# WATERSCAPES OF **RESILIENCE**

Harmonizing Nature and Flood Resilient Community Living

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Harmonizing Nature and Flood Resilient Community Living

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Figure 1.Wetland Flooding Ceibas, Entre Rios, Argentina (Credits:Edith Polverini)





The landscape around is changing rapidly especially owing to climate change and other environmental conditions. How are we able to live in harmony with nature and respect its biodiversity, or do we continue to create a stark divide between the built environment and the natural world?

“No matter how much one may love the world as a whole, one can live fully in it only by living responsibly in some small part of it. Where we live and who we live there with define the terms of our relationship to the world and to humanity.” (Berry, 1980, p.123). Humanity is steadily drifting away from its fundamental connection with nature. This growing disconnect raises concerns, as many of the solutions we develop inadvertently lead to greater challenges in the future. A deeper understanding of how humans and nature can coexist is essential, with both needing to be respected in their natural states. The research therefore intends to delve into the potential of wetlands to support sustainable living while addressing the critical environmental challenges of water management, biodiversity loss, and urbanization.

Ecopsychologists (cf. Roszak et al., 1995; Roszak, 2001; Fisher, 2002) have echoed Leopold’s statement that feeling a sense of belonging to the broader natural community may be a prerequisite for increasing environmental protection. They argue for fostering ecological behaviour through expanding our sense of self, for ‘if the self is expanded to include the natural world, behaviour leading to destruction of this world will be experienced as self-destruction’ (Roszak, 1995). Wetlands are dynamic ecosystems, vital to global biodiversity, providing essential ecological services such as water filtration, carbon sequestration, and habitats for diverse species. However, they are increasingly threatened by climate change, particularly rising sea levels and increased flood events.

Simultaneously, human interventions in these regions, such as urban expansion and infrastructure development, further disrupt the ecological balance. Given the rising water levels in the Netherlands, it is critical to prepare for future challenges. Embracing flood-resilient housing and allowing the intentional flooding of certain regions can help restore the balance between human habitation and natural ecosystems. Traditional flood defenses frequently involve substantial interventions that can negatively impact wetland ecosystems, underscoring the need for more adaptive, sustainable approaches to housing design.

Additionally, the disintegration of community life is troubling, as more people experience isolated living, far removed from the once vibrant family modules and communal organizations that formed the

heart of society. The notion of ‘family’ is evolvig and the types of communities are changing.

How can we then as designers adapt to this disconnect between man and nature?

This research proposes to explore housing designs that incorporate innovative construction techniques and sustainable materials to create adaptable living environments. By integrating flood-responsive architecture with community-centered design, the study aims to develop a framework for housing that aligns with environmental preservation goals while enhancing social cohesion. Through an analysis of existing resilient housing models and an exploration of new design principles, this research seeks to contribute to a broader understanding of how housing in wetland areas can be both resilient and regenerative, fostering sustainable living and stronger, flood-adaptive communities.

"In the natural world, everything is designed to fit in and work with its environment, constantly adapting, evolving, and responding to changes. Nature has been dealing with dynamic conditions for billions of years, creating forms and strategies that are regenerative, resilient, and sustainable. If we want to build truly sustainable systems, we need to start learning from the organisms and ecosystems that have done it successfully over time." (Benyus, J. M. (1997))

Figure 2.Midden Delfland (Authors own Image)



*How can innovative, resilient housing design in wetland areas support environmental sustainability while fostering community living ?*

| Sub question | Problem |
| --- | --- |
| What are the specific climate change-induced challenges the Netherlands faces regarding flooding, changing ecological dynamics and their impacts on local communities? | Unpredictable flooding patterns, increased rainfall, rising sea levels, biodiversity loss, agricultural threats. |
| What specific design features in resilient housing support social interaction and a sense of community in flood-prone areas? | Resilient architecture is still an evolving field and usually tends to loose out on the community living aspect, and there is a need to understand community living with ecological shifts. |
| How are the current construction technqiues used in seasonal flood prone regions and ecological shifts in the Netherlands and what is the significance of these in architectural practices? | Understanding current techniques with the need for innovative, resilient design in the future to address climate change challenges. |
| What are the main principles and strategies of resilient community planning, and how have these been applied in other regions similar to the Netherlands, especially in dealing with rising waters and environmental changes? | Considering rising waters and environmental changes, resilient techniques must be identified and adapted to be used innovatively for Netherlands context. |

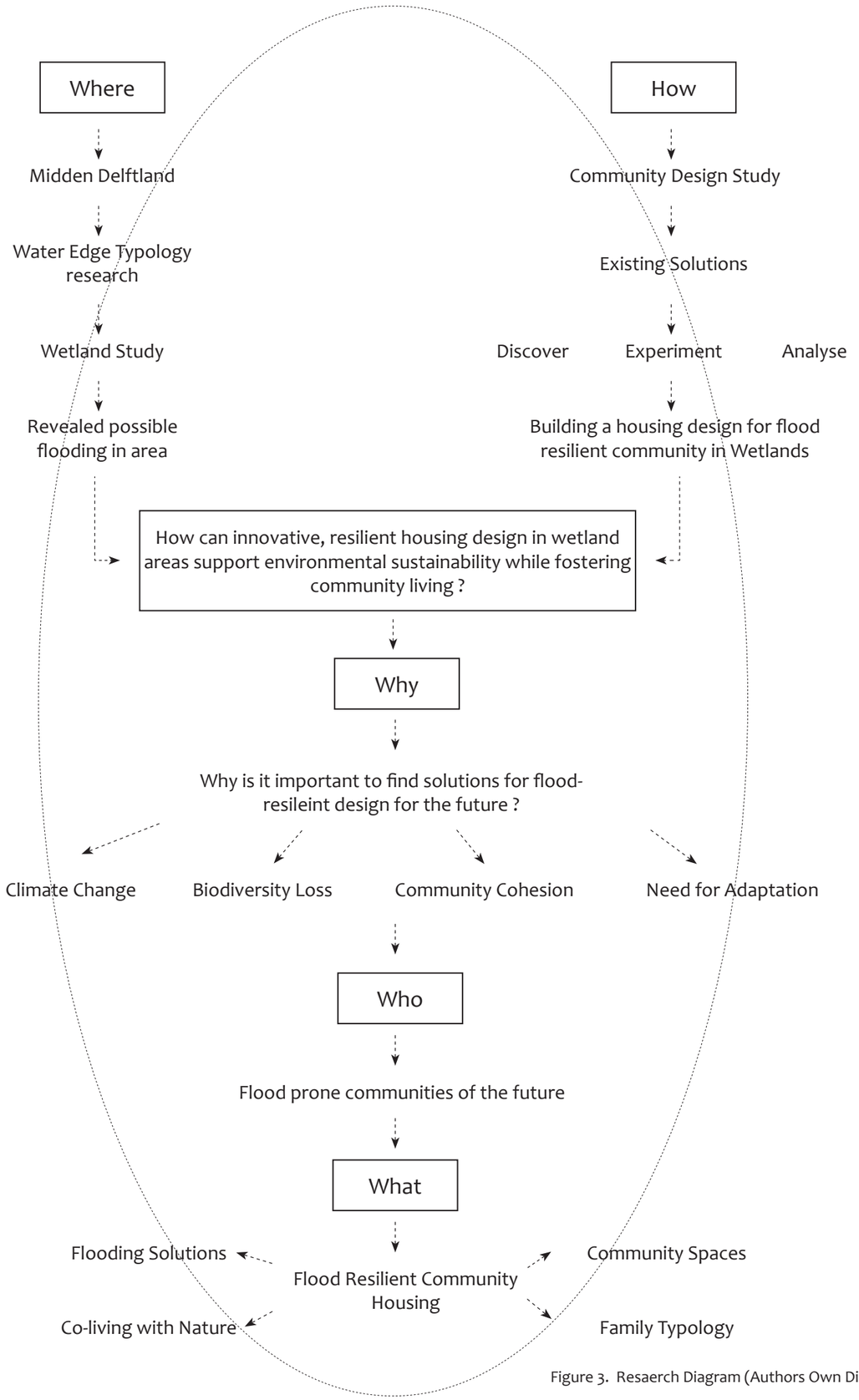


Figure 3. Resaerch Diagram (Authors Own Diagram)





With the aim to find adaptive ways of living, to support the unpredictable future growth of communities and wetlands, I will look closely into 3 main actors involved: Wetlands, Resilient architecture and community living.

1. Wetlands

Flooding, a primordial force of nature, has shaped the world since time immemorial, reflecting the rhythm of the earth's cycles. Our responsibility lies in embracing these natural patterns, designing not in opposition to them, but in harmony—evolving with the changing tides of time. Ecological urbanism, introduced by Mohsen Mostafavi and Gareth Doherty in their book 'Ecological Urbanism'(2010), advocates for an interdisciplinary approach to urban planning that integrates ecological processes into the built environment. This theory recognizes the city as a complex system where architecture, infrastructure, and natural systems must co-evolve. In wetland areas, ecological urbanism emphasizes designing for the specific ecological characteristics of the site, which includes enhancing water management and biodiversity conservation. In an example of working on flooding conditions of the city of Mumbai the authors advocate instead of engineering solutions that aim to dominate natural processes (like heavy infrastructure to prevent flooding), the city's plan should focus on working with natural systems to create a more sustainable and resilient urban environment.

Biophilic design, as defined by Stephen Kellert (2008), emphasizes the deep, inherent connection humans have with

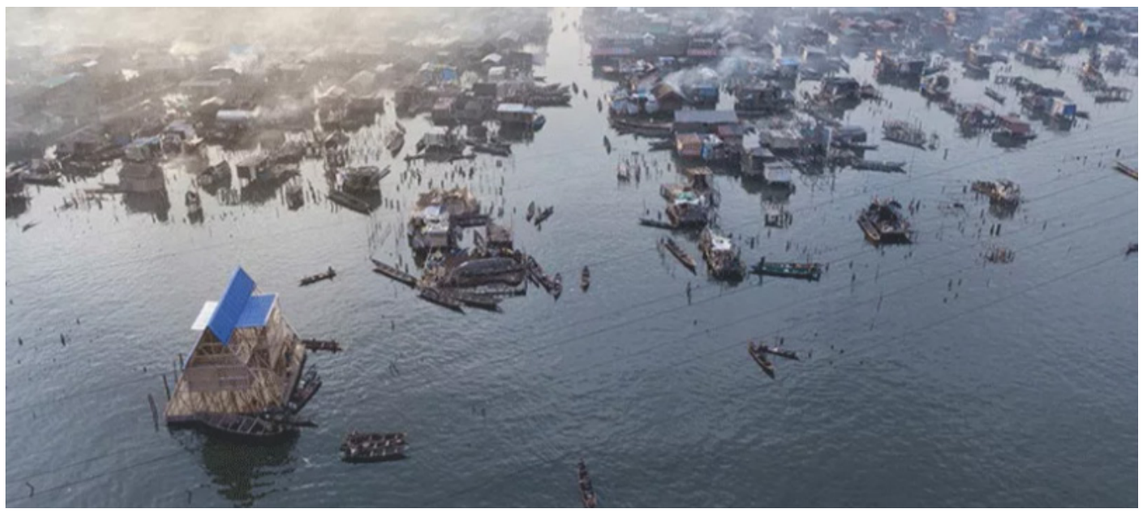

Figure 4. Lagos Water Community in the book Ecological urbanism, (Mostafavi 2010)

nature, proposing that integrating natural elements into architecture not only enhances human well-being but also improves the ecological performance of built environments. When applied to wetland architecture, biophilic design principles become particularly powerful, as they guide the integration of water features, vegetation, and wildlife habitats into urban and architectural spaces. For instance, water bodies in such areas are not seen merely as obstacles to development but as integral components of the design. Green roofs, living walls, and rain gardens can be employed to absorb and filter excess water, while raised platforms or stilts allow for buildings to coexist with periodic flooding. This integration supports not only ecological functions, such as water purification and biodiversity conservation, but also enhances human well-being by providing direct contact with nature.
Moreover, these designs foster a reciprocal relationship between people and the environment. Buildings designed with biophilic principles in wetland areas can incorporate communal spaces that engage with the surrounding landscape, promoting community living that is both mindful of, and responsive to, the natural processes at play.

In “Design with Nature,” Ian McHarg (1969) further emphasizes the importance of integrating natural water systems into urban design, advocating for a holistic approach that views water not merely as a resource to be managed but as a vital component of the ecosystem. He underscores the necessity of understanding local hydrology and the natural patterns of water flow to design with the landscape rather than against it, allowing for more resilient developments. McHarg suggests incorporating water features such as ponds, wetlands, and streams to enhance stormwater management, mitigate flooding risks, and provide ecological benefits that support biodiversity. In wetland environments, this nexus is critical as it ensures that architectural interventions do not degrade but instead enhance the ecological integrity of the region. He also highlights the cultural and aesthetic value of water, noting that well-designed water systems enrich community spaces, offering recreational and contemplative areas that improve the quality of life for residents while promoting ecological integrity.

2. Resilient Architecture

Resilience theory lies at the core of this actor, which explores how systems, including urban and architectural, can absorb shocks, adapt, and continue functioning in the face of disturbances. In flood-resilient architecture, resilience refers to the ability of housing and infrastructure to withstand flooding events, recover

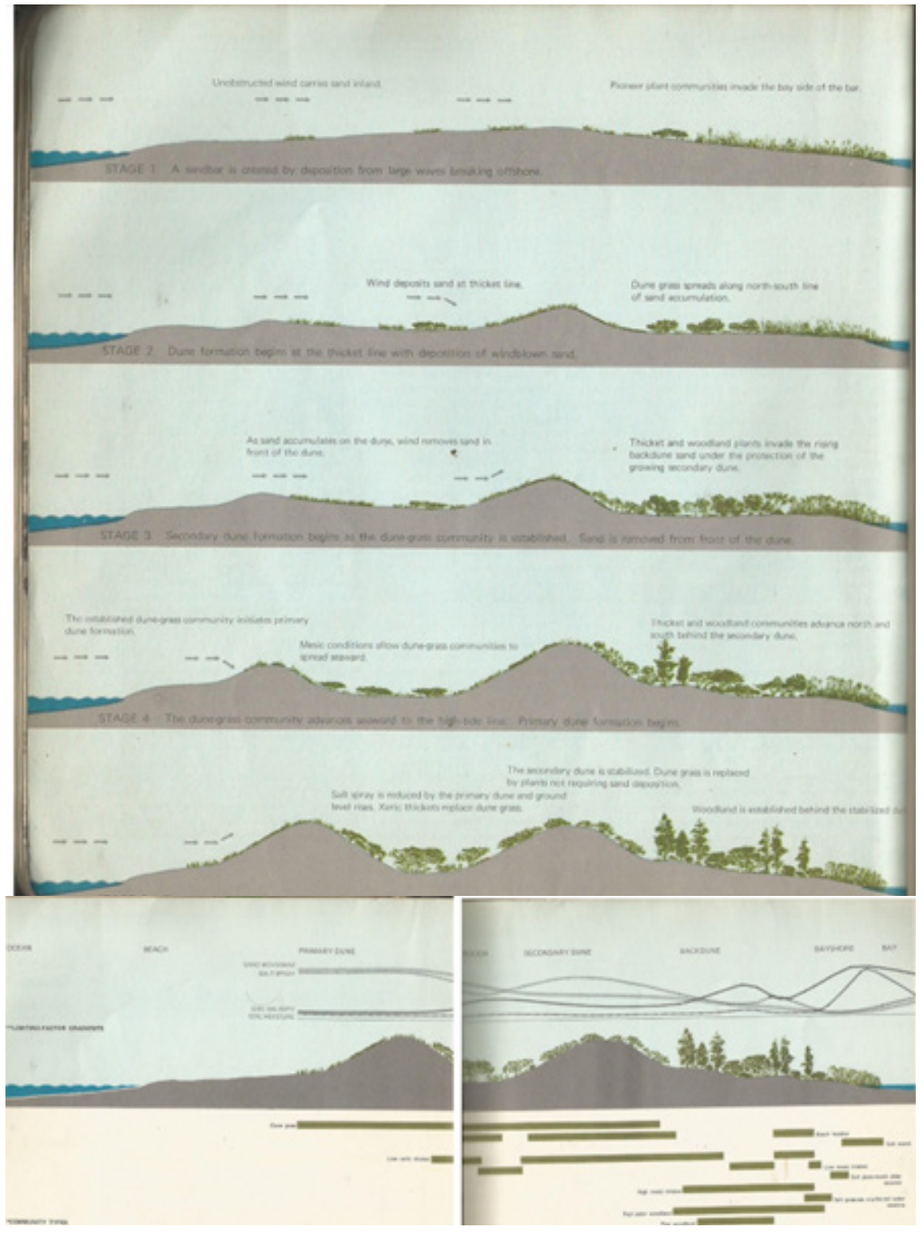


Figure 5. Understanding local Hydrology and the natural patterns of water flow to design with the landscape rather than against it, allowing for more resilient developments. (McHarg,1969)

rapidly, and evolve to accommodate future challenges. The design process is informed by anticipating risks and incorporating flexible, adaptable building methods that promote long-term sustainability. In the Netherlands, resilience in architecture has long been a necessity due to the country's geography—over a quarter of the land lies below sea level. Traditional strategies, like polders and dikes, demonstrate how resilience has been built into the Dutch landscape. Future flood-resilient architecture, however, must go beyond passive defensive measures, moving toward active adaptive systems such as floating or amphibious structures, raised foundations, and permeable landscapes that allow for water absorption.

Resilient architecture also requires an innovative and adaptive approach to climate change. Specific to climate science, adaptation is defined as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits mutual opportunities" (IPCC 2007a, p. 869). As the country faces increased flood risks, housing solutions must be flexible and future-proof. Theoretical models such as "dynamic equilibrium" argue that architecture should evolve continuously, adapting to changing environmental conditions rather than adhering to static design principles (Furtado, 2011). For example, amphibious architecture, which can rise and fall with changing water levels, or modular, floating neighbourhoods, could play a pivotal role in the Netherlands' response to rising sea levels. Research and development in construction technologies, such as climate-responsive materials and renewable energy integration, should also be emphasized. An example could be green solutions applied to vertical and horizontal envelopes of buildings, such as green walls and green roofs, aimed at reducing vulnerability to floods by reducing runoff (Mannucci, 2022).

3. Community Living

Designing flood-resilient housing that promotes social interaction and community cohesion involves the integration of physical, social, and environmental considerations that shape the relationships between built spaces and communities, especially in the context of disaster-prone regions. Chandrasekara (2021) in his research suggests that communities with high levels of bonding social capital (close-knit ties) and bridging social capital (connections across different groups) are better able to respond to environmental hazards. The presence of well-designed public spaces encourages the formation of these social ties, providing opportunities for residents to gather, share information, and collaborate in response to floods.

Placemaking is a key concept mentioned by Ellery (2019) in urban design that emphasizes the creation of vibrant public spaces that reflect the needs and aspirations of the community. In flood-resilient housing, placemaking principles can guide the development of spaces that not only serve practical functions (such as water management) but also become social hubs. By incorporating flexible, multi-functional public spaces, housing designs can offer areas for recreation, socialization, and cultural activities, even in flood-prone settings. In the context of flood resilience, placemaking might include designing elevated walkways or amphibious spaces that can be used both during floods and in normal conditions, ensuring that public areas remain accessible and functional in various scenarios. These spaces should encourage daily use, fostering a sense of ownership and connection among residents.

Figure 6. Floating Houses Ijburg despicting community housing in Netherlands by Marlies Rohmer Architecture and Urbanism (Floating Houses (n.d.))

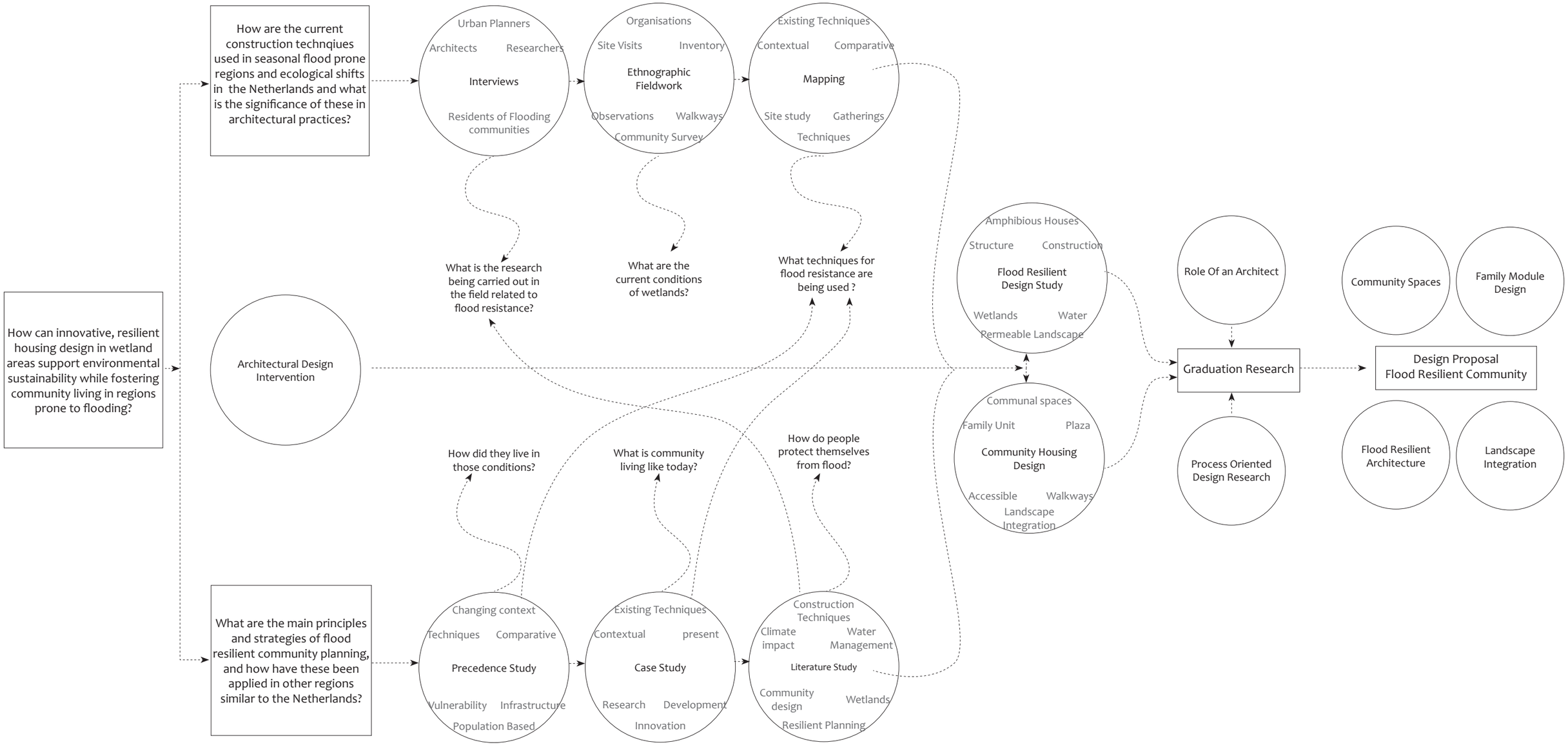


Figure 7. Research Methods Diagram (Authors own Diagram)

The first phase involves a precedence study in which relevant theoretical foundations and real-world examples of flood-resilient and sustainable housing projects are analyzed. This literature review examines academic articles, architectural case studies, and technical reports on flood-resilient housing, sustainable construction methods, and community-driven design. It also includes interviews with professionals such as architects, urban planners, and sustainability experts specializing in flood-prone areas. This blend of literature review and expert interviews aims to capture the current understanding of effective design principles, sustainable material choices, and resilient construction methods, providing a foundation for further analysis. The precedence study also aids in defining key parameters for sustainable and resilient housing in wetlands and highlights areas that lack research or practical implementation.

The second phase focuses on data collection and analysis through both case studies and ethnographic research. Case study analysis targets successful flood-resilient housing projects in various wetland and flood-prone regions. Case studies are selected based on their demonstrated resilience, sustainability, and success in fostering community well-being. Detailed data is collected on each case, including project documentation, construction methods, materials used, spatial layouts, and environmental impact reports. Analysis of these cases reveals adaptable and scalable strategies, allowing for the comparison of effective elements across different environmental and social contexts. Ethnographic methods, including structured observations and informal interviews, provide insights into residents' daily interactions with the built environment, their perceptions of community living, and their adaptability to sustainable practices in flood-prone areas.

The final phase of the researh is design simulation and prototype development, informed by the findings from literature, interviews, case studies, ethnographic research. Design simulations assess the flood resilience, sustainability, and community adaptability of proposed solutions under various scenarios. Prototyping allows iterative refinement, ensuring that the final designs meet the needs for resilience, environmental integration, and social cohesion.

This structured methodology—encompassing precedence study, data collection and analysis, and mapping—provides a comprehensive framework for designing flood-resilient, sustainable, and community-oriented housing suited to wetland and flood-prone environments.

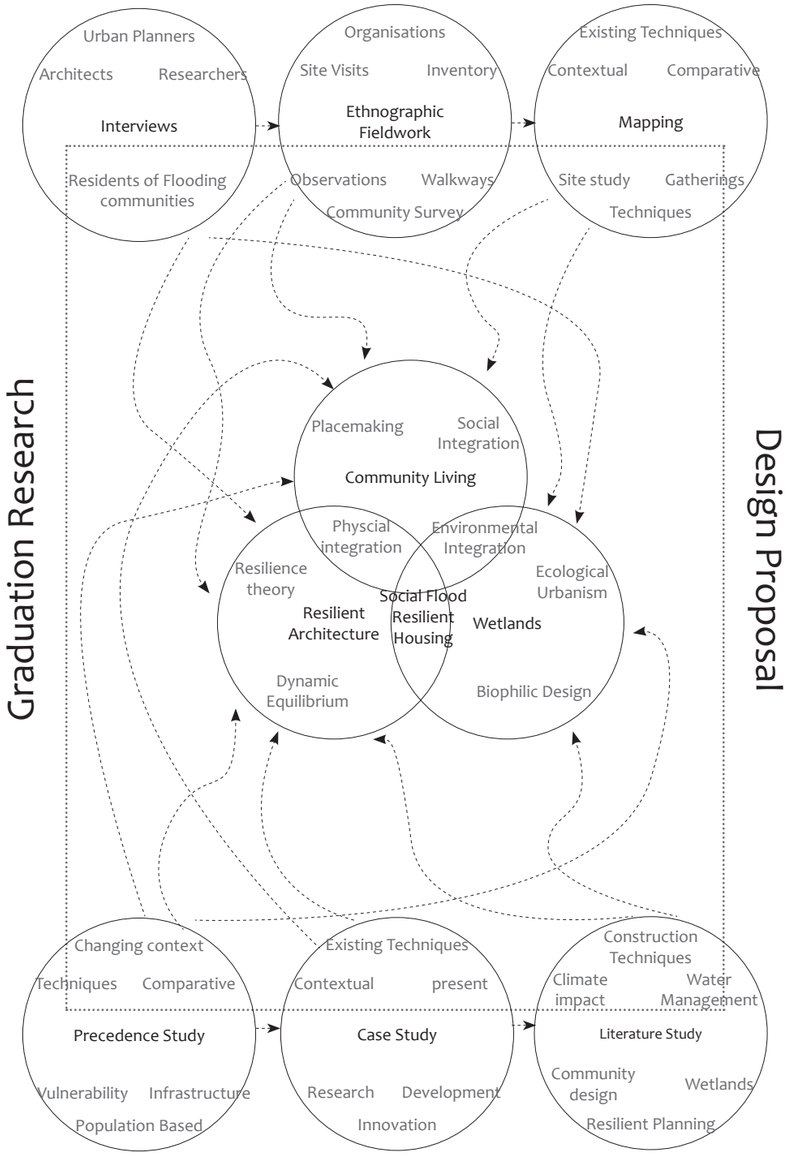


Figure 8. Theoretical Framework and Methodology Overall Diagram (Authors own Diagram)

RELEVANCE

The increasing impact of climate change has rendered traditional approaches to land management and environmental adaptation inadequate for the future. Rather than attempting to control or alter the natural processes for human benefit, it is imperative that society shifts toward embracing nature's inherent dynamics. Acknowledging the inevitability of rapid climate change and adopting appropriate strategies for coexisting with these evolving conditions is essential. By fostering harmony between human settlements and natural ecosystems, we can mitigate the future consequences of damage already inflicted, and build more resilient communities capable of thriving in a changing world.

Designing housing that can adapt to floods while ensuring environmental sustainability, such as through the use of nature-based solutions (e.g., wetlands restoration, permeable pavements), can offer critical environmental benefits. Studies by Ellery & Ellery (2019) highlight the importance of integrating green infrastructure with built environments to enhance resilience while supporting ecological balance and also emphasizes that strong community networks foster recovery and collective action during crises.

Several initiatives and best practices from around the world provide valuable insights into resilient community living and the construction techniques used.

For example, in the Netherlands, the concept of "floating houses" has been embraced in flood-prone areas. These houses can rise with the water level, ensuring residents remain safe and dry. These examples show how adaptive architecture, when combined with community-centered design, can create sustainable housing models that foster well-being and environmental stewardship. Integrating resilient architecture with sustainable construction materials has helped create adaptable communities (Moon, 2015). Another example is the Makoko floating school in Lagos, Nigeria, designed by the architect Kunlé Adeyemi (Collins, 2015).

In Indonesia, for instance, traditional stilt houses have been adapted using modern materials to address rising water levels, demonstrating how local architectural practices can evolve to meet new environmental challenges (Nursaniah et al., 2019). This type of adaptive architecture is essential for protecting communities from climate-induced risks while preserving cultural practices. Furthermore, resilient housing design must also prioritize community well-being, which is where community-based disaster management strategies play a crucial role. In India, the Orissa Cyclone Preparedness

Figure 9. Schoonschip in Amsterdam's innovative circular neighbourhood, prototype for urban floating houses (Cutieru, A. (2024)

Programme is an example of how involving local communities in decision-making and planning has strengthened resilience among vulnerable populations (Thomalla & Schmuck, 2004). Such participatory approaches align with social capital theory, which emphasizes that strong social networks within communities enhance their ability to recover from disasters. Housing that integrates shared spaces for social interaction, as well as architectural elements that respect local traditions and environment, can significantly contribute to both environmental sustainability and community cohesion.

The review of global best practices emphasises that resilient community living is not a one-size-fits-all solution. It must be context-specific, integrating local knowledge and topology. The relevance of this research lies in its potential to address two interconnected global priorities: the need for climate-adaptive housing and the creation of sustainable, socially resilient communities. By addressing both environmental and social dimensions of resilience, this research question opens pathways for innovative housing solutions that not only protect against floods but also enhance community strength and environmental health.

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