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DESIGNING RESILIENT URBAN RIVER CORRIDORS: TRENDS IN RIVER REDEVELOPMENT PROJECTS IN THE LAST TWO DECADES

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ABSTRACT

Urban riverfronts provide a distinctive fusion of ecological and social systems and have potential to serve numerous functions. One of their possible roles is enhancing the city's flood resillience which is of crucial importance given that 90% of all natural disasters are water related. However, managing the competing demands and interests within the limited space of the urban river corridor can result in space and time conflicts over competing needs and interests, and conflicting use. This paper aims to identify the primary functions given to urban river corridors and to uncover which of these roles are prioritized in contemporary redevelopment projects in Europe spanning the last two decades.

Through a comprehensive review of various literature resources and a review of European river redevelopment projects, five dominant roles of urban river corridors were identified: flood protection infrastructure, public spaces, ecological corridors, transport routes, and provision of a city's image and identity. The study addittionally employed field research to collect spatial data. After observing and mapping the distribution of programs and uses, the design patterns and trends of the study area were examined using spatial analysis. Specifically, the spatial distribution of various features was assessed and correlations and patterns that emerge were identified aiming to uncover the prevailing design trends.

The research results highlight a shift in focus on urban river corridors' dominant functions. Two out of the five pre-established roles receive more emphasis in the new redevelopment projects. River corridors are mainly redesigned to contribute to flood resilience. This indicates that flood management is becoming increasingly challenging for cities. In contrast, there is also a growing emphasis on designing riverbanks as social spaces. Finally, the findings indicate the importance of considering conflicting functions in multifunctional urban river landscapes for the purpose of preventing them from undermining each other's benefits or value.

Keywords: flood resilience; multifunctional infrastructures; resilient city, riverfront, river redevelopment

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1. INTRODUCTION

Many European cities have moved away from their rivers over the last hundred years. Due to deindustrialization, city riverfronts lost their primary function as industrial areas and became dilapidated brownfields. Amidst the shifting landscape of the industrial era and growing emphasis on commodification, sustainability, and urban resilience, European cities over the past few decades have undergone a transformative process for their riverfronts. This is especially visible in cities in Western Europe with Germany, France, Spain, UK, and Netherlands as the forerunners of this process [1], [2]. Germany's industrial history left a legacy of disused riverfronts, which led city officials and urban planners to envision a new chapter in the evolution of riverfront areas.

Climate change and rising flood risks have prompted a paradigm shift towards embracing flood-resilient solutions as integral components of the design of the riverfronts [3], [4]. Urban planners and designers aim for multifunctional flood protection infrastructure along the rivers, acknowledging the diverse stakeholders who hold an interest in urban riverbanks. The industrial significance of rivers and their banks loses relevance, and in the Post – Fordist era riverbanks are being revitalised to serve different functions. This research explores the prevailing functions influencing the design of urban riverbanks in Europe today and explores which of those functions are given priority in river redevelopment projects over the last two decades. Different approaches for enhancing the fluvial flood resilience of city communities are presented through river redevelopment projects as case studies. This study is significant because it advances knowledge of urban flood resilience and design, presenting location-specific case studies that are envisioned as models for contemporary 21st-century cities.

2. METHODOLOGY

A comprehensive review of relevant literature resources was conducted to identify the various roles that urban river corridors in Europe play for the last two decades. The literature review encompassed academic journals, research papers, books, reports, and other reputable sources related to urban planning and design of riverfronts. The scientific literature review results were supplemented by a media review and important variables in the domain of urban riverfronts were identified. The literature was coded based on the pre-defined variables.

German urban river corridors and redevelopment projects were particularly examined through case study methodology [5]. Primary data on the phenomenon such as photo documentation was collected by field research, and spatial analysis of the redevelopment plans was employed to examine design patterns and trends within the study areas. Through cluster analysis of the cases in Germany listed in Table 1, three case studies were chosen as the most diverse and representative of their cluster and are represented more thoroughly in the paper: Isar Riverfront in Munich, Elbe Riverfront in Hamburg, and the the Neckar Riverfront in Heilbronn.

3. FINDINGS

3.1. Emerging trends in the roles of urban riverfronts

Riverfront redevelopment projects in Europe have emerged as transformative endeavors, aiming to repurpose former industrial sites and ports into thriving city districts. Notably, the trend of redeveloping brownfields along rivers into multifunctional spaces has gained momentum, and as a main catalyst for these redevelopments is the goal of achieving better flood resilience of communities [6], [7] and ‘returning’ the river to the citizens [8], [9]. However, a few events of national or international character can also be regarded as triggers for redevelopment and such examples are Expo’92 in Sevilla, the 1992 Olympic Games in Barcelona, Expo 2008 in Zaragoza, BUGA 2019 in Heilbronn or the 2024 Olympic Games in Paris [2], [10]. Thus, city riverfronts have evolved into highly congested spaces, assuming numerous roles within urban environments and proving essential for fluvial flood resilience. Through strategies such as spatial stacking and time shifting of different functions, they have adopted multifunctional design which greatly contributes to resilience in general [11]. Five dominant roles for urban river corridors were found, outlining the essence of river redevelopment in contemporary urban planning and design:

1. Flood protection infrastructure: riverbanks often serve as the buffer zone between the river and the nearby communities, absorbing the excess water before it reaches the urban area or serving as a retention zone for the water. They are not a complete solution to the problem of flooding, but they play a very important role in flood protection. The construction of floodwalls, levees, creation of wetlands, or green spaces are some of the flood mitigation strategies employed in the praxis.

2. Public spaces that provide recreation: riverbanks are ideal locations for public spaces as residents can have a direct connection to nature which can sometimes be located very far from urban centers. Activities like picnics, sunbathing, fishing, swimming, or jogging can take place there. This also helps in promoting a sense of community and strengthens social resilience.

3. Ecological corridors: City rivers support diverse arrays of plant species or animal species as they are an important habitat for them. Additionally, many rivers serve as migratory corridors for different aquatic species.

4. Major transport routes: Throughout history, rivers have been one of the primary transportation routes. Riverbanks also take this role as many cities have grown along their riverbanks, and their morphology is dictated by the river making the riverbank a very favorable position for placing major transport routes.

5. Provision of a city's image and identity [12]: riverfronts are often a key component that shapes the aesthetic identity of a city and provides a sense of place for the residents. The waterfronts are the image of 'city marketing', and very often become locations for 'Starchitects masterpiece' buildings. As rivers take up a historical role in shaping cities, they also become a symbol of the city as is the Danube River for Budapest or the Thames River for London.

Table 1. Prioritized roles in river redevelopment projects in European cities from the last two decades

City	Flood control infrastructure	Public space amenities	Ecological corridor	Longitudinal transport	City image	City	Flood control infrastructure	Public space amenities	Ecological corridor	Longitudinal transport	City image
Munich [13]	✓	✓	✓			Paris [7],[10],[11]	✓	✓		✓	✓
Berlin [15]	✓	✓			✓	Lyon [13]	✓	✓	✓		
Heilbronn [9],[10]	✓	✓	✓		✓	Perpignan [1],[14]	✓	✓	✓		✓
Offenbach [19]	✓	✓			✓	Montpellier [18]	✓	✓	✓		✓
Cologne [20]	✓				✓	Toulouse[1]	✓	✓	✓		
Miltenberg [13]	✓	✓				Orléans [9]	✓	✓	✓		
Wuppertal [13]	✓	✓				Saint-Étienne [21]	✓			✓	
Leipzig [13]	✓	✓				Metz [13]	✓	✓	✓		
Bad Kreuznach [13]	✓	✓				Cordoba [22]	✓	✓	✓		
Hamburg [13],[4]	✓	✓		✓	✓	Zaragosa [13]	✓	✓	✓		
Hanover [13]	✓	✓				Barcelona [13]	✓	✓	✓		
Regensburg [13]	✓	✓	✓	✓		Elche [23]	✓	✓			
Basel [24]	✓	✓	✓		✓	Bilbao [25], [26]	✓	✓		✓	✓
Zurich [13]	✓		✓			Madrid [27]	✓	✓	✓		✓
Doesburg [13]	✓	✓				Lisabon [28]	✓	✓			✓
Kampen [13]	✓	✓				Bratislava [29]	✓	✓		✓	✓
Liverpool [20], [25]		✓			✓	Skopje [30]					✓
Prague [31]	✓	✓				Belgrade [30], [32]		✓			✓
Rotterdam [25],[33]	✓	✓			✓	Ljubljana [34]	✓	✓	✓		✓

Based on the reviews, the first conclusion that can be drawn is that the redevelopment projects vary in scale and functions prioritized. The primary focus of urban riverfronts revolves around flood control infrastructure, which is mostly accompanied by the creation of public amenities. Few city rivers have maintained their function as ecological corridors; however, there is a noticeable upward trend in integrating nature-based solutions to enhance the ecological function of these urban waterways in recent decades leading to many rivers being cleaned and restored to their ecological function. The

transport corridors are replaced by public spaces or are often redesigned to be multifunctional by placing the driveways underground.

3.2. Implementing the concept of flood resilience into urban river redevelopment projects

The main motive for initiating river redevelopment projects today is building more sustainable and resilient cities. The idea of sustainability faces a challenge in developing resilience capacities within cities and integrating resilience as its fourth dimension [11]. However, the concept of resilience remains somewhat vague and lacks a clear definition. To put the concept into action, we need to address questions like "resilience to what?" and "resilience for whom?"[35]. There is no perfect technological solution for achieving resilience. There are, rather, a range of robust options for managing urban risks through a combination of infrastructure, targeted projects, technology, and ecosystem services. Secondly, recognizing that risks will always be present, cities are encouraged to continually improve their information, communication, and early warning systems, as well as emergencies, evacuation, and reconstruction planning to enhance resilience. Resilience, in this context, refers to a system, community, or society's ability to withstand, absorb, adapt to, and recover from hazards efficiently, including preserving and restoring essential structures [36].

This paper presents case studies that address the fluvial flood resilience of communities through urban river redevelopments. Numerous interpretations of flood resilience have been presented in the existing literature. Corresponding frameworks also present a variety of indicators by which the resilience to floods could be assessed [4], [37], [38]. Resilience and resistance are distinct concepts that can be categorized into separate strategies. However, in flood risk management literature, flood resistance and flood resilience strategies are sometimes referred to as simply ‘flood resilience’. Resistance aims to reduce flood probability using barriers such as embankments, whereas resilience focuses on minimizing flood consequences by adapting land use, such as elevating housing structures. When applied to urban settings, flood resilience involves considering flood prevention measures and adapting land use to reduce the impacts of disasters. It is considered a promising approach to address climate change and future flood risks in cities. However, some scholars argue that resilience and resistance are not clear opposites, as resilience also encompasses attributes, such as persistence and robustness. Consequently, both strategies are vital elements for achieving effective resilience from flooding in cities [39]–[41]. Riverbank cases in Table 1 are evaluated primarily for their flood-resistant design, which plays a vital role in enhancing the overall fluvial flood resilience of communities in cities. Moreover, the analysis of several cases reveals that they not only emphasize flood resistance but also integrate strategies related to multifunctionality, adaptation, and transformation, which are key attributes associated with resilience.

3.3. Three case studies of river redevelopments

The following section provides detailed insights into three case studies of urban river redevelopment projects in Germany with approximately similar scales. Each case study represents a distinct spatial solution for the redevelopment of a riverfront, whose use was previously exclusively limited to industry, transport, or flood protection infrastructure. The selected case studies are situated in a similar cultural context; they are all based in urban surroundings and represent diverse ways in which flood protection can combine waterside public spaces and improve the city's image through multifunctional design.

3.3.1. Isar Plan in Munich

The Isar River, once a wild alpine river with gravel islands and sandbanks, was hydraulically regulated in the 19th century owing to repeated flooding in Munich. However, with climate change posing new challenges, a restoration project was initiated to create a riverbed with varying widths, gravel banks, and stone islands to improve flood control and enhance the river's ecological value. Before its redevelopment, Isar River was mostly regarded as simply an infrastructure or even an enemy of the city. The project aimed to restore an eight-kilometer stretch of the Isar River, which was previously canalized, to its natural state [3], [42]. This project sought to improve flood control, biodiversity, and recreational quality. Steep embankments were replaced with flat sloping banks and naturally

developing banks, promoting the near-natural appearance of the Isar River. New dikes were constructed to protect lower-lying city districts and riverbanks were restored to provide suitable habitats for flora and fauna. The cross-river sills were replaced with flat ramps and stone rock steps, allowing fish to pass easily. Gravel bars, restored to their natural state as re-naturalized public spaces and beaches, offer level and stable terrain for people to sit and relax [43].

One of the significant challenges faced during the implementation of the Isar Plan was the projected climate change impacts on rain patterns. Climate change projections indicate uncertain changes in areal precipitation, leading to potential increases in floods due to higher winter runoff. To achieve these objectives, the previously fixed and canal-like riverbed was transformed into a dynamic river landscape [44]. The main channel was widened from 50m to 90m, allowing more space for the river and improving the flood runoff [13].

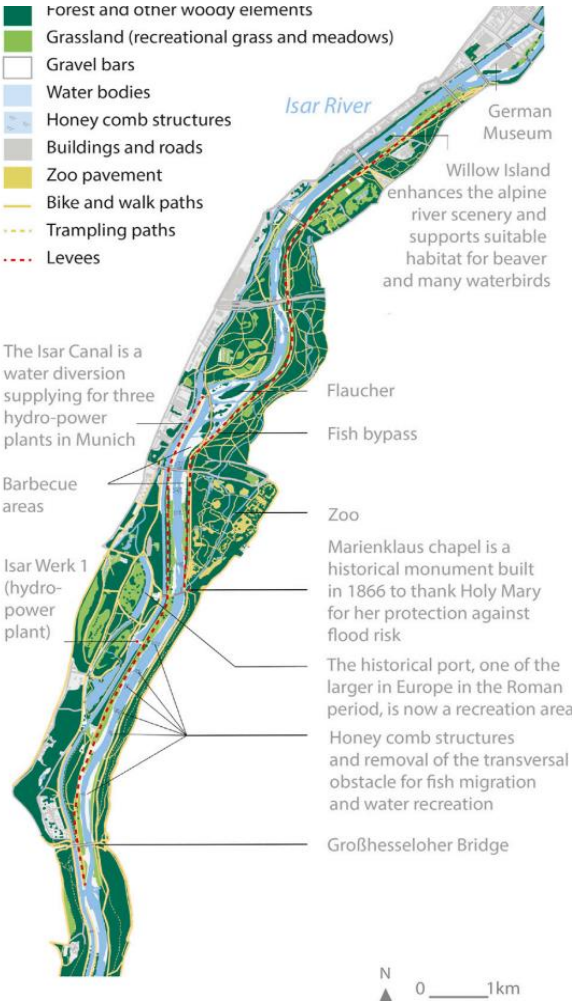

Fig. 1. Isar Restoration Project. Adapted from Serra-Llobet et al., 2022.

Fig. 2. Isar, Munich © author

Fig. 3. Isar, Munich © author

3.3.2. Hafen City project in Hamburg

The vision of Hafen City aimed to reclaim the waterfront for the inner city, expanding beyond the initial sections along the river Elbe embankment. The Masterplan envisioned distinct neighborhoods and sought to establish HafenCity as a symbol of economic and urban breakthrough for the 21st century, improving Hambourg's city image. It was designed to be a model for other European inner cities, showcasing innovative design and sustainability while remaining flexible to accommodate future changes. HafenCity key features included a strong connection between buildings and water, flood protection through elevated structures, vibrant ground-floor spaces for public use, and a diverse mix of functions [45], [46].

The HafenCity area originally lays outside the dike line and at relatively low elevations, making it prone to regular flooding with heights varying between 4.4 to 7.2 meters above mean sea level rise. To address flood risk, Hamburg opted for the "dwelling mound solution" which involved elevating bridges and streets to a minimum height of 7.5 meters above sea level, with buildings incorporating the dwelling mound as a basement. Several basements serve as parking areas, while others function as shops. To safeguard against storm surges, all openings, including windows, are equipped with temporary flood gates for protection. Legal changes were required for the realization of the dwelling mound solution, including amendments to Hamburg's harbour law to convert HafenCity areas from harbor usage to a mixed urban neighborhood, and changes to the city's land use plan [4].

Fig. 4. HafenCity Plan © ASTOC/KCAP Architects & Planners/Hamburgplan

Fig. 6. HafenCity © author

Fig. 5. HafenCity © author

3.3.3. BUGA 2019 and Neckarbogen Project in Heilbronn

In the city of Heilbronn at the turn of the last millennium, an area north of the train station had lost its once vital role as a handling, storage, and industrial zone. The ground in the area was heavily contaminated with spilled oil, rubble, unexploded bombs, and remnants of its industrial past. In 2019 the Federal Garden Show (BUGA) took place, transforming the industrial hub into a new, forward-looking district [16], [47]. The "Modellquartier Neckarbogen" is a housing scheme that is a part of the exhibition. The transformation of Neckarbogen's urban fabric is anchored in landscape architecture, which played a central role in connecting fragmented riverscapes, eliminating spatial obstacles, and reclaiming previously inaccessible plots. Over two kilometers of open space have been reclaimed from unused land along urban riversides. The new developments integrate crucial landscape functions like noise reduction, stormwater management, and protection of urban wildlife, which are all integrated into the so-called "smart" multifunctional landscapes [48].

The urban landscapes left after the Garden Exhibition not only shape the urban core but also serve vital flood protection functions. Neckarufer embankment park offers recreational space, while its terraces also serve as flood retention area areas. With Felsenufer, Hafenberg Park features embankments of earth and stone rising to 12 meters. The walls and gorges double as climbing walls and vertical playgrounds, respectively. Rock fragments and gravel fields on Hafenberg hill slopes provide biotopes for lizards and thermophile insects. Karlssee Lake serves as a recreational area with a beach and wooden decks while doubling as a stormwater retention pond connected to the river Neckar via water steps [49].

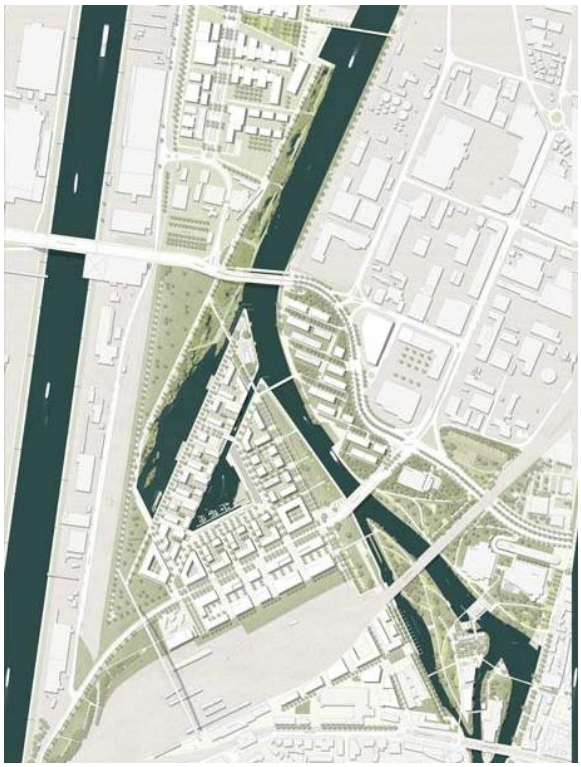

Fig. 7. Neckarbogen Project, Heilbronn © Machleidt GmbH Städtebau + Stadtplanung

Fig. 8. Habitat © BUGA Heilbronn 2019 GmbH

Fig. 9. Felsenufer © Benner

4. DISCUSSION

Many cities have historically developed along the rivers. Riverbanks are attractive locations within the city because of their proximity to natural waterbodies. They have always served as important transportation routes because of their locations within the city fabric. Riverbanks and rivers are critical ecological corridors that provide habitats for diverse plant and animal species, which means that they should contribute to biodiversity conservation and enhance overall ecosystem health. Simultaneously, riverbanks act as flood protection buffers, mitigating the impact of flooding and safeguarding adjacent urban areas from water-related hazards. Moreover, the multifunctionality of riverbanks extends to recreational opportunities, with the potential for walking trails, parks, waterfront promenades, and outdoor spaces that promote physical activity; foster a sense of community; offer opportunities for cultural events and tourism; and add to the overall aesthetic appeal and image of the city.

There is a big competition for waterfront spaces and certain conflicts arise. From a planning perspective, these can be conflicts of ownership, heritage, identity and culture, social and environmental justice, etc. The solution to this problem often involves designing multifunctional spaces near rivers. By leveraging nature-based solutions and innovative urban planning strategies, river redevelopment projects can effectively combine flood resilience with the creation of dynamic and accessible public spaces, thereby resulting in resilient, people-oriented, and environmentally conscious urban areas. For instance, the Isar River redevelopment rejects canalization and broadens the width of the river, increases contact with nature, and offers space for activities such as relaxation by providing an urban beach. The flood protection strategy for the Elbe River in Hamburg is

completely different: it moves the riverbank further into the river and raises it by more than 7m, with which it adds a parking space under the public space, as is the example of the Niederhafen promenade. The Hafen City area in Hamburg, on the other hand, employs a solution in which all buildings are artificially raised so that they embrace the flood. The area also utilizes a system of elevated paths and floating platforms that allow connectivity during flood events [13]. As river corridors and riverbanks do not offer enough space for all required roles to coexist at the same time and place, many of these roles intertwine with each other - green spaces serving as public spaces or enjoyable landscape designs that attract tourists and enhance the aesthetics of a city. It is clear from these examples that multifunctionality is deeply rooted in the contemporary design of urban riverbanks. Further research is required to address conflicts stemming from diverse urban riverfront functions, particularly in relation to utilizing digital tools and big data across all redevelopment project phases in the context of emerging smart cities.

5. CONCLUSION

This study conducted a comprehensive investigation into the roles of urban river corridors in the context of river redevelopment projects. Five dominant trending roles of the contemporary urban riverbanks were identified: flood protection infrastructure, public spaces, ecological corridors, transport routes, and contribution to the city's image and identity. The most prioritized role in new redevelopment projects remains the riverbank's contribution to flood control followed by provision of public space as the second most prioritized function. The trends show that urban riverfronts that serve as important arteries in city transportation systems are being redesigned by removing transport functions and replacing them with public spaces. The findings indicate that river redevelopment projects in Germany follow trends in Europe and place high importance on flood control and the provision of public spaces. This priority emphasizes the crucial importance of mitigating the increasing risks of flooding, which has become more pronounced in the face of climate change. The multifunctionality and flood-resistant design of the analyzed case studies greatly contribute to city flood resilience and city resilience overall.

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REFERENCES

[1] Rode S., Valette P. (2019). Par-delà les limites communales, le fleuve au cœur du projet de territoire métropolitain? Comparaison entre Perpignan et Toulouse, Sud-Ouest Eur. Rev. Géographique Pyrén. Sud-Ouest, no. 47.

[2] Tort-Donada J. et al. (2020). Bridging the gap between city and water: A review of urban-river regeneration projects in France and Spain, Sci. Total Environ., vol. 700, p. 134460.

[3] Urban Waters | Isar Plan. https://urban-waters.org/en/projects/isar-plan (accessed Apr. 14, 2023).

[4] Restemeyer B. et al. (2015). A strategy-based framework for assessing the flood resilience of cities – A Hamburg case study, Plan. Theory Pract., vol. 16, no. 1, pp. 45–62.

[5] Flyvbjerg B. (2006). Five Misunderstandings About Case-Study Research, Qual. Inq., vol. 12, no. 2, pp. 219–245.

[6] Knieling J., Fellmer M. (2013). Climate Adaptation in Metropolis Hamburg: Paradigm Shift in Urban Planning and Water Management towards "Living with Water"?, in Climate Change Adaptation in Practice, John Wiley & Sons, Ltd, pp. 83–93.

[7] Niederhafen Promenade: Hamburg River Flood Protection. https://urbannext.net/niederhafen-promenade/ (accessed Apr. 14, 2023).

[8] Beck A., Cruxen I.A. (2019). New uses for old rivers: Rediscovering urban waterways, Projections.

[9] Rode S. (2010). Reconquête urbaine de la Loire et risque d'inondation: des représentations aux aménagements urbains, Géocarrefour, vol. 85, no. 3, Art. no. 3.

[10] Bauer-Babef C. (2021). Seine River could become swimming ground for Paris 2024 Olympics, www.euractiv.com,.https://www.euractiv.com/section/health-consumers/news/seine-river-could-become-swimming-ground-for-paris-2024-olympics/ (accessed Nov. 10, 2021).

[11] Ahern J. (2013). Urban landscape sustainability and resilience: the promise and challenges of integrating ecology with urban planning and design, Landsc. Ecol., vol.28, no. 6, pp. 1203-1212.

[12] Adamiczka H., Macalik J. (2019). The river's role in the city's brand image–a case of Wroclaw (Poland) and Prague (Czech Republic), Proc. of International Business Information Management Conference (33rd IBIMA) Granada, Spain, p. 10–11.

[13] Prominski M. et al. (2017). River.space.design: Planning Strategies, Methods and Projects for Urban Rivers. Walter de Gruyter GmbH.

[14] Freytag T., Bauder M. (2018). Bottom-up touristification and urban transformations in Paris, Tour. Geogr., vol. 20, no. 3, pp. 443–460.

[15] Marotta I. (2018). Flussbad Berlin Re-Naturalization Project for the Spree River in the Museum Island, Advanced Materials Research, https://www.scientific.net/AMR.1149.76 (accessed Nov. 13, 2020).

[16] BUGA Heilbronn 2019 | sinai. https://sinai.de/projekt/wettbewerbe/buga-heilbronn-2019 (accessed Jul. 25, 2023).

[17] 'Neckarbogen Heilbronn', FUTURE HISTORY, Feb. 04, 2019. https://www.future-history.eu/de/ansicht/neckarbogen-heilbronn-heilbronn-2027-romalu3 (accessed Jul. 25, 2023).

[18] Romain F., (2014) Southern France riverbank projects in Montpellier and Perpignan: from designed space to interpreted space, J. Landsc. Archit., vol. 9, no. 1, pp. 32–41.

[19] 'Offenbach Harbour'. https://henninglarsen.com/en/projects/featured/rsd-offenbach-harbour (accessed Jul. 25, 2023).

[20] Maliene V. et al. (2012), Brownfield Regeneration: Waterfront Site Developments in Liverpool and Cologne, J. Environ. Eng. Landsc. Manag., vol. 20, no. 1, pp. 5–16.

[21] Ultsch J. (2010) Les temporalités de l'interface ville-rivière à travers le cas de Saint-Étienne et du Furan, Géocarrefour, vol. 85, no. 3, Art. no. 3.

[22] 'Guadalquivir River | Urban Nature Atlas'. https://una.city/nbs/cordoba/guadalquivir-river (accessed Aug. 11, 2023).

[23] El Valle trenzado en Elche (Alicante), España|Grupo Aranea, 2013. https://jesusgranada.com/valle-trenzado-elche-grupo-aranea-paisajismo (accessedAug.10, 2023).

[24] Open space and nature conservation concept: for a high quality of life - 3Land. https://3-land .net/en/projects/2020-open-space-and-nature-conservation-concept.html (accessed Jul.25, 2023).

[25] Giovinazzi O., Moretti M. (2009). Port Cities and Urban Waterfront: Transformations and Opportunities, TeMA - J. Land Use Mobil. Environ., vol. 2.

[26] Zorrotzaurre: Una Isla para vivir, trabajar y disfrutar, Zorrozaurre. https://www.zorrotzaurre.com/ (accessed Aug. 14, 2023).

[27] Feinberg M. I., Larson S. (2019). Madrid Río, El Matadero and the Nature of Urbanization, Ariz. J. Hisp. Cult. Stud., vol. 23, pp. 175–190.

[28] Medeiros E. et al. (2021). Urban Planning Policies to the Renewal of Riverfront Areas: The Lisbon Metropolis Case. Sustainability 2021, 13, 5665.

[29] Momirski L. A., ‘Blue Frontiers. Comparing Urban Waterfront Redevelopment Bratislava - Izola - Pärnu - Venice - Viana do Castelo’, Accessed: Aug. 14, 2023. [Online]. Available: https://www.academia.edu/9319700/Blue_Frontiers_Comparing_Urban_Waterfront_Redevelopment_Bratislava_Izola_P%C3%A4rnu_Venice_Viana_do_Castelo

[30] Čamprag N., (2019). Re-imagineering Belgrade and Skopje: urban megaprojects between politics and struggle, Eur. Plan. Stud., vol. 27, no. 1, pp. 181–200.

[31] ‘Koncepce pražských břehů’, Pavla Melková. https://www.pavlamelkova.com/expertni-a-pedagogicka-cinnost/strategie-a-koncepce/koncepce-prazskych-brehu/ (accessed Aug.09, 2023).

[32] Petrović-Balubdžić M. (2017). Creating the Belgrade waterfront identity through a prism of architecture and urban planning competitions, Spatium, no. 37, pp. 74–81.

[33] Romein A. (2006). Leisure in waterfront redevelopment: An issue of urban planning in Rotterdam’, Int. Pap. Delft Delft Univ. Technol.

[34] ‘Works’, PublicSpace. https://www.publicspace.org/works/-/project/g072-preureditve-nabrezij-in-mostovi-na-ljubljanici (accessed Aug. 10, 2023).

[35] Cutter S. (2016). Resilience to What? Resilience for Whom?, Geogr. J., vol. 182.

[36] Rudolph-Cleff, A. (2016). ‘Urban Interplay’, pp. 75–94.

[37] Bertilsson L. et al. (2019). Urban flood resilience – A multi-criteria index to integrate flood resilience into urban planning, J. Hydrol., vol. 573, pp. 970–982.

[38] Hammond M. J. et al. (2015). Urban flood impact assessment: A state-of-the-art review, Urban Water J., vol. 12, no. 1, pp. 14–29.

[39] Serre D. et al. (2018) Contributing to urban resilience to floods with neighbourhood design: the case of Am Sandtorkai/Dalmannkai in Hamburg, J. Flood Risk Manag., vol. 11, no. S1, pp. S69–S83.

[40] Dahlberg R. (2015) Resilience and Complexity Conjoining the Discourses of Two Contested Concepts.

[41] Abdulkareem M., Elkadi H. (2018). From engineering to evolutionary, an overarching approach in identifying the resilience of urban design to flood, Int. J. Disaster Risk Reduct., vol. 28, pp. 176–190.

[42] Rossano F. (2016). Isar Plan: The Wild as the New Urban?, Contour J., vol. 1, no. 2.

[43] Zingraff-Hamed A. et al. (2022). Effects of recreational use on restored urban floodplain vegetation in urban areas, Urban For. Urban Green., vol. 67, p. 127444.

[44] Kondolf G. M. et al. (2021). Restoring Dynamic Fluvial Processes in Urban Rivers: Learning from the Aire and Isar Rivers., Landsc. Archit. Front., vol. 9, no. 4, pp. 10–28.

[45] ‘Genesis of an idea’, hafencitycom. https://www.hafencity.com/en/overview/genesis-of-idea (accessed Apr. 14, 2023).

[46] ‘Masterplan’, hafencitycom. https://www.hafencity.com/en/overview/masterplan (accessed Apr. 14, 2023).

[47] ‘Heilbronn | BUGA 2019 Quartierskoordination Baufeld I’, Pesch und Partner. https://www.pesch-partner.de/projekte/heilbronn-stadtquartier-neckarbogen-quartierskoordination-baufeld-i/ (accessed Jul. 25, 2023).

[48] ‘Rahmenplan Modellquartier Neckarbogen – MACHLEIDT’. https://machleidt.de/heilbronn-rahmenplan-neckarbogen/ (accessed Jul. 25, 2023).

[49] ‘BUGA Heilbronn 2019’, Landezine, 2020. https://landezine.com/buga-heilbronn-2019/ (accessed Jul. 25, 2023).