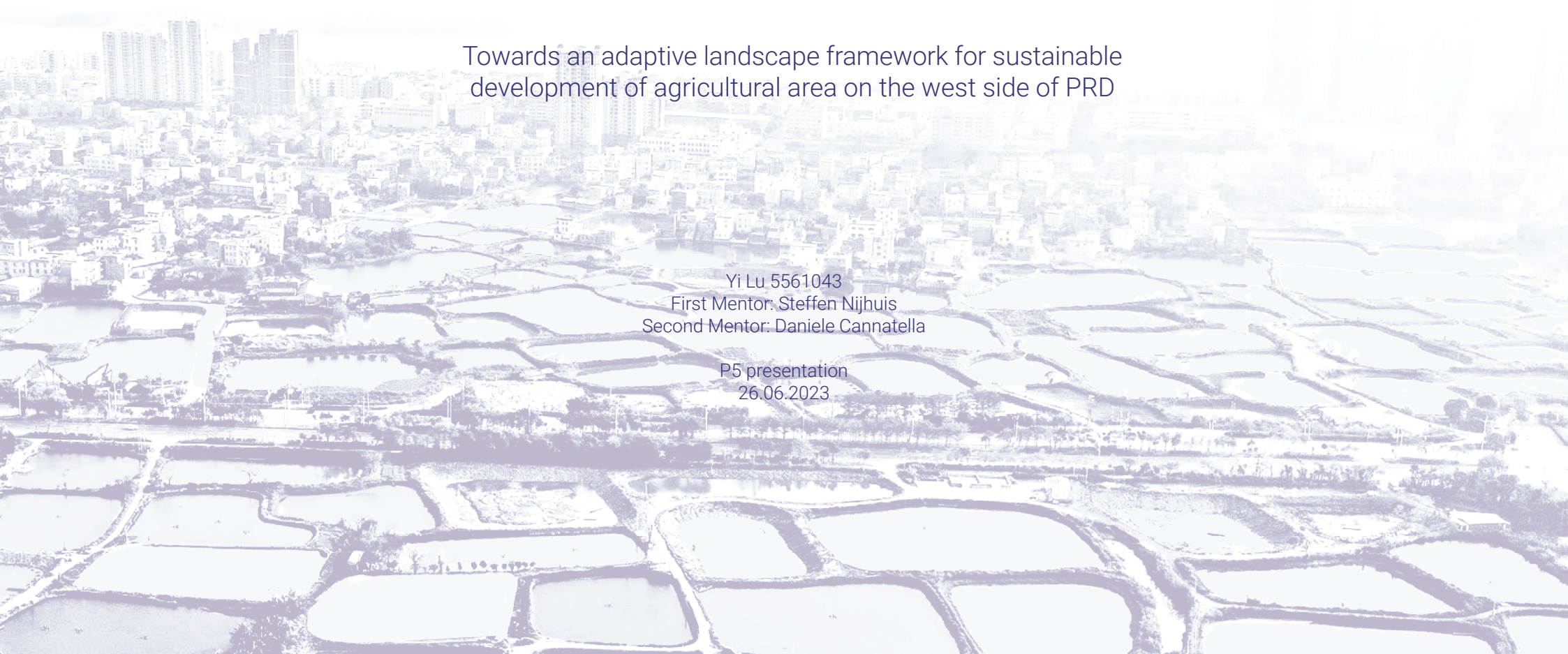
From the Water

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

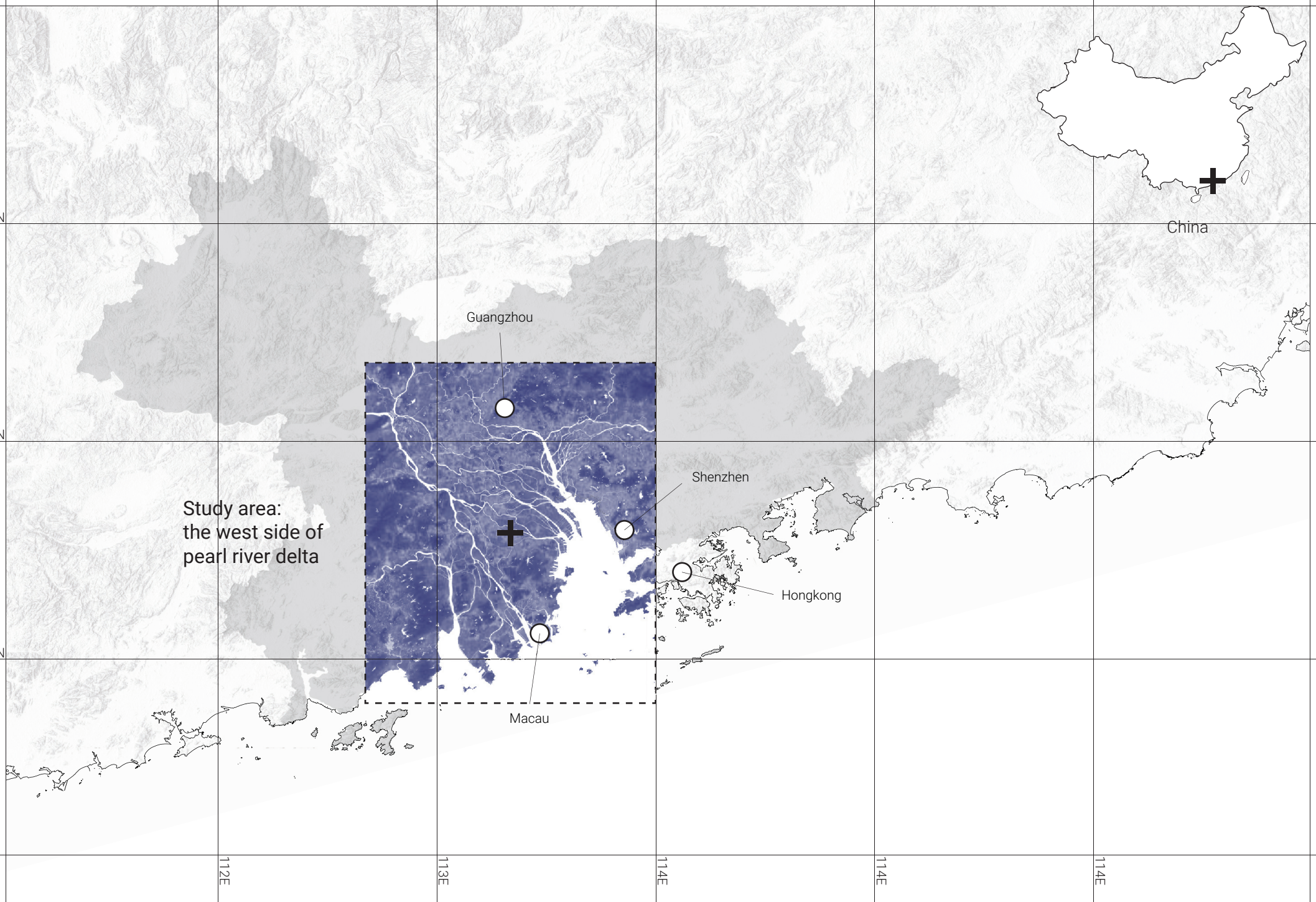


Yi Lu 5561043
First Mentor: Steffen Nijhuis
Second Mentor: Daniele Cannatella

P5 presentation
26.06.2023

Ancient 17th century Chinese art Rice farming in a paddy
Source: Yu zhi geng zhi tu by Jiao, Bingzhen, 1696

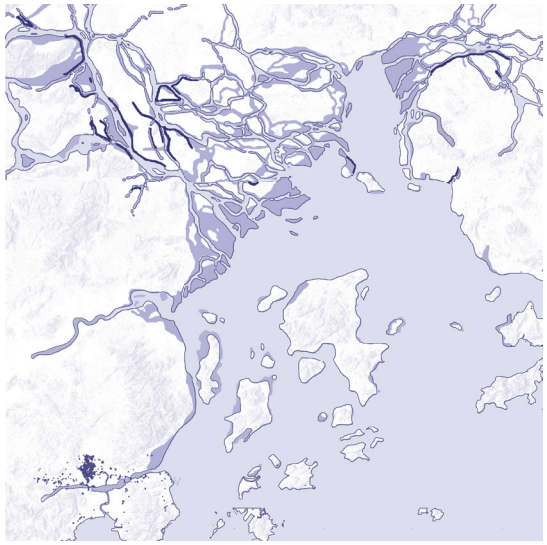
Study area: the Pearl River Delta



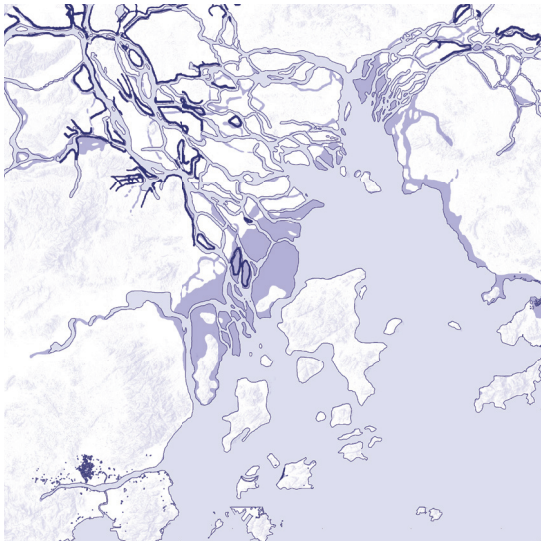
The Pearl River Delta: metropolis and agriculture-based area

Photo: https://geoshen.com/posts/the-pearl-river-delta-megalopolis

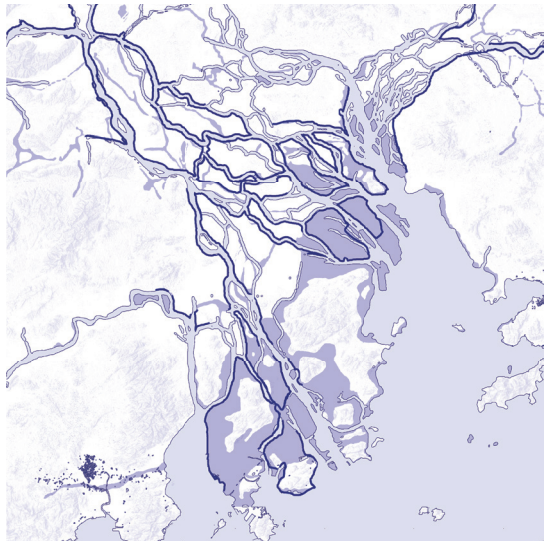
Agriculture as land formation



1000-1300



1300-1600



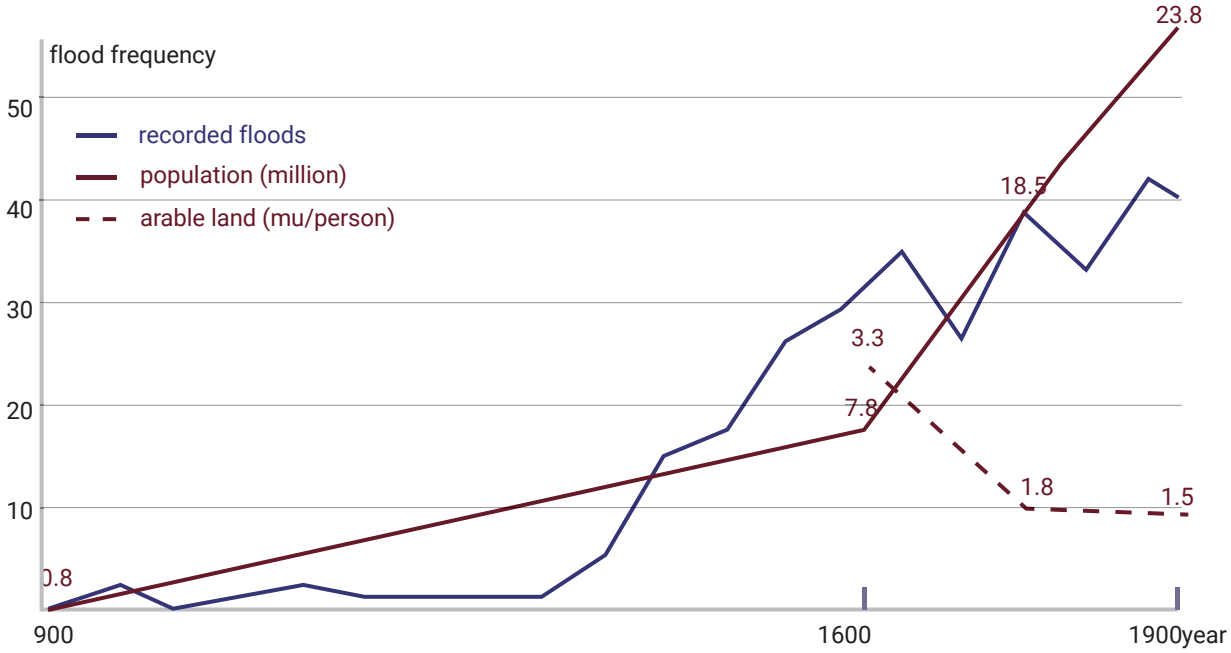
1600-now

Source: adapted from Xiong and Nijhuis, 2019

Limited land resource

dense population

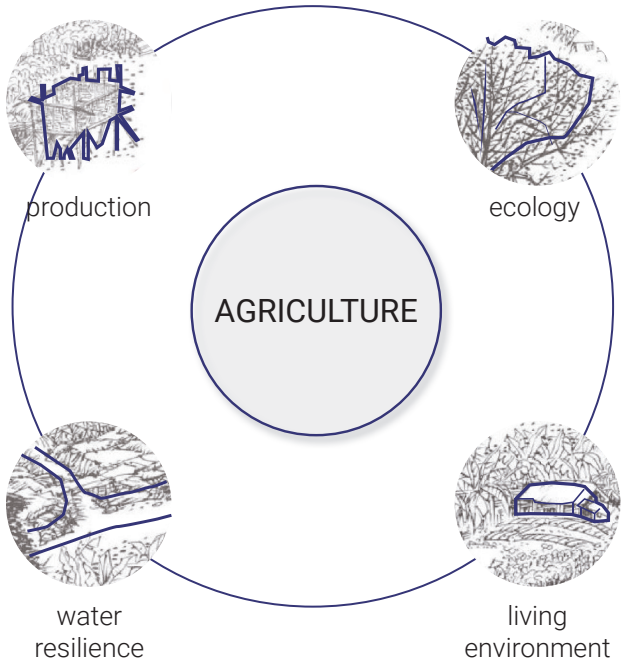
frequent flooding



Data: Chen, 2018

Source: Maryknoll Mission Archives, 1947

Agriculture responses as a multifunctional system



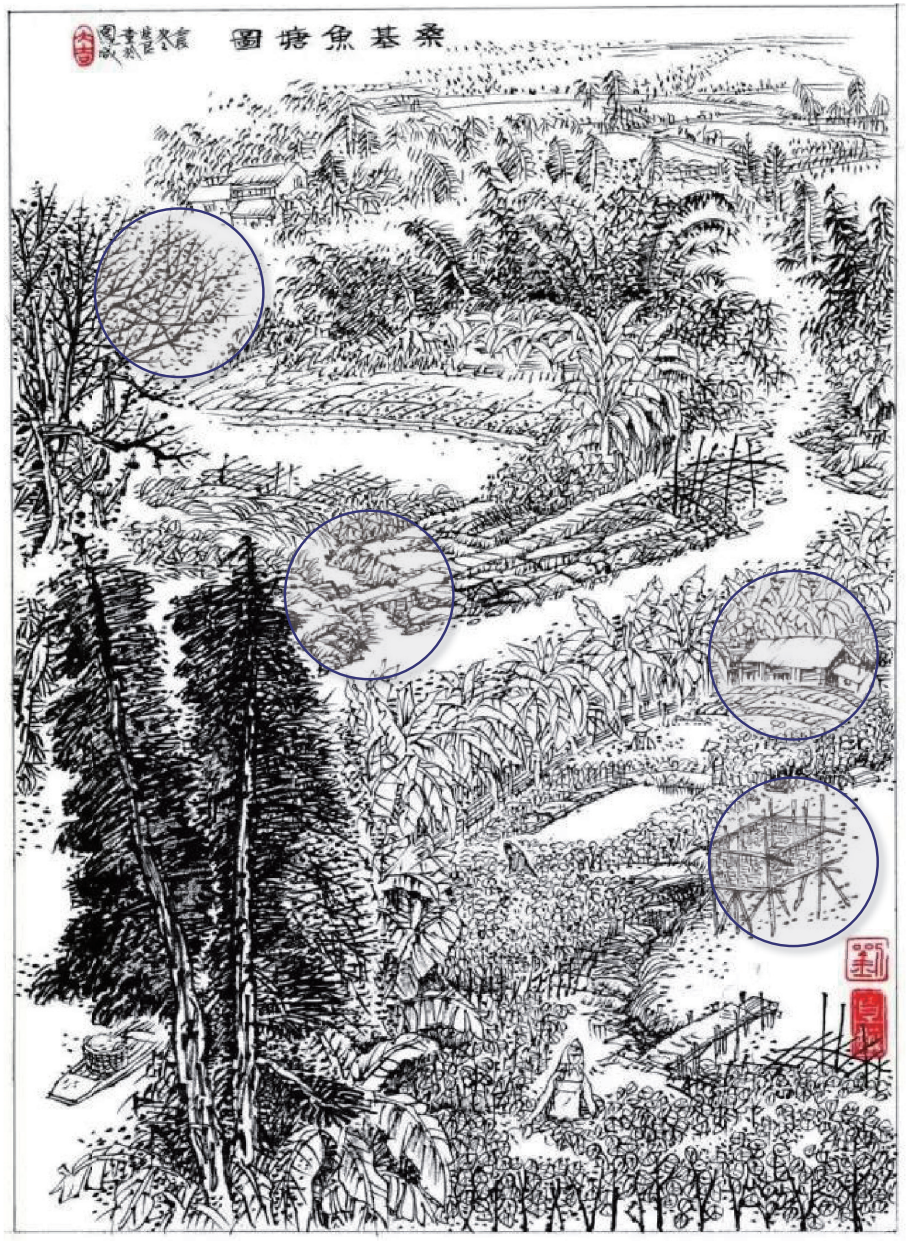


Image: Dikepond Drawing by Faliang Liu


Traditional agriculture

Urbanization

Photo: http://hdd-group.com/zw/index.php?c=article&id=204

Intensive agriculture

Photo: http://www.geog.com/id.jsp?id=536

Environment degradation

Photo: http://hdd-group.com/zw/index.php?c=article&id=204

Flooding risk

Source: Tianheng Zhang (left); https://www.sohu.com/a/166946485_174909 (right)

Landscape homogenization

Source: https://www.sohu.com/a/421445573_120120992 (left); https://new.qq.com/rain/a/20220930A0BTV500 (right)

Lost of cultural memory

Source: google image

Increasing demand in the future

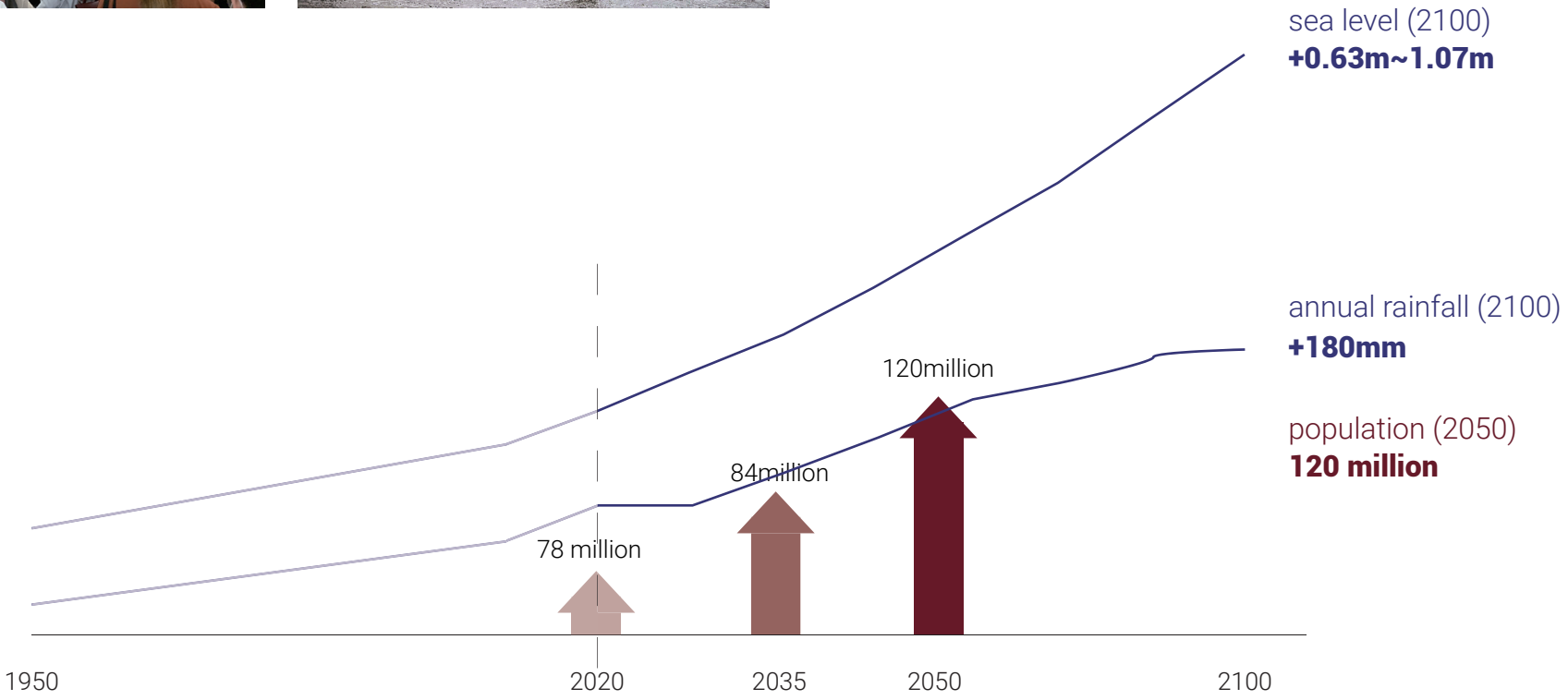


Image: Visual China (left); Nanfang Daily (right)
Data: Hong Kong climate change report 2015; Department of Natural Resources of Guangdong Province; Fan Gang

Can the current planning solve these problems?

*A **single evaluation method** was used to virous land types zoning.*

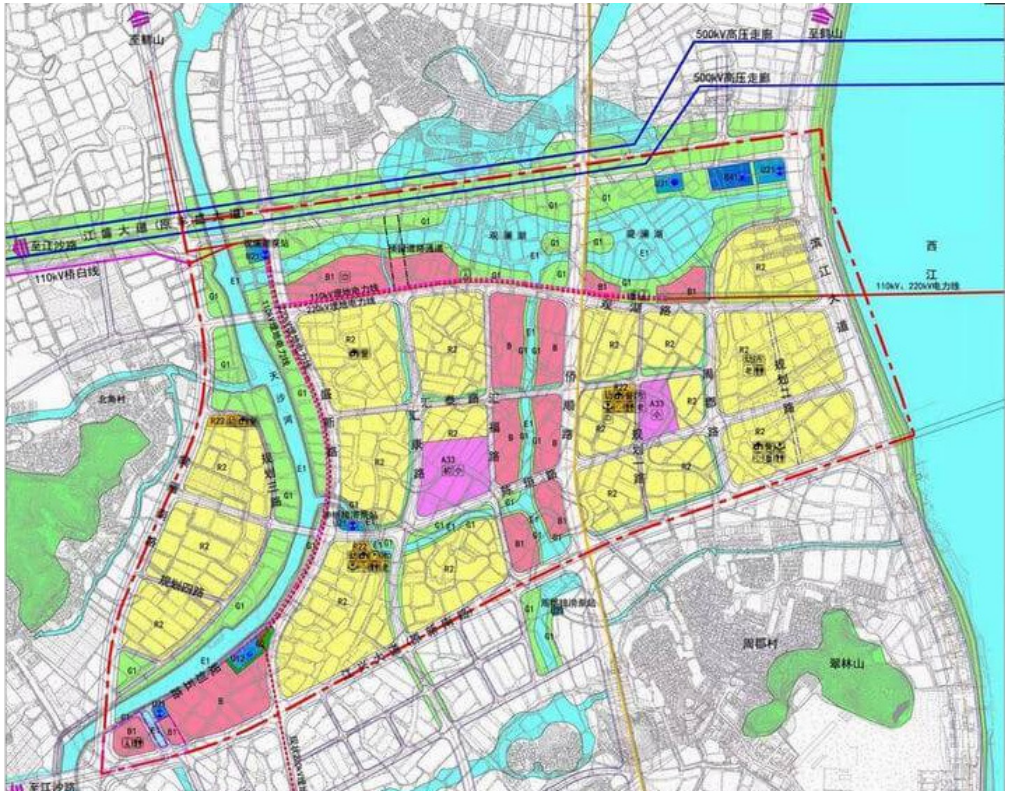
Lin Gao et al, 2019

*There is a **lack of coordination among the authorities** of urban planning, environmental management, and hydraulic engineering.*

Diego Sepulveda Carmona et al, 2014

*Large-scale interventions have replaced the historically diverse environmental and cultural heritage of the PRD with more **uniform, featureless topographies.***

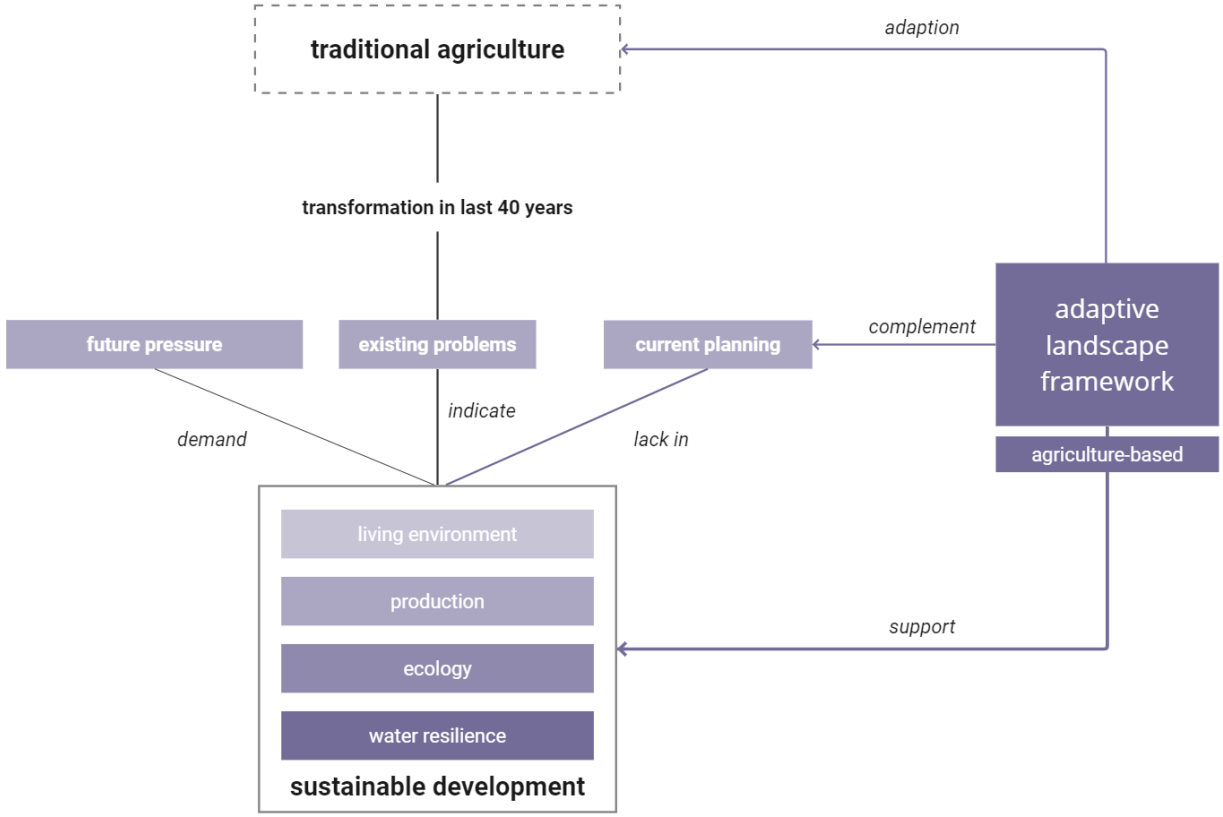
Shenghui Guo, 2010



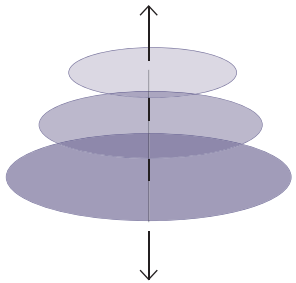
A planning in Jiangmen

Source: Jiangmen City Planning and Design institute, 2020

*To support the **sustainable development** of the agricultural area on the west side of PRD by applying an **adaptive landscape framework***



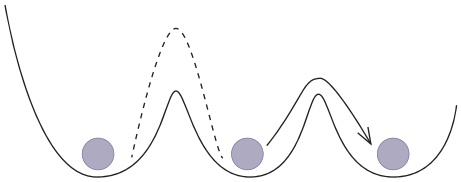
An adaptive landscape framework



Landscape-based urbanism

Physical landscape structures and associated natural processes are seen as fundamental to creating favourable conditions for future development.

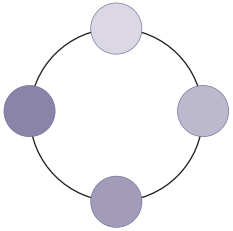
Steffen Nijhuis, 2022



Social-ecological resilience

It provides a valuable context for the analysis of social–ecological systems, an area of explorative research under rapid development with policy implications for sustainable development.

Folke et al., 2002



Ecosystem service

the direct and indirect contributions of ecosystems to human well-being

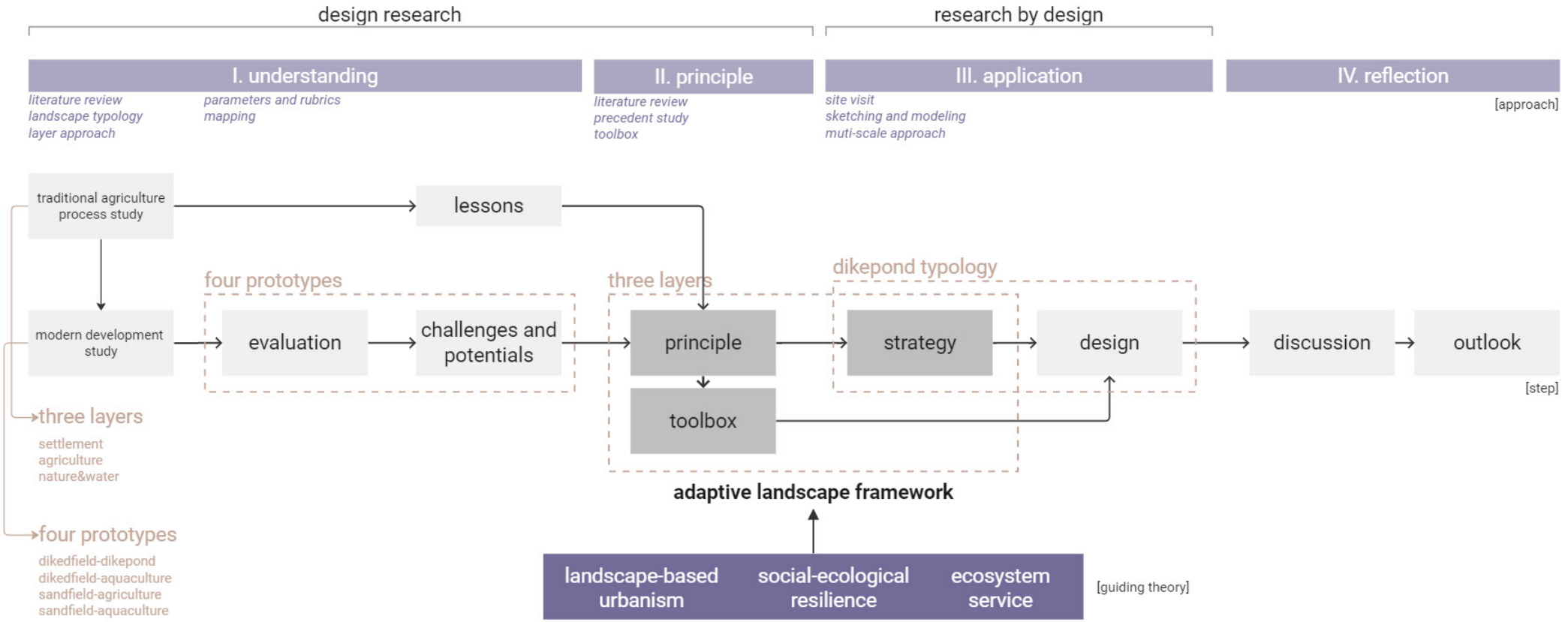
TEEB, 2010

Subquestions

To support the sustainable development of the agricultural area on the west side of PRD by applying an adaptive landscape framework.

Understanding	Principle	Application	Reflection
SQ1: How to understand the formative power of agricultural practice on the west side of PRD, and the challenges and potentials of different agricultural typologies?	SQ2: What principles could be set to form an adaptive landscape framework?	SQ3: How to apply the principles to local-scale design on the west side of PRD and bring social and environmental benefits to the area?	SQ4: What experience could be learnt through the project in order to serve the objective better?

Methodology

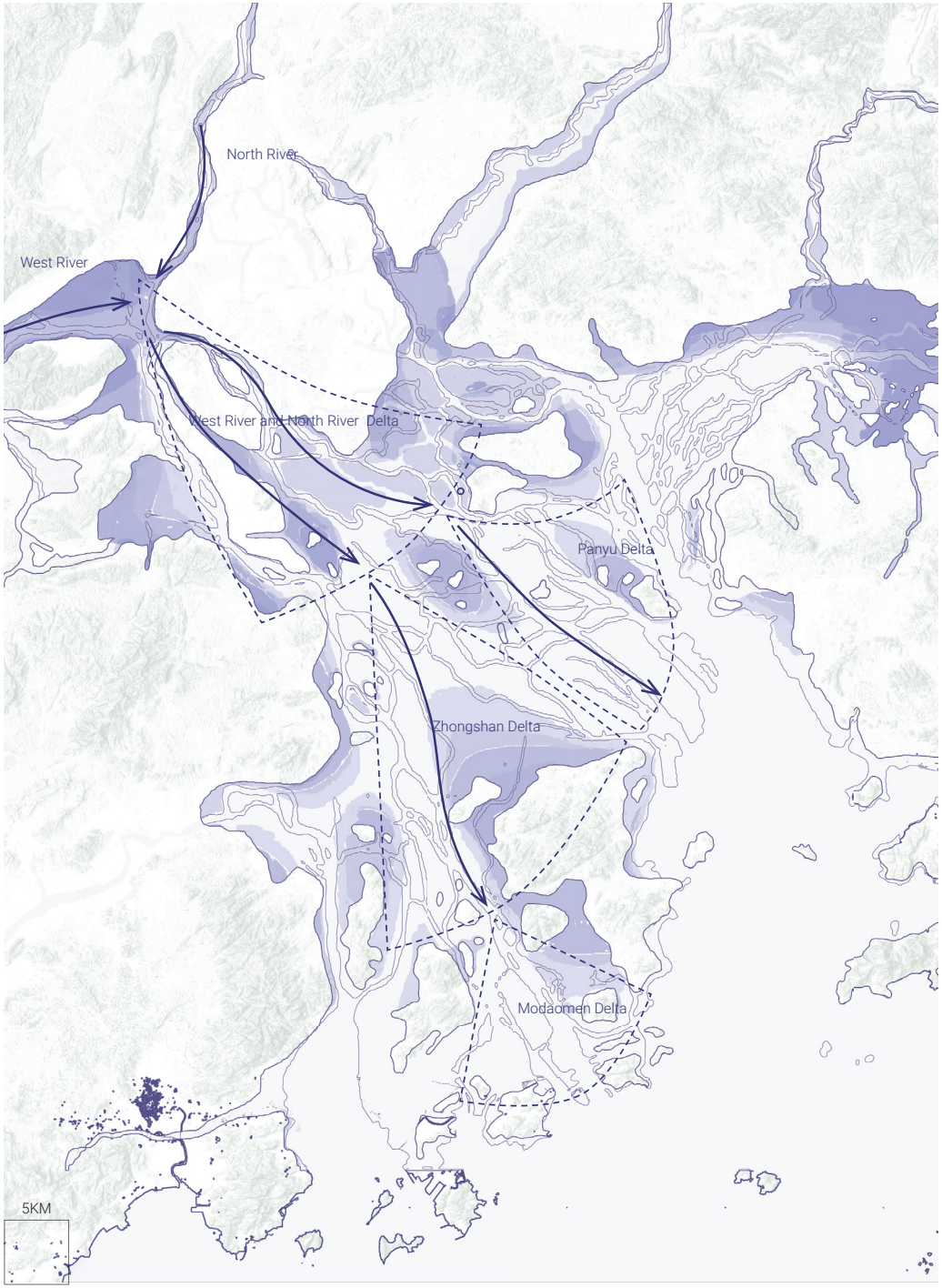


Understanding through process

SQ1: How to understand the formative power of agricultural practice on the west side of PRD, and the challenges and potentials of different agricultural typologies?

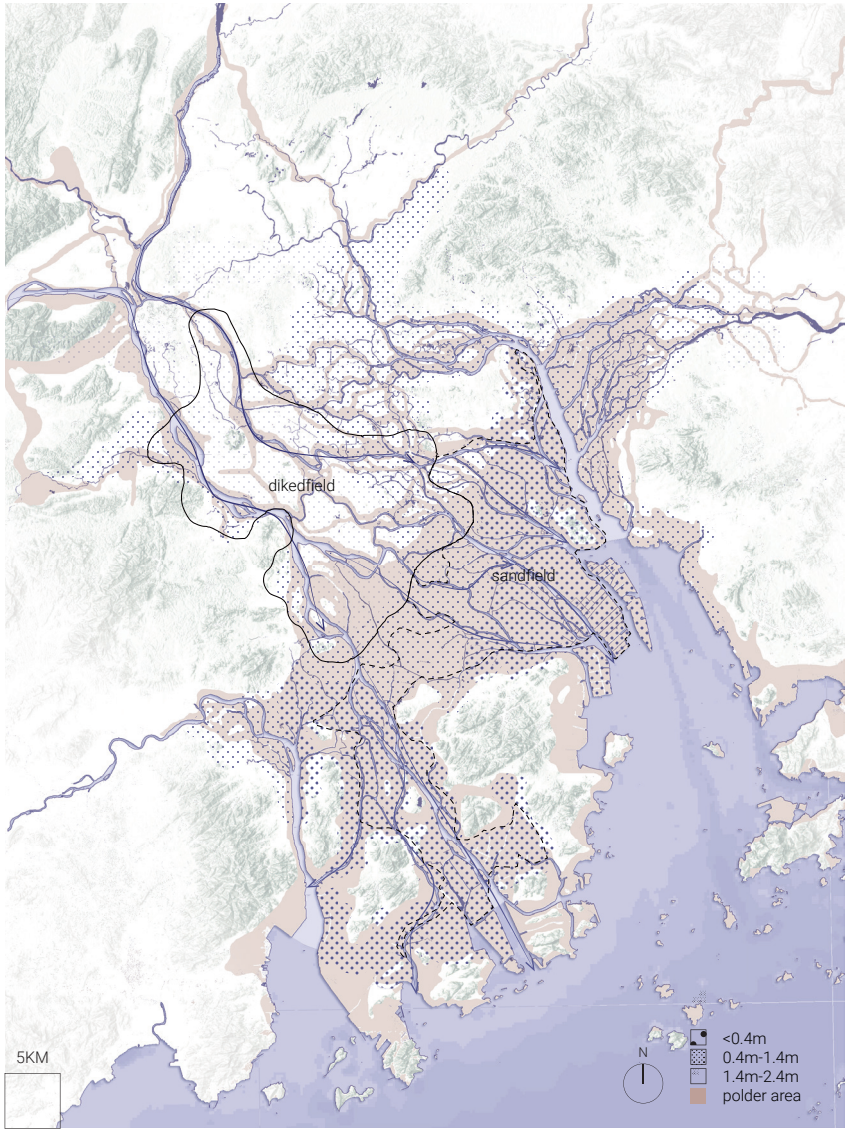
Figure: Qing Qianlong Coastal map of China (1787-1801)

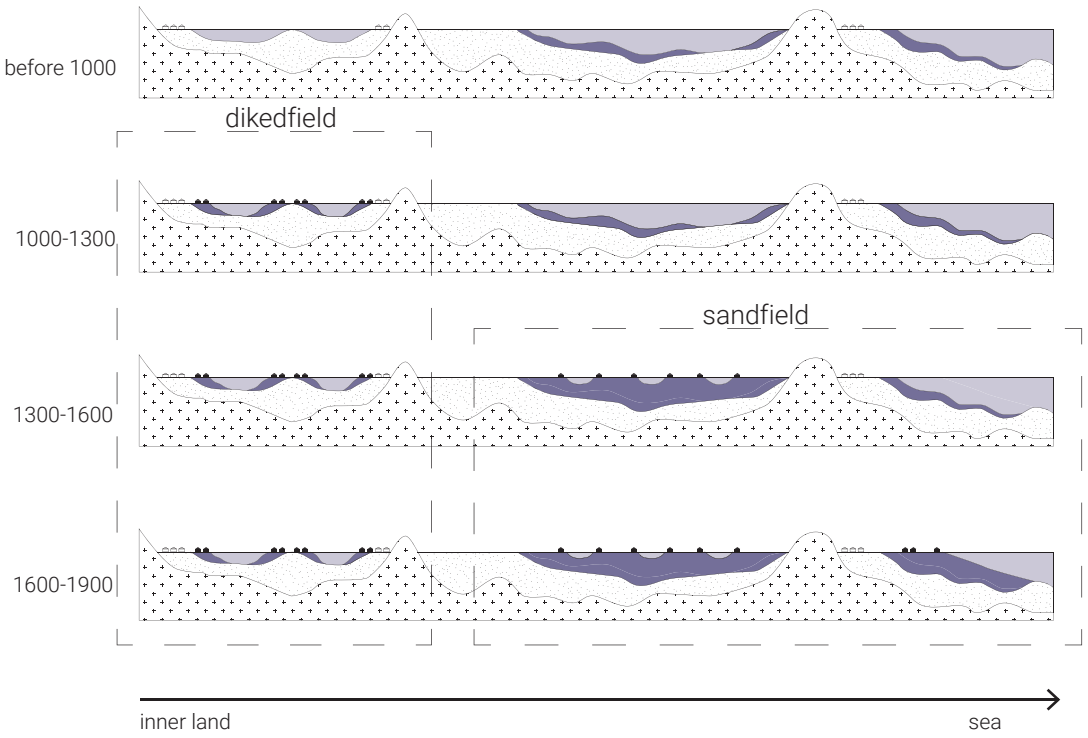
The land formation



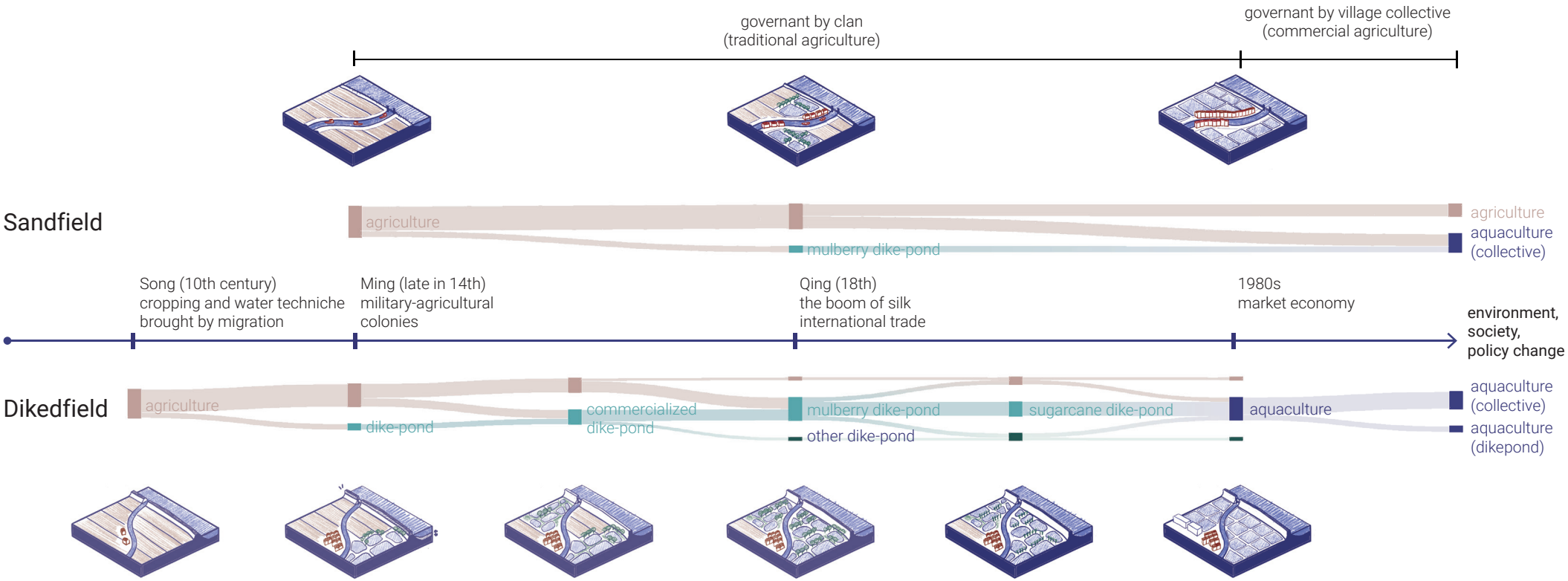
Source: adapted from Wu, 2014

The land formation

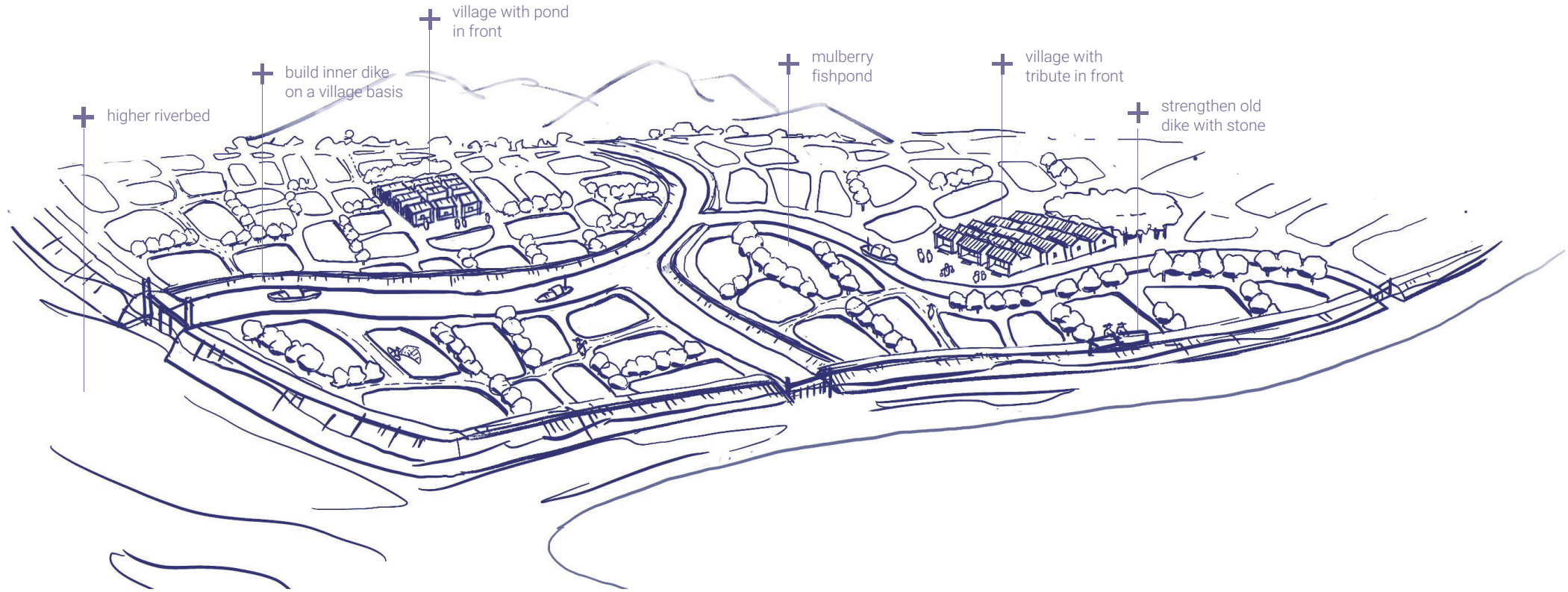




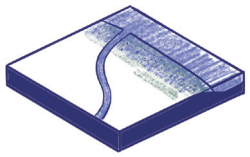
The incremental process



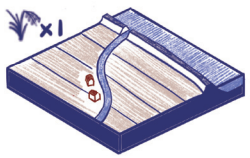
Dikedfield (18th century)



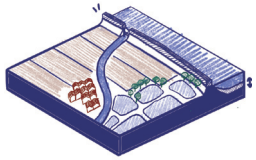
Before Song | Song (10th) | Ming (14th-17th) | **Qing (18th)** | 1930s | After open-up policy



tidal zone

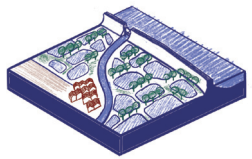


cropland

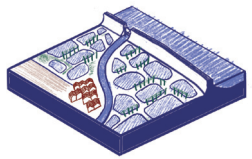


dike-pond

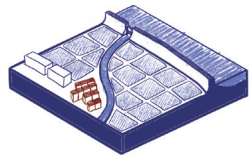
commercialized dike-pond



mulberry dike-pond

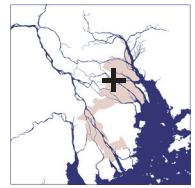


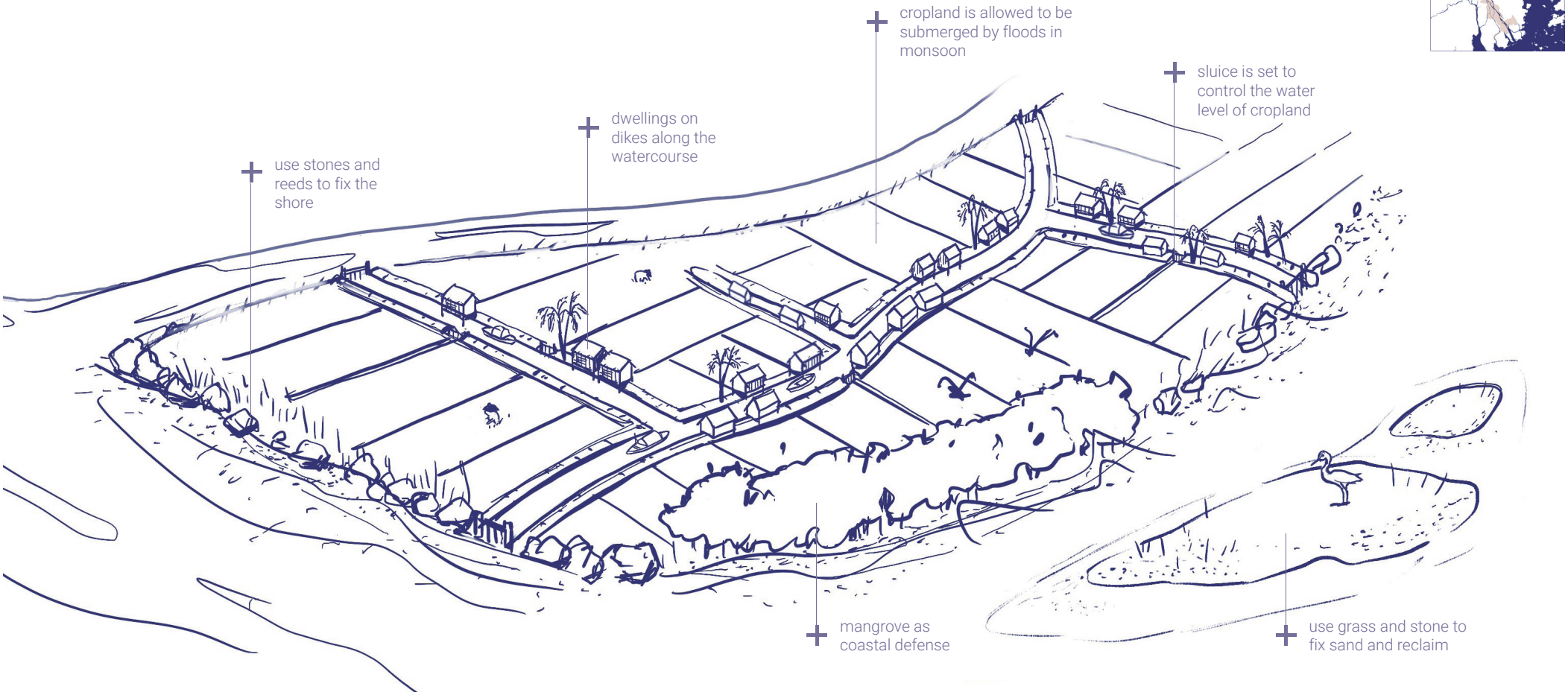
sugarcane dike-pond



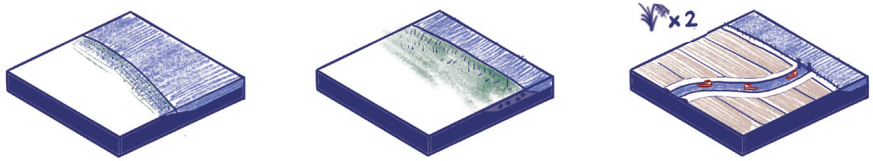
aquaculture (collective)

Sandfield (18th century)

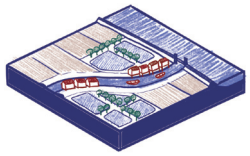




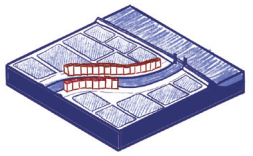
Before Ming | Ming (14th-17th) | Qing (18th) | After open-up policy



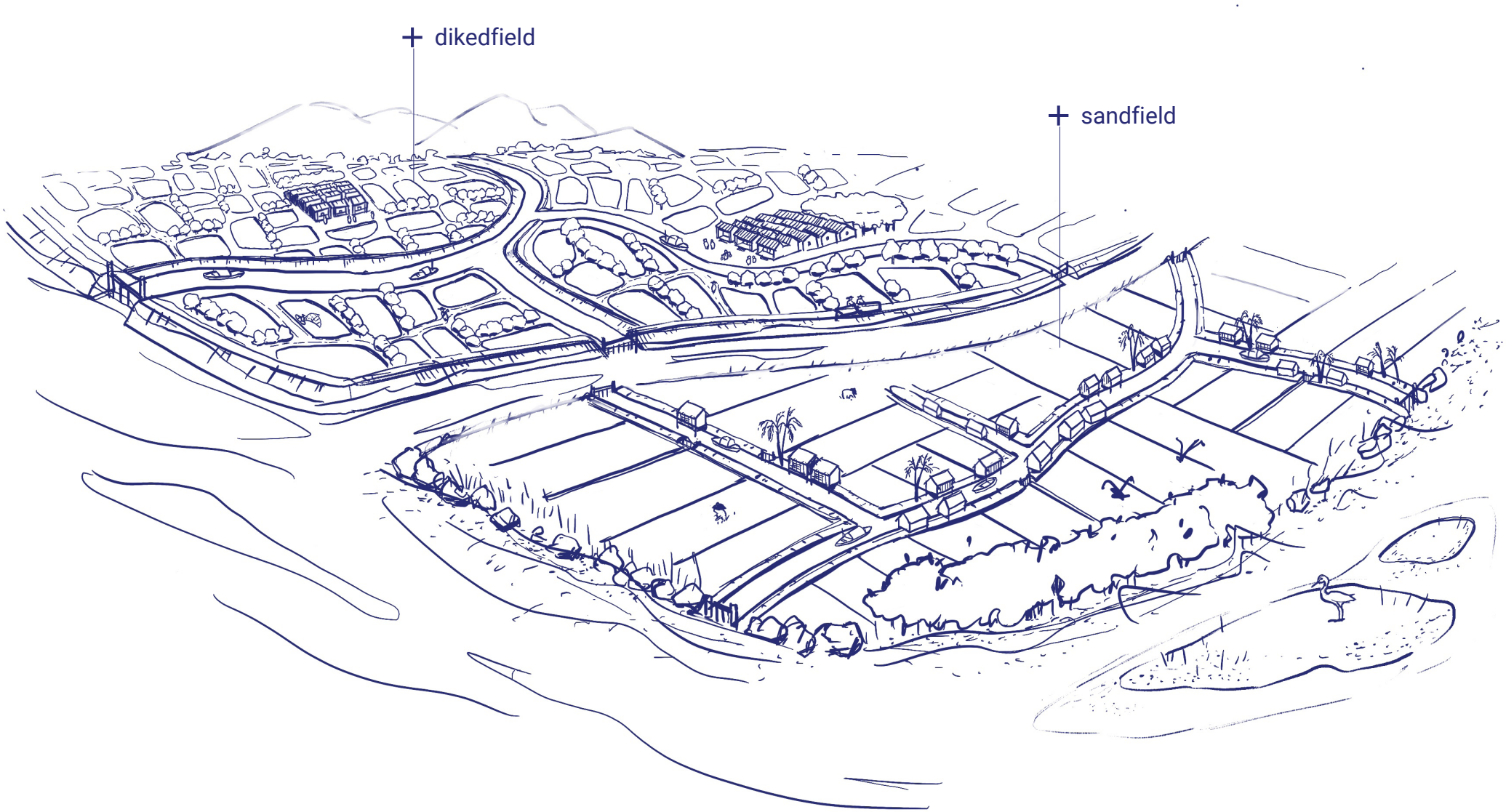
estuary ---------- (reclamation) ----------> cropland



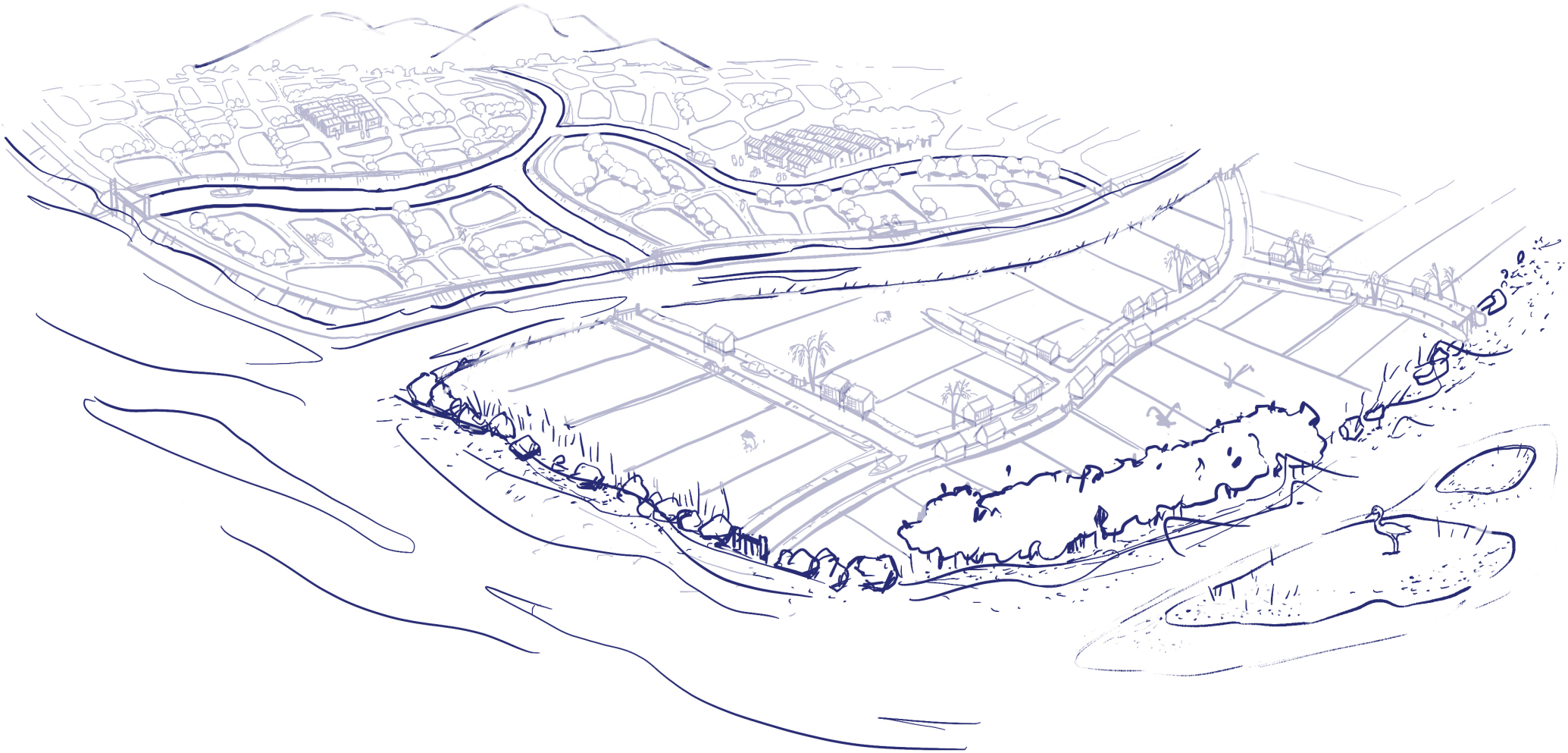
cropland with mulberry dike-pond

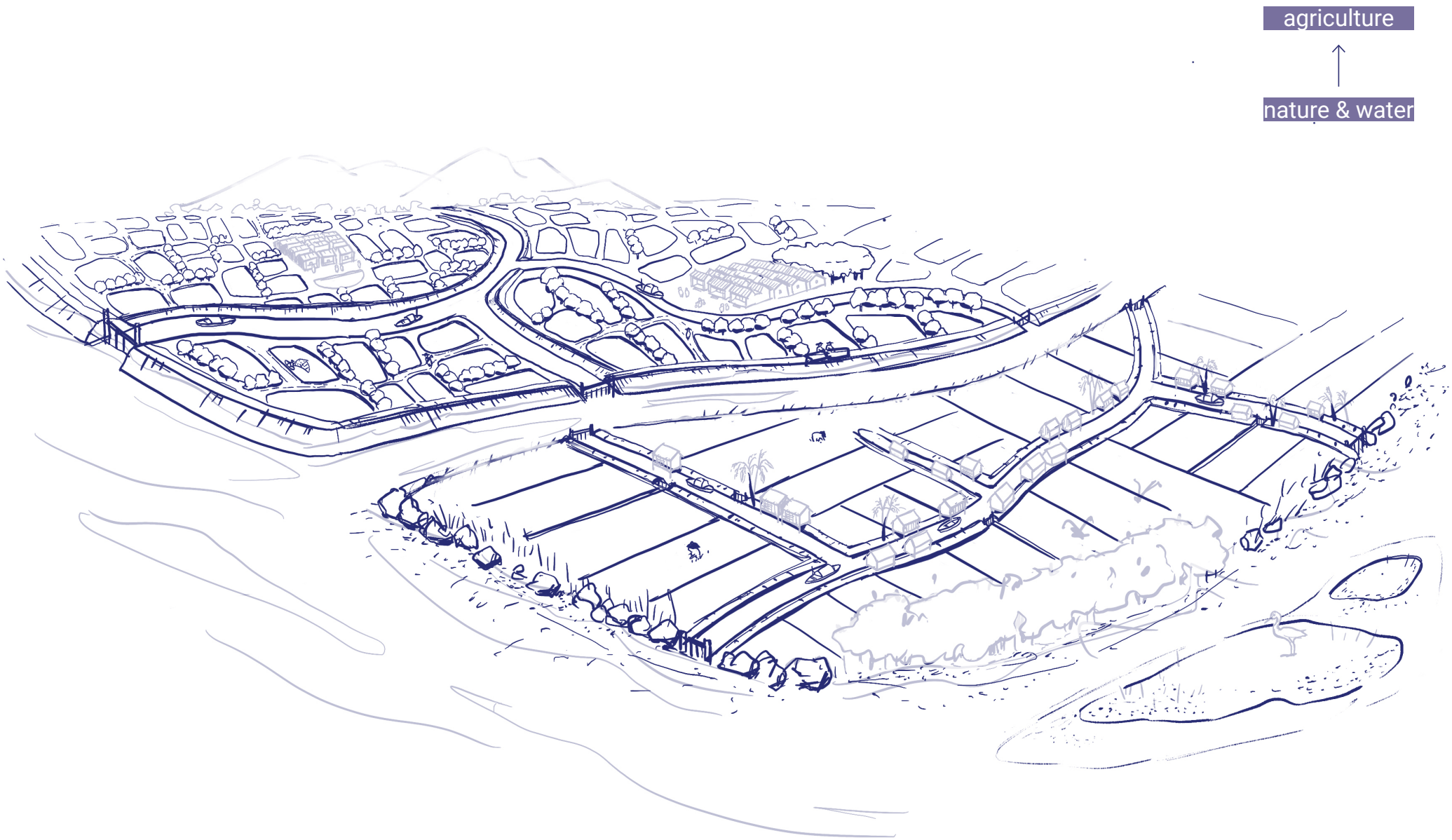


aquaculture (collective)


dikedfield
sandfield

nature & water




agriculture
nature & water

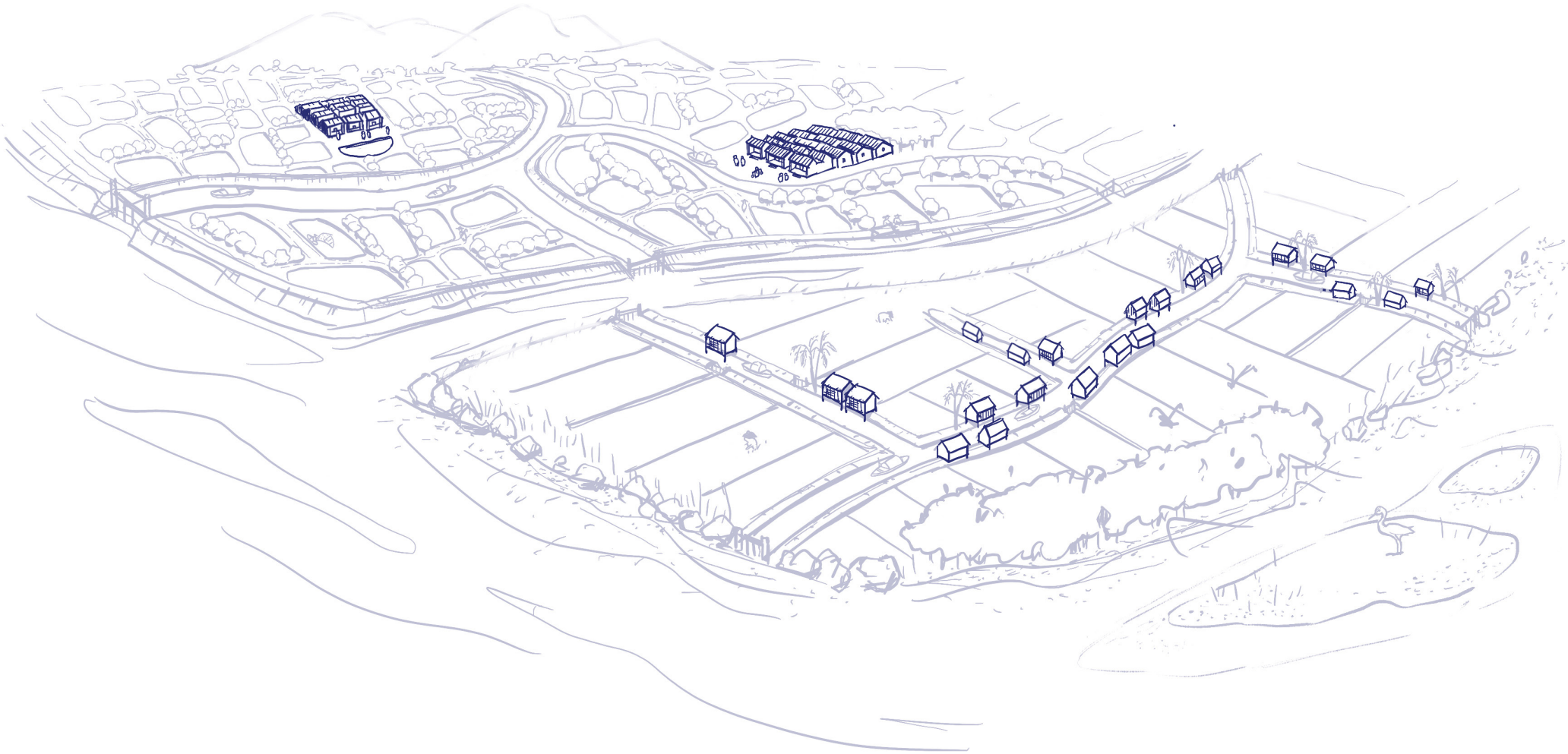
settlement

↑

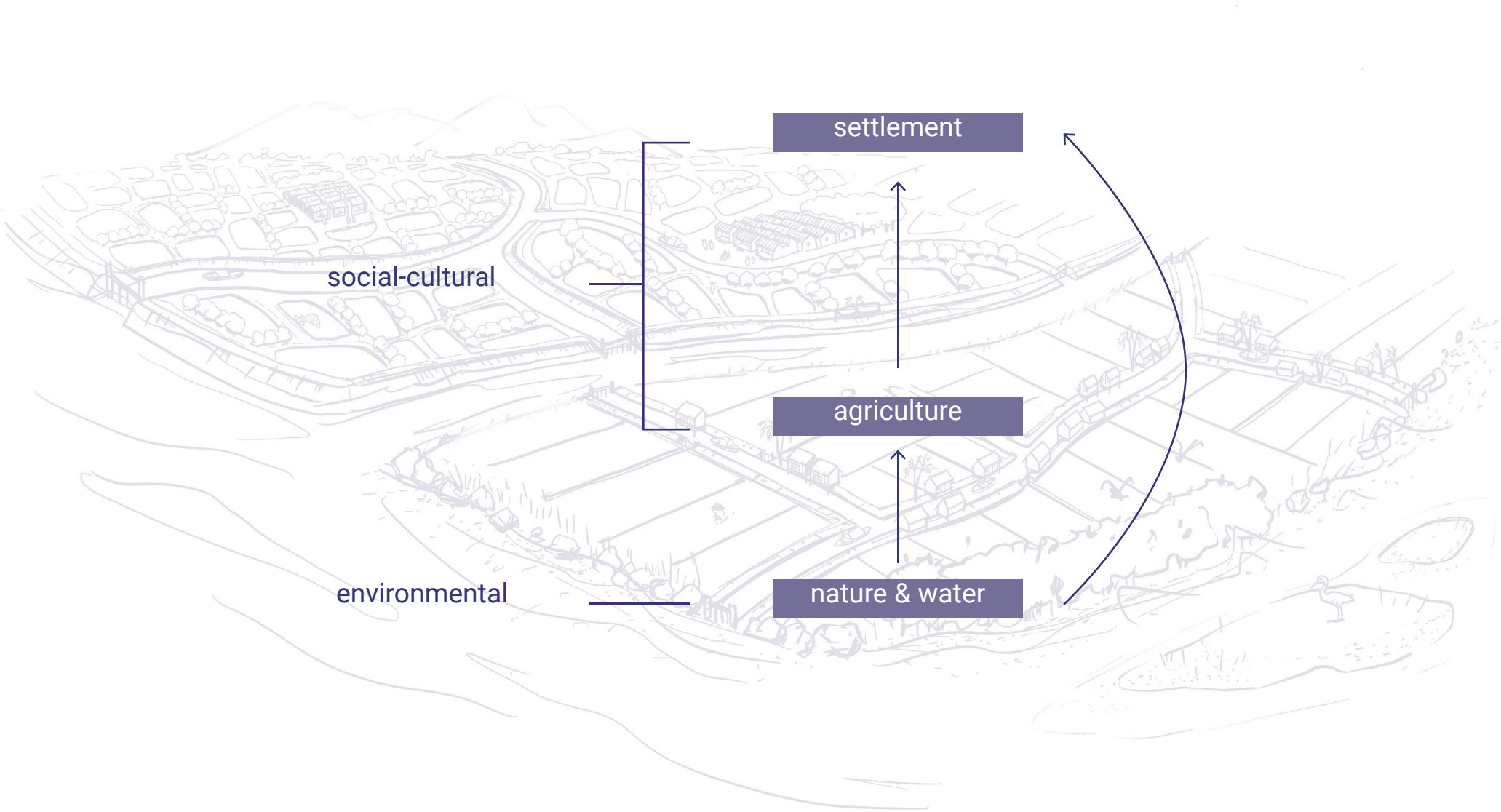
agriculture

↑

nature & water



social-ecologial system with three layers



The lesson

nature & water

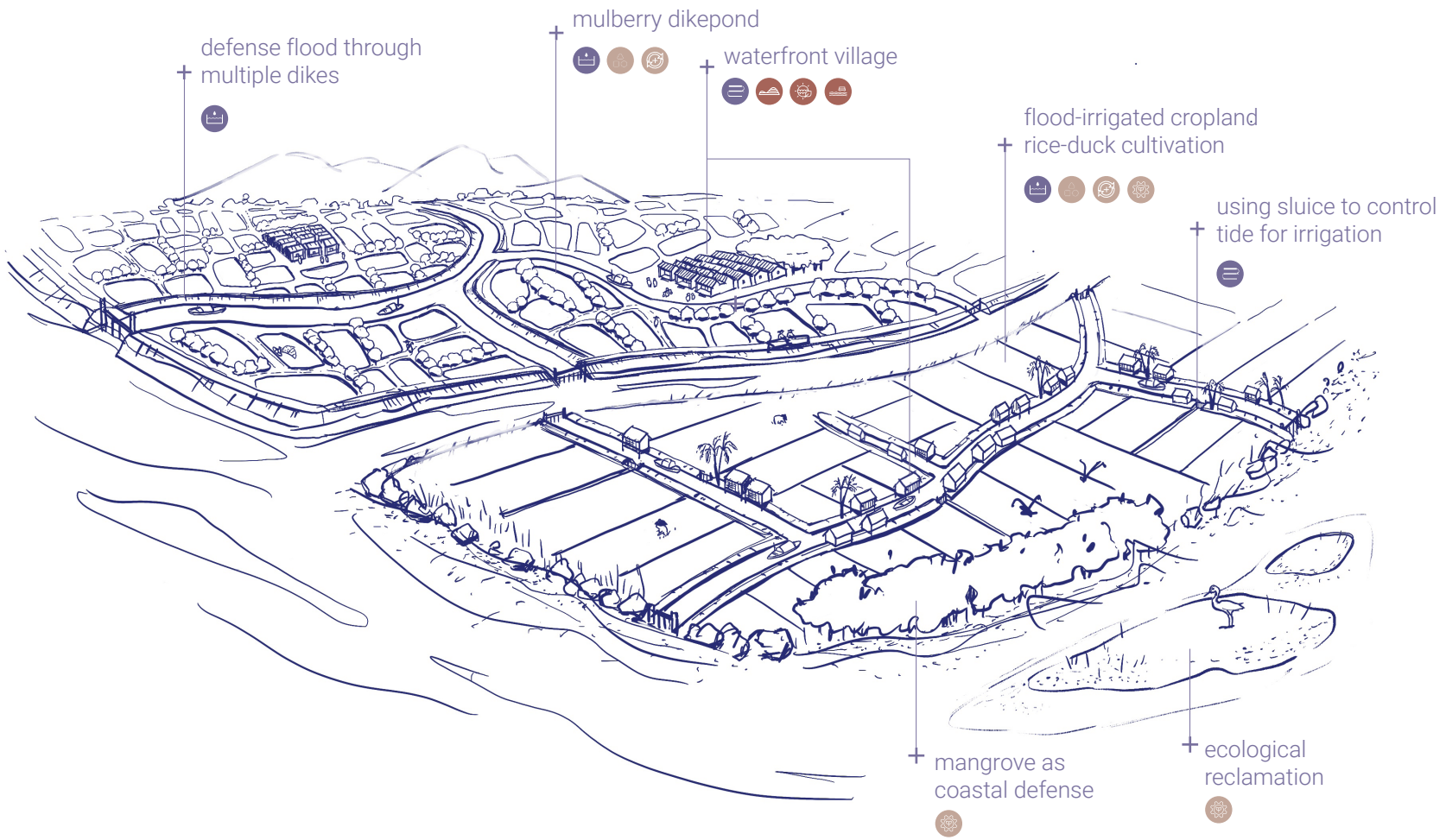
- multiscale network & connectivity
- space for water

agriculture

- multifunctional
- regenerative and efficient
- work with nature

settlement

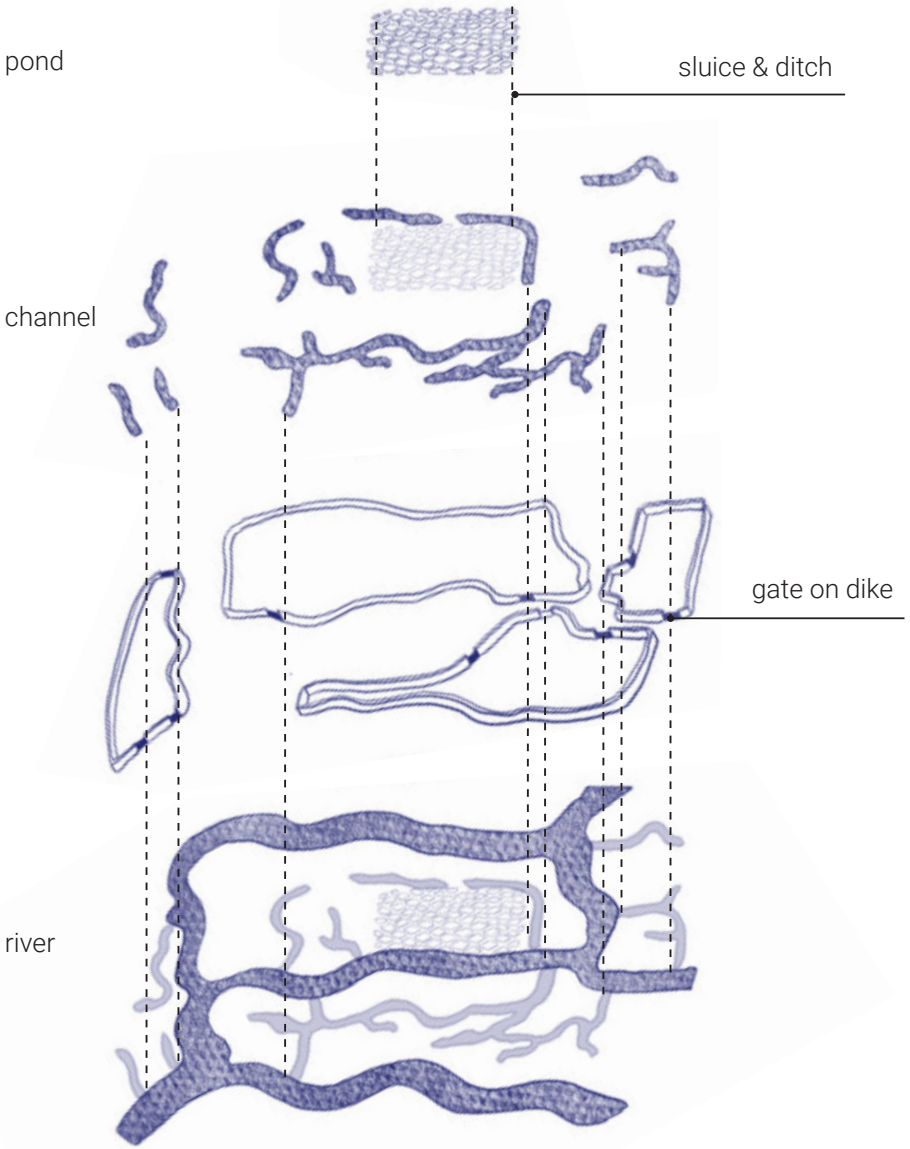
- make use of terrain & land efficiency
- sufficient resource supply
- water-related public space



Case 1: Water structure in dikedfield

multiscale network & connectivity

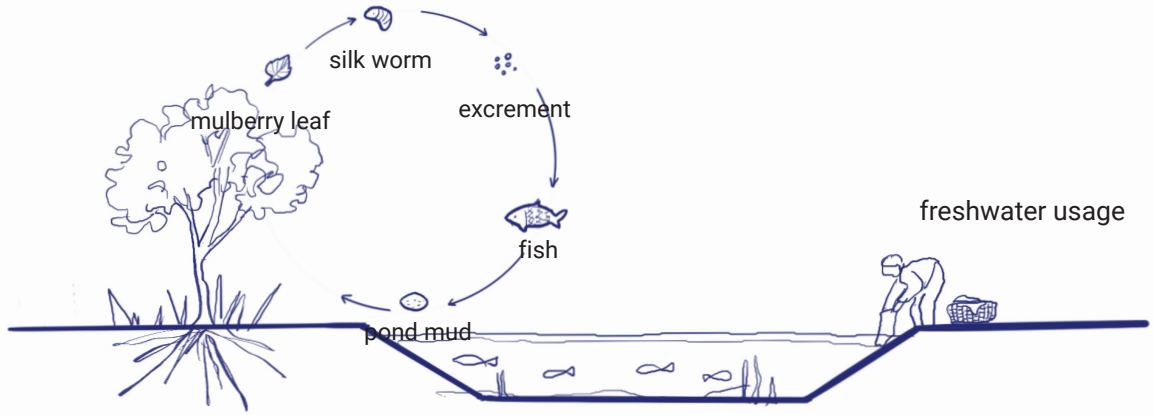
space for water



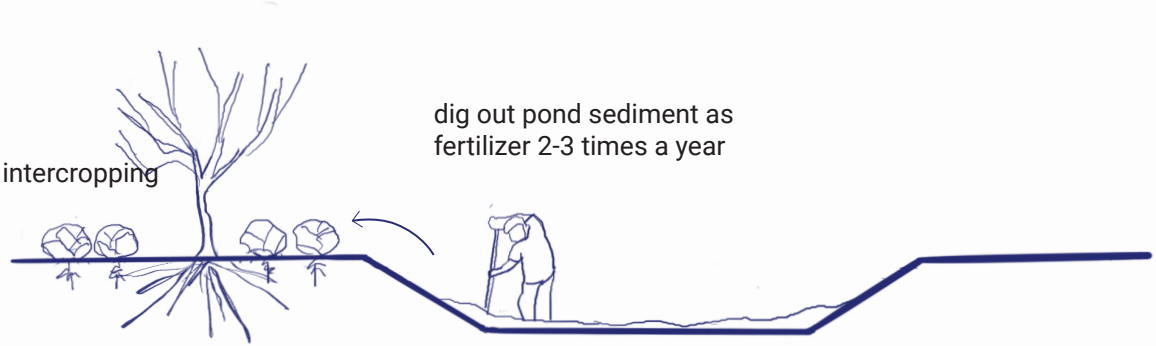
Case 2: Mulberry dikepond

- space for water
- multifunctional
- regenerative and efficient
- work with nature

Wet season



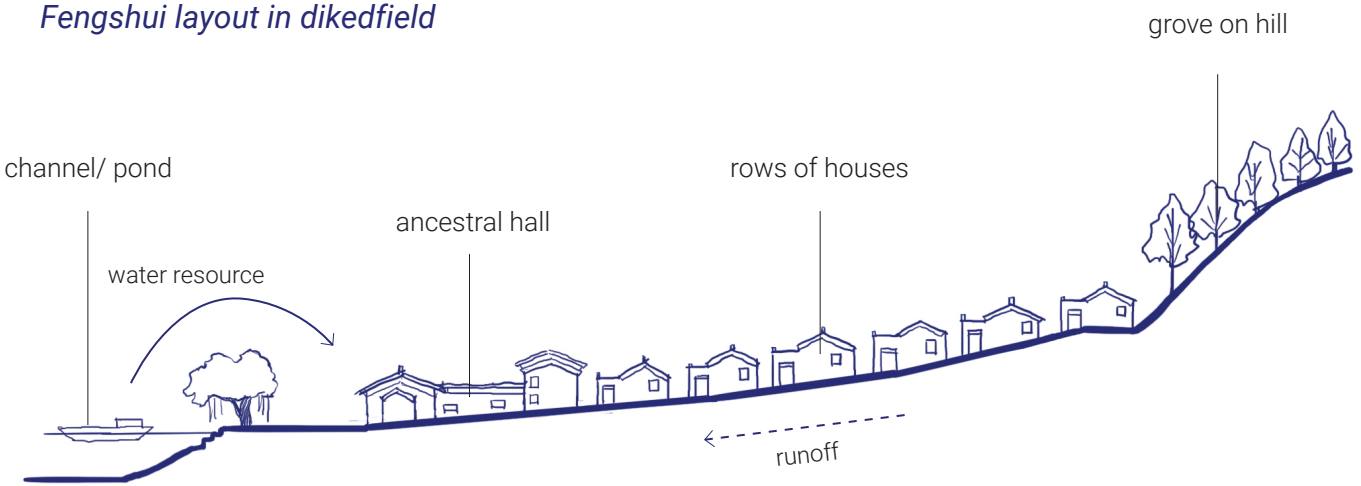
Dry season



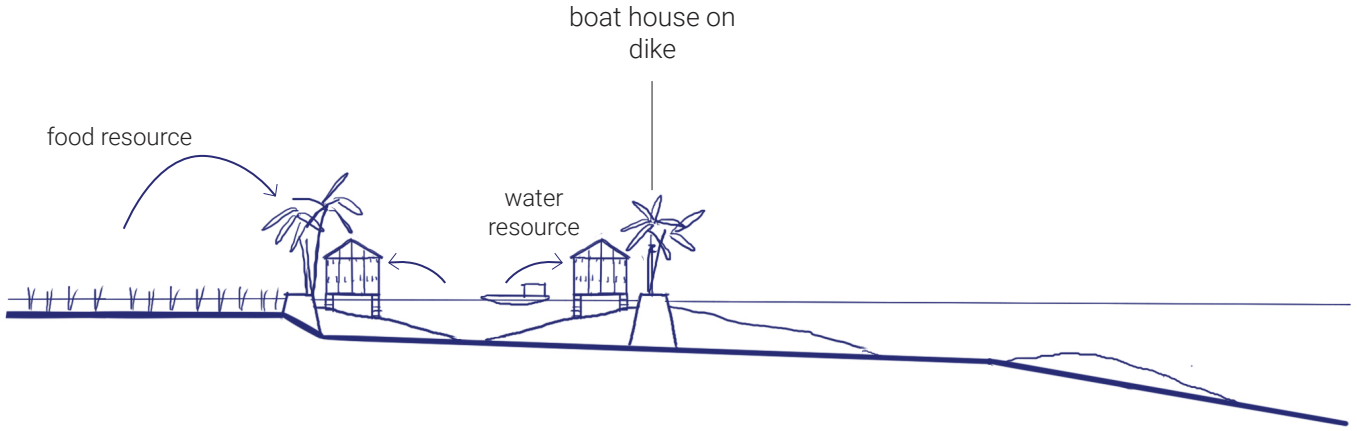
Case 3: Waterfront village

- multiscale network & connectivity
- make use of terrain & land efficiency
- sufficient resource supply
- water-related public space

Fengshui layout in dikedfield



Boat houses in sandfield

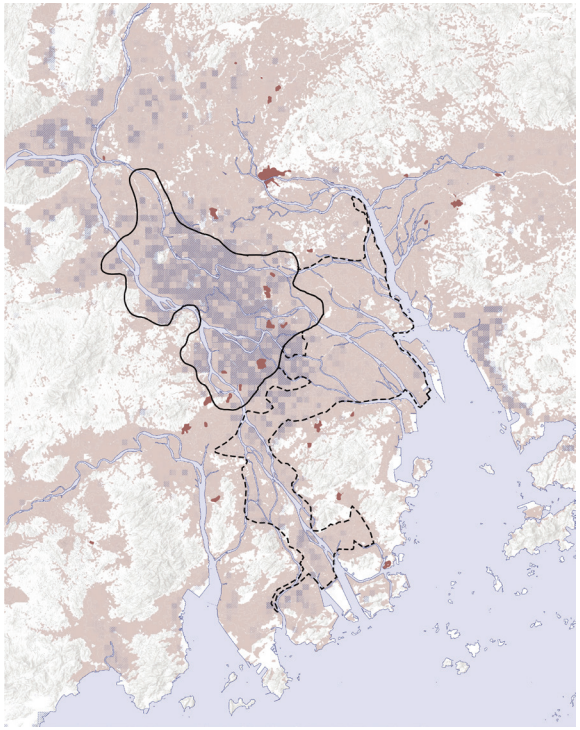


The modern transformation (1978--)

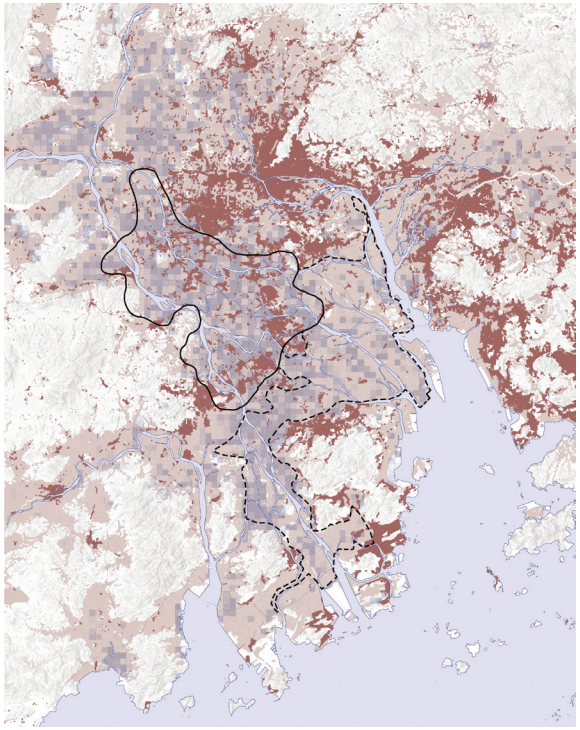
Source: Yang, 2011 (top); http://www.gxxjzy.com/nd.jsp?id=536 (bottom)

Urbanization & Agriculture intensification process (mega scale)

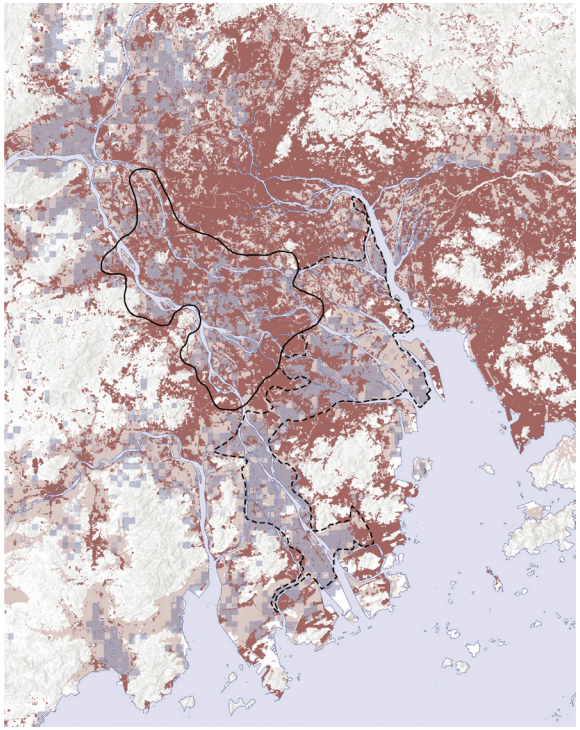
1950



2000



2020



dikedfield
sandfield
urban area
farmland
fishpond

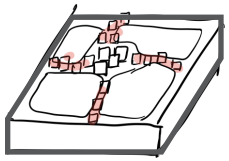
Data: GLOBALMAP30; Zhang, W. et al., 2021

Urbanization mode (micro scale)

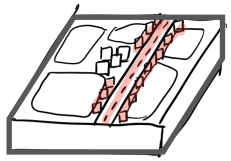
Dikedfield

development intensity

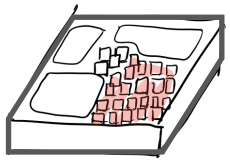
settlement



along the dike
(on exsisting land)

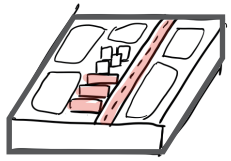


along the linear structure
(highway/ river)



take over the ponds

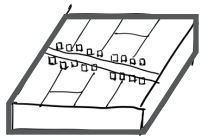
industrial area



along the linear structure
(highway/ river)

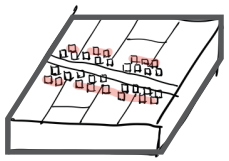
around the village

Sandfield

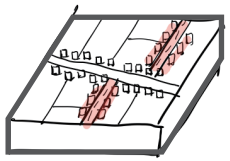


development intensity

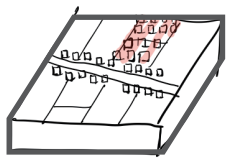
settlement



expand in row

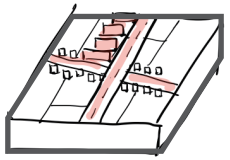


expand along road



expand as cluster

industrial area

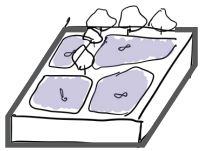


along the linear structure (highway/
river)

Photo: Xiaomeng T., 2019 (left 1); Shawei Z. et al., 2022 (right 1-3); others are from google image

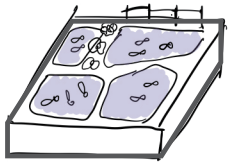
Agriculture intensification mode (micro scale)

Dikedfield

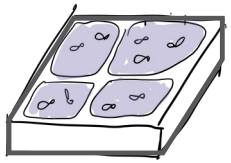


development intensity

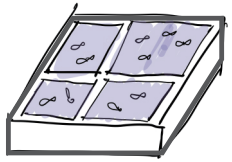
dikepond



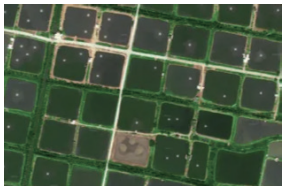
intensive aquaculture (grow vegetation on the dike)



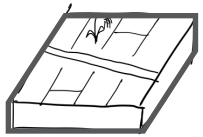
intensive aquaculture (narrow the dike)



intensive aquaculture (unified)

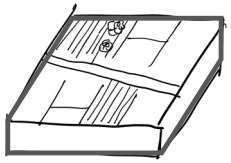


Sandfield



development intensity

agriculture



commercial crops

+vegetable greenhouse

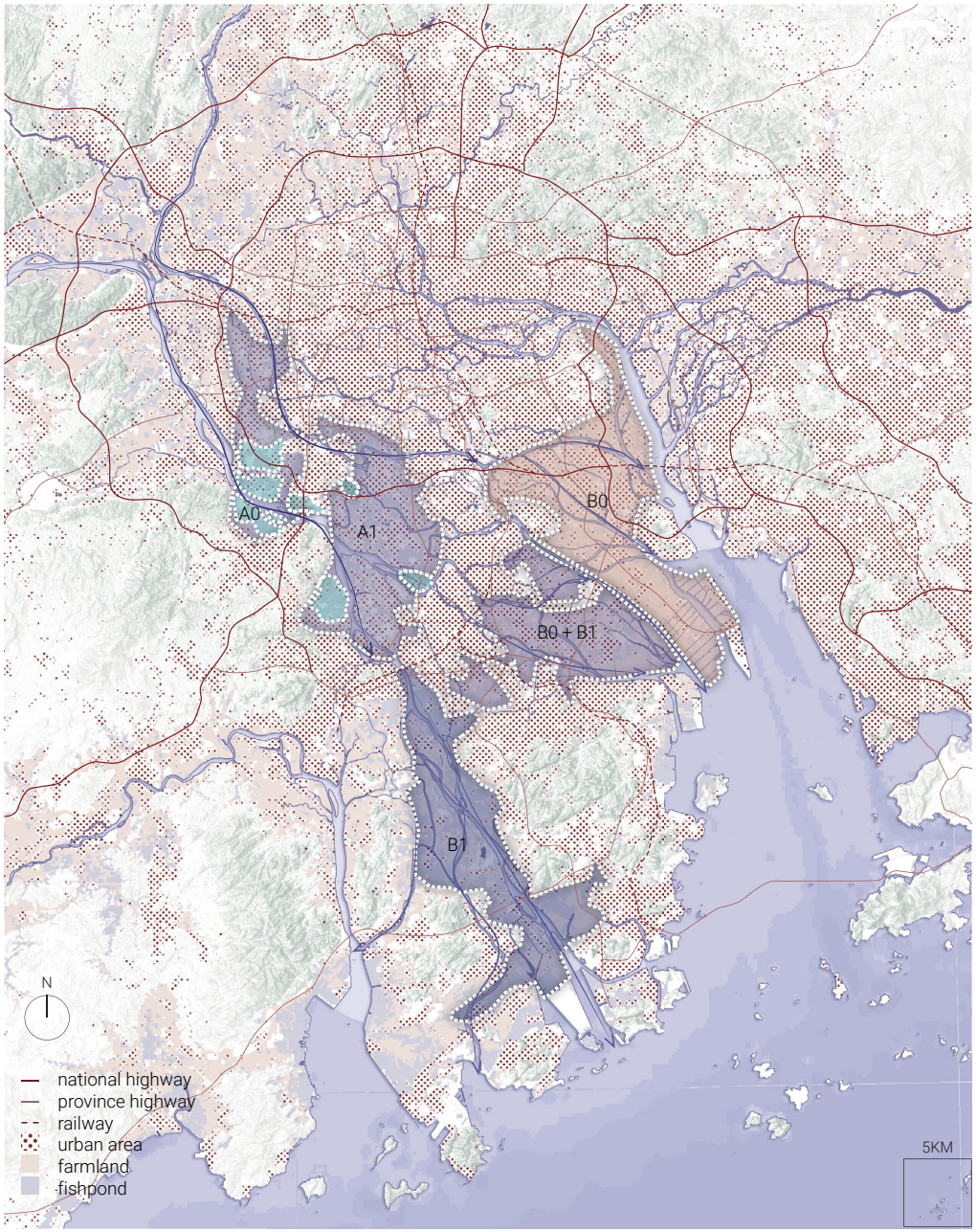
aquaculture

intensive aquaculture

+breeding shed

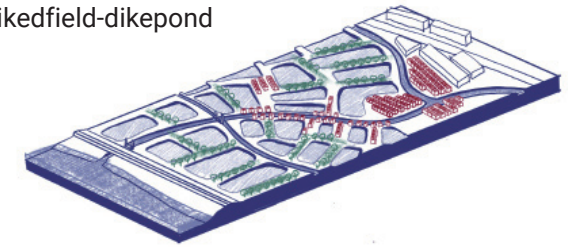
Photo: Xiaomeng T., 2019 (left 1-2); google earth (left 3); others are from google image

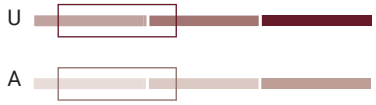
Landscape structure with four typologies



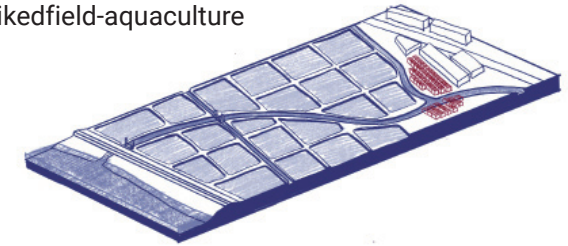
Dikedfield

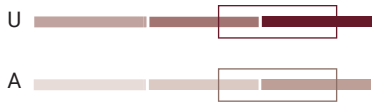
A0-dikedfield-dikepond





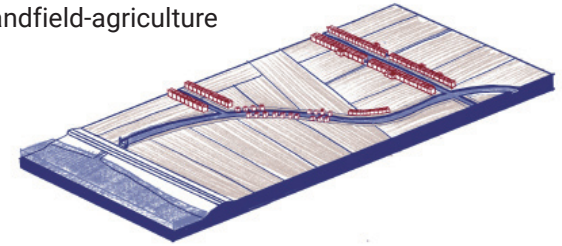
A1-dikedfield-aquaculture

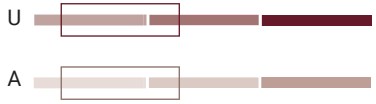




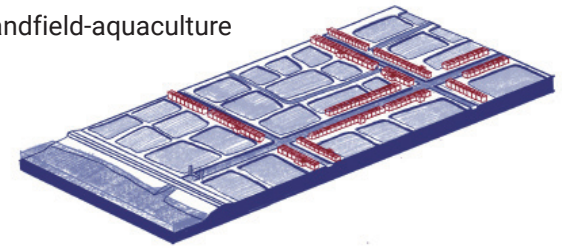
Sandfield

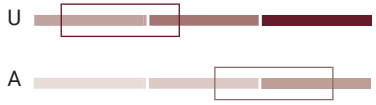
B0-sandfield-agriculture



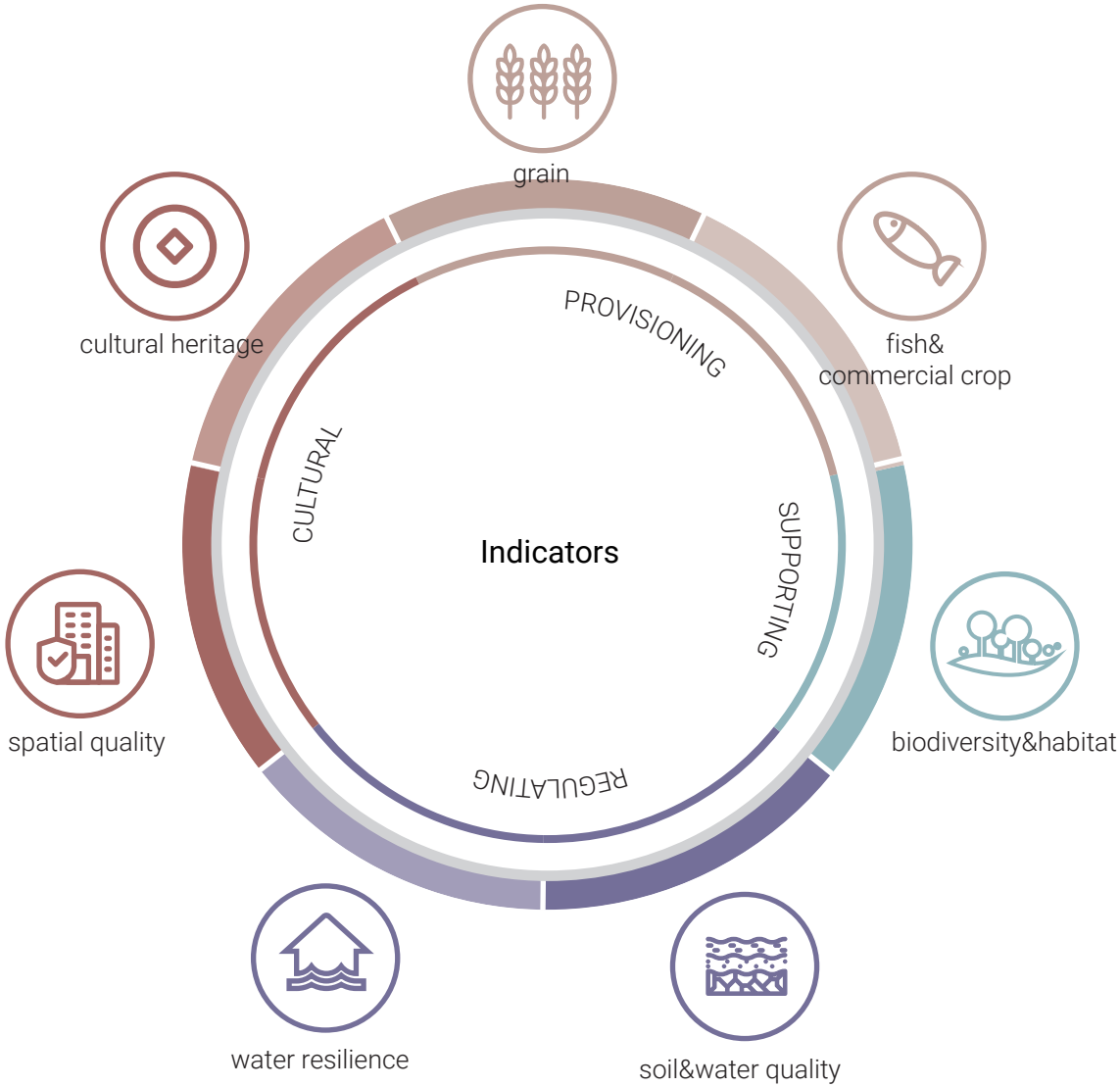


B1-sandfield-aquaculture





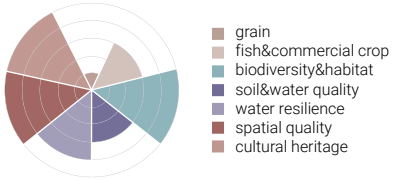
Evaluation

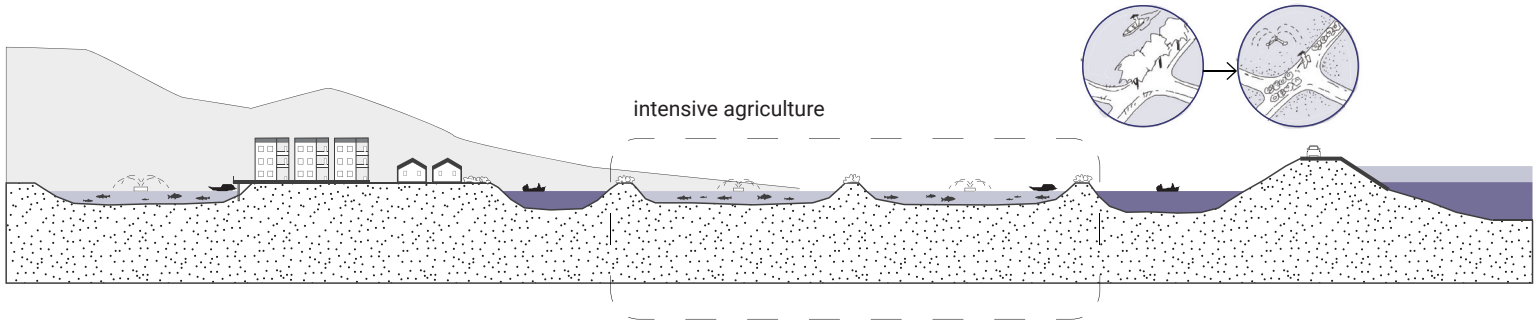

grain
fish&
commercial crop
biodiversity&habitat
soil&water quality
water resilience
spatial quality
cultural heritage
PROVISIONING
SUPPORTING
REGULATING
CULTURAL
Indicators

ecosystem service	provisioning		regulating			cultural	
sustainable goal	production		ecology		water resilience	living environment	
indicator	grain	commercial	habitat quality	soil/water quality	flood buffering	spatial quality	cultural heritage
standard	-the productivity of grain crop	-the productivity of commercial product like fish, fruit and vegetables	-landuse habitat suitability -threat factor (residential area, industrial area, high way) (standard reference: Wu et al., 2021)	-the level of soil pollution by pesticides and water eutrophication according to the intensity of agriculture	-natural and man-made capacity to infiltrate and reduce surface run-offs (indices of soil type and run-off coefficient) -water connectivity (standard reference: Jian et al., 2021)	-accessibility of open green/ water space -disturbance of infrastructure (highway, factories)	-perservation of tradional agricultural landscape pattern and water structure (standard reference: Liu, 2016)
high(5)	high productivity	high productivity	suitable and less threat	less soil pollution and water eutrophication	good capacity, good connectivity	enough green space with little disturbance	well preserved
low(1)	no production	no production	unsuitable, many threats	high soil pollution and water eutrophication	bad capacity, bad connectivity	little green space with heavy disturbance	heavily destructed

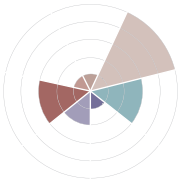
Characteristic

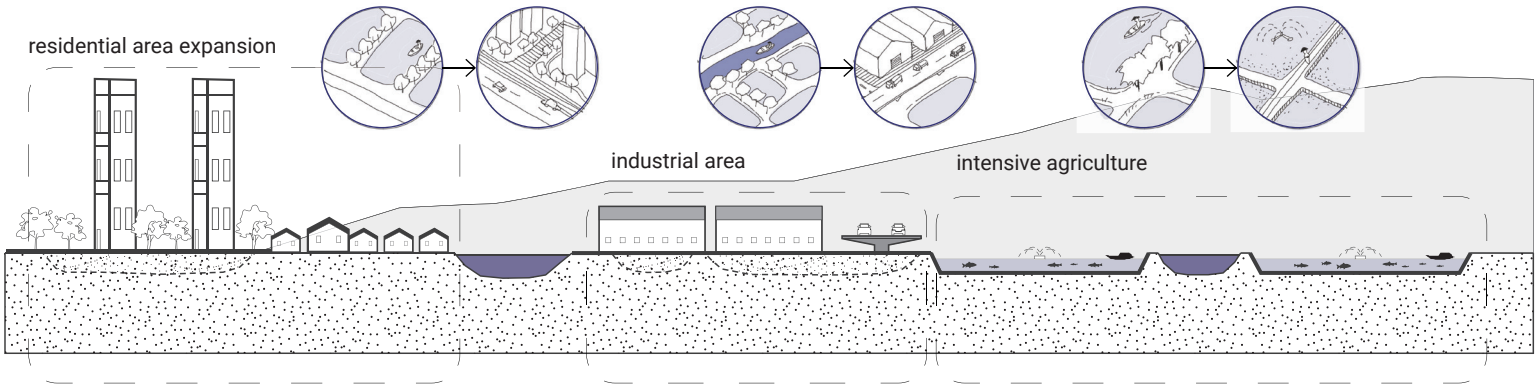
A0-dikedfield-dikepond



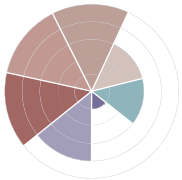


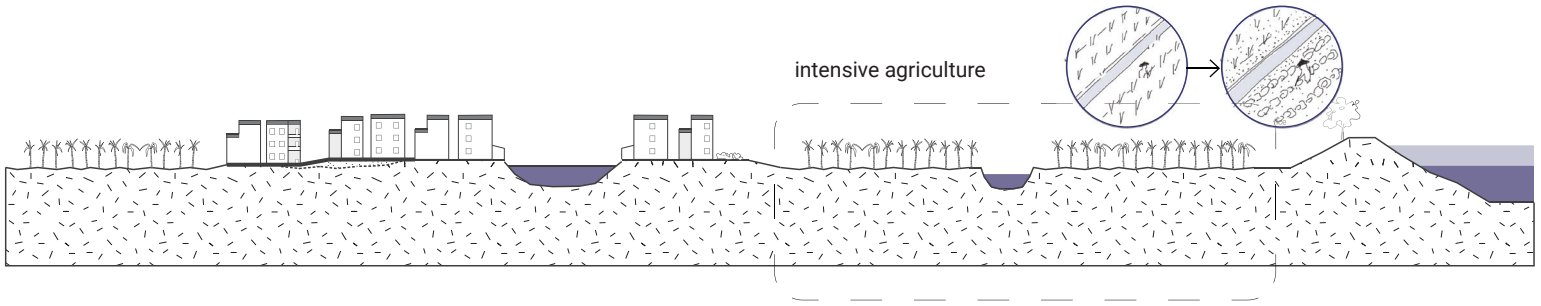
A1-dikedfield-aquaculture



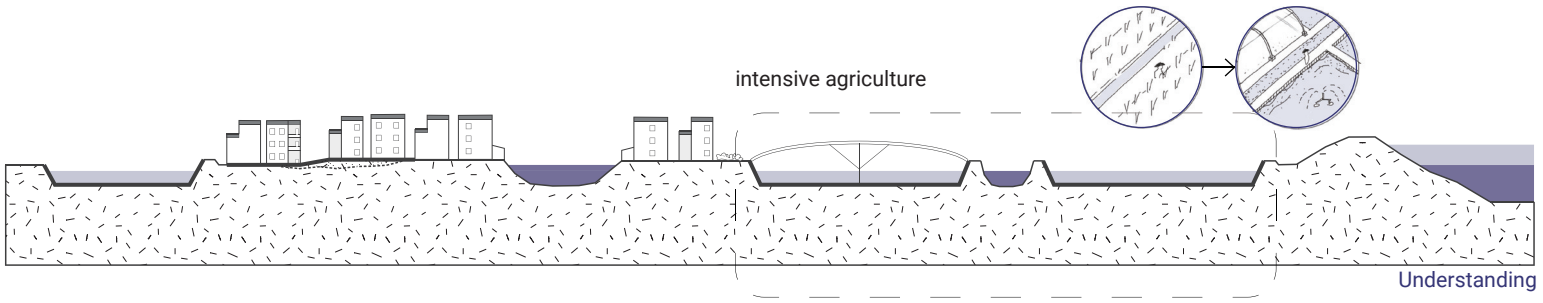


B0-sandfield-agriculture



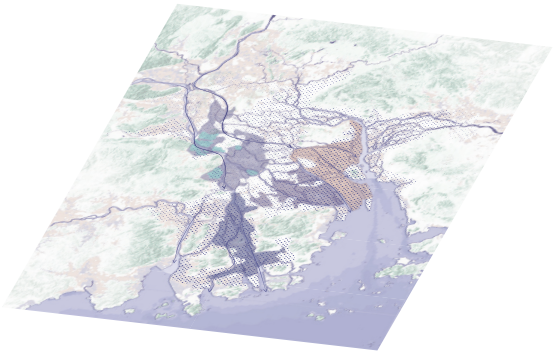


B1-sandfield-aquaculture



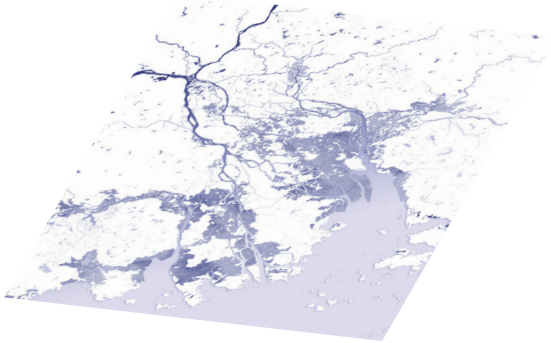
Response to future threat

evaluation

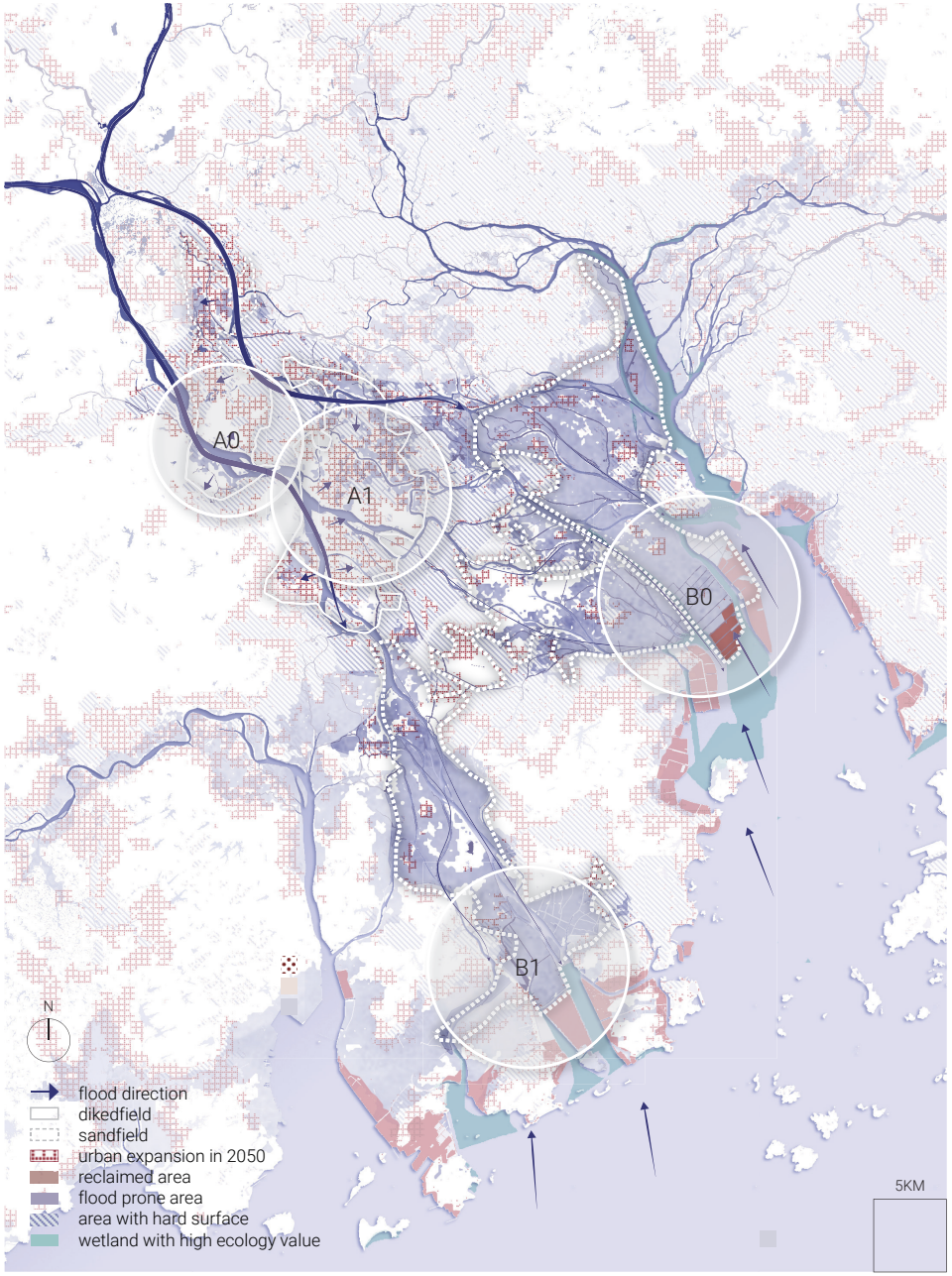


urban expansion
area in 2050

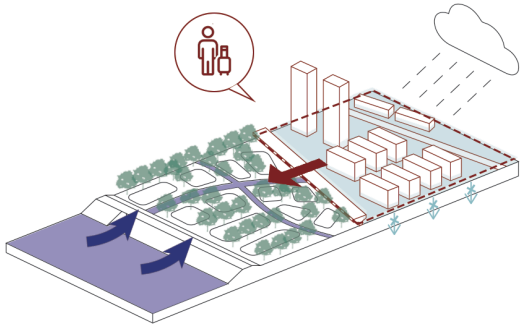
flood-prone area



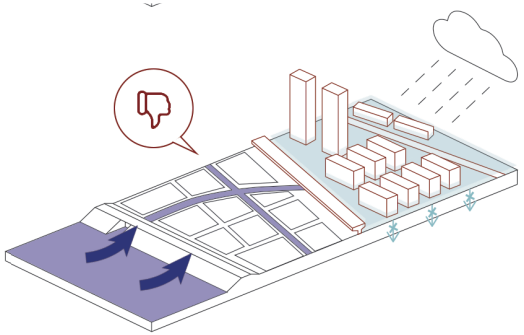
Challenge



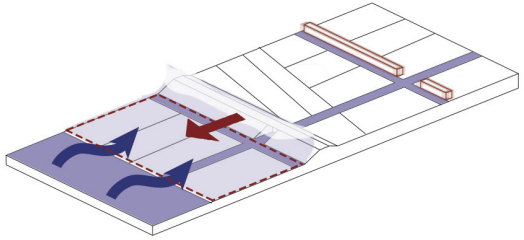
A0-dikedfield-dikepond



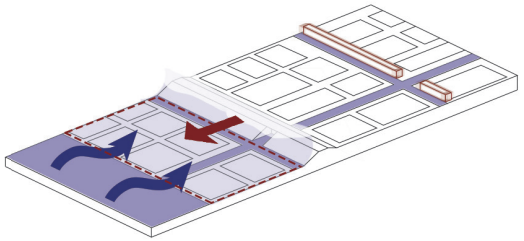
A1-dikedfield-aquaculture



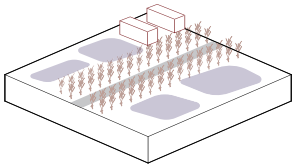
B0-sandfield-agriculture



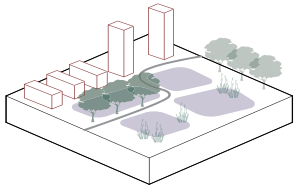
B1-sandfield-aquaculture



Food supply and open space

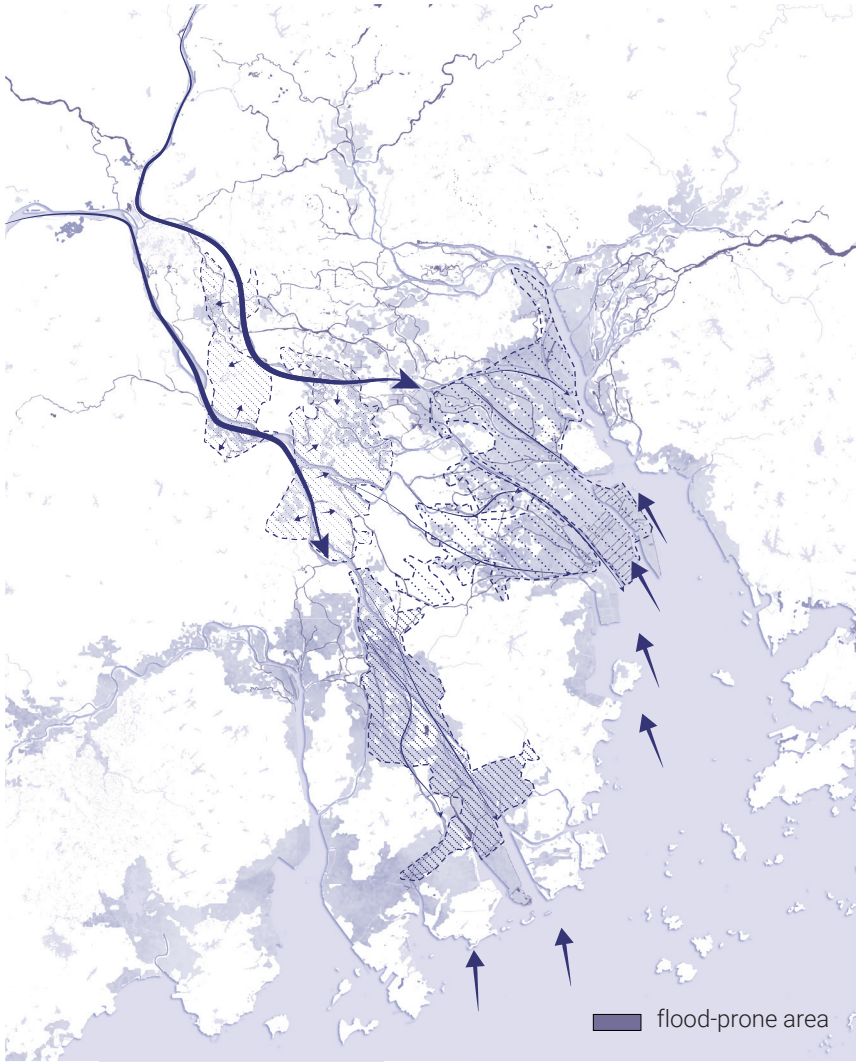


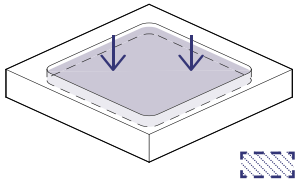
urban farming



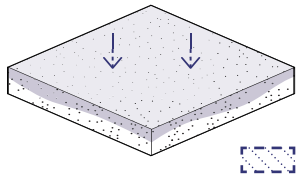
waterfront space

Flood mitigation

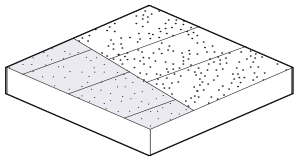




pond

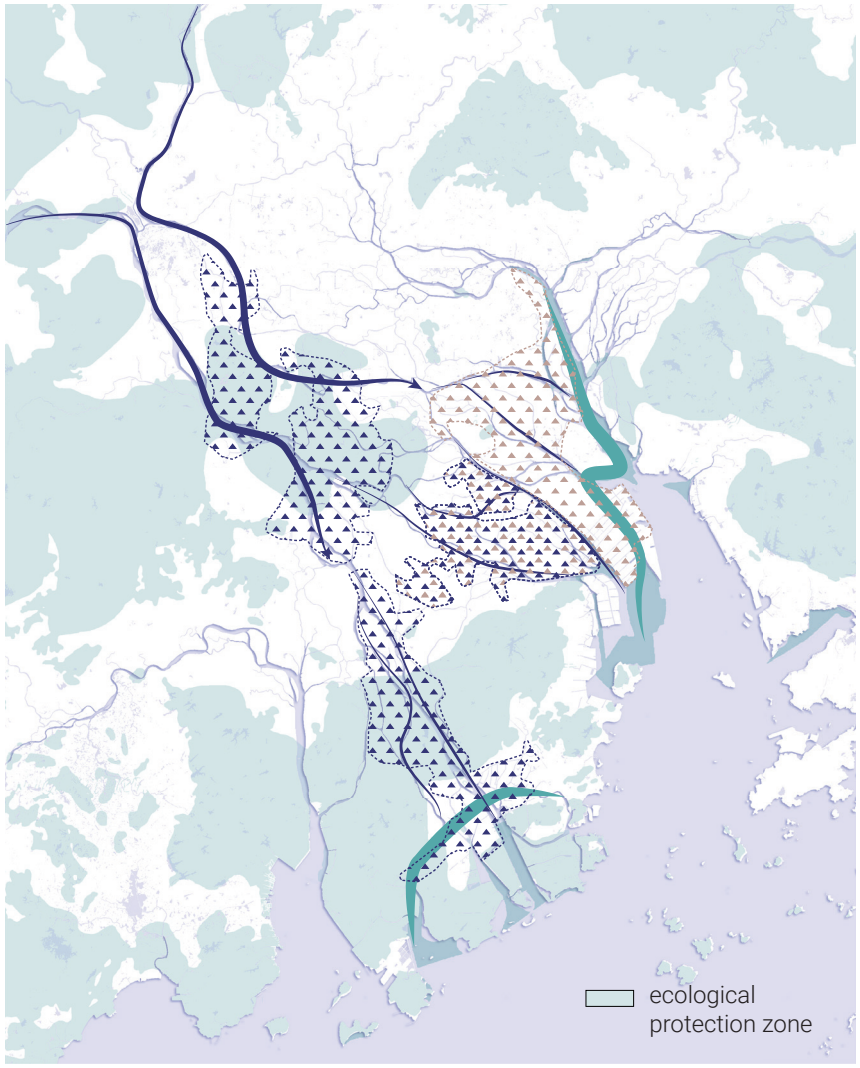


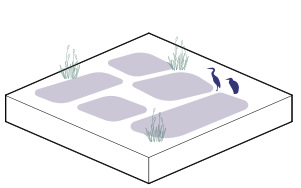
salty loam



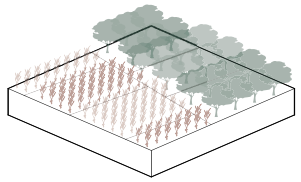
floodplain in sandfield

Potential

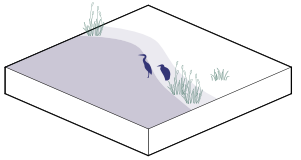




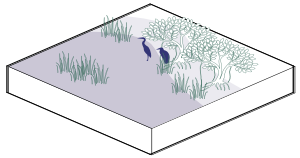
wetland



orchard &
cropland



river shore

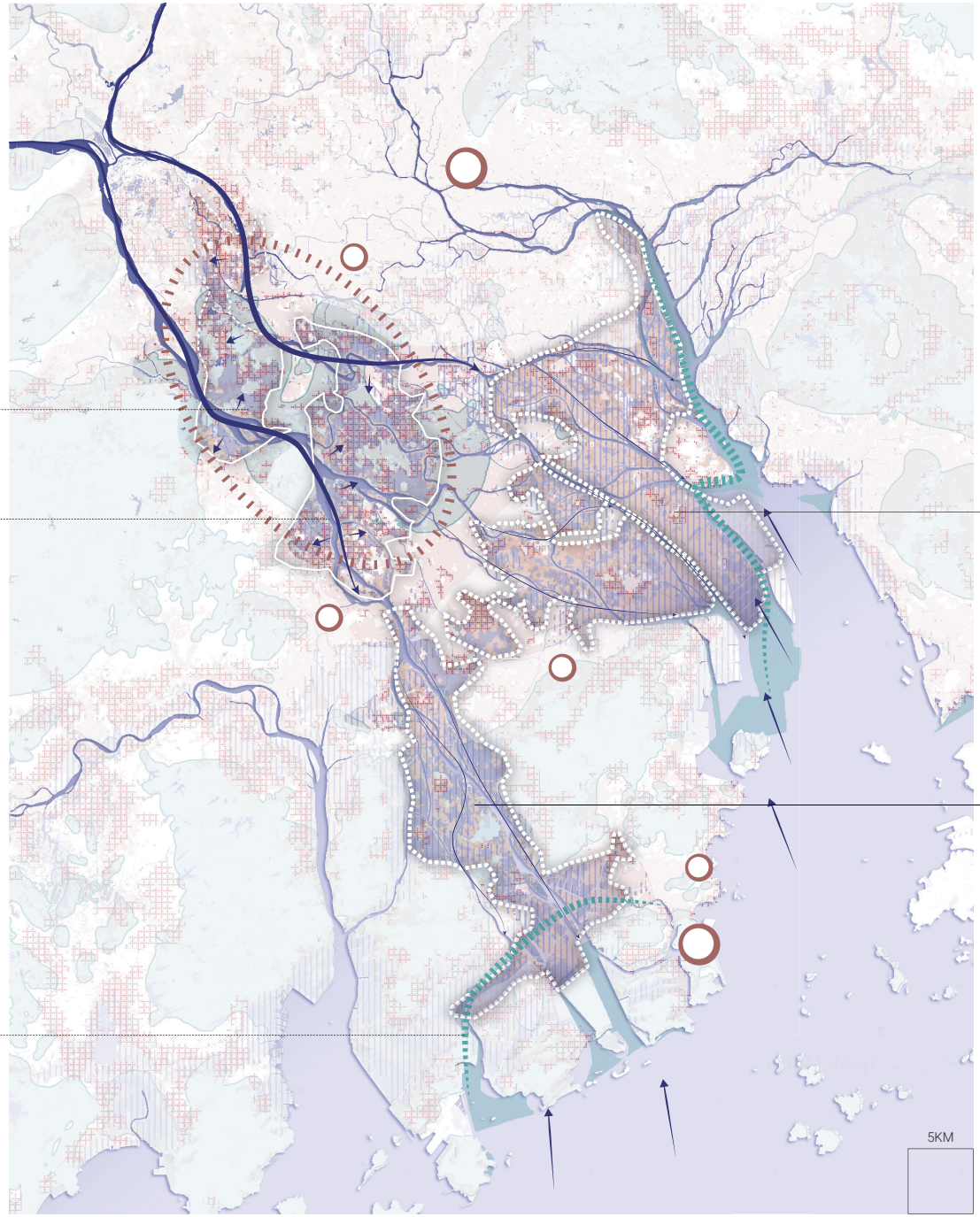


tidal brakish marsh

Regoinal vision

Dikefield
an eco-friendly productive living area in response to urban waterlogging

The buffer
water and ecological buffer zone along the river network and coastal zone



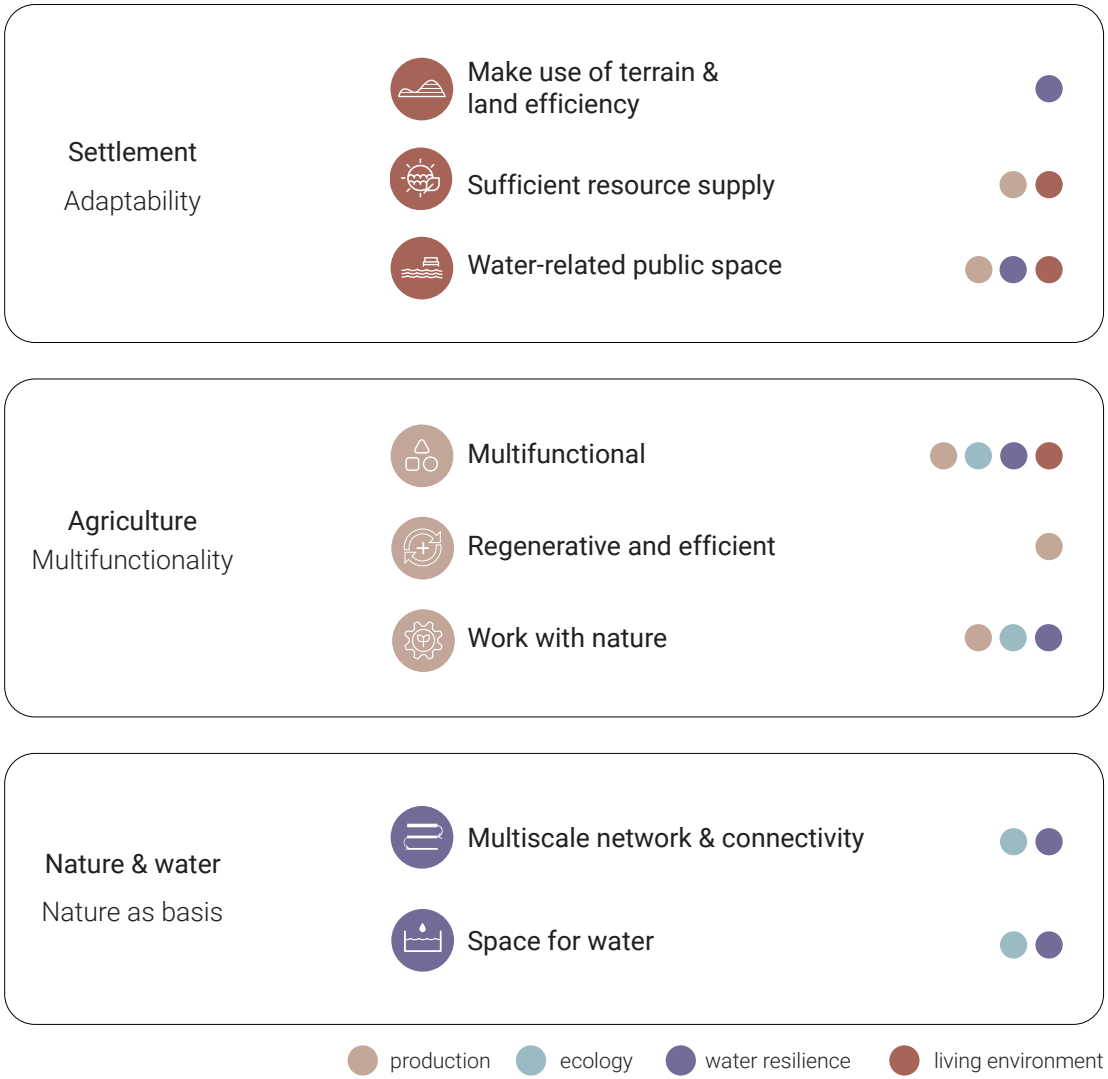
Sandfield
a crop-producing area conducive to coastal habitats and storm surges

Principle

SQ2: What principles could be set to form an adaptive landscape framework?

Photo: http://hdd-group.com/zw/index.php?c=article&id=204

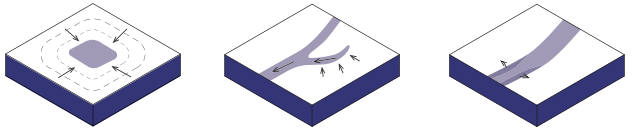
Principle


Settlement
Adaptability
Make use of terrain & land efficiency
Sufficient resource supply
Water-related public space
Agriculture
Multifunctionality
Multifunctional
Regenerative and efficient
Work with nature
Nature & water
Nature as basis
Multiscale network & connectivity
Space for water
production
ecology
water resilience
living environment

Toolbox

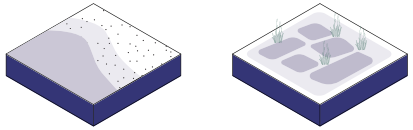
nature & water

multiscale network & connectivity



add waterbody | add tributes | widening&dredging

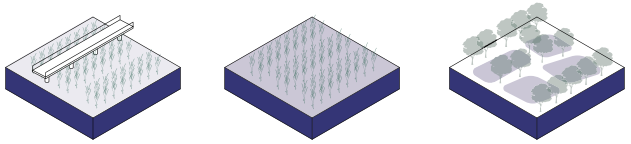
space for water



create flood plain | create wetland

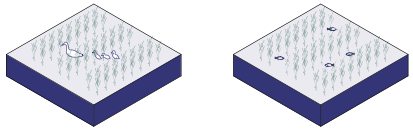
agriculture

multifunctional



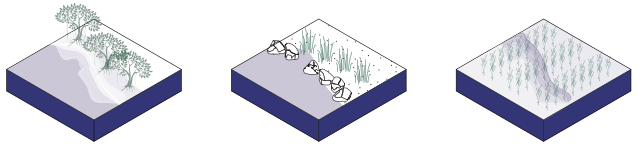
add recreation | water resilient ricefield | dikepond

regenerative and efficient



raise duck in ricefield | rice-fish rotation

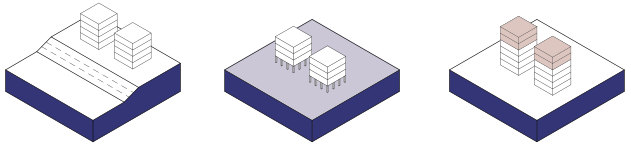
work with nature



mangrove as coastal defence | ecological reclamation | use fresh tide for irrigation

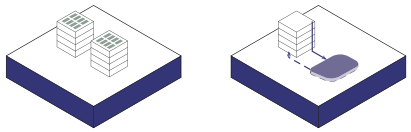
settlement

make use of terrain & land efficiency



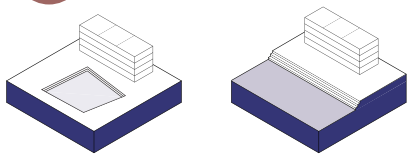
highland | stilt building | increase plot ratio

sufficient resource supply



roof garden/ farming | rainwater circulation

water-related public space



water plaza | waterfront space

Design exploration

SQ3: How to apply the principles to local-scale design on the west side of PRD and bring social and environmental benefits to the area?

Photo: https://www.octgulou.com/

Example for dikefield-dikepond

Gulao Town

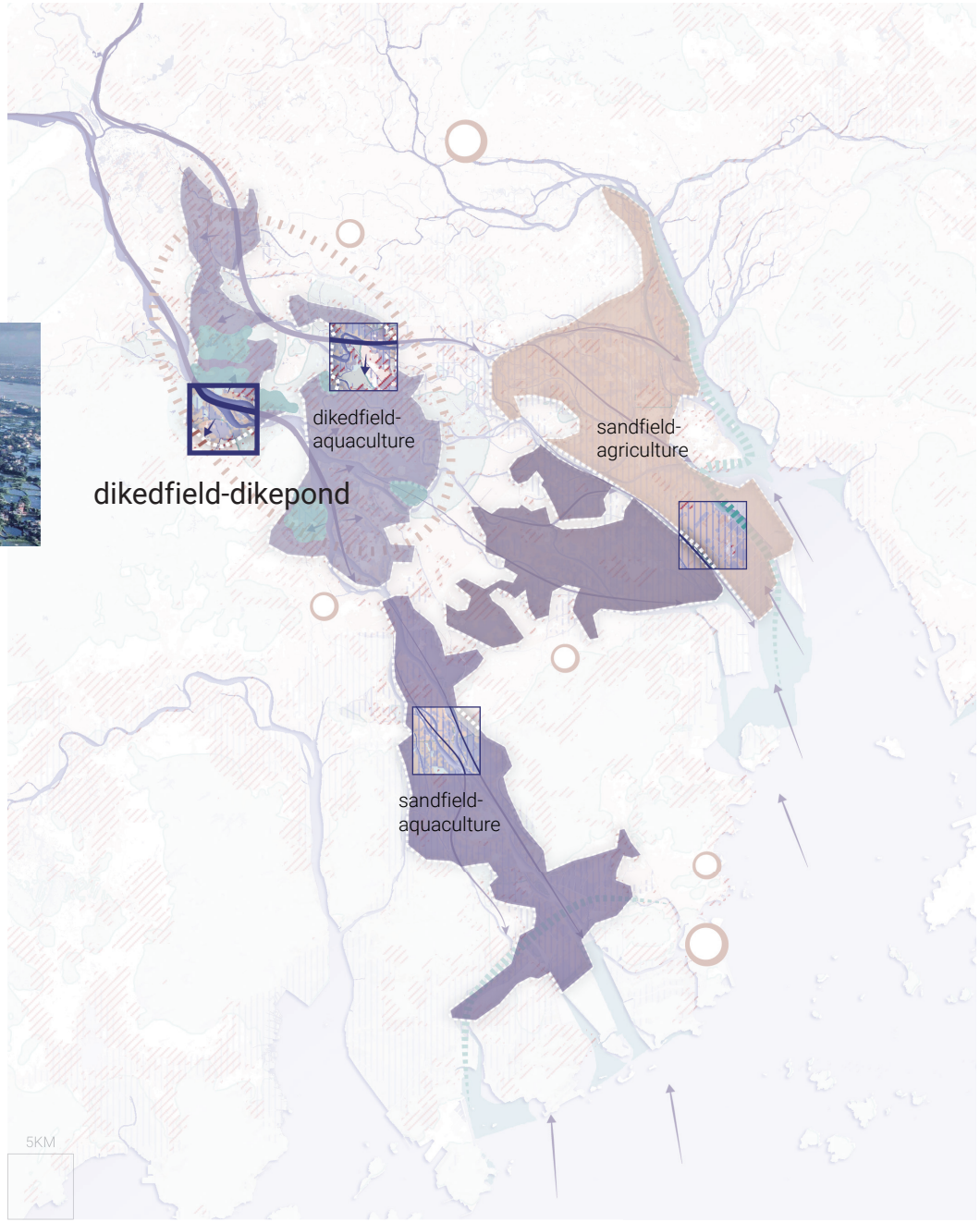
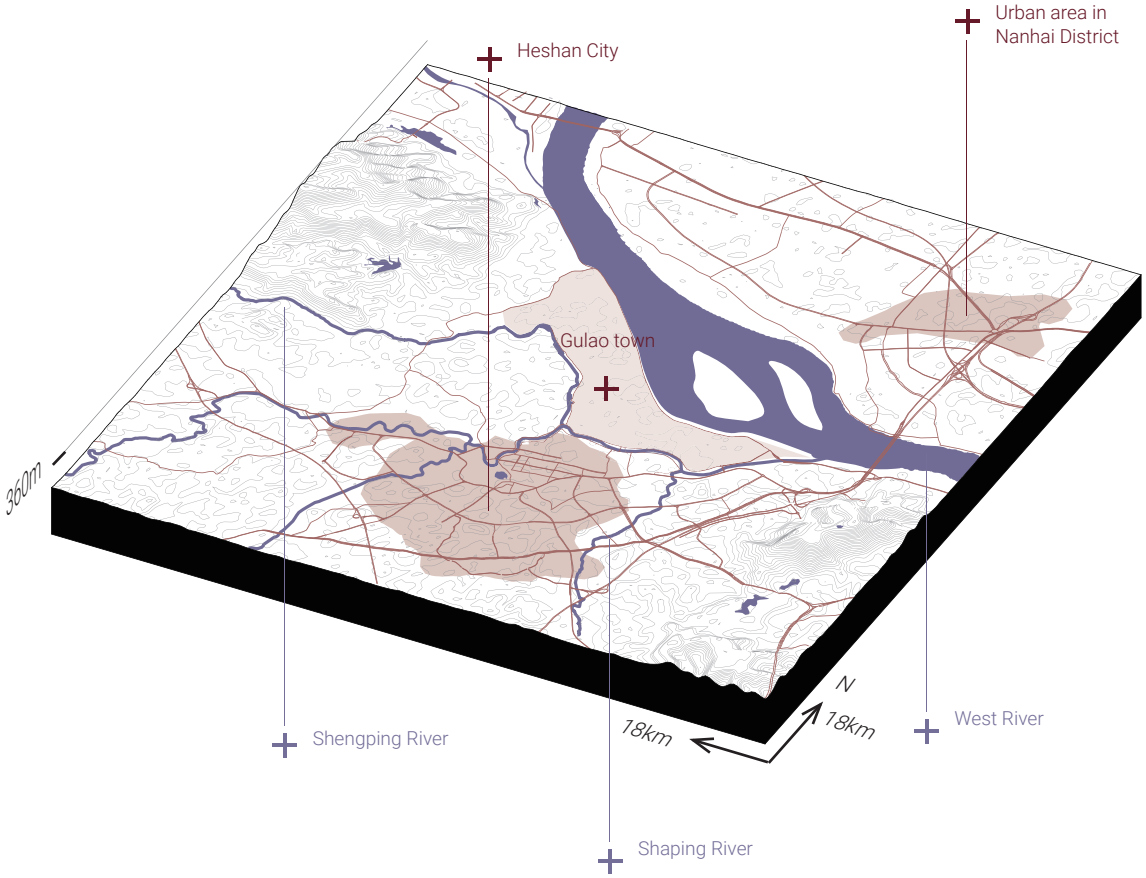
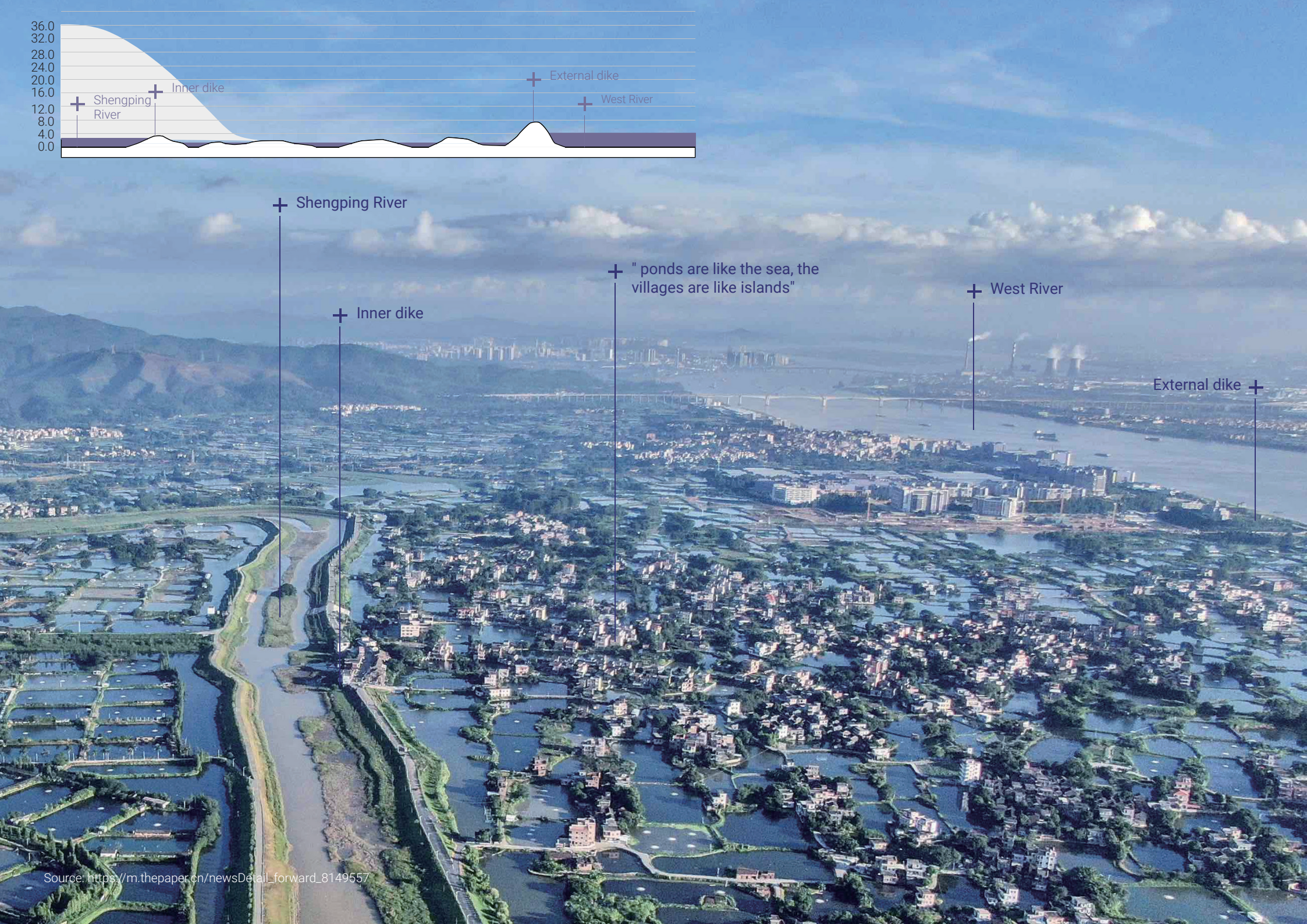


Photo: google image

The Gulao Town





Source: https://m.thepaper.cn/newsDetail_forward_8149557

The dilemma: abandoned village

Source: Guangzhou Mzai

The dilemma: a 'disneyland' for urban residents

Photo: https://www.octgulou.com/

What if we start by applying the adaptive landscape framework?

Understanding

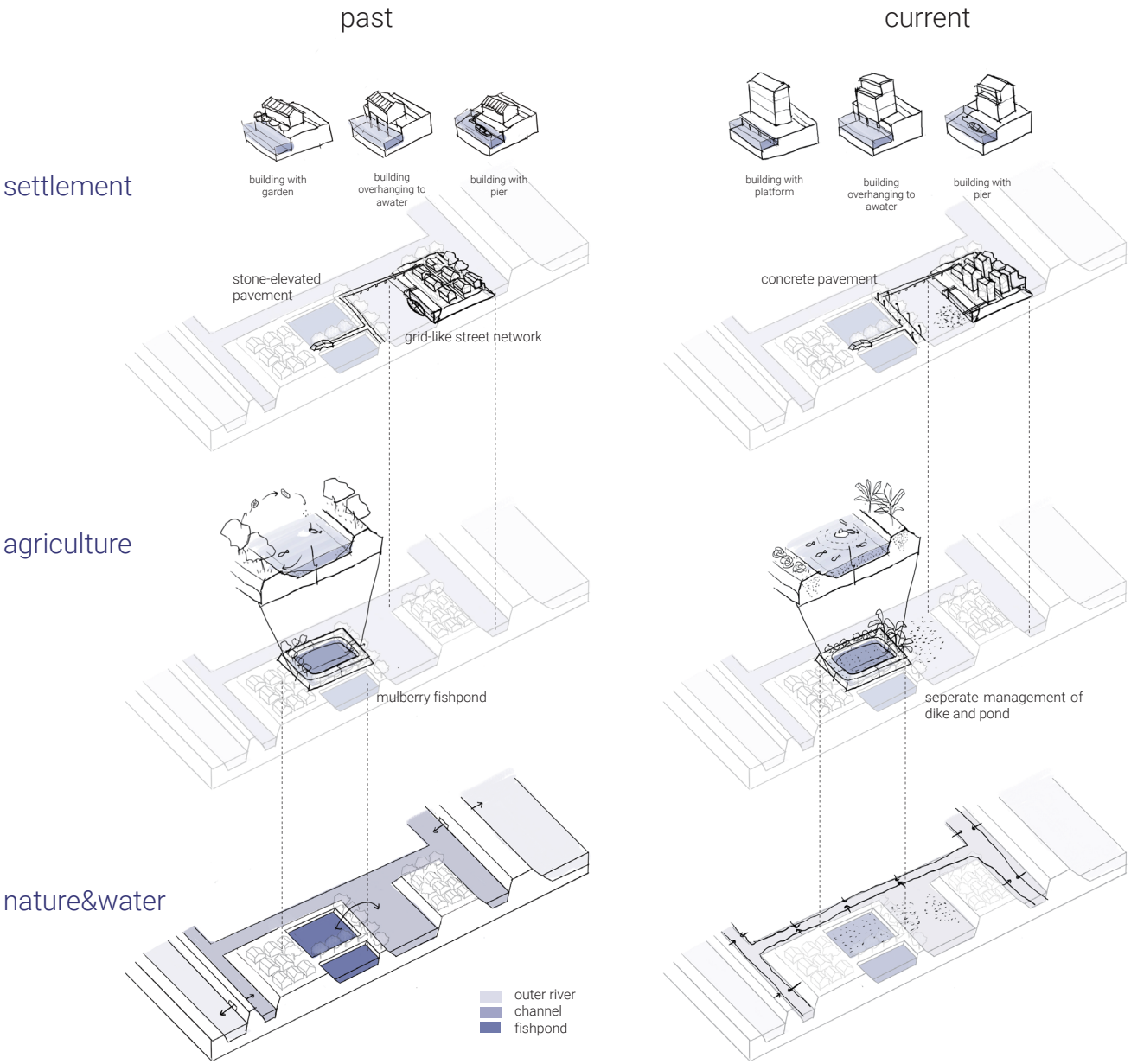


Photo:https://www.bilibili.com (top); Wenxiu Chi (middle); http://gd.ifeng.com/a/20200312/13945662_0.shtml (bottom)

Strategy on water

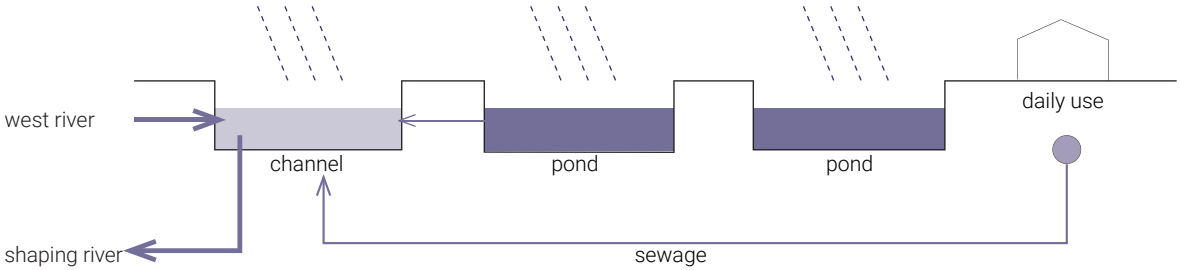
1 *water supply and discharge adjustment*

2 *treatment of polluted water and sewage*

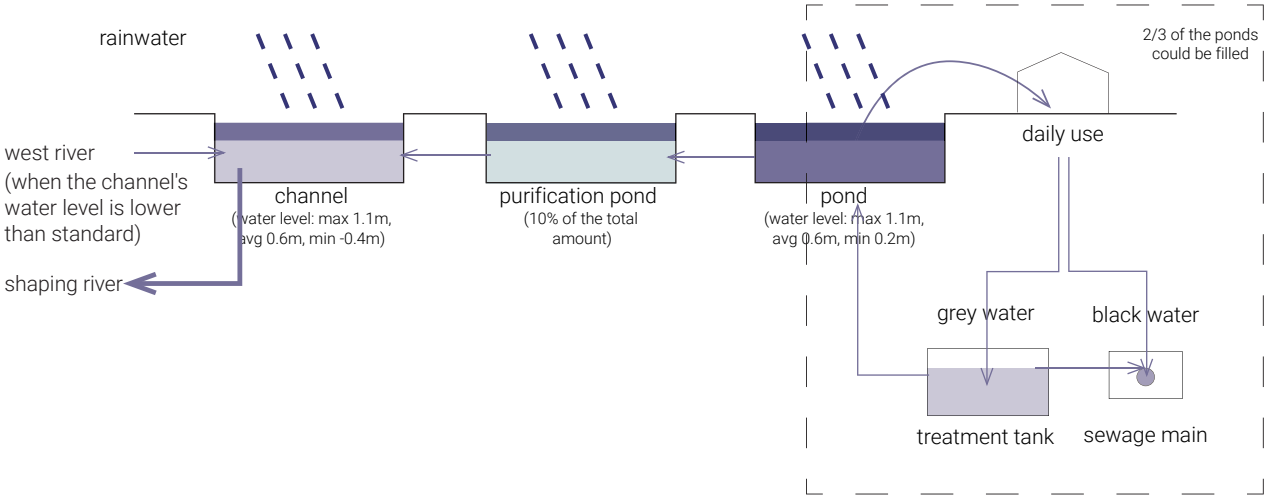
3 *rainwater retain, restore and reutilize*

4 *guaranteed water capacity*

current

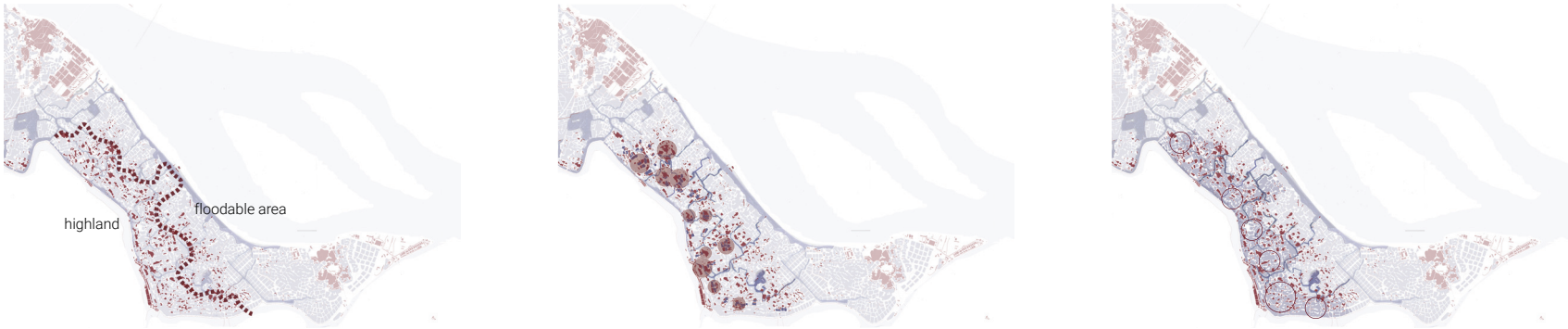


proposed

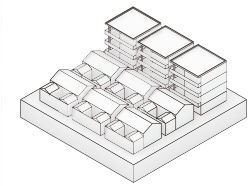


Strategy on agriculture and settlement

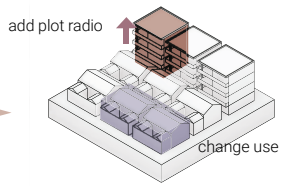
current situation | rural tourism | urban expansion → development intensity



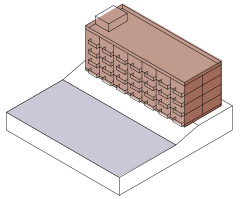
settlement



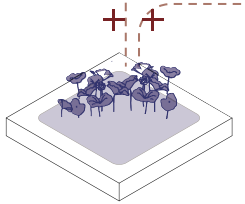
existing local village



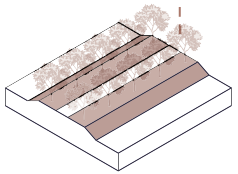
existing village renewal



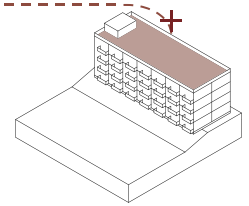
construct on expanded dike



landscape pond

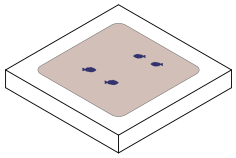


productive public greenery

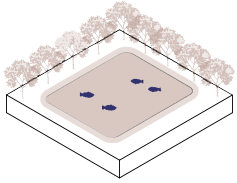


roof farming

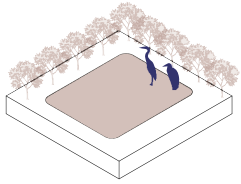
agriculture



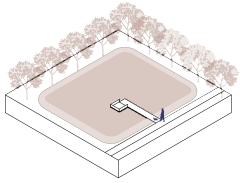
existing intensive aquaculture



dikepond



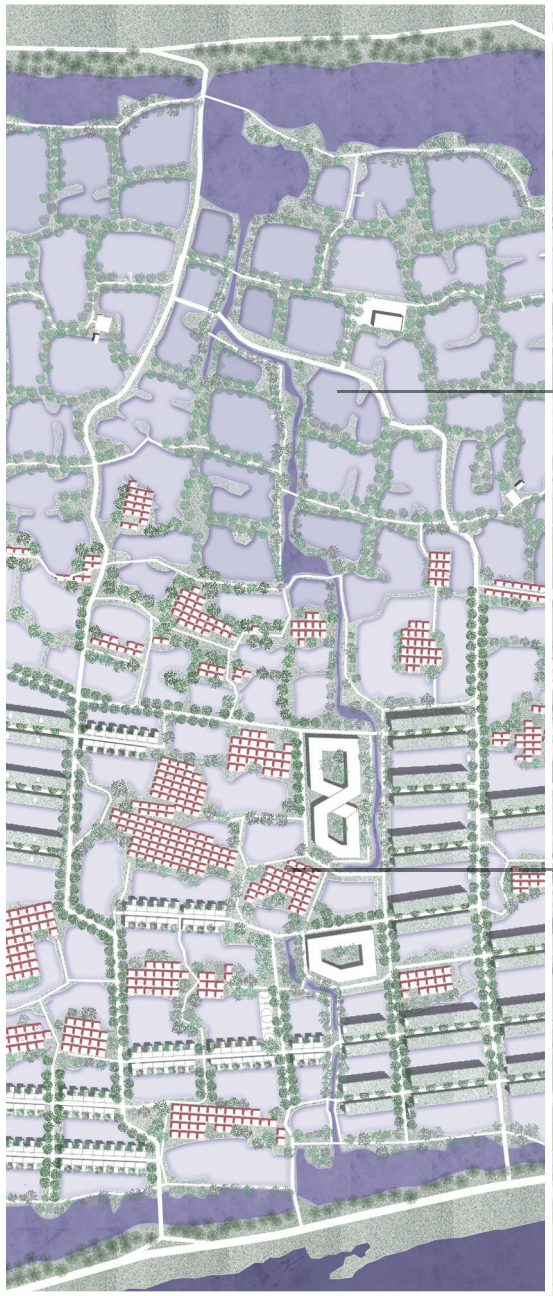
eco-management



recreational infrastructure

multifunctional dkepond

transformation
combination



❶ agricultural produciton area
production+

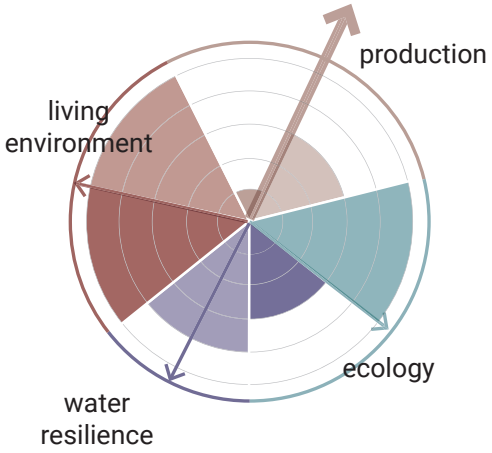
❷ residential area
living environment+

N

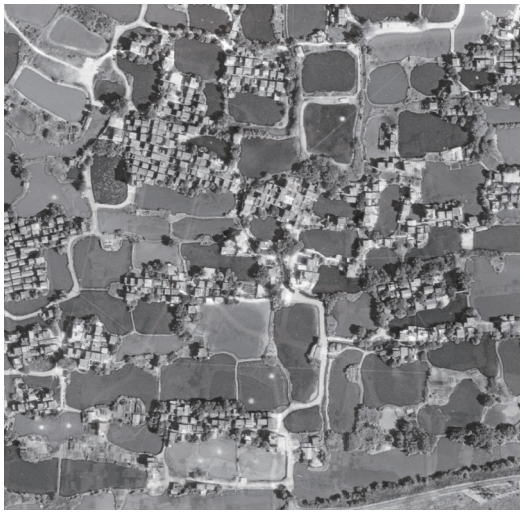
0 100 500m

01 Agricultural production area

+agricultural experience,
+ecological conservation,
+nature education

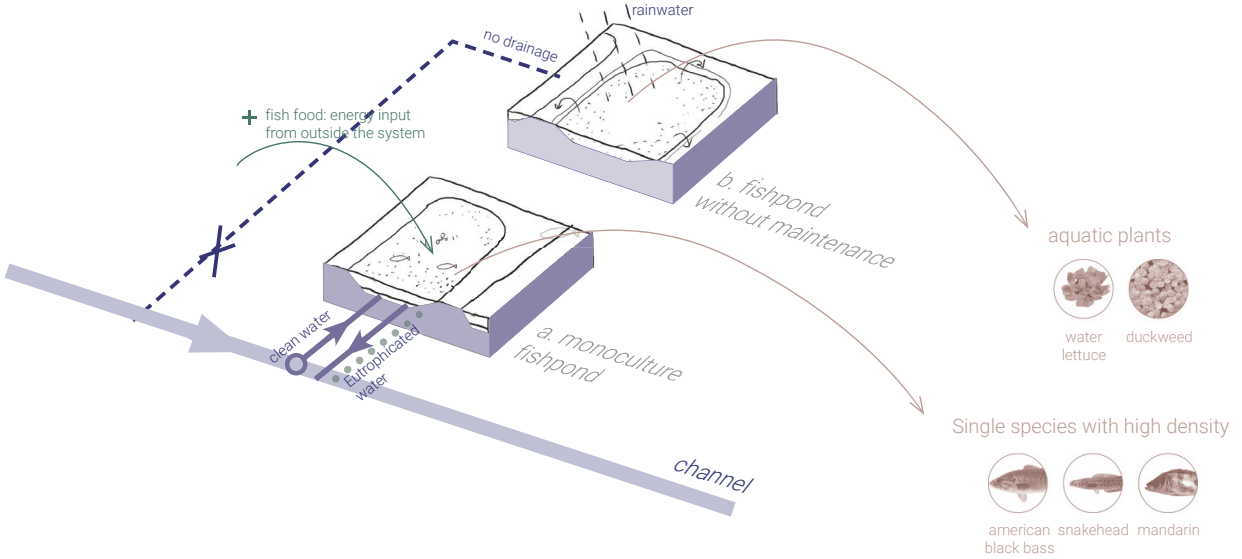


Goal on sustainability

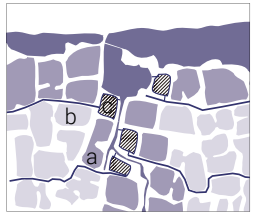


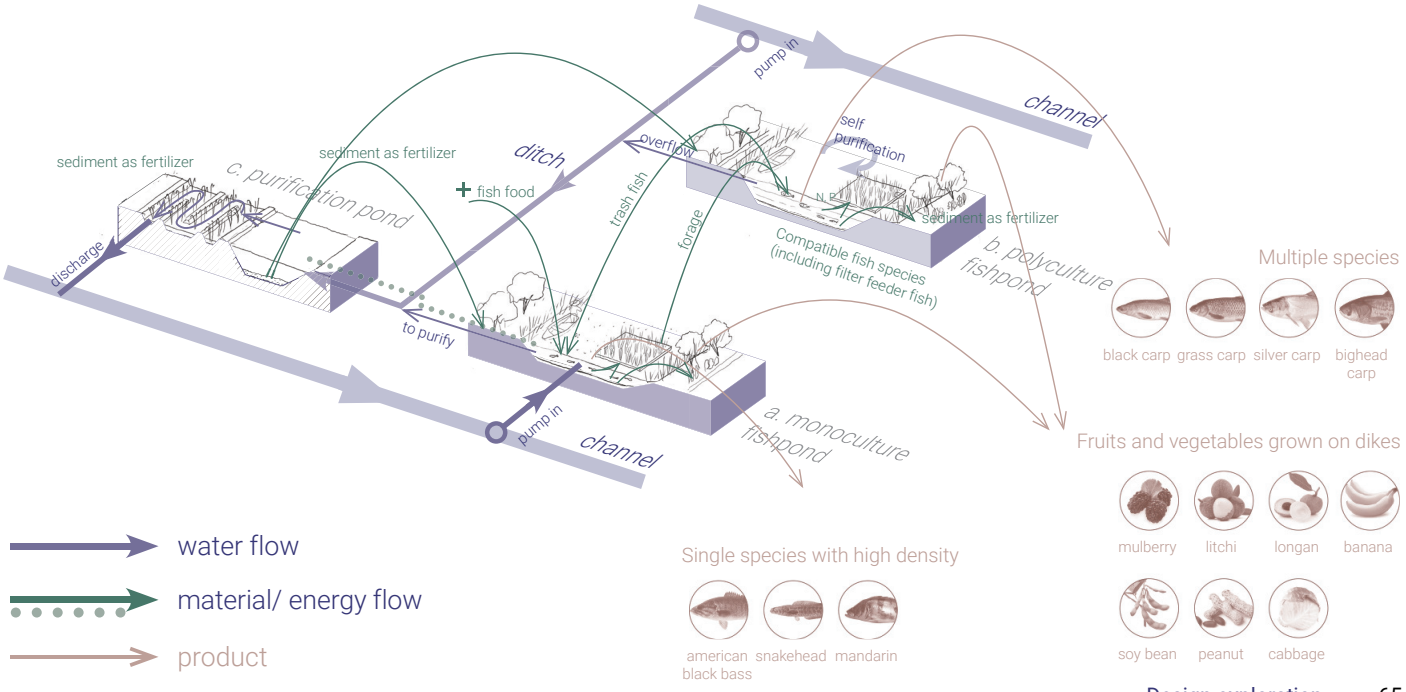
Regenerative system

Current: open system

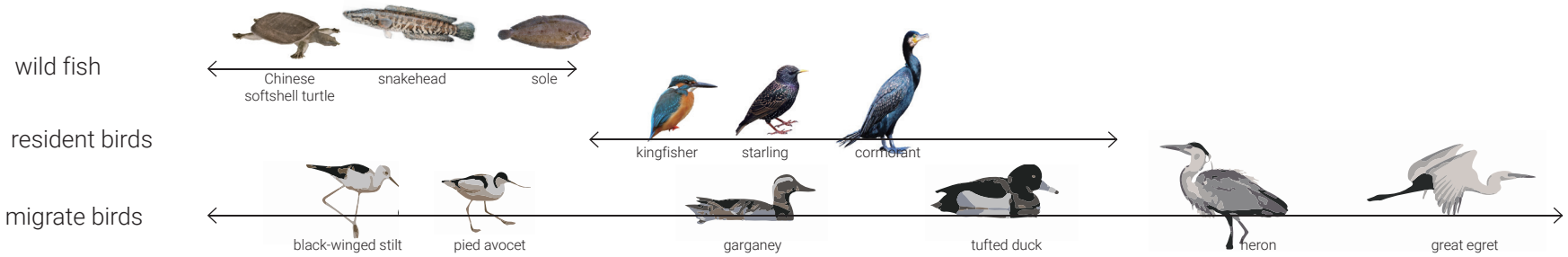


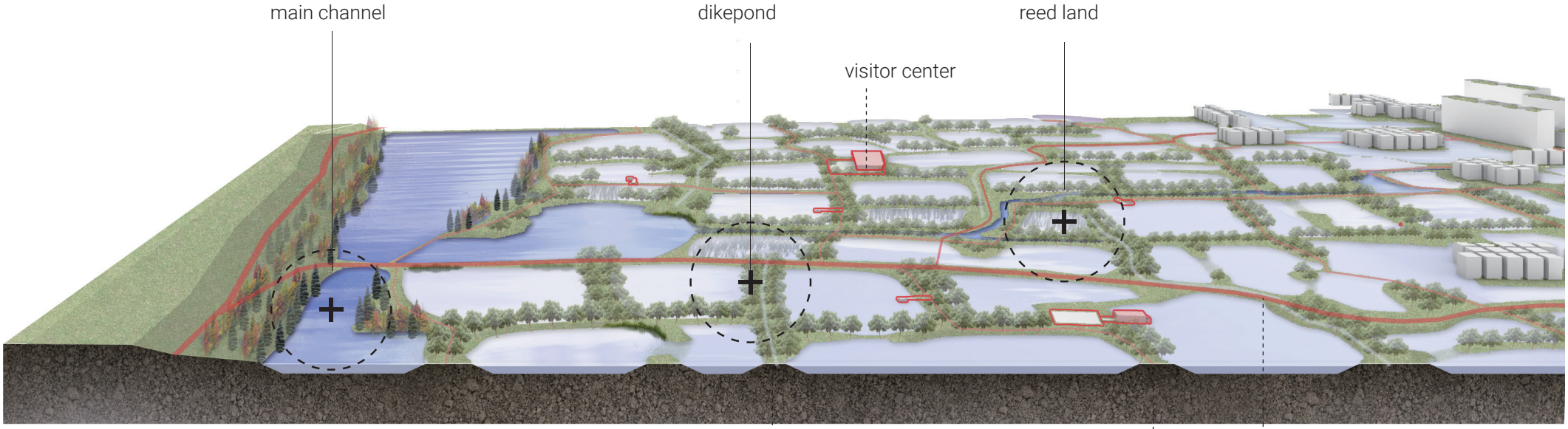
Proposed: semi-open system



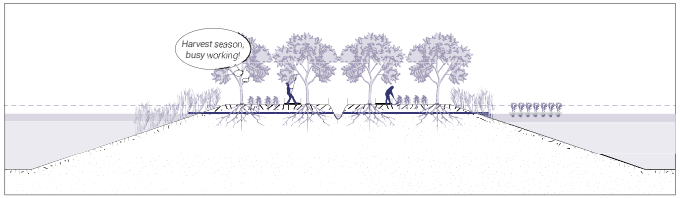


Ecology and recreation: an attraction to human and wildlife

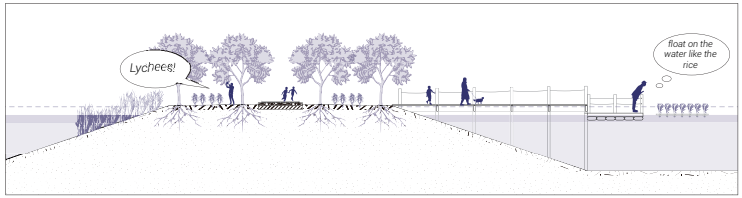




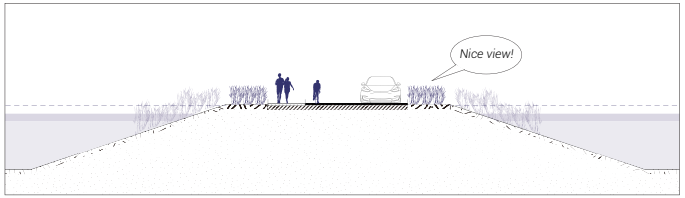
farming dike



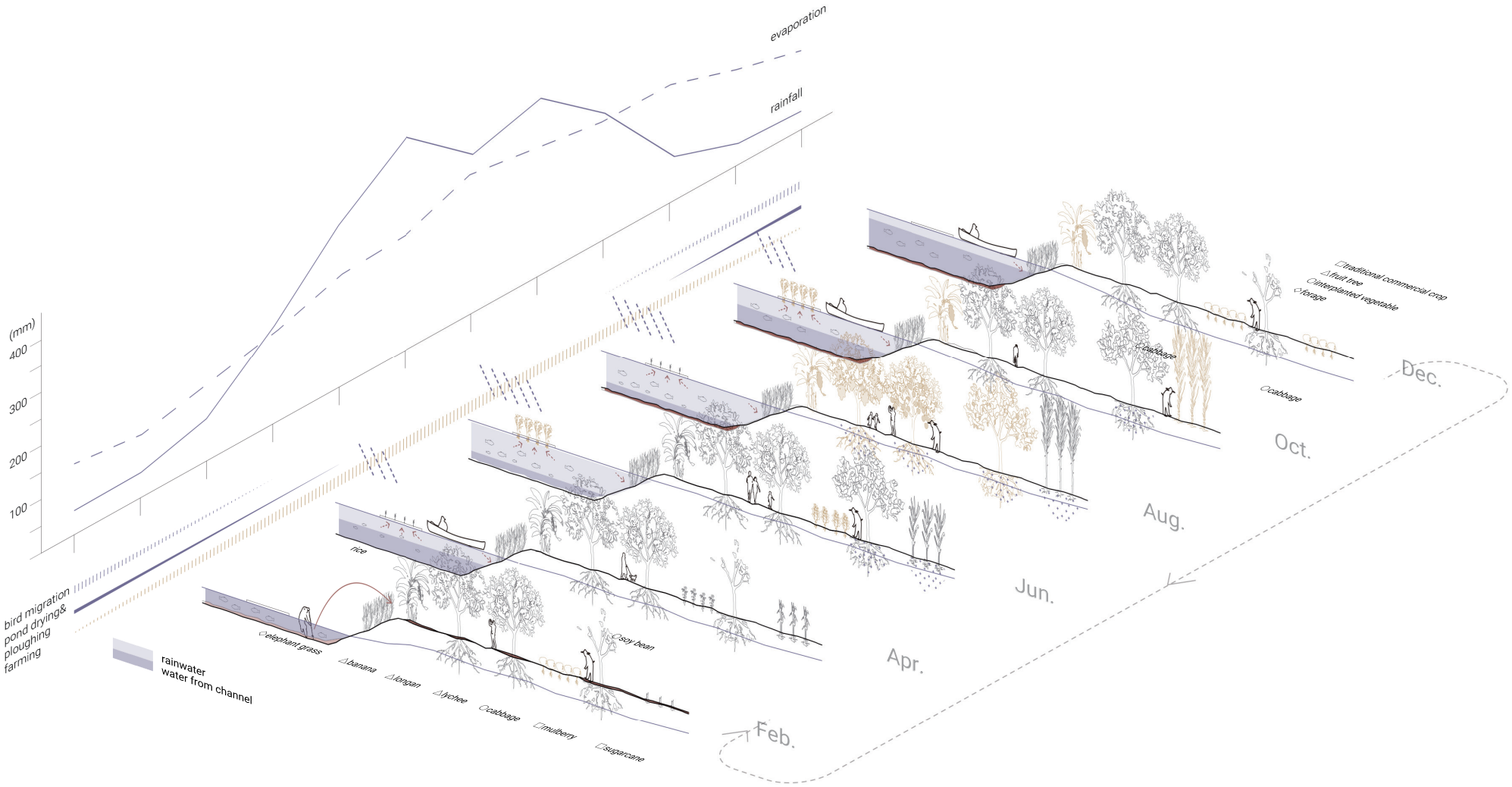
experiential dike



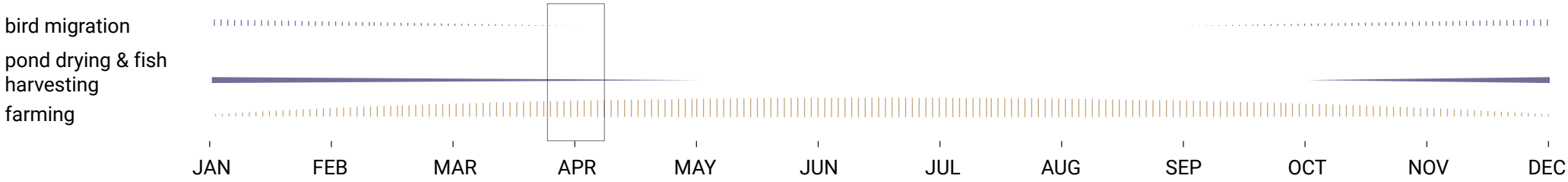
motorway



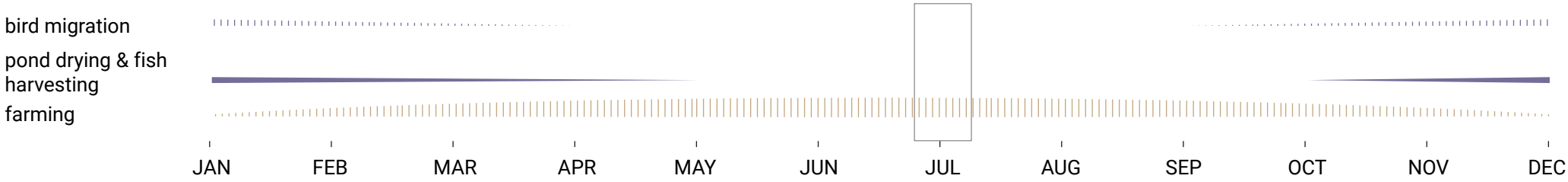
Maintenance: yearly cycle



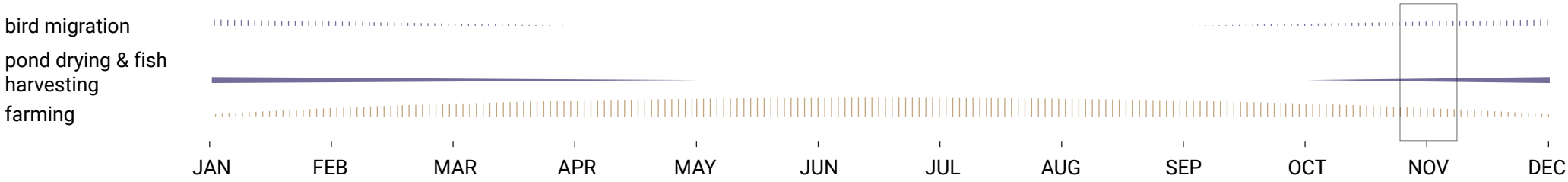
April (Dry season)



July (wet season)

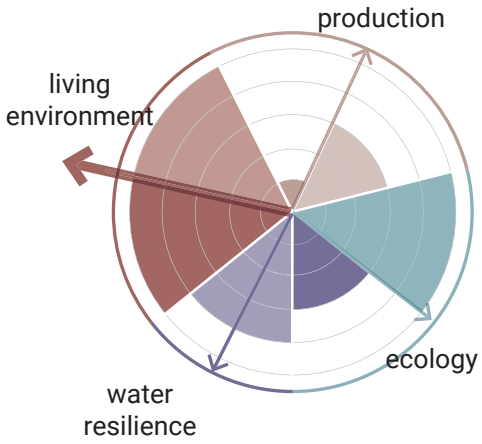


November (dry season)

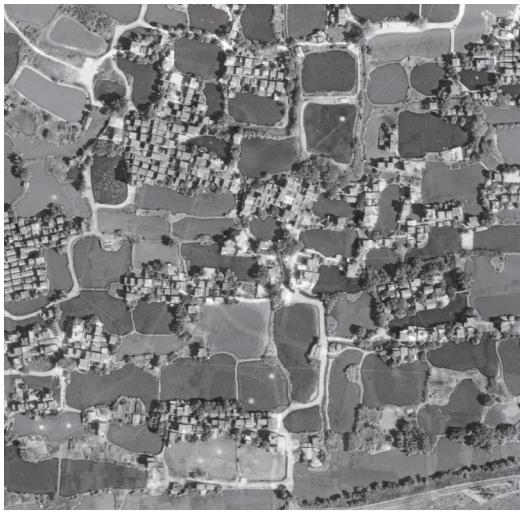


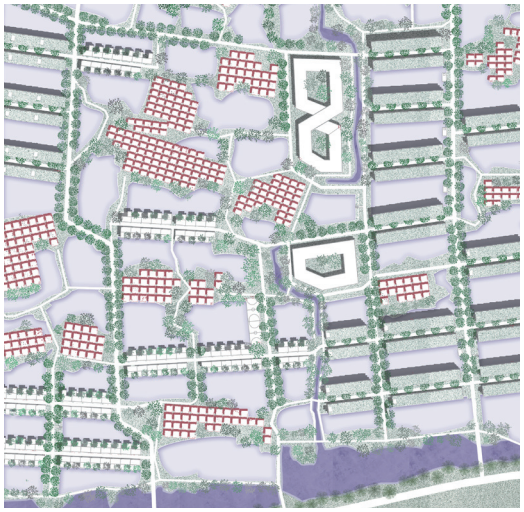
02 Dikepond neighbourhood

+water resilience
+urban farming
+waterfront social life

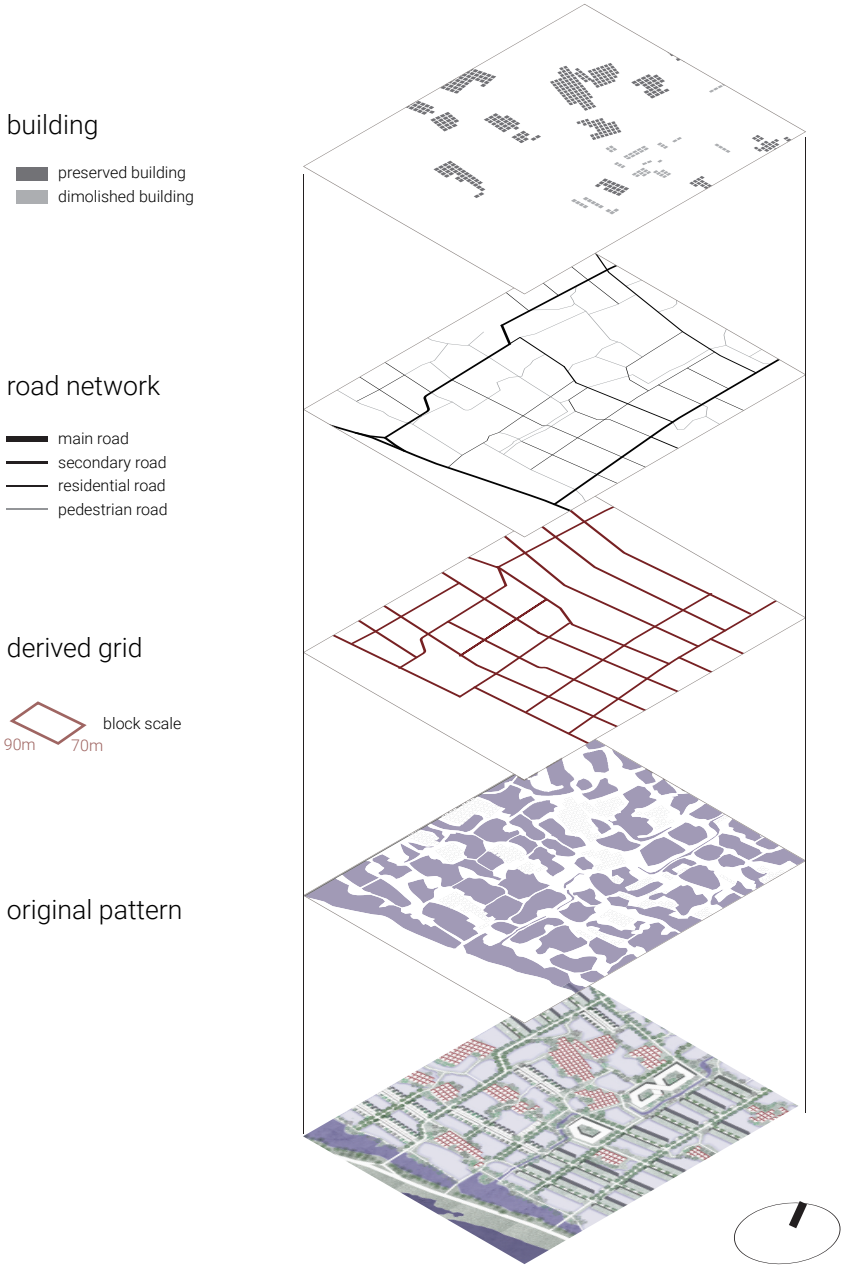


Goal on sustainability

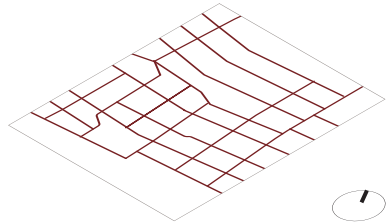




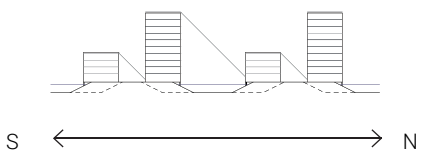
The new neighbourhood pattern

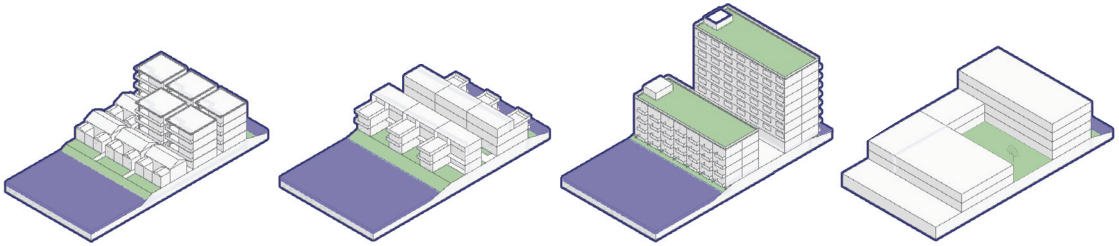


Building and landscape axis



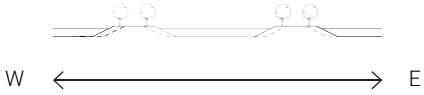
building axis

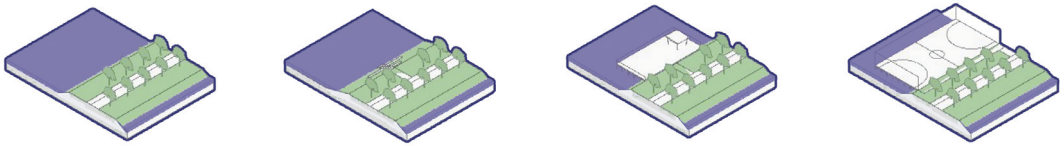




local village | terrace house | flat | public building

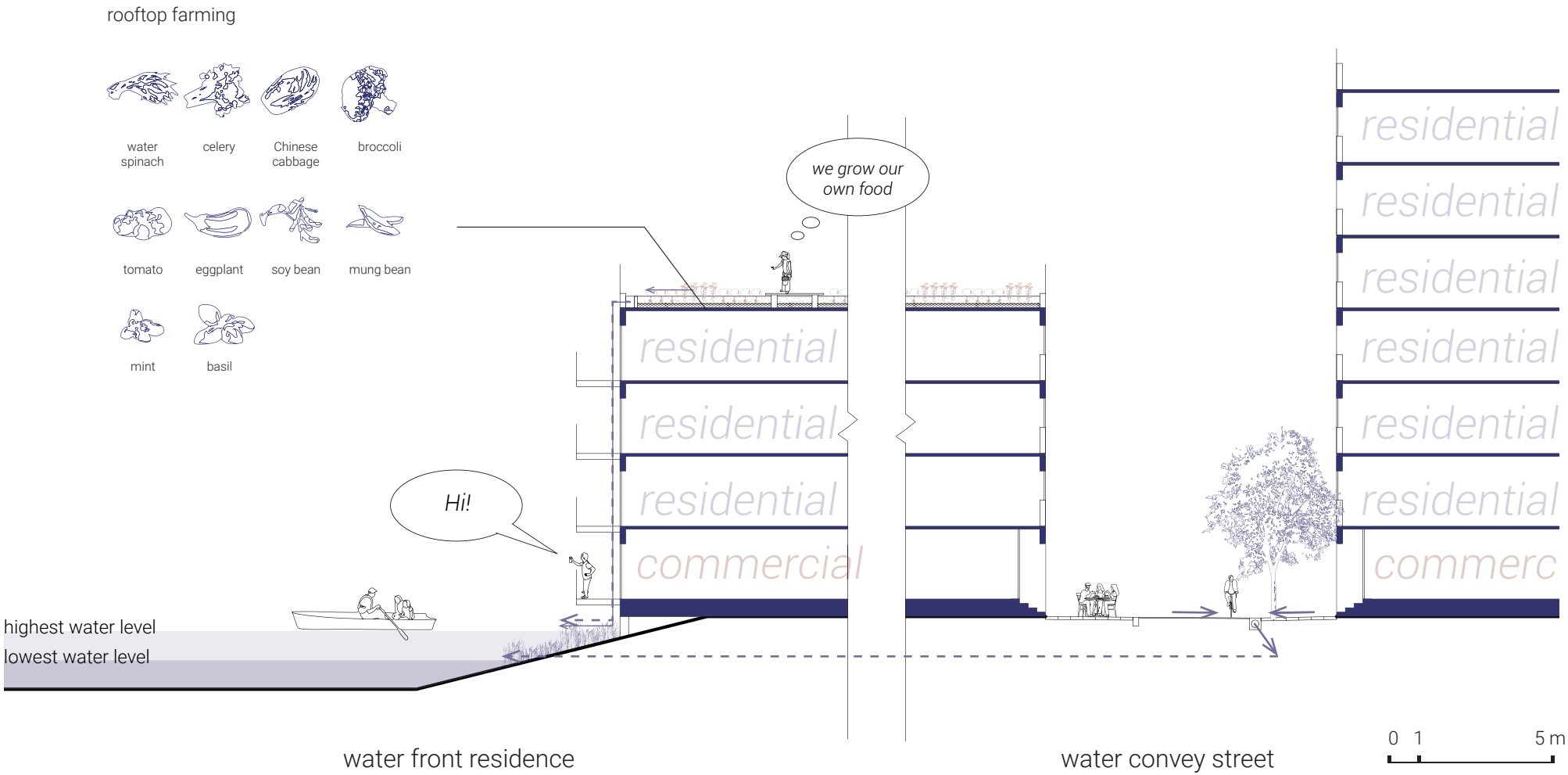
landscape axis



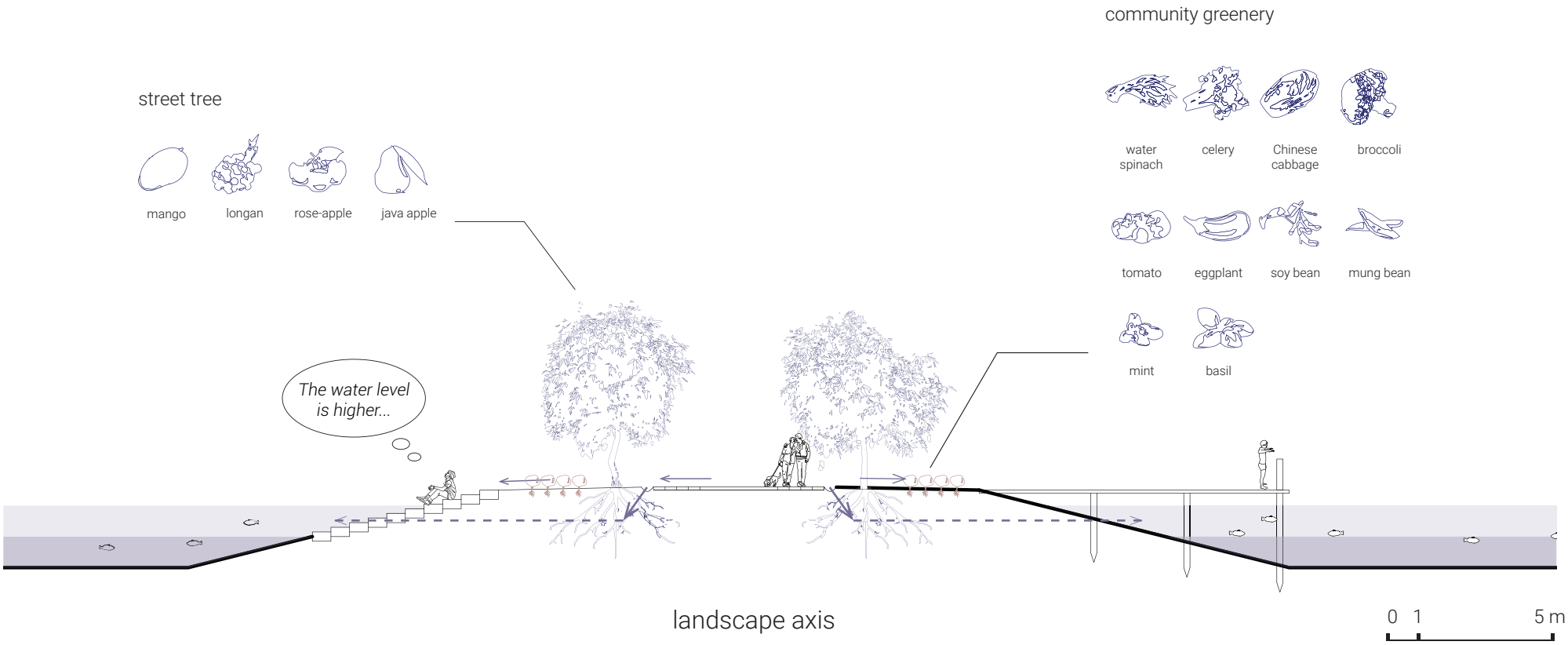


urban farming | waterfront steps | platform | playground

Production and water management

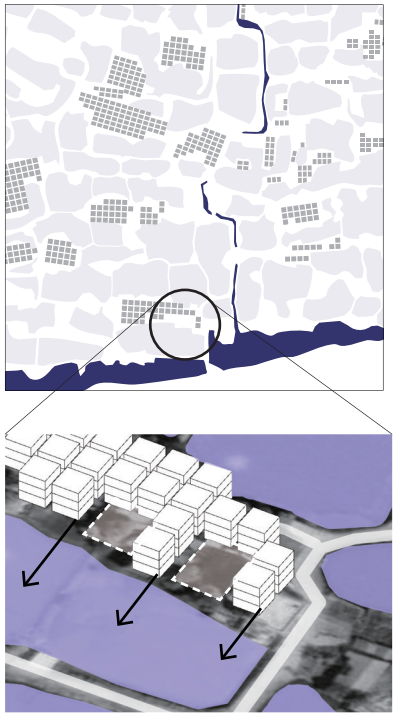


Production and water management



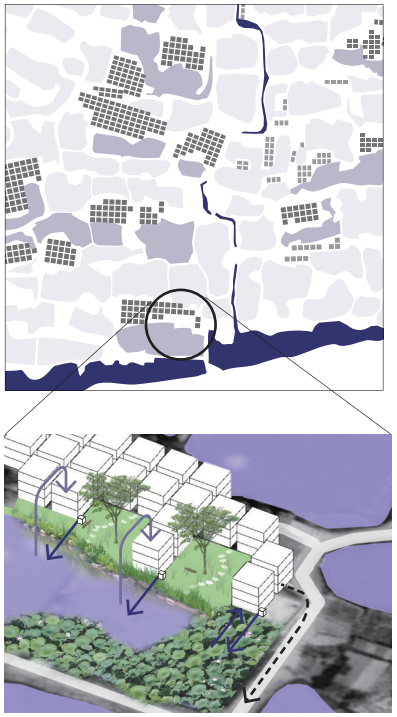
Process

current situation



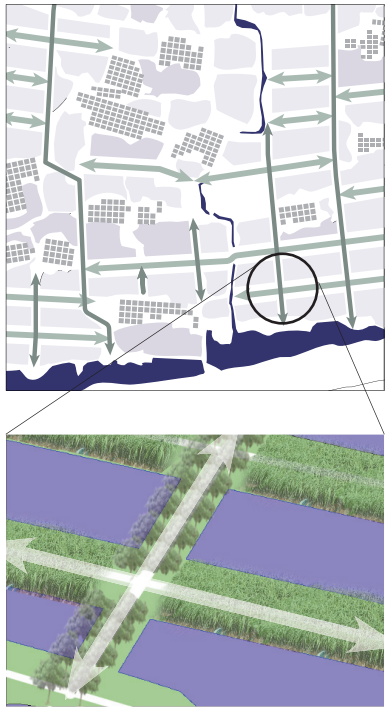
-abandoned backyard
-sewage pollution

1. village renewal



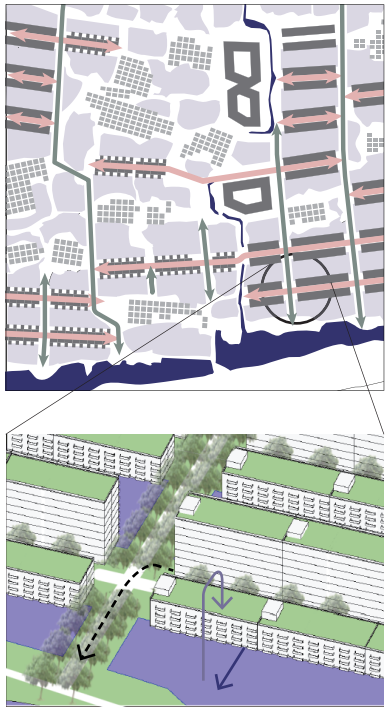
-public garden
-water infrustructure
-landscape pond

2. preparation: Modularization



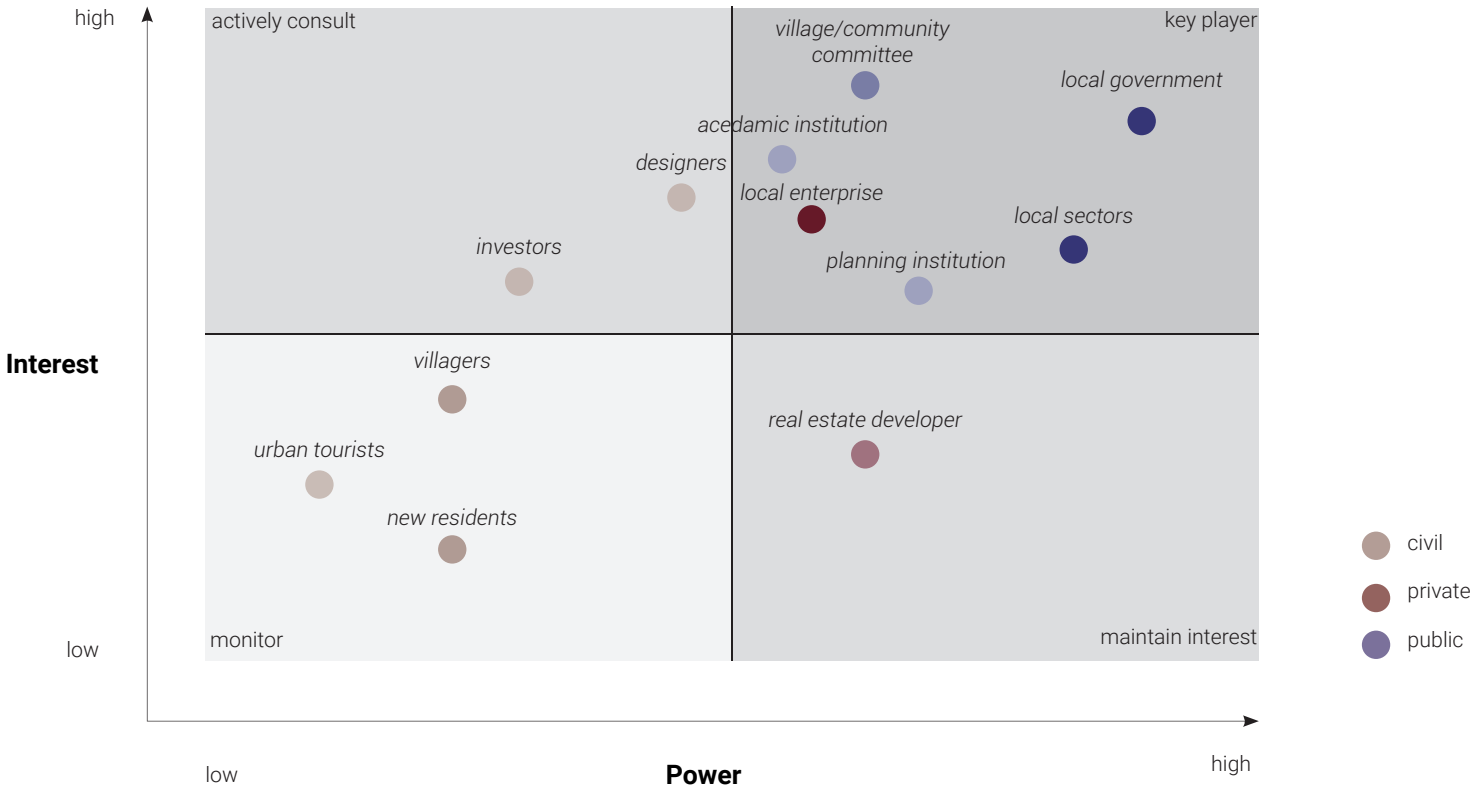
-north-south: landscape axis
-west-east: cultivation with annual crop

3. new neighbourhood



-north-south: landscape axis
-west-east: buildings

Stakeholder



Stage 1. Municipal engineering construction (2023-2025)

[planning, construction]

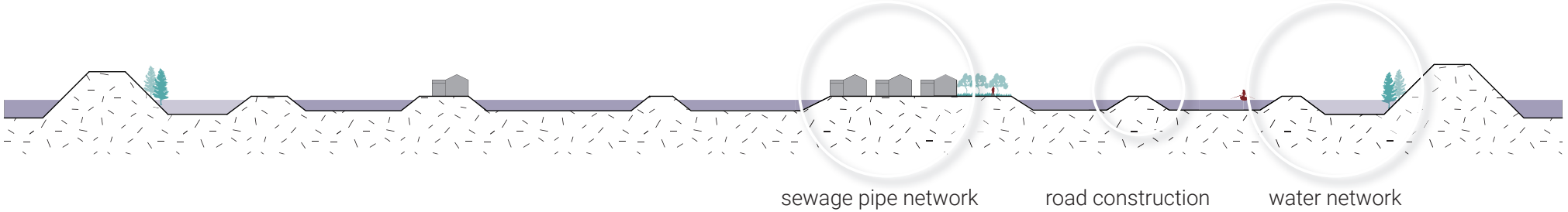
- **planning**
- transportation and water conservancy infrastructure construction

social

- set up condition for introducing new industry

environmental

- water connection and quality improvement

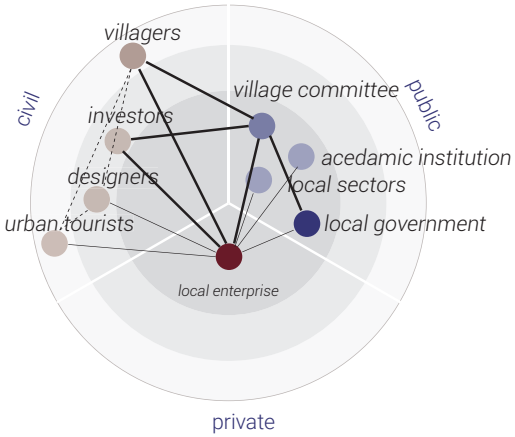


sewage pipe network

road construction

water network

Stage 2: rural tourism (2025-2050)



[construction, management]

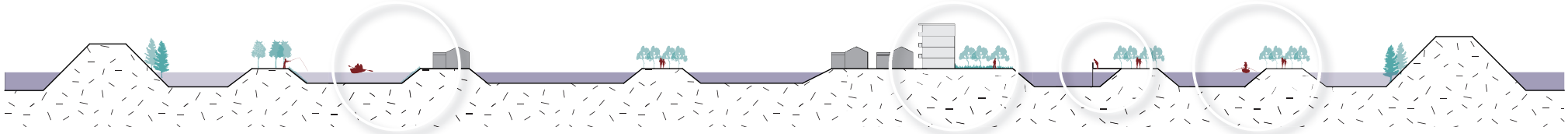
- **set up local enterprise, coordinating with villagers and investors**
- agritourism
- renewal of the local village, Introduce homestay and business

social

- promote first and third industry
- increase local people's income and attract villagers back

environmental

- rainwater utilization
- water quality qualified
- better environment for people and creatures



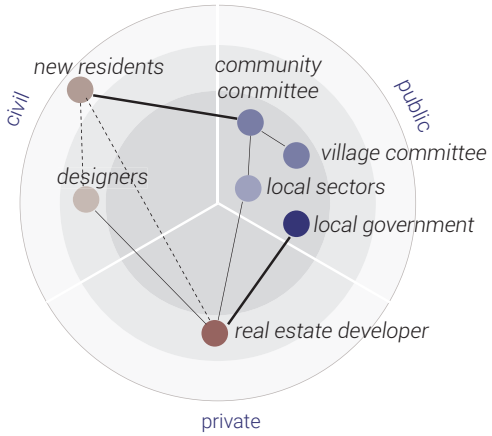
public space improvement

building renewal

slow traffic network & tourism infrastructure

regenerative agriculture

Stage 3. urban expansion (2050-)



[planning, construction, management]

- **landuse adjustment planning**
- new resiential area construction
- move in new residents, set up community committee for management

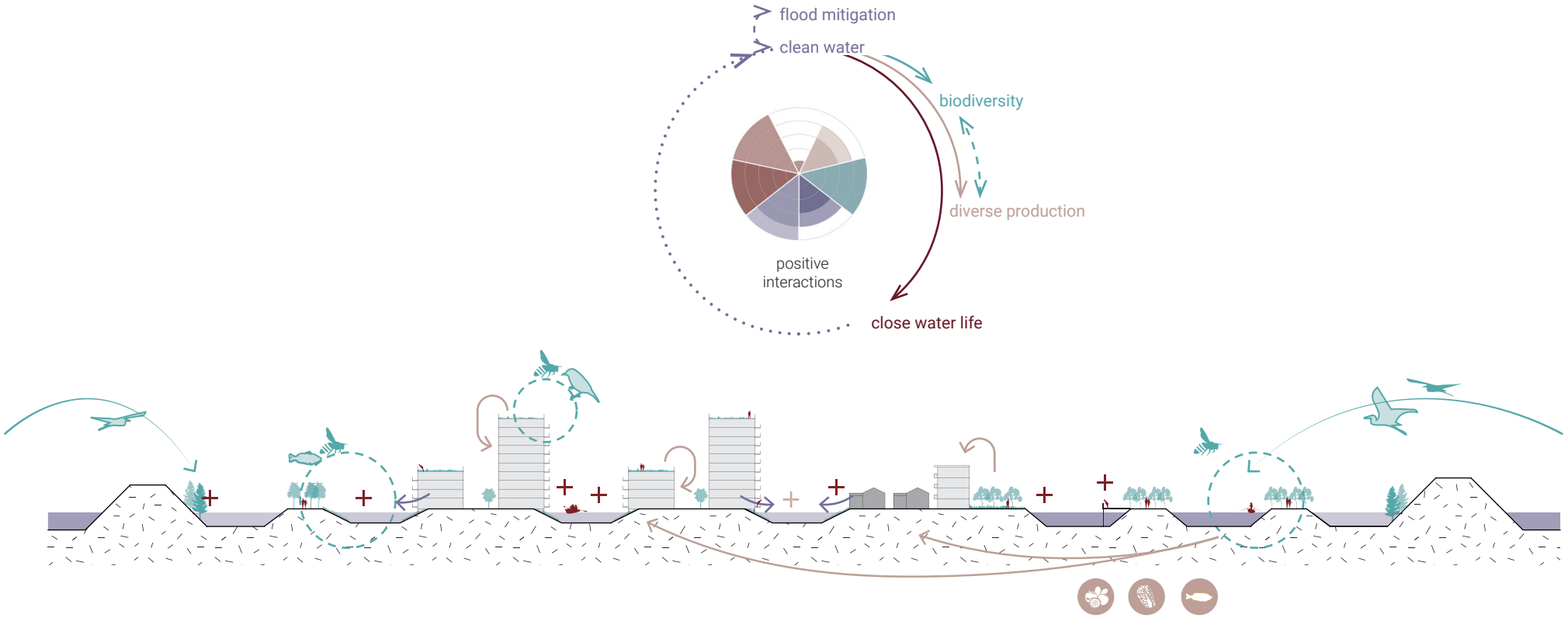
social
- more accomodation
- provide new job opportunity for villagers

environmental
- sustainable community

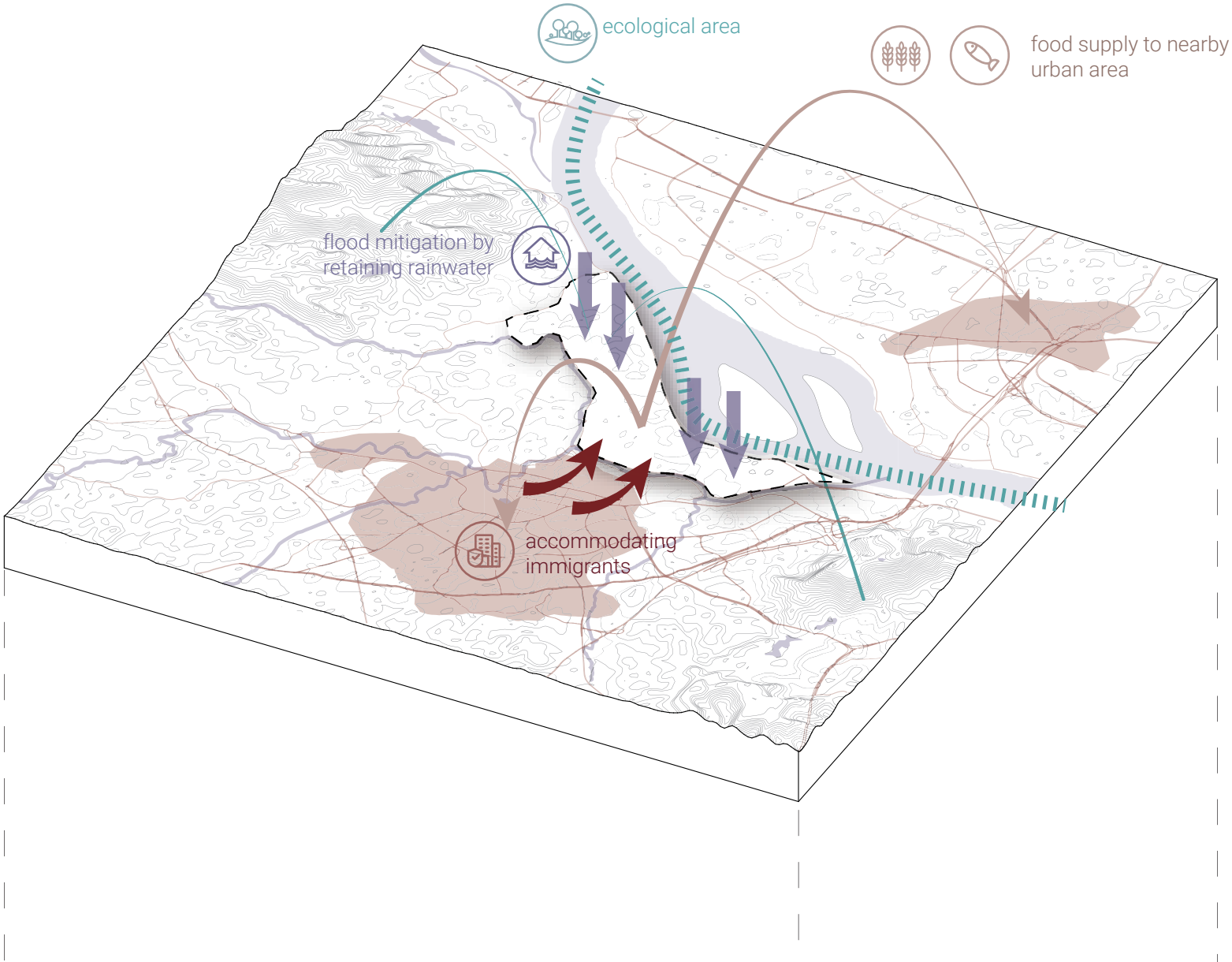
new buildings & road network

community park & urban farming

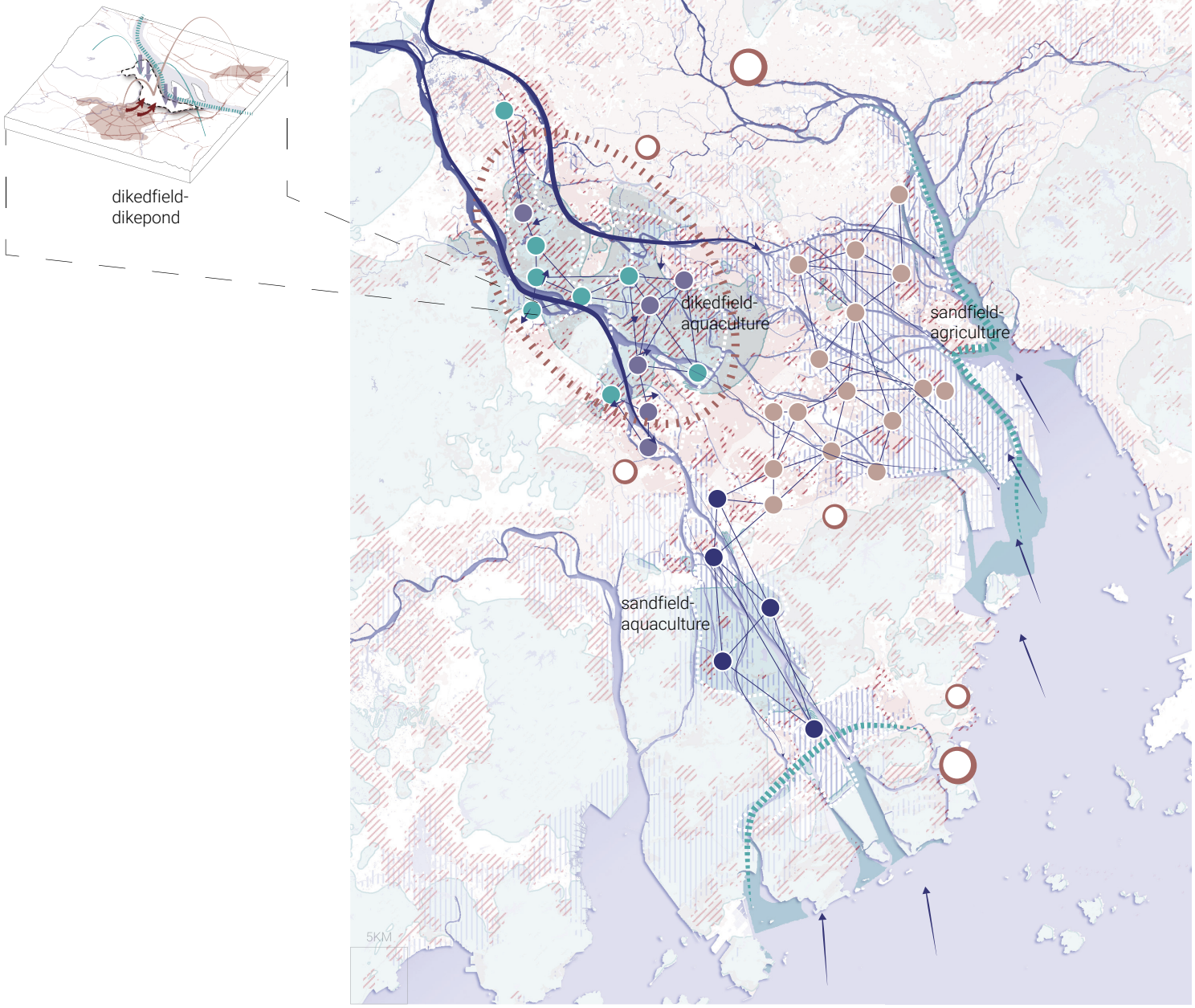
Landscape value



Value towards the surrounding area



Towards the regional vison



From the Water.....

Local knowledge and experience

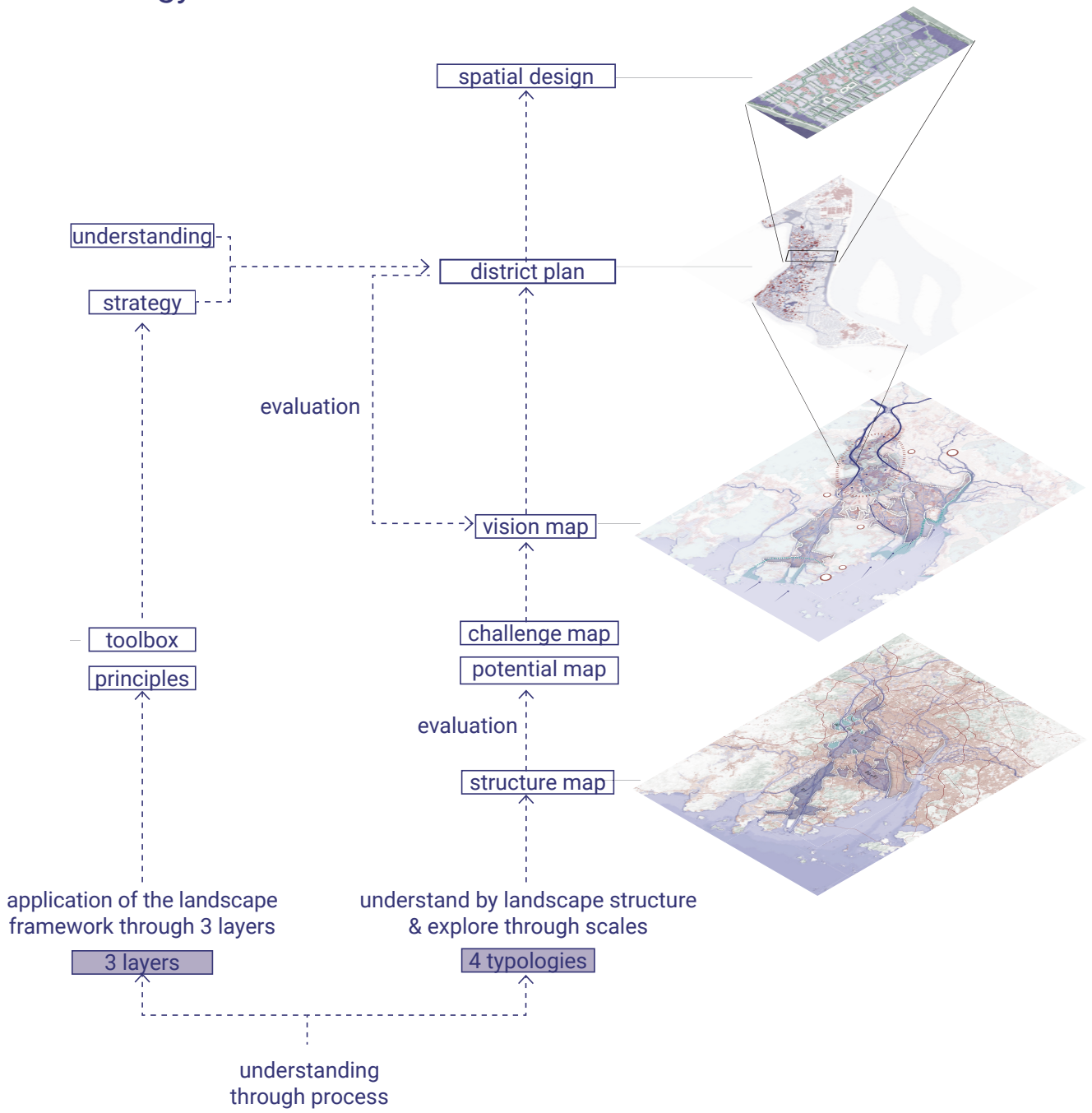








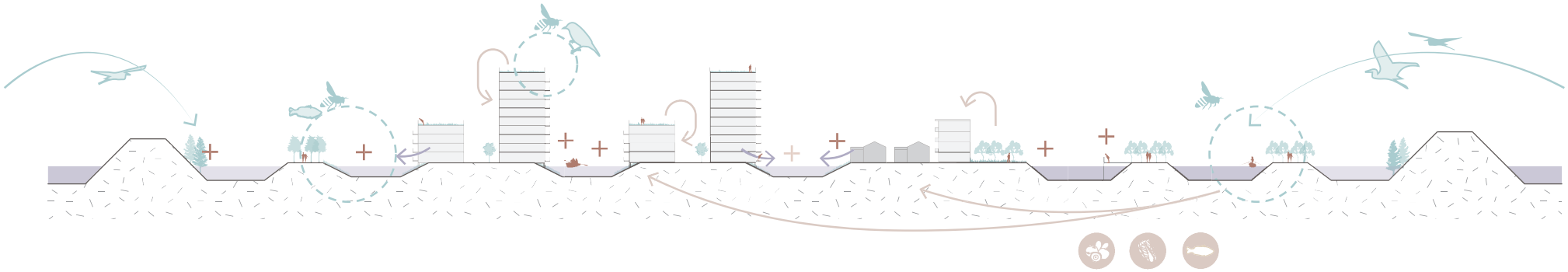
Landscape framework methodology




桑基魚塘圖

From the Water

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



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