunicativas do Habitar'. São Paulo: Annablume, 2009, p. 39.

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Coastal city learning model Reflecting Climate Change Adaptation Measures with other Cities.

KEYWORDS:
Climate Change, Coastal Cities, Adaptation Measures, Comparable Model

Abstract

As the impact of climate change on coastal cities becomes clearer, cities are developing new strategies to deal with the impact of this change, according to recent publications on water-related assessment studies, as well as following the results of the H2020 Marie Curie project SOS Climate Waterfront and its spin-offs (Sanders 2020) (Sanders et al., 2021).

This development is reinforced in view of the various reports that have appeared recently; whereby the expectations for global climate change and sea level rise becomes clearer and the need for adaptation measures gains ground compared to mitigation measures as the priority (Deltares 2018a 2018b 2021) (IPCC 2020) (Van de Meulen 2020).

With this increasing threat, its clear that small and large coastal cities will look for measures that will specifically help in their own situation to move along with the climate change effects, so that the lives of their inhabitants and thus their cultural phenomenon can be conserved or will not be drastically changed, but can change with the changes (Deltares 2019) (Murphy 2022) (Roo 2011) (Van Bergen 2021).

In order to encourage cities to support each other in this development, to learn together how choices can be adapted and communicated with their citizens and stakeholders, and how the related changes to these choices can become cost-efficiently, a model has been developed with which cities can compare each other's situation in the light of their worked-out measures; a model that covers both hard built environmental and more fluid cultural measures and what is in-between, large and small-scale, expensive and cheap measures. Existing models have been used for generating this model (WUR 2019) (Deltares 2022) (Hendriksen 2022) (Lin 2020) (Van Bergen 2019), and relevant case-studies as well (Berkens 2014) (Dal 2021) (Hooimeijer 2022) (Mispelblom 2019) (Van Bergen 2019).

To model is tested on the six cities from the H2020 Marie Curie SOS Climate Waterfront programme: Lisbon of Portugal, Rome of Italy, Thessaloniki in Greece, Gdansk in Poland, Stockholm of Sweden and Amsterdam in the Netherlands. Each of these cities their coastal circumstances and actual adaptation measures taken and those that are in consideration, were given a place in the model and involved parties were asked for reflection, in order to process their recommendations into a first guide to using the model, as a contribution to the european scale for all comparable coastal situations.

It is becoming increasingly clear that the impact of climate change on life on our planet is becoming increasingly influenced by climate change. This is illustrated by the shift in topics that have been successively discussed at the climate conference over the past few years. While in Paris in 2015 the focus was still mainly on reducing greenhouse gas emissions, recently in 2022 at the conferences in Montreal, Canada (UNFCCC-COP15 2022a) and Cairo, Egypt (UNFCCC-COP27 2022b) the focus respectively was on preserving biodiversity and rising resilience: starting a 'loss and damage fund', to react adaptative on the changing living conditions caused by climate change. Reading the accompanying conference statements, a sense of responsibility is also emerging on a global scale, and the trend of continued negative results in reducing greenhouse gas emissions leads to a shift in focus towards adaptive measures (COP15 and COP27). Also, the increasing effects of climate change call for systematic risk management, more adaptation and accelerated decarbonization (Woetzel/McKinsey 2020).

The same trend change could be observed in the Netherlands; Deltares consultant (former governmental research centre for coastal defence) was the first to come up with scenarios for the future coastal defence of the Dutch delta (Deltares 2019) (surfacing approximately 50% of the land area in the entire west of the country in terms of size) in the event of further sea level rise (assuming emissions of greenhouse gases exceed the agreed amount in the UN Paris agreement, which is based on a maximum of 1.5 degrees of global warming). Then the Agricultural University of Wageningen (WUR 2019) and Delft University of Technology (RDM 2022) followed with plans for a completely new and different landscape design respectively concerning the whole country and the most crowded areas in the western part of the country. The Delta Commissioner, the Netherlands' most important government adviser on coastal defence, also stated that long-term coastal defence planning is necessary, as the western part of the country would not be able to be kept dry with the current constructions if the sea level rises by more than 2.0 metres.

These developments show the first steps in the Netherlands to invest extensively in a new coastal defence in addition to the current mitigation program (CO_2 neutral in 2050) (Rijksoverheid 2019).

These first plans illustrate that such plans will go much further than coastal defence alone. The climate change for the Netherlands shows that (KNMI 2021), in addition to the expected sea level rise, there will be wetter and drier periods in the future, which will also affect the agricultural sector and overheat the cities, partly because the water level in the rivers will fluctuate more strongly. With all the associated problems, such as a threat to the health of the elderly, salinization of the agricultural area with a major negative impact on potato and flower bulb cultivation, lack of cool water for energy plants, as well as an accelerated loss of biodiversity in the nature reserves spread across the country.

What is new is that, in addition to the strategic prospects mentioned above, Deltares consultancy has made a decision model for developing scenarios (Deltares 2022) that could also be used for other deltas. The question that may be critically asked is whether such a model for deltas in general can be made from the Dutch context, because many deltas, unlike the Dutch situation, have not previously worked on comparable structural coastal defences. Shouldn't a comparison of deltas around the world be made first, at least to explore whether situations occur there that are completely different from those in the Netherlands? A critical note that makes the H2020 Marie Curie program 'SOS Climate Waterfront' (Lusofna 2018) interesting to include in this search for robust adaptive scenarios, in particular because this program examines learning points between a number of european deltas, without taking a biased position. The participants visit each other successively to work out sustainable city-designs in conversation at locations. This implicitly creates a shared picture of the differences between the six deltas from which the participants in the program come: Lisbon in Portugal, Rome in Italy, Thessaloniki in Greece, Gdansk in Poland, Stockholm in Sweden and Amsterdam in the Netherlands. Unfortunately, this implicit comparison is not an active part of the program.

That is why additional research has been done for this, a model has been built on the research question: 'What model can be a tool for city management to compare their climate-change situation with that of other cities, for mutual learning and creating adaptation measures for the city for a safe and prosperity future?' to compare the situation of these deltas with their sensitivity to climate change, and that model has been tested at the six delta locations of this programme. Before presenting the results, the following aspects are discussed: the backgrounds and the result of the model, the test results based on visits to the six deltas and then the possible refinements of the model, with conclusions and evaluation.

The CCLM-model generated

In recent years, a few models have been compiled in the Netherlands to develop adaptive scenarios for climate change (Deltares 2022) (UNDP 2010) (Downing and Patwardhan 2020). The Deltares model shows to be the most hands-on and offers a wide range of measures that can be taken to compensate for and defend against the changes caused by climate change. The many other models as the ones from the UNTP and Downing & Patwardhan are more models of processes, being roadmaps to gather and select data for creating strategies. None of these models are in principle location-bound, and none are basic enough to compare the situation between cities.

That is why a new model, the *Coastal City Learning Model* (CCLM) specifically for cities located on the coastal shores, has been developed in which the following can be visualized side by side: the local situation of the city and the surrounding area, the prognosis for the changing impact of climate change, the measures that have been implemented and which are planned, to place next to these results the first observations of negative influence of climate change on water quantity and quality, the situation in the landscape and the well-being of the inhabitants as well as flora and fauna, see Figure 83. The underlying idea of this model is that it can be filled in for cities, as a snapshot of the present with observations that say something about climate-sensitive aspects, about future developments; to compare these snapshots of cities with each other, to copy measures from each other, to learn from each other's strategies, as can be said: 'If the past teaches, what does the future learn?' (Murphy and Crumley 2022).

Because this is a new model, it needs to be tested, and the urban situations of the six in the SOS Climate Waterfront program are ideally suited for this. Therefore, the model has been filled in with the respective participants of the CPONH NGO organization who visited these cities, as a first proof of results, to clarify both the comparability and the practical usability of the model, to improve the model for general use, inside and outside this EU H2020 Marie Curie project.

The six EU test-cities
The participating cities in the SOS Climate Waterfront program are: Lisbon of Portugal, Rome of Italy, Thessaloniki in Greece, Gdansk in Poland, Stockholm of Sweden and Amsterdam in the Netherlands, and for each the model is filled-in for first comparison and testing its usability.

Lisbon in Portugal:
Lisbon, located on the Atlantic Ocean in the delta of the Tagus River, is an old city from 1200 AC with approx. 500k inhabitants, with initial problems related to climate change, such as: overloading of the sewage system with the increasing number of heavy rains, increased risk for the expensive apartment complexes on the ocean side in case of sea level rise and a threat to bird diversity, also quantitatively in the riverbed area south of the Tagus. The draining of water from the river across the border in Spain for irrigating the southern Spanish provinces also results in extra low water levels in the summer, endangering South-Portugal's own irrigation and endangering the riverbed as a foraging area for the birds. See Figure 84 for the result of the filled-in model. Based on the report of Fred Sanders, secondee from CPONH NGO.

Rome in Italy:
Rome of 753 BC, located on seven hills on the river Tiber, is nearby the sea thanks to the suburb of Ostia, and has approximately 3,000 inhabitants. Over the centuries, the city has expanded to the river, so that high river levels lead to problems. It is also increasingly hotter in the city in the summer and due to the dense buildings, there is little room to create green open spaces. The city wants to expand and there are plans to take climate change more into account. Based on the blogs of Karel Mulder, secondee from CPONH NGO.

Thessaloniki in Greece:
Thessaloniki of 315 BC is located on the river Vardar and has about 350k inhabitants. The city is located on the Aegean Sea, in open connection with the Mediterranean Sea. The sea level rise in the Mediterranean is still small, but dams are raising the water levels in the Aegean Sea, which, in combination with higher river levels, will lead to flooding in the city, against which few measures can be built due to the abundant UNESCO heritage. Based on the blogs of Jelle-Jochem Duits, secondee from CPONH NGO.

Gdansk in Poland:
Gdansk, located on the eastern side of the Baltic Sea, has a fairly wide Vistula delta. The river flow is drained to the Baltic Sea before Gdansk with a canal to prevent high water in the city. However, the city still has regular floods that flood the centre when the sea level rise coincides with high river levels in the many other smaller rivers that flow through Gdansk. Flood areas have been created to lower river levels, but the effect is until so far limited. Gdansk is therefore inhibited in its ambitions to build new residential areas (Sanders et all 2022).

Stockholm in Sweden:
Stockholm, city in the archipelago, with a population of 900k in the city and 2 million people in the region, located on the Baltic Sea is working on the many sustainable challenges associated with climate change, but will suffer little from sea level rise because the soil of Scandinavia is rising faster, bouncing back without the weight of the last ice-age kilometre-thick layer. Based on Karen Jonkers reporting, secondee from CPONH NGO.

Amsterdam in the Netherlands:
Amsterdam area with approx. 1,500k inhabitants and the same number of tourists every year, has the prob-lem that the threats from climate change are great (sea level rise, heavy rainfall, heat stress in the summers and soil subsidence because the 10 meters of peat on which the city is built settles) while there is a huge need of +50% housing. Based on the EU paper (Sanders et al 2022).

The results and the proposed CCLM-model evaluated
Seeing the results of using the proposed CCLM model for the six cities of the H2020 Marie Curie program SOS Climate Waterfront, there seems to be enough information in the model to place the cities side by side, with the questions: which have the same type of problem and can there be a basis for mutual learning by comparing the implemented and planned measures.

As a first taste of this proposed use of the model it can be said that: 1. the situational conditions of Lisbon and Thessaloniki show to be comparable (threat of sea level rise and high river levels for a classical city with many monuments), 2. the situation in the cities of Gdansk and Amsterdam-area show to be quite similar (city near a river-delta that suffers from increasingly sea level rise, causing the old city to suffer from flooding, blocking housing develop-ments and putting agricultural production under pressure), and

3. the situation in the cities of Rome and Stockholm are more isolated within the group of six cities in this research programme: Rome is more inland and mainly has the problems of many large cities in Europe and beyond (summer heat stress and the inability to dealing with heavy rainfall in the autumn), while Stockholm has relatively few disadvantages of climate change (no worries about sea level rise because the land surface rises faster, and suffers less from hotter summers and a wetter autumn).

It should be noted that little is known about the state of the flora and fauna in and around these six cities. This may reflect the fact that the project was set up on the basis of architecture and urban planning. But for Scandinavia, for example, Hugo Sanders secondee of CPOH NGO brought the message that the shifting of the seasons due to climate change has a negative influence on the growth of plants and mushrooms, because the mutual symbiosis between crops — the simultaneous availability to each other — disappears, resulting in a decline in growth and maturity. Unfortunately, for information on this we have to talk about sidekick interests of the seconds that make the available information limited, such as the decline of the insect world.

The model is only effective if comparable cities are also given the opportunity to learn from each other's situation, to consider measures taken in one situation in the other situation or if they can also be considered. As an example, the comparison of the situation in Gdansk/Poland and Rotterdam/Netherlands (Amsterdam area) can be sought. Both cities struggle with the contradiction between the importance of closing the estuary against the high-water situations that already exist, and which are predicted to become worse due to climate change, versus the further economic growth of the port and the desire of people for apartments on the water. In Rotterdam, a closable barrier has been built for this purpose, which can be closed at high water, when the situation is most critical. This is a protective measure that can also be considered in Gdansk. On the other hand, Rotterdam could consider constructing similar retention basins upstream in the rivers that feed the estuary, basins with which Gdansk has achieved good results for artificially lowering the river level when effects accumulate (Sanders et al 2022). In short, it seems effective to clearly visualize the situations and the effects of climate change in order to recognize comparable situations, so that a process of mutual learning can start.

Despite these first relevant results, the model only seems relevant if it provides more than just situational comparability, but that the influences of climate change and the measures taken and

planned can be substantively compared and discussed. In order to take that comparison further in depth, it was thought that the model could be improved one step if it could be indicated for each theme whether this is a critical aspect or not. To this end, the model has been expanded with the option (a bar in the diagram) of adding accents or text (see the example of the situation in Amsterdam in Figure 90).

Recommendations

The message of Marie Curie (1867 - 1934) is that where people meet, experiences and knowledge are exchanged and that both enrich their insights. With that message, there is a logic that the H2020 EU program has opted for a segment Marie Curie program, which seeks new insights to deal with climate change by bringing together investigative people from different countries to discuss the situation with each other on location: the urgency and possible necessary measures to have a high-quality conversation.

The introduced CCLM-Model can contribute to this, as an instrument to stimulate a good substantive discussion and to engage in depth for the benefit of conclusions. The model only proves itself when it is used in practice. The presentation, the test and the proposed improvement of the model can therefore be seen as a first step and contribution for the use of others, because the more climate change is globally accepted, the more measures will be considered and it will become useful that cities compare with each other in order to monitor effectiveness and cost efficiency.

LOCAL SITUATION CITY-ENVIRONMENT	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
CLIMATE-CHANGE IMPACT FORECAST	Sealevel rise	Rainfall	Drought	Flora & Fauna
MEASURES TAKEN OR IN THE PLANNING	Physical	Non-Physical	Behavioural	Run-Away-For
RISK AND IMPACT OBSERVATIONS	Water	Land	Citizens	Flora & Fauna

Figure 82: Coastal City Learning Model (CCLM) generated to be tested on 'SOS Climate Change' project cities.

LISBON	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACTERISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	Rising land from the sea	Tagus river south of city with wide riverbed	City situated on two hills, centre and vilage ancient	500k citizens; beside tourists also Brasilian
CLIMATE-CHANGE IMPACT FORECAST	Sealevel rise as predicted for the Atlantic Ocean	More severe rainfall	More dry countryside and city heat-stress	Riverbed bird populations are in danger
MEASURES TAKEN OR IN THE PLANNING	No-building oceanshore new sewage in citycentre	The 1755 flooding line is made visual in the city	None	Airfield is planned on a new location
RISK AND IMPACT OBSERVATIONS	Flooding of the city centre, summer heat stress	Summer drought in countryside	Older citizens move to the countryside	Birds breeding grounds flood on floodplains

ROME	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	Seaside distance	River bank narrowed by dykes	Densely built city on seven hills	3000k citizens many global visitors
CLIMATE-CHANGE IMPACT FORECAST	Nor relevant	Less rainfall in general	Longer warmer periods	No info
MEASURES TAKEN OR IN THE PLANNING	Local widening riverbed	None	None	No info
RISK AND IMPACT OBSERVATIONS	Flooding along river Tiber	Drought in countryside	Heat-stress	No info

THESSALONIKI	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	At the Agean sea cul-de-sac of M-sea	River on the west side of city	Centre not dense, many Unesco heritage buildings	350k citizens, 2nd city of Greece
CLIMATE-CHANGE IMPACT FORECAST	Watter accumulation increases sealevel rise	No issue	Drier summers	No info
MEASURES TAKEN OR IN THE PLANNING	Unesco heritage blocks physical measures	None	None	No info
RISK AND IMPACT OBSERVATIONS	Flooding from the sea	None	None	No info

Figure 83: The filled-in CCLM-model for Lisbon in Portugal.

Figure 84: The filled-in CCLM-model for Rome in Italy.

Figure 85: The filled-in CCLM-model for Thessaloniki in Greece.

GDANSK	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	City at the Baltic sea between rivers	City between vistula and small river	Old city the canals	Densed city 470k citizens
CLIMATE-CHANGE IMPACT FORECAST	High water levels by sea-water compression	More periodes of severe rainfall	No problem	No info
MEASURES TAKEN OR IN THE PLANNING	Canal to relief riverwater water retention basins	None	None	Irrigation polder delta
RISK AND IMPACT OBSERVATIONS	Numurous floodings	Dry and wet periodes countryside	No new housing for city growth	No info

STOCKHOLM	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	City on 7 connected peninsula's	River Soderstrom in centre	Dense city on connected islands	900k citizens less immigrants
CLIMATE-CHANGE IMPACT FORECAST	Sea level rise is no issue due to landrise	More intens rainfall	Longer dry periods	No info
MEASURES TAKEN OR IN THE PLANNING	None	Increase capacity sluss to prevent flooding	Green architecture	None
RISK AND IMPACT OBSERVATIONS	None	None	None	No info

AMSTERDAM	SEASIDE SHORE CHARACTERISTICS	RIVER DELTA SITUATION	CITY CHARACETRISTICS	POPULATION CHARACTERISTICS
LOCAL SITUATION CITY-ENVIRONMENT	Connected to the sea by canal and locks	River flows throught southern Rotterdam delta	Compact city with suburbs around it	800k inhabitants, 1500k area included mixed population
CLIMATE-CHANGE IMPACT FORECAST	Locks block sealevel side on short notice	Rainfall increases, drainage can not cope	Summers atrts earlier and wamrer, heat strees in centre	Loss of local insects, exotic crayfish and insects increasing
MEASURES TAKEN OR IN THE PLANNING	Water retention new area's more coastal defence	None	None	Some households move to eastern higher areas
RISK AND IMPACT OBSERVATIONS	Water complexity blocks planning of new housing	Agricultural production is inhiited due to increase of rainfall and drought	Not yet	Loss of biodiversity in general, and risk of reduction of pollinators

Figure 86:The filled-in CCLM-model for Gdansk in Poland.

Figure 87:The filled-in CCLM-model for Stockholm in Sweden.

Figure 88: The filled-in CCLM-model for Amsterdam in the Netherlands.

Figure 89: Updated model after first testing on the SOS climate Waterfront project cities; example Amsterdam.

Notes

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Team Project III

Clean the Soil, Thessaloniki

The main objective of the project is to transform one of the most industrial sites, Menemeni into a new zone for the city, helping the city to grow and improve the standard of living of its inhabitants and especially of the neighbouring districts. To design the project, information was collected on the sea level rise and geological systems. The main objective of the project is to rebalance natural spaces and industry, accommodating floods, adapting rising water levels in green public spaces, bringing stability to a currently vulnerable area. The aim of the project is to make the whole area resilient to natural disasters, ensuring the protection of the natural systems of fauna and flora for the enjoyment of the community. Around the area it is a densely populated area that has few spaces for contemplation and immersion in nature. Considering the surroundings, the industry, the harbour, the marshes and road infrastruture, the project proposes an integrated solution that solves the problems of the waterfront by creating qualified public spaces for the enjoyment of the population.

Figure 90: Conceptual sketch.

Figure 91: Photomontage of Thessaloniki.

Figure 92: Photographs of study area.

Figure 93: Render.

Figure 94: Diagrams.

Figure 95: Section.

Figure 96: Site plan.

Figure 97: Render.

Figure 98: Diagrams.

Figure 99: Section.

Figure 100: Axonometric.

Our planet is in peril. The climate crisis is asking us to rethink our current situation. It demands from us that we take radical action to create a more sustainable human habitat where our anthropogenic footprint can coexist with nature. The SOS Climate Waterfront group embraced this enormous challenge to outline new pathways for our cities, especially those that are at the forefront of this growing crisis. As one of the speakers who was invited to join the last session in Lisbon, I witness an extremely rich and thoughtful exchange that enabled everybody to approach this complex reality from multiple angles and scales. The outcomes of this multidisciplinary collaboration defined a fundamental step to envision a different future. We urgently need more of this work!

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