

# REVIVING A DYING DELTA

*Cultivating Human and More-Than-Human  
Synergy in the Indus Delta through  
Networks of Care*

Mahaa Ejaz

Mentors: Luca Iuorio, Anne Loes Nilsson

P5 Presentation



Arabian Sea

Karachi

Indus Delta



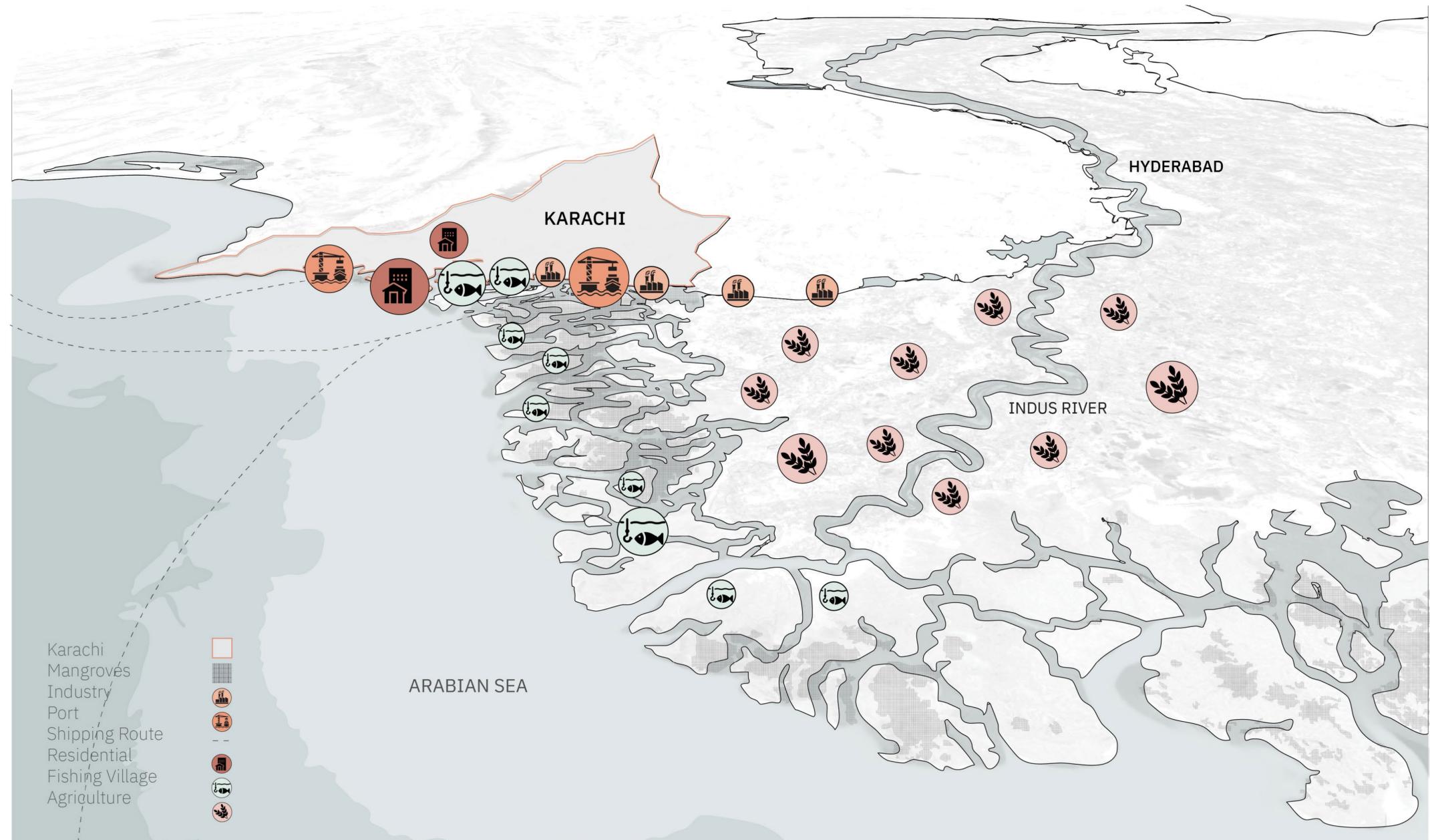
# WHAT *IS* THE INDUS DELTA?

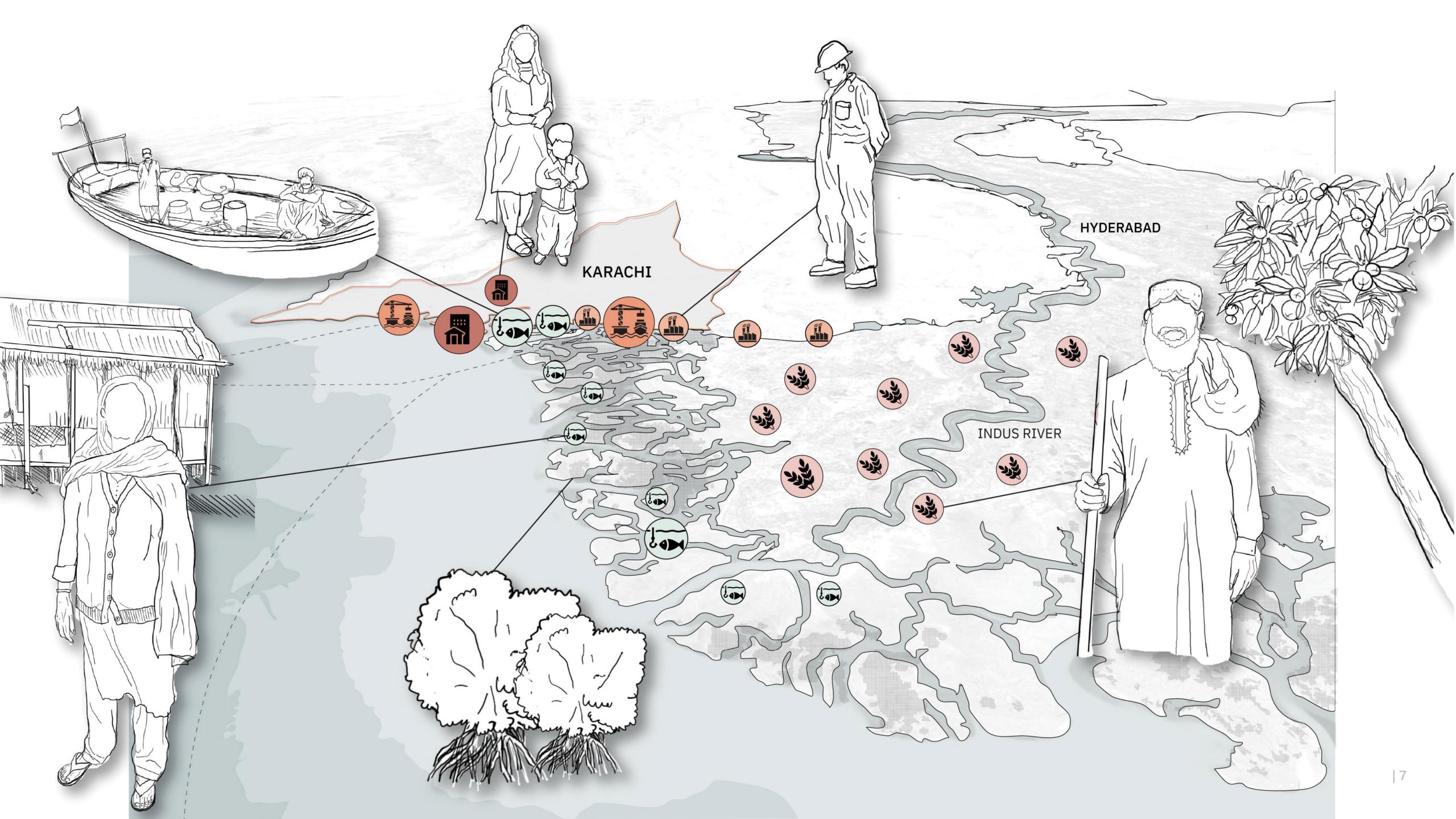


## Indus River Basin

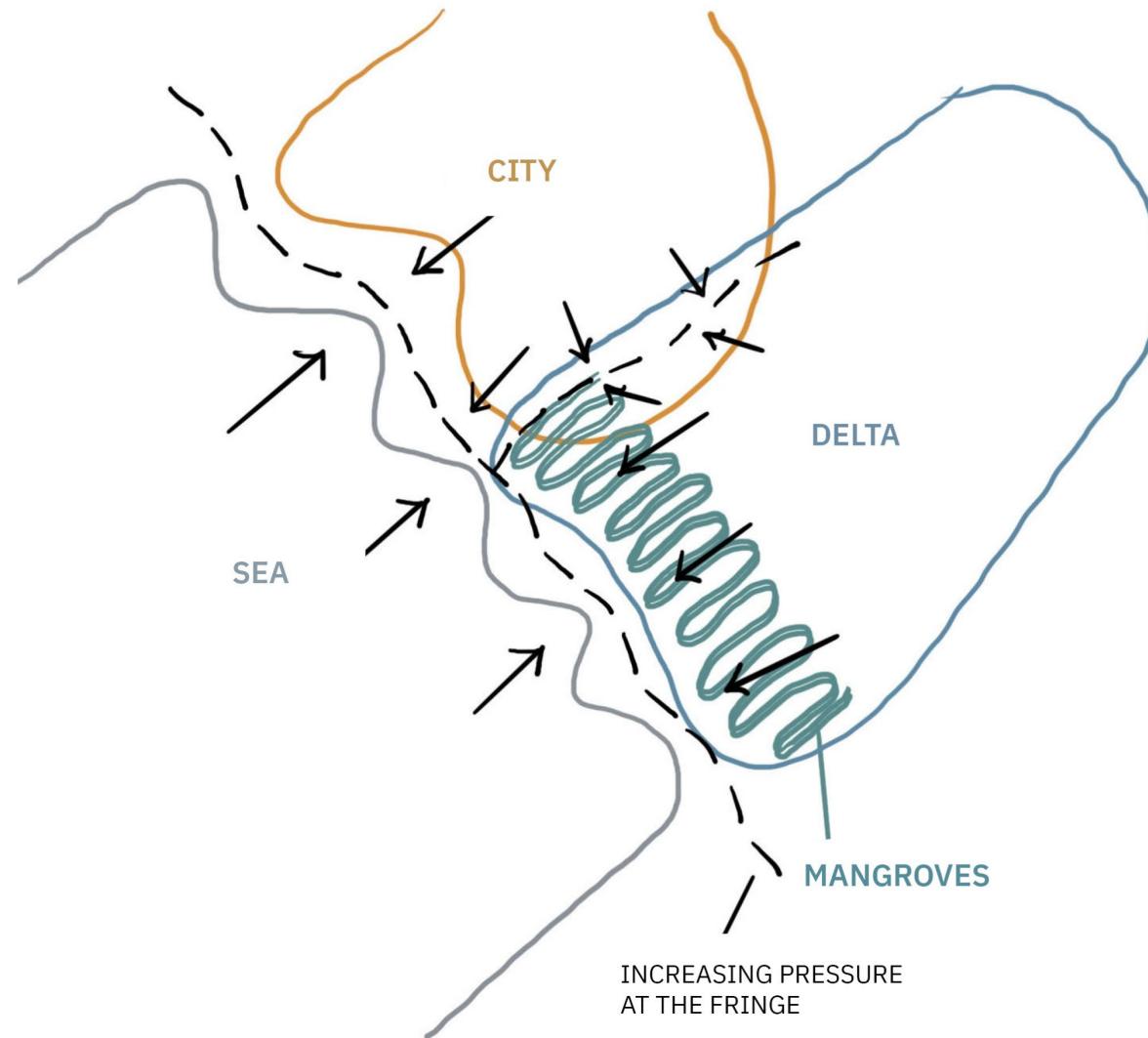


## Indus Delta - Typologies





## Indus Delta Mangroves - Pressure at the Fringe



## Death of the Indus delta

*It was from the port towns of this region that Arab dhows laden with merchandise set sail for distant towns in the days of yore. Today, these towns lie deserted -- an eloquent comment on the ecological devastation that has visited the Indus delta. What went wrong?*

Arif Hasan

Published on: 05 Jan 2012, 1:45 pm

STARVED of fresh water and no longer able to withstand the encroaching Arabian Sea, the Indus is dying a slow death. The channels of this mighty and historic river

## Indus river delta dying a slow death

Construction of dams for irrigation and power has choked off much of its fresh water supply

Web Desk July 09, 2015



PHOTO COURTESY: WWF

The over 3,000-km-long Indus river is a lifeline for several farming and fishing communities in Pakistan, beginning in the Himalayas and flowing down to the Arabian Sea, where it forms a 600,000 hectare delta.

## Why Sindh's farmers are up in arms over the Cholistan canal project

"On the one hand, fertile farmland is being swallowed up by luxury housing schemes. On the other, farmers are being driven further from their livelihoods. How can we justify this?" questions WWF-P's Hammad Naqi Khan.



## Sorrow Of The Indus Delta And Its Displaced People

Zuhail Ahmed Pirzada

Climate Crisis, Pakistan Floods Update, SPOTLIGHT, Features, Environment, Main Slider

October 7, 2022



## Ignored by Pakistan, the Indus delta is being lost to the sea

If authorities do not act fast, the Indus delta will cease to exist, spurring mass migration and huge ecological consequences

ENGLISH



## A nearly dead delta

One of predominant sources of this degradation is severely curtailed water discharge downstream of Kotri Barrage

By Masood Lohar April 18, 2022



A VIEW of the Indus river delta from space.—Nasa/File



# WHY IS THE INDUS DELTA DYING?

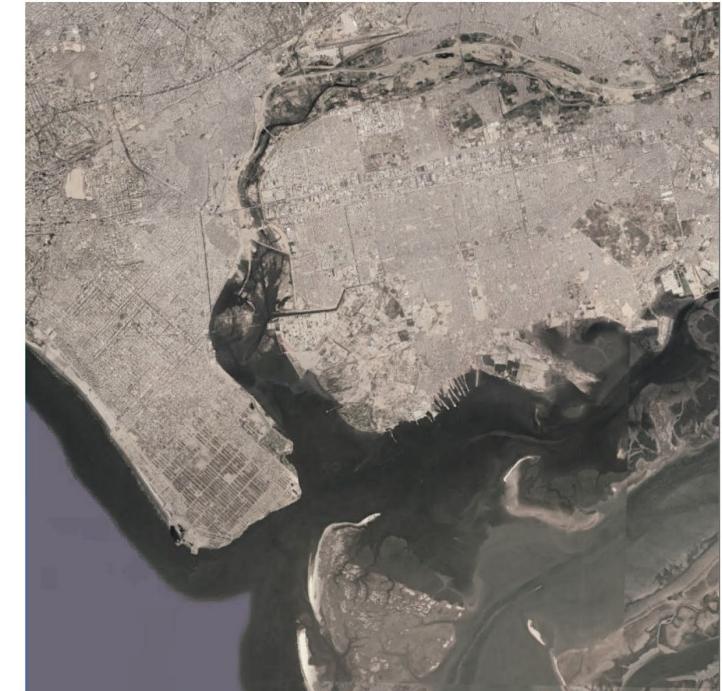
## Pressures on the Indus Delta



Freshwater Scarcity and Sediment Disruption



Sea Level Rise and Salinisation



Urban Densification

## Pressures on the Indus Delta



Freshwater Scarcity and Sediment Disruption



Sea Level Rise and Salinisation

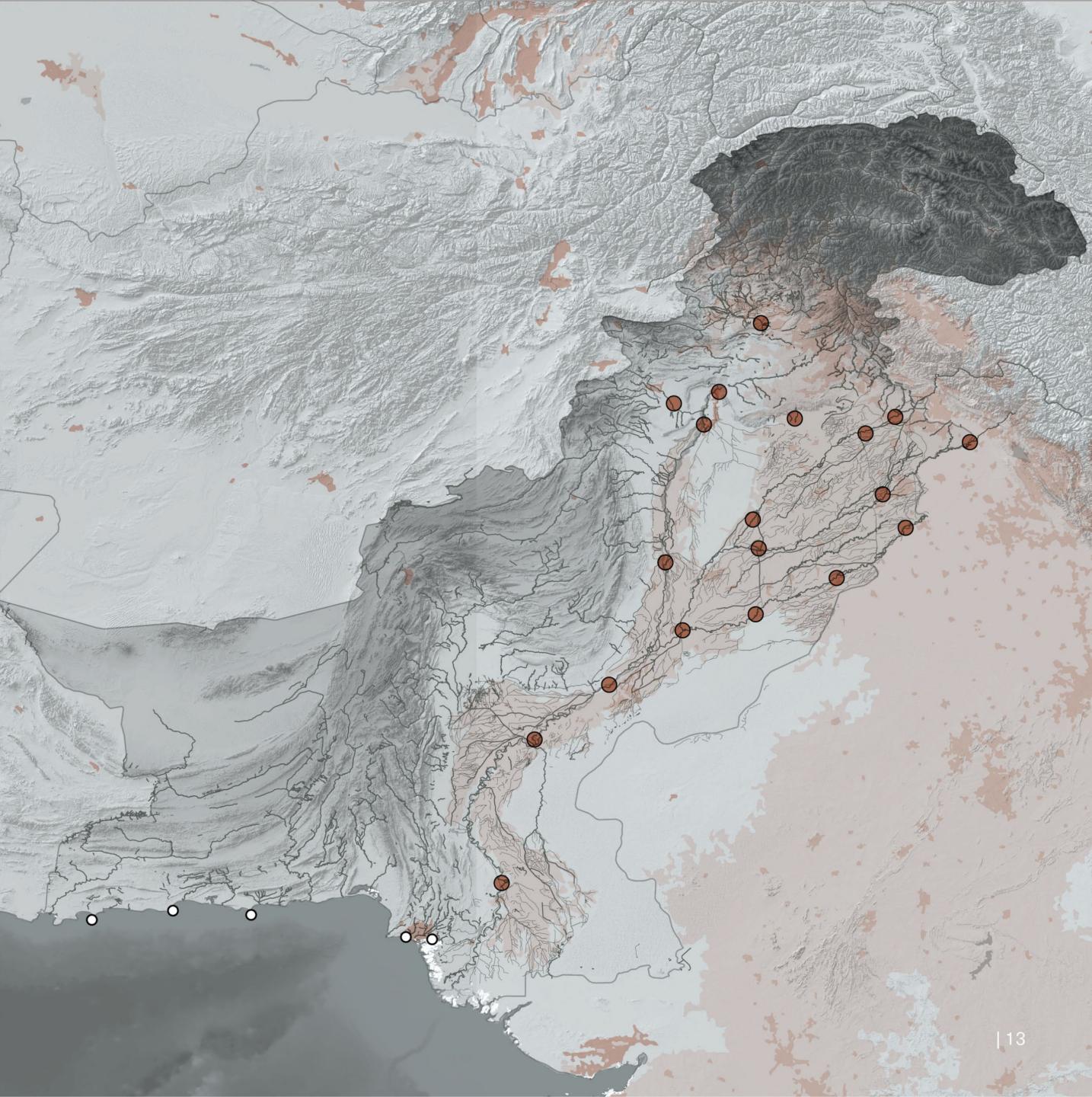


Urban Densification

# 1. Freshwater Scarcity and Sediment Disruption *Hydropolitics*

- Built-up (high density)
- Built-up (low Density)
- Mangrove Forests
- River Network
- Dams
- Ports

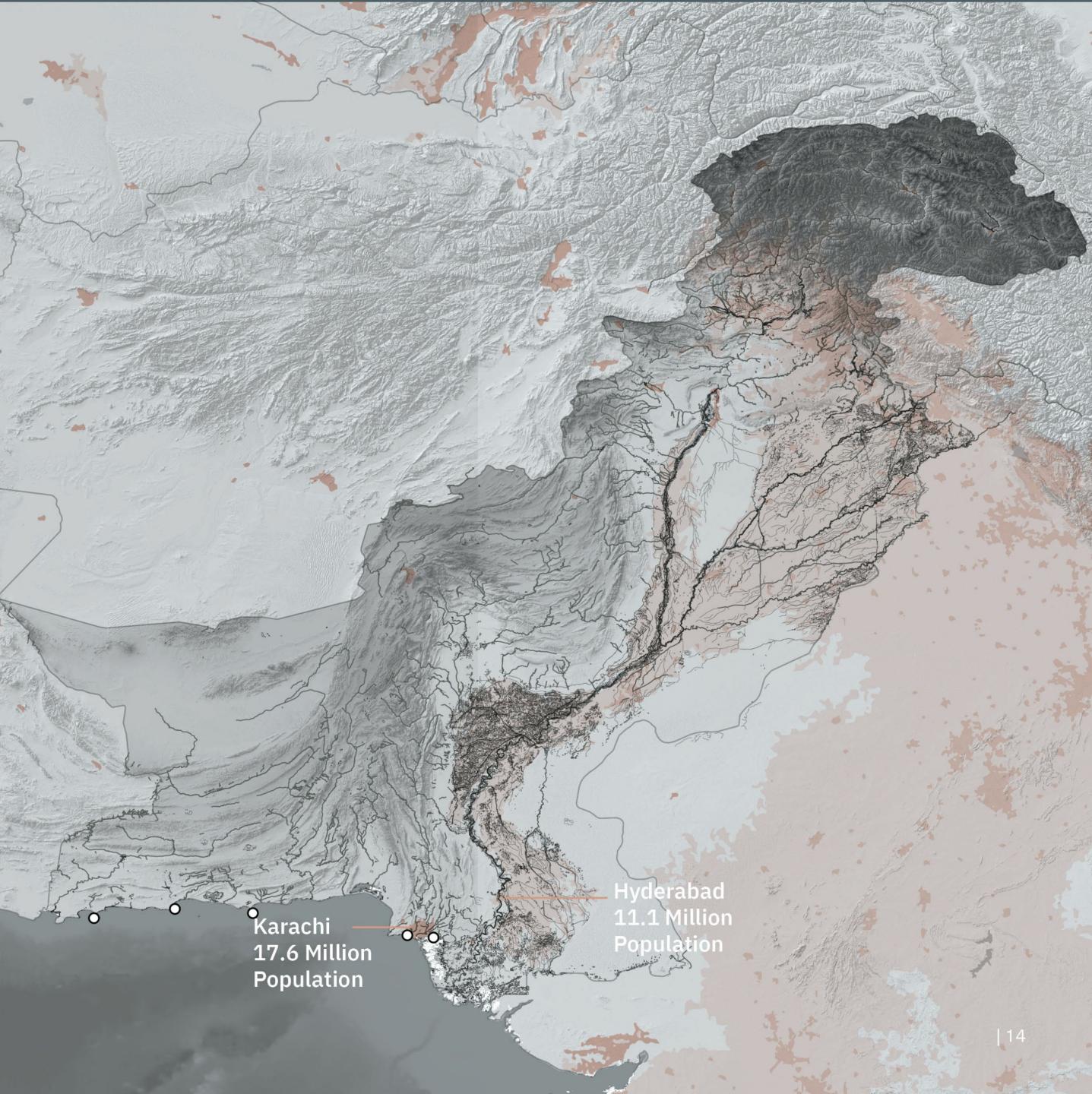
0 100 200 km



## 1. Freshwater Scarcity and Sediment Disruption *Flood Risk*

- Built-up (high density)
- Built-up (low Density)
- Mangrove Forests
- Maximum Flood Extent (Jul-Aug'24)
- River Network
- Ports

0 100 200 km



## Pressures on the Indus Delta



Freshwater Scarcity and Sediment Disruption

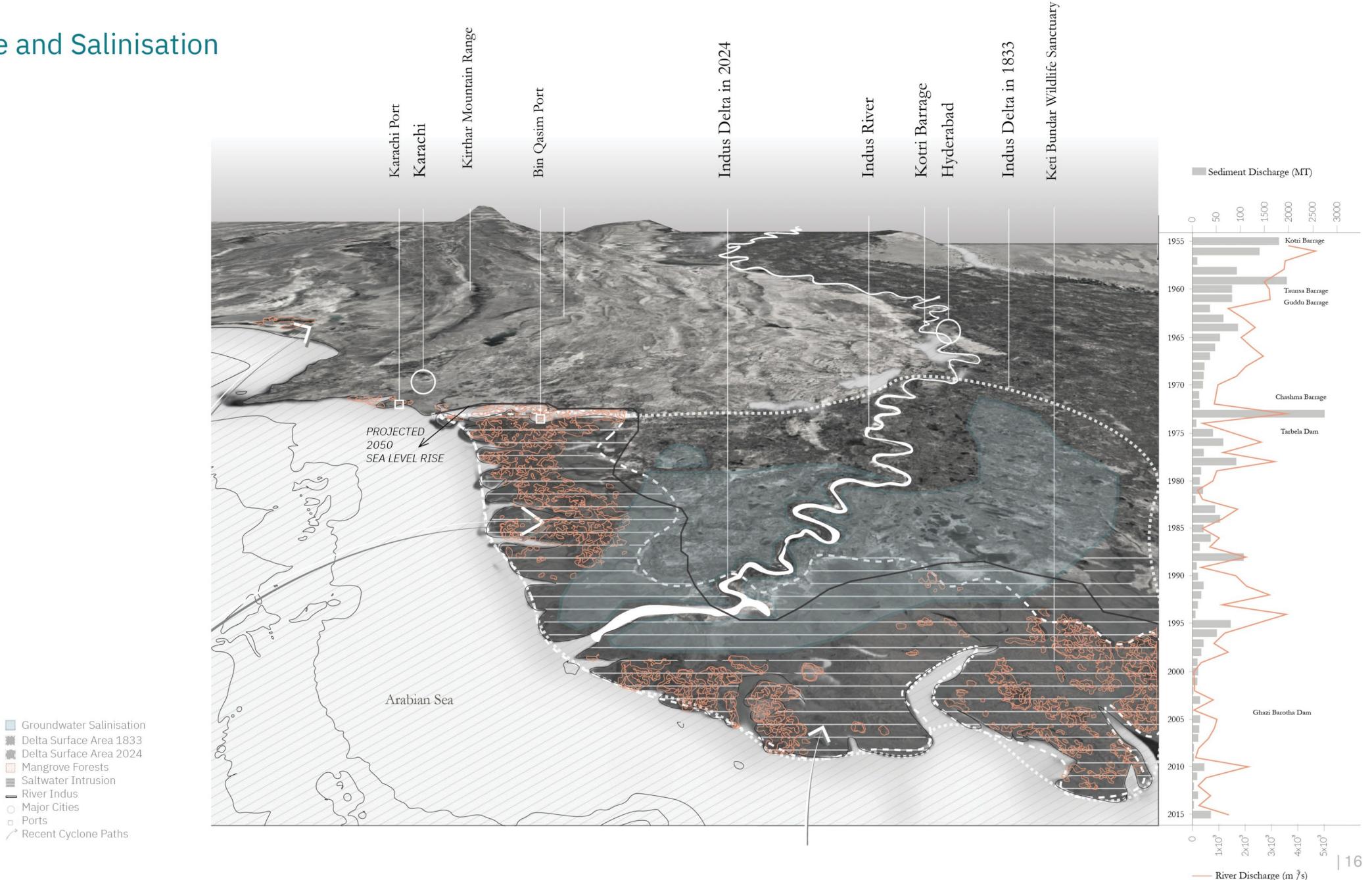


Sea Level Rise and Salinisation



Urban Densification

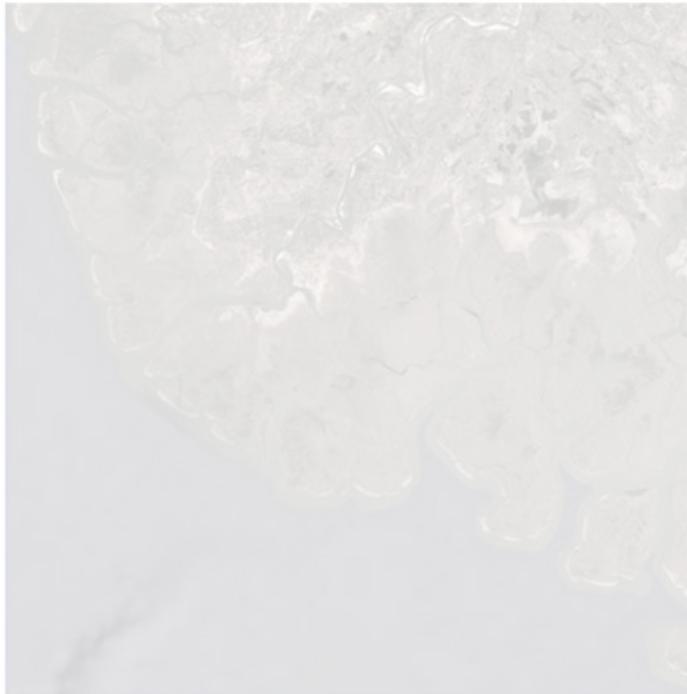
## 2. Sea Level Rise and Salinisation



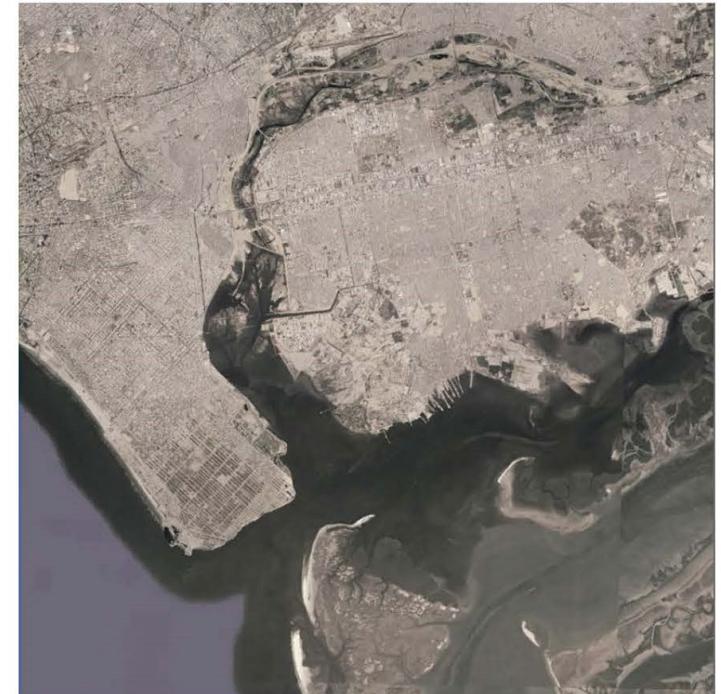
## Pressures on the Indus Delta



Freshwater Scarcity and Sediment Disruption

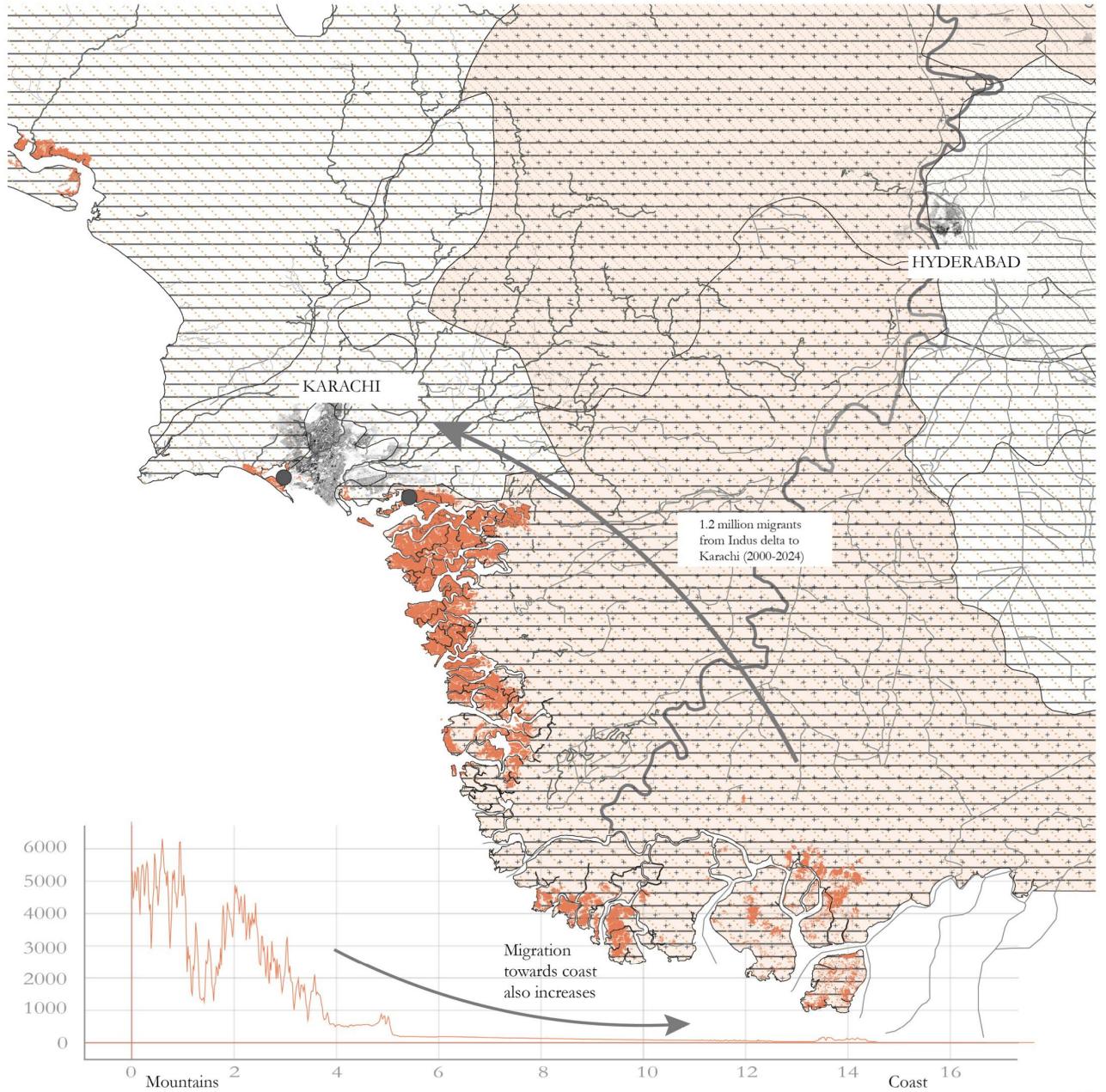


Sea Level Rise and Salinisation



Urban Densification

### 3. Urban Densification *Rural to Urban Migration*



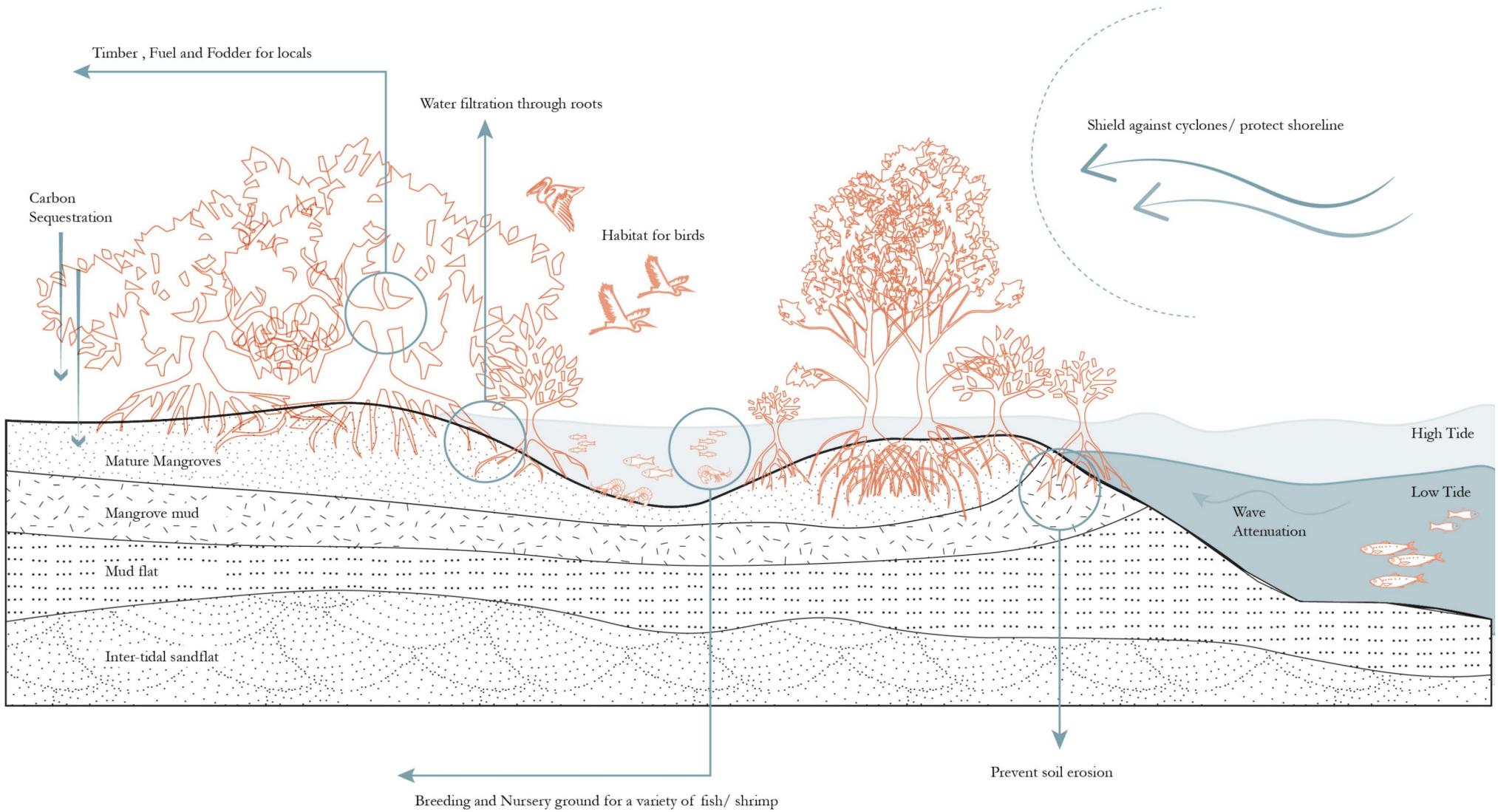
### 3. Urban Densification *Karachi's Expansion*

- District Boundary
- Karachi Urban Area 2020
- Karachi Urban Area 2000
- River Network
- Ports

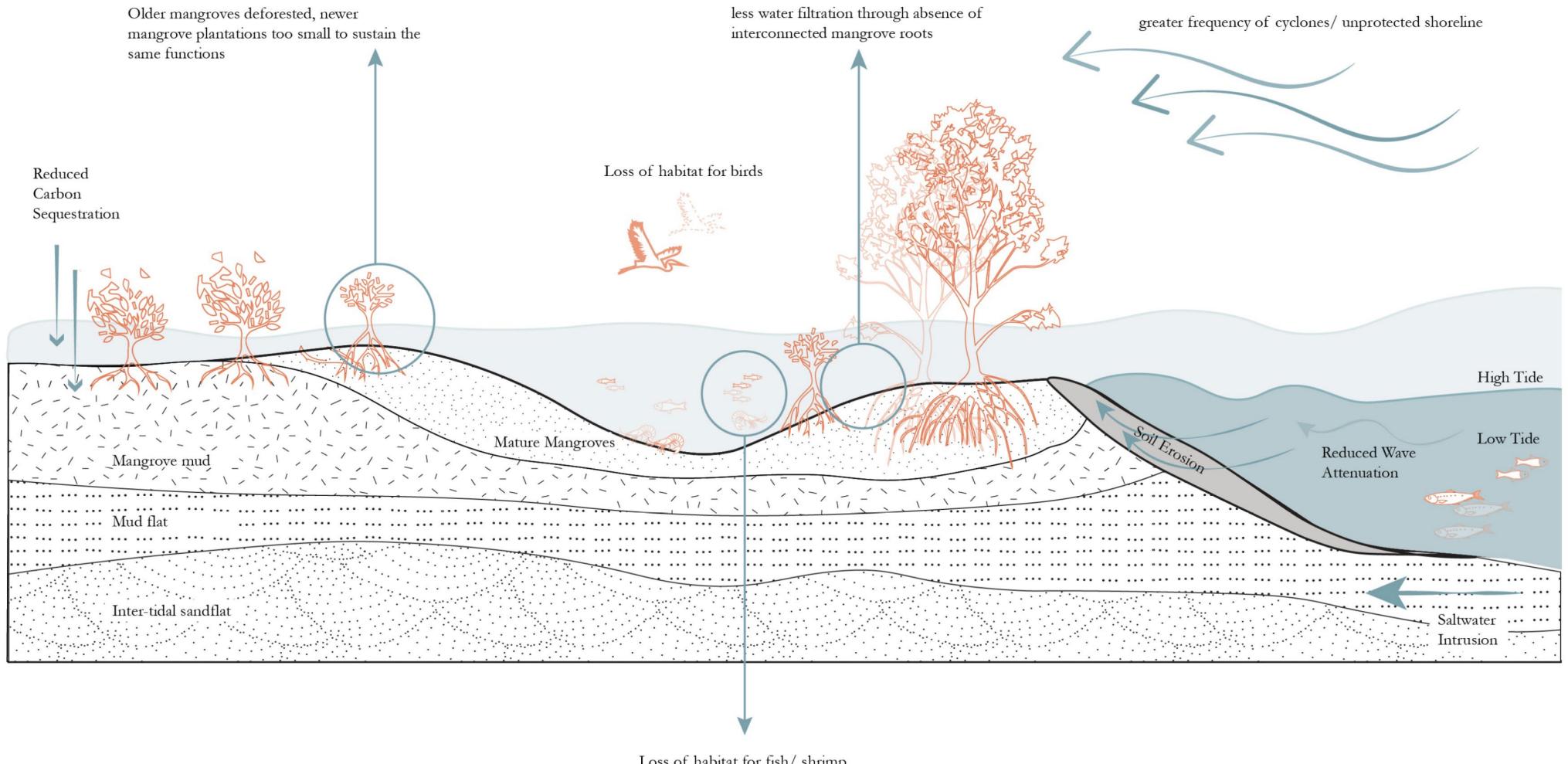
0 | 10 | 20 km



## Impact on Mangrove Ecosystems



## Impact on Mangrove Ecosystems



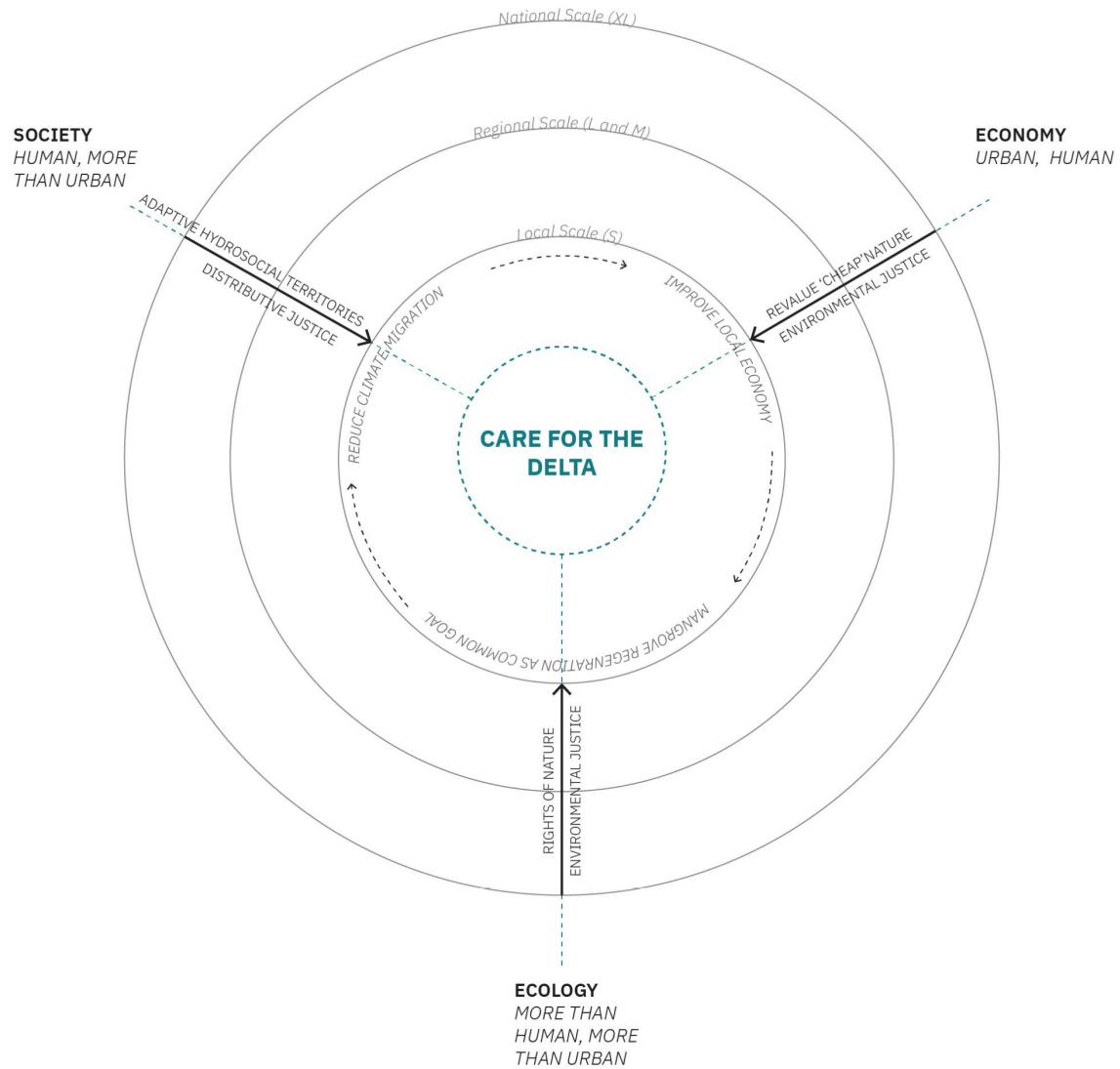
How can **networks of care**, enable humans to nurture the **Indus Delta mangrove ecosystem**, fostering **harmony** between **human** and **more-than-human** populations?



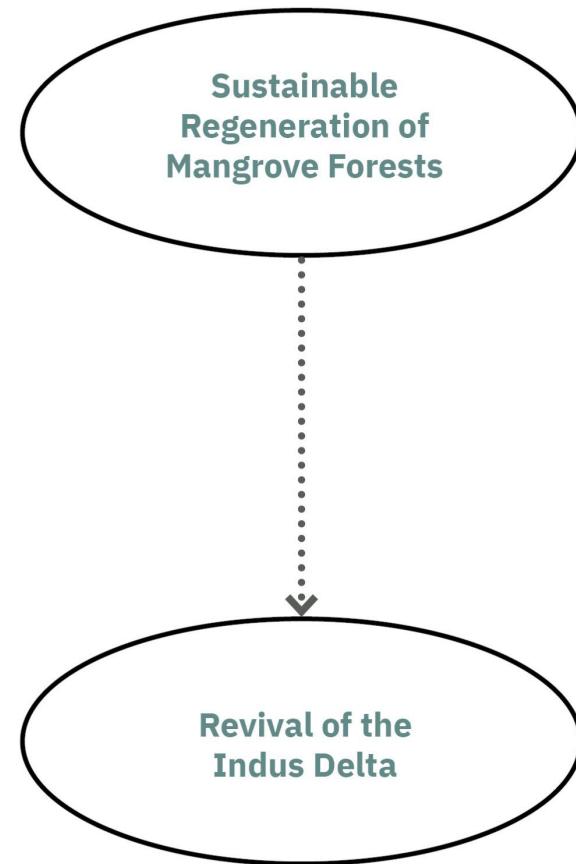
## What is 'Care'?



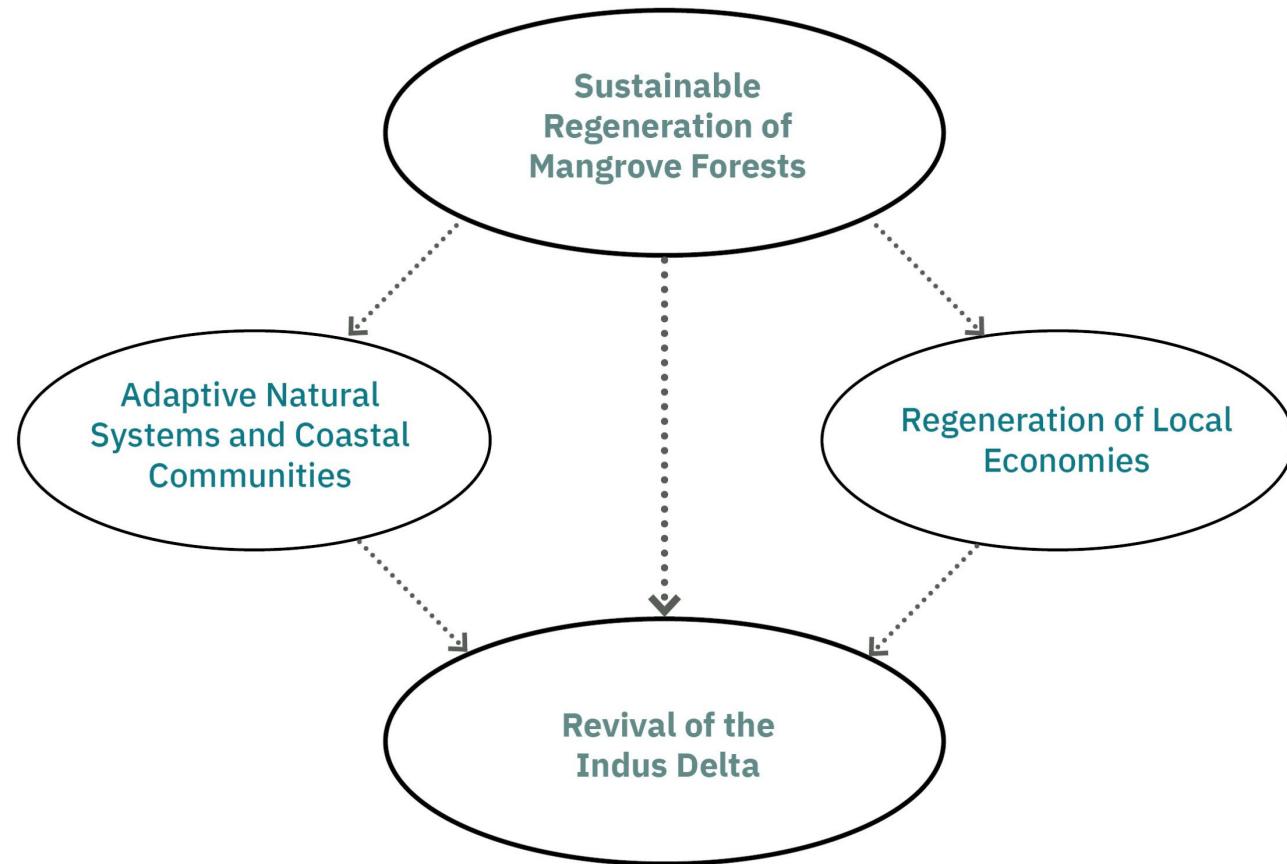
## Conceptual Framework



## Research Aim



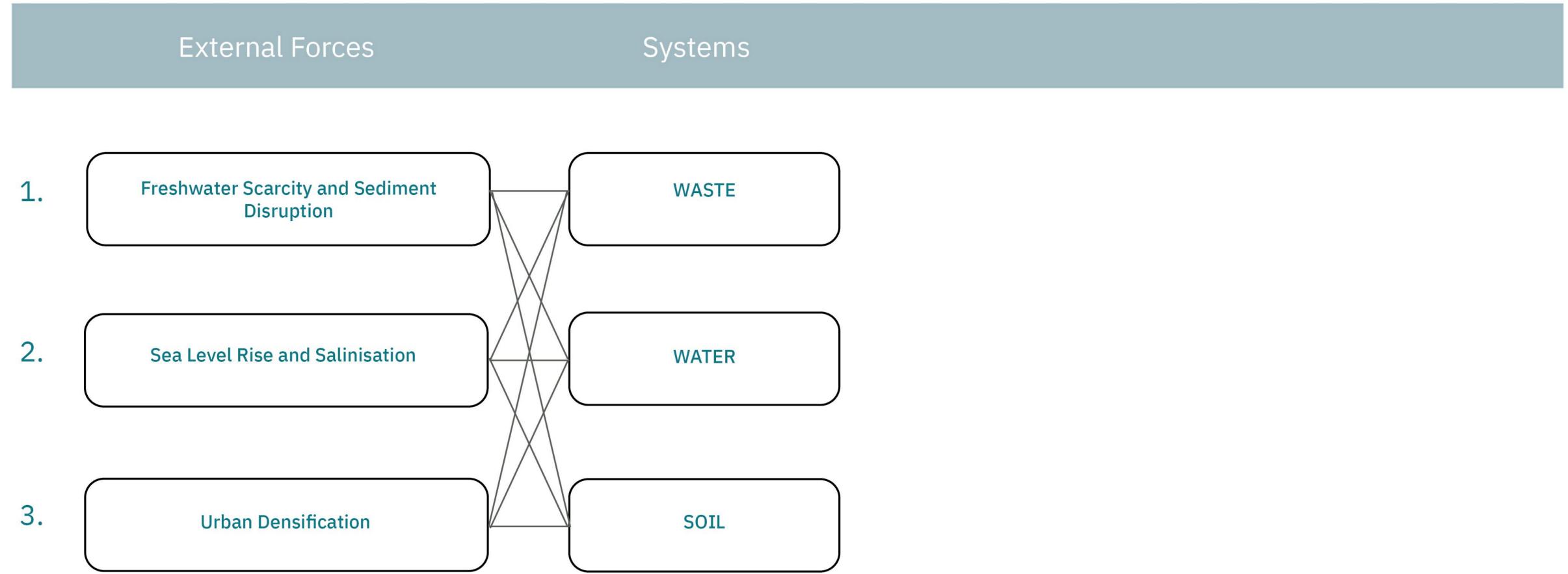
## Research Aim



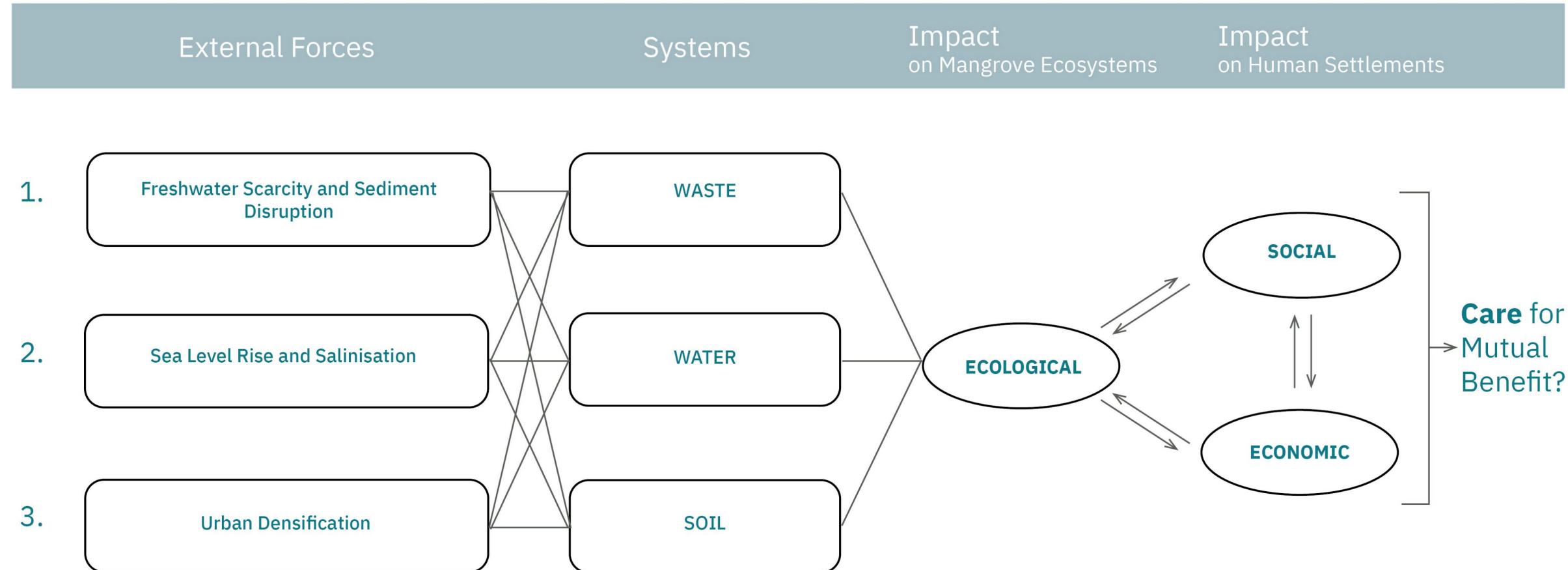
# METHODOLOGY



## Analysis Framework



## Analysis Framework



# Approach

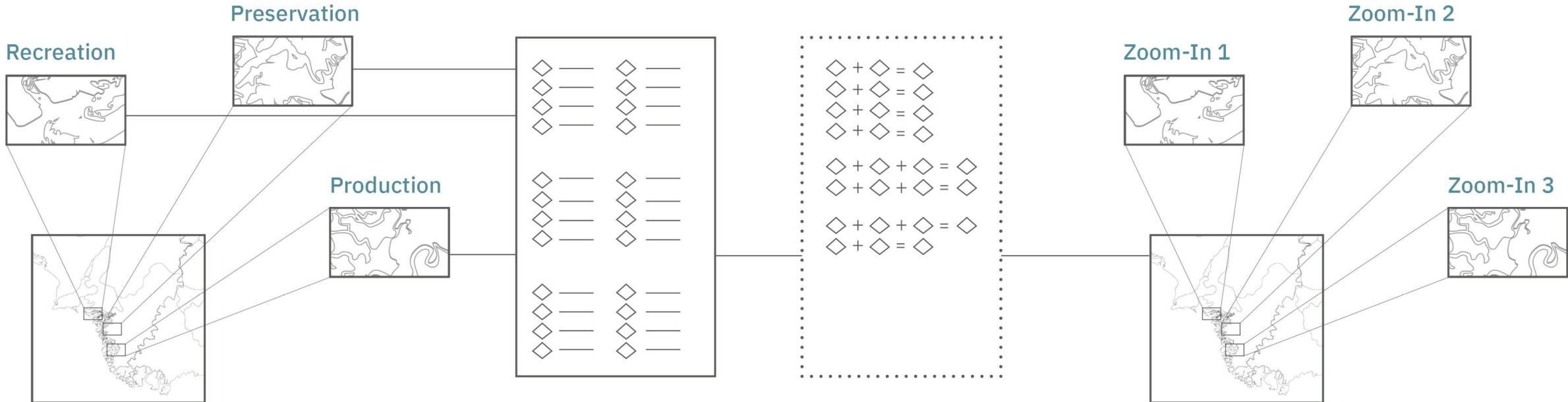
*Research By Design*

## Scenarios as Networks of Care

## Toolkit Extraction

## Toolkit Combinations Evaluation

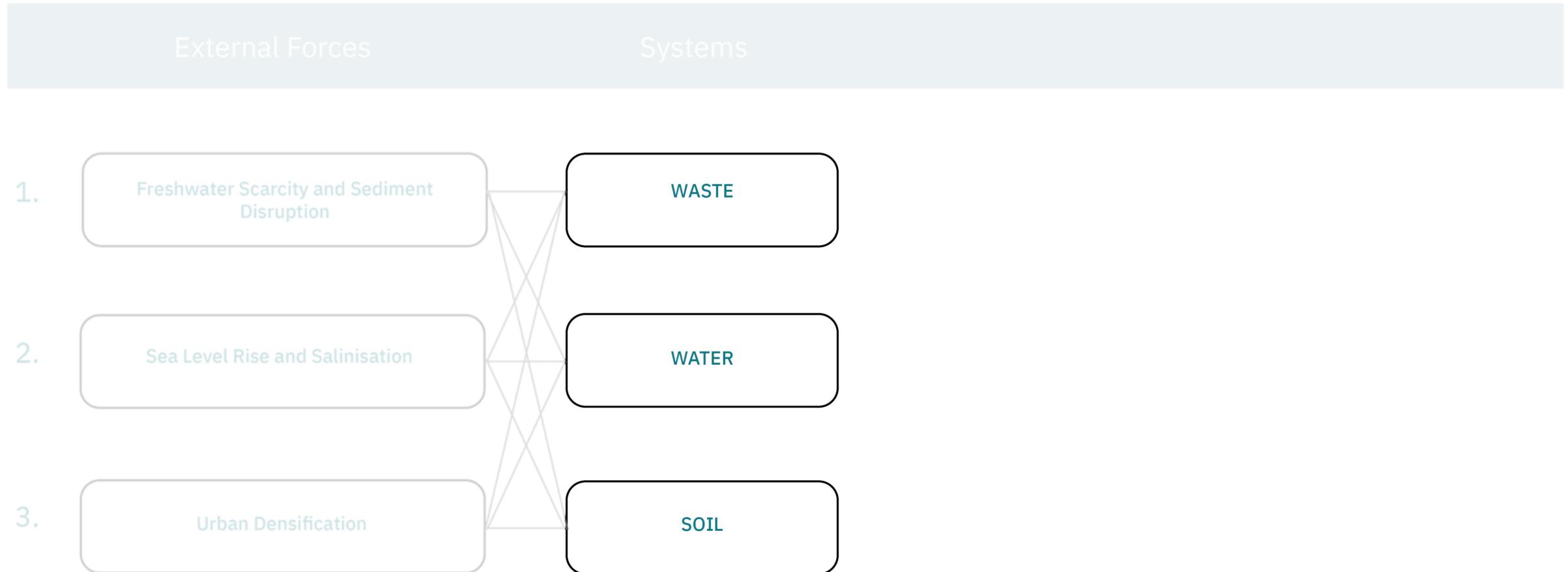
## Proposed Vision



# ANALYSIS



## Analysis Framework



## Delta - Freshwater Flow

- District Boundary
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake
- River Network
- Sea

0 | 10 | 20 km



## Delta - Land-Use

District Boundary

Built-up  
Agriculture  
Grassland  
Shrubland  
Wetlands  
Mangroves

River Network

Sea

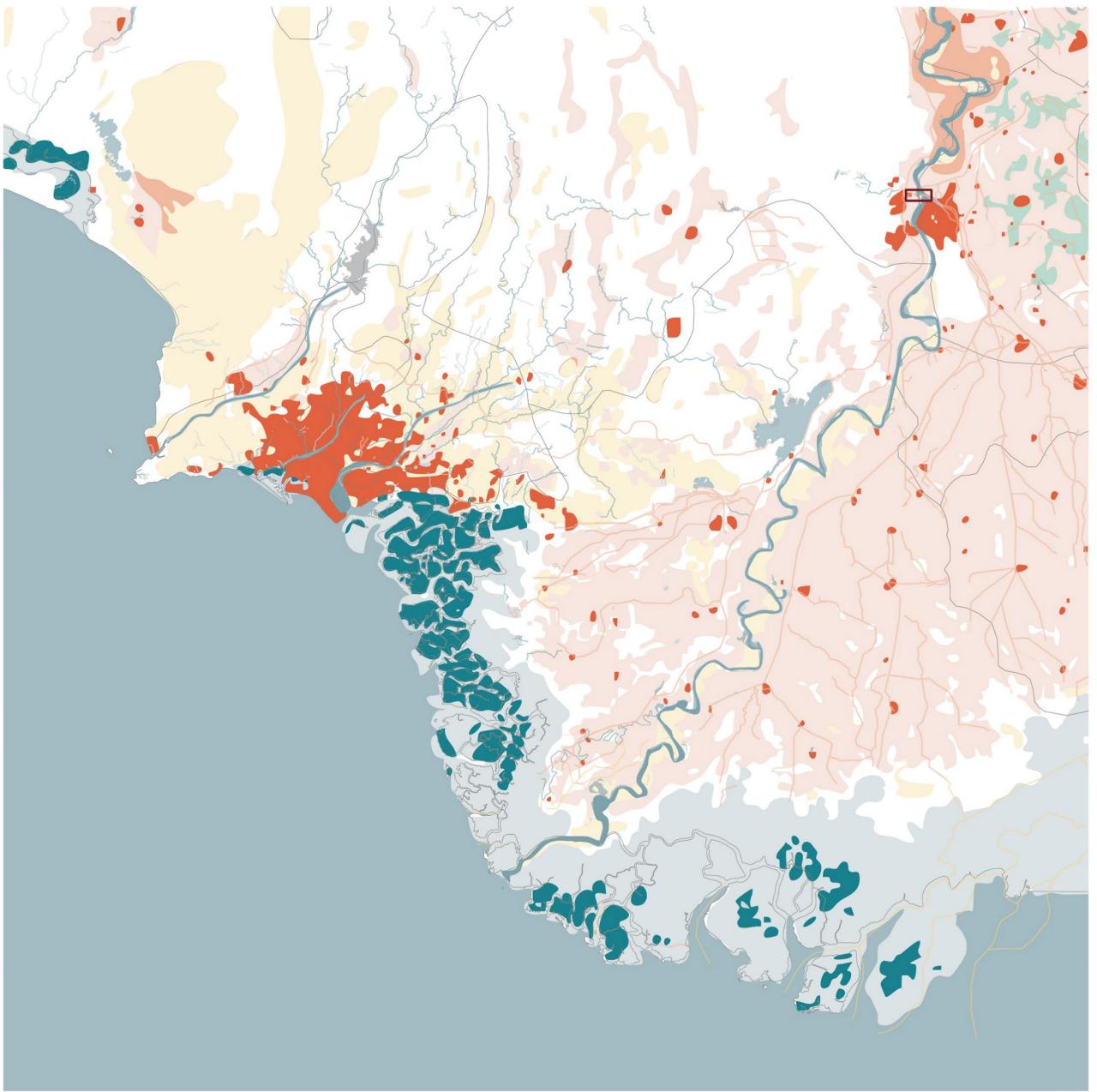
Dam/ Barrage

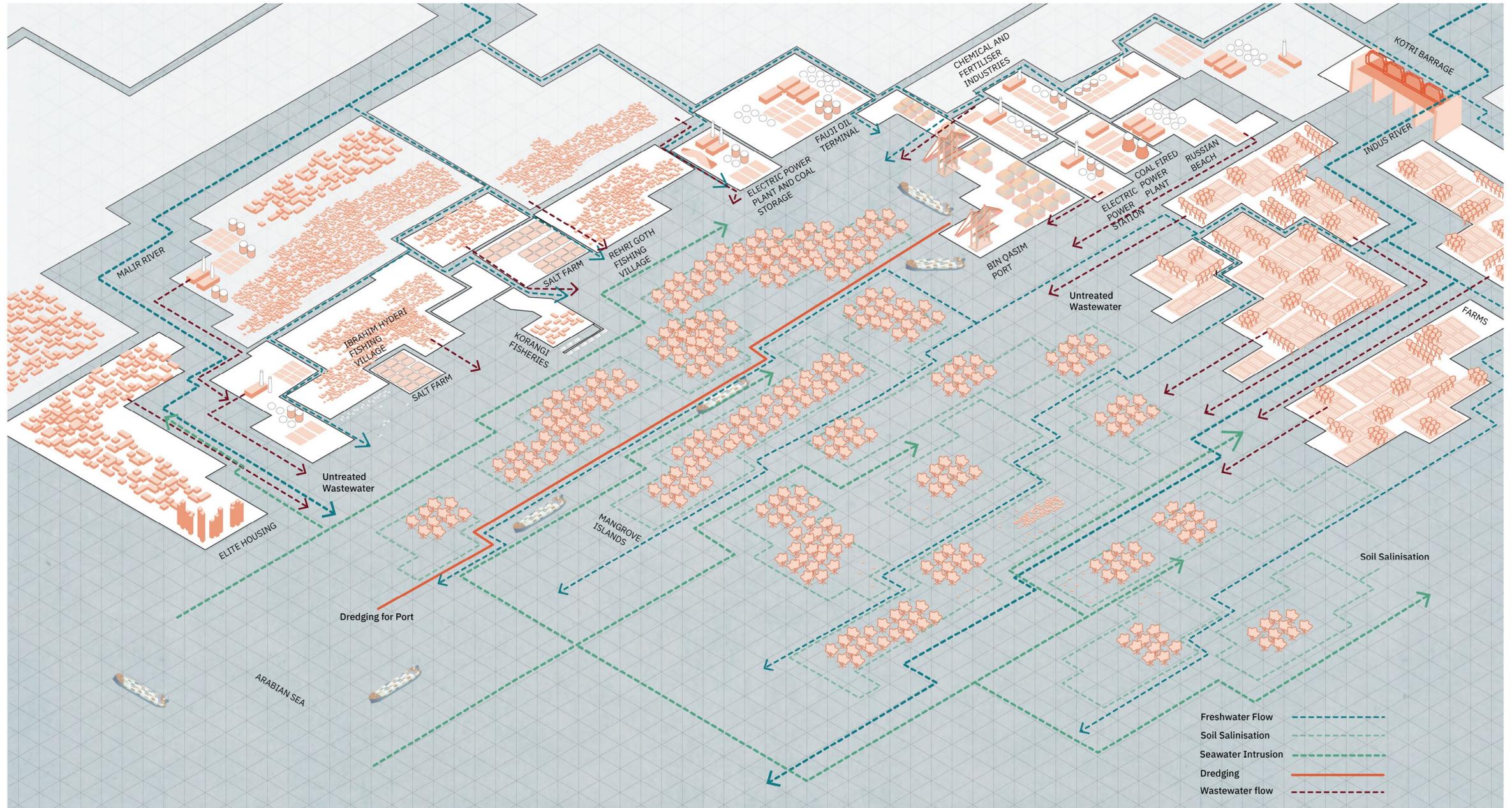
Canal  
Ditch  
Stream  
Tidal channel  
Marsh

Reservoir

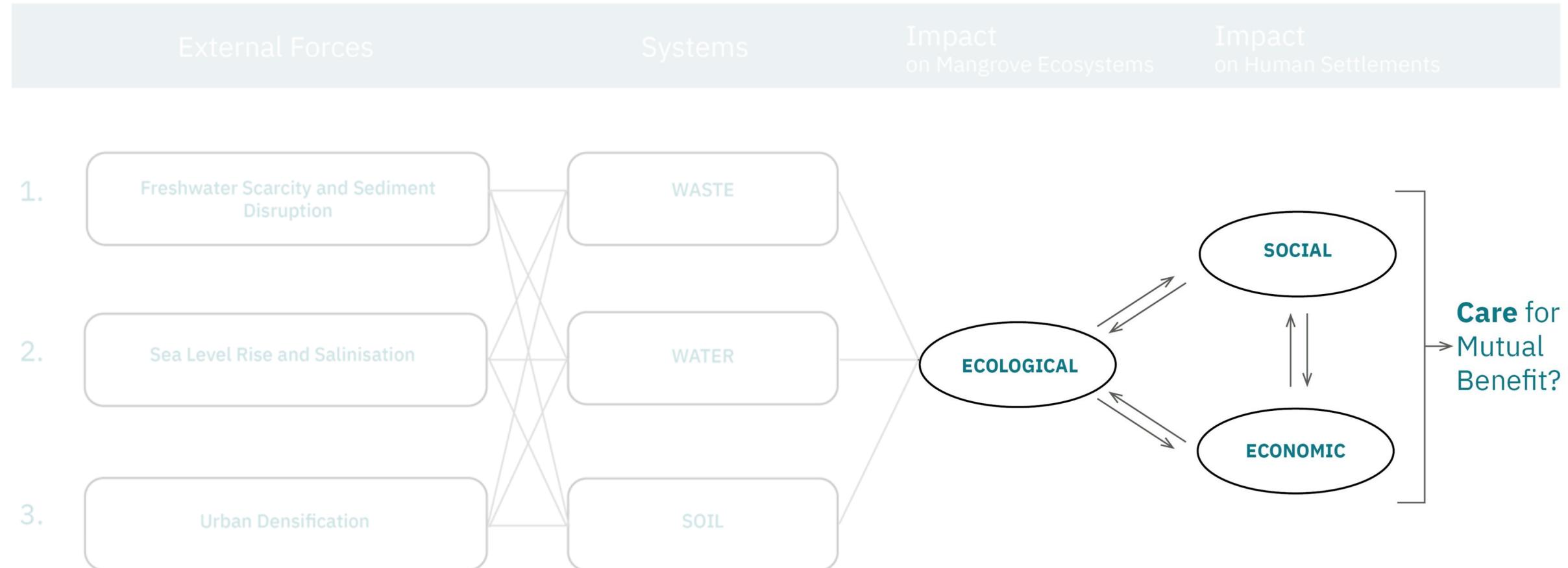
Lake

0 10 20 km





## Analysis Framework



# FIELDWORK



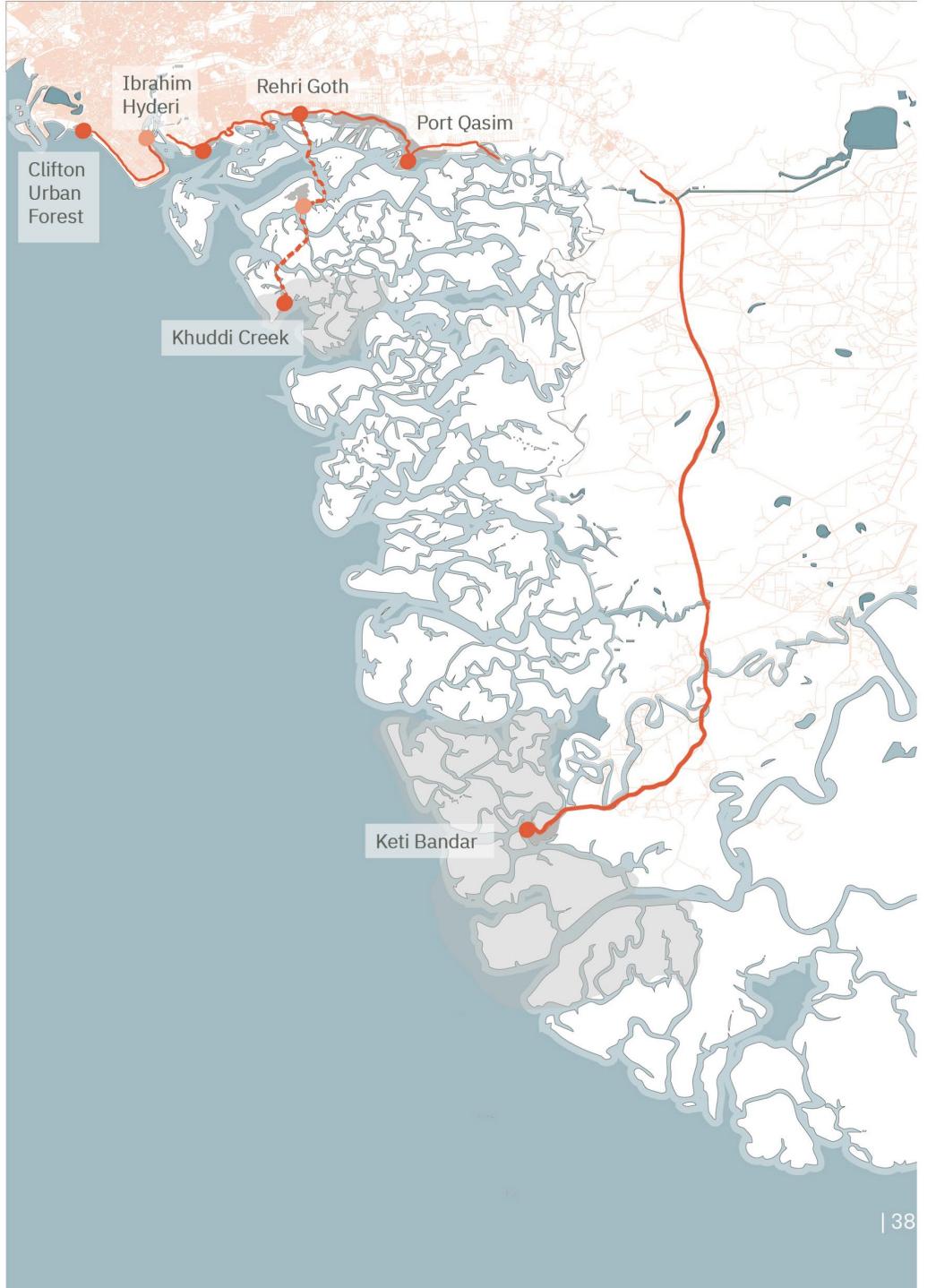
## Fieldwork Routes

- Water Networks
- Road Networks
- Fieldwork Route
- Points of Interest

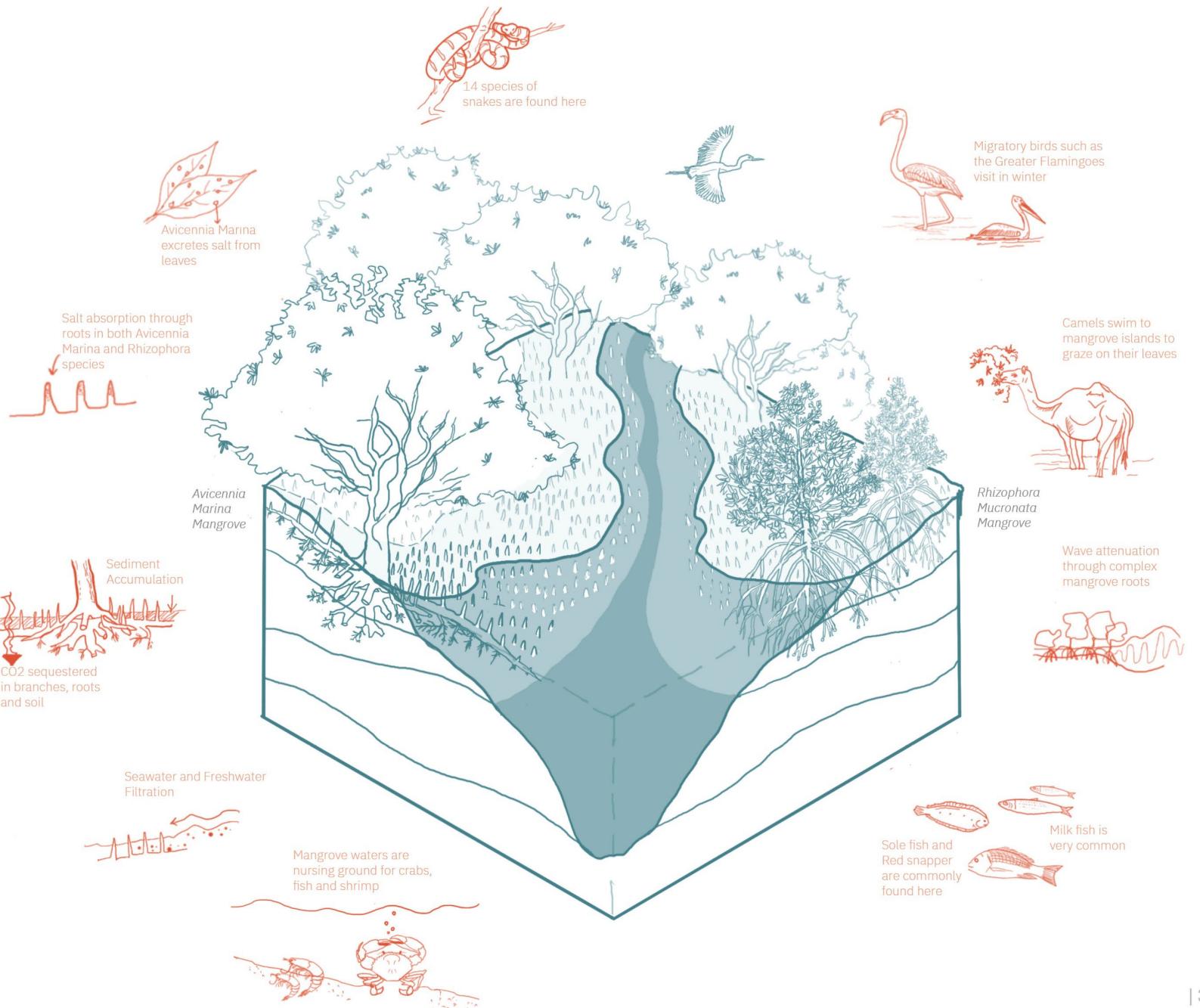
Fishing Villages by density (high - low):

- ① Ibrahim Hyderi
- ② Rehri Goth
- ③ Keti Bandar
- ④ Khuddi Creek

0 10 20 km



# More-than-Human/ More-than-Urban Ecology



# More-than-Human/ More-than-Urban Ecology

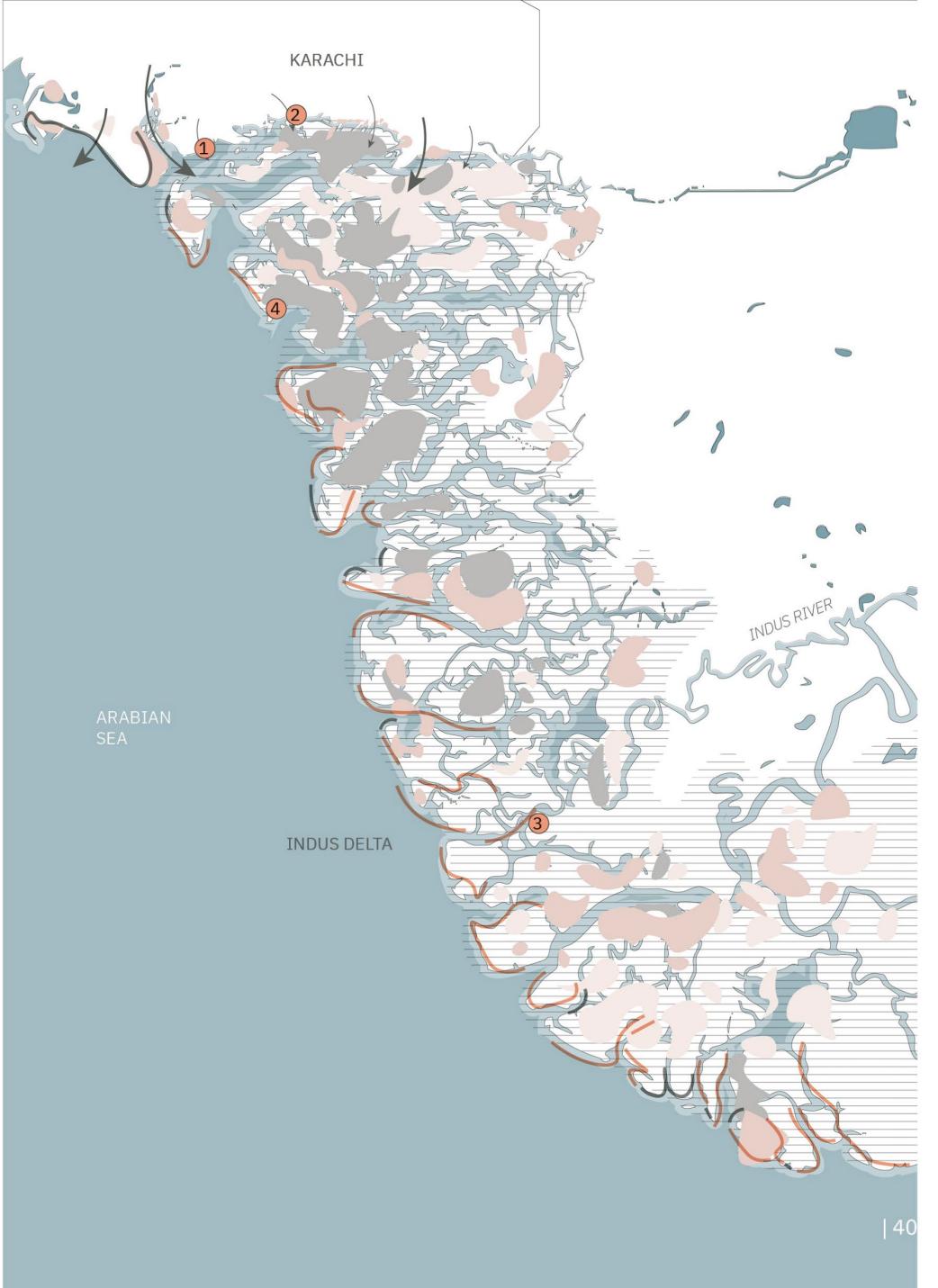
- Water Networks
- ≡ Seawater Intrusion
- Wastewater flow from Karachi
- Sediment Erosion
- Sediment Accretion

Fishing Villages by density (high - low):

- ① Ibrahim Hyderi
- ② Rehri Goth
- ③ Keti Bandar
- ④ Khuddi Creek

Mangrove Loss  
Mangrove Gain  
No Change in Mangroves

0 10 20 km



# Human/ More-Than-Urban Society

Rehri Goth

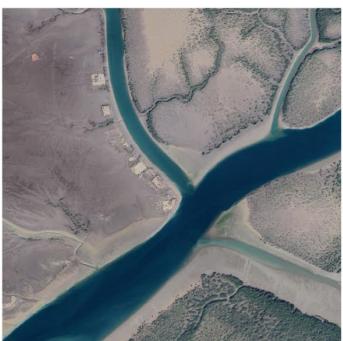


Dense Urban Village

Keti Bandar



Khuddi Creek



Small cluster of homes

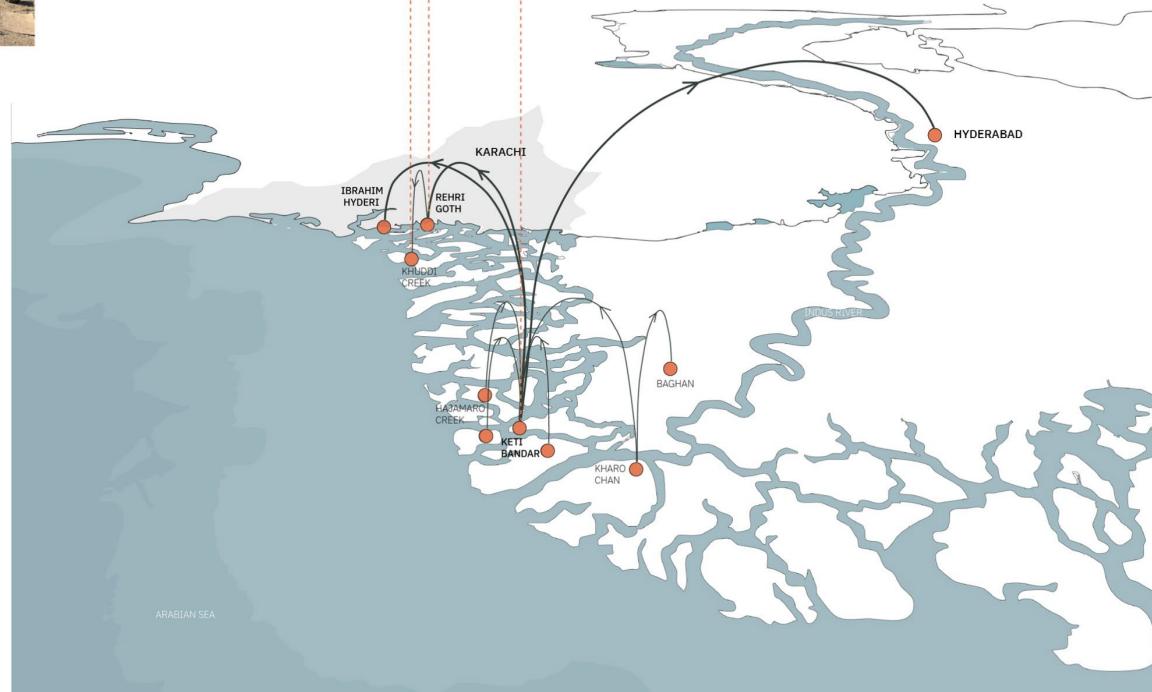
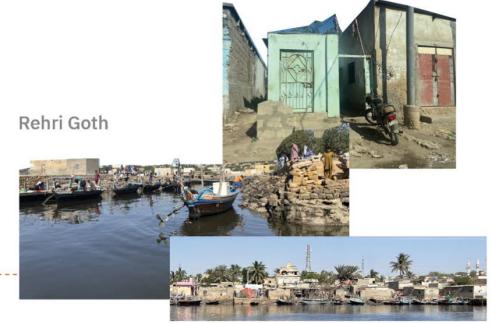
Khuddi Creek



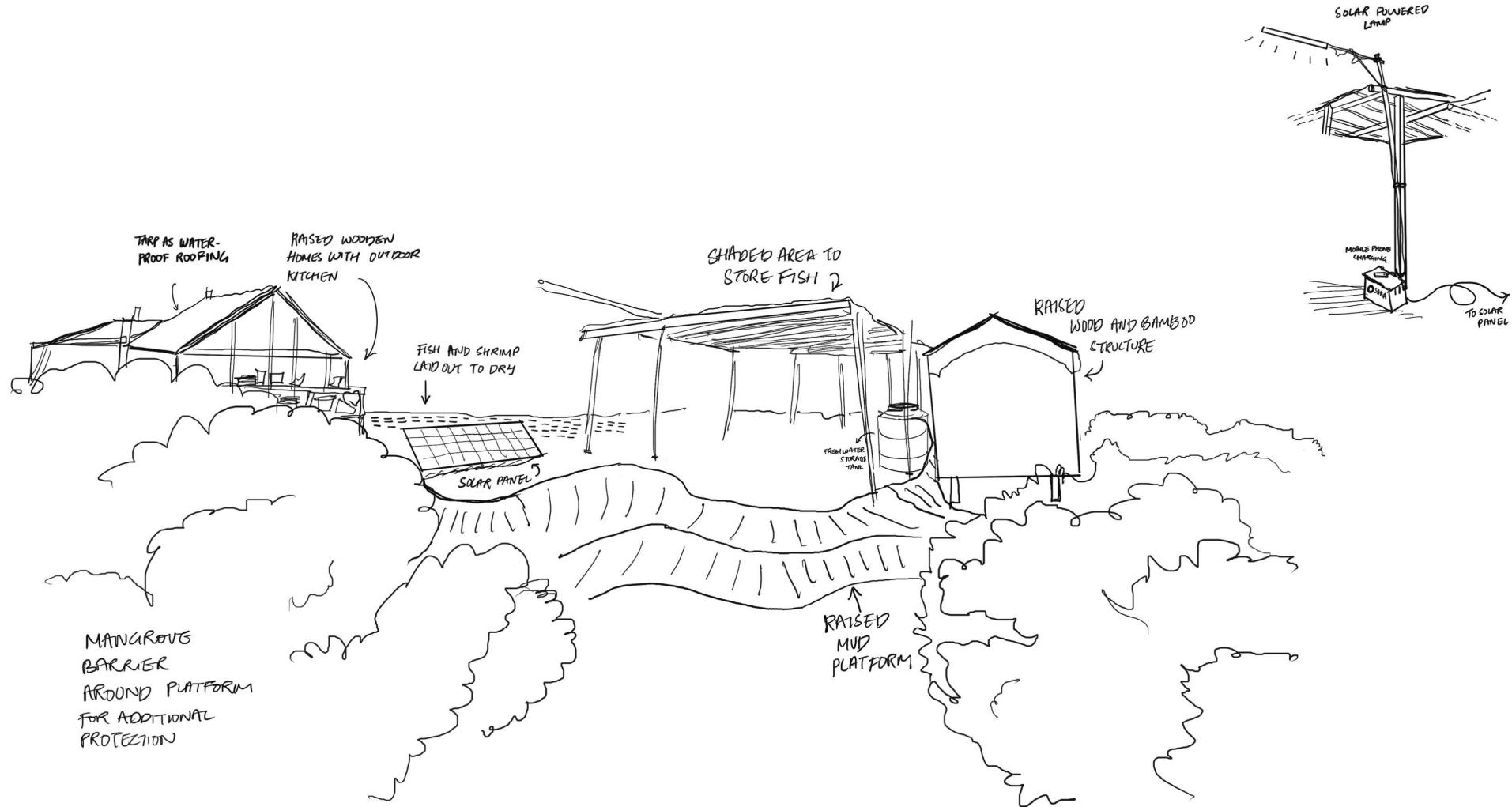
Keti Bandar



Rehri Goth



## Human/ More-Than-Urban Society - Remote Fishing Settlements



## Human/ Urban Economy

■ Water Networks  
■ Ship Route from Port  
■ Road Network  
■ Mangrove Forests

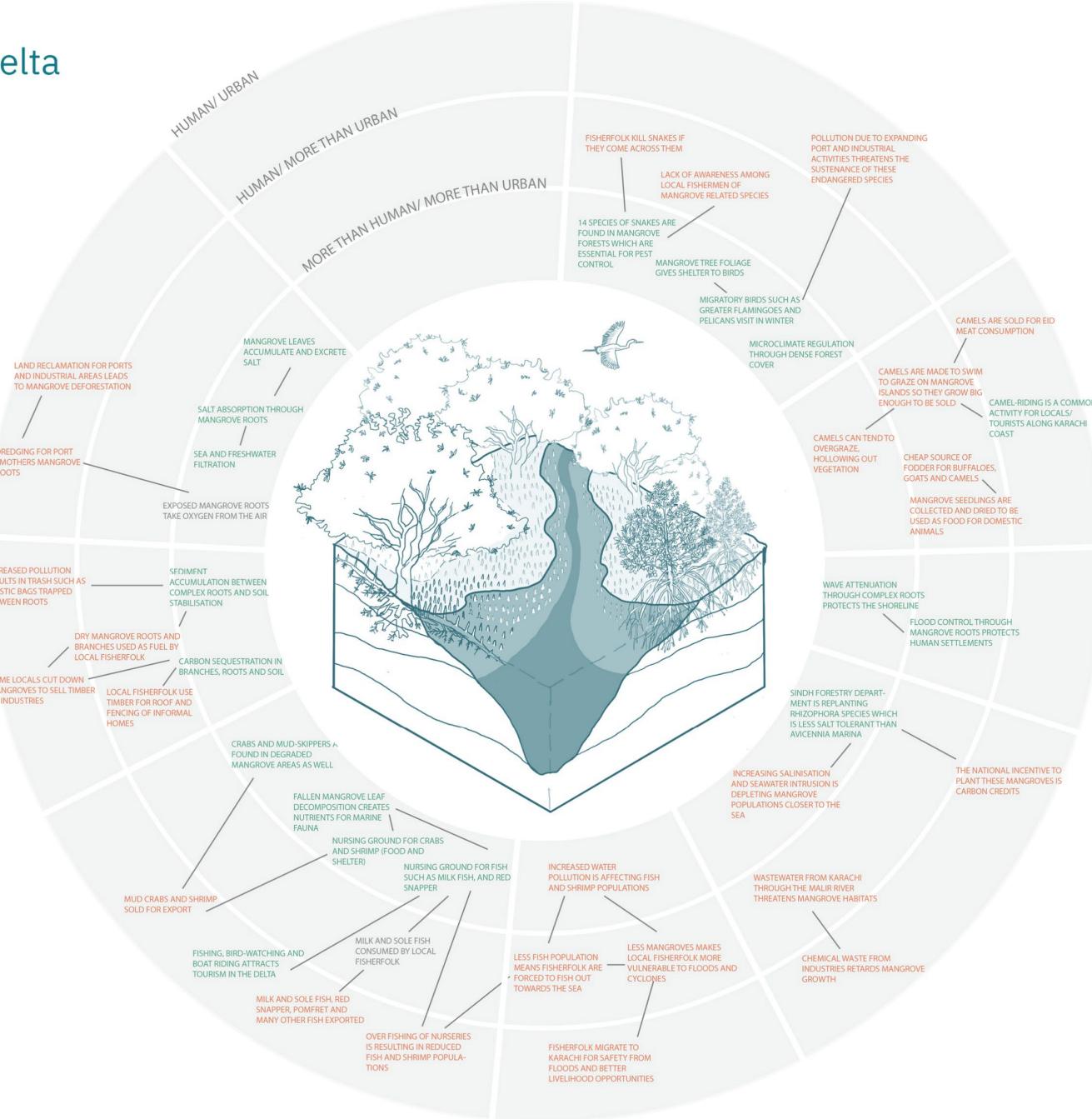
Fishing Villages by density (high - low):  
① Ibrahim Hyderi  
② Rehri Goth  
③ Keti Bandar  
④ Khuddi Creek

■ Reclaimed Land through Mangrove Deforestation  
→ Wastewater flow from Karachi

0 10 20 km



# Mangroves as Core of the Delta



## Local Case Studies

### Existing Relationship With Mangroves

#### RECREATION



*Fishing Tours by Local Fisherfolk*  
(Source: khanaymeikyahai)



*Mangrove Biodiversity Park, Karachi  
(2024) by TPL* (Source: TPL Website)

#### PRESERVATION



*Local Replantation Efforts* (Source: Arab News)



*Environmental Activists on Social Media* (Source: Shah Mehran)

#### PRODUCTION



*Local fishing practices*  
(Source: M. Hussain Khan)

*IUCN Shrimp Aquaculture Project - Bottom-up Initiative, Indus Delta.*  
(Source: IUCN)

# NETWORKS OF CARE



## RECREATION



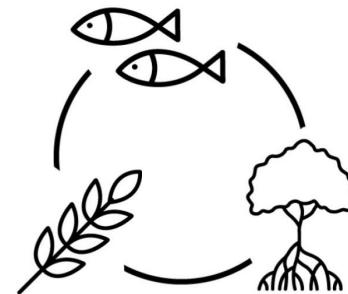
Reconnecting mangroves  
with urban life

## PRESERVATION



Restoring natural flows and  
sedimentation processes

## PRODUCTION



Creating adaptive livelihoods  
through agricultural gradients.

**RECREATION**



**Reconnecting mangroves  
with urban life**

**PRESERVATION**



**Restoring natural flows and  
sedimentation processes**

**PRODUCTION**



**Creating adaptive livelihoods  
through agricultural gradients.**

## Delta: Existing Condition

District Boundary

Built-up

Agriculture

Grassland

Shrubland

Wetlands

Mangroves

River Network

Sea

Dam/ Barrage

Canal

Ditch

Stream

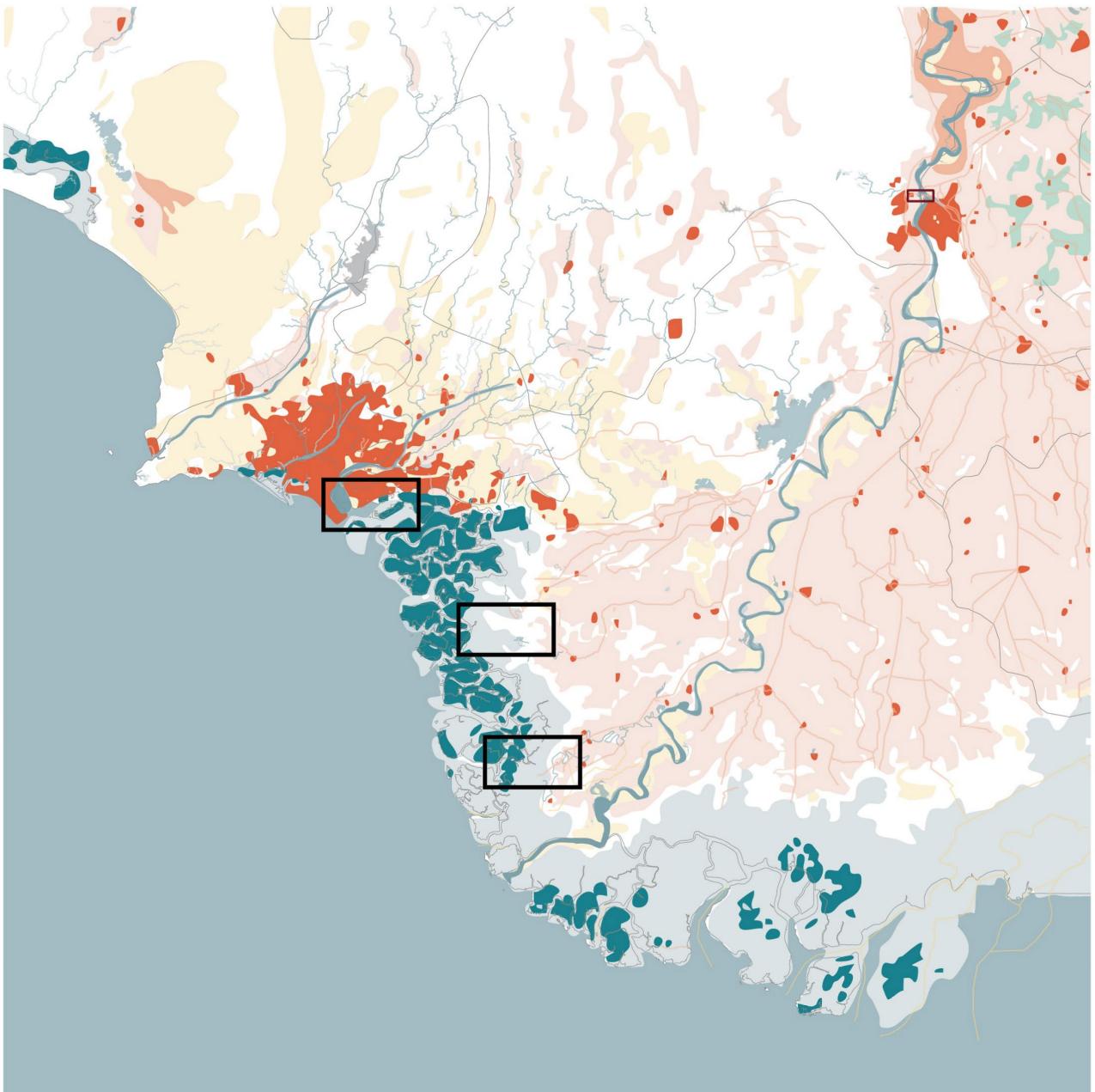
Tidal channel

Marsh

Reservoir

Lake

0 | 10 | 20 km



## Network of Recreation

District Boundary

Built-up

Agriculture

Grassland

Shrubland

Wetlands

Mangroves

River Network

Sea

Dam/ Barrage

Canal

Ditch

Stream

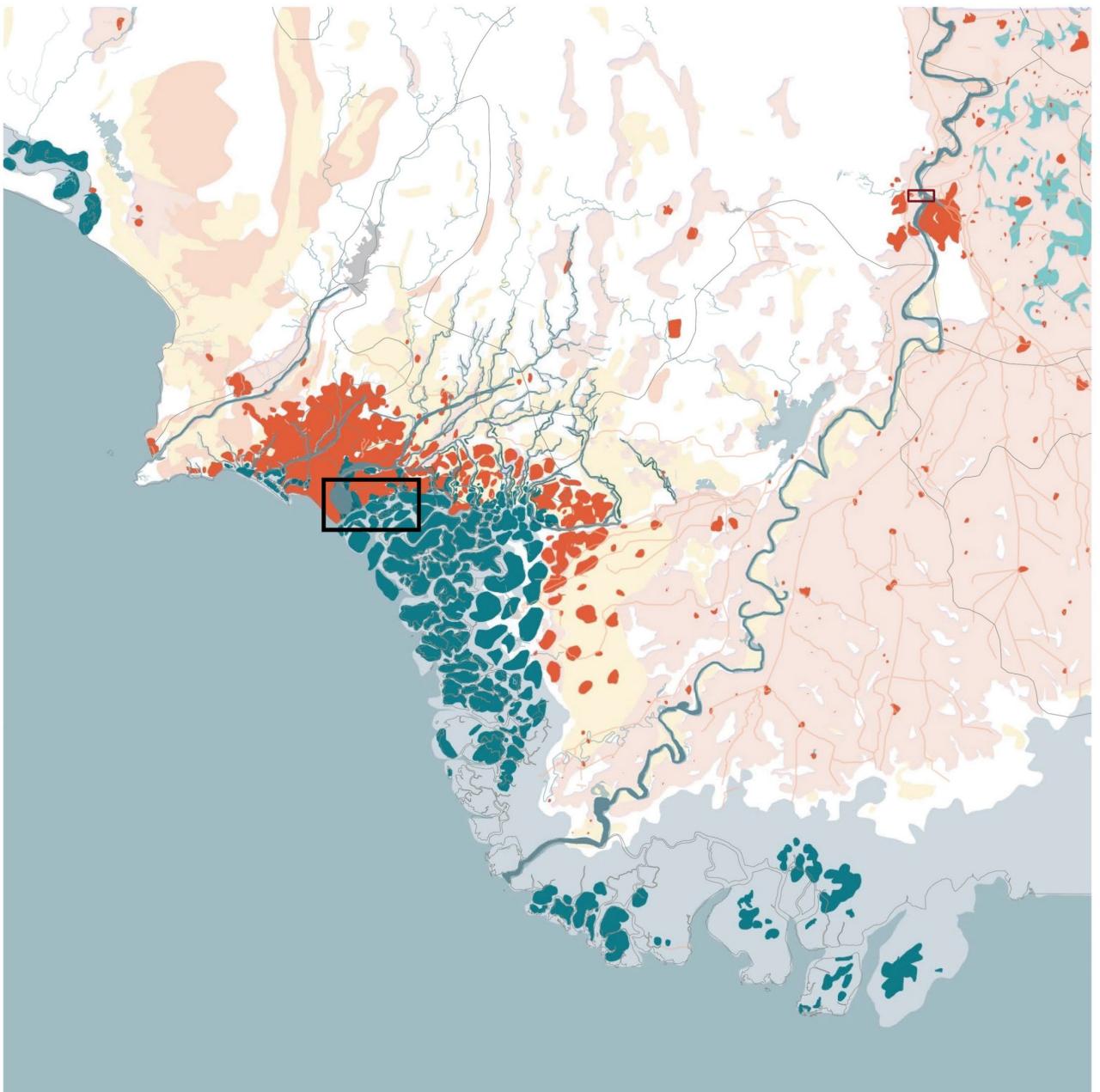
Tidal channel

Marsh

Reservoir

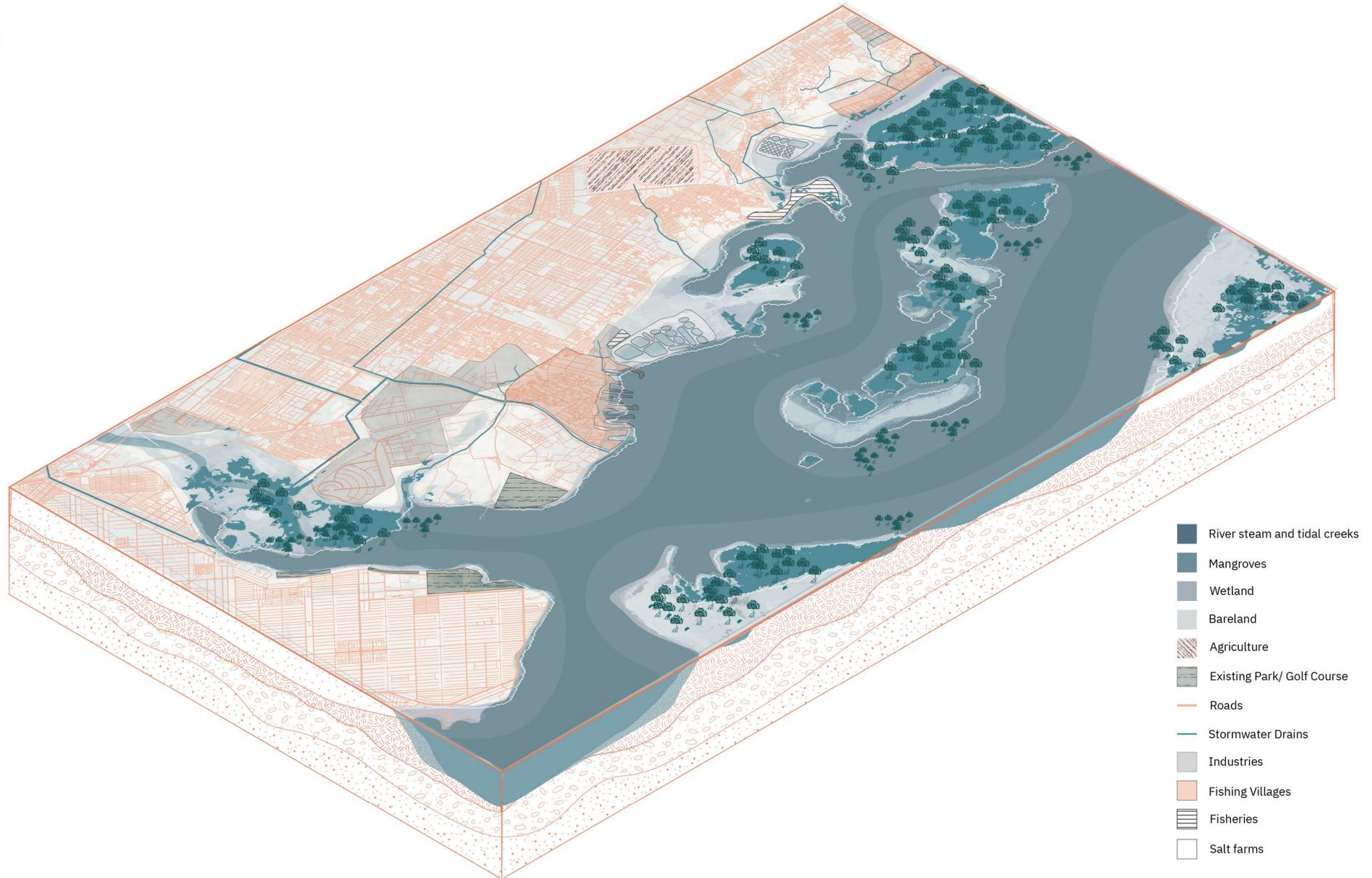
Lake

0 | 10 | 20 km



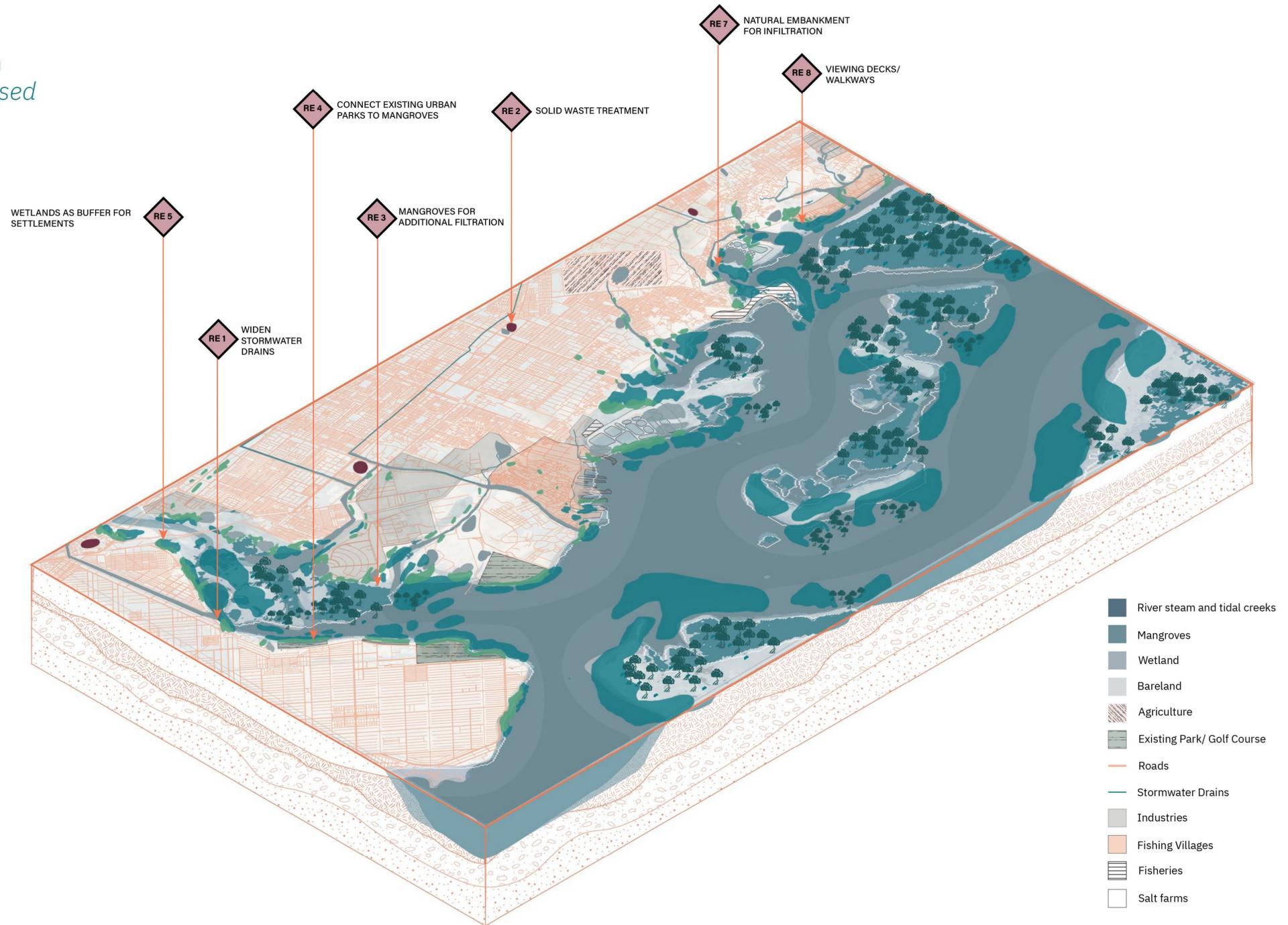
Network of Recreation  
Zoom-in Area 1: Existing

*Karachi Coast and Delta*

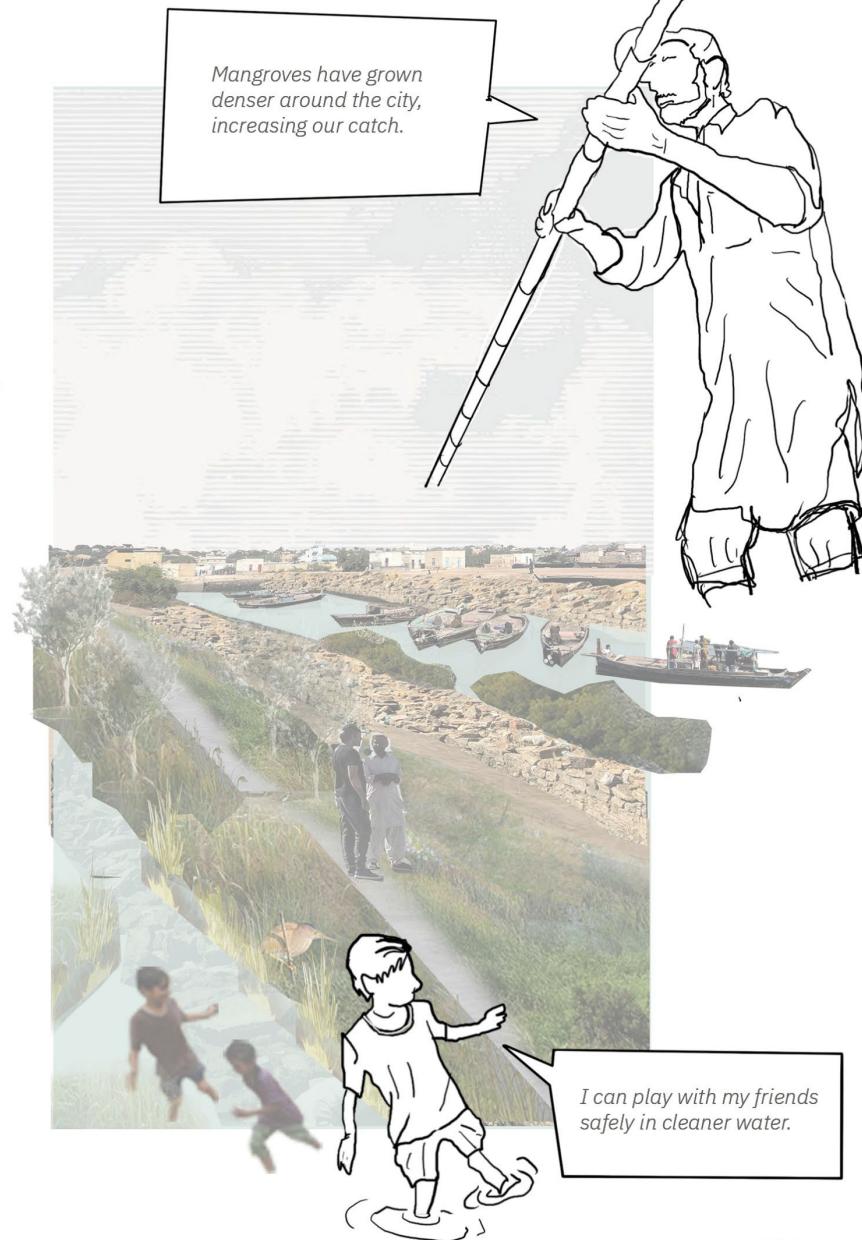
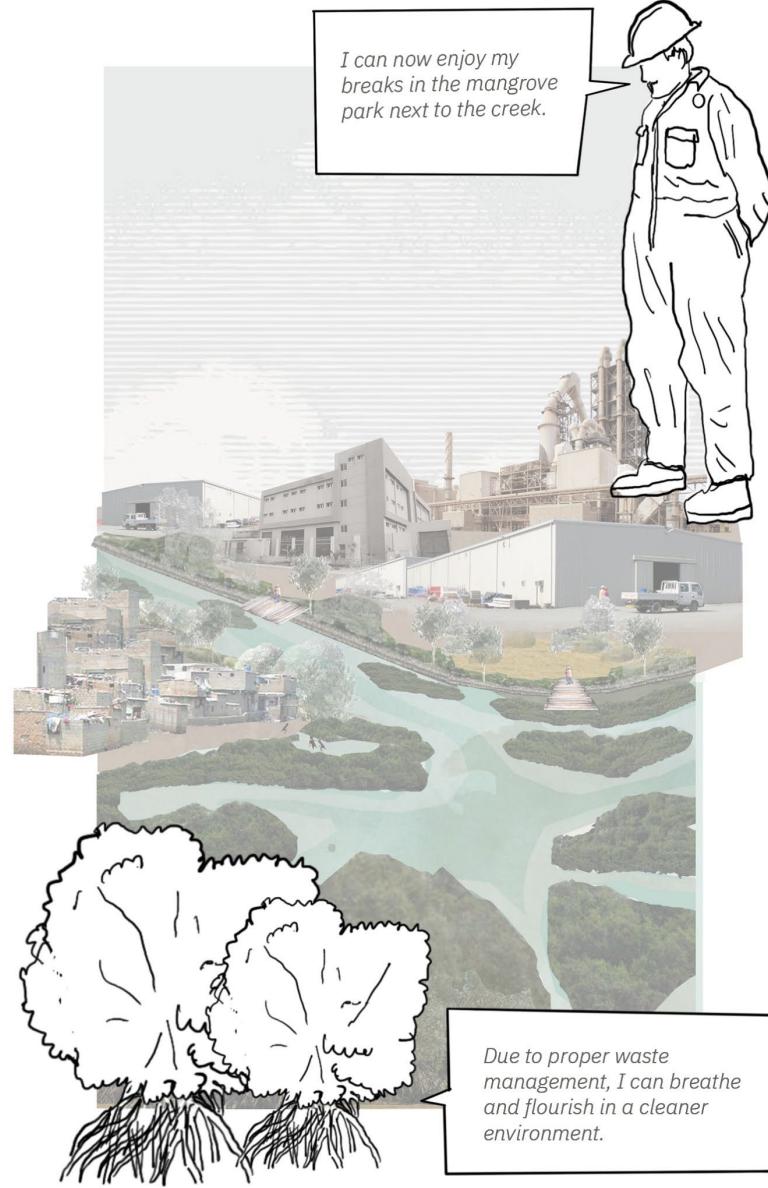
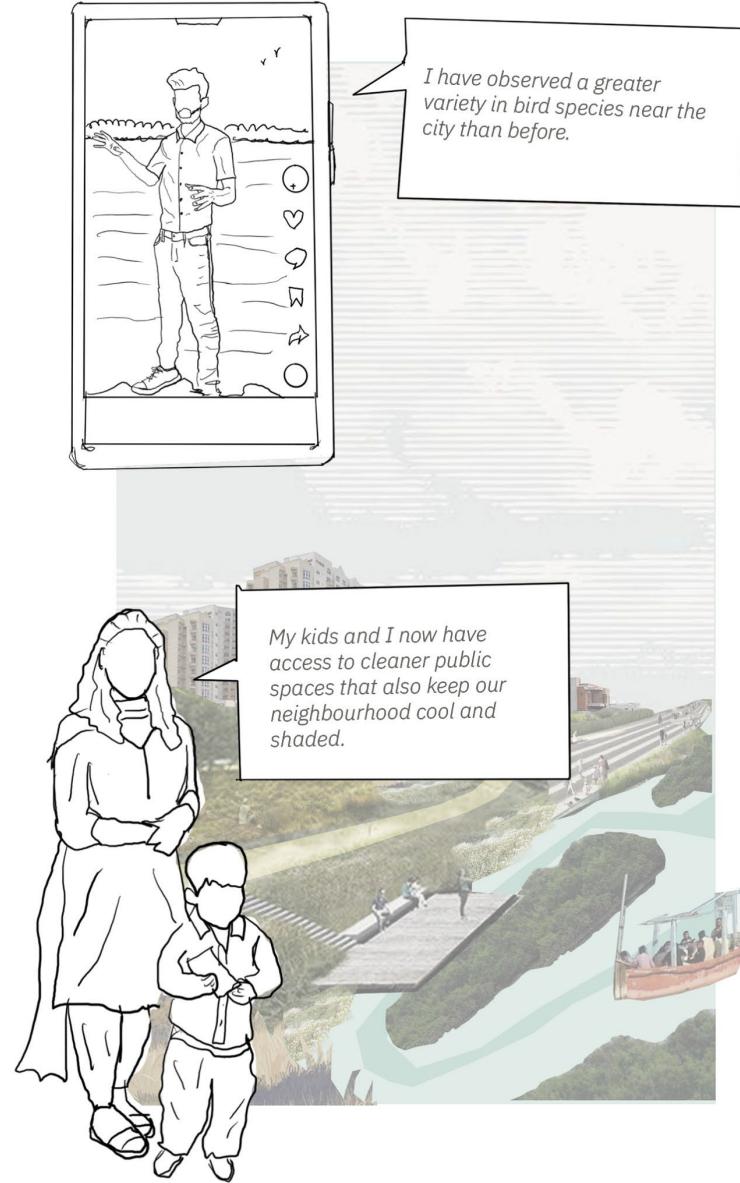


## Network of Recreation

### Zoom-in Area 1: Proposed







RECREATION



Reconnecting mangroves  
with urban life

PRESERVATION



Restoring natural flows and  
sedimentation processes

PRODUCTION



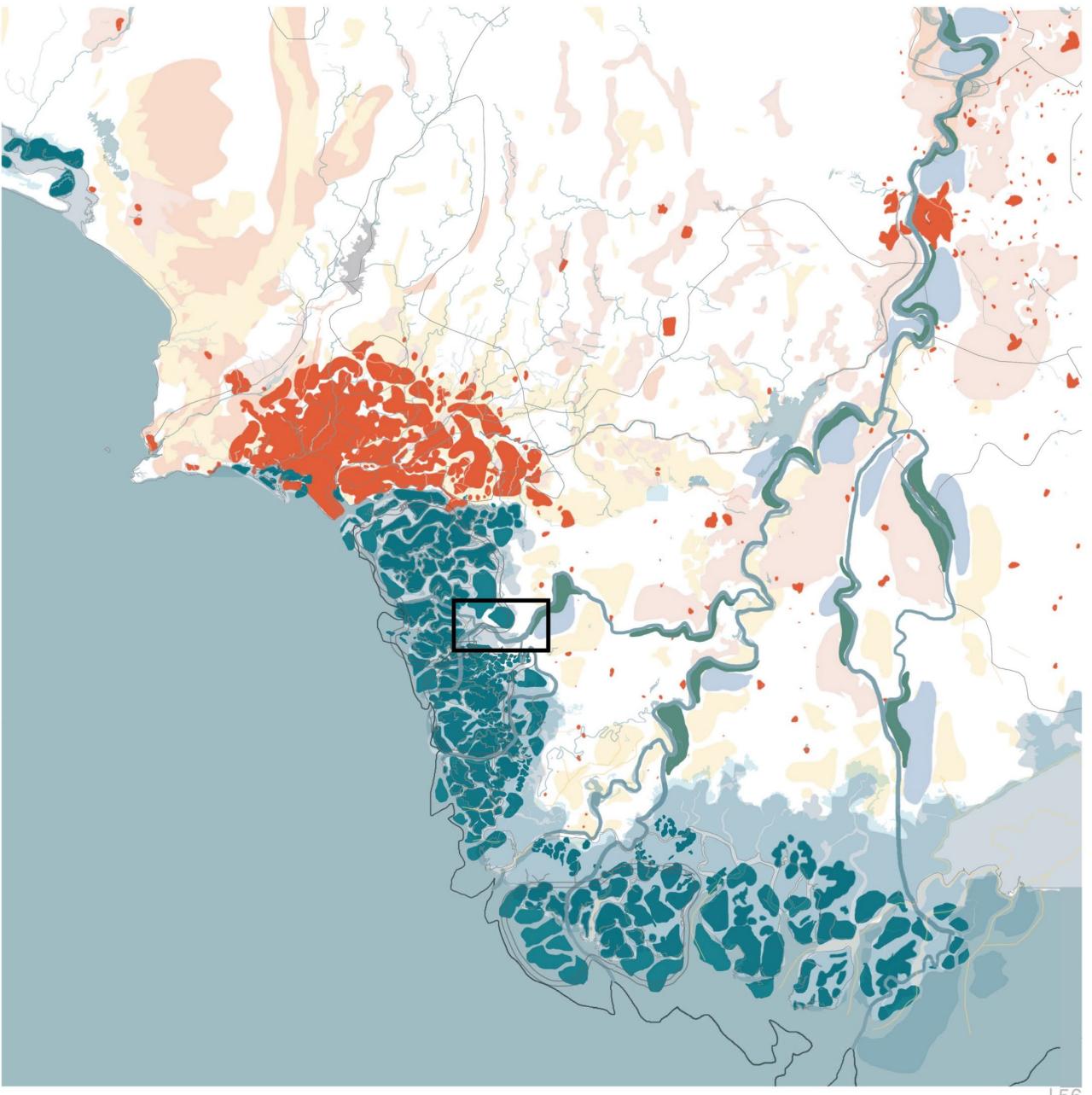
Creating adaptive livelihoods  
through agricultural gradients.

## Network of Preservation

■ District Boundary  
■ Built-up  
■ Agriculture  
■ Grassland  
■ Shrubland  
■ Wetlands  
■ Mangroves  
■ River Network (based on 1950s map)  
■ Sea

— Canal  
— Ditch  
— Stream  
— Tidal channel  
■ Marsh  
■ Reservoir  
■ Lake  
■ Floodplains  
■ Natural embankments

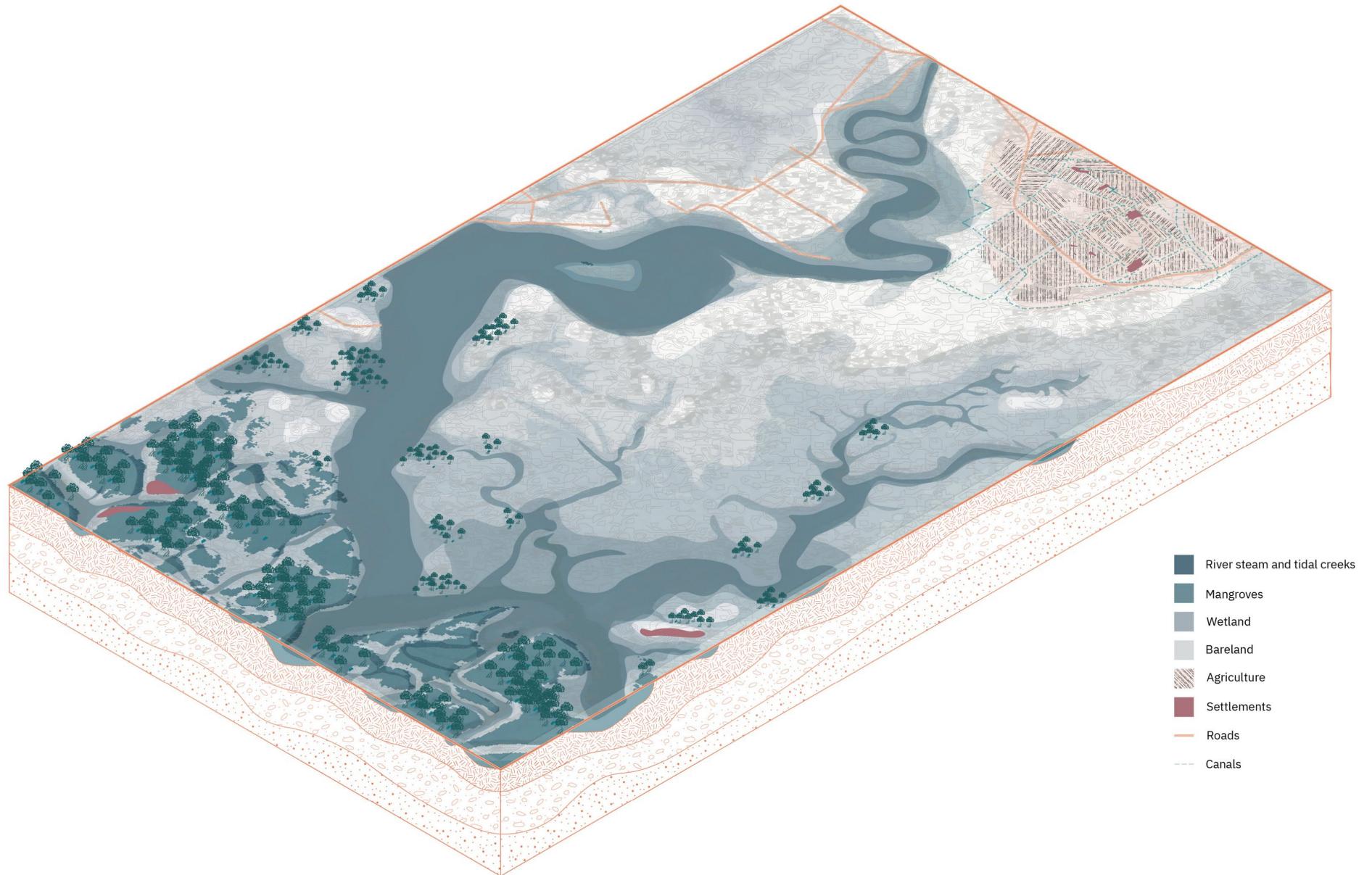
0 10 20 km



# Network of Preservation

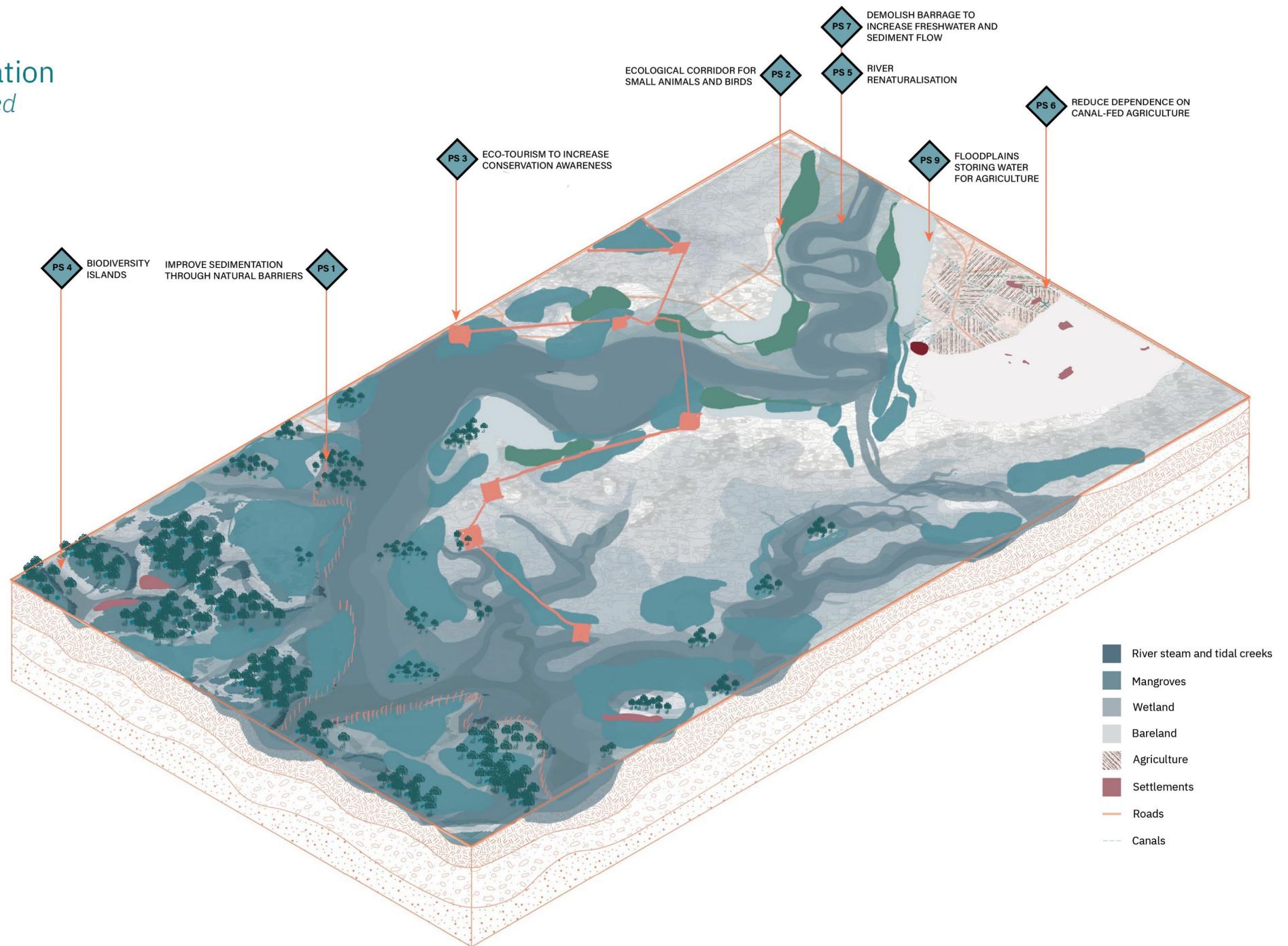
## Zoom-in Area 2: Existing

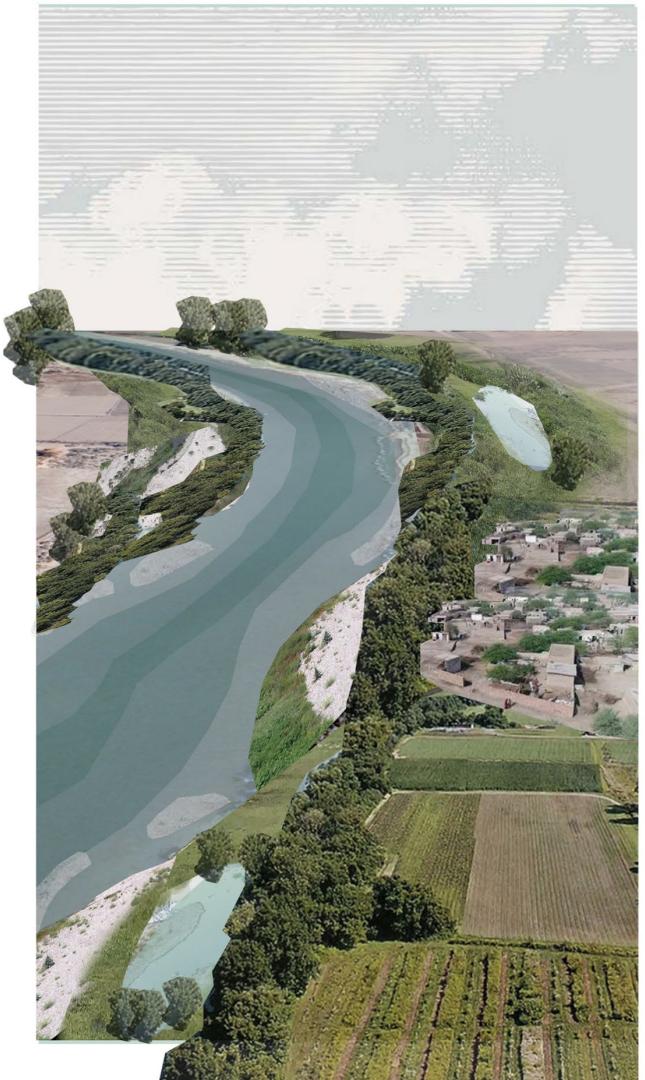
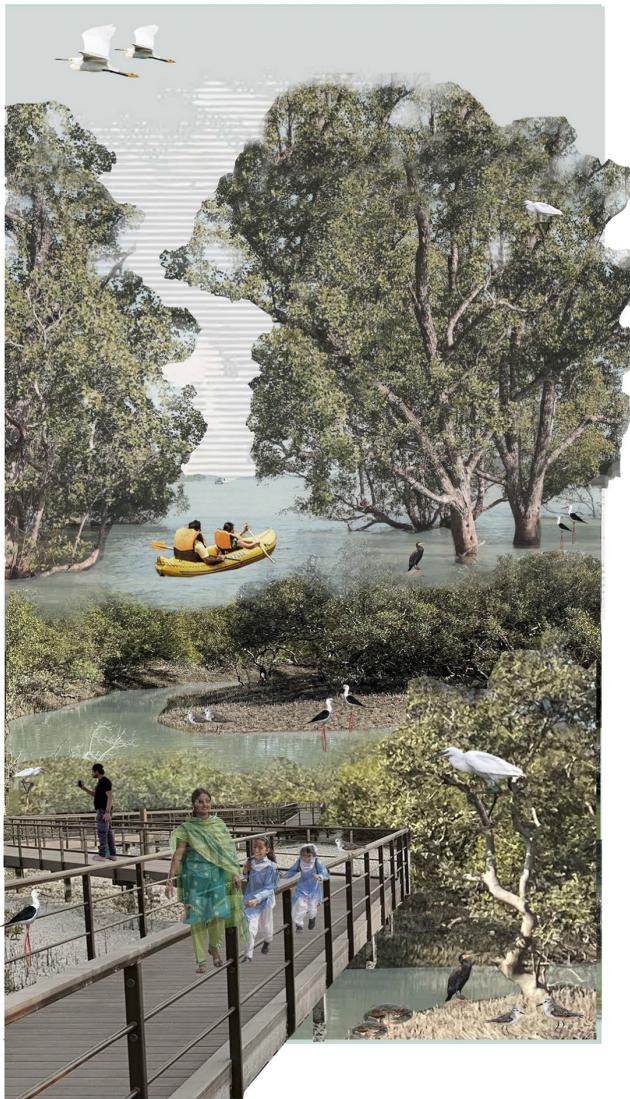
### Remote Settlements

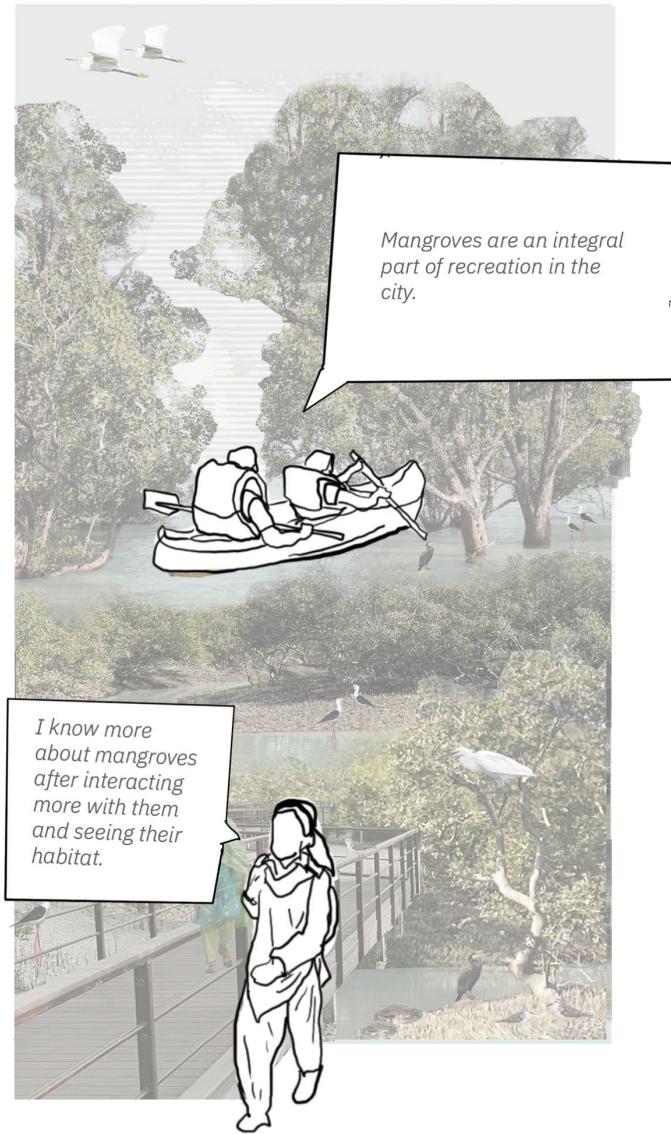


# Network of Preservation

## Zoom-in Area 2: Proposed







**RECREATION**



Reconnecting mangroves  
with urban life

**PRESERVATION**



Restoring natural flows and  
sedimentation processes

**PRODUCTION**



Creating adaptive livelihoods  
through agricultural gradients.

## Network of Production

- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network
- Sea

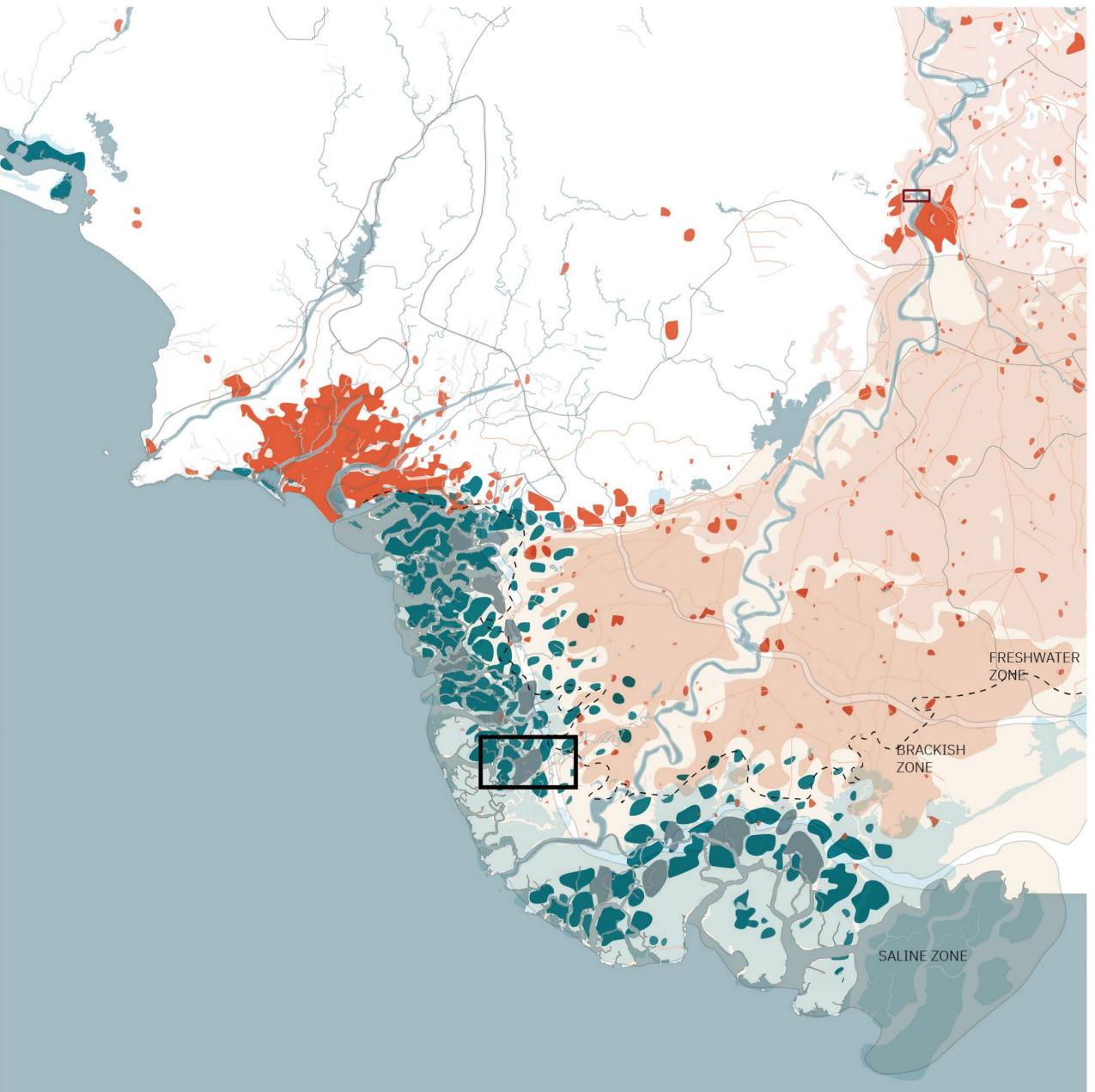
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake

- Shrimp aquaculture
- Shrimp and Salt tolerant fruits and vegetables
- Freshwater fruits and vegetables

— Predicted 2050 shoreline

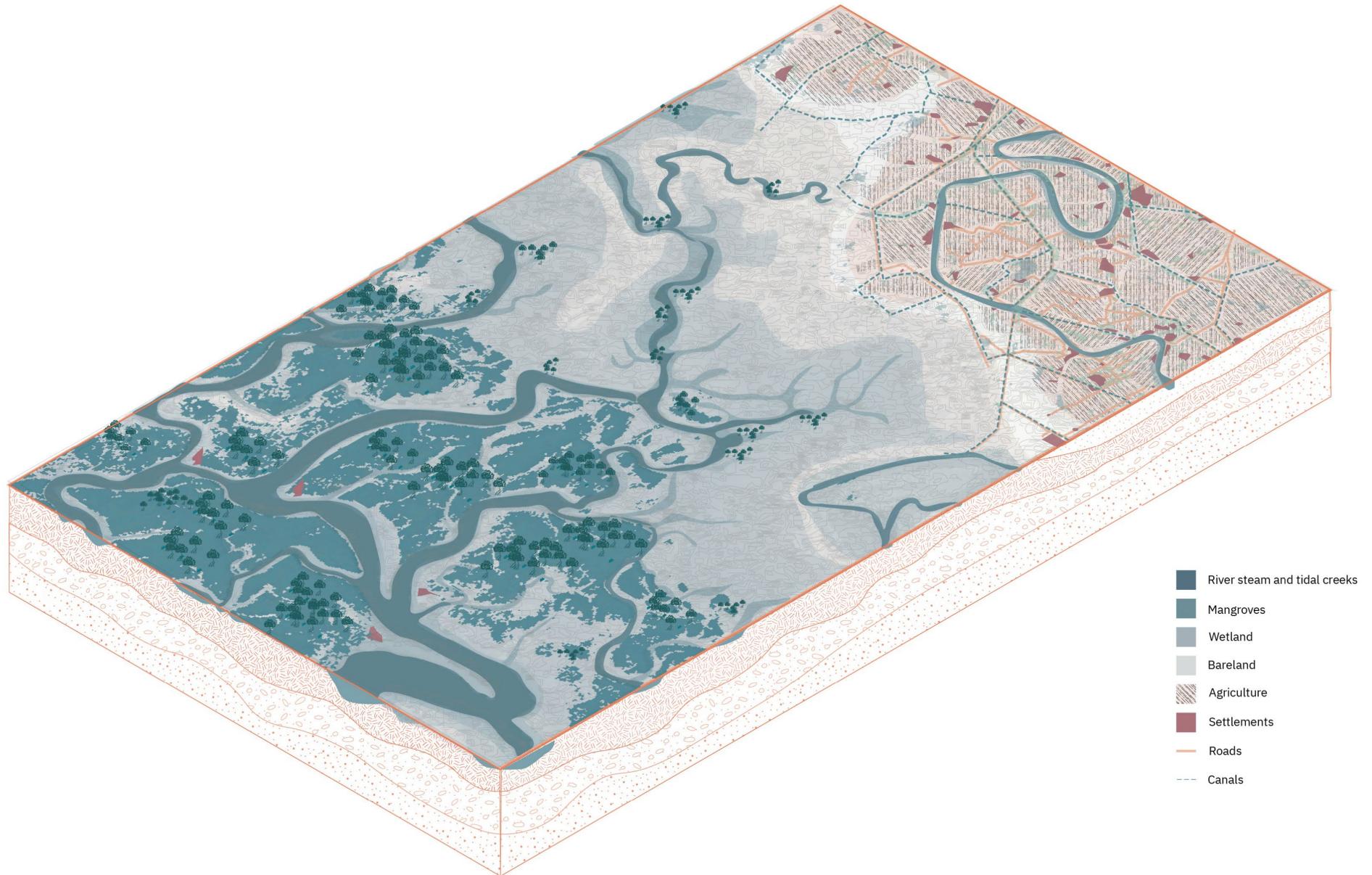
0 | 10 | 20 km



# Network of Production

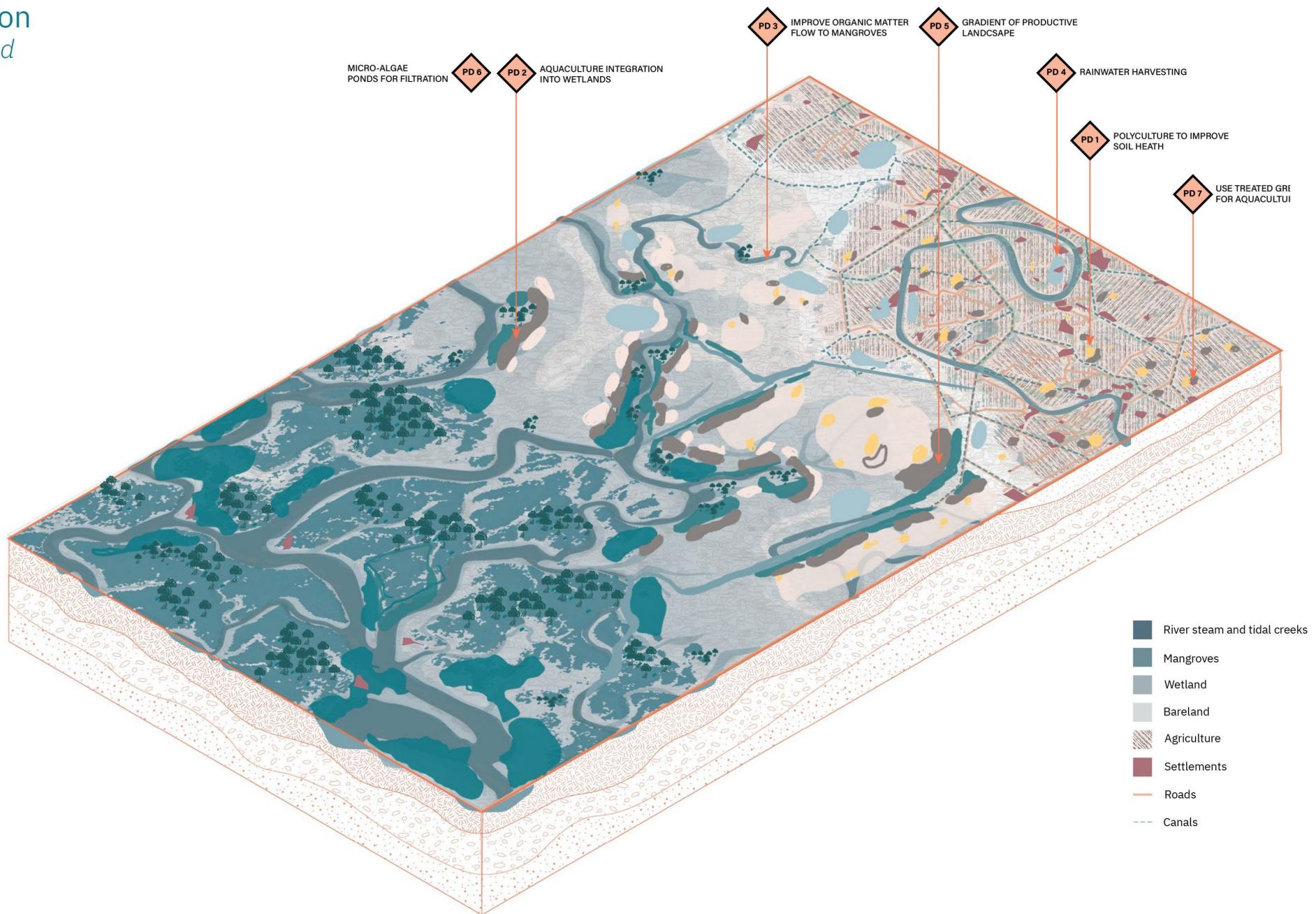
*Zoom-in Area 3: Existing*

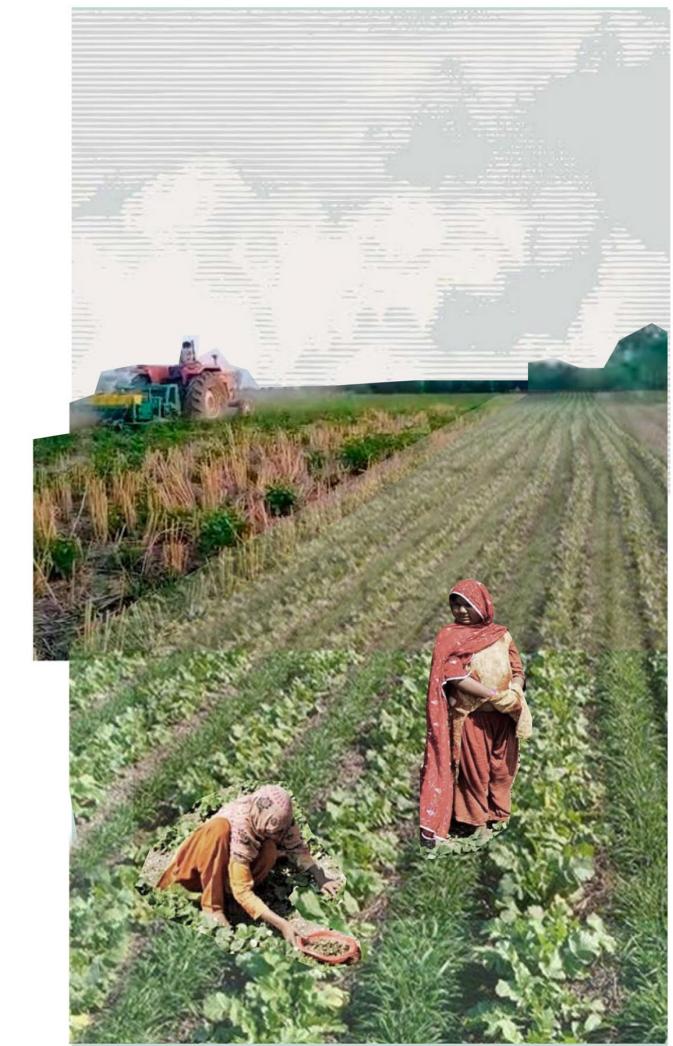
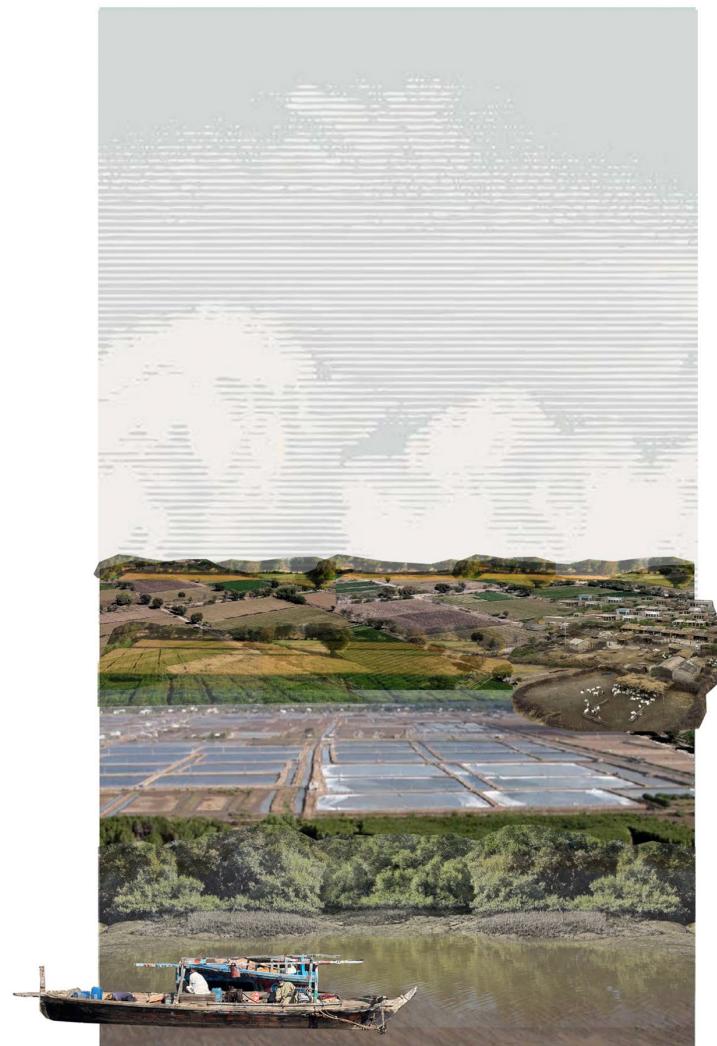
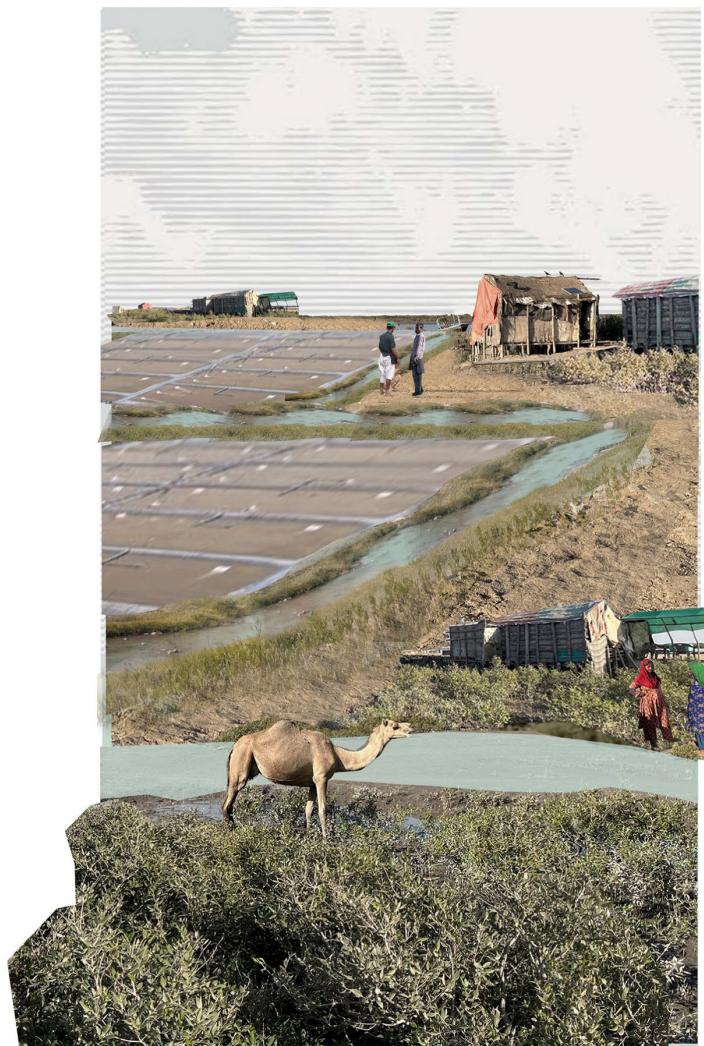
*Dense Agriculture and  
Mangrove Islands*



# Network of Production

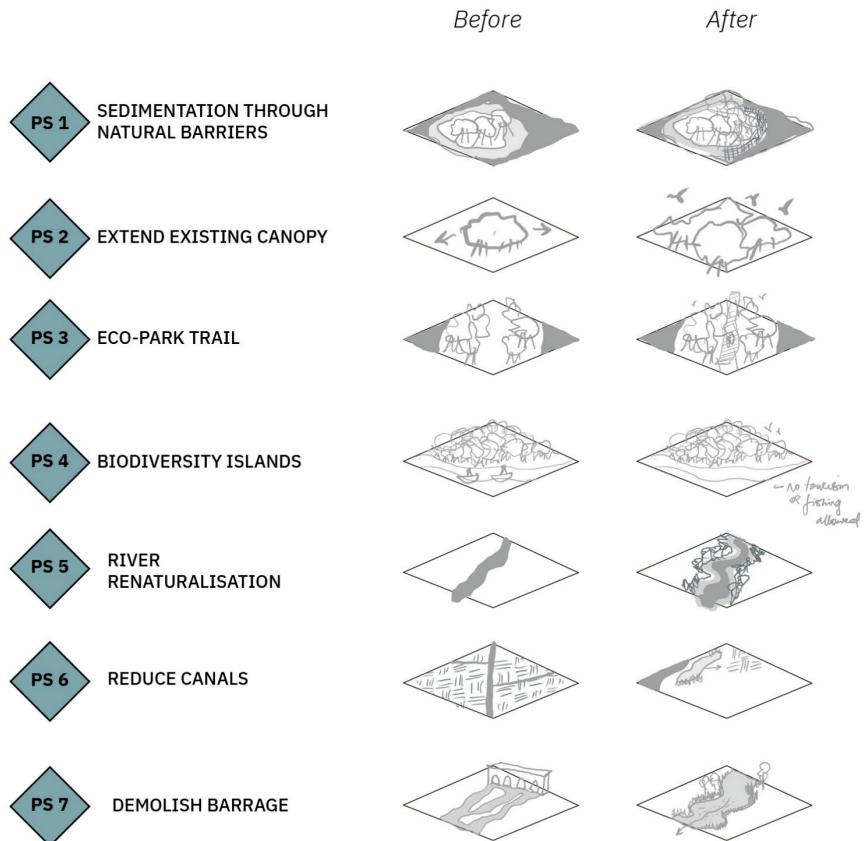
## Zoom-in Area 3: Proposed







## Network of Recreation *Toolkit of Strategies - Evaluation*

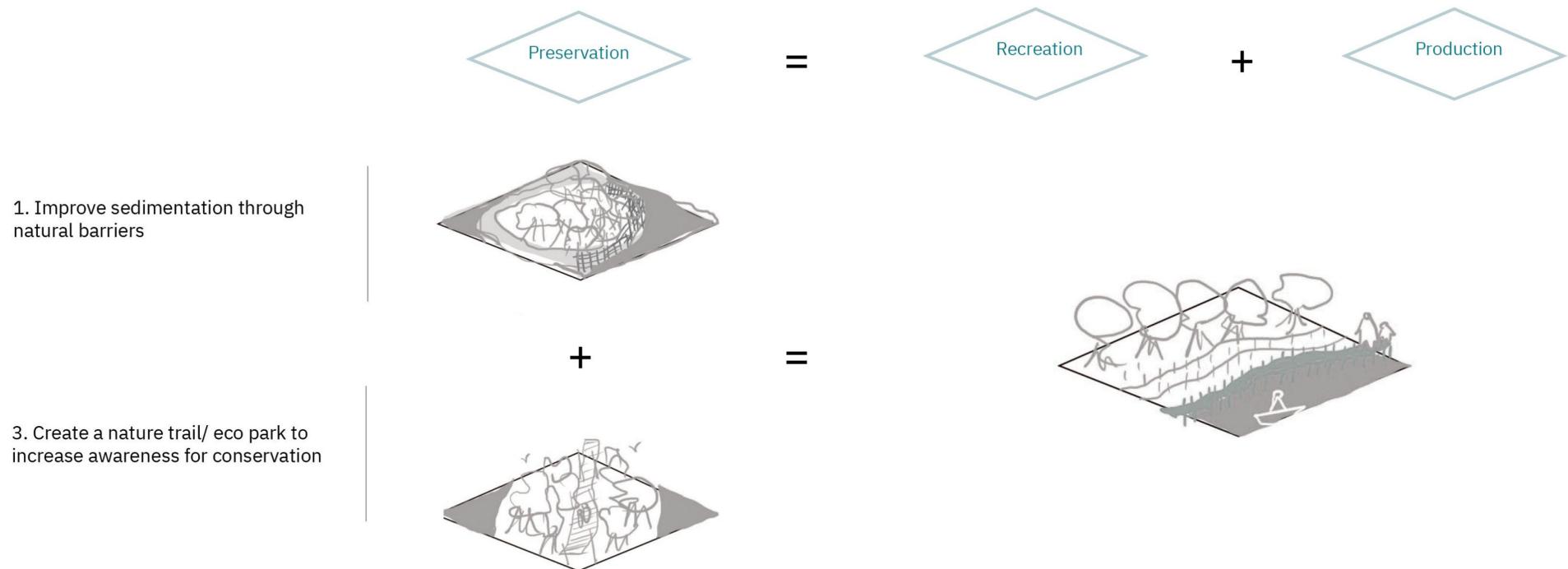


	Ecological	Social	Economic
INCREASED BIODIVERSITY	Medium	Medium	Medium
IMPROVED SOIL HEALTH	Medium	Medium	Medium
IMPROVED WATER RETENTION / INFILTRATION	Medium	Medium	Medium
PROPER WASTE MANAGEMENT	Medium	Medium	Medium
INCREASED MANGROVE GROWTH	Medium	Medium	Medium
ACCESS TO CLEAN WATER	Low	Low	Low
FOOD SECURITY	Low	Medium	Medium
ACCESS TO GREEN-BLUE SPACES	Low	Low	Low
FLOOD MITIGATION	Low	Medium	Medium
INCREASED AWARENESS OF MANGROVES	Low	Low	Low
INCREASED EMPLOYMENT OPPORTUNITY	Low	Low	Low
IMPROVED LOCAL ECONOMY	Low	Low	Low
INCREASED USE OF RENEWABLE ENERGY	Low	Low	Low
REDUCED FLOOD-RELIEF EXPENSES	Low	Low	Low
INCREASED ECO-TOURISM	Low	Low	Low

# Vision for the Indus Delta



## Re-evaluation of Toolkit Strategies



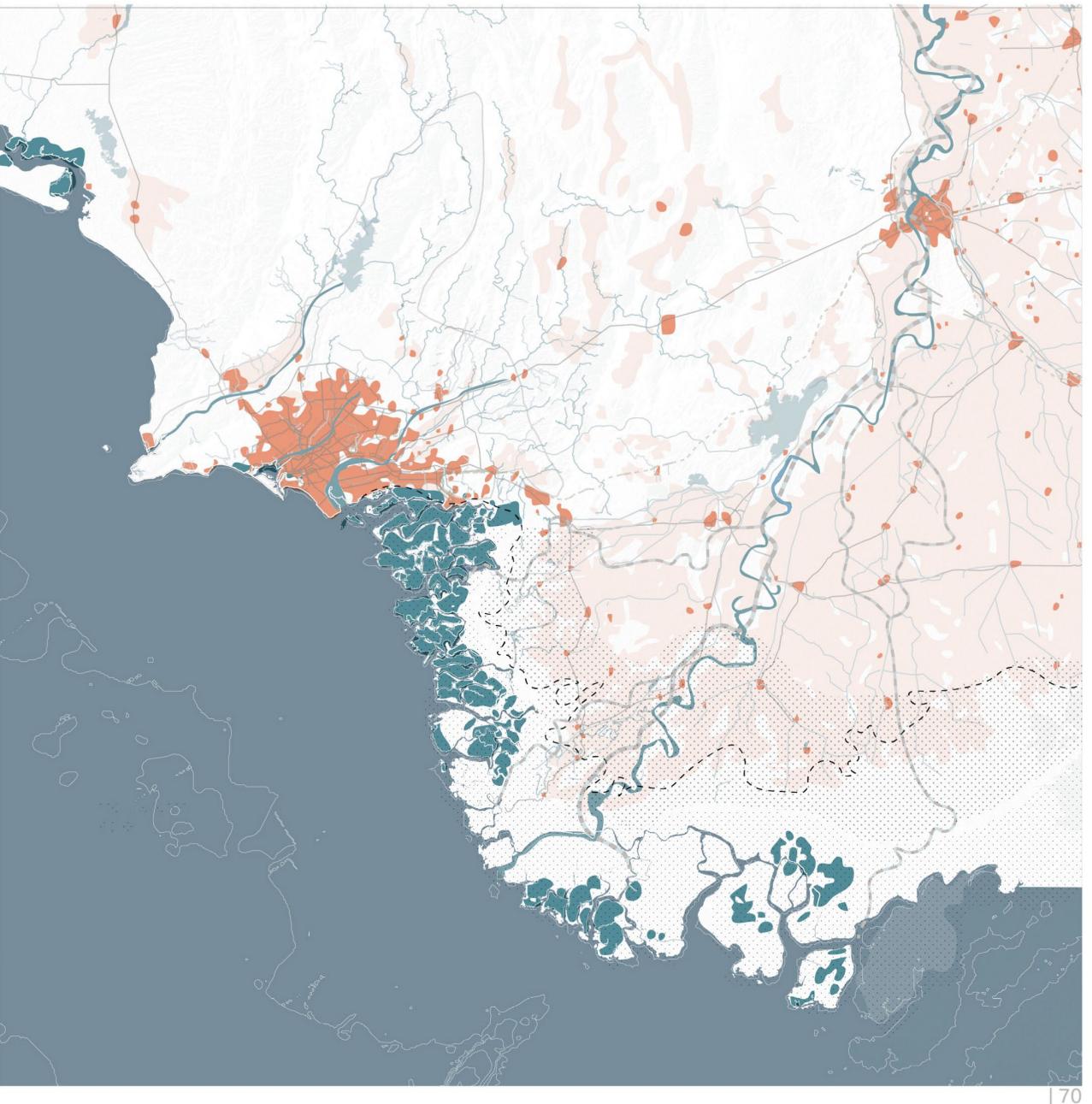
## Delta - Existing Condition

□ District Boundary  
■ Built-up Current  
■ Agriculture  
■ Existing Mangroves

— Canal  
— River  
— Stream/ Stormwater Drains  
■ Lake/ Reservoir  
■ Wetland  
— Indus River 1950 Path  
— Road Network  
-- Rail Network

● Saline Zone  
● Brackish Zone  
-- 2050 Shoreline

0 | 10 | 20 km



# Delta Vision - Green/ Blue Network

*Recreation and Preservation*



# Delta Vision - Agricultural Gradient

*Production and Preservation*



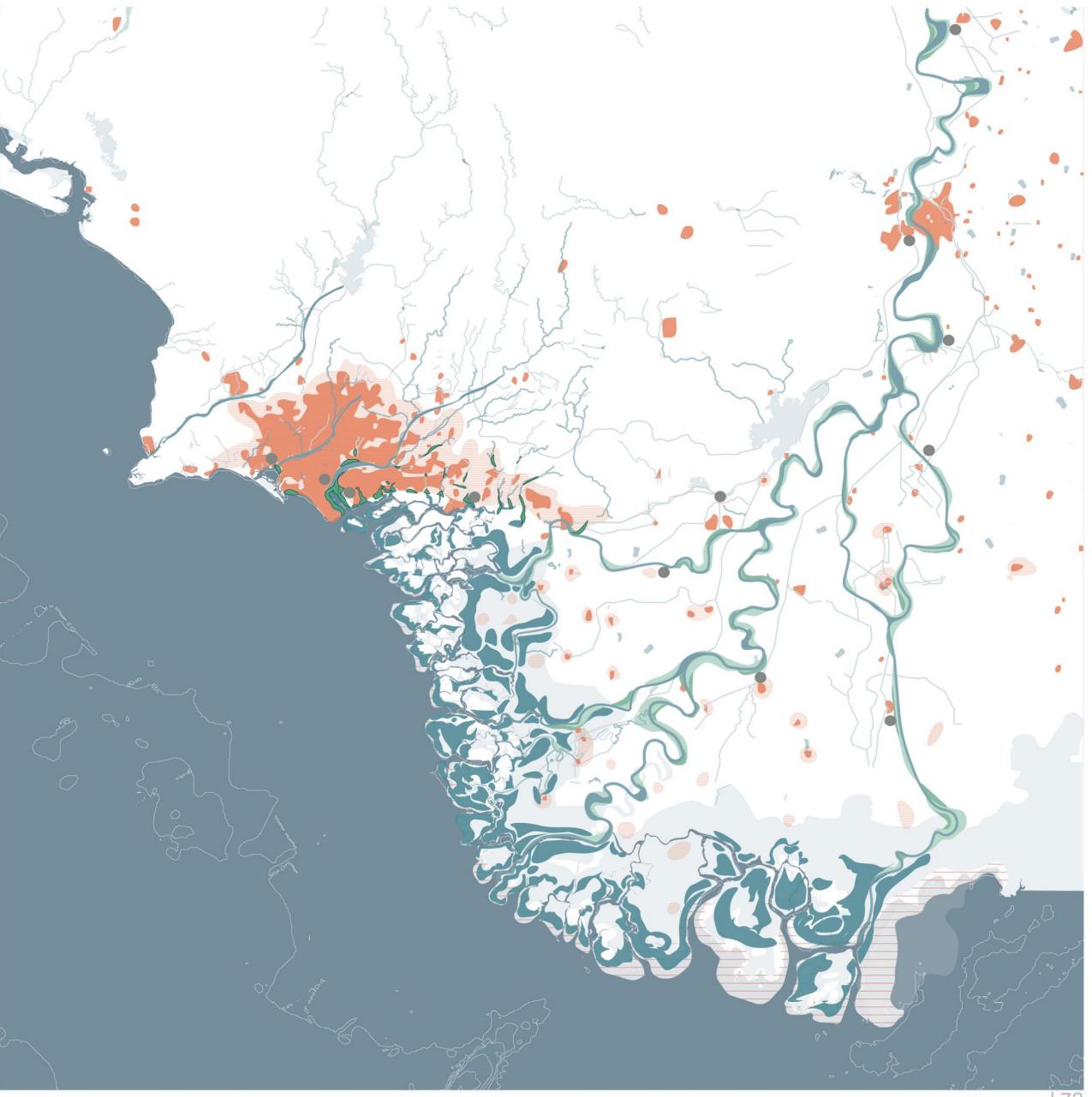
# Delta Vision - Urban to Rural Migration

*Recreation and Production*

District Boundary  
■ Built-up Current  
■ Built-up Increase 2050  
■ Canal-fed Agriculture  
■ Rain-fed Agriculture  
■ Aquaculture and Salt-tolerant farming  
■ Aquaculture  
■ New Mangroves  
■ Existing Mangroves

— Canal  
— River  
— Stream/ Stormwater Drains  
■ Lake/ Reservoir  
■ Wetland  
■ Flood plains  
■ Natural Embankments  
■ Urban Parks  
— Extended Shoreline

0 10 20 km



## Combined Delta Vision 2050

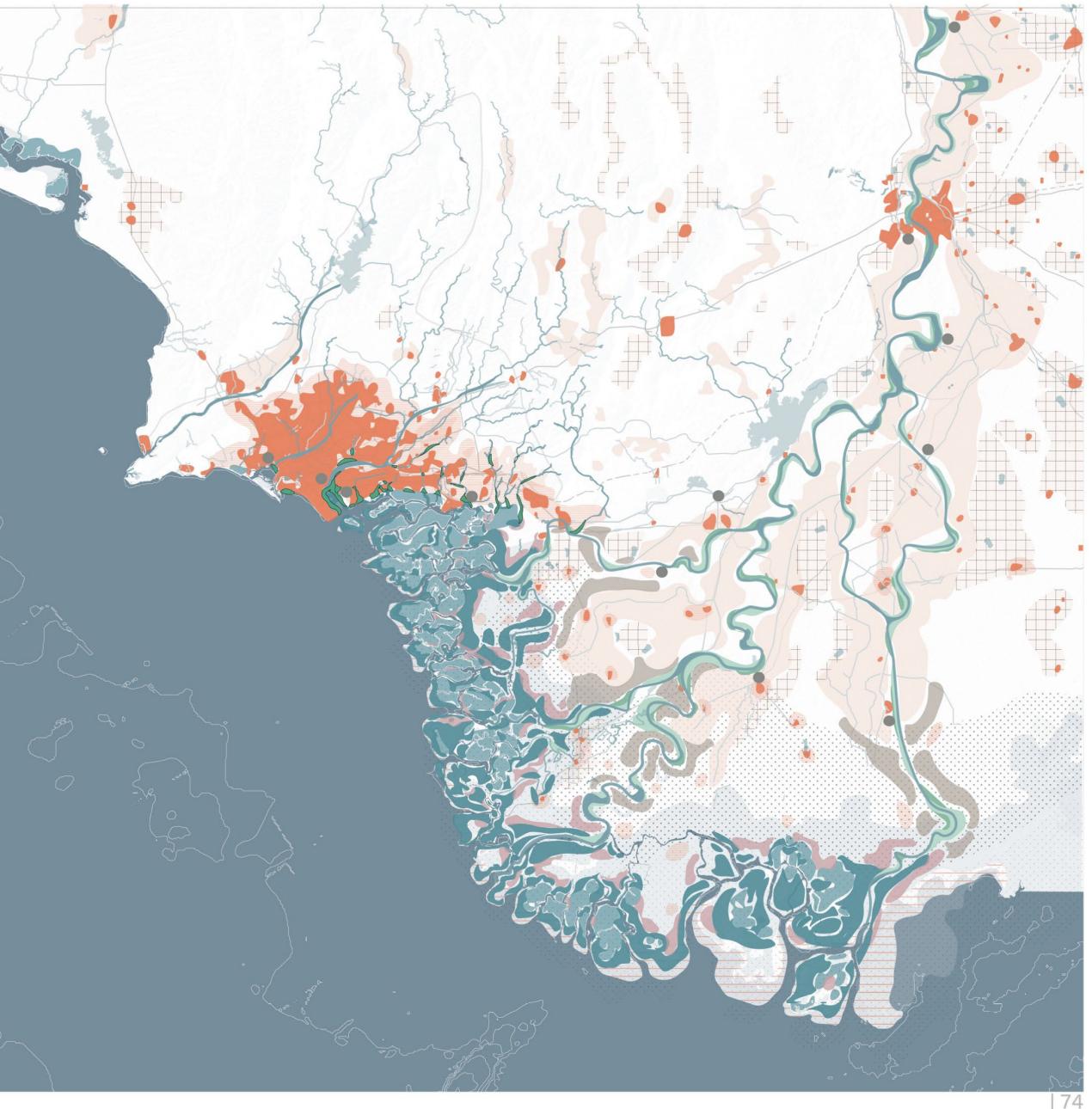
- District Boundary
- Built-up Current
- Built-up Increase 2050
- Canal-fed Agriculture
- Rain-fed Agriculture
- Aquaculture and Salt-tolerant farming
- Aquaculture
- New Mangroves
- Existing Mangroves

- Canal
- River
- Stream/ Stormwater Drains
- Lake/ Reservoir
- Wetland

- Flood plains
- Natural Embankments
- Urban Parks
- Extended Shoreline

- Saline Zone
- Brackish Zone

0 | 10 | 20 km



## Combined Delta Vision 2050 - Zoom-Ins

- District Boundary
- Built-up Current
- Built-up Increase 2050
- Canal-fed Agriculture
- Rain-fed Agriculture
- Aquaculture and Salt-tolerant farming
- Aquaculture
- New Mangroves
- Existing Mangroves

- Canal
- River
- Stream/ Stormwater Drains
- Lake/ Reservoir
- Wetland

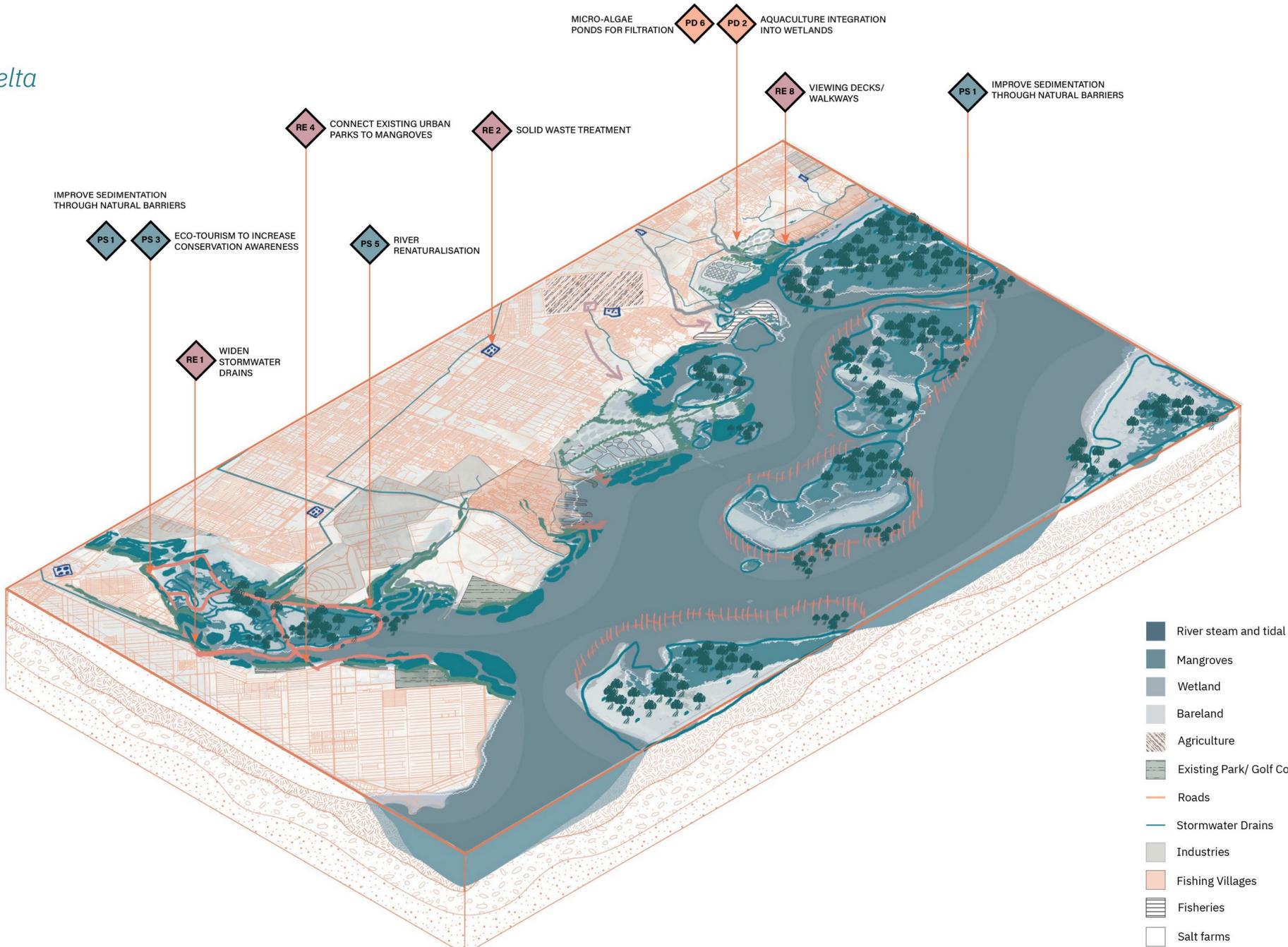
- Flood plains
- Natural Embankments
- Urban Parks
- Extended Shoreline

- Saline Zone
- Brackish Zone

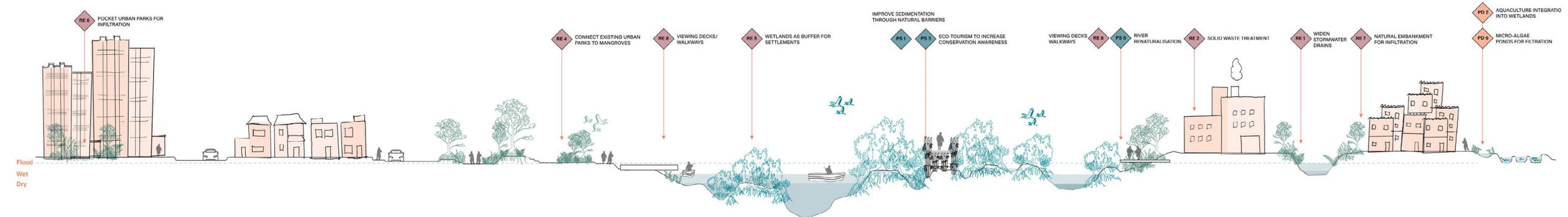
0 10 20 km



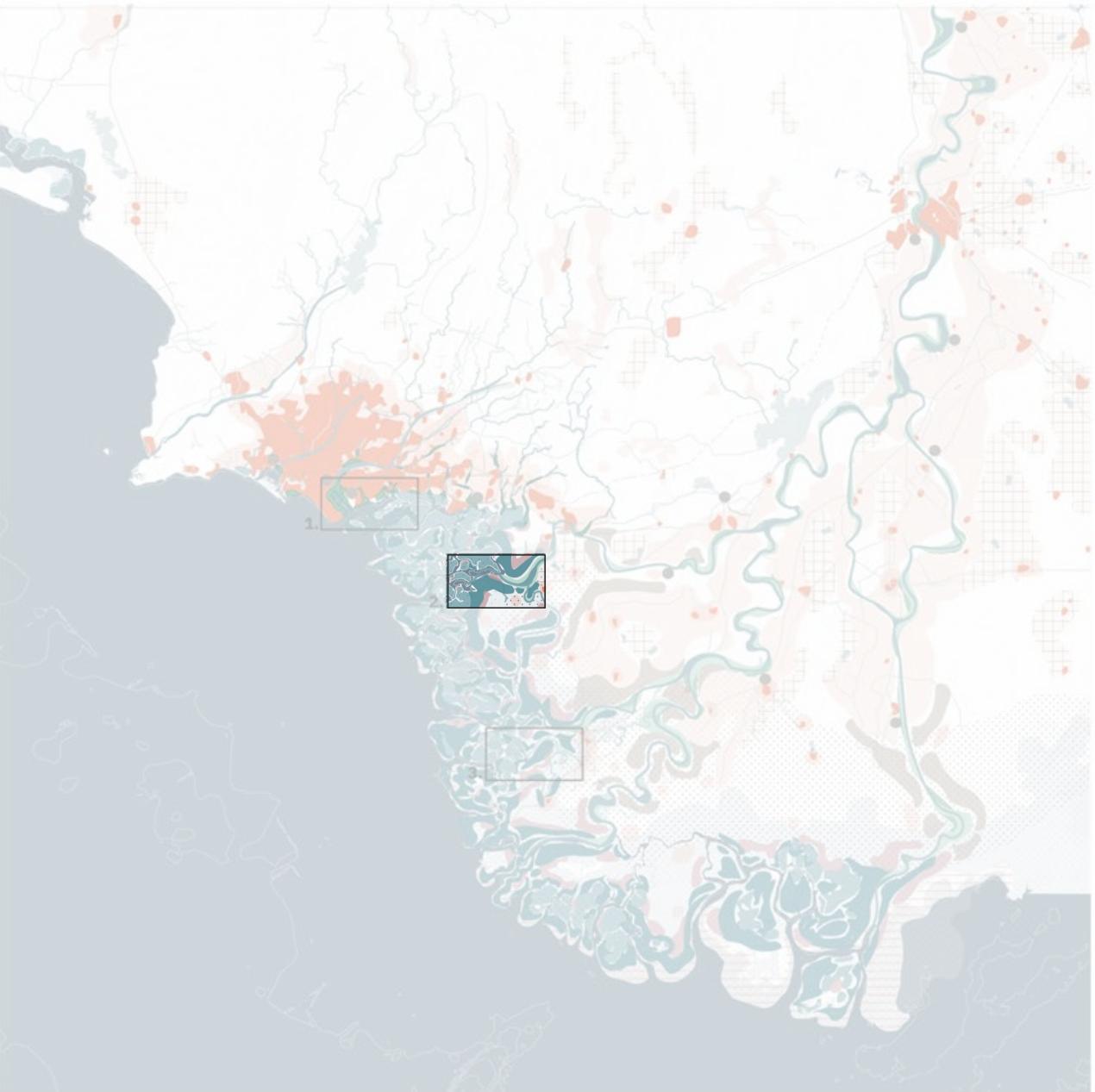
## Zoom-in Area 1: Karachi Coast and the Delta



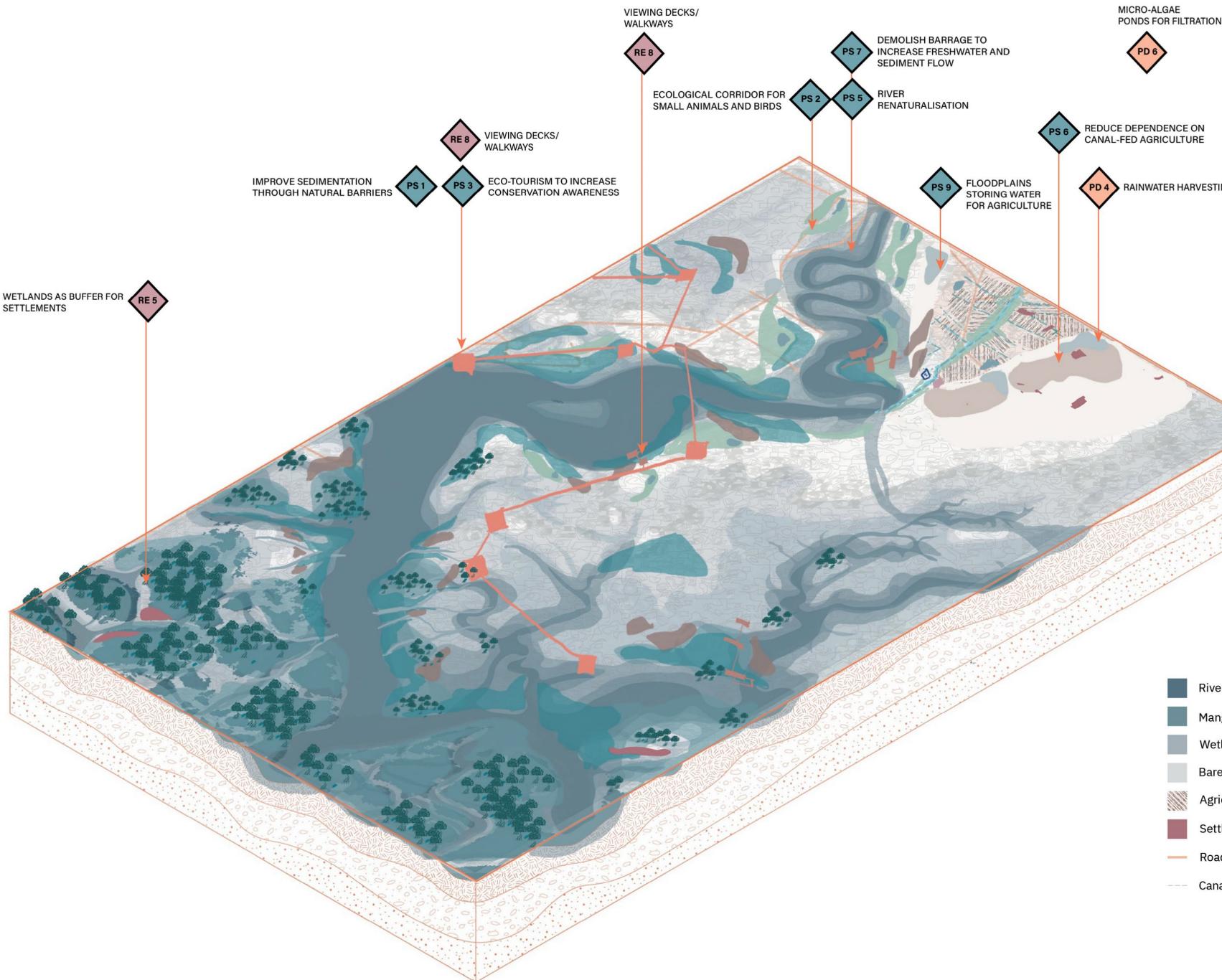
**Zoom-in Area 1:**  
*Karachi Coast and the Delta*  
*Typology Section*



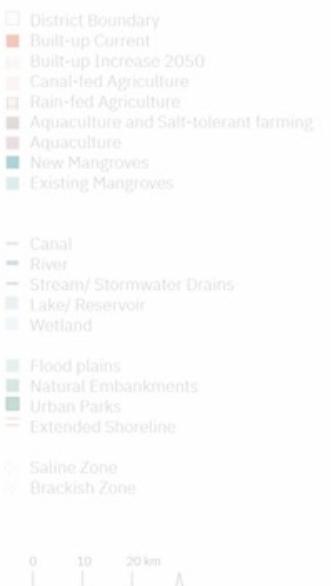
## Combined Delta Vision 2050 - Zoom-Ins



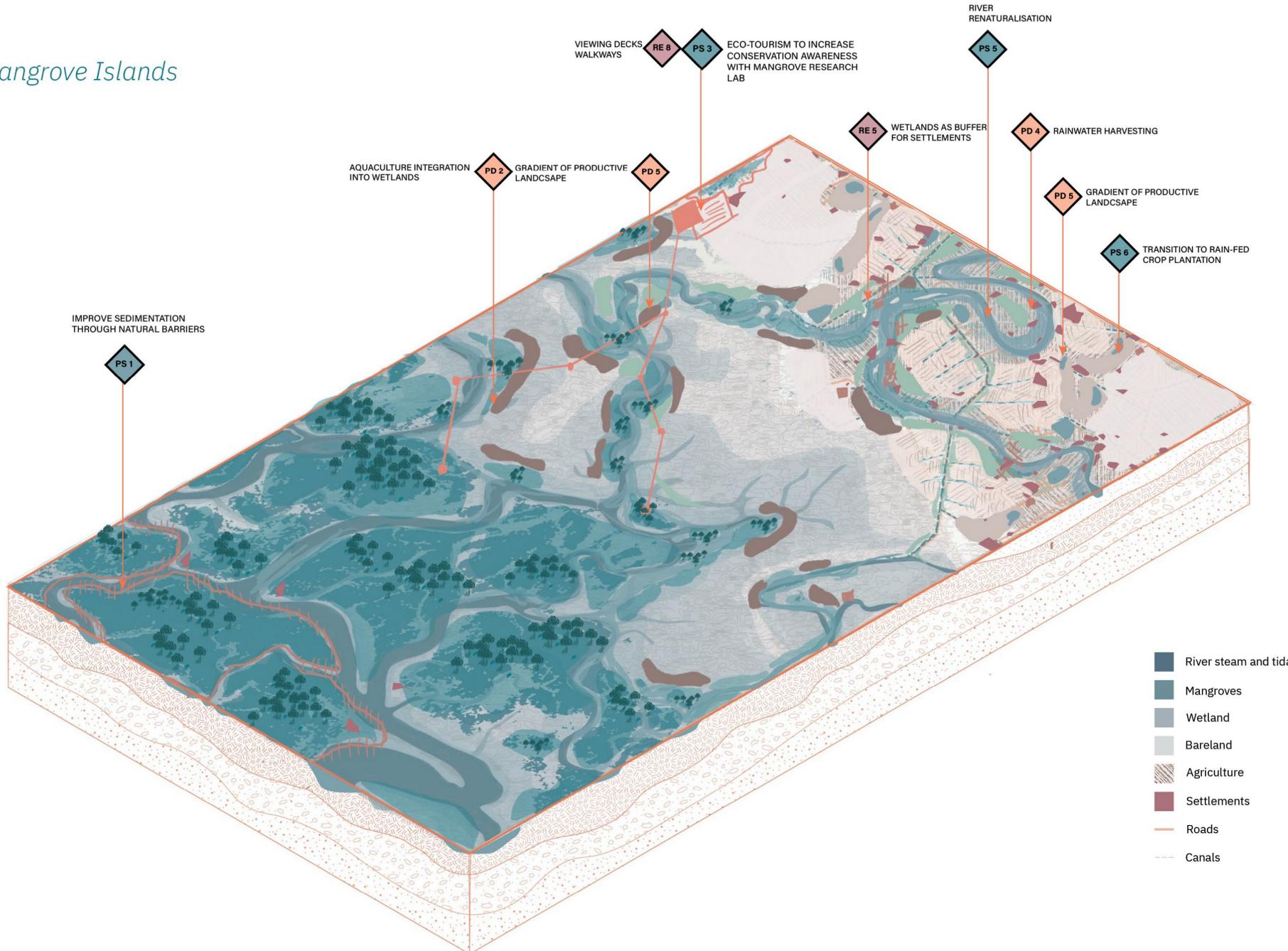
## Zoom-in Area 2: Remote Settlements



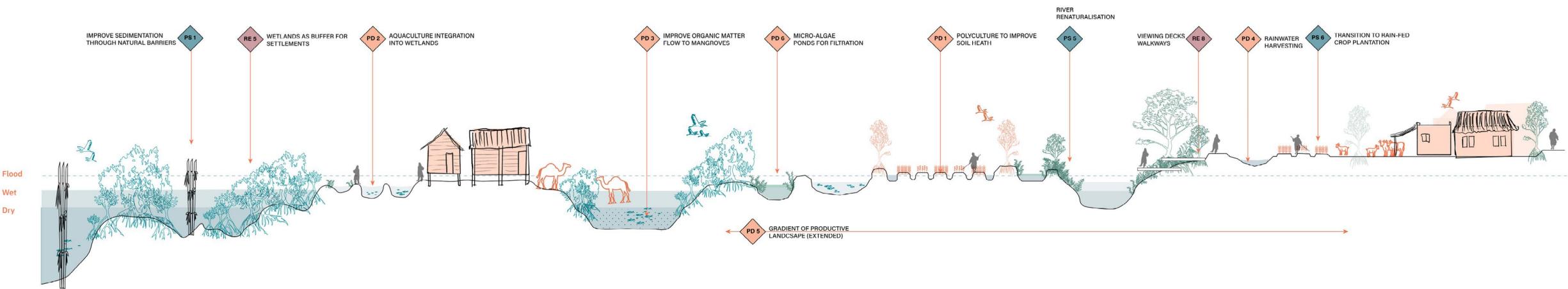
## Combined Delta Vision 2050 - Zoom-Ins



## Zoom-in Area 3: Dense Agriculture and Mangrove Islands



**Zoom-in Area 3:**  
*Dense Agriculture and Mangrove Islands*  
 Typology Section



## Phasing and Implementation

Phase	Priority Actions	Focus Areas	Stakeholders Engaged
1. Urgent (Years 2-5)	<ul style="list-style-type: none"> <li>• Ensure clean water reaches the delta (e.g. treated wastewater, improved storm drains)</li> <li>• Set aside and protect mangrove zones along coast and creek edges</li> <li>• Launch low-cost production pilots (e.g. community aquaculture, polyculture, etc.)</li> </ul>	Karachi Coast and Tidal Creeks	Local fisherfolk, Local farmers, NGOs like Pakistan Fisherfolk Forum (PFF), Sindh Building Control Authority (SBCA), Karachi Development Authority (KDA), Defence Housing Authority (DHA) Karachi Water & Sewerage Corporation (KWSC), Sindh Solid Waste Management Board (SSWMB)
2. Short-Mid Term (Years 5-10)	<ul style="list-style-type: none"> <li>• Restore degraded wetlands and convert flood-prone farmland into buffers</li> <li>• Support livelihood diversification (shrimp ponds, salt-tolerant crops, eco-tourism pilots)</li> <li>• Enforce no-fishing zones in key regeneration sites</li> </ul>	Remote delta villages & saline agriculture zones	Farmers, Fisherfolk, Sindh Environmental Protection Agency (SEPA), Ministry of Climate Change Pakistan, Provincial Disaster Management Authority (PDMA Sindh) WWF-Pakistan and IUCN Pakistan
3. Long Term (Years 10-25)	<ul style="list-style-type: none"> <li>• Formalize recreation networks (urban mangrove parks, eco-trails)</li> <li>• Build governance partnerships (water-sharing, zoning, community monitoring)</li> <li>• Scale up productive mosaics based on ecological performance</li> </ul>	Across entire delta gradient (inland to sea)	Government of Sindh (Planning & Development Department), Sindh Coastal Development Authority (SCDA), Sindh Forest Department, Indus River System Authority (IRSA), Water and Power Development Authority (WAPDA), WWF-Pakistan and IUCN Pakistan

# Conclusion



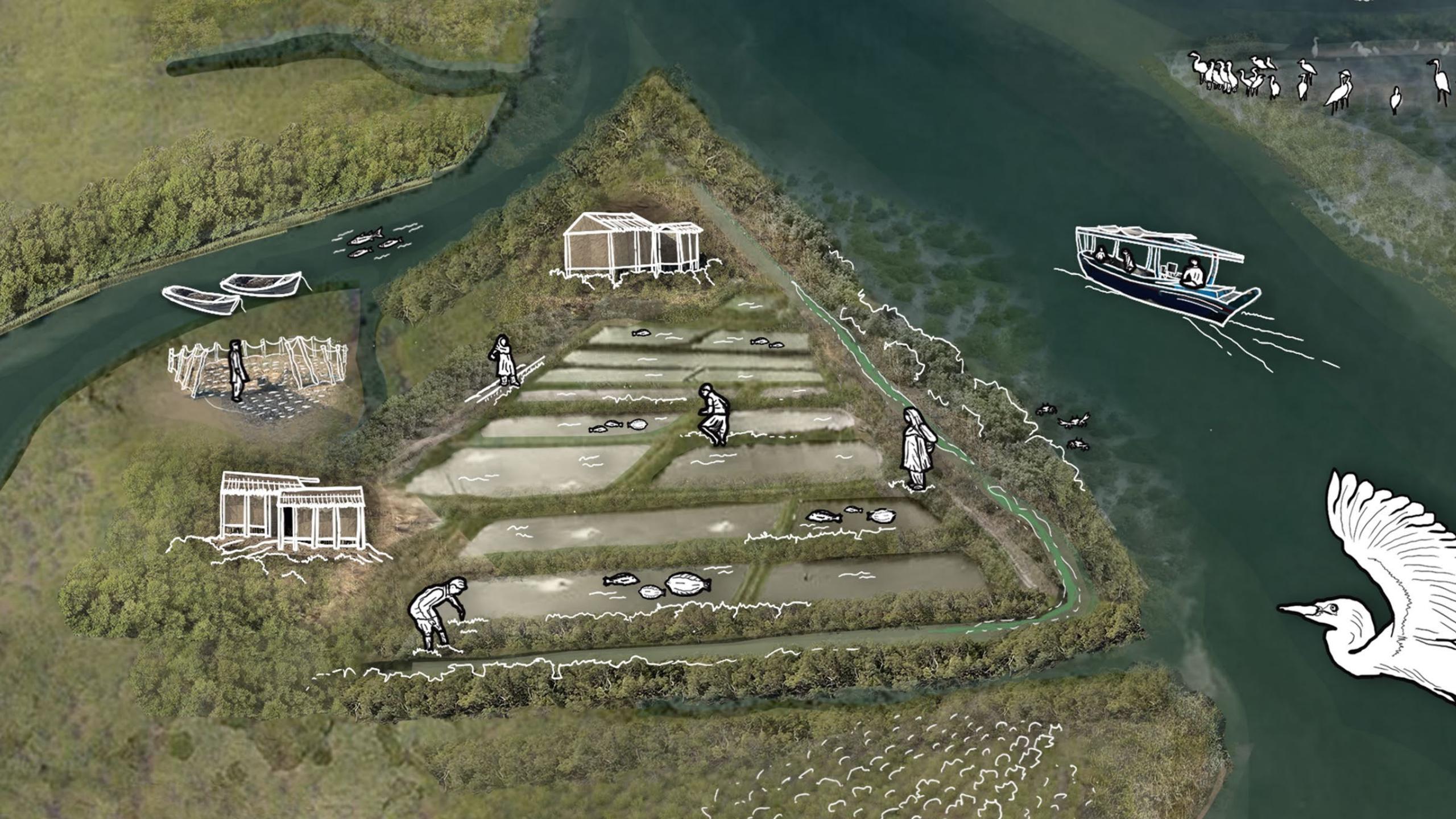
How can **networks of care**, enable humans to nurture the **Indus Delta mangrove ecosystem**, fostering **harmony** between **human** and **more-than-human** populations?

















THANK YOU



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