"Nước, Nước"

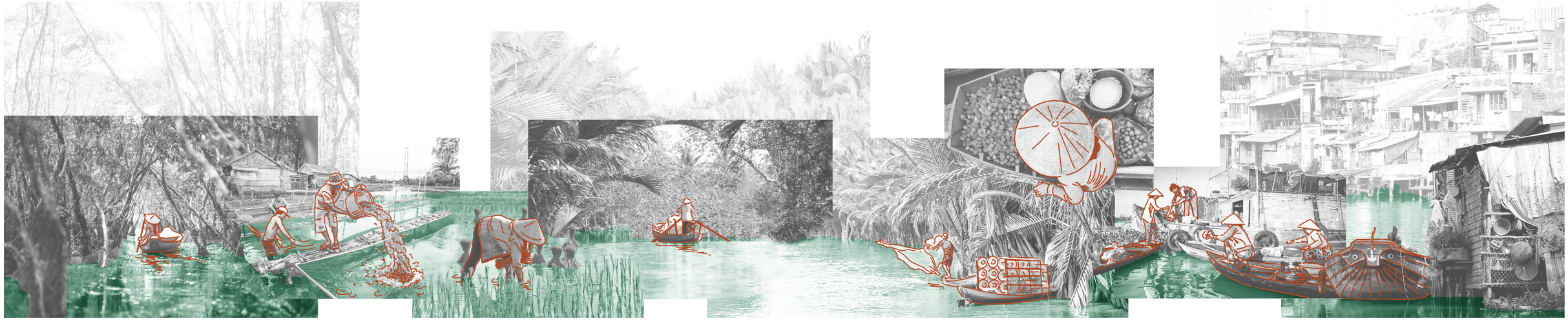
"Hydro–Harmony"

Establishing a resilient landscape system for the Mekong Delta,
to achieve the harmonious co-existence of humans and water

Name: Hao Wang
Mentor: Steffen Nijhuis, Geert van der Meulen
Lab: Resilient Coastal Landscape M.Sc. Landscape Architecture P5 Presentation

FASCINATION

*In Vietnamese, the word for **water** and the word for **a nation**, **a country** and **a homeland** are one and the same: **"Nước"**.*





65,000sq km
More than **20%** of population
largest **rice**, **fruit** and **fisheries** producer



Source: https://www.insideasiatours.com/vietnam/southern-vietnam/mekong-delta



Source: https://www.voyage-prive.nl/ppl/reis-vietnam-hanoi-authentiek-vietnam-met-optionele-verlenging-naar-mui-ne/63882

CONTENT

01 Introduction

02 Theoretical Framework

03 Analysis & Understanding

04 Strategy & Principle

05 Design Exploration

06 Refelection

01

Introduction



Name: Tran
Age: 53
Nationality: Vietnam
large rice fields

"I think this year's rice production will be reduced by at least 30%."

"Well I can tell you, all my fish are dead now."

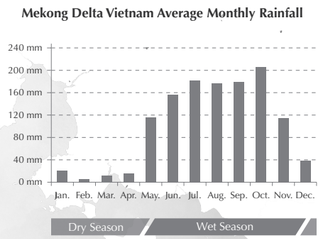


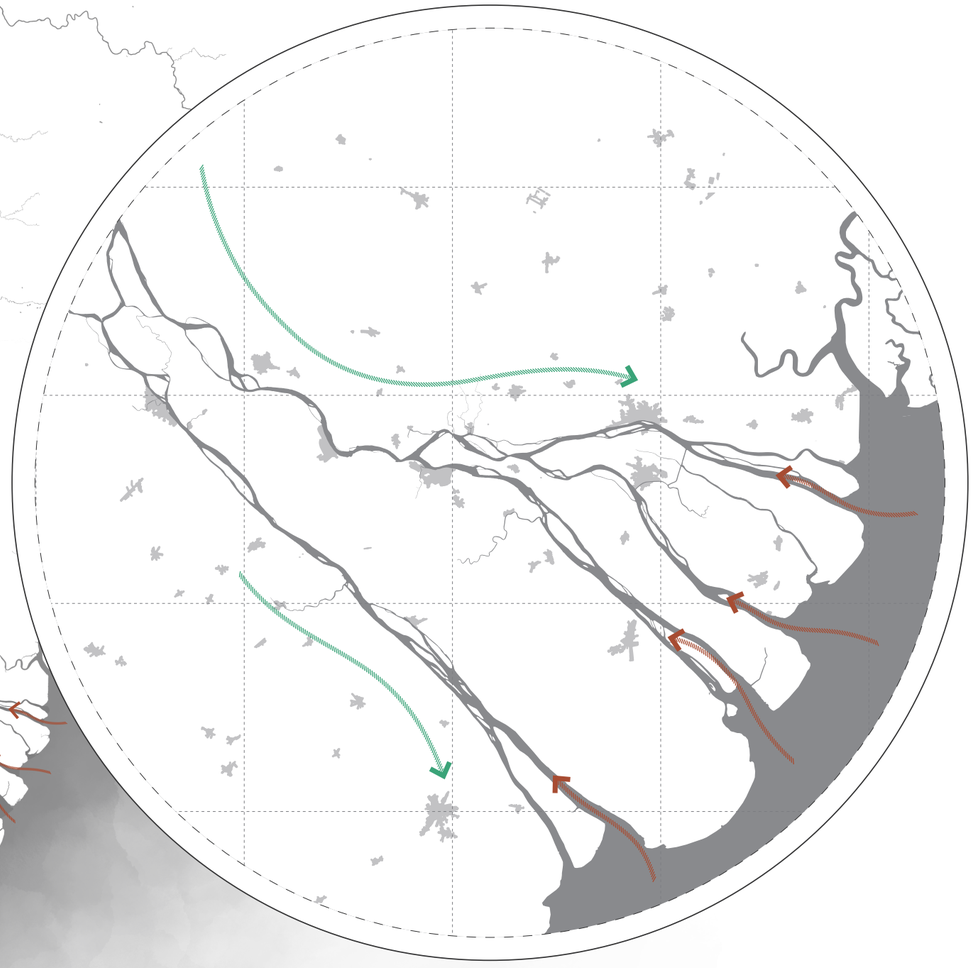
Name: Vien
Age: 62
Nationality: Vietnam
A fish farm and a garden with pomelo trees in Ben Tre

BEFORE

Tonle Sap Lake
30-35% of the delta's water supply

Cambodia





May - Nov
During the wet season,
the **lake fills up with floodwaters**

Dec - Mar
During the dry season,
the lake **slowly discharges water** into the delta,
this **fresh water can wash away salt water**.

Apr
Lakes usually drain completely.
This causes a rise in salinity in the delta that lasts for about a month.

Tran



"… Back then you could just eat off of the rivers … and [there were] ricefields, as far as the eyes could see. You could get lost in them."



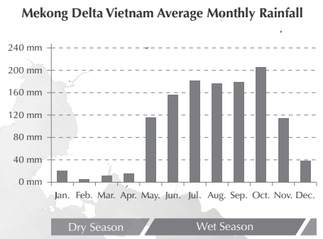
Vien

"People would always have barrels of water ready. My farm has five ponds with which we collect rainwater throughout the year"



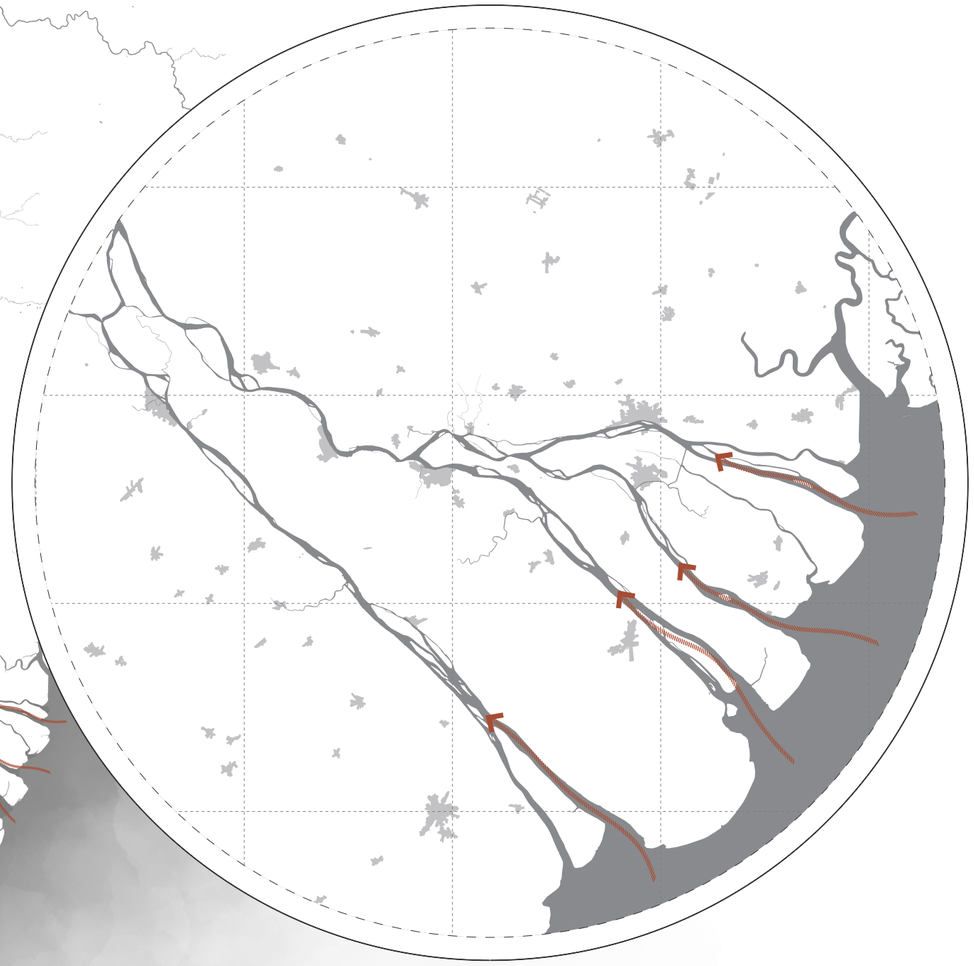
NOW

Tonle Sap Lake
30-35% of the delta's water supply



May - Nov
During the wet season,
the **lake doesn't fill up**

Dec - Apr
During the dry season,
not enough water to flush out the salt water.



Tran



"You can't even use it to wash the pigsty, let alone use it to water your crops."



"I have lost not only my fish and shrimp, but much of mt pomelo garden to the salt."

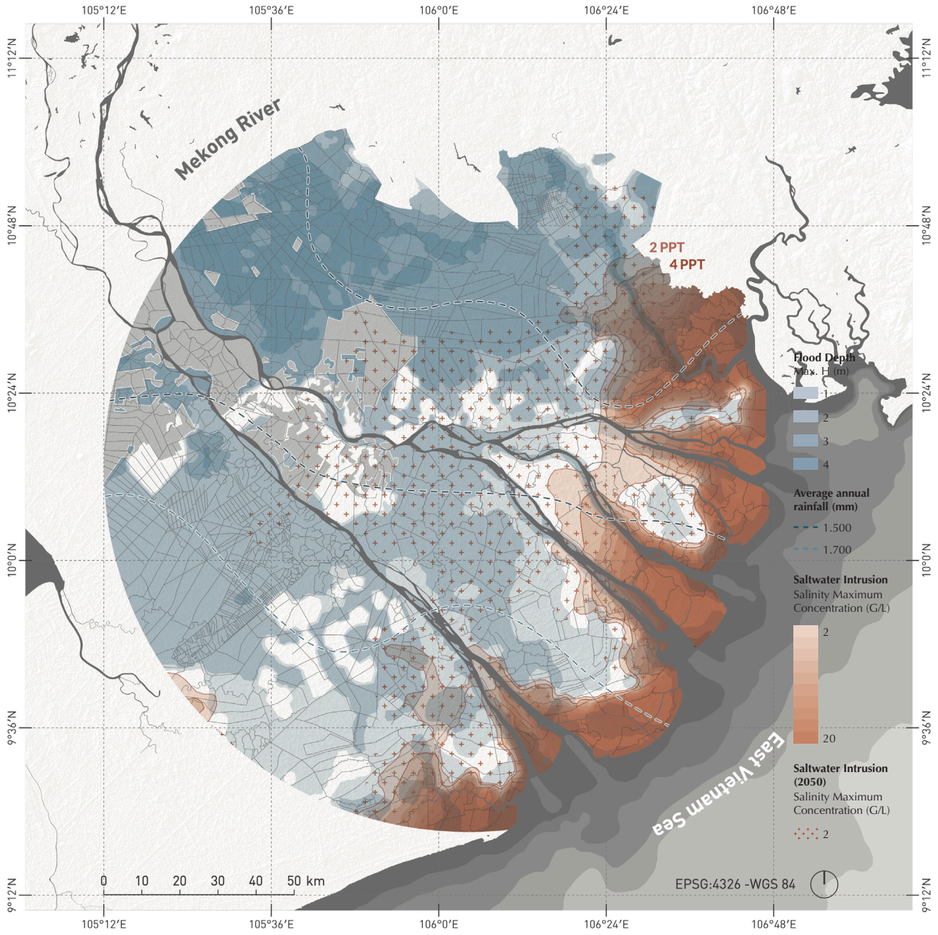
"I have to buy fresh water for household use and, as much as possible, for the farm."

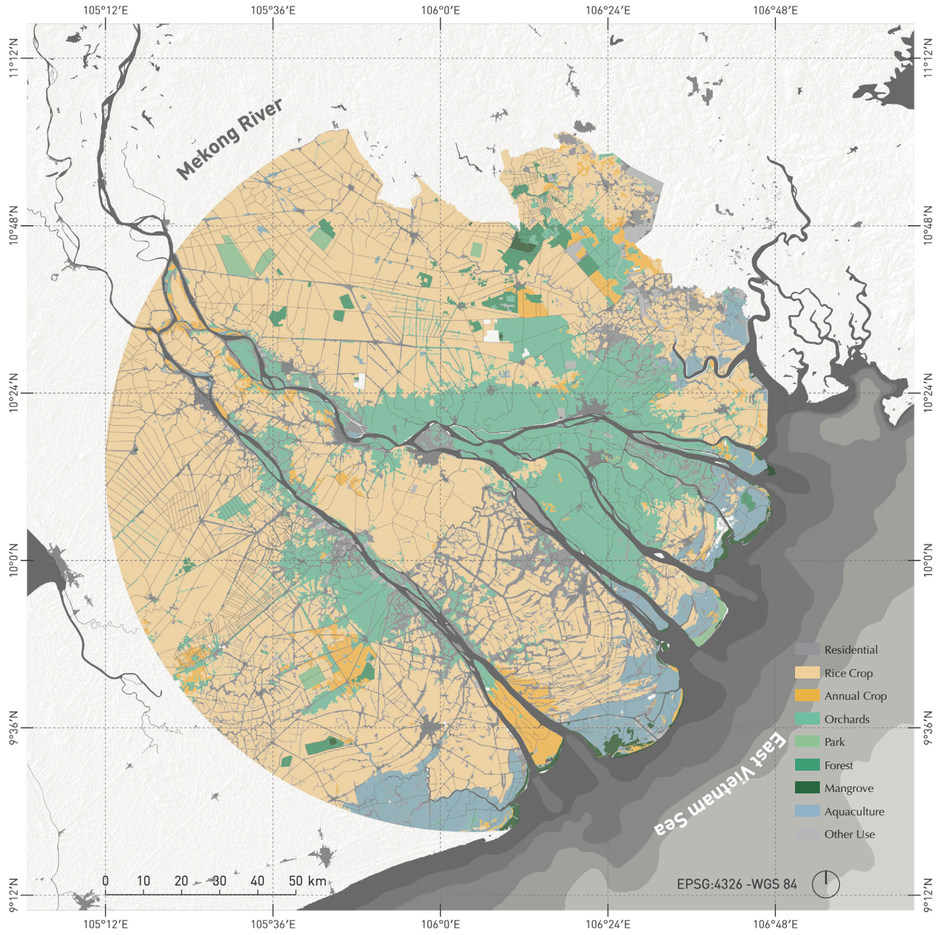
Vien




Source: https://vietnamnet.vn/english/tin-tuc/the-mekong-delta-locals-respond-to-drought-and-saltwater-intrusion-227262.html

PROBLEM FIELD

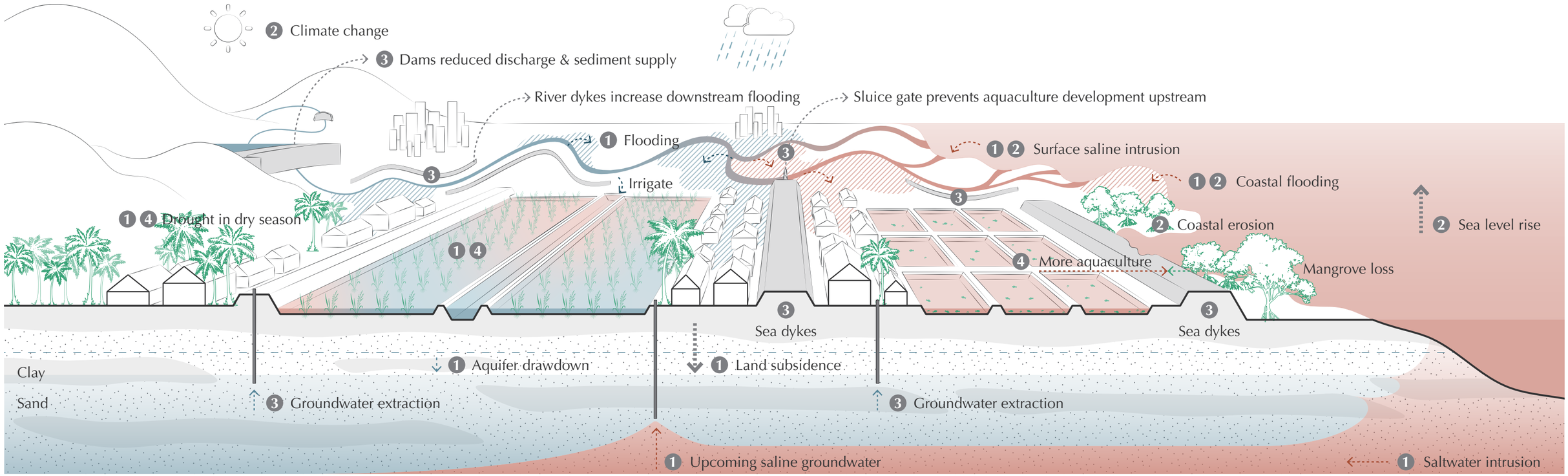




PROBLEM FIELD

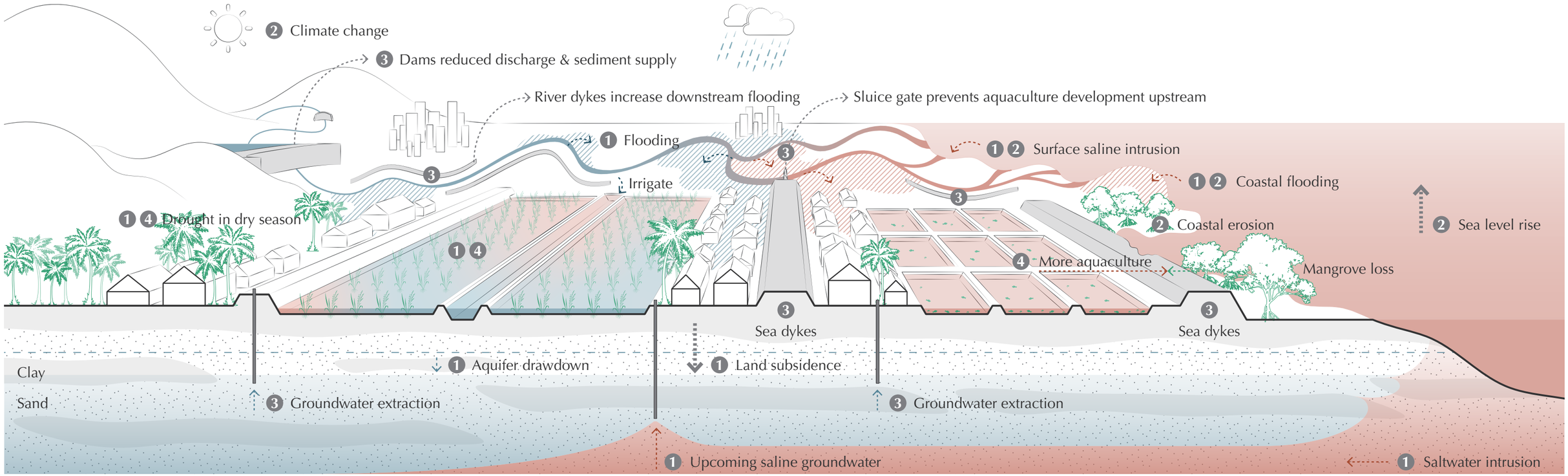
When these four issues are located in the landscape, it can be noticed that they influence each other throughout the landscape system.

1 Serious water issues
2 Challenges posed by climate change
3 Rigid Water Management
4 Unsustainable Production Practice

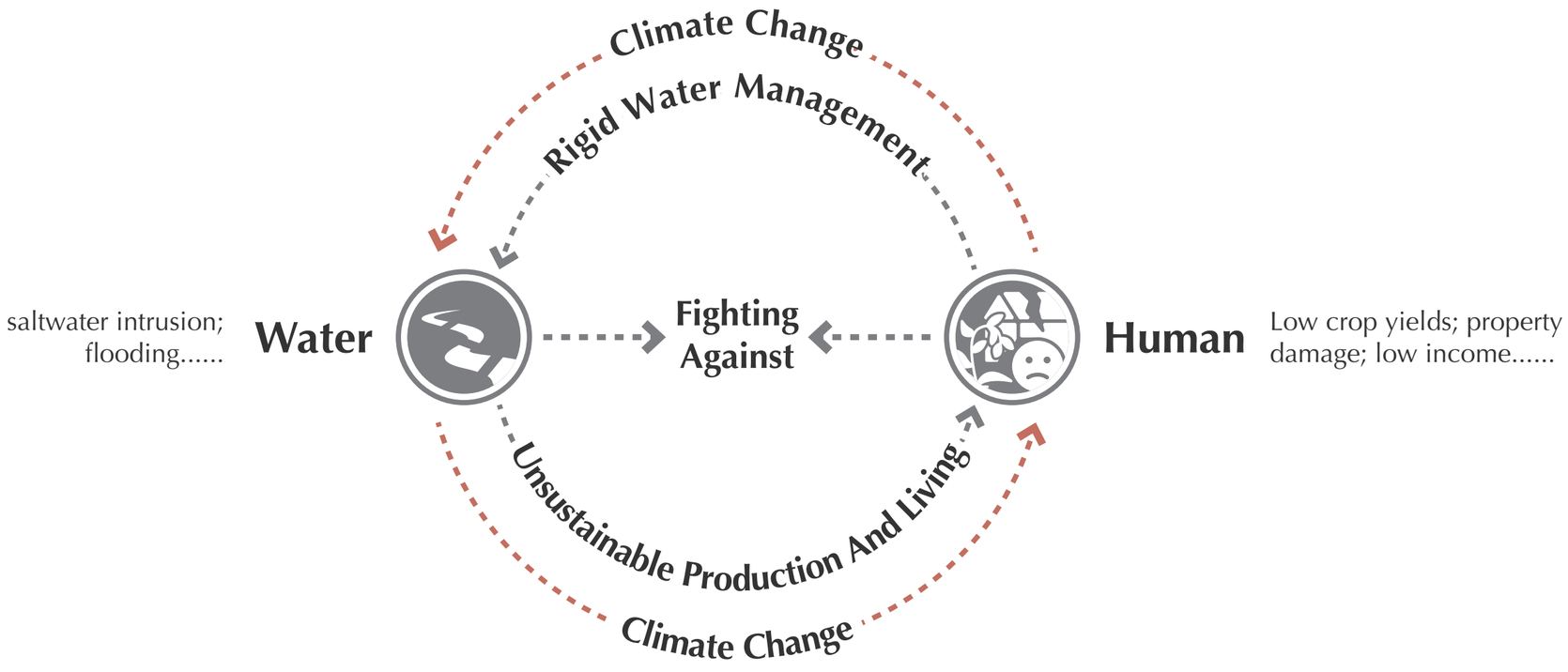


PROBLEM FIELD

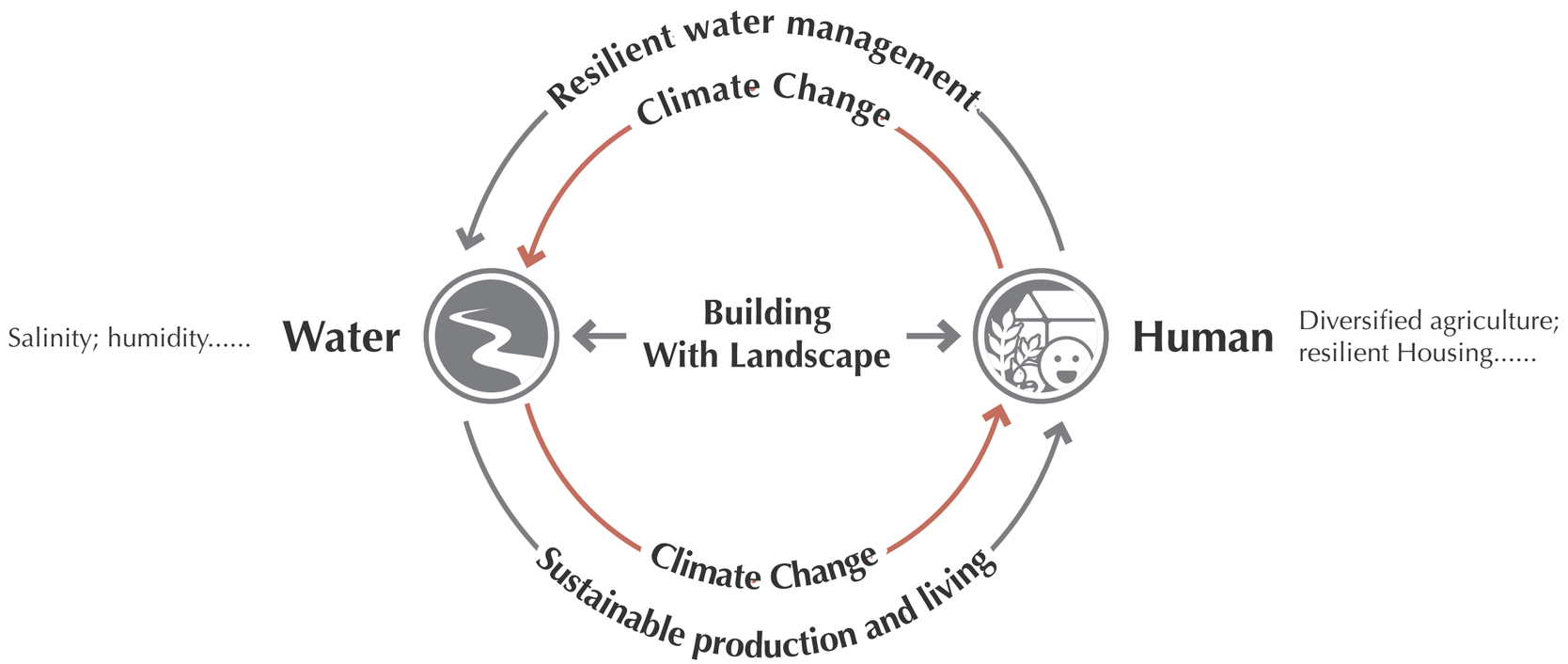
ALL THESE PROBLEMS ARE BOUND UP IN WATER
PEOPLE ARE FIGHTING AGAINST WATER



PROBLEM STATEMENT



RESEARCH OBJECTIVE



RESEARCH OBJECTIVE

"To contribute to a **resilient system** for the Mekong Delta through exploring design-oriented landscape approaches to realize the **harmonious coexistence of human and water**."

02

Theoretical Framework

THEORETICAL FRAMEWORK

“Work with nature, not against it.”

Building With Landscape

Landscape As A System

+

Resilience Capacity

Approach

- **Natural-based Solutions**
- **Nature-Inclusive Agriculture**

Challenges

Problems in the current situation.

Opportunities

The potential of the current situation, the logic of natural operation.

Design

Giving natural spaces to fulfill their potential.

Building With Landscape

Water system

The foundation of the MKD's landscape system

Ecology & Production

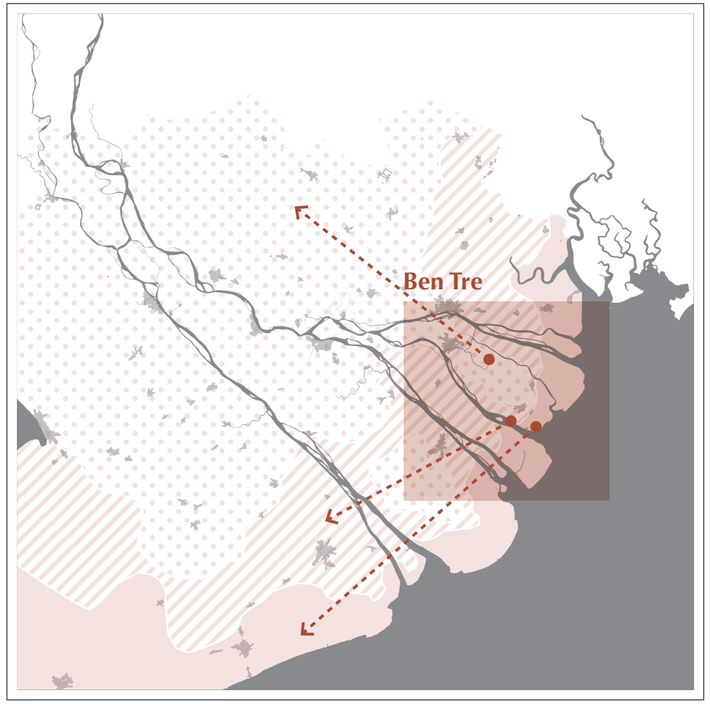
Explore more possibilities of coexistence between ecology and production.

Settlement

People's daily behaviour and life.

PROJECT STRUCTURE

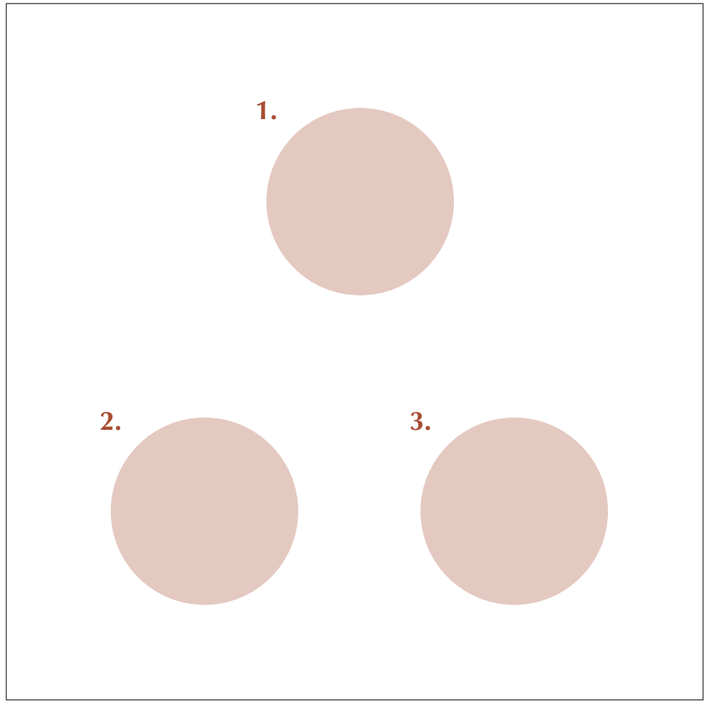
Basin Scale



Regional Scale



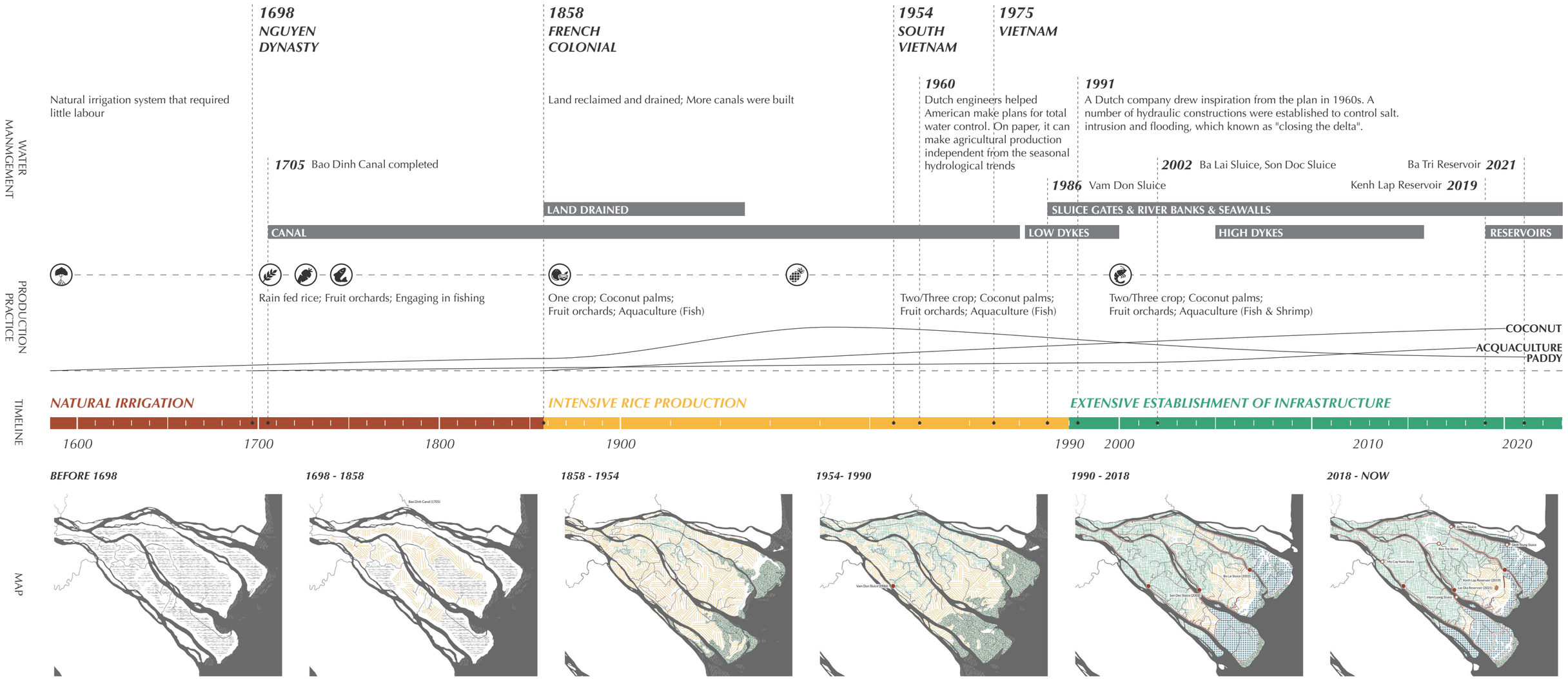
Local Scale



03

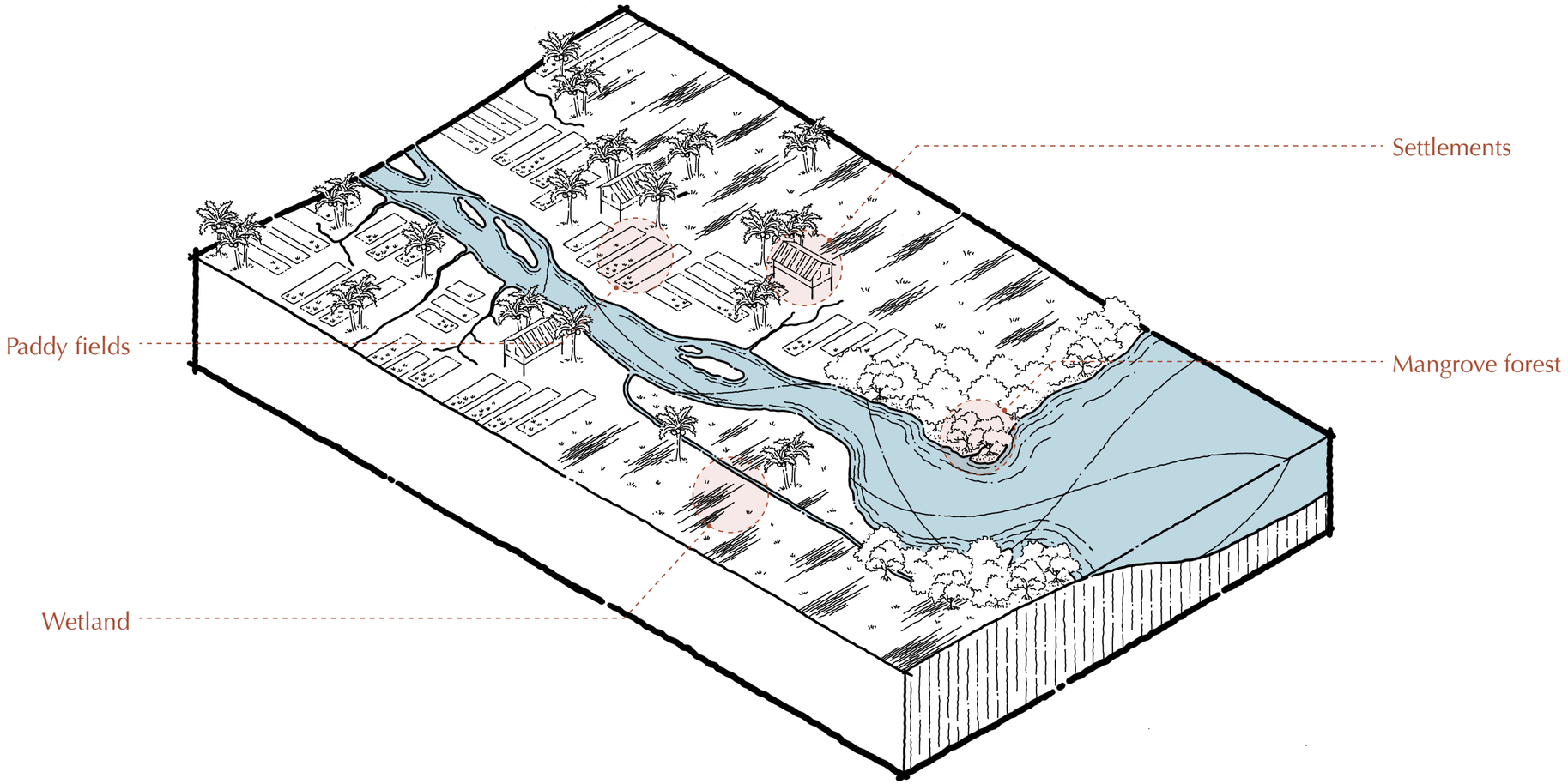
Analysis & Understanding

HISTORICAL DEVELOPMENT



Natural Irrigation (1600-1858)

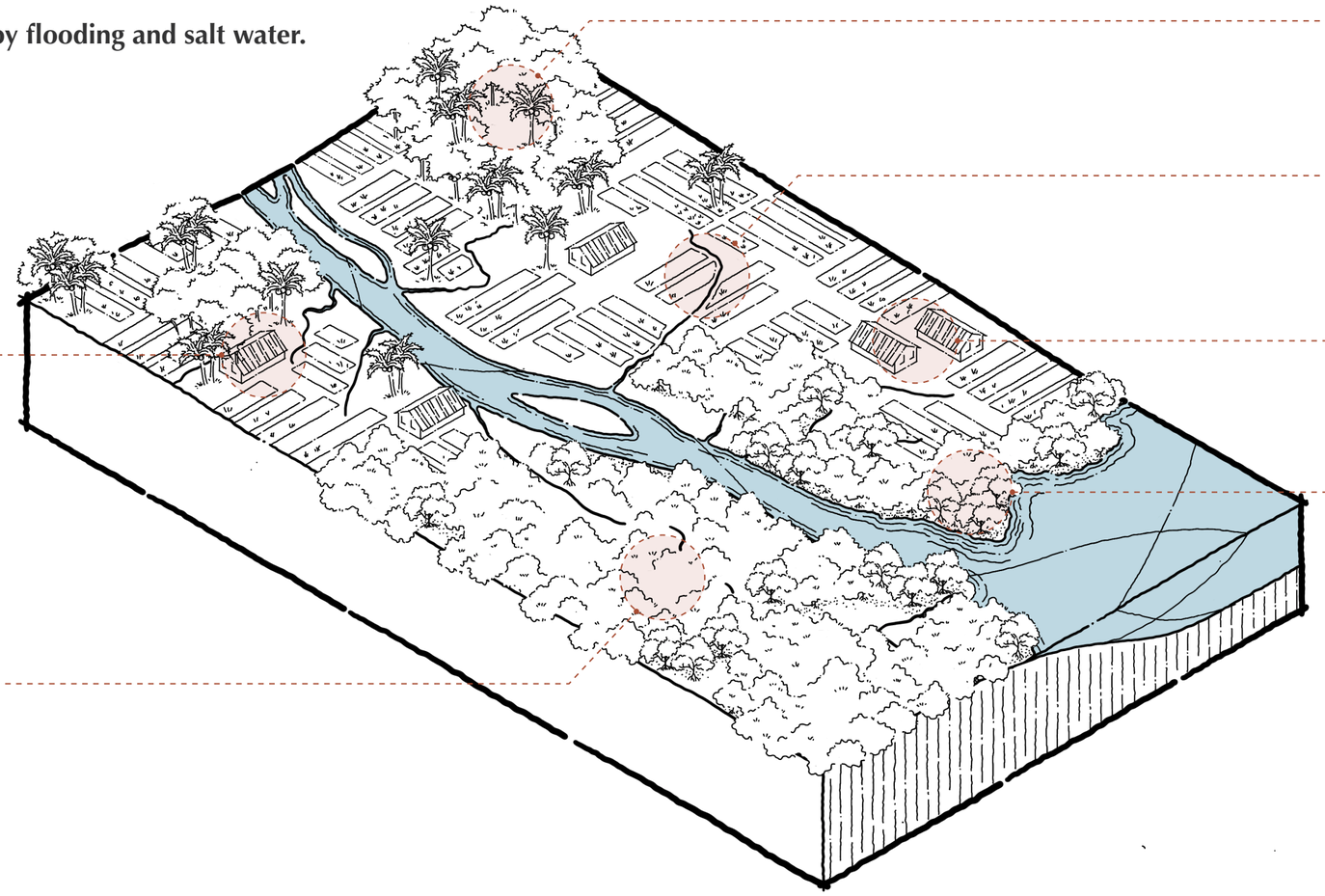
- The landscape consists of a **few paddy fields with most of the wetlands.**
- Settlements are mostly concentrated around farmland and channels.



Intensive Rice Production (1858-1990)

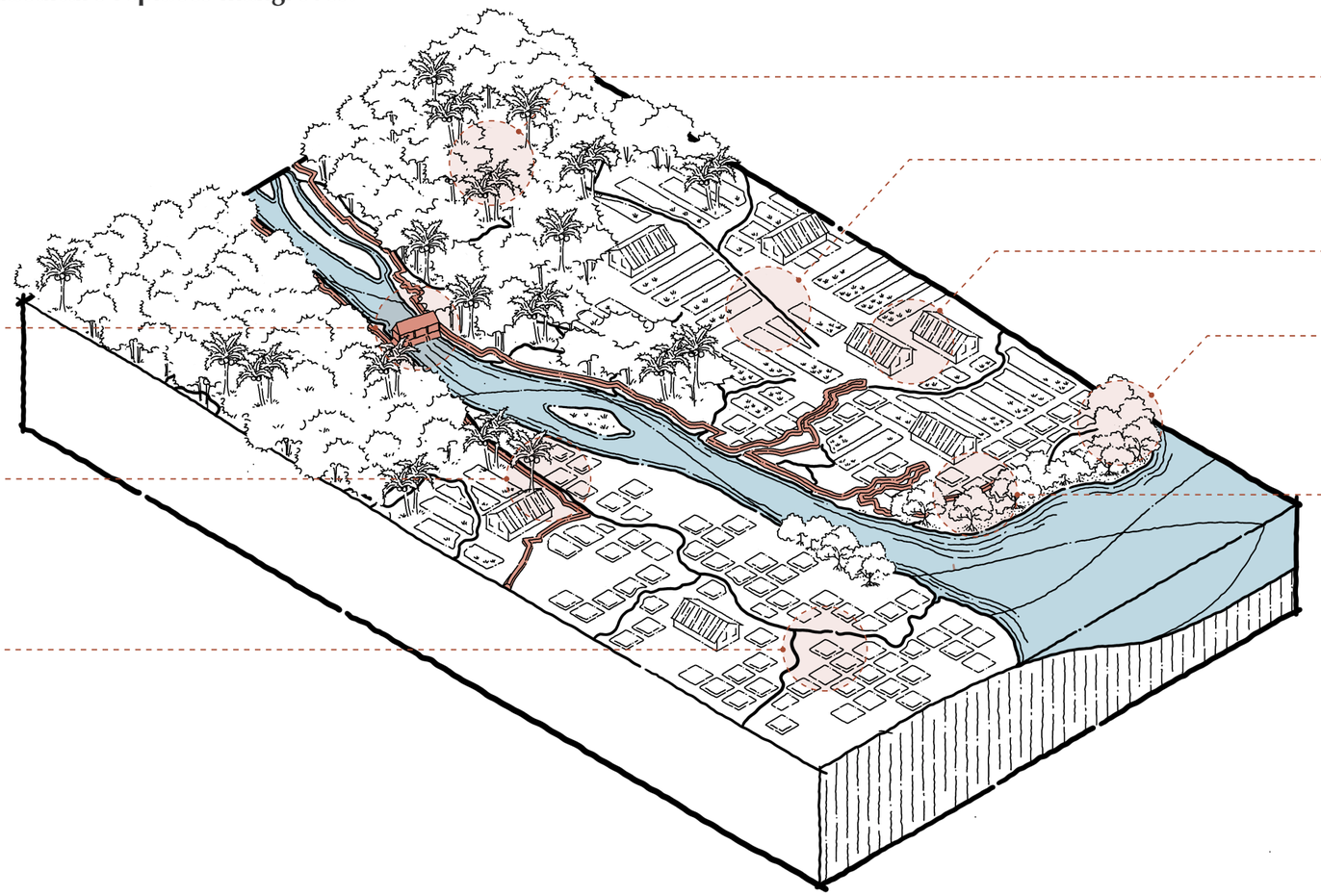
- **The colonial government drained most of the land for rice cultivation** and introduced coconut cultivation.
- Settlements increased, mainly centred around farmland and dykes.
- The coastal parts have extensive mangrove forests.

This new rice field is actually threatened by flooding and salt water.



Extensive Establishment Of Infrastructures (1990-Now)

- To maintain this production, the government built intensive facilities.
- Aquaculture and coconut cultivation have increased dramatically
- **As the population increased, massive aquaculture replaces mangroves.**

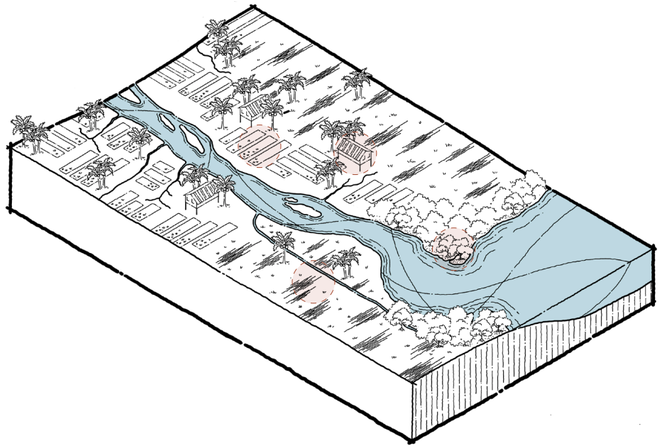


HISTORICAL DEVELOPMENT

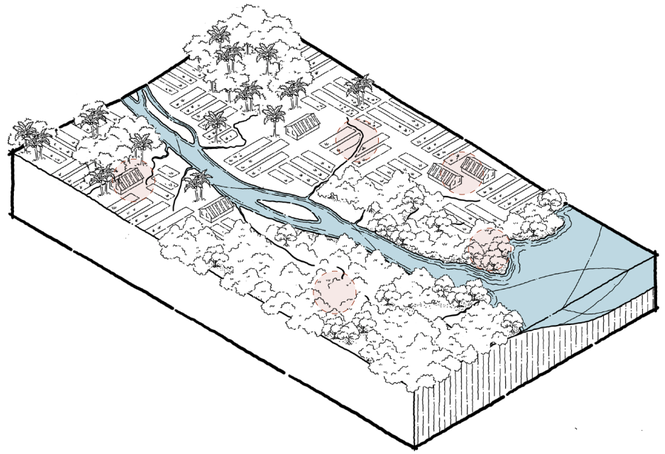
- As the population grows and the city develops, Ben Tre chooses to fight against nature to solve the comming problem.
- Most of time, some outsiders have more discourse about the landscape

- learn from traditional wisdom to live in harmony with nature
- Put the power of discourse in the hands of the locals

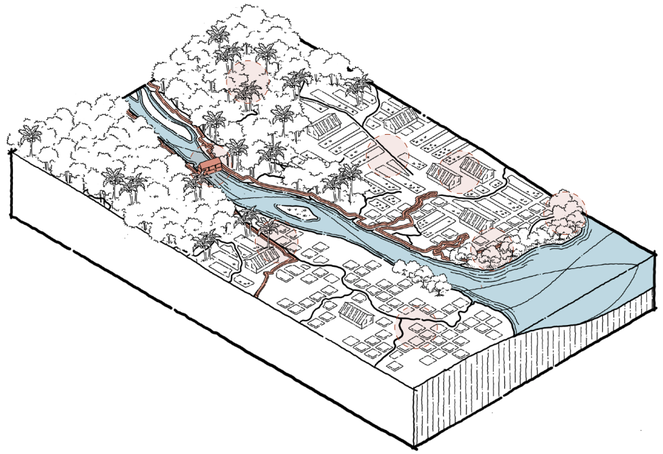
Natural Irrigation (1600-1858)



Intensive Rice Production (1858-1990)



Extensive Establishment Of Infrastructures (1990-Now)









Challenges

Opportunities

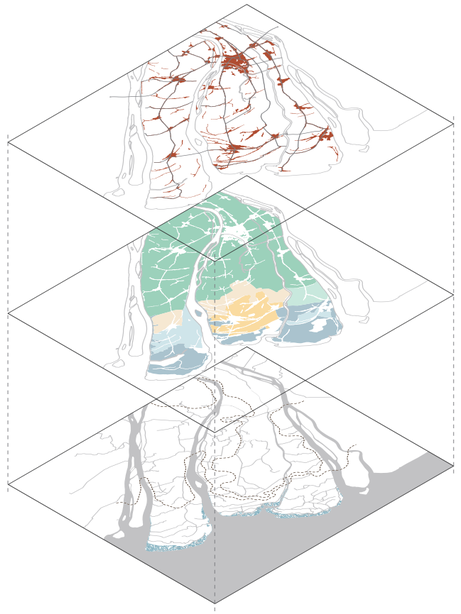
Design

Building With Landscape

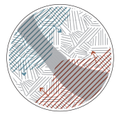
Settlement

Ecology & Production

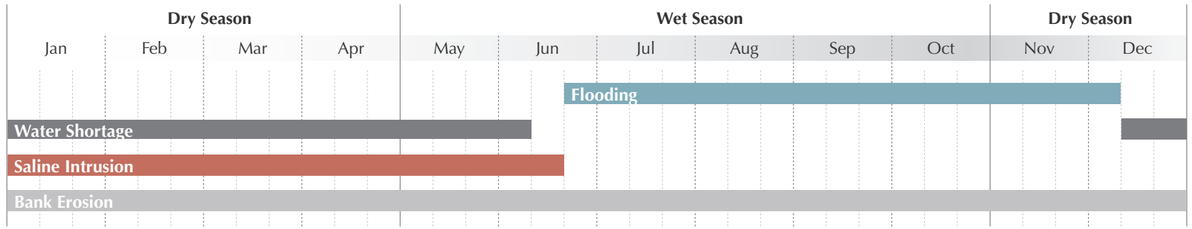
Water system



CHALLENGE Water System

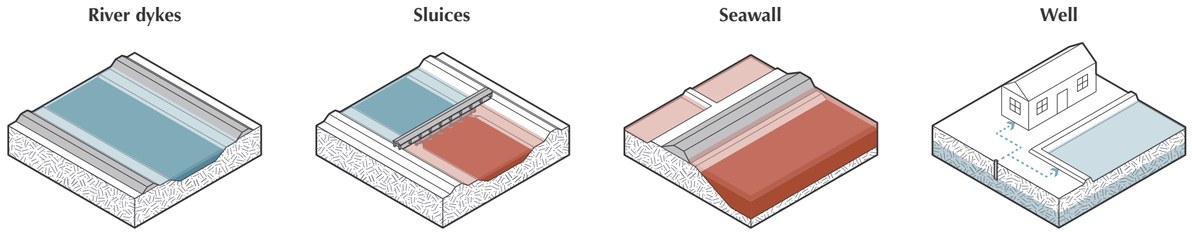


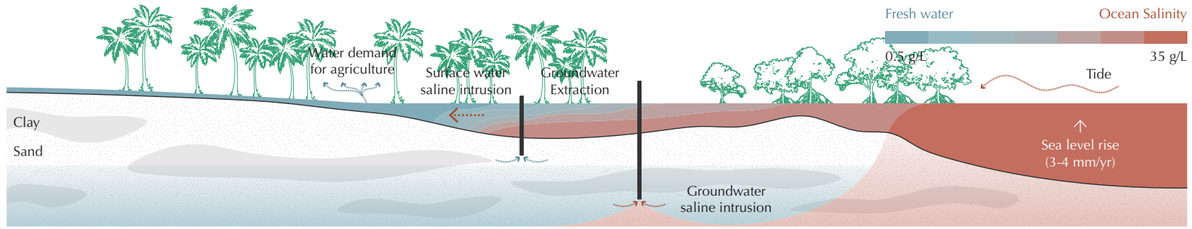
Water issues and climate change

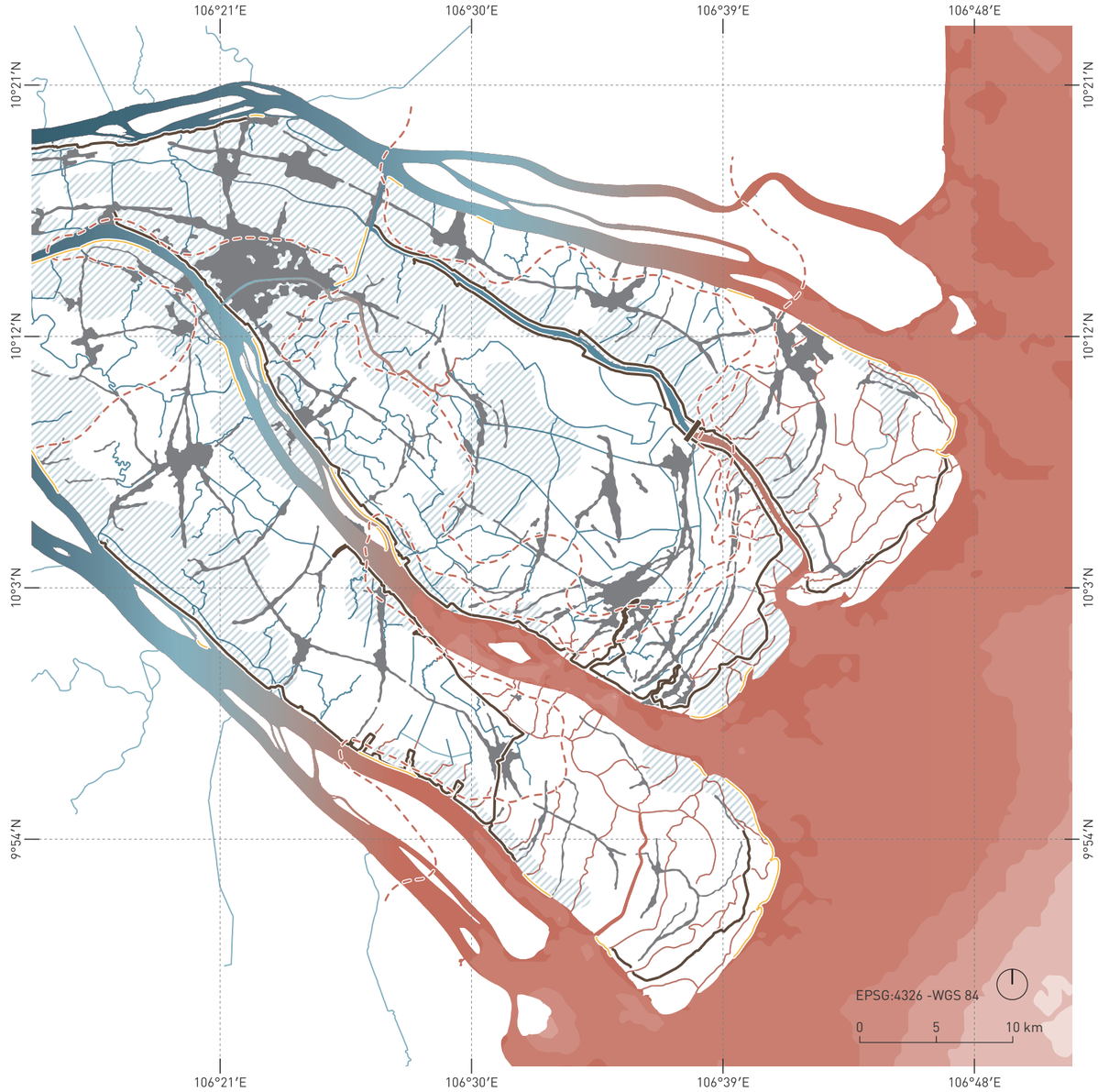




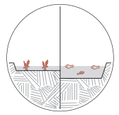
Rigid water management facilities







CHALLENGE Ecology & Production



Decline in production



Source: https://e.vnexpress.net/photo/news/mekong-delta-hit-by-worst-drought-ever-4071241.html



Source: https://e.vnexpress.net/photo/news/mekong-delta-fishers-in-distress-as-fish-die-en-masse-4096646.html



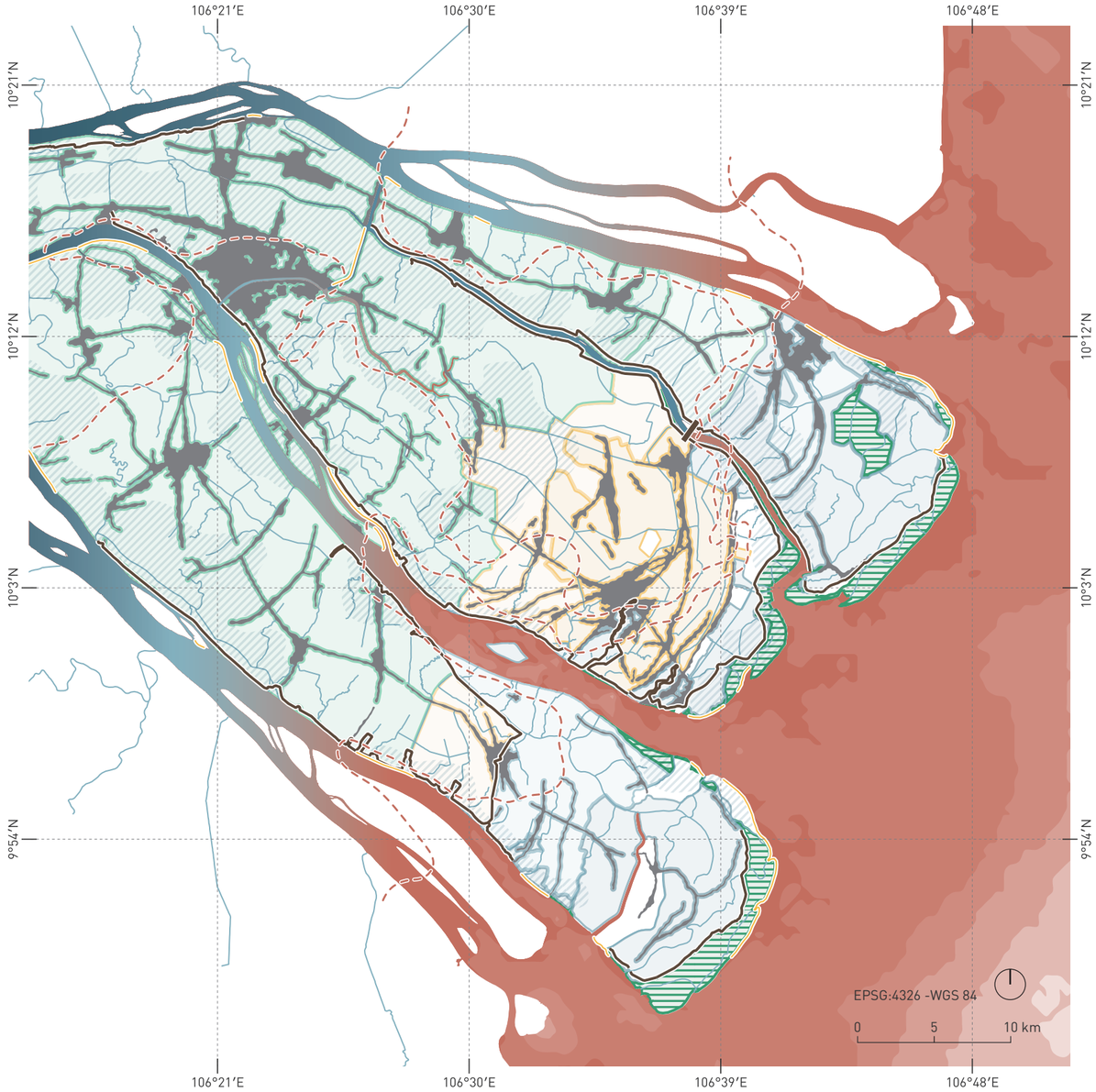
Source: http://coastal-protection-mekongdelta.com/images/0005.jpg



Mangrove loss



Source: https://www.mekongeye.com/2018/09/17/a-damaged-delta/



CHALLENGE Settlement

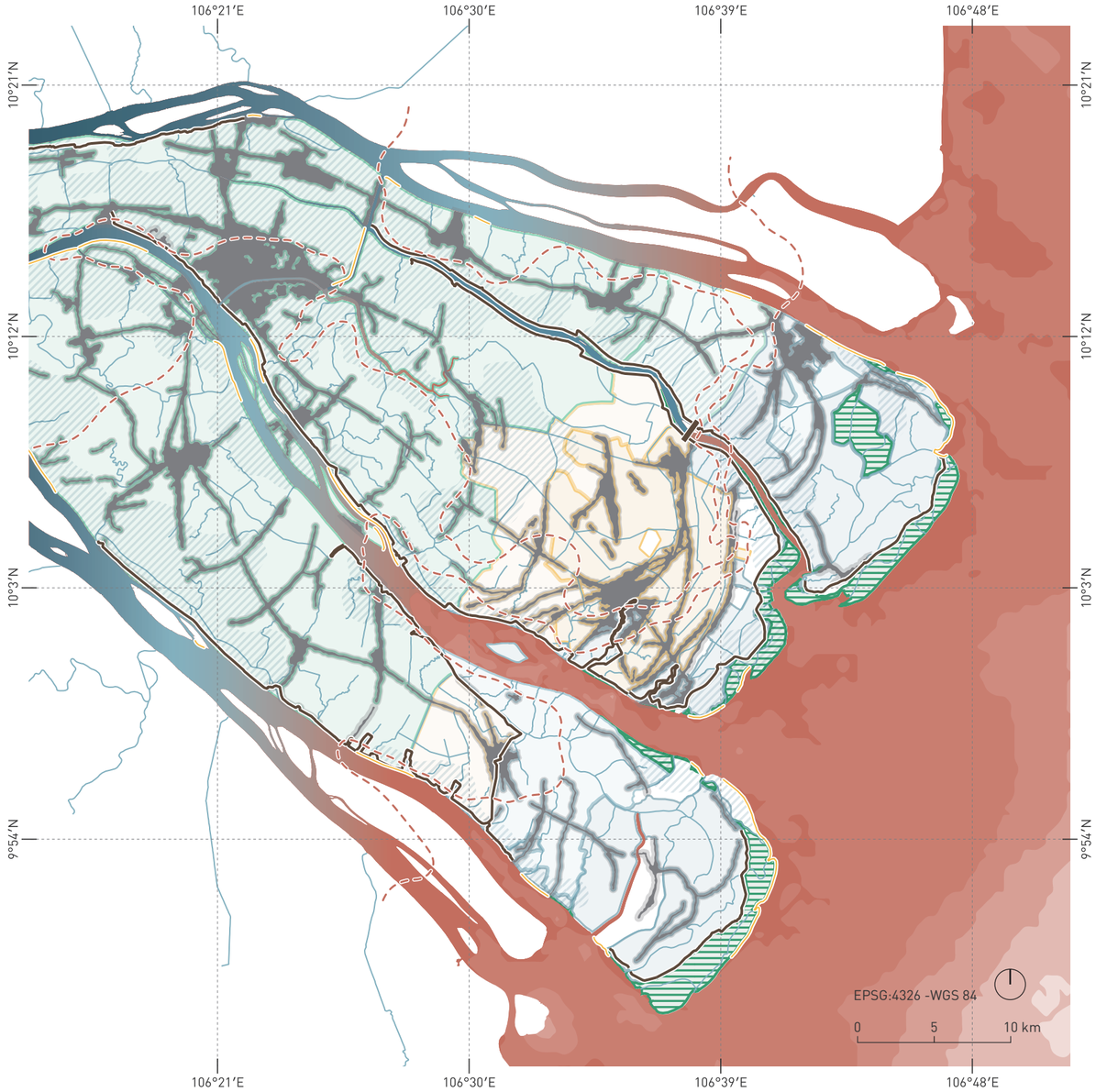
Houses threatened by natural disasters



Source: https://dialogue.earth/en/climate/inundation-of-ho-chi-minh-city-disproportionately-impacts-least-affluent-districts/



Source: https://e.vnexpress.net/news/news/environment/gov-t-approves-more-anti-erosion-funds-for-mekong-delta-4662485.html



OPPORTUNITY Water System

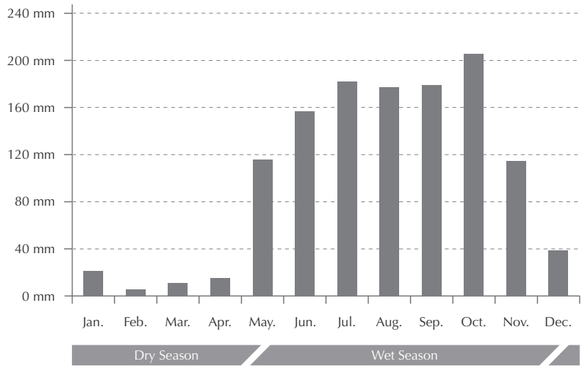


Gradients



Reservoirs

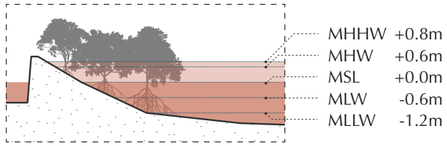
Mekong Delta Vietnam Average Monthly Rainfall



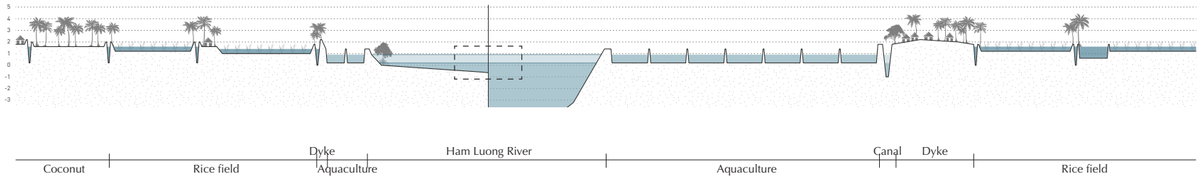
Seasonal water level changes



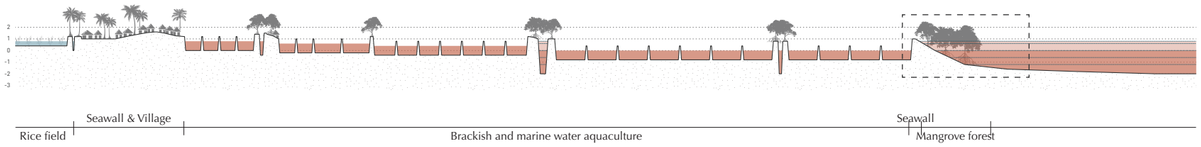
Daily tidal level changes

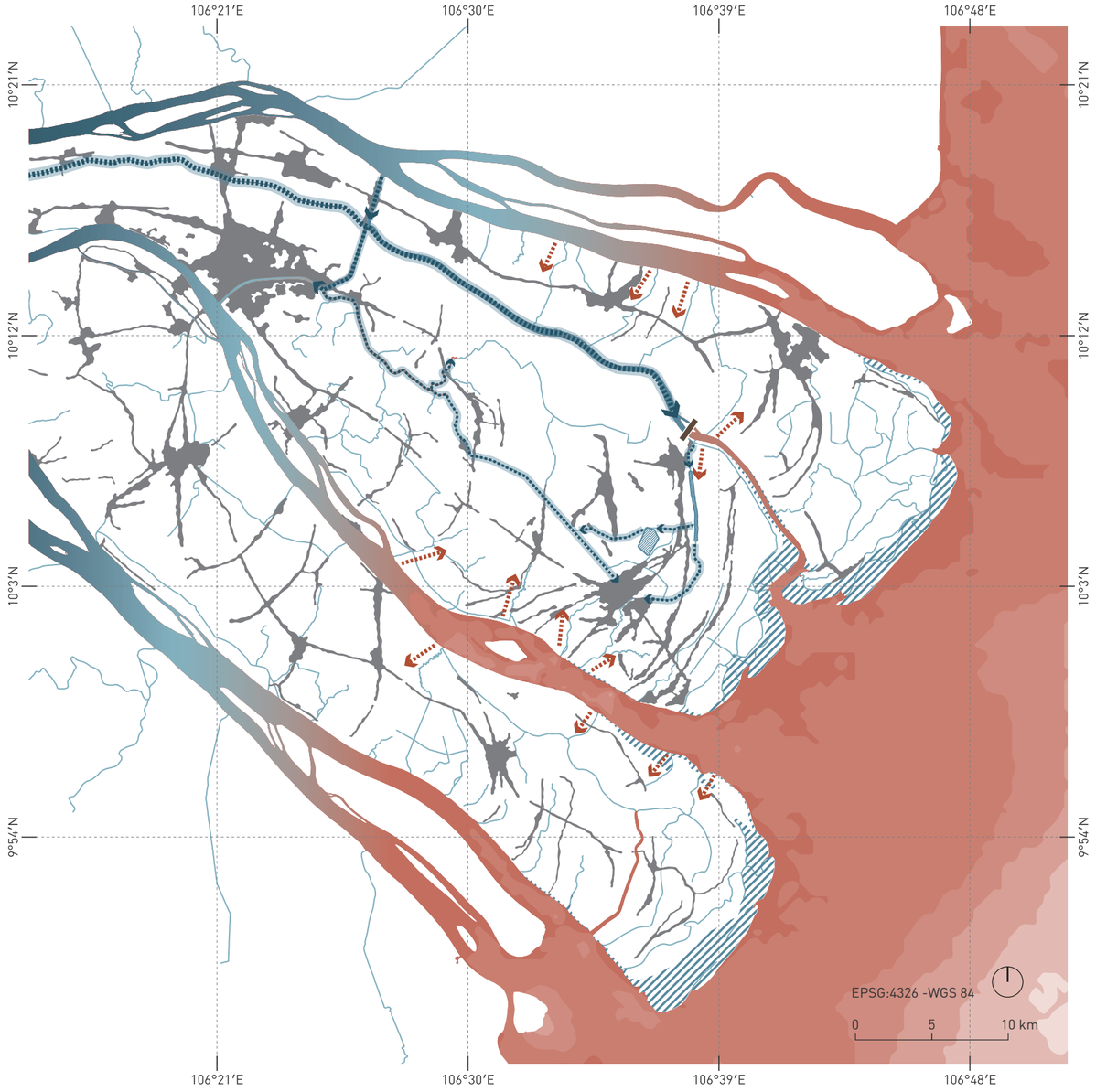


Cross section of Ham Luong River H:L=1:50



Coastal area section H:L=1:50



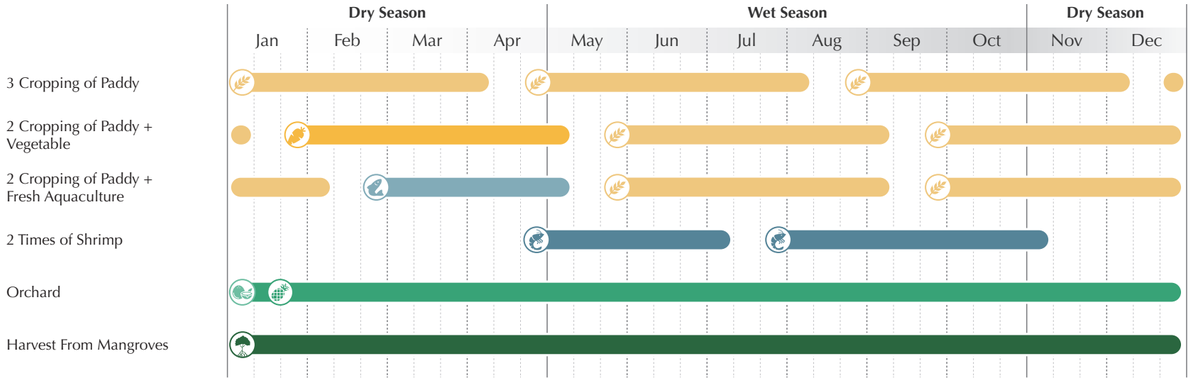


OPPORTUNITY Ecology & Production



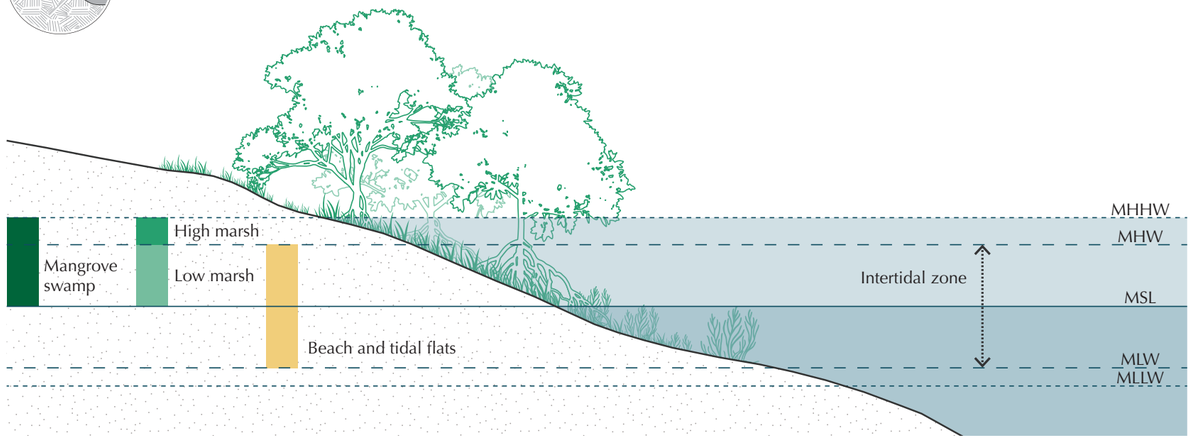
Rich production practice

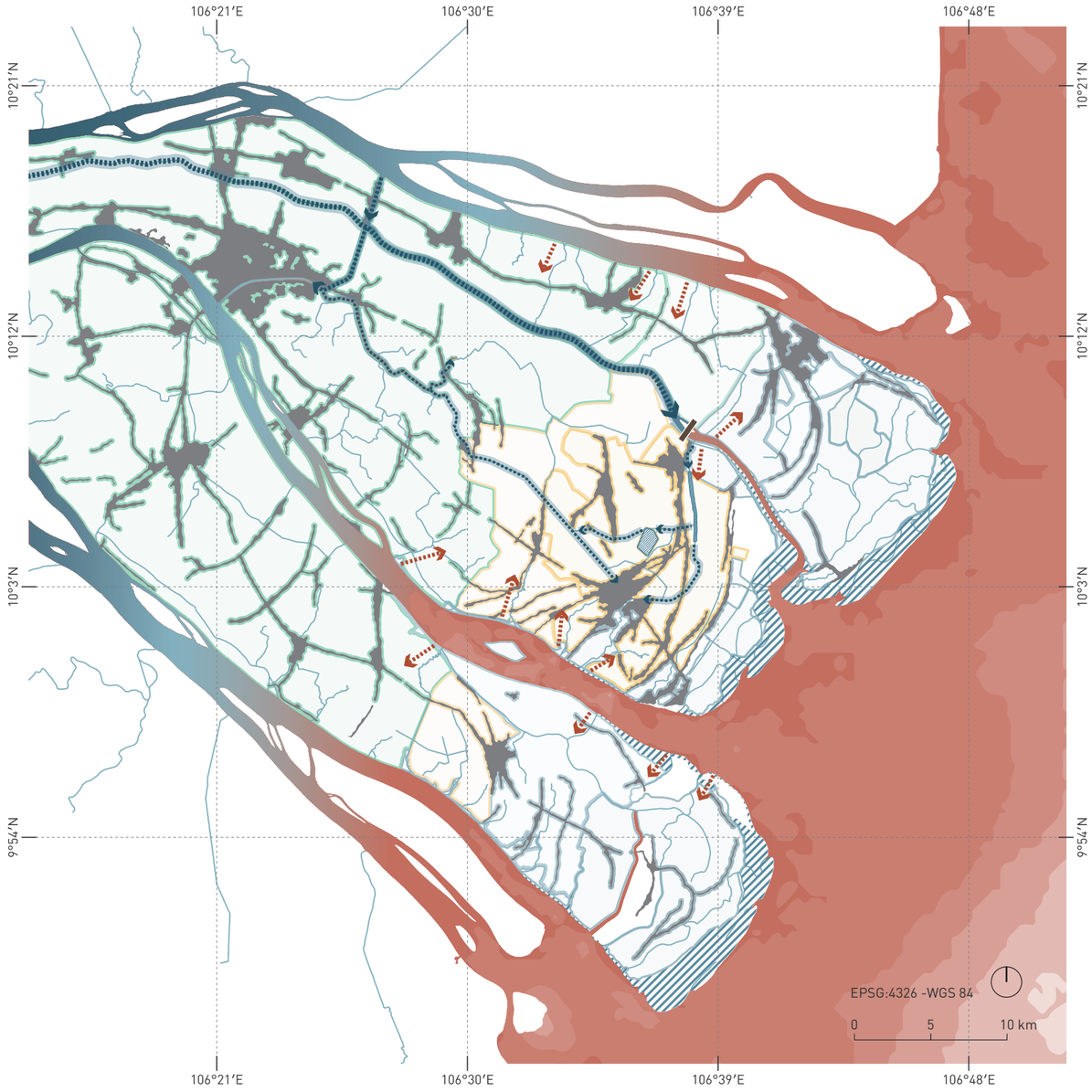
Rice | Vegetables | Fresh Aquaculture | Brackish Aquaculture | Coconut | Fruits | Mangroves





Natural restorative capacity



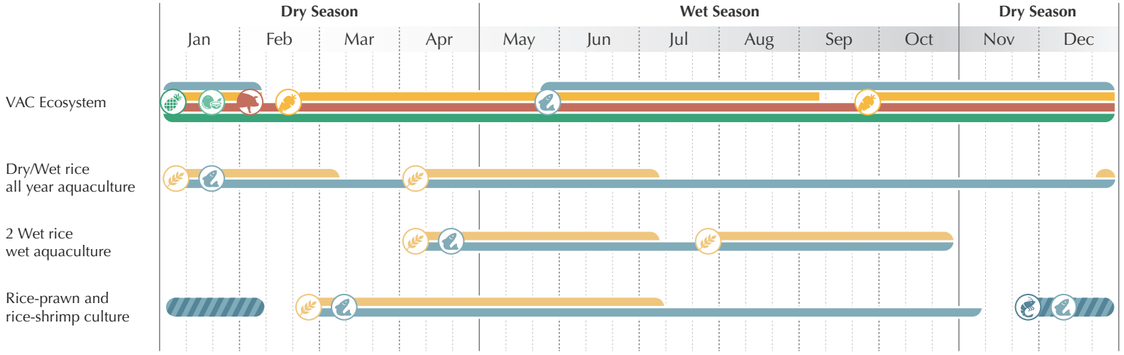


OPPORTUNITY Ecology & Production

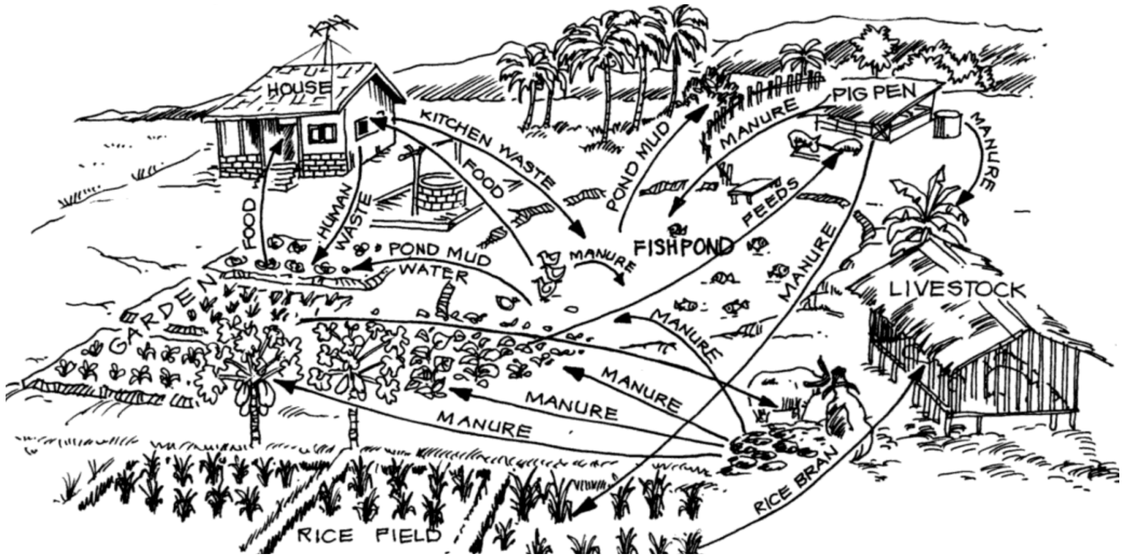


Traditional wisdom

Full utilisation of time and space



Materials flow



Source 1: Integrated agriculture-aquaculture A primer

OPPORTUNITY Settlement

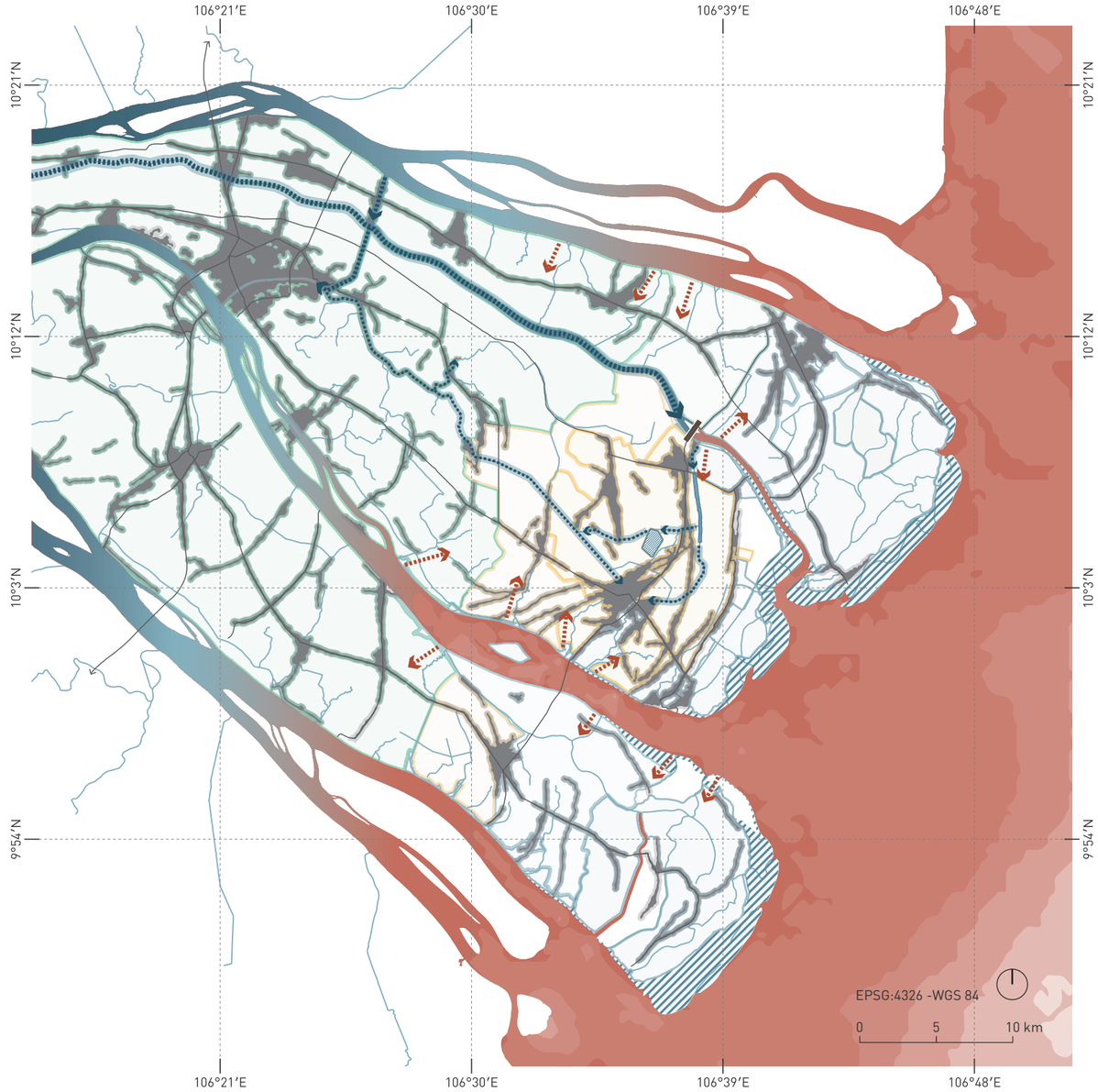
Traditional settlement patterns



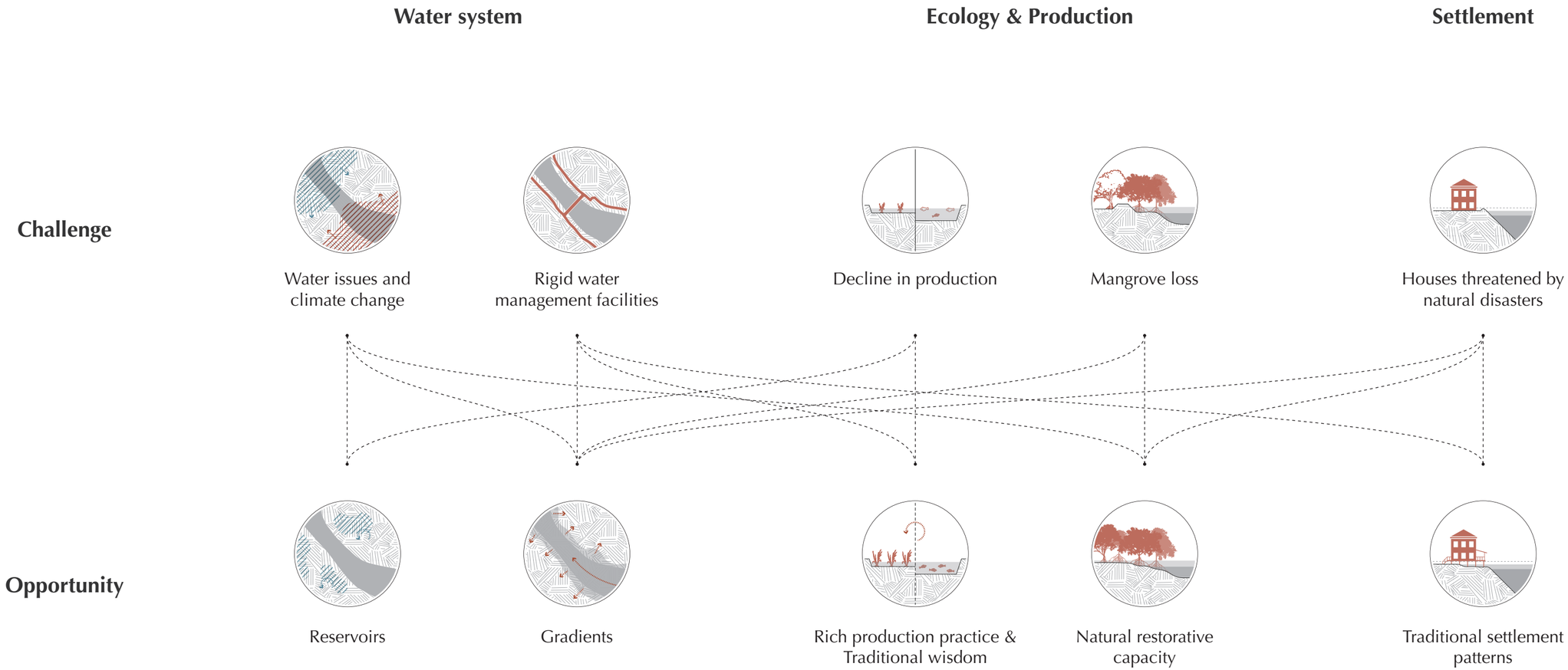




Source 1: https://mekongreview.com/a-suitable-house/; Source 2: https://www.terragalleria.com/vietnam/picture.viet55096.html; Source 3: https://globetrottergirls.com/vietnams-mekong-delta-floating-markets-and-life-on-the-river/; Source 4: https://yaleclimateconnections.org/2022/12/amphibious-houses-are-designed-to-float-during-floods/; Source 5: https://wanderingwheatleys.com/cai-be-floating-market-how-to-visit-mekong-delta-on-your-own/



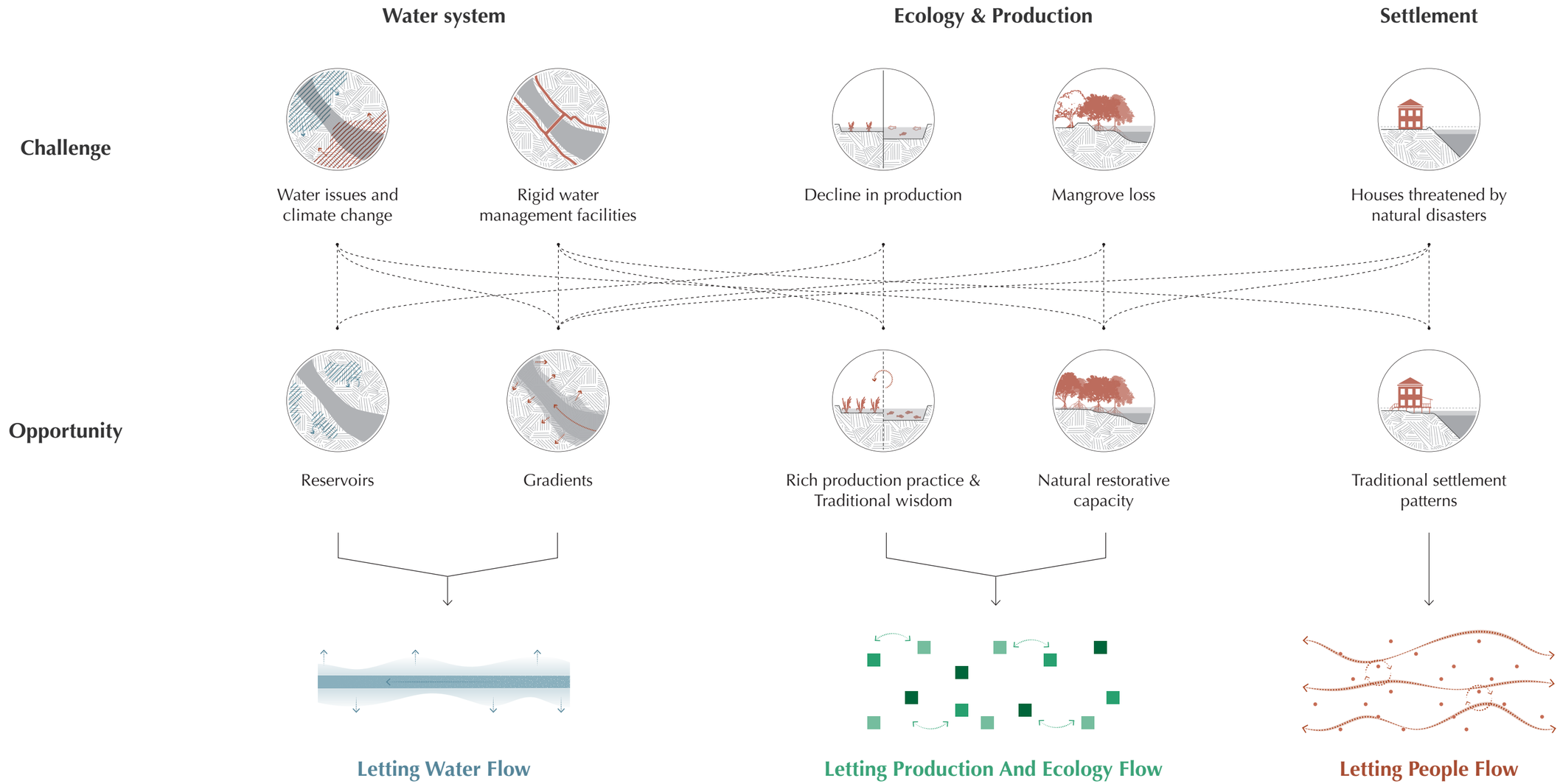
CHALLENGE & OPPORTUNITY



04

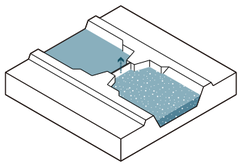
Strategy & Principle

STRATEGIES

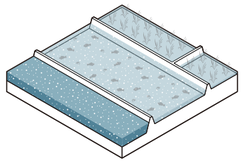

Water system
Ecology & Production
Settlement
Challenge
Water issues and climate change
Rigid water management facilities
Decline in production
Mangrove loss
Houses threatened by natural disasters
Opportunity
Reservoirs
Gradients
Rich production practice & Traditional wisdom
Natural restorative capacity
Traditional settlement patterns
Letting Water Flow
Letting Production And Ecology Flow
Letting People Flow

PRINCIPLE

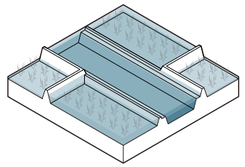
Letting Water Flow



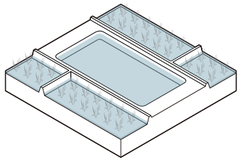
Restoring salinity gradients



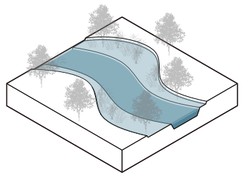
Make use of brackish water



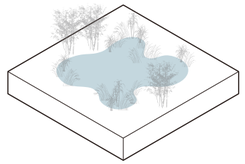
Different level of dykes



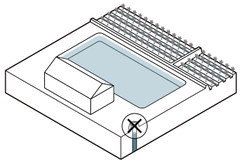
Small water retention pond



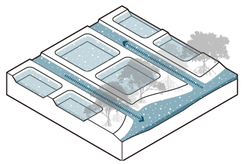
Flood plain



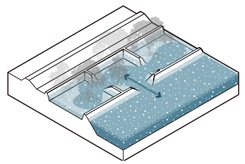
Reservoirs



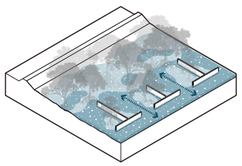
No groundwater use



Separate in & outflow channels

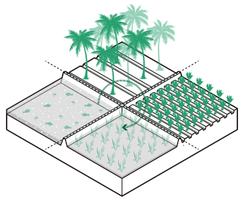


Restoring intertidal zones

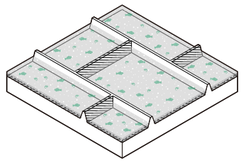


Sediment trapping

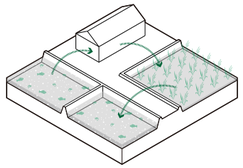
Letting Production And Ecology Flow



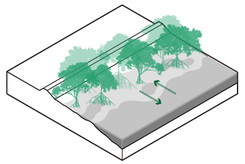
Rotation



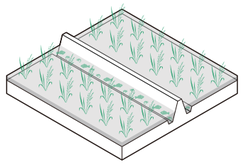
Industrial transformation



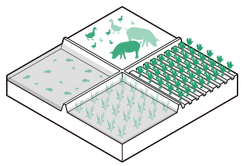
Material flows and cycles



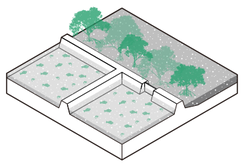
Integrating vegetated foreshores



Agri - Aquaculture

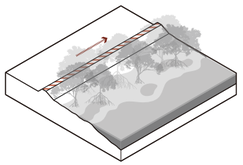


VAC system

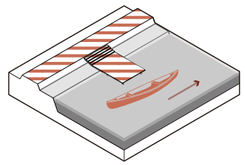


Eco-agriculture

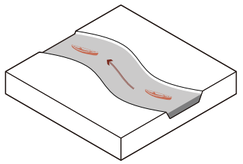
Letting People Flow



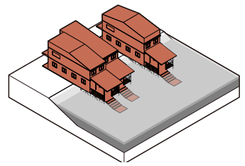
Tourist route



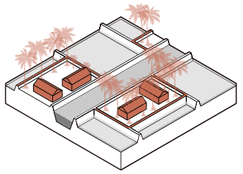
Quay



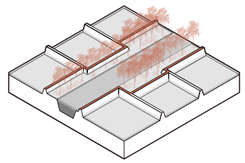
Waterway transport



Traditional settlement

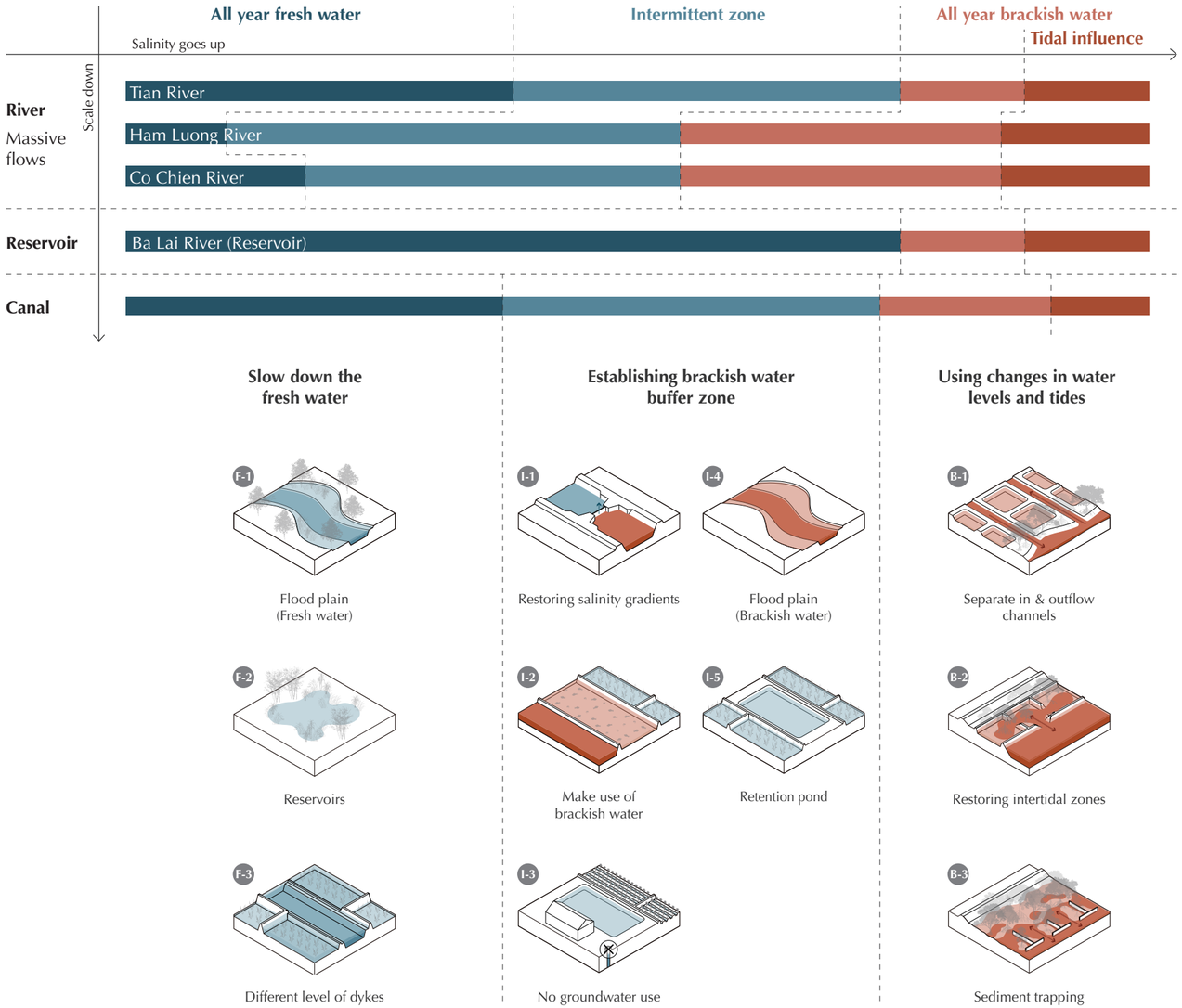


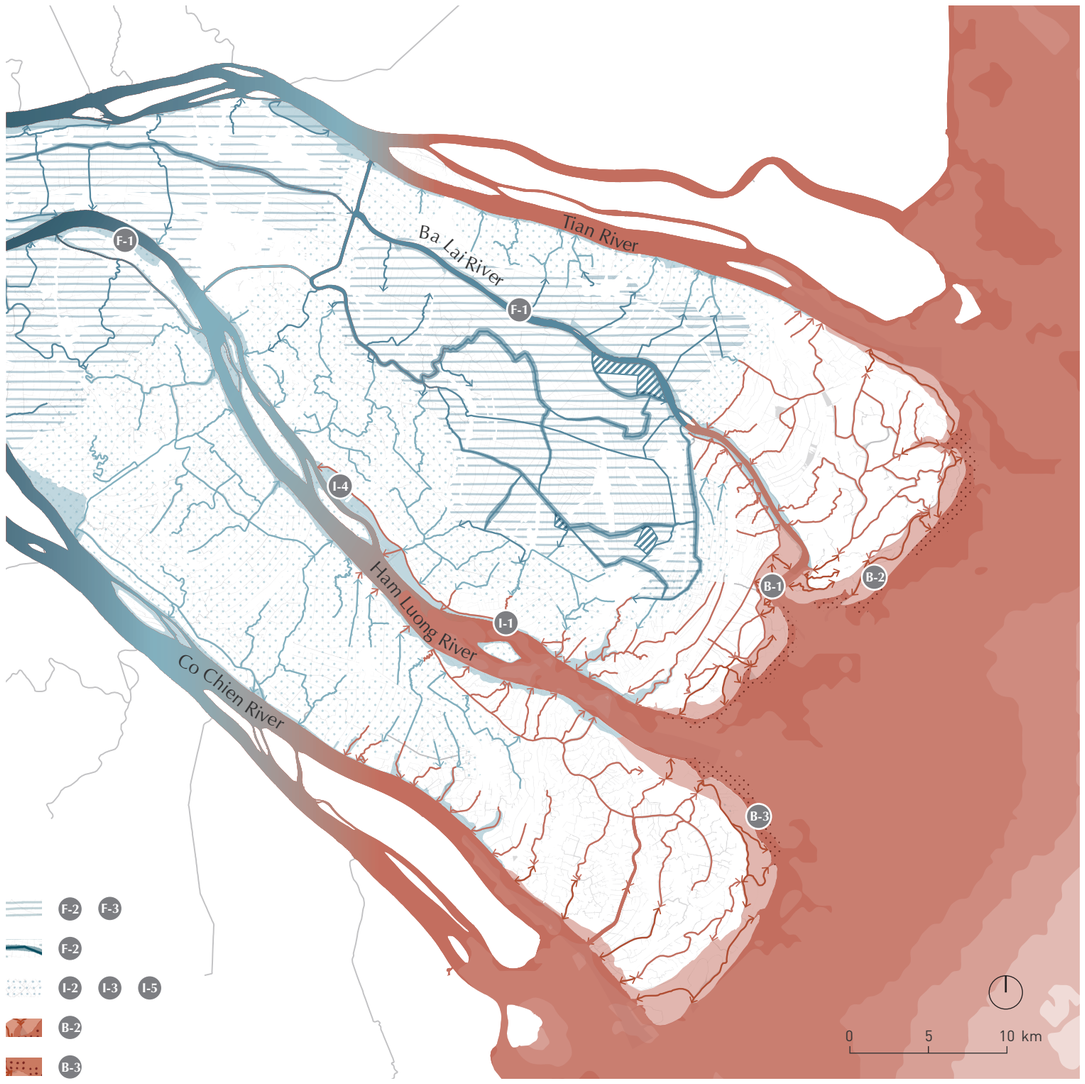
Keeping the original landscape



New waterfront spaces

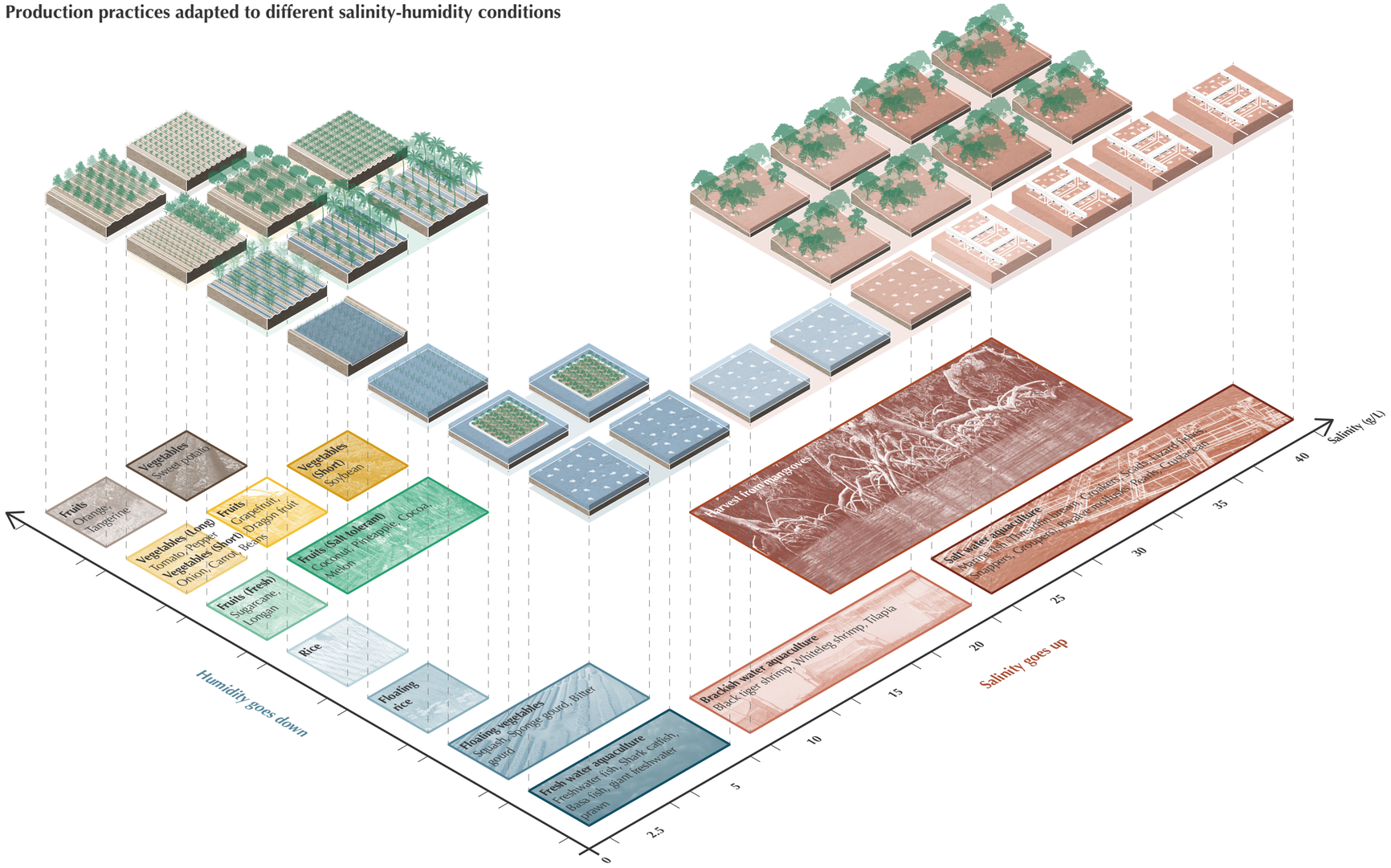
LETTING WATER FLOW





LETTING PRODUCTION AND ECOLOGY FLOW

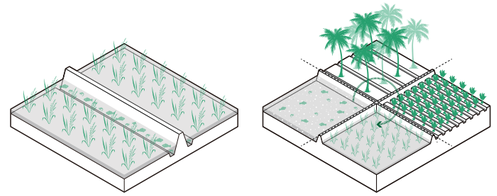
Production practices adapted to different salinity-humidity conditions



Traditional Wisdom

Rotation & Agri - Aquaculture

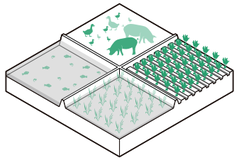
Switching production practices according to seasonal changes in natural conditions.



- Rice & Floating rice
- Rice & Vegetables
- Rice & Floating vegetables
- Rice & Brackish water aquaculture
- Rice & Fresh water aquaculture
- Fruits & Fresh water aquaculture

VAC system

The VAC system is a traditional method of household food production in rural areas of Vietnam. In this system people combine garden, livestock and fishpond in order to achieve income in a year-round cycle. (VAC in Viet Namese is vuon, ao, chuong which means garden/pond/livestock pen)



- Rice & Vegetables
- Rice & Fruits & Fresh water aquaculture
- Rice & Fresh water aquaculture
- Mangrove & Brackish water aquaculture

LETTING PRODUCTION AND ECOLOGY FLOW

Fruits


Orange

Vegetables


Sweet potato

Vegetables (Long season)


Tomato


Pepper

Vegetables (Short season)


Onion


Carrot


Onion

Fruits


Grapefruit


Dragon fruit

Vegetables (Short season)

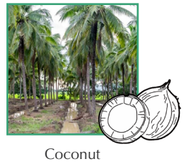

Soybean

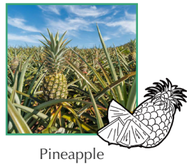
Fruits (Fresh)


Sugarcane


Longan

Fruits (Salt tolerant)

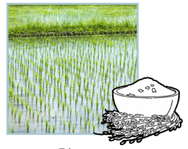

Coconut


Pineapple

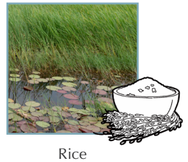

Cocoa


Melon

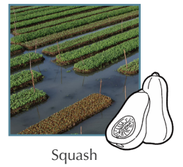
Rice

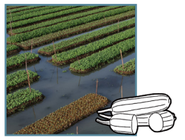

Rice

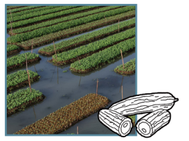
Floating rice


Rice

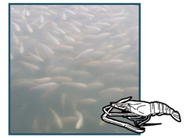
Floating vegetables

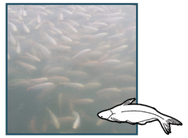

Squash


Sponge gourd


Bitter gourd

Fresh water aquaculture


Giant prawn


Basa fish

Brackish water aquaculture


Tiger shrimp


Whiteleg shrimp


Tilapia

Harvest from mangroves



Salt water aquaculture


Threadfin bream


Croakers

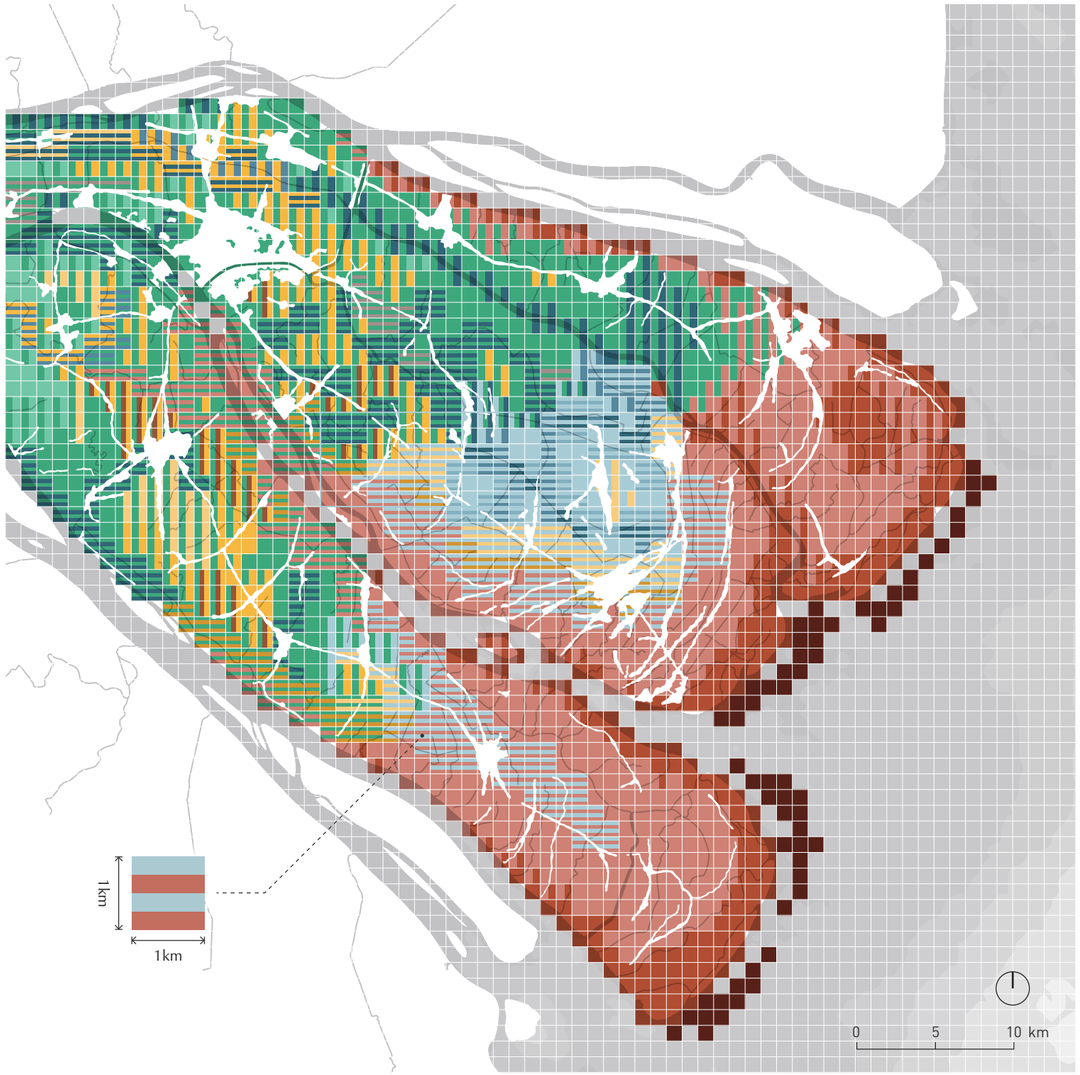

Scads


Lizard fishes

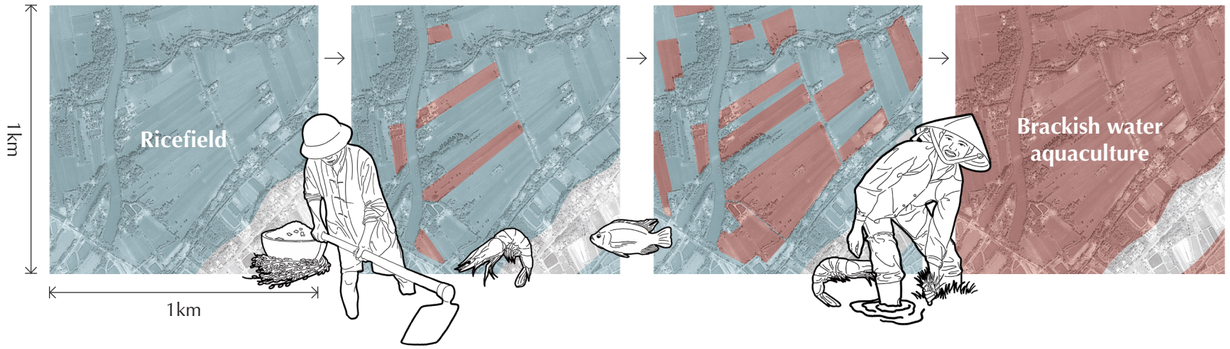

Bivalve mollusks


Crustacean

LETTING PRODUCTION AND ECOLOGY FLOW



The model shift started with a few farmers and then developed through mutual learning among farmers.



Farmers can autonomously change modular production as the climate changes.



LETTING PEOPLE FLOW



New building typologies

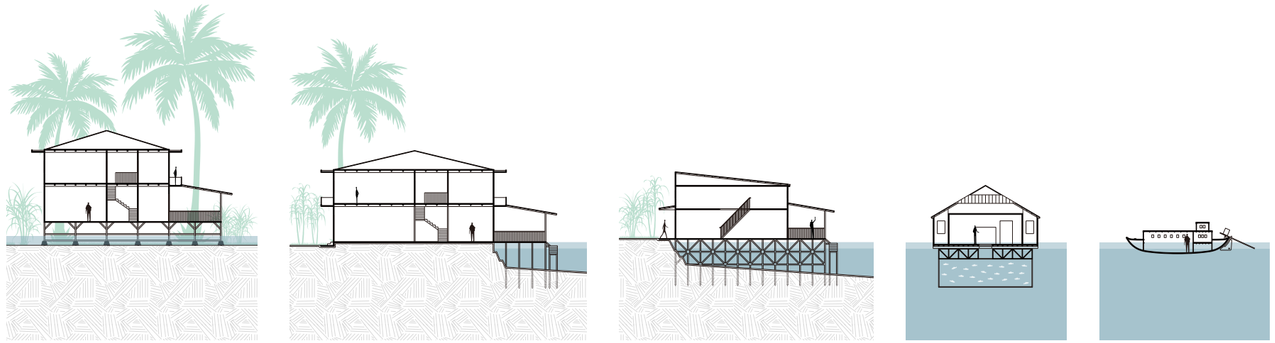
1 House on stilts (inland)

2 House partly on gound and on water

3 House on stilts (river bank)

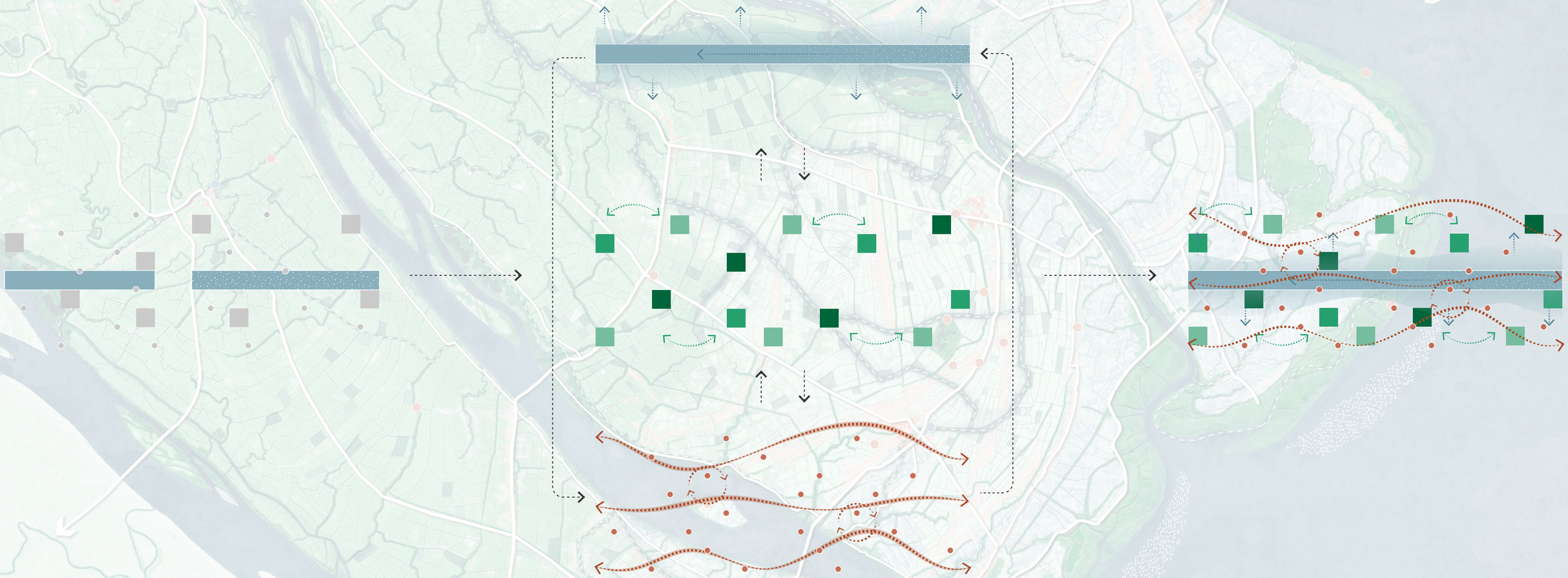
4 Floating house

5 Houseboat



- Historical, architectural, artistic, religious heritage
- Traditional craft village
- Tourist attraction
- Floating market
- Natural landscape
- Main tourist route
- Secondary tourist routes
- Boating routes

APPROACH

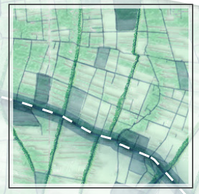


VISION


Orchards
Rice fields and floating farms
Mangrove associated aquaculture
Mangrove forest
City and village
Wetland
Canal with reservoir
Flood plain
Sediment trapping structures with new growth mangroves
Floating aquaculture
Tourist routes and boating routes
Historical heritage
Floating market
0
2.5
5 km

05

Design Exploration



Freshwater Reservoir



Brackish Water Transition Zone



Growing Bank

BRACKISH WATER TRANSITION ZONE

Basin Scale



Intersection zone

Regional Scale



Local Scale



Brackish water transition zone

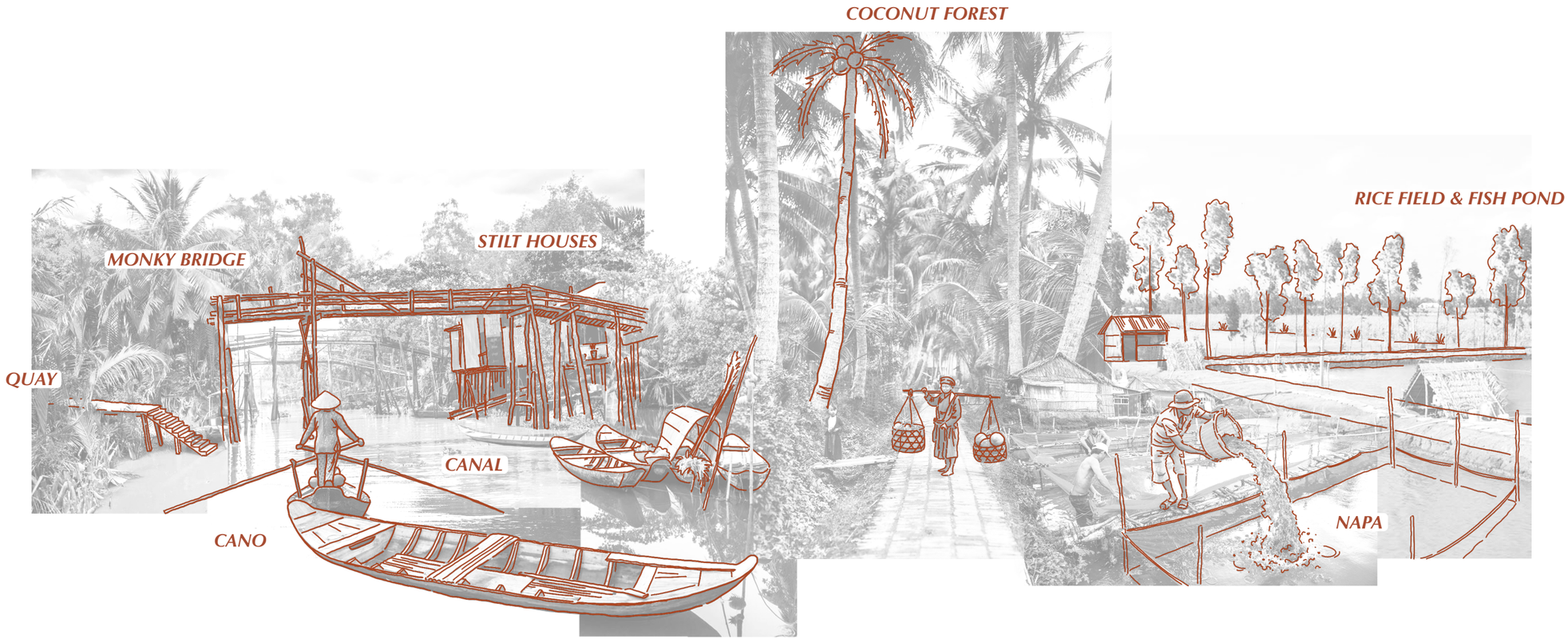
BRACKISH WATER TRANSITION ZONE Landscape Characteristics



BRACKISH WATER TRANSITION ZONE Landscape Characteristics



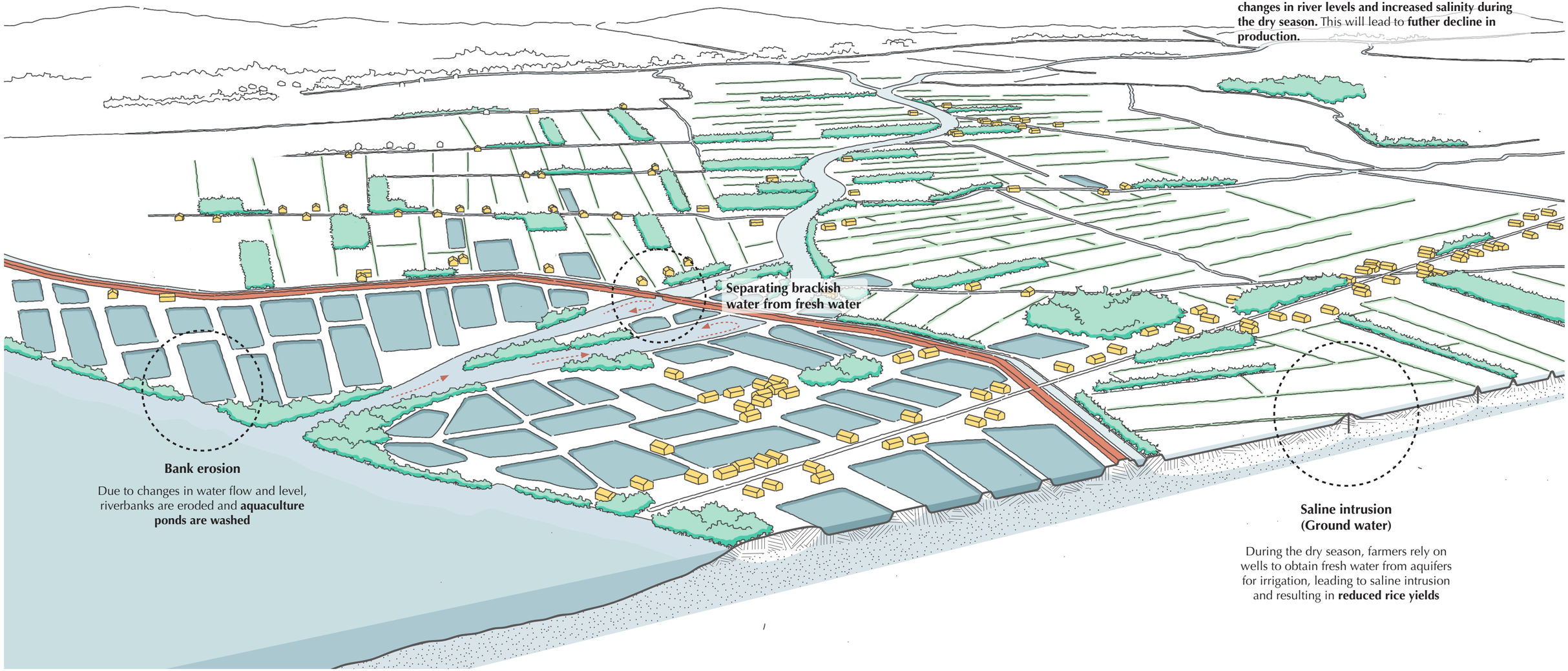
BRACKISH WATER TRANSITION ZONE Landscape Characteristics



BRACKISH WATER TRANSITION ZONE Problems

Climate change

Climate change will lead to rising sea levels, **increased changes in river levels and increased salinity during the dry season.** This will lead to **futher decline in production.**



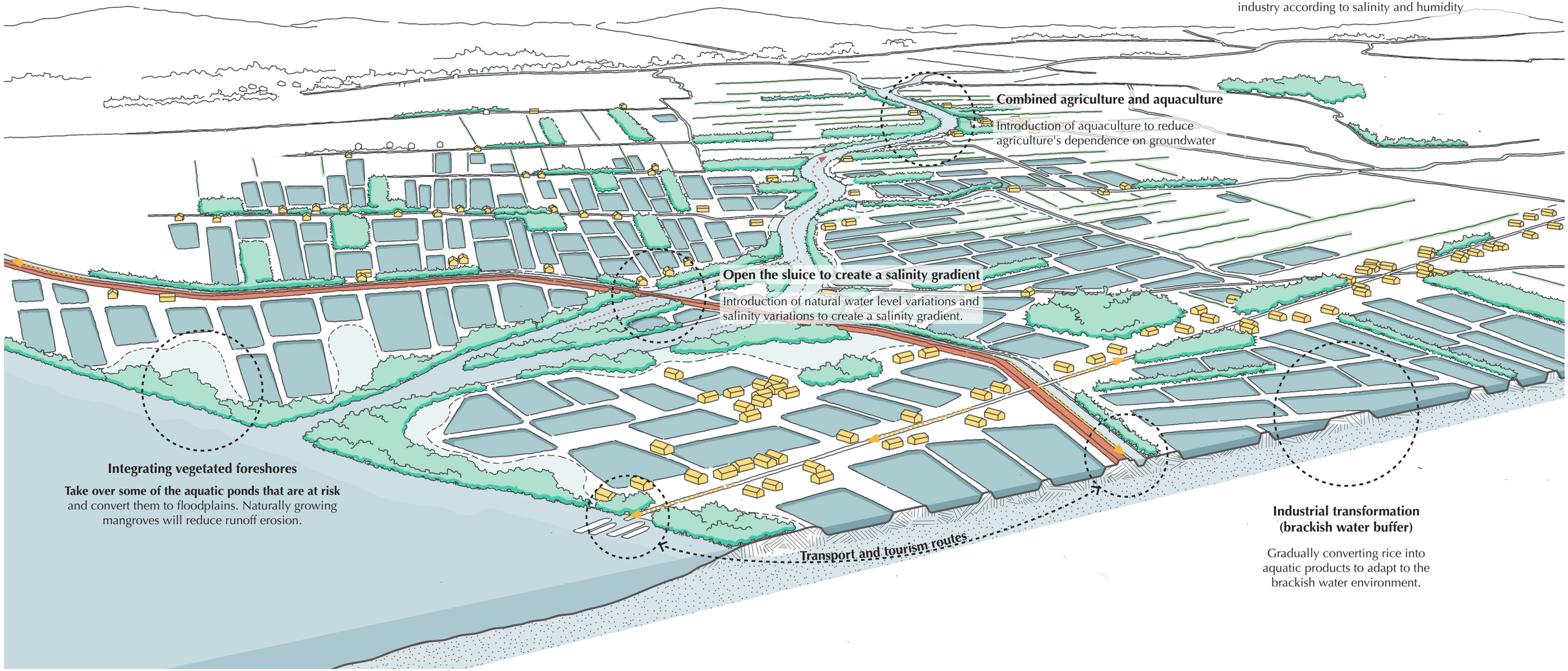
Bank erosion

Due to changes in water flow and level, riverbanks are eroded and **aquaculture ponds are washed**

Saline intrusion (Ground water)

During the dry season, farmers rely on wells to obtain fresh water from aquifers for irrigation, leading to saline intrusion and resulting in **reduced rice yields**

BRACKISH WATER TRANSITION ZONE Goals

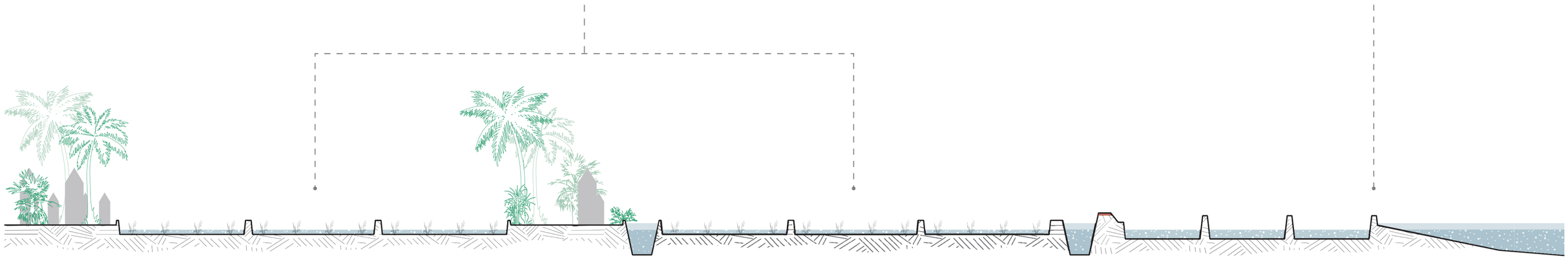


BRACKISH WATER TRANSITION ZONE Salinity Gradient Section

Current situation

Rice yields have declined significantly due to salt intrusion. Rice cultivation is not adapted to natural water conditions and is not sustainable.

Bank erosion



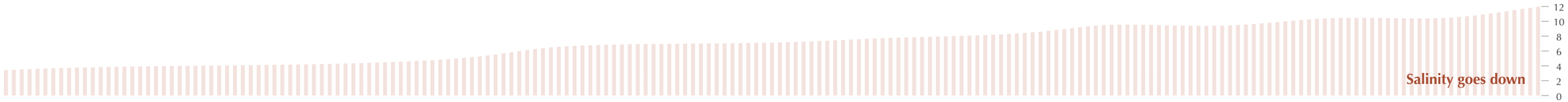
L:H = 1:5

Rice field

Rice field

Aquaculture pond

Ham luong river



BRACKISH WATER TRANSITION ZONE Salinity Gradient Section

5-10 years

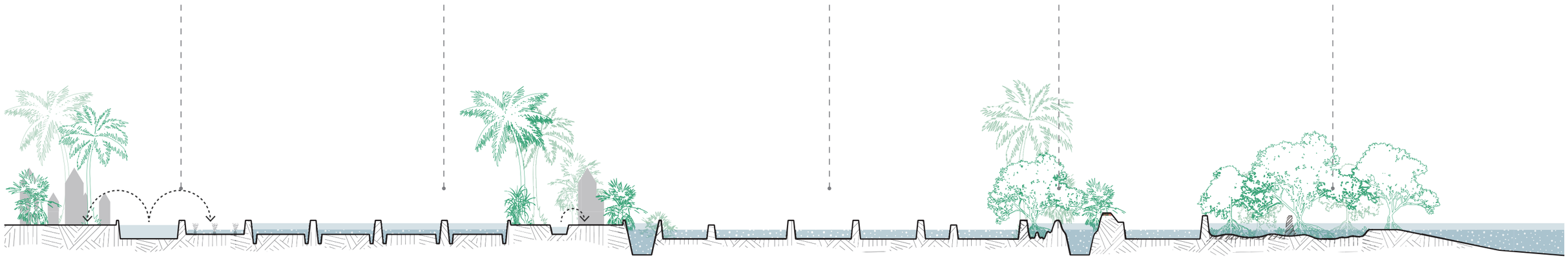
Converted rice fields into small retention and vegetable gardens to reduce groundwater use.

Convert rice fields into shrimp-rice farms.

Convert rice fields into aquaculture ponds.

Establish river dyke greenways to enrich the function of river dyke.

Open some of the aquaculture Pond dykes and convert them to floodplains. Take advantage of seasonal water level changes to promote foreshore vegetation growth.



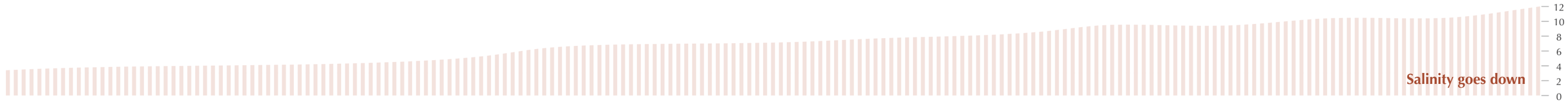
L:H = 1:5

Rretention pond	Vegetables	Rice-shrimp farm	Rretention pond	Associated mangrove aquaculture	River dyke greenway	Aquaculture pond	Flood plain	Ham luong river

Rice-shrimp farm

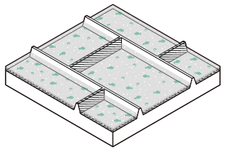
Mangrove aquaculture belt

Aquaculture pond & Flood plain

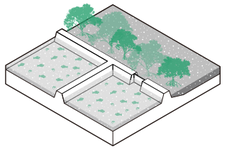


MANGROVE AQUACULTURE BELT

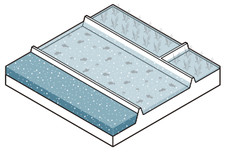




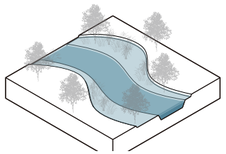
Industrial transformation



Eco-agriculture

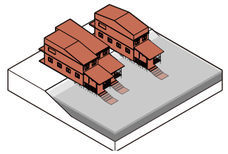


Make use of brackish water

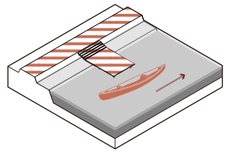


Flood plain

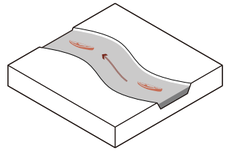




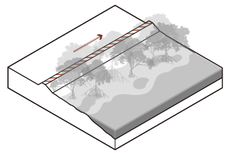
Traditional settlement



Quay



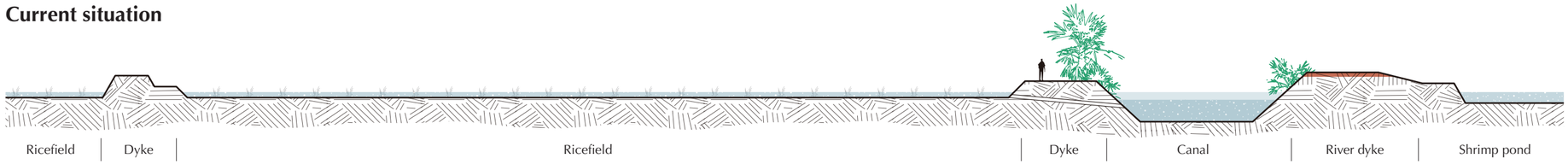
Waterway transport



Tourist route

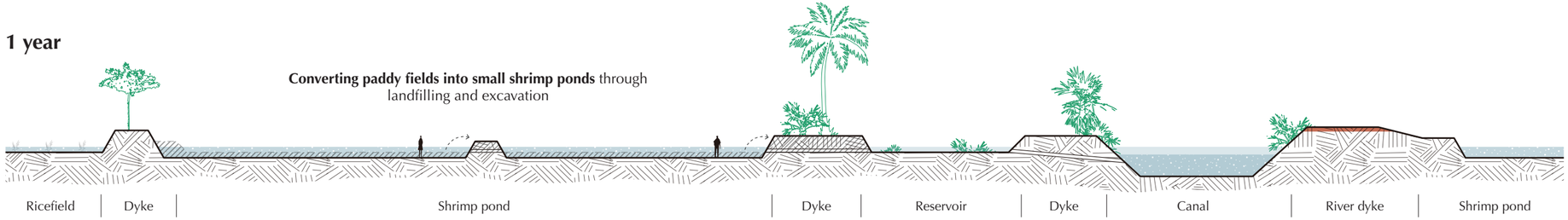
MANGROVE AQUACULTURE BELT Intervention and process

Current situation



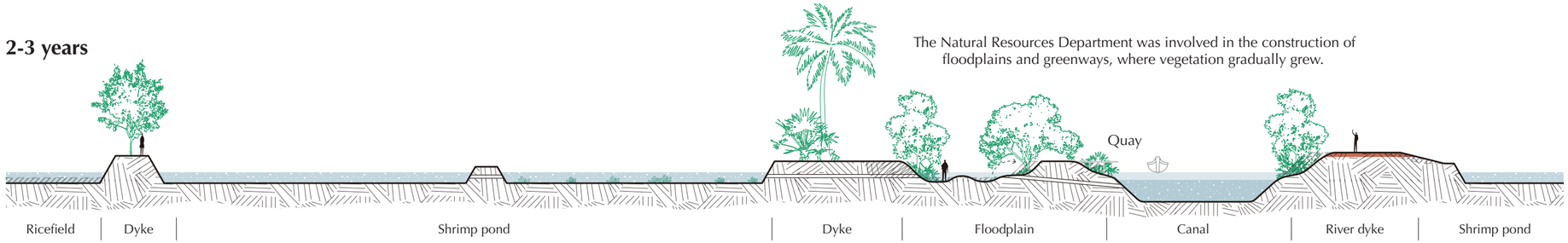
1 year

Converting paddy fields into small shrimp ponds through landfilling and excavation



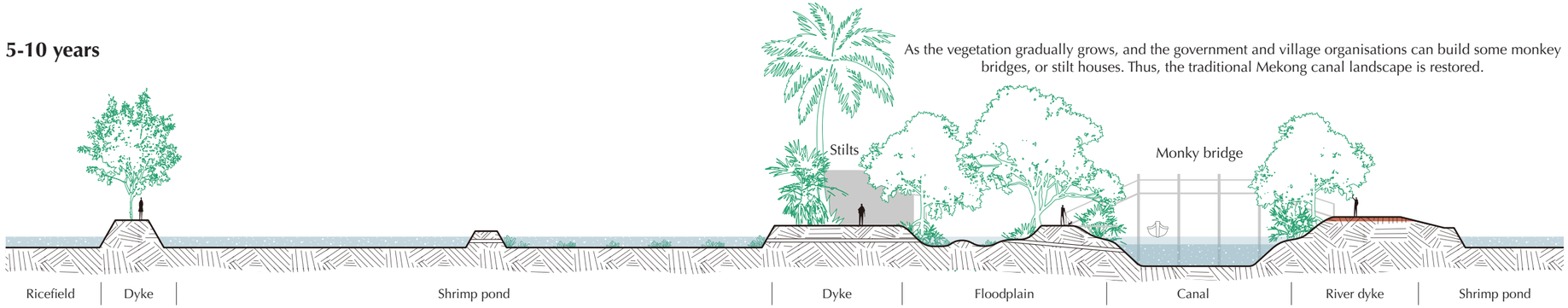
2-3 years

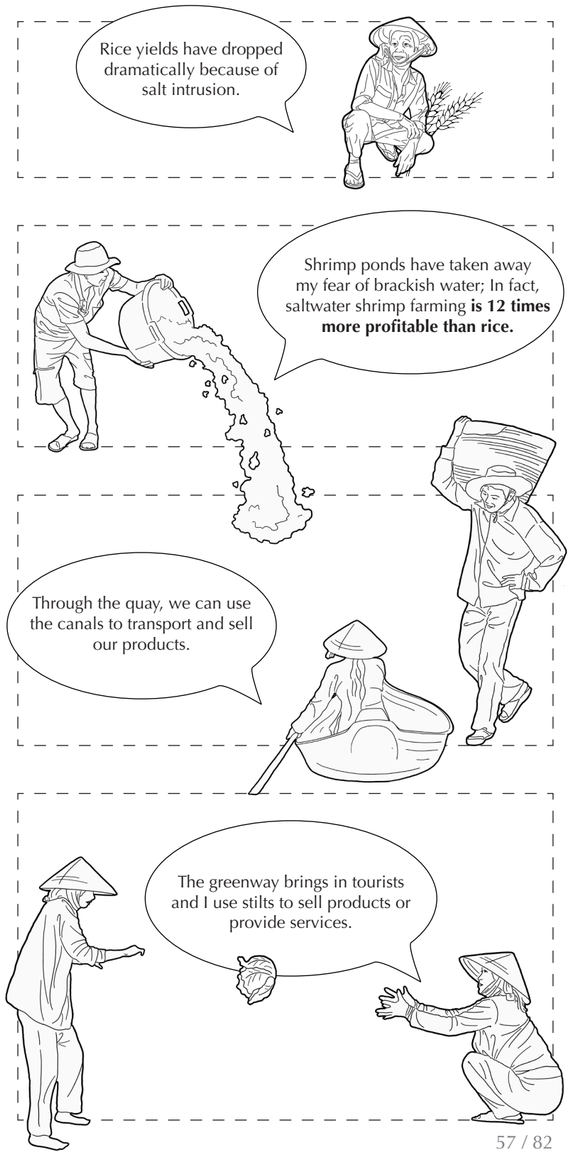
The Natural Resources Department was involved in the construction of floodplains and greenways, where vegetation gradually grew.



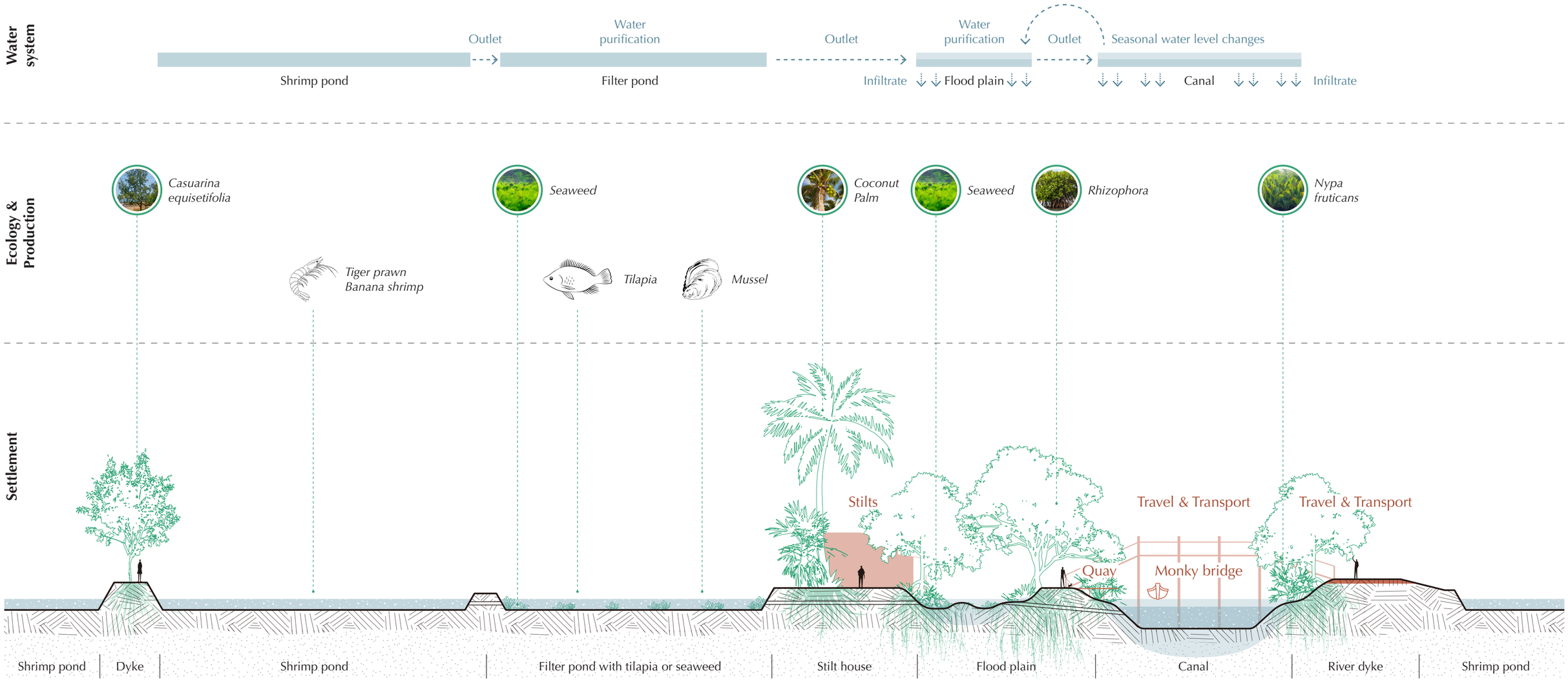
5-10 years

As the vegetation gradually grows, and the government and village organisations can build some monkey bridges, or stilt houses. Thus, the traditional Mekong canal landscape is restored.





MANGROVE AQUACULTURE BELT Operation of the landscape system



MANGROVE AQUACULTURE BELT Greenway ecological communities

Fauna


Eurasian tree sparrow


Common sandpiper


Greater coucal


Mallard


Duttaphrynus melanostictus


Lissachatina fulica


Junonia almana


Pantala flavescens


Scaly-breasted munia


White-winged tern


Asian green bee-eater


Northern shoveler


Oriental garden lizard


Papilio demoleus


Acraea terpsicore


Orthetrum sabina


Chinese pond heron


Zebra dove


Common greenshank


Flat-tailed house gecko


Graphium agamemnon


Hypolimnas bolina

Flora


Rhizophora


Seaweed

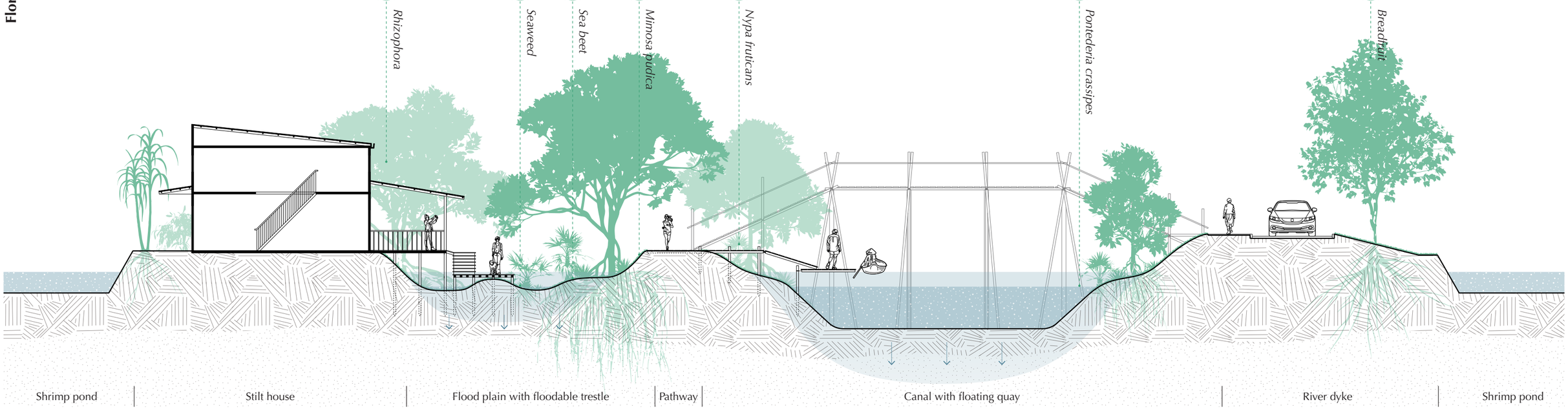

Sea beet


Mimosa pudica


Nypa fruticans


Pontederia crassipes


Breadfruit



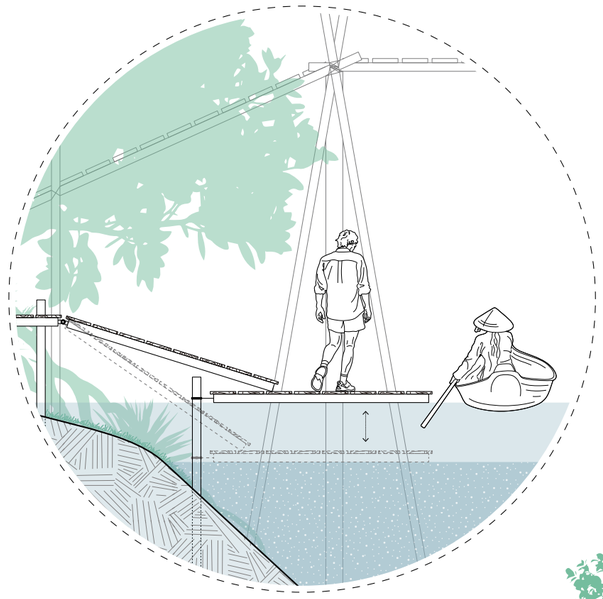
Shrimp pond | Stilt house | Flood plain with floodable trestle | Pathway | Canal with floating quay | River dyke | Shrimp pond

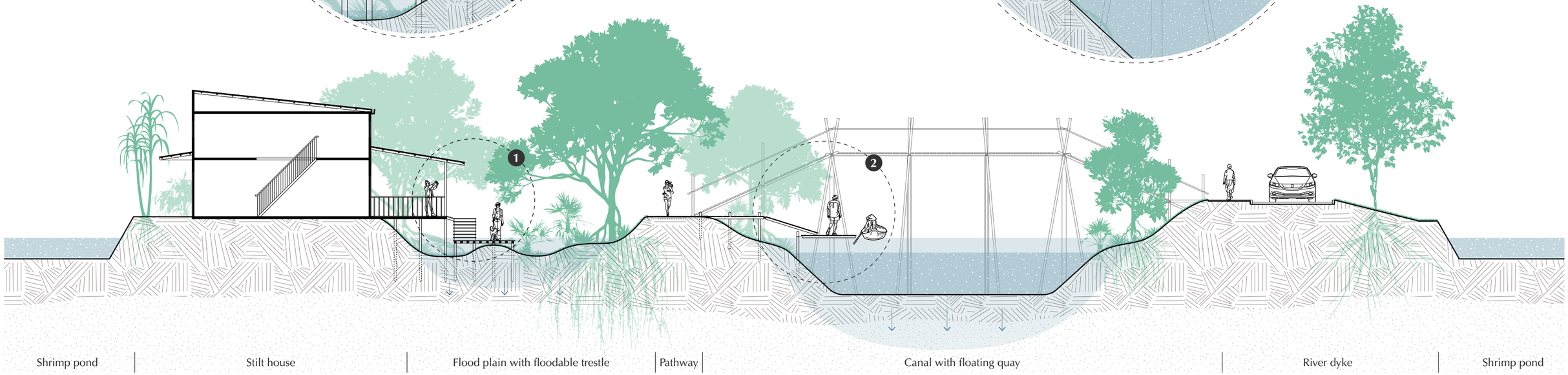
MANGROVE AQUACULTURE BELT Detail of the greenway

1 Stilt house viewing platform with floodable trestle



2 Floating quay





MANGROVE AQUACULTURE BELT Current situation

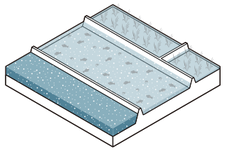


MANGROVE AQUACULTURE BELT Traditional Canal With New Functions

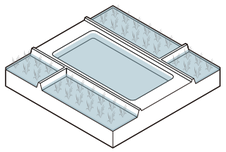


RICE-SHRIMP FARM

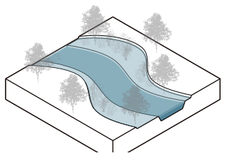




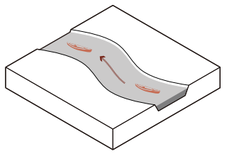
Make use of brackish water



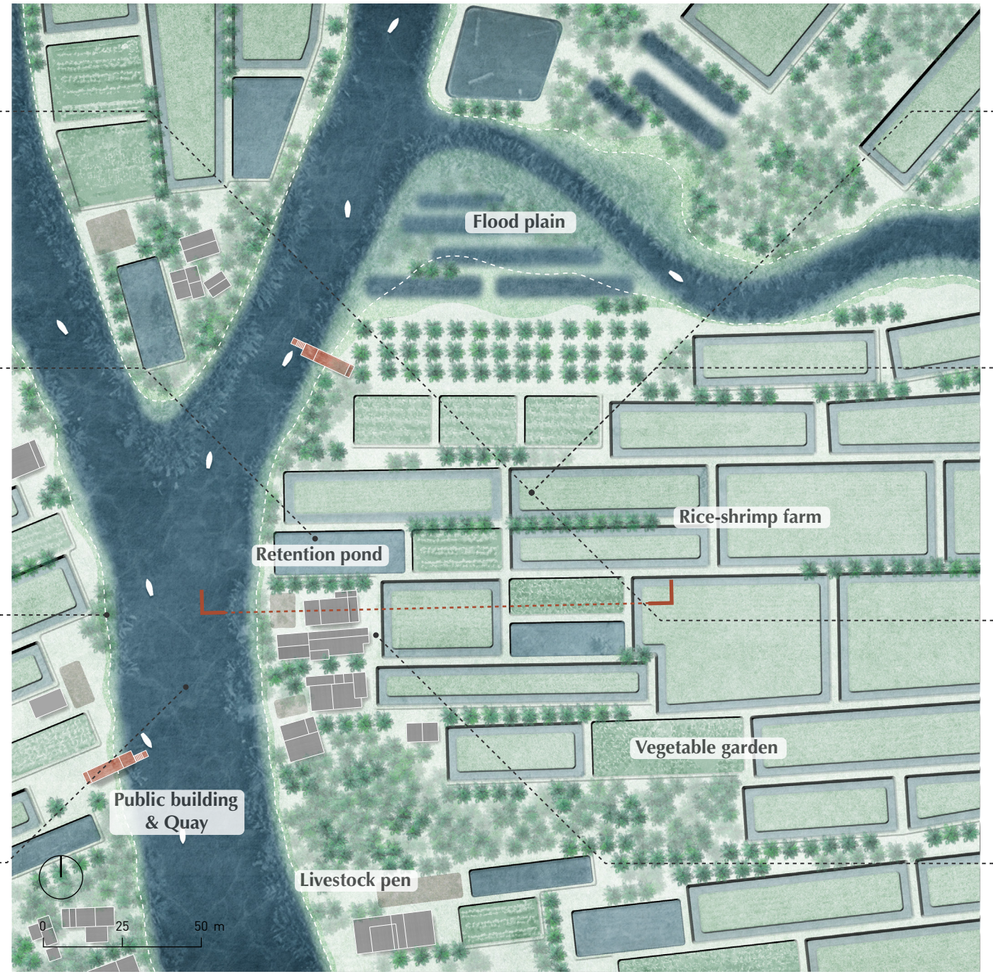
Small water retention pond

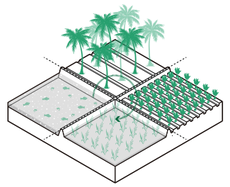


Flood plain

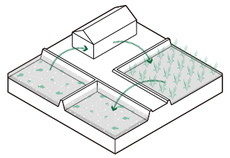


Waterway transport

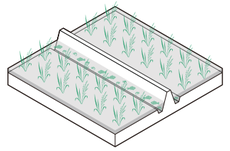




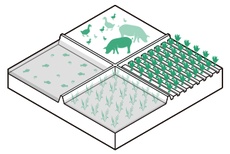
Rotation



Material flows and cycles

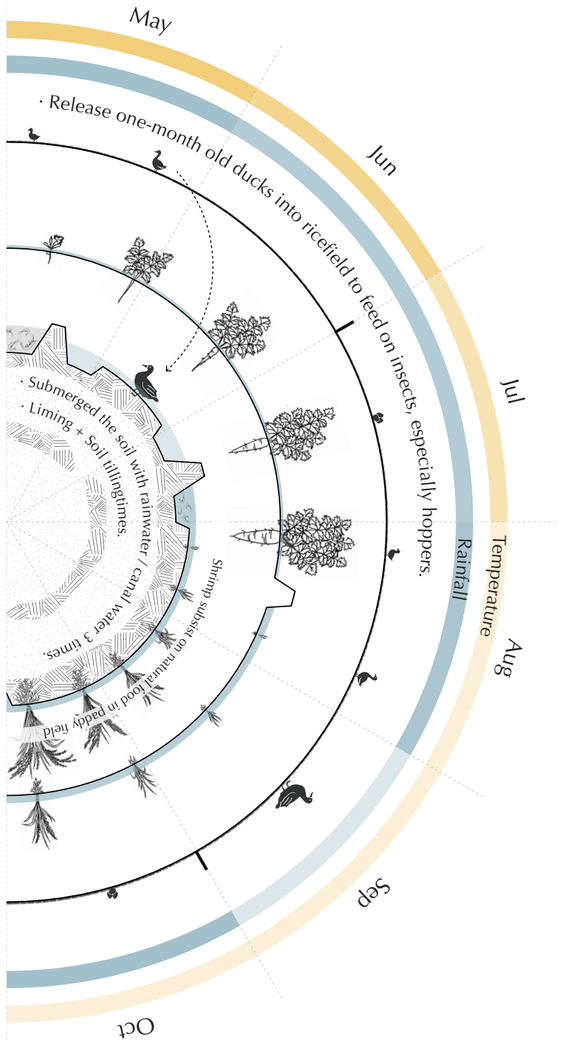


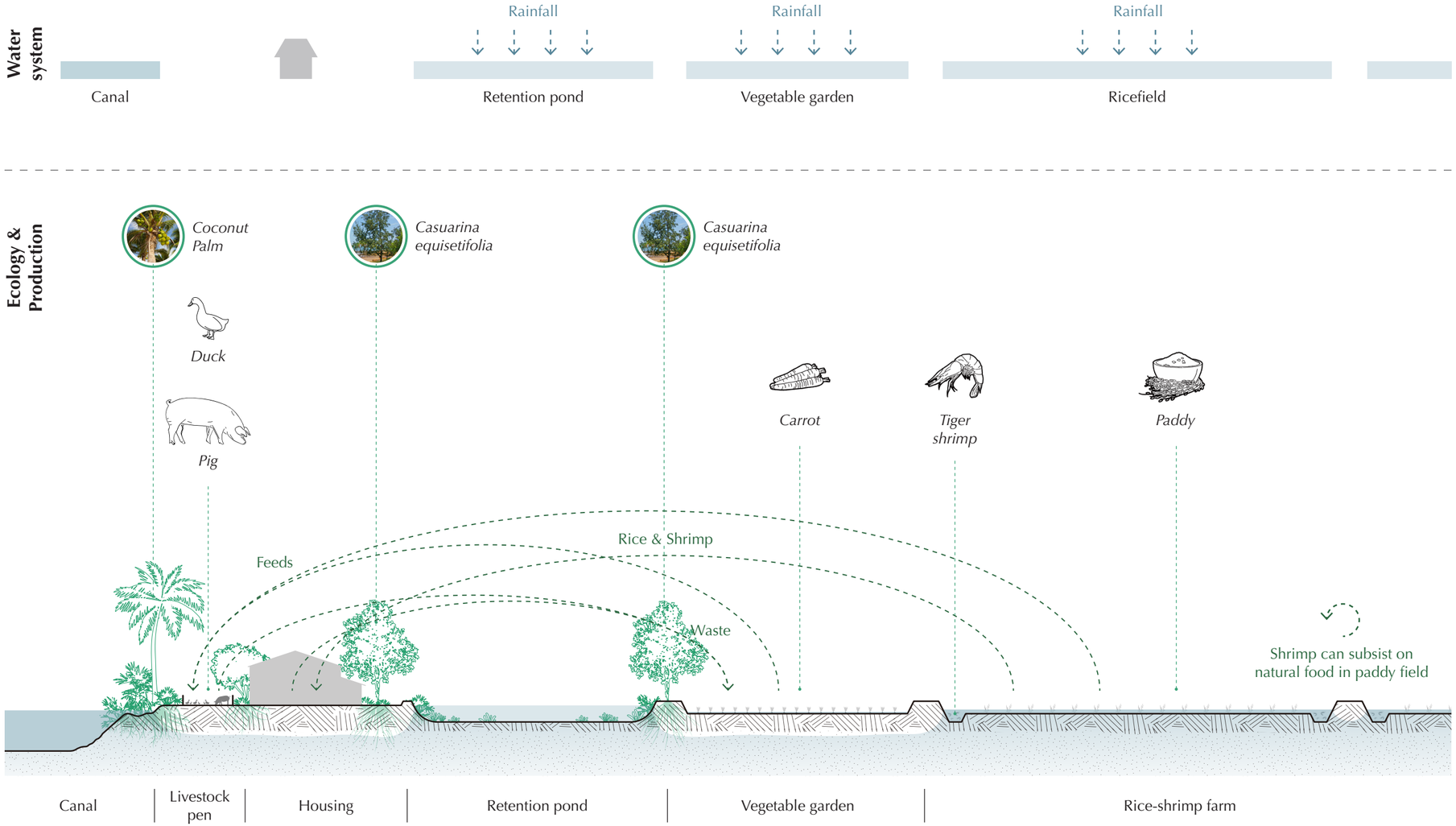
Agri - Aquaculture



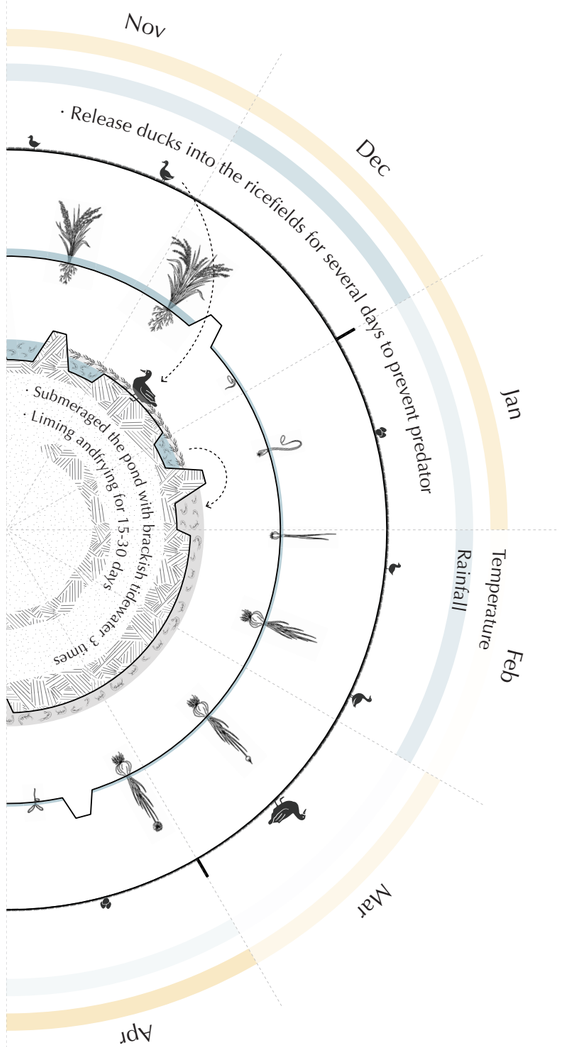
VAC system

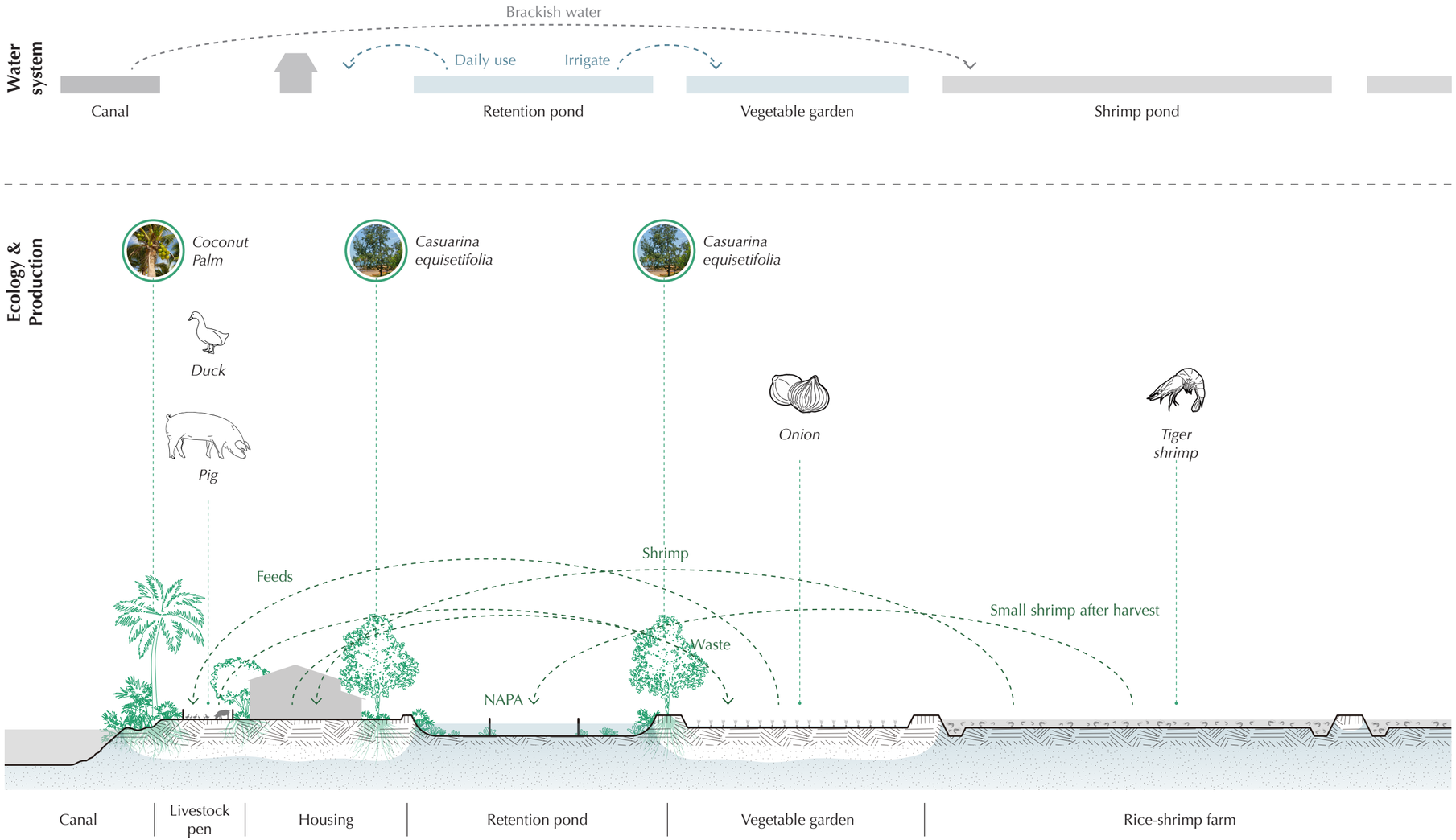
RICE-SHRIMP FARM Wet season (May - Oct)

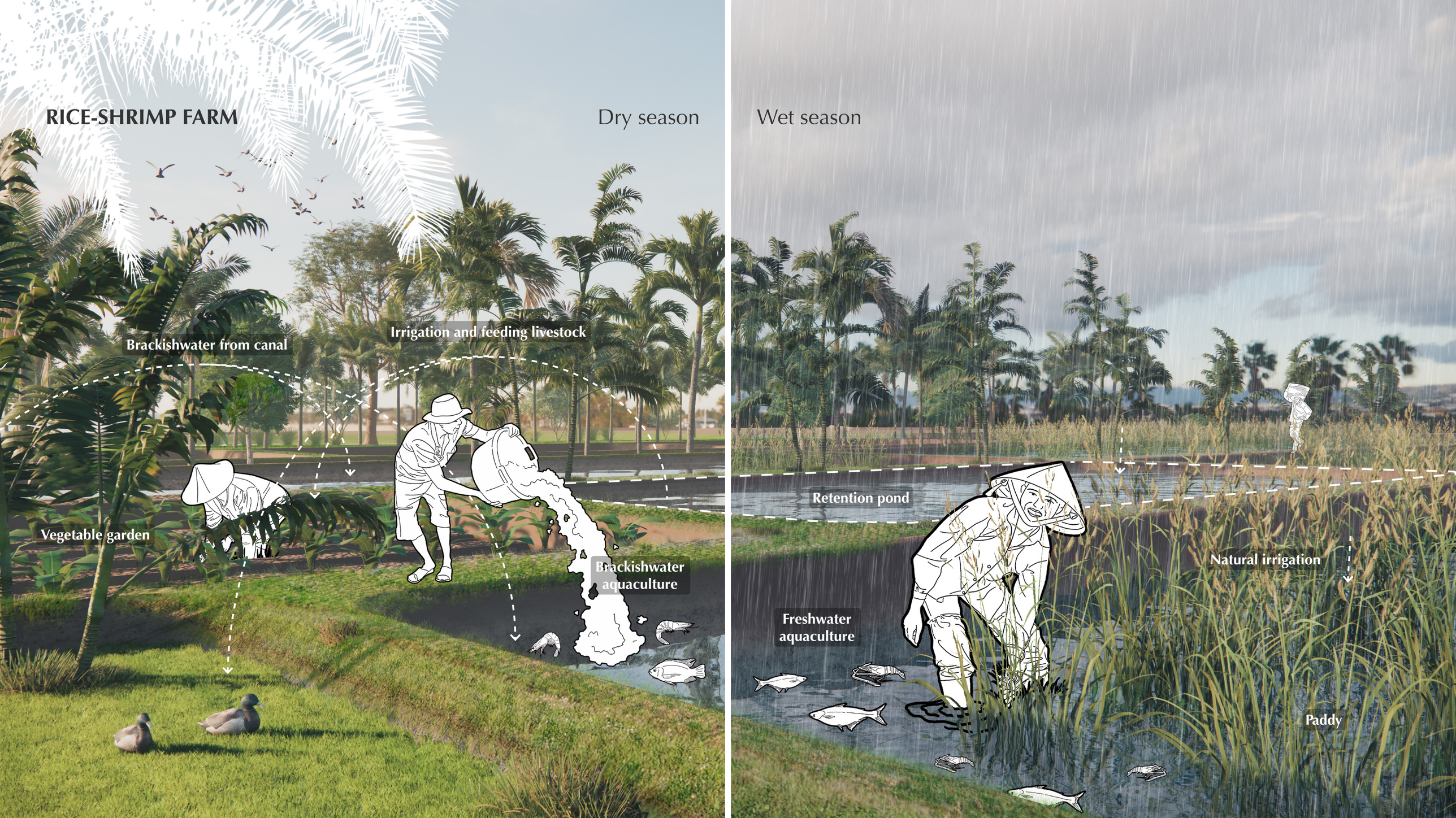




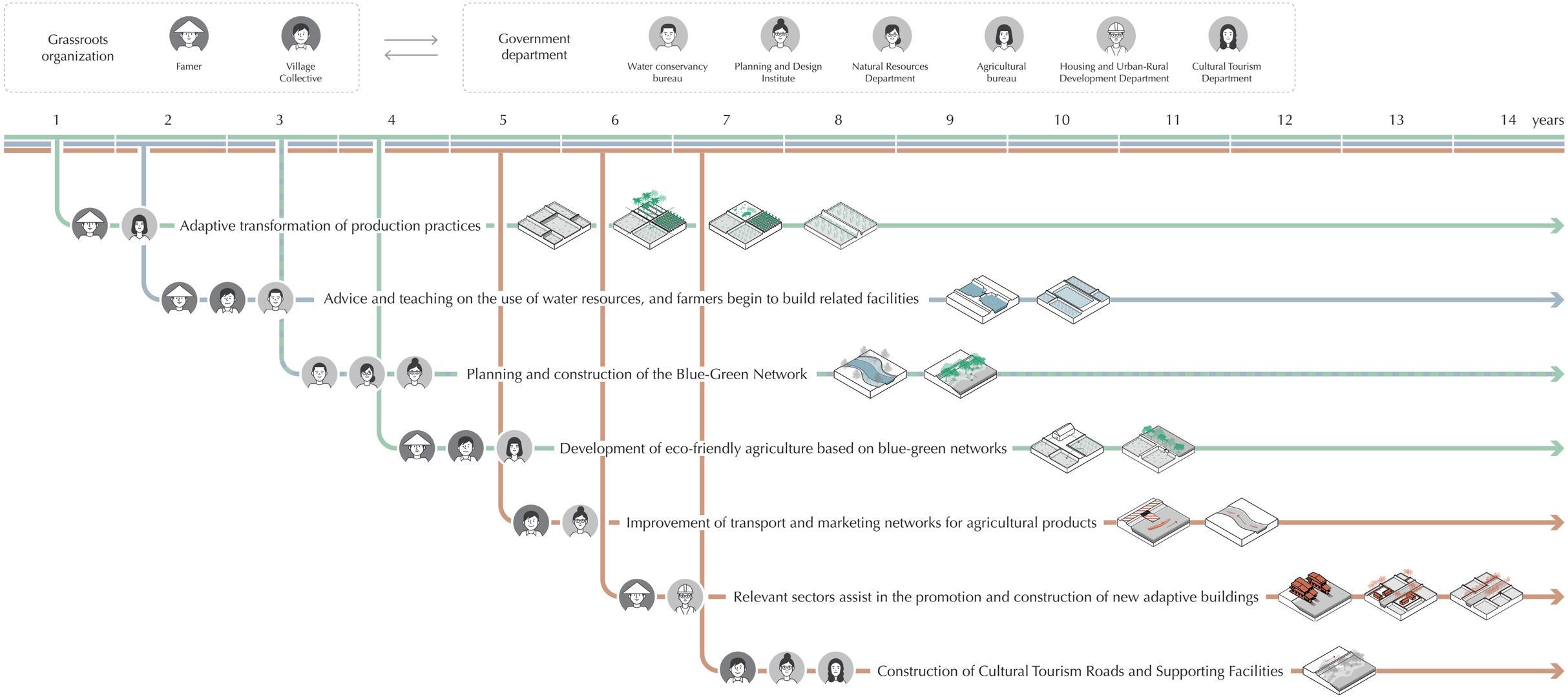
RICE-SHRIMP FARM Dry season (Nov - Apr)






RICE-SHRIMP FARM
Dry season
Wet season
Brackishwater from canal
Irrigation and feeding livestock
Vegetable garden
Brackishwater aquaculture
Retention pond
Natural irrigation
Freshwater aquaculture
Paddy

STAKEHOLDER & PROCESS




1
FRESHWATER RESERVOIR
2
BRACKISH WATER TRANSITION ZONE
3
GROWING BANK

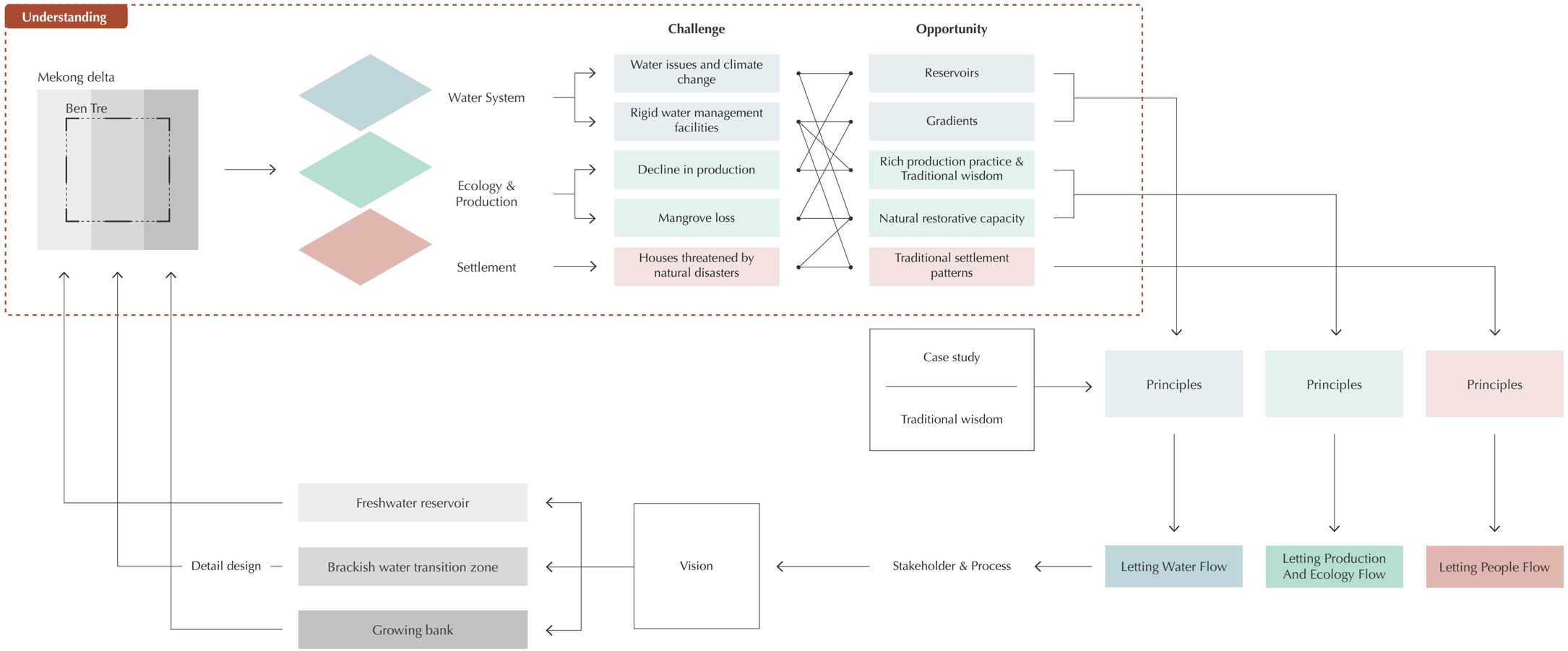

"To contribute to a **resilient system** for the Mekong Delta
through exploring design-oriented landscape approaches to
realize the **harmonious coexistence of human and water**."

06

Reflection

SQ1 UNDERSTANDING

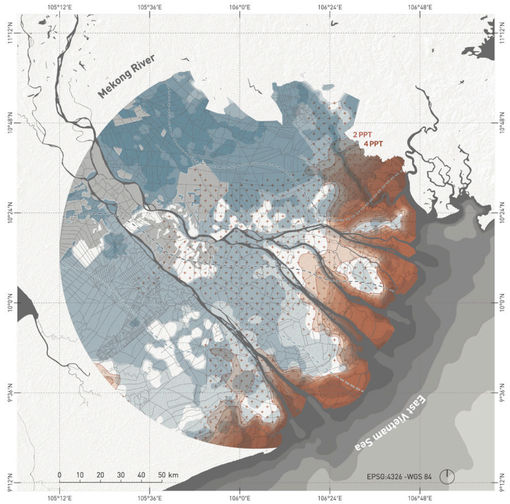
What is the relation between the landscape context and the environmental and spatial challenges in VMD? and what are the potentials to address them?

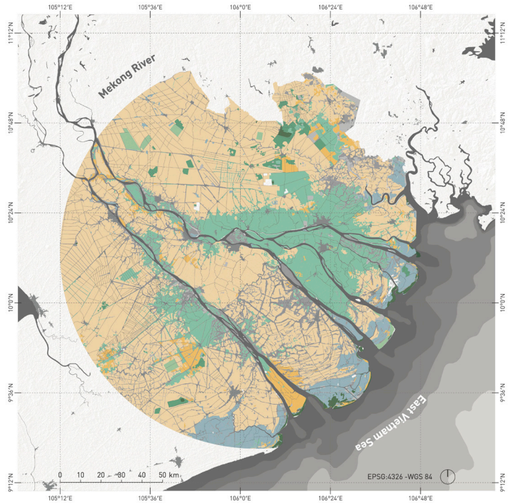


SQ1 UNDERSTANDING

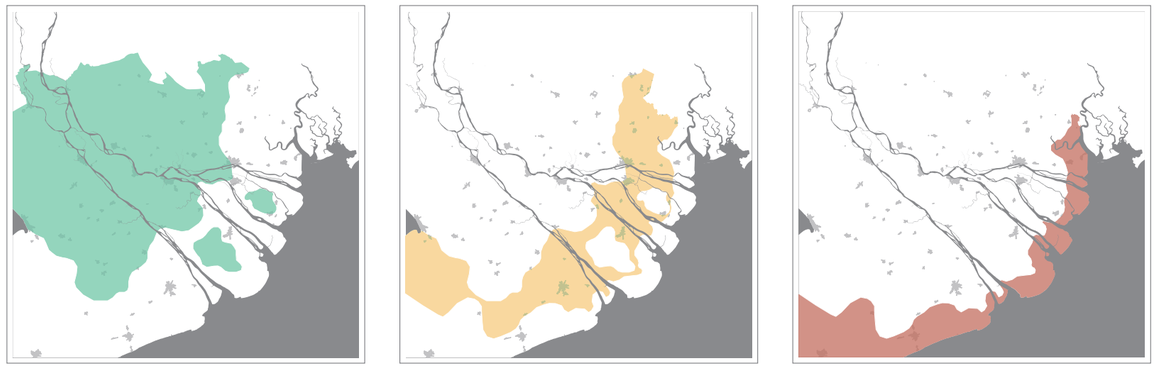
What is the relation between the landscape context and the environmental and spatial challenges in VMD? and what are the potentials to address them?

Basin Scale



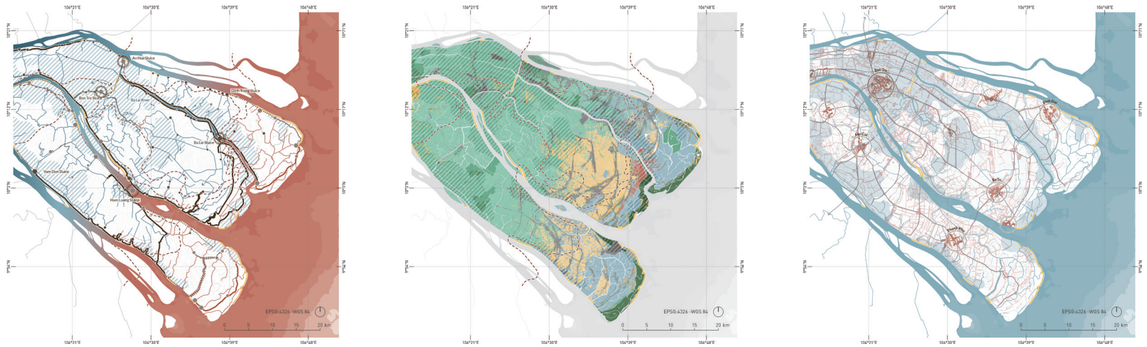


Three typologies

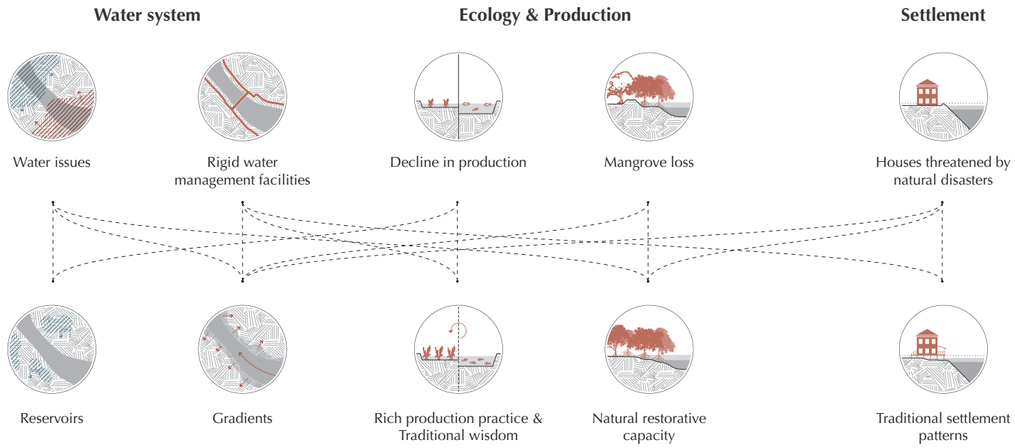


Regional scale

Three layers

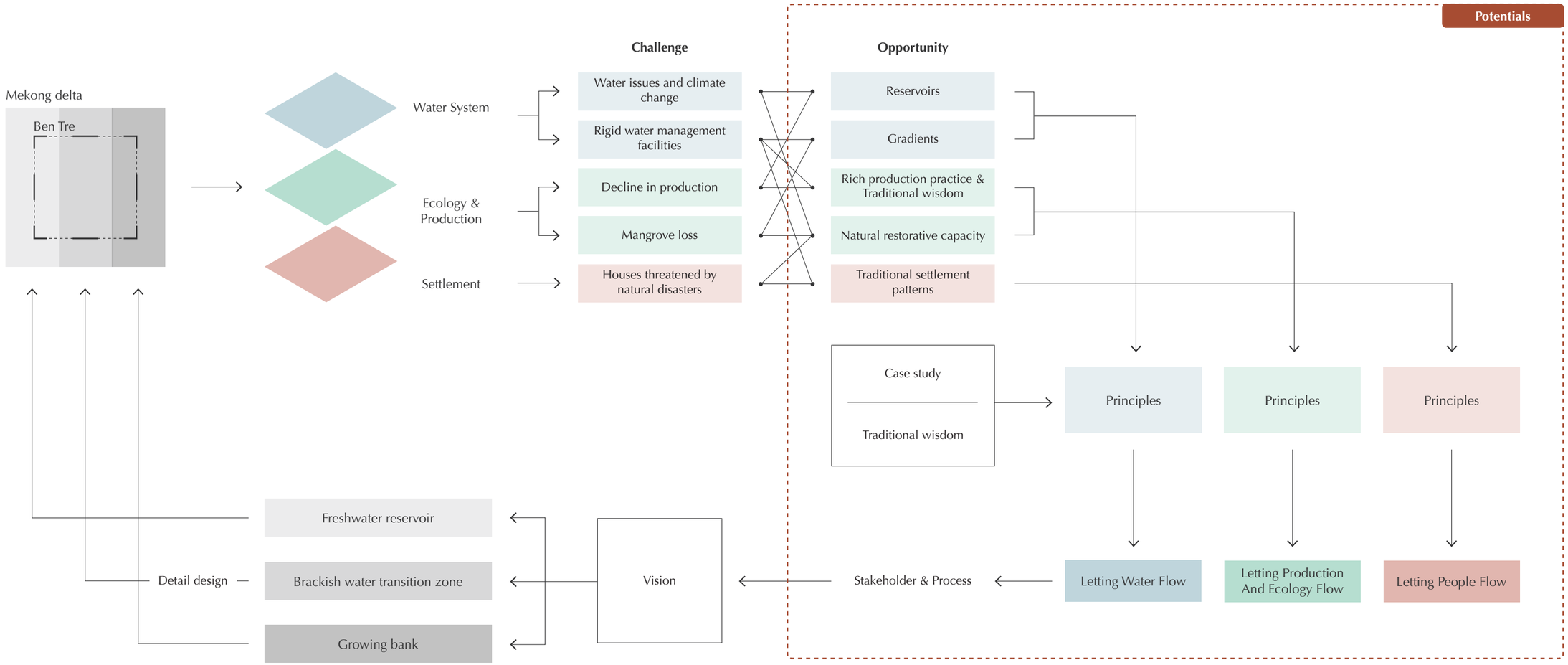


Challenge & Opportunity



SQ2 POTENTIALS

What strategies and principles can be employed in terms of water management, production, settlement, and ecological perspectives?



SQ2 POTENTIALS

What strategies and principles can be employed in terms of water management, production, settlement, and ecological perspectives?

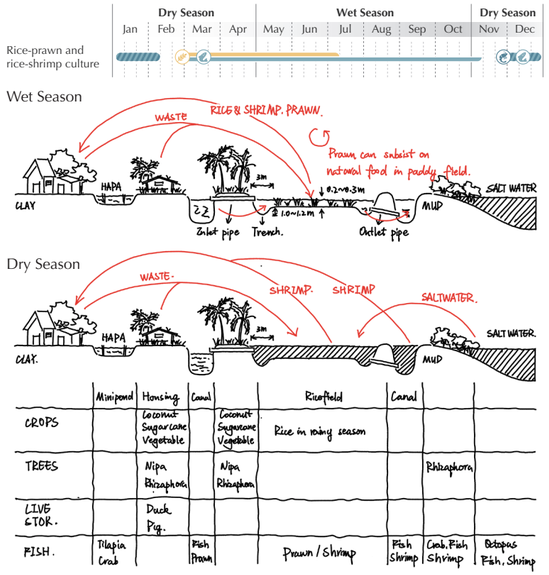
Case study

Wave Attenuating Willow Forest

Noordwaard, Netherlands | Deltares

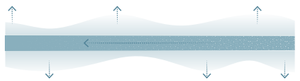


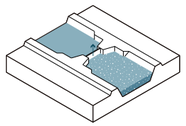
Traditional wisdom



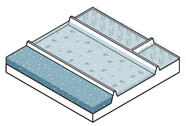
Strategies and principles

Letting Water Flow

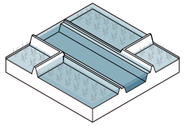




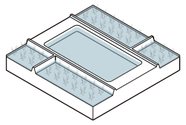
Restoring salinity gradients



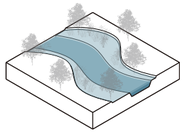
Make use of brackish water



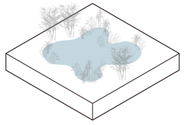
Different level of dykes



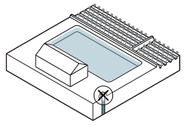
Small water retention pond



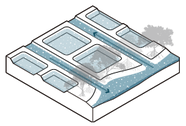
Flood plain



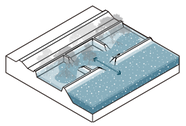
Reservoirs



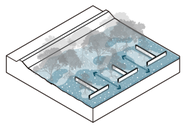
No groundwater use



Separate in & outflow channels

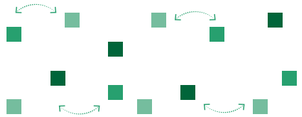


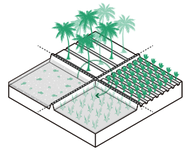
Restoring intertidal zones



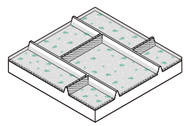
Sediment trapping

Letting Production And Ecology Flow

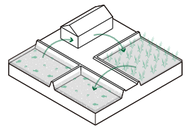




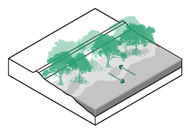
Rotation



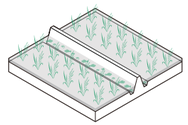
Industrial transformation



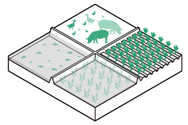
Material flows and cycles



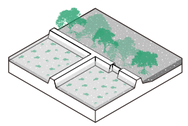
Integrating vegetated foreshores



Agri - Aquaculture

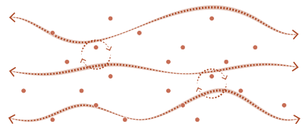


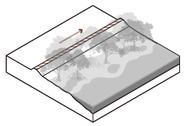
VAC system



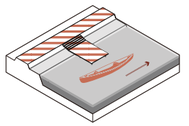
Eco-agriculture

Letting People Flow

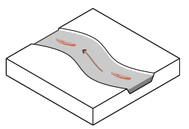




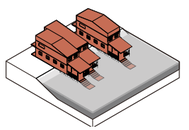
Tourist route



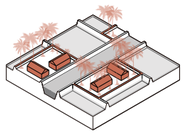
Quay



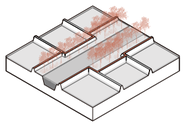
Waterway transport



Traditional settlement



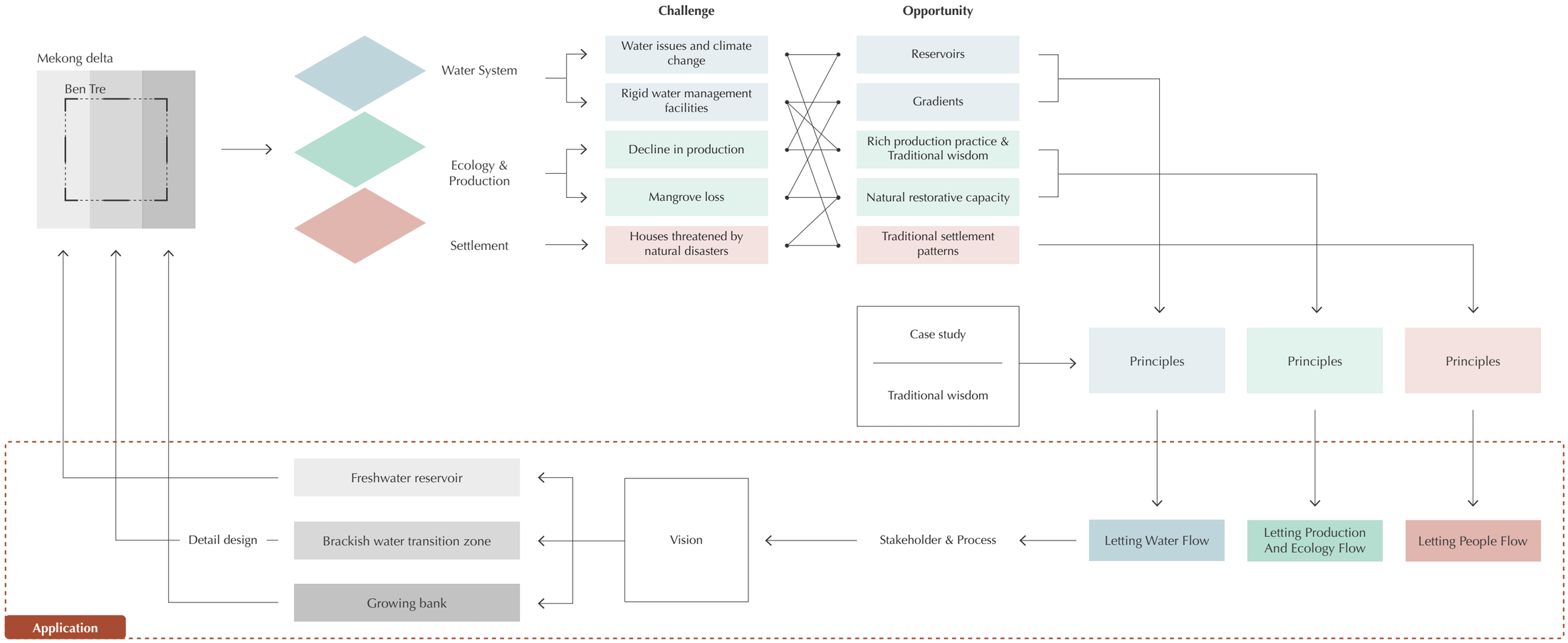
Keeping the original landscape



New waterfront spaces

SQ3 APPLICATION

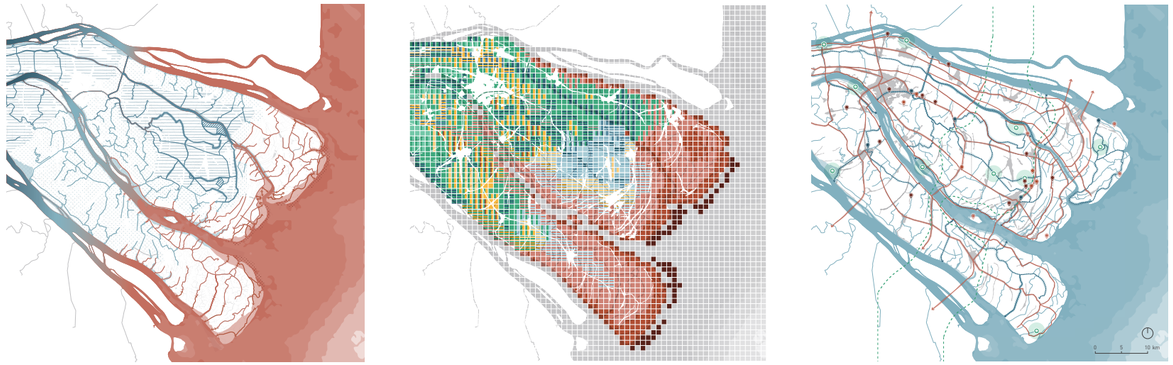
How to apply resilient design strategies and principles across scales?



SQ3 APPLICATION

How to apply resilient design strategies and principles across scales?

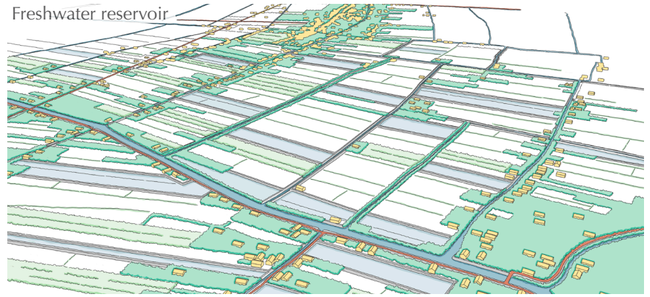
Design strategies in regional scale

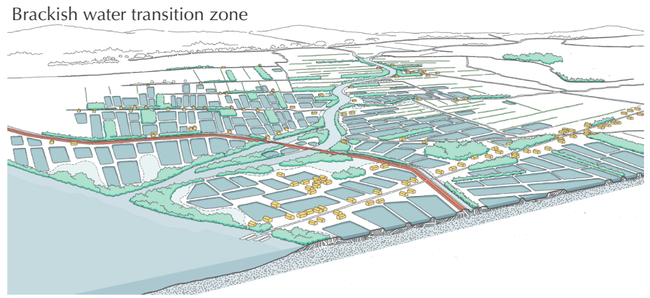


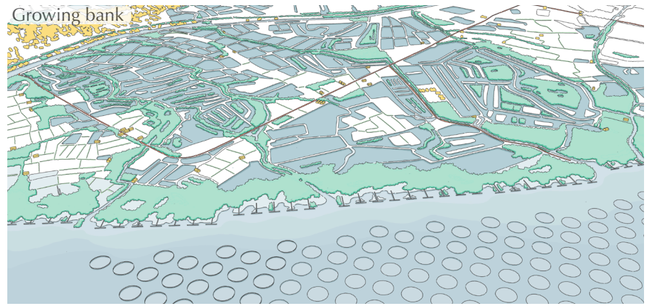
Vision



Three local scale degign ideas (Mach with landscape typologies)



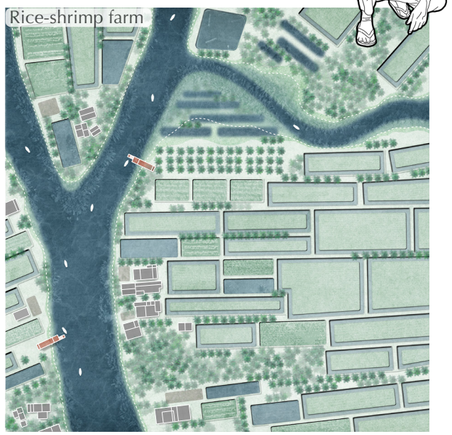




Detail design

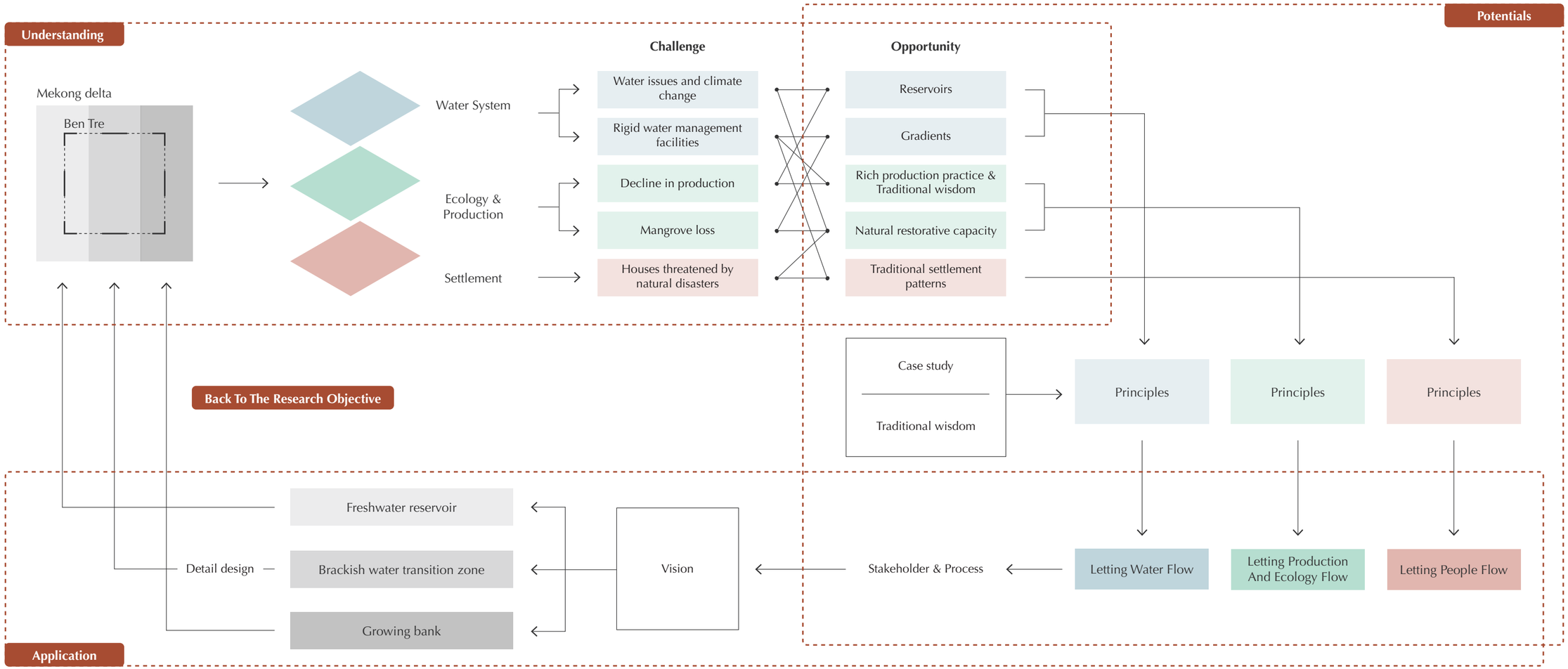






BACK TO THE RESEARCH OBJECTIVE

How does the project help VMD to create a resilient landscape system?



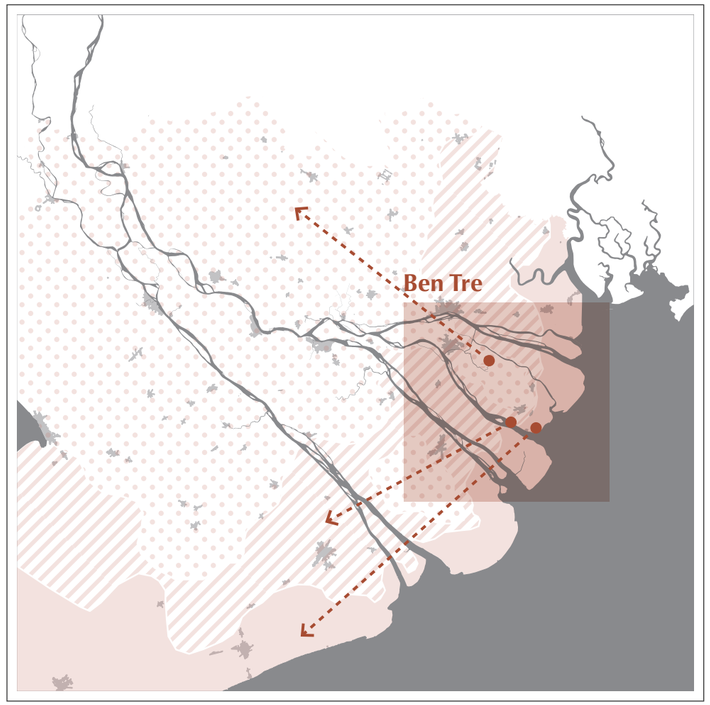
BACK TO THE RESEARCH OBJECTIVE

How does the project help VMD to create a resilient landscape system?

- **Cross-scale design applications**

  By designing across scales, not only does it provide a long-term plan that is more generalised at large scales, it also provides a short-term, site-specific way of implementing strategies.

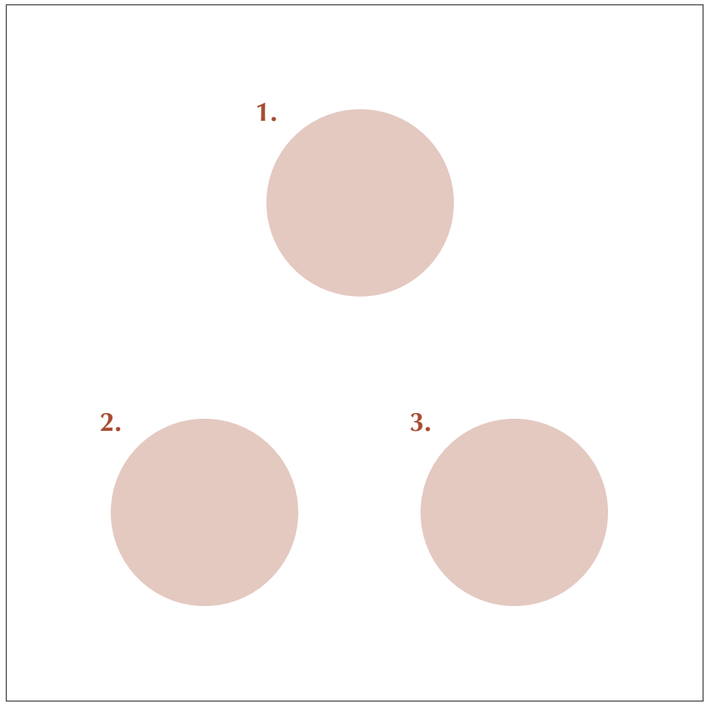
Basin Scale



Regional Scale



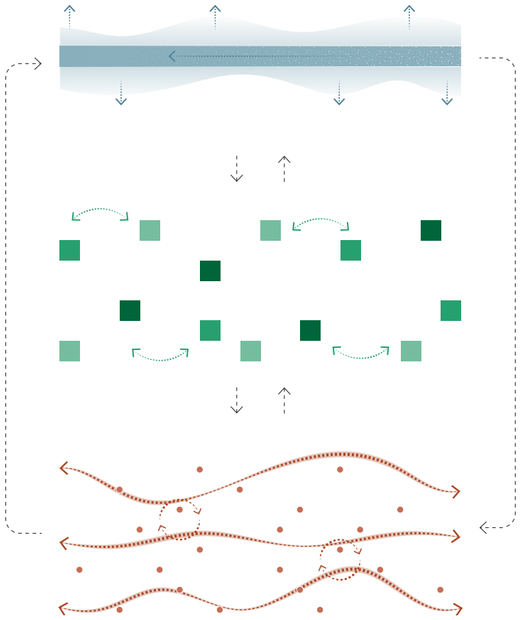
Local Scale

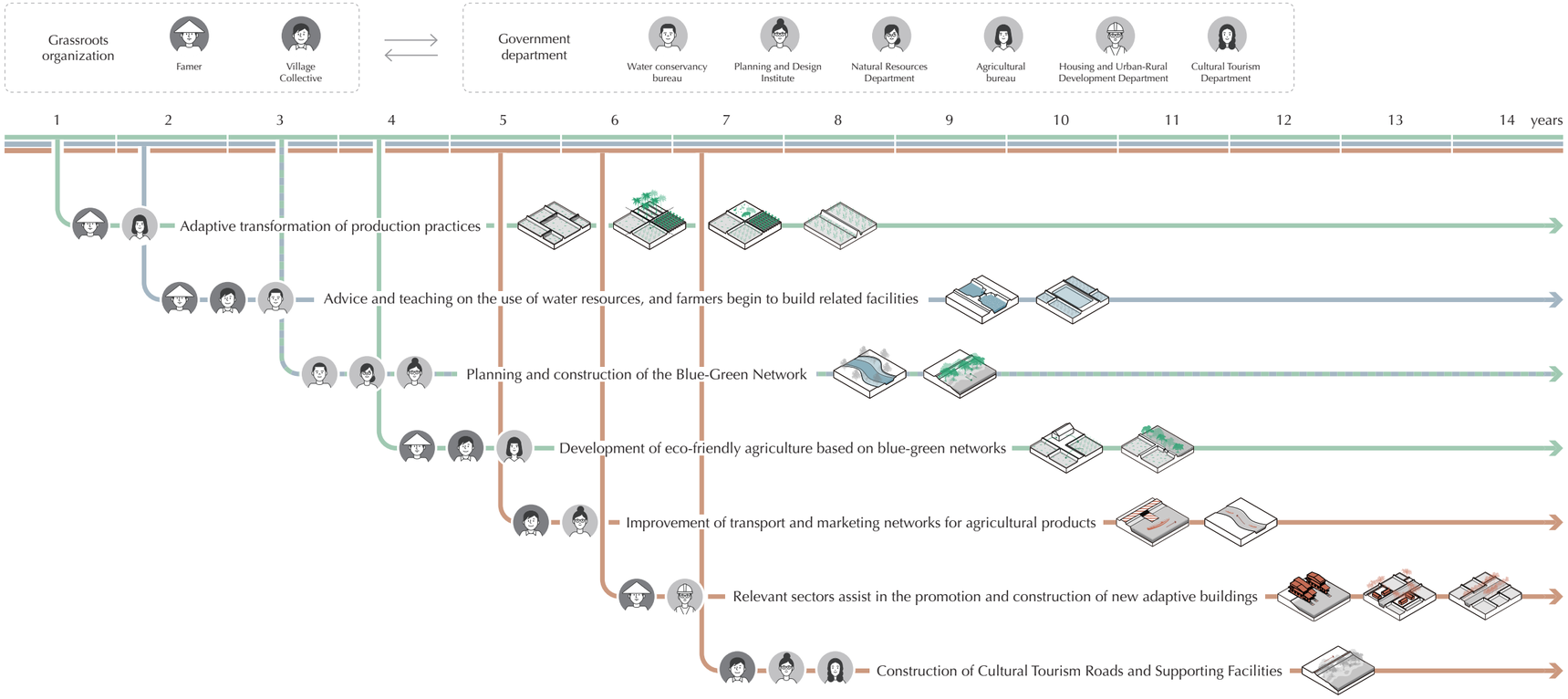


BACK TO THE RESEARCH OBJECTIVE

How does the project help VMD to create a resilient landscape system?

- **Interaction between strategies and division of responsibilities**
  - Strategies are not implemented overnight, nor do they advance in one direction. Because they are interdependent, they need to be constantly adjusted to reach a good state.
  - Balance and coherence between the top-down and bottom-up approaches can only be achieved by ensuring that all stakeholders are involved in the decision-making and operational processes.





BACK TO THE RESEARCH OBJECTIVE

How does the project help VMD to create a resilient landscape system?

- **Iterative process**
  - The regional scale vision is planned and projected based on current conditions and potential changes.
  - It is to be expected that in practice, when there is more participation of the local people, the specific situation and the experience of the farmers will in turn influence the planning.
  - Planning is not a quick fix and needs to be adapted in practice.



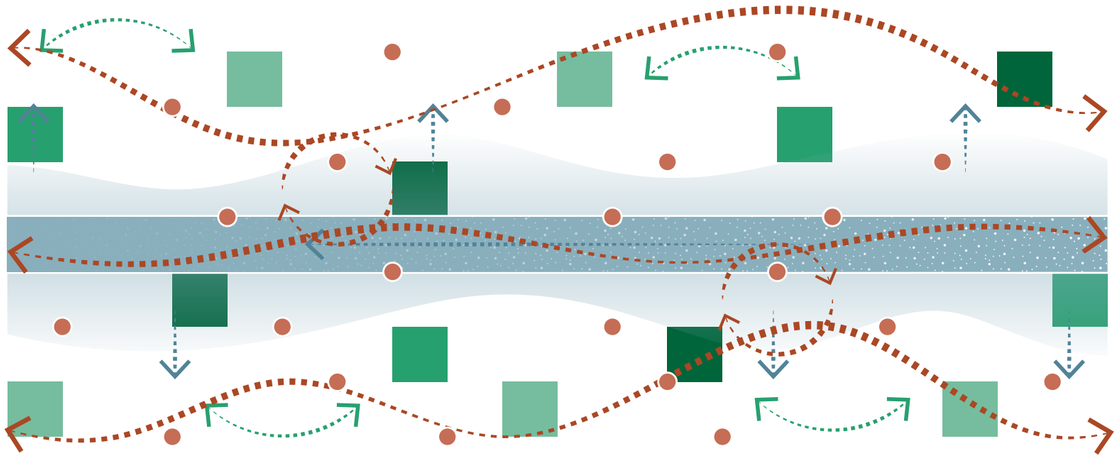


BACK TO THE RESEARCH OBJECTIVE

How does the project help VMD to create a resilient landscape system?

- **A change of mindset**

  When human beings begin to change themselves to adapt to climate change, it may not be an effective way in the short term, but in the long term it is the only way to achieve harmony between human beings and nature.



"Nước, Nước"

“Hydro–Harmony“

In conclusion, what I want to do is to provide a long-term strategy and an on-site approach to achieve **"WORK WITH NATURE, NOT AGAINST IT"**.

As the title suggests, people sing about water and homeland, which means that only when people are willing to follow the resilience of water and make changes, they will be able to reach a harmonious coexistence and face the unknown future.

