

# Designing Resilient Landscape Frameworks

Landscape Architecture Design Explorations in the  
Nile Delta, North-West Europe, Paraná River, Pearl  
River Delta, Taihu Lake Basin, and Wadden Sea Region



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Delta, North-West Europe, Paraná River, Pearl River Delta,  
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# Acknowledgements

This publication presents ten MSc graduation projects of the Resilient Coastal Landscapes Lab 2023. Our group consists of students who are pursuing the Landscape Architecture and Urbanism track, under the guidance and coordination of Prof Dr Steffen Nijhuis. Our learning consisted of practical excursions and weekly sessions where students shared their projects, enabling them to track their progress and accumulate experiences throughout their educational journey. These sessions have been instrumental in refining our methods and perspectives, with a particular focus on landscape-based design, planning, and resilience. We would like to express our heartfelt appreciation to Prof Steffen Nijhuis for his attentive support, addressing our curiosities, project-related matters, and personal inquiries. His insightful comments and suggestions have not only provided clarity but have also fueled our enthusiasm for learning. We would also like to extend our gratitude to our dedicated panel of mentors, whose support has been invaluable to us: Dr Gregory Bracken, Dr Daniele Cannatella, Dr Fransje Hooimeijer, Dr Lei Qu, Ir. M. Marco Lub, Dr Martine Rutten, and Robbert Jan Van Der Veen. We sincerely thank them for their valuable advice, sharing their experiences, and unwavering support in both challenging and less challenging times.

Studying during times of significant global changes, when our advanced society must confront numerous new challenges such as rapid warming, rising sea levels, the sixth mass extinction, extreme weather events, and others, was likely as demanding as devising solutions to address them. The journey towards obtaining our master's degrees was as adventurous and intriguing as it was stressful, but ultimately it brought hope that things can still be repaired, that there is still hope. As a collective of now graduated students, we hope that after all the effort and hard work we put into our projects, these ten designs will reflect and clearly present our intentions to create a new, non-invasive, resilient environment for all species to share. We hope that our work, both small and grand ideas, will open discussions in the field and inspire new areas of inquiry or topics for the upcoming generations of landscape architects and urbanists.

Resilient Coastal Landscape lab graduates, June 2023

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FIG. 1 Aerial photo-flying over Paraná River

# Introduction

This design lab explores landscape-based design approaches for resilient coastal landscapes. Coastal landscapes are vital for ecosystems and the global economy, supporting dense populations in delicate water-dominated environments. However, these landscapes face numerous threats and are highly vulnerable. To ensure a sustainable future, implementing spatial strategies and design solutions becomes essential. These measures aim to enhance resilience, effectively manage vulnerabilities, and strengthen the ability to face natural and human-induced challenges.

## **Ten projects**

The projects span across various regions worldwide, including the Nile Delta, North-West Europe, Paraná River, Pearl River Delta, Taihu Lake Basin, and Wadden Sea Region. Each project is dedicated to distinct themes such as landscape-nature network, nature conservation, water-resilient polder landscapes, and sustainable Revitalisation. Despite their diverse locations, all ten projects share a common objective: fostering sustainable ecosystems and promoting urban growth.

A landscape-based multiscale design approach is applied, acknowledging the interconnectedness of different scales and systems within the urban landscape, and promoting a holistic and integrated design process. In addition, the research through design methodology allows for exploration and experimentation within the design process, enabling the discovery of innovative and sustainable solutions for urban landscapes (Nijhuis & De Vries, 2019). Furthermore, by integrating natural processes into the design, both entities strive to create resilient and ecologically urban landscapes.

## **Flowscapes Studio**

The lab is part of the Landscape Architecture MSc “Flowscape” graduation studio, emphasizing the importance of theoretical foundations in urban landscape infrastructures, particularly the framework and corridor approaches (Nijhuis & Jauslin, 2015).

In summary, the Resilient Coastal Landscape lab and Flowscape Studio share a common foundation in the theoretical principles of urban landscape infrastructures, adopt a landscape-based multiscale design approach, value research through design, and emphasize the integration of natural processes in the design practices.

# INTERFACE OF THE WADDEN SEA REGION

Along the coastline near Dorum-Neufeld, Lower Saxony, Germany, land reclamation efforts are underway to develop salt marshes against the sea dikes. Previously, these salt marshes were converted into agricultural land by endikement and artificial drainage systems. As a result, the interface in the region became fragmented and the gradient between sea and land shortened, reducing its overall resilience and loss of dynamic processes. Now, salt marshes are partly restored and developed through the installation of wooden groynes as a form of nature conservation and improvement of coastal defences, but sea level rise keeps threatening their existence. Behind the sea dikes climate change also threatens agricultural productivity and safety of local residents, as weather conditions are becoming more extreme.

Photo: Alamy, Franz Blickwinkel







# MANMADE MARVELS

## Unveiling Lower Saxony's Altered Horizons

FIG. 4 The heathlands in the Lower Saxony near Hamburg. The landscape is notable for its peatland, which has been transformed into extensive water bodies through human extraction. These water bodies now serve as crucial and biodiverse habitats within the region. I selected this image to showcase how human actions have shaped the landscape over centuries, while also providing hope that not all human activities inevitably lead to disaster.

Photo: Anežka Vonášková, 2023, TU Delft



# GULAO TOWN: A TRADITIONAL DIKEPOND AREA

FIG. 5 Gulao Town is a lowland surrounded by river network, and has Heshan city to its south. Therefore, it's a typical area facing challenge of water threat and urban expansion. Gulao Town is also one of the oldest dikepond in the PRD. With the protection of dikes towards the river, dikeponds are able to cultivate inside the dike. There is an old poem describing the landscape as "the ponds are like the ocean, and the settlements are like the islands." Today's agriculture is still the main industry of Gulao Town. But it's facing the dilemma, due to the lack of economic development, the youngsters are leaving the village. Some of the villages and fish ponds are gradually abandoned. While the tourism project "Gulao Waterfront" in 2020 has transformed a portion of the traditional water town into a Disneylandlike destination for urban residents.

Photo: [https://m.thepaper.cn/newsDetail\\_forward\\_8149557](https://m.thepaper.cn/newsDetail_forward_8149557)





# EGYPT: NILE THROUGH THE DESERT

FIG. 6 The Nile carves a vibrant green strip through the desert, a lifeline of fertile land amid vast arid expanses

Photo: Connect Images / Alamy Stock Photo.





# CITIES BUILT ON AGRICULTURAL LAND IN THE PRD

FIG. 7 After the implementation of economic reforms and the opening up of China in 1978, the Pearl River Delta region experienced rapid industrialization and urbanization. The government's push for the development of secondary and tertiary industries led to the conversion of vast farmlands into industrial and residential areas. The dikedfield, characterized by its developed economy and flat terrain suitable for construction, became the focal point for urban expansion, and traditional villages were surrounded by rapidly growing townships.

Photo: Xiaomeng Tian, 2019







## GUANGZHOU'S URBAN DILEMMA

FIG. 8 Demand for urban construction and the need for green space often bring metropolitan cities into dilemma.

Photo: Hao Feng, 2023







## URBANIZATION OF DIKEDFIELD IN THE PRD

16.9 For the dikefield, the settlement patches firstly grows into the continuous "edges" around the ponds. With the construction of new infrastructure, settlement as well as factories develop along highways or canals (Tian, 2019). Finally, the large mosaic of residential area and industrial plot take over the pond and expand along the villages, which will be connected to the adjacent villages and combined as a large cluster of 2~6 times the original scale (Yang et al., 2022).

Photo: Zhaolin Liang ([https://www.sohu.com/a/406935381\\_355825](https://www.sohu.com/a/406935381_355825))

# WATER TOWN XITANG

FIG. 10 The traditional water town in the Taihu Lake Basin is the typical landscape in this region

Photo: Riccardo Biondani / Alamy Stock Photo





# DYKE POND SYSTEM IN THE PRD

FIG. 11 The dyke pond system is one of the most fundamental agriculture types in the Greater Bay Area, which has a close spatial relationship with rural settlements.

Photo: Zhaolin Liang ([https://www.sohu.com/a/406935381\\_355825](https://www.sohu.com/a/406935381_355825))







百利保



# GUANGZHOU'S URBAN DENSITY

FIG. 12 Guangzhou is one of the most typical metropolitan cities in the Great Bay Area (GBA). The fast development contributes to massive urban construction in a relatively short time. However, the prosperity comes at the expense of urban green space.

Photo: Hao Feng, 2023



## Project Overview



**Grow With the Flow /** Coastal Interface development, Resilient Landscape Framework, Dynamism

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Venne van den Boomen

**a River Reborn /** Nile River Basin, Natural River Dynamics, Historical practices

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Hilde Huijboom

**The River and the Mosaic /** Drought Resilience, Agricultural Landscapes, Landscape Ecology

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Victoria Imasaki

**From the Water /** Landscape Framework, Sustainable Development, Traditional Agriculture

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Yi Lu

**Tomorrow's (P)ARK /** Landscape Network, Rewilding, Nature Conservation

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Anežka Vonášková

**Ecocharge /** Resilience Framework, Water Management, Landscape as Infrastructure

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Jiaqi Qiu

**Sponge Polder /** Polder Landscape, Cultural Landscape, Resilience Capacity

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Qian Yao

**Guangzhou Metropolitan Park /** Resilient Coastal Landscapes, Green and Blue Infrastructure

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Chuhan Zhang

**Smart Village /** Agricultural Upgrading, Digitalisation, Sustainable Revitalisation

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Minshi Zhang

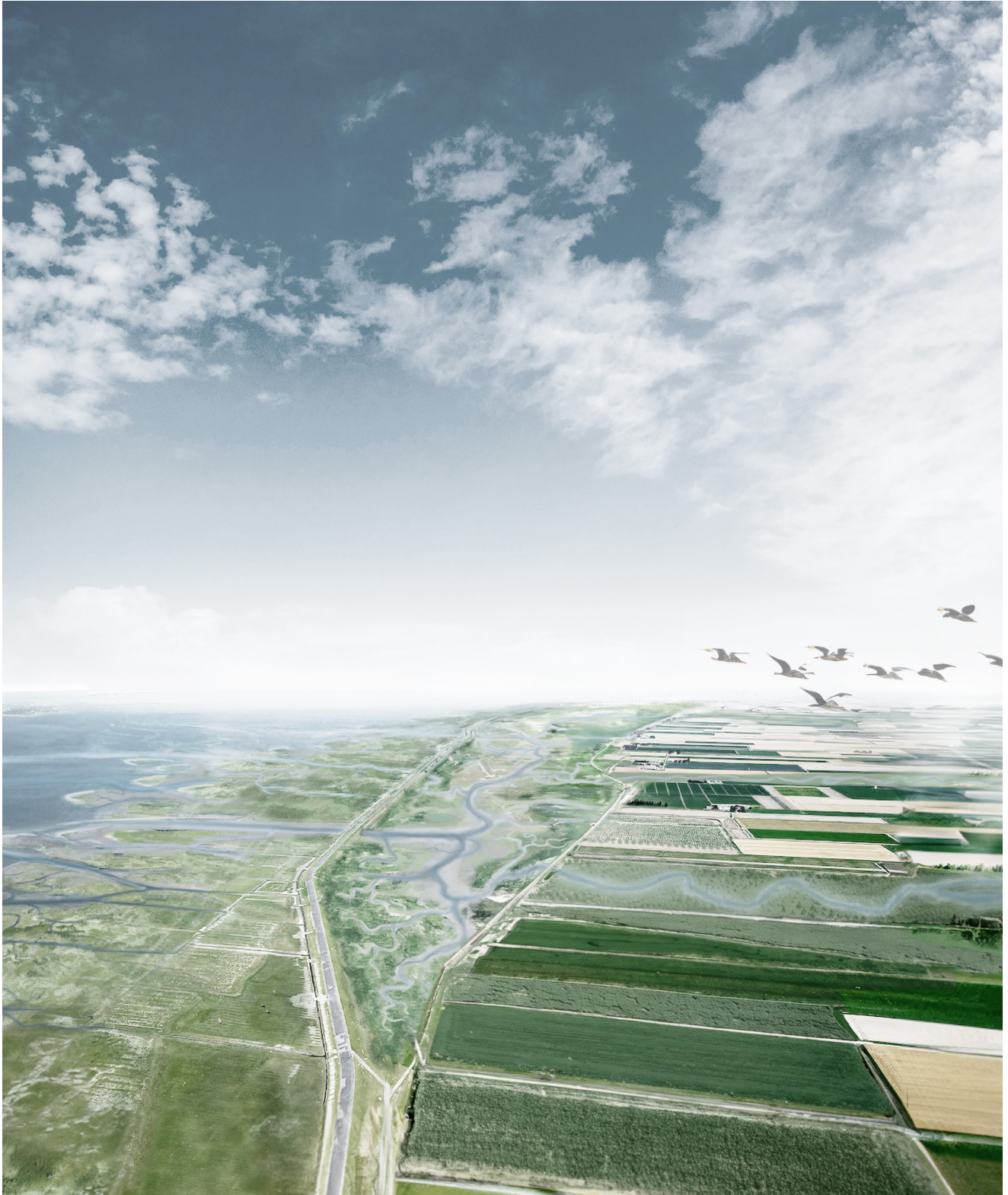


FIG. 13 Birdsvie with projection of design interventions, softening the direct barrier between sea and land at the Dutch coastline near Groningen.

# Grow With the Flow

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## Developing a Resilient Coastal Interface for the Wadden Sea Region

Venne van den Boomen

Supervisors

Steffen Nijhuis, Landscape Architecture

Robbert Jan Van der Veen, Urban Design

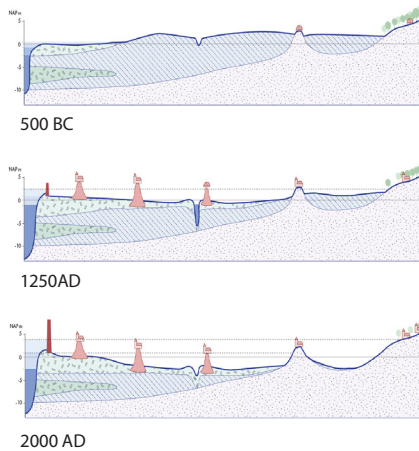
### **Introduction**

The Wadden Sea Region comprises the islands, Wadden Sea, and the embanked coastal marshes of the Netherlands, Germany, and Denmark. This region serves as the transitional territory or coastal interface between the North Sea and north-western Europe's mainland. Coastal interfaces are among the most cultivated and vulnerable environments, threatened by the combined effects of climate change and human actions (Ward et al., 2020). The coastal interface of the Wadden Sea Region is a vulnerable environment due to ongoing land reclamations through dike development, artificial drainage, and traditional flood engineering practices. These activities have led to the fragmentation and fixation of the sea-land continuum. To support the development of freshwater-based agricultural practices in the region, artificial hydrological systems have been introduced. This has led to the almost complete disappearance of naturally occurring biogeochemical gradients along the interface. Between 65 and 75 percent of the region's terrestrial surfaces consist of agricultural pastures, meadows, and cropland (Schep, IJntema, & van Beukering, 2021). The current land use practices heavily rely on an artificial hydrological system. This system has transitioned from being dynamic and balanced to static and imbalanced, making it vulnerable to disturbances. The challenges facing the region today, such as drought, irregular precipitation patterns, alluvial flooding, sea level rise, and soil salinization, are expected to exert more pressure on existing land use systems in the future. This is due to the unprecedented rates at which global climate change is increasing (Oppenheimer et al., 2019).

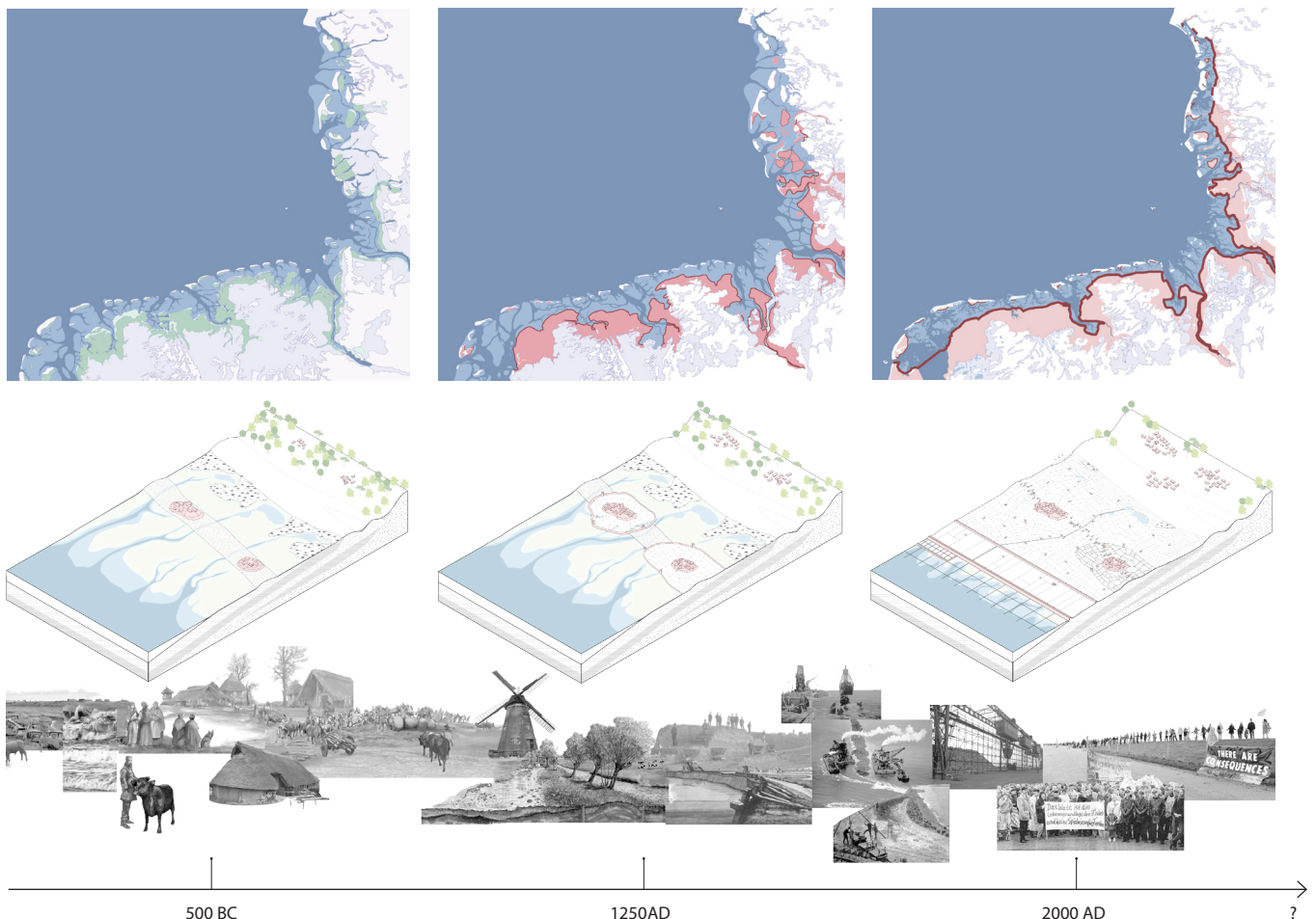
Grow With the Flow: Developing a Dynamic Coastal Interface for the Wadden Sea Region explores the potential of landscape architectural design in the redevelopment of the coastal interface within the territory of the Wadden Sea Region. The aim is to increase its socio-ecological resilience and restore balance between land and sea. Due to the project's scale, we defined a set of theoretical guidelines based on resilience theory (Holling, 1973; Ahern, 2011) and the landscape-based approach (Nijhuis, 2019). These guidelines were then translated into operational principles based on the interface typologies present in the region. These principles were tested through design at a regional and local scale level within the Dutch Wadden Sea Region. The aim was to explore possibilities for new synergies between living and production along the new interface.

## Hypothesis: the lacking interface

FIG. 14 Historical development of the coastline and interface of the Wadden Sea Region, from a dynamic interface, to a closed-off interface



The introduction of dikes and hard infrastructure in the medieval period and the impressive growth of technological innovation in flood protection and drainage systems in the 20th century resulted in the reduction and eventual loss of most of the dynamic interactions between land and sea (Betten, 2018). As a result, the overall interface system of the Wadden Sea Region has become fragmented and imbalanced, with hydrological systems becoming separated. Recent efforts have been made to create a more unified approach to land management in the region. However, political boundaries limit the development of large-scale integration of forms, functions, and flows within the landscape, hindering the formation of the Wadden Sea Region as a cohesive cooperating system. Meanwhile, climate change-related issues are challenging our current imbalanced land-use systems, such as agriculture and industry, which heavily rely on freshwater supply and cannot adapt to these challenges. The region is already experiencing drought, dredge surplus, reduced water quality, waterlogging, salinisation, and flooding, which will become more severe in the future (de Jong, 2007). It is necessary to reconsider our approach to managing the natural landscape and explore alternatives to the current standard practices in order to establish a foundation for a sustainable future.



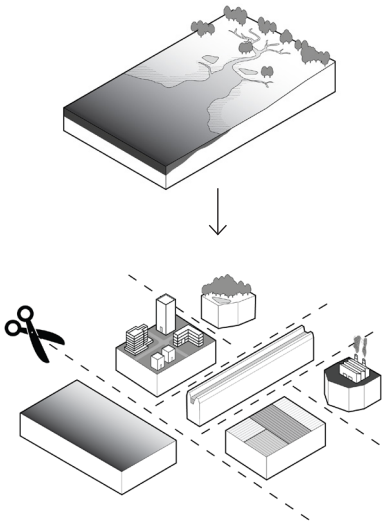


FIG. 15 Above - A schematic representation of fragmentation and separation of the interface system

FIG. 16 Right - During a study visit this past summer along the coastline of the Wadden Sea Region, the author encountered many consequences of the fragmentation of the interface and human interventions within the landscape: sluice gates closing off the coastline to keep the sea water out (1), long dikes separating habitats (2), artificial water systems to allow drainage and water supply in and out of the low-lying polders (3) and the continuous watering of agricultural fields (4).

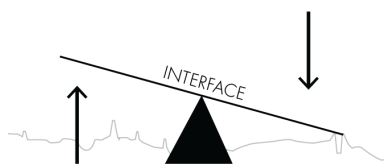


FIG. 17 Top - The interface is imbalanced

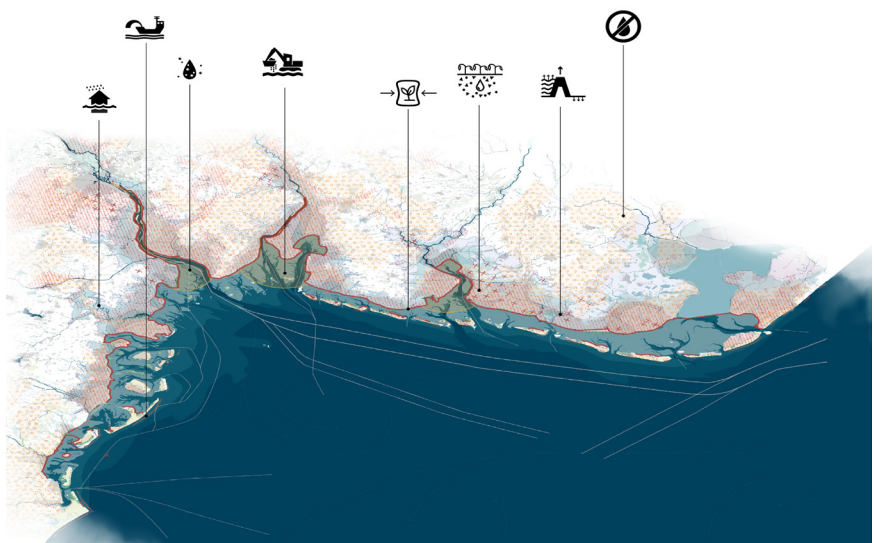


FIG. 18 Overview of challenges projected on the Wadden Sea Region

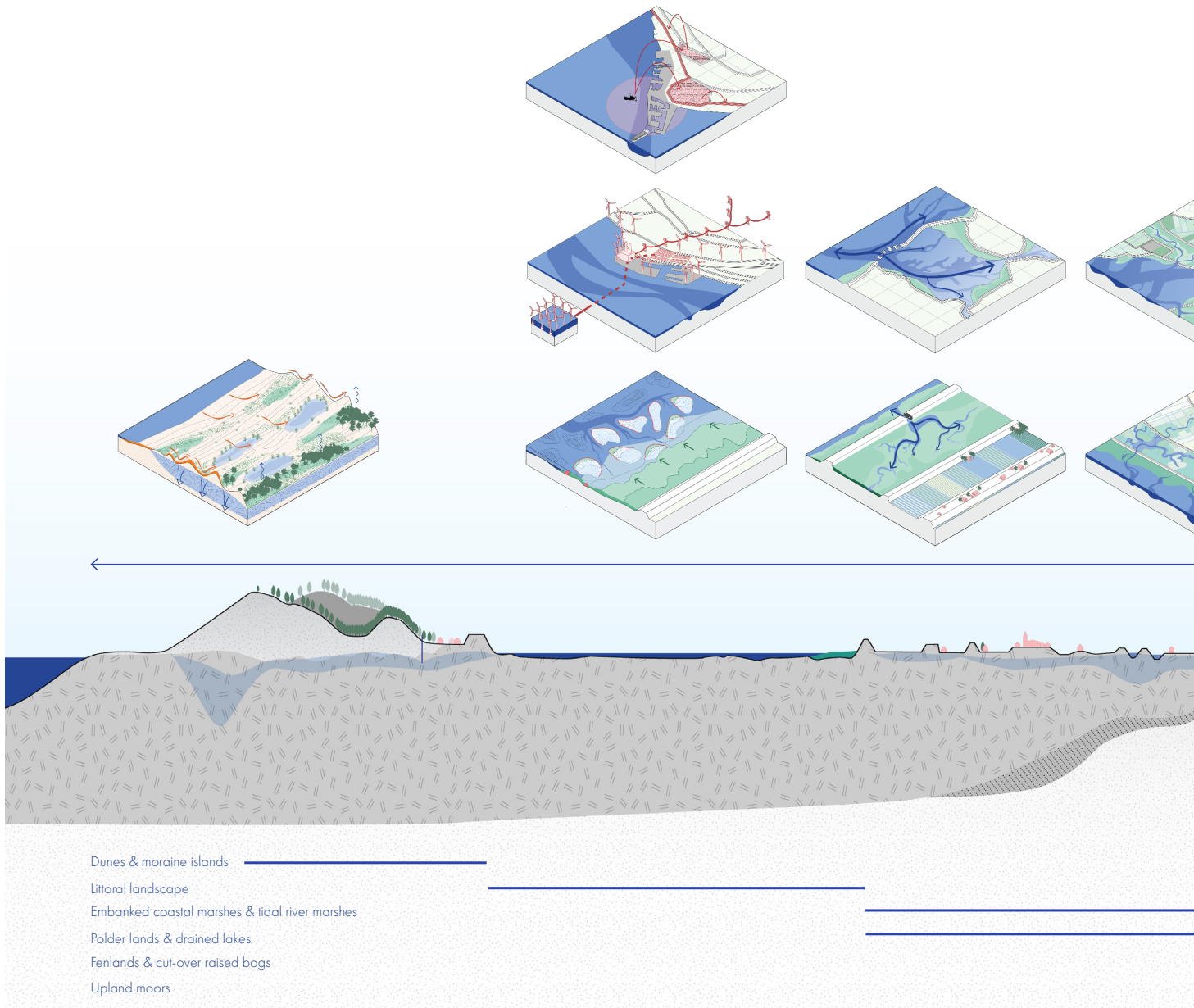


FIG. 19 A wide range of design principles are implemented along the entire interface to improve the overall interface system

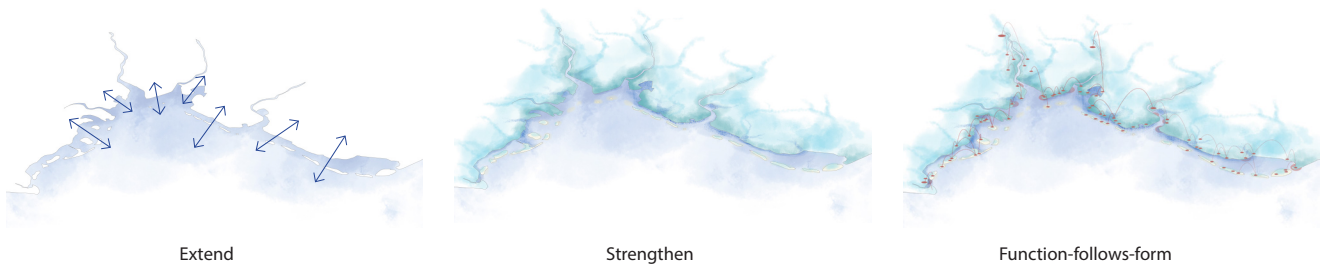
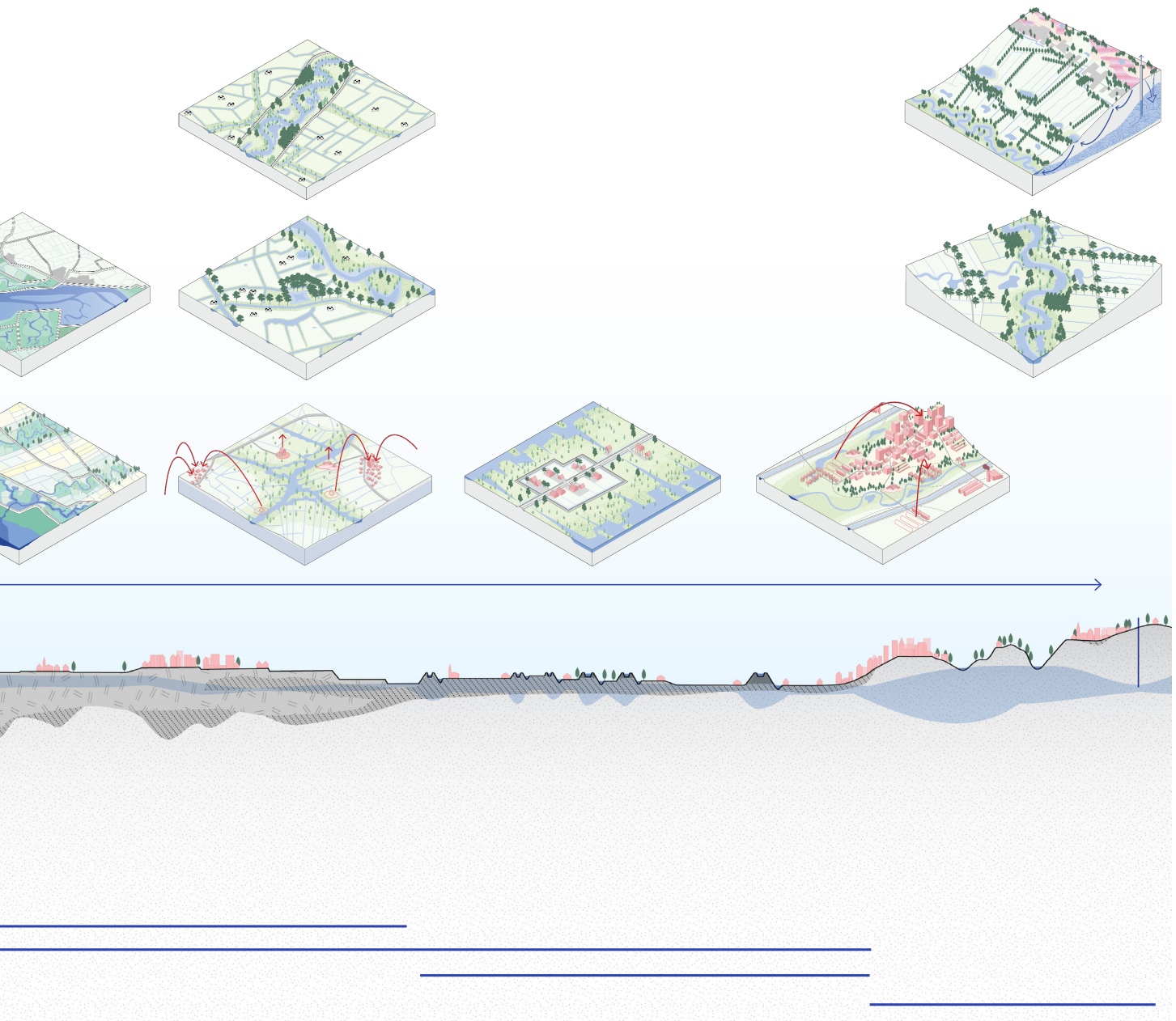


FIG. 20 Main focal points for the systemic vision for the wadden sea region



### **Operational principles for systemic change**

Restoring hydro-morphological structures between inland water systems and the littoral landscape, while ensuring they match socio-ecological functions on the surface level, promotes sustainable improvement of the future interface. Natural fluxes, conditions and processes are considered primary design tools to propose a shift; From closing off the inland water system from the sea and relying upon hard infrastructure and artificial water systems, to an approach which strengthens the water gradient, makes use of design-with-nature and takes on a functions-follow-form approach. Characteristic topographic interface elements are identified and a total of 15 principles are proposed to improve each interface element, eventually improving the overall interface system

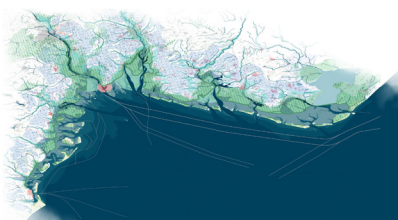


FIG. 21 Overview of potentials for a new interface framework projected on the Wadden Sea Region

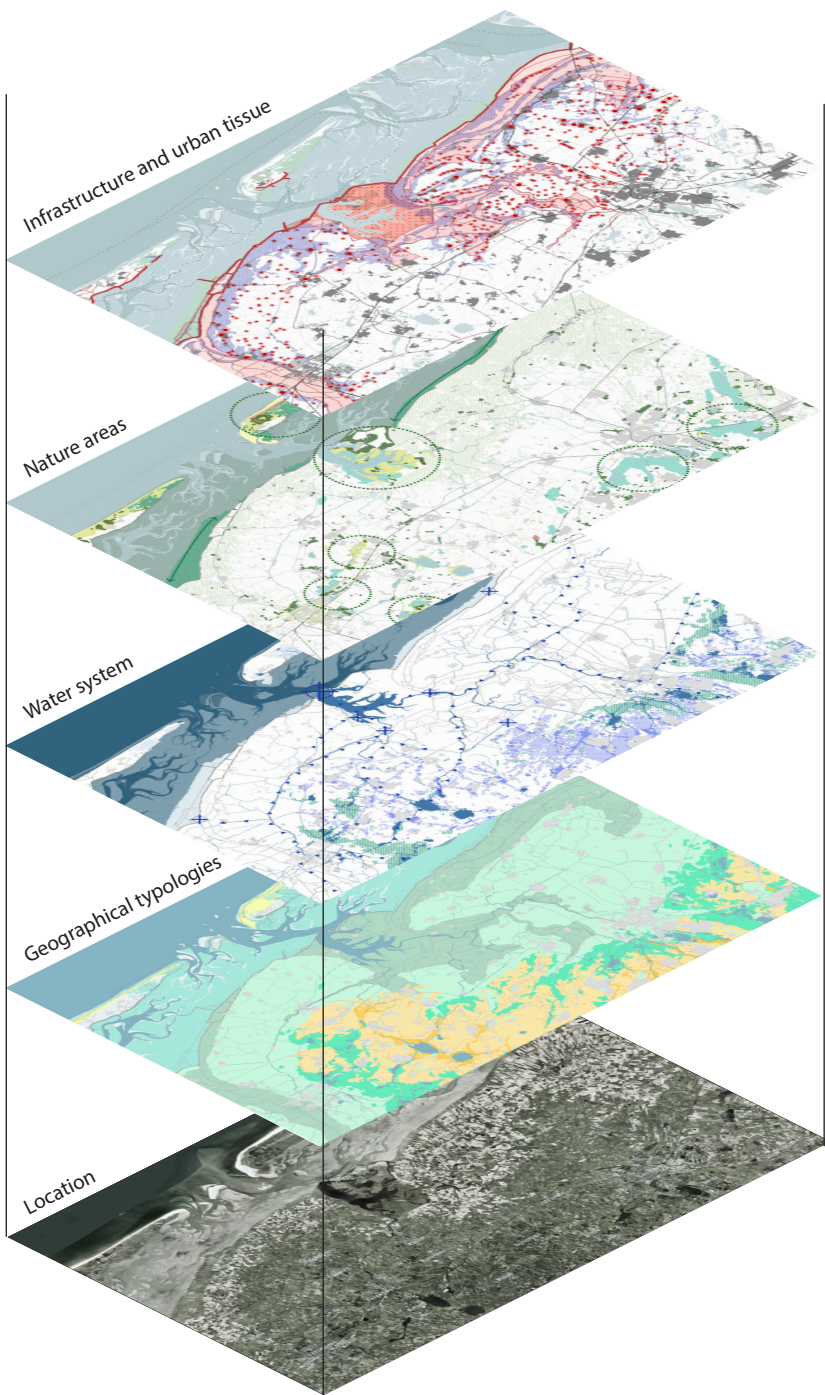


FIG. 22 Analysis of the different layers within the landscape, which were taken into account for the regional design

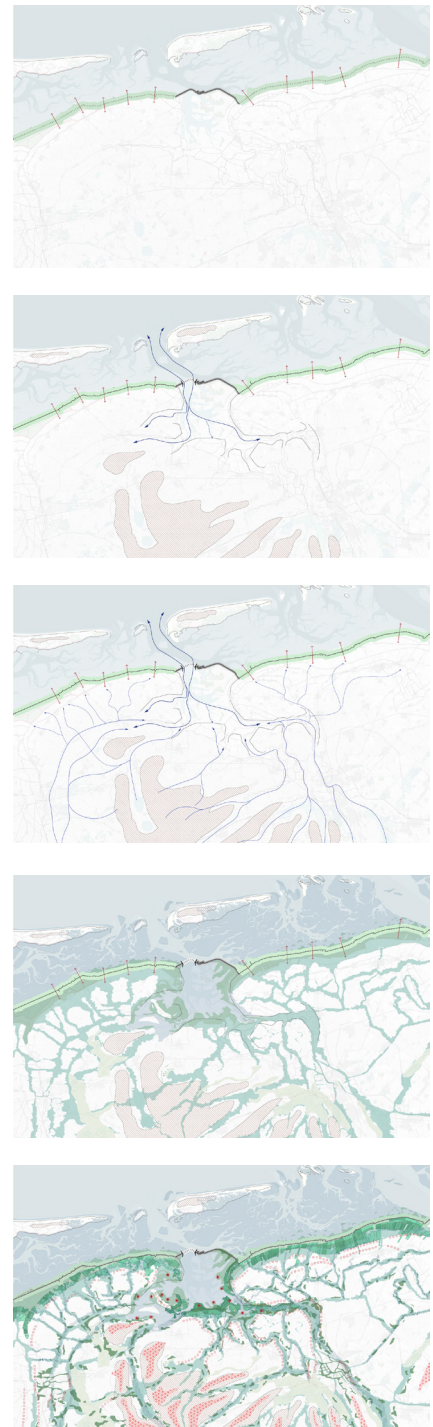


FIG. 23 Development of the new interface framework, which opens up the coastline, while strengthening fresh water structures. Within the framework, dynamic processes improve the saline-fresh water gradient. Adapted land uses improve the overall balance within the new system

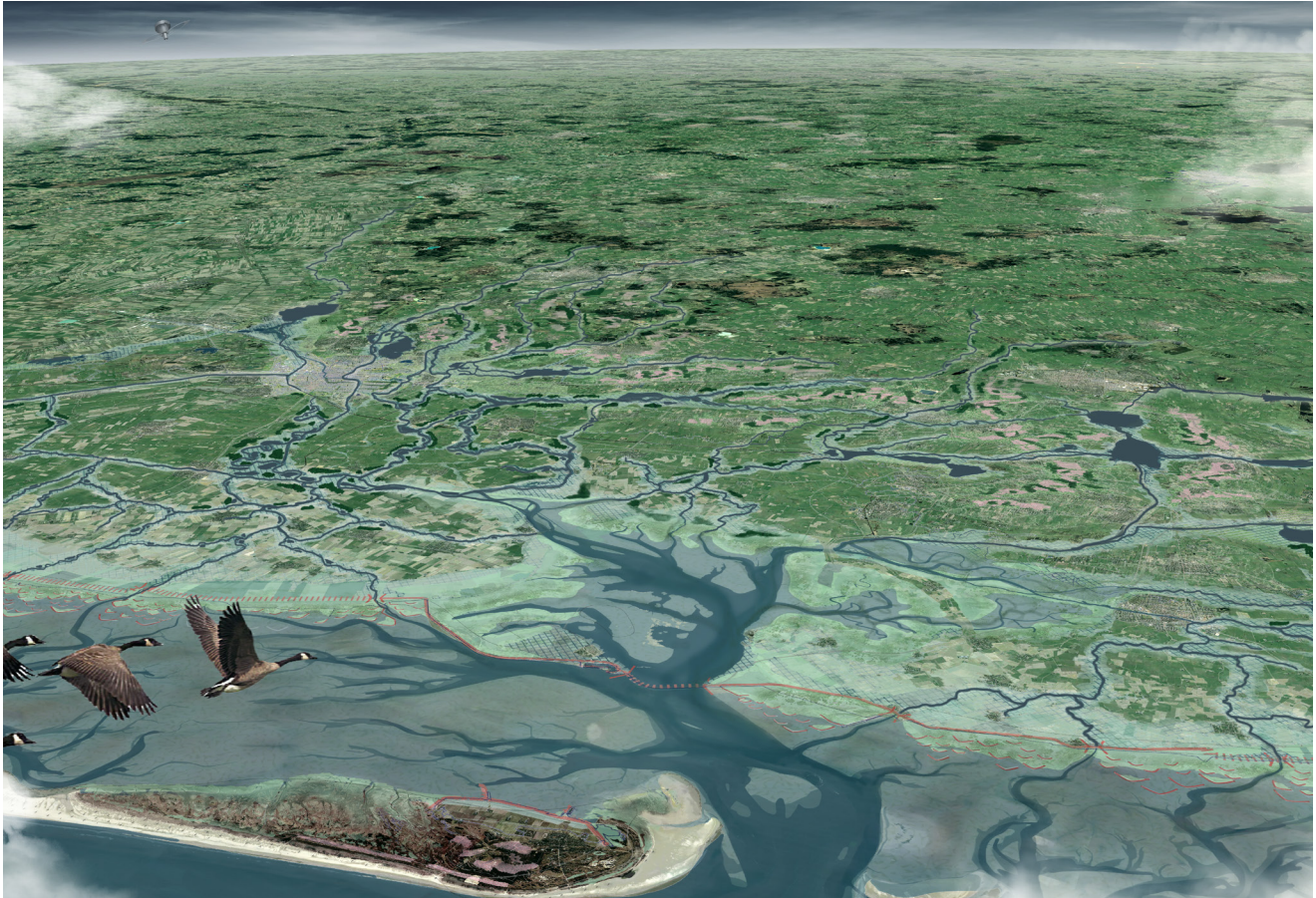


FIG. 24 Over time, the reconnected interface develops as a single holistic system, more in balance with the natural conditions of the landscape, more resilient to disturbances and able to grow with future changes

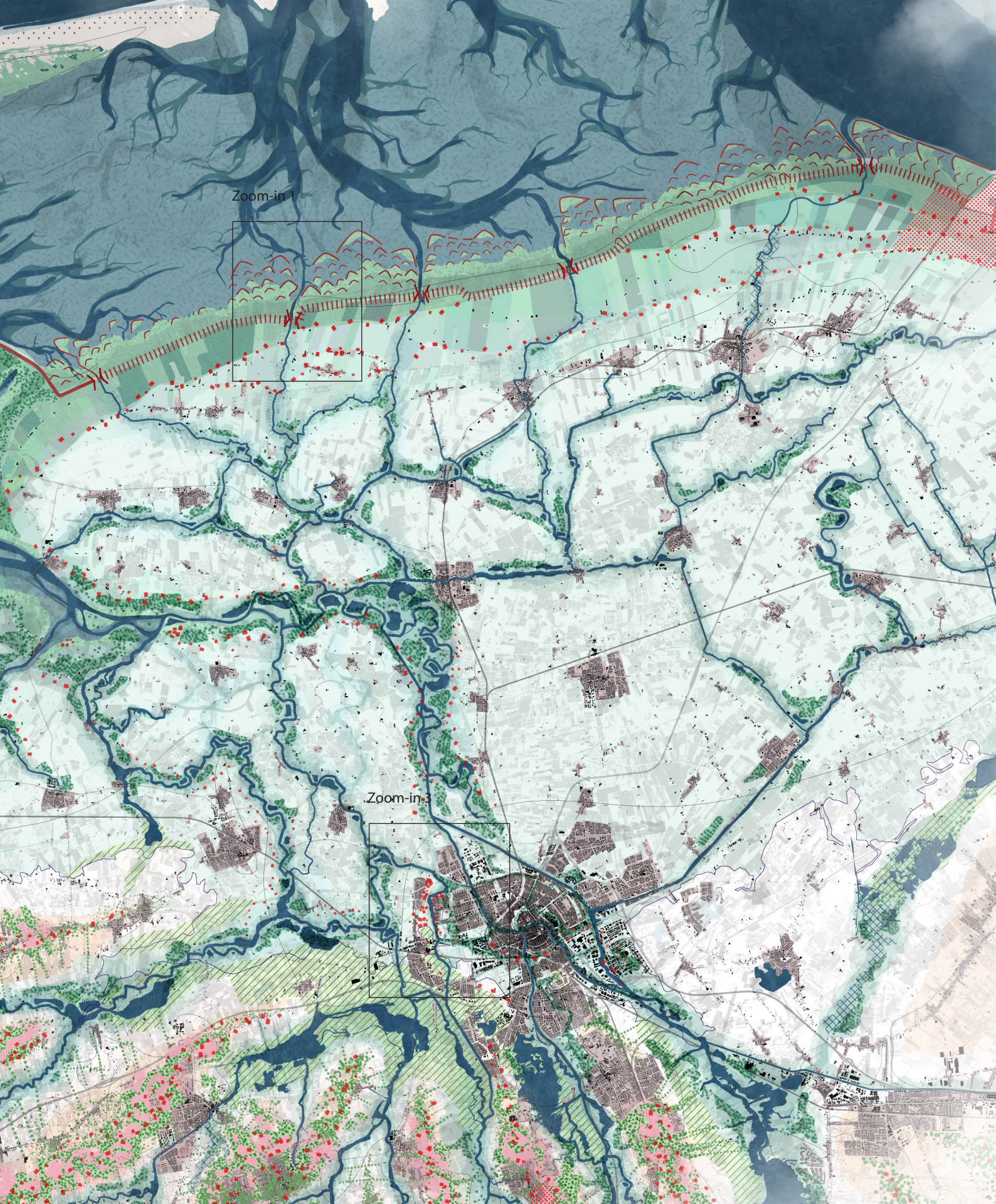
### **Testing design principles on a regional scale**

The study area chosen to test the operational principles through regional design is located along the northern coastline of the Netherlands. The Groningen and Friesland region is ideal for interface development due to its historic maritime landscape. Although it has been closed off to the influence of the sea, it offers the greatest potential for interface development. New human-determined systems require a critical spatial approach to reintroduce dynamic and natural processes into the landscape in a controlled manner. A landscape-based framework has been established, which combines existing structures such as historic dikes and main water networks. The sea is allowed back into the landscape through a sediment-friendly barrier on one side, while dynamic nature areas on the elevated moraine sand ridges increase the fresh water recharge capacity on the other side. The water network, which comprises brook valleys, rivers, and historic creeks, is granted more space to allow for fluvial dynamism. This network will serve as a multifunctional interface corridor to direct hydrological processes. The result is a stronger saline-fresh water gradient within and along the new interface framework, where new forms of land use, such as agroforestry, productions of bio-based building materials and the allocation of settlement on elevated areas, follow the gradient of the new wetter conditions, reinvigorating connectivity between land and sea.

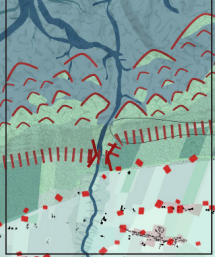


Zoom-in 2

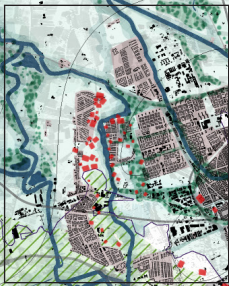




Zoom-in 1



Zoom-in 2



## The f(L)ood zone



FIG. 25 The f(L)ood zone focuses on new types of production landscapes within the new interface, aquaculture, salt tolerant crops and bio-based material production alternate

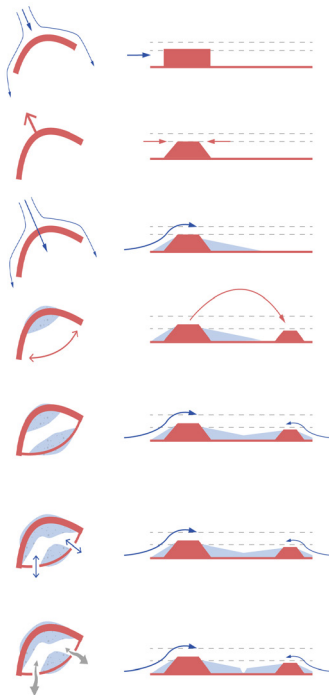


FIG. 26 Above - Design principles for the bio-based breakwaters

FIG. 27 Right - Oyster reefs settle on the bio-based breakwaters, providing ecosystem support and new opportunities for farmers

The first zoom-in is along the direct barrier between sea and land, where a broad coastal buffer zone reintroduces dynamism into the landscape. The current flood barrier is expanded through sediment accretion seaward by introducing bio-based breakwaters and an extensive double dike landward. The combination of continuous sediment deposition, increased local sediment holding capacity, and natural succession of salt marshes enables the coastal buffer zone to keep up with sea level rise, thereby improving coastal flood resilience. Reintroducing tidal dynamism into the landscape, while also improving freshwater structures, creates a stronger saline-fresh gradient. To ensure future access to fresh water in agricultural areas, it may be necessary to abandon those currently threatened by saline seepage and adjust their land use. This can be supported by reactivating historic dikes and creating new ring dikes, which allow for greater dynamism while still protecting other areas. The terrain, which is partly saline, partly brackish, and partly fresh, offers new opportunities for food and material production that align with the biogeochemical gradient of the interface. Towards the sea-side, aquaculture, vast natural areas, and innovative saline crops follow the natural conditions of the overall interface and alternate over time in response to future needs. The stimulation of tidal activity, sediment accretion, and nutrient supply encourages the development of tidal flats, gullies, mudflats, and salt marshes. These habitats provide valuable land areas for shorebirds and potential grazing or adapted croplands. Historic water structures are returning to the landscape, allowing for more space for fluvial dynamics. The new floodplains that are created offer opportunities for the production of bio-based building materials, the material produced can be used for the local construction of housing.





FIG. 28 Above - The new interface corridors diversify the monocultural landscape

FIG. 29 Right - The historic creeks, which have been reduced and straightened for agricultural purposes, regain space through the development of riparian ridges. In between, fluvial dynamics is stimulated through renaturalization of creek beds and wetter conditions. A new program, consisting of strategic settlement and adapted crops (such as flax and hemp) is adjusted to local elevations and hydrological conditions

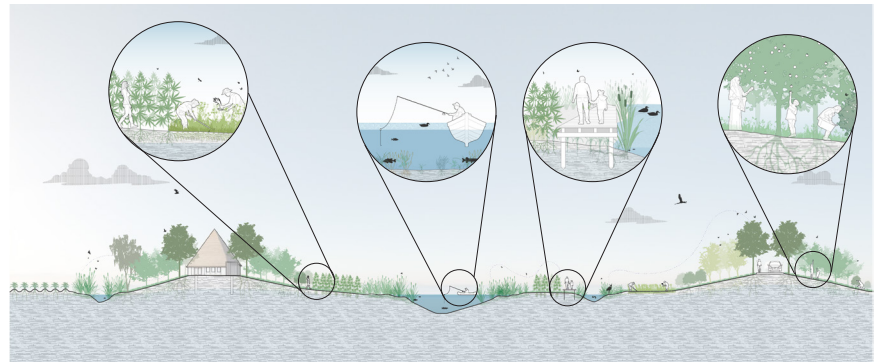


FIG. 30 Transformation of monocultural crops, which are highly dependent on fresh water, to adapted salt tolerant crops and cattle farming

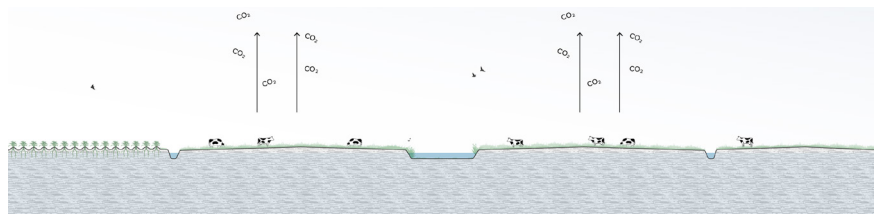
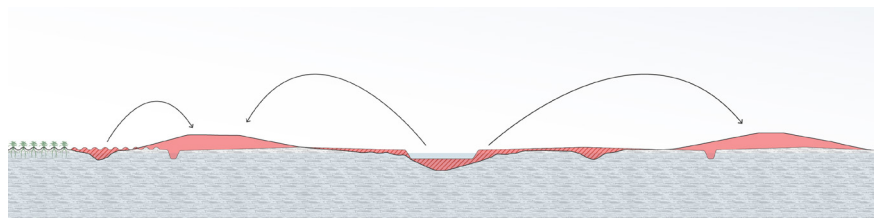




FIG. 31 Multifunctional infrastructure dikes acts as a way to protect towns, while bringing people closer to the sea



FIG. 32 Dokkum, an historic maritime town, will be reconnected to the Wadden Sea, reviving local businesses

### **Living Lauwersmeer**

The second zoom-in is situated at Lauwersmeer, formerly known as Lauwerszee. This historic inland sea was closed in 1969 and has since been turned into a freshwater lake through drainage. Unfortunately, the closure of Lauwersmeer has resulted in the loss of dynamic estuarine processes in the landscape, cultural heritage, and significant natural areas of the Dutch Wadden Sea. Historic and ongoing excavations, as well as artificial drainage of the polders, have resulted in the progressive subsidence of the inland polders. This has led to an increase in saline seepage and overall flood risk. Living Lauwersmeer has proposed reopening the lake and turning it into an estuary, which would act as the main doorway for the development of the interface framework. The implementation of a semi-open surge barrier reopens Lauwersmeer and allows for the restoration of dynamic sedimentary processes in the landscape. This restores the saline-brackish-fresh water gradient of the interface, while a network of dikes ensures the safety of valuable areas. In the new tidal landscape, modern terp villages are situated on elevated positions using dynamic sedimentary processes to level up flood-sensitive areas. This reconnects the local people of Friesland and Groningen to their heritage, as living with water will once again become part of their daily lives.

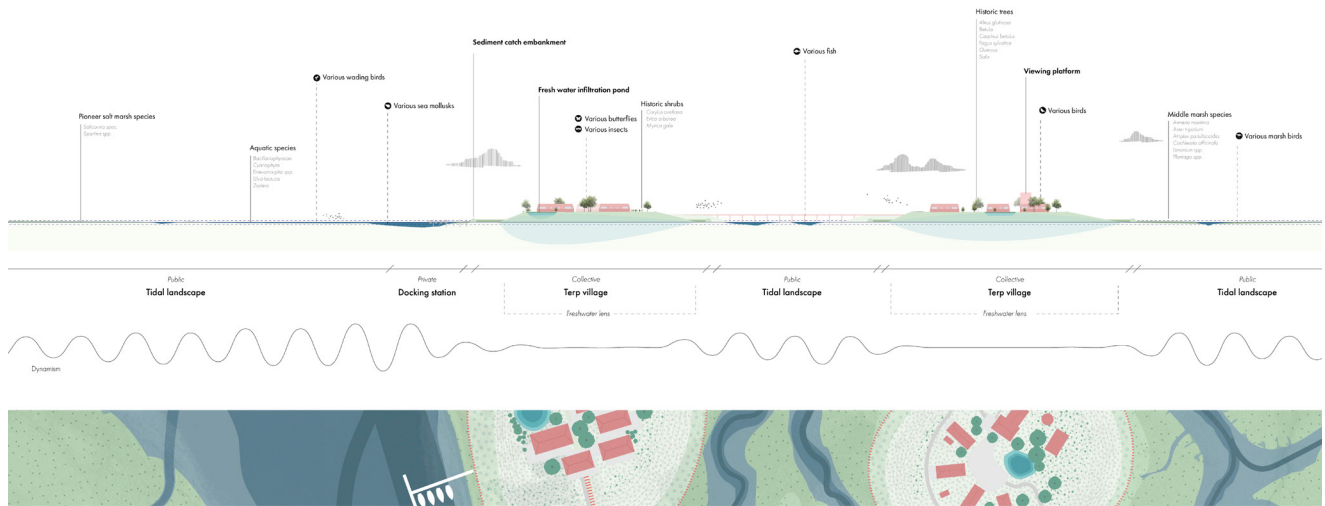


FIG. 33 Because of the open character of the tidal landscape, the new terp villages provide an extensive view of the area

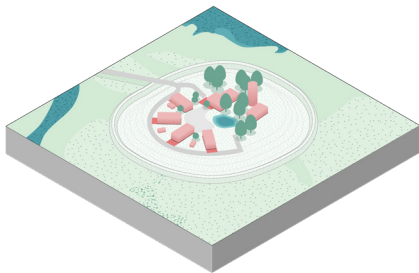


FIG. 34 Above - Modern terp villages on the edges of the estuarine marshes

FIG. 35 Right - The tidal landscape introduced in the area can be experienced from the existing viewing platform, where one comes face-to-face with a dynamic spectacle between sea and land



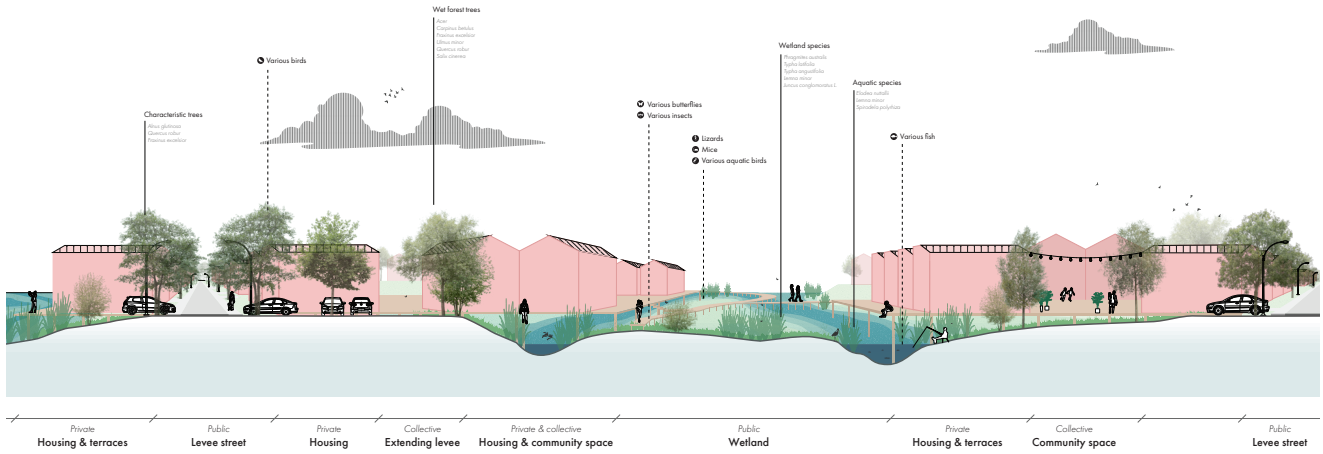


FIG. 36 Local elevation differences enable different species of plant to settle. For example, within the lower-lying wetland aquatic, while on the drier elevated levee streets trees can settle.

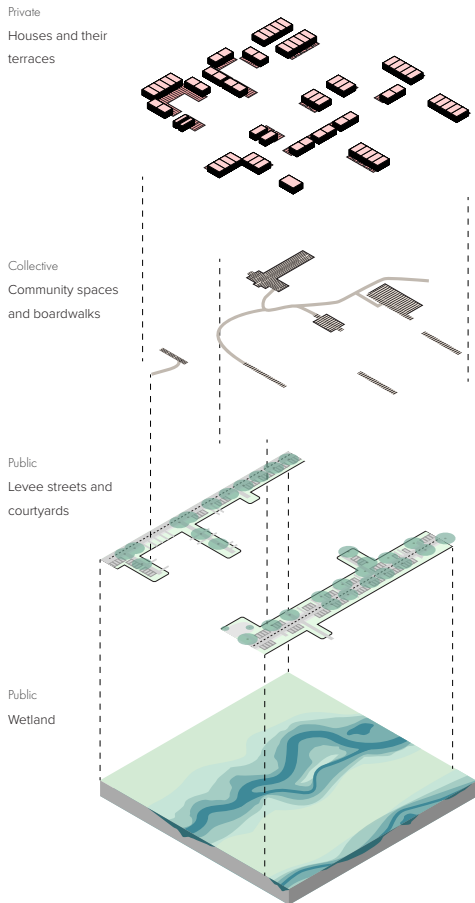


FIG. 37 Different layers in the design feature different degrees of ownership, varying from private, collective and public

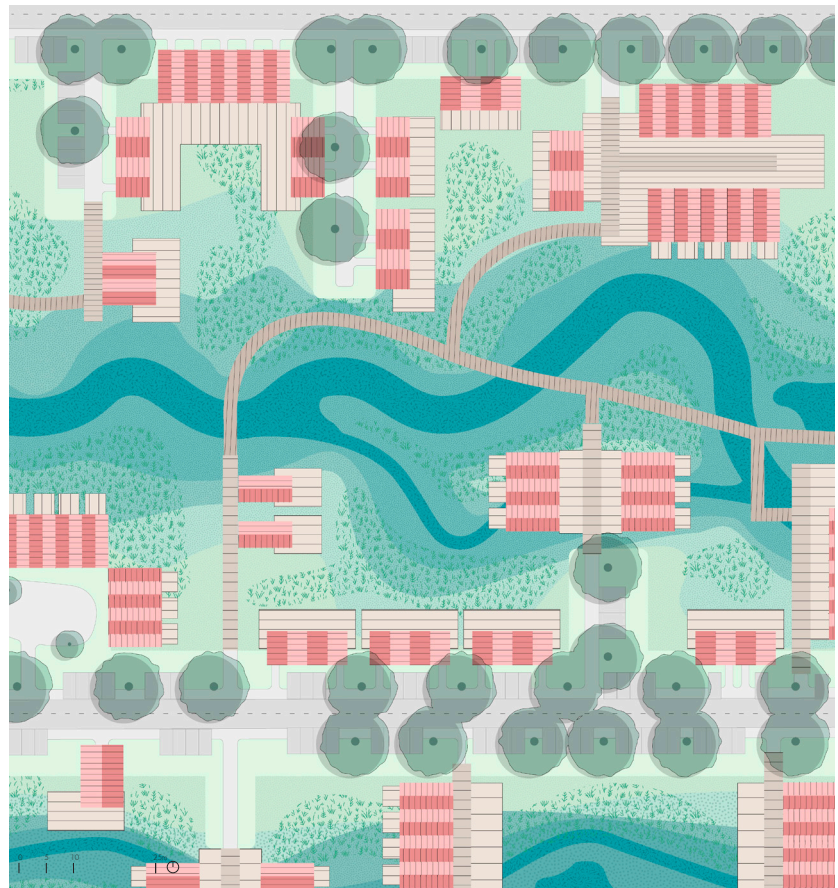
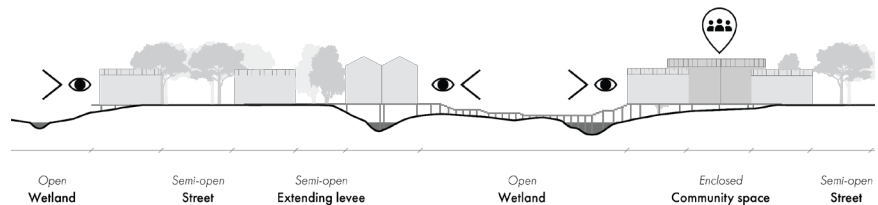


FIG. 38 Infrastructure, parking and housing is concentrated around levee streets, leaving more space for water to move through the area. Adapted stilt housing allows integration between living and nature.



FIG. 39 The newly established wetland act as a public garden for local residents and the people of Groningen

FIG. 40 Right - Height differences and vegetation variation create different experiences in the neighbourhood



### **The urban flood fringe**



FIG. 41 Residents can view the wetland and its flora and fauna from the convenience of their homes

The third design zoom-in is located along the city edge of Groningen. The condition of urban growth and the possibility of more extreme weather events in the future provide an opportunity to create new adapted living forms that combine and integrate housing and water storage. In the case of Groningen, this means enabling more space for water to flow through the lowest points in the area freely and adapting to new wet conditions through the development of an urban wetland. At the interface scale, the site serves as a transitional area between the higher sandy soils and the lower peat and clay soils. The cultural grassland, which is already wet and currently requires pumping, is transformed into a wetland with a range of gradients due to local variations in height.

At the neighbourhood scale, an interconnected wetland is created, providing space for new forms of adapted housing and gradient-rich local habitats to intertwine. This blurs the barrier between urban living and nature. To enable living in these wetter conditions, stilt neighbourhoods and levee streets are introduced as concentrated infrastructural arms within the landscape. The housing construction deviates from tradition as the buildings are not compact. Instead of private gardens, the wetland serves as a communal garden for both residents and visitors.



FIG. 42 The Pyramids of Giza, with a shaduf in the foreground, ca. 1934–1939 (photo: Imago History Collection / Alamy Stock Photo)

# a River Reborn

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## Restoring the natural river system in the Nile River Basin

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### **Introduction**

The Nile River Basin is the catchment area of the Nile River. It covers almost 10% of Africa. The Nile is the longest river in the world, known as the “father” of African rivers. The river empties in the Mediterranean Sea after rising south of the equator and flowing into northern Africa. The River is formed by three main streams, the Blue Nile, The Atbara which originates in the Ethiopian highlands, and the White Nile, which headstreams flows into lake Victoria and Albert. The basin includes parts of Tanzania, Burundi, Rwanda, the Democratic Republic of the Congo, Kenya, Uganda, South Sudan, Ethiopia, Sudan and Egypt (Hopwood, et.al. , 2023). The River Nile has been a lifeline for northeastern Africa for thousands of years, supporting the growth of civilization, agriculture, and trade. The history of the Nile can be traced back to ancient times. The fertile banks of the Nile has supported the civilization of the ancient Egyptians. Since Egypt received almost no rain, the ancient Egyptians worshiped the river and considered the water from the Nile as the source of life. The Greek historian Herodotus has written, “Egypt is the gift of the Nile”. The ancient Egyptians developed ways to make perfect use of the gift of water, a complex system of irrigation to irrigate their fields to produce large amounts of crops to support the growing population. The Nile also played a crucial role in trading routes in the region, goods were transported to the Mediterranean Sea and then traded throughout the ancient world (Tvedt, 2021). During these ancient times, the relationship between people and the Nile was symbiotic. A harmonious balance between men and nature. In the 19th century, Europeans came to explore the Nile River. The Nile became political, and Europeans sought power to control the river’s waters and the land surrounding the river. Nowadays, the Nile still plays a vital role in civilization in northeast Africa. Water is a vital resource for agriculture, industry and domestic use. However, the Nile is facing multiple threats, including pollution, climate change and overuse (Tvedt, T., Oestigaard, T., 2015).

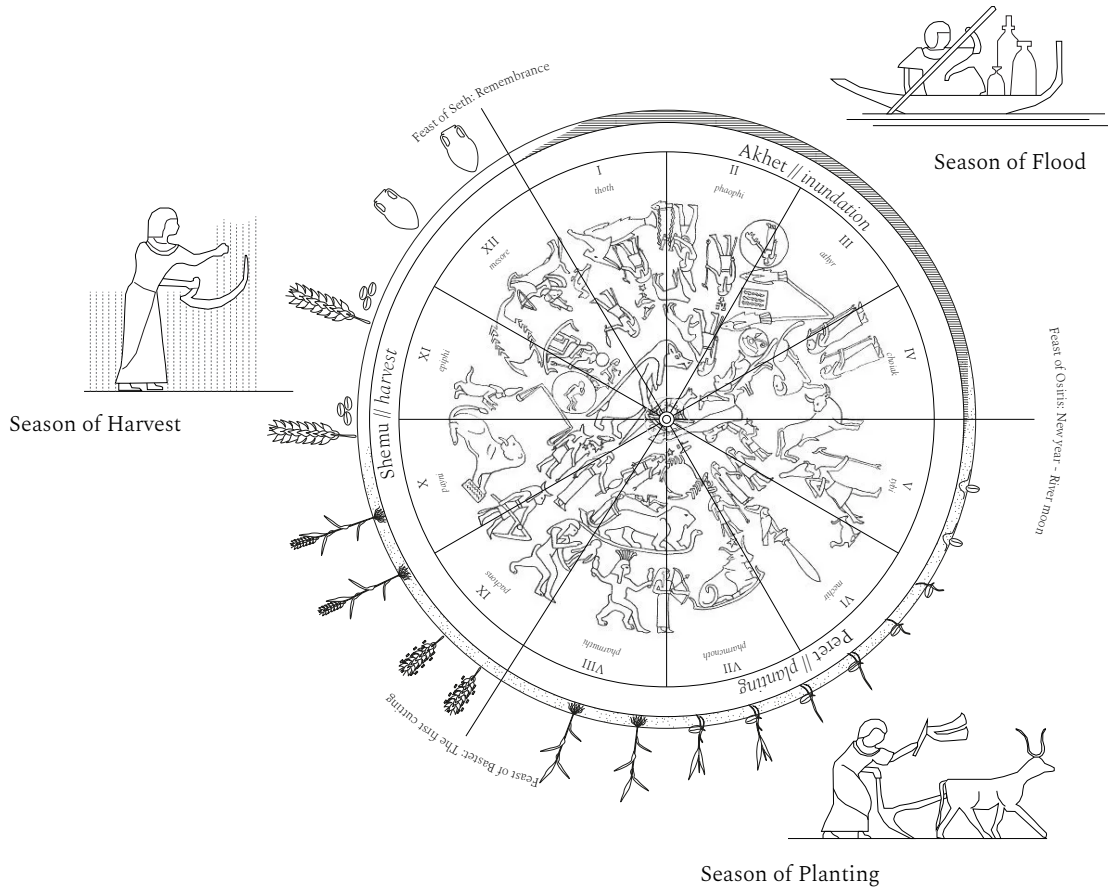


FIG. 43 The three seasons of Ancient Egypt

### The symbiotic relationship

During ancient times, the relationship between humans and the Nile can be described as symbiotic. There was a codependence between humans and nature. The Nile River would flood annually, leaving a rich natural silt deposit, creating fertile ground along the banks of the river, and creating conditions to grow food and build civilizations. Their farming practices were in harmony with the cycles of the earth. A great example of this is the seasonal calendar of the ancient Egyptians. Their calendar consists of three seasons based on the cycle of the Nile River. The civilisation relied heavily on the annual flooding of the Nile, which defined the agricultural cycle. The three main seasons are Akhet (flooding), Peret (growing) and Shemu (harvest) (Abdou, 2022).

During Akhet, the season of inundation, the Nile would flood the land. Depending on rainfall in the Ethiopian highlands, the river would overflow its banks and deposit nutrient-rich silt on the floodplains. During the Peret season, the floodwaters would recede, leaving behind a layer of moist and fertile soil, perfect for planting seeds. The harvest season, Shemu, was the time when the crops were ripe and ready to be harvested and stored for consumption throughout the year.

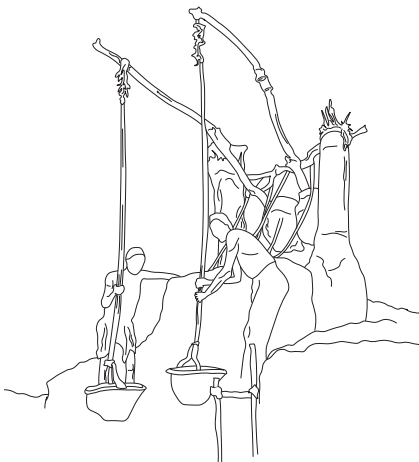


FIG. 44 The Shaduf, an ancient water lifting device that has been used since the Pharaohs.

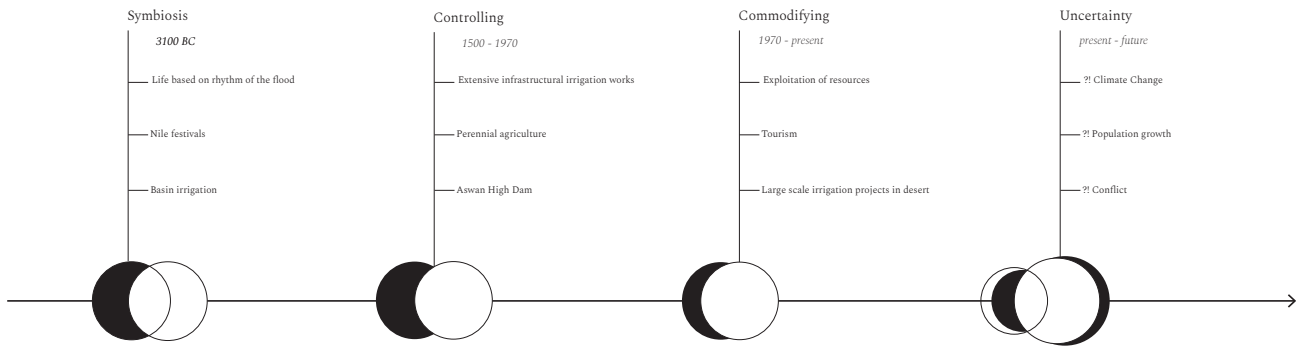


FIG. 45 Schematic timeline representing the change in relationship between humans and nature in the Nile River Basin

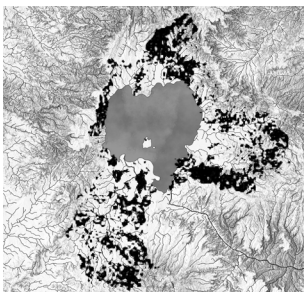


FIG. 46 Cropland 1989

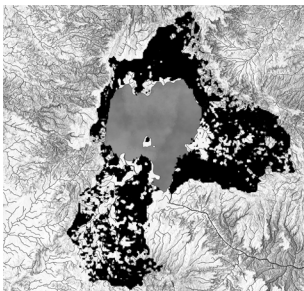


FIG. 47 Cropland 2005

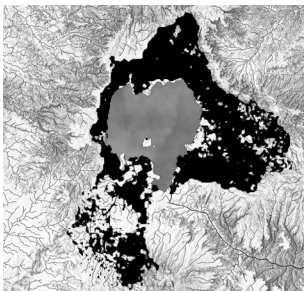
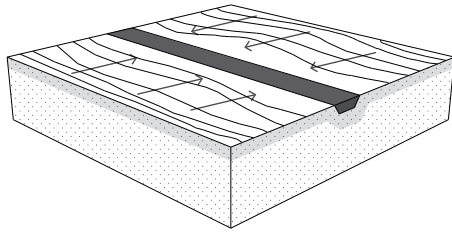


FIG. 48 Cropland 2019

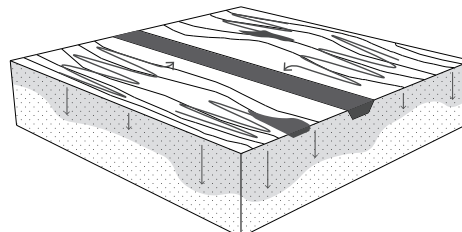
### Change over time

For five thousand years, nature has dominated the river's constitution and functions, but from the mid-nineteenth century to today, different countries and regimes have increasingly influenced the Nile river system (Tvedt, 2021). Ambitious water management of big irrigation projects and the building of large dams has resulted in an imbalance in the relationship between the river, delta, sea, and people. The landscape of the Nile River Basin has changed from dynamic and natural, to a highly controlled and obstructed river. Before the Nile was completely tamed in Egypt, the river had resisted erosion and subsidence in the delta from the sea for thousands of years. It carried nearly 200 million tonnes of soil and sediment annually. Sea currents and waves always tend to erode the coastline, before, the Nile water filled with sediment battled this coastal erosion. The Aswan Dam changed that natural battle between silt and sea overnight (Tvedt, 2021). Upstream, countries are growing rapidly. The demand for food and space has resulted in deforestation around the sources of the Nile. As a consequence, deforestation has led the soil to erode. Dams are obstructing the flow of eroded soil and have been building up in the lakes. These places have become more prone to flooding. A big part of the current landscape of the Nile River Basin consists of hard structures. The coast is currently defended by concrete, irrigation canals are hard concrete channels without vegetation and the large dams are massive structures obscuring the natural water flow. The landscape can currently be described as, non-resilient. It is a sturdy landscape, unable to move with change over time. Current measures are fixed and unable to move with future uncertainty. The Nile River Basin has shifted from a nature-dominated river landscape into a human-dominated river landscape. The people living in the Nile River Basin may become victims of this disbalance.

### Slow the Flow

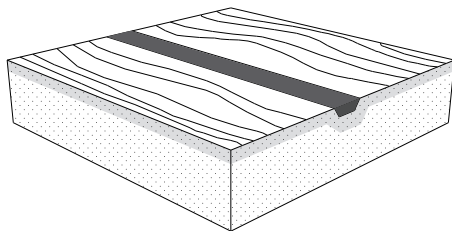


before

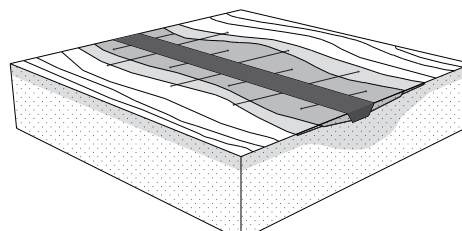


after

### Allow the Flow

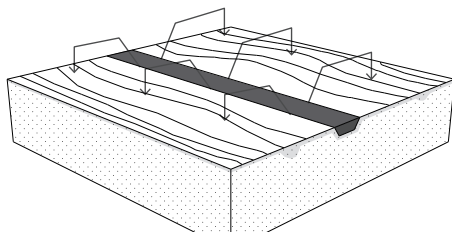


before

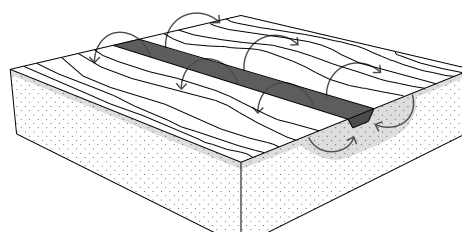


after

### Balance the Flow



before



after

FIG. 49 The three main principles to restore the flow of the natural river system of the Nile.

### **To restore the flow**

To work towards a resilient Nile River Basin, three main principles are explored. To restore the flow of the Nile River, three main principles are explored. Slow the flow, Allow the flow and, Balance the flow. The first principle, slow the flow involves implementing measures to slow the flow of water during the wet season, the strategy involves the careful capture and retention of water, allowing it to be stored for future use. The second principle, 'allow the flow', is a key element in the restoration of river systems. This principle emphasises the importance of allowing natural fluctuations in water levels. The third principle, 'balance the flow', plays a key role in restoring the health of river systems. This principle focuses on achieving a balance in the flow of water, with a strong emphasis on creating circular water cycles. It goes beyond the concept of simply 'taking' from the river and emphasises the importance of giving back to the natural system.

### Upstream, midstream, downstream.

Generally speaking, the river system can be divided into upstream, midstream, and downstream. Based on this, the three design locations are chosen. The upstream section of a river system refers to the part of the river that is closer to its source, where the river originates. The midstream section of a river system represents the transitional zone as the river progresses from its source toward its mouth. The downstream section of a river system is the part that is closer to the river's mouth, where it meets a larger body of water like an ocean, sea, or lake.

FIG. 50 The upstream, midstream and downstream section of a river system, divided into a dry and wet season.

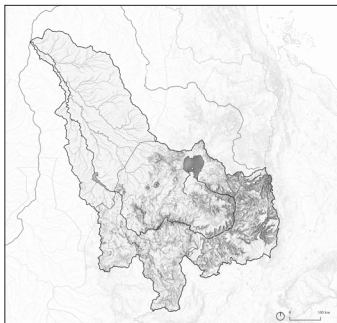
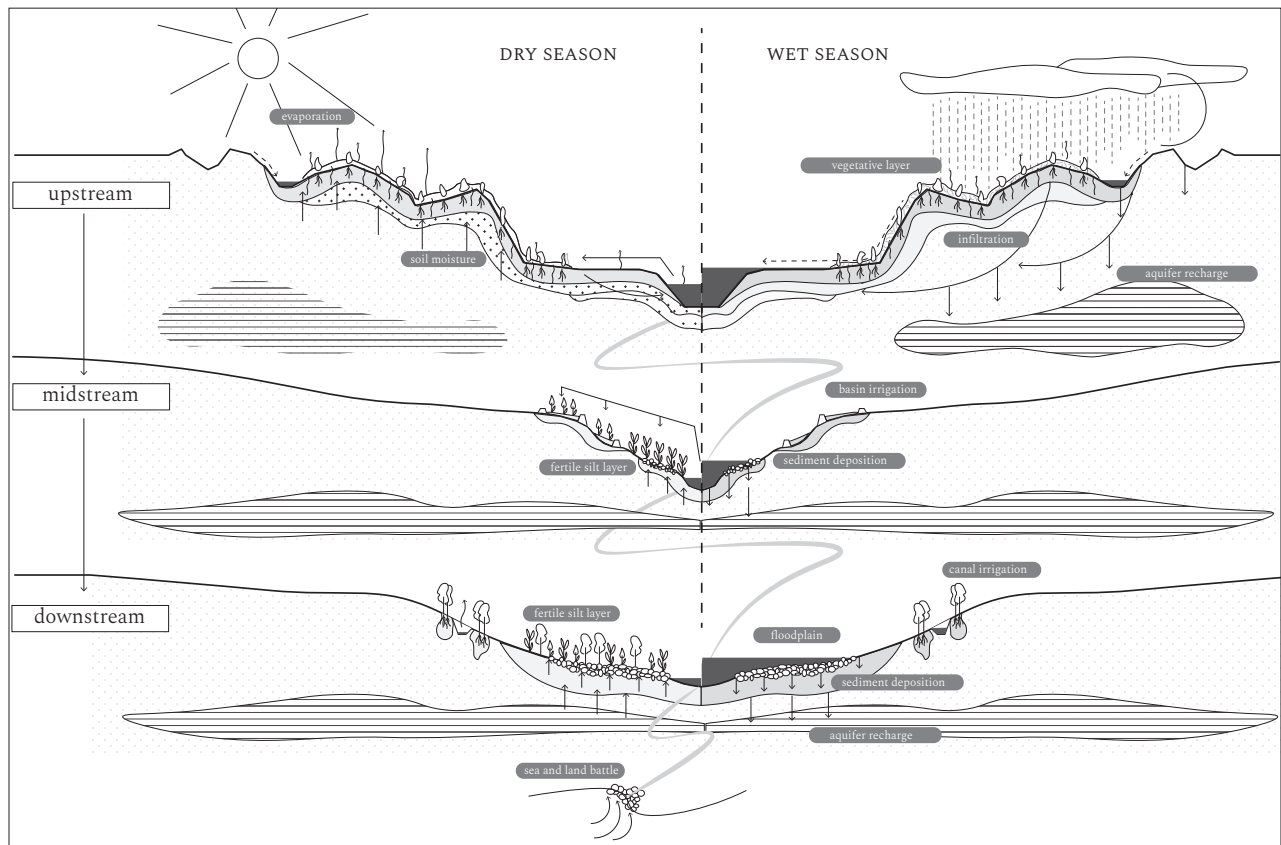


FIG. 51 Upstream region

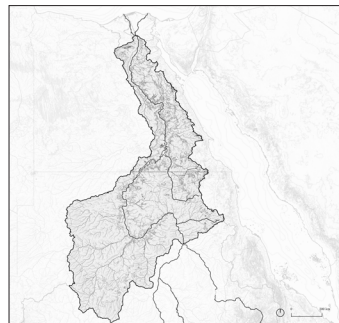


FIG. 52 Midstream region

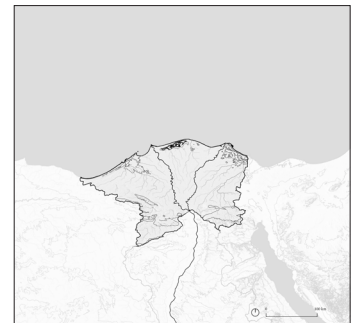
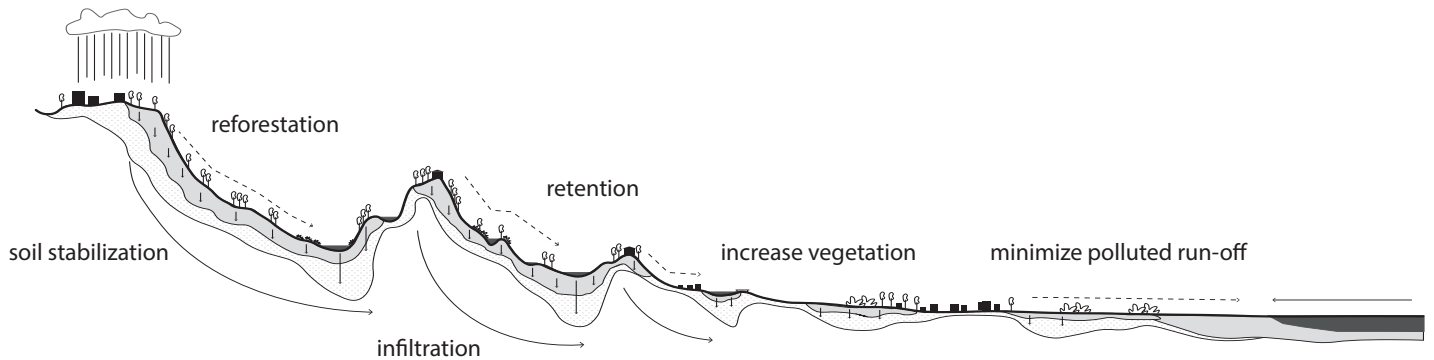
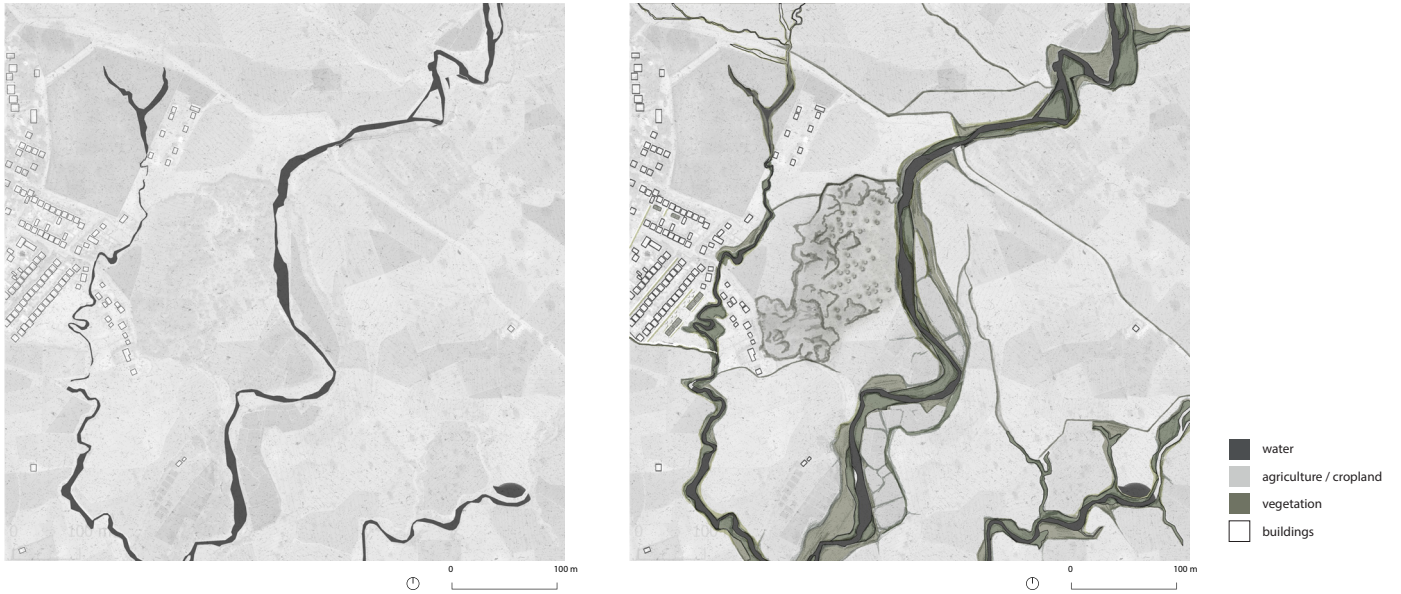


FIG. 53 Downstream region



### **Sponge Lake Land of Tana**

FIG. 54 (Top left) region near lake Tana, current situation.

FIG. 56 (Top right) regional design of implementing the slow, allow and, balance the flow.

FIG. 55 (Down) section of the desired situation

The design is located upstream in the basin near one of the river's main sources, Lake Tana in Ethiopia. This site faces some local challenges such as soil erosion, land degradation, droughts and floods. While this has a major impact on the local scale of the region, it also affects the river system and thus the basin as a whole. The site is located on the northeastern side of Lake Tana, at the edge of a village (Enferaz), with high steep mountains in the north. In the design, a series of design principles are implemented and blended into a community space in between the edge of the village and a seasonal stream. The community space includes a series of home gardens, providing food and products for the local inhabitants. The home gardens can play an important role in improving the nutrient intake of the inhabitants of Enferaz. To provide the home gardens with water and to prevent flooding during monsoon rains additional waterways are dug out following the fanya juu strategy, to conserve soil and water. The waterways are lined with papyrus reed, which helps to build soil solidity and conserve and purify the water. The papyrus reed can be harvested and can be used to make the local fisherman boat called

Tanqua. A community building is introduced in the middle of the site, to serve as a place where food and products can be stored and processed. A negotiant space is introduced along the seasonal waterway, which serves as a floodplain during the peak rain season, merging into a wetland area, providing a home and shelter to wildlife while fertilizing the soil during the low rain season, leaving the soil moist the land can be used for agricultural purposes during the dry season. By increasing the sponge capacity of the Lake Tana region and managing the retention, detention and discharge of water, the flow can become more gradual rather than a high peak and long low. If the water from Lake Tana can be released more gradually into the Blue Nile, this would mean a reduction in the risk of flooding and drought further down the river system. A more gradual flow could encourage an acceptance of river dynamics and fluctuations, as they are more gradual and therefore less impactful changes.

FIG. 57 (Down) section showing the implementation of local practices to improve water and soil health while also improving the local community



FIG. 58 Enset plant



FIG. 59 Vertiver grasses

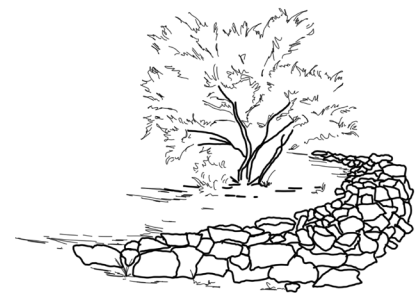
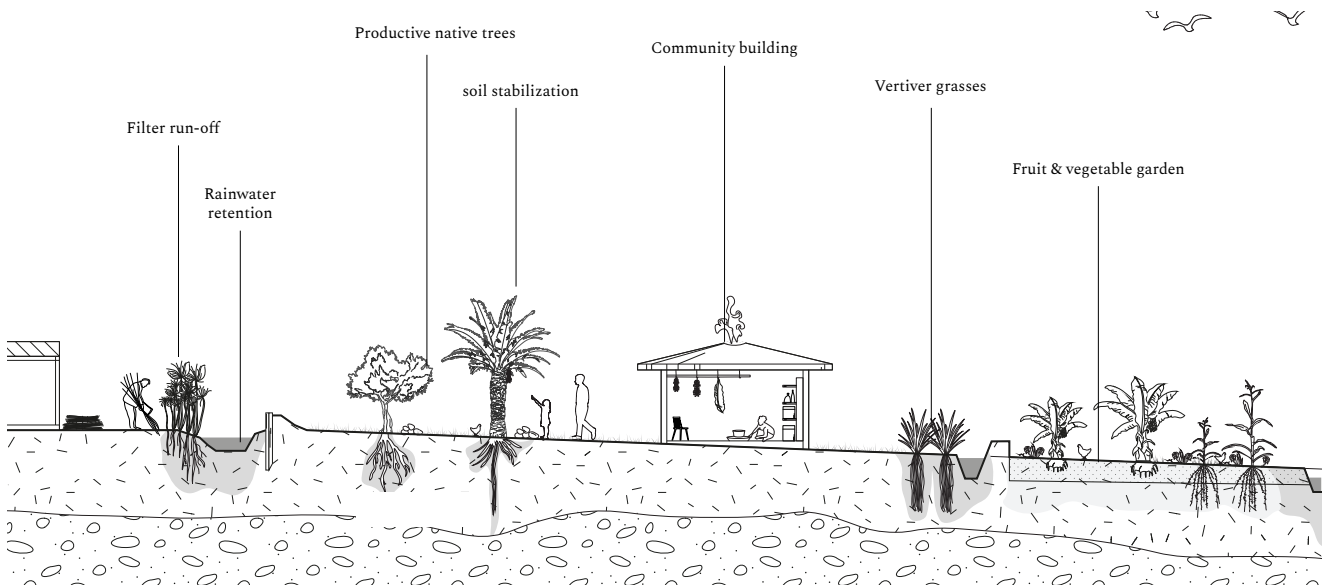


FIG. 60 Eyebrow terraces



## Watergardens of Aswan

The midstream design is located in the urban context of Aswan, Egypt, along the banks of the river. The city suffers from an extremely arid climate and receives almost no rainfall. The extreme climate creates harsh conditions for the city's inhabitants. The Nile is the source of life, providing water for agriculture, drinking and transport. The Nile at Aswan can be described as completely tamed, since the construction of the Aswan High Dam in 1970, the water level experiences almost no fluctuations and no seasonal differences. The dam has created a continuous flow of water, providing year-round irrigation and generating enormous amounts of hydroelectric power. On the downside, the dam has reduced the resilience of Aswan and the basin as a whole by preventing the natural processes of river dynamics. The local design consists of a series of water gardens throughout the city of Aswan. The gardens have multiple scales and can be private, semi-private, or public. Waterways are connecting the gardens, forming a blue-green network throughout the city. The designs in the network allow water fluctuations. For example, the riverfront water garden. This water garden is a large public park. The park is designed to welcome water into the urban tissue. Straight lines of water flow into the garden, distributing along the park and further into the city's green-blue network. The park has different height levels, overall the park is lower than the rest of the city, paths are elevated from the ground, and trees and vegetation borders are slightly elevated from the ground. For the rare occurrence of flash floods, the park can completely overflow. For high water, some parts of the park will remain dry because of the elevation differences, and throughout the year, the park is a green oasis in the arid city. The mid-stream design focuses on restoring the natural dynamics of the Nile. Increasing the ability to adapt to different seasons and water level fluctuations.

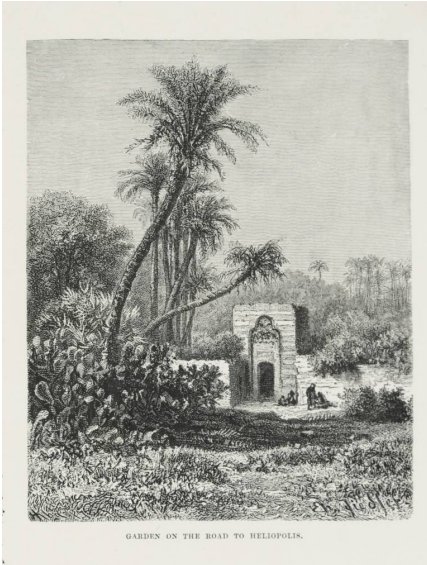


FIG. 62 Garden on the Road to Heliopolis, Fiedler, Bernhard, via Wikimedia Commons

FIG. 61 (Down left) current situation of Aswan region

FIG. 63 (Down right) desired situation of Aswan region

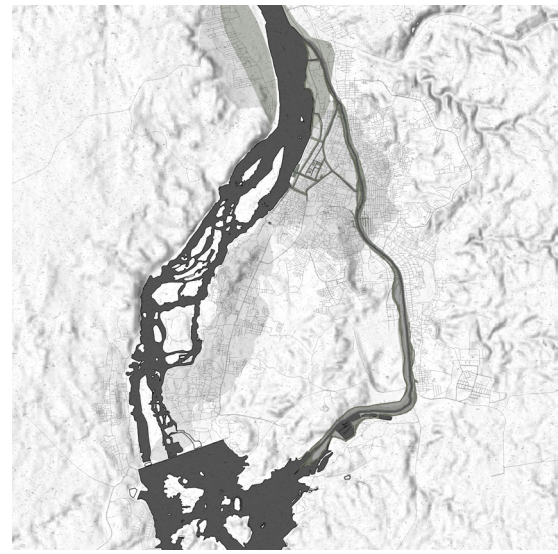
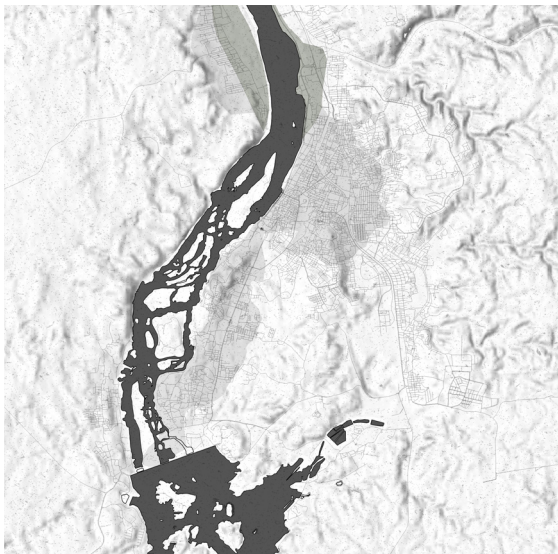




FIG. 65 (Right) Map showing local design of green-blue network of watergardens in the old town of Aswan.

FIG. 64 (Down) visualization of the large public waterpark of Aswan. The design is inspired by the Islamic garden style.

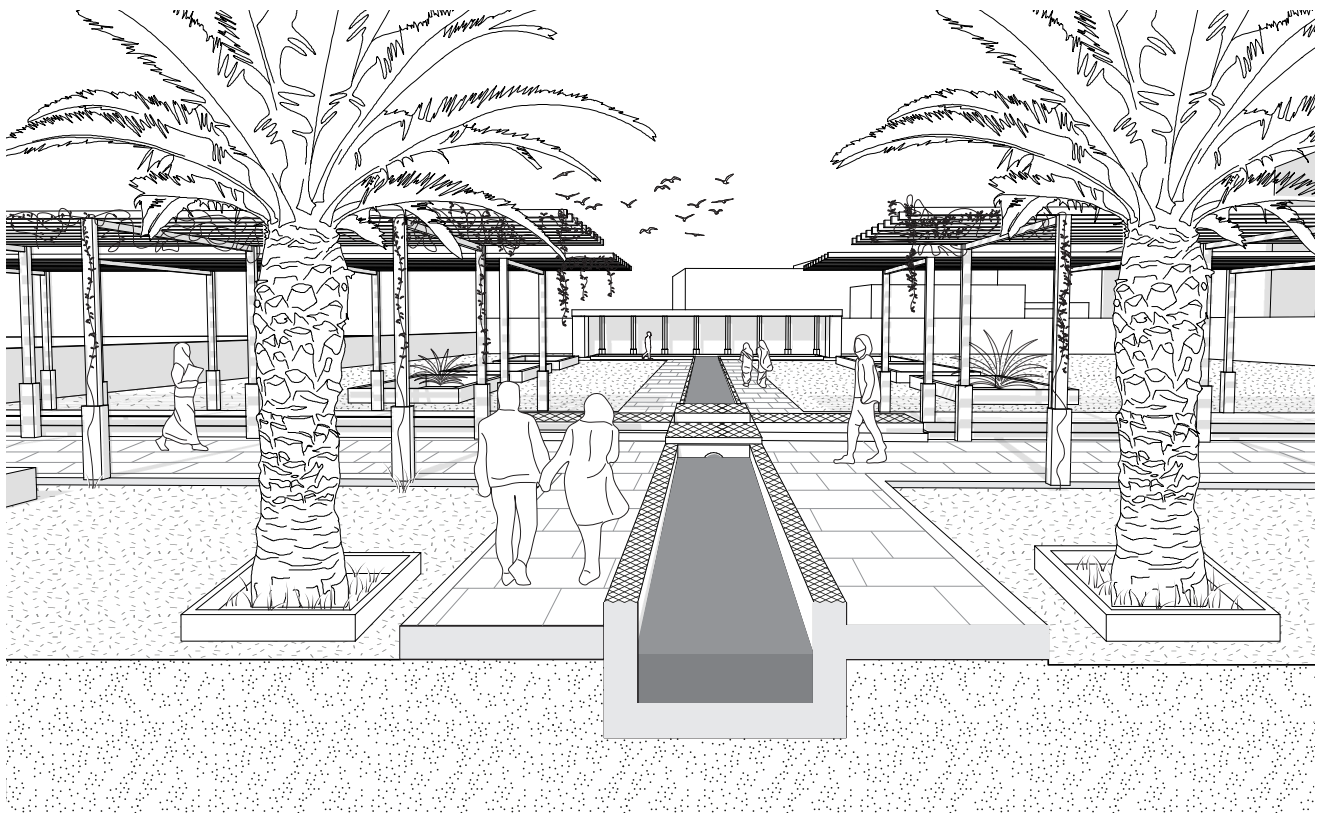




FIG. 66 (Left) current situation of Rosetta region

FIG. 67 (Right) desired situation of Rosetta region

### **Canal Connections of Rosetta**

The downstream design is located in the Nile Delta, at the agricultural land along the Rosetta branch in the Rosetta promontory. The delta has been a vital and historically significant region in Egypt. Before the completion of the Aswan High Dam each year the Nile would flood, leaving the fertile silt and sediment. The delta is known for its fertile soil, which results from the deposition of silt and sediment carried down from the Nile River. The fertile soil makes the delta perfect for productive agriculture and it is therefore a crucial source of food for Egypt. Nowadays, the soil is degrading, the soil is being exploited by agriculture and chemical fertilizers are needed to be able to grow crops. The chemical fertilizers and run-off from cities and industry lead the river and irrigation canals to deteriorate. The local design in the Rosetta promontory is focussing on the irrigation canals. The design introduces a negotiation space, a buffer zone, around the main irrigation canal. This buffer zone is designed to help mitigate certain local problems, like pollution, rebuild respect between humans and the water system, and introduce an equal distribution of water within the irrigation canals. On the other hand, the buffer zone could help allow back some natural river fluctuations and dynamics within the water system. By allowing a certain amount of flood, the soil can rebuild its fertility. The design includes a collective pumping place, where the water can be distributed among farmers equally and can serve as a meeting place for the local inhabitants, where ideas and knowledge can be shared. The buffer space is lined with native trees, like the date palm. It serves as an aesthetic and historical symbol, but also creates shade, thereby minimizing the evaporation rates within the canal.

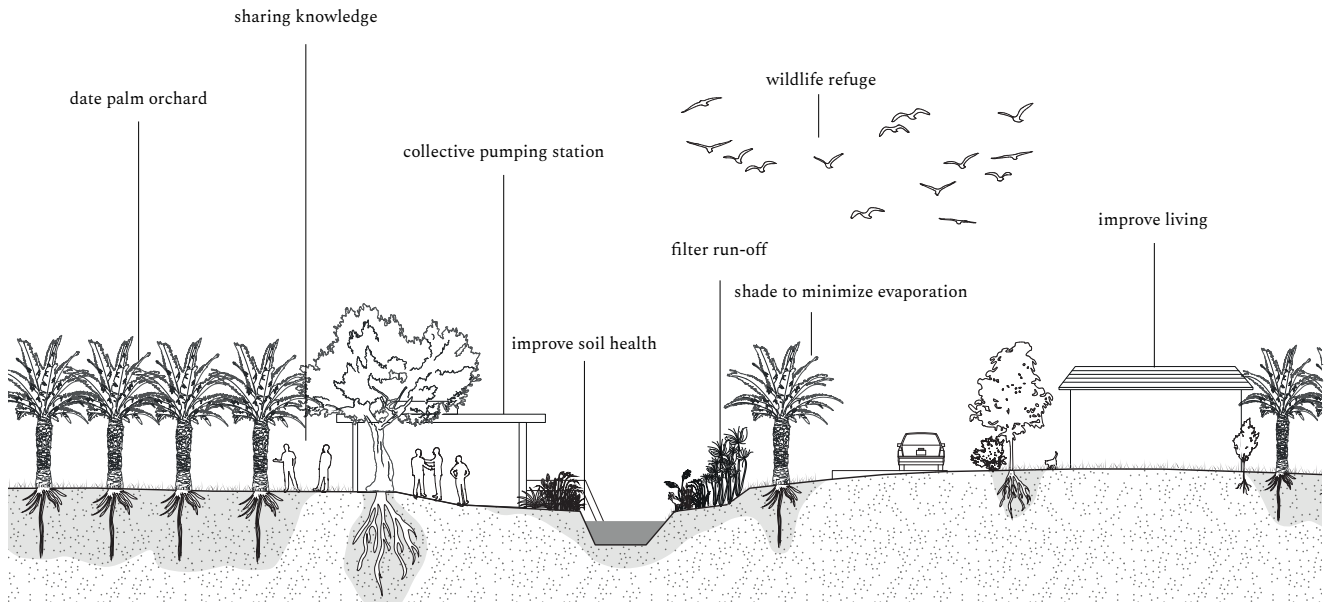


FIG. 68 The collective pumping place is placed along the buffer zone around the irrigation canal. The collective pumping place is inspired by ancient practices of pumping water from the canal collectively to provide equal amounts of water to each farmer.

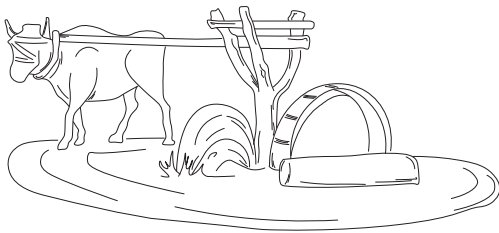


FIG. 69 Saqiya, an ancient water lifting device

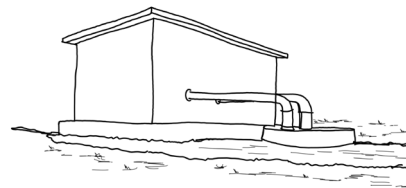


FIG. 70 Collective pumping place

### **Towards a resilient Nile River basin**

Together, these designs not only address local challenges, but are interconnected as part of the wider Nile River system. They promote a harmonious coexistence with the river and the water, emphasising balance and symbiosis over opposites. Through these innovative approaches, the Nile Basin becomes more resilient, allowing natural processes and dynamics to flourish, ultimately contributing to the long-term sustainability and vitality of the basin.



FIG. 71 Tributary of the Paraná River seen from the airplane during study visit to the region

# The River and the Mosaic

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## Regenerative cycles in production landscapes

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### **Introduction**

The Paraná River is the second longest in South America and has always been a corridor for the migration of flora and fauna across the continent. In recent decades, it became one of the most important economic axes of the continent, crossing some of its most populous areas. However, in 2019, a severe drought event in the Upper Paraná River basin (UPRB) exposed the watershed's structural vulnerabilities, with water flows steadily dropping and causing uncountable economic and ecological losses.

Currently, the land use practices in the UPRB primarily revolve around monocultural crops such as sugar cane and soybeans, along with grazing fields for meat production – similar to at least 6% of the global surface (ESRI, 2022). This land use offers minimal water retention capacity, resulting in a fragile hydrologic system. The area suffers from issues such as topsoil erosion, water eutrophication, and the sedimentation of rivers and springs. Consequently, the system has transitioned from a state of stability to disruption, with rainfall rushing downstream during the wet season and causing aquifers to deplete rapidly during the dry months.

The River and the Mosaic: Regenerative Cycles in Production Landscapes, initially triggered by the 2019 drought event, is a project that explores how Landscape Architecture can enhance the water retention capacity in the UPRB – a production landscape, generic and similar to many other production basins in the world. In order to address an issue as broad as drought, in such a big scale, a theoretical framework was first defined. It departed from literature review on non-equilibrium theories addressing the ideas of resilience (Ahern, 2011); ubiquitous wetness (Da Cunha, 2018); multi-species approaches (Bellacasa, 2021; Escobar, 2018); and the Casco Concept (Sijmons, 1991). Such was translated into operational principles for each of the hydro-topographical categories in the basin: headwaters, slopes, and flatlands.

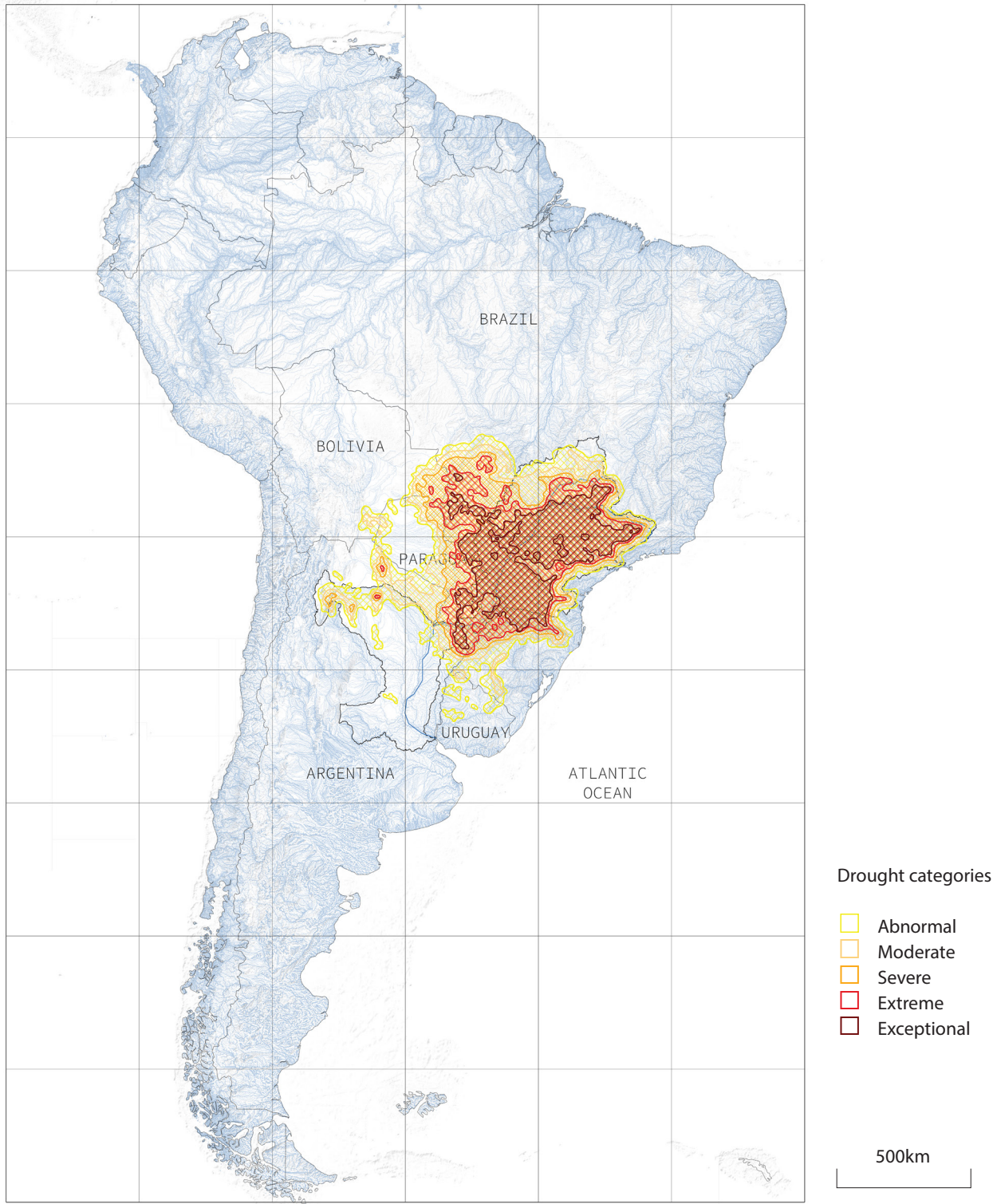


FIG. 72 Map of drought categories in the Paraná River Basin, adapted from Naumann (2021) by the author

## How does the hydrologic system work?

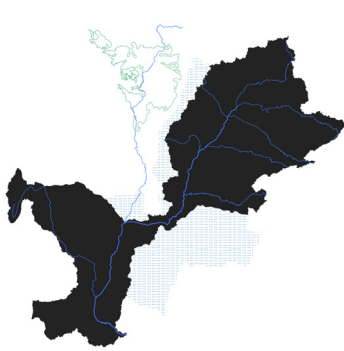


FIG. 74 The system as a whole.

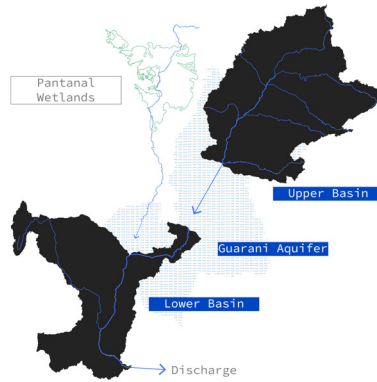


FIG. 75 Parts of the system

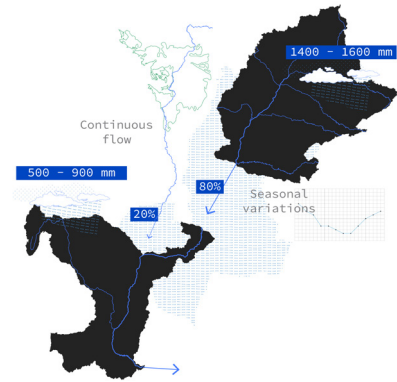


FIG. 76 Rainfall and waterflow patterns

## How does land use make a landscape vulnerable to drought?

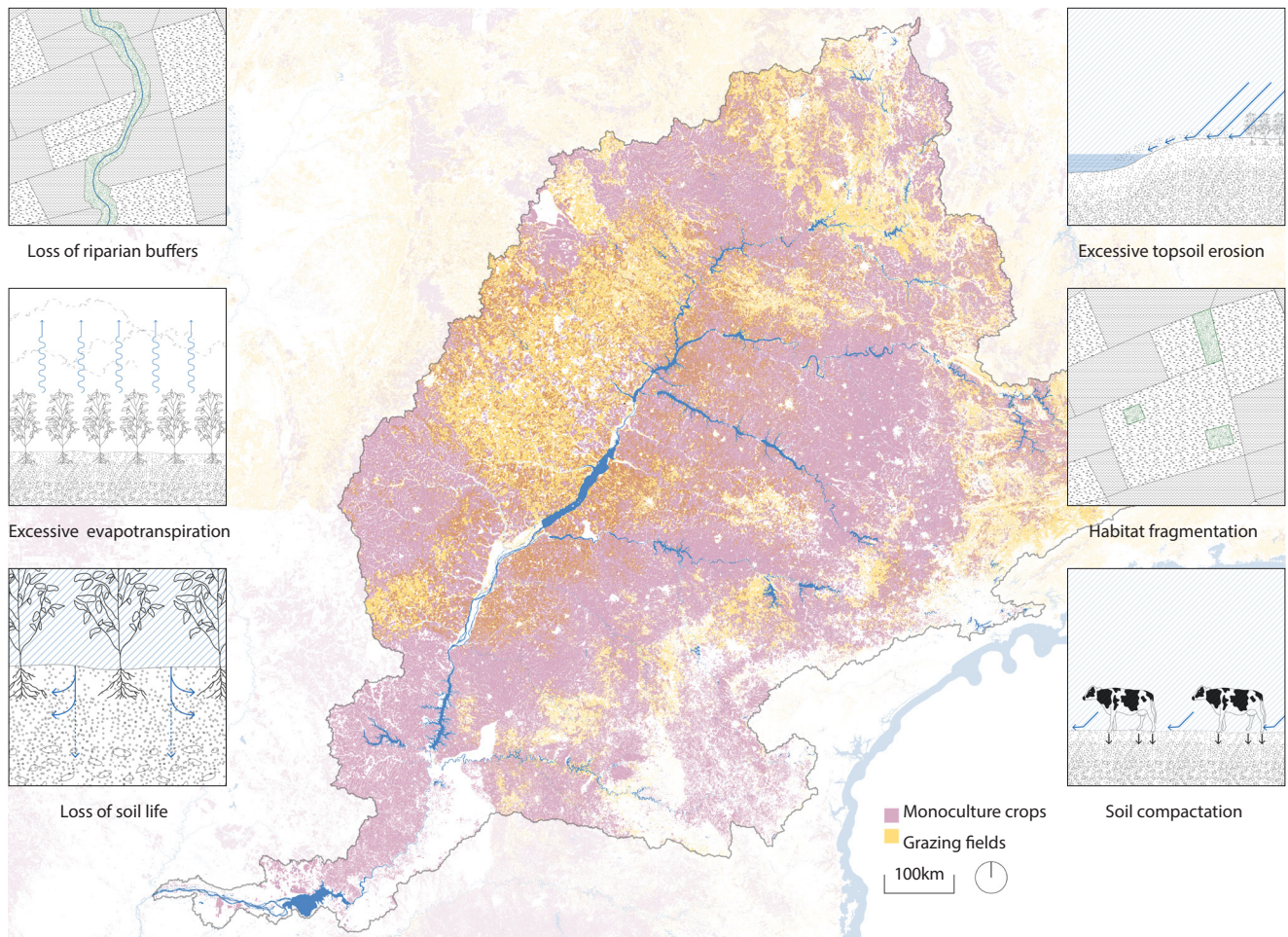


FIG. 73 Map of land use in the Upper Paraná River Basin, data from ESRI (2022) and Projeto MapBiomias (2022)



1



2



3



4

FIG. 77 The study visit happened during the month of January, which is the rainy season. Rainflows were flowing freely in the landscape (1), especially in fields recently cleaned because of harvest (2). Local agronomists came up with special solutions to try to cope with topsoil erosion. Most of the landscape is generic because of widespread sugarcane plantations (3) and grazing fields for cattle (4).

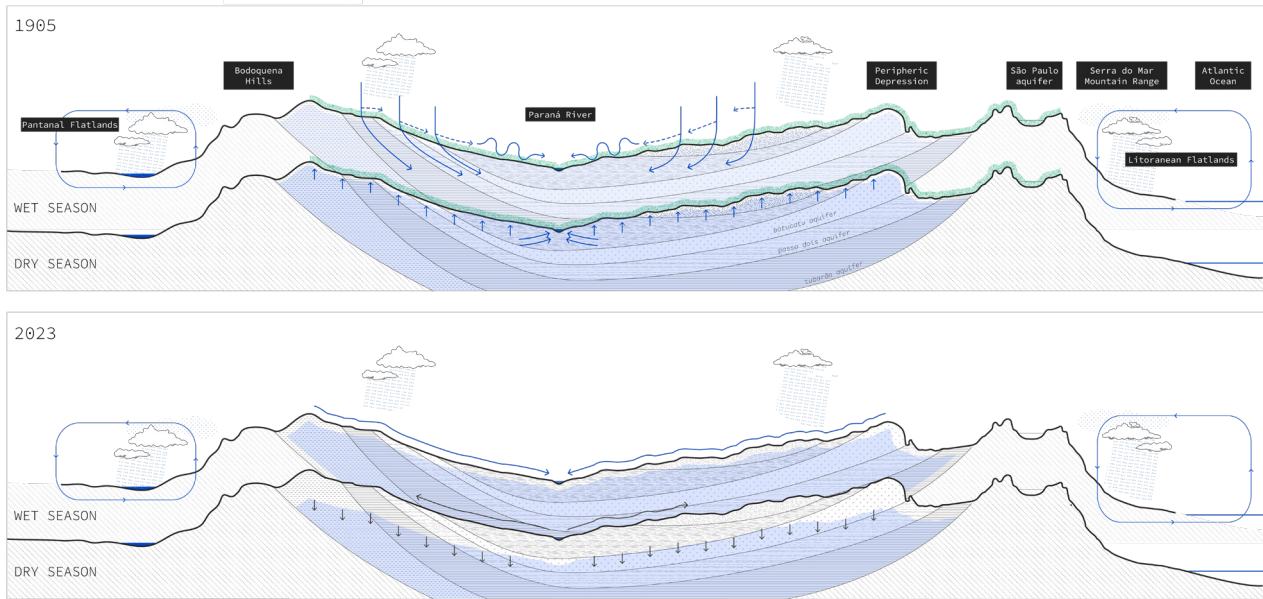


FIG. 78 Comparison of the hydrologic cycle

### **Hypothesis: disruption of the hydrologic cycle**

When studying the previous hydrologic cycle described by the first geologists to explore the Upper Paraná River Basin and contemporary ecologists, it becomes clear that changes in land use have disrupted a previously stable system. Before, rainfall would be retained by the complex Atlantic Forest and riverine marshlands. The Guarani Aquifer would be charged during the wet season. Nowadays, most of the rainfall immediately rushes downstream, very little is retained. How can this cycle be regenerated?

Simulations made using AutoCAD Civil 3D illustrate how rainfall flows over each of these categories, suggesting spatial attitudes to enhance water absorption and minimize topsoil erosion. For the headwaters, buffer zones around the springs protect them from sedimentation and pesticides, and the implementation of special aquifer zones where the top layer is porous and thin guarantee proper protection and water recharge. For the slopes, the main goal was to minimize soil erosion with contour planting, avoiding the eutrophication of water bodies. Contour planting should be done following concepts of landscape connectivity (Dramstad, 1996), connecting isolated reminiscent riparian corridors and patches fragmented by economic activities, as well as taking advantage of infrastructural lines (roads, railways) to implement green corridors. The principles for the flatlands aimed at re-creating, as much as it is possible, the original dynamics of these places, mostly lost as a consequence of the construction of hydroelectric dams. Bypasses are dug to regenerate dried marshlands, extending the residence period of rainfall before it reaches the main body of the Paraná River and creating varied conditions for diverse fish, plants, birds, and mammals. Sediments coming from the tributaries because of topsoil erosion can be trapped by aquatic plants, forming shallow marshes and preventing water eutrophication. Finally, a small bypass is proposed through hydroelectric dams, slightly reducing their capacity, but regenerating the original input of sediments and nutrients into the system downstream.

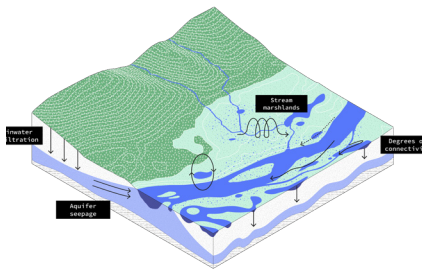
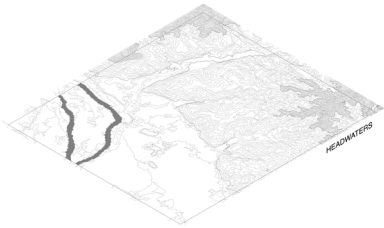
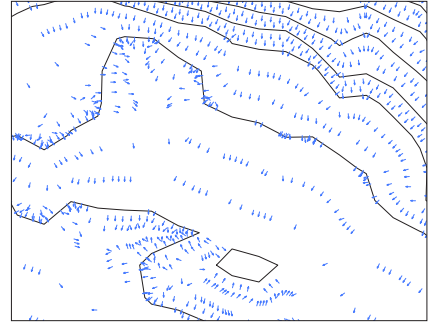
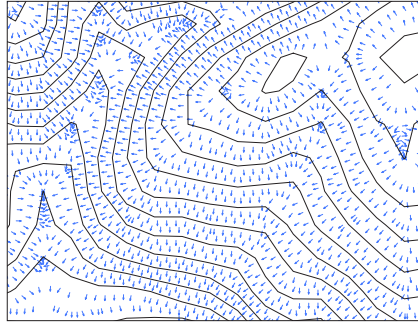
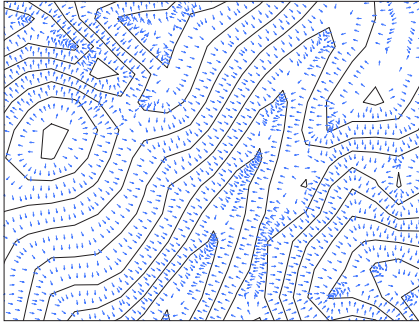


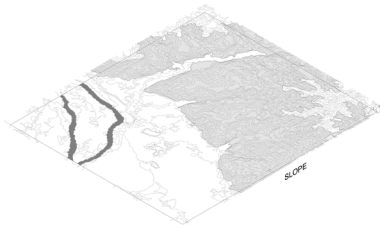
FIG. 79 Original rainfall dynamics in the landscape



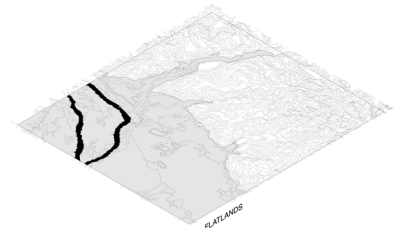
FIG. 80 Preserved patch of Atlantic Forest



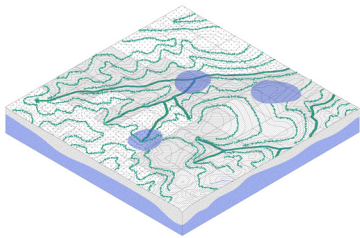
headwaters



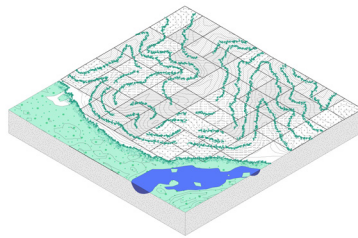
slopes



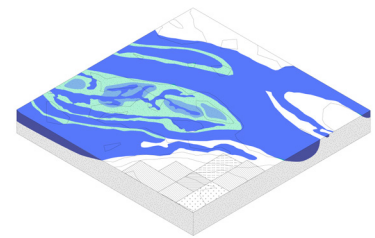
flatlands



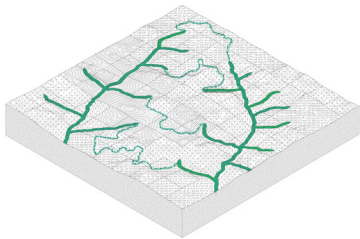
special aquifer recharge and protection areas



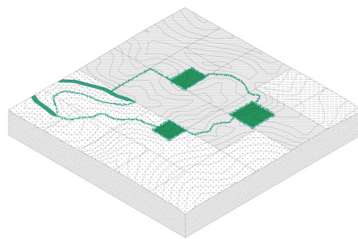
control erosion with contour planting



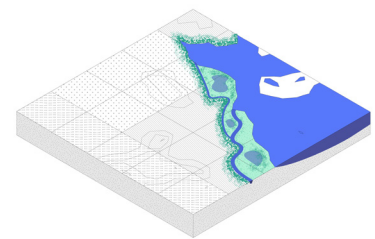
regenerate riverine islands



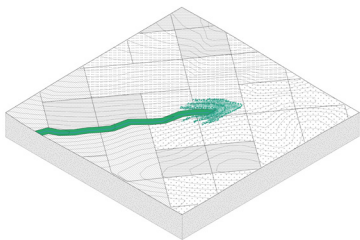
connect isolated riparian remnants



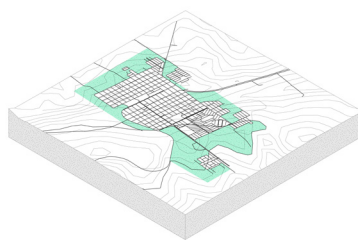
connect isolated forest fragments



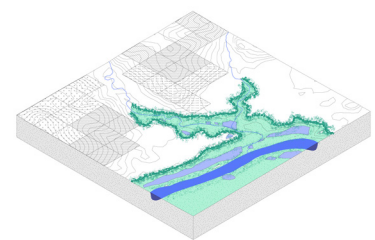
create new bypasses



recreate buffers around springs



control urban sprawl



regenerate dried marshlands

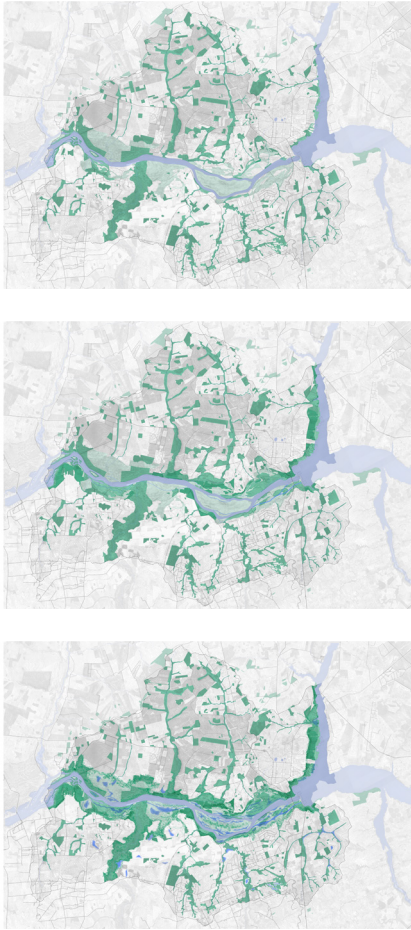
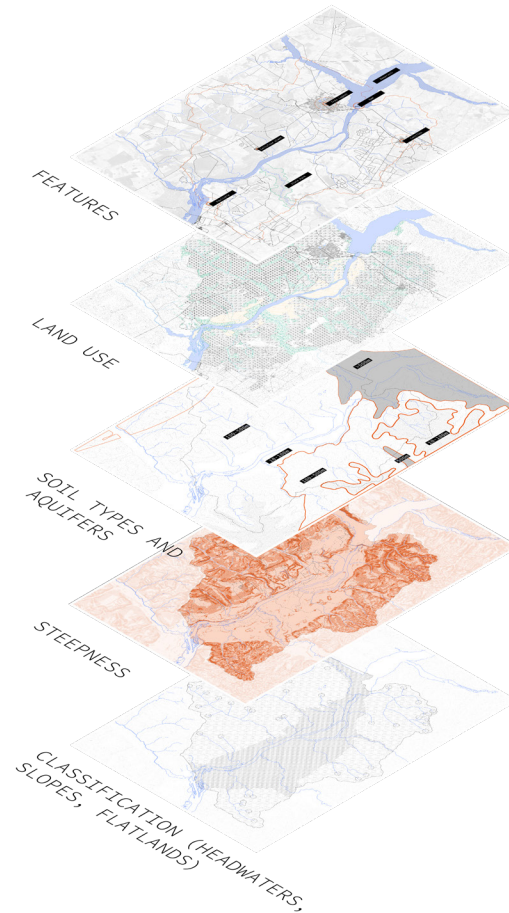


FIG. 81 Left - Rainfall patterns defined hydro-topographic categories, which have operative principles designed to fit the flows

FIG. 82 Above - How the regional framework has been elaborated, and the layers of the landscape that were taken into account



These principles are applied on a group of watersheds visited by the author in January 2023. Together, they form a representative grouping of land uses (sugar cane, eucalyptus, cattle, urbanization, reservoir) on a representative hydro-topographic context along the Paraná River. Following the Ecological Method of Ian Mcharg (Mcharg, 1969), there is special attention to the layers of the landscape: topography, soil composition, aquifers, and land use distribution. The main goal of this application is to implement a regional framework that accommodates slow ecological processes, and buffers the impact coming from the user space (economic activities, infrastructure, cities).

Firstly, the remaining green spaces located directly along the Paraná River are connected by regenerated marshlands and new forest patches, filling the voids that allowed grazing fields and sugar cane fields to reach the banks of the river. Therefore, the Paraná River would have a framework of spaces buffering the impacts from human industries. Secondly, this framework is spatially reaffirmed by the creation of bypasses, which reactivate the dried marshlands and slowly make the framework wetter and wetter.

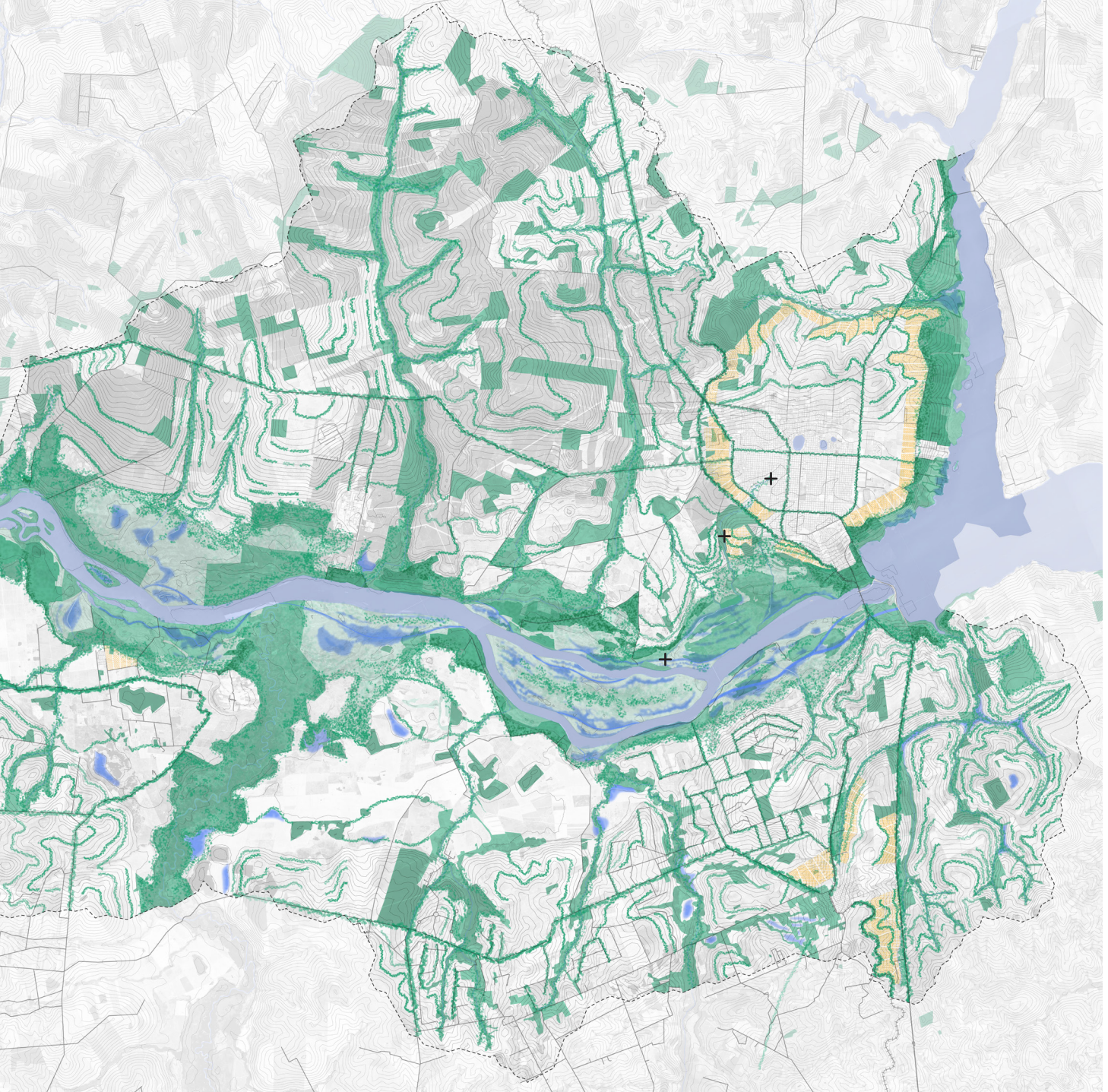


FIG. 83 A regional framework enhances the landscape's resilience and provides room for slow ecological processes

Thirdly, rows of contour planting are traced along the slopes according to the type of land use and steepness, as well as the soil composition. There is an area that characterizes as special aquifer recharge and protection, since the aquifer is covered only by a 10-metre top layer made of porous sandstone. The green lines are also traced aiming at creating the highest degree of landscape connectivity.

Three detailed case studies along a particular tributary of the Paraná River illustrate how the framework manifests in the experiences of local communities, flora, and fauna, and creates more harmonious coexistence between ecology and economy. They correspond to the classifications of headwaters, slopes, and flatlands.

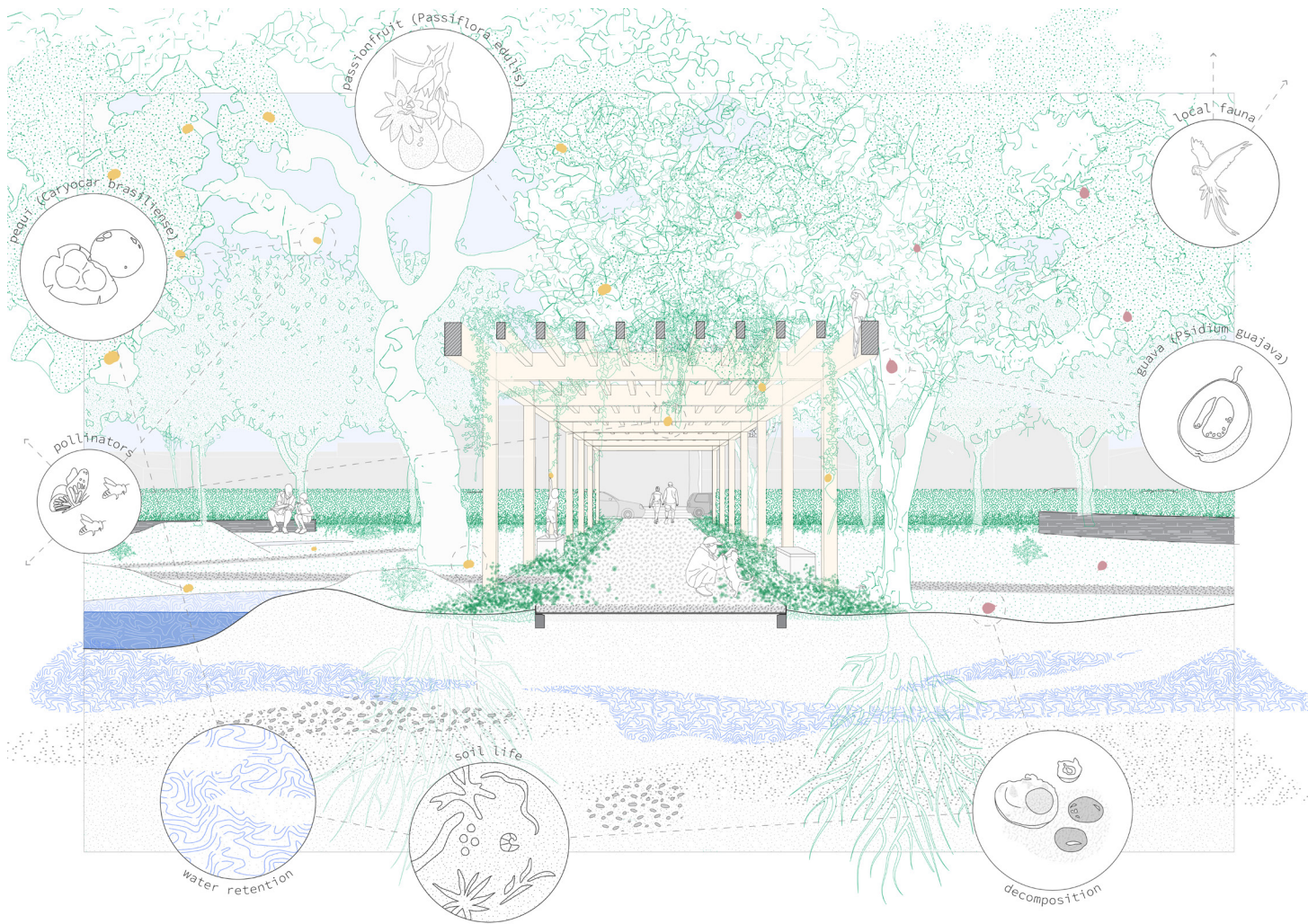


FIG. 84 Section cut of the pergola along the spring area in the proposed Central Market park, and imagined relationships of interdependence

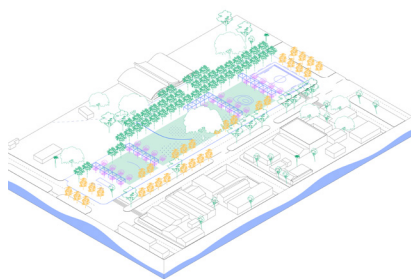
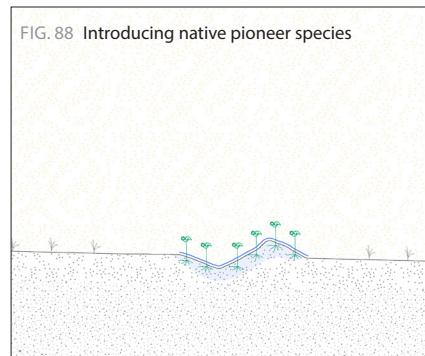
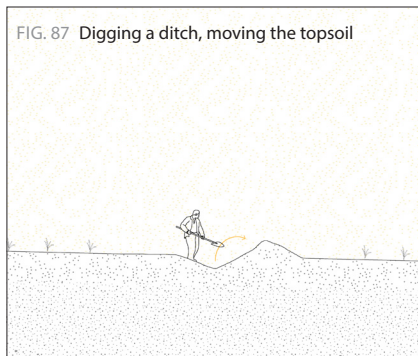
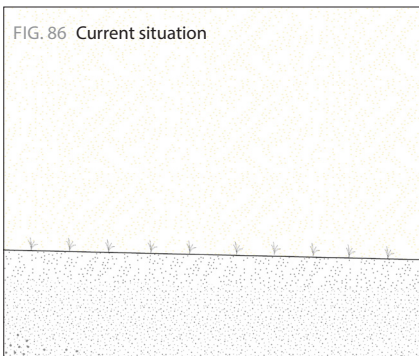
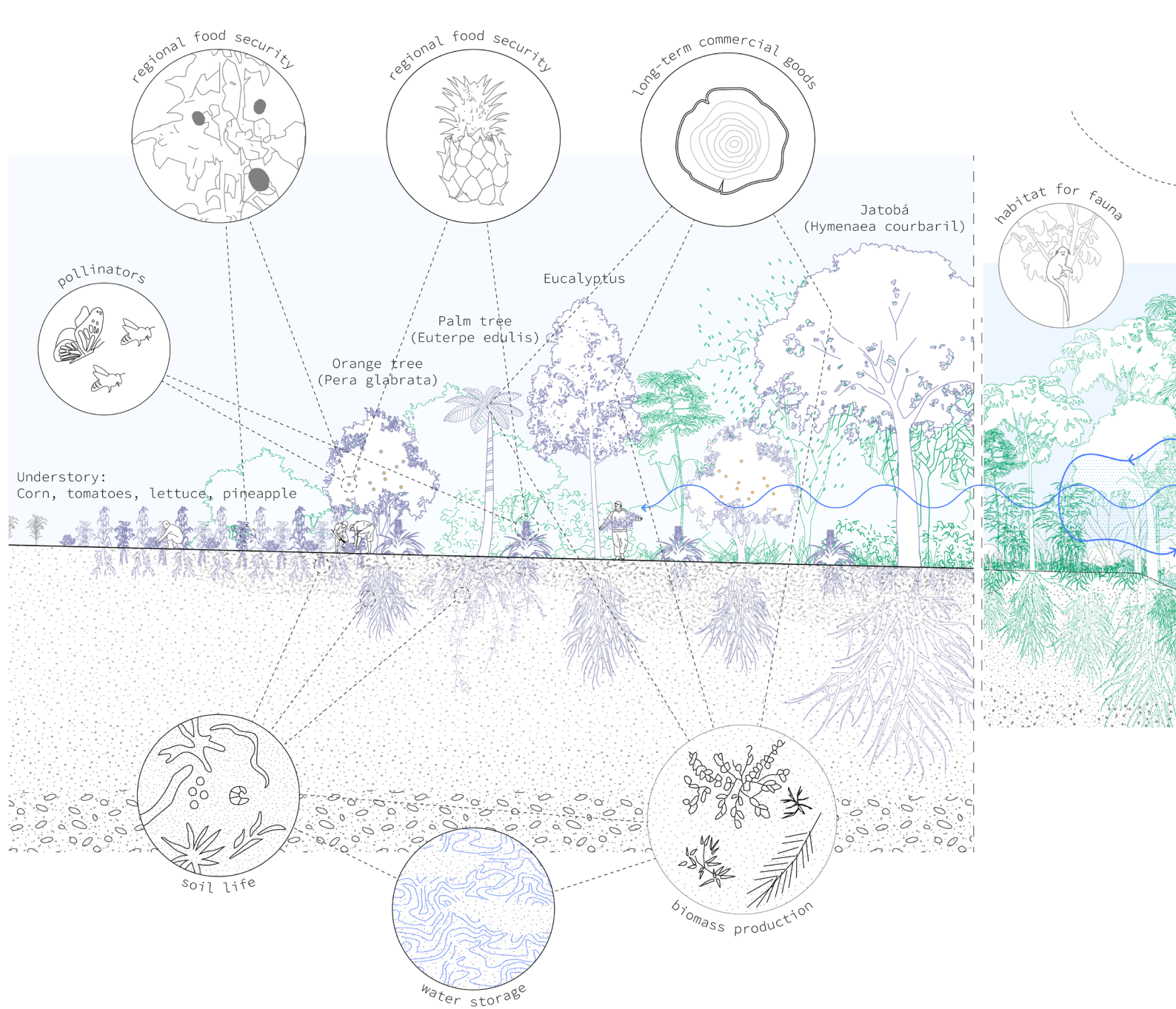


FIG. 85 Planting diagram for the park

The Headwaters zoom-in is located at the Central Market Square of the city of Três Lagoas. It is the social heart of the city and the main place to taste local fruit and food. However, the water spring is buried underneath an impervious parking lot, only with one metallic grid to drain rainwater coming from the neighbouring avenues. The main premise here is that Landscape Architecture can help people understand the biome, or the place, they live in, so this parking lot is envisioned as a future park where the spring is protected and visitors can experience processes of the landscape. A 60-meter offset is defined around the spring as an area of special protection. The outermost corners of the park are used as rainwater reservoirs for the dry season, covered with a soccer pitch and a “water square” with sprinklers for hot days. When the reservoirs are full, the water surplus is slowly released towards the spring area, forming ponds that qualify leisure spaces. Four circulation axes separate these different parts of the programme, creating direct access to the Central Market. These paths are covered by a wooden pergola structure surrounded by native fruit trees, attracting both humans and birds. A fifth axis goes through the park in the longitudinal sense, creating a meandering gravel path for contemplative strolls.



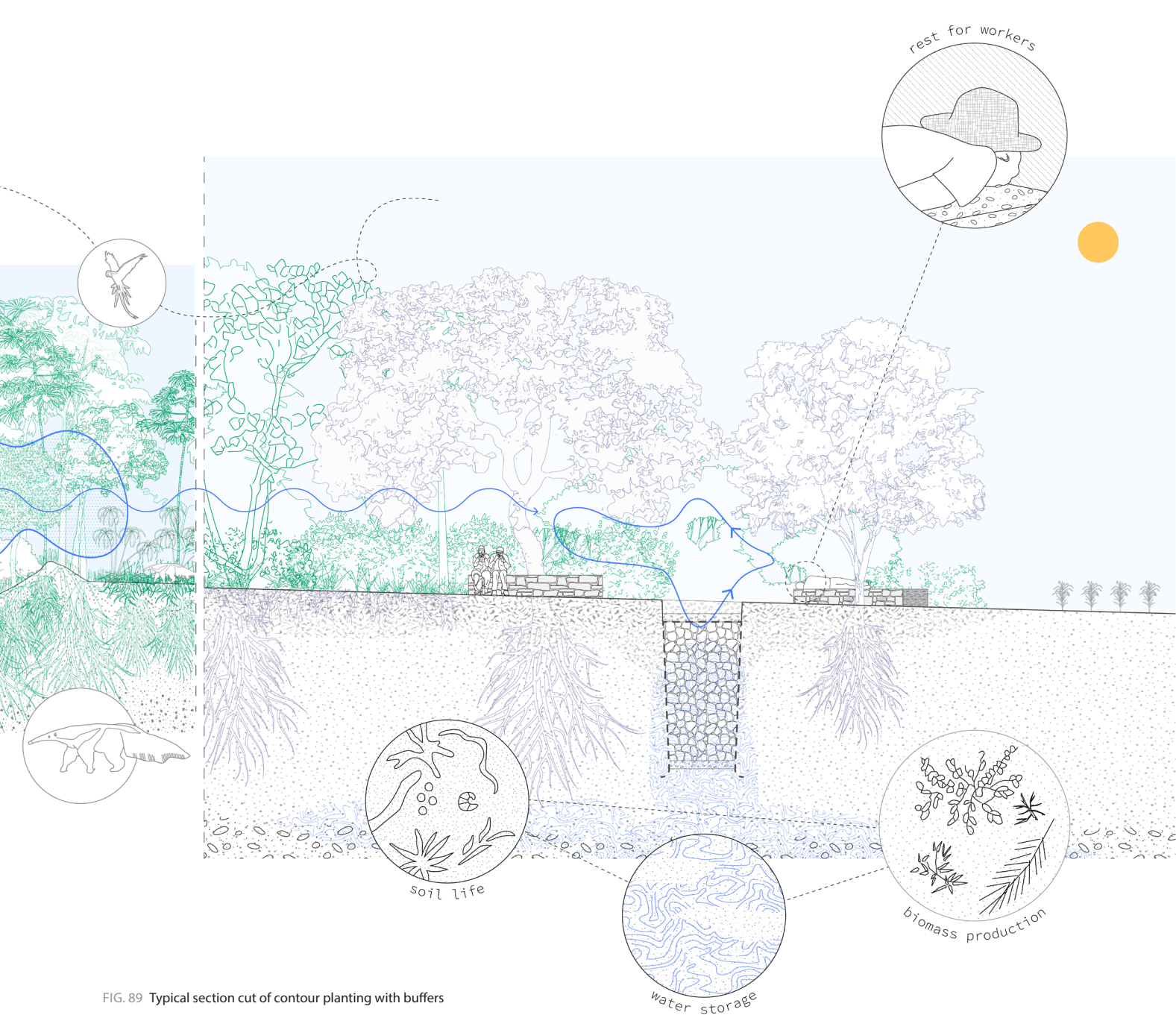
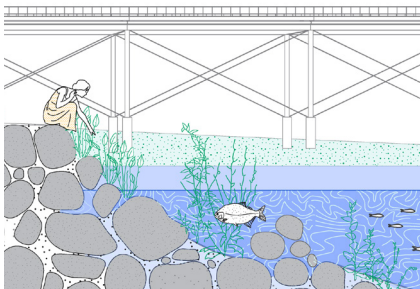
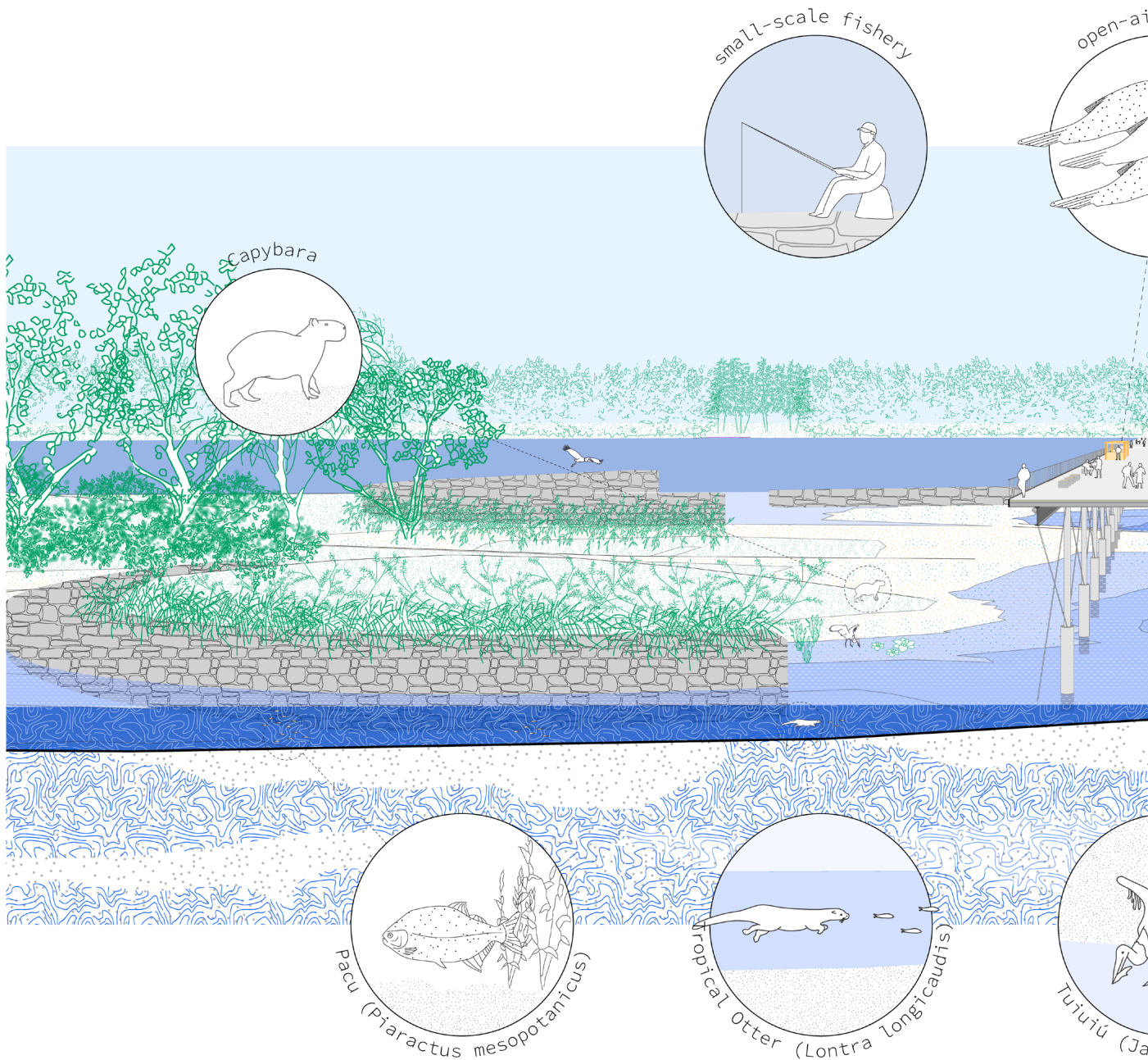


FIG. 89 Typical section cut of contour planting with buffers

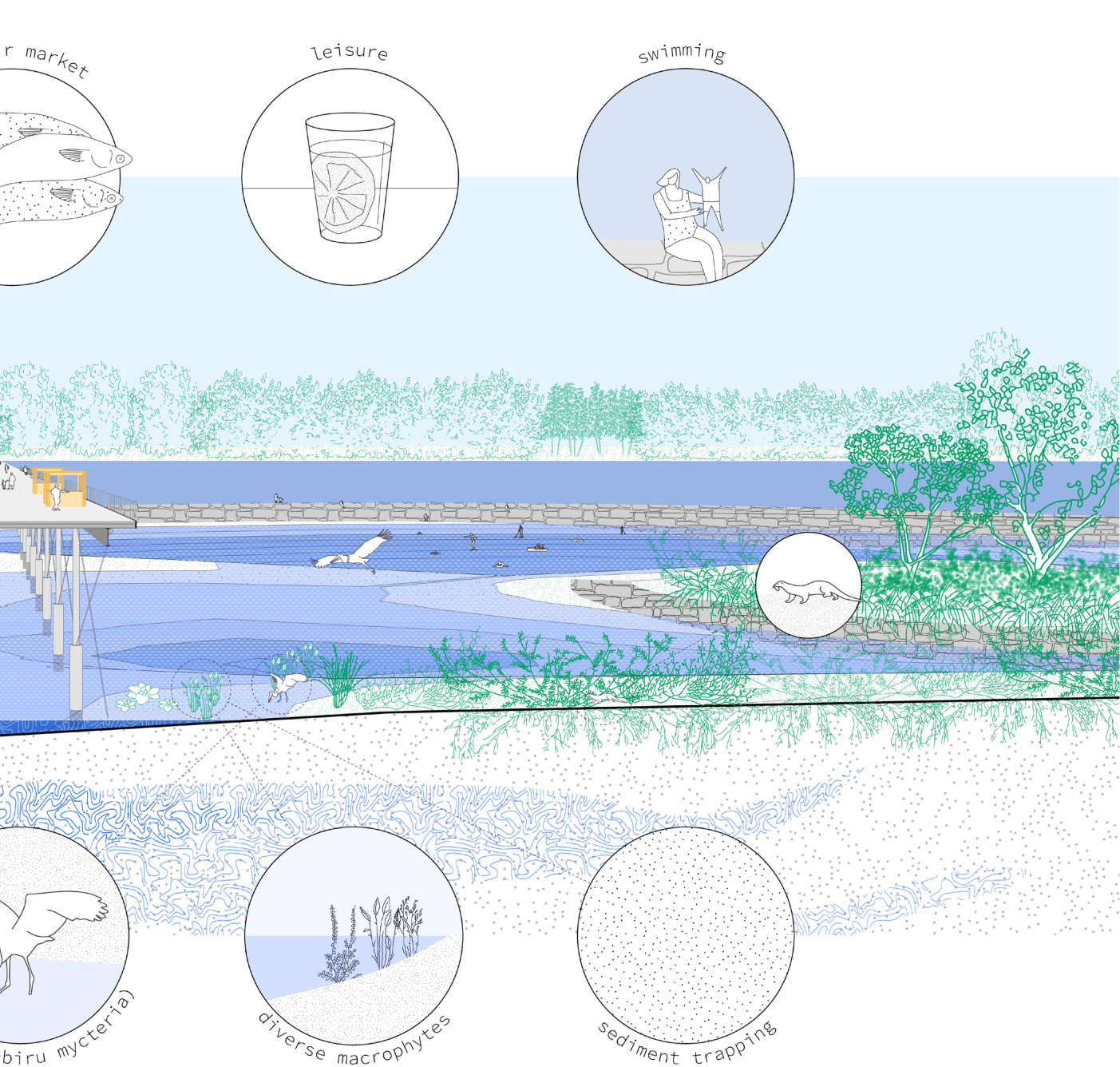
Once water accumulates in the spring area, it flows down towards the Slopes. This zoom-in showcases how contour planting could be implemented. During the dry season, a ditch is dug, which also moves away the topsoil layer, highly “contaminated” with invasive agricultural seeds. Pioneer species are introduced, watered, and covered with a layer of cellulose to prevent evapotranspiration. During the first wet season, water accumulates and infiltrates the ditch, which also activates the dormant seed bank. Thanks to the shadow cast by the pioneer species, climax trees and shrubs can start growing during the following dry season. As the system advances, relationships of dependence grow more and more complex, as it goes with natural succession. Slowly, bigger animals start using it as a movement corridor. While the rows of contour planting represent the framework for the slopes to absorb water and prevent topsoil erosion, adding negotiation spaces in the form of gradients at the margins of the system would buffer harmful pressure coming from the user space (intensive agriculture). As spaces where economy and ecology are at a better balance, uses such as agroforestry and resting spaces for workers could help mitigate the edge effect and influence from pesticides. It is an opportunity for the region to be autonomous in its food production, re-territorializing flows of goods.



Finally, the stream reaches the Flatlands. These are designed as marshlands, initiated by a bypass and shaped by flows directed by stone barriers. The design for the barriers comes from a series of experiments with riverine soils undertaken at the Department of Water Management of the Delft University of Technology. The goal is to retain water before it reaches the main body of the Paraná River, while creating a diversified habitat for many types of birds, animals, fish, and plants. The barriers are designed to create varied speeds of flows, water depths, and lake widths. A bridge is proposed as an elevated street with markets, bars, restaurants, and spots for swimming – all leisure activities currently connected to the flatlands.

FIG. 90 Section cut of the marshland and the pedestrian bridge

FIG. 91 Stone barriers direct flows that sculpt the marshlands, and provide habitat for fish and plants, enhancing ecological resilience



The three zoom-ins aimed at showing how the regional framework is experienced by humans, plants, and animals. The three spaces can work individually, but should preferably be implemented as a system for optimal regeneration of the local hydrologic cycles. They all share the same goal of enhancing water retention in the basin, storing rainfall in the Guarani Aquifer to prepare the region for worsening dry seasons. However, they also build upon the idea of ecological resilience, which states that diversity and redundancy allow the framework to provide for all living beings during disturbance events, prevent the complete decay of the entire system. The main conclusion is that, if not approached from a purely technical point of view, water retention can be a leverage to enhance a landscape's resilience and ecological value as a whole.



FIG. 92 City development upon agricultural land (Image: Xiaomeng Tian, 2019)

# From the Water

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## Towards an adaptive landscape framework for sustainable development of agricultural area on the west side of PRD

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Daniele Cannatella, Urbanism

### **Introduction**

The Pearl River Delta is currently one of the world's fastest-growing city clusters. However, it has been a low-lying area with scarce land resources throughout history due to its dense population and frequent water-related hazards. The traditional agricultural system in the region was a response to these contradictions, serving as a multifunctional system that sustained the land and shaped the local society and culture over centuries. However, with China's reform and opening up in 1978, a significant amount of agricultural land was converted into urban construction and intensive agriculture, the disappearing traditional agricultural system has led to arising social and environmental issues such as increased flood risks, environmental degradation, landscape homogenization, and the loss of cultural heritage.

This graduation project focuses on the development of the remaining agricultural areas on the west side of the PRD. It emphasizes the urgent need for diverse ecosystem services to support the growing population in the face of climate extremes. In this case, an economy-dominated or monofunctional planning approach alone is insufficient to ensure sustainability. Therefore, building upon the region's agriculture-based background, the study adopts an adaptive landscape framework as an adaptation of the traditional agricultural system. By integrating the theories of landscape-based urbanism, social-ecological resilience, and ecosystem service, the landscape framework aims to facilitate sustainable development of this area in terms of production, ecology, water resilience, and living environment.

The study considers agricultural development in the PRD as a long-term process and recognizes the agricultural system as a social-ecological system. Through the learning of the development process, the agricultural area could be divided into two main typologies: dikedfield and sandfield, and further subdivided into four landscape typologies. Together, they compose the landscape structure of the region. By analyzing and evaluating the challenge and potential associated with each typology, an overarching regional vision is proposed. Principles derived of the traditional agricultural system will serve as design guidelines, while the design exploration in Gulao Town, will be conducted to showcase part of the regional vision and tangible social and environmental value brought to the local area.

## Vision

In the regional structure, the agricultural areas serve as water buffers, restoring and releasing floodwaters along the riverside and coast. Additionally, ecological patches are created along the water network, forming an ecological buffer zone for the city. The dikedfield can be developed as eco-friendly productive communities, addressing urban waterlogging issues, while the sandfield can be developed as crop-producing areas that support coastal habitats and mitigate storm surges.

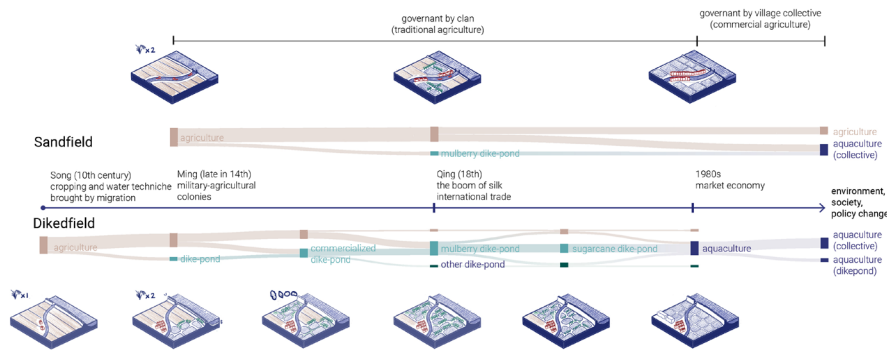


FIG. 93 The development process of traditional agriculture

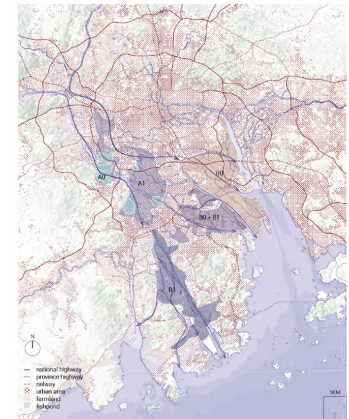


FIG. 94 The landscape structure

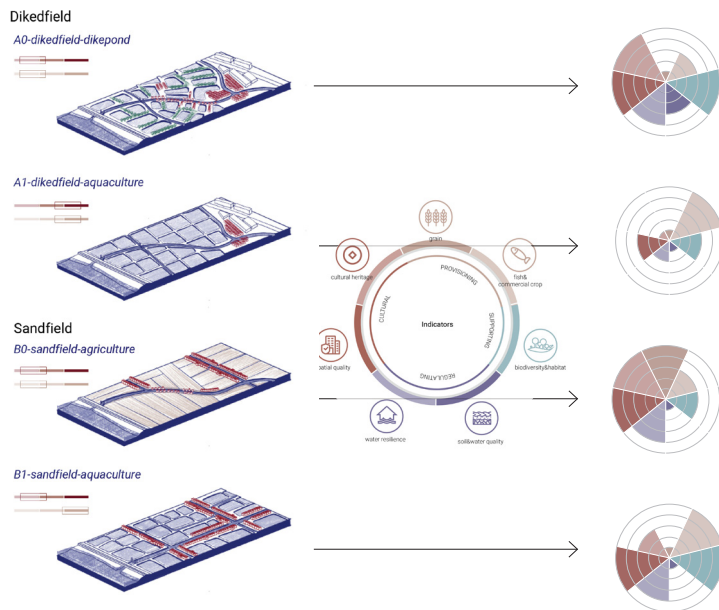


FIG. 95 Landscape typologies division according to different development intensity of urbanization and agriculture intensification and evaluation

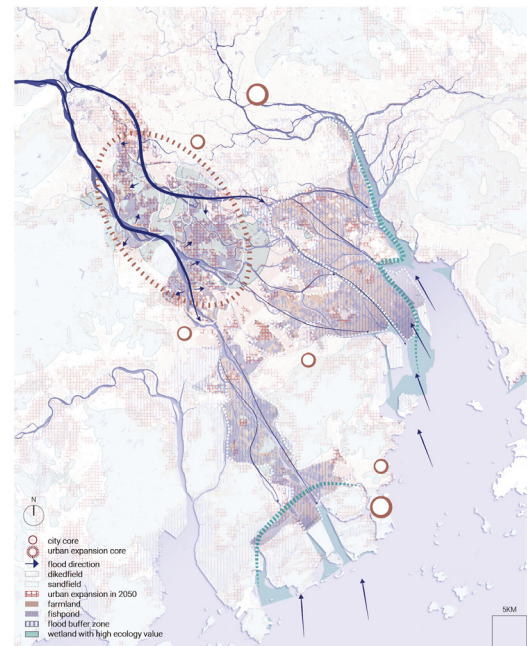


FIG. 96 The regional vision

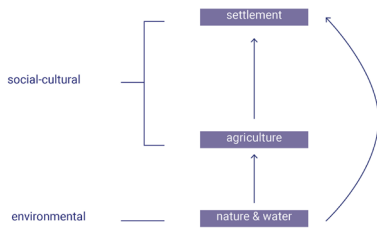


FIG. 91 The structure of traditional agriculture

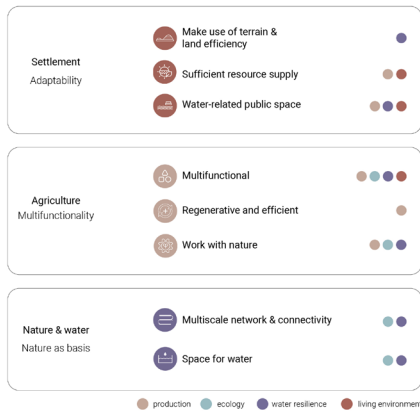


FIG. 97 Design principles

## Principles

Based on the characteristics of dikedfield and sandfield, as well as insights from Chen’s research in “Rural Landscape Planning and Theoretical Tradition” (2010), the agricultural system in the Pearl River Delta can be viewed as a social-ecological system consisting of three interconnected layers: nature and water, agriculture, and settlement. Lessons can be derived from each of these three aspects, and the design principles closely aligned with the sustainable goal are further drawn upon.

**Nature and water:** Nature and water is considered as the basis for the other layers within the landscape framework. The design should be determined by the physical and biological factors of the site, rather than solely relying on human intervention and technological prowess (Ruff, 1982). This is evident in how people adapt agricultural models to fit natural conditions, select suitable habitats, and utilize natural processes efficiently in construction and production.

**Agriculture:** The key principle of agriculture is its multifunctionality, which can be accomplished through the integration, stacking, or time-shifting of functions (Ahern, 2011). To achieve the coexistence of multiple functions, it is crucial to efficiently utilize limited energy and materials within the system.

**Settlement:** Settlement should be an adaptive choice based on the aforementioned principles. It is essential to provide people with a safe and comfortable living environment. Therefore, settlements should be selectively established in stable areas with minimal natural interference, where the surrounding environment is suitable to fulfill both material and spiritual needs through human intervention.

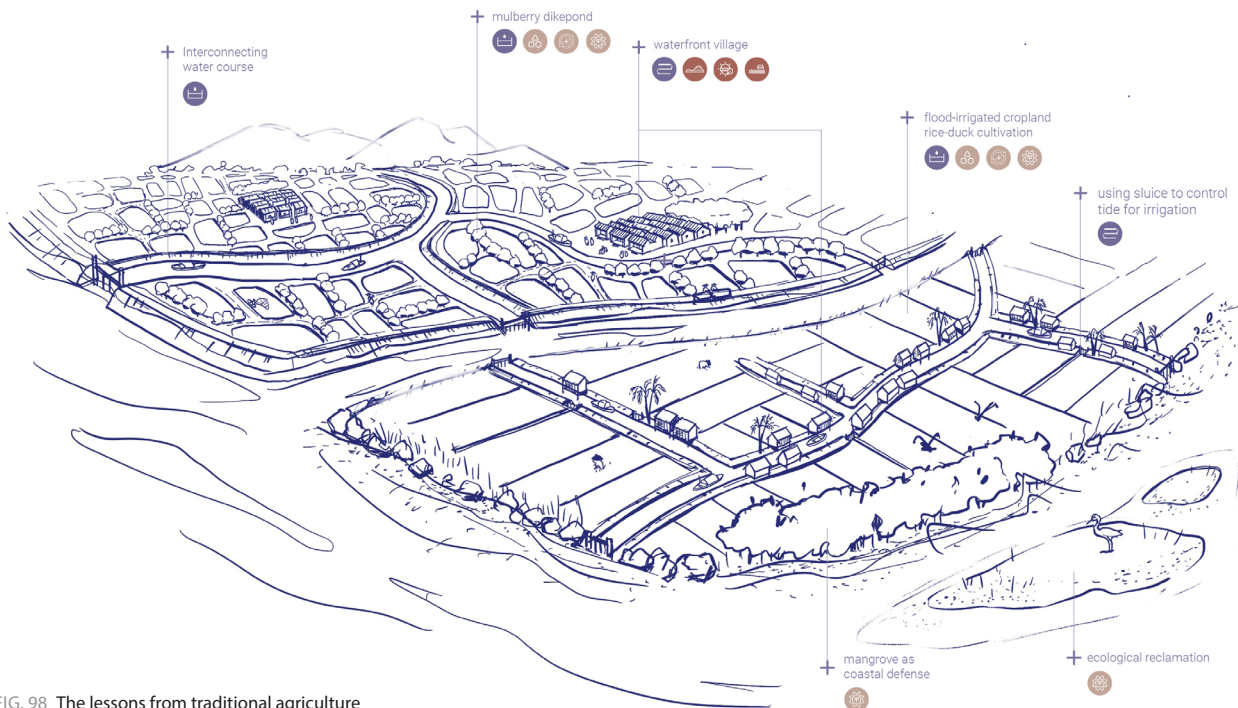


FIG. 98 The lessons from traditional agriculture



FIG. 99 A view of Gulao Town (Source: [https://m.thepaper.cn/newsDetail\\_forward\\_8149557/](https://m.thepaper.cn/newsDetail_forward_8149557/))

### Results: Design exploration in Gulao

While areas with the same landscape typologies are likely to share the similar characteristic, the overall vision of the region can be achieved by providing development model to each typology and accomplished by local projects. In this case, Gulao Town is selected as an example of the dikepond typology.

Gulao Town is a lowland surrounded by river network, and has Heshan city to its south. Therefore, it's a typical area facing challenge of urban expansion and water threat. Meanwhile, due to the lack of economic development, the villages and fishponds are being abandoned with the leaving of the youngster. The design exploration aims to giving a response towards these problems through the application of landscape framework, which results as proposed strategies towards the district and corresponding local spatial design.

#### Strategy proposed for the district

The strategies are generated according to the principles. The nature and water layer defines the fundamental landscape structure, and helps framing the development of agriculture and settlement programs. The strategies towards the latter ensure the ecological services of the system, and allows the continuous adjustment of the form and function of the landscape in line with the natural and social process.

A typical strip that represents the landscape structure of Gulao Town exemplifies the impacts of the strategy with spatial design. The design of this strip has two main focuses: enhancing the value of agricultural production areas other than production and the value of residential areas other than living environment.

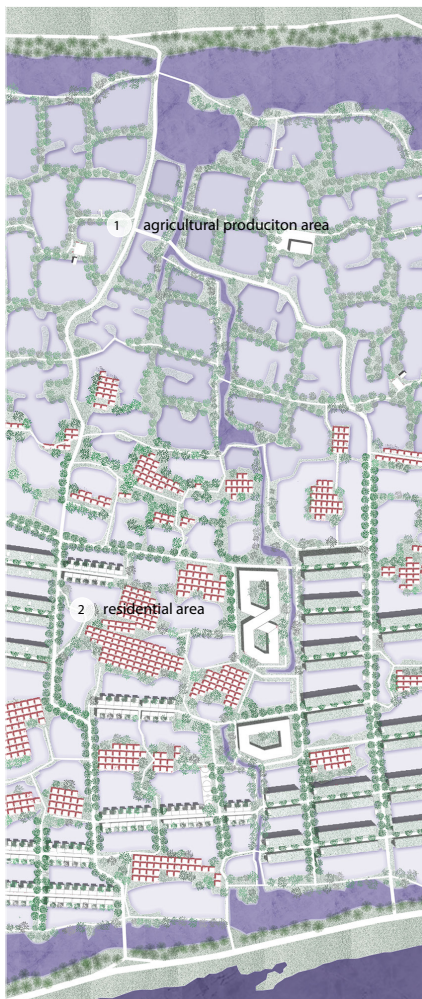


FIG. 100 The plan of the strip

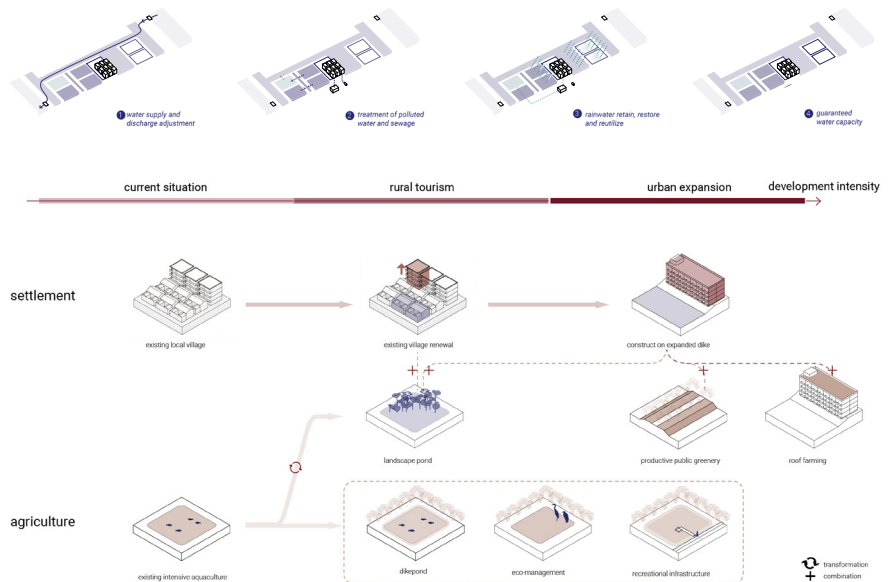


FIG. 101 The strategies on water, agriculture and settlement



FIG. 102 The abandoned dike (photo: Wenxiu Chi, 2022)

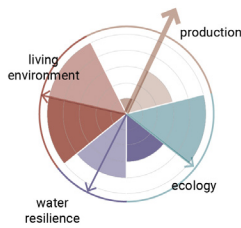


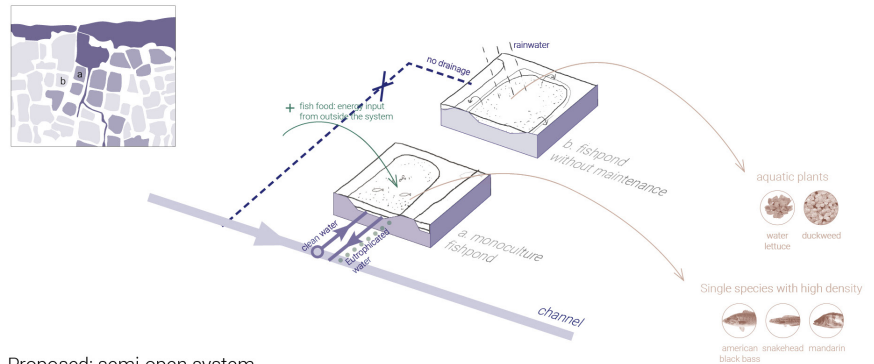
FIG. 103 The sustainable goal

### Agricultural production area: production+

The main problems of the production area come to the low productivity of the disconnected ponds and the high pollution of the intensive aquaculture. Therefore, the transformation of the agricultural area will start with the upgrade of agricultural model. This starting step can ensure the water quality and ecosystem stability of the fishpond, and furthermore bring virtuous circle with more diverse product, less cost of feed and fertilizer, and higher productivity.

The production zone also becomes a high quality habitat composed of fishpond wetland, reedland and water courses. Moreover, the dikes will serve not only as a daily farming area for farmers, but also as an agrotourism destination for sightseeing, agricultural experiences, and nature education. In this context, a demonstration area showcasing circular agriculture and habitat with diverse species provides extra attractions for the local tourism industry.

#### Current: open system



#### Proposed: semi-open system

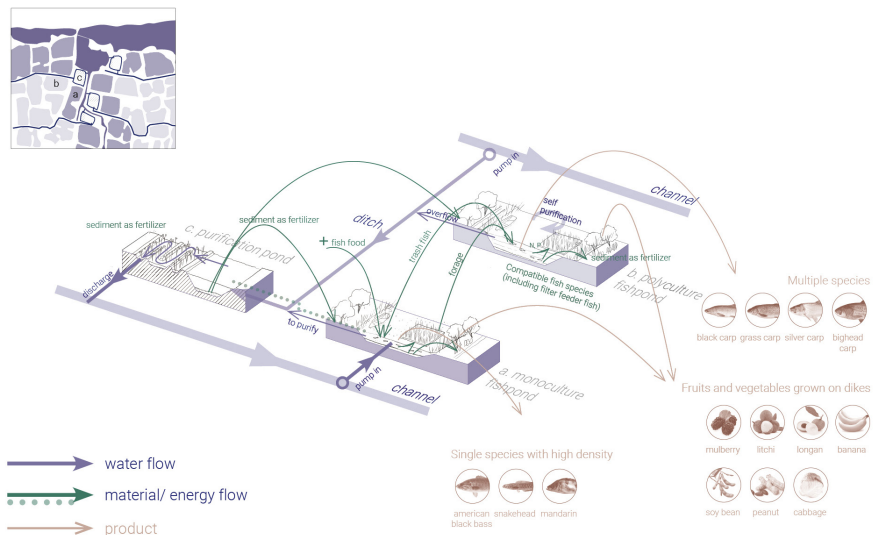
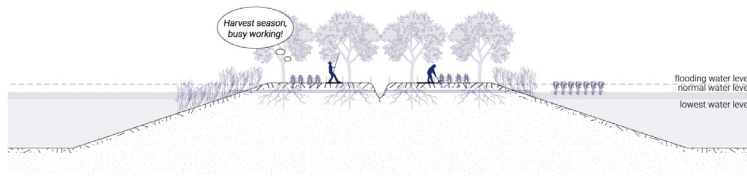
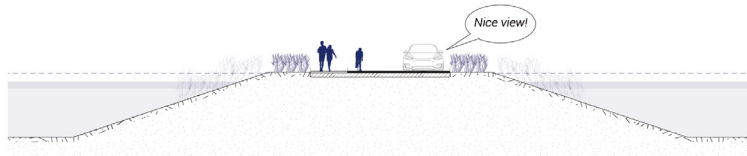


FIG. 104 The regenerative system

1. farming dike with ditch (8m)



2. motorway (10m)



3. experiential dike (12m)

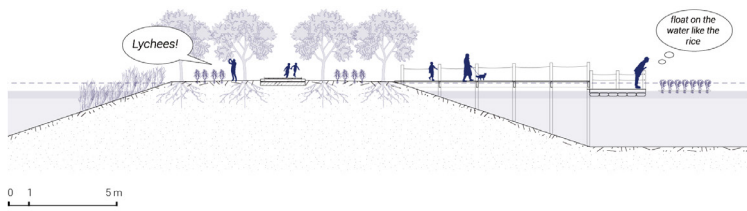


FIG. 105 Diverse dikes



FIG. 106 Yearly scenarios

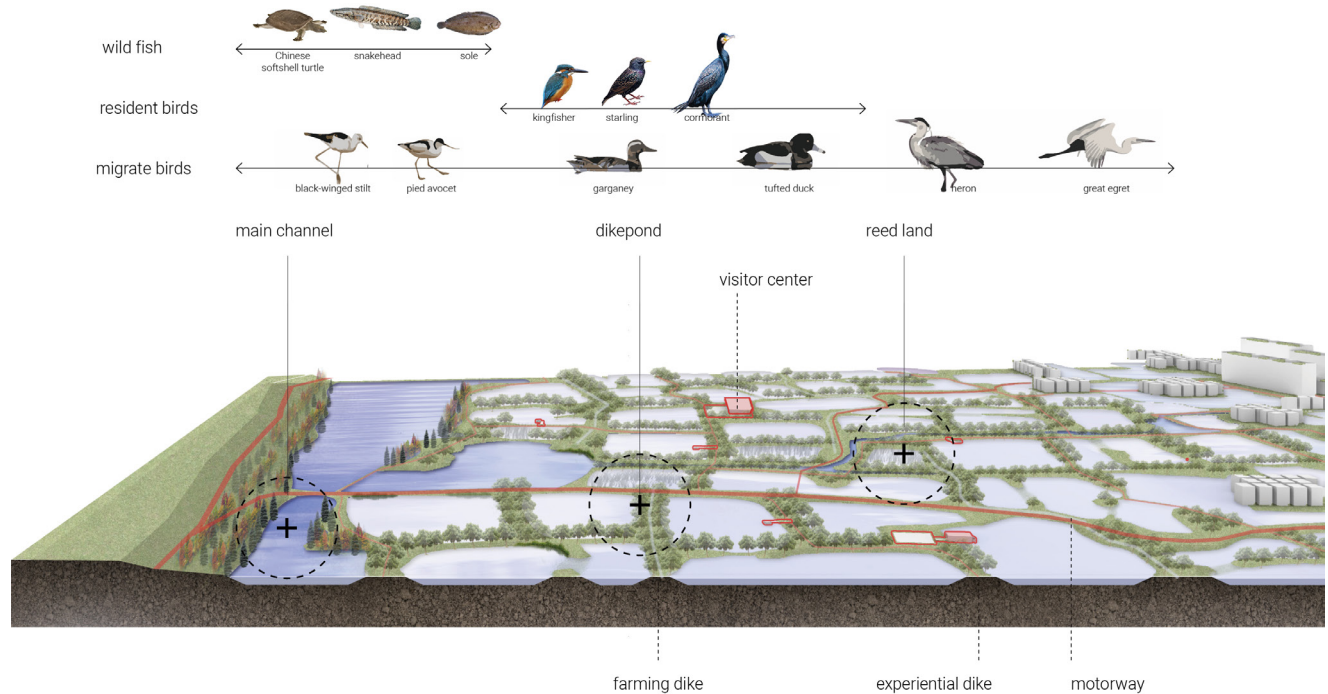


FIG. 107 Attraction to human and wildlife



FIG. 108 The landscape pattern (Source: [https://www.facebook.com/nhvisit/posts/2267420333480295/?locale=hi\\_IN](https://www.facebook.com/nhvisit/posts/2267420333480295/?locale=hi_IN))

### Residential area: living environment+

The residential area is focus on the relative highland, which is also a potential area for urban expansion. Therefore, a new dikepond neighbourhood is proposed in this area, aiming to create pleasant living space integrating production and water resilience.

To preserve the landscape pattern and provide adequate space for flood mitigation, the construction area will adopt a grid layout inspired by the original dikepond pattern. With a dense network, the residential roads will prioritize slow traffic and serve as spaces for socializing and relaxation. Historic villages of cultural significance will be preserved and connected by pathways. While new buildings will be aligned along the dikes, placing water areas at the center of the blocks.

The new neighbourhood can engage production and water management. As it provides available space for farming like rooftop farming and community gardens, and visible water structure that people can perceive the water level in time. Meanwhile, the community could have a strong bonding with each other through multiple activities organized around the landscapes.

Finally, there is a mutually beneficial relationship between different values and functions. It is important that this positive cycle is created, ensuring that stakeholders benefit from it and actively maintain it. This allows the Gulao Town to truly become an area constantly enriched with diverse values.

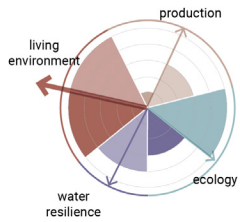


FIG. 109 The sustainable goal

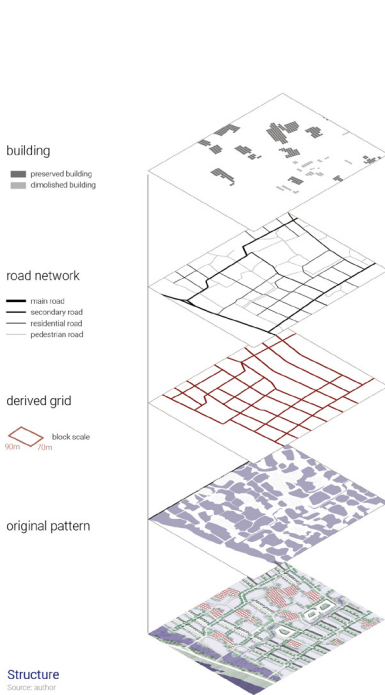


FIG. 110 The structure of new neighbourhood

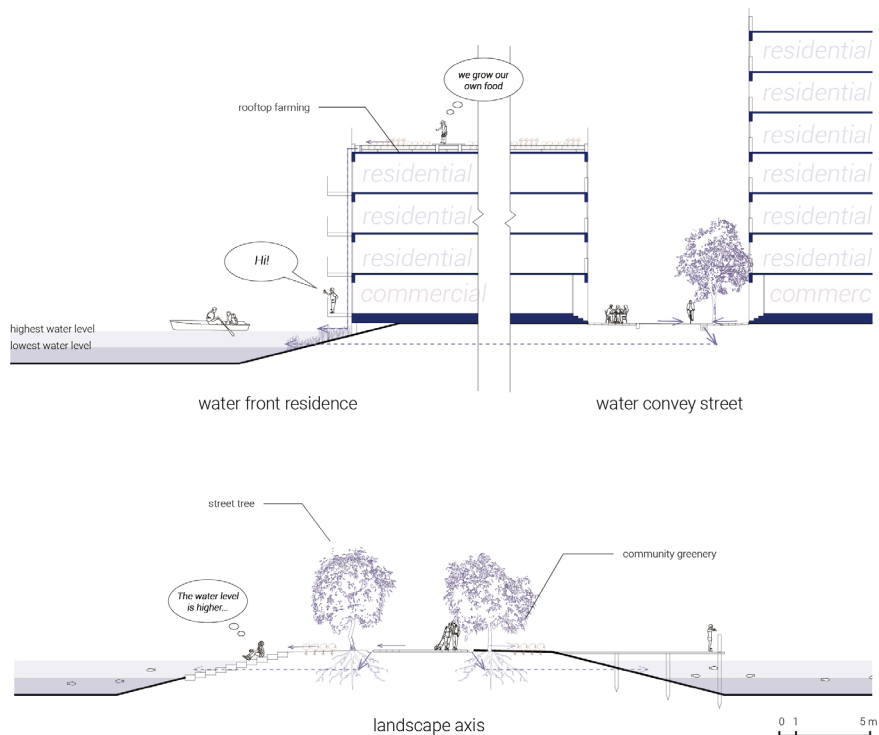


FIG. 111 The building and landscape axis



FIG. 112 Water connects the community together



FIG. 113 The new neighbourhood remains connection with the traditional village



FIG. 114 A peaceful night along the main channel

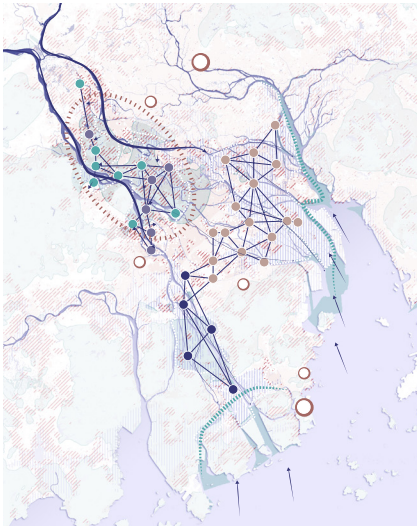


FIG. 115 The chain effect in realizing the vision

### Conclusion

The Pearl River Delta metropolis, as a complex system, faces the long-term and intricate challenge of achieving a balance between human activities and the natural environment. By regarding the Pearl River Delta as an agriculture-based area, this project proposes a vision for the agricultural area in the PRD and derives instructive design principles. The design exploration demonstrates how landscape-based design can deliver tangible and diverse local benefits, and works as an attractive and predictable vision to promote the joint participation of the government, developers, and local residents.

The vision based on the landscape framework stems from the sustainable services provided by the ecosystem. Meanwhile, it could be further integrated and improved in alignment with visions that prioritize social and economic development, such as The Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area' and local overall planning. By regarding the former as a strong complement to and support for the latter, it will facilitate the refinement and implementation of landscape strategies and assists in constructing a more comprehensive and sustainable development system for the region.

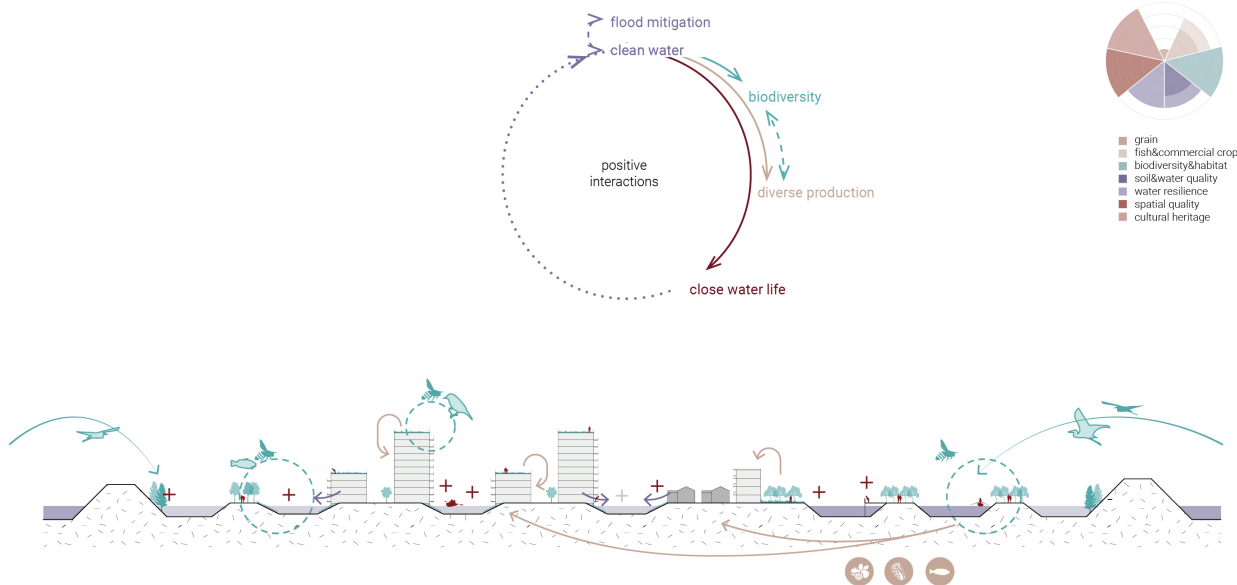


FIG. 116 The improvement of landscape values in Gulao



FIG. 117 North Sea bloom [contains modified Copernicus Sentinel data (2017), processed by ESA, CC BY-SA 3.0 IGO]. Capturing the grand-scale atmosphere. The envisioned Tomorrow's (P)ARK extends across the territories of three countries: the Netherlands, Germany, and Denmark, encompassing a substantial part of North-Western Europe. The conceptual proposal seeks to unite nations through nature, provocatively showcasing that nature disregards our imagined borders.

# Tomorrow's (P)ARK

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## Designing the biggest continuous Nature and Landscape Network of North-West Europe

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### Introduction

In our ever-changing world, human activity has left a profound impact on the planet. As the dominant species, we have built cities, advanced technology, and explored space. But our progress has come at a great cost to nature. The Anthropocene era has brought many species to the brink of extinction, with 28% facing threats according to the IUCN Red List.

Inspired by the story of Noah's Ark, Project Tomorrow's (P)ARK aims to create the largest national park in North-West Europe. Utilizing Natura 2000 areas and a one-kilometer buffer zone, this interconnected structure will harmonize with major cities like those in the Netherlands, Germany, and Denmark. The project focuses on transforming the surrounding areas of national parks, creating non-invasive environments where nature can thrive.

(P)ARK involves changes in agriculture, cities, infrastructure, and fragmented National Parks. It promotes a non-invasive environment where all species can coexist. This is achieved through innovative agriculture, rewilding natural areas, and creating movement corridors and habitats for biodiversity. A pedestrian pathway from Amsterdam to Copenhagen showcases nature's beauty and potential for restoration. The (P)ARK app connects communities and policymakers, facilitating collaborative initiatives. An analytical tool defines social foundations and planetary boundaries in land use.

The project's ultimate goal is to heal the human-nature relationship, encouraging a modern pilgrimage focused on reconnecting with nature. It envisions an attractive model of a new living environment, a haven for ecological preservation. While it cannot stop the sixth mass extinction, Project Tomorrow's (P)ARK is a tangible step towards safeguarding remaining biodiversity of local resources to spontaneously develop into Smart Villages, thereby reducing dependence on urban centres and contributing to the development of metropolitan regions. The proposed framework and design strategies offer valuable insights for planners, policymakers, and stakeholders seeking to foster the sustainable development of Smart Villages in a spatial perspective.

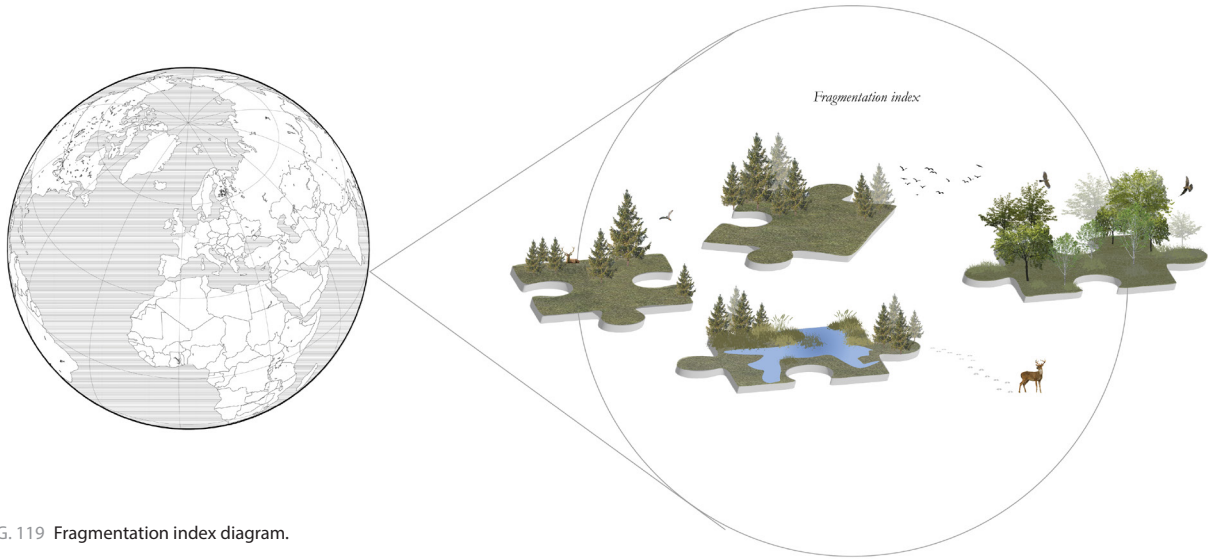


FIG. 119 Fragmentation index diagram.

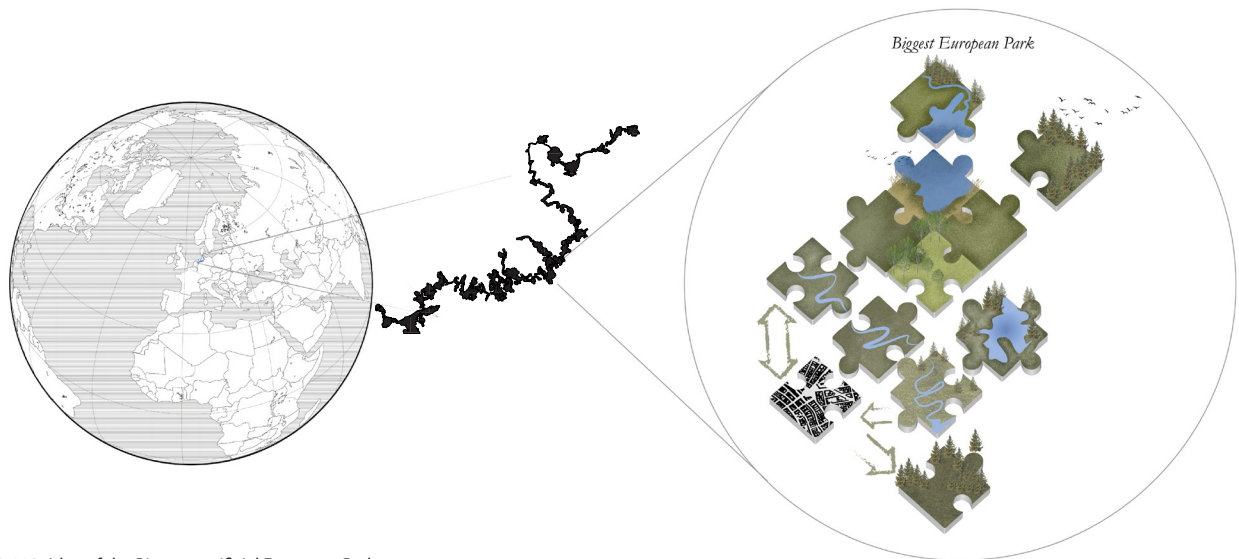


FIG. 118 Idea of the Biggest artificial European Park.

## Landscape Fragmentation and urgent need for REWILDING

The central challenge addressed in this work revolves around the pressing issue of diminishing animal and plant biodiversity. Within the context of this complex problem, my focus in the thesis was specifically directed towards a critical aspect: landscape fragmentation. Over centuries, human activities, construction, and infrastructure have gradually broken down once cohesive landscapes into progressively smaller units, resembling fragmented puzzle pieces (depicted on this page as landscape puzzles).

This fragmentation poses significant obstacles to the movement, migration, and genet-

ic exchange among various animal groups, particularly those lacking wings or extensive limbs, hindering their ability to navigate their natural environments.

The theoretical portion of the thesis delved into a comprehensive understanding of landscape fragmentation and its diverse types. Subsequently, through exploration, design, and study, the goal was to identify solutions that could propose coherent and continuous landscape units. The essence of the entire project revolves around the vision of connecting and revitalizing permeable structures, fostering an environment where all animal

species, including humans, can flourish. This concept is elucidated in the second diagram, which also includes the proposed design of a park in northwestern Europe.

The chosen region for the project, namely this part of Europe, was selected due to its dense urban and road infrastructure, coupled with one of the most densely populated agricultural landscapes. These areas, primarily utilized as monocultures, possess formidable export strengths, with the Netherlands being a prominent example. For a more detailed overview, the thesis project is available on the university's website.

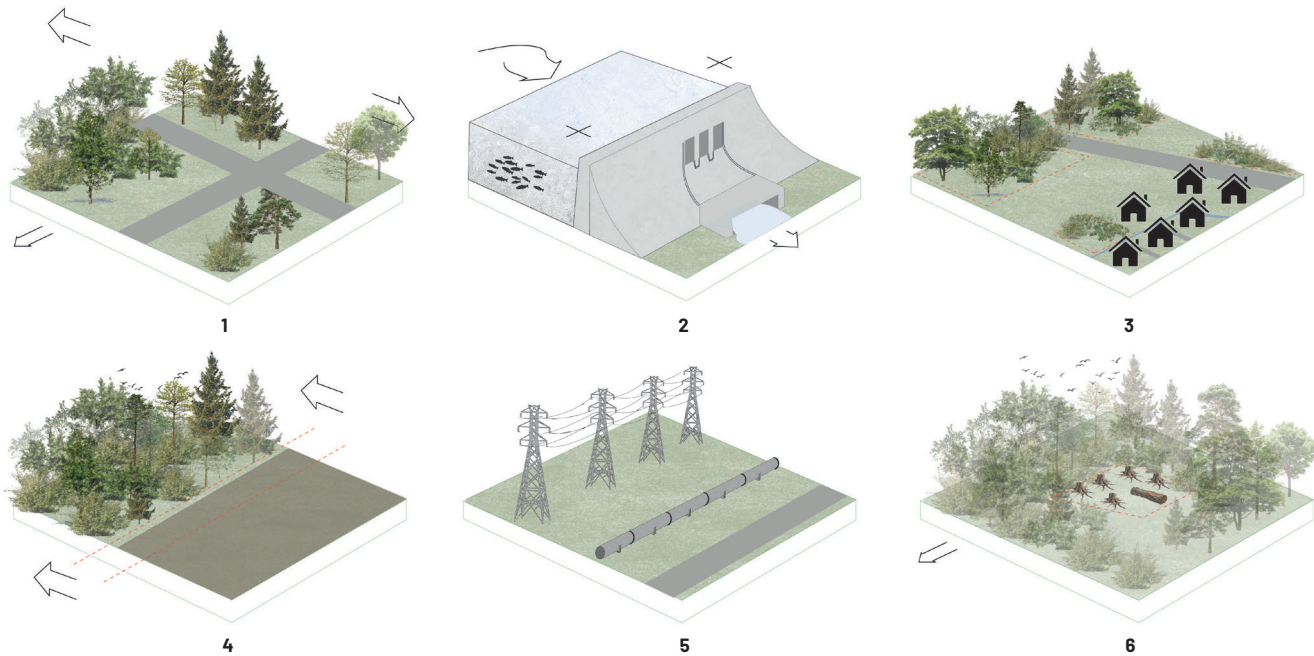


FIG. 121 Diagram identifying six fundamental types of landscape fragmentation.

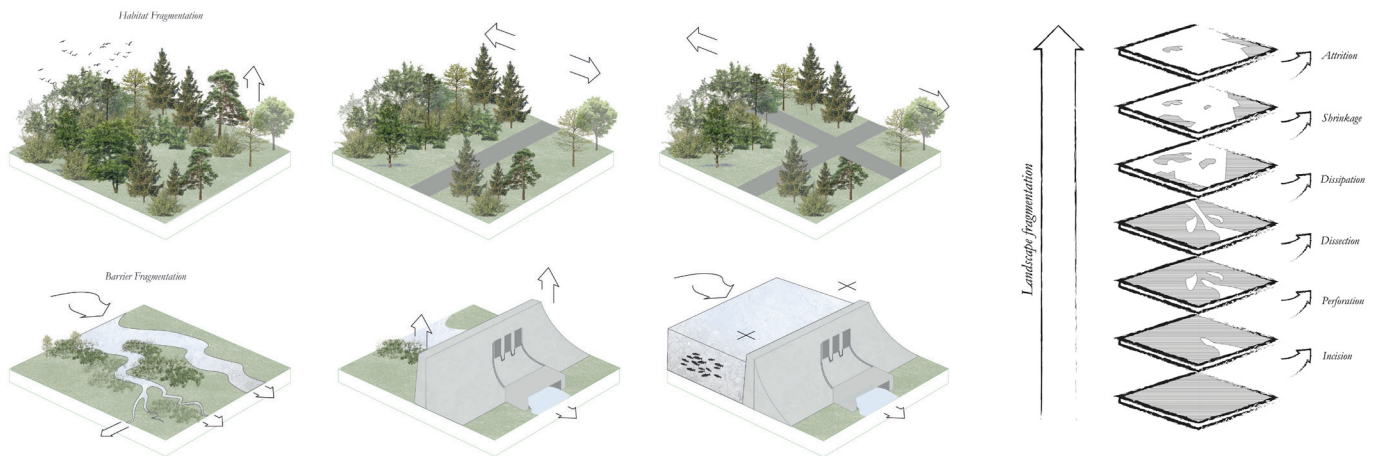


FIG. 120 Diagram illustrating the principles of the formation of certain types of fragmentation.

Various types of fragmentation have been identified through my analysis of northwest Europe, each presenting unique challenges and implications. These are: Habitat Fragmentation (1), Barrier Fragmentation (2), Patch Fragmentation (3), Edge Fragmentation/Edge Effect (4), Linear Fragmentation (5), Perforation Fragmentation (6).

Within this spatial research, I also endeavored to identify and describe the specific processes leading to these fragmentations. This was primarily done to enable us to propose measures in new situations that

prevent definitive division. In terms of design principles, R.T. Forman has explored numerous possibilities with his design principles for designers.

In conclusion, it can be said that there are various options that allow permeability through already divided landscapes. However, the most crucial aspect is to eliminate fragmentation altogether or propose bold solutions, such as new forms of national parks. These parks aim to inspire and mimic original landscapes to restore migration corridors for large mammals down to small vertebrates or amphibians.

At this moment, we are returning to the roots of landscape architecture and the work of Frederick Law Olmsted, who, even in his time, warned against destructive practices towards the environment.

It is evident that there is no other option but to start designing radical and even megalomaniacal landscape projects that uniquely respond to the destruction and speed of today's environmental degradation—without which, we would not be here.

**Design scale XL-M**

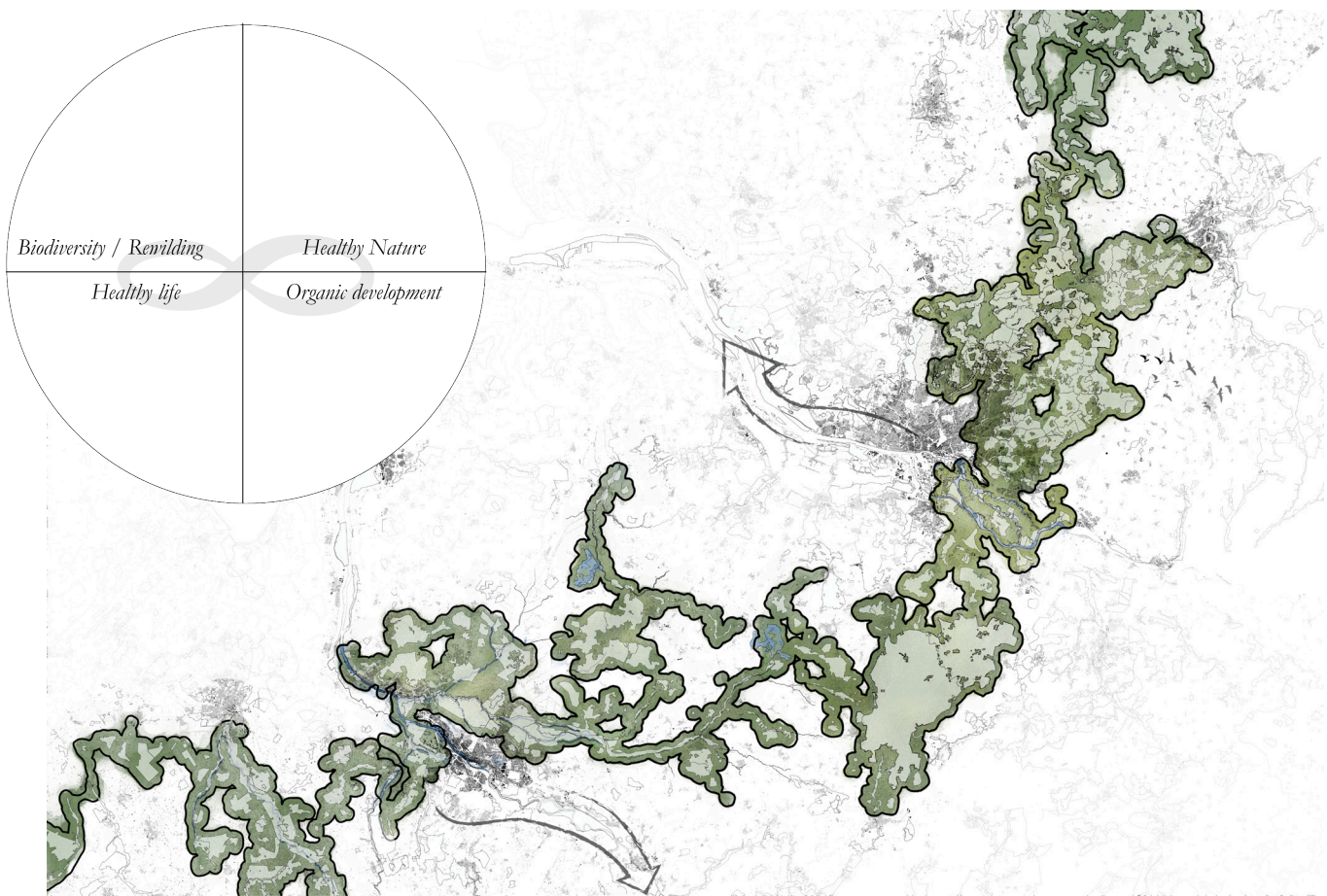


FIG. 123 Landscape Structure with 1km buffer applied - Bremen and Hamburg (light green areas represent national parks, protected landscape areas, or Natura 2000).

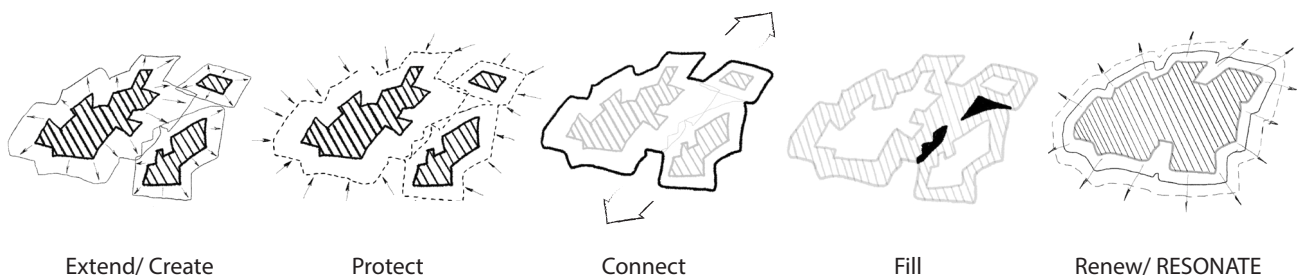


FIG. 124 Broad Principles XL

In the process of analysis, it was necessary to integrate work with systematic design, primarily for practical reasons in order to accommodate varying scales. To initiate the analysis of a specific area, I had to come up with an initial form and a logical path for my future project, Tomorrow's (P)ARK. For the initial sketching, I developed a palette of essential principles: Extend/create, protect, connect, fill, renew/Resonate.

The first step involved mapping the areas falling within the qualification of protected areas, national parks, or Natura 2000. I created a one-kilometer buffer around them, forming a somewhat intricate and continuous zone. At this point, we can refer to the abstract map at the top of the page, which was essentially the first tangible structure describing the specific locations where the park permeates.

My intention was not to zone but to integrate villages, towns, and certain parts of infrastructure, especially railway lines, into the structure. In places where there was no connection, these elements supplemented the zone. At this moment in the research, a circular diagram was also created to describe how this step towards a new non-invasive environment aligns with a healthy life and organic development.

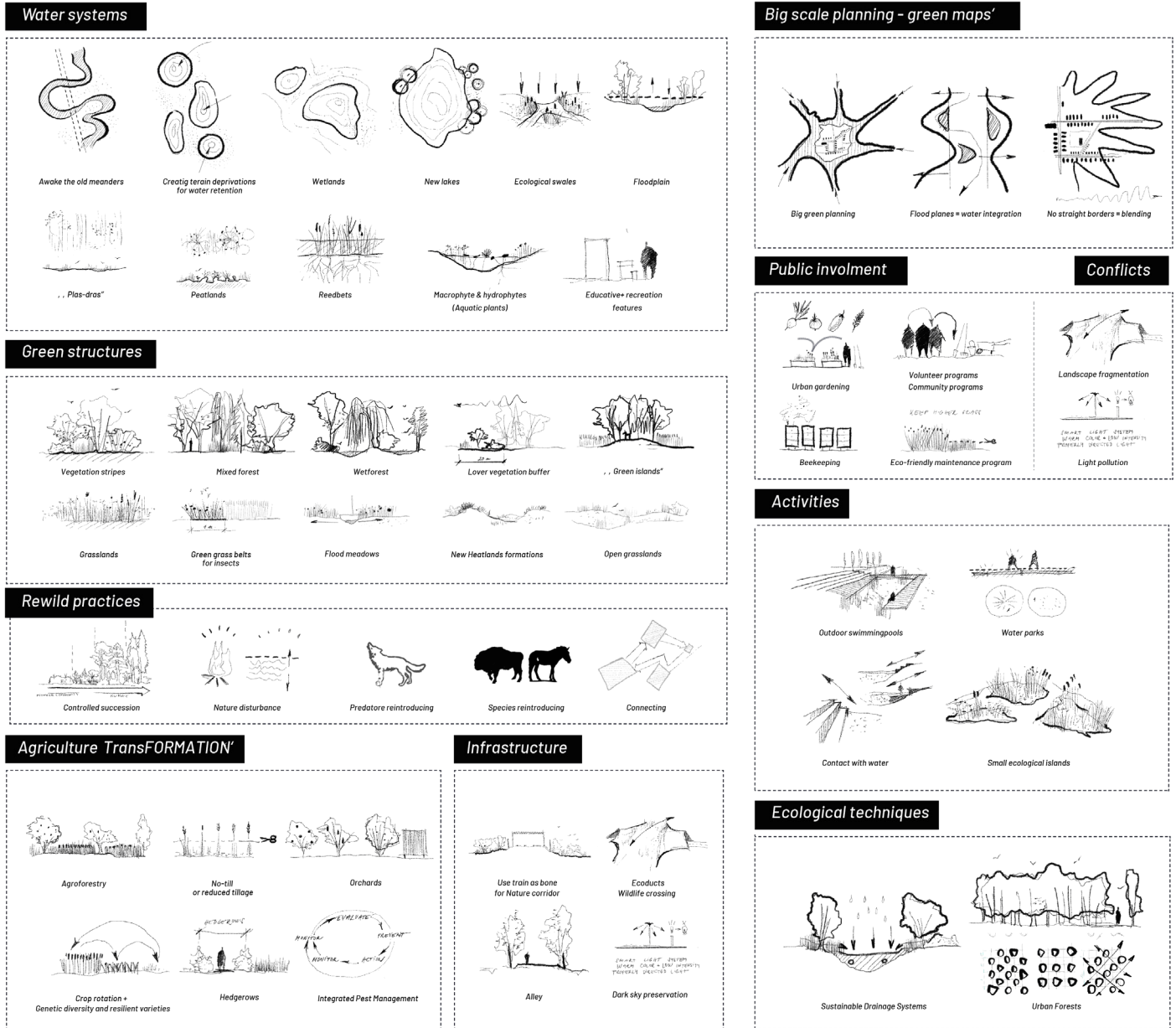


FIG. 125 Design Principles M-S (Urban x Extra Urban).

## Design principles M-S

For medium and small scale, a toolbox of solutions has been created that address four themes related to the fragmented landscape and aim to mitigate this spatial phenomenon in Extra- Urban and Urban Landscapes. These four sectors are the water system, green structures, agriculture transformation, and infrastructure.

Each intervention aims to strengthen or create new ecotopes that provide shelter and expand habitat for a variety of animal and plant species. Together, they will create a robust mosaic of cultural landscape, which has the potential to survive and adapt to an uncertain future associated with climate change, social pressures, and similar challenges.

The final aim of this range is to provide these guidelines to individuals, local communities, and other communities to achieve the targets of a resilient landscape. These guidelines encompass both small and large interventions that each of us can undertake.

FIG. 126 One Flew over the Lower Saxony (graphic made by author, base map Google Earth - 2023).

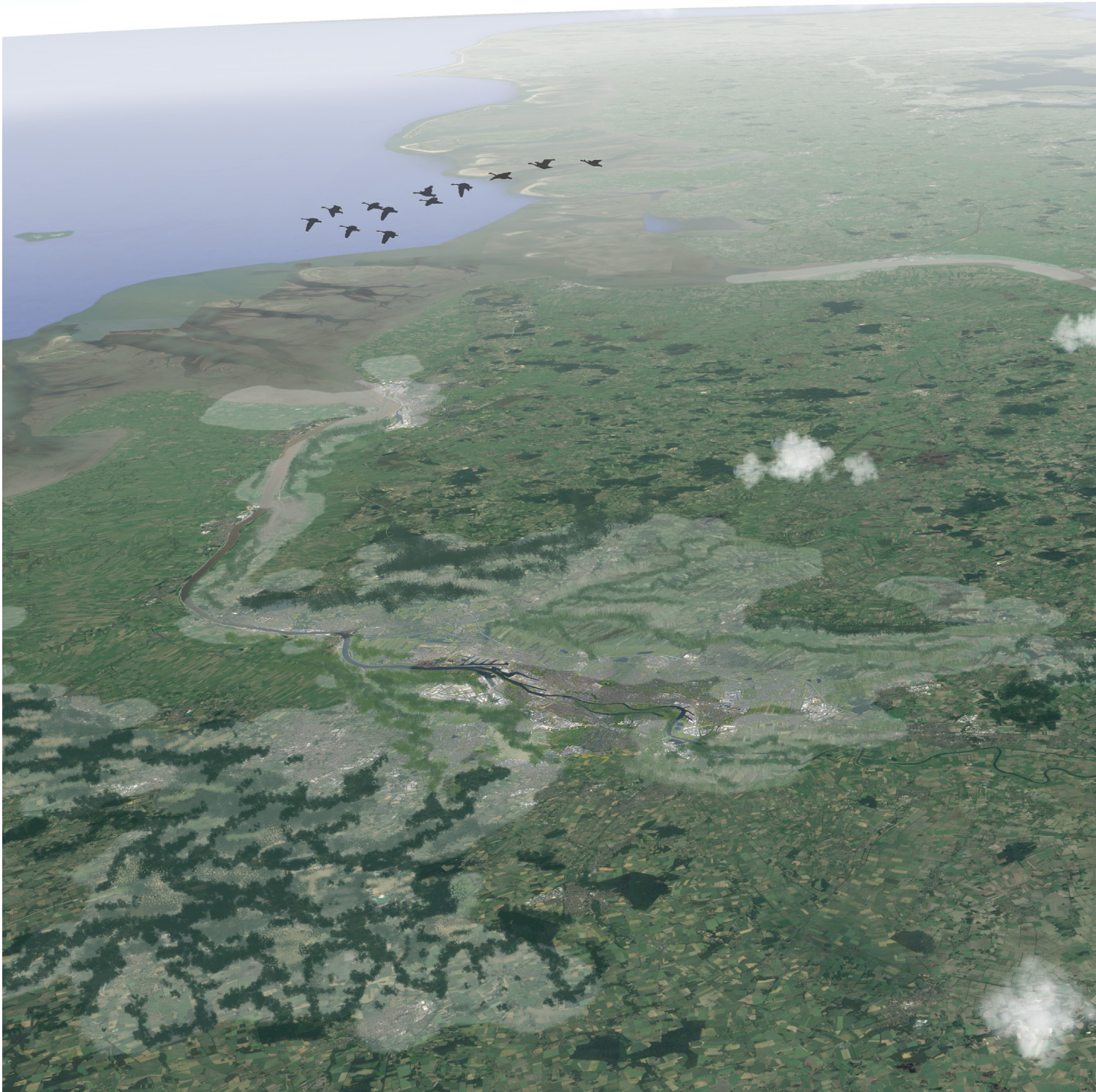






FIG. 127 Main walking path diagram from Amsterdam to Copenhagen.

### **From Amsterdam to Copenhagen**

One integral aspect of the project involves the proposal for an extensive hiking trail that spans the entire territory, connecting Amsterdam, Hamburg, and Copenhagen through the unique concept of walking. This trail, measuring just under 1700 km, is designed to be completed in approximately 420 hours or, translated into daily performance, can be walked in two months. Considering an average daily walking time of 5-6 hours at a pace of approximately 4 km per hour, individuals can cover about 25 kilometers per day, and the trail features minimal elevation gain. The trail is thoughtfully integrated with a network of campsites and natural accommodations, strategically spaced every 10 kilometers along the hiking section. This setup enables hikers to plan their schedule comfortably, ensuring easy access to water, food, safe fire usage areas, and showers at regular intervals. Local rangers will oversee each hiking segment, maintaining knowledge of the current number of participants, and can intervene in case of difficulties or issues, including repairs to roads, bridges, or campsites. In Germany, official designation of natural accommodations as campsites is proposed to comply with existing legislation.

The decision to incorporate walking into this project stems from a profound recognition of the importance of a healthy connection to nature in human existence on our planet. Embracing the historical tradition of pilgrimages, the project encourages people to embark on this journey not for religious reasons but to rediscover the intrinsic beauty and significance of nature, recognizing it as an indispensable element for our existence.

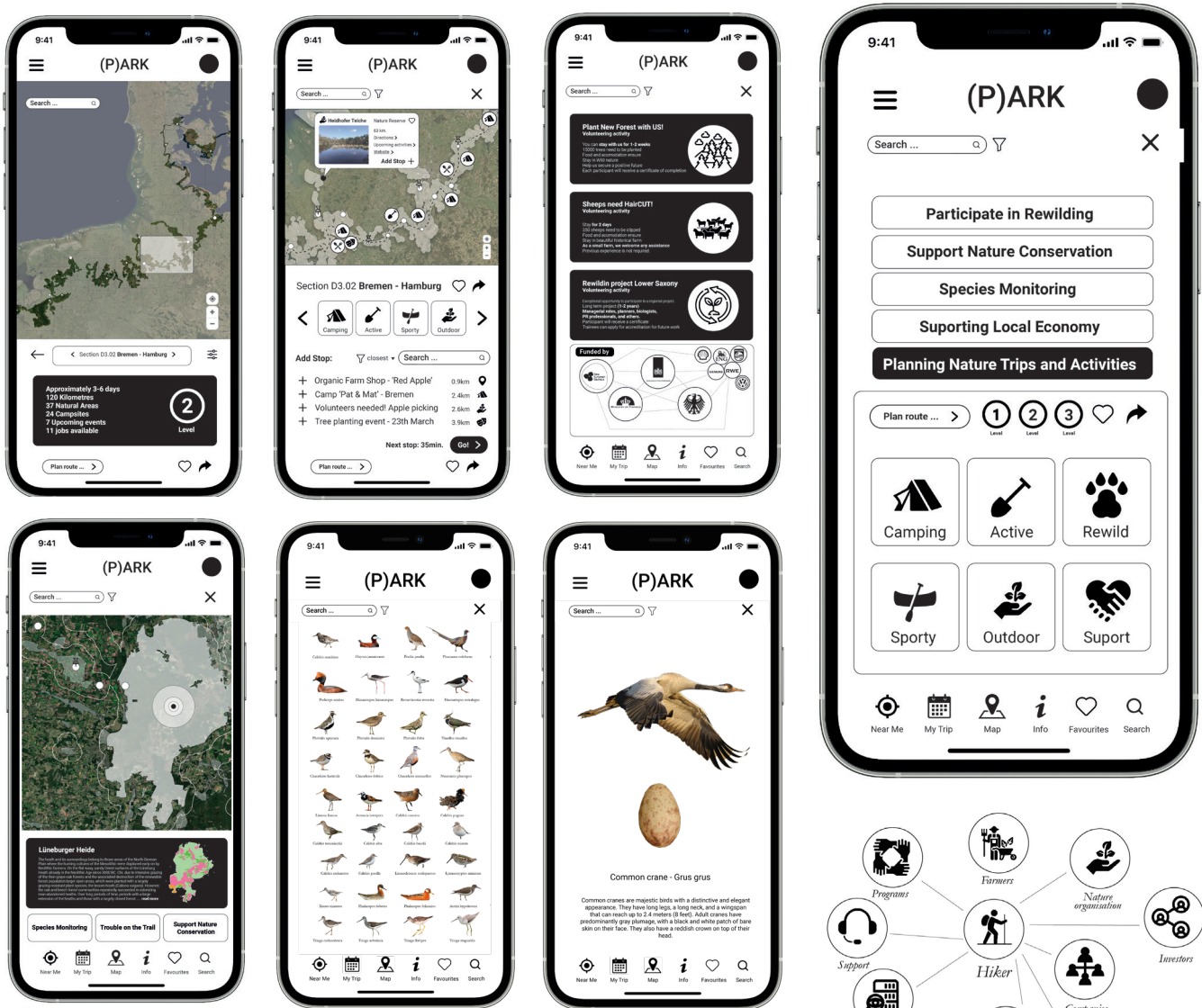


FIG. 128 Visual language of the (P)Ark App.

## **(P)ARK App User Interface**

(P)ARK's upcoming mobile app is a pivotal addition, set to provide a secure platform for organizing volunteering, fostering collaborations, and sharing vital campsite information. It aims to be accessible to every visitor, emphasizing inclusivity among hikers and private landowners. At its core, the application aspires to create a unified digital space that transcends geographical and administrative boundaries, aligning diverse stakeholders, goals, and ideas. Through this platform, (P)ARK aims to encourage effective communication and connection, emphasizing key initiatives like Rewilding, Nature Conservation, and species monitoring.

Beyond its navigational role, the app is a comprehensive resource aiding practical trip planning, offering advice for novice hikers, and providing educational insights into local flora and fauna. It seamlessly integrates utility with cultural and educational dimensions, enriching the (P)ARK experience. Users can plan journeys, report environmental findings, and contribute to campsite maintenance or other affiliated causes, fostering a holistic engagement within the (P)ARK community.

FIG. 129 Design location - Schneverdingen , artist impression of the site by Autor 2023.





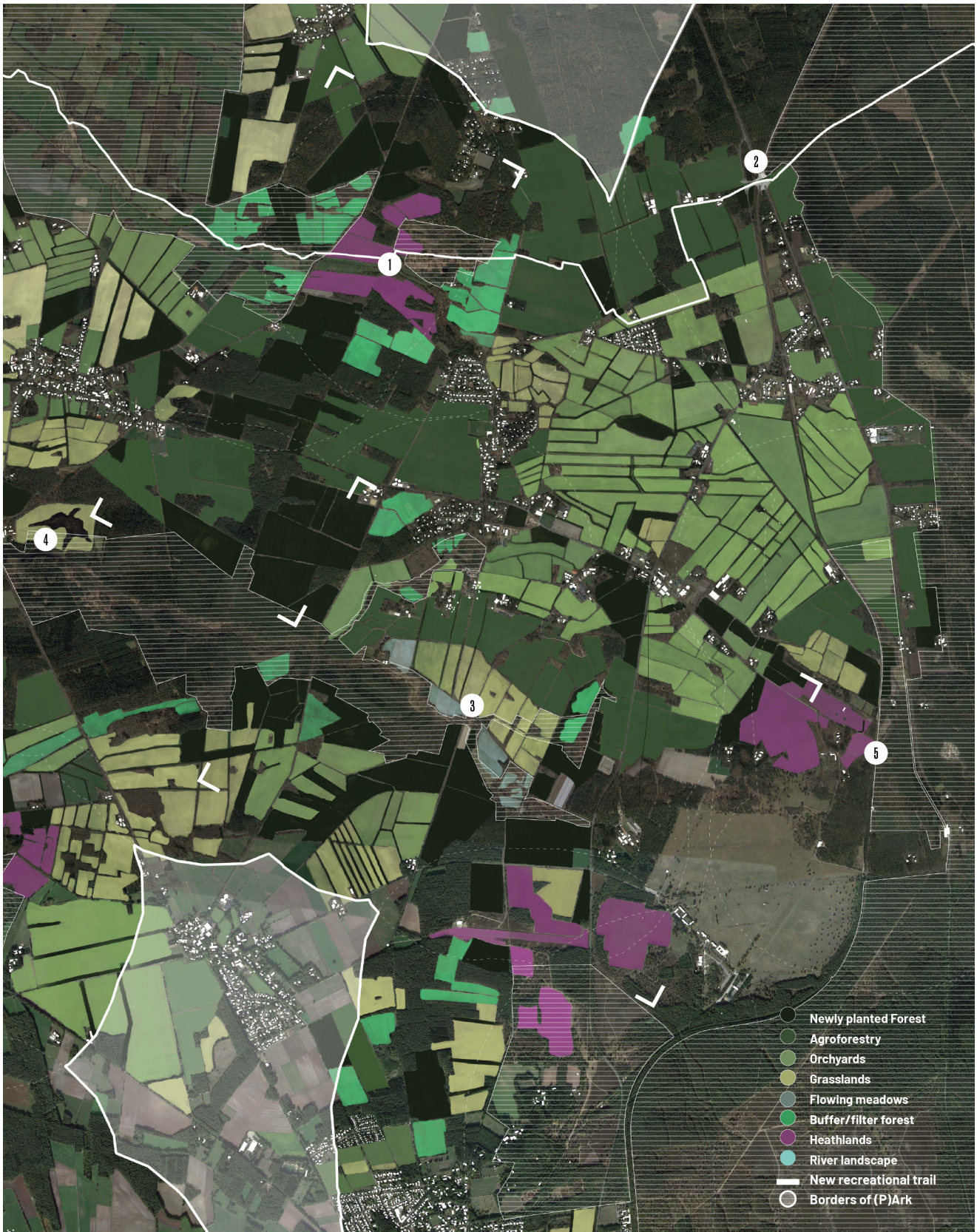
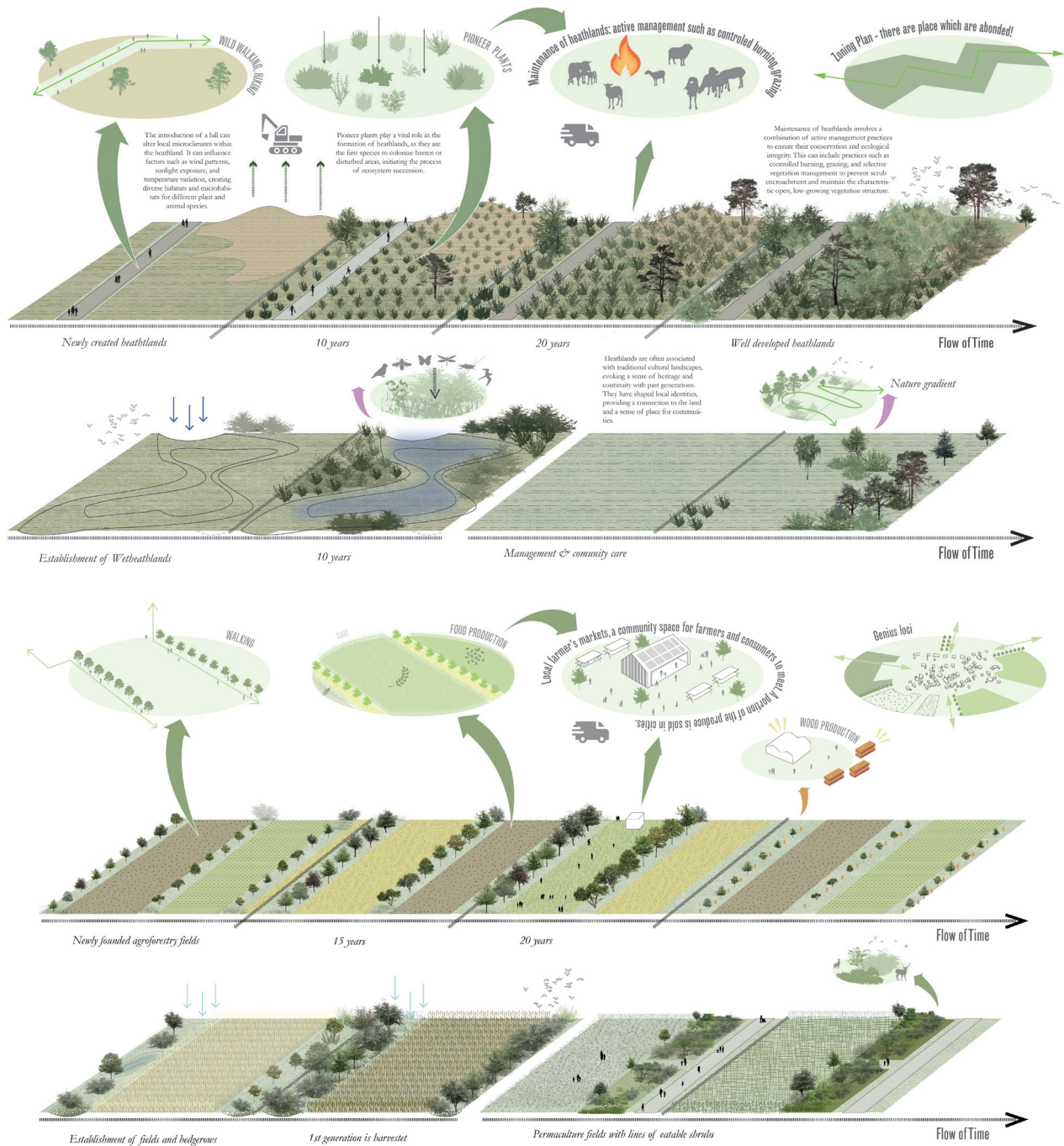


FIG. 130 Design location - Schneverdingen, main ground plan.



## A rich landscape mosaic

As the territory for the detailed design, I chose the agricultural landscape, which constitutes more than 65% of the Northwestern European territory. I wanted to select the most problematic aspect of today's cultural environment and transform it into a form that would be species non-invasive and, on the contrary, allow and offer different environments that are attractive to species. Thus, an environment full of well-designed forests was

created, which can also be used for circular economy, landscape-inclusive agriculture in the form of agroforestry, orchards, mixed pastures, and aquatic environments suitable for European species of endangered orchids.

Apart from spaces designated for use, the existing areas of heathlands were newly defined and expanded, which naturally occurred in these territories. Due to global changes

and, above all, acid rain, these ecotopes are slowly disappearing because grass species are starting to dominate over heathers. Therefore, in this case as well, people take the initiative, and through controlled sheep grazing and partial grass burning, they contribute to the preservation of this important ecotope. Every environment designed in this test demonstrates that it can be economically advantageous and leads to a sustainable model for the future.



FIG. 131 Farmland conversion to Orchards.

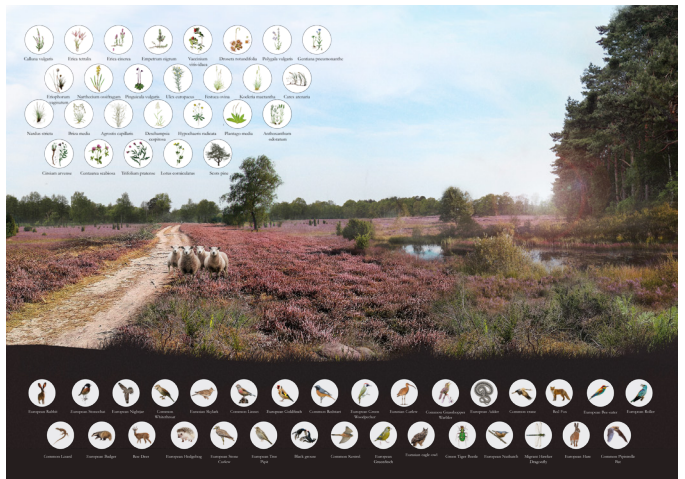


FIG. 132 Heathland transformation/restoration.



FIG. 133 Agriculture transformation; towards Regenerative Agriculture.

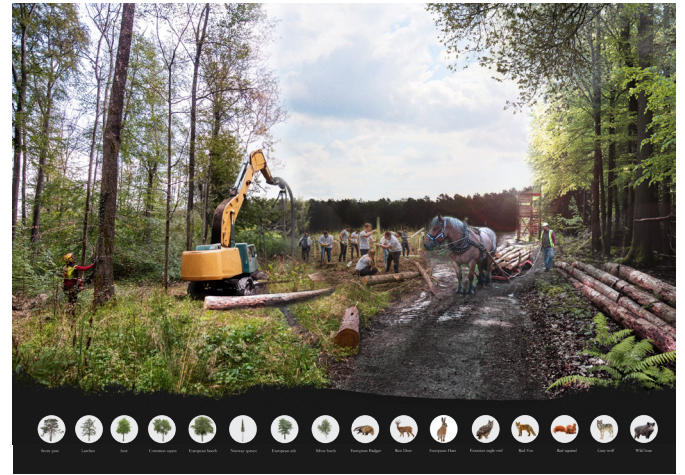


FIG. 134 Restoration of the Wumme River, Sustainable forestry and tree diversification, and Agricultural Typologies.

**A rich landscape mosaic (before x after)**

As highlighted earlier, significant changes are underway, particularly in the monocultural agricultural sector. Visually, I aimed to depict how these principles and technologies could reshape the current landscape. The envisioned transformation not only makes economic sense but also enhances visual appeal, making it more user-friendly for local communities. This includes the potential for cultural huts, beehives, and the simplicity of fruit harvesting from agroforestry fields.

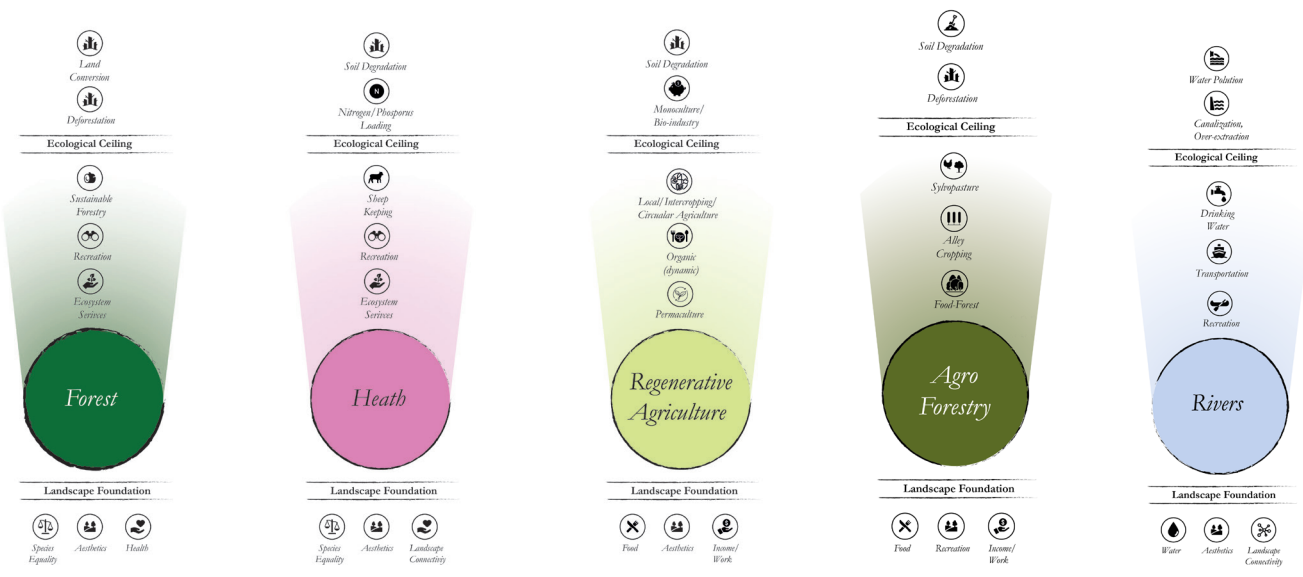
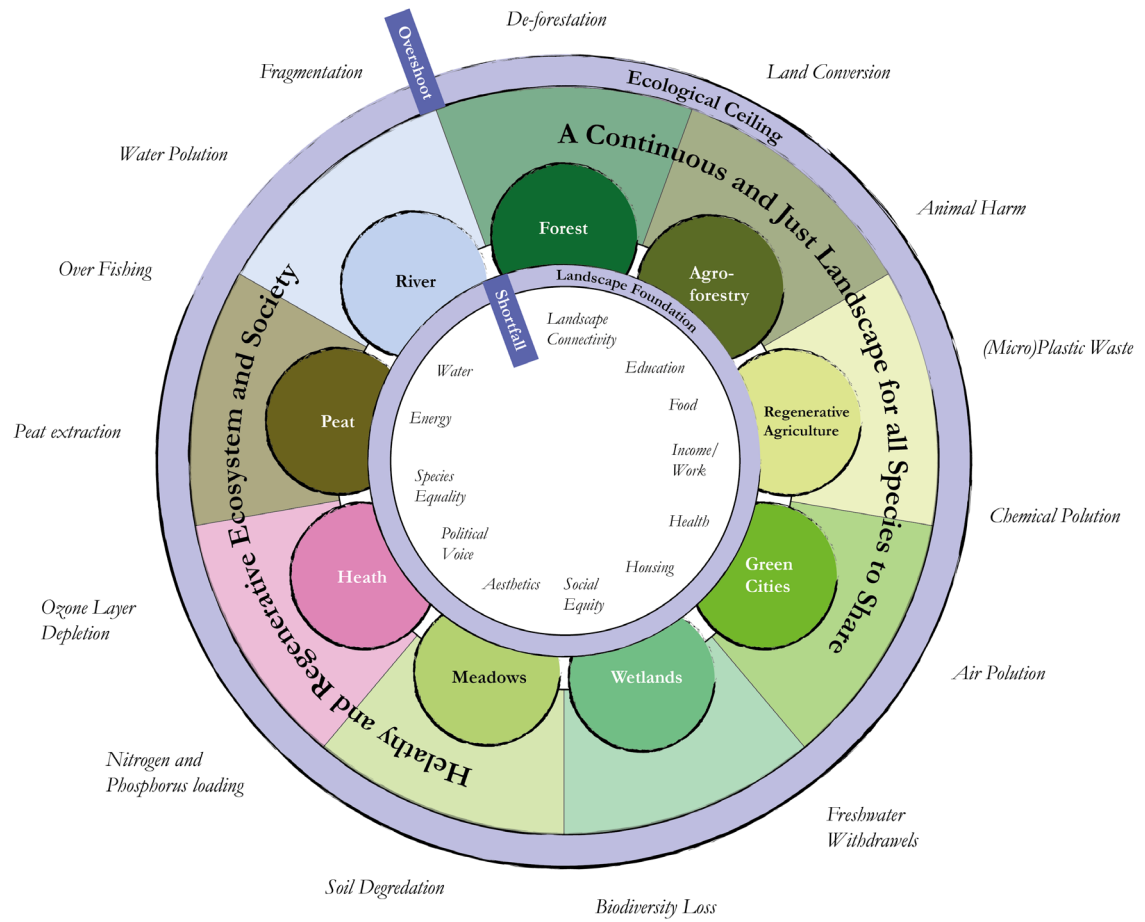


FIG. 135 Landscape Architecture Doughnut Analysis (by Author, 2023;adapted from Raworth, 2017).

## Landscape Architecture in Doughnut

Kate Raworth's Doughnut Economics theory, embraced by cities like Amsterdam, Copenhagen, and Brussels, extends seamlessly into landscape architecture. The theory introduces the concepts of a social foundation and an ecological ceiling—crucial to the landscape profession. Aligning the global economy within these boundaries mirrors the (P)ARK project's aim: a continuous and equitable landscape network.

Implementing this theory involves tailoring the doughnut model to specific landscape types. Delineating boundaries for each type outlines a progression from regenerative to degenerative practices until the ecological ceiling is approached. An exploration of the environmental impact unveils challenges, underscoring the urgency for balanced interventions.

The landscape architect's role is guiding practices into the doughnut, using it as a critical analytical tool. Identifying stakeholders and policymakers becomes paramount, fostering accountability for actions. Strategies for transitioning to sustainable states can manifest bottom-up through local initiatives or top-down through legislation.

The challenge lies in quantifying criteria, recognizing irreversible losses, and guarding against ontological flattening. With typologies as a foundation, visualizing a future landscape aligning with ecological and social justice becomes plausible. A landscape interconnected and productive, yet respectful of nature's limits, emerges as a tangible vision. The ability of landscape architects to illustrate this future becomes a potent tool in advocating for Earth's limits.

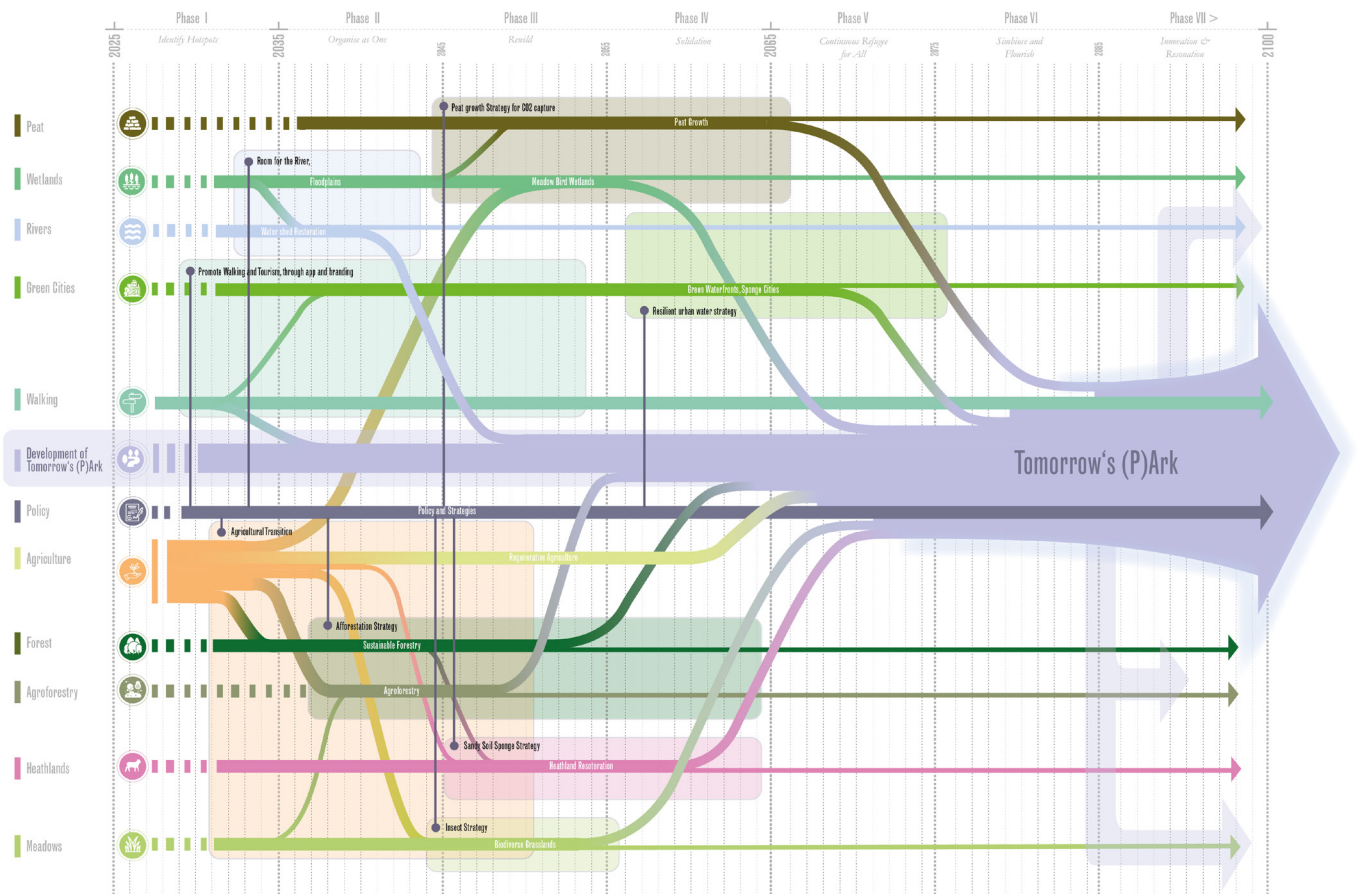


FIG. 136 Phasing scheme and time schedule prognosis.

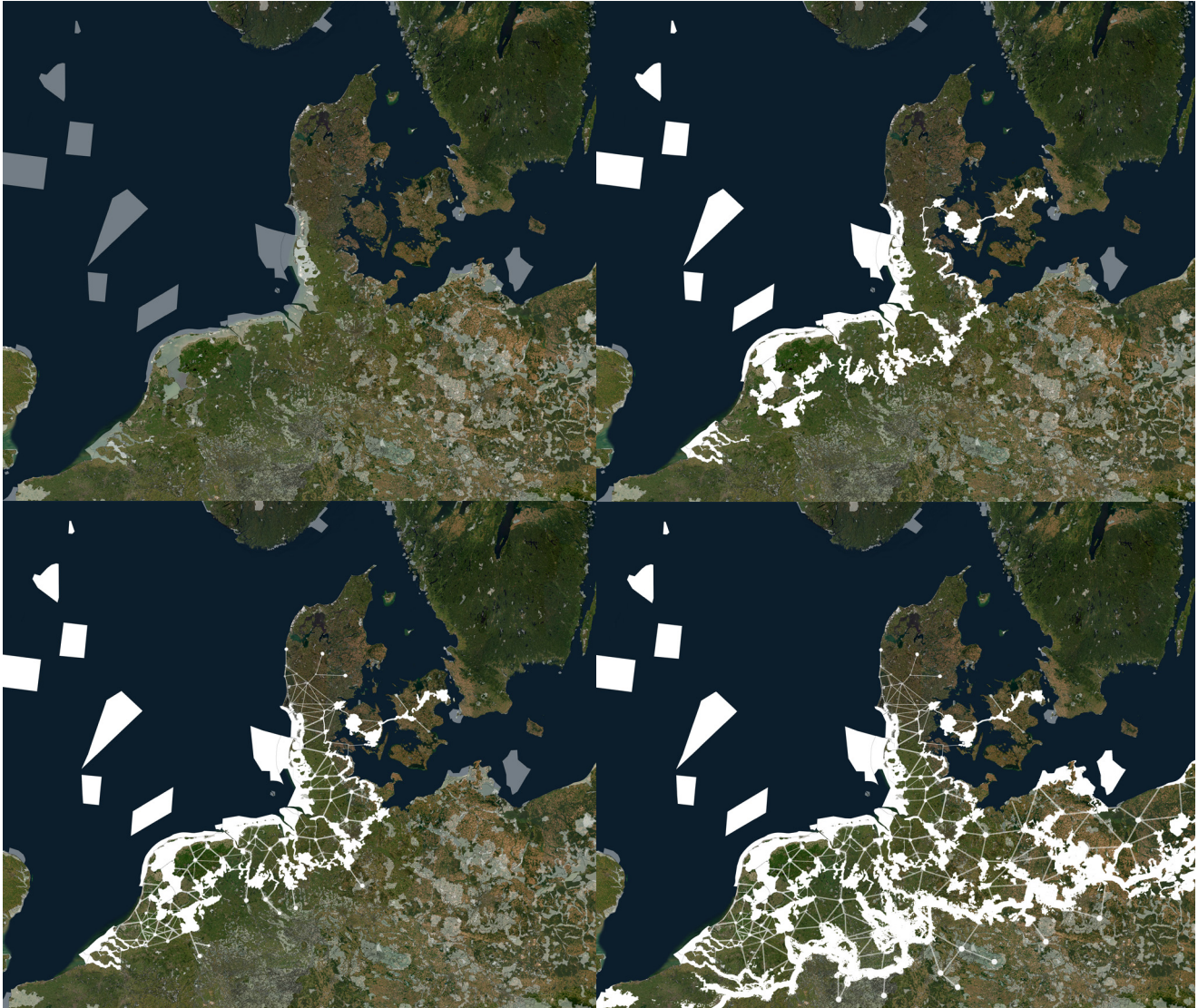


FIG. 137 An expanding vision for Europe / How far this can go? (by Author, based on Google Earth, 2023).

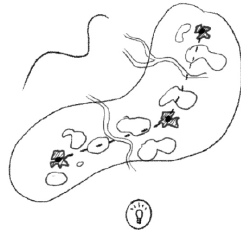
## **Conclusion**

This work encapsulates a protracted exploration into crafting a new blueprint for a national park, spurred by an intrinsic fascination with landscapes, their intricate perception, and the dynamics of natural systems. The central inquiry revolves around the role of landscape architects in pioneering novel forms of national parks and nature conservation. The interdisciplinary essence of the study emphasizes the necessity of engaging various disciplines in a comprehensive planning process, especially during times of environmental and social crises. Drawing inspiration from the contributions of Frederick Law Olmsted to national park creation, the study advocates for the integration of national park design into landscape architecture studies. Notably, the proposed Tomorrow's (P)ARK project is positioned as a reflective amalgamation of historical landscapes and a forward-thinking initiative, addressing both traditional and contemporary challenges. Simultaneously, the project responds to urgent global issues, offering a visionary approach to biodiversity, climate change, and the creation of resilient landscapes.



*Identify Hotspots*

forget about fragmentation,  
solve imaginary boundaries



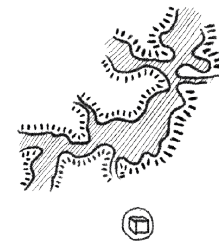
*Organise as one*

Imagine the biggest continuous  
park, linked by trails



*Rewild*

Strengthening natural areas,  
rewilding



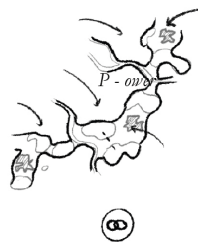
*Solidation*

A strengthened and resilient  
structure of cultural landscape

Now

2040

2065



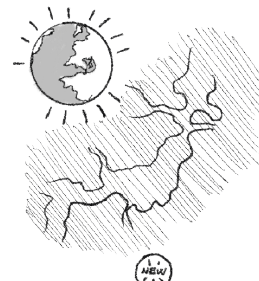
*Continuous Refuge for All*

carbon sink, climate buffer,  
biodiversity hotspot



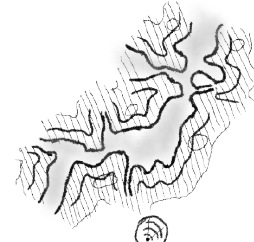
*Symbiose & Flourish*

co-living with nature, go to the  
symbiocene



*INNOVATION*

breeding ground for all species and  
innovation



*resoNATION*

New culture of nature conservation,  
fully protected planet

2080

2100

2120

???

ARK

(P)ARK

= Designing the biggest continuous Nature and Landscape Network of North-West Europe.

The design proposal for Tomorrow's (P)ARK emerges as a visionary endeavor encompassing ecological, social, and cultural dimensions, showcasing a commitment to sustainability and biodiversity. A critical evaluation underscores the importance of flexibility in defining park boundaries and the exploration of alternative shapes. The research-through-design methodology signifies a commitment to pushing traditional landscape architecture practices, merging site visits, and firsthand observations to deepen contextual understanding. The narrative delves into complex ethical considerations, addressing issues such as the inherent value of nature, integration of cities into the landscape, and ethical implications of land use. The text advocates for transparent and collaborative approaches, aligning human and natural elements harmoniously. Acknowledging potential limitations, the narrative concludes with recommendations emphasizing international collaboration, multidisciplinary teamwork, transparency in cost calculations, and fostering partnerships with organizations focused on rewilding policy. The personal reflections encapsulate transformative insights, emphasizing the importance of collaboration, interdisciplinary teamwork, and a sense of responsibility for designing a sustainable future.



FIG. 138 The Pearl River Delta Landscape: Mountain, Floodplain, Estuary

# EcoCharge

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## Towards the Resilient Design Framework for Freshwater Managed Recharge in the Pearl River Delta

Jiaqi Qiu

Supervisors

Steffen Nijhuis, Landscape Architecture

Martine Rutten, Water Management

### Introduction

In southern China, the Pearl River Delta relies on abundant water sources as the second largest river in the country. The wet season from April to September offers opportunities for freshwater conservation. However, rapid urban expansion has turned the delta into the world's largest urban region, causing water scarcity in six cities with less than 700 cubic meters of freshwater per capita, well below the global standard.

Current water management prioritizes defense over optimization, leading to significant wastage of freshwater. To address this, a resilience design framework based on the landscape as a system is needed. This approach can store water during wet seasons and release it in droughts or salt intrusion, promoting sustainable ecosystems and urban growth.

The water supply accounts for only **2%** of the total rainfall

But result permanent acquisition of **1733.33 ha** of land

supply magnitude comparison

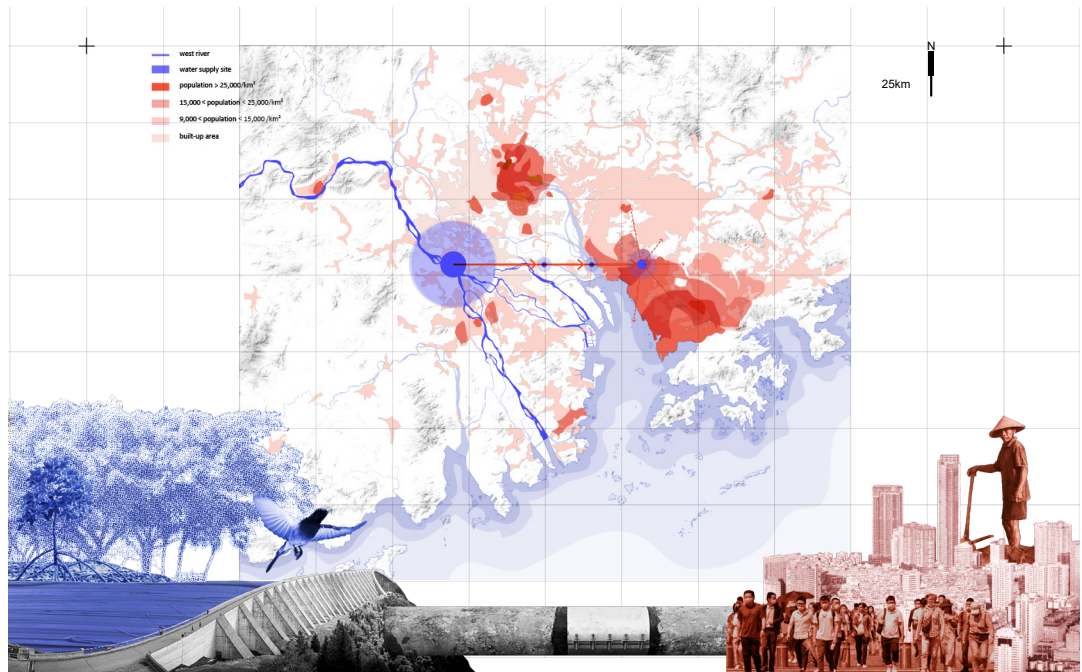


FIG. 139 Existing Solution for Freshwater Supply: Centralized Freshwater Supply

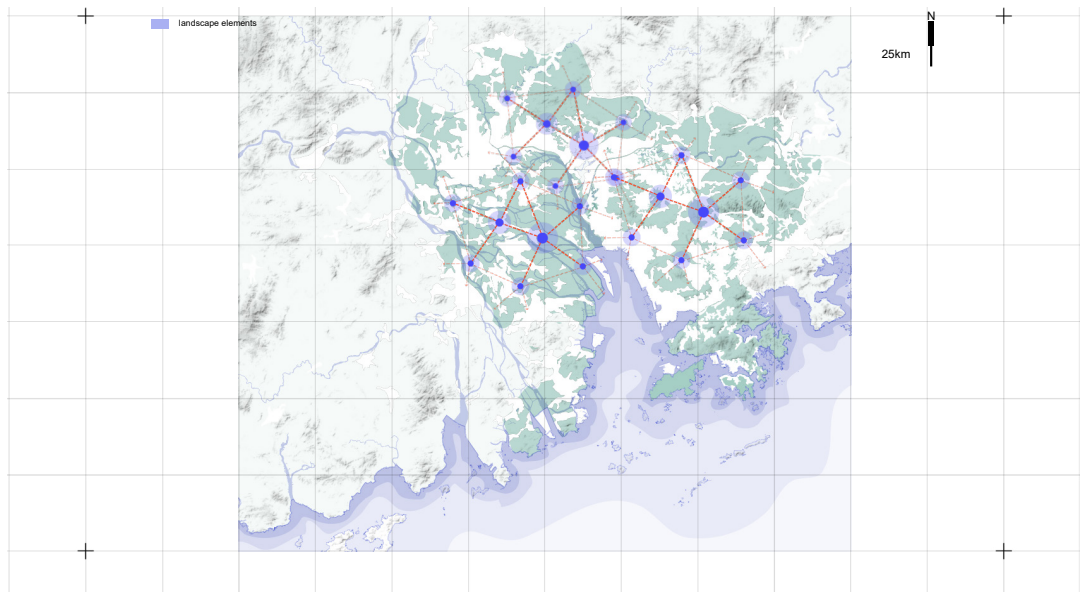
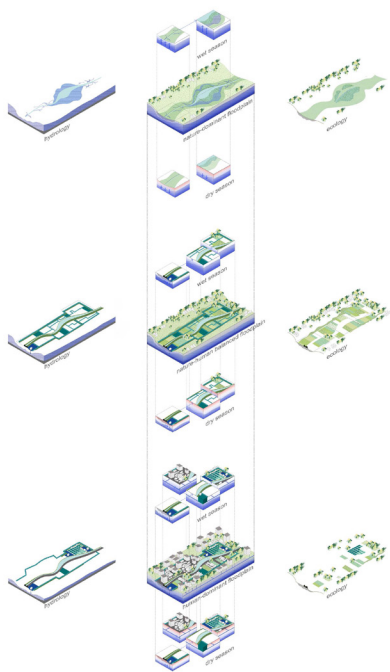


FIG. 140 Alternative Solution for Freshwater Supply

### **Problem Statement & Research Objective**

-The infrastructures function in a single-goal-oriented way:  
To address this, the government's proposal entails a 113-kilometer-long freshwater supply project in the Pearl River Delta, which only accounts for 2% of total



precipitation, not addressing the root water scarcity causes. It reduces runoff, disrupting the natural hydrological cycle, and increasing the risk of winter drought events.

-The existing water flow does not operate in the holistic system:  
 Insufficient understanding of the holistic hydrological system hinders implementing landscape-based design principles for freshwater managed recharge. Freshwater interact with various physical spaces, including the atmosphere, ground surface, soil types, and aquifer layers. Reassessing landscape types based on the hydrological cycle allows for a sustainable and efficient approach to freshwater management.

-The potential of the landscape is ignored:  
 To promote sustainability, restoring the landscape ecosystem and exploring opportunities for freshwater recharge is essential. The PRD region's diverse landscapes offer potential for freshwater conservation and management. Understanding interactions between ecosystems, hydrology, and socio-economic aspects is crucial for optimizing precipitation, runoff, and aquifer recharge supports urban development and ecological preservation. So the research objective is "to identify and explore landscape-based design principles and resilient design framework for water scarcity issues in the Pearl River Delta".

FIG. 141 Landscape Change from BC to 21C

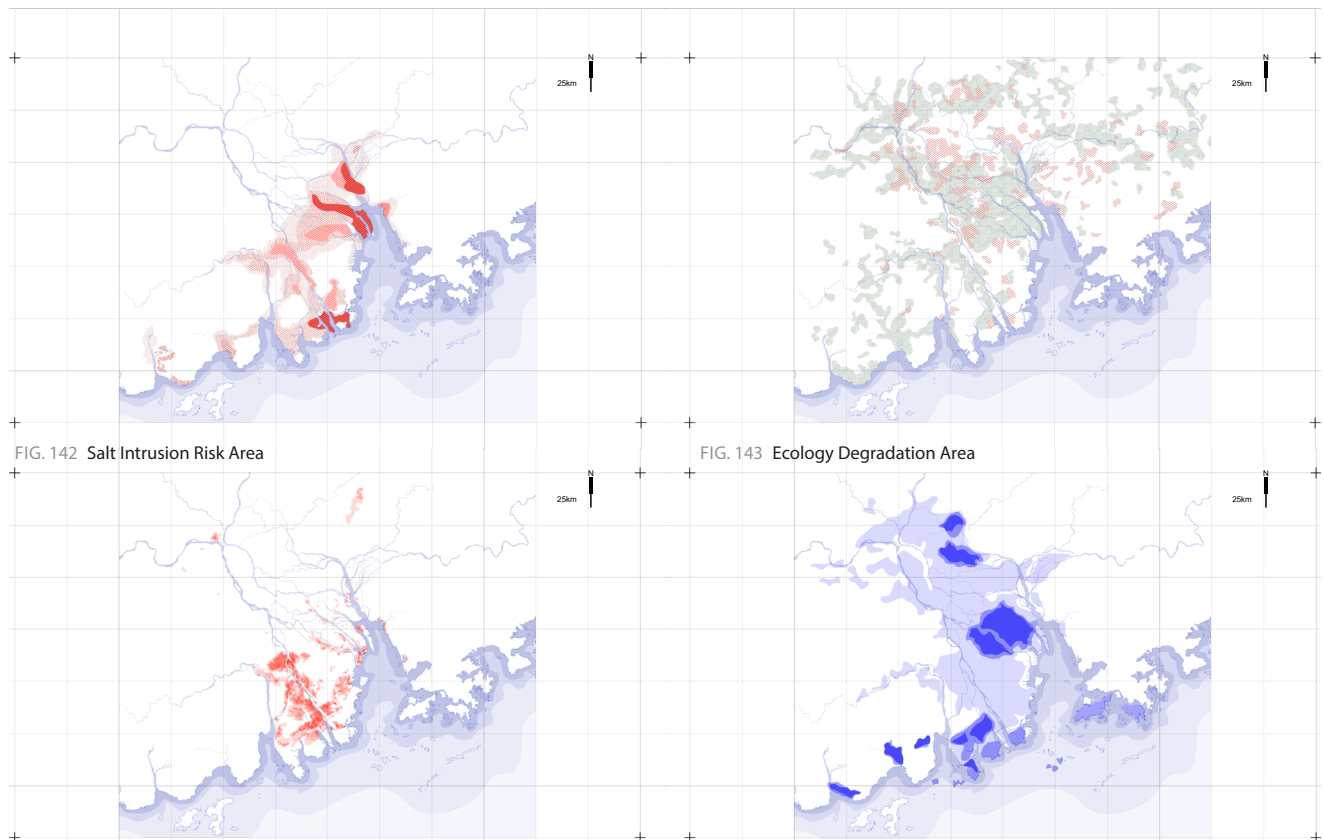


FIG. 142 Salt Intrusion Risk Area

FIG. 143 Ecology Degradation Area

FIG. 144 Soil Subsidence Risk Area

FIG. 145 Storm & Flood Risk Area

## Theory & Methods

-How to understand the landscape context from the perspective of landscape as a system?

Landscape as a system offers a systematic approach to reevaluating the delta contexts based on various landscape types. Additionally, it facilitates understanding through layered analysis, allowing for the examination of multiple hydrological cycle aspects. These steps aid in exploring landscape potential by reconsidering characteristics and interactive processes within the cycle.

Resilience thinking further supports modularizing systems across geographical areas due to the decentralized distribution of mountains, flood plains, and coastal interfaces. In design exploration, resilience thinking guides the application of spatial principles aligned with natural processes for enhanced outcomes.

-What are the potentials of the landscape as a system to develop a resilient landscape framework?

To answer this question, the research examines the relationship between the hydrological cycle and different layers:

1. Hydro-geology: Aquifers as Inter-Annual Water Stocks for Freshwater Managed Recharge

Understanding their distribution and characteristics in the PRD using a landscape systems approach enhances our comprehension of underground water resources and the hydrological cycle. As integral components of the landscape-based water cycle, conserving and recharging aquifers is essential for sustainable water management.

2. Soil: Permeability as a Key Condition of Freshwater Managed Recharge

Mapping soil types helps determine water conservation and recharge approaches, including infiltration, retention, and storage. Soil permeability, the key to freshwater conservation, depends on the ability to allow water to penetrate deep into the ground and be stored in aquifers. Improving soil permeability is vital for ensuring the availability and sustainability of freshwater resources.

3. Ecology: Landscape Type as an Operative Field for Freshwater Managed Recharge

Understanding landscape-hydrological cycle interactions provides a practical framework for landscape-based solutions. Mountains in the east offer infiltration potential, flood plains with water bodies like dikes ponds can be reused, and the 1,500 km coastline presents space for multifunctional mangrove ecosystems. Comprehending the relationship between landscape types and the hydrological cycle's stocks and flux optimizes freshwater replenishment and reduces water loss to evaporation and surface flow.

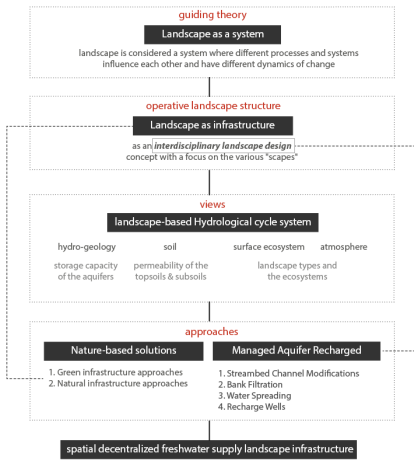


FIG. 146 Theoretical Framework

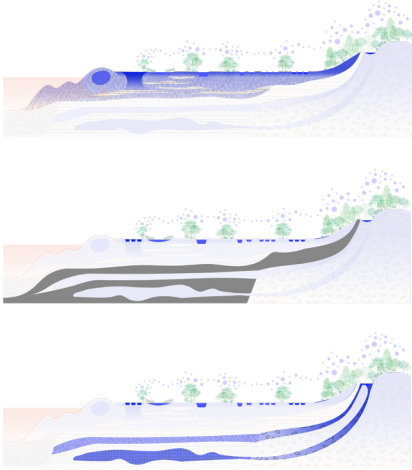


FIG. 147 Hydro-geology Study: Aquifers & Aquitard

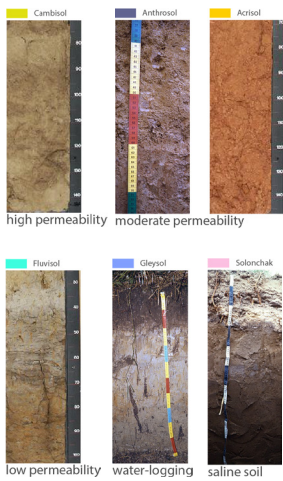


FIG. 149 Soil Type Study

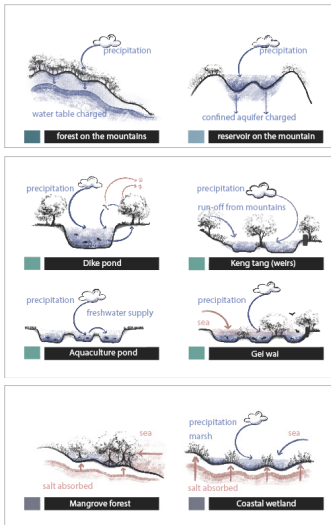


FIG. 151 Landscape Type Study

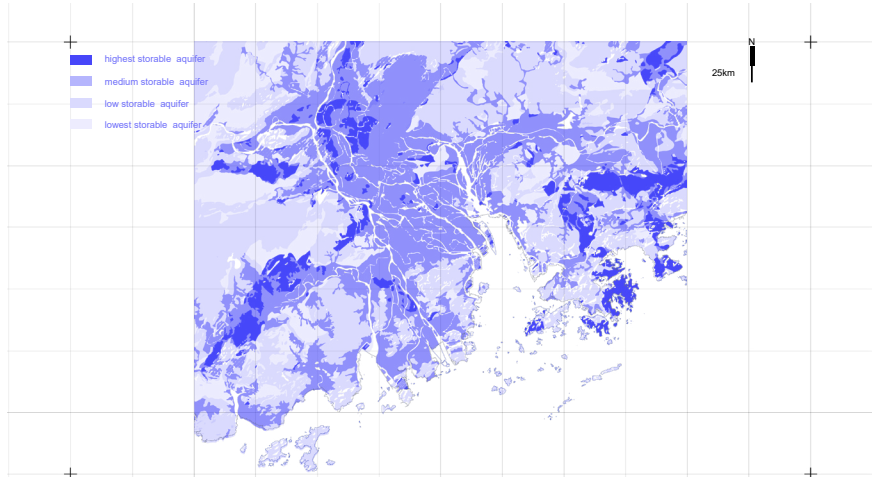


FIG. 148 Potential Map of Aquifer: Groundwater Storage Capacity

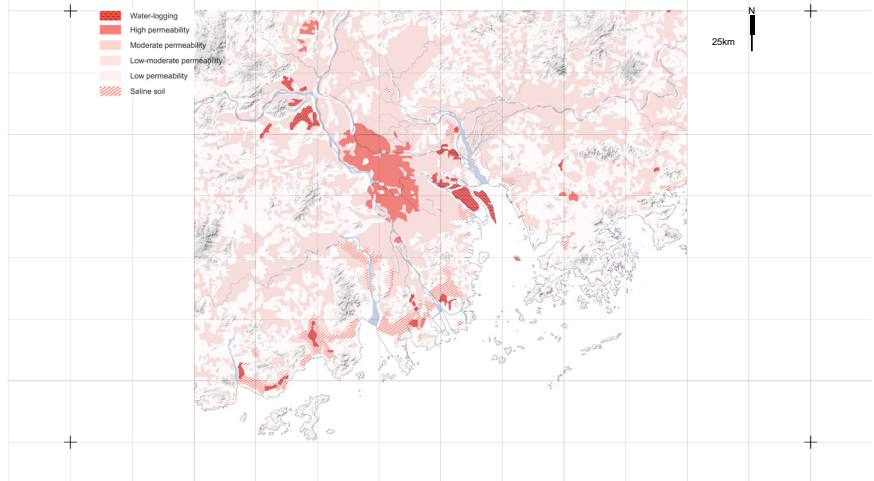


FIG. 150 Potential Map of Topsoil

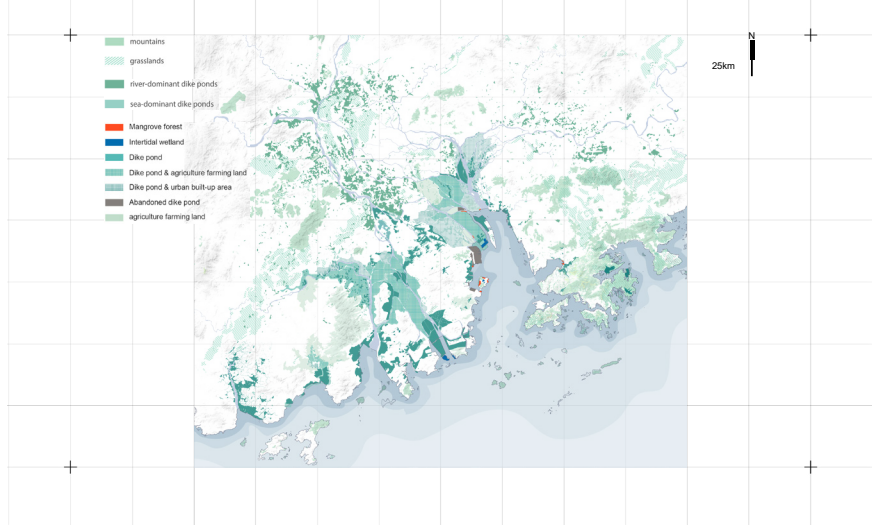


FIG. 152 Potential Map of Landscape Ecosystem

-Proposed Water Flow System

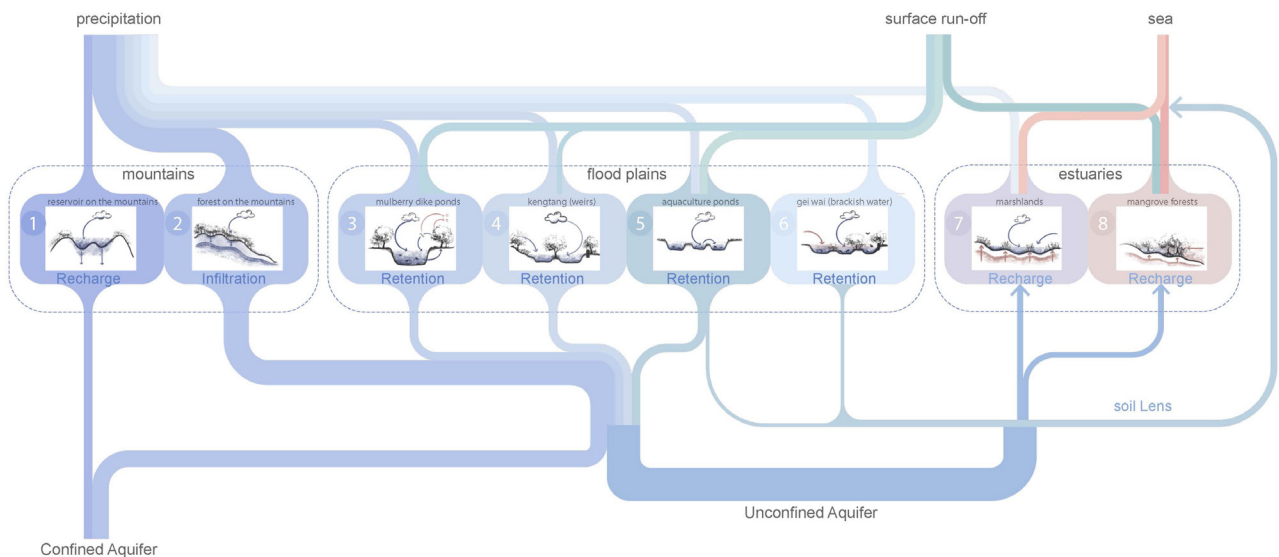
Systematical understanding of the three layers is summarized in the proposed "Water Flow System." This new system offers significant improvements over the existing one:

1. Enhanced Use of Precipitation and Surface Runoff:

The proposed flow chart optimizes the utilization of precipitation and surface runoff, reducing water wastage and directing resources more efficiently.

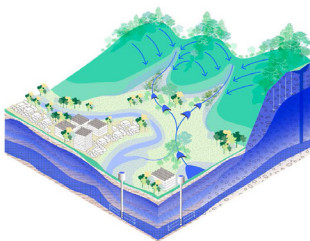
2. Conservation Across Multiple Systems:

By treating the landscape as an operative field and considering interactive processes of precipitation and surface runoff, the proposed water flow system fosters conservation across various interconnected systems.

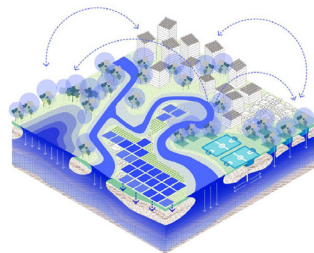


- 1. precipitation - recharged to the confined aquifers
- 2. precipitation - infiltrated - groundwater flow - recharged to brackish land
- 3. precipitation - retained in the pond (- infiltrated - recharged to brackish land)
- 4. surface runoff - retained in the pond (- infiltrated - recharged to brackish land)

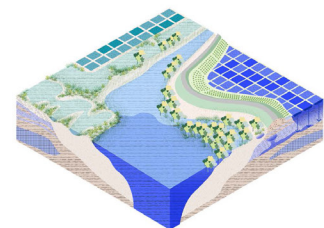
- 5. precipitation - retained in the pond - soil lens
- 6. precipitation - retained in the gei wai - adapting to the fluctuated saltwater
- 7. precipitation - retained in the marshland - absorbing the saltwater
- 8. surface runoff - retained in the pond (- infiltrated - recharged to brackish land)



Mountains as the water tower



Floodplains as water-absorbing sponges



Estuaries as adaptive interfaces

FIG. 153 Water Flow System

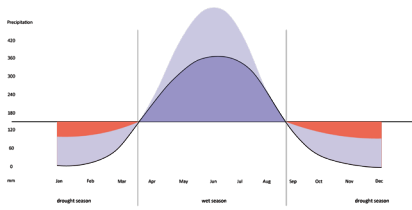


FIG. 154 Water Flow System Across Time

### 3. Conservation Across Time:

The new system takes advantage of natural ecosystem processes to enhance regulation and adaptability. During the wet season, it promotes water recharge into the soil and aquifers, and in drought, it ensures soil moisture retention and facilitates groundwater table rise.

### 4. Conservation Across Geographical Areas:

The system capitalizes on the unique features of different geographical regions. Mountains act as water towers, utilizing elevation to recharge surrounding areas. Floodplains serve as sponges, effectively retaining stormwater and floods. Estuaries function as adaptive interfaces, countering saltwater intrusion and storing freshwater through ecosystem functions.

## Design exploration

-Mountain as the water tower

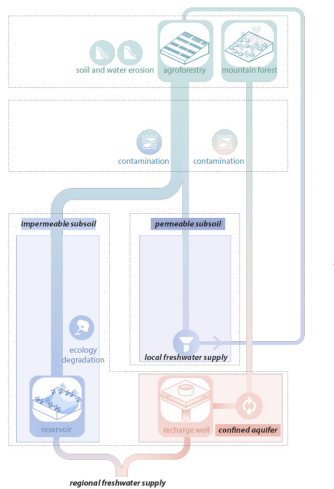
The site is in the southeastern part of Shenzhen, within Longgang District's mountainous watershed. This densely populated region faces a significant water challenge, with water consumption surpassing available supply. Utilizing the hills' water storage capacity could help address this deficit.



FIG. 155 Site assessment: Qinglingjing Mountain

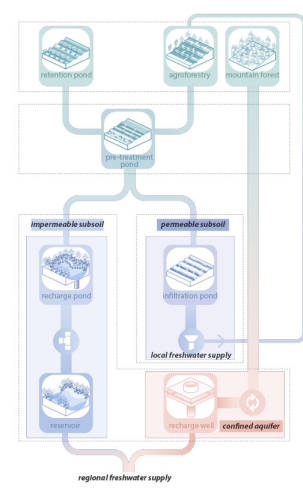
The site receives abundant rainfall (1726.2mm annually), but most of it becomes runoff (925.1mm), causing erosion and environmental degradation. Adjusting surface runoff coefficients through prudent mountain development (0.25-0.35) can mitigate water loss and pollution while promoting groundwater storage.

Existing run-off coefficients: 0.54



Existing water flow system of the mountain

Proposed run-off coefficients: 0.25-0.35



proposed water flow system of the mountain



FIG. 156 Water Flow System in the Mountain

Spatial planning considers drainage basins, stream network, and topography to apply natural runoff principles effectively. Overlaying soil, hydrological, and vegetation layers helps determine specific conditions for varied vegetation approaches, such as forests, recharge ponds, and mangrove ecosystems, establishing a dynamic landscape for sustainable water management.

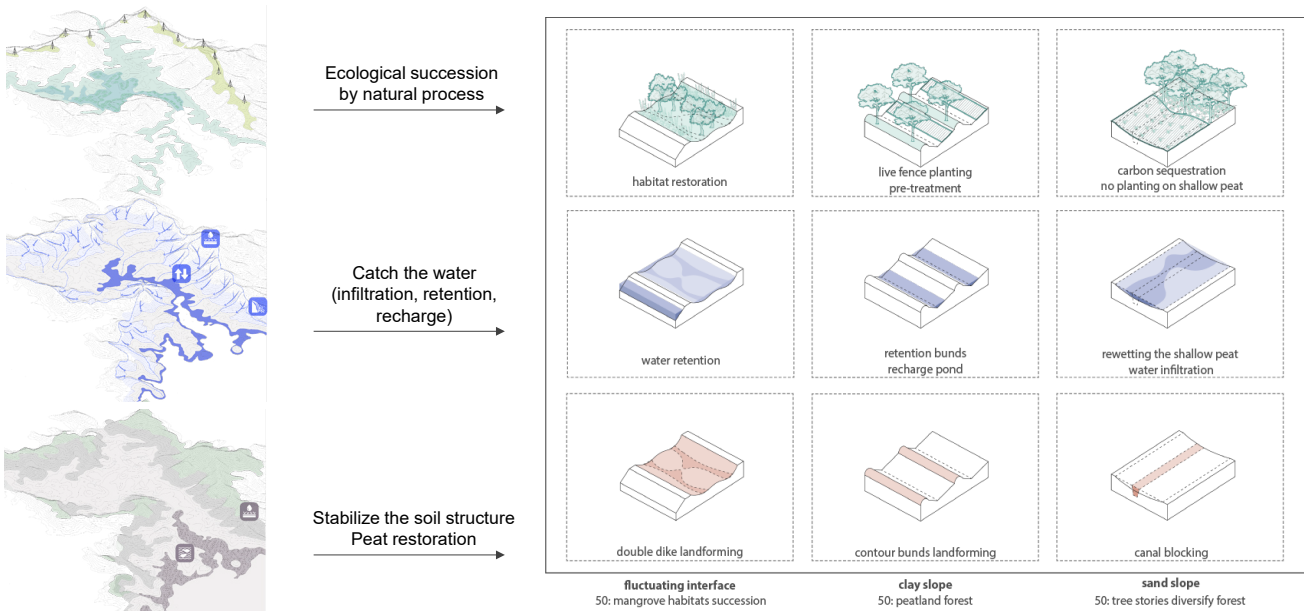


FIG. 157 Strategies and Principles

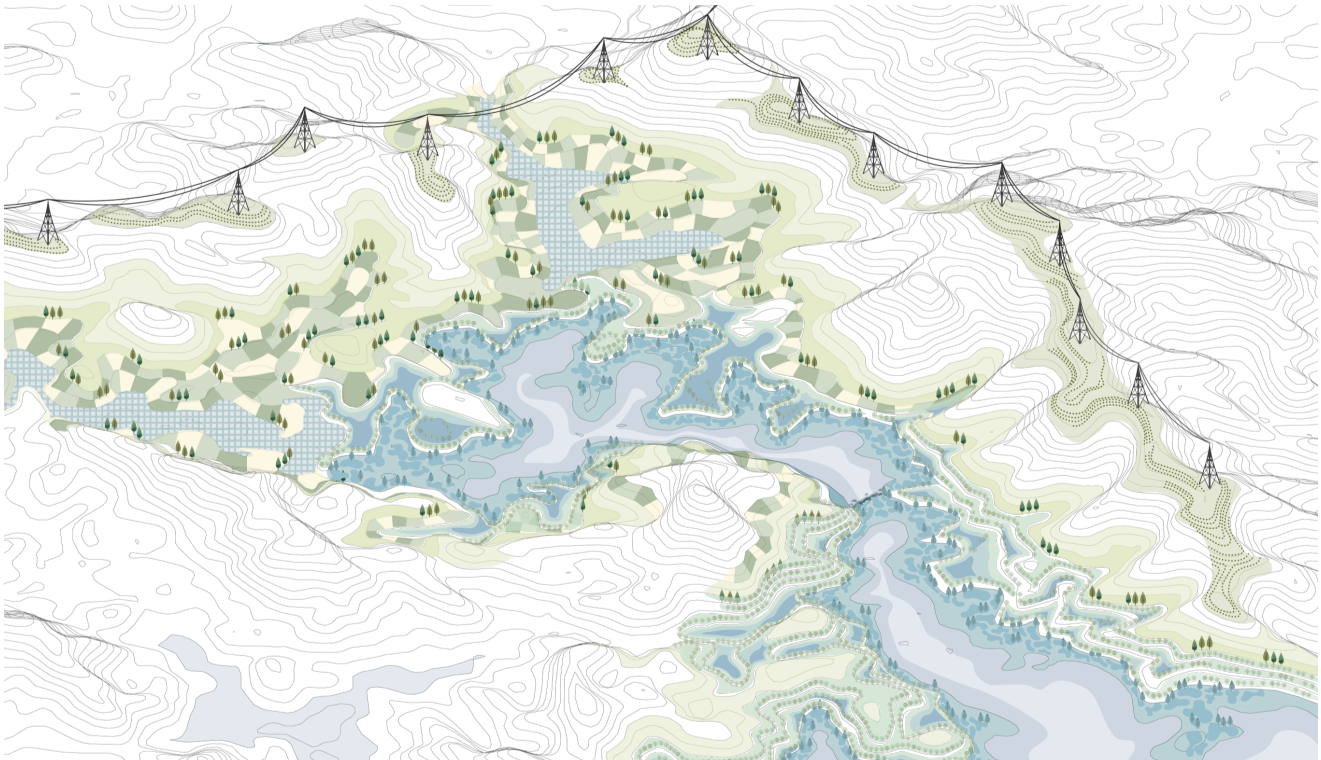


FIG. 158 Bird View

On the sandy slope, retention ponds and shallow peat help retain and infiltrate water, promoting groundwater recharge. Restoring broken topsoil involves blocking original drainage canals with dead leaves and fostering peat moss succession. Over time, a diverse tree canopy ecosystem replaces the dominant eucalyptus community. On the clay slope, contour planting establishes a wet surface and an underground water table. Fruit trees stabilize the hillsides, while contour bunds retain runoff and restore peat soil. The wetland features a double dike system with mangrove ecosystems, maintaining stable water conditions and supporting habitat. Mangrove succession further restores stable water and soil conditions.

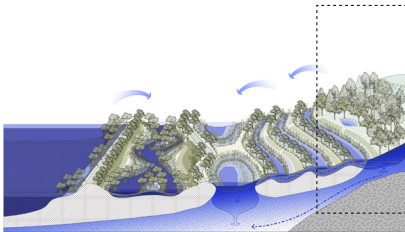


FIG. 159 Sandy Slope Restoration

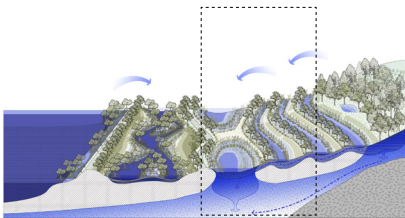


FIG. 160 Clay Slope Contour planting

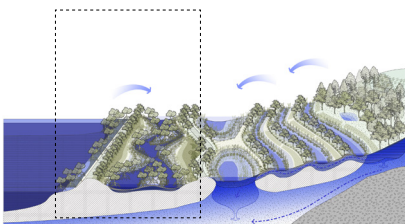


FIG. 161 Interface Wetland Ecosystem Restoration



-Floodplain as the sponge

### 1. Flood Corridor

The floodplain area, like the Hetang flood plain, has experienced historical changes from natural to human dominance. Urban expansion disrupts the ancient water systems, leading to inadequate flood protection. The current water system needs improvement to address rainstorm and flood risks.

three key spatial strategies are provided to recharge the freshwater and optimize the landscape value spatially.

The widened river canal creates a flood corridor for storing peak floods and storms. By relocating the current dike inland, a new floodplain is created along the canalized border, providing space for extreme floodwater. The transformation promotes biodiversity and social diversity, offering opportunities for recreation and outdoor education.



FIG. 162 Masterplan of Flood Corridor

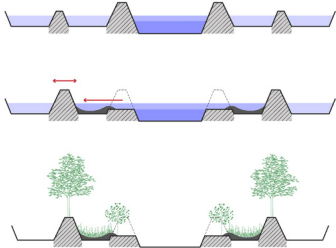


FIG. 163 Strategies of Flood Corridor

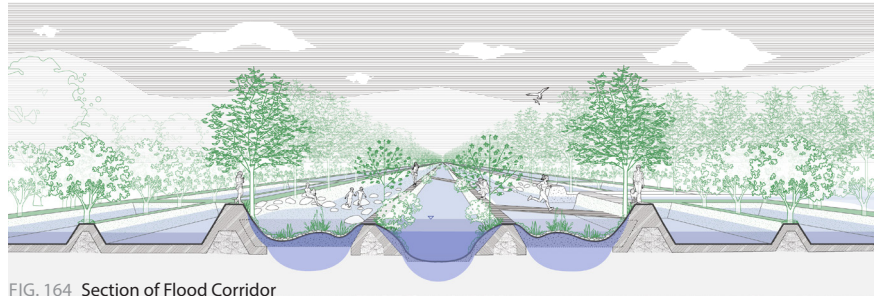


FIG. 164 Section of Flood Corridor



FIG. 165 Perspective of Flood Corridor

## 2. Infiltration Ponds

Second, the innovative approach involves purifying excess water and replenishing groundwater through infiltration buffers within the wetlands. By channeling excess floodwater and stormwater from vulnerable regions into the dike ponds, lower natural terrains are recharged effectively. The wetlands act as reservoirs, collecting and infiltrating water, while clay soil excavations facilitate urban development.

This transformative process not only serves as an efficient water management solution but also promotes agrotourism and water-related recreational activities, making the area an appealing destination for visitors. Embracing this strategy fosters sustainable practices that harmonize ecological balance with socio-economic progress, forging a greener, more resilient future.

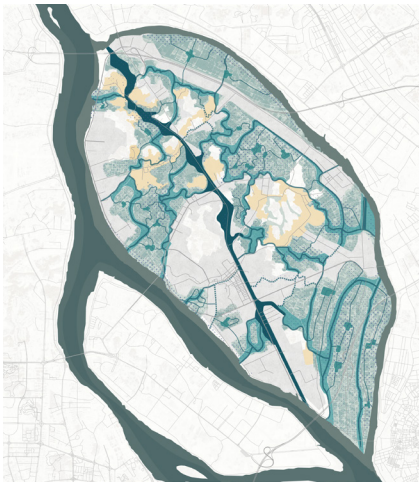


FIG. 166 Materplan of Infiltration Ponds

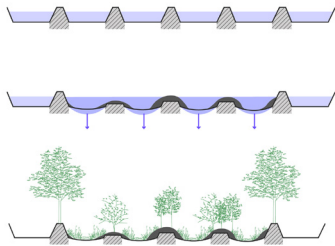


FIG. 167 Strategies of Infiltration Ponds

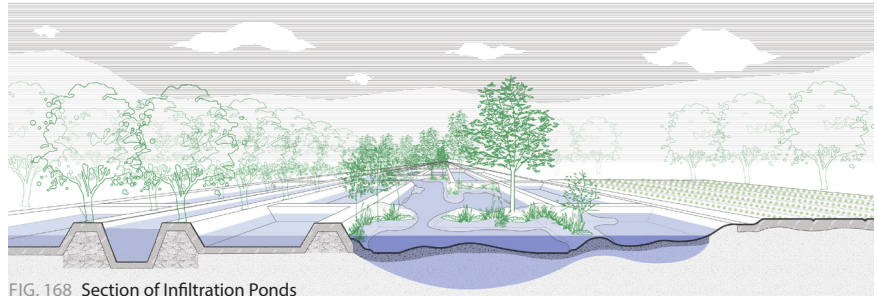


FIG. 168 Section of Infiltration Ponds



FIG. 169 Perspective of Infiltration Ponds

### 3. Proposed Freshwater conservation and Recharge Hierarchy in the historical village

Finally, the village streets as a carrier, form a new hierarchy of water management system, connecting human activities. The wetland infiltration buffer connects the village physically and spiritually, with each entrance square featuring ponds for prayers and rainwater collection. The village's spatial structure originated from fengshui ponds near the canal, shaping its main street and hierarchy from there to streets and alleys.



FIG. 170 Masterplan of Village

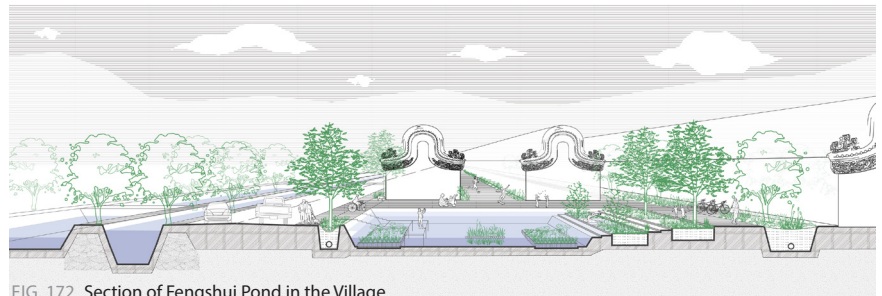


FIG. 172 Section of Fengshui Pond in the Village

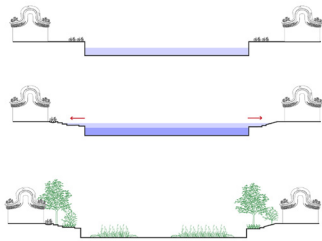


FIG. 171 Strategies of Fengshui Pond in the Village

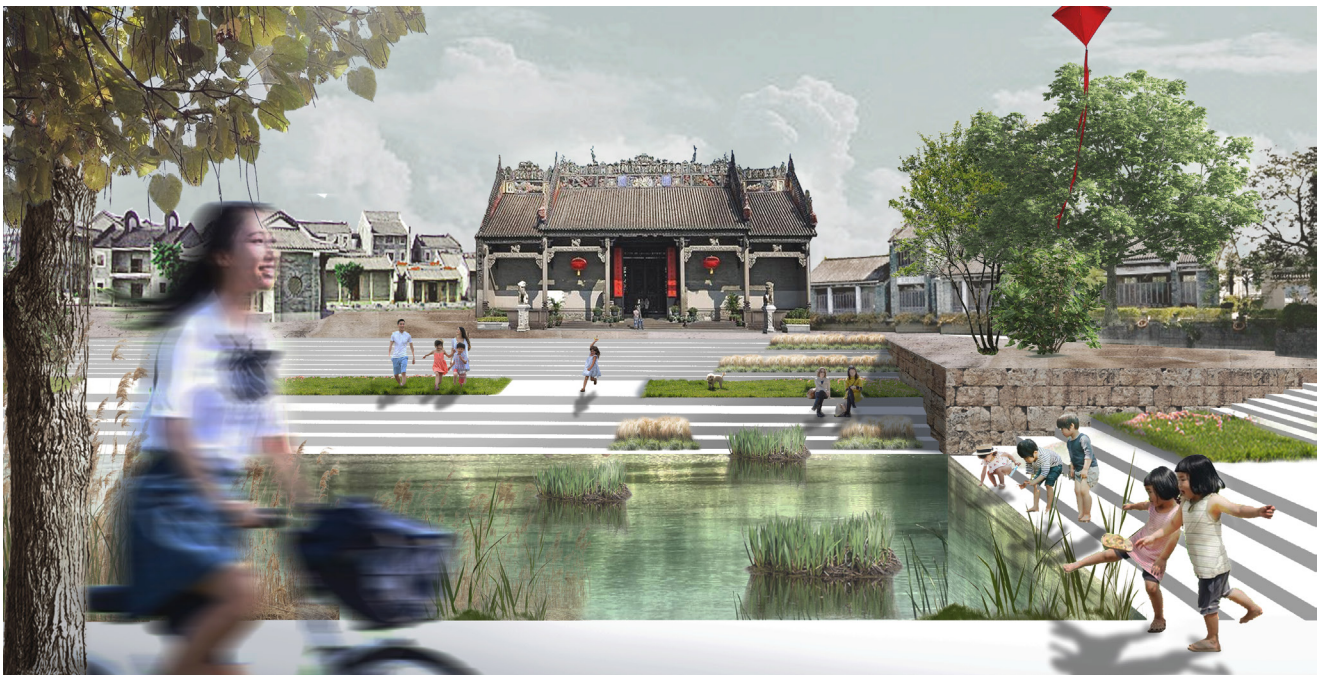


FIG. 173 Perspective of Fengshui Pond in the Village



FIG. 174 Perspective of Historical Street in the Village



FIG. 175 Perspective of Private Courtyard in the Village

## **Reflection & Conclusion**

Following is the reflection for this project by answering my research questions.

RQ1 &2: How can the landscape contexts in the PRD be understood as a system and What are the potentials of the landscape as a system for developing a resilient landscape framework?

The project experimentally explores the theory of landscape as a system and presents a resilient framework that understand the landscape into multiple layers, ultimately identifying it as a water flow system. In China, water scarcity is a common issue due to historical development and policy factors, like the urban clusters in the Yangtze River Delta. By incorporating Chinese traditional water management practices and the unique landscape characteristics of the delta, this project establishes a hydrological cycle-based water flow system that stimulates natural processes across multiple systems, geographic areas, and time, contributing to the construction of resilient urban delta projects in China.

RQ3: What landscape-based principles can be applied in different landscape contexts to optimize the potential for freshwater conservation and recharge?

“Design the framework” is a kind of “design the method”, because it provides a systematic thinking approach to understanding freshwater storage design. By analyzing the site in layers and applying landscape-based principles, a diverse landscape with a detailed water flow system is created. This site-specific approach optimizes freshwater conservation, enriches the overall framework, and provides insights for similar projects in other locations. Adopting this method ensures professional and effective freshwater resource management in various landscapes.

RQ4: What landscape-based principles can be applied in different landscape contexts to optimize the potential for freshwater conservation and recharge?

The lessons learned for promoting resilient landscape systems on different scales, is using five guiding strategies of resilient design. Firstly, embracing resilience shifted from single-goal to multifunctional infrastructure, deepening understanding of the hydrological cycle. Secondly, implementing redundancy and modularization enabled effective functioning across various timeframes, geographies, and systems. The mountain pilot considered ecological succession and species adaptability, while the floodplain incorporated local lifestyles to enhance water flow and benefit biodiversity and social diversity. These strategies offer valuable insights for fostering resilient landscapes, ensuring adaptability to changing conditions and promoting sustainability.





FIG. 178 Lougang polder in the Taihu Lake Basin

Source: [http://www.huzhou.gov.cn/art/2022/6/27/art\\_1229213483\\_59053548.html](http://www.huzhou.gov.cn/art/2022/6/27/art_1229213483_59053548.html)

# Sponge Polder

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## The revival of traditional polder wisdom in the Taihu Lake Basin

Qian Yao

### Supervisors

Steffen Nijhuis, Landscape Architecture

Gregory Bracken, Spatial planning & Strategy

### **Introduction**

Polders in the Taihu basin have a history of over two thousand years. The low-lying topography and dense water network create convenient geographical conditions for the reclamation of polders. Later, with the rapid population growth, mulberry-dike-fish-pond was constructed in order to make full use of the limited land resources, which is a sustainable and ecological agricultural model, supporting biodiversity and water resilience as well as providing a basis for settlement in this region. The historical polder landscape closely linked the water system, agriculture system, and settlement system, and then derived water culture, rice culture, fish culture, and silk culture.

However, since 1950s, the Taihu Lake basin has been under drastic urbanization, which caused a threat to water safety and cultural heritage. The city invasion of the rural area and road construction leads to the siltation of the watercourse. As a result, the polder landscape was fragmented and lost its water resilience gradually. Water crises including eutrophication, flooding, and drought become more frequent, influencing the cultivation of crops and the traditional settlement's safety. Additionally, the region has lost its unique cultural identity as a result of the standardization of agriculture.

In general, the polder landscape in Taihu basin is facing three main problems: city invasion, water safety issues, and loss of cultural heritage. Compared to the civil engineering method to solve these challenges, landscape intervention costs much less, builds up a more adaptive and resilient system, and brings aesthetic experience as well. Therefore, how to learn from historical practice to protect precious cultural heritage while restoring the water resilience in the Taihu basin through landscape approaches is the key challenge. The landscape approaches start from the base layer like soil and water, helping to create a sustainable social-ecological system as well as being flexible enough to adapt to future challenges.

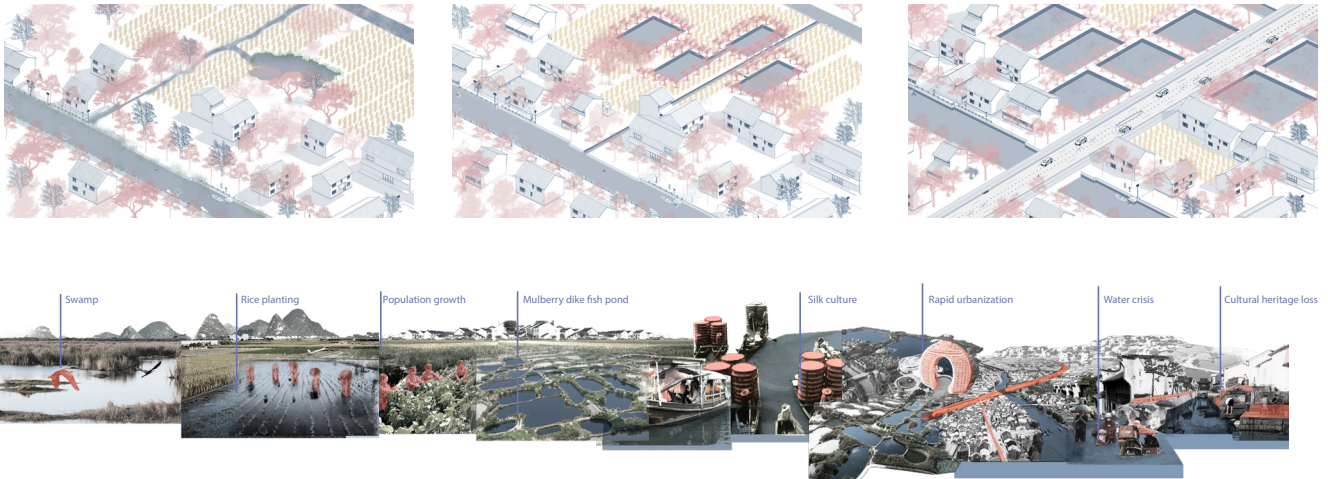


FIG. 179 Polder landscape development

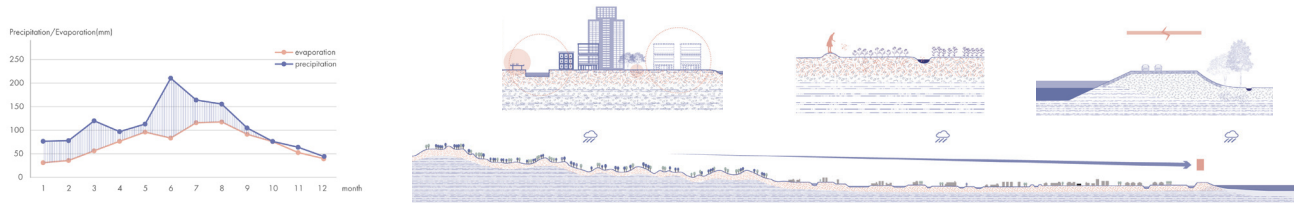


FIG. 180 Challenges in Lougang polder

### Challenges and potentials

The interdependence of the water system, agriculture system, and settlement system is evident in the historical development of the Lougang polder landscape. Lougang polder is known for its sophisticated system of dikes, sluices, and canals, which have allowed it to withstand floods over the centuries. From the rice agriculture landscape to the dike pond agriculture landscape to the fragmented modernized landscape today, the water, agriculture, and settlement systems have undergone continuous changes. These three layers combined to create a robust and stable polder landscape system.

Nevertheless, these three systems have been built into three separate units in recent years. Higher dikes are built for flood protection; fish pond expansion has occupied the space of dikes; industrial development invades the traditional villages and dike ponds. All of these constructions turn polders into the less resilient and fragmented landscapes.

By understanding how these three systems worked and their interrelationships, we could get some inspirations and clues from historical experience and apply them to the design, thus generating a landscape that is more in line with the local context. In the design part, I explore the potential of polder that helps to alleviate these challenges while bringing more possibilities to this region, making it a sustainable and resilient complex system.

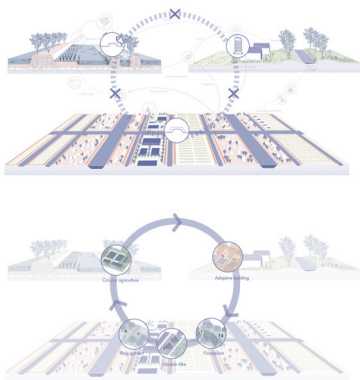


FIG. 181 Water, agriculture, settlement systems relationship

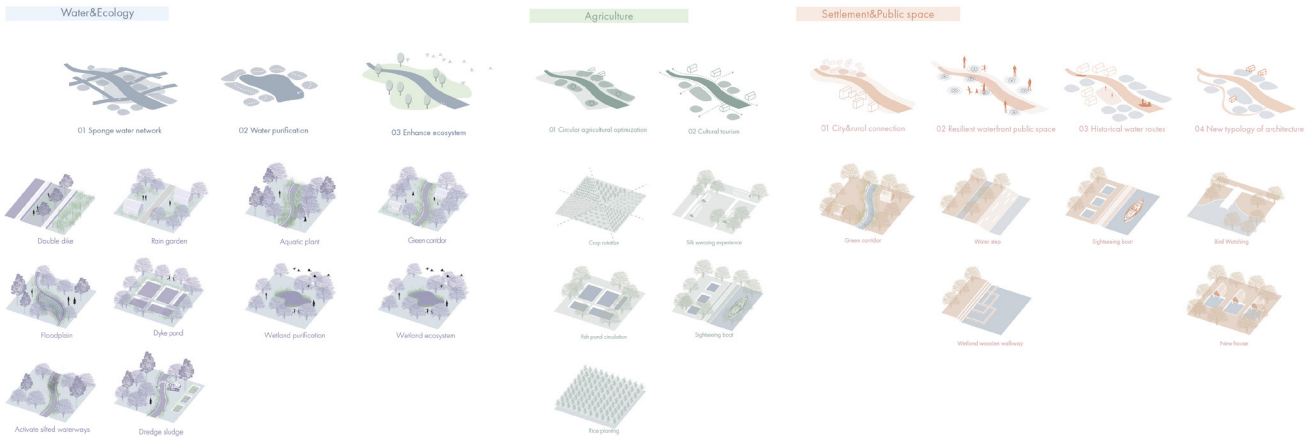


FIG. 182 Water, agriculture, settlement systems principles

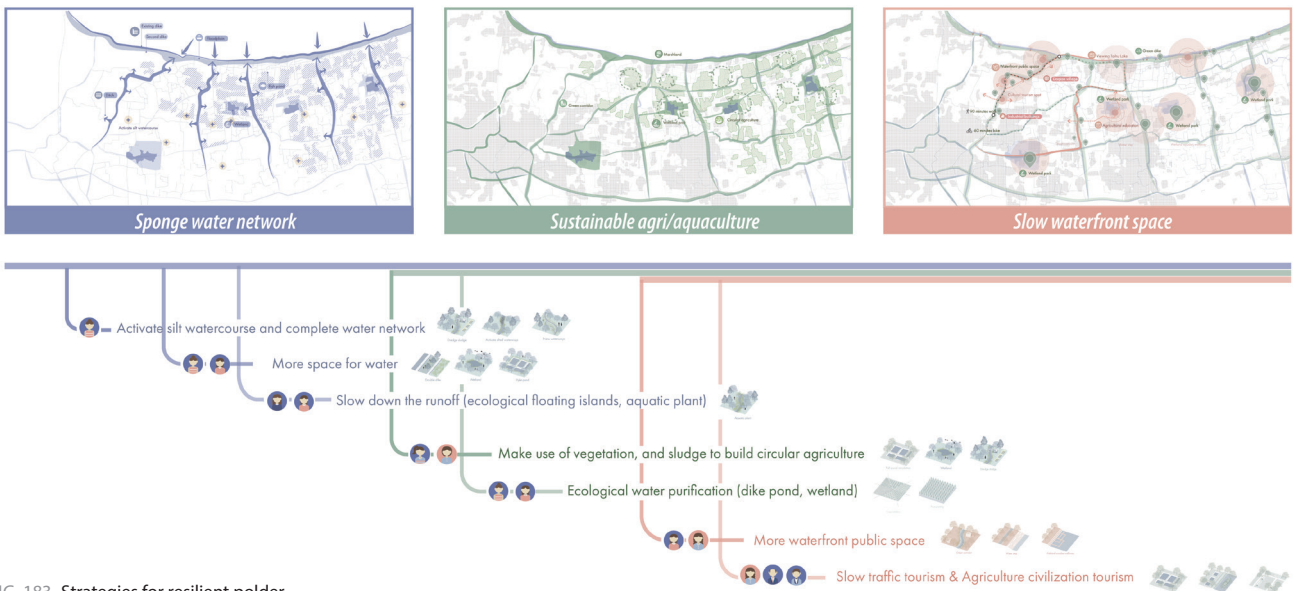


FIG. 183 Strategies for resilient polder

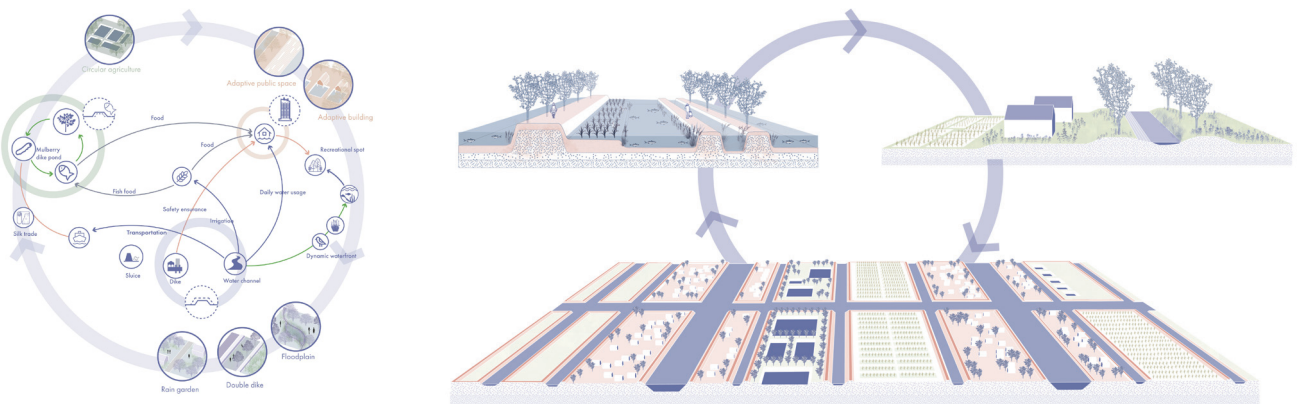


FIG. 184 Reconstruct stable and sustainable polder system

## Principles

### 1) Water

To create a resilient water system, it is crucial to increase the capacity for water storage and decrease the speed of runoff. Considering the issue of silt watercourse caused by city construction, the sludge will be excavated to create a water vein system that can discharge water during the rainy season. Secondly, more spaces like floodplains will be created for an emergency. Ecological floating islands and aquatic plants will be incorporated along the main waterway to slow down the runoff. Additionally, to further improve water quality in the region, the small lake will be converted into a wetland and, together with the surrounding dike pond, a water purification center will be established.

### 2) Agriculture

Learning from history, the success of the mulberry dike fish pond teaches us that the key aspect of a sustainable agriculture system is to utilize waste effectively in creating a circular ecology and economy. The design strategy is to follow the ecological rule and embed aquaculture in an artificial ecosystem where mass and energy cycle between water and land to make the best use of materials and recycle materials, thus guaranteeing stable output and economic benefits.

### 3) Tourism

To address the disconnect between people and the polder due to fast urbanization, a strategy for settlement and public space must prioritize the creation of more public spaces and a slow traffic system to restore the close relationship between people and water. Furthermore, agricultural civilization tourism will be introduced to remind people of the precious value of mulberry dike ponds in this region.

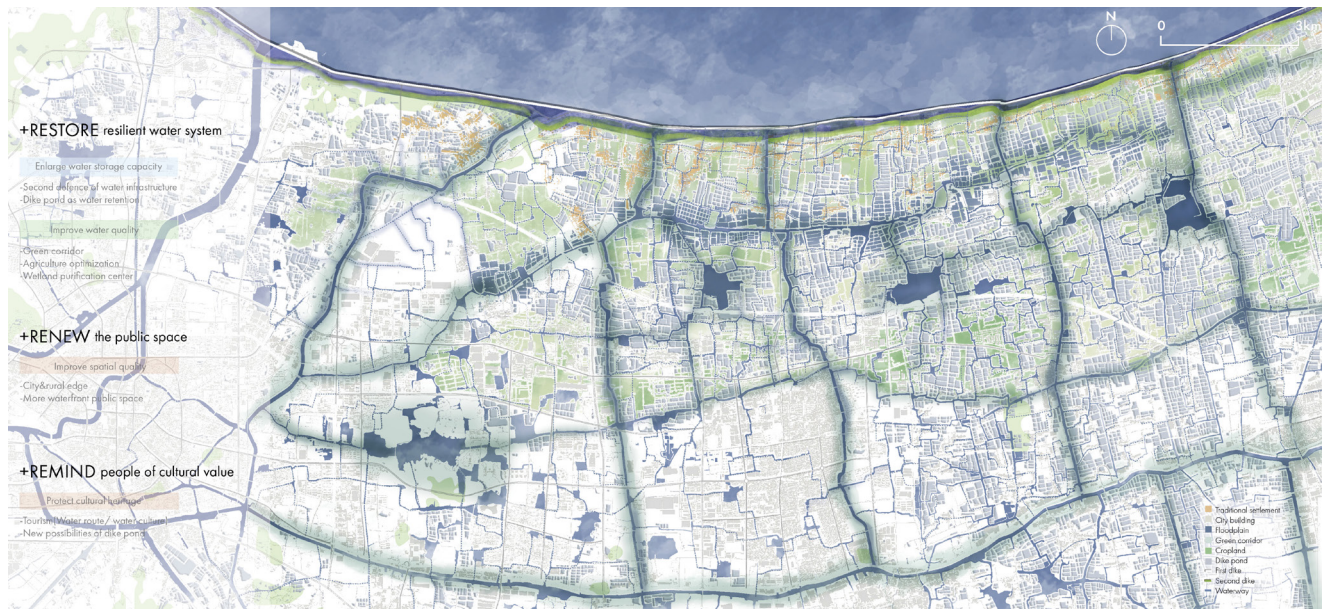


FIG. 185 Vision map—Resilient polder landscape



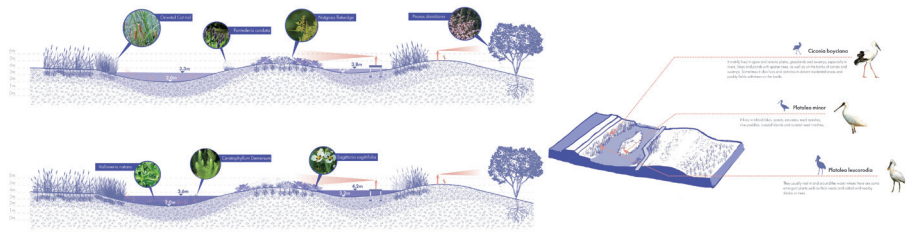


FIG. 189 Natural succession in floodplain (right)

FIG. 190 Floodplain during normal and rainy season (below)



## 02 Sponge agriculture

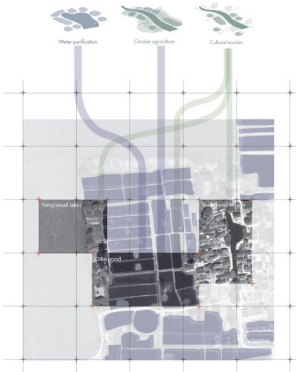


FIG. 191 Dike pond zone

The design of sponge agri/aquaculture design gets inspiration from traditional mulberry dike fish ponds, introducing a new sustainable and circular way to reduce the pollutant from aquaculture, as well as to integrate with educational and recreational functions, transforming dike ponds to adapt to modern ecological and economic development, ensuring their viability in the current context.

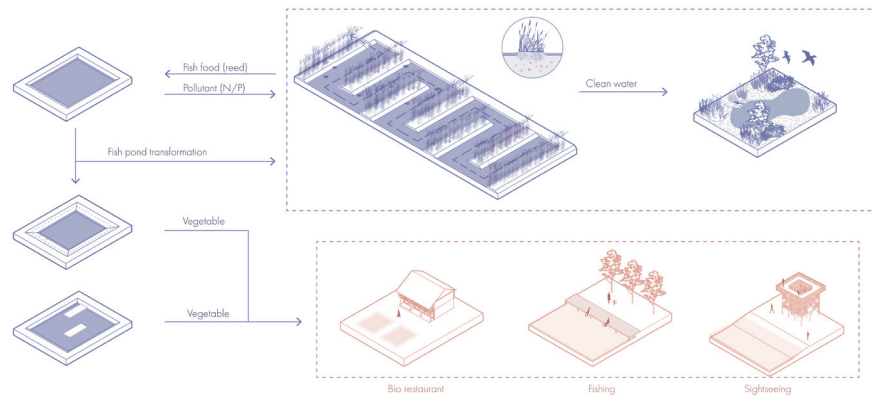


FIG. 192 New possibilities for dike pond



FIG. 193 Circular agriculture vision



FIG. 194 Purification pond recreation

### 03 Sponge peri-urban

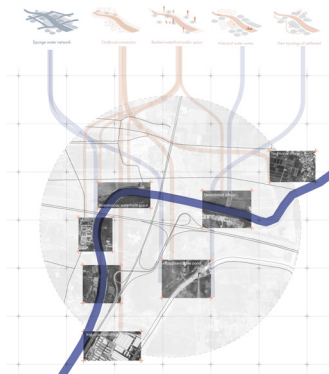


FIG. 195 Peri-urban zone

The sponge peri-urban involves establishing a well-connected sponge water system in this region. Simultaneously, the proposal revitalizes the vanished dike ponds by transforming them into visible recreational spaces with additional water purification capabilities, enhancing both the functionality and aesthetic appeal of this area. The design aims to strengthen urban-rural synergy and integrate water storage function with entertainment function, while also preserving and promoting the cultural value of the area.

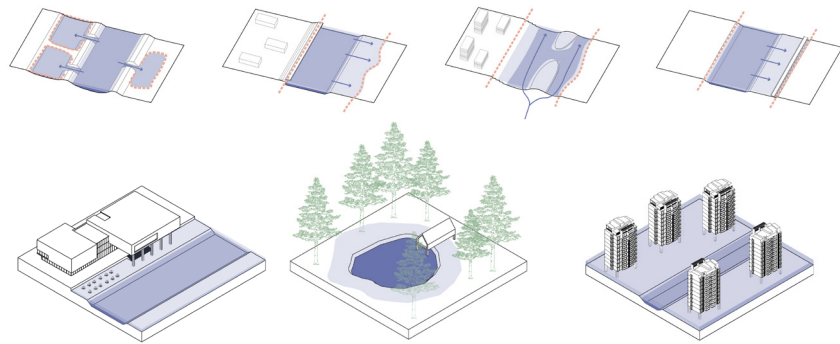


FIG. 196 Sustainable urbanization



FIG. 197 Pond space design



FIG. 198 Peri-urban waterfront public space in normal season

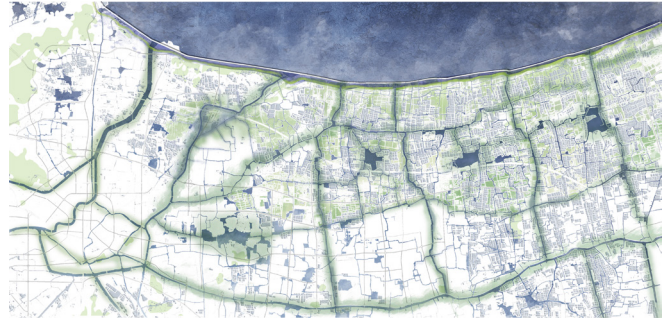


FIG. 199 Peri-urban waterfront public space in rainy season

2023-2025



2025-2030



2030-2035



FIG. 200 Strategic phasing plan (2023-2035)



FIG. 201 Sponge peri-urban birdview

## Conclusion

By learning from historical practices, this project explored the possibilities of the polder in alleviating water crises and rapid urbanization, aiming at restoring a resilient water system, renewing the public space, and reminding people of the cultural value of the polder landscape. The Lougang polder has a history of over two thousand years of living with water, which left precious polder wisdom on the land. The design should respect the local culture and integrate it into the contemporary context with the demands of the present and the uncertainties of the future. By employing these time-tested techniques, we could create a design that honors the past, accepts the present, and gets ready for difficulties in the future.

The three site-specific design performs different roles in clarifying regional planning. The sponge lakeshore line helps to explain how the sponge water network system increases the water resilience in the region as well as generates natural succession and benefits for spatial quality. The sponge aquaculture demonstrates how to transform agriculture into a more sustainable and ecological form. Spatial quality improvement and cultural heritage protection are elaborated on in sponge peri-urban design, explaining how water management combines with the waterfront public space and allows for sustainable urbanization. As a result, the design helps to create a sustainable social-ecological system that is flexible enough to adapt to future challenges.

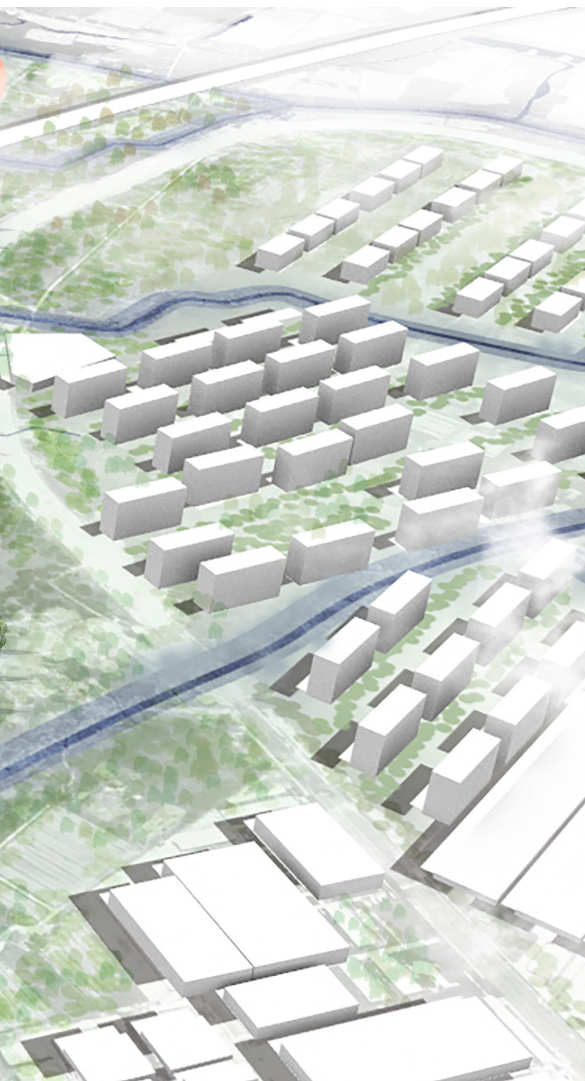




FIG. 202 Urban environment Guangzhou (Photo: Hao Feng, 2023)

# Guangzhou Metropolitan Park

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Design of the landscape-nature network in Guangzhou to increase the adaptive resilience in the urban environment

Chuhan Zhang

Supervisors

Steffen Nijhuis, Landscape Architecture

Lei Qu, Spatial Planning and Strategy

## **Introduction**

Guangzhou is one of the metropolitan cities in the Great Bay Area (GBA). It experienced massive urban construction in a relatively short time. However, the development prosperity comes at the expense of urban green space. The problems of green space lead to lower resilient capacity, which means higher flooding risks and more environmental problems. Under this condition, making the city more resilient, livable, eco-friendly, and sustainable becomes a public concern and a big challenge for Guangzhou.

This project proposes to design a landscape-nature network in Guangzhou, which takes into account the green, blue, recreation, historical remains, and slow traffic systems. The design will use landscape approaches to strengthen urban resilience against climate change. First, the research will interpret the site from the perspective of time and space, with an understanding of historical development and the current landscape system. Then, learning from the case study of Boston Metropolitan Park and the historical wisdom of managing water and green could help to conclude principles and strategies for designing the Guangzhou Metropolitan Park. The design exploration will apply different strategies and principles on regional, meso, and local scales. The green patches inside the city will be preserved and more connections will be created. Moreover, nature and landscape areas, including green space and blue systems, historical areas, recreation spots, and urban networks will be concerned together for a more coherent human-nature relationship.

The creation of a landscape-nature network will provide more benefits for the city through landscape design. It aims to create a social-ecological inclusive and future-proof Guangzhou and also has the potential to become an inspiration for other metropolitan cities.

## Landscape-nature network

This project aims at reforming the landscape systems in metropolitan cities. Demand for urban construction and the need for green space often bring metropolitan cities into dilemma. Moreover, coastal cities still face challenges from both internal systems and external threats of climate change. The loss of resilient capacity inevitably makes the city more and more vulnerable to climate change. Therefore, designing a more resilient system would be important. This project proposes a “landscape-nature network” for the development of metropolitan cities. Guangzhou, an essential coastal metropolitan city in southern China, will be used as a case to explain the landscape-nature network more in context. “Landscape as a system”, “Ecosystem service”, and “Resilient design” (The Resilient Design Institution, 2023) are regarded as the background theories for the project. The landscape-nature network includes both landscape and nature in the system. It contains city parks, nature reserves, and wetland parks. It is built based on the green-blue network, which links people and nature throughout the city by managing waterways (blue), planting, and parks (green) through a combination of infrastructure, ecological restoration, and urban design (Blue/Green Network Strategy, n.d.). Based on the green-blue network, the landscape-nature network also consider other social aspects. It consists of five layers, the green system, the blue network, the historical spots layer, the recreational system and the slow traffic network. The idea is to preserve the green patches inside the city and create more connections. Besides, nature and landscape areas, including green space and blue system, historical areas, recreation spots and slow traffic networks will be regulated to co-exist with each other. This landscape-nature network will bind people with the landscape system for a more future-proof Metropolitan city.

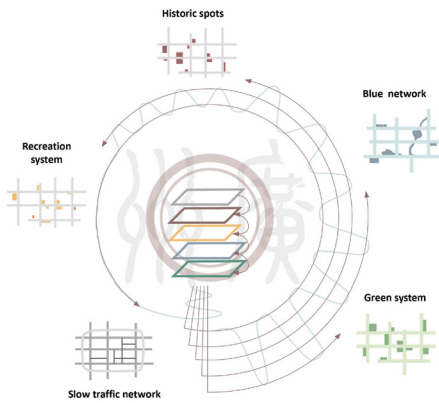
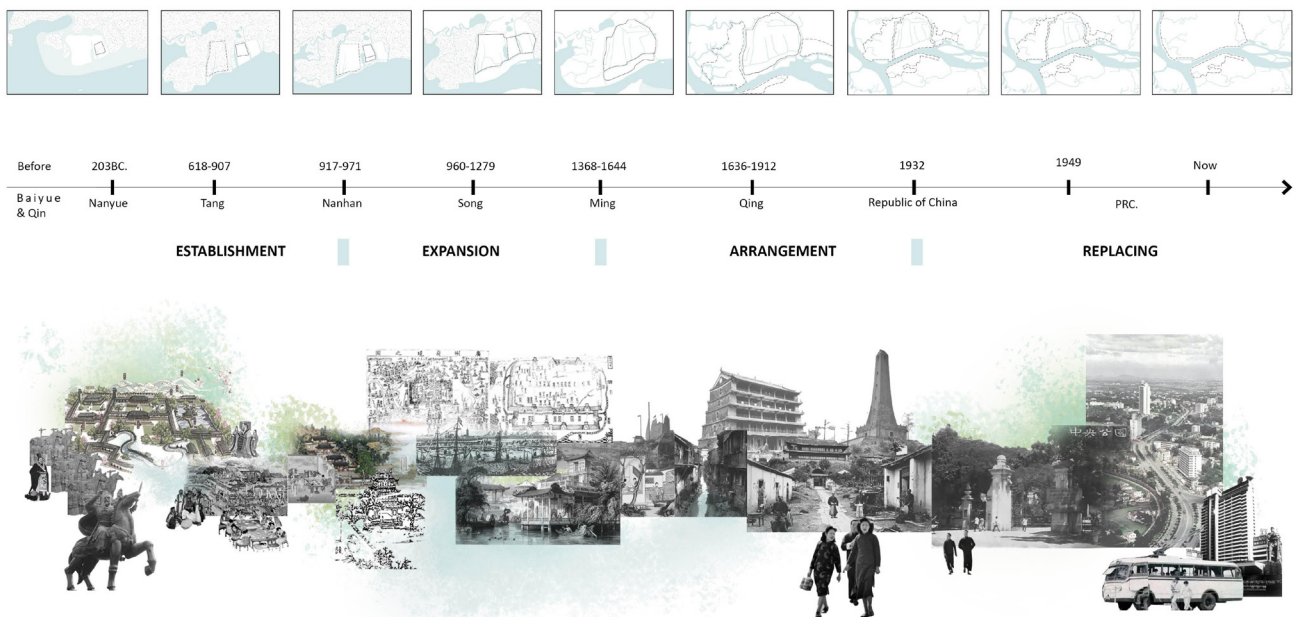


FIG. 203 (TOP) Framework Landscape-nature network

FIG. 204 (Bottom) History development of Guangzhou  
Data source: (Liu, 2015); Historical maps of Guangzhou; (Guan, 2010) Redrawn by author



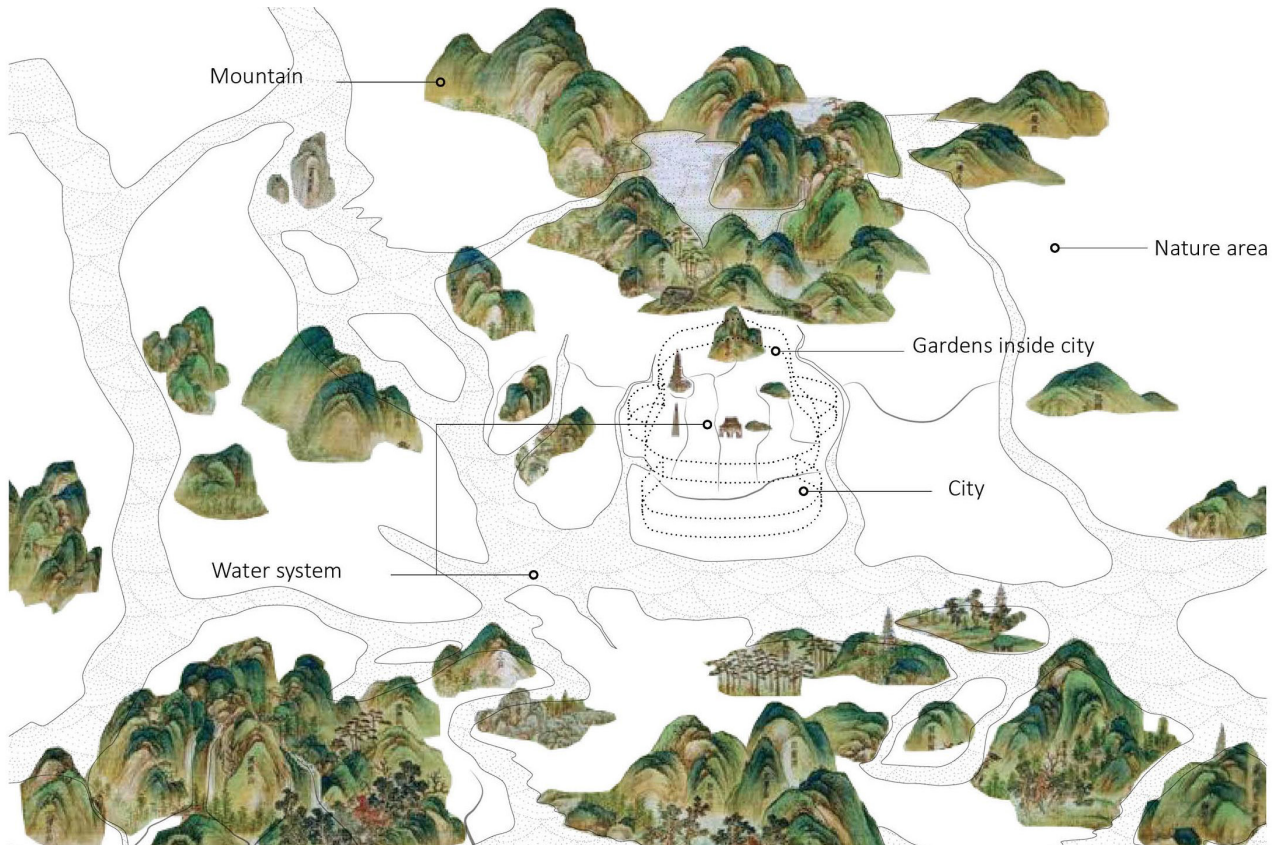


FIG. 205 Landscape-nature network in the past

### Regional strategies and principles

The project researches the historical change in Guangzhou. It helps to depict the traditional city-nature relationship. The city was part of the landscape and nature. People show more respect for nature when they build the city and have a stronger connection with the landscape and nature. The Boston Metropolitan Park is used as a case study. Boston and Guangzhou share some similarities. They both grew from a small commercial city into a metropolitan city. They are faced with problems like pollution and irrational urban land use brought on by fast urban expansion (Moga, 2009).

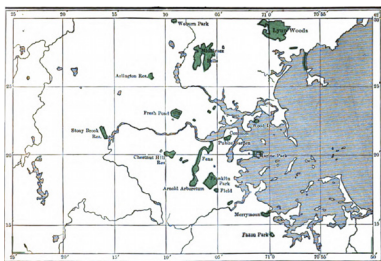


FIG. 206 Green space of Boston in 1892 and 1902  
 Retrieve image from: [https://commons.wikimedia.org/wiki/File:The\\_open\\_spaces\\_of\\_Boston\\_in\\_1892\\_and\\_1902\\_compared.png](https://commons.wikimedia.org/wiki/File:The_open_spaces_of_Boston_in_1892_and_1902_compared.png)

Based on the case study and other traditional wisdom from history, some general principles and strategies for creating a metropolitan park are proposed. Strategies focus on preserving the resources and making connections in both natural and social layers. The Regional strategies consist of three layers, the water layer, the green layer and the recreational and historical layer. The design will use water as the backbone. It will manage the blue system based on the rivers and reservoirs of the city. The green layer consists of mountain forests, parks inside the city and new green connections along the water or transportation system. The green strategies work on problems of green loss inside the city center. Besides, The design will fully make use of Guangzhou's cultural characters. It will use slow traffic way to connect the cultural remains and recreational spots. Principles aim to practice the

strategies in patches, connections and neighborhoods. The principles for patches are related to water bodies, parks, informal greens and mountain areas. For the water body, the connection of the water system and softening the water edges are among the principles. Other principles include increase biodiversity and stormwater management. The principles for connections are about the connection along the traffic system and the connection along the water, for example, increasing the sponge capacity along the road and softening the river bank. The principles for neighborhood make use of the space in the districts by applying rooftop green, eco-parking lots and community gardens.

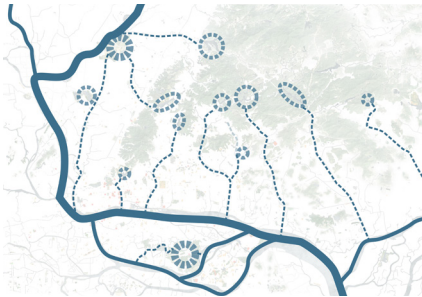


FIG. 207 Water strategies for Guangzhou Metropolitan park

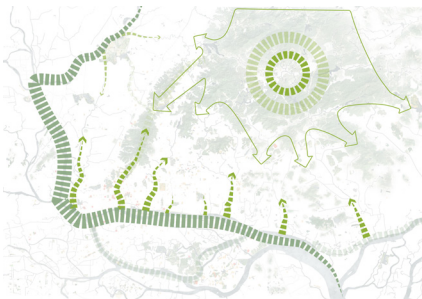
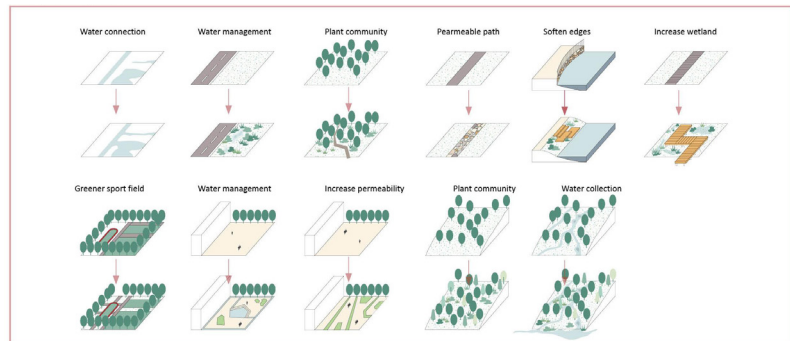


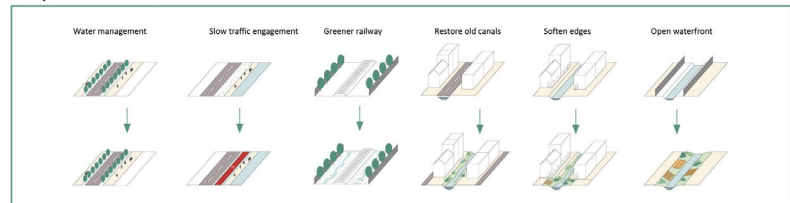
FIG. 208 Green strategies for Guangzhou Metropolitan park



FIG. 209 Cultural-historical strategies for Guangzhou Metropolitan park



Principles for connections



Principles for neighborhood

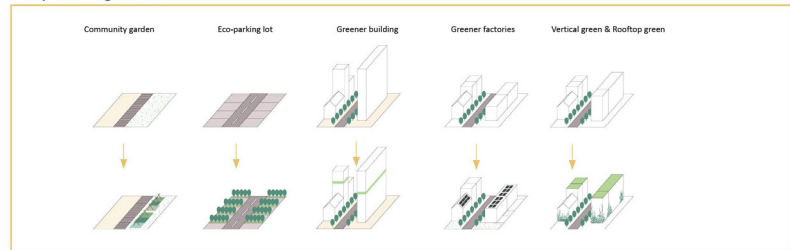


FIG. 210 Principles for Guangzhou Metropolitan park

**Design exploration**

On the regional scale, the design shows how to create a landscape-nature network in Guangzhou and the idea of the Guangzhou Metropolitan Park. The design proposes a new landscape system for Guangzhou, which is made up of the green core in the mountain area, the Pearl River waterfront corridor, the cultural-historical center and the inner city waterfront corridor.

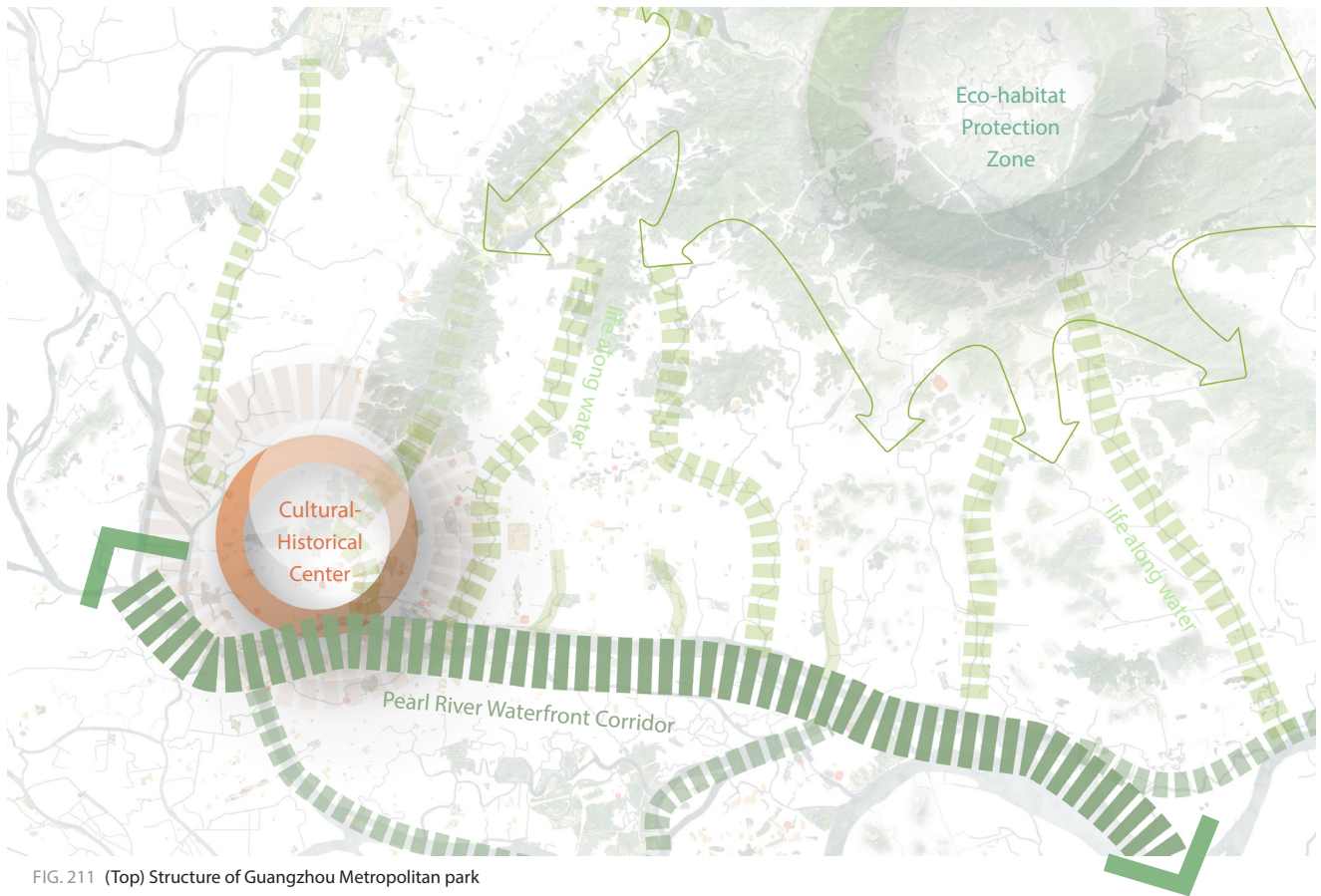


FIG. 211 (Top) Structure of Guangzhou Metropolitan park



FIG. 212 Regional strategies for mountain and inner city river

Each part of the metropolitan park contributes to a stronger capacity to deal with urban green problems and urban flooding issues. For the existing parts of the structure in the mountain area and inner city waterfront area, the research calls for protection, eco-recovery and slight interventions. For the more problematic and missing parts in the old city center and Pearl River waterfront, the research uses a more detailed design to elaborate the strategies and principles on different scales.





FIG. 213 Vision for Guangzhou Metropolitan Park



### Pearl River Waterfront Corridor

The Pearl River waterfront corridor creates a linear riverfront park with multiple functions. Now the Pearl River waterfront area is under flood risk on Typhoon days and is a relatively mono-function linear space. From the water perspective, the design creates more room for water and provides stronger protection against river floods. From the green perspective, the design creates green connections along the river to form a riverfront linear park. And for the recreation part, the design tries to create diverse public spaces for citizens with multi-functions along the corridor.

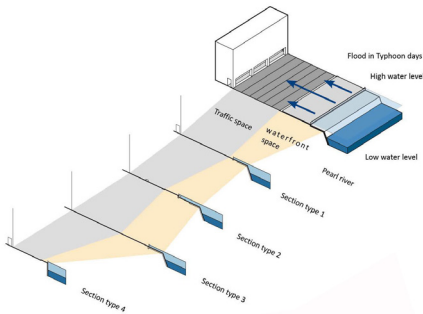
FIG. 214 Vision for Pearl River Waterfront Corridor

Protection area

Floodable area-Haizhu Square

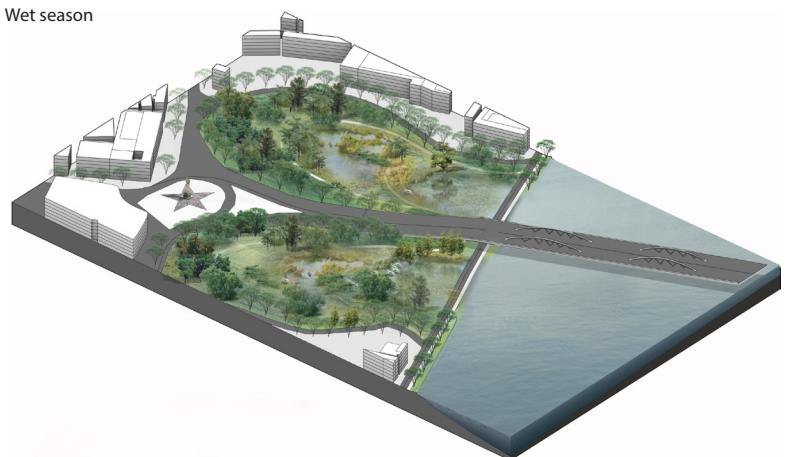
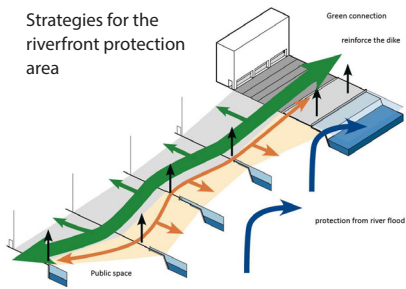
Current Pearl riverfront

Dry season



Strategies for the riverfront protection area

Wet season



Vision for the riverfront protection area

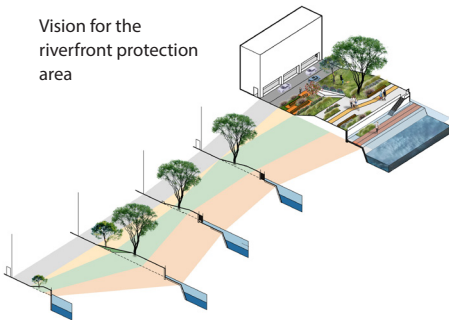
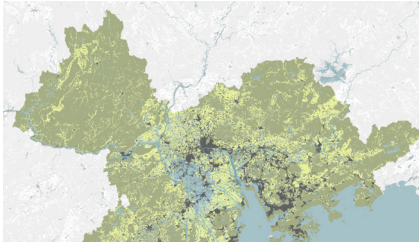


FIG. 215 Design of protection area

FIG. 216 Design of floodable area in dry and wet seasons



### **Cultural-historical center**

Stormwater flooding is one of the most serious problems in the old city center of Guangzhou. Besides, the city also suffers from lacking green connection and historical memory loss. With analysis of potentials and challenges, the design concentrates on the regeneration of old canals, improvement of green connections and creation of a slow-life historical city.

FIG. 217 (Top) Vision for Cultural-Historical Center

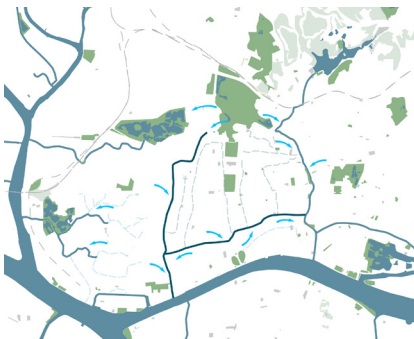
FIG. 218 (Right) Critical area in the old city Center

FIG. 219 (Bottom series of pictures) Water-green-Recreation strategies

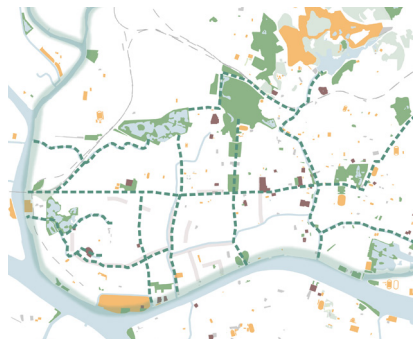


0M 500M 1500M

Water strategies



Green strategies



Cultural-recreational strategies

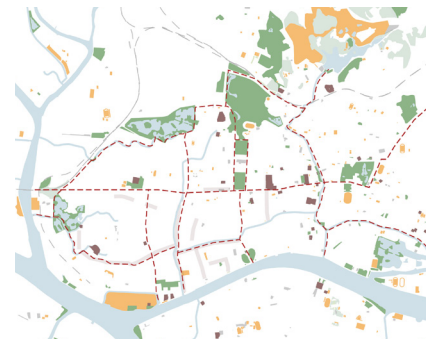


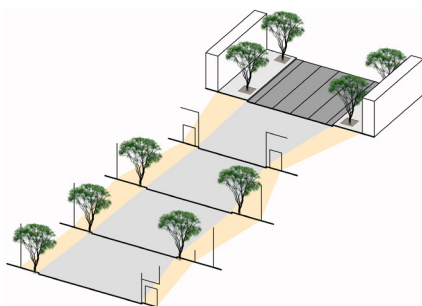
FIG. 220 (Top right) Strategic design for transforming Yudaihao river in the living block

FIG. 221 (Bottom series of pictures) Strategic design for creating green connection

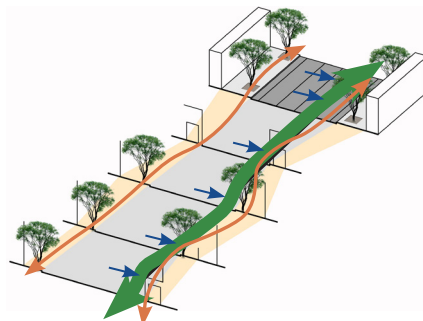
FIG. 222 (Right) Strategic design for transforming Yudaihao river in the commercial block



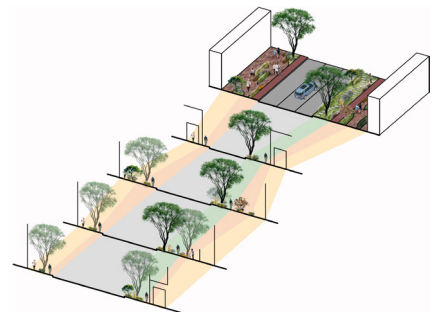
Current street of the old axis



Strategies of street transforming



Vision for the street green connection



## Conclusion

This project creates a Landscape-nature network in the typical metropolitan city, Guangzhou. The design aims to deal with problems arising from the fast urban expansion in Guangzhou and increase the resilient capacity of the urban environment. The landscape-nature network creates a more resilient system for the urban environment. It forms the green and blue connections on the regional scale and concerns the cultural value of the city. Mountain space not only could be nature reserves and eco-habitats but also helps with storing and holding excess rainwater in the rain seasons. It could also provide freshwater supply in dry seasons. Rivers and canals could not only be the backbone of the green connections but also provide room for stormwater. In the old city, more resilient green patches and connections assist neighborhood water management. The design helps with improving the urban environment and decreasing stormwater flooding inside the city center. The cultural value will also be promoted at the same time. The Pearl Riverfront corridor helps with relieving the negative effects on the city from river flooding. The new landscape system makes up for the city's lack of green space, unbalanced distribution of greens and lack of ecological concern. By doing this, it will effectively improve the city's ability to deal with internal and external challenges.

FIG. 223 A landscape-nature network in Guangzhou

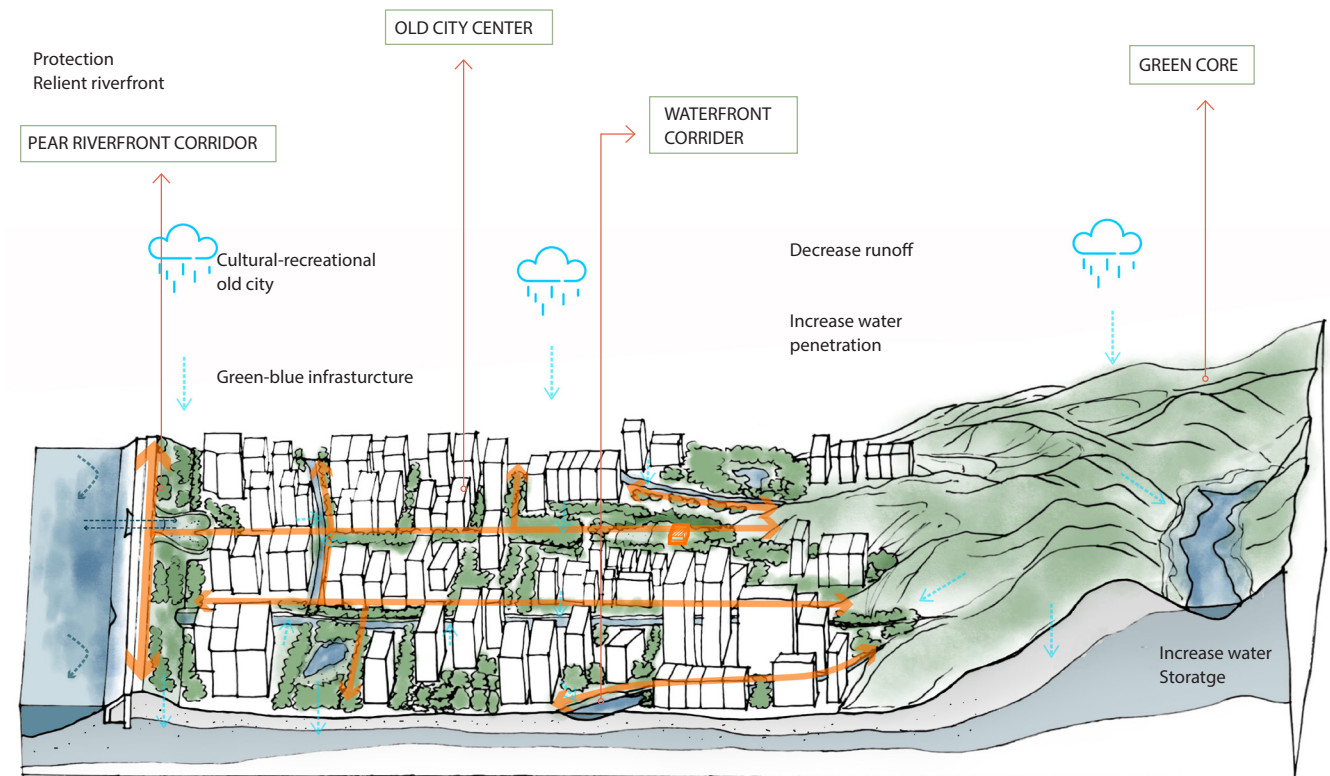




FIG. 224 The atmosphere in Smart Villages: The waterfront as an ecological area that holds better rural living quality, and also feeds the development of agriculture. With the digital technology, the water level can be monitored to protect the countryside. And local people, whether they are villagers, farmers or visitors, can upload any problems they find in the countryside to help enhance their living quality

# Smart Villages

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## Rural revitalisation strategies based on Taobao Village development model in rural areas of GBA

Minshi Zhang

Supervisors

Lei Qu, Spatial Planning & Strategy

Steffen Nijhuis, Landscape Architecture

### Introduction

China's rapid urbanisation and industrialisation seriously impacted rural areas, which is reflected significantly in the Greater Bay Area. With globalisation and digitalisation, the emergence of Taobao villages has become a new model for rural development in China. However, socio-economic activities entering in Taobao villages with digital technology were unguided and lacked spatial planning. Consequently, the pursuit of economic growth has resulted in the sacrifice of agricultural resources, degradation of the ecological environment, and terrible spatial quality. With the regionalisation and integration of the Greater Bay Area, the need for sustainable rural revitalisation has become urgent.

To envision future possibilities for rural development, this project introduces the concept of Smart Villages, aiming to enhance agricultural productivity and improve rural liveability. With the Dutch layer approach as the main methodology, the project understands the essential resources that support Smart Villages development and evaluates the spatial conditions of rural areas at regional, district, and local scales. To conclude, the key design elements for Smart Villages development include agricultural agglomeration, accessible networks, and rural liveability. The project shows a potential Smart Villages development framework that serves as a guidance for rural areas. A series of spatial design strategies are also presented and applied to two design cases, Xingtan in Foshan and Chikan in Jiangmen. They represent rural areas at different levels of development, showcasing scenarios of agro-industrial and eco-agricultural development respectively. It demonstrates how rural areas make use of local resources to spontaneously develop into Smart Villages, thereby reducing dependence on urban centres and contributing to the development of metropolitan regions. The proposed framework and design strategies offer valuable insights for planners, policymakers, and stakeholders seeking to foster the sustainable development of Smart Villages in a spatial perspective.

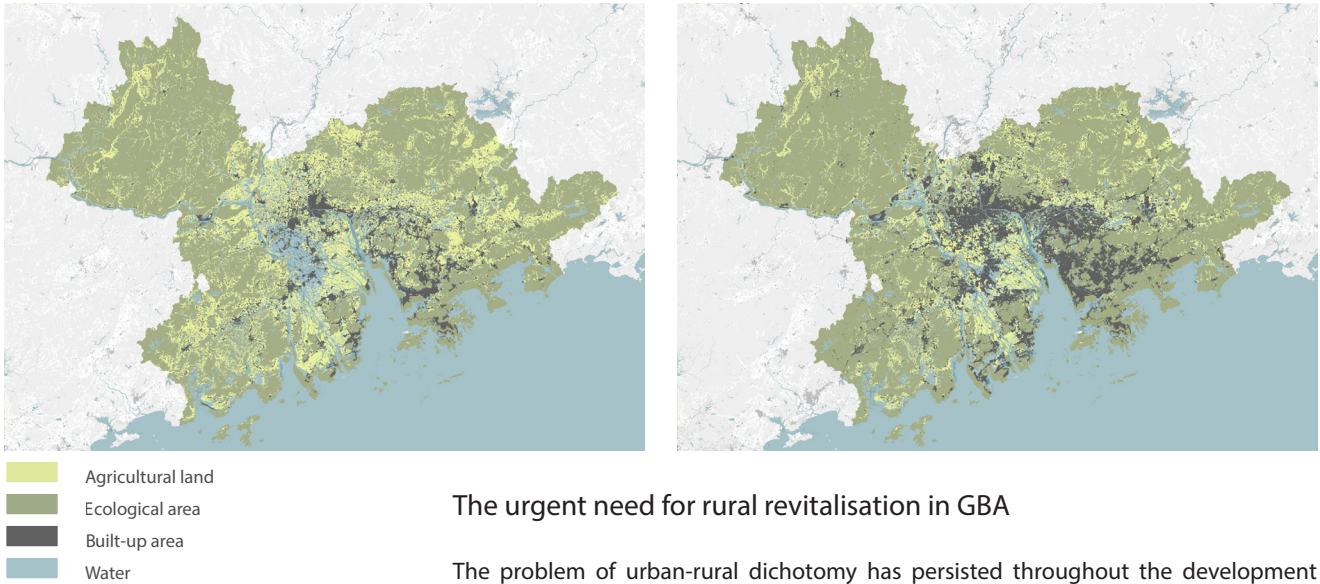


FIG. 226 (Top right) Land use mapping in 2000 shows that agricultural land was the dominant function of GBA with rich soil and water resources.

FIG. 227 (Top left) Land use mapping in 2020 shows that the built-up areas had severely eroded and destroyed the original agricultural land after two decades of rapid urbanisation.

### The urgent need for rural revitalisation in GBA

The problem of urban-rural dichotomy has persisted throughout the development of urbanisation in China. Rural industrialisation started to happen during the 1950s. The non-agricultural activities being collectivised by the commune system directly resulted in the decay of agriculture. Industrial development inevitably takes a further toll on traditional agriculture. According to T. Liu, Shi, Wang, and Yang (2018), agricultural land has been changed to construction land in varying degrees across the country, with the most significant decline, particularly in the eastern coastal area. The accelerated industrialisation development had led to uneven distribution of developing resources between urban and rural areas, including job opportunities. As rural development is still based on the agricultural sector, young people migrate to cities for jobs rather than stay in small villages. As human resources decline, the lagging rural economic development reinforces the dichotomy between urban and rural areas. The three rural problems, also known as ‘San Nong problems’, are typical rural development dilemmas in China, which include the rapid non-agriculturalisation of the rural population, industry and land use.

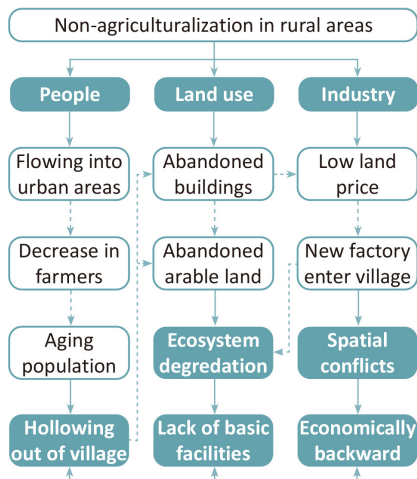


FIG. 225 The vicious cycle of rural disease.

Despite the many difficulties encountered, Taobao Village shows the possibility of future rural development since it developed quickly in the past decade. From a globalisation perspective, the emergence of e-commerce can provide more market opportunities for rural economic development. Since digital platforms can create more efficient and transparent market information, economic transactions across time and space have become possible. Instead of being limited by the central place theory, rural economic development can participate in the global market with the support of the online platform.

The Greater Bay Area, as one of the most developed metropolitan regions in China, is the research focus of the project. With the concentration of economic development and rural resources, GBA has become one of the first regions to experience the development of Taobao villages and has witnessed their prosperity. Therefore, it is of great interest to study the resources of the rural areas and identify the possibility of developing smart villages in the future with the GBA as an example.

## Implications from Taobao Villages

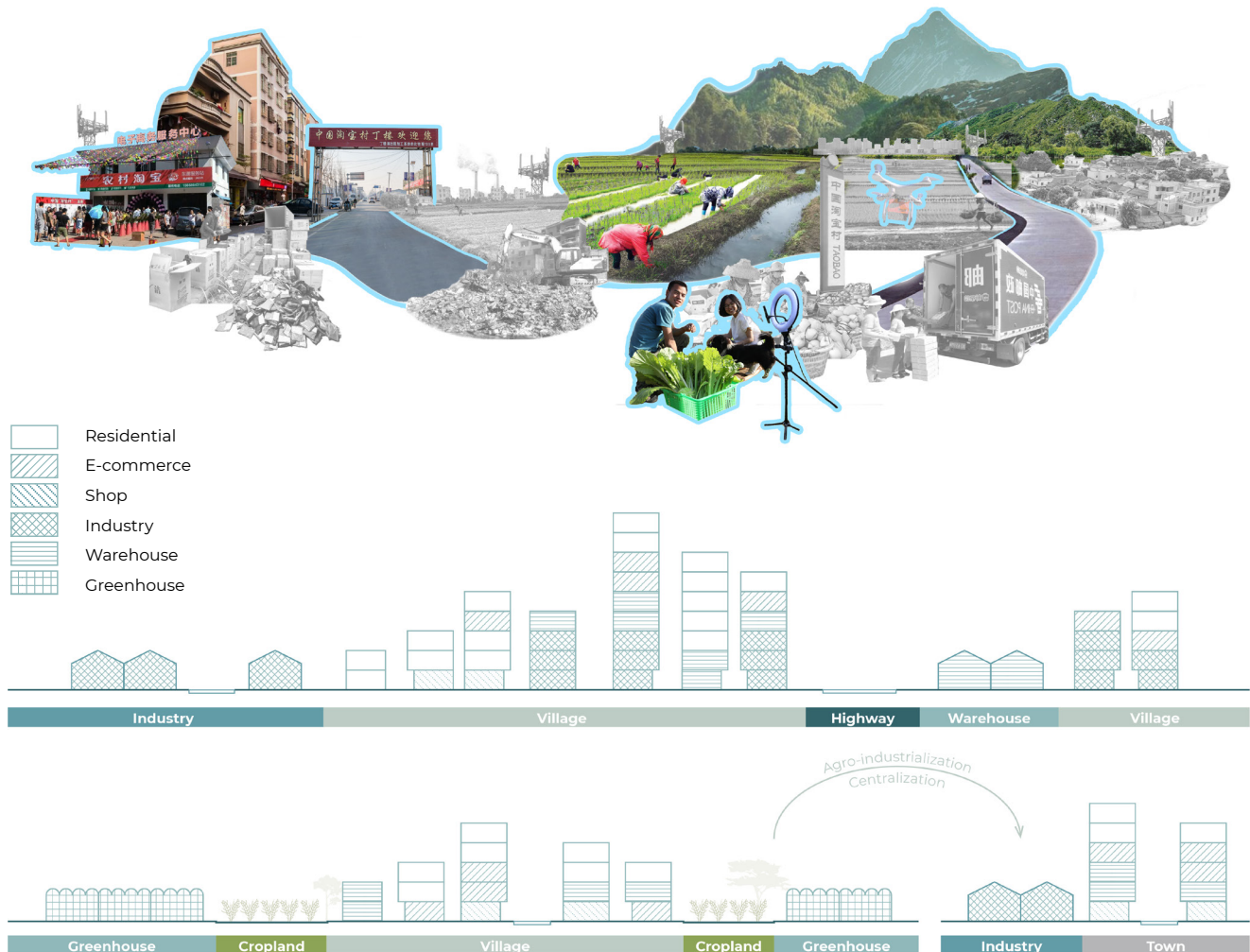
FIG. 229 (Top) Aiming at the balance of positive spatial qualities for rural development.

FIG. 230 (Middle) The urbanisation process has transformed agricultural land into construction land in industrial-based Taobao village and the village has experienced horizontal and vertical expansion.

FIG. 228 (Down) The traditional agricultural land is well preserved in agricultural-based Taobao village and greenhouses have become important space for improving agricultural efficiency and productivity. Agricultural by-products are gathered to the nearest town, where has better logistic resources.

During the initial cognition of Taobao Villages, it was initially concluded that village types could be classified into two types, including industrial-based and agricultural-based Taobao Villages. Generally speaking, villages based on industrial development mainly occur in suburb areas and are more likely to develop Taobao models, while a few occur in remote rural areas with sufficient infrastructure and resources.

The case study of Lirendong village, as well as Shahe and Yanxia villages, allow for the spatial changes of Taobao Villages to be summarised. Industrial space provides the basis for economic behaviour to take place. In particular, agriculture is far more important in the countryside than other manufacturing industries. Logistics facilities provide the physical spatial link to the e-commerce chain, stringing together the intangible economic behaviour and physical space. And the quality of the living environment determines the potential for sustainable development of the village. Changing and improving the spatial conditions can help the economic model of e-commerce to thrive and also promote the construction of Smart Villages.



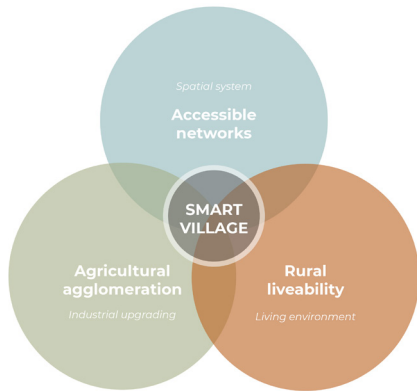


FIG. 232 Design principles of Smart Villages development.

## Principles of Smart Villages development

It is necessary to enhance existing resources and implement scarce resources to support the development of smart villages. With the Dutch layer approach, the whole region of GBA is analysed from the substratum, network, occupation, and cultural layers. In conclusion, many areas already have good basic conditions, which will become potential areas to be developed first and be used as activation points to help to surrounding rural areas.

In order to further guide the development of areas with potential, specific rural spaces and other underlying conditions are understood by analysing three typical rural areas, which could represent most of the rural conditions in GBA. Typically, the development of villages is closely related to the water system, agricultural basis and even mountain terrain, while industry develops along the road network. As a conclusion, the spatial segregation problem is found in rural development.

The project proposes three fundamental design principles, including agricultural agglomeration (the substratum layer), accessible network (the network layer), and rural liveability (the occupation layer), with a design toolkit from regional to local scale. The principles are applied on different layers, stimulating agricultural development with better ecological and economic benefits, enhancing connectivity for developing villages and local industries, and integrating rural living space with natural environments.

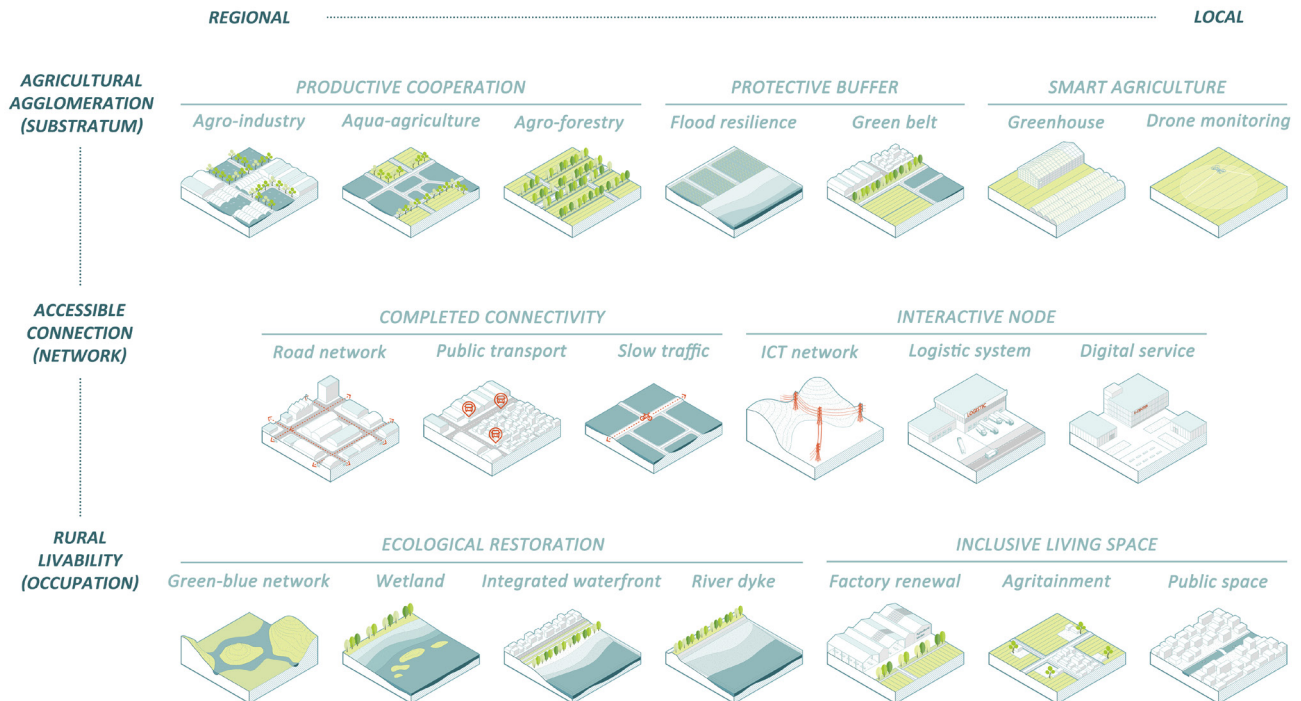


FIG. 231 The toolkit of design principles from regional to local scale. They are applied on different layers to stimulate agricultural development with better ecological and economic benefits, to enhance connectivity for the development of villages and local industries, and to integrate rural living space with natural environments.

### Accessible network

- + Logistic park
- ⚓ Port
- ▬ Highway

### Agricultural agglomeration

- Agro-industrial area
- Aquacultural area
- Eco-agricultural area

### Rural livability

- Agro-industrial developing village
- Agricultural upgrading village
- ▭ Agro-industrial developing area
- ▭ Eco-agricultural developing area
- Green-blue network
- Mountain
- Water

## The proposal and design exploration

The overall design strategy allows for classifying potential smart villages into agro-industrial and eco-agricultural development. Different areas with the potential to develop into these two types of villages can be identified on the GBA scale, and two strategic areas have been selected to demonstrate the design strategy.

As the industrialisation of the countryside has already taken place extensively in the GBA, remedying and correcting the severe effects of historical development is one of the critical aims of future rural development. Developing the first category of villages can inspire the development of other rural areas. Large areas of countryside in the remote suburbs of the GBA can be developed with their resources, showing the possibility of a future where the countryside does not have to rely on resources from cities. For rural revitalisation, agriculture-based strategies are the potential advantage that sets it apart from urban development. Cooperation between different industries is possible to improve agricultural sector, including agro-industry, aqua-agriculture and agro-forestry.

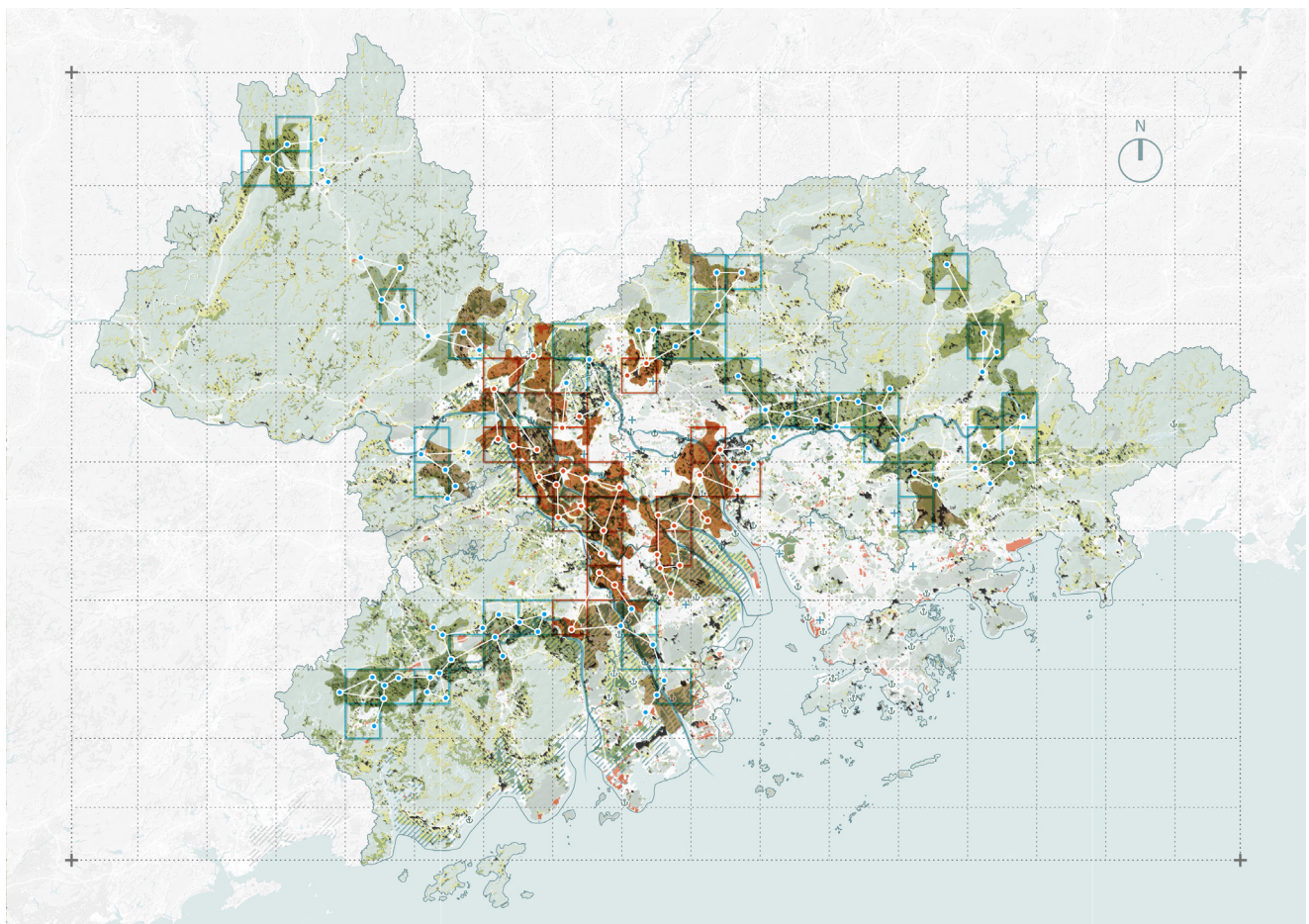


FIG. 233 Smart Villages development framework is developed to guide the possible application of the design strategy based on the available development resources. In areas where development resources are plentiful, they can be found to have the potential to be guided to develop into smart villages first.

Taking the case of Xingtian in Foshan as an example, four layers of design strategies are proposed to serve as guidelines for the agro-industrial development type of village and will be applied with specific tactical strategies, focusing on substratum, productive, living, and cultural layers respectively. Finally, the picture of the future smart village is an integrated network of villages that cooperate with each other, based on agro-industrial cooperation, and have a radical impact on the surrounding area. The e-centre becomes the main public platform for gathering rural activities and digital development, while the green-blue network associated with the rural track provides better living environments.

FIG. 234 The digital platform acts as a centralised virtual hub where villagers can access basic information about their own community, including infrastructure development, agricultural practices and other relevant data. Furthermore, different stakeholders can communicate on this platform, which promotes self-governance in Smart Villages.

Digitalisation has played a key role in stimulating the development of Smart Villages by providing a digital platform to facilitate the sharing of various types of information. The Smart Villages system is an integrated framework that the productive system, liveable system, and interconnected system are all related to each other and will never work separately. The physical system consists of spatial transformation and different flows within it, supporting the agro-industrial transition in rural areas, while the digital system stimulates the spatial transformation.

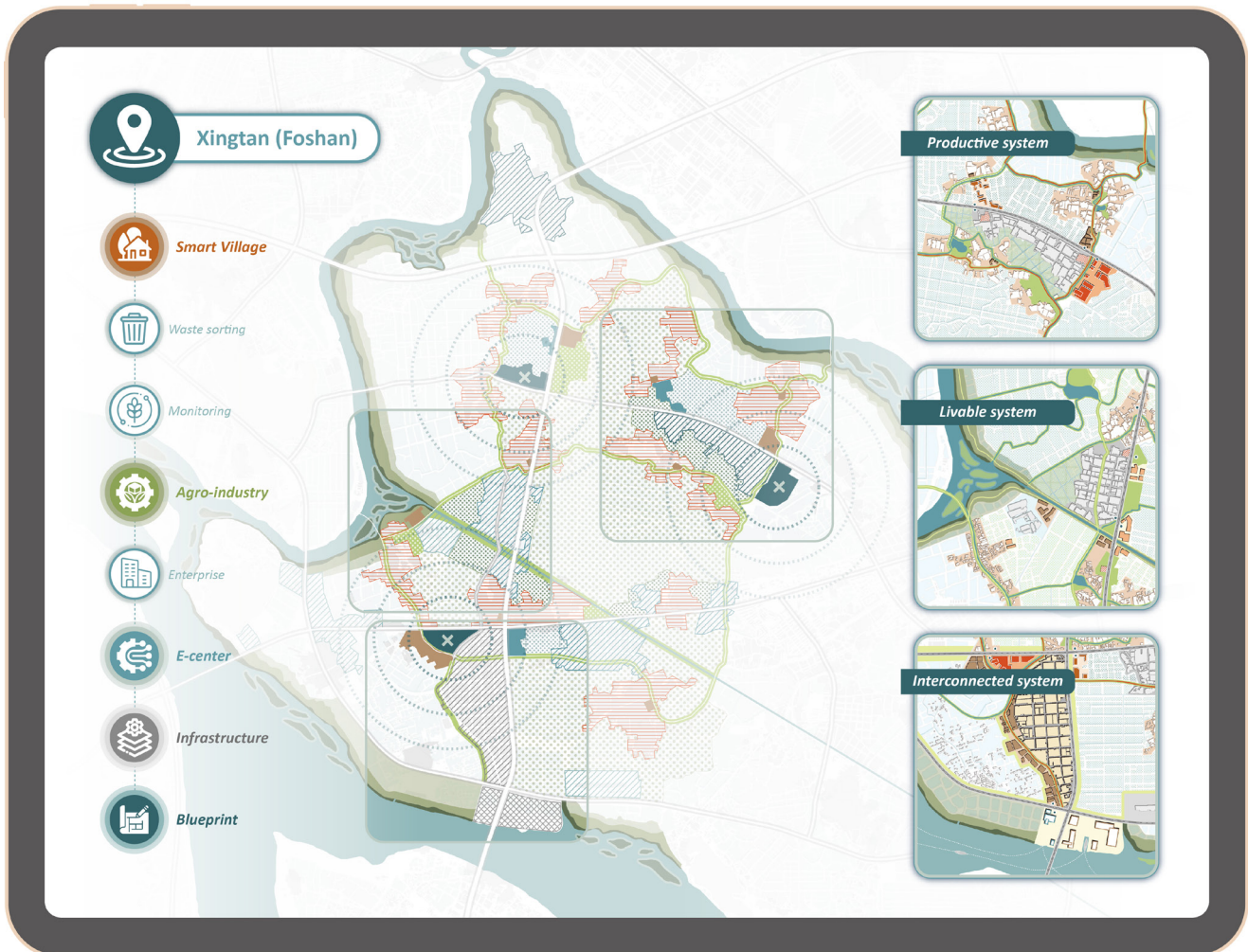
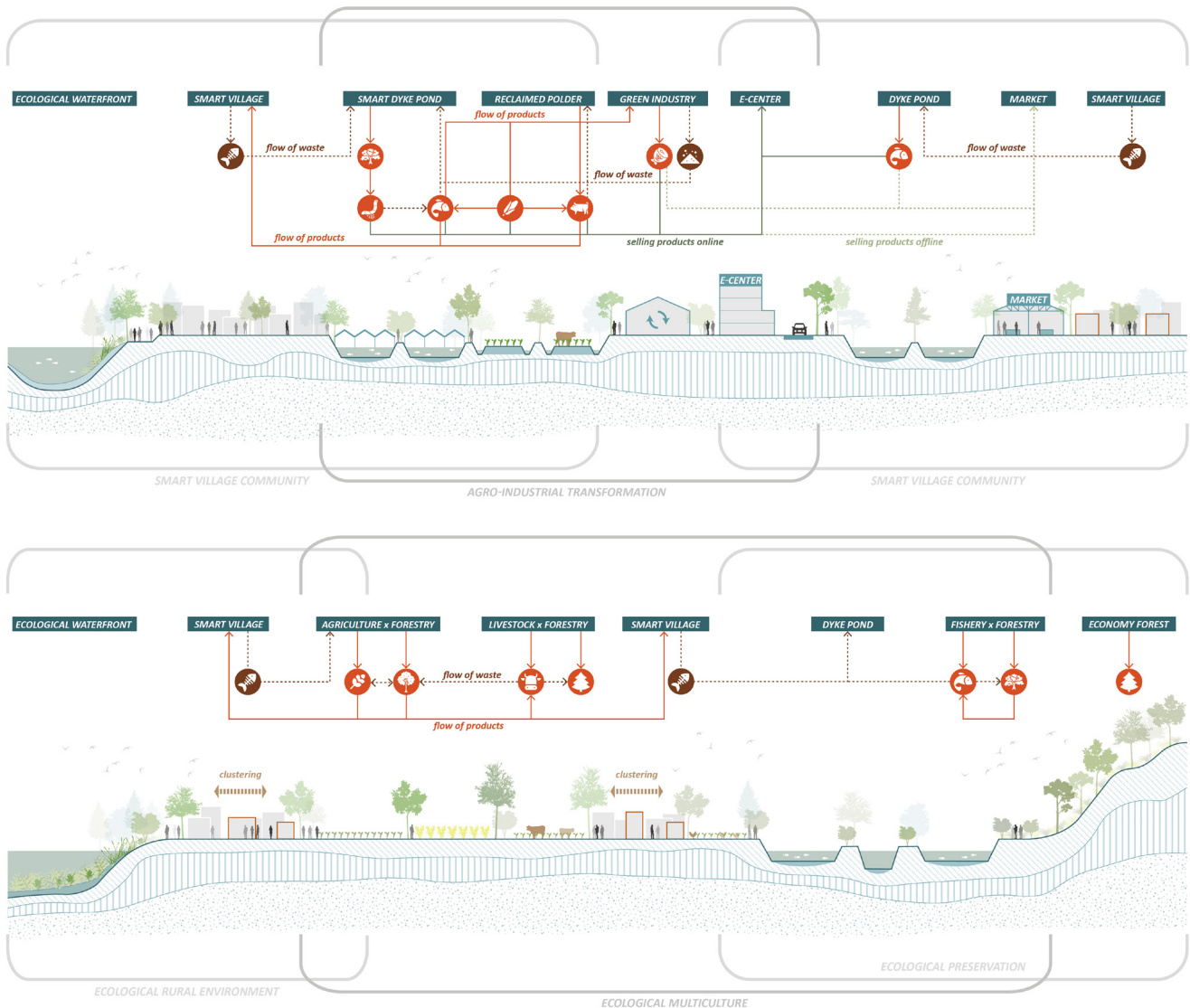


FIG. 235 (Top) By creating a circular flow system of products and waste, the agro-industrial transformation encourages the cooperation between different functional spaces, which breaks the spatial segregation. With a longer production chain, more job opportunities will be provided. People can sell the agricultural products online, and the local market will also sell the agro-products, becoming an offline part of the rural e-commerce.

FIG. 236 (Down) The system of eco-agricultural upgrading can diversify and enlarge rural agriculture, which is beneficial to maintaining soil fertility and local biodiversity. With the online auction encouraging the collective selling of agro-products, the expansion and development of villages will be more clustered to promote agglomeration effects.

One of the most basic ideas for agro-industrial development is to develop and upgrade the agricultural substrate and industry in the countryside to enable them to cooperate. The integration and advancement of productivity is the primary concern of developing the rural economy. Introducing new technologies and innovative practices aims to create an agro-based agglomeration in which industry, agriculture, and village are interrelated.

The circulation system of material flows generated in the space is the potential to increase rural productivity and provide more job opportunities. Developing productive systems still relies on well-constructed interconnected systems and aims to provide a more sustainable rural environment. Additionally, ICT technologies can support the communication of product information between farming and industrial areas to help agro-industrial cooperation. The e-centre also plays an important role in enhancing digital literacy within rural communities and empowering farmers.



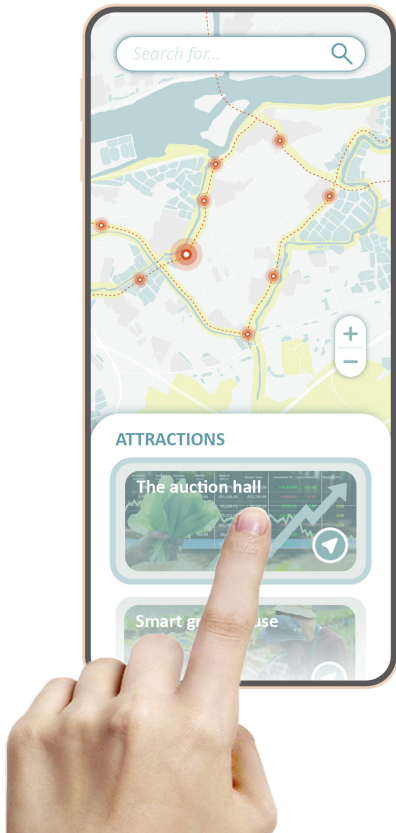


FIG. 238 Digital platform showing information of attractions and activities in rural areas.

To demonstrate the potential of Smart Villages development based on ecological agriculture, Chikan is chosen as a showcase to illustrate a complementary strategy. Ecological protection is an essential strategy for enhancing the liveability of the countryside and promoting environmental sustainability.

The integration of agriculture and ecosystems will increase the biodiversity of the area, which feeds into the development of ecosystems. Thus, smart agriculture and agro-forestry have become the main design strategies. By assessing the soil conditions of farmland, crops can be mixed in different areas, promoting biodiversity and creating a more resilient agricultural system. Implementing crop rotations at different times of the year can further improve soil fertility and reduce the risk of pests and diseases. The introduction of woodland strips within farmland can carry the rural track, providing pathways for people to access the farmland and connect with the surrounding ecosystem.

Digital platform helps with marketing agro-products in Smart Villages. The digital auction hall helps sell agricultural products online, expanding the economic benefits of the rural industry. Implementing an online auction platform offers many benefits to both farmers and buyers. On the other hand, the tourism industry is also helping rural revitalisation in remote areas. Online platforms can effectively attract visitors as it disseminates information regardless of distance.

The expansion of villages in these remote areas may follow an agglomeration pattern, creating larger clusters of interconnected villages. This approach could create a continuous village space that provides better public spaces and services for villagers and benefits the village economy through the advantages of agglomeration. By expanding villages together, resources can be shared more effectively and economies of scale can be achieved.

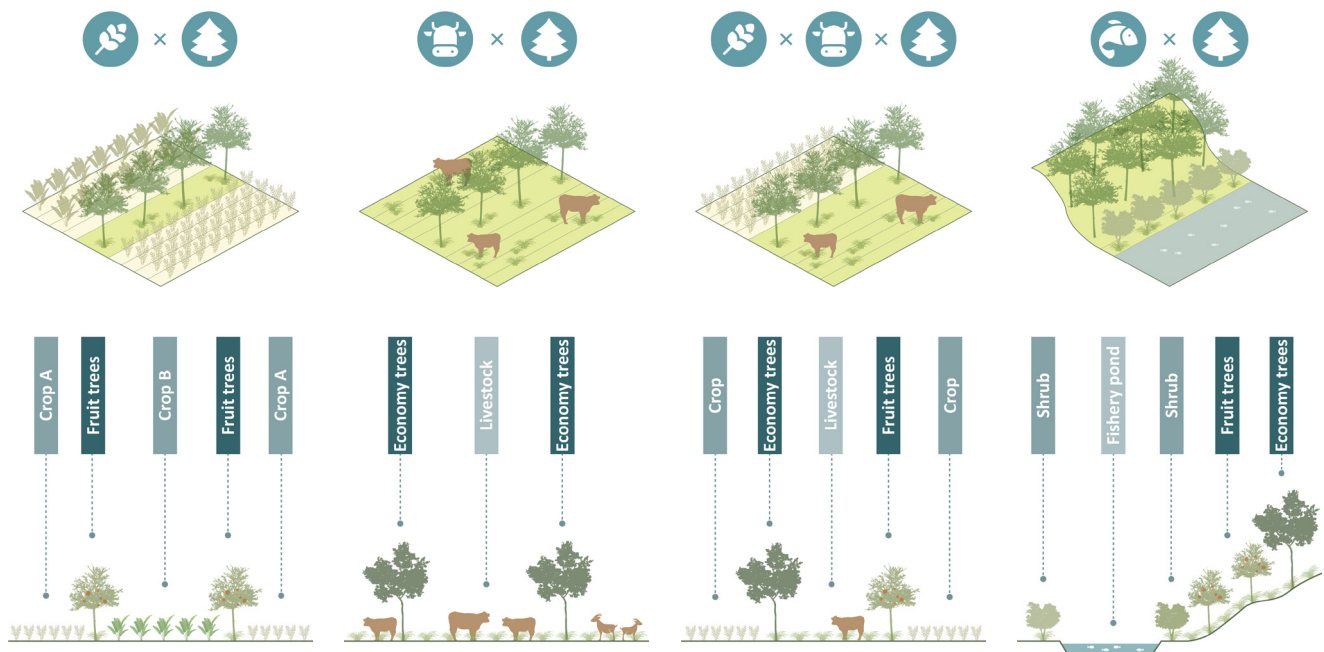


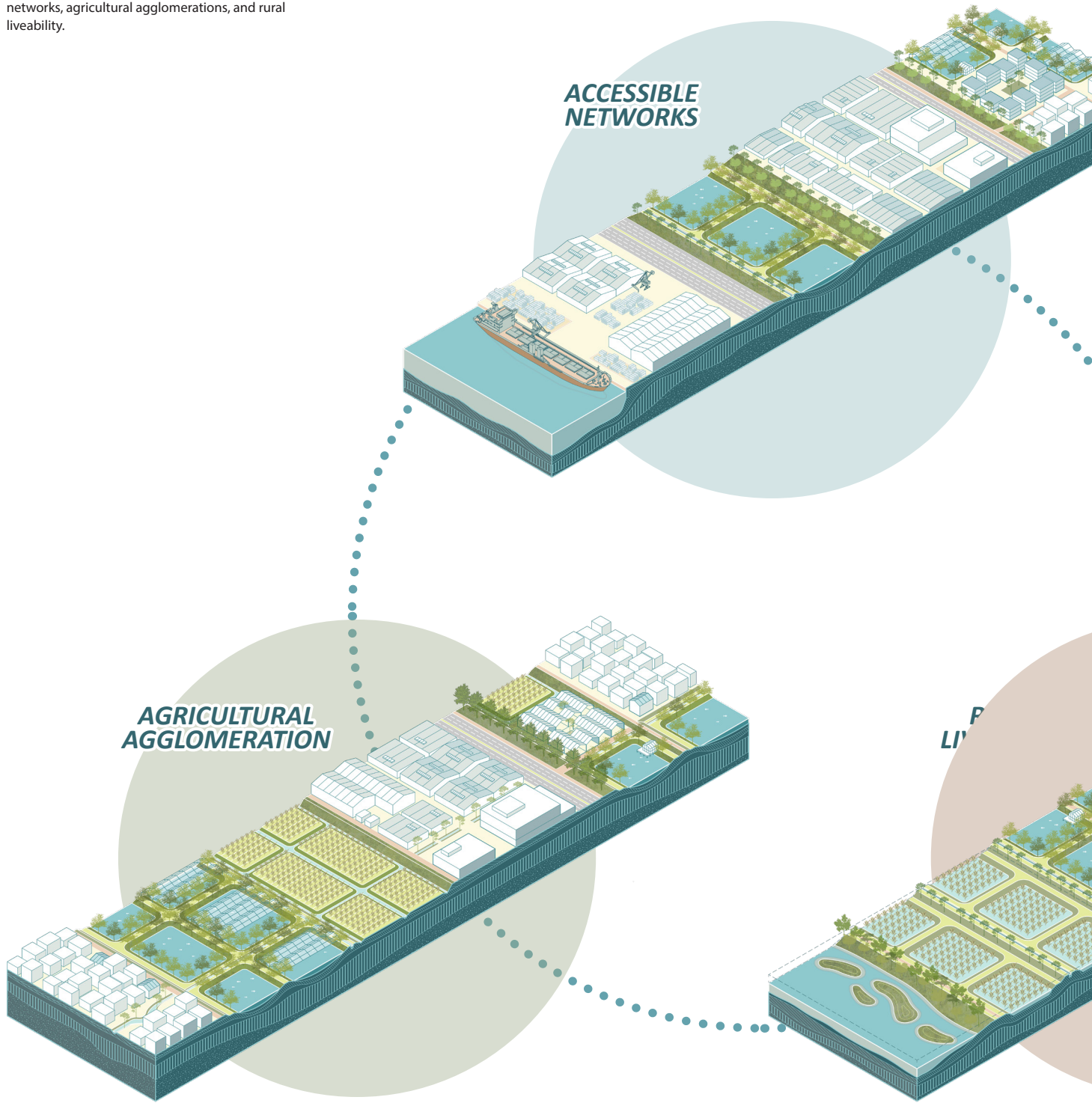
FIG. 237 The spatial components of agro-forestry practices consists of cropland, livestock farming, and forestry.



FIG. 239 (Top) Imagination of sustainable agro-industrial collaboration in the Smart Villages. With technology such as drone monitoring, the growth of crops and livestock in the farmland will be well monitored and those information can be shared with the local factory easily, which can encourage their cooperation.

FIG. 240 (Down) Imagination of eco-agricultural development that emphasises sustainable farming practices with digital technology. The construction of public transportation facilities will improve the accessibility of rural areas so as to enhance rural liveability.

FIG. 241 Spatial conditions are the basis for thriving SmartVillages development, including accessible networks, agricultural agglomerations, and rural liveability.



## Conclusions

In the face of the challenges of modernisation, the Smart Village development framework offers a promising avenue for the independent and sustainable development of rural areas. Instead of a singular dependence on urban resources, the development of rural areas can be pursued by creating a system of mutually supportive networks. The project proposes two types of strategy: agro-industrial development and eco-agricultural development. Agro-industrial development focuses on transforming rural industries based on local agriculture, stimulating rural economic growth and providing digital opportunities. Eco-agricultural development emphasises upgrading traditional agricultural practices, creating sustainable agricultural systems and protecting rural areas from the negative effects of urbanisation while promoting agricultural productivity and sustainable development. By understanding the underlying spatial conditions in rural areas to identify the types of agricultural settlements that can be developed, the possibilities for smart village development in the region are opened up. Strategies based on agriculture are essential for rural revitalisation, as agriculture forms the basis of rural areas and distinguishes them from urban development.

Spatial conditions play a key role in the successful development of smart villages. While digital infrastructure is important, it is not the only determinant of smart village development. The key lies in meeting spatial imperatives such as a productive landscape, connected systems and an enabling living environment. By creating agricultural agglomerations based on local agriculture, enhancing rural livability through ecological conservation measures, and creating accessible physical and electronic networks, smart villages can flourish by facilitating the exchange of information and products.

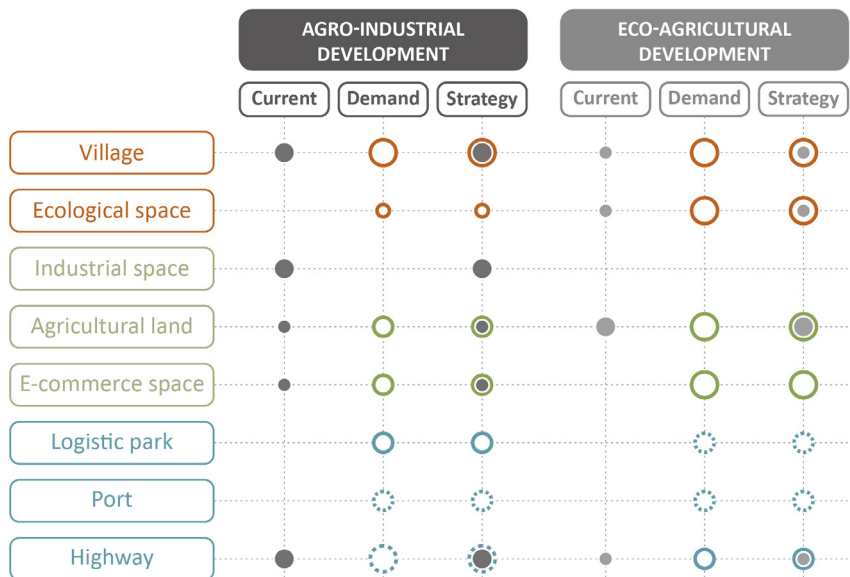
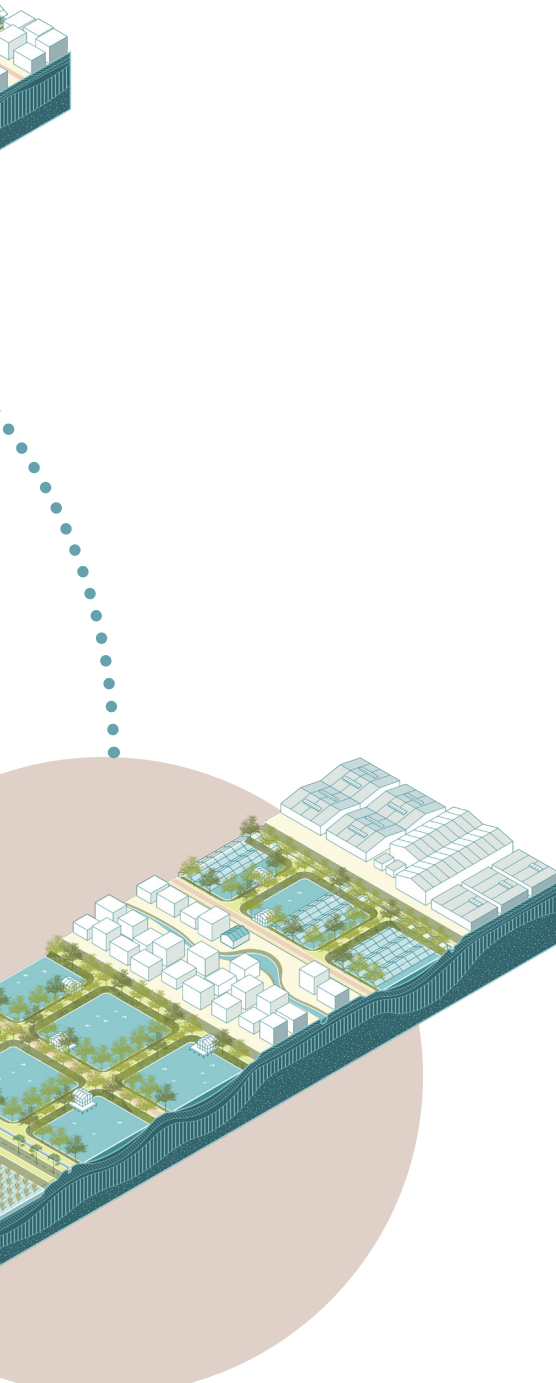


FIG. 242 The agro-industrial development is the primary potential for the development of Smart Villages, while the eco-agriculture development is a complementary strategy.



FIG. 243 Group photo in Marker Wadden

# Reflection

After several months of intensive work and dedication, all ten projects are deeply rooted in their specific sites, thanks to a comprehensive understanding of the local landscape dynamics and processes. At the same time, there is something that binds them together: an overarching form of positioning towards the place, and a desire to address pressing problems of our contemporary world. All the work produced within the Resilient Coastal Landscapes graduation lab is built upon the idea of taking the landscape, with all its inherent processes and layers, as the basis for further developments. Proposals for challenges such as drought, floods, mass extinctions, and many others, emerge from a reading of the site's potentials and frailties, its vegetation and soils, its history - which leads to proposals that are sensitive and site-specific, delicate yet powerful, across many scales.

The idea of a landscape framework has been developed in many of the projects, providing room for slow ecological processes and attending the needs of local flora and fauna, while coexisting with all dynamics related to infrastructure, economy, culture and society.

As the title suggests, *Grow, With the Flow* adopts an adaptive and flexible approach to coastal interface design. The translation of landscape-based design principles into a new regional coastal interface framework promotes dynamic processes and reconnects the sea and land. The framework aims to increase the interface's resilience and self-sustainability while ensuring that land use is in harmony with the area's natural conditions. Analysis and design at various scales demonstrate the potential of a landscape-based approach on a systemic to local scale by producing site-specific design tools that are applicable along the entire interface. The interface framework is implemented at the regional level, integrating existing structures with new developments. Additionally, three local thematic zoom-in designs demonstrate the spatial configuration of existing structures and the potential of the new interface framework on a smaller scale.

--Venne van den Boomen

A River Reborn is a project that draws its inspiration from the past by implementing it for a sustainable and resilience future of the river Nile. The project aims to restore the natural river system by allowing the river to experience natural dynamics, slowing down the river flow by increasing the sponge capacity of the surrounding landscape and balancing the river system by not only taking from the river but also giving back. The project takes on a transboundary approach and uses the natural elements in the landscape as borders, ignoring political boundaries. The designs not only focus on restoring the river system but also include local practices that enhance the value of the local communities.

--Hilde Huijboom

The project *The River and the Mosaic: Regenerative Cycles in Production Landscapes* took the challenge of designing a green and blue spatial armature in a landscape of intensive agriculture and exploitation. Triggered by the worst drought the Paraná River ever experienced, this regional framework aimed at giving room for riverine processes

currently choked by agricultural industries, while mitigating their negative impacts on the hydrologic cycle. However, different forms of production and occupation of the landscape are also proposed and explored in three zoom-ins, showing that a framework can not only “mitigate the mess” caused by human activities, but also steer them in more site-adequate directions.

--Victoria Imasaki Affonso

Like the title of the thesis “From the Water,” this project serves as a reminder for people to perceive the Pearl River Delta as an agricultural-based region, where the local population relies on the landscape they have created from water. Therefore, the objective of this project is to interpret the traditional agricultural system from a landscape perspective and provide guidance for the future development of the agricultural area. It is a great opportunity to gain and apply locally specific knowledge and experience. The insights gained from the construction and development of the agricultural system can effectively complement the landscape framework methodology.

--Yi Lu

The venture known as Tomorrow’s (P)ARK stands as a groundbreaking paradigm shift in landscape innovation, heralding a new epoch of sustainability and resilience. Through meticulous exploration across spatial scales and an unwavering commitment to interdisciplinary collaboration, this visionary project redefines the creation of national parks and nature conservation. Drawing inspiration from historical landscapes and the enduring legacy of Frederick Law Olmsted, Tomorrow’s (P)ARK aspires to seamlessly integrate with natural conditions, navigating the intricate challenges of the modern era.

In Tomorrow’s (P)ARK, the proposed framework transcends regional confines, showcasing a remarkable adaptability and scalability across both systemic and local scales. The intricate interplay of ecological, social, and cultural dimensions is manifested in a comprehensive approach that not only sets a precedent for future projects but also prompts ethical considerations. The project encourages contemplation on nature’s intrinsic value, advocates for transboundary integration, and champions inclusive decision-making processes, guiding us towards a future characterized by harmonious coexistence between humans and nature.

More than envisioning a resilient landscape system, Tomorrow’s (P)ARK emerges as a catalyst for dialogue and thoughtful discourse. Through its lens, the project not only offers a glimpse into a sustainable future but also provides a tangible pathway towards it, demonstrating the transformative potential inherent in landscape-based design.

-Anežka Vonášková

Guided by the landscape as a system and resilience thinking, the project applies layering analysis and multiscale analysis approaches to explore landscape-based solutions and the resilient design framework for freshwater managed recharge in the PRD. It innovatively identifies the role of typical landscape type of the PRD, like the mountain as the water tower, flood plain as the sponge and coastal estuary as adaptive interface, which not only assemble the landscape type as a system, but also optimize the unique advantages of the landscape ecosystem.

The interdisciplinary perspective from water management techniques for freshwater managed recharge in the Pearl River Delta complements this approach. Through these efforts, the aim is to develop effective solutions to address water scarcity, promote freshwater supply sustainability for the PRD.

--Jiaqi Qiu

The project "Sponge Polder", located in the Taihu Lake Basin in China, explores the potential of polders in alleviating water crises and rapid urbanization, trying to rebuild the interdependent relationship among the water, agriculture, and settlement system, which has been disrupted by ongoing urban development. Compared to the civil engineering method to solve these challenges, landscape intervention costs much less, builds up a more adaptive and resilient system, and brings aesthetic experience as well. Therefore, how to learn from historical practice to protect precious cultural heritage while restoring the water resilience in the Taihu basin through landscape approaches is the key challenge in this project. The landscape approaches start from the base layer like soil and water, helping to create a sustainable social-ecological system. By implementing a resilient polder system, not only will current challenges be addressed, but preparations will also be made to tackle uncertainties in the future, enabling sustainable ecological and economic development.

--Qian Yao

In the project "Guangzhou Metropolitan Park" by Chuhan Zhang, a landscape approach is used to create a resilient landscape system in the metropolitan city. It starts with understanding the landscape system, which unravels the changing process of the city from both spatial and time perspectives. Based on the case study of Boston Metropolitan Park and traditional city-nature wisdom, the project proposes a Landscape-nature network in Guangzhou. This network, while serving as an urban park system, can help the city address multiple challenges aroused by climate change. With the concept of design through scale and landscape as a palimpsest, this project works within the urban context. It works with more critical and problematic areas to explain how the overall concept and general principles could be applied within context step by step. The project focuses on the problems of green space and aims at creating a social-ecological inclusive and future-proof Guangzhou.

--Chuhan Zhang

Through the project "Smart Villages", Minshi Zhang understands the potential of the landscape as a resource and integrates it effectively into rural development strategies for the Greater Bay Area. As the basis for development in rural areas, the landscape provides the physical context and natural assets that form the basis for various development activities. Using the Layer Approach to understand the substratum, networks and occupations within a complex rural system, it is evident that these elements are not yet fully synchronized in their interactions. This recognition emphasizes the need for comprehensive planning and coordinated efforts to optimize the relationships between spatial components. In this project, the proposed digital cultural layer is a powerful catalyst for developing landscape strategies. Digital practices can stimulate and shape the evolution of the landscape, which in turn provides a platform for cultural expression and development. By adopting a framework that supports the systematic development and application of diverse landscape-based strategies, rural areas can capitalize on the inherent potential of their landscapes. It encourages the implementation of landscape-focused initiatives

to enhance rural liveability and optimize the benefits derived from the landscape. The significance of the landscape as a basis for interaction with other systems becomes clear. The landscape connects various elements such as natural resources, infrastructure, social networks and economic activities. Using the landscape as a foundation allows for effective interaction between these systems and promotes cooperation, innovation and synergistic development in rural areas.

--Minshi Zhang





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An aerial photograph of a coastal landscape. In the foreground, there is a large, organized grid of rectangular aquaculture ponds, likely for shrimp or fish farming, separated by narrow earthen paths. To the left of the ponds is a dense residential area with many small, multi-story buildings. In the background, a wide river or canal flows through the landscape, and beyond that, a range of green mountains is visible under a clear blue sky with some light clouds.

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