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# RISING WITH THE TIDE:

## SOCIAL AND ENVIRONMENTAL PERFORMANCE OF FLOATING PUBLIC SPACE "THE CASE OF AQUAPRAÇA, BELÉM"

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# Rising with the Tide: Social and Environmental Performance of Floating Public Space

"The Case of AquaPraça, Belém"

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# ABSTRACT

Climate change increases the vulnerability of coastal, riverine and delta towns to flooding, sea level rise and other water related problems. In response, floating architecture has received increased interest as a possible adaptive technique. Existing work, however, has concentrated primarily on technical performance, engineering solutions and residential applications, with rather less emphasis being given to the social dimensions of floating public spaces. This thesis addresses this gap by assessing AquaPraça, a floating public platform developed in Belém, Brazil.

Situated in the Amazon region, and influenced by a long relationship with water, Belém offers a particularly suitable context for examining the role of floating public space in climate sensitive urban contexts. Drawing on literature from public space theory, climate-adaptive architecture, floating architecture and social acceptance research, the study proposes a conceptual framework with five interconnected dimensions: everyday public life and social interaction, collective participation and sense of belonging, environmental awareness, public acceptance of floating architecture, and accessibility and inclusiveness.

A mixed-method approach was employed, combining visual-behavioral mapping with a visitor perception survey. . Behavioral observations were evaluated using images and video recordings that documented patterns of occupation, mobility, and social engagement, while survey responses gave insight into visitors' experiences and impressions of the platform. The poll was distributed through local community, academic and institutional channels in Belém.

The results show that AquaPraça was effective as a location for public occupation, environmental interaction and interaction with water. The platform stimulated social activities, strengthened awareness of environmental issues and created generally positive impressions of floating architecture. The findings also pointed to notable difficulties between technical adaptability and social integration. Concerns regarding maintenance, accessibility, safety, and long-term usability remained significant, while increased environmental visibility did not necessarily lead to deeper environmental understanding.

The thesis argues that floating public spaces should be understood not only as adaptive infrastructures, but as socio-spatial contexts where relations between people, water and climate adaptation are experienced and negotiated. The research adds to a growing understanding of the social dimensions of floating architecture, looking at public acceptance, everyday occupation and social integration. Ultimately, the study suggests that the long-term success of floating public spaces may depend as much on their social integration as on their technical ability to adapt to environmental change.

# 1 INTRODUCTION

## FRAMING FLOATING PUBLIC SPACE IN A CLIMATE-VULNERABLE CONTEXT

Climate change is transforming the relationship between water and urban life, creating a need for adaptive public spaces that support not only environmental resilience but also social interaction and collective experience.

Climate change represents one of the largest alterations to Earth's surface throughout the twenty-first century. As described by the IPCC (2023) increasing global temperature rates, accelerating sea level increase, increased frequency of heavy rainfalls and floods etc., will be transforming urban regions along coastlines and rivers across the world. Therefore, climate change represents a structural transformation to link land, water and urban living conditions.

Research on urban resilience suggests that vulnerability is shaped not only by exposure to environmental risks, but also by the capacity of cities and communities to adapt to changing conditions (Adger, 2000). Traditionally, climate adaptation strategies have focused primarily on protective infrastructure designed to reduce environmental risk through flood barriers, drainage systems, and engineered protection measures. More recent urban studies, however, increasingly emphasize the importance of sustaining social life and public occupation under environmental stress (Meerow, Newell & Stults, 2016). Public spaces play an important role in urban life by supporting social interaction, collective visibility, informal activities, and civic participation. As discussed by theorists such as Jan Gehl and Henri Lefebvre, public environments contribute not only to circulation within cities, but also to the social production of urban life through gathering, observation, and shared occupation. Despite their social significance, discussions surrounding climate adaptation often prioritize technical and infrastructural responses while giving comparatively less attention to how environmental change may affect the quality, accessibility, and experience of public space.

1 **AQUAPRAÇA IN VENICE, 2025** PHOTO BY DSL STUDIO

Architecture is no longer merely focused upon minimizing the negative consequences of climate change. Rather, it is now focused upon discovering new methods of coping with the changes occurring due to climate change. One method is utilizing “floating” architecture. Floating architecture may provide an opportunity for communities located in flood zones or experiencing flooding to create habitable structures in addition to providing opportunities for communities located near large bodies of water. As discussed by Olthuis and Keuning (2010), floating architecture introduces alternative ways of inhabiting flood-prone and waterfront environments by allowing structures to rise and fall with changing water levels. Busse et al. (2022) further describe floating urbanization as an emerging adaptive strategy capable of increasing resilience within vulnerable waterfront regions. These structures utilize buoyant systems that enable them to float above water surfaces when flooded while returning to stable locations when waters recede. Much of the existing research related to floating architecture focuses on technical performance, environmental engineering, and housing solutions ; however little research exists on the social and experiential dimensions of floating public spaces.

This thesis investigates AquaPraça as a case study through which to examine the relationship between floating architecture, public occupation, and environmental experience. The research explores how floating public spaces may contribute to climate adaptation not only through their physical relationship with water, but also through their influence on public life, environmental awareness, and everyday urban experience. Through behavioral mapping, spatial analysis, and survey-based evaluation, the study examines the social potentials and limitations of floating public space within climate-vulnerable urban contexts.

Climate adaptation extends beyond flood protection, requiring new relationships between water, public space, and urban life that can respond to increasing environmental uncertainty.

## 1.1
# RESEARCH BACKGROUND

### URBAN VULNERABILITY AND WATER-SENSITIVE CITIES

Urban vulnerability to climate change is driven by the relationship between environmental hazards and spatial and social inequalities (Adger, 2000). The coastal and deltaic cities are most susceptible to compound risk as a result of sea level rise, tide fluctuations, and heavy rainfall (IPCC, 2023). These conditions increasingly challenge the stability of urban infrastructure, public space, and everyday urban life.

The majority of the Global South are undergoing fast urban expansion and have undeveloped infrastructures, which makes them more vulnerable (UN-Habitat, 2022). Poor drainage, informal urbanization and lack of environmental infrastructure often enhance vulnerability to flood and environmental stress, especially in vulnerable shoreline and low-lying zones. As a result, climate adaptation is increasingly recognized not only as a technological difficulty but also as a spatial and social issue of the functioning of the city and the preservation of public life under changing climatic conditions.

Recent discussions on water-sensitive urbanism point to the need for a reconsideration of the city-water relationship. Water-sensitive techniques do not see water as a threat to be separated through constructed barriers and defensive infrastructure, but rather as an opportunity for adaptable strategies that can embrace environmental conditions as part of urban life and public space (Shannon, 2013). These approaches increasingly emphasize water as an active spatial condition that shapes urban occupation, environmental perception, and social experience.

In this topic, public spaces are especially relevant as they sustain social contact, communal visibility, informal trading and ordinary urban activity. But public spaces located in vulnerable waterfront areas are becoming increasingly prone to flooding, environmental instability, and changing climate conditions. But research on climate adaptation has so far been preoccupied with technical infrastructures and large-scale environmental management. The significance of public space in climate-adaptive urbanism has been relatively neglected.

2 **BANGKOK, THAILAND, 2011** BY PAULA BRONSTEIN/ GETTY IMAGES

## 1.2
## PROBLEM STATEMENT

THE SOCIAL GAP IN CLIMATE-ADAPTIVE DESIGN

Places of the city are not simply open areas. They are the areas where people do things together. According to Klinenberg (2018), these are called “places of social infrastructure,” because they aid in establishing confidence among residents, stimulate communication, and increase a resident’s ability to survive through adversity. Likewise, Gehl (2011) indicates that how enjoyable and easily accessible public spaces are; has an influence upon how many people will use them to engage in various social and recreational activities that enhance the quality of life within the city.

The impact of climate change on how individuals utilize public spaces includes limiting accessibility, comfort and safety. Flooding, tidal variation, and other severe weather events cause instability of these types of public spaces, thereby reducing opportunities for social interaction. Residents will continue to perform necessary functions during extreme weather conditions; however, social and discretionary activities are more susceptible to disruptions due to the effects of climate change (Gehl, 2011).

While constructing defensive measures such as drainage systems and flood protection walls are essential to protecting communities from flooding, most current climate adaptation planning approaches fail to recognize the potential for public spaces to also adapt (Meerow et al., 2016). Resilience theories emphasize the need for flexibility and change; however, very little research exists regarding the ability for public spaces to undergo adaptive physical transformations, while maintaining support for social life.

This gap is particularly relevant to climate vulnerable cities located in the Global South, where public space serves as an important mechanism for informal economies, cultural practices and social organizations. Thus, the vulnerability of public space extends far beyond physical exposure, to include broad social and political implications.

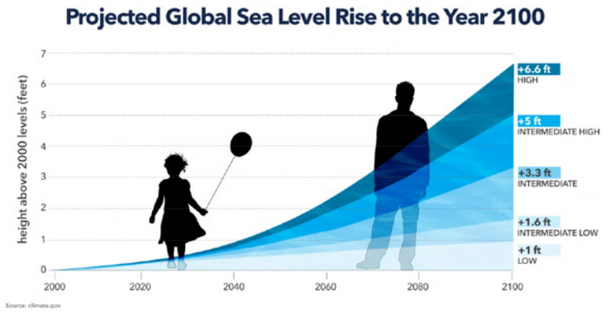
Adapting to climate change through the design of floating spaces offers alternative solutions to those previously used by attempting to fight the water. Floating designs allow the structure to float with rising/falling water levels, thus creating new perspectives on the concepts of land and water

While the technical feasibility of floating architecture is well documented, its role as a social environment and catalyst for environmental awareness remains largely unexplored.

(Olthuis & Keuning, 2010). However, despite extensive study into the technical feasibility of floating public spaces, relatively little research is available on the social implications of utilizing floating public spaces.

Although floating architecture is receiving increasing attention in discussions related to climate adaptation, virtually all prior studies have focused on engineering, regulatory and housing issues (Olthuis & Keuning, 2010). In contrast, there is a significant knowledge deficit regarding floating public spaces as functional social environments, particularly in climate vulnerable cities in the Global South. For example, in cities such as Belém, where water poses both a threat to environmental sustainability and a source of cultural identity, successful adaptation requires not only ensuring the resilience of infrastructure, but also ensuring that public life continues uninterrupted. Unless researchers conduct a systematic assessment of user perceptions of floating public spaces, interaction patterns and social acceptance of these spaces; floating public platforms risk continuing as either conceptual or symbolic adaptations of public space; rather than functioning as integrated urban infrastructures.

Additionally, utilizing floating architecture as a means to create awareness of environmental issues may also contribute to altering users’ perceptions of their relationship with water in the city. Although previous research has indicated some potential benefits of this type of experience; limited research exists to demonstrate whether experiences gained from observing changing environmental conditions will lead to increased environmental awareness or understanding of climate adaptation.




3 FUTURE SEA LEVELS THROUGH 2100, BASED ON THE FIVE FUTURE PATHWAYS DESCRIBED IN THE NOAA’S 2022 REPORT, GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES. THESE PATHWAYS DIFFER DEPENDING ON FUTURE RATES OF GREENHOUSE GAS EMISSIONS AND GLACIER AND ICE SHEET LOSS. THE “LOW” SCENARIO IS BASED ON THE WORLD SHARPLY LOWERING EMISSIONS, WHILE THE “INTERMEDIATE” AND HIGHER SCENARIOS ARE ASSOCIATED WITH HIGHER GLOBAL EMISSIONS. HUMAN FIGURES ARE ADDED TO SHOW THE RELATIVE HEIGHT OF SEA LEVEL RISE. CREDIT:GRAPHIC BY NRDC. INFORMATION FROM CLIMATE.GOV, ADAPTED FROM SWEET ET AL., 2022.

**4 AQUAPRAÇA PICTURE IN BELEM, 2025** PHOTO BY LEONARDO FINOTTI

# 1.3
# RESEARCH AIM & QUESTIONS

## EVALUATING AQUAPRAÇA

### 1.3.1 RESEARCH AIM

The research will examine how floating public spaces could allow cities to adapt to climate change using AquaPraça in Belém as an example. In addition, the research will analyze whether floating public spaces would increase social cohesion, promote community engagement, improve environmental awareness, and create opportunities for climate adaptation for cities that experience water-related problems.

In what ways do floating public spaces such as AquaPraça foster greater social connection and community engagement in Belém while supporting climate adaptation and raising environmental awareness?

### 1.3.2 RESEARCH QUESTIONS

- How does AquaPraça, as a floating public space, address the relationship between public occupation, environmental responsiveness, and social experience?

-How are climate change, flooding, and rising water levels affecting public space conditions in Belém?

- What does AquaPraça reveal about the potential and limitations of floating public spaces within climate-sensitive urban contexts such as Belém?

## 1.4
# RESEARCH OBJECTIVES

ASSESSMENT FRAMEWORK

Existing literature on floating architecture has largely focused on technical innovation, environmental engineering, and climate adaptation strategies, while giving comparatively limited attention to the social and experiential dimensions of floating public space. In addition, few studies have examined how floating architecture is publicly perceived and socially occupied within climate-vulnerable urban contexts such as Belém. This research therefore aims to investigate AquaPraça not only as a floating structure, but as a socially experienced public environment in which environmental awareness, public occupation, and climate adaptation intersect.

In order to address these gaps and respond to the research questions, the study pursues the following objectives:

- To examine how AquaPraça functions as a floating public space through patterns of public occupation, social interaction, and environmental engagement.

- To investigate how floating public architecture is perceived and experienced by users within the environmental and cultural context of Belém.

- To critically evaluate the potentials and limitations of floating public spaces in contributing to climate-adaptive urban resilience.



## 1.5
# THESIS STRUCTURE

STUDY ORGANIZATION

This thesis contains seven chapters.

Chapter 1 describes the research background, defines the problem statement and states the aims, questions, and objectives of this research. This chapter sets out both the theoretical and methodological foundations of this study.

Chapter 2 reviews all pertinent literature related to climate change effects on public spaces and their vulnerabilities, floating architecture as an adaptive measure, and social performance and acceptance of public spaces. This chapter forms the basis of the theoretical framework which guides the evaluation of the case study.

Chapter 3 analyzes the environmental, urban, and spatial-social context of Belém. The analysis includes factors such as climatic conditions, behavior around water, relationships between public space and water, and situates the case study within a broader urban vulnerability framework.

Chapter 4 discusses the methodology used in this research, including case studies, surveys, indicator measures, visual-behavioral maps, and data analysis techniques.

Chapter 5 reports on the major findings from the study of AquaPraça. The results relate to social interaction, community involvement, environmental awareness, acceptance by the public and accessibilty.

Chapter 6 compares and contrasts the findings with those based on the conceptual framework and research questions; evaluates the potential of floating public spaces to function socially and adaptively; and suggests implications for climate-adaptive urban design in Belém and similar contexts.

Chapter 7 summarizes the principal conclusions of this study; highlights its theoretical and practical significance; and identifies avenues for further research.

# 2

# LITERATURE REVIEW

PUBLIC SPACE, CLIMATE ADAPTATION, FLOATING ARCHITECTURE, AND SOCIAL ACCEPTANCE

Climate adaptation is not only a technical challenge but a social and spatial one, requiring new frameworks that connect water, public space, and everyday urban life.

The literature reviewed shows that climate change is changing our way of thinking and planning in terms of cities. We can no longer view cities as static, however rather as a dynamic system driven by changing water regimes and weather events and various environmental hazards. Therefore adaptation is becoming increasingly prominent; moving away from simply reducing emissions to develop methods for cities to be adaptable to the impacts of climate change.

In recent years there has been increasing interest in the concept of urban resilience, specifically the idea that cities should be viewed as complex systems comprised of interconnected physical, ecological and social network structures (Meerow et al., 2016; Adger, 2000). Resilience involves flexibility and adaptability within a complex system rather than attempting to manage the environment. The focus of adaptation efforts, particularly those related to water sensitive cities, is now towards embracing or working with water regimes rather than resisting them.

Although adaptation is increasingly recognized across sectors, much of the existing research remains focused on the development and implementation of structural and infrastructural measures to reduce risk, such as levees, flood barriers, and drainage systems. While these interventions play an important role in reducing flood exposure, they often conceptualize water as a threat to be excluded from urban environments rather than as an integral component of urban life. Consequently, the social and experiential implications of climate adaptation within everyday public space remain comparatively underexplored (Nath, 2024; Zhou et al., 2024).

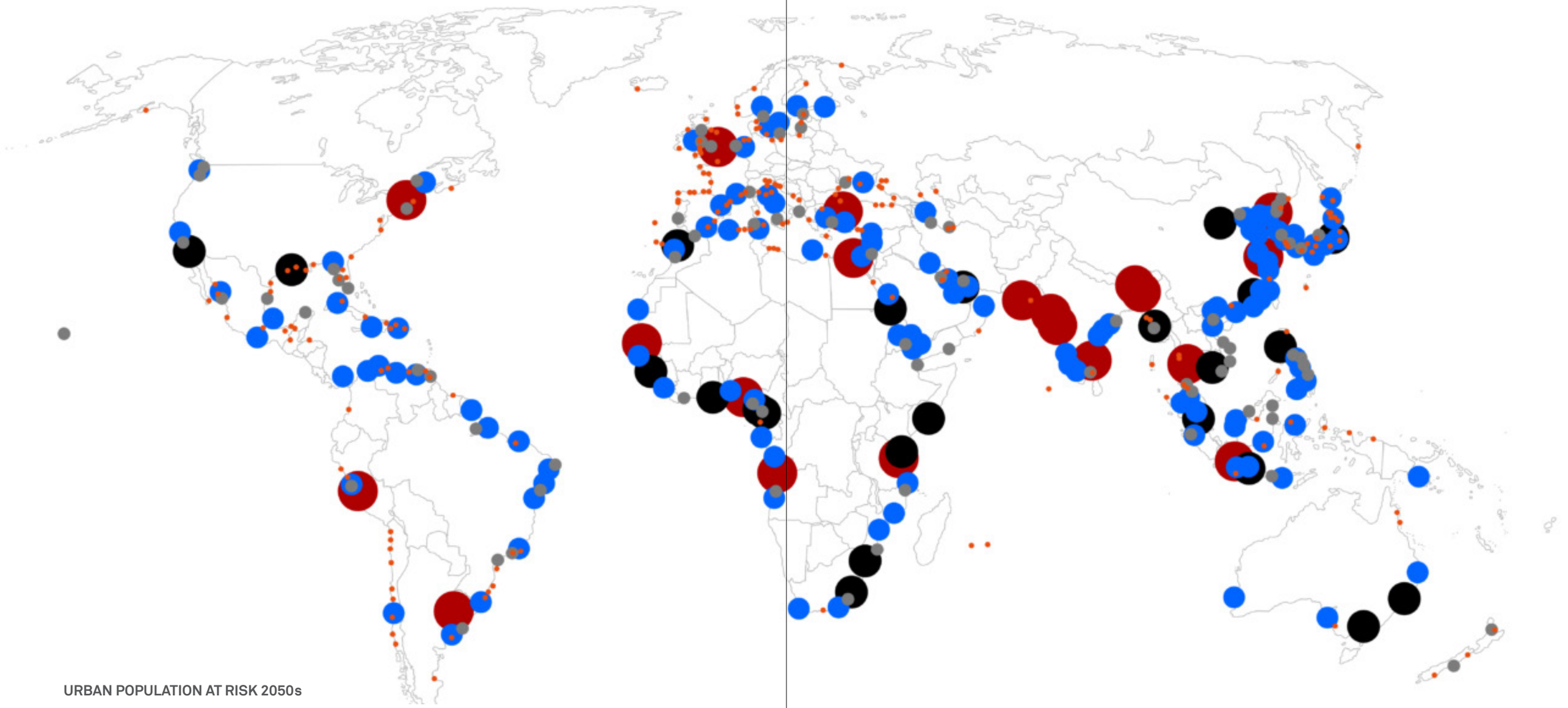
The future of climate-adaptive urbanism lies not only in protecting cities from water, but in redefining how people live, interact, and engage with changing environments.

As Gehl (2011), Whyte (1980), and Carmona et al. (2010) demonstrate, the design and availability of public space influence how people interact socially, participate in civic life, and engage with their communities. Klinenberg (2018) further expands on this role through the concept of social infrastructure, arguing that public spaces foster trust, visibility, and collective resilience. Despite their importance, these social dimensions are often overlooked in climate adaptation research, which has traditionally focused on technological and infrastructural solutions to environmental risk (Adger et al., 2005; Nath, 2024).

In addition to being technical, adaptation is also social, reflecting the perceptions and experiences of people who encounter changes. There is considerable relevant research on how individuals adopt new concepts or ideas, and how they interact with their environments. Yet, few of these ideas have been applied in studying floating public spaces. Specifically, while there have been some investigations into adaptive architecture, there have been no extensive examinations of the relationships between adaptive architecture, social interaction and environmental awareness. (Rombach et al., 2026)

This Chapter attempts to address this void by synthesizing **four bodies of research: public space theory, climate-adaptive architecture, floating architecture and studies on social acceptance.** Through integrating these four theoretical frameworks, it develops a conceptual framework for examining floating public spaces as a social and spatial strategy for climate adaptation.

5 PATRICK LYNCH. **"J. MAYER H. FILLS TIMES SQUARE WITH X-SHAPED LOUNGE CHAIRS"** 07 SEP 2016. ARCHDAILY.



URBAN POPULATION AT RISK 2050s

10,000,000 +

5,000,001 - 10,000,000

1,000,001 - 5,000,000

500,001 - 1,000,000

100,000 - 500,000

6 **CITIES A RISK FROM SEA LEVEL RISE OF 0.5 METRES BY 2050S** SOURCE: C40. CITIES PROJECTED TO EXPERIENCE AT LEAST 0.5 METRES OF SEA LEVEL RISE BY THE 2050S UNDER RCP8.5.

# 2.1
# PUBLIC SPACE AND SOCIAL EXPERIENCE

Historically, public space has been viewed almost solely through the lens of physical locations, including streets, squares, and parks (Carmona et al., 2010). Contemporary urban theories tend to see public space as having a relationship with social connections and meanings. (Qi, J., Mazumdar, S. & Vasconcelos, A.C., 2024) Lefebvre's (1991) concept of 'the production of space', shows that both social relations, political structures, and power determine how our environments develop; and that, therefore, the physical structure of public spaces does not determine their character or function.

Drawing upon Lefebvre's work, Carmona et al. (2010) expand this perspective to include factors such as accessibility, inclusiveness, safety and how diverse ways in which people utilise public spaces. These characteristics illustrate that effective public spaces require not only design but also provide the basis for feelings of identity and shared responsibilities. Thus, public space serves as a socio-spatial infrastructure where physical layout and social life are mutually connected. (Qi et al., 2024)

Much urban design research points out how public spaces affect everyday social interactions. Gehl (2011) identifies three kinds of uses of public space: necessary, optional, and social. Necessary uses occur even in less-than-ideal conditions, whereas optional and social uses depend heavily on the quality and amenity of the space. The latter two are important to create vibrant cities. Whyte's (1980) observational studies added to Gehl's typology by illustrating how minor features of a space e.g., seating, edge treatments, microclimate, affect usage and interaction. Whyte's work demonstrates that socialness in public depends on design and environmental conditions. Together, these studies suggest that the social vitality of public space is shaped not only by social behavior, but also by environmental and spatial conditions.

Later research  continues this line of thought by conceptualizing public space as social infrastructure. Klinenberg (2018) suggests that meeting places help foster confidence, social bonds, and group cohesion. His view aligns with resilience theory, which highlights the role that social networks play in helping communities cope with, and recover from,



7 **LIFE BETWEEN BUILDINGS, JAN GEHL**

Greatly simplified, outdoor activities in public spaces can be divided into three categories, each of which places very different demands on the physical environment: **necessary activities, optional activities, and social activities.**

disturbances (Meerow et al., 2016). Everyday social interaction therefore represents a critical mechanism through which public spaces contribute to urban resilience and collective life.

At the same time environmental justice literature emphasizes that exposures to environmental hazards are dispersed unevenly across urban populations (Adger, 2000). Those living in environmentally vulnerable neighborhoods have limited access to resources that allow them to adjust to changing circumstances (Tuhkanen et al., 2022). In these contexts, public spaces frequently perform multiple roles simultaneously by supporting commerce, informal economies, social interaction, and collective organization. (Finn & Cobbinah, 2022) Consequently, disruptions caused by flooding, extreme weather, or environmental instability may affect not only physical infrastructure, but also the social systems and everyday practices that depend upon these spaces. When these spaces are disrupted due to climate-related distresses it may negatively affect those who utilize the space. Not only are public spaces “nice” to have but also fundamental components of city operations. They support informal workers. They assist people in interacting with one another. When public spaces are lost or damaged it impacts peoples’ livelihoods and their ability to collectively act as a community.

Thus public spaces should be recognized as a fundamental component of urban society rather than mere desirable amenities. Ignoring social factors in adaptation planning may overlook significant vulnerabilities. Adaptation planning needs to take into consideration how public spaces promote mutual support and cooperation.If adaptation planning focuses primarily on technical or structural adaptations they may fail to account for the social dimension of vulnerability. As resilience theory suggests, maintaining the continuity of public space occupation, interaction, and collective activity is essential for equitable climate adaptation (Meerow et al., 2016).

This gap becomes particularly important when considering waterfront and flood-prone environments, where environmental instability directly affects patterns of occupation and use. Adaptable public spaces capable of responding dynamically to environmental conditions may therefore become increasingly relevant within climate-vulnerable contexts. Emerging approaches, including floating and amphibious environments, demonstrate new forms of spatial adaptation that can accommodate environmental change while maintaining public occupation and functionality (Busse et al., 2022; Huebner, 2025). Such approaches begin to bridge the gap between traditional assumptions of spatial stability and the environmental uncertainty increasingly shaping contemporary public life.

8 **THE MARKET AT BELÉM IN PARÁ STATE, BRAZIL -** LUCINDA ELLIOTT 2020

## 2.2
# CLIMATE ADAPTATION AND ADAPTIVE ARCHITECTURE

The most recent data available from the IPCC (2023) shows that climate change is an active factor in shaping how cities operate. Cities experience higher risks due to the large number of residents and the extensive amount of built infrastructure which is why there is need for both sustainable and resilient design practices when designing buildings and public environments.

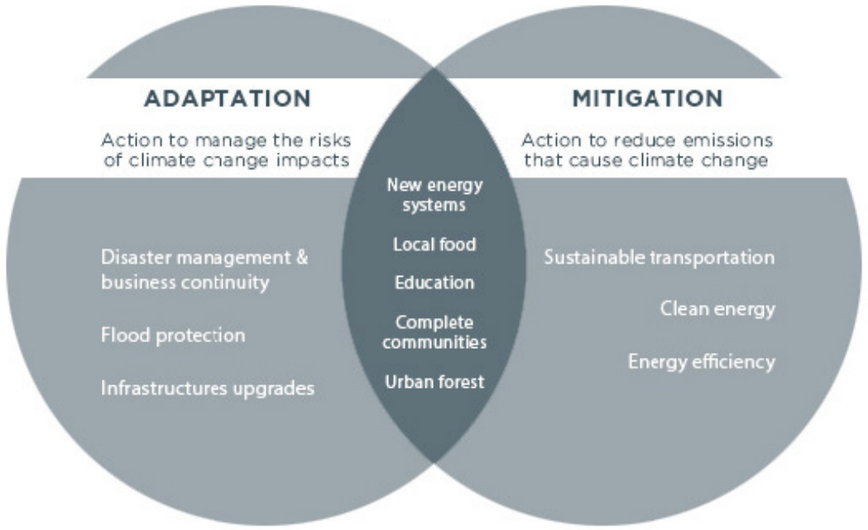
Architectural approaches to environmental issues have historically focused primarily on sustainability through strategies such as energy-efficient building envelopes, passive solar orientation, renewable energy generation, and environmentally conscious material selection (McDonough & Braungart, 2002). However, the increasing frequency and severity of climate-related disturbances demonstrate that many earlier approaches focused mainly on reducing the causes of climate change rather than addressing how built environments can continue functioning under changing environmental conditions.

Urban environments operate through interconnected environmental, social, and infrastructural systems that are increasingly vulnerable to disruption. Consequently, climate adaptation is becoming increasingly important within architectural discourse. Adaptation refers to adjusting human and environmental systems to either existing or anticipated climate conditions to decrease vulnerability and enhance resilience (Intergovernmental Panel on Climate Change [IPCC] 2023). Architecturally, this requires redefining traditional notions of stability, permanence, and control. Rather than attempting to protect against the variable effects of environmental changes, Nijhuis and de Vries (2019) propose that design should engage with the variability of environmental processes.

The challenge of climate change is no longer only reducing impacts, but ensuring that cities, buildings, and public spaces can continue functioning under uncertain future conditions.

This shift has contributed to a broader transition from sustainability toward climate resilience. While mitigation strategies primarily seek to reduce the magnitude of climate change, adaptation focuses on modifying built environments to respond to current and future environmental conditions (Boulanger, 2023). As Adger et al. (2005) argue, effective climate response requires engagement with both environmental and social dimensions across multiple scales. Coastal flooding, sea level rise, and increasing environmental uncertainty illustrate that reducing emissions alone is insufficient; architectural approaches must also address ongoing environmental variability and future climatic risks.

9 **BUILDING CLIMATERESILIENCESANGSANGUAN, S. (2020,JANUARY 10).** BUILDINGCLIMATE RESILIENCE. PINTEREST.RETRIEVED DECEMBER1, 2023, FROMHTTPS://IN.PINTEREST.COM/



Adaptive design extends beyond technical performance, linking environmental resilience with the social and spatial conditions that sustain urban life.

Recent adaptive design approaches reflect a broader transition from mitigation toward adaptation. Emerging strategies include water-sensitive urban design, floodable landscapes, amphibious and floating structures, and other spatial responses that accommodate rather than resist environmental forces (Busse et al., 2022; Huebner, 2025). Additional adaptation measures include elevating buildings in flood-prone areas, integrating green and blue infrastructure to manage stormwater and reduce urban heat island effects, developing flexible building systems that can be modified over time, and incorporating passive climate-responsive features such as shading devices, natural ventilation, and thermal mass to improve thermal comfort under changing climatic conditions (Graça et al., 2022; Rydborg et al., 2020; Yao et al., 2021).

The focus of some of these design alternatives represents a larger paradigm shift in thinking - from pursuing stability to embracing change; from attempting to control nature to responding to its impact; and from merely mitigating the impact of nature to coexisting with it. (Rydborg et al., 2020 pgs 113-130) The previous paradigm utilized barriers or drains as primary defenses against nature. However, adaptive design typically utilizes a combination of man-made and natural design components.

With the emergence of this new paradigm of thinking, architecture is viewed as being connected to a dynamic environment. Rather than simply being static objects, buildings and public spaces are adaptable, able to change as the climate and society evolve (Aigwi et al., 2023). In this sense, architecture is increasingly expected to function not only as shelter or infrastructure, but also as a facilitator of climate resilience and environmental adaptation (Ma & Ren, 2025).

Recent scholarship additionally emphasizes that climate adaptation involves social and spatial dimensions in addition to technical performance. Nath (2024) states that adaptation strategies have historically focused on technical and infrastructural solutions to climate change, but recent research has shown how climate change affects everyday urban life by altering mobility, accessibility and the ways people interact with one another.





The built environment operates as an integrated system where the physical and social components of the built environment operate together. In terms of public spaces, they provide the foundation upon which collective life is constructed, social cohesion is developed, and cultural identity is expressed. (Low et al. 2005). When climate-related disasters impact public spaces, the effects go far beyond just damage to property to alter social connections and the overall urban experience. (Friesenecker et al. 2025).

10 FLOOD BARRIERS, IRONBRIDGE GORGE

11 **(2024). RE-GREEN NORTH KENSINGTON PROJECT FROM,LONDON** - LUKE O'DONOVAN

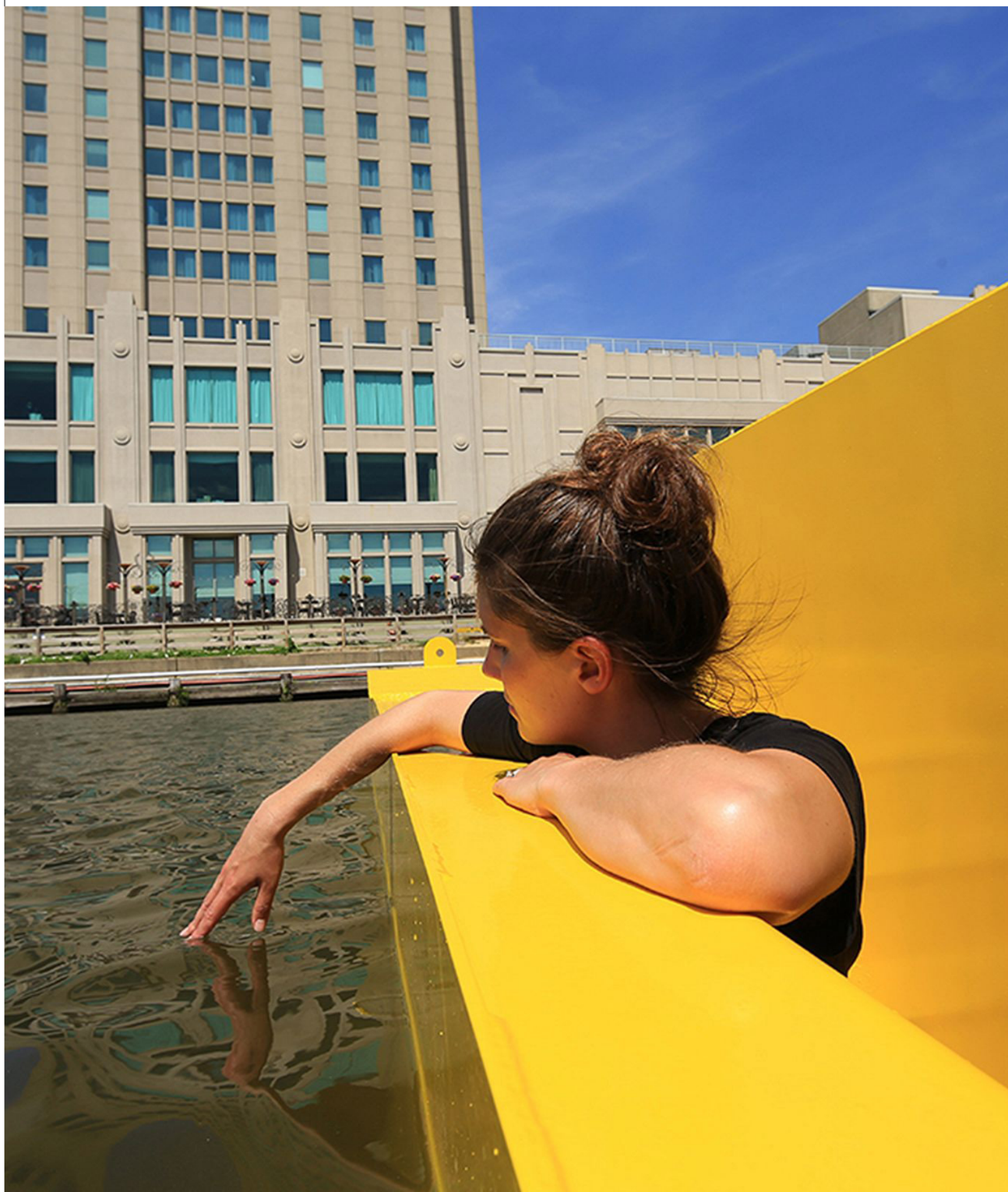
Architecture can transform environmental processes into lived experiences, making climate change perceptible through everyday interaction with space.

Adaptation therefore extends beyond technical protection toward broader socio-spatial transformation. Perceptions of risk, collective behavior, and environmental awareness influence how people occupy and experience adaptive environments (Adger, 2000). As Gómez-Redondo et al. (2024) suggest, successful adaptive environments depend upon accessibility, continuity of social interaction, flexibility of use, and the ability to maintain public life under changing environmental conditions. Spatial adaptation must therefore be evaluated not only according to environmental performance, but also according to its social consequences and ability to sustain meaningful public occupation.

Architecture also plays an important role in shaping environmental awareness. Rather than functioning solely as physical enclosure, architecture influences how environmental conditions are perceived and experienced through bodily and sensory interaction (Pallasmaa, 2005). Climate-related risks are often understood most strongly through direct experience rather than abstract information (Weber, 2006). Architecture can make environmental processes perceptible through embodied and sensory interaction, thereby increasing awareness of climatic conditions and their impacts (Pallasmaa, 2005).

This is consistent with Pallasmaa's (2005) understanding that architectural experiences are primarily tactile. Users do not simply observe space visually; therefore, when users interact with their surroundings, they form a physical connection with those surroundings through movement, materiality, sound, atmosphere, and environmental exposure. Public spaces in particular provide opportunities for users to observe environmental processes directly through prolonged occupation, interaction, and collective experience (Gehl, 2011). Environmental changes such as fluctuations in water levels, ecological cycles, and climatic variability therefore become part of the spatial experience itself (Díaz-Pinzón et al., 2025).

Within this context, adaptive architecture increasingly seeks not only to respond to environmental change technically, but also to make environmental conditions socially visible and experientially accessible. Floating architecture represents one example of this shift by placing users in direct proximity to environmental variability through movement, buoyancy, and changing relationships with water. In this sense, adaptive environments can simultaneously function as climate-responsive structures and as spaces through which environmental change becomes publicly experienced and collectively understood.



13 (2025). FLOATLAB, HÖWELER + YOON ARCHITECTURE

## 2.3
## FLOATING ARCHITECTURE AS AN ADAPTIVE STRATEGY

Floating architecture reframes water as a condition to inhabit rather than resist, creating new possibilities for climate adaptation, public occupation, and environmental experience.

Rising sea levels, increased frequency of flooding events, and unsteady water cycles make the traditional land-based model of developing urban areas difficult to continue. In response, Architects and Urban Planners are exploring alternative approaches that allow built environments to adapt to water rather than resist it. Floating architecture represents one of these emerging approaches. Olthuis and Keuning (2010) define floating architecture as structures that remain buoyant on the surface of water and stabilize themselves using anchoring devices. Compared to traditional buildings that rely on a fixed foundation, floating structures can move vertically in response to changes in the level of the water. Because of this feature, floating structures can maintain their functionality under changing conditions such as tidal fluctuations, seasonal flooding, and long term increases in sea level.

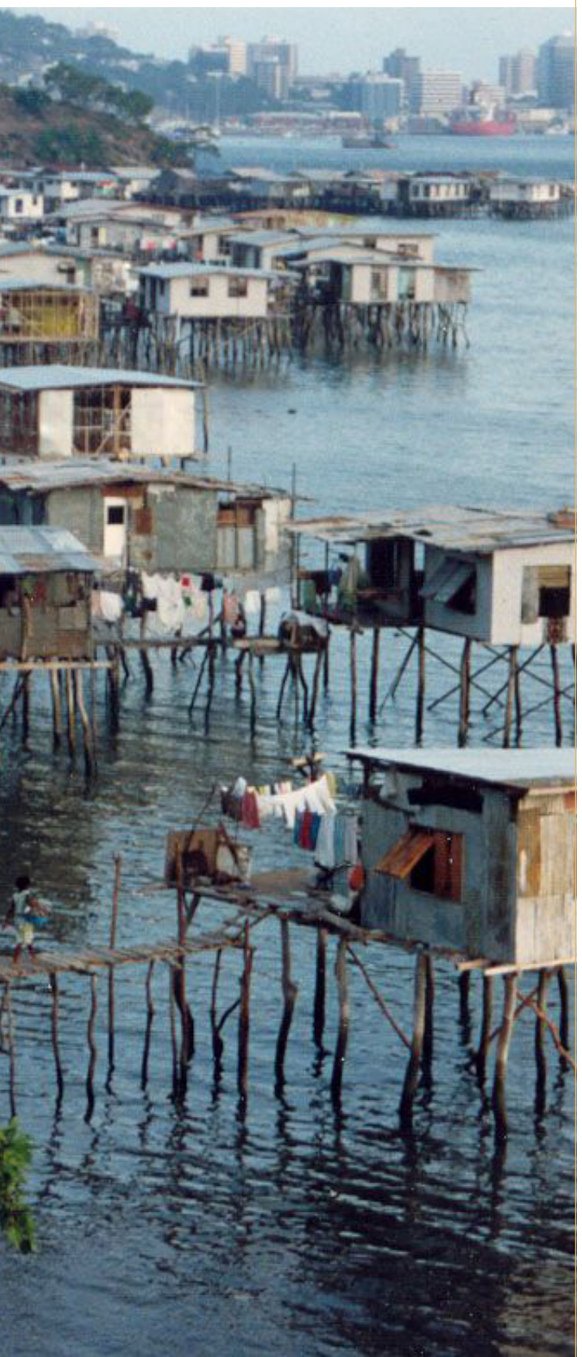
While floating architecture may seem like a recent innovation, Huebner (2025) states that there are long standing vernacular practices of architectural development that have occurred in regions that are sensitive to hydrological variations such as Southeast Asia, the Amazon Basin and Lake Titicaca. The historical examples from these regions demonstrate that architecture can develop directly in response to environmental processes instead of attempting to control environmental processes through rigidly structured infrastructure. However, most modern cities have been developed with a focus on land. Therefore, the idea of developing cities on land was based on the need for stability and control over natural systems. In addition, when the twentieth-century came to an end, water-based communities were generally displaced by land developments due to the notion that cities need firm ground. Grydehøj (2015 pgs. 96-117) discusses how today's climate issues are causing individuals to question previous notions of land-based urban living and consider alternatives based on urban living on water once again.

Advances in engineering and construction technologies have further expanded the possibilities of floating architecture through buoyant platforms, modular systems, and improved anchoring technologies capable of supporting residential units, public facilities, and infrastructure on water surfaces (Vilain, 2019). In contrast to conventional flood-protection strategies based primarily on resistance and separation, floating architecture operates through adaptation and accommodation. Rather than preventing environmental variability, floating environments attempt to coexist with changing water conditions while maintaining functionality and occupation.

Even though there is a growing amount of interest in floating architecture, most of the research related to floating architecture continues to focus on engineering, rule-making, and other technical aspects of floating architecture. Most research concerning floating architecture examines structural integrity; material selection; and the way that the structure fits into existing city systems. Conversely, very little research exists examining how people use or inhabit floating spaces. (Lin et al., 2019, pg. 883)

15 KAMPONG AYER IN BRUNEI

16 STILT VILLAGE OF HANUABADA IN PORT MORESBY, PAPUA NEW GUINEA



This gap becomes particularly visible in relation to floating public space. While research on floating housing and adaptive infrastructure has expanded considerably, limited literature examines how floating public environments support social interaction, accessibility, collective occupation, and environmental experience within everyday urban life (Lin et al., 2019, p. 884). Floating architecture is therefore often approached primarily as a technical response to environmental hazards while questions related to public perception, social use, and community engagement remain comparatively underexplored (Li et al., 2025).

Within this context, floating public space represents an important intersection between climate adaptation and public life. Civic environments located directly on water surfaces create new forms of spatial occupation that challenge conventional assumptions regarding accessibility, environmental interaction, and relationships between land and water. Rather than functioning solely as adaptive infrastructure, floating public spaces also introduce new environmental experiences capable of shaping how users perceive and engage with climate variability. However, despite growing experimentation in practice, there remains relatively limited theoretical and empirical research examining how floating public spaces function socially and experientially (Rombach et al., 2026, pp. 568–590).

### 2.3.1 TYPOLOGIES OF FLOATING ARCHITECTURE

Floating architecture encompasses various typologies that differ in terms of their relationships with water; degrees of permanency; and intended uses. While all floating structures share a basic design element of buoyancy; their configurations, technical systems and modes of operation vary greatly.

Residential floating homes represent one of the more well-established applications. These structures are permanently situated on water surfaces and are generally linked to the urban infrastructure network (utilities, transportation systems, etc.). Examples such as Amsterdam's IJburg district exemplify how residential floating environments can be integrated into current urban settings while ensuring a comfortable quality of life; accessibility; and urban connection (de Graaf, 2009). Such examples also demonstrate the possibility for long-term replacement options for traditional land-based housing in water-sensitive zones.

Between land and water sit amphibious buildings. According to English and Watson (2015); these buildings rest on dry land most of the time but float when flooded; remaining anchored in place as water levels rise. An example of an area where amphibious buildings would work well would be locations subject to periodic flooding; allowing residents to maintain their standard layouts while providing added flexibility. Also, amphibian systems tend to be seen as more cost-effective and better suited to localized needs versus permanent floating homes. (Ameh et al., 2024)

17 FLOATING NEIGHBORHOOD IN AMSTERDAM, THE NETHERLANDS

In addition to residential applications; floating public infrastructure has become a significant application category. This includes: floating parks; cultural platforms; recreational spaces; and civic environments designed to support shared/collective use. Unlike housing which supports long-term habitation; these spaces support temporary shared-use experiences with water-based environments; enabling cities to expand public life onto water surfaces while maintaining accessibility and flexibility. (Garkhel & Verma, 2020)

18 (2018) FLOATING ISLAND PARKS- MARSHALL BLECHER AND STUDIO

### 2.3.2 FLOATING PUBLIC SPACE AND ENVIRONMENTAL INTERACTION

Floating public spaces extend many of the functions traditionally associated with land-based public environments, including gathering, recreation, observation, and cultural activity, onto water surfaces. In doing so, they introduce new spatial relationships between architecture, environmental conditions, and public occupation. Water no longer functions merely as surrounding scenery or environmental threat, but becomes part of the spatial and sensory experience itself.

Unlike many forms of adaptive infrastructure that remain largely invisible within everyday life, floating public spaces place users in direct proximity to environmental variability. Changes in water level, buoyant movement, and physical interaction with waterfront conditions become part of the public experience of space. Consequently, floating environments have the capacity not only to respond to environmental change technically, but also to make climate variability publicly visible and experientially accessible.

At the same time, floating public spaces are required to function simultaneously as adaptive systems and as usable public environments. Beyond responding to changing environmental conditions, they must also support accessibility, continuity of use, social interaction, and public occupation comparable to land-based public spaces. These dual expectations create important spatial and social challenges regarding comfort, usability, safety, and long-term integration into everyday urban life.

Although floating public spaces remain relatively underrepresented within the academic literature, several experimental projects demonstrate both the possibilities and limitations of this emerging typology. The Floating Pavilion in Rotterdam illustrates the use of floating platforms for exhibitions, public events, and climate adaptation initiatives, while simultaneously testing new approaches to water-based urban development (PublicDomain Architects, 2014). Similarly, Copenhagen's harbour baths reconnect recreational public life with the waterfront by transforming formerly underutilized harbour areas into active public spaces. The Makoko Floating School in Lagos further demonstrates how floating architecture can respond to environmental vulnerability in flood-prone settlements, while also revealing challenges related to implementation, maintenance, and socio-economic inequality (Riise & Adeyemi, 2015).

While these projects differ significantly in scale, context, and function, they collectively illustrate the growing potential of floating public environments to combine environmental adaptation with public occupation and social use. At the same time, they also reveal the experimental and still-evolving nature of floating public space within contemporary architectural practice. Questions regarding accessibility, long-term occupation, public acceptance, and integration into everyday urban life therefore remain central to evaluating floating public architecture as more than a purely technical adaptive strategy.

The value of floating public space lies not only in its technical adaptability, but in its ability to connect climate resilience with everyday public experience.

19 **MFS IIIX3 – MINJIANG FLOATING SYSTEM. CHENGDU, CHINA 2018.** MFS IIIX3 IS THE FOURTH PROTOTYPE AND THIRD ITERATION OF THE MAKOKO FLOATING SCHOOL

20 **THE FLOATING PAVILION IN ROTTERDAM,** DESIGNED BY DELTASYNC AND PUBLICDOMAIN ARCHITECTS,

## 2.4
## SOCIAL ACCEPTANCE AND PUBLIC EXPERIENCE

The acceptance of floating environments is often accompanied by uncertainty, particularly when users encounter unfamiliar spatial conditions associated with water-based occupation. Research examining floating communities in Indonesia demonstrates that although residents expressed concerns regarding maintenance costs, legal frameworks, and lifestyle adjustments, many respondents nevertheless viewed floating environments positively in relation to environmental adaptation (Rombach et al., 2026). These findings suggest that the success of floating environments depends not only on technical performance, but also on broader social acceptance and the ability of users to adapt to unfamiliar environmental conditions.

Studies of floating residential environments further indicate that floating occupation may contribute to strong forms of social cohesion and neighborhood identity. Research on houseboat communities, for example, demonstrates that residents often develop close social networks and shared community identity through collective experiences associated with water-based living . Although adaptive environments may initially challenge conventional expectations regarding permanence, stability, and everyday occupation, they may also create opportunities for new forms of social interaction and collective identity (Rombach et al., 2026).

In this regard, public space offers a unique platform for assessing the social dimensions of climate adaptation strategies. Because public spaces are accessible to diverse user groups, they provide opportunities for people to encounter, experience, and evaluate climate-adaptive interventions through everyday activities. As a result, public spaces serve as valuable settings for investigating user perceptions, patterns of use, and the integration of climate-adaptive design within daily urban life (Tuhkanen et al., 2022; Qi et al., 2024)

### 2.4.1 UNDERSTANDING SOCIAL ACCEPTANCE IN ADAPTIVE ENVIRONMENTS

Social acceptability refers to the extent to which individuals and communities perceive an intervention as legitimate, desirable, and compatible with existing social norms and practices. This dimension is particularly important in the context of climate adaptation, as many adaptive measures introduce unfamiliar spatial conditions that require users to adjust established patterns of behaviour and expectations (Rogers, 2003; Weber, 2006).

Rogers' (2003) Diffusion of Innovations Theory provides a useful framework for understanding how users evaluate and adopt new spatial environments. Factors such as perceived advantage, compatibility with existing practices, complexity, observability, and familiarity influence whether new environments become socially accepted. Applied to floating architecture, this framework reveals important tensions between environmental adaptability and public perception. While floating environments can certainly assist with flooding risks, they break down the typical relationships between building design, structure, and permanent presence. As a result, users may initially perceive floating environments as unfamiliar or uncertain due to their departure from conventional land-based models of habitation and urban development (Busse et al., 2022; Rombach et al., 2026).

Perceptions of safety, comfort, and accessibility play a critical role in determining whether innovative climate-adaptive spaces become socially accepted.

Safety and structural stability perceptions are perhaps even more critical than other aspects. Solidity and permanency are common attributes of built environments; however, floating structures introduce both movement and physical contact with the water. Although these characteristics do not affect reliability, they do impact user's comfort with entering, using, and interacting in the space. (Lin et al., 2019)

Ultimately, social acceptability is based not only on performance criteria, but on experiential criteria including accessibility, spatial clarity and perceived comfort.

Public spaces play an important role within this process because they allow users to engage with unfamiliar spatial forms without requiring long-term commitment. Through repeated occupation and everyday interaction, initially unfamiliar environments may gradually become normalized as part of ordinary urban experience. Social acceptance is therefore closely connected to direct spatial experience and ongoing public use.

21 **THE FLOATING ISLAND, BRUGES, BELGIUM.**
DESIGNED BY OBBA

### 2.4.2 ENVIRONMENTAL AWARENESS AND EXPERIENTIAL LEARNING

Environmental awareness represents another important dimension in evaluating climate-adaptive public environments. Environmental psychology research demonstrates that people respond more strongly to environmental conditions they directly experience than to abstract information or statistical data (Weber, 2006). Experiential engagement therefore plays an important role in shaping public understanding of environmental change and climate-related processes.

Architecture can mediate environmental awareness by making ecological dynamics visible within the built environment. Rather than concealing natural processes through rigid infrastructure, adaptive design strategies can reveal environmental change and encourage users to engage more directly with ecological systems (Pallasmaa, 2005; Bélanger, 2016). Floating public spaces intensify this relationship by situating users within dynamic water environments, where movement, proximity to water, and changing spatial conditions make hydrological processes more perceptible. In doing so, they can influence how users interpret environmental variability and climate-related change (Busse et al., 2022; Díaz-Pinzón et al., 2025).

This perspective aligns closely with Pallasmaa's (2005) understanding of architecture as a sensory and bodily experience. Users do not simply observe architecture visually, but also experience space physically through movement, touch, sound, and environmental exposure. In adaptive public environments, these sensory experiences may contribute to greater awareness of environmental processes and climate-related conditions. In assessing floating public spaces as climate adaptable environments, their success depends upon several dimensions related to their social performance. Social acceptance and environmental awareness influence how people view these spaces. However, their success is also dependent upon their ability to support use, interaction and accessibility in daily urban life. (toward climate-adaptive waterfront walking spaces: thresholds and cross-modal mechanisms of multi-sensory comfort, 2026)



Accessibility, social interaction, environmental awareness, and public acceptance collectively shape the social performance of floating public spaces.

One important dimension concerns social interaction. Social interaction refers to the extent to which the space supports encounters, gathering and informal activities. As Gehl (2011) argues, successful public spaces encourage users to remain within spaces, observe others, and participate in collective life. Within floating environments, the continuity of these activities becomes particularly important in determining whether floating spaces function as integrated components of everyday urban life. Closely related to social interaction is the issue of collective participation and sense of belonging. Studies of floating communities indicate that shared environmental experiences and spatial proximity may contribute to strong forms of collective identity and social cohesion (Callegaro, 2019). Within public environments, this dimension is influenced by repeated use, collective activities, familiarity, and patterns of shared occupation (Qi et al., 2024).

Environmental awareness itself forms part of this broader experiential framework. Direct engagement with water and environmental variability may influence how users perceive and understand climate-related processes. Through sensory and embodied interaction with environmental conditions, users can develop a greater awareness of ecological dynamics and climate-related change (Pallasmaa, 2005; Weber, 2006). Similarly, public acceptance of floating architecture depends on how users perceive issues such as safety, comfort, legitimacy, and usability within unfamiliar environmental conditions (Rogers, 2003; Busse et al., 2022). Accessibility and inclusiveness represent another essential dimension of social performance. Public environments must remain physically and socially accessible to diverse user groups in order to support equitable occupation and participation. Within floating environments, accessibility may be influenced not only by physical connectivity and circulation, but also by perceptions of openness, stability, and psychological comfort. These dimensions are closely interconnected. Environments perceived as accessible, safe, and familiar are more likely to support repeated occupation, social interaction, and long-term public acceptance. Increased familiarity may additionally strengthen both environmental awareness and social integration over time. Examining these dimensions collectively therefore provides important insight into how floating public spaces operate simultaneously as adaptive environments, social spaces, and public experiences.

## 2.5
## CONCEPTUAL FRAMEWORK AND RESEARCH GAP

Floating public spaces should be evaluated not only as climate-adaptive infrastructure, but as socio-spatial environments shaped by public occupation, environmental interaction, and collective experience.

Although research related to climate adaptation, adaptive architecture, and floating environments has expanded significantly in recent years, important gaps remain regarding the social and experiential dimensions of floating public space. Existing literature on floating architecture continues to focus primarily on technical performance, engineering systems, and environmental resilience, while comparatively limited attention has been given to how floating environments are publicly occupied, socially experienced, and environmentally perceived within everyday urban life.

Similarly, literature concerning climate adaptation often prioritizes infrastructural responses and environmental management strategies while giving less attention to the role of public occupation, social interaction, and collective experience within adaptive environments. Public space theory, on the other hand, extensively addresses social interaction, accessibility, and collective urban life, yet rarely examines how these relationships are altered under conditions of environmental instability or fluctuating water conditions. As a result, floating public spaces remain insufficiently examined at the intersection of environmental adaptation, public life, and spatial experience.

This gap becomes particularly significant because floating public spaces operate simultaneously across environmental, spatial, and social dimensions. Unlike conventional adaptive infrastructure that often remains visually or socially detached from everyday public life, floating public environments place users directly within changing environmental conditions. Consequently, their evaluation cannot rely solely upon technical measures of environmental performance. Instead, understanding floating public space requires examining how users occupy, perceive, navigate, and socially engage with adaptive environments in practice.The literature reviewed throughout this chapter suggests that the success of floating public environments depends not only upon environmental adaptability, but also upon their capacity to sustain meaningful forms of public occupation and collective experience. Issues such as accessibility, social interaction, environmental awareness, familiarity, participation, and public acceptance therefore become central to understanding whether floating public spaces can function as socially viable adaptive environments rather than remaining experimental or symbolic interventions.

Based upon these discussions, this thesis develops a conceptual framework through which AquaPraça is evaluatedwW across **five interconnected dimensions: everyday public life and social interaction; community participation and sense of belonging; environmental awareness; public acceptance of floating architecture; and accessibility and inclusiveness.** These dimensions emerge directly from the intersections identified throughout the literature between public space theory, adaptive architecture, floating environments, and social acceptance research.

Rather than evaluating AquaPraça solely as a technical climate-adaptive structure, this framework approaches floating public space as a socio-spatial environment shaped by environmental interaction, public occupation, and collective experience. In doing so, the thesis seeks to contribute toward a more socially grounded understanding of floating public architecture within climate-vulnerable contexts.

22 **TABLE 2.1 CONCEPTUAL FRAMEWORK LINKING LITERATURE REVIEW TO ANALYTICAL DIMENSIONS**

| Literature body | Core Arguments from Literature | Relevance to AquaPraça | Framework Dimension(s) |
|---|---|---|---|
| **Public Space Theory** | Public spaces support social interaction, civic engagement, everyday public life, and the development of social connections and belonging. | Provides the theoretical basis for evaluating how AquaPraça functions as a public space and supports social use and collective experiences. | Everyday Public Life & Social Interaction; Collective Participation & Sense of Belonging |
| **Climate-Adaptive Architecture** | Architecture can contribute to climate adaptation by responding to environmental change while fostering public awareness and resilience. | Frames AquaPraça as an adaptive intervention that makes environmental conditions and climate challenges more visible and publicly experienced. | Environmental Awareness |
| **Floating Architecture** | Floating environments offer alternative ways of inhabiting water-prone areas and creating adaptive relationships between people, water, and the built environment. | Provides the spatial and environmental context through which AquaPraça operates as a floating public space and climate-adaptive prototype. | Environmental Awareness; Public Acceptance of Floating Architecture; Accessibility & Inclusiveness |
| **Social Acceptance Research** | The success of innovative environments depends on public perception, trust, familiarity, usability, acceptance of innovation | Supports the evaluation of how users perceive, accept, and engage with AquaPraça as a novel floating environment. | Public Acceptance of Floating Architecture; Accessibility & Inclusiveness; Collective Participation & Sense of Belonging |

# 3 CONTEXT ANALYSIS: BELÉM

## URBAN AND CLIMATE CONTEXT

Defined by its relationship to river, tide, and rainfall, Belém represents an urban condition where water structures both everyday life and environmental risk.

Understanding Belém's environmental and urban context is essential for assessing the applicability of climate-adaptive architectural strategies such as floating public space. Located within the Amazon estuary, one of the world's largest river systems, Belém occupies a unique geographical setting that has shaped its historical patterns of settlement, mobility, and urban development. Like many coastal and delta cities, Belém faces increasing pressure from climate change. Rising sea levels, more intense precipitation events, and recurring flooding are expected to have significant impacts on low-lying areas and waterfront infrastructure (Mansur et al., 2016; IPCC, 2023). The IPCC further identifies cities located in river deltas and estuaries as among the most vulnerable to climate-related hazards, including flooding and sea-level rise (IPCC, 2023).

The process of population growth and the extension of infrastructure make it more difficult for cities to adapt to changes in climate. The World Cities Report points out that many cities in the Global South face both social and environmental challenges caused by their high rate of urbanization and limited infrastructure for adaptation.Consequently, there is an increasing need to develop urban design approaches that integrate environmental processes and climate resilience into the planning and development of cities (Zhou et al., 2024; Graça et al., 2022).

This chapter explains how the environmental, climatic, and urban context of belém sits within the larger contextual conditions of the city in order to situate the aqua-praça project. The analysis starts with an overview of belém's geographic and environmental characteristics followed by a discussion of climate related risks and vulnerabilities. Next we examine the history of belém's relationship with its water front and the role of public spaces in everyday life in belém. Finally, this section discusses how these contextual characteristics effect design strategies that take into account climate-related adaptability.

# 3.1
# GEOGRAPHIC AND ENVIRONMENTAL CONTEXT

Belém is the capital of Pará state in northern brazil and sits near the mouth of the Amazon River where freshwater from the amazon basin meets tidal water from the Atlantic Ocean. The complex hydrological condition created here provides a unique geographic location for the city.

he area surrounding Belém is characterized by extensive wetlands, mangroves, river channels, and low-lying terrain that is susceptible to flooding during periods of heavy rainfall and high tides. These ecosystems play an important role in regulating water flows, supporting biodiversity, and maintaining the ecological balance of the Amazon estuary (Barros & Albernaz, 2014, pp. 810–820). The close relationship between the city and its surrounding hydrological systems has significantly influenced patterns of settlement, mobility, and urban development throughout Belém's history (Mansur et al., 2016).

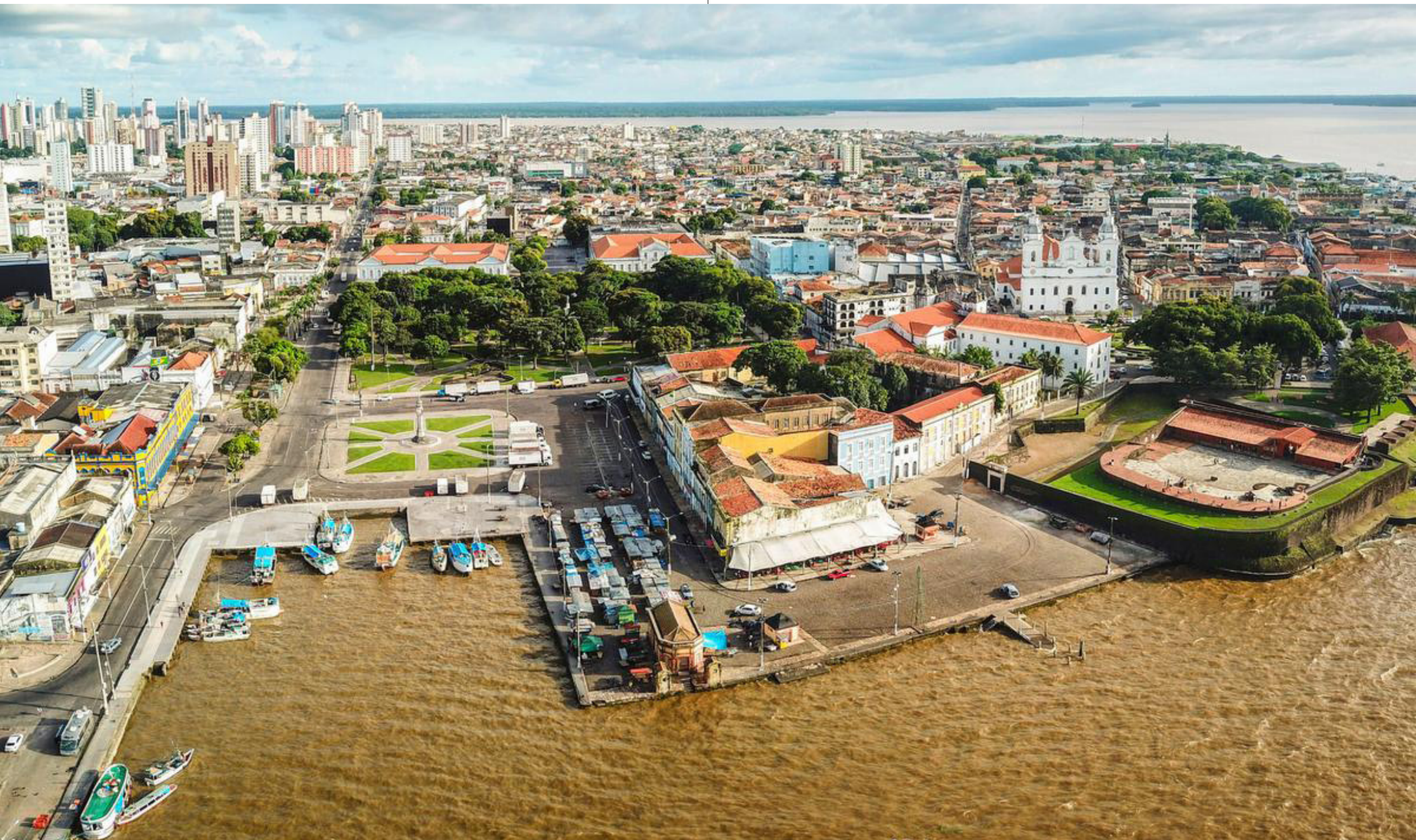
Guajara bay forms a central element in the city's urban landscape and functions as a key interface between the construction environment and aqueous ecosystems. In addition to functioning as a transportation route for people and goods; guajara bay has been an important spot for trade and cultural interchange. Continuing today; river-based shipping remains a very important way for communities surrounding the amazon region to get connected to belém.

However, being close to water also presents some obstacles. Many parts of belém are located on lower ground than others; and they flood when there is either heavy rain or high tide. As such; water pattern have a significant impact on how belém is organized and how much vulnerable it is to environmental-risk.

23 MAP3.1 STATE OF PARA, BRAZIL

24 **MAP3.2 CITY OF BELEM, BRAZIL**

25 **CITY OF BELEM, BRAZIL** COURTESY OF VISIT BRASIL



# 3.2
# CLIMATE CONDITIONS AND ENVIRONMENTAL VULNERABILITY

Belém has an equatorial tropical climate characterized by high temperatures, high humidity, and intense seasonal rainfall. According to data from the National Institute of Meteorology (INMET), Belém receives more than 3,000 mm of rainfall annually, making it one of Brazil's wettest cities (INMET, 2025). The rainy season typically extends from December to May, during which prolonged periods of heavy precipitation frequently contribute to flooding in low-lying areas.

Climatic conditions associated with tidal fluctuations in the Amazon estuarine system produce complex hydrological processes that significantly influence the urban environment of Belém. Tidal variations can reach several meters in amplitude, periodically altering water levels along riverbanks and waterfront areas throughout the city (Carvalho et al., 2025). As illustrated in Figure 27, these daily tidal cycles create a constantly changing relationship between land and water along Belém's waterfronts.

When there are high tides during heavy rain events; drainage capacity is frequently exceeded resulting in recurring urban flooding. This interaction between fluvial and tidal processes represents one of the primary components of the environmental vulnerability of belém. Not as single event type phenomena but as part of overlapping hydrological systems that operate at multiple temporal scales; flooding in the city is a result.

Climatic assessments conducted by both national and international organizations indicate that Belém is likely to experience increasing exposure to climate-related hazards. The Brazilian Panel on Climate Change (PBMC) identifies the Amazon region as particularly sensitive to changes in precipitation patterns, hydrological regimes, and coastal processes (PBMC, 2016). Similarly, global climate assessments identify estuarine and delta cities as among the urban systems most vulnerable to climate-related hazards due to their exposure to sea-level rise, flooding, and hydrological variability (IPCC, 2023). These conditions are expected to place increasing pressure on low-lying urban areas and waterfront infrastructure in cities such as Belém (Mansur et al., 2016).

In addition to environmental exposure socio-economic vulnerability plays a crucial role in defining impacts of climatic hazards in urban settings. Flooding events can interfere with traffic networks damage infrastructures affect housing conditions specifically in densely populated neighborhoods that are located near waterways. Research on urbn vulnerability in amazon has demonstrated that social economic inequalities amplify environmental hazards since low-income communities are more likely to dwell in flood prone areas with limited access to infrastructure services. (Manslur et al., 2016, pp. 625-643).

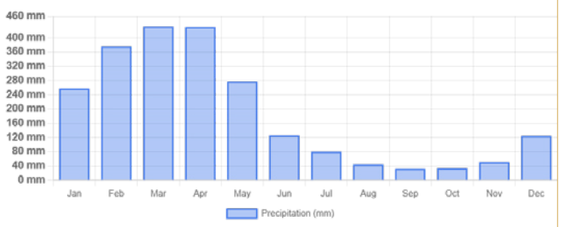
The seasonal distribution of rainfall reinforces these vulnerabilities even further. As described in figure x, rainfall amount peaks first half of year; which creates a cyclical period of heightened environmental stress within the urban system.

Because of these environmental conditions; these create great constraints for both planning public spaces within urbanized areas. Traditional fixed-ground based infrastructures generally fail to deal with dynamic interaction between water and urban spaces in belém. This is why there is currently a trend towards using adaptive approaches that directly engage with water rather than trying to exclude it.

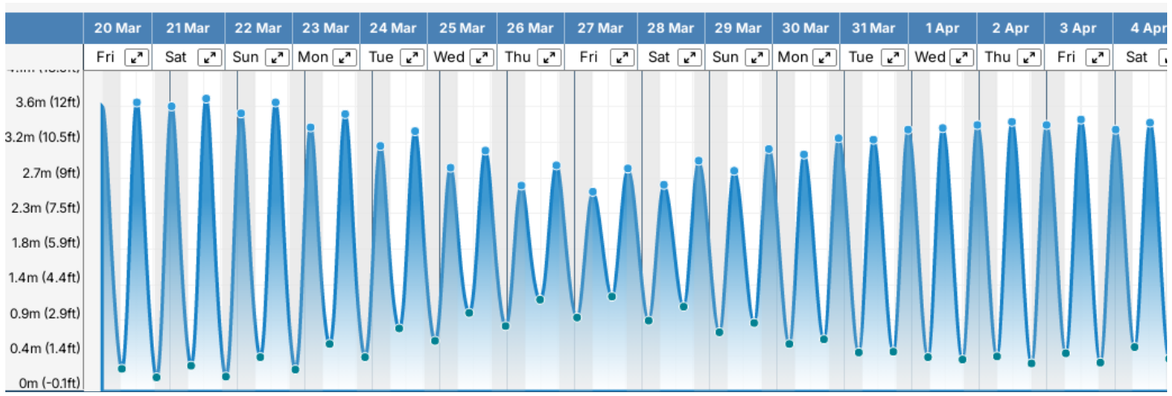
Within this context; climate-adaptative approaches such as floating architecture offer new possibilities for designing public spaces that remain useful under changing climatic conditions by allowing structures to move with water levels rather than resist them.

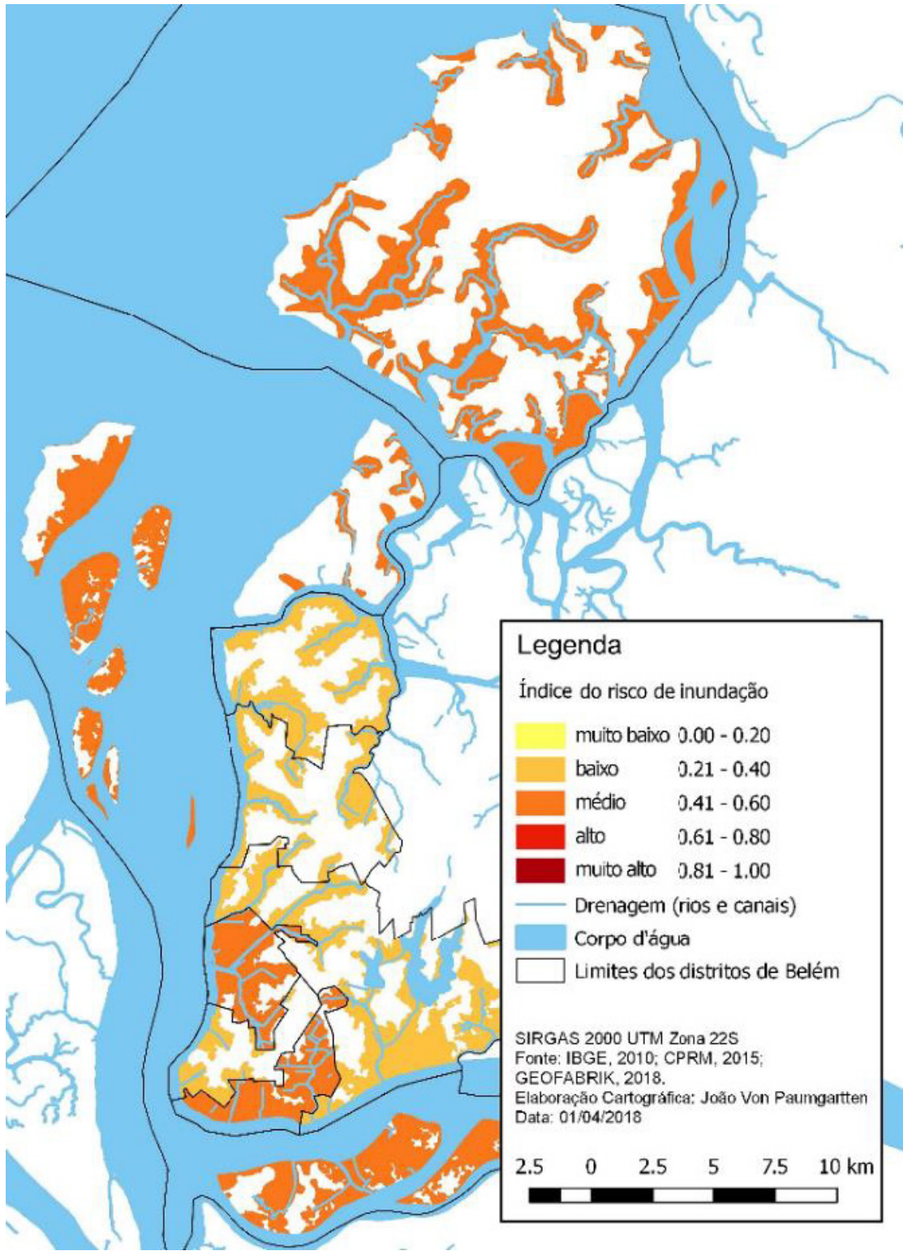
> The dynamic interaction between water, climate, and urban life in Belém highlights the need for adaptive public spaces that can respond to changing environmental conditions.

**26 MONTHLY PRECIPITATION LEVELS IN BELÉM SHOWING SEASONAL RAINFALL PATTERNS** WEATHER-AND-CLIMATE.COM. (2026, JUNE 16).




**27 DAILY TIDAL VARIATIONS IN BELÉM ILLUSTRATING FLUCTUATIONS IN WATER LEVELS WITHIN THE ESTUARINE SYSTEM.** WEATHER-AND-CLIMATE.COM. (2026, JUNE 16).






28 **FLOOD RISK INDEX MAP OF BELÉM, ILLUSTRATING THE SPATIAL DISTRIBUTION OF FLOOD-PRONE AREAS ACROSS ADMINISTRATIVE DISTRICTS. HIGHER-RISK ZONES ARE CONCENTRATED ALONG RIVERBANKS, TIDAL CHANNELS, AND LOW-LYING COASTAL AREAS**

### 3.2.1 MAPPING FLOOD RISK AND URBAN VULNERABILITY

A geographic study of flood risk in Belém provides evidence of how the urban landscape is affected by hydrologic processes. A flood risk index map (see Figure 27), displays the location of areas in the metropolitan area at greatest risk of flooding, and specifically illustrates how river banks, tidal streams, and coastal lowlands have been targeted by risk.

Risk of flooding varies greatly depending on the neighborhood. Areas that tend to be at lower risk include neighborhoods such as Belém, Entroncamento, and Benguí. Other neighborhoods that are at higher risk include Guamá, Mosqueiro, and Sacramenta. In general, neighborhoods are at greater risk due to topography, drainage, proximity to bodies of water.

There is a strong relationship between the flood risk areas and the hydrography of the city. Recurring Seasonal floods occur in areas with poor drainage infrastructure and/or expansion of residential developments into areas of low elevation. Residents living in neighborhoods adjacent to the Guajará Bay and secondary waterways are especially susceptible to these hazards.

It's important to recognize that flood risk in Belém is both a social problem and an environmental problem. There is a significant overlap between the locations of neighborhoods at risk of flooding and the areas experiencing economic disadvantage. Research studies have demonstrated that there is a relationship between poverty levels and increased likelihood of residing in a flooded area due to lack of access to service lands and adequate infrastructure. As a result, the social vulnerability and environmental exposure can be correlated throughout the city resulting in inequitable levels of risk.

**29 VERY POOR WOODEN FAVELAS HOUSES IN THE CITY BELEM (SUMAUMA).** DI MARITIME ART BLOG

By mapping flood risk researchers are able to identify both environmental and social aspects related to the issue of flooding in Belém. The data illustrate that the level of vulnerability results from the interaction between natural systems and urban growth rather than simply the presence of a particular environmental condition. Understanding this concept is critical to developing climate mitigation strategies that take into account both physical and social vulnerabilities.

### 3.2.2 FLOOD RISK AND SOCIAL PERCEPTION

Although a geographic analysis clearly identifies specific neighborhoods that exhibit high levels of flood hazard/vulnerability, surveys do not provide consistent evidence that residents perceive flooding as a major risk within those same neighborhoods. Data collected from survey participants presented in Table 3.1 demonstrate that although flooding is a common occurrence, it was rarely cited by residents as the most serious risk facing them in their respective neighborhoods.

Many respondents stated crime as their number one concern regardless of whether they resided in an area that exhibited high levels of flood hazard. The fact that respondents cite crime as their main concern in spite of residing in an area that exhibits high levels of flood hazard supports the notion that individual perceptions of risk are influenced by a variety of factors beyond the actual environmental conditions themselves.

In addition, however, over half of all respondents who participated in the survey reported having had personal experience with flooding. Specifically, many respondents reported that flooding occurred with regularity (e.g., monthly or weekly) in neighborhoods such as Guamá, Sacramenta, Mosqueiro. (Paumgartten et al., 2018). The impact of flooding upon the quality of residents' daily lives was evident based on responses regarding how flooding directly impacted their ability to engage in normal daily activities. Examples of these impacts included loss/damage to vehicles/goods/property; inability to travel/move around; and/or restricted/inhibited access to homes/residential dwellings.

Therefore, this example highlights an important distinction between assessment and evaluation of risk based upon technical criteria versus residents' perceptions of risk. Based upon their own experiences, residents' understandings of risk are predicated upon what happens to them as a result of the environmental event(s) occurring in their community/neighboring communities. Therefore, residents view flooding as less of an abstract/ hazardous environmental event; instead, as an interruption/disruption to their usual day-to-day urban lives.

By comparing how individuals assess/enumerate flood risk using either technical methods or social-based measures, we can see that identifying vulnerabilities in urban areas is much more complex than previously recognized. Although some may argue that maps/criteria used to estimate flood risk are accurate/valid (i.e., medium/high risk); residents will focus on their own experiences/damages from past events (e.g., loss of transportation, damage to housing and other property).

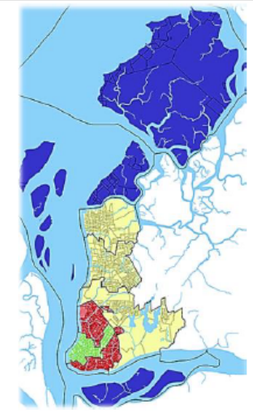
The difference between assessing risk technically versus socially is relevant to our research because it demonstrates that informing the public about climate-related risks requires more than just providing information; it requires acknowledging how people understand, conceptualize, climate-related risks.

30 **TABLE 3.1 LIVING WITH FLOODS**

| Administrative District | 6. (…) option that best reflects the feeling of risk: | 7. Remembers flood events in the district of residence: | 8. (…) option that best reflects the frequency of flood episodes in the district of residence: | 9. Have been directly affected in any flood episode: | 10. (…) which losses or damages were experienced in the flood episodes |
|---|---|---|---|---|---|
| Belém | Robbery 74% Flood 5% | Yes 59% | Annually 36% | No 35%; Yes 65% | Loss of automobiles / motorcycles 24% |
| Benguí | Robbery 74% Flood 7% | Yes 68% | Monthly 40% | Yes 100% | Other: interdiction on public roads to access my home 58% |
| Entroncamento | Robbery 76% Flood 6% | Yes 60% | Monthly 32% | Yes 100% | Other: traffic disorder 52% |
| Guamá | Robbery 77% Flood 6% | Yes 82% | Weekly 43% | Yes 100% | Loss of furniture / equipment 44% |
| Icoaraci | Robbery 79% Flood 0% | Yes 50% | Monthly 57% | Yes 100% | Other: interdiction on public roads to access my home 37% |
| Mosqueiro | Robbery 78% Flood 0% | No 67% | Monthly 67% | Yes 100% | Loss of furniture / equipment 67% |
| Outeiro | Robbery 100% Flood 0% | No 50% | Monthly 60% | Yes 100% | Loss of furniture / equipment 60% |
| Sacramenta | Robbery 79% Flood 4% | Yes 62% | Weekly 41% | Yes 100% | Loss of furniture / equipment 35% |

31 **TABLE 3.2 TECHNICAL AND SOCIAL PERCEPTION OF FLOOD RISK**

| Areas: | | Belém | Entroncamento, Benguí, and Icoaraci | Outeiro and Mosqueiro | Guamá and Sacramenta |
|---|---|---|---|---|---|
| Technical perception | Flood risk index | Low | Low | Medium | Medium |
| | Exposure index | High | High | Very high | Very high |
| | Vulnerability index | Medium | Medium | Medium | Medium |
| Social perception | Flood frequency | Annually | Monthly | Monthly | Weekly |
| | Experienced losses or damages | Loss of cars /motorcycle | Other: traffic disorder; Other: interdiction on public roads to access my home | Loss of furniture / equipment | Loss of furniture / equipment |



32 **TECHNICAL AND SOCIAL PERCEPTION OF FLOOD RISK ACROSS DISTRICTS OF BELÉM, SHOWING DIFFERENCES BETWEEN MEASURED FLOOD EXPOSURE AND RESIDENTS' PERCEIVED RISKS AND EXPERIENCED IMPACTS.**

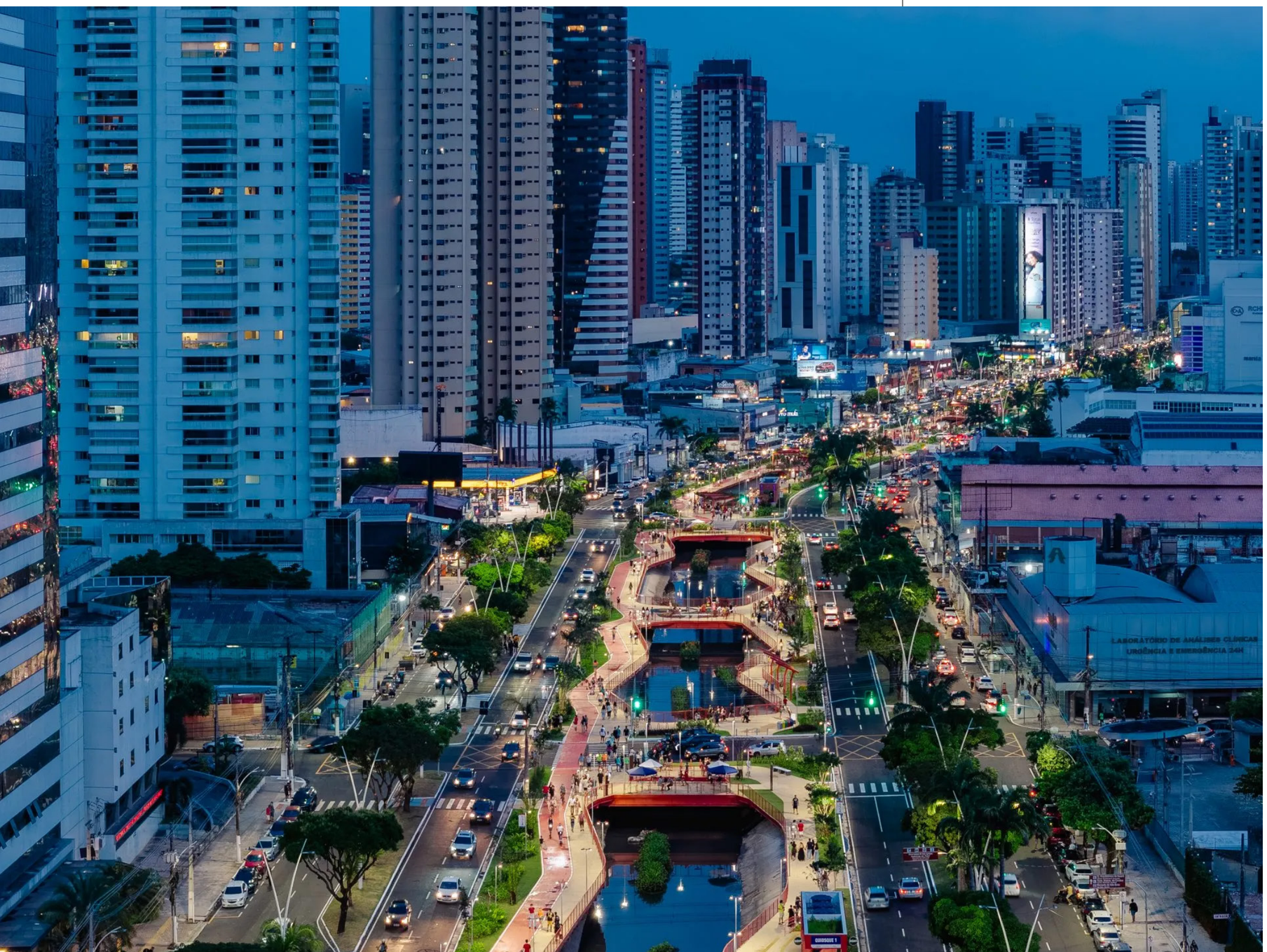
## 3.3
## URBAN DEVELOPMENT AND WATERFRONT DYNAMICS

The history of the urban development of Belém can be traced back to its geographical location at the head of the Amazon River estuary. In 1616, Belém was founded as a Portuguese colonial town. At that time, the town represented an important point where inland navigation networks met with seaborne trade routes. Throughout the entire period of the nineteenth-century rubber boom, when Belém underwent rapid urban expansion and the construction of ports, commercial areas, and public promenades along the waterfront, the relationship between the city and the surrounding waters continued to represent a fundamental aspect of the urban development of Belém. Although many historic waterfront areas continue to define the contemporary spatial structure of Belém, several former port and industrial sites have been transformed into public and cultural spaces that reconnect the city with Guajará Bay. Notable examples include the Ver-o-Peso marketplace and the Estação das Docas complex. These interventions illustrate a broader transformation of the waterfront from a predominantly economic and logistical interface to a space increasingly associated with leisure, tourism, cultural activities, and community engagement (Castro & Tavares, 2020).

Despite these historical changes in what constitutes a “waterfront” for the residents of Belém; however, the relationship between urban growth and water in Belém remains complex. Due to fast-paced population growth in addition to subsequent rapid urban sprawl throughout much of the twentieth century, many low-income residents chose to locate themselves in flood-prone regions around rivers and drainage ditches. Frequently, these same individuals settled in these hazardous zones in informal communities. Consequently, both environmental risk factors and social inequities increased substantially as described previously. In light of the fact that Belém will host the United Nations Climate Change Conference (COP30) in November 2025; however, an entirely new wave of change is taking place in Belém. The decision to host COP30 has resulted in significant investment into new transportation systems, public spaces, etc. A multitude of projects have been undertaken with respect to enhancing access to all portions of the city, upgrading public services and increasing the attractiveness of Belém as an international destination (D’Auria, 2025).

33 **VER-O-PESO MARKET** PRESIDENT OF BRAZIL ANNOUNCES BELEM AS COP30 VENUE | TV BRICS, 03.06.23

34 **NOVA DOCA LINEAR PARK** PHOTO BY MANUEL SÁ, LEONARDO FINOTTI -ARCHDAILY




One example of such projects includes waterfront and public open space redevelopment. Examples of such redevelopment efforts include Porto Futuro and Nova Doca Linear Park. Both projects seek to turn unused and/or poorly utilized waterfront areas into publically-accessible areas where people may engage in recreational activities, use cultural resources and enjoy nature-based amenities. (Abreu, G. 2025) Thus far, these two types of projects seem to reflect an overall trend towards developing a more prominent role for the waterfront in contemporary urban culture while simultaneously increasing the ability of Belém to successfully accommodate international events such as COP30. Other examples of additional projects related to hosting COP30 include restoration/ renovation of existing historic urban landscapes, construction of new public parks and improved connectivity throughout the city. There is evidence that many of these projects are nearly complete; thus indicating a rapidly-expanding scope of urban transformation on behalf of preparing Belém for COP30. Ultimately, together, each project seeks to establish a sustainable urban legacy that transcends the duration of COP30. Nevertheless, these very recent changes have elicited considerable criticism. Large-scale investments contribute significantly to modernizing cities internationally; however, such investments do little if anything to address long-standing issues including flooding vulnerability, inadequate infrastructure and spatial inequity. (Rasch, 2016)

These competing interests exemplify a critical dilemma associated with transforming urban areas like Belém: reconciling global attention, urban modernization and infrastructure upgrades with local social and environmental realities. Through its preparations for hosting COP30, Belém demonstrates a larger struggle faced by municipalities everywhere, adjusting to climate change while being subject to both urban development pressures and environmental risks. Within this dynamic environment, the waterfront serves as a primary testing ground for innovative models of urban development. An example of such models would be AquaPraça. Rather than attempt to control or eliminate water-related processes (i.e., tidal cycles), Aqua Praça engages directly with hydrological forces. As a floating public platform situated within Guajará Bay, AquaPraça provides an alternative paradigm for intervention.

35 **NOVA DOCA LINEAR PARK** PHOTO BY MANUEL SÁ, LEONARDO FINOTTI -ARCHDAILY

## 3.4
## PUBLIC SPACE AND SOCIAL LIFE IN BELÉM

Belém's public spaces are formed through both formal planning and informal practice, social inequality, and daily experience. How people relate to each other, participate in the city, and feel part of the city, depend greatly upon the quality, accessibility, and quantity of public spaces. (Castro & Tavares, 2020).

Much of Belém's population lives in informal or semi-formal settlements; many of these are located in areas prone to flooding or along water bodies. (UN-Habitat, 2022). Neighborhoods characterized by informal settlements typically have fewer formal parks and plazas, and more informal street environments, waterfronts, and common-use spaces for residents' daily activities.

Community life and social interactions occur in these areas. They serve as sites for social exchange, economic activity, and support for traditional culture. The frequency of social interactions is limited due to the availability of infrastructure to support those activities; the presence of environmental hazards; and unequal access to resources that would enable equitable participation. (Facundes et al., 2024)

Concurrently, the social invisibility of certain populations influences how public space is distributed throughout the city. Many of the formally invested public spaces , including the ones designed to attract tourists, are located in centralized and/or commercially viable areas. Peripherally located and informal communities continue to experience inadequate access to safe, accessible, and well-designed public space. These limitations limit the ability of diverse social groups to fully participate in public life. (Oliveira & Dias, 2025).

From a theoretical standpoint, accessible and inclusive public spaces are critical to fostering social interaction, participation, and collaborative urbanism. (Qi et al., 2024) Gehl stresses that effective public space design encourages users to remain longer periods of time and engage in routine activities. Klinenberg identifies public space as a type of social infrastructure; he views public space as a mechanism to connect people individually and collectively build community resilience.

However, in cities experiencing social/spatial inequality not all members enjoy equal benefit from these advantages. Access to and utilization of public spaces varies depending on factors such as location; safety concerns; environmental quality; etc. As a result, public space represents one of the most prominent mechanisms for measuring equity/inclusiveness within a city. (Castro & Tavares, 2020).

Furthermore, in cities with significant water-related issues, specifically estuarine cities, public space is influenced significantly by proximity to water. Waterfronts provide recreational opportunities and social areas. However, because they also present environmental risks and lack adequate infrastructure; for many residents living in flood-prone areas interacting with water becomes more about managing potential danger/disruption than about recreation/awareness of environmental conditions.

Differing perceptions regarding utilizing/water-based recreation spaces matter when considering climate-resilient public spaces. Although climate resilient public spaces attempt to mitigate environmental effects; success will rely heavily on how different demographics perceive/access/use those spaces. (Facundes et al., 2024)

36 **NOVA DOCA LINEAR PARK** PHOTO BY MANUEL SÁ, LEONARDO FINOTTI -ARCHDAILY

37 **TUCUNDUBA RIVER, BELEM.** PHOTO BY AP PHOTO/PAULO SANTOS

## 3.5
## CLIMATE ADAPTATION CHALLENGES AND OPPORTUNITIES

Environmental and urban conditions in Belém illustrate the complexities associated with climate adaptation in estuarine cities. As discussed previously, Belém faces challenges related to tidal fluctuations, intense precipitation events, and recurrent flooding, all of which are expected to intensify under future climate scenarios, placing additional pressure on infrastructure, housing, and public space systems (Mansur et al., 2016; IPCC, 2023).

For decades, cities have relied on grey infrastructure, including drainage systems, floodwalls, and engineered barriers, to reduce flood risk. While such measures can provide important short-term protection, they often fail to accommodate the dynamic hydrological processes characteristic of estuarine and coastal environments. Consequently, there is growing recognition that flood management should integrate both engineered and nature-based approaches capable of responding to environmental variability and uncertainty (European Commission, 2015; Zhou et al., 2024).

More recent climate adaptations focus on flexible approaches that utilize water characteristics rather than oppose water dynamics. Nature-Based Solutions (NBS); i.e. wetland restoration, parks and green spaces that can accommodate periodic flooding are increasingly being viewed as options for mitigating environmental impacts while providing social and ecological benefits. (Zhou et al., 2024). For instance; floodable parks can hold excess water during heavy rains yet are available for public use when dry. This illustrates how cities can create hybrid designs combining resiliency with recreation and social uses.

Global climate adaptation guidelines provide valuable insight for adapting to changing environmental conditions. Implementation of adaptive strategies are however dependent on local environmental-social-institutional factors. (Adger et al., 2005; IPCC, 2023). In Brazil; National Regional Climate Assessments identify the importance of integrating both environmental vulnerability and socio-spatial inequality into adaptation strategies. The Brazilian Panel on Climate Change (PBMC) notes that climate adaption strategies must take into consideration the interrelation between hydrologic systems, urbanization growth, and social vulnerability. Cities similar to Belém; where flooding is both a frequent environmental occurrence and a socio-economic issue require not only physical infrastructure development but also improved government, community, individual awareness, planning and design approaches. (Paumgartten et al., 2018).

COP30 preparation efforts have generated new urban initiatives aimed at improving resiliency and enhancing environmental quality, e.g., improved drainage, transportation options; converting waterfronts into public spaces. Research indicates however that even if implemented these measures do not necessarily resolve long-standing social, socioeconomic disparities that exist in informal communities relative to centrally located/tourist areas receiving greater investment. Uneven progress demonstrates why inclusivity must be addressed in climate-focused urban design. (Paumgartten et al., 2018). Experimental/small-scale design projects offer alternatives for testing innovative design/adaptation approaches. (Adger et al., 2005; IPCC, 2023). AquaPraça provides a unique case study of engaging with dynamic environmental conditions differently than traditionally designing land-based infrastructure solutions. By creating floating public platforms operating within dynamic water systems AquaPraça offers new possibilities for adaptable design.

AquaPraça engages with local environmental issues as well as the social demands for accessibility, interaction, and awareness; thus providing an asset to larger adaptation strategy attempts by allowing cities to respond to climate change in more adaptable/more variable manners. (Nunes et al., 2020)

Although floating architecture is generally conceptualized as having relevance within high-design/experimental contexts; it is reasonable to consider the potential for its application in addressing real-world social/spatial challenges facing informal/flood-prone neighborhoods in Belém. Consequently, there is merit in questioning whether these types of project can become practical solutions for large portions of the city beyond simply serving as exemplary representations.

38 **THE HISTORICAL CENTER OF BELÉM WITH THE CONTEMPORARY CITY SKYLINE IN THE BACKGROUND.** PHOTOGRAPHER: STEFAN KOLUMBAN

# 4

# METHODOLOGY

## RESEARCH DESIGN AND CASE STUDY APPROACH

By combining behavioral observation and user perception, this study examines floating public space as a social and spatial experience rather than solely as adaptive infrastructure.

This chapter discusses the methods of investigation that have been employed to determine the functioning of AquaPraça as a floating public space within the context of an urban environment sensitive to climatic conditions in Belém. A combination of qualitative and quantitative methods was adopted as part of a mixed-method case study. These methods were utilized to investigate how users behave in terms of their use of space and their perceptions of the space.

Methodologically, the study has an inter-disciplinary character; drawing upon principles of architecture, social interaction, and perceptual processes of environmental experience. In contrast to most studies on floating structures, which focus on technical performance, this study focused on the social and spatial facets of floating structures. Therefore, this study employed two types of methods; namely visual behavioral mapping (photographic and video based) and perception-based surveys. The two approaches are complementary in that they allow for a systematic understanding of how the space is used (visual-behavioral mapping), and how the space is understood and valued (perception-based survey) by users. By integrating both methodologies, the study provides a more holistic view of the function of floating public spaces in climate-adapted cities.

## 4.1
## RESEARCH DESIGN

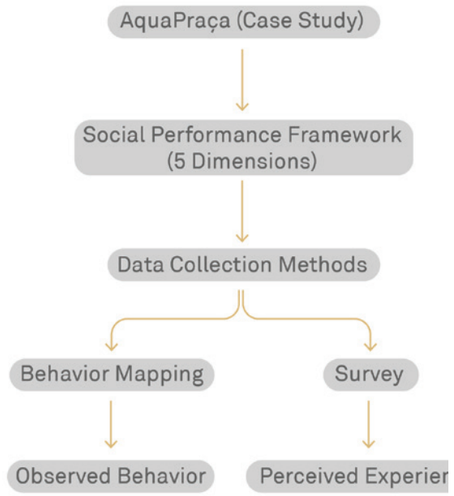
The study employs a single-case study design using a mixed-methods approach. The case studied is the platform AquaPraça. Using this methodology provides the means to explore in detail how the platform is used and perceived by its users.

As outlined in Chapter 2, there are five main dimensions of analysis:

- Social Interaction and Everyday Public Life
- Collective Participation & Sense of Belonging
- Environmental Engagement and Climate Awareness
- Public Acceptance of Floating Architecture
- Accessibility/Inclusiveness

These dimensions form an analytical framework that will be used to assess the social performance of AquaPraça.

Visual-behavioral mapping and perception-based data collection are used to collect information about each dimension.






## 4.2
## CASE STUDY SELECTION: AQUAPRAÇA

AquaPraça is a case study because it is a unique single case. A case study is selected for this research to explore an experimental form of climate-resilient architecture (floating public platforms) which links public space, environmental awareness and urban resilience.

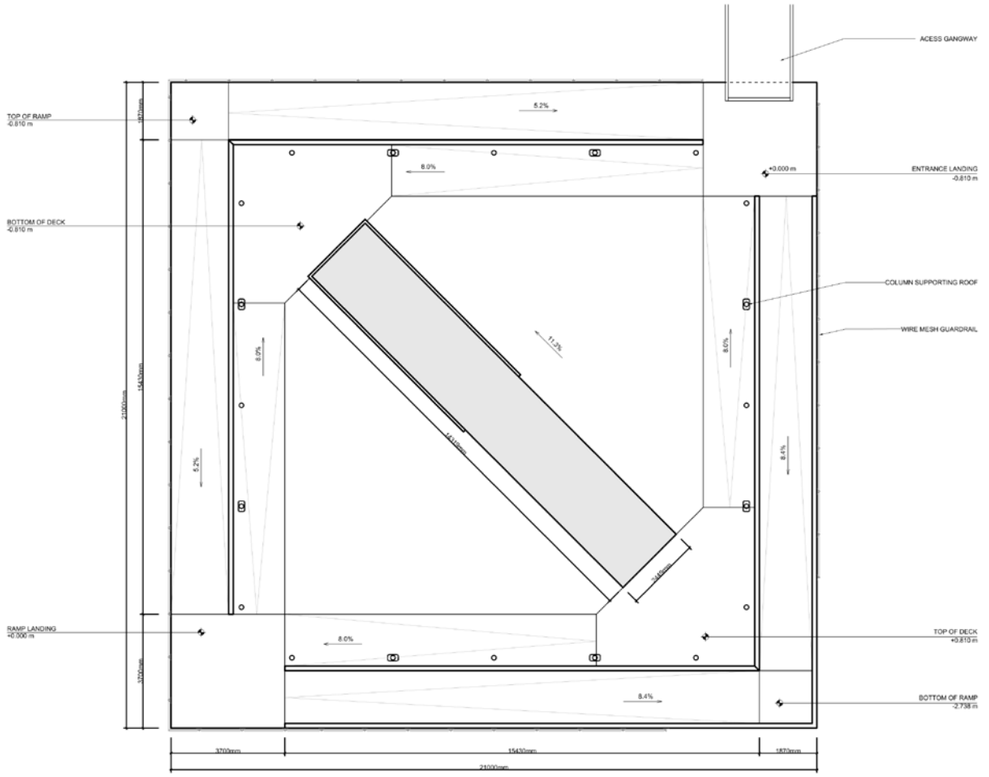
AquaPraça is placed along the edge of the Guajara bay in the Amazon estuary area. This particular location has large tidal variations and experiences periodic flooding. Water in the area varies in height over many meters throughout the year; thus continually transforming the relationship between land and water. Consequently, the AquaPraça is a floating structure supported through the application of buoyancy, displacement, and equilibrium principles, allowing the platform to move up and down with changing water heights. Through its adaptable mechanisms, AquaPraca maintains a constant and fluid relationship with the water, providing users with a direct view of the river while creating opportunities for users to observe their surroundings environmentally.

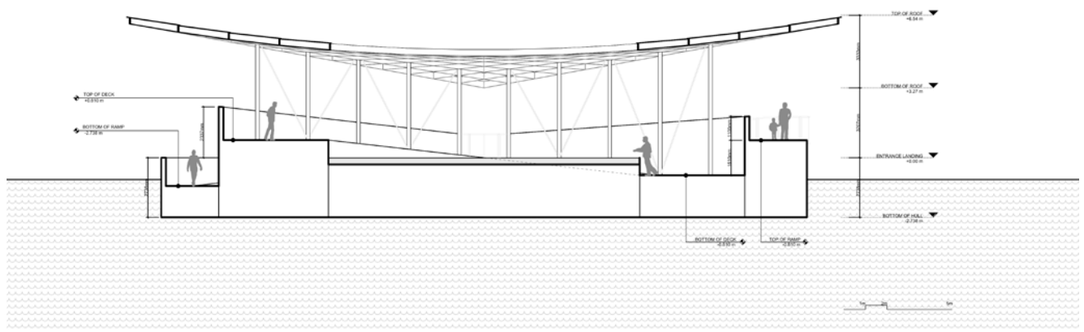
In total AquaPraça spans approximately 400 m2, and as a multi-use public space offers flexibility to accommodate a variety of uses including events, exhibitions, workshops and casual gathering places for 150 plus individuals. As an initial pilot development as part of an international climate-resilient design competition, it was initially exhibited as part of the Venice Architecture Biennial and then installed in Belém for use during COP30 as part of the Italian pavilion. Following those uses, AquaPraça will remain as part of the city's cultural infrastructure rather than remaining as a temporary installation.

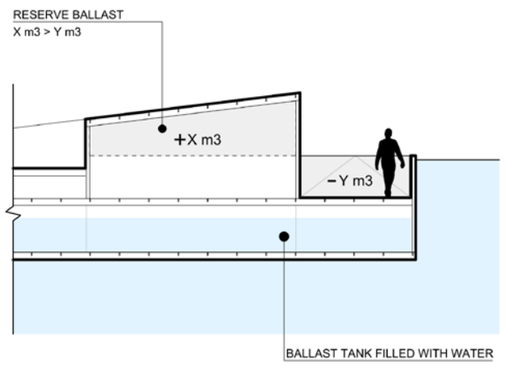
Its location provides additional credibility for using AquaPraça as a case study. Historically and geographically speaking, Belém has always had a connection with water and currently is experiencing increased amounts of flooding related to climate factors, creating an ideal test bed for developing and testing new forms of adaptive urbanism. In this way, AquaPraça operates both as a technical solution to climate-related issues and as an experiential space for people to experience climate-related issues daily.

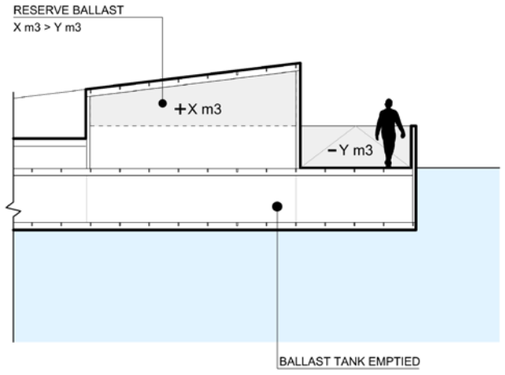
In addition to its architectural and environmental characteristics, AquaPraça functions as a social space. Due to its openness and accessibility, it fosters interactions among users, promotes gatherings and allows users to participate in a variety of activities. Thus, it can serve as an exemplary model to examine how floating public spaces promote social inclusion.

Therefore, due to its environmental and social attributes, AquaPraça represents an appropriate and easily assessable case study to analyze the social function of floating public spaces.



## 4.3
## VISUAL–BEHAVIORAL MAPPING METHOD

Visual–behavioral mapping was used as the primary observational method for evaluating how AquaPraça was occupied and experienced as a floating public environment. Behavioral mapping is commonly employed within public space research to examine how users move through, gather within, and interact with spatial environments (Whyte, 1980; Gehl & Svarre, 2013). The method enables researchers to identify patterns related to circulation, occupation, duration of stay, environmental interaction, and social activity. Previous studies examining public space use and spatial behavior have similarly utilized observational mapping techniques to understand relationships between design, movement, and social interaction (Gehl, 2011).

Because the researcher does not permanently reside in Belém, the analysis was conducted through systematic observation of photographic and videographic documentation of AquaPraça during both organized events and everyday occupation conditions. Photographs and videos were treated as observational data sources allowing repeated review of user behavior, movement patterns, and spatial occupation over time. The use of visual documentation additionally enabled the recording of spontaneous interactions and environmental engagement occurring under different conditions and moments of use.

The visual material used within the study was collected from multiple sources. Access to project documentation was facilitated through the researcher's professional involvement with the AquaPraça project and collaboration with local architects, project team members based in Belém during COP30-related activities, and institutional partners associated with the platform. Additional photographs and videos were provided by professional photographer Peter White, who has been documenting AquaPraça as part of an ongoing documentary project related to the platform. Further visual documentation was obtained from institutional sources including SECULT(Municipal Secretary of Culture) and the Italian Ministry of Foreign Affairs during COP30-related public events and activities associated with AquaPraça. Supplementary material was also gathered through publicly available social media content and online documentation related to the project.

The collected visual material was systematically reviewed in order to identify recurring patterns of spatial occupation and environmental interaction. The analysis focused on:

/circulation and movement patterns,

/gathering and stopping locations,

/types of activities occurring within the space,

/group formations and occupation density,

/and users' interactions with water and environmental conditions.

These observations were directly connected to the conceptual framework established in Chapter 2.

Social interaction was assessed through patterns of gathering, prolonged occupation, informal interaction, and clustering behavior throughout the platform. Particular attention was given to areas where users remained for extended periods or repeatedly interacted with others.

Collective participation and sense of belonging were examined through observations of organized events, workshops, performances, and temporary collective occupations occurring within the platform. Shared activities and patterns of collective gathering were used to evaluate the extent to which AquaPraça functioned as a civic and participatory environment.

Environmental awareness was evaluated through users' physical and visual relationships with water and surrounding environmental conditions. This included observing where users positioned themselves relative to the platform edge, how they oriented themselves toward the water, and whether environmental observation became part of the occupation of the space.

Public acceptance of floating architecture was examined through behavioral indicators related to comfort, hesitation, duration of stay, and willingness to occupy different areas of the platform.

Observations focused on whether users demonstrated confidence, uncertainty, or avoidance behavior while occupying the floating environment.

Accessibility and inclusiveness were assessed through circulation patterns, ease of movement, occupation distribution, and the ability of different users and group types to occupy the platform simultaneously. Spatial concentration and avoidance patterns were additionally analyzed in order to identify areas perceived as more or less comfortable for occupation.

The integration of visual-behavioral mapping with the conceptual framework enabled the research to evaluate AquaPraça not only as a physical structure, but also as a socially experienced and environmentally interactive public environment.





## 4.4
## SURVEY DESIGN AND INDICATORS

The research survey component was aimed to explore perceptions and experiences of AquaPraça as a floating public space and climate adaptive habitat. The study includes not just the people who physically came to the platform, but also those who acquired information about the platform through photos, videos, media coverage and online documentation. By include both direct and indirect exposure types, the research had the opportunity to explore wider public impressions of floating public architecture beyond the simple act of site occupation.

The survey was initially developed in English, then subsequently translated into Brazilian Portuguese with the assistance of a Brazilian colleague to ensure language clarity and accessibility to the local respondents. The poll was sent out in February 2025 and carried out mainly through the online networks of AquaPraça, Belém, and the cultural and architectural communities linked to COP30.

Respondents were identified using a combination of purposive and convenience sampling approaches. The first distribution was made through professional and institutional networks related to the AquaPraça project, such as local architects working on the project, SECULT and the Italian Embassy in Belém. Additional support for distribution was supplied by contacts at the Universidade Federal do Pará (UFPA). Professors there disseminated the survey with their students and broader academic networks. To extend participation outside the architectural and institutional networks, the poll was also distributed through local social media outlets and Facebook news/community groups related to Belém. This form of distribution sought to reach respondents with no particular professional or academic interest in climate adaptation or design, permitting a wider spectrum of public viewpoints on AquaPraça and floating public spaces.

The survey was structured based on the conceptual framework presented in Chapter 2, especially on public space sociology, environmental psychology, environmental perception, and social acceptance of adaptable environments. The questionnaire was designed to operationalize the five analytical dimensions identified from the literature review: everyday public life and social interaction, collective participation and belonging, environmental

awareness, public acceptance of floating architecture, and accessibility and inclusiveness.

The questionnaire contained open-ended and closed questions. The implementation of multiple choice questions permitted comparisons between respondents and the detection of recurring patterns, while open ended questions gave participants the possibility to expand on experiences, worries and opinions. This combination gave both structured and qualitative insight into the social and environmental perception of AquaPraça.

The survey was divided into thematic areas. The first questions gathered demographic data, including as age, occupation, educational background, familiarity with AquaPraça and impressions of climate-related issues in Belém. Other portions examined respondents' perceptions of climate adaptation, floating architecture and the wider public role of AquaPraça.

Questions related to social interaction focused on whether respondents perceived AquaPraça as socially engaging, whether the space encouraged interaction with others, and which spatial characteristics appeared to support gathering and informal activity. Collective participation and sense of belonging was investigated by asking questions on participation in events, workshops, performances and shared public experiences taking place on the platform.

The assessment of environmental awareness was based on the respondents' perception of how AquaPraça influenced their understanding of the concepts of climate adaptation, flooding, and the city and water interaction. Particular focus was made to whether the project had an impact on the environmental perception of the respondents before and after the platform experience.

Public acceptance of floating architecture was explored using questions about comfort, safety, stability, usability, and desire to support future floating projects. Accessibility and inclusiveness were assessed with the perceptions of ease of mobility, openness of space, comfort of diverse user groups and general usability of the platform in varied environmental and social settings.

Together, the survey and visual-behavioral mapping methods operationalized the conceptual framework established in Chapter 2 through both observed behavior and user perception. This methodological integration enabled the research to evaluate AquaPraça not only as a floating structure, but also as a socially experienced and environmentally perceived public environment.

# 4.5
# DATA ANALYSIS

A mixed quantitative and qualitative methodology was used to assess the data from the visitor perception survey and the visual–behavioral mapping. It was directed to analyze AquaPraça as a public floating environment, through the conceptual dimensions defined in Chapter 2: everyday public life and social interaction, collective participation and sense of belonging, environmental awareness, public acceptance of floating architecture, and accessibility and inclusiveness.

These analytical characteristics were used to categorize replies to the survey structured questions. Descriptive statistics (frequencies, percentages, etc.) were utilized to detect general tendencies, repeating perceptions and common response patterns among the participants. The quantitative research was not intended to get predicted statistical outcomes but to establish general tendencies about the perception and experience of the respondents regarding AquaPraça as a floating public area..

Open-ended survey responses were qualitatively evaluated to uncover reoccurring themes, interpretations, worries and impressions expressed by respondents. Special focus was given to how participants expressed their experience of social interaction, environmental awareness, comfort, accessibility and impressions of floating architecture. This qualitative review provides new insights to the survey results by allowing the respondents to articulate their opinions and experiences in their own words.

The visual-behavioral mapping analysis was methodically interpreted by repeated observation of images and video recordings capturing AquaPraça during the organized events and non-programmed occupation . To ensure comparability between methodologies, behavioral observations were coded along the same conceptual dimensions as the survey.

Environmental awareness was explored through the analysis of user interaction with water and the surrounding environmental conditions, including user orientation to the shoreline, observation of the river, and physical interaction with the floating environment. Public acceptance of floating architecture was analyzed using behavioral variables such as comfort, hesitancy, readiness to occupy different regions of the platform and length of stay within the floating environment.

The accessibility and inclusivity of the space was evaluated by examining the circulation patterns, the distribution of occupations, the fluidity of movement, and the presence of different users and group kinds in the space. We paid special attention to locating places that were socially lively or comparatively underused, for understanding how users moved and inhabited the floating world.

Then, the observed behavioral patterns were compared with the replies of the survey to find correlations between spatial occupation and user perception. For example, areas identified by behavioural mapping were compared with survey responses about comfort, social engagement and shared experience. Water-related environmental participation observations were also examined, along with survey responses about environmental awareness and climate perception.

The research managed to analyze AquaPraça from two complimentary perspectives: the physical occupation of the space and the social and environmental perception, integrating behavioral observations and visitor perceptions. This integrated analytic approach provides a wider understanding of AquaPraça as not only a floating architectural structure, but also as a socially experienced public environment created by occupation, interaction and environmental participation.

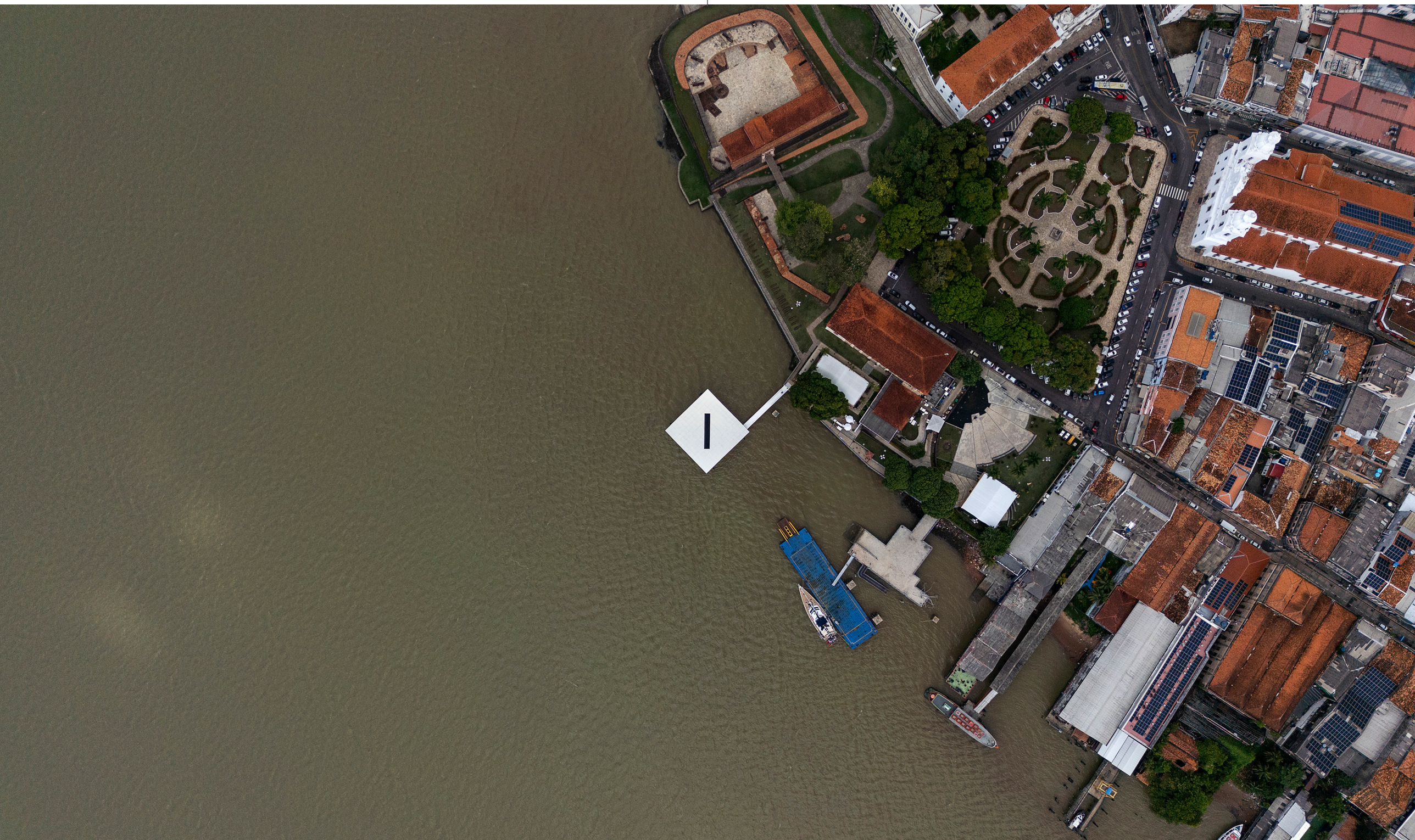
Table 4.1 summarizes how the conceptual framework established in Chapter 2 was operationalized through both visual–behavioral mapping and survey evaluation methods.

| Analytical Dimension | Visual–Behavioral Mapping | Survey Evaluation | Quantitative Measures |
|---|---|---|---|
| **Everyday Public Life and Social Interaction** | Circulation patterns, gathering locations, prolonged occupation, informal interaction, clustering behavior | Perceptions of social interaction, comfort, gathering, and everyday use of the platform | Activity frequencies; social interaction ratings; comfort ratings |
| **Collective Participation and Sense of Belonging** | Participation in events, collective occupation patterns, shared activities, temporary civic gatherings | Perceptions of shared experience, participation in workshops/events, civic and cultural engagement | Event participation rates; willingness to participate; importance of public participation |
| **Environmental Awareness** | Orientation toward water, environmental observation, physical interaction with water and floating conditions | Perceptions regarding climate adaptation, relationship between the city and water, environmental awareness before and after exposure | Awareness of flooding; climate adaptation understanding before/after exposure |
| **Public Acceptance of Floating Architecture** | Occupation duration, willingness to occupy different areas, hesitation or avoidance behavior, comfort within floating environment | Perceptions of safety, stability, usability, comfort, and willingness to support similar floating projects | Rates of Support for future floating projects; perceived safety; maintenance concerns |
| **Accessibility and Inclusiveness** | Movement patterns, circulation, occupation distribution, coexistence of different users and group types | Perceptions regarding ease of movement, openness, inclusiveness, and usability for different user | Accessibility ratings; movement concerns; inclusiveness perceptions |

39 **TABLE 4.1 OPERATIONALIZATION OF ANALYTICAL DIMENSIONS AND EVALUATION METHODS**

40 **AQUAPRAÇA PICTURE IN BELEM, 2025** PHOTO BY LEONARDO FINOTTI

41 **AQUAPRAÇA PICTURE IN BELEM, 2025** PHOTO BY LEONARDO FINOTTI



# 5

# AQUAPRAÇA EVALUATION

AquaPraça offers an opportunity to examine how floating public space performs beyond its technical and environmental functions. Through observation of everyday occupation and analysis of visitor perceptions, this chapter explores how the platform mediated relationships between people, water, and public life. The findings are presented through five dimensions that together evaluate the social and environmental performance of the project.

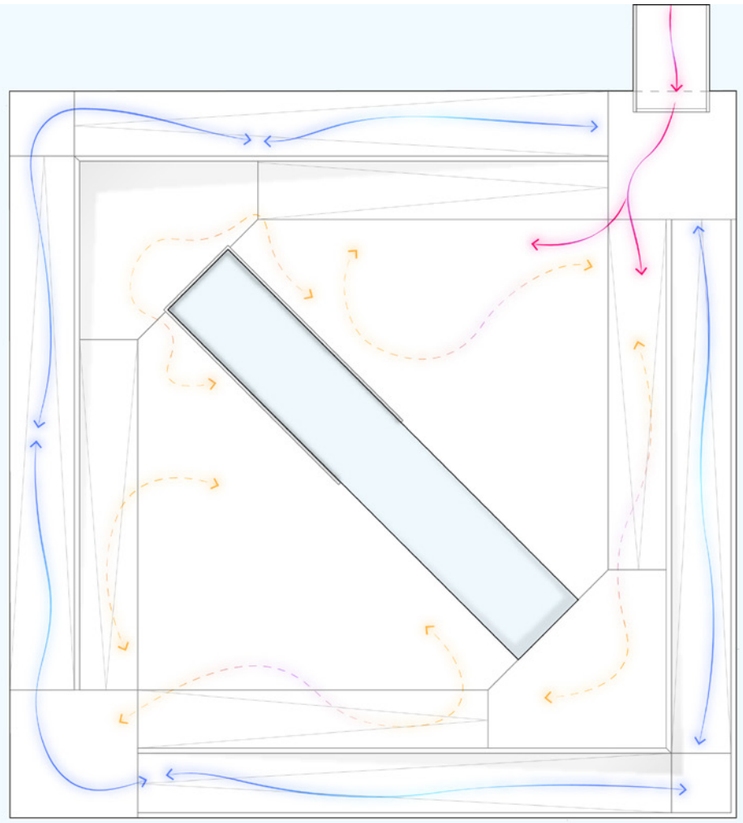
# 5.1
# SOCIAL INTERACTION AND EVERYDAY PUBLIC LIFE

AquaPraça fulfills two primary roles both as an architectural floating structure and a public environment where mobility, congregation, watching and interaction with environment happen constantly. An essential question for this study is if floating public spaces could provide daily forms of urban living (everyday) and at the same time be a part of a climate adaptive strategy. Based on evaluations, it appears AquaPraça has been able to accommodate many types of public occupations; nonetheless, these occur in ways that are spatially uneven and conditional upon how the platforms are used.

The visual mapping indicated that the pattern of occupancy on the platform was significantly affected by the spatial organization of the platform. Occupancy on the platform did not occur uniformly over space, but rather tended to be focused about seating areas and along the edges of the center water channel(water table). Seating units and areas adjacent to the water edge allowed for longer duration stays and informal interactions and environmental observation. The water interface was found to be the most active spatial condition within the platform. It provided three main uses: circulation route, viewing/looking zone and gathering space.

User movement patterns further validated this spatial hierarchy. Typically users moved along the periphery of the platform until they reached locations where they transitioned into more stationary positions located near seating units and the water edge. This pattern created a dynamic flow between user movement and occupation of the space; in fact, in many cases user movement itself produced a social condition (i.e., pauses, conversations etc.) in addition to providing a means of getting from one point to another.

**42 AQUAPRAÇA IN VENICE, 2025**
PHOTO BY DSL STUDIO



Entry Flow
inward movement from gangway

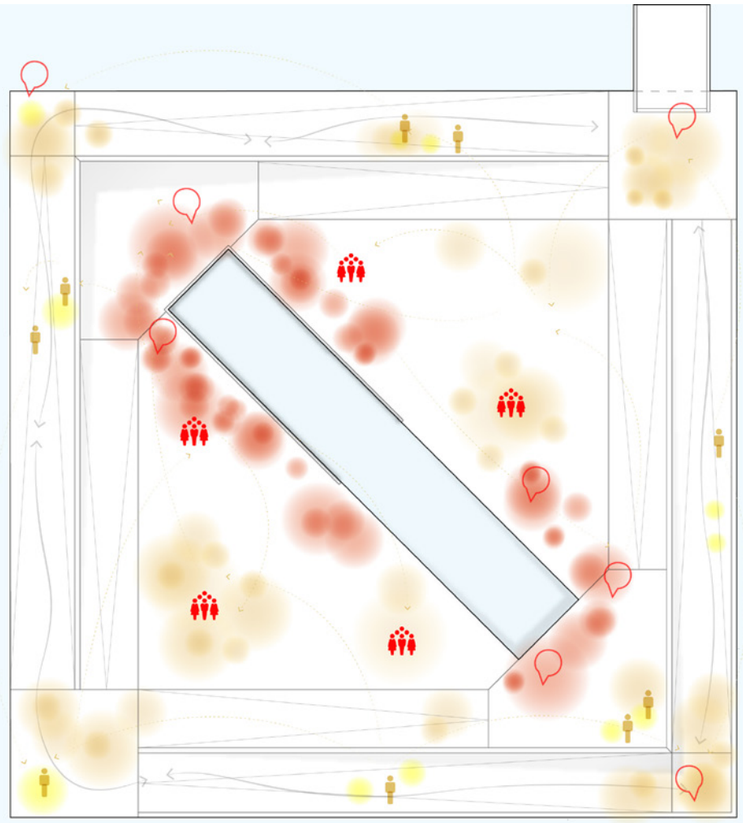
Primary movement
Contunuous perimeter circulation loop

Secondary movement
Movement towards seating areas and water table

**MOVEMENT**

Movement is structured primarily along a continuous perimeter loop, with entry flows distributing users laterally. The central area is not a primary circulation zone but is accessed through secondary path.

43 VISUAL BEHAVIORAL MAPPING
MOVEMENT



High density
Prolonged stay, strong social interaction, main gathering area

Medium density
Moderete stay, small group interaction, activity spillover

Low density
Short stay, casual standing, passing by, transitional pause

Large Group
10+ people events, performances, collective activities

Medium Group
2-6 people conversation, friends family groups

Individual
Solitary occupation, observing, resting, taking pictures

**SOCIAL DENSITY & INTERACTION**

Areas of prolonged occupation correspond directly with zones of intensified social interaction, indicating that spatial configuration and water proximity strongly influence collective behavior. The platform supports multiple layers of social occupation ranging from informal interpersonal encounters to organized collective gathering.

44 VISUAL BEHAVIORAL MAPPING
SOCIAL DENSITY & INTERACTION

Behavioral studies demonstrated that there were marked differences between everyday use and planned activities. When users participated in events, occupation increased dramatically and became much more concentrated spatially than when users engaged in unprogrammed activity. Specifically, occupation was high around seating areas facing performance/ presentation area. Conversely, when users occupied the space on their own initiative and without programming, the occupation was fractured (smaller groupings), less dense and less collectively interactive. However, small groups and individuals continued to use the space and specifically the water interface; conversely, prolonged collective interaction was not consistent among users.

Thus, overall these results indicate that AquaPraca attracts users to occupy the space and engage with the natural environment. However, the degree to which social interaction is maintained among all users over varying conditions of occupancy is not equal. There were areas within the space that were underutilized during quiet times indicating that some areas of the space relied upon activation to sustain continuous public engagement.

Survey responses generally reinforced these observations. Respondents frequently characterized AquaPraça as an open space that was calming and socially accessible. Many respondents stated that they found the visual/physical relationships between themselves and water on the platform to be among its most distinguishing characteristics. Other respondents noted that they enjoyed the relatively casual nature of the platform and that it differed from other publicly accessible spaces in Belém. Observing the surrounding landscape and taking photographs represented one of the most common activities reported by visitors (44.4%), followed by relaxing/ resting (33.3%), socializing and meeting people (37%), and participation in events or workshops (22.2%). Passing through the platform as part of everyday movement patterns was reported by 25.9% of respondents.

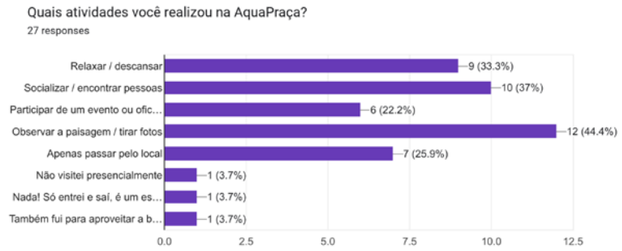
45 **AQUAPRAÇA EVERYDAY USE** PHOTO BY PETER WHITE

46 **AQUAPRAÇA DURING THE ORGANIZED EVENT** PHOTO BY LEONARDO FINOTTI

**Q16. Which activities did you do at AquaPraça?**

*Checkboxes*

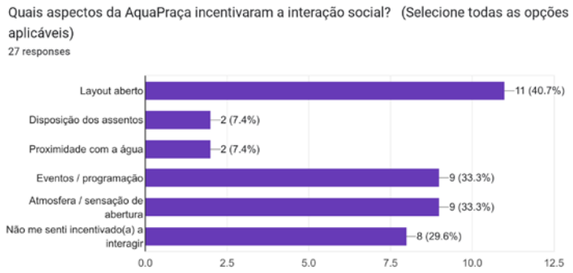
- Relaxing / resting
- Socializing / meeting people
- Participating in an event or workshop
- Observing the view / taking photos
- Passing by
- I did not visit in person
- Other: _____




**Q20. Which aspects of AquaPraça encouraged social interaction?**

*Checkboxes*

- Open layout
- Seating arrangements
- Proximity to water
- Events/programming
- Atmosphere/sense of openness
- I did not feel encouraged to interact
- Other: _____



**Q18. Did you interact with other visitors while at AquaPraça?**

- Yes
- No




While observation of the landscape and socialization were each cited by roughly half of respondents as activities they engaged in while occupying the platform; 40.7% of respondents described interaction with others in AquaPraça as 'somewhat easy,' while 33.3% selected a neutral response and 11.1% reported some degree of difficulty interacting with other visitors. Thus, the fact that large numbers of people occupy a particular space does not guarantee that they will interact with each other.

A number of respondents also raised issues concerning whether AquaPraça would continue to attract high levels of public use outside organized event schedules or periods of heightened interest. Other respondents questioned whether they would feel comfortable or able to effectively use a floating public space.

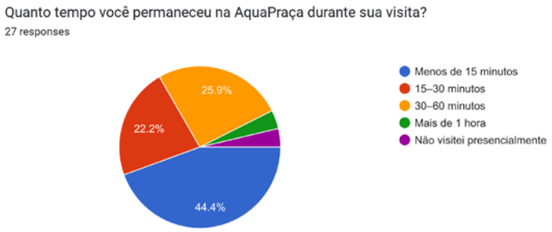
47 **AQUAPRAÇA EVERYDAY USE** PHOTO BY LEONARDO FINOTTI

**Q19. How easy was it to meet or talk with others in AquaPraça?**

- Very easy
- Somewhat easy
- Neutral
- Somewhat difficult
- Very difficult

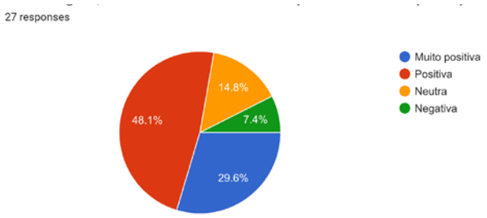
**Q15. How long did you stay at AquaPraça during your visit?**

- Less than 15 minutes
- 15–30 minutes
- 30–60 minutes
- More than 1 hour
- I did not visit in person




**Q14. Overall, how would you describe your impression of AquaPraça?**

- Very positive
- Positive
- Neutral
- Negative



## 5.2
## COLLECTIVE PARTICIPATION AND SENSE OF BELONGING

In addition to supporting everyday public occupation, AquaPraça also functioned as a temporary civic environment in which collective participation, cultural programming, and shared public experience became central aspects of the spatial atmosphere. While the previous section focused on everyday occupation and informal social use, this section examines how organized activities transformed the platform into a more collectively oriented public setting.

The visual observations showed that workshops, performances, exhibitions, and other programmed activities significantly altered the social dynamics of the platform. During these moments, occupation became denser and more spatially concentrated around common focal points. The seating configuration played an important role in structuring this collective condition by organizing users toward performances and presentations while maintaining visual openness toward the surrounding waterfront.

At the same time, participation within AquaPraça remained spatially fluid rather than strictly organized. The platform did not establish rigid separation between participants and observers. Some users directly engaged in workshops or activities, while others remained within circulation zones observing events from varying distances. As a result, collective participation extended beyond formally programmed areas and dispersed throughout the platform through movement, gathering, and shared observation.

The survey findings reinforced the perception of AquaPraça as a socially and culturally engaging public environment. Respondents frequently associated the platform with gathering, cultural exchange, and collective urban experience. Events and public programming were identified as one of the strongest factors encouraging social interaction, selected by 33.3% of respondents, alongside the platform's atmosphere and sense of openness (33.3%) and open spatial layout (40.7%). Several participants also stated that organized activities increased both their interest in the project and their understanding of its environmental and social intentions.

48 **AQUAPRAÇA DURING THE ORGANIZED EVENT** PHOTO BY PETER WHITE

49 **AQUAPRAÇA DURING THE ORGANIZED EVENT** PHOTO BY PETER WHITE

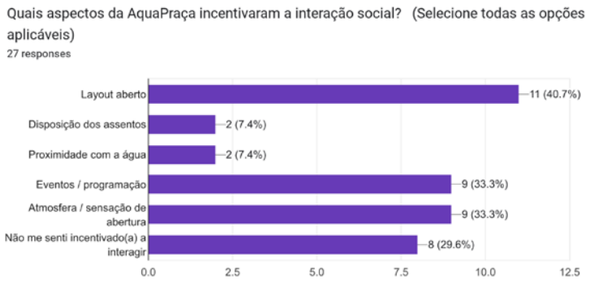
**Q20. Which aspects of AquaPraça encouraged social interaction?**

*Checkboxes*

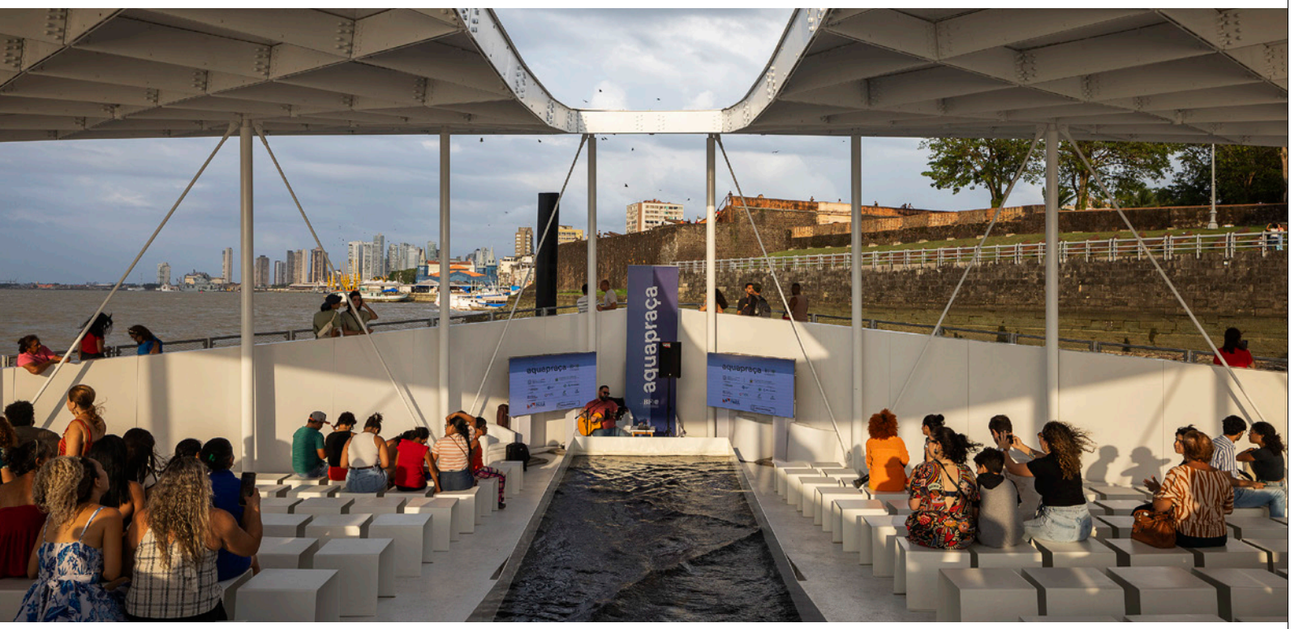
- Open layout
- Seating arrangements
- Proximity to water
- Events/programming
- Atmosphere/sense of openness
- I did not feel encouraged to interact
- Other: _____

**Q21. While in AquaPraça, did you feel part of a shared experience or community?**

- Yes, strongly
- Somewhat
- Not really
- Not at all



**50 AQUAPRAÇA DURING THE ORGANIZED EVENT** PHOTO BY EREN SEZER

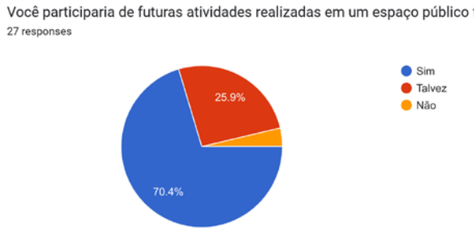



**Q25. How important is public participation for projects like AquaPraça?**

- Very important
- Important
- Somewhat important
- Not important

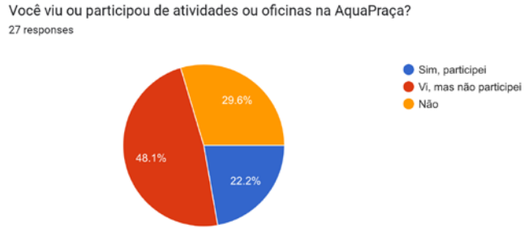
**Q26. Would you participate in future activities hosted in a floating public space?**

- Yes
- Maybe
- No




**Q24. Did you see or participate in activities or workshops at AquaPraça?**

- Yes, I participated
- I saw them but did not participate
- No






However, the findings also suggest that the strongest forms of collective participation remained highly dependent on programming and institutional activation. As discussed in Section 5.1, occupation patterns became noticeably more fragmented during non-event conditions. Although the platform continued to support informal public use, collective engagement decreased considerably outside organized activities. This indicates that AquaPraça currently operates more successfully as an activated civic environment than as a continuously self-sustaining public space. Survey findings additionally demonstrated strong public support for participatory programming within floating public environments. Approximately 59.3% of respondents identified public participation as ‘very important’ for projects such as AquaPraça, while 70.4% expressed willingness to participate in future activities hosted within floating public spaces.

The survey responses additionally revealed questions regarding the continuity and inclusiveness of participation. While many respondents valued the cultural and environmental atmosphere of the platform, some suggested that AquaPraça’s experimental identity may appeal more strongly to audiences already engaged with architecture, environmental discourse, or cultural programming. Others questioned whether the same level of public participation could be maintained outside high-profile events associated with COP30 or institutional initiatives.

Overall, the survey data reflects an underlying contradiction regarding the civic function of AquaPraca. On one hand, the platform has been able to generate numerous instances of collective awareness and moments of collective urban experience. On the other hand, nearly all examples of this collective activation have occurred as a direct result of programming/institutional support rather than occurring naturally through users’ daily routine public behavior. Thus, AquaPraca can be viewed as less of a traditional public square and more as a civic prototyping concept in which architectural elements, environmental advocacy, and cultural programming converge.

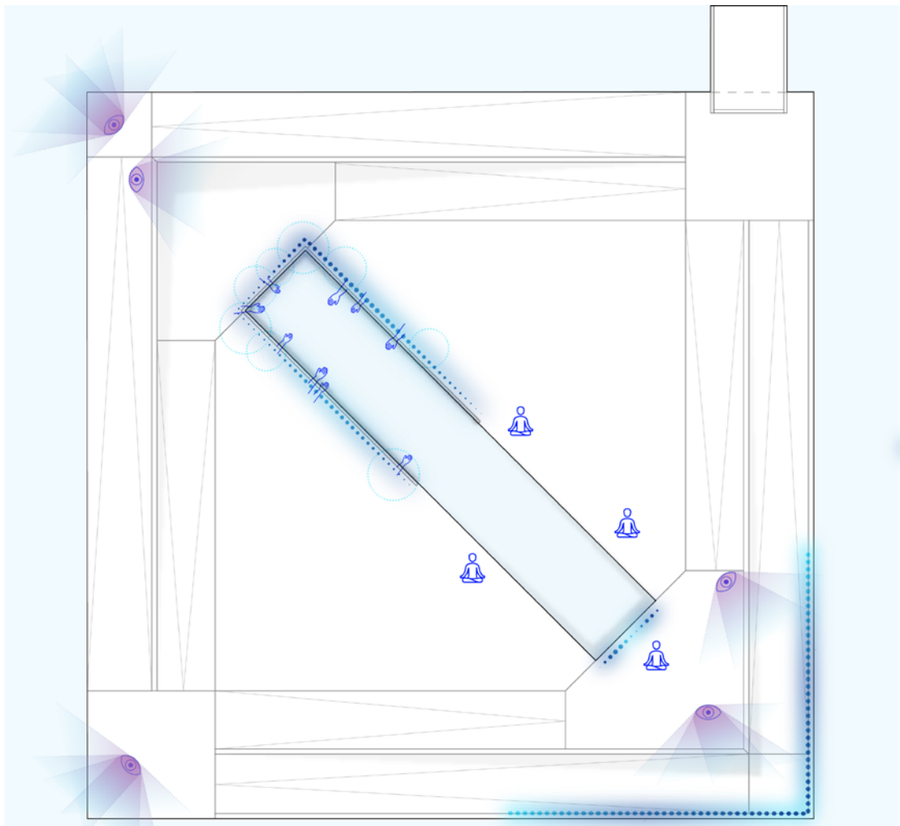
## 5.3
# ENVIRONMENTAL ENGAGEMENT AND CLIMATE AWARENESS

What makes AquaPraça so unique is how it has enabled users to consider environmental conditions as part of their overall public experience. Instead of isolating water from urban living experiences, AquaPraça brings users closer to the water and to the changing environmental conditions. As such, AquaPraça serves as a type of environmental interface that spatially makes climate adaptation visible and accessible.

The results of the mapping of user behaviors demonstrate that water consistently functioned as the primary environmental attractant on the platform. As noted earlier, the largest number of users occupied areas nearest the water and views of the Guajará Bay. Beyond influencing social occupancy however, the spatial distribution of users resulted in heightened awareness of environmental conditions due to continuous orientation of users to water and changing environmental conditions.

Many users would sit, stand, converse, rest etc., with their backs towards the river or the water table. The open perimeter provided unobstructed visual access to the bay at all times providing an ongoing presence of environmental conditions to users within the platform's experience. Additionally, there were multiple instances documented where users went to the water's edge to observe and directly engage with the surrounding landscape (as opposed to gather) as well.

Moreover, AquaPraça promoted types of sensory engagement with environmental conditions typically absent from conventional urban public spaces. Users, especially children, were repeatedly seen touching the water, leaning over the edge of the platform and/or engaging physically with the floating status of the platform itself. In each instance, users' environmental awareness was converted from conceptual abstraction into embodied/spatial experience.




51 VISUAL BEHAVIORAL MAPPING
WATER INTERACTION & ENVIRONMENTAL ORIENTATION

Survey findings strongly associated AquaPraça with climate adaptation, resilience, and increased awareness of the relationship between the city and water. Prior to the survey, 63.9% of respondents stated that they had already noticed increasingly frequent flooding or extreme weather events in Belém, while 44.4% reported that flooding affects daily life in the city ‘very much. Following exposure to AquaPraça, 36.1% of respondents reported that their understanding of climate adaptation became either ‘much clearer’ or ‘a little clearer,’ while 77.8% expressed interest in seeing additional floating or climate-adaptive projects developed in Belém. Several respondents also identified AquaPraça as an innovative response to flooding and environmental vulnerability within the city.

Many respondents described the floating condition itself as a physical demonstration of environmental vulnerability and adaptation. Rather than communicating climate adaptation solely through technical infrastructure or policy discourse, AquaPraça translated environmental awareness into a public and inhabitable spatial condition that could be directly experienced through movement, gathering, and observation.

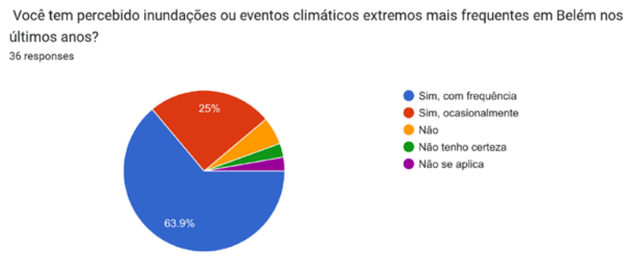
**Q8. How much do you think flooding affects daily life in Belém?**

- Not at all
- A little
- Quite a lot
- Very much

**52 AQUAPRAÇA INTERACTION WITH WATER TABLE** PHOTO BY LEONARDO FINOTTI

**Q7. Have you noticed more frequent flooding or extreme weather events in Belém in recent years?**

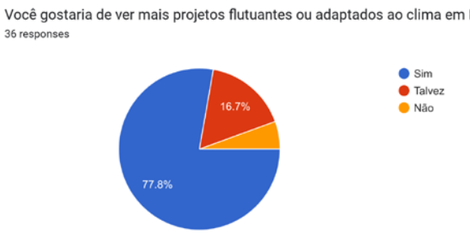
- Yes, frequently
- Yes, occasionally
- No
- Not sure
- Not applicable




**53 AQUAPRAÇA INTERACTION WITH WATER TABLE** PHOTO BY PETER WHITE

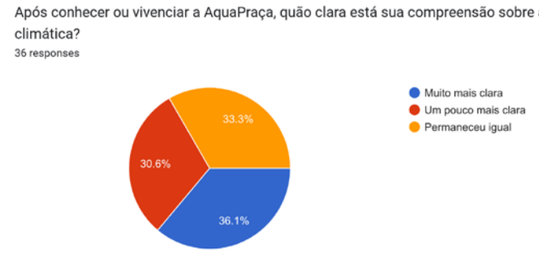
**Q29. Would you like to see more floating or climate-adaptive projects in Belém?**

- Yes
- Maybe
- No




**Q28. After experiencing AquaPraça, how clear is your understanding of climate adaptation?**

- Much clearer
- A little clearer
- Unchanged



At the same time, the findings also revealed important limitations regarding the depth of environmental engagement generated through the platform. Although many users demonstrated curiosity and environmental awareness, this awareness often remained experiential or symbolic rather than deeply educational. Several respondents questioned whether the project represented a practical climate solution or primarily functioned as a demonstrative cultural installation associated with COP30 and environmental representation. Open-ended survey responses additionally revealed skepticism regarding the project's long-term public role, with some participants describing the platform as visually impactful yet socially limited or insufficiently integrated into everyday urban life.

This distinction reveals an important tension within the environmental role of AquaPraça. On one hand, the project appears highly effective in generating visibility, environmental curiosity, and public discussion regarding climate adaptation. On the other hand, many respondents appreciated AquaPraça primarily as an environmental symbol while remaining uncertain regarding its broader practical application or long-term contribution to urban resilience.

Thus, according to these findings, AquaPraça best serves as an experiential method of environmental communication. Through the combination of water, public use of space, and floating design elements located within a shared spatial environment, the AquaPraça platform provides opportunities for climate adaptation to be made socially visible and collectively experienced.



54 **AQUAPRAÇA INTERACTION WITH WATER** PHOTO BY PETER WHITE

## 5.4
# PUBLIC ACCEPTANCE OF FLOATING ARCHITECTURE

AquaPraça does not merely introduce floating architecture as a technical response to climate vulnerability, it also presents floating architecture as a publicly accessible and inhabitable urban condition. As such, the platform allows users to directly experience, interpret, and assess the concept of floating architecture itself. The study found that there exists a simultaneous influence on user perceptions of AquaPraça due to curiosity, awareness of the environment, ambiguity towards the feasibility of floating structures over the long term, and doubt about their long-term applicability as a feasible option.

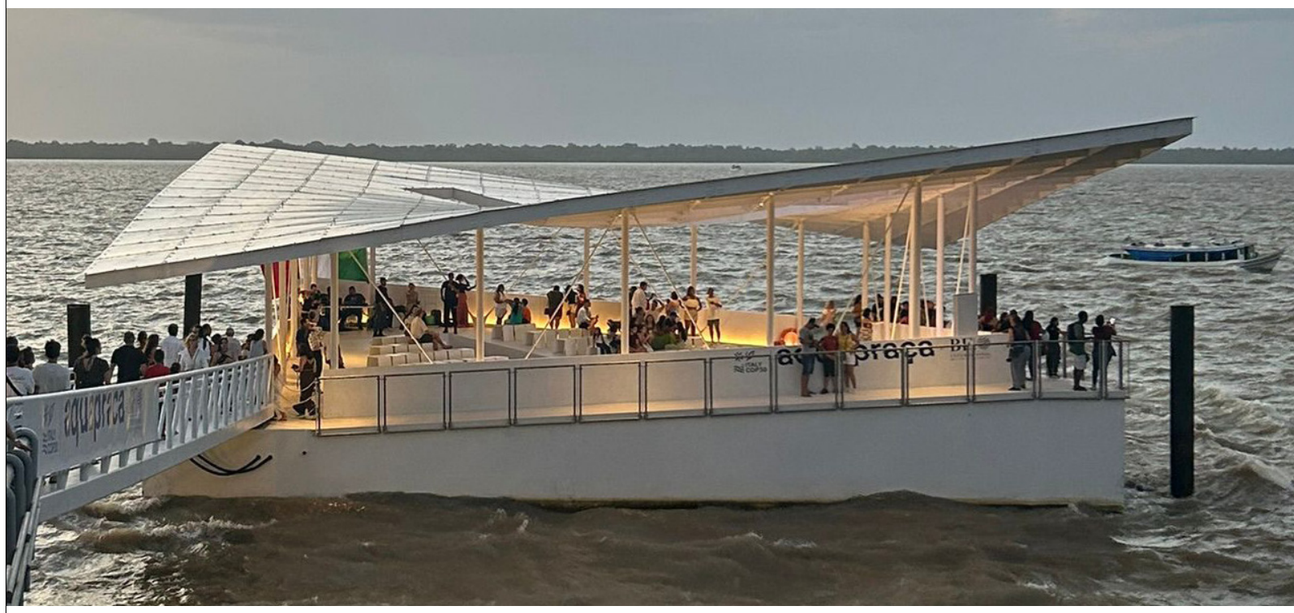
The behavioral observations demonstrated that most users occupied the platform comfortably and interacted with the floating environment without strong visible hesitation during both organized activities and everyday use. People circulated freely throughout the platform, gathered near the water edge, and remained within the space for extended periods of time.

The novelty of AquaPraça appeared to play an important role in attracting attention and encouraging exploration. Observations such as prolonged observation of the water's edge, standing/ walking along the water's edge, touching the surface, etc., indicate a great deal of curiosity among users related to occupying space above water. Thus, AquaPraça not only served as infrastructure, but also as a space for users to experience and witness an unusual urban condition.

Findings based on surveys supported this duality. Many respondents described AquaPraça as innovative, forward-looking, and environmentally relevant. More than half of respondents (52.8%) stated that floating structures could help Belém adapt to rising water levels, while an additional 33.3% responded 'maybe,' indicating cautious optimism toward floating adaptive environments. The floating nature of the platform itself was frequently identified as one of the project's most distinctive and attractive characteristics. Moreover, 77.8% of respondents reported wanting to see additional floating/climate resilient projects developed in Belém indicating a generally favorable attitude toward novel environmental infrastructure..



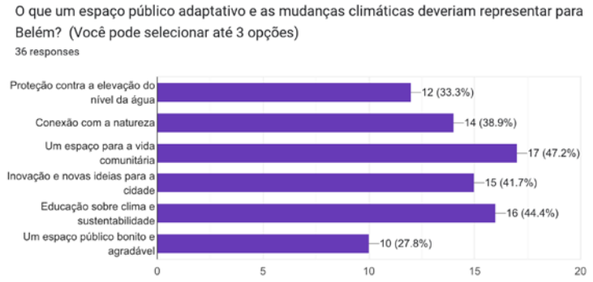
55 **AQUAPRAÇA EVERYDAY USE** PHOTO BY EREN SEZER



**Q9. What should a public space adapting to climate change represent for Belém?**

*(You may select up to 3 options)*

- Protection from rising water
- Connection with nature
- A space for community life
- Innovation and new ideas for the city
- Education about climate and sustainability
- A beautiful and enjoyable public space
- Other: _____




**Q11. Do you think floating structures can help Belém adapt to rising water levels?**

- Yes
- Maybe
- No

56 **AQUAPRAÇA DURING THE ORGANIZED EVENT** PHOTO BY EREN SEZER

At the same time, a positive reaction was typically followed by uncertainty about long-term feasibility. Respondents frequently raised worries about maintenance, safety, structural stability, accessibility and scalability. The main concerns of floating public places were maintenance and long-term durability, which were chosen by 63.9% of the respondents. Other issues raised were safety (38.9%), accessibility and movement within the platform (41.7%) and not understanding how floating systems work. These findings are significant in that they imply the resistance to floating architecture was less a function of the floating condition, and more to do with concerns about long-term management, longevity and everyday usability.

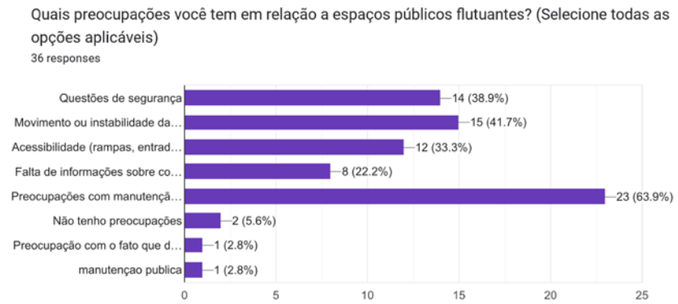
Many respondents liked the idea of AquaPraça in concept but were not sure about its implementation on a larger scale. Many of the participants talked about the platform in terms of an experimental installation or symbolic environmental statement rather than a viable long-term strategy. This conflict was also highlighted in open-ended comments. Some users criticized the limited everyday activation of the site, the limited access after COP30, or the undetermined long-term aim.

These paradoxes are extremely important. AquaPraça appears to be very successful in generating visibility, environmental discussion and public curiosity about climate adaptation. However, the same qualities that make it attractive (novelty, symbolism and visibility) also reinforce the perception of it being exceptional rather than ordinary urban infrastructure.

The results also imply that direct spatial experience is a significant factor for public acceptability. The users who visited the platform in person were generally more confident and comfortable with the floating environment than those who knew about AquaPraça just through images or media representations. What this implies is that the occupation itself could be a way of normalizing floating architecture by translating abstract ideas of the environment into real spatial experience.

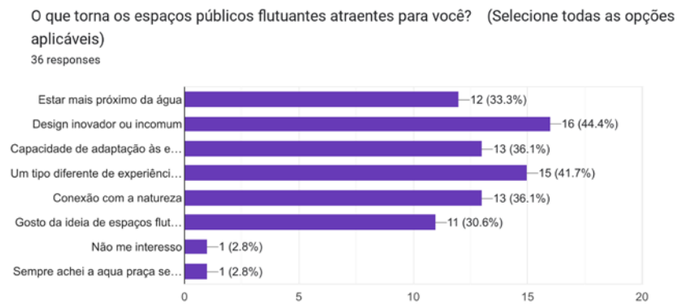
**Q12b. What concerns do you have about floating public spaces?**
*(Select all that apply)*

- Safety concerns
- Movement or instability of the platform
- Accessibility (ramps, entrances, ease of movement)
- Lack of information about how the floating system works
- Worries about maintenance or long-term durability
- I have no concerns
- Other: _____




**Q12a. What makes floating public spaces appealing to you?**
*(Select all that apply)*

- Being closer to the water
- Innovative or unusual design
- Ability to adapt to floods
- A different kind of public experience
- Connection with nature
- I generally like the idea of floating spaces
- Other: _____

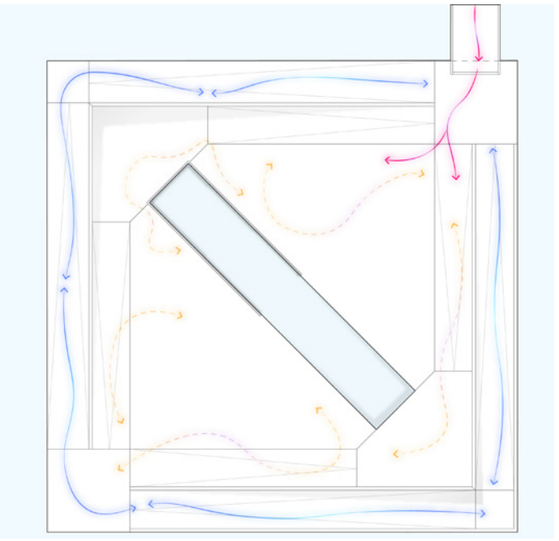


## 5.5
## ACCESSIBILITY AND INCLUSIVITY

The results demonstrate that although AquaPraça presents itself as an open and accessible floating environment where anyone can gather, participate, etc., its evaluation shows that the way users are able to engage in the space, does not depend simply upon its openness. The evaluation clearly indicates that the platform has been successful in promoting group activities, use of the space and environmental awareness, but at the same time reveals significant physical, psychological and social constraints that restrict how users use the space differently.

At a physical level, AquaPraça allows individuals to occupy the space with flexibility of movement and occupation. Users have access to free flowable movement between various zones of seating and social gatherings to the waterfront without enclosures or defined limits of use. It was common to see people, their families, etc. using the space together; thus indicating that AquaPraça provides a multi-functional public use area. However, there were still patterns of occupation that varied across the platform. As previously noted, activity concentrations tended to occur at sitting zones and at the waterfront interface, while areas of the platform had much less usage. Thus the variation in usage across the platform indicated that some parts of the platform provided a greater feeling of comfort, safety and social attraction than did other parts, even though there were no physical barriers limiting use.

Survey comments supported this finding. There were several comments made by respondents expressing concerns relative to balance, movement and comfort while walking on a floating surface especially as it relates to older adults, children, etc. Other respondents questioned if they would be able to continue to utilize the space when it becomes crowded, when it rains, etc. Concerns regarding safety, movement, and accessibility appeared consistently throughout the survey responses. Approximately 41.7% of respondents identified accessibility and ease of movement as important concerns related to floating public spaces, while 38.9% expressed concerns regarding safety and platform instability. This implies that floating public environments introduce psychological barriers to utilization less frequently encountered in typical urban public spaces.



57 VISUAL BEHAVIORAL MAPPING
CIRCULATION

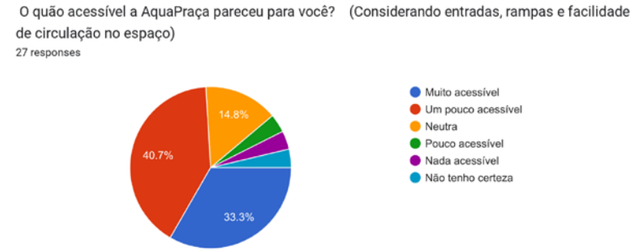


An additional type of exclusion based on a combination of symbolic and cultural identity relative to AquaPraça has emerged from the evaluation process. By virtue of its experimental design and high degree of environmental visibility and distinctiveness, AquaPraça appears highly attractive to visitors with interests in architecture, environmentalism or cultural programming. At the same time, due to these very attributes, it may inadvertently create an impediment to user groups that do not relate to these types of cultural engagements. Some respondents suggested that AquaPraça is primarily attracting audiences interested in environmentalism/cultural programming; this leads to more general questions regarding the extent to which experimental climate adaptive public spaces are socially inclusive.

Additionally, the study showed that events were important in establishing familiarity with the floating environment and facilitating increased numbers of users' involvement. Through programing collectively occupying the platform seemed to decrease hesitation and increase users' comfort via shared activity and social exposure. Beyond event days, however, the platform typically exhibited low social diversity and activity, becoming relatively more observational in nature. This suggests there are questions as to whether floating public environments can support inclusive daily occupations independent of programmatic activation/institutional support.

**Q17. How accessible did AquaPraça feel to you?**
*(Considering entrances, ramps, and ease of movement within the space)*

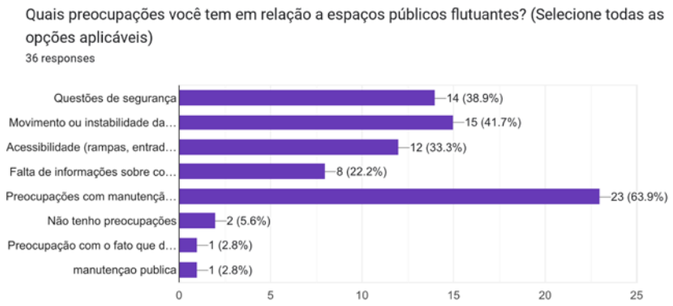
- Very accessible
- Somewhat accessible
- Neutral
- Not very accessible
- Not accessible at all
- Not sure



58 **AQUAPRAÇA EVERYDAY USE** PHOTO BY LEONARDO FINOTTI

**Q12b. What concerns do you have about floating public spaces?**
*(Select all that apply)*

- Safety concerns
- Movement or instability of the platform
- Accessibility (ramps, entrances, ease of movement)
- Lack of information about how the floating system works
- Worries about maintenance or long-term durability
- I have no concerns
- Other: _____








# 5.6
# SYNTHESIS OF FINDINGS

The evaluation results show clearly that AquaPraça has successfully supported social occupation, environmental engagement and temporary collective activation in a floating public environment. Nevertheless, it also demonstrates numerous restrictions with regards to long term occupational behavior and inclusiveness. Based on these results AquaPraça should not be regarded as a fully completed model for floating public space, but as an experimental public platform showing both strengths and weaknesses of floating public architecture.

It becomes apparent from all parts of the evaluation that water significantly influences how people behave when they use AquaPraca. Visual representations clearly show that areas closest to water attract longest occupations, most interactions with each other, most observations and most gatherings during both events and day-to-day usage. The direct proximity to water thus seemed to greatly determine how occupants behaved socially and environmentally.

Moreover, it can be shown from the evaluation that AquaPraca is able to allow different kinds of public occupation at the same time. During events AquaPraca serves as an active civic environment where collective participation and shared attention are key components of the spatial experience. By contrast, outside of events use of space was characterized by fragmentation and lower intensity compared to events. Informal use continued on AquaPraca even outside events, however many areas were relatively unoccupied during quiet hours.

Thus, one of the main contradictions of this project becomes apparent here: AquaPraca is very successful as an event-oriented public space; however, whether it will be possible to maintain comparable levels of daytime occupation remains unclear. Much of the greatest social interaction and collective participation observed in the course of this evaluation depend on specific cultural programs or institutional actions.

At the same time, the evaluation suggests that public acceptance of floating architecture remains conditional. Support appears strongest when AquaPraça is understood as a cultural, environmental, or temporary civic intervention. Confidence becomes less stable when floating architecture is considered as permanent everyday infrastructure integrated into

the city's urban fabric. Survey findings demonstrated generally positive public perceptions toward AquaPraça and floating public architecture. Approximately 77.8% of respondents expressed interest in seeing more floating or climate-adaptive projects developed in Belém, while many respondents associated the platform with innovation, environmental awareness, and new ways of engaging with the waterfront. However, respondents mentioned recurring concerns about comfortability, accessibility, maintenance costs and long term usability again and again in their survey answers. Thus while AquaPraça generates interest and attraction for many users; others perceive floating as unfamiliar or transitory. In this sense, AquaPraça demonstrates that while floating architecture can successfully become socially imaginable and publicly engaging, its transition into normalized urban infrastructure remains uncertain.

Accessibility and inclusiveness represent critical areas of complexity: although AquaPraça is physiologically open to everyone, evaluations indicate that openness alone is not sufficient for providing equal confidence or involvement. the study identifies that aspects of familiarity, cultural association and psychological comfort are equally critical determinants of inclusivity in floating public architecture. Since none of the users were physically barred from utilizing the platform, differing degrees of hesitation and apprehension resulted from being uncertain in regards to how to behave in novel environmental conditions.

Additionally, evaluations indicate that AquaPraça operates best as an experiential space: The project effectively encourages environmental awareness, sensory engagement with water, and public interaction within a climate-sensitive setting. However, this environmental engagement often remained symbolic or experiential rather than deeply educational or transformative. Many users appreciated the atmosphere and environmental qualities of the platform without necessarily viewing it as a practical long-term solution.

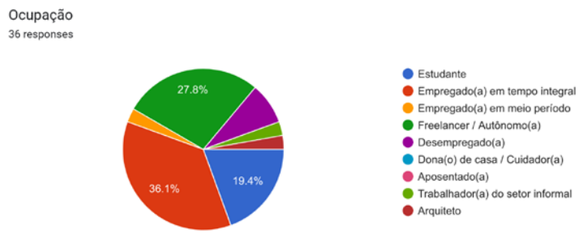
Based on the overall results from this evaluation, it can be concluded that AquaPraça should be understood as an experimental public platform which makes both obvious advantages/possibilities (and disadvantages/weaknesses) visible for floating public architecture: AquaPraça succeeds in allowing for gathering, social interaction, environmental awareness, civic visibility and climate sensitivity; meanwhile it opens up challenges for establishing inclusive, continuous public occupation within a novel/familiar floating environment.[S

**Q1. Please indicate your age:**

- Under 18
- 18–24
- 25–34
- 35–44
- 45–54
- 55–64
- 65 or older

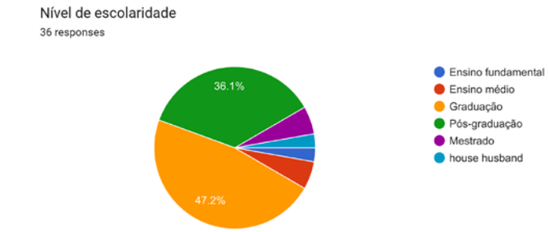
**Q4. Occupation**

- Student
- Employed full-time
- Employed part-time
- Freelancer / Self-employed
- Unemployed
- Homemaker / Caregiver
- Retired
- Informal sector worker
- Other (please specify): _____




**Q3. Education level**

- Primary
- Secondary
- Under-graduate
- Post -graduate
- Other



# 6 DISCUSSION & CONCLUSION

This chapter interprets the findings of the AquaPraça evaluation in relation to the conceptual framework and the broader literature on public space, climate-adaptive architecture, floating environments, and social acceptance. Building on the results presented in Chapter 5, the discussion examines how the project contributes to current understandings of floating public space and its potential role within climate-sensitive cities. Finally, the chapter will conclude with a reflection on the implications of this research, some of the limitations of this work, and how it can contribute to wider debates about the social dimension of climate adaptation and floating architecture.

# 6.1
# AQUAPRAÇA AS A SOCIAL AND CLIMATE-ADAPTIVE PUBLIC

AquaPraça provides evidence that the floating public architecture is more than just a technical response to climate vulnerability. Environmental conditions, public occupation, social interaction and environmental perception will connect within floating urban environments. The findings of the study provide evidence for larger conversations about climate adaptability and adaptive architecture, that emphasize adaptation as both physical and social processes, not as a purely engineering solution (Beatley, 2012; Newman et al., 2009). The findings indicate that the floating public spaces should be assessed not only by their adaptability, but also by their ability to promote public life, environmental awareness, and social acceptance.

One of the strongest findings from this study is related to the connection between environmental closeness and public occupation. Unlike many other public spaces, where environmental factors play second fiddle to circulation or programming, Aqua Praça provided the water as a main element forming movement, attention and length of stay. Observations of behavior clearly showed that the parts of the platform that were the most heavily used, were those that included the waterfront and seating area. People would repeatedly congregate at the waters edge and sit down, watch the river, talk to each other and hang out.  These findings support theories of public space, that demonstrate attractive environmental elements, encourage social and optional behaviors. Gehl (2011), describes why people linger in public spaces, because they want to see something interesting happening. They need to find comfort and value in their surroundings. Whyte (1980), explains that there needs to be room for socializing in public spaces. There needs to be room to take photos, read books etc. He defines that we need to consider public spaces to include space for people to relax, feel safe, and enjoy their surroundings. AquaPraça's occupants followed these principles, using the water as a resource for their enjoyment. It was not just visual stimuli, but a way to enjoy a place.

In addition to supporting theories of public space, AquaPraça challenges common assumptions made about successful public spaces. Successful public spaces are assumed to create high levels of intense social interaction. But the data collected during this study shows that AquaPraça had times of great social interaction and times of very little. Sometimes the entire park seemed empty. This implies that there could be other ways for publicness to occur in floating public spaces. Publicness can mean watching a beautiful view, listening to music, feeling safe, reading a book etc. These kinds of experiences are not represented in common public space assessment models, which typically only measure social interaction as a key measure of success.

Data from the study also supports ideas from environmental psychology, that environmental knowledge comes from embodiment and sensorimotor action, not just visual action (Kaplan & Kaplan, 1989; Pallasmaa, 2012). Instead of looking at the water only visually users interact with it through movement and proximity. Users touched the water, leaned over the side etc. These actions show that AquaPraça encourages forms of environmental awareness based on lived spatial experiences. Climate adaptation becomes visibly inhabited and socially visible instead of just a part of technical solutions. This finding complements ideas presented in climate- adaptive architecture, that climate adaptation should not only be seen as a technological/infrastructure solution for environmental changes. Authors like Beatley (2012), Newman et al. (2009), suggest that climate adaptation must incorporate environmental awareness and user involvement in adaptive urban planning. AquaPraça exemplifies climate adaptation as socially experienced via day-to-day occupation and interaction rather than embedded in technical aspects.

However, this study finds some limitations in this kind of environmental awareness. Many respondents saw AquaPraça as relating to climate adaptation and environmental awareness; however 30.5% said that their awareness of climate adaptation changed nothing as a result of seeing the project. This complicates the assumption that increased environmental visibility always results in better environmental awareness. While AquaPraça created awareness and interest in climate adaptation; it did not necessarily increase general awareness about adaptive urban strategies. This indicates that awareness requires more than just experiential education; it also needs more broad educational programs and institutionalization.

Findings of this study also contribute to an expanding body of research investigating floating architecture beyond its historical emphasis on technical adaptation and residential purposes. Much of existing literature has focused on performance, buoyancy systems, and flooding. Aqua Praça illustrates that floating environments should be studied as sociospatial contexts influencing public interaction, environmental perception and occupation patterns. Thus, this study responded directly to a gap in the literature concerning lack of understanding of the social implications of floating public spaces.

Additionally, findings from the study suggest that present literature on floating architecture might have too strong an emphasis on technical feasibility and inadequate understanding of social integration. Problems with access, familiarity, maintenance and long term usability occurred multiple times through survey responses and behavioral observations. These problems were hardly ever emphasized in previous discussions on floating architecture although they appear to affect users' experiences and evaluations of floating environments greatly. Therefore social performance may be equal to engineering performance or flood resilience for long term success of floating public spaces.

Finally, the findings illustrate that public acceptance of floating architecture is highly dependent upon familiarity and personal experience. Users who personally visited AquaPraça tended to have higher degrees of comfort and confidence towards the floating environment compared to users who only knew the project through photographs or media representation. Personal occupation turned the abstract environmental concept of floating architecture into a lived and socially understandable state. The findings are consistent with innovation adoption theory stating that acceptance of untested innovations progresses through exposure, trial, and experience (Rogers, 2003). Studies examining environmental innovation and adaptive infrastructure have found similar trends, where users reduce perceived uncertainty as they gain experience with new intervention. The findings imply that acceptance of floating architectures may rely less on the floating condition itself, but rather on opportunity for repeated occupation, experience building trust overtime.

Moreover, the findings also indicated that public acceptance should not be viewed as either support or rejection of floating architecture. Many respondents were enthusiastic towards AquaPraça, yet raised questions about maintenance, safety, accessibility, and long term viability. Acceptance seems to exist as a negotiation process rather than as an absolute position. The discovery extends prior social acceptance research indicating that positive attitudes may not eliminate concern for long-term implementation.

Accessibility in floating public spaces cannot be measured simply by physical openness or circulation. Even though AquaPraça was open to everyone throughout this study; users occupied the platform differently due to comfort level with water, psychological feelings towards the floating condition itself, familiarity with water and cultural identity with project. This discovery expands theories regarding accessibility in public space literature. Carr et al. (1992) suggested that accessibility is defined by whether or not you feel welcomed and comfortable entering a space once you enter. Aqua Praça illustrated that floating environments add unique psychological barriers of accessibility including felt security, familiarity with water and comfort in unfamiliar conditions. Therefore inclusivity in climate-adapted public spaces should be analyzed through physical design and experiential perspective.

Overall, the discoveries support and build on four different types of literature introduced in Chapter 2. The first type involves public space theory explaining occupancy and engagement; however, AquaPraça exhibited ways of environmental publicness that are not totally explained by typical assessments for public space. The second type involves climate-adapted architectural theory emphasizing awareness/resilience; however, this study shows that visibility does not produce deeper environmental knowledge. The third type involves floating architectural literature focusing primarily on technical adaptations; however this study illustrates social integration is essential in addition to occupant interactions daily usage. The fourth type involves social acceptance literature emphasizing familiarity/exposure; however this study illustrates acceptance is negotiable even when users agree to support.

Instead of viewing AquaPraça as a model for resilient city making now; this study suggests that it should be thought of as an evolving public prototype illustrating new relationships between water, public life, environmental knowledge, and climate adaptation through social negotiations within cities sensitive to climates.

**59 AQUAPRAÇA IN CASA DAS ONZE JANELLAS, BELEM**
PHOTO BY LEONARDO FINOTTI

## 6.2
## LIMITATIONS OF THE STUDY

Several limitations affected the scope and depth of this research and should be acknowledged when interpreting the findings. These limitations relate primarily to the scale of data collection, the methodological constraints associated with behavioral observation, and the evolving public perception of floating architecture within the local context.

A principal restriction is related to the number of participants surveyed. With 36 participant responses, the survey produced good insight into both public views and general trends regarding AquaPraça; nevertheless, the findings need to be viewed as exploratory and not as a statistical representation of the larger population of Belém. Even though there were attempts to use a variety of methods to disseminate the survey throughout the local community and public, there is potential that respondents may have had greater interest in one or multiple aspects of environmental issues, architecture, culture etc., which could have possibly shaped their total perceptions of the project.

The research was also limited by the nature of the observational methodology. Because the researcher was not based in Belém during the evaluation period, visual–behavioral mapping relied heavily on photographic and videographic documentation collected during specific moments of occupation. Although this method enabled repeated analysis of movement patterns, gathering behavior, and environmental interaction, it limited the ability to continuously observe the platform across different times, weather conditions, seasons, and occupation intensities. Consequently, certain temporary interactions or evolving behavioral patterns may not have been fully captured within the analysis.

Another limitation concerns the evolving public familiarity with floating public environments themselves. Since AquaPraça remains an experimental and relatively unfamiliar spatial condition within Belém, many respondents encountered floating public space for the first time through this project. Perceptions regarding comfort, accessibility, safety, and usability may therefore partly reflect unfamiliarity with the floating condition rather than stable long-term attitudes toward floating architecture more generally. Public perceptions may change significantly through repeated exposure and continued occupation over time.

This research also has limitations relative to evaluating the technical performance and sustainability aspects of the project. Specifically, while the focus of this research was on social occupation, environmental perception, and user experience, no evaluation was conducted relative to the projects' engineering systems, hydrologic performance, or infrastructural efficiencies. Therefore, interpretations of the findings should not be considered a complete technical assessment of AquaPraça's environmental resilience or operating effectiveness.

Lastly, this research is limited to being a single case study in a particular environmental and cultural context. While AquaPraça offers significant insights into the social and environmental dimensions of floating public space, as well as user experiences and negotiations surrounding floating architecture in response to changing climate conditions, the results should not be assumed to be applicable to all types of floating architecture or climate adaptive public spaces. Different climatic conditions, urban cultures, and social contexts will likely generate substantially different forms of occupation, perception, and user engagement.

Even though there are limitations to this research, this study provides critical insight into how floating public spaces are socially engaged with, environmentally perceived and collectively negotiated through in climate sensitive urban environments. Unlike previous studies that provide conclusive evidence supporting floating urbanism, this research presents an exploratory framework for investigating the socio-spatial dimensions of climate-resilient floating public space.

## 6.3
## IMPLICATIONS FOR BELÉM AND SIMILAR CITIESSPACE

It has been observed that the importance of AquaPraça goes far beyond being an assessment of one floating public place. It illustrates how climate adaptive public spaces can add to urban resiliency in cities where water is already part of daily life. For this reason, the relevance of the study is most apparent in Belém, whose history, culture, and physical arrangement were developed over centuries based on rivers, tides, and water front uses.

Many climate adaptation stories highlight the need for cities to “live with water,” but Belém has a history of social, cultural, and economic relationships with water. Water is not a new element brought about by climate change in Belém, but rather an aspect of its identity and everyday operation. Therefore, the issue is not developing new relationships with water, but instead adapting established ones to increased uncertainty of environmental factors.

AquaPraça is important in this sense because it demonstrated how climate adaptive design can utilize the existing environmental connection rather than replace or create distance from it. Additionally, the research suggests that floating public spaces may assist in closing the gap between institutional climate goals and everyday public experience. Climate adaptation is often discussed using policy frameworks, technical infrastructure, and environmental planning techniques. However, these methods are often detached from everyday urban activity. AquaPraça translated climate adaptation into an actual, available and accessible public area for citizens to inhabit, experience and evaluate. Consequently, AquaPraça converted climate adaptation from an abstract policy discussion into a visual and experientially understood condition.

This implication is particularly relevant as Belém host COP30 and increasingly positions itself within global discussions on climate change and environmental resilience. The project demonstrates that climate adaptation can be communicated not only through policy and infrastructure but also through public space. As a result, floating public environments may serve as platforms through which environmental challenges become more accessible to broader segments of society.

At the same time, the study highlights an important distinction between technical adaptation and social adaptation. Although respondents generally viewed AquaPraça positively and frequently associated it with climate adaptation and innovation, concerns regarding maintenance, accessibility, safety, and long-term usability remained significant. These findings suggest that technical feasibility alone does not guarantee social integration. Adaptive environments must also become trusted, familiar, and meaningful components of everyday urban life. The success of climate-adaptive public spaces therefore depends not only on how effectively they respond to environmental conditions, but also on how successfully they are integrated into the social and cultural fabric of the city.

Floating architecture in particular needs to pay attention to these issues. The majority of current discourse concerning floating urban development is concerned with engineering solutions, flood protection, and technology innovation. The findings from AquaPraça suggest that we should give comparable emphasis to questions related to: social usage, accessibility, acceptability among the general public, and long term usage on an everyday basis. As such, the study posits that the successful implementation of floating public spaces may ultimately rely as much on social integration as it does on successful technical performance.

While the environmental and cultural contexts in which Belém exists are certainly unique; however, other riverine,delta and coastal cities around the world are beginning to face similar challenges. Thusly, the study suggests that floating public spaces may assist cities in becoming more resilient not only in terms of responding to changing environmental conditions; but also as a platform for allowing residents to understand those environmental conditions in meaningful ways. Instead of simply serving as an adaptive infrastructure; floating public spaces may be seen as a platform for community participation in environmental understanding, civic activity and public dialogue.

# 6.4
# CONCLUSION

To better understand the social dimensions of floating public space through the lens of AquaPraça in Belém, Brazil, this thesis took a different approach from what most of the current literature on floating architecture takes. That literature is mostly about the technological adaptation, the engineering performance of floating structures, and their ability to resist floods. By treating AquaPraça as a public space (not just a floating object) instead of as a single element of a floating structure, this research attempted to provide some answers as to how users experience and interact with their environment in relation to floating environments.

In summary, the results show that there are benefits associated with floating public spaces that extend far beyond their capacity to adapt to environmental challenges. In addition to being able to demonstrate new ways that people can relate to each other and to water through shared experiences at AquaPraça, the findings illustrate how the creation of a new relationship between people, water, and public life in a floating environment can occur. Although AquaPraça primarily exists because of environmental challenges, it created a space for individuals to collectively interpret and negotiate the way they perceive environmental challenges.

As such, in addition to serving as a means to mitigate flood risks, AquaPraça illustrated how water could be used to enhance public activity and social experience. At the same time, however, the results provided a number of important insights related to the tension between climate adaptation and the manner in which we discuss it today. For example, while AquaPraça was successful in generating environmental awareness and public interest in a flooding issue; these responses did not necessarily indicate that either environmental awareness had increased or that social inclusion would increase over time. Similarly, technical feasibility did not imply public acceptance. Concerns existed in regards to issues like accessability, maintenance, safety, and long term usability amongst respondents who responded positively to AquaPraça. Thusly, it appears that climate adaptation cannot solely be measured through technical performance. Therefore, it is necessary for adaptive environments to have social relevance, familiarity, and be incorporated into our daily lives as well.

Therefore, the study provides evidence that floating public spaces must be evaluated as socio-spatial environments as well as adaptive infrastructures. This represents the primary contribution of this research. The vast majority of studies currently available in the area of floating architecture have investigated how floating systems functioned. This study identifies why understanding how floating systems are socially experienced is equally important. Furthermore, this study adds to an increasing body of knowledge that recognizes that achieving success in climate-adaptive environments will depend upon both social integration and technical adaptation.

From a perspective specific to Belém, the findings represent an important viewpoint. Unlike many cities where the focus of adaptation efforts is on learning to live with water; Belém has historically been shaped by water as a significant aspect of its environmental, cultural, and economic identity. Henceforth, the challenge faced by Belém is not establishing new relationships with water as a result of climate change; but adapting pre-existing relationships with water due to changes caused by climate change. In this regard, AquaPraça provides a valuable lesson on how public spaces can help facilitate that process through engaging residents in collective experiences with respect to water, facilitating individual reflections and experiences with water.

Finally, the value of AquaPraça resides in demonstrating both the potentialities and limitations of floating public environments. Furthermore, AquaPraça illustrates that adaptation is not merely a matter of technology, infrastructure, or environmental management; but also of how people perceive and respond to environmental changes; how they relate to water; and how new types of public activities develop in response to evolving urban conditions. As climate uncertainty continues to alter urban landscapes globally, studying the social aspects of adaptation may ultimately prove as important as developing the technical adaptations themselves.

# 7 APPENDICES

# A- SURVEY QUESTIONNAIRE AND RESULTS

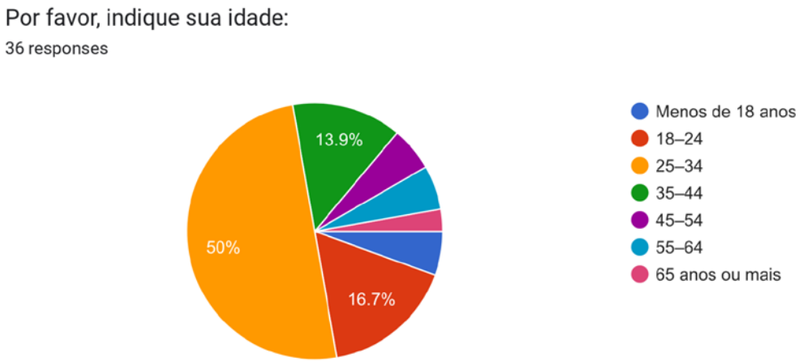
**AquaPraça is a floating public space designed to help Belém find new ways to live with water. As the city deals with hotter weather, more rain, and frequent floods, this project invites people to use a public area that rises and falls with the water. It is also a place to meet, relax, and enjoy nature. This survey asks how people view and use AquaPraça, how they feel there, what they do, whether it brings different groups together, and if it helps raise awareness about environmental changes and the challenges facing Belém's waterfront.**

**We want to hear from people who have visited AquaPraça or are seeing it for the first time in photos. Your feedback will help us learn about the social value of floating public spaces and how they could help Belém adapt to climate and environmental changes. All answers are anonymous and used only for academic research. Thank you for taking part and helping Belém plan for a future shaped by water.**

## SECTION 1 — Contextual Information

**Q1. Please indicate your age:**

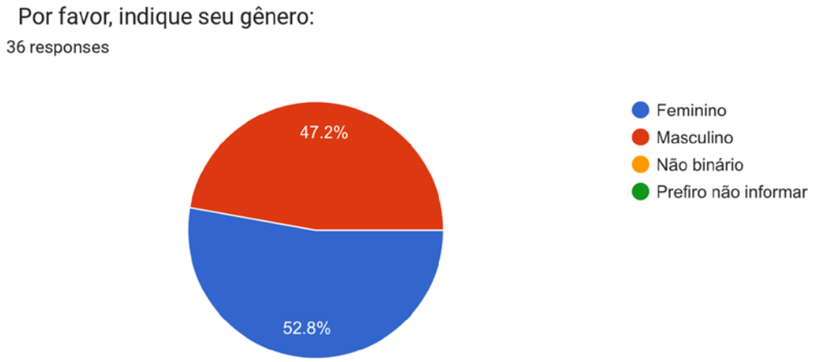
- Under 18
- 18–24
- 25–34
- 35–44
- 45–54
- 55–64
- 65 or older





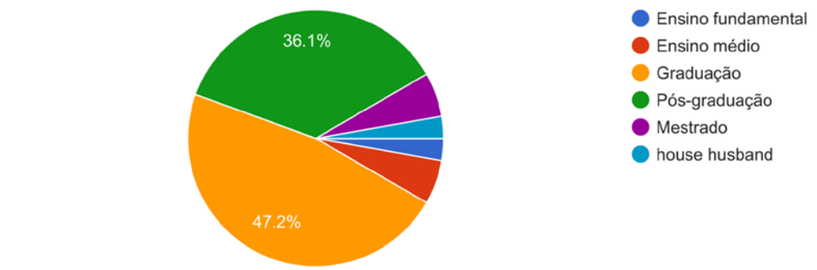

**Q2. Please indicate your gender**

- Female
- Male
- Non-binary
- Prefer not to say



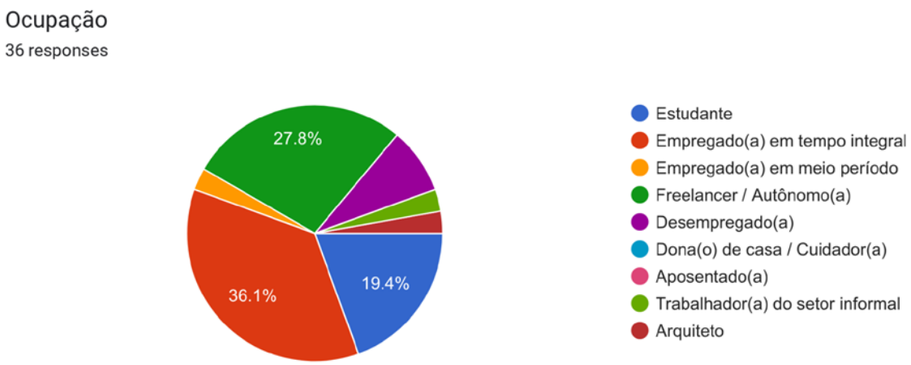

**Q3. Education level**

- Primary
- Secondary
- Under-graduate
- Post -graduate
- Other



**Q4. Occupation**

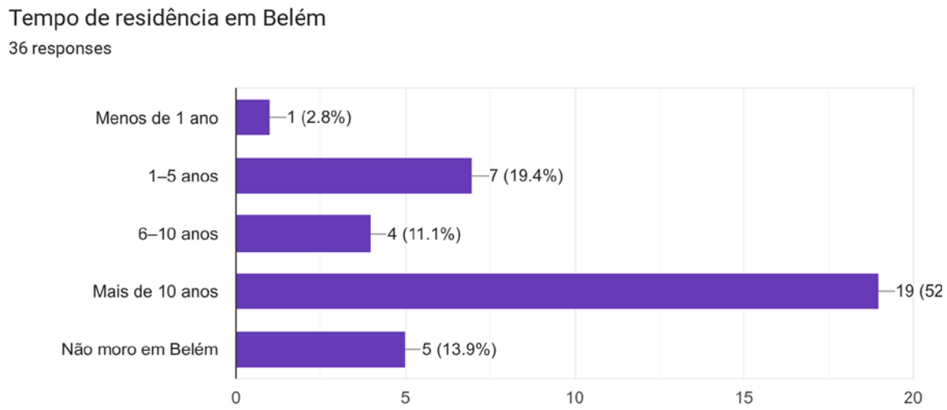
- Student
- Employed full-time
- Employed part-time
- Freelancer / Self-employed
- Unemployed
- Homemaker / Caregiver
- Retired
- Informal sector worker
- Other (please specify): _____






**Q5. Length of residence in Belém**

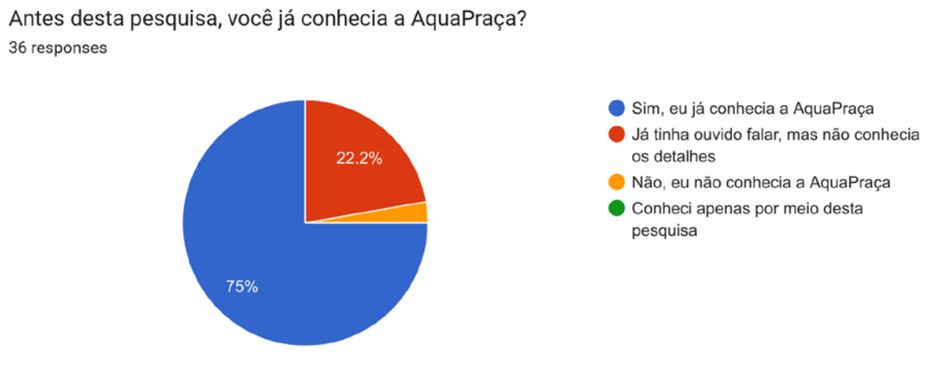
- Less than 1 year
- 1–5 years
- 6–10 years
- More than 10 years
- I do not live in Belém



## SECTION 2 — Awareness & Climate Context

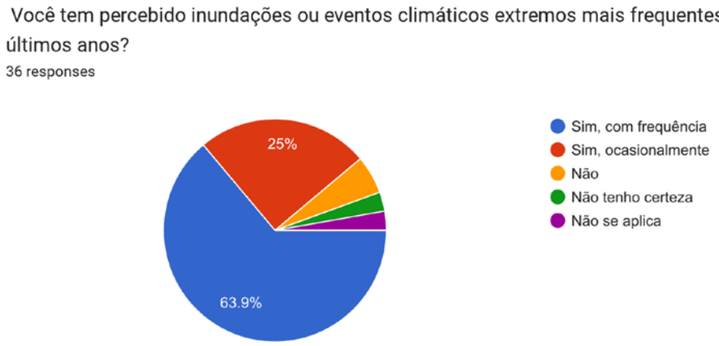
**Q6. Before this survey, were you familiar with AquaPraça?**

- Yes, I already knew about AquaPraça
- I had heard of it but did not know the details
- No, I did not know about AquaPraça
- I only learned about it through this survey




**Q7. Have you noticed more frequent flooding or extreme weather events in Belém in recent years?**

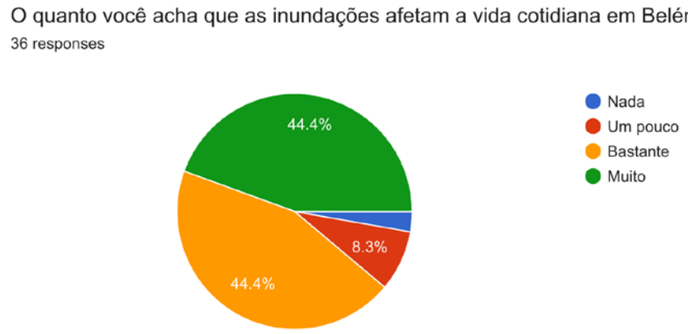
- Yes, frequently
- Yes, occasionally
- No
- Not sure
- Not applicable






**Q8. How much do you think flooding affects daily life in Belém?**

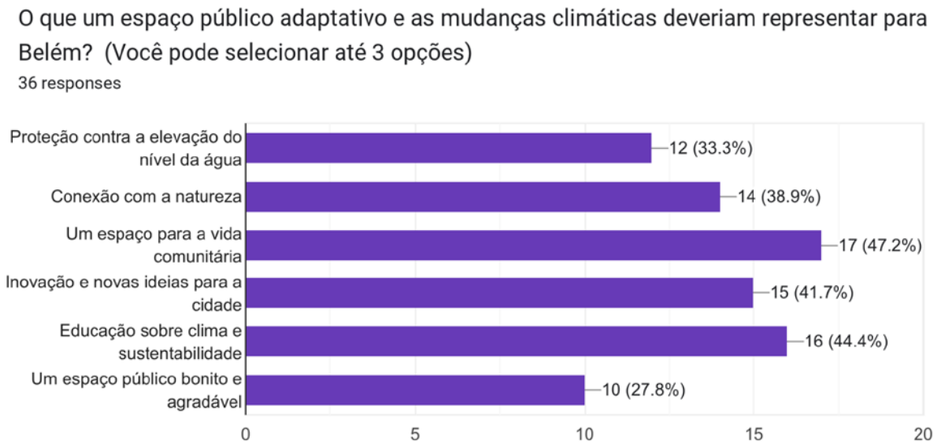
- Not at all
- A little
- Quite a lot
- Very much



**Q9. What should a public space adapting to climate change represent for Belém?**

*(You may select up to 3 options)*

- Protection from rising water
- Connection with nature
- A space for community life
- Innovation and new ideas for the city
- Education about climate and sustainability
- A beautiful and enjoyable public space
- Other: _____




## SECTION 3 — Floating Architecture Perception

**Floating structures** are spaces built to stay on water rather than on land.

They rise and fall with water levels caused by rain, tides, or floods, allowing them to remain usable instead of being flooded.

**Q10. Before this survey, had you heard about floating structures in general?**

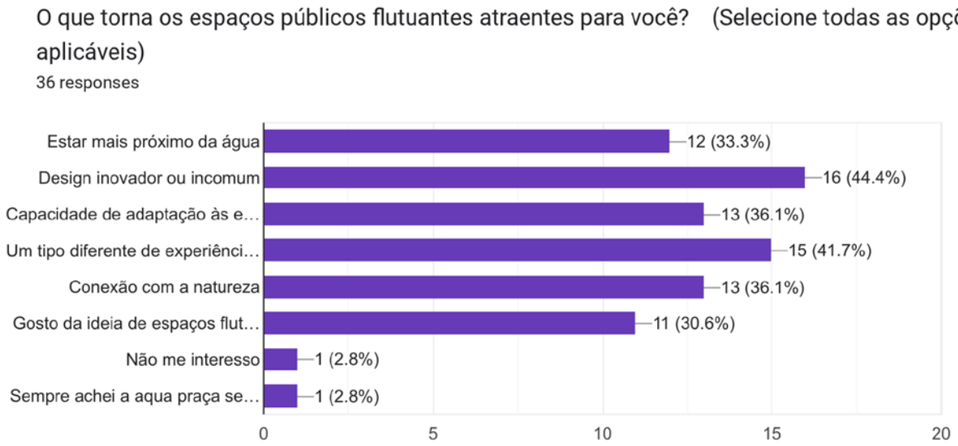
- Yes
- No

**Q11. Do you think floating structures can help Belém adapt to rising water levels?**

- Yes
- Maybe
- No

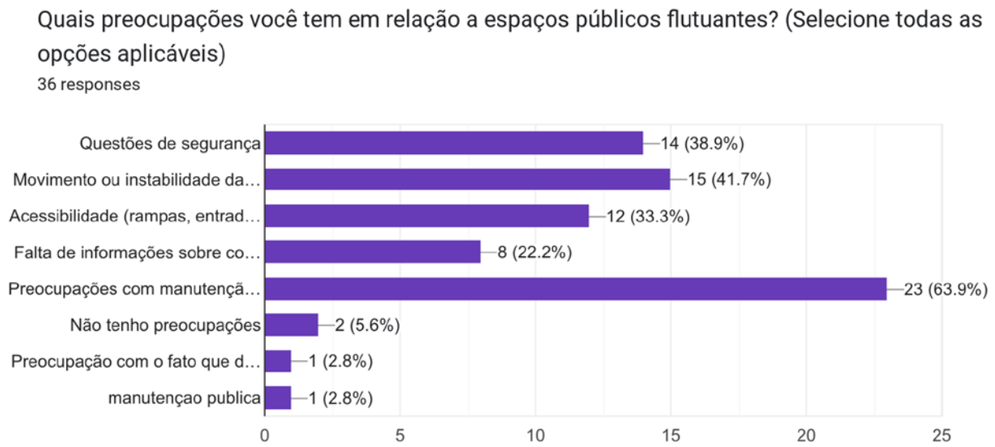
**Q12a. What makes floating public spaces appealing to you?**
*(Select all that apply)*

- Being closer to the water
- Innovative or unusual design
- Ability to adapt to floods
- A different kind of public experience
- Connection with nature
- I generally like the idea of floating spaces
- Other: _____




**Q12b. What concerns do you have about floating public spaces?**
*(Select all that apply)*

- Safety concerns
- Movement or instability of the platform
- Accessibility (ramps, entrances, ease of movement)
- Lack of information about how the floating system works
- Worries about maintenance or long-term durability
- I have no concerns
- Other: _____



## SECTION 4 — Experience of AquaPraça

**12 images & 2 video** into this section.

AquaPraça is a floating public space that shows how cities like Belém can adapt their public areas to rising water and climate change. The 400-square-meter platform is anchored along Guajará Bay in the Amazon River system and rises and falls with the river, following Archimedes' principle. It adjusts naturally to the Amazon Delta's daily tides, which can vary by up to four meters. Visitors can see for themselves how natural and built systems work together and observe the changing water landscape up close.

AquaPraça is meant to be a welcoming spot where people can gather, relax, and take part in community activities. It acts as a civic center, hosting cultural programs, public events, and discussions about climate resilience. The project was first introduced in a simpler version in Venice and later featured at COP30 as an extension of the House of Eleven Windows. Today, it is a cultural landmark and a symbol of cooperation between Italy and Brazil. Located where the Amazon River meets the Atlantic Ocean, one of the world's busiest estuaries, AquaPraça is a new example of adaptive public space and shows how Belém can connect with its waters while preparing for a stronger future.

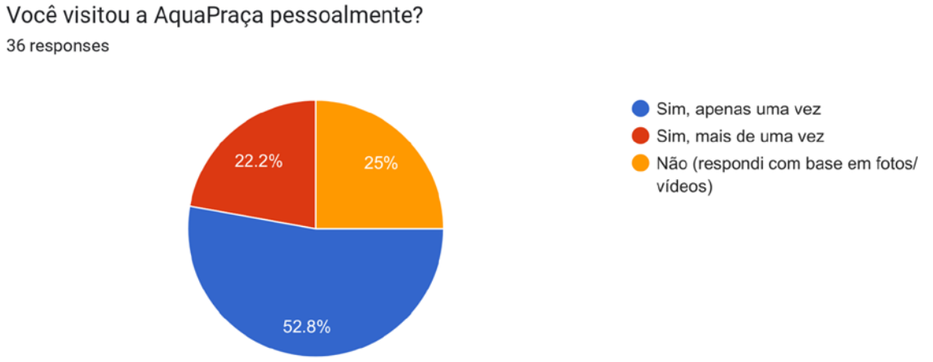
*The following questions focus on your experience and impressions of AquaPraça.*

*Please answer the following questions based on your personal visit or on what you observe in the images and videos above.*



**Q13. Have you visited AquaPraça in person?**

- Yes, only once
- Yes, more than once
- No (answer based on photos/videos)

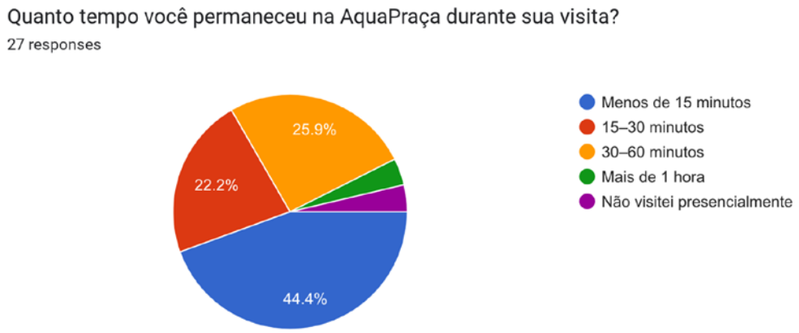



**Q14. Overall, how would you describe your impression of AquaPraça?**

- Very positive
- Positive
- Neutral
- Negative

**Q15. How long did you stay at AquaPraça during your visit?**

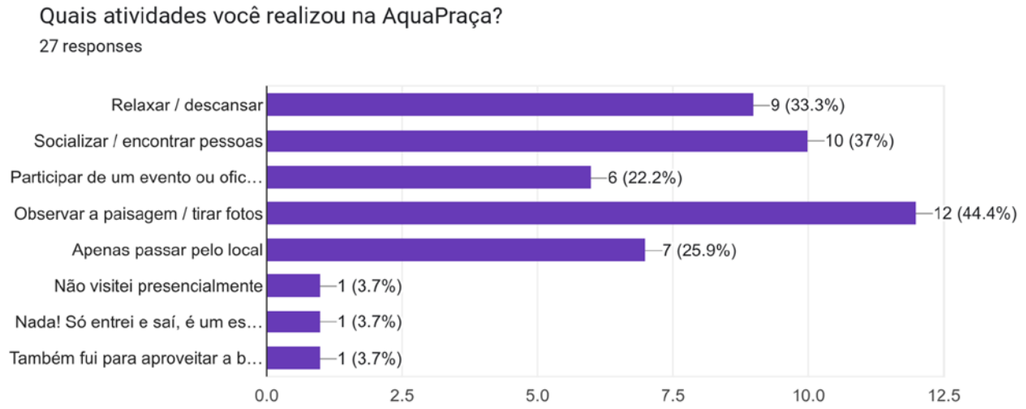
- Less than 15 minutes
- 15–30 minutes
- 30–60 minutes
- More than 1 hour
- I did not visit in person




**Q16. Which activities did you do at AquaPraça?**

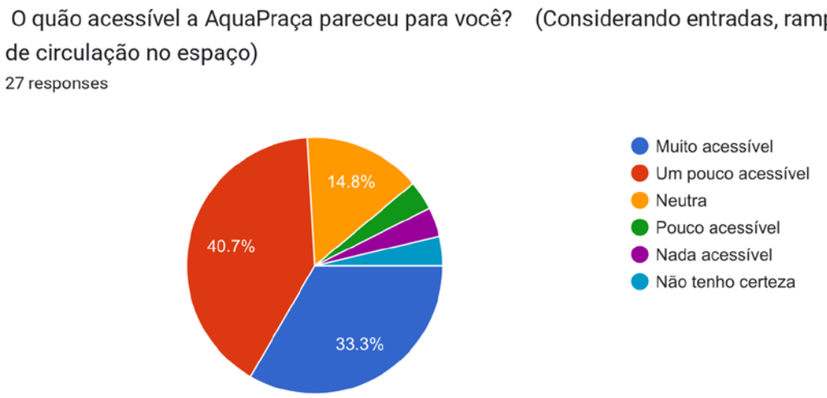
*Checkboxes*

- Relaxing / resting
- Socializing / meeting people
- Participating in an event or workshop
- Observing the view / taking photos
- Passing by
- I did not visit in person
- Other: _____



**Q17. How accessible did AquaPraça feel to you?**
*(Considering entrances, ramps, and ease of movement within the space)*

- Very accessible
- Somewhat accessible
- Neutral
- Not very accessible
- Not accessible at all
- Not sure




**SECTION 5 — Social Interaction**

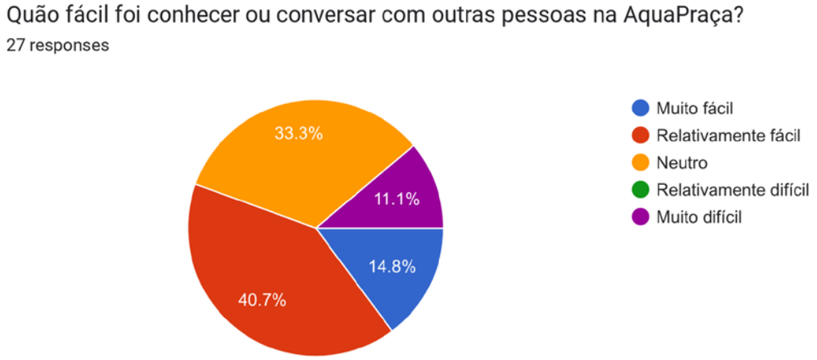
These questions ask about how you interacted with others in the space.

**Q18. Did you interact with other visitors while at AquaPraça?**

- Yes
- No

**Q19. How easy was it to meet or talk with others in AquaPraça?**

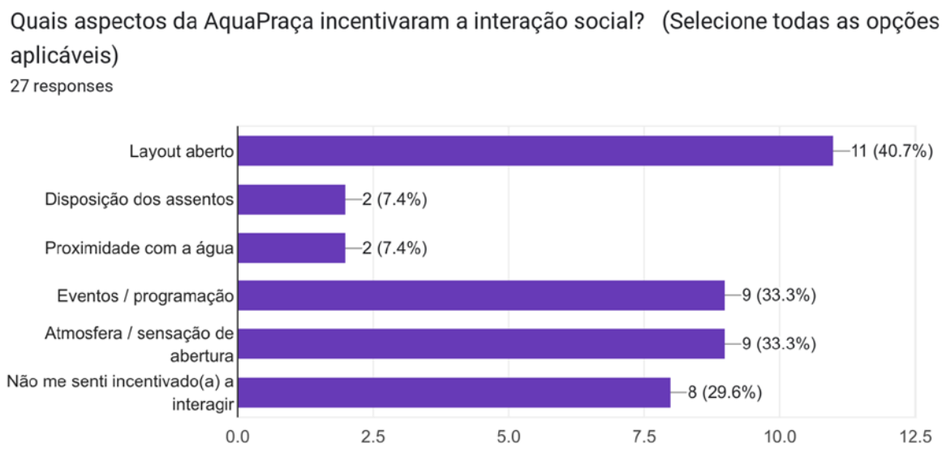
- Very easy
- Somewhat easy
- Neutral
- Somewhat difficult
- Very difficult



**Q20. Which aspects of AquaPraça encouraged social interaction?**

*Checkboxes*

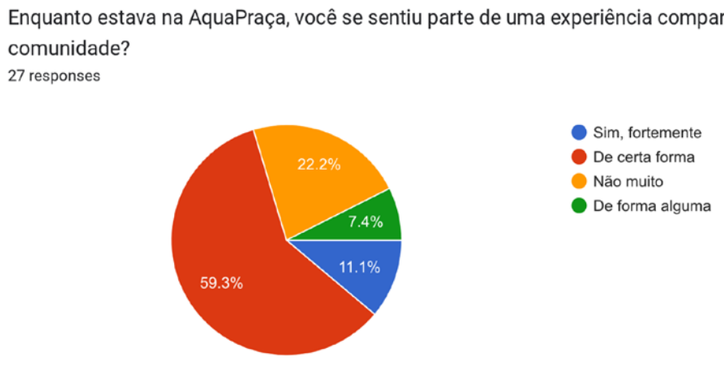
- Open layout
- Seating arrangements
- Proximity to water
- Events/programming
- Atmosphere/sense of openness
- I did not feel encouraged to interact
- Other: _____





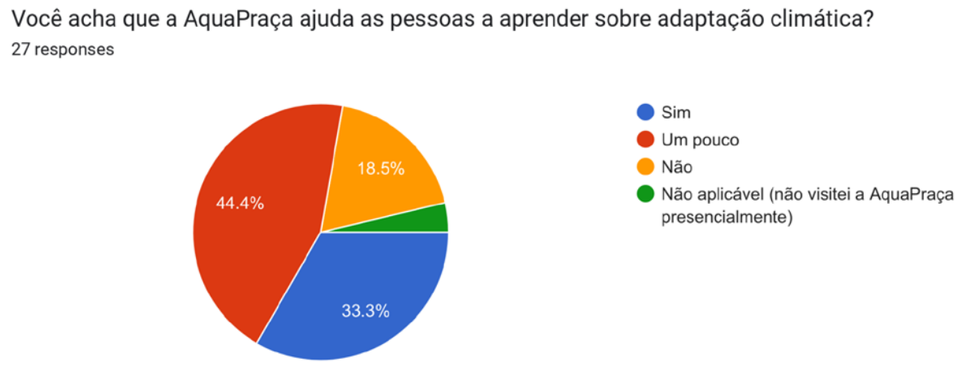

**Q21. While in AquaPraça, did you feel part of a shared experience or community?**

- Yes, strongly
- Somewhat
- Not really
- Not at all



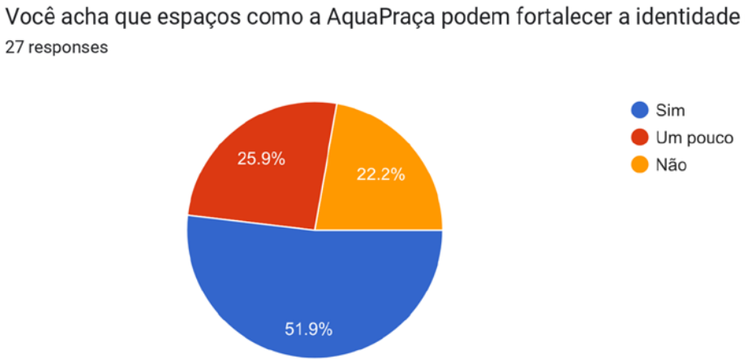

**Q22. Do you feel AquaPraça helps people learn about climate adaptation?**

- Yes
- Somewhat
- No
- Not applicable (I have not visited AquaPraça in person)



**Q23. Do you think spaces like AquaPraça can strengthen community identity in Belém?**

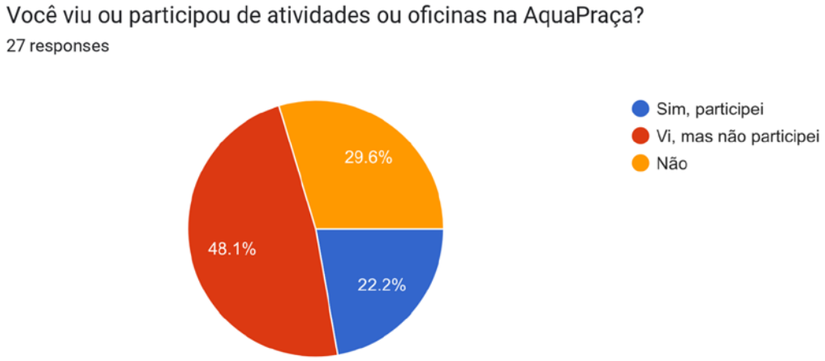
- Yes
- Somewhat
- No
- Not applicable (I have not visited AquaPraça in person)




## SECTION 6 — Community Participation

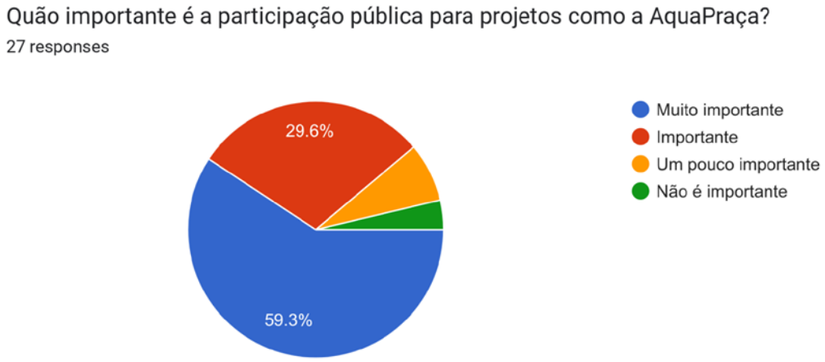
**Q24. Did you see or participate in activities or workshops at AquaPraça?**

- Yes, I participated
- I saw them but did not participate
- No



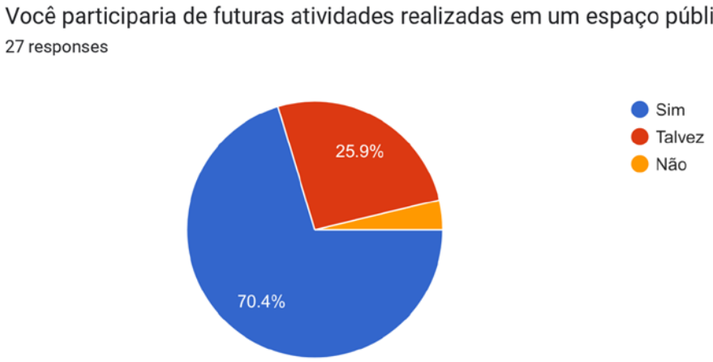

**Q25. How important is public participation for projects like AquaPraça?**

- Very important
- Important
- Somewhat important
- Not important



**Q26. Would you participate in future activities hosted in a floating public space?**

- Yes
- Maybe
- No

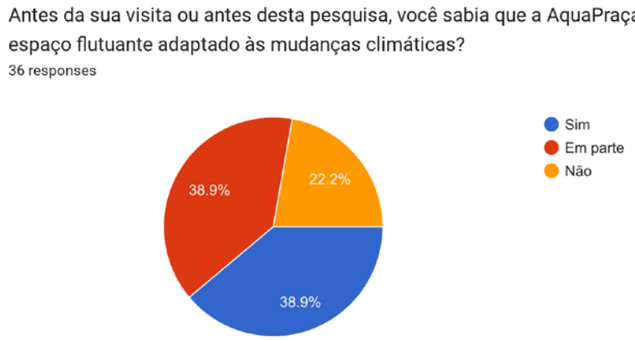



**SECTION 7 — Environmental Awareness (Before vs After AquaPraça)**

These questions explore whether AquaPraça influenced your understanding of climate and water.

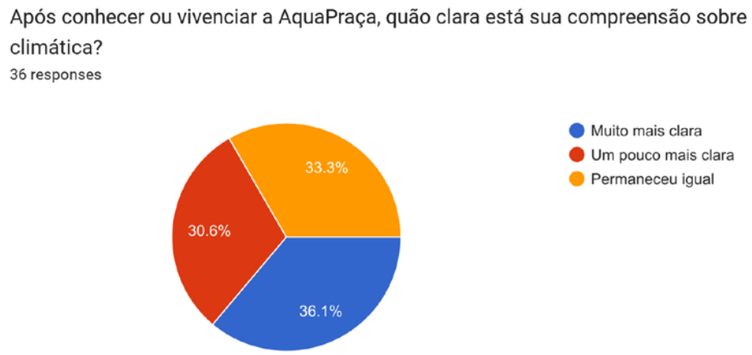
**Q27. Before your visit or before this survey, did you know AquaPraça was designed as a floating climate-adaptive space?**

- Yes
- Somewhat
- No




**Q28. After experiencing AquaPraça, how clear is your understanding of climate adaptation?**

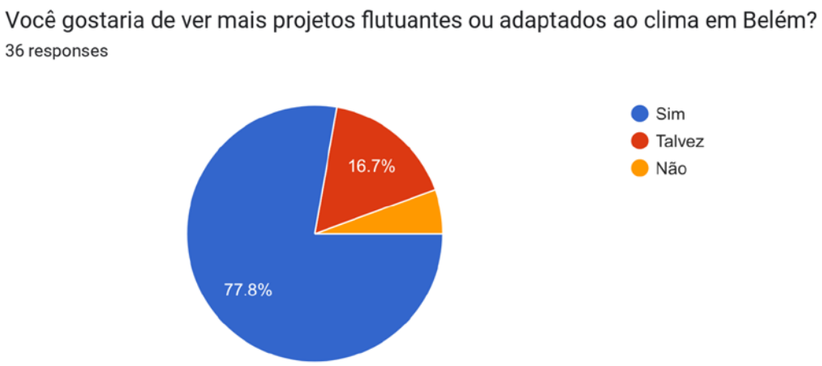
- Much clearer
- A little clearer
- Unchanged



## SECTION 8 — Future Vision

**Q29. Would you like to see more floating or climate-adaptive projects in Belém?**

- Yes
- Maybe
- No




**Q30. In one sentence, what could floating public spaces represent for the future of Belém?**

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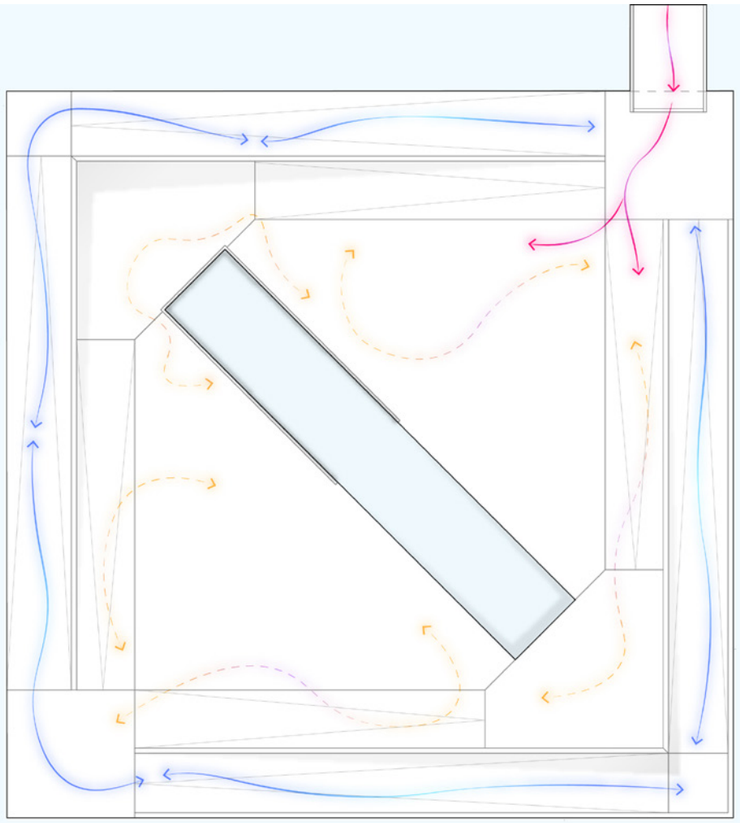
Thank you for taking the time to share your experience and thoughts. Your input contributes to research on how public spaces can adapt to water and climate challenges in Belém.

# B- VISUAL-BEHAVIORAL MAPPING DIAGRAMS



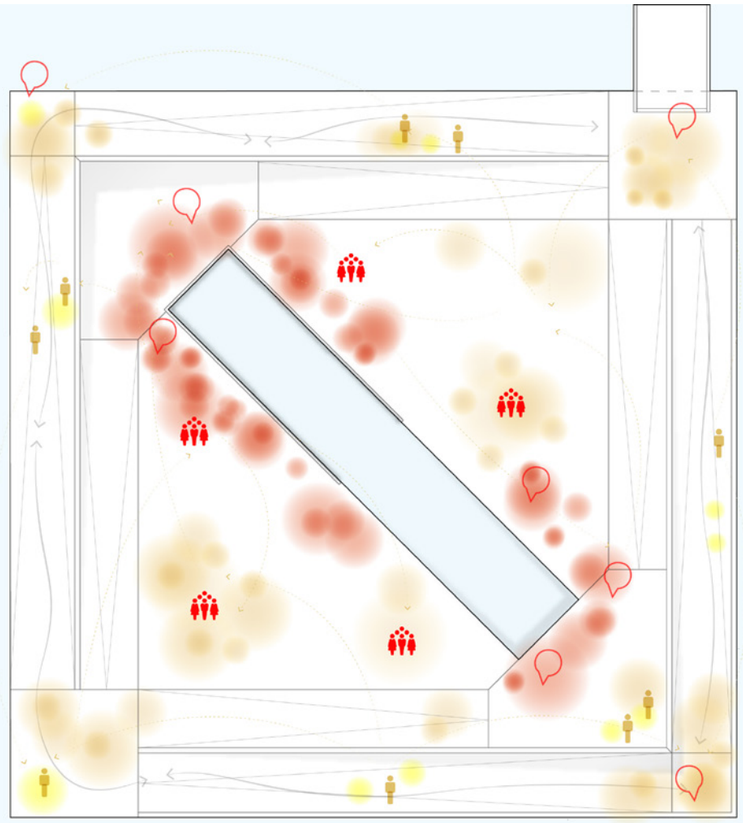
Entry Flow
inward movement from gangway

Primary movement
Contunuous perimeter circulation loop

Secondary movement
Movement towards seating areas and water table

**MOVEMENT**

Movement is structured primarily along a continuous perimeter loop, with entry flows distributing users laterally. The central area is not a primary circulation zone but is accessed through secondary path.



High density
Prolonged stay, strong social interaction, main gathering area

Medium density
Moderete stay, small group interaction, activity spillover

Low density
Short stay, casual standing, passing by, transitional pause

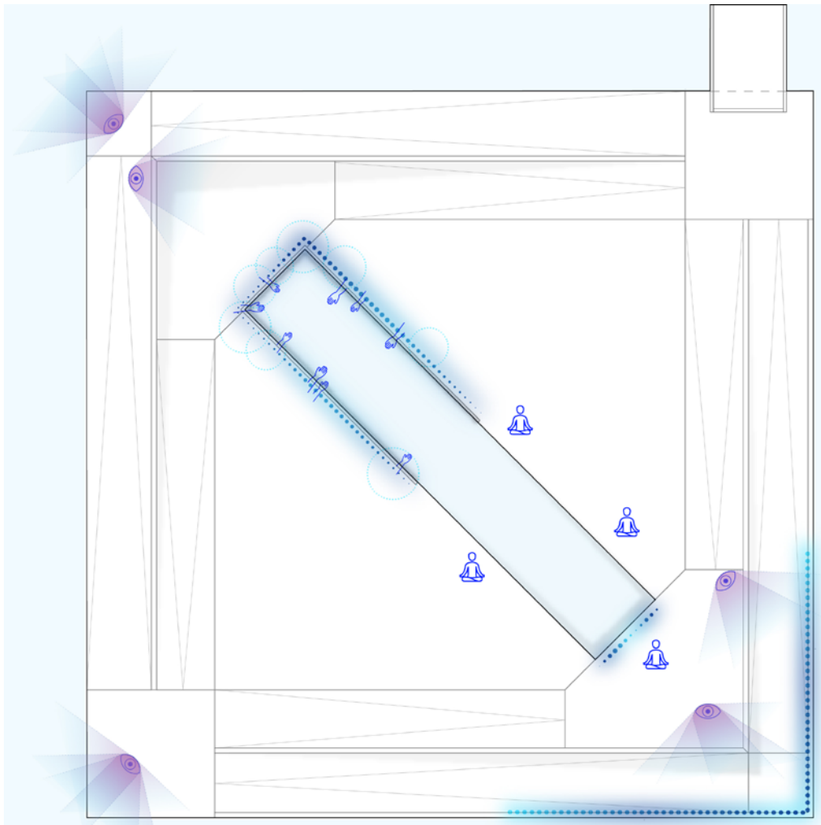
Large Group
10+ people events, performances, collective activities

Medium Group
2-6 people conversation, friends family groups

Individual
Solitary occupation, observing, resting, taking pictures

**SOCIAL DENSITY & INTERACTION**

Areas of prolonged occupation correspond directly with zones of intensified social interaction, indicating that spatial configuration and water proximity strongly influence collective behavior. The platform supports multiple layers of social occupation ranging from informal interpersonal encounters to organized collective gathering.



**water interaction zone**
Areas of strongest attraction where people interact and observe water

**Visual orientation**
Visual connection beyond the the platform towards the environment

**Tactile interaction points**
Locations where users touvh or engage directly with the water

**Sitting/leaning**

**WATER INTERACTION & ENVIRONMENTAL ORIENTATION**

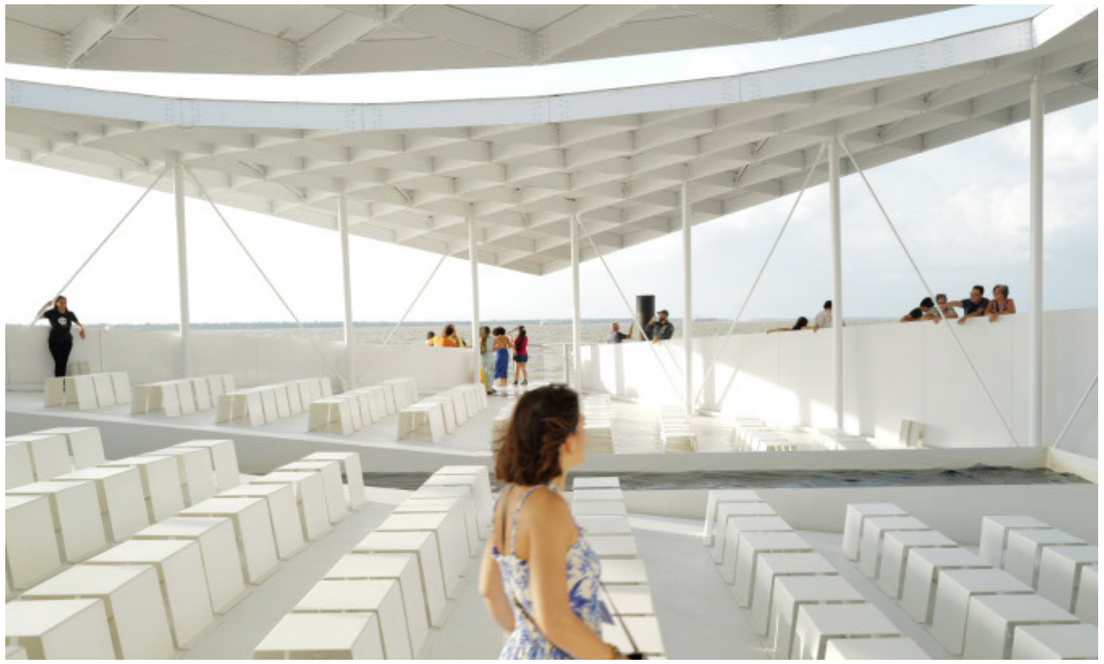
Water operates as an active spatial attractor rather than a passive background condition. Observed behaviors demonstrate prolonged occupation, bodily orientation, tactile interaction, and collective attention directed toward the water interface.
The platform establishes both internal and external environmental awareness through continuous visual and physical proximity to water.

## C- ADDITIONAL IMAGES AND OBSERVATION MATERIAL

aquapraça
BF
ITALY
COP30

ITALY
COP30

aquapraça



# 8 BIBLIOGRAPHY

Abreu, G. (2025). COP30 drives the creation of new tourist spaces and infrastructure works in Belém. Agência Pará de Notícias. https://agenciapara.com.br/news/72272/cop30-drives-the-creation-of-new-tourist-spaces-and-infrastructure-works-in-belem

Adger, W. N. (2000). Social and ecological resilience: Are they related? Progress in Human Geography, 24(3), 347–364. https://doi.org/10.1191/030913200701540465

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. Global Environmental Change, 15(2), 77–86. https://doi.org/10.1016/j.gloenvcha.2004.12.005

Aigwi, I. E., Duberia, A., & Nwadike, A. N. (2023). Adaptive reuse of existing buildings as a sustainable tool for climate change mitigation within the built environment. Sustainable Energy Technologies and Assessments, 56, 102945. https://doi.org/10.1016/j.seta.2022.102945

Ameh, H., Badarnah, L., & Lamond, J. (2024). Amphibious architecture: A biomimetic design approach to flood resilience. Sustainability, 16(3), 1069. https://doi.org/10.3390/su16031069

Barros, D. F., & Albernaz, A. L. K. M. (2014). Possible impacts of climate change on wetlands and its biota in the Brazilian Amazon.

Beatley, T. (2014). Blue urbanism: Exploring connections between cities and oceans. Island Press. https://doi.org/10.5822/978-1-61091-564-9

Busse, M., de Graaf-van Dinther, R. E., & van Veelen, P. C. (2022). Floating urbanization: A conceptual framework for resilient urban development. Sustainability, 14(9), 5120.

Caldarice, O., Brunetta, G., & Tollin, N. (2018). Urban resilience for risk and adaptation governance: Theory and practice. Springer. https://doi.org/10.1007/978-3-319-76944-8

Callegaro, M. (2019). Houseboat communities as floating neighbourhoods for degrowth: How living afloat is reshaping the urban morphology of European metropolises. In I. Geddes, N. Charalambous, & A. Camiz (Eds.), Cities as Assemblages: Proceedings of the XXVI International Seminar on Urban Form (ISUF 2019). Tab Edizioni. https://doi.org/10.36158/978889295357445

Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2010). Public places urban spaces: The dimensions of urban design. Routledge.

Carvalho, J. T., Silva, R. C. V., Souza Filho, P. W. M., & colleagues. (2025). Hydrodynamic modeling as a decision-support tool for coastal management in the Pará River Estuary and Guajará Bay, eastern Amazon. Hydrology, 13(6), 152. https://doi.org/10.3390/hydrology13060152

Castro, M. D., & Tavares, A. C. (2020). The social production of public space in the city of Belém-PA: The case of Complexo Feliz Lusitânia e Feira do Açaí. Cadernos de Geografia. https://doi.org/10.14195/0871-1623_42_5



D'Auria, M. (2025, September 5). With most projects over 90% complete, Belém prepares to welcome the world. COP30 Infrastructure. https://cop30.br/en/news-about-cop30/with-most-projects-over-90-complete-belem-prepares-to-welcome-the-world

Díaz-Pinzón, L., Sierra, L., Trillas, F., & Herrera, L. (2025). The socio-cultural value of urban wetlands: Insights into local sustainable management. Journal of Environmental Management, 395, 127933. https://doi.org/10.1016/j.jenvman.2025.127933

Edwards, B. (2010). Rough guide to sustainability: A design primer. RIBA Publishing. urn:oclc:record:1319585039

English, E. (2009). Amphibious Foundations and the Buoyant Foundation Project: Innovative strategies for flood-resilient housing.

Facundes, A., Chuma, V. J., & Mustin, K. (2024). Urban green space exposure is low and unequally distributed in an Amazonian metropolis. Environmental Conservation, 50(3), 168–178. https://doi.org/10.1017/S0376892924000092

Finn, B. M., & Cobbinah, P. B. (2022). Planning and climate change in African cities: Informal urbanization and 'just' urban transformations. Journal of Planning Literature. https://doi.org/10.1177/08854122221128762

Friesenecker, M., Schneider, A., Bügelmayer-Blaschek, M. et al. Socially equitable climate risk management of urban heat. npj Urban Sustain 5, 8 (2025). https://doi.org/10.1038/s42949-025-00202-2

Garkhel, K., & Verma, R. (2020). Floating architecture as a new paradigm of architecture. ResearchGate. https://www.researchgate.net/publication/350629996_Floating_Architecture_as_a_new_paradigm_of_architecture

Gehl, J. (2011). Life between buildings: Using public space. Island Press.

Gehl, J., & Svarre, B. (2013). How to study public life. Island Press.

Gómez-Redondo, S., Gómez, N. P., Obregón, L. J., Coca, J. R., & Díaz, A. P. (2024). Urban transformations for universal accessibility: Socio-educational dialogue. Urban Science, 8(4). https://doi.org/10.3390/urbansci8040161

Graaf, R. de. (2009). Innovative water management in the Netherlands: Floating urbanization. Journal of Urban Design, 14(4), 465–479. https://doi.org/10.1080/1573062X.2010.527351

Graça, M., Cruz, S. S., Monteiro, A., & Neset, T. S. (2022). Designing urban green spaces for climate adaptation: A critical review of research outputs. Urban Climate, 42. https://doi.org/10.1016/j.uclim.2022.101126

Grydehøj, A. (2015). Making the most of small islands: Island studies and the sustainability of island communities. Island Studies Journal, 10(1), 96–117. https://doi.org/10.1111/area.12207

Huebner, J. (2025). Floating and stilted structures as strategies in coastal climate adaptation: A review of vernacular and emerging approaches. Ocean & Coastal Management, 252. https://doi.org/10.1016/j.crm.2025.100719

Instituto Nacional de Meteorologia. (2022). Normais climatológicas do Brasil 1991–2020. INMET. https://doi.org/10.1016/j.crm.2025.100719

Instituto Nacional de Meteorologia. (2025, November 11). COP30: Belém mais quente e mais chuvosa. https://portal.inmet.gov.br/noticias/cop-30-bel%C3%A9m-mais-quente-e-mais-chuvosa

Intergovernmental Panel on Climate Change. (2023). Climate change 2023: Synthesis report. IPCC. https://www.ipcc.ch/report/ar6/syr/

Klinenberg, E. (2018). Palaces for the people: How social infrastructure can help fight inequality, polarization, and the decline of civic life. Crown.

Lefebvre, H. (1991). The production of space. Blackwell.

Lin, Y.-H., Lin, Y.-C., & Tan, H.-S. (2019). Design and functions of floating architecture: A review. Marine Georesources & Geotechnology, 37(7), 880–889. https://doi.org/10.1080/1064119X.2018.1503761

Low, S., Taplin, D., & Scheld, S. (2005). Rethinking urban parks: Public space and cultural diversity. University of Texas Press. https://books.google.it/books?id=cUhYBCSAYIEC

Ma, X., & Ren, J. (2025). Resilient urban and architecture design—Strategies for low-carbon and climate-adaptive cities. Buildings, 15(14). https://doi.org/10.3390/buildings15142408

Mansur, A. V., Brondizio, E. S., Roy, S., Hetrick, S., Vogt, N. D., & Newton, A. (2016). An assessment of urban vulnerability in the Amazon Delta and Estuary: A multi-criterion index of flood exposure, socio-economic conditions and infrastructure. Sustainability Science, 11(4), 625–643. https://doi.org/10.1007/s11625-016-0355-7

McDonough, W., & Braungart, M. (2002). Cradle to cradle: Remaking the way we make things. North Point Press.

McPhearson, T., Andersson, E., Elmqvist, T., & Frantzeskaki, N. (2015). Resilience of and through urban ecosystem services. Ecosystem Services, 12, 152–156. https://doi.org/10.1016/j.ecoser.2014.07.012

Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. Landscape and Urban Planning, 147, 38–49. https://doi.org/10.1016/j.landurbplan.2015.11.011

Nath, S. (2024). Mobilising transformative community-based climate change adaptation. Urban Transformations, 6. https://doi.org/10.1186/s42854-023-00059-7

Nijhuis, S., & de Vries, J. (2019). Design as Research in Landscape Architecture. 10.3368/lj.38.1-2.87



Nunes, H. G. G. C., Silva, J. A. F., & Furtado, L. G. (2020). Urban climate and environmental perception about climate change in Belém, Pará, Brazil. Research, Society and Development, 9(7). https://doi.org/10.33448/rsd-v9i7.4776

Olthuis, K., & Keuning, D. (2010). Float!: Building on water to combat urban congestion and climate change. Frame Publishers. https://www.researchgate.net/publication/354374792_Float_Building_on_Water_to_Combat_Urban_Congestion_and_Climate_Change

Painel Brasileiro de Mudanças Climáticas. (2016). Impactos, vulnerabilidades e adaptação às mudanças climáticas. PBMC.

Pallasmaa, J. (2005). The eyes of the skin: Architecture and the senses. Wiley.

Paumgartten, J. V., Maués, L. M., & Rocha, C. A. (2018). Risco de inundação na cidade de Belém (PA): A percepção técnica e social do risco. Revista Brasileira de Gestão e Desenvolvimento Regional, 17(1). https://doi.org/10.54399/rbgdr.v17i1.6172

Qi, J., Mazumdar, S., & Vasconcelos, A. C. (2024). Understanding the relationship between urban public space and social cohesion: A systematic review. International Journal of Community Well-Being, 7. https://doi.org/10.1007/s42413-024-00204-5

Rasch, R. J. (2016). Income inequality and urban vulnerability to flood hazard in Brazil. Social Science Quarterly, 98(1), 1–16. https://doi.org/10.1111/ssqu.12274

Riise, J., & Adeyemi, K. (2015). African water cities. Lars Müller Publishers.w

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

Rombach, S., van den Brink, M., Restemeyer, B., & Horlings, I. (2026). Exploring the social and spatial dimensions of floating urban development: A typology of floating communities. Journal of Water and Climate Change, 17(2), 133–145. https://doi.org/10.2166/wcc.2025.158

Rydborg, M. P., Lauring, M., & Brunsgaard, C. (2020). A review of climate change adaptive measures in architecture within temperate climate zones. Journal of Green Building, 15(2), 113–130. https://doi.org/10.3992/1943-4618.15.2.113

Shannon, K. (2013). From theory to resistance: Landscape and urbanism in the age of climate change. In K. Shannon & M. Smets (Eds.), The landscape of contemporary infrastructure (pp. 142–163). NAi Publishers.

Tuhkanen, H., Cinderby, S., de Bruin, A., Wikman, A., Adelina, C., Archer, D., & Muhoza, C. (2022). Health and wellbeing in cities: Cultural contributions from urban form in the Global South context. Wellbeing, Space and Society, 3, 100071. https://doi.org/10.1016/j.wss.2021.100071

UN-Habitat. (2022). World cities report 2022: Envisaging the future of cities. United Nations Human Settlements Programme.

Vilain, B. (2019). Living on water: Floating urban structures as a response to rising waters (Master's thesis, Delft University of Technology). https://hdl.handle.net/20.500.12608/89136

Weber, E. U. (2006). Experience-based and description-based perceptions of climate risk: Why global warming does not scare us (yet). Climatic Change, 77, 103–120. 10.1007/s10584-006-9060-3

Whyte, W. H. (1980). The social life of small urban spaces. Conservation Foundation.

Yeang, K. (2006). EcoDesign: A manual for ecological design. Wiley-Academy. urn:oclc:record:1391412072

Yin, R. K. (2018). Case study research and applications: Design and methods (6th ed.). Sage.

Yao, R., Wang, L., Huang, X., Niu, Z., Liu, F., & Wang, Q. (2021). Urban heat mitigation using green and blue infrastructure: Drivers, effectiveness, and future needs. Sustainable Cities and Society, 75, 103306. https://doi.org/10.1016/j.scs.2021.103306

Zhou, K., Kong, F., Yin, H., Destouni, G., Meadows, M. E., & Andersson, E. (2024). Urban flood risk management needs nature-based solutions: A coupled social-ecological system perspective. npj Urban Sustainability. https://doi.org/10.1038/s42949-024-00162-z