

HYBRIDIZATION OF PUBLIC SPACES AS A TOOL FOR ADAPTING CITIES TO CLIMATE CHANGE

Marija Stojkovic¹

Abstract

The paper examines the application of the concept of hybridization in the design of public spaces in the function of adaptation of cities to climate change. The concept of hybridization is a relevant topic that discussed in this paper from the point of view of contemporary demands of climate change. As a process, hybridization implies combining and mixing different urban structures, programs and activities, which creates complex, heterogeneous urban spaces. Contemporary problems of overheating, flooding and droughts, which occur more and more often, establish new requirements for the design of public open spaces and their adaptation to the areas of influence. In this regard, the new climate function encourages the development of new hybrid types of public spaces due to the addition of new functions and programs, as well as the establishment of new relationships between natural and built elements in public spaces. In this sense, the goal of this paper is to define why and how hybridization of public spaces is used in the present-day city as a means of adapting to climate change. Analysing examples of good practice of adaptation of public open spaces to climate change in a systematized way shows which types of public open spaces hybridization can be recognized as a function of adaptation, in which domains hybridization is realized and which climatic and other additional functions are implemented by these new types of public open spaces. The results of the work indicate that the application of the concept of hybridization of open public spaces, in addition to adaptation to climate change, has the potential to contribute to the realization of multiple benefits, including increasing social inclusiveness, integration of nature, flexibility of space, reduction of resource consumption, as well as the overall quality of urban life.

Key words *hybridization, public spaces, climate change, adaptation*

¹M.Arch, Phd student, Faculty of Architecture, Belgrade, stojkovic.marija4@gmail.com, 0009-0005-0871-0589

1. INTRODUCTION

Cities are undergoing rapid urban transformation due to densification of the population, intensive and diverse uses and users, increasing mobility, new and complex living conditions. In response cities need to create urban spaces that can respond to the emerging hybrid conditions and expectations. Hybrid spaces are defined as “contemporary spaces shaped by a dynamic process which aims to synergize the various aspects of urban design from spatial configuration and programming to utilization and management” [1].

Emerging hybrid urban space typologies can be dynamic and contested, reflecting the synergies and tensions between spatial configurations, programmes, patterns of use, and governance. Within this context, the concept of public space today is more open to new urban types such as “shared spaces or relational spaces, as well as diversified typological hybrids” [2].

Climate change represents one of the greatest challenges facing contemporary society. It manifests through rising temperatures, changing precipitation patterns, sea-level rise, and the increasing frequency and intensity of extreme weather events, affecting human health, natural resources, biodiversity, ecosystems, and numerous sectors of development. In this context, public open spaces are recognized as particularly vulnerable to climate impacts while also offering significant potential for implementing measures that mitigate these effects and enhance urban resilience [1]. This study is founded on the premise that the climate adaptation function should be integrated into the design of public spaces, enabling the emergence of new hybrid public space types that simultaneously perform multiple functions and generate benefits for both people and nature. Such hybrid public spaces are increasingly being conceptualized, planned, and implemented in practice, and a growing body of research has demonstrated their benefits [3], [4]. However, the existing literature lacks a systematic conceptualization that explicitly links the diverse domains of climate change adaptation with the specific modalities of hybridization through which these adaptive capacities are realized.

The aim of this study is to explain why and to explore how the hybridization of public open spaces can serve as a tool for climate change adaptation by establishing a clear and systematic framework for understanding the relationship between hybridization, climate change, and public open spaces.

2. METHODOLOGY

This paper uses a qualitative research approach combining conceptual analysis and case study analysis. The research was structured in two complementary stages.

In the first stage, a review of the relevant literature was conducted to examine the concepts of hybridization and public open spaces and to provide an overview of public space typologies that adopt an ecological approach to design. Particular attention was given to explaining how climate adaptation functions contribute to the emergence of new hybrid public space types.



In the second stage, five selected international examples of hybrid public spaces were analysed using a structured analytical framework. The case studies were selected because they represent implemented examples of different public space typologies addressing climate-related hazards through ecological design. Each case was analysed according to the type of public open space, the climate change hazard addressed, the climate adaptation function performed, the domain of hybridization, the spatial methods of hybridization, and the resulting environmental and social benefits. The findings were compared and discussed to identify patterns in the relationship between hybridization and climate change adaptation, as well as the benefits of applying hybridization as a strategy for adapting public open spaces to climate change.

3. HYBRIDIZATION AND PUBLIC SPACE

3.1. What is hybridization?

Hybridization is defined as a process in which separate and distinct entities or processes create a new entity or process (hybrid), which may share certain characteristics with each of its sources. Hybridization as a process is as old as history itself, but the pace of mixing accelerates and its scope expands due to major structural changes, such as new technologies or new environmental demands.

Hybridity (hybridization) has been investigated within various disciplines such as biology, genetics, racial perspective, chemistry, language and culture. In French, "bricolage" has long been a common term. Mixing, blending, fusing, and blending are other terms and nuances with longer origins than the term "hybridity." Mixing plays a role in agriculture (mixing crops), cooking (ingredients), weaving (tissues, motifs), healing (herbs, methods), art (genres, materials), fashion (styles), etc.

Hybridity in the context of architecture and urban planning is most often associated and sometimes identified with the concepts of mixed-use, flexibility and multifunctionality [2]. Contemporary hybrid development can redefine the urban form, scale and location of public spaces, as well as the ways in which public spaces relate to their surroundings, as well as the ways in which they are used, experienced and managed [1]. Urban space can become fully hybridized with other development functions. At the city level, places can be reinvented through new uses of space and interactions that people empower. The concept of hybridization, in space, is manifested in the form of high-density residential buildings, industrial urban zones, infrastructural-transit spaces, recreational green hybrids and urban voids [1]. Neighborhoods can be hybrid for several reasons: built-up density; density of population and users; concentration and diversity of functions and activities. "The hybridization of space is based on a multifunctional connection with the inner city structure and suburban areas" [6].

The concept of public spaces today is more open to new urban types, such as "common spaces or relational spaces, as well as diversified typological hybrids". Infrastructural and technological nodes are transformed into "common places" or defined as "interspaces" [2].

3.2. Forms and domains of hybridization in public space

The ambiguity of the concept of hybridization and the complexity of the concept of public space allow the concept of hybridization in the context of public spaces to be broken down into five individual domains (cultural, functional, nature/built, private/public and digital/physical).

Table 1. Domains of hybridization in public space

Domain of hybridization	Definition
Cultural	Mixing of different cultural identities, social practices and symbolic meanings in space. Hybrid urban spaces in this domain are created through the meeting of different traditions, styles, cultural narratives and ways of using space [7].
Functional	Combination of different functions and activities within the same space or structure through layered organization and interweaving of programs, increasing flexibility and intensity of use [8].
Nature / built	Integration of architectural and infrastructural elements with natural and landscape systems. Hybrid spaces are created through the merging of urban fabric with green infrastructure, landscape elements, ecological principles and natural processes [6].
Private / public	Interweaving of public and private spaces and functions, creating semi-public and transitional spaces where public and private activities coexist [2].
Digital / physical	Integration of digital technologies with physical urban space. Digital systems, communication technologies, smart infrastructure and virtual platforms influence the way space is used and perceived, creating hybrid urban environments [2].

Shaping hybrid spaces requires a departure from formal models and established typologies, as well as an assessment of the potential of spatial situations. Certain design methods that create hybrid spaces can be identified, including program layering, spatial and/or program connectivity, intersection of programs and functions through existing natural and/or infrastructural elements, combining landscape and architectural design, multidisciplinary approach and mixing of typologies. Complex forms, dispositions, hybrid internal and external connections, underground, multi-level or elevated public spaces are some examples of manifestations of hybrid public space [1].

4. CLIMATE CHANGE AND PUBLIC SPACE

4.1. The problem of public spaces in response to climate demands

The future will bring warmer and wetter winters, hotter and drier summers, rising sea levels, more flooding and other extreme weather. Because of the delayed effects from greenhouse gas emissions, we are locked into significant climate change, regardless of any emission reductions that we may secure now. Adaptation to climate change means making towns and cities more resilient. Well-designed, flexible public spaces are their best chance to adapt to these threats. Spaces that are softer, greener,



more organic and natural will store water and are critical to modifying urban temperatures [9].

Encouraging higher urban densities makes urban areas more efficient, for instance in their use of resources and the provision of public services. But it does increase pressure on green space. In particular, small-scale local spaces, which will make life in a warming city tolerable, are being permanently lost to development [10].

Green spaces with a generous planting of trees link to form a network offering cooler, cleaner air. Adaptation demands understanding how towns and cities work naturally. Urban green spaces form a natural infrastructure that is as critical to support urban life as streets, railways, drainage and sewers — and just like these, it is an infrastructure that needs investment. At the same time, this will create much more beautiful, healthier places. Good urban design should provide solutions for the management of water, temperatures and biodiversity [9].

Table 2. Climate change hazards and adaptation measures relevant to open spaces [5, 9]

Climate change hazard	Adaptation options
High temperatures	• Development of high-quality green infrastructure • Increasing the availability and use of water surfaces • Shading and orientation that reduces the influence of solar radiation • Ensuring ventilation by matching the location, orientation and morphology of buildings, green and water surfaces • Using "cold" materials for covering the ground and roofs in order to increase reflexivity
Floods	• Securing the land needed to manage flooding (<i>Fluvial floods</i> occur when rivers, lakes or streams overflow onto neighboring land, responsibilities are regional or national; <i>Pluvial floods</i> occur when extreme rainfall causes flooding independent of overflowing rivers or lakes, responsibilities are typically local) • Creation of solid barriers against flooding, when necessary • Mitigation of flooding through the adequate selection of location, organization, and space design in the new development of the settlement • Use of sustainable urban drainage and stormwater management approaches to slow runoff water and integrating it into the natural cycle • Understanding the logic and path of flooding - creating a place for water: a) using green infrastructure and recreating functional floodplains valley, b) by providing temporary spaces for retaining water in the flow extreme events, c) planning reservoirs and greening the coast in order to retain and reduce the outflow of water, d) by directing the flow flooding away from sensitive areas and by constructing secondary channels flooding
Droughts	• Creation of reservoirs in the upper and lower reaches of the river • Provision of space for rainwater treatment and water recycling • Use of urban water management approaches

	• Use of separate drainage systems • Use of plants with a low need for water, underground capacities water conservation and search for new sources of water for use in crisis periods
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4.2. New hybrid public spaces in response to climate change

The following section presents overview of different types of public spaces that use an ecological approach in design, with a special focus on their role in responding to the challenges of climate change and improving the resilience of modern cities. The new climate function encourages the development of new hybrid types of public spaces. It requires the integration of new functions and programs, such as water management. Also, it establishes new relationships between natural and built elements within public spaces, helping to mitigate overheating and prevent the formation of urban heat islands, etc.

1. Sponge Parks / Floodable Parks

What they do: absorb rainwater, cool the city and reduce the possibility of flooding.

- Lawns, wetlands and sunken fields absorb storm water
- Can be temporarily flooded without damage
- When dry, they can have other functions [11]

2. Urban Forest Plazas

What they do: reduce heat, improve air quality and boost biodiversity.

- Dense tree canopies above public squares
- Permeable substrates instead of classic paving
- Lower temperatures (often 5–10°C cooler in summer) [12]

3. Climate Cooling Spaces

What they do: mitigate the urban heat island effect.

- Earthen embankments, trees, porous rock
- Orientation of the space to catch the wind
- Bright or vegetated areas [13]

4. Biodiversity Squares

What they do: restore biodiversity within the city.

- Meadows of wild flowers instead of classic lawns
- Nesting habitats, dead wood, "hotels" for insects
- Seasonal changes are accepted as a quality, not a disadvantage [14]

Table 3. Potential climate change hazards and suitable hybrid types of open public spaces

Climate change hazard	Hybrid type of open public space
High temperatures	• Urban Forest Plazas • Climate Cooling Spaces



	Biodiversity Squares
Floods	Sponge Parks / Floodable Parks

5. HYBRIDIZATION AND CLIMATE-RESPONSIVE URBAN DESIGN

The analysis of examples of good practice in adapting public open spaces to climate change allows us to verify whether the hybridization of public open spaces in the function of adaptation can be linked to different types of public open spaces and whether hybridization in these cases is realized in different domains. In addition, through the examples, potential new types of hybrid spaces that realize climate functions, as well as multiple benefits, in addition to climate, provided by selected public open spaces, have been identified.

Table 4. Examples of hybrid public spaces and their adaptation to climate change hazards

01 Example		Climate adaptation	
 Figure 1. Water Square Benthemplein, Netherlands, https://www.urbanisten.nl/work/benthemplein	Type of open public space	Climate change hazard	Function
	Sponge / Floodable square	Floods High temperatures	Storm water storage Controlled infiltration and delayed drainage systems
Hybridization			
Domain of hybridization	Spatial methods		Benefits
Nature / Built Functional	Regeneration Integration and combination of function Program layering		Climate benefits: Preventing flooding; Increasing thermal comfort during heatwaves Other: Flexibility and multifunctionality Social cohesion and local development.

02 Example		Climate adaptation	
 Figure 2. Stork Meadow Nature Park, Denmark, https://www.archdaily.com/1021185/stork-meadow-nature-park-cf-moller-architects	Type of open public space	Climate change hazard	Function
	Climate Cooling Space / Public nature park	Floods Drought	Wastewater management - rainwater is collected in purification basins Storm surge protection

Hybridization		
Domain of hybridization	Spatial methods	Benefits
Nature/built	Intersection of programs and functions through existing natural elements	Climate benefits: Preventing flooding; Preserving the nature; Improving urban biodiversity
Functional	Spatial connectivity	Other: Creation of activity node Flexibility and multifunctionality

03 Example		Climate adaptation	
 Figure 3. Piazza Matteotti Public Gardens, Italy, https://www.archdaily.com/1024703/innovations-in-public-spaces-gardens-plazas-and-landscape-parks-of-2024	Type of open public space	Climate change hazard	Function
	Climate cooling space / Public garden	High temperatures	Addition of shade-providing trees Draining pavements Adding water surface
Hybridization			
Domain of hybridization	Spatial methods	Benefits	
Nature / built	Integration of function	Climate benefits: Urban cooling and reduction of heat island effect; Microclimate regulation; Improving urban biodiversity; Other: Flexibility and multifunctionality	
Cultural	Redefinition of meaning		

04 Example		Climate adaptation	
 Figure 4. Climate islands, Spain, https://www.simonprize.org/work2022/climate-islands-public-spaces-in-barcelonas-port-vell/sheet/	Type of open public space	Climate change hazard	Function
	Climate cooling space / Promenade	High temperatures	Water clouds (system of vapor masts with sequential activation) Pavement with a low thermal index
Hybridization			
Domain of hybridization	Spatial methods	Benefits	
Nature / built	Integration and combination of function	Climate benefits: Improving urban biodiversity; Reducing the 'heat island' effect; Lowering pollution; Other: Social cohesion and local development.	
Functional	Reshaping/Transformation		



05 Example		Climate adaptation	
 Figure 6. The Cloud Forest Plaza, China, https://worldlandscapearchitecture.com/the-cloud-forest-plaza-wuhan-china-terrain-studio/?v=3a2d7564baee	Type of open public space	Climate change hazard	Function
	Urban Forest Plaza	Floods High temperatures Drought	Stormwater collection Passive water filtration and retention systems Mist cooling systems Rain gardens and bioswales
Hybridization			
Domain of hybridization	Spatial methods	Benefits	
Nature / built	Integration of function	Climate resilience: Preventing flooding; Delayed drainage; Heat reduction; Improving urban biodiversity Other: Social cohesion and local development..	
Functional	Combination of landscape and urban design		

The selected case studies demonstrate that, in practice, emerging hybrid public spaces are primarily designed to address climate-related challenges associated with rising temperatures and flooding, whereas strategies for managing drought are considerably less represented. Flood mitigation emerges as the most prominent climate adaptation function of these new public spaces, followed by urban heat reduction and biodiversity enhancement. In addition to these climate-related benefits, multifunctionality and social inclusion represent important other benefits that arise from climate-adaptive design.

6. CONCLUSION

Given the complexity of spatial hybridization as a concept that can be interpreted and applied in various ways, this study examines it as a tool for adapting public open spaces to climate change. The analysis is based on selected case studies of public open spaces, through which the domains and spatial methods of hybridization are identified and explored in relation to their contribution to climate adaptation, particularly in mitigating high temperatures and floods while drought related adaptation measures are less evident in the selected case studies and require further research.

By deconstructing hybridization into its key domains (cultural, functional, nature–built, private–public, and digital–physical) and climate change into specific hazards (high temperatures, floods, and droughts), the research establishes a clear and systematic framework for understanding the relationship between hybridization, climate change, and public open spaces.

Through this analytical approach and the examination of diverse public spaces selected for their climate-adaptive characteristics, the study demonstrates that the hybridization of public open spaces can be associated with a variety of spatial typologies, including floodable squares, public nature parks, public gardens,

promenades, experimental ecological gardens, and urban forest plazas. Furthermore, hybridization can be realized across multiple domains, particularly the nature–built, functional, and cultural domains.

The findings also suggest that the growing need for climate adaptation is itself driving the emergence of new types of public open spaces. Beyond their environmental role, these spaces generate additional benefits, including greater flexibility and multifunctionality, stronger social cohesion and local development, and the creation of new activity nodes. Overall, the research confirms the significance of hybridization as an effective tool for climate change adaptation, highlighting its contribution to urban design and the development of more sustainable, resilient, and vibrant public open spaces.

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