Lessons to Learn

Scaling Traditional Knowledge to Face Increasingly Complex Challenges

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Anthropogenic climate change underscores that water is fundamental to sustaining life on Earth and therefore warrants great design intelligence.

This essay presents several landscape architectural graduate projects that incorporated key lessons from the analysis of traditional water systems. Throughout their studies, students engage with case studies as sources of learning and inspiration for spatial design. No design is conceived in isolation; instead, it invariably builds on designers' prior experience and intergenerational knowledge embedded in indigenous communities, whether implicit or explicit.[1] The Circular Water Stories (CWS) lab focuses on long-lasting water systems as a foundation for landscape architectural design and situates the lab's work within a landscape approach. This approach is understood as an integrative way to address complex, real-world water challenges across ecological, spatial, technical, social, cultural, economic, and institutional dimensions, while recognising multiple objectives, actors, scales, and trade-offs (Sayer et al., 2013). The Illustrative Method (Bobbink et al., 2022) helps operationalise this by making relationships among water flows, landform, infrastructure, livelihoods, cultural practices, and governance visible and comparable. Unlike contemporary interventions, the case studies capture the evolution of water-sensitive design over time, providing richer insights into how social, ecological, and economic dimensions interact within functioning landscape systems.

Fig. 1
Conceptual drawing of possible transformations of the dike-fish pond ratio in the Pearl River delta, China. Adapted from Ma (2025).

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Given the wide range of projects developed within the CWS lab, only a few lessons learned from traditional water systems were highlighted for each project. The selection aims to reflect the diversity of insights by showcasing the different facets of these systems. These brief descriptions cannot capture the full depth of the knowledge embedded in each project. For a more comprehensive exploration of the projects and the traditional water systems that inspired them, readers were invited to consult the CWS website[2], where detailed analyses and design outcomes are available.

Students are drawn to the CWS lab to deepen their understanding of water systems and to recognise the valuable knowledge embedded in traditional practices. At the outset of their graduation projects, they investigated traditional water systems as a case study. These systems are tailored to specific geographical and climatic conditions and functions, without advanced technological interventions. More importantly, these landscapes embody active community participation in shaping and maintaining the environment.

SITE AND DATA

Preferably, students choose a traditional water system site they are familiar with and can visit, or they choose a case that represents a particular landscape type and features specific water management techniques or rituals they want to work with. Some students are drawn to traditional water systems, which have nearly disappeared. Others are especially interested in sites with little water to determine how people survive.

Given the time constraints inherent in a graduation year, preferences are generally given to projects in countries with reliable and comprehensive datasets. Nevertheless, students who come from and choose to work in regions such as China or the African continent need to overcome limited access to standardised geospatial data. In such cases, foundational cartographic resources must be compiled by utilising publicly available tools, including satellite imagery, online databases, atlases, and relevant academic literature. Moreover, height and soil maps are essential for analysing the structure and functioning of a site's hydrological system. Historical websites, literature reviews, oral histories, and available topographical maps support documentation of cases in which the water system has disappeared. Understanding, selecting, and integrating all available documentation is critical for any water system analysis and design interventions.

NATURE-BASED INTERVENTIONS

Most human-made water systems examined in the lab have been engineered using nature-based interventions[3], relying exclusively on locally available materials. Over time, these systems have evolved incrementally through adaptation processes shaped by shifting environmental conditions and changing the needs of local communities. With the advent of industrialisation and the drive for large-scale infrastructure, some water systems have become increasingly disconnected from their immediate physical and cultural contexts. In such cases, students are encouraged to focus their analysis on the pre-industrial phase of these systems, when designs are still congruent with local conditions, available resources, and community-based management. Emphasising this historical context enables students to gain deeper insight into the human intelligence behind the different cultures that understood and worked with water as a life-sustaining element and driving force within the landscape.

METHOD

All students used the Illustrative Method (Bobbink et al., 2022), an analytical approach grounded in landscape architecture that has been progressively refined since the lab's establishment in 2019. This mapping method, illustrated throughout the book, provides critical insights into how the 'DNA' of landscapes, often originally shaped by indigenous communities, has been transformed into functional, adaptive water systems that serve various societal needs. The most instructive case studies are those characterised by complexity, layered narratives, and a spatial context in which urban development has not yet entirely supplanted the cultural landscape, such as the Kampung Naga System in Indonesia, where residents precisely understand the system's carrying capacity. When water usage exceeds this threshold, such as increased demand for irrigation, cooking, cleaning, and other needs, the system is at risk of collapse. In such situations, families are sometimes compelled to relocate to preserve the village's ecological balance. This method also enables students to transfer lessons from a traditional water system to a different site for the graduation project, using the case study as an analytical lens rather than as a model to be duplicated.

HOLISTIC AND INDIGENOUS

Circular drawing is a crucial tool in this reflective and analytical process. This drawing is instrumental in helping students conceptualise and visualise a given site's systemic, spatial, functional, and cultural dimensions. Circular drawings support critical thinking by offering a holistic overview of complex systems. Therefore, graduate students are strongly encouraged to develop circular drawings as an integral part of their design process. Whether used to guide development or as a post-design reflection tool, the drawing assesses whether the (urban) landscape proposal achieves a level of ingenuity and contextual sensitivity comparable to those of traditional water systems.

For their graduation project, students increasingly seek a holistic approach to restoring values perceived as lost or diminished. The notion of holistic restoration, as introduced by Pandey, offers a framework for simultaneously addressing ecological degradation, biodiversity loss, and sustainability challenges. This approach draws on cultural heritage, local knowledge systems, and community-based practices, and advocates for a more integrative model of environmental design. While the CWS lab initiated its research on traditional water systems by recognising the value of historical landscape-based knowledge systems, recent years have seen a broader resurgence of interest in indigenous epistemologies. The publication of Lo—TEK: Design by Radical Indigenism (Watson, 2019) reinforced this shift, underscoring the relevance of indigenous knowledge systems for contemporary architecture and urbanism.

HOPE AND AESTHETICS

In parallel, McHarg (1969)'s seminal work *Design with Nature* experienced a resurgence in landscape architecture curricula. More than 50 years after its publication, it profoundly influenced students. As Lewis Mumford noted in his review of McHarg's work: 'In presenting us with a vision of organic exuberance and human delight, which ecology and ecological design promise to open up for us, Ian McHarg revives the hope for a better world.' The

hope of contributing to a fairer and more sustainable world through landscape design remains a central motivation for many students. However, the lab is critical of the existing pedagogical imperative to guard against the reductive assumption that landscape architecture alone can resolve complex global challenges by embracing nature and indigenous wisdom. Therefore, students are encouraged to articulate a critical and context-sensitive understanding of their professional role.

Anne Whiston Spirn extends McHarg's ecological perspective by understanding the landscape as both a natural and cultural process. Her approach brings the ecological function, cultural meaning, and aesthetic experience into the same field of design. Aesthetics, in this context, is not treated as a visual embellishment but as a means of making water processes perceptible, experiential, and meaningful to people who inhabit a landscape (Spirn, 2000).

For many students, recognising the sustained and reciprocal relationships between people and landscapes has become an important turning point. It challenges the idea of the designer as an external problem-solver and instead positions the landscape architect as a participant in ongoing ecological, cultural, and spatial transformations. Combining these dimensions forms the basis of a rigorous and meaningful thesis within the CWS lab.

THREE APPROACHES

Following the analysis of traditional water systems, students reflected on their findings by identifying a range of value dimensions: landscape, strategic, functional, material, sustainable, tangible, and intangible. The findings inform students' graduation projects, either directly or indirectly. Notably, expressing appreciation for the depth of site-specific knowledge, communities involved in constructing, maintaining, and inhabiting these landscapes demonstrate an acute understanding of local environmental conditions and efficiently use readily available materials and practices that often enhance quality of life while minimising ecological impact.

Over several years, three primary approaches have emerged through which students engage with traditional water systems as both conceptual and analytical foundations for their graduation projects. The first is the interpretative approach. In this model, the selected traditional water system provided a contextual framework for design interventions. The original system is still physically present in the landscape, although it is often only partially functional and increasingly misaligned with the current environmental and societal conditions. Various pressures, ranging from population growth and changing lifestyles to rapid climate change, biodiversity loss, and water-related problems such as flooding, scarcity, and pollution, pose significant risks to the continued viability of these systems. These challenges are often interrelated and compounded, and demand multifaceted and context-sensitive responses. The traditional water system requires clarification, and sometimes restoration, to gain meaning.

Second, students engage with the transformation approach by reimagining a lost traditional water system at approximately the exact location. These projects do not aim to (partly) reconstruct the original system but rather to reveal the underlying essence of the historical water landscape, acknowledging it as a valuable repository of tangible and intangible memory. This approach catalyses the development of new (urban) landscapes that respond to contemporary challenges in which water plays a critical role. Traditional water systems have been altered.

The examples show that the distinction between the interpretation and transformation approaches is fluid, but helpful for understanding the designer's intention.

Third, the experimental approach involves dismantling and relocating traditional water systems to alternative sites. This approach holds significant promise for bolder exploration, particularly in landscapes that experience intense pressure from rapid environmental and societal changes. This approach exemplifies 'research by design' more explicitly than the other two approaches, offering a speculative, yet methodologically grounded framework for adaptive landscape strategies.

INTERPRETATION

Students using this approach typically select sites with which they are familiar and are often situated within their own cultural or geographical backgrounds. Through site-based inquiry, they encountered the ingenuity embedded in these systems. Many of these have been constructed, adapted, and maintained by indigenous and local communities for centuries. This engagement reveals the landscape's unique characteristics and highlights its heritage value.

To avoid the pitfall of reducing the traditional water system to a mere restoration project, students were encouraged to enhance their relevance by addressing contemporary needs. This approach invites a reinterpretation of the historical context, thus enabling the system to adapt. A thorough diagnosis is essential to understand why the system no longer functions, as this insight forms the basis for envisioning its future potential. Students interviewed community members and other knowledge holders, such as local NGOs, to determine which practices remain effective and which have deteriorated. Moreover, the site's cultural context plays a critical role. It is essential to consider whether the local community still engages with or desires to engage with, for example, agricultural practices for which the water system was originally designed. A commonly identified issue is the lack of available labor required for the system's upkeep and functionality. However, the long-term functioning of these systems cannot be sustained without economic outputs, such as agricultural products, or other tangible benefits, such as tourism. Regular physical involvement by local water workers, designers, and system keepers who actively manage, repair, and utilise it is essential for its continued viability.

Three projects employing the interpretive approach are examined to illustrate the lessons learned from traditional water systems through analysis and foundation for design: ancient salination in China, quenching thirst in Peru, and bridging the gap back to life in China.

ANCIENT SALINATION

In the case of the Sea Salt Fields on the island of Hainan, China, the project Ancient Salination: A Generator for the Sustainable Development of the Salt Villages in Danzhou addressed the declining salt industry. Currently, only a few local community members remain involved in salt production, and the practice is no longer economically viable. Parts of the system have fallen into neglect, exacerbated by the migration of younger generations from the island. Further investigation revealed that the degradation of salt fields has contributed to the deterioration of the coastal defense landscape, a

historically significant byproduct of salt production. Giving up salt harvesting poses a growing risk of flooding for coastal communities, especially with rising sea levels. To raise awareness of this issue and reinvigorate the local cultural identity, the project proposes partially restoring traditional salt-winning practices in this unique volcanic landscape and reimagining it as a sustainable tourist destination. This vision is plausible, given the artisanal nature of salt production at this site, which involves a variety of site-specific structures and materials, offering visitors a tangible and engaging spatial experience. Specially designed routes immerse tourists and locals in the ecological significance of coastal defense systems. Visitors are guided by the landscape to understand the maintenance of the coastal ecosystem required for salt production. (Figures 2, 3, and 4)

Lessons learned: The project positions ancient salination as a cultural heritage practice and catalyst for sustainable development to mitigate flood risks, enhance biodiversity, and promote recreational opportunities along the coastline.

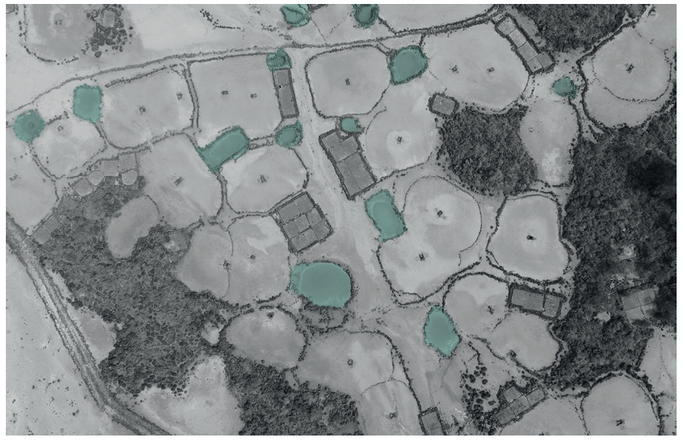


Fig. 2
The inundated salt fields collect seawater, initiating salt extraction. This concentrated brine is subsequently distributed over intricately carved volcanic stones designed to retain a thin film of saltwater. As further evaporation occurs under solar radiation, crystalline salt gradually accumulates and can be harvested. Adapted from a photograph by Ran Yan.

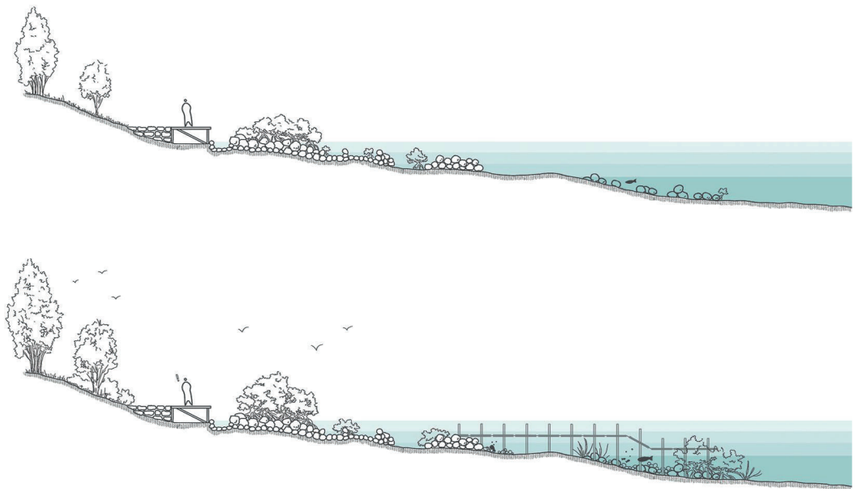


Fig. 3
Section 1 illustrates the design of the pathway along the shoreline using materials from the site itself. Section 2 depicts the second phase of implementation; the underwater structure stabilises the shore and creates new habitat spaces. Adapted from Yan (2021b).

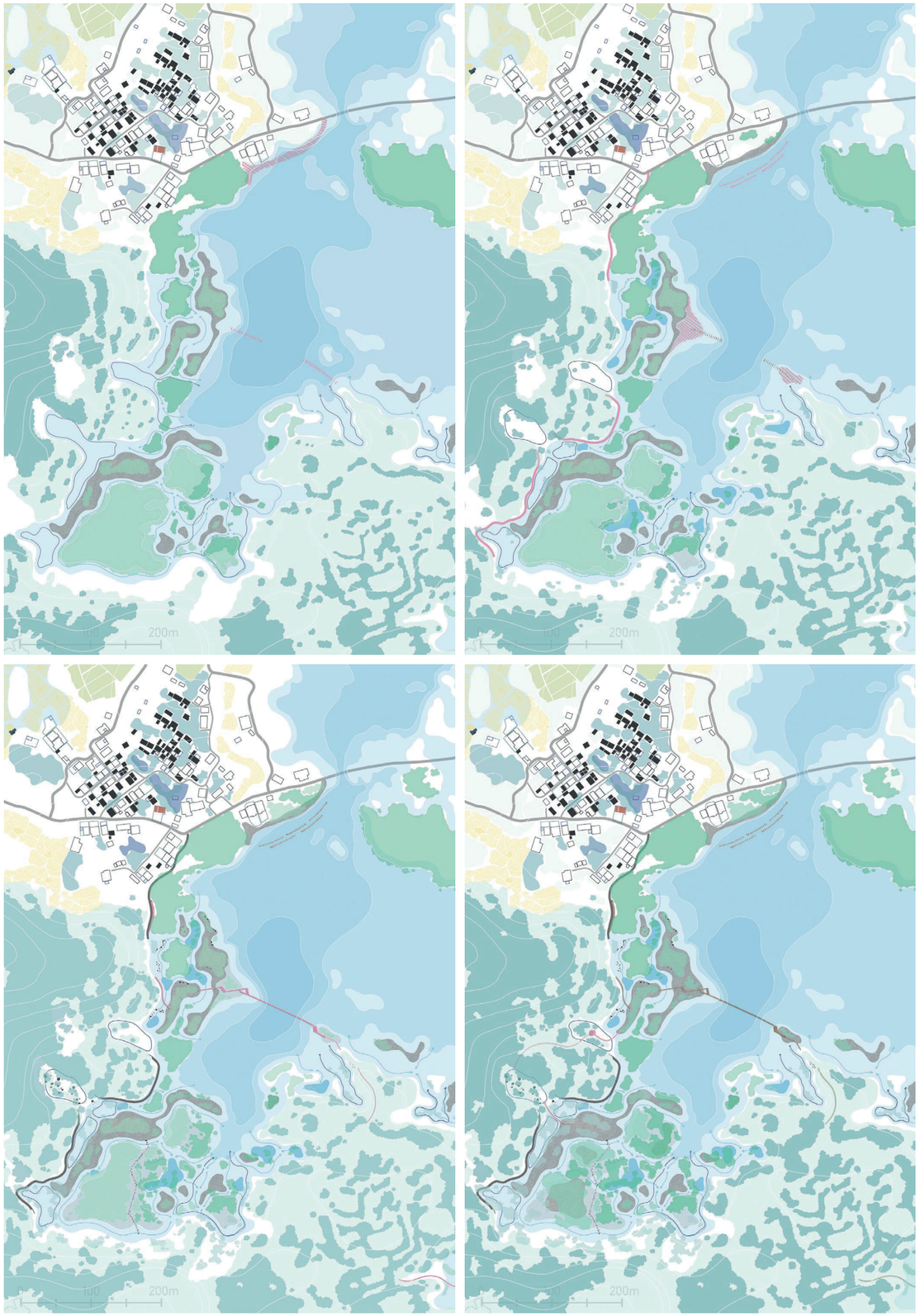


Fig. 4
A sequence of maps, the first showing the site before the interventions, illustrates the landscape changes resulting from the design's implementation. Adapted from Yan (2021b).

In the case of the Amunas water system in the Andes of Peru, the government began to recognise the harm caused by the decline of this ancient infrastructure to the growing water problems in Lima, the coastal capital. In her project, Quenching Thirst: Cooperation and Interaction by Living with Water from Huamantanga in the Hills to Lima on the Coast, reimagines the value of mountain water systems and their role in sustaining local and urban populations. Restoring the Amunas System helps regulate and stabilise the flow of the river towards Lima, ensuring a more consistent and reliable water supply and enabling the transformation of riverbanks into meaningful public spaces for education, community gathering, and renewed appreciation of water as a shared and finite resource.

By acknowledging and valuing the traditional water practices of highland communities, the project supports ecosystem restoration and offers local opportunities to improve living conditions. The revival and expansion of the ancient system, including the integration of retaining ponds, not only restores water infrastructure but also opens new possibilities for ecotourism. Hikers were invited to learn from the community and their ancestral knowledge. As local beliefs hold: 'If all the snow disappears, the world will end—natural waterfalls and lakes are creative places where worlds merge into one another, where you can find treasure or be bewitched by the mountain spirits—mountain lakes making up the eyes, where life springs up from an underlying world. ' Revaluing water needs to be rediscovered, especially by authorities and citizens. Therefore, the design extends beyond the local practice site along the river, bringing newly harvested water to the city. Water awareness plays a vital role in public space design, for example, by being able to touch or see it and by using and encountering its irrigation capacity. (Figures 5, 6, 7 and 8)

Lessons learned: Recognising these practices beyond their functional benefits reflects an appreciation for the circular, regenerative nature of the system. The project introduced new spatial compositions that use vernacular elements to foster deeper connections among people, water, and landscapes.

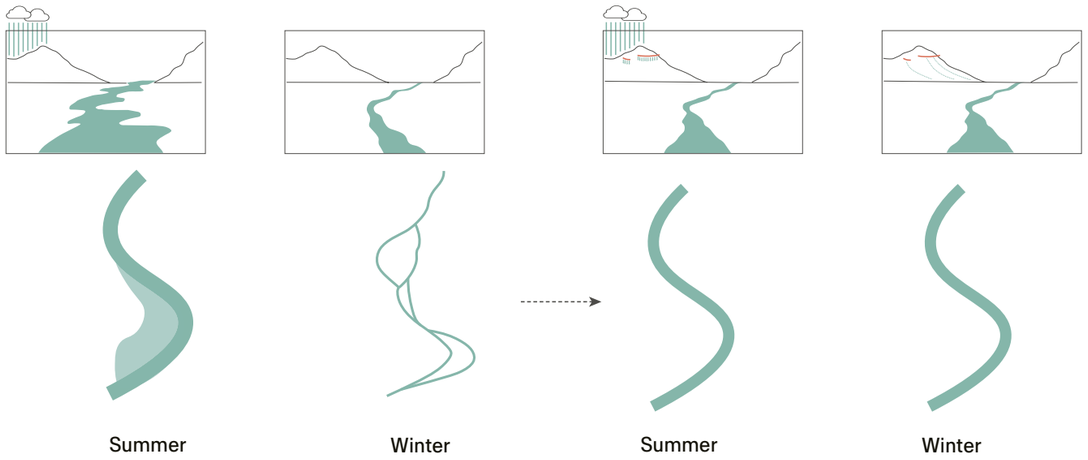
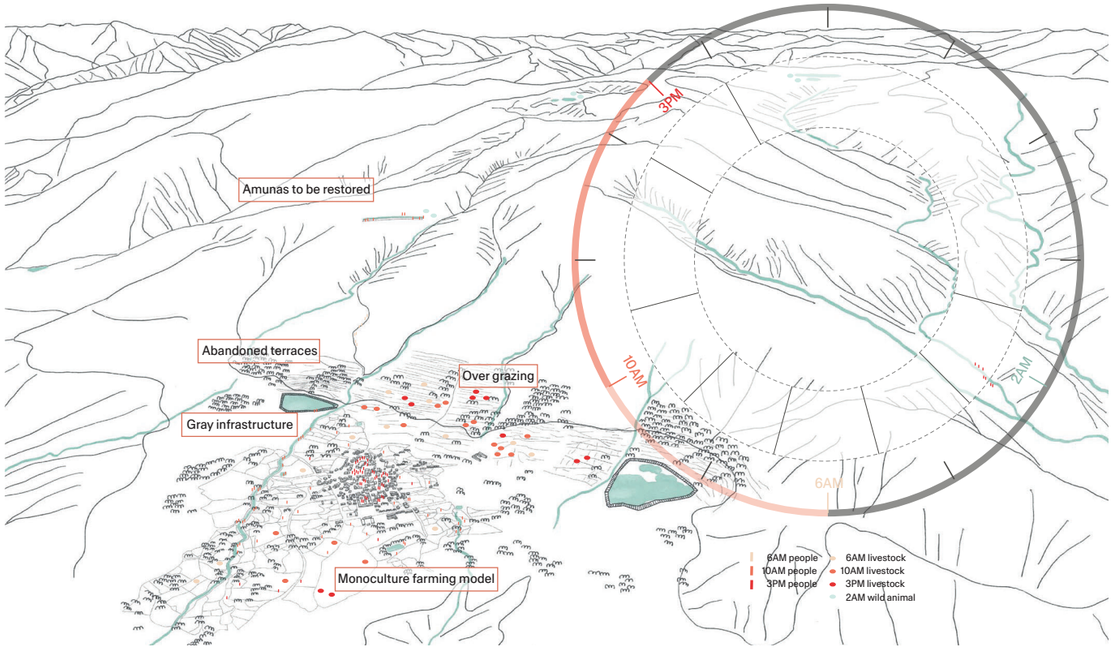


Fig. 5
Diagram of a more regular river flow, mitigating both flooding and drought. Adapted from Liang (2023b).



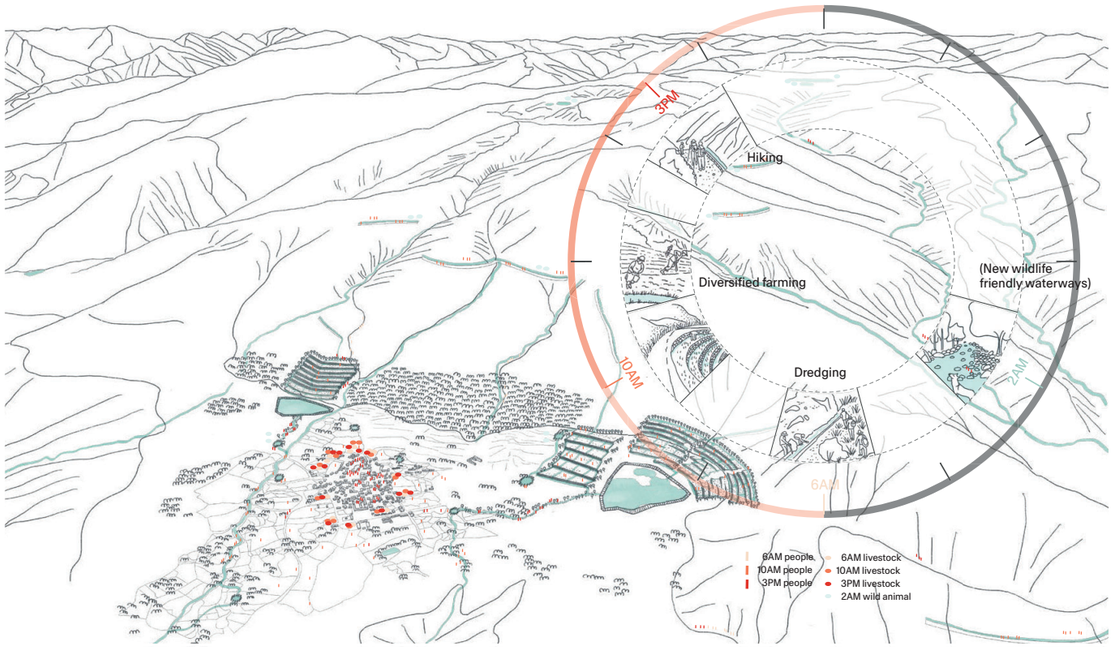
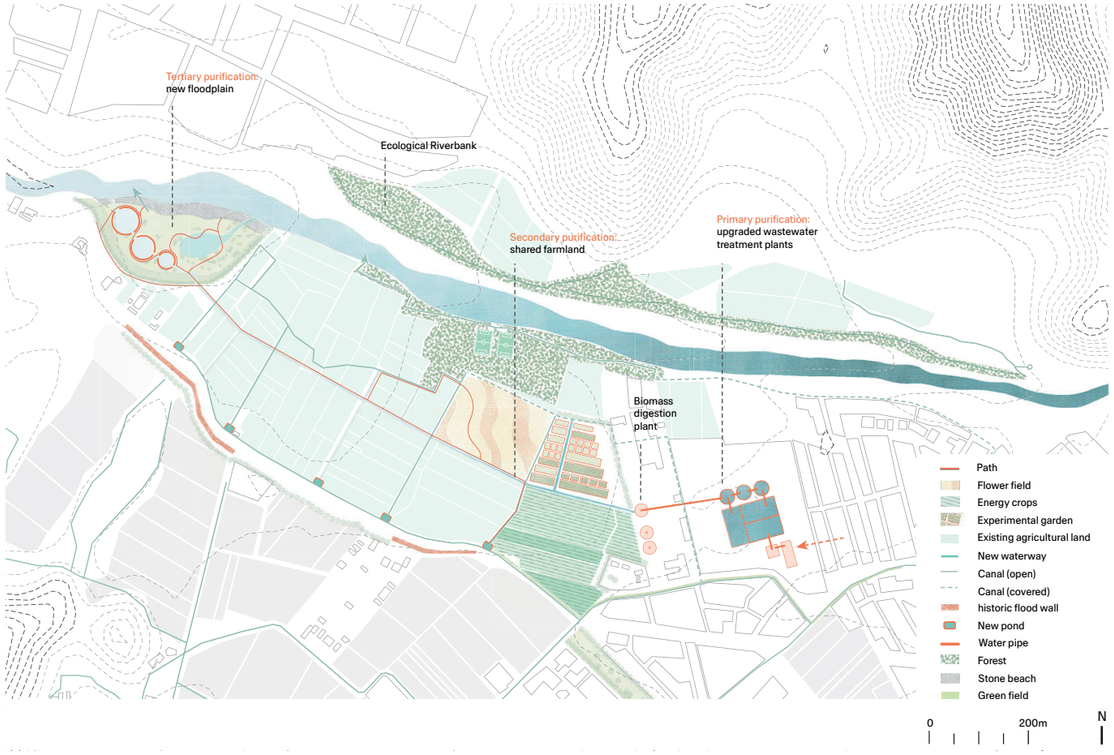
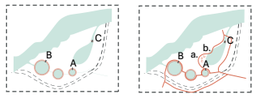
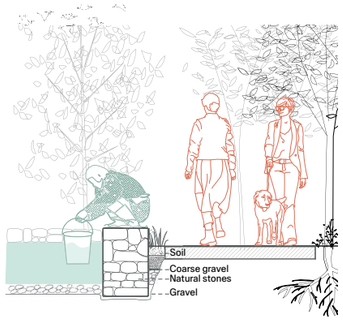
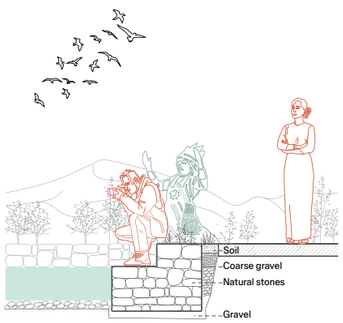


Fig. 6
The design enhances people's activity in Huamantanga. It is based on a well-functioning water system, which enables diversified planting patterns and a variety of products. A greater variety of activities and experiences attracts visitors and hikers. Ecological restoration and water management create a more consistent flow within the river system. Adapted from Liang (2023b).









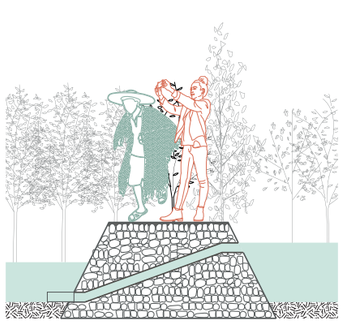


Fig. 7
The design incorporates vernacular materials within the park to strengthen the visual and cultural connection to the mountain village. Adapted from Liang (2023b).

Fig. 8
Three types of shared farms are proposed along the river: an experimental garden, an energy crop field, and a flower field, each serving as a model for sustainable agriculture. Treated recycled urban water irrigates the gardens, while strategically placed vegetation (shrubs, tree rows, and solitary trees) provides spatial structure, shade, soil stabilisation, and supports groundwater recharge. The design fosters a renewed relationship between people and water, encouraging respectful and efficient use of resources. Adapted from Liang (2023b).

BRING LINPAN BACK TO LIFE

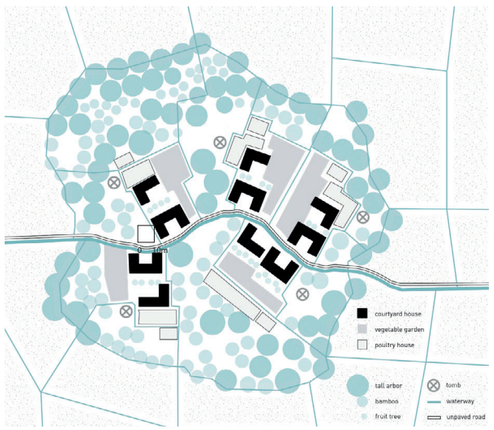
Having spent part of her childhood on the Chengdu Plain, the student approached the project with a personal connection to the region. She was particularly struck by the ingenuity of the Dujiangyan water project, a monumental hydraulic system initiated as early as 260 BCE that continuously developed over time. This ancient engineering feature comprises a weir head that diverts water from the river into an extensive irrigation network. The weir head consists of three key components: the Fish Mouth Levee, the Flying Sand Weir, and the Bottleneck Channel, which collectively earned the UNESCO World Heritage status system in 2000. Understanding the functionality of this complex infrastructure is a significant challenge. However, it was essential to grasp its profound role in regulating water flow and facilitating irrigation across the expansive Chengdu Plain. (Figure 9)

Over more than 2,000 years, the irrigation network on the Chengdu Plain has evolved into a sustainable Linpan System. Linpan typically comprises an almost self-sufficient cluster of approximately 20 farmsteads belonging to an extended family surrounded by trees, bamboo groves, irrigation channels, and cultivated farmland. Together, these elements support a circular and resilient lifestyle.

While thousands of Linpan once characterised the landscape of the plain, rapid urbanisation, the withdrawal of farmers, and the younger generation's pursuit of alternative lifestyles have led to a gradual decline in the system. The project *Bringing Linpan Back to Life: Revival of the Linpan Community, Sichuan, China* (Z. Zhang, 2023) seeks to reinterpret the Linpan model by emphasising its circularity and historical and cultural significance. Fortunately, local governments have recognised the value of these traditional settlements. Informed by social analyses, three new Linpan models—the modern pan, urban pan, and ecological pan—are proposed.

The Modern Linpan model primarily focuses on enhancing rural lifestyles and optimising land use. This is achieved through improvements to the residential environment and diversification of income sources. Environmental upgrades include relocating tombs and poultry enclosures; enhancing infrastructure, including roads, irrigation networks, and residential buildings; and expanding green spaces and communal activity areas. Although agriculture remains the primary livelihood, residents increasingly engage in tourism-related ventures. However, these developments have only a modest impact on the internal spatial organisation and circulation within the Linpan settlement. (Figure 10)

Fig. 9
Traditional Linpan, plan and circularity diagram. Adapted from Z. Zhang (2023).



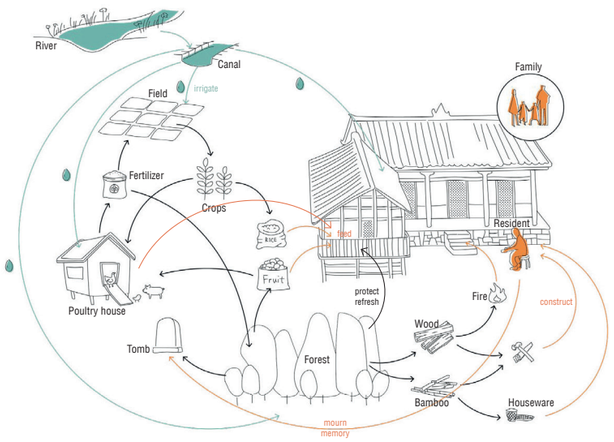
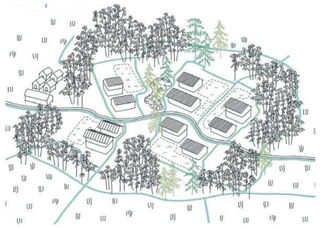


Fig. 10
Modern Linpan, plan and circularity diagram. Adapted from Z. Zhang (2023).



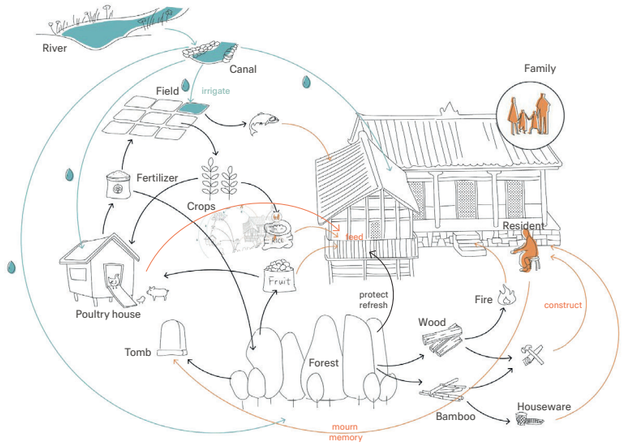


Fig. 11
Ecological Linpan, plan and circularity diagram. Adapted from Z. Zhang (2023).

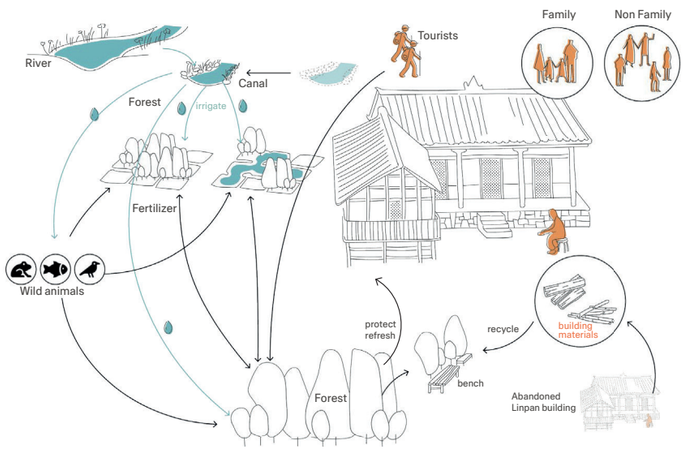
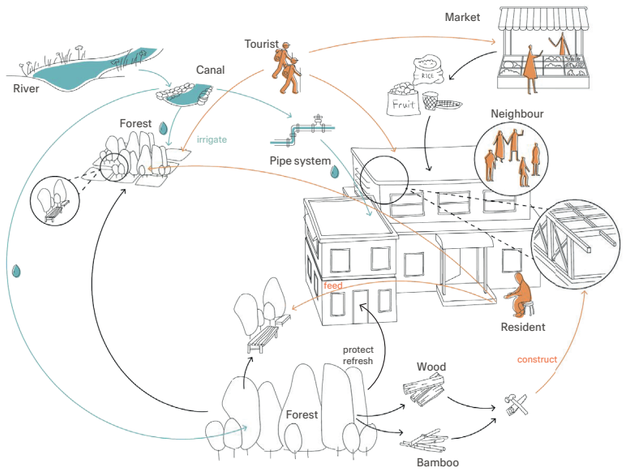


Fig. 12
Urban Linpan, plan and circularity diagram. Adapted from Z. Zhang (2023).



The Ecological Linpan model highlights significant lifestyle shifts and the reconfiguration of agricultural practices, as many residents no longer rely on farming as their primary livelihood. Increasingly, individuals commute to urban centres for employment, leading to a gradual reduction in on-site agricultural activities. As a result, the remaining farmland is repurposed for ecological restoration, including forest expansion, softening of the edges of irrigation canals, and the introduction of wetland systems. Agricultural functions are diminished within this emerging forested matrix, while ecological processes and biodiversity are gaining prominence. (Figure 11)

Urban Linpan responds to evolving lifestyles, shifts in agricultural functions, and the transformation of traditional family-based structures. It departs from the single-family homestead model by adopting alternative housing typologies, such as apartment-style dwellings that accommodate multiple households. In this form, Linpan functions more as a neighborhood, housing up to 150 residents. The inclusion of recreational facilities further supports this transition. As a circular system, the urban pan is characterised by more frequent exchanges of materials and resources with the external environment, reflecting heightened connectivity and systemic complexity. (Figure 12)

Lessons learned: By reinterpreting carefully designed circular living units rooted in traditional water management systems, this project offers sustainable living alternatives that respond to the demands of a rapidly transforming society and to the challenges posed by climate change and ecological degradation. These variants are designed to accommodate a range of contemporary lifestyles and support economic sustainability, while safeguarding the fundamental principles of the traditional Linpan typology.

In this category, we also find graduation projects such as Pop Out Milan, Unveiling Milan's urban renaissance through the rebirth of the Navigli Canal System as a landscape connection and social link (Filippoli, 2023), and The Canal Story, Canal du Midi, and Living Water Heritage (Sun, 2022). Due to their size and function, these Grand Works are manifestly visible in the landscape, and their heritage values are evident.[4] The endeavor to engineer these large systems and appreciate the craftsmanship and technical knowledge involved in digging and constructing these waterways and waterworks is not only locally meaningful but also regionally and nationally significant. Students transform these structures, which are no longer used for shipping goods, so that people can experience the landscape and stories of the past from a water perspective. Furthermore, in both projects, the water edges were partially softened to make the land-water gradient more flexible and therefore allow for greater biodiversity. In the Pop Out Milan, the system transforms into a green-blue recreational lung structure for the city.

TRANSFORMATION

Given the complexity and scale of traditional water systems, it is not always feasible to analyse all components within the scope of a single graduation project. For instance, regarding farm ponds on the Taoyuan Tableland in Taiwan, the graduate later discovered that the system also includes elements such as springs, washing houses, and upstream temples. These features were not incorporated into the design. The project focused on retention basins and proposed a reinterpretation of these structures in the context of urbanisation. In the project based on the Sprengen System[5], the historical water system no longer generates energy for mills but repurposes water elements to promote sustainable farming practices. In another case, the traditional

water system was a more abstract source of inspiration. Because of the existing polder-boezem system[6] and its position close to Amsterdam, a huge shipbuilding industry was established, which thrived from the late 16th century to the end of the 17th century. The sector disappeared, whereas significant portions of the water system remained intact. In the fourth example, the legacy of historical water knowledge disappeared, but was mentally reintroduced into the public realm through design. The project reactivates ancient expertise to address contemporary urban water challenges, while making the historical narrative of water visible and experiential. By embedding this knowledge into the city's public spaces, the design allows citizens and visitors to engage with the enduring significance of water management, thereby adding a new chapter to a century-long story.

Four projects employing the transformation approach were examined to illustrate how lessons are derived from traditional water systems through analysis and design: Farm Ponds of Tayuan in Taiwan, Revive the Sprengenbeek Landscape in the Netherlands, Intermotion Landscape in the Netherlands, and Revealing Rome's Water-Based Culture in Italy.

FARM PONDS OF TAOYUAN

Over 10,000 farm ponds were constructed on the Taoyuan Plain in Taiwan to retain water for irrigating paddy fields, vegetable gardens, tea plantations, and fish farming. These ponds are part of an extensive hydraulic system, including settlements and temples, fed by a network of canals that tap into rivers.

However, this traditional hydraulic landscape has been significantly altered by rapid urbanisation and the expansion of transportation infrastructure. Many ponds have been drained and built and rice fields and fish farms have steadily declined. In response to these changes, the graduate proposed a new application for the remaining ponds in her project titled Reviving Ponds in the Urban Network: *Towards Resilient Water Landscapes* (Kao, 2021). (Figure 13)

The design envisions the continued use of the pond system for fish farming and recreation, and more importantly, for stormwater management. During typhoons, which often bring intense rainfall over short periods, ponds could serve as crucial reservoirs to prevent urban flooding. This approach seeks to restore and enhance the network function of the original system by integrating new urban water structures accompanied by green infrastructure. (Figure 14 and 15), respectively.

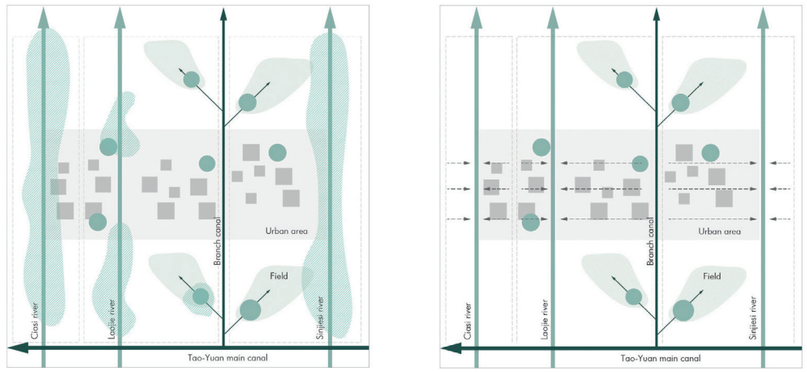


Fig. 13
Creating a robust water structure to mitigate flooding. Adapted from Kao (2021).

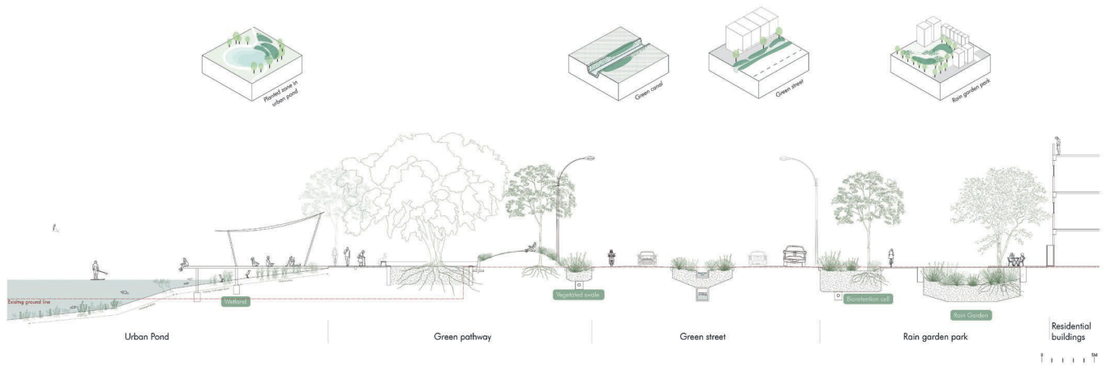


Fig. 14
Street runoff is collected in wadis, where the majority infiltrates the ground; excess water is conveyed through drainage pipes to the pond for filtration. Adapted from Kao (2021).

Fig. 15
The pond, located in the upper portion of the image, has been redesigned and extended with a secondary basin to establish a park landscape capable of seasonal water storage and filtration. The park's layout incorporates tree-lined walkways that offer shade and frame scenic views of the urban environment. Adapted from Kao (2021).

Fig. 16
The bridge connects adjacent neighborhoods and is designed as a crossing point and a social space for gathering, interaction, and engagement with the water landscape. Adapted from Kao (2021).

At the same time, the transformation of ponds balanced long, unobstructed view corridors in this densely urbanised region. The project underscores the importance of enhancing public awareness of the functional and cultural value of these traditional water systems, emphasising their role in fostering a deeper connection between communities, water, and cultural heritage. (Figure 16)

Lessons to learn: By recognising the traditional water system as a mediating infrastructure capable of storing excess water and releasing it to support plant growth, the design investigates new possibilities for its application within an urbanising context.

INTERMOTION LANDSCAPE

An analysis of the polder-boezem system and the industrial heritage of the Zaanstreek region in the Netherlands revealed the existence of a once-thriving global shipping industry.[6] Today, only those familiar with the history of the area can discern the remaining traces. The entrepreneurial spirit of that era served as a key source of inspiration for the design project, *Intermotion Landscape. An Experimental Design on Movement, Place Making and the Appreciation of the Cultural Landscape in the Zaanstad Area* (Chen, 2023b). A multifunctional boat serving as a mobile landscape intervention was central to this project. (Figure 18)

It hosts a peat garden, library, laboratory, and maintenance shed stocked with tools and materials to support the care of the peat polder landscape and the development of new public spaces within the town. Resembling a modern-day ark, the boat moves slowly through the landscape, observing, learning, and fostering sustainable transformation. The ship acts as a connector between the urban fabric and fragile rural peat landscape, emphasising the region's water-based connectivity while inviting participants to engage actively in the stewardship of their environment. (Figure 19)

Landscape transitions from a historically engineered, water-based industrial zone through a period of decline to a renewed vision of hope and resilience. When families are engaged in the shipbuilding industry, water management is integral to the community's well-being. In the current design proposal, water again emerges as a unifying element. The graduation project offers poetic reflection on water as a medium for transportation, connection, and cultural memory.

Lessons to learn: The shipbuilding industry has emerged from the polder–boezem system, a drainage infrastructure engineered to regulate water levels in low-lying areas. In this project, the potential of this water network for slow and sustainable transport was rediscovered. The elements of the system, such as sluices and piers, are reinterpreted as central public spaces, reviving their historical social and functional roles within the landscape.

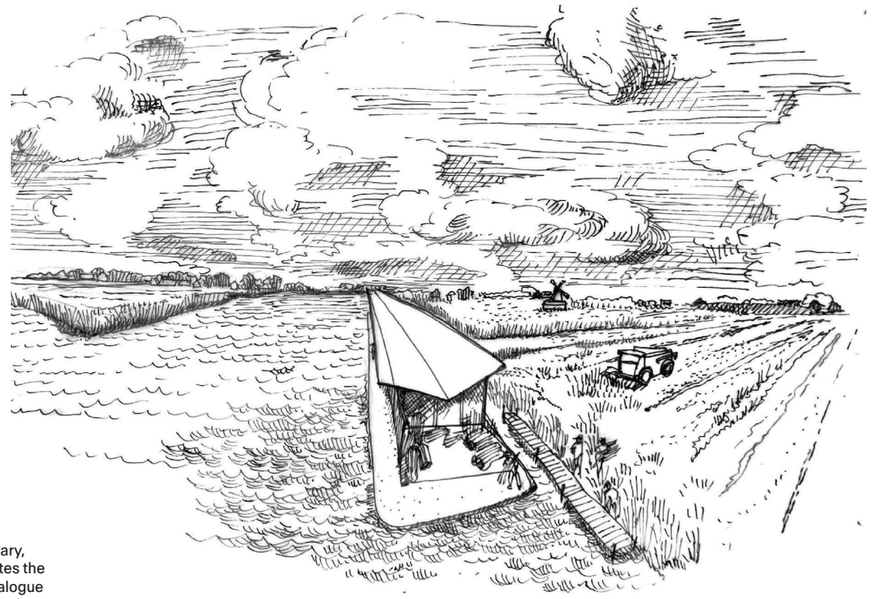


Fig. 18
The boat, serving as a museum, library, shed, and viewing platform, navigates the landscape, fostering an ongoing dialogue with the surrounding landscape that intensifies at each stop. Adapted from Chen (2023b).

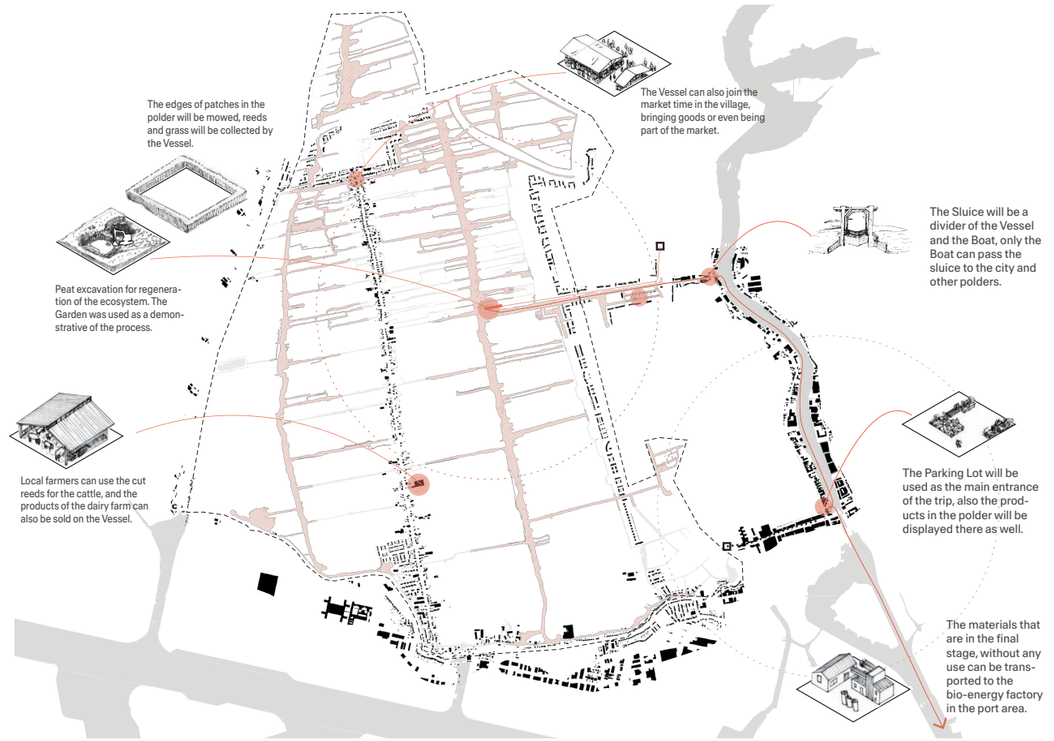


Fig. 19
Map of the design area illustrating the boat's navigational route through the peat landscape, including all designated stops and associated activities. Adapted from Chen (2023b).

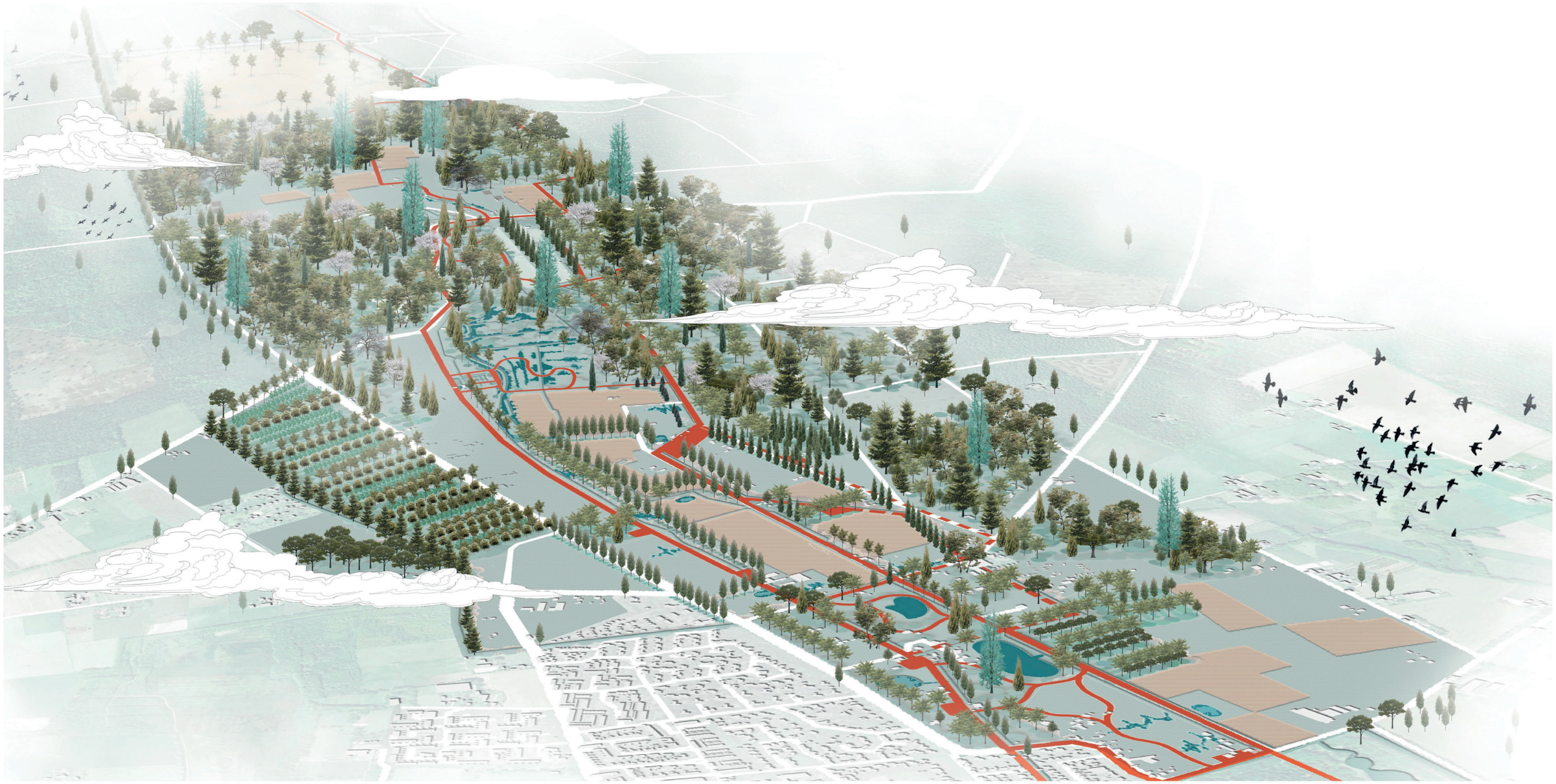


Fig. 17
The axonometric illustrates numerous water elements that form part of the Sprengen system. Carefully designed pathways reveal the system's historical function and structure and highlight the contemporary value of clean water for both natural ecosystems and renewed agricultural practices. Adapted from Jiang (2022b).

REVIVE THE SPRENGENBEEK LANDSCAPE

The human-made streams of the Sprengen System in the Netherlands are still in place and have been rediscovered by local historical organisations who step-by-step restore them, demonstrating the cleverness of people to pull the water out of the mountain and use its flow to gain energy. Because the water quality is excellent, people can touch it and feel its freshness and cooling effects. Waterworks, mills, and dams have vanished, but are partly reestablished as nice elements in the landscape, clarifying the former system. The project, *Revive the Sprengenbeek Landscape: Integrating a heritage water system into the renewed circular agricultural landscape at Vaassen, Veluwe* (Y. Jiang, 2022b), uses the system's understanding to accelerate the transformation of today's farming practices by diversifying the forest and crops in agricultural fields, ensuring that more water is stored and can infiltrate into the soil. (Figure 17)

Sprengen will be maintained as needed for production. Moreover, keeping Sprengen will benefit specific vulnerable and pristine ecological biotopes that are typical of the area's water quality and soil conditions. In the design, the Sprengen System served as a driver for ecological production.

Lessons to learn: The invention of the Sprengen System enabled the use of flowing water for milling, making it possible for the thriving paper industry to rise. Building upon this system, sustainable agriculture and the support of rare ecological habitats now offer a renewed interpretation of its value, one that emphasises the high quality of the water it provides.

REVEALING ROME'S WATER-BASED CULTURE

The project *Revealing Rome's Water-Based Culture: a resilient, dynamic and interactive layer* (Di Nicola, 2020b) draws inspiration from the ancient Roman understanding of water management.

Over centuries, the inhabitants of Rome, a city founded initially on marshlands, developed a technologically advanced society that coexisted with water in sophisticated ways. As the city expanded, the increasing water demand necessitated sourcing from the surrounding landscape. Water is transported over long distances via aqueducts and used for alimentary, sanitary, and recreational purposes. Today, however, water infrastructure is largely hidden from view, and many residents take the supply for granted, unaware of Rome's exceptional hydraulic legacy. In the face of contemporary climate challenges, such as intensified flooding and drought, and a city that does not act on them, the contrast with the ingenuity of ancient water management is striking. In response, the student mapped the remnants of Rome's historic water infrastructure within the city's historical centre, including the ruins of bathhouses, ponds, fountains, and statues. Surprisingly, many of these elements still exist, but are hidden and disconnected, both physically and culturally. When designing a water experience path within a selected area, the project re-establishes these connections by linking historical water features with newly introduced elements, such as infiltration zones and collection basins, designed to mitigate flooding and support urban cooling through vegetation. This project addresses contemporary environmental challenges and reactivates Rome's water heritage as a visible, functional, and educational part of the urban fabric. (Figure 20)

Lessons to learn: The project ensures the continuity and renewed relevance of this cultural legacy by uncovering Rome's historical water-based culture and enhancing it by transforming existing elements and introducing new ones.

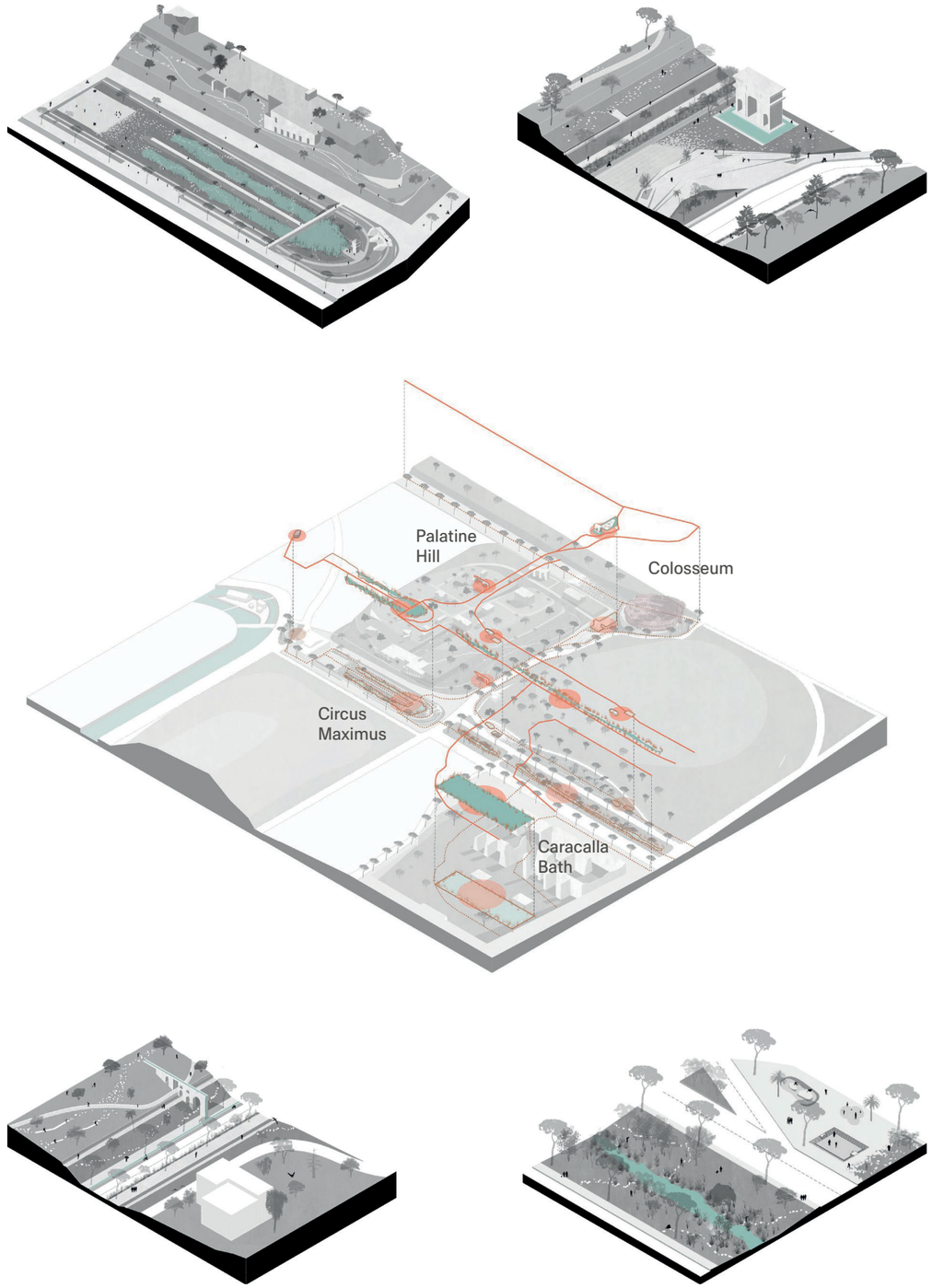


Fig. 20
A network of pathways connects historical and newly introduced water elements, which have been transformed into public spaces for rest and recreation, while offering opportunities to engage with and learn about Rome's rich, innovative water history. Adapted from Di Nicola (2020b).

EXPERIMENTATION

Students begin their graduation project by selecting a design site and identifying its specific environmental and spatial challenges. In response to these challenges, they selected a traditional water system case, either in its entirety or in part, that offers relevant insights for the selected context. This case study provides a foundation for experimentation, allowing students to explore how historical water management principles can inform innovative, site-responsive design interventions.

In addition to analytical research, experimentation is also an integral component of the design process. Through the interpretation and transformation approach, students engage in on-site experimentation with various elements of the traditional water system to explore how to restore, adapt, and expand it. This process allows them to assess what aligns with spatial composition and performs best from a technical standpoint. Experimentation is central to the projection approach as it encourages the emergence of unexpected insights and innovative ideas. It is inherently iterative, and involves cycles of conception, testing, and evaluation. Reflections arising from these cycles provide successive design proposals and refinements. Design experiments can occur at any process stage and address various concerns, including spatial composition, materiality, functionality, contextual integration, temporality, and beyond.[7]

The projection approach embraces experimentation to generate innovative design solutions grounded in the traditional water system knowledge derived from their case studies. This method challenges them to reinterpret and recontextualise historical practices in response to contemporary and future challenges. In several of the designs discussed in this case, the *Untold Waters*, traditional upstream water systems initially developed for agricultural purposes, are extended and adapted to structure downstream settlement areas, reintroducing and reimagining lost practices relevant to the design site. In the *Living with Drought Prone Landscapes* project, a traditional water system from a dry region is projected and tailored to a different yet increasingly drought-prone context on another continent as a proactive adaptation strategy. Two student projects that exemplify the projection approach are examined to illustrate how valuable insights can be drawn from traditional water systems: *Untold Waters* in South Africa and *Living with Drought-Prone Landscapes* in Rwanda.

UNTOLD WATERS

The practice of slowing, diverting, and utilising floodwaters to moisten soil has been developed across various cultures and environmental contexts, resulting in diverse and site-specific water management strategies. These approaches have demonstrated long-term sustainability mainly because of the deep local understanding of natural cycles and landscape dynamics, particularly among farming communities. In contrast to many contemporary solutions, which often depend on mechanised and linear infrastructure, traditional methods emphasise a hands-on approach. This approach prioritises direct human involvement, care, and application of local knowledge over purely engineered interventions.

In the project *Untold waters: Regrowing a coextensive urban riverine landscape through flood mitigation and rehabilitation strategies, South Africa* (Vollmer, 2025b), this hands-on methodology is central to the design. The project emerged through an iterative process of sketching and site-based thinking, which is particularly appropriate for the context of Sir Lowry's Pass River. Here, informal settlements on the riverbed represent a vulnerable community struggling with the challenges of daily survival. The project responded to these conditions through a deeply site-responsive and community-engaged approach to water and landscape resilience.

Recognising that human and nonhuman patterns in this context cannot be rigidly designed or imposed, the project adopts a similarly flexible and adaptive approach. This allows space for continuous experimentation, transformation, growth, and individual agency. Drawing inspiration from the Saaidamme water system on the opposite side of the mountain range, this project introduces simple water infrastructure and maintenance practices as fixed landscape elements. These interventions serve not only to guide the flow of water but also to provide a foundational framework upon which dynamic, unpredictable processes and narratives can emerge, evolve, and shape future landscapes. (Figures 21, 22 and 23)

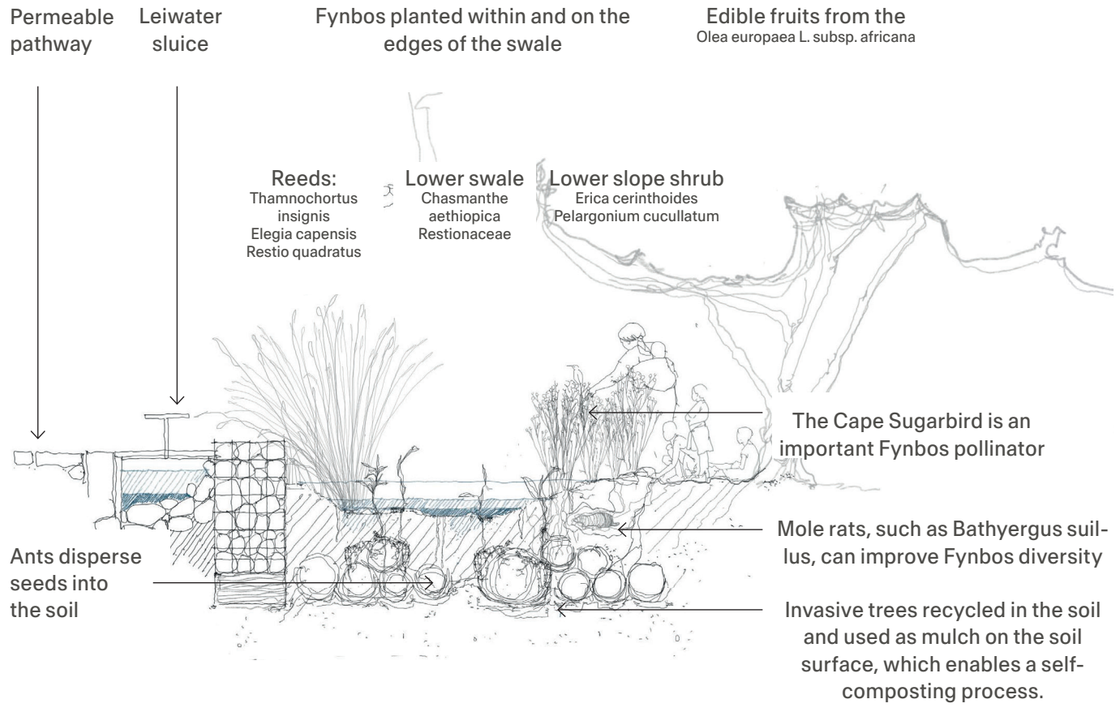


Fig. 21
The designed detail section illustrates a sheared water channel (positioned to the left) in conjunction with a swale—a shallow, engineered drainage feature intended to capture and manage surface water runoff, and elements of soil rehabilitation. Various Fynbos species are introduced, serving as biological soil stabilisers and valuable botanical resources that can be sustainably harvested for medicinal properties. Adapted from Vollmer (2025b).

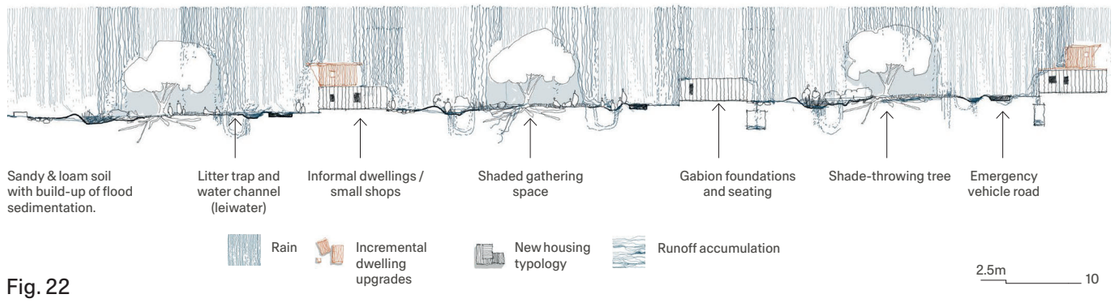


Fig. 22

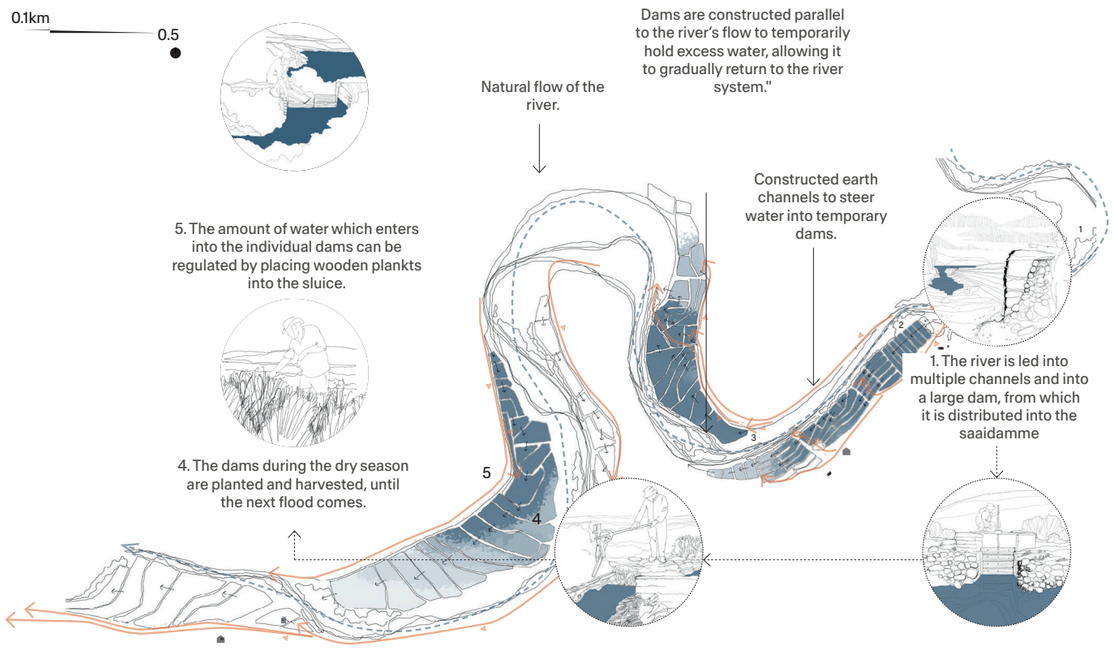


Fig. 23

Fig. 22
The village's relief is adapted through Saaidamme techniques to integrate water into its surroundings, protect houses from flooding, and capture rainwater in the swales. Adapted from Vollmer (2025b).

Fig. 23
Map of the Saaidamme built on Witkleigat farm in the Northern Cape, South Africa, illustrating the flow of water and the filling of Saaidam basins during the Hantam River flood. Adapted from Vollmer (2025b).

Lessons to Learn: The Saaidamme water system is a seasonal and manually operated system that relies on the active involvement of water workers for its functioning and maintenance. Water from the river is directed into a series of compartments by opening and closing sluices, forming temporary dams, and requiring the regular dredging of channels. This system is managed through direct on-site observation, reflecting an intimate and responsive relationship between humans and water. This close interaction forms the conceptual foundation for a design project, emphasising the value of human engagement in sustainable water management. The traditional water system also inspired the project's use of materials and techniques.

LIVING WITH DROUGHT PRONE LANDSCAPES

The *Living with Drought Prone Landscapes: Spatial Design Interventions for Rain and Dry Season Mitigation Systems in Ryabega* (Delobbe, 2024) demonstrates a compelling example of the experimentation approach. In this graduate thesis, the designer explored a nature-based water management system for an arid region, aiming to capture every drop of rain. Drawing on traditional knowledge from the Khadin Water System in Rajasthan, India, these principles are transferred to the Intara y'Iburasirazuba Plateau near Ryabega, Africa. The impression of the design site remains lush but exhibits signs of ecological decline, floods, and droughts. Contemporary water systems in the region are becoming increasingly inadequate in the face of escalating climate extremes, placing pressure on agriculture and local livelihoods.

In response, a design is proposed that integrates lessons from the Khadin system to create an infrastructure capable of mediating between rainy and dry seasons. This initiative is implemented incrementally in collaboration with local NGOs that engage community members in one of the country's most impoverished areas.

The community can proactively prepare for droughts and flooding by initiating the project immediately. The proposed system comprises small-scale interventions near individual households complemented by a larger regional infrastructure to facilitate rainwater infiltration into the soil. Strategically placed basins collect water for irrigation and capture sediment, which can then be used as natural fertilizers to restore and support agricultural cycles. Revised planting schemes have been introduced to enhance groundwater recharge and provide shade, thereby reducing the surface evaporation. (Figure 24 and 25), respectively.

Over time, the crop palette has gradually adapted to evolving climatic conditions, supporting long-term agricultural resilience. By focusing on water and humidity conservation, improving soil moisture retention, and ensuring reliable access to drinking water, the project aims to be locally sourced and community-built. Ultimately, it seeks to enhance Ryabega's

Fig. 24
The new water system implemented across the landscape. Adapted from Delobbe (2024).

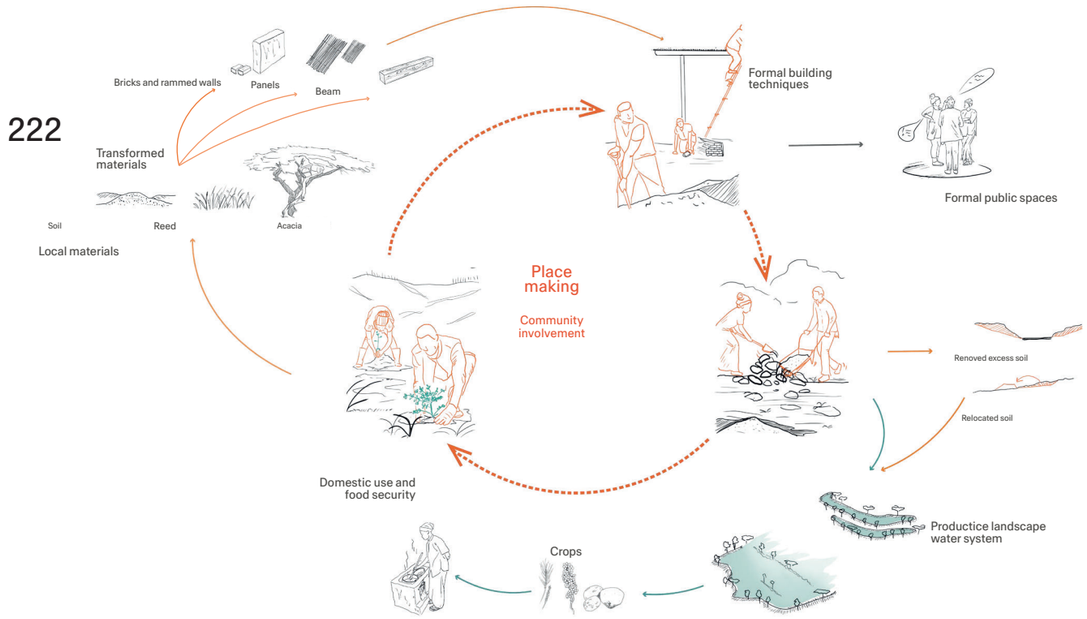


Fig. 25
The newly implemented design elements are grounded in principles of material circularity, emphasising the life cycles and provenance of materials. This approach highlights the narrative of each material—its origin, usage, reuse, and eventual reintegration into the environment or built system—thereby promoting sustainable design practices and resource efficiency. Adapted from Delobbe (2024).

water and economic autonomy, while reducing its vulnerability to climate change, drawing on practices already familiar in regions accustomed to similar environmental challenges. As these interventions take on a more architectonic character throughout the village, the quality and attractiveness of the public spaces are simultaneously enhanced. (Figure 26)

Lessons to Learn: By implementing a traditional water system from an arid region onto the design site in anticipation of similar climatic conditions, the project adopts a proactive strategy for environmental adaptation. It emphasises community involvement, as local inhabitants can construct and maintain the system and position capacity-building as a key component of long-term ecological resilience.

NOTHING NEW

In conclusion, to design a circular water story, it is essential to define and investigate the catchment area of the traditional water system and design site. A comprehensive understanding of the water cycle in this context is critical. This establishes a wider landscape framework in which water, land, ecosystems, settlements, livelihoods, cultural practices, and institutions interact. This landscape-based approach provides a grounded basis for addressing contemporary water challenges. Moreover, identifying water sources, mapping flow paths, and assessing precipitation levels, whether rainfall or snowfall, are crucial for understanding the context. Additionally, it requires analysing evaporation and transpiration rates, the morphology of water bodies, patterns of water use, and interactions among surface water, groundwater, and soil conditions were analysed.

Traditional water systems are nothing new, but they are a reminder that we do not need to reinvent the wheel when dealing with the growing impacts of climate change. The analysis revealed that long-lasting water systems offer rich, site-specific, and climate-responsive technical knowledge, complemented by a nuanced understanding of the social, ecological, and economic dimensions that have developed over time. The spatial patterns and forms of these human-made systems emerge from a deep-rooted sense of place

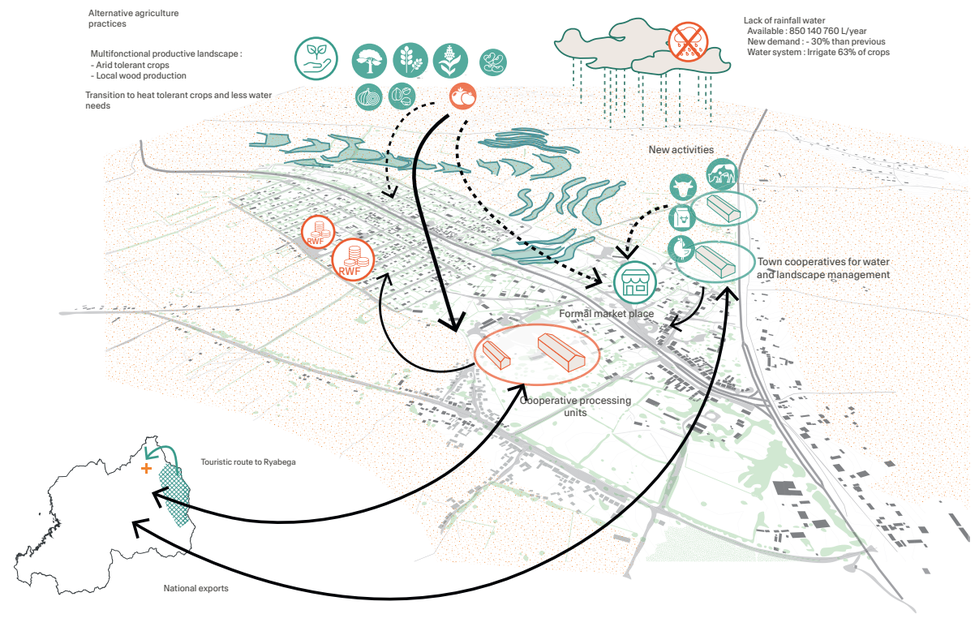


Fig. 26
The proposed design enhances the local village economy by integrating various productive activities. These include establishing acacia forests for timber and related products and developing dairy farming, poultry and beef production, and ecotourism initiatives. Collectively, these interventions aim to diversify income sources and promote sustainable rural livelihoods. Adapted from Delobbe (2024).

and are governed by underlying, systemic spatial logic. Engaging with these case studies fosters a critical awareness of the vital, yet often neglected, role of water in contemporary society.

The graduation projects illustrate that studying traditional water systems enables students to develop design approaches that acknowledge and respect the interconnections between water, the environment, and local cultural practices. Moreover, attending to ecological processes and temporal changes is essential to creating spatial interventions that are both resilient and environmentally responsible. Depending on the specific project site, the integration of elements, such as water filtration technologies, flood management infrastructure, or existing industrial facilities, may be part of the design. However, the inclusion of such interventions must be critically assessed, supported by well-substantiated reasoning, and thoroughly evaluated for their long-term impact on the landscape.

Perhaps the most profound insight gained from laboratory exploration is the renewed recognition of our responsibility to care for water as a valuable life-sustaining element. Traditional practices remind us that site-specific stewardship was integral to human survival. Long-lasting systems embody a way of life centred on a symbiotic, often also a spiritual relationship with water and, more broadly, with the natural world.

NOTES Lessons to Learn

1. Locals who gained knowledge by doing and living on a specific site for a long time.
2. https://circularwaterstories.org
3. Definition: Interventions that use the natural functions of healthy ecosystems also provide numerous economic and social benefits.
4. See *Grand Projects: Water as Infrastructure*.
5. A Sprengen System is a historical Dutch water management technique that uses artificial springs (called *sprengen*) to supply water for industrial or agricultural use, particularly for powering watermills. The springs were generated by piercing the slope and revealing groundwater to the surface.
6. A water management system in the Dutch delta designed to drain excess water from low-lying areas known as *polders* into a higher-level called the *boezem* network. From the *boezem*, water is further discharged into even higher external bodies, such as rivers or the sea. This system uses a series of pumps, canals, and sluices to manage water levels and prevent flooding in reclaimed land below sea level.
7. The experimentation definition is based on course description methodology (2024–25) of the master track of Landscape Architecture, TU Delft.