



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 Nilleson

P5 Presentation



Karachi

Indus Delta

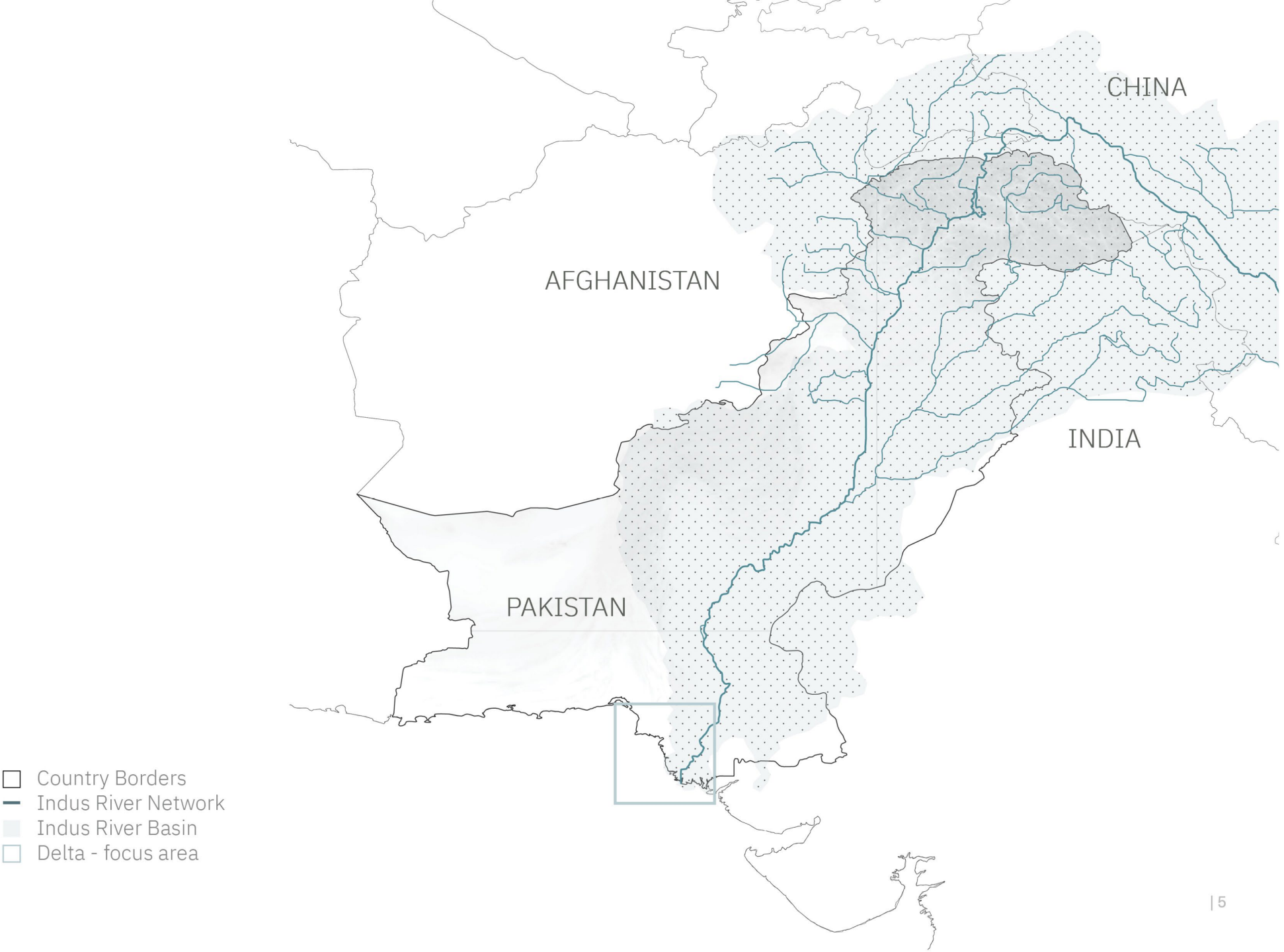
Arabian Sea



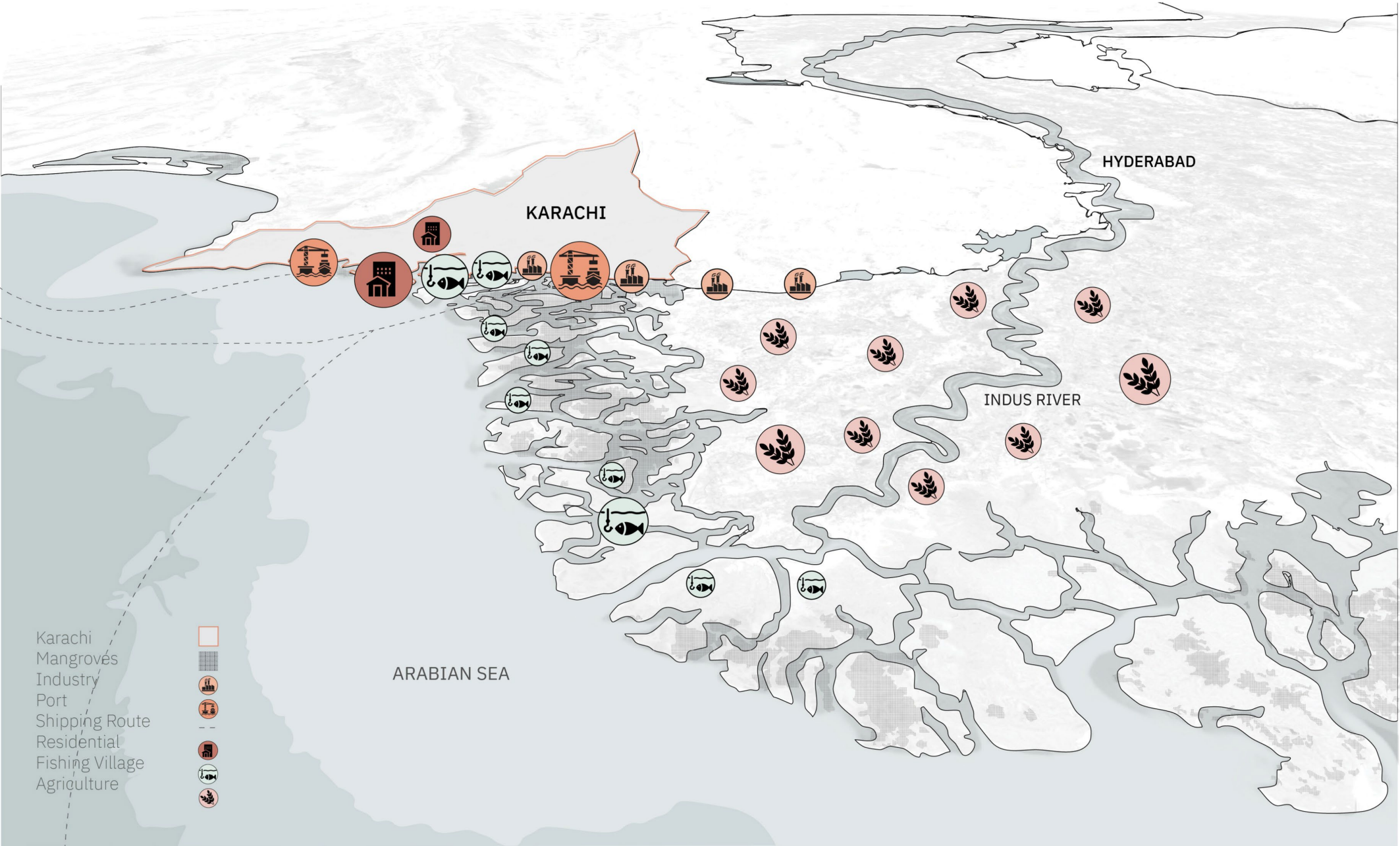
WHAT *IS* THE INDUS DELTA?

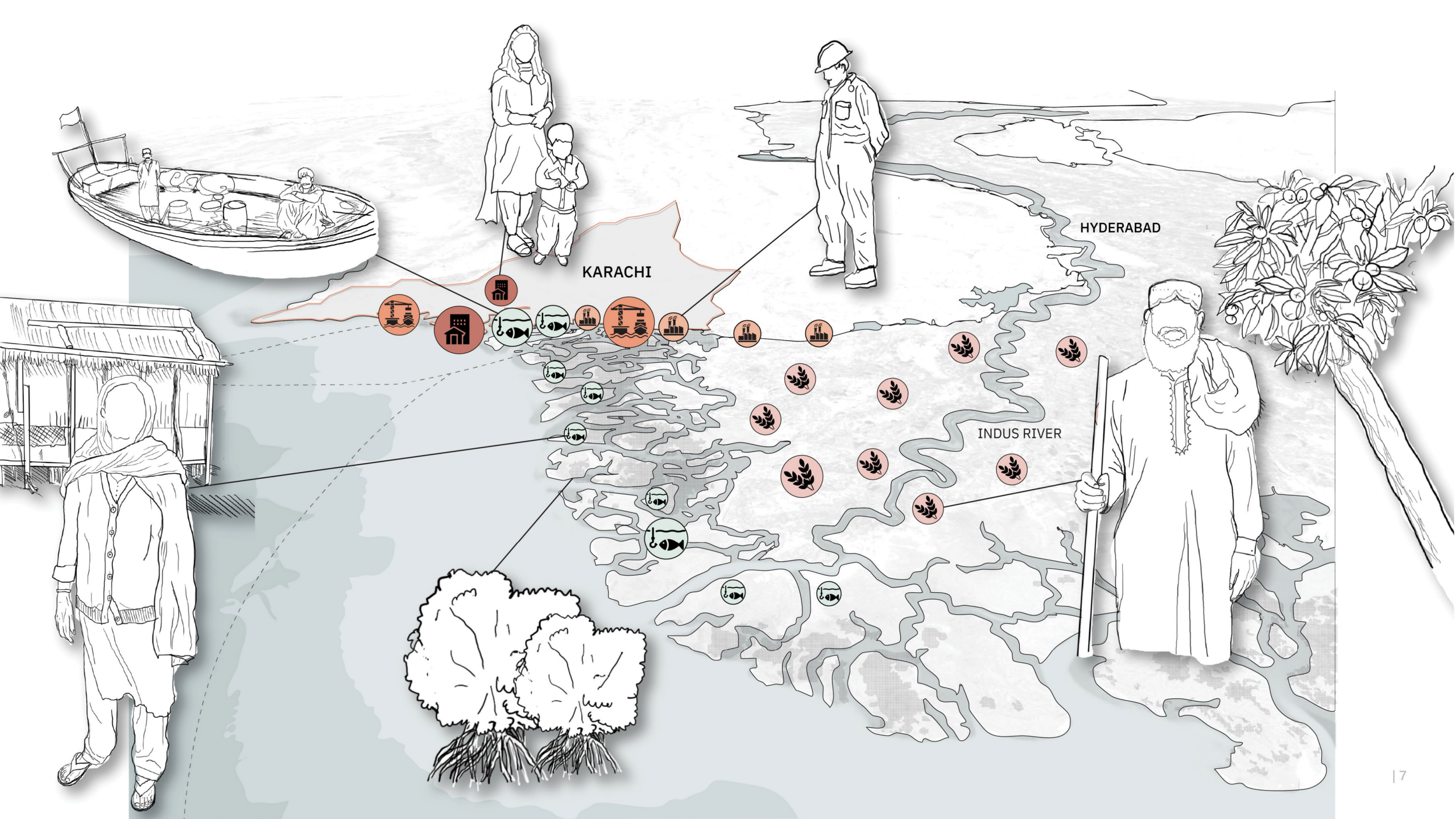


Indus River Basin

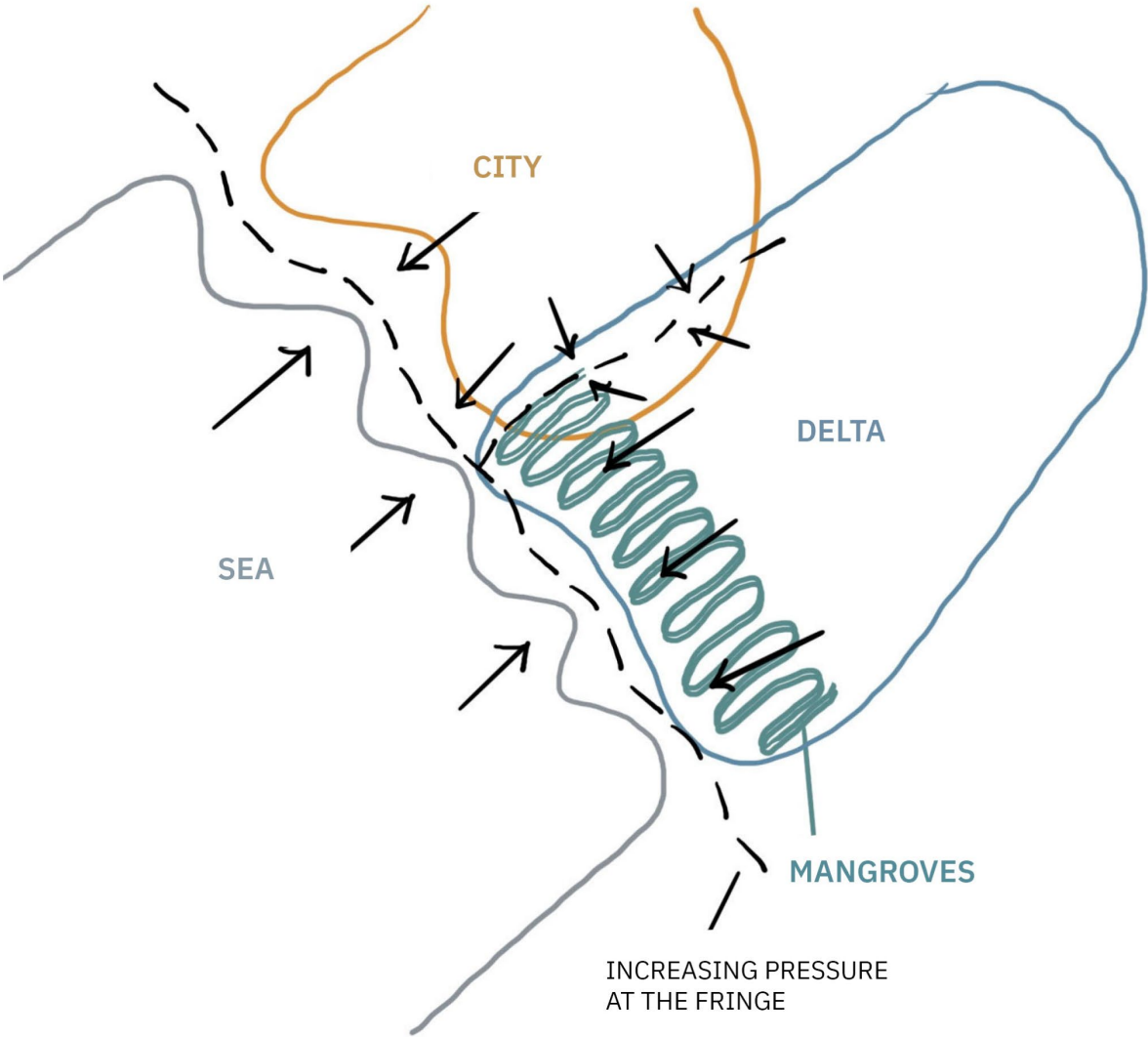


Indus Delta - Typologies





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

Zuhaib 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, 2025



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

WHY IS THE INDUS DELTA *DYING?*



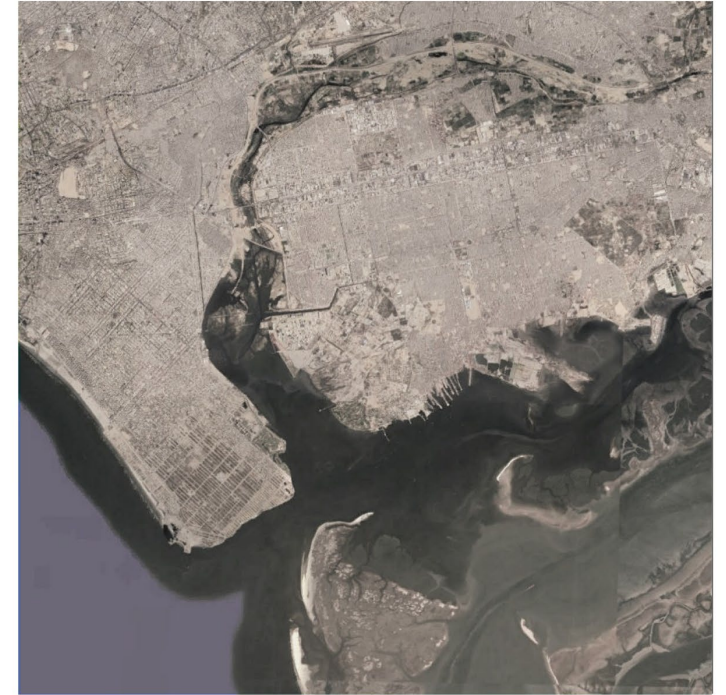
Pressures on the Indus Delta



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

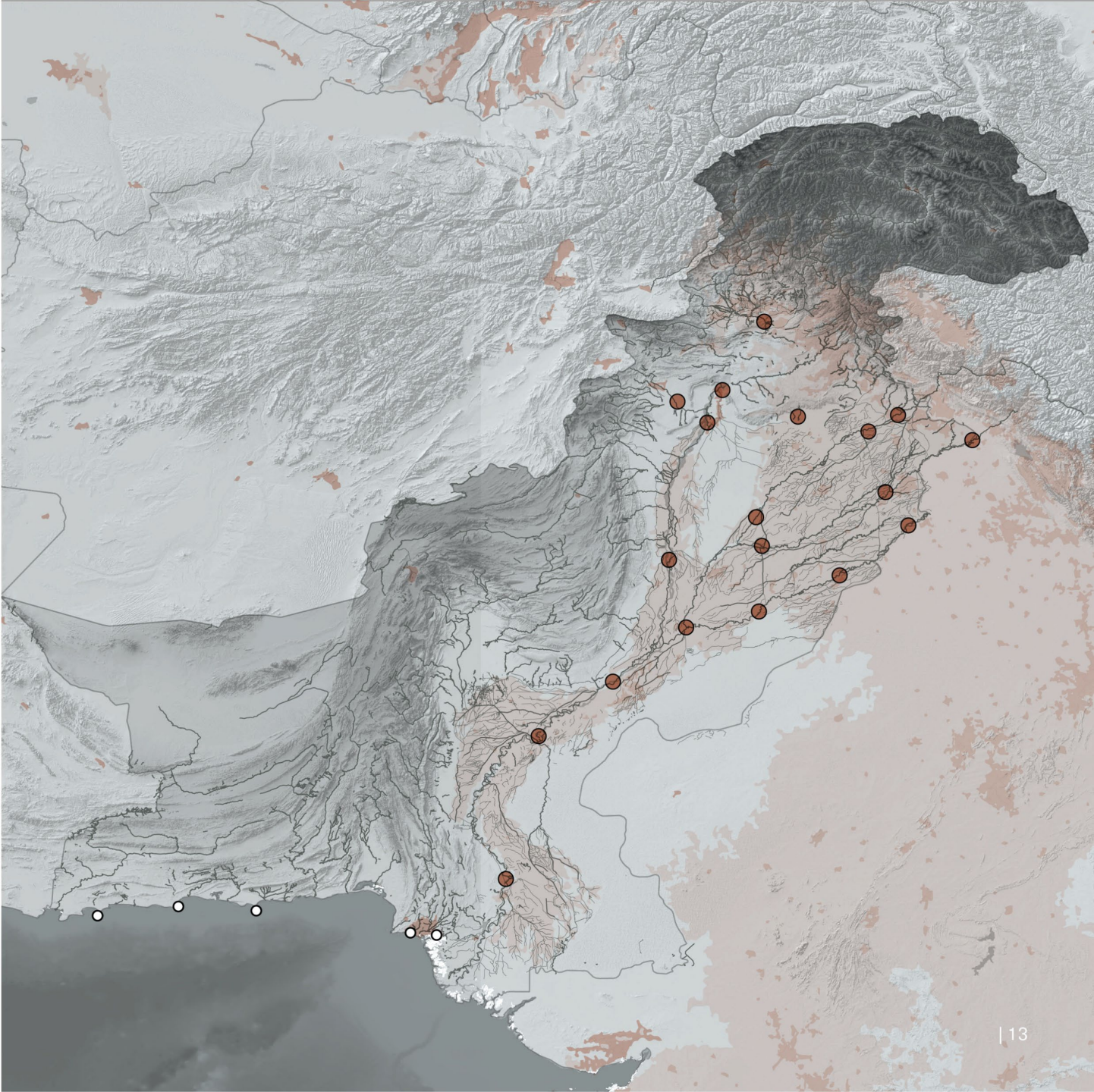


Urban Densification

1. Freshwater Scarcity and Sediment Disruption
Hydropolitics

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

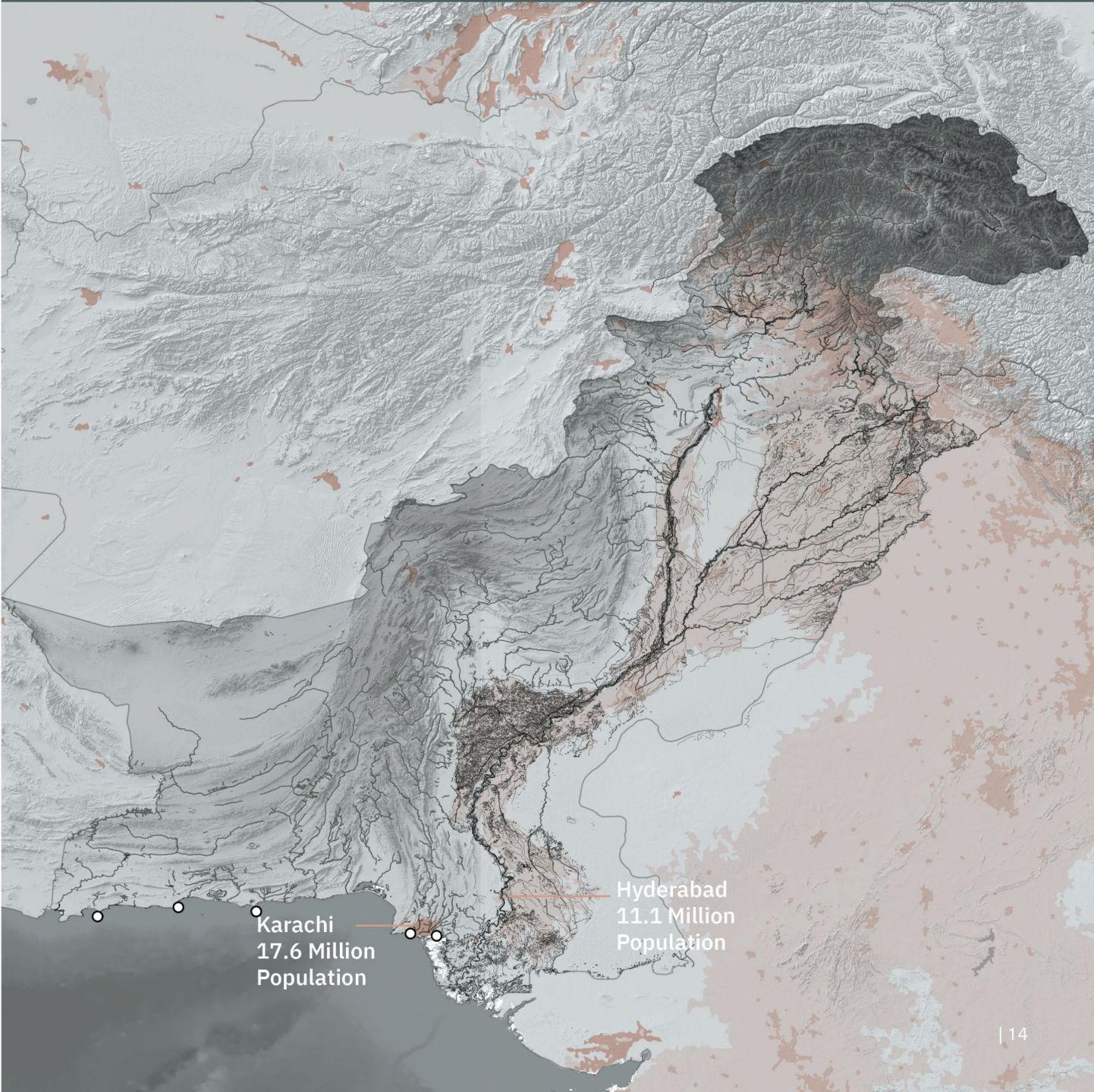
0 100 200 km



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

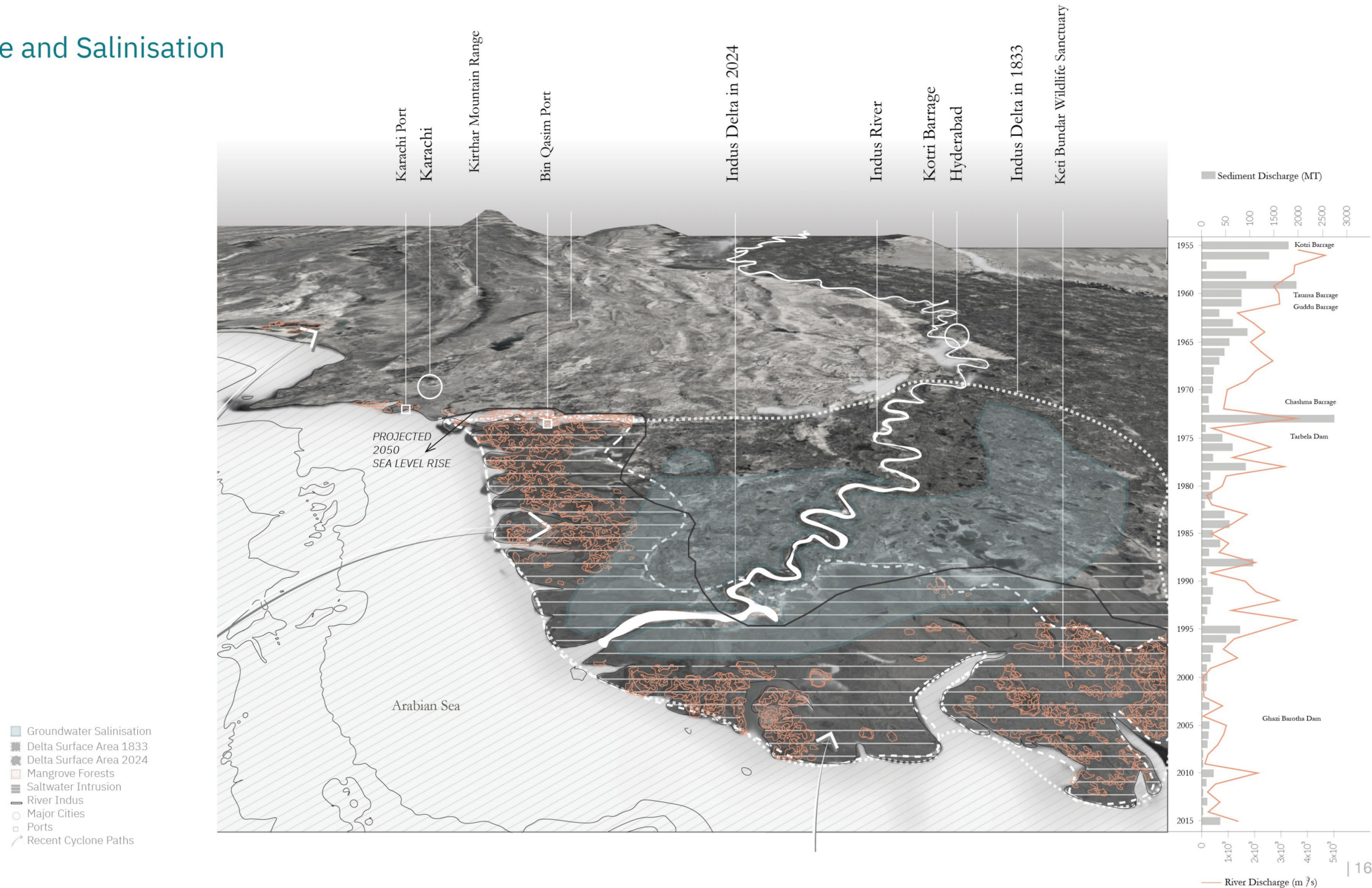


Sea Level Rise and Salinisation



Urban Densification

2. Sea Level Rise and Salinisation



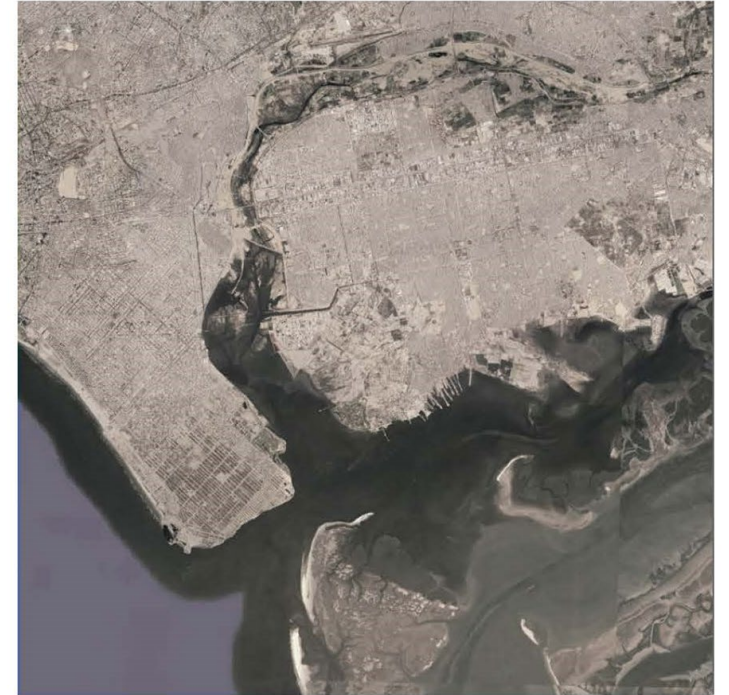
Pressures on the Indus Delta



Freshwater Scarcity and Sediment Disruption



Sea Level Rise and Salinisation



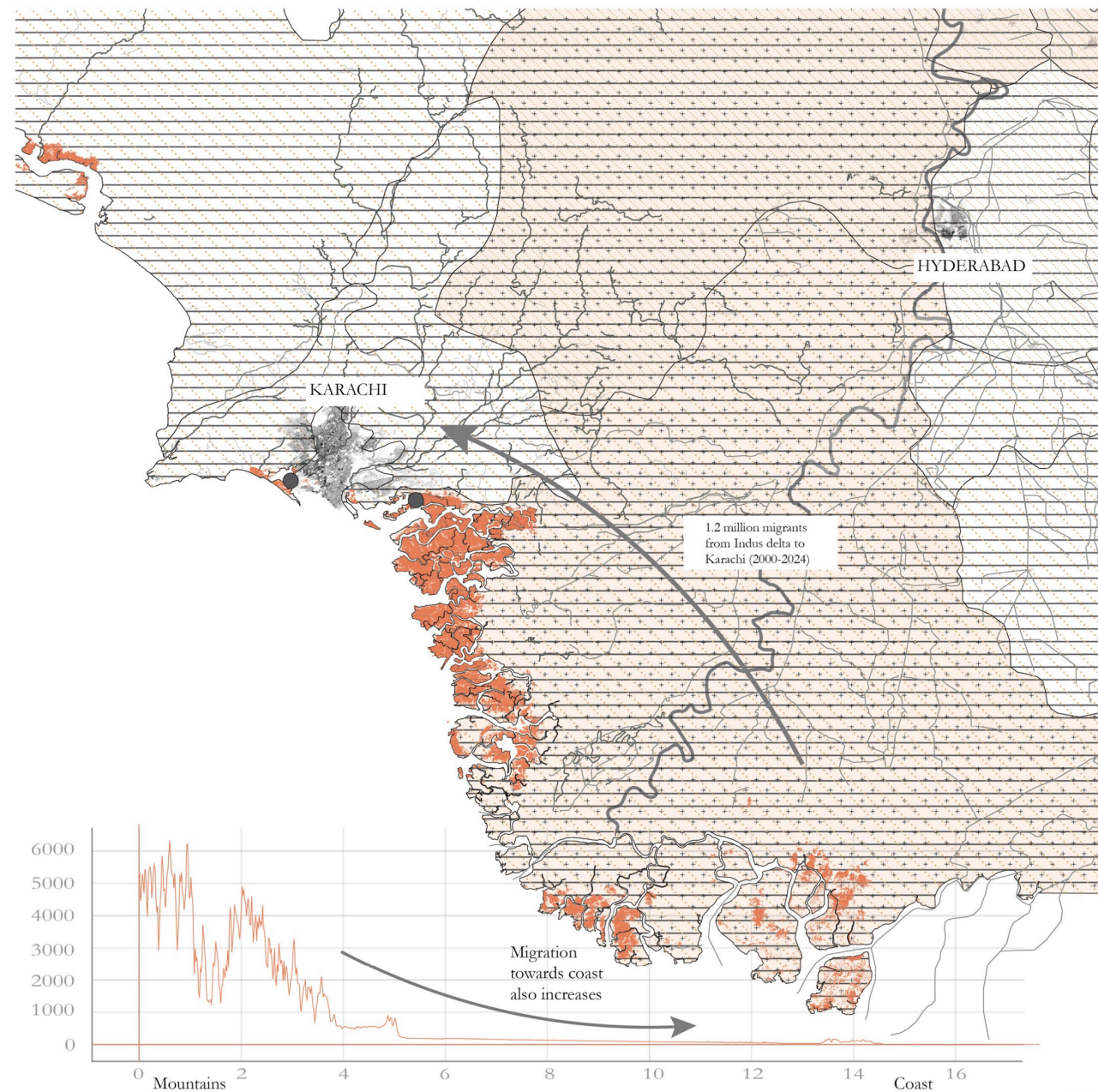
Urban Densification

3. Urban Densification

Rural to Urban Migration

- District Boundary
- Densely Populted Major Cities
- Mangrove Forests
- River Network
- Ports
- Riverine Flood Risk (high)
- Drought Risk (high)
- Cyclone Risk (high)
- Stormsurge Risk (high)
- Migration of People

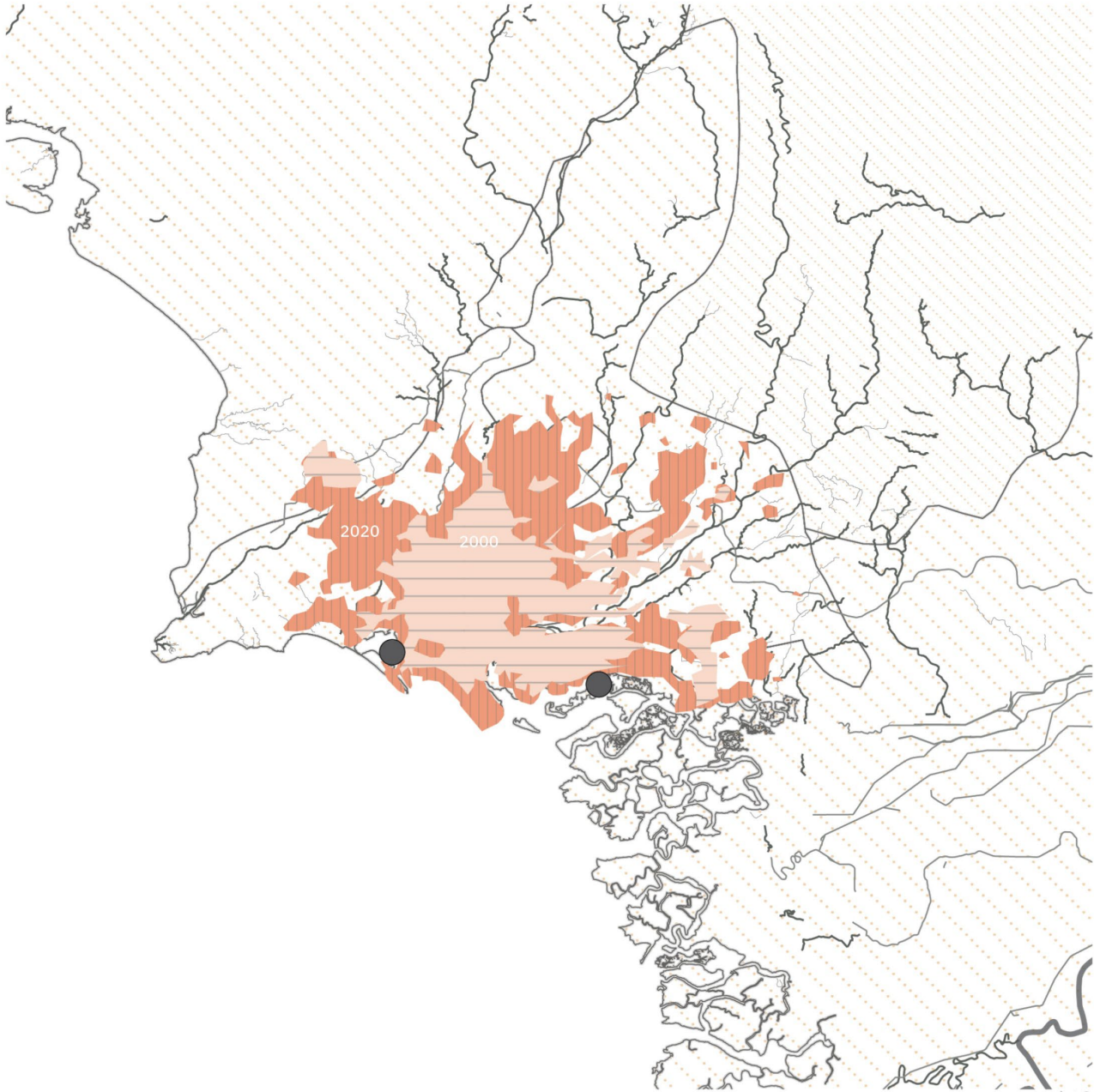
0 10 20 km



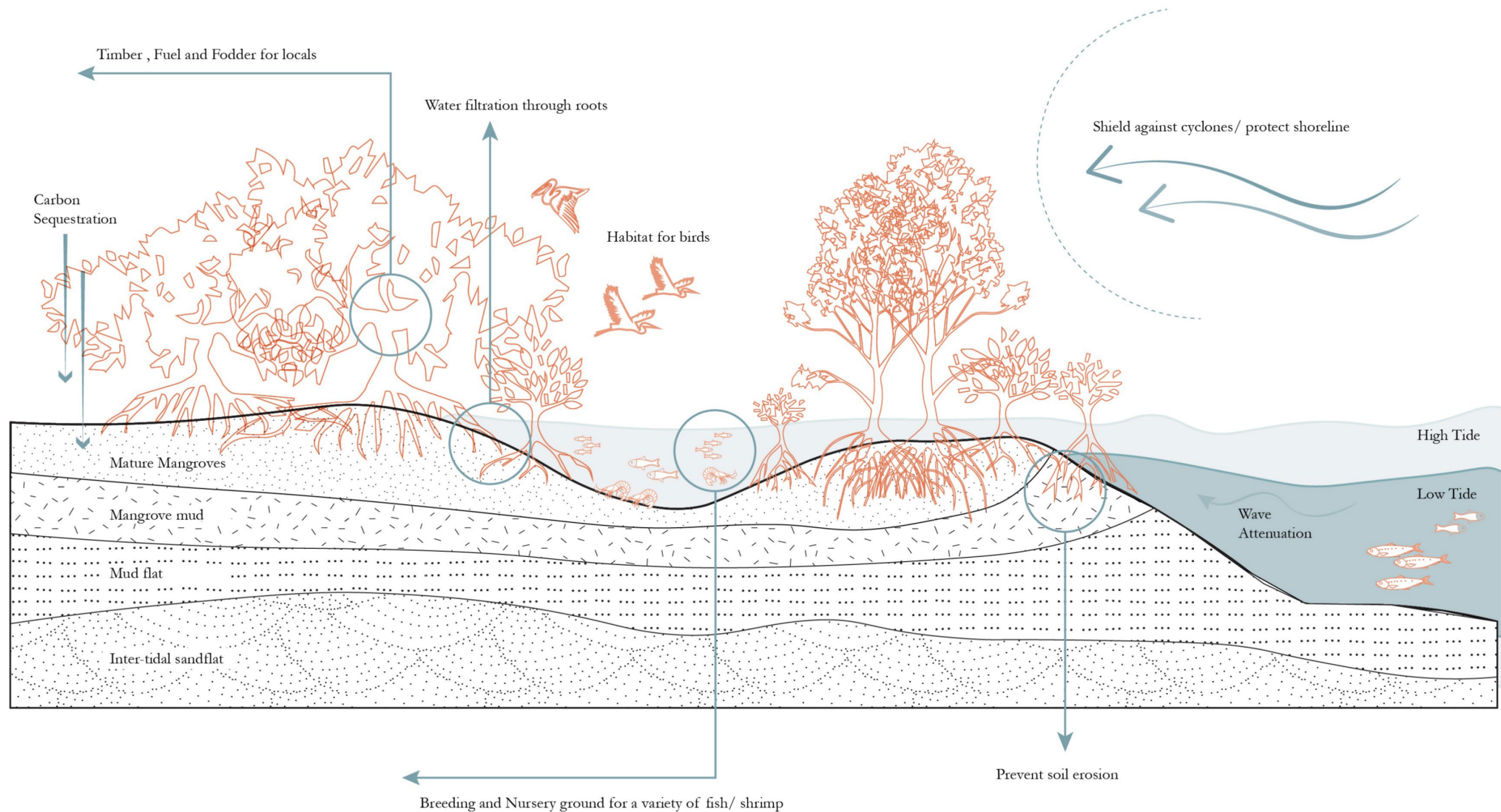
3. Urban Densification
Karachi's Expansion

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

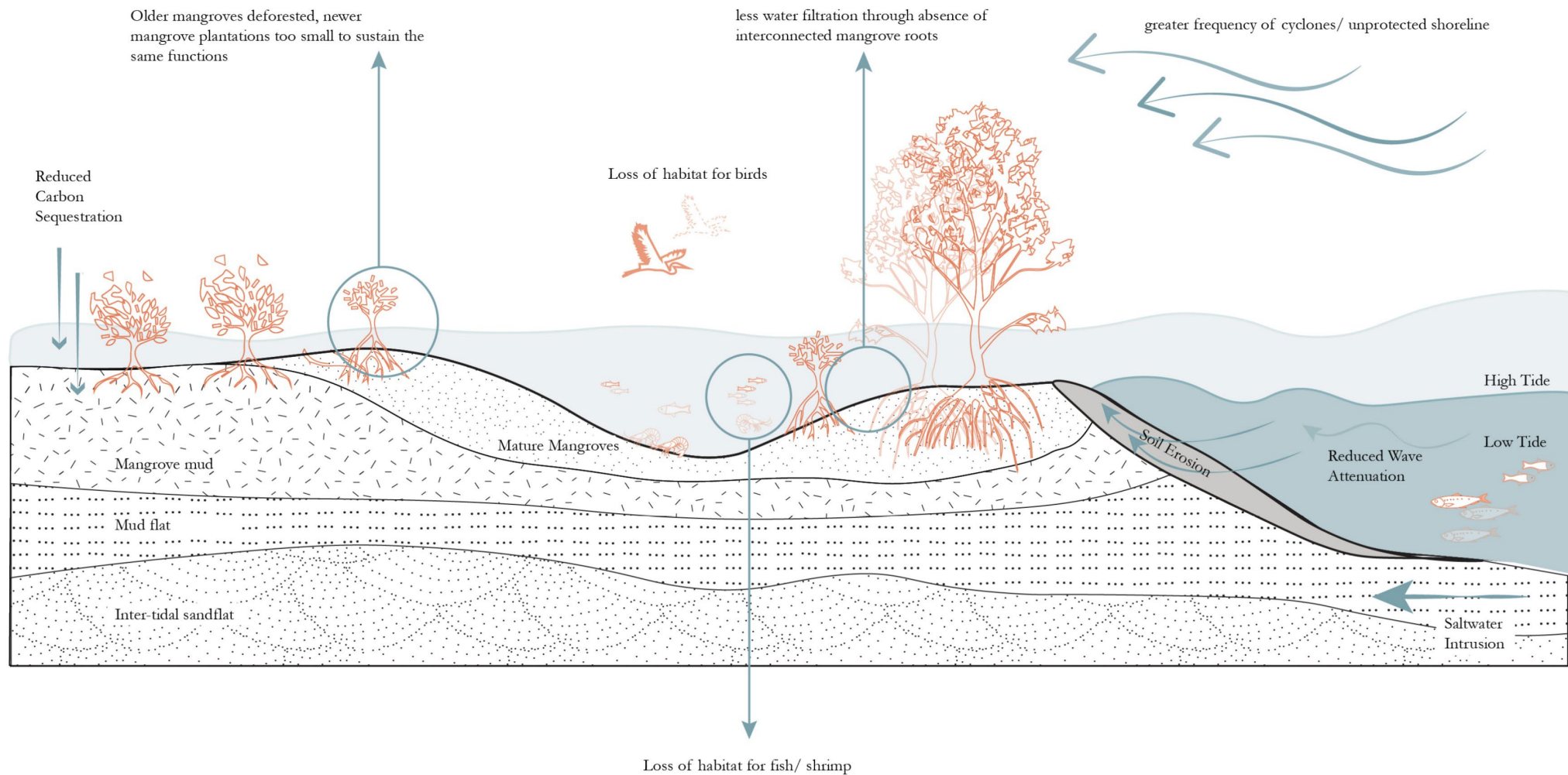
0 10 20 km



Impact on Mangrove Ecosystems



Impact on Mangrove Ecosystems



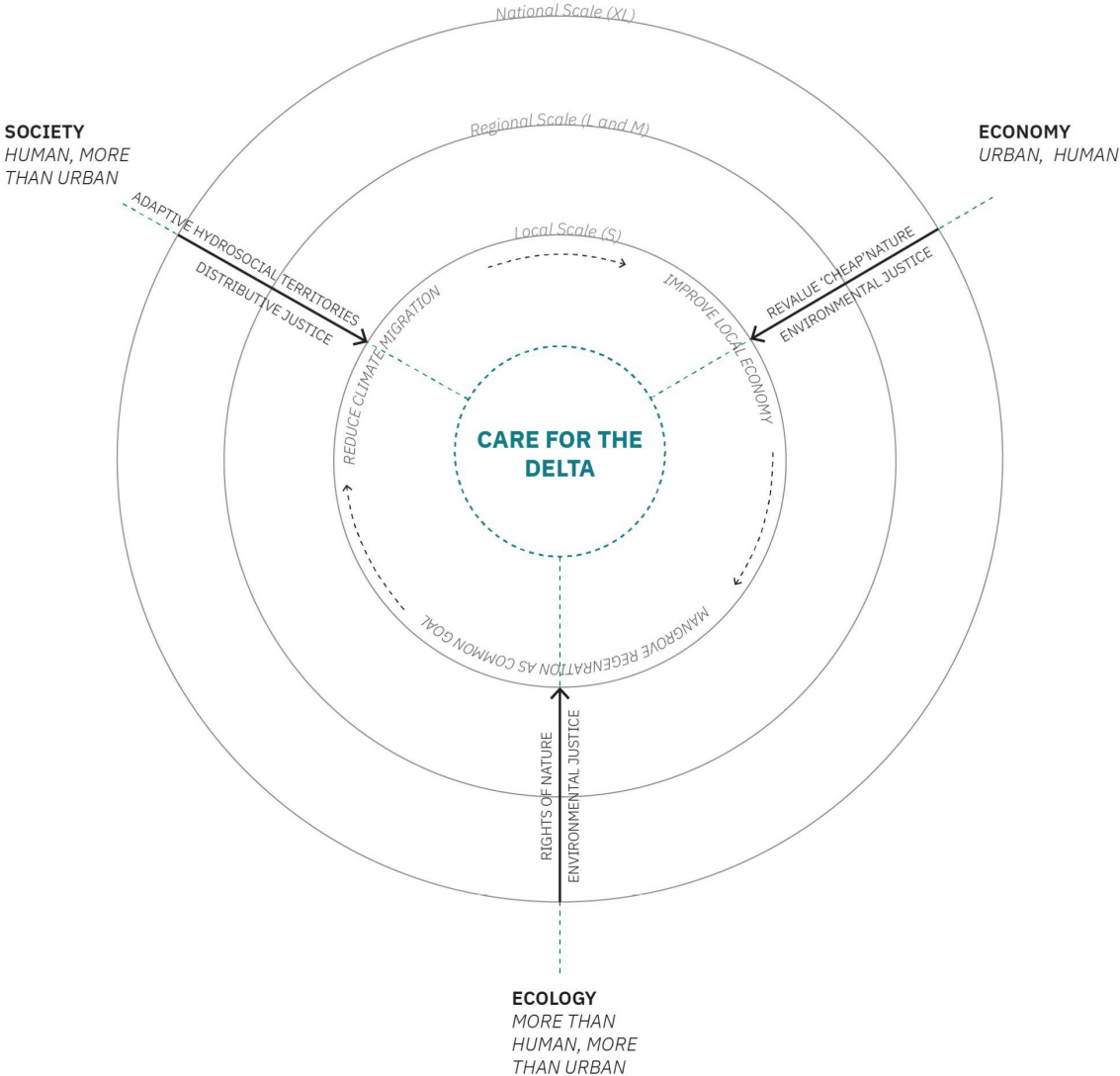
How can **networks of care**, enable humans to nurture the **Indus Delta mangrove ecosystem**, fostering **harmony** between **human** and **more-than-human** populations?



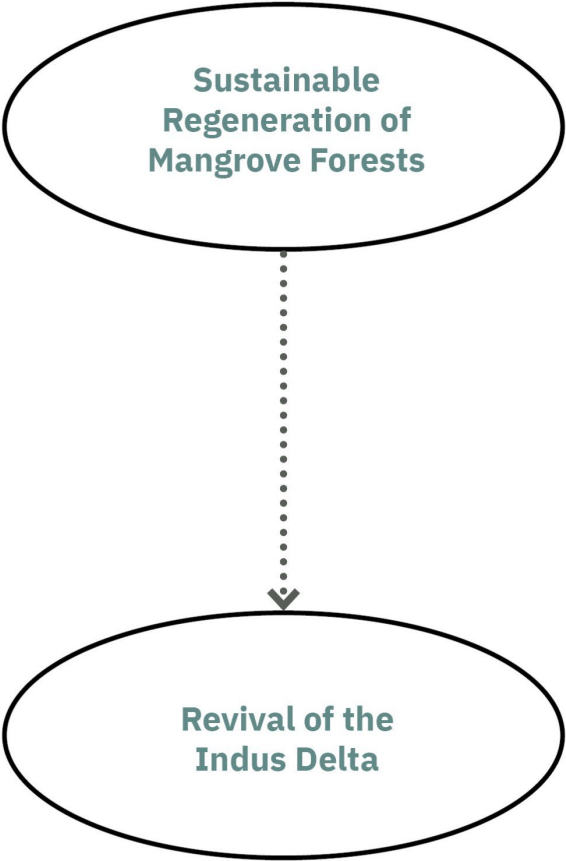
What is 'Care'?



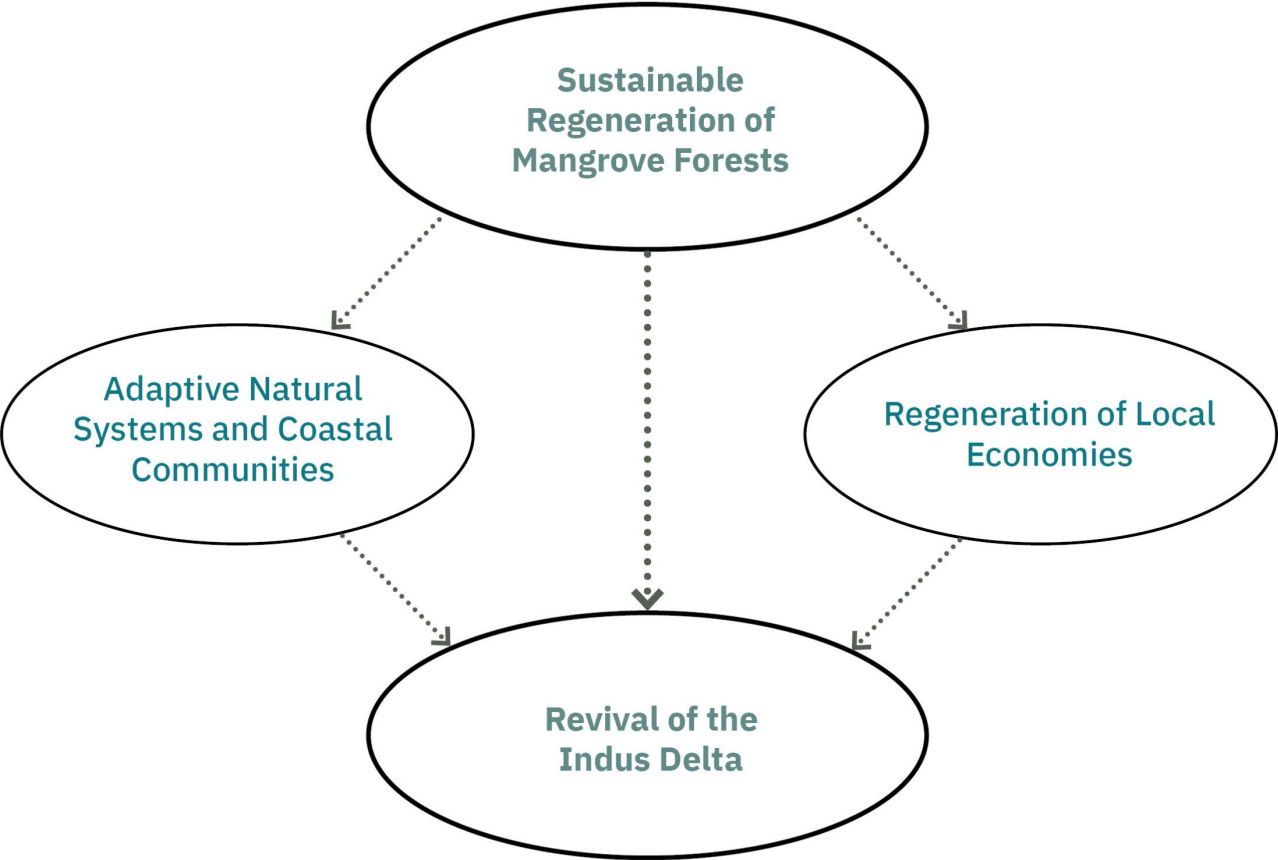
Conceptual Framework



Research Aim



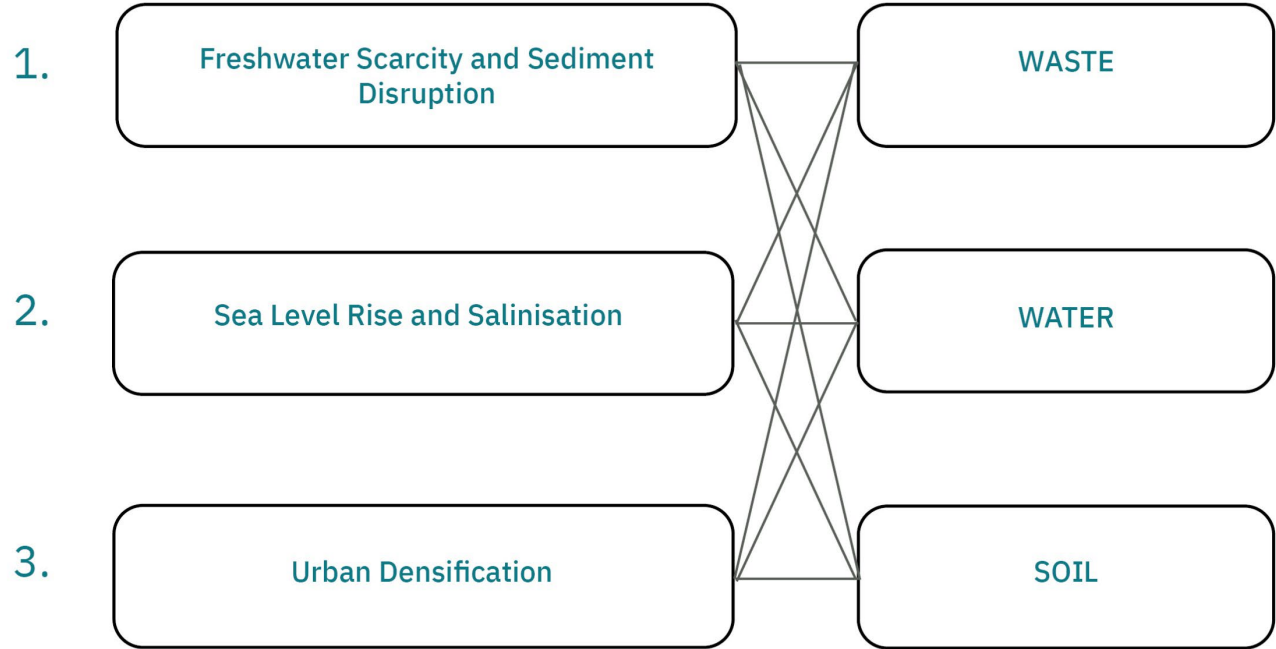
Research Aim



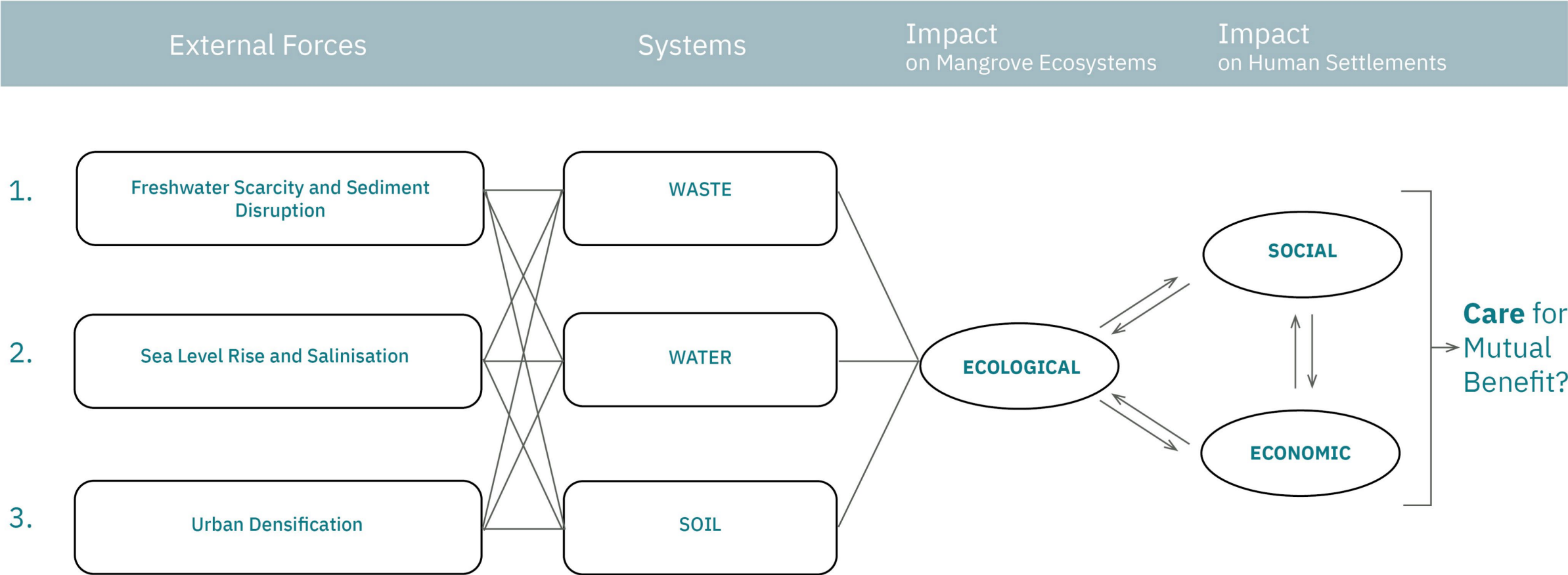
METHODOLOGY



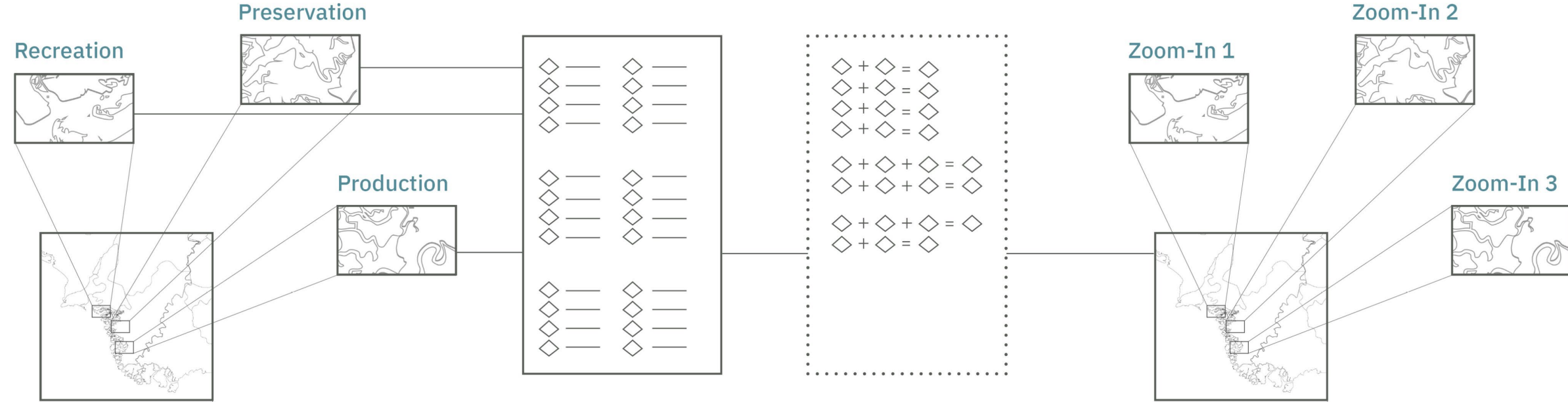
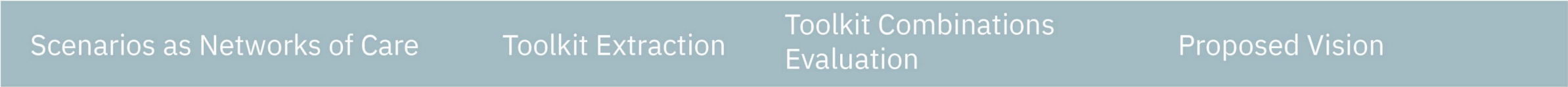
Analysis Framework



Analysis Framework



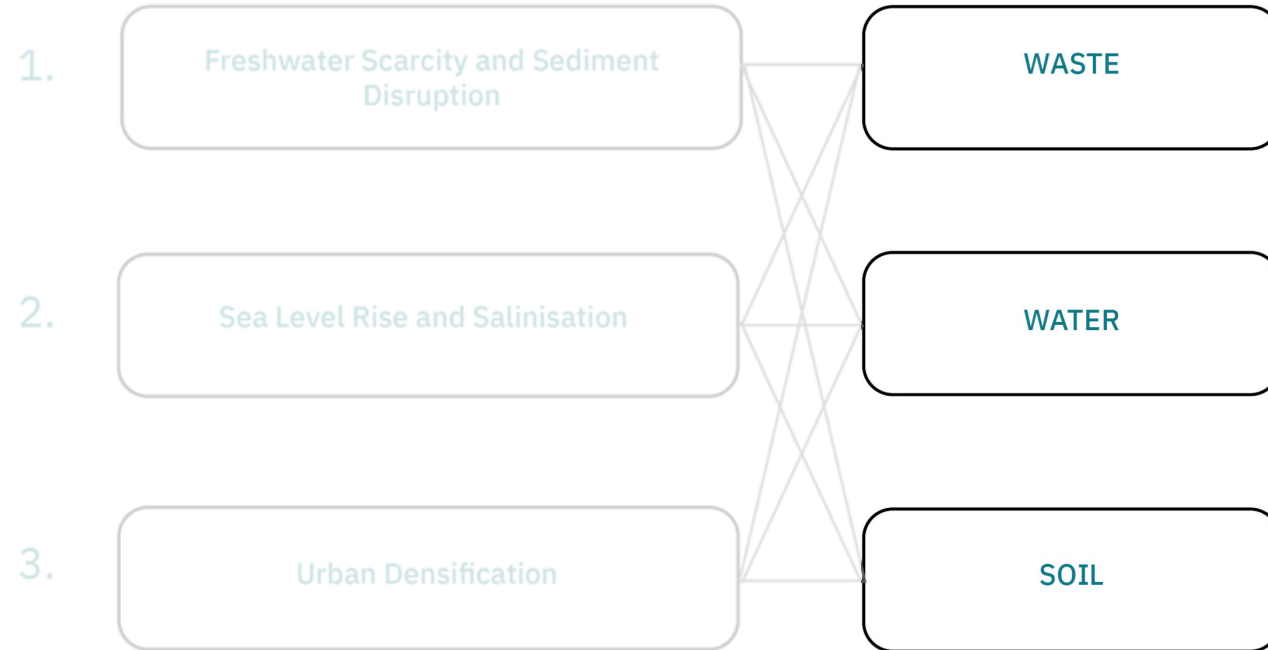
Approach
Research By Design



ANALYSIS



Analysis Framework



Delta - Freshwater Flow

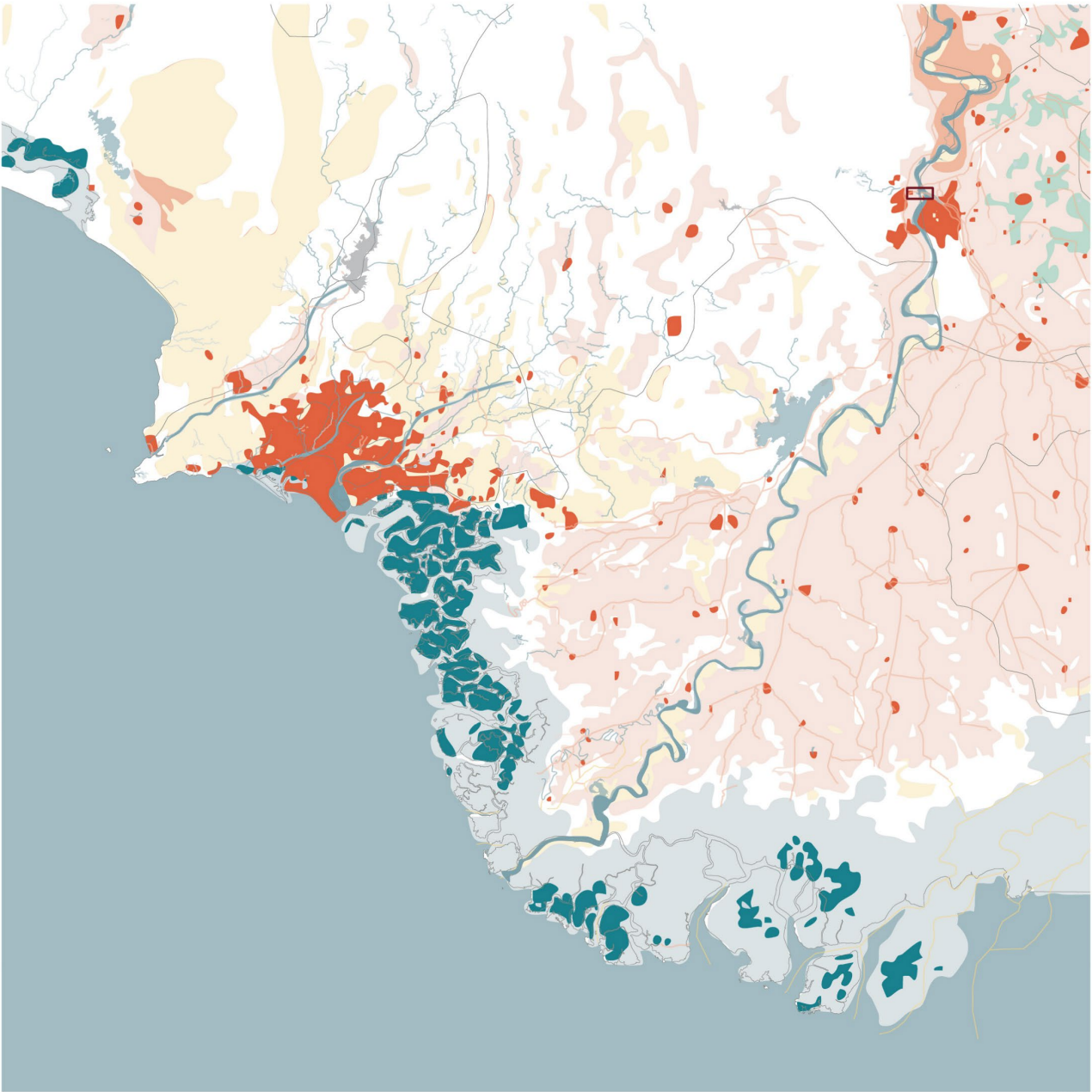
- District Boundary
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake
- River Network
- Sea

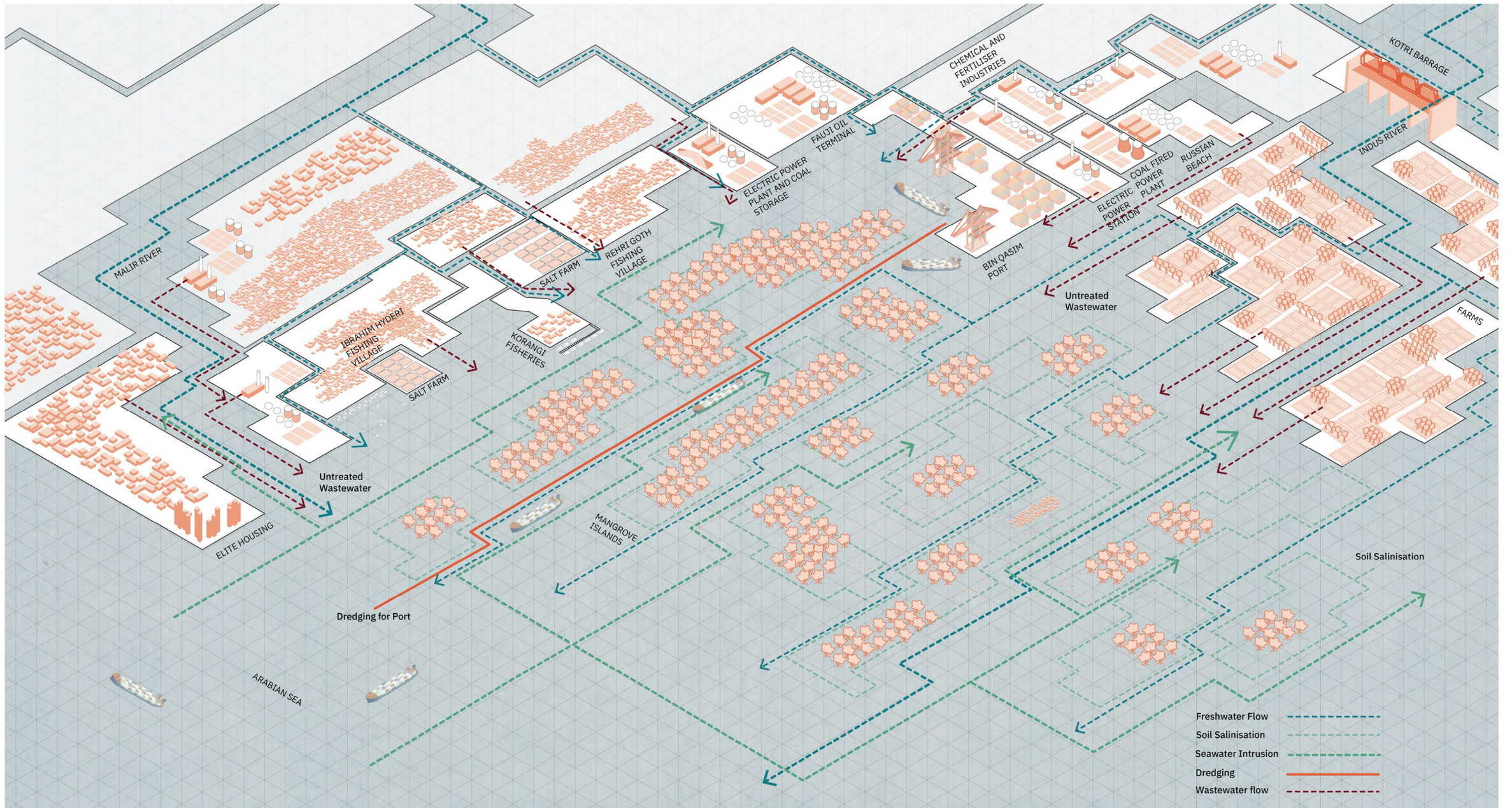
0 10 20 km



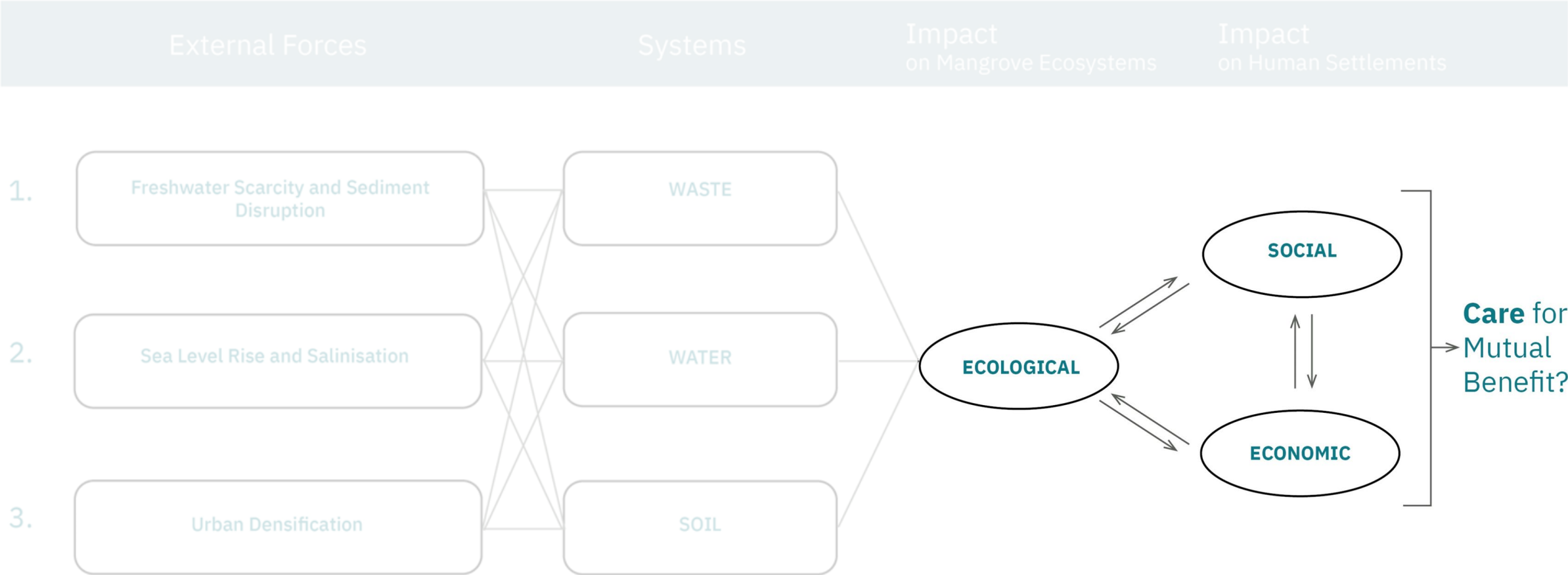
Delta - Land-Use

- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network
- Sea
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake





Analysis Framework



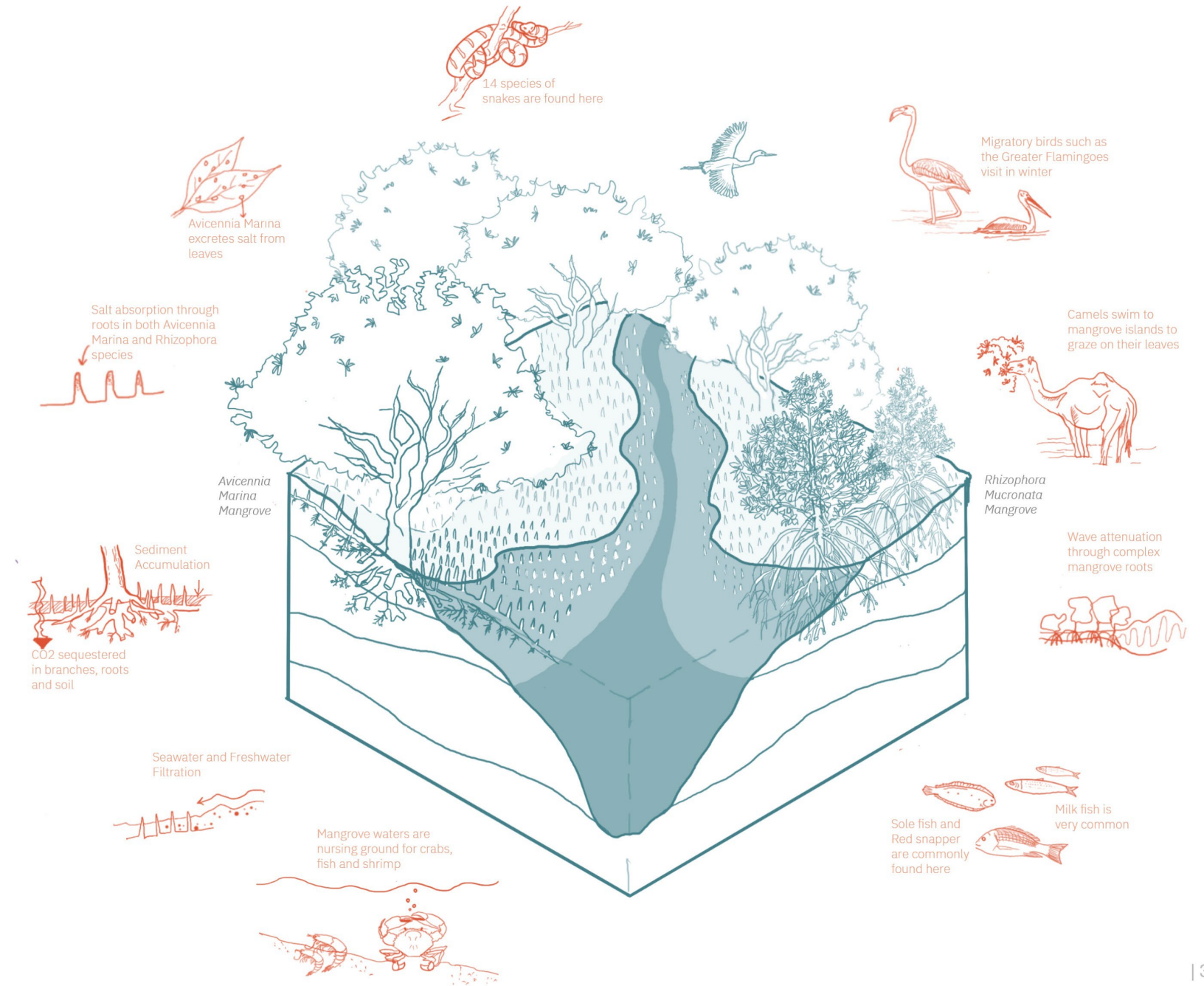
FIELDWORK



Fieldwork Routes

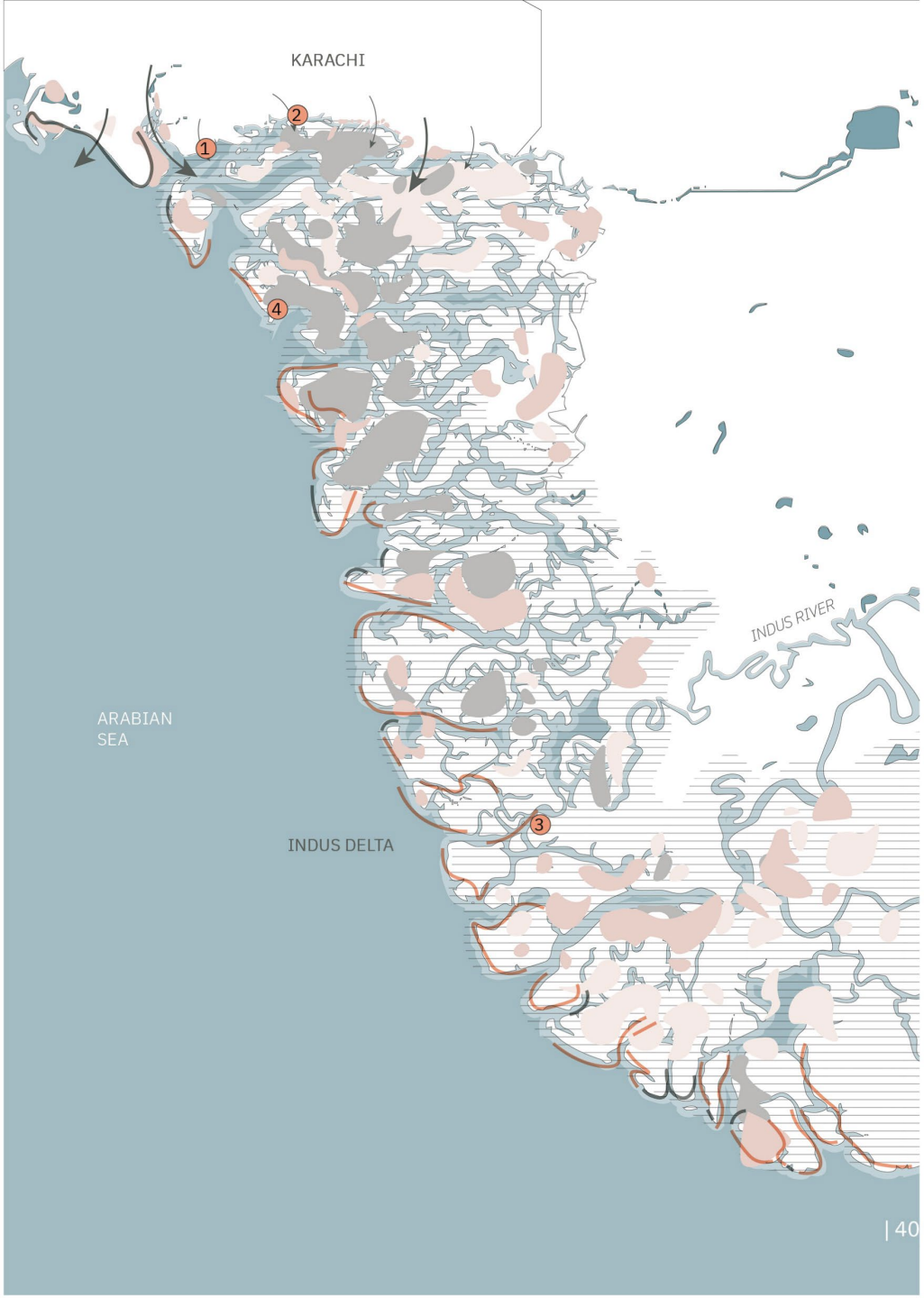


More-than-Human/ More-than-Urban Ecology



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



Human/ More-Than-Urban
Society

Rehri Goth



Keti Bandar

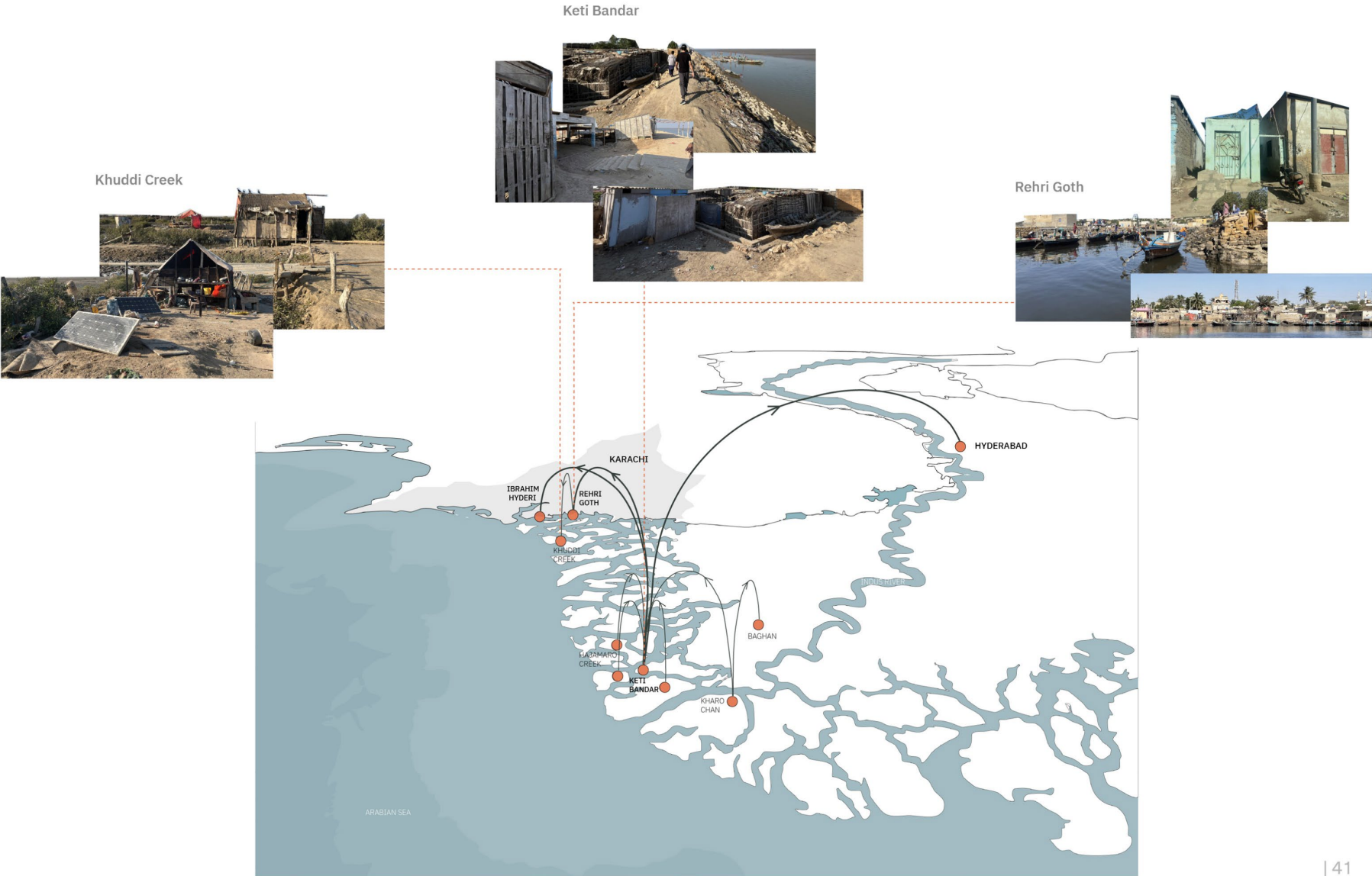


Khuddi Creek

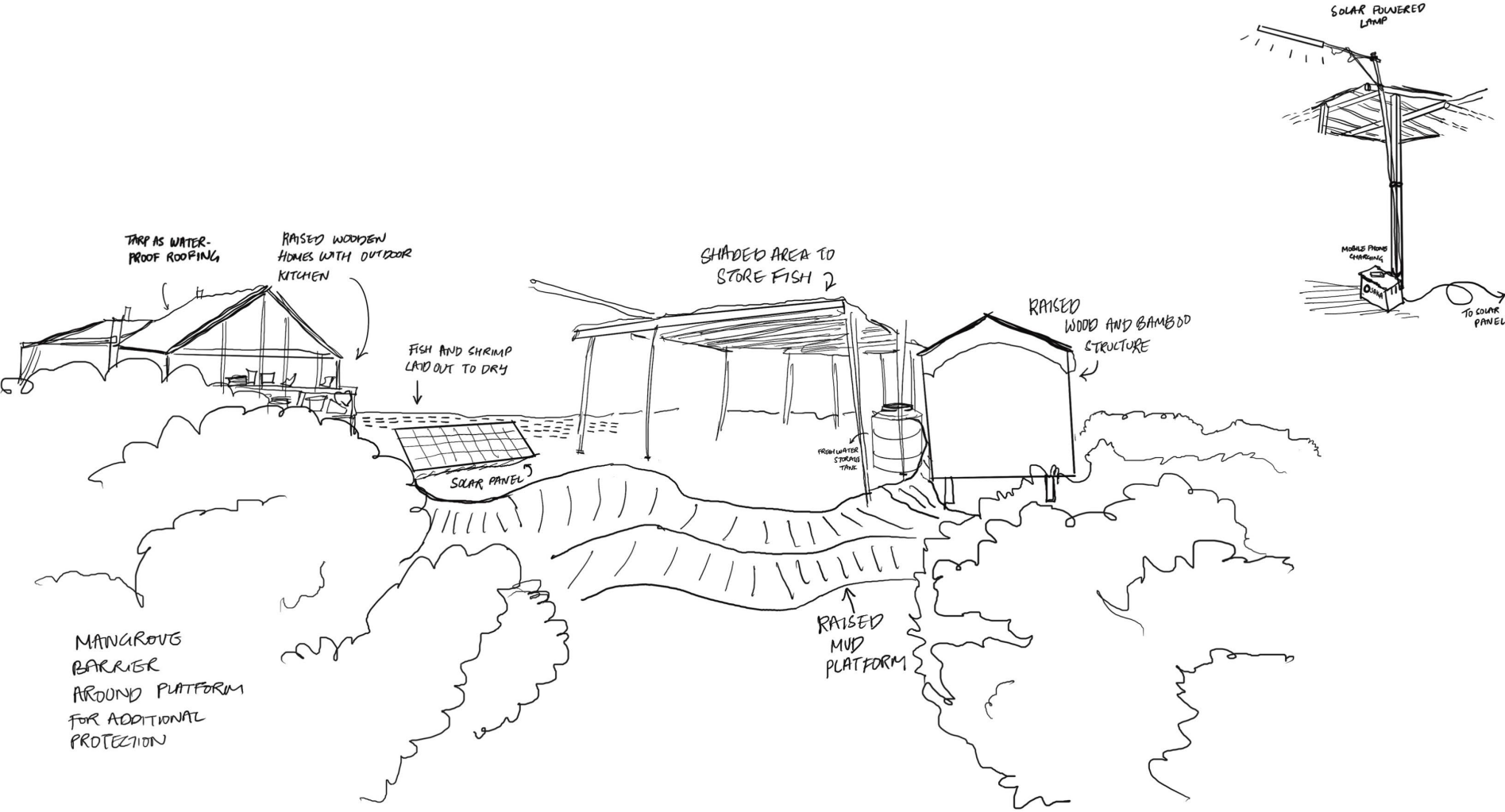


Dense Urban Village

Small cluster of homes



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

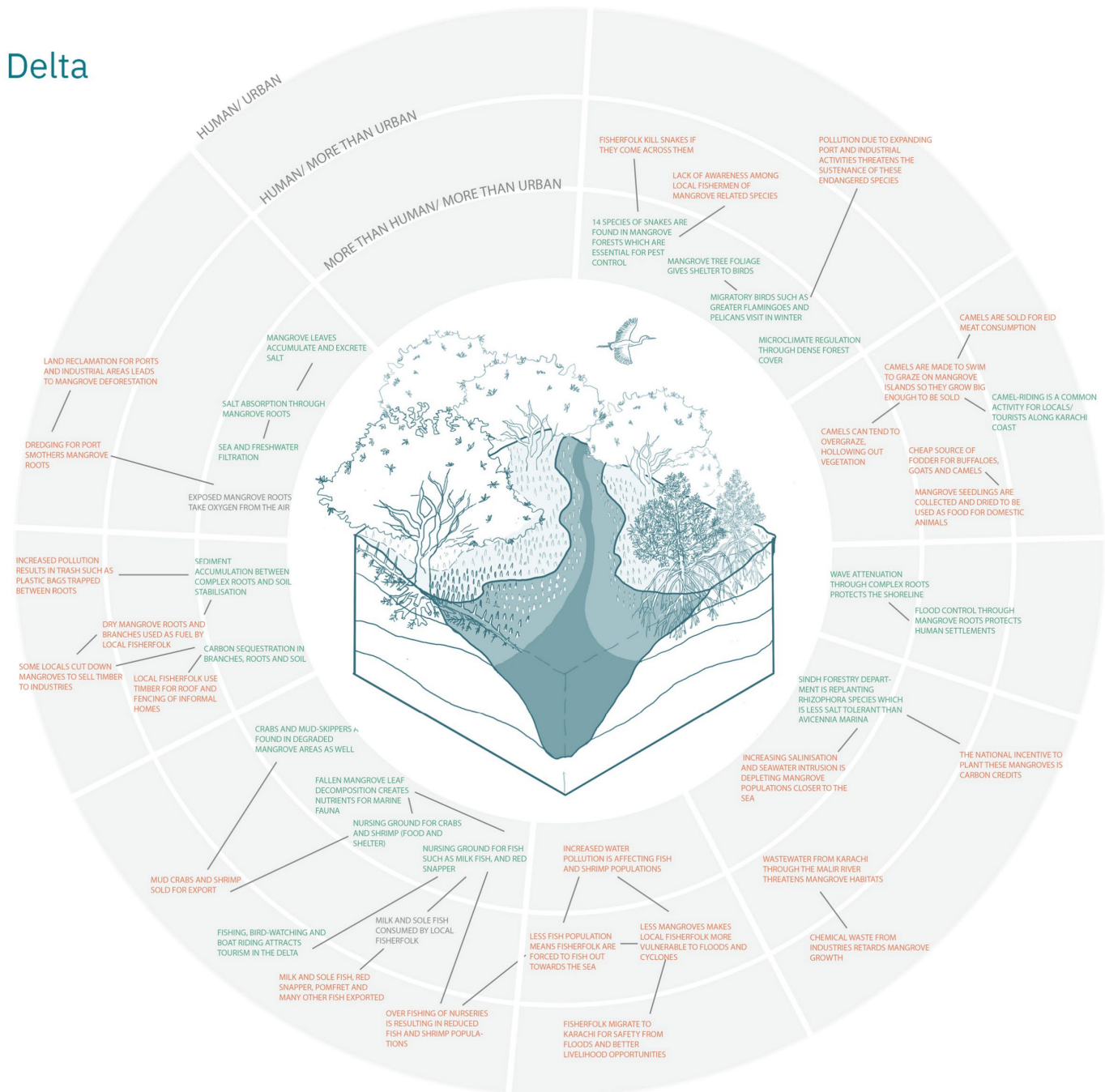


Human/ Urban
Economy

- 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



Mangroves as Core of the Delta



Local Case Studies

Existing Relationship With Mangroves

RECREATION



Fishing Tours by Local Fisherfolk
(Source: khanaymeikyahai)



The Mahigeer Mangrove Tour



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

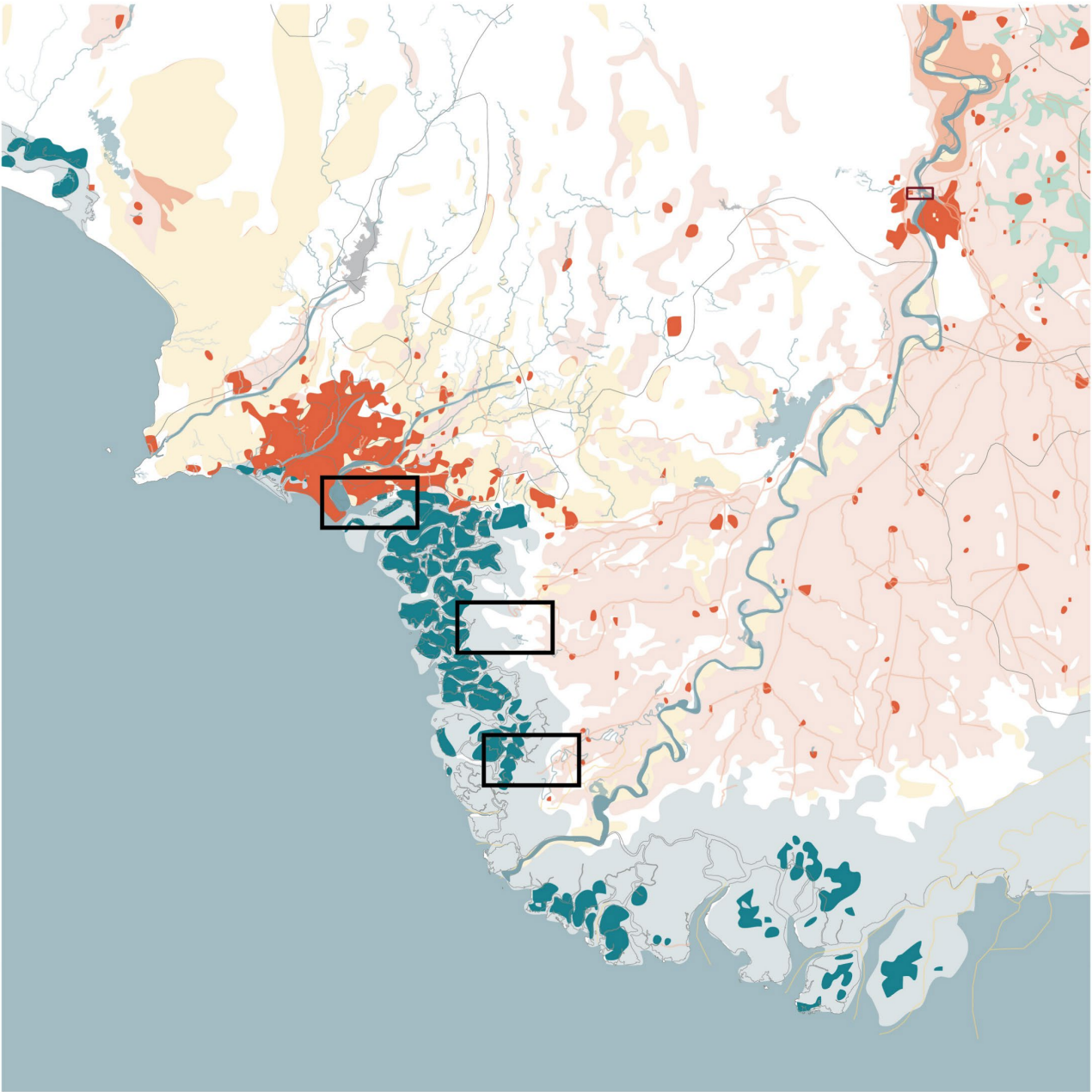
PRODUCTION



Creating adaptive livelihoods
through agricultural gradients.

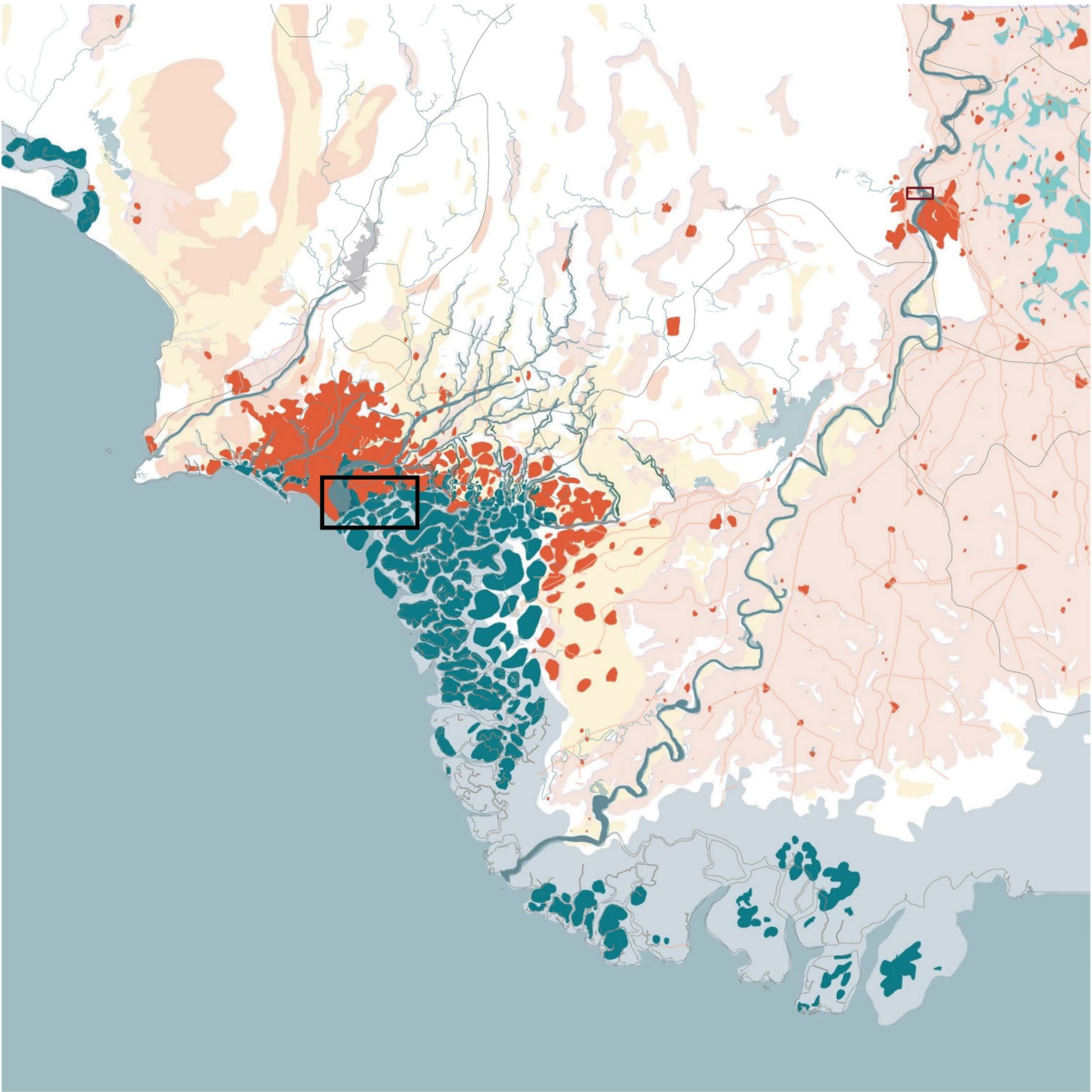
Delta: Existing Condition

- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network
- Sea
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake



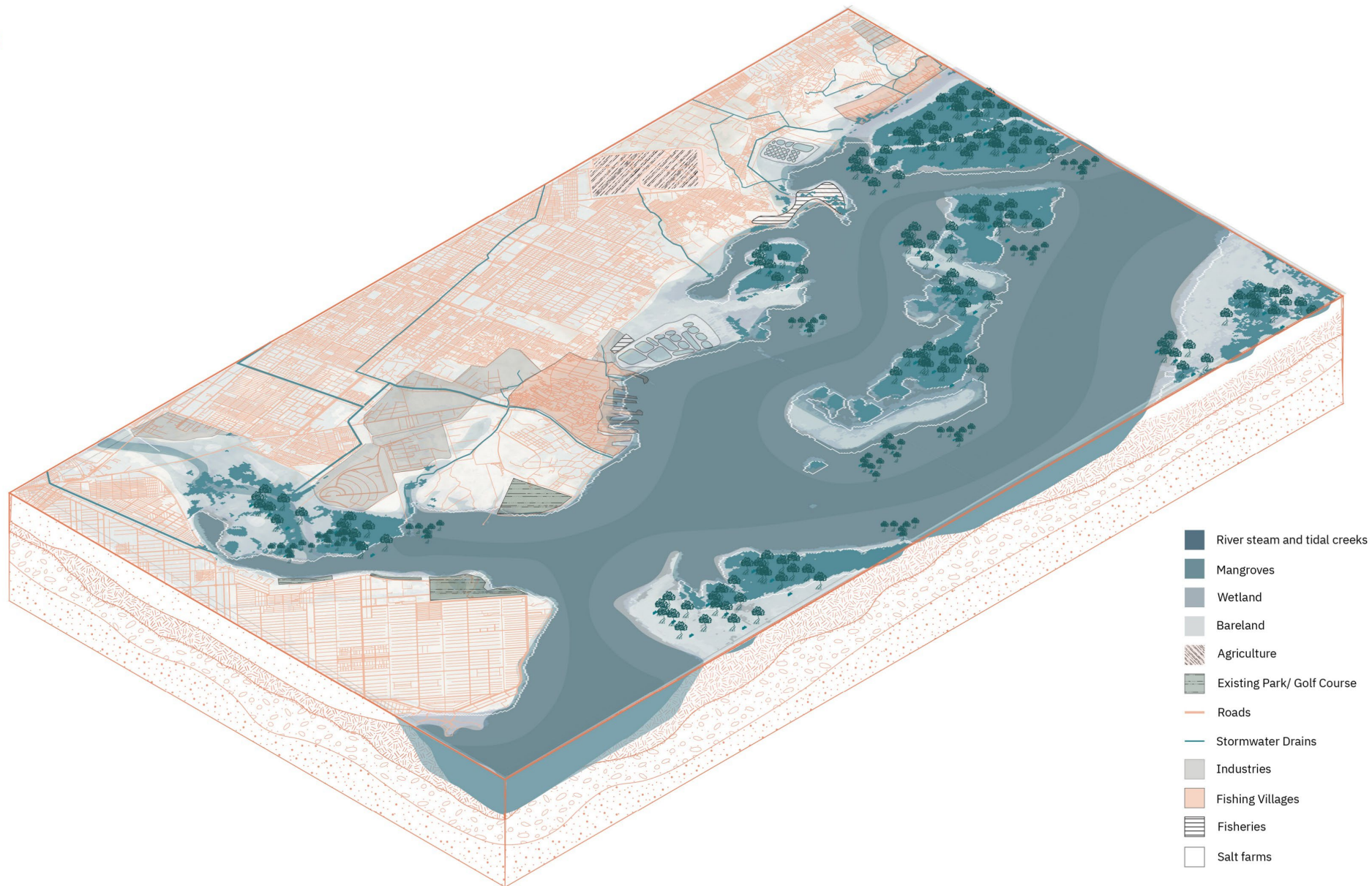
Network of Recreation

- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network
- Sea
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake

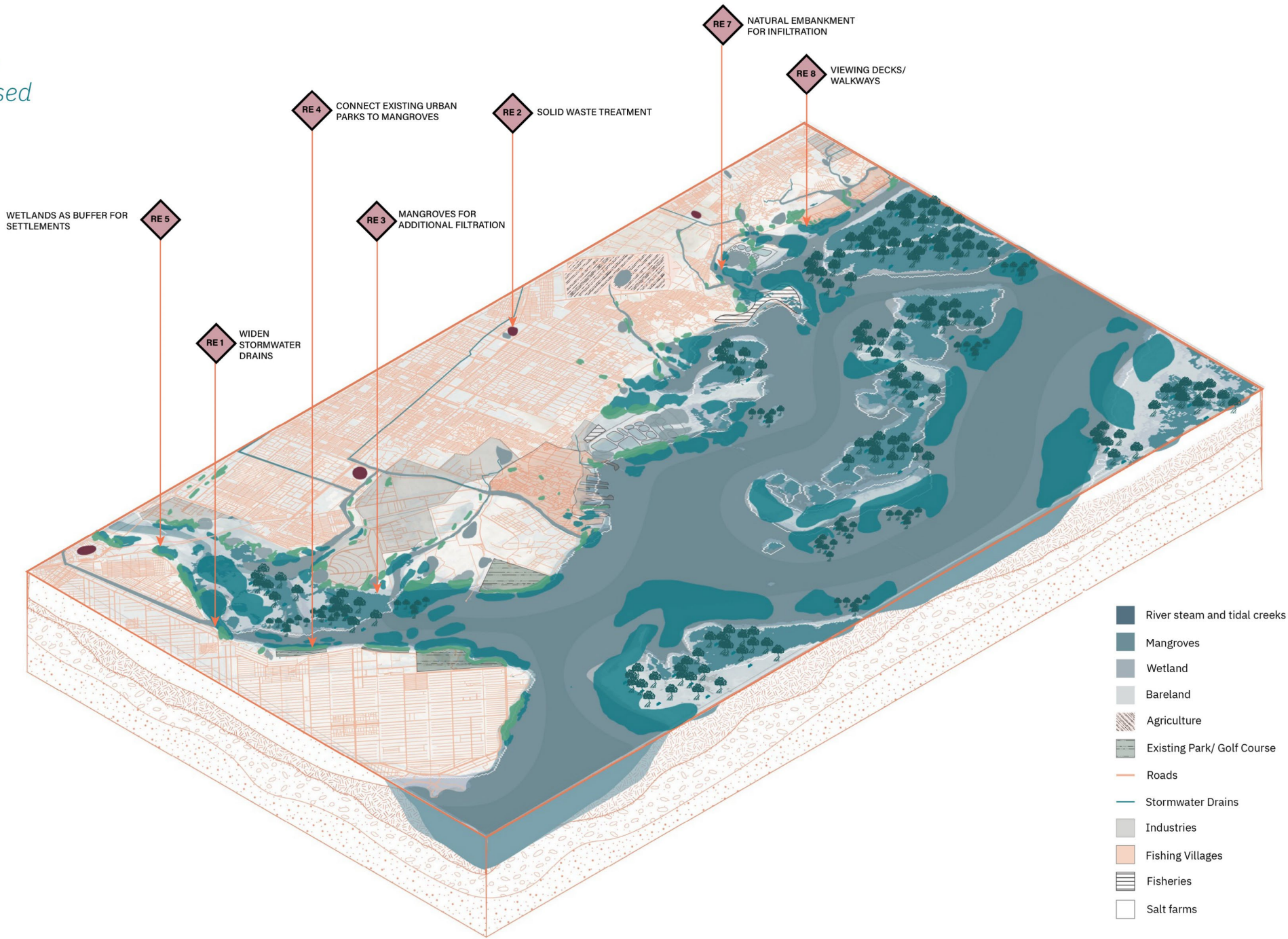


Network of Recreation
Zoom-in Area 1: Existing

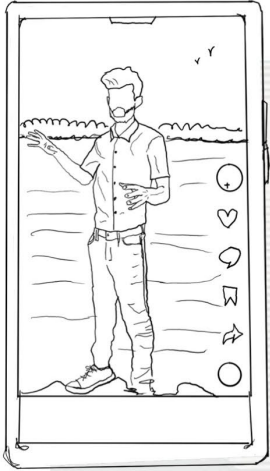
Karachi Coast and Delta



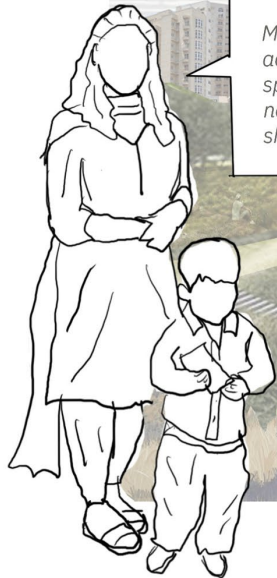
Network of Recreation
Zoom-in Area 1: Proposed







I have observed a greater variety in bird species near the city than before.



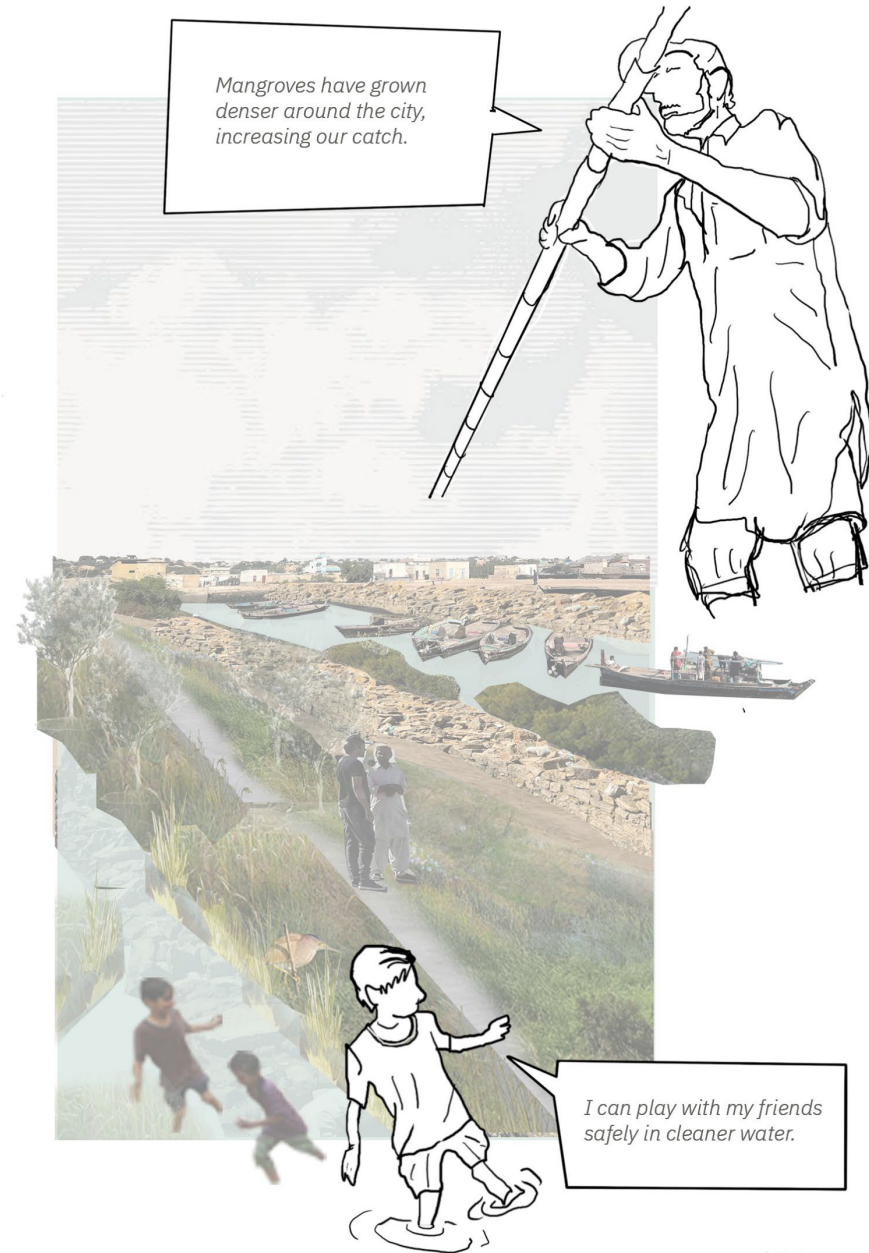
My kids and I now have access to cleaner public spaces that also keep our neighbourhood cool and shaded.



Due to proper waste management, I can breathe and flourish in a cleaner environment.



I can now enjoy my breaks in the mangrove park next to the creek.



Mangroves have grown denser around the city, increasing our catch.

I can play with my friends safely in cleaner water.

RECREATION



Reconnecting mangroves
with urban life

PRESERVATION



Restoring natural flows and
sedimentation processes

PRODUCTION

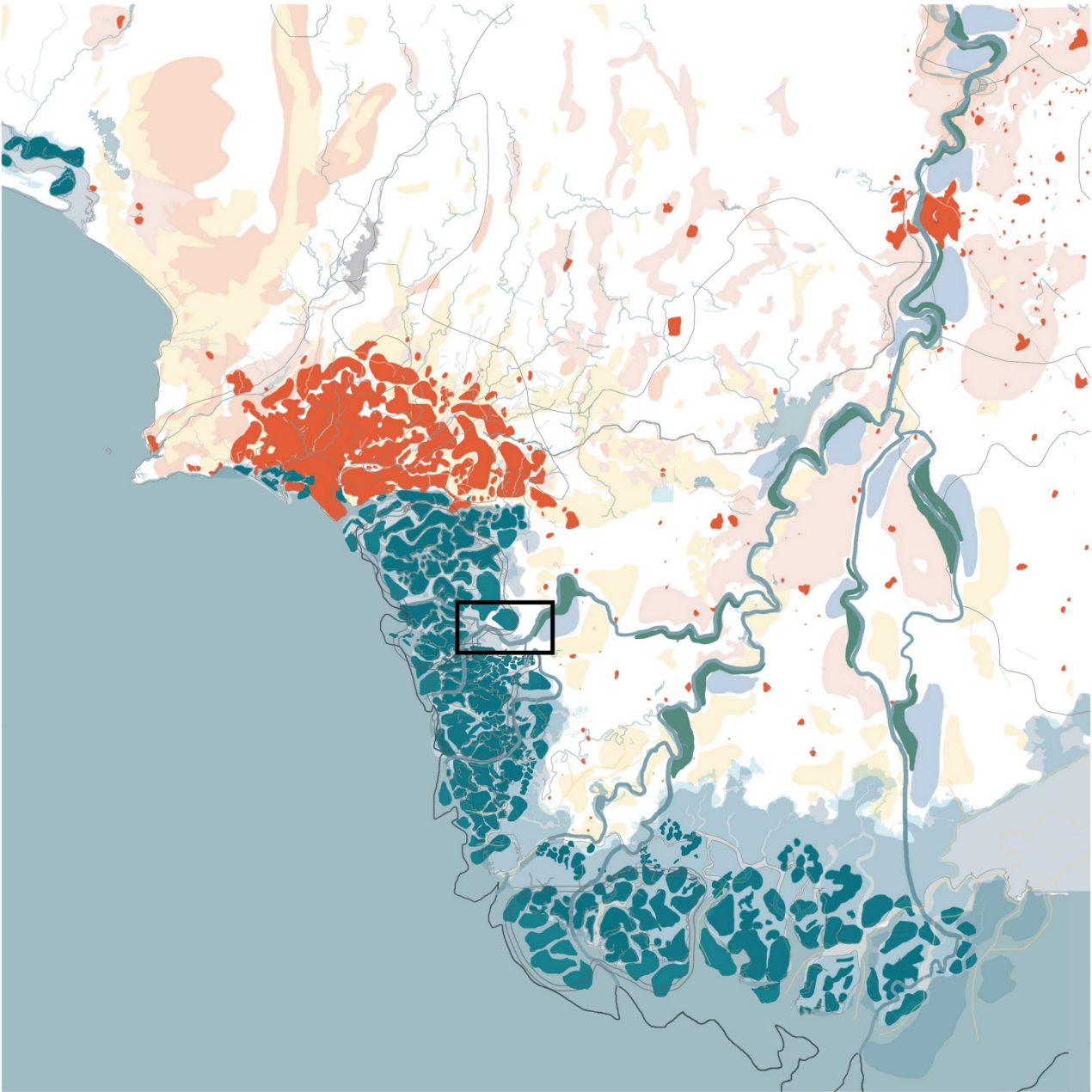


Creating adaptive livelihoods
through agricultural gradients.

Network of Preservation

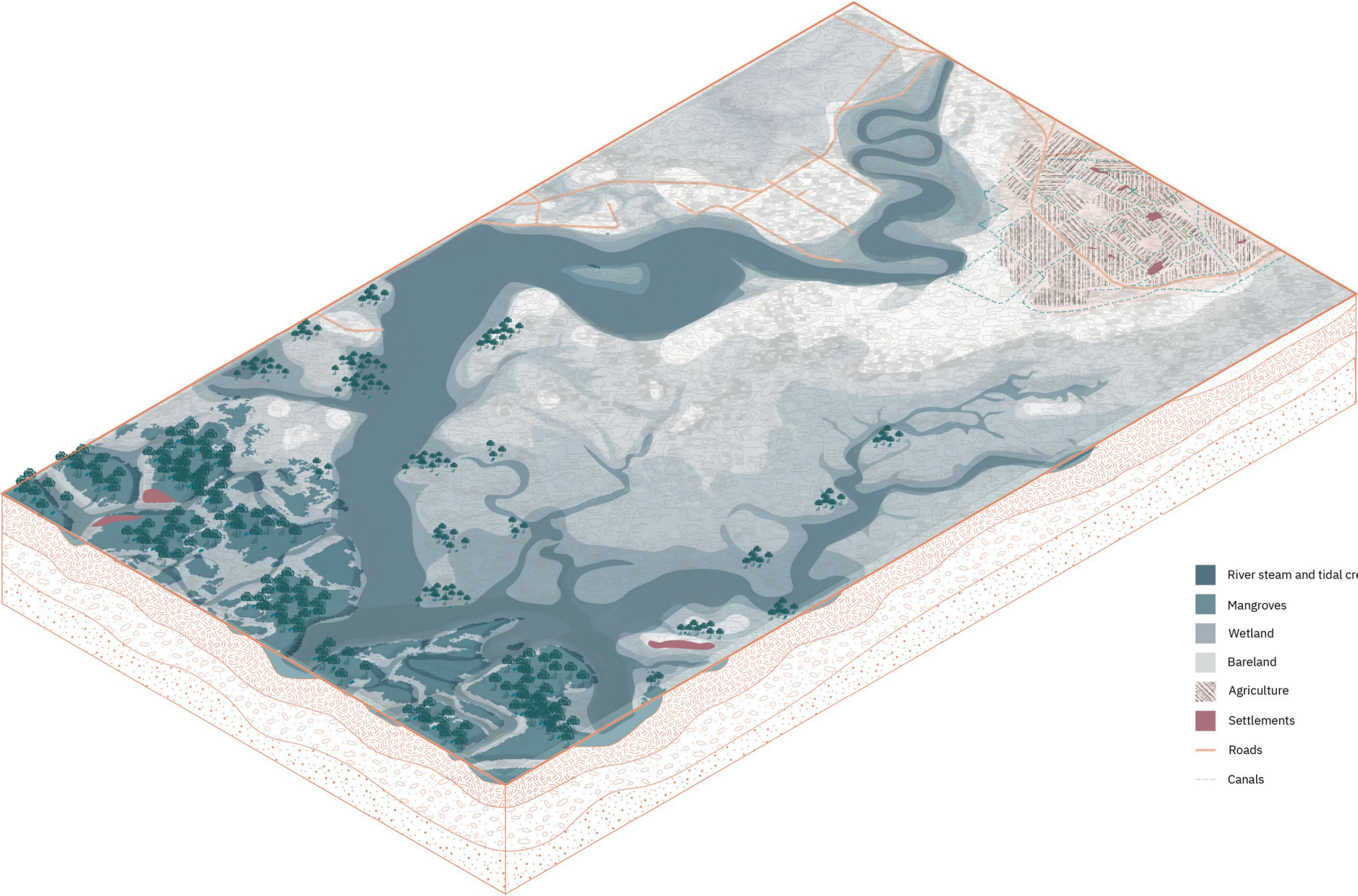
- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network (based on 1950s map)
- Sea
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake
- Floodplains
- Natural embankments

0 10 20 km

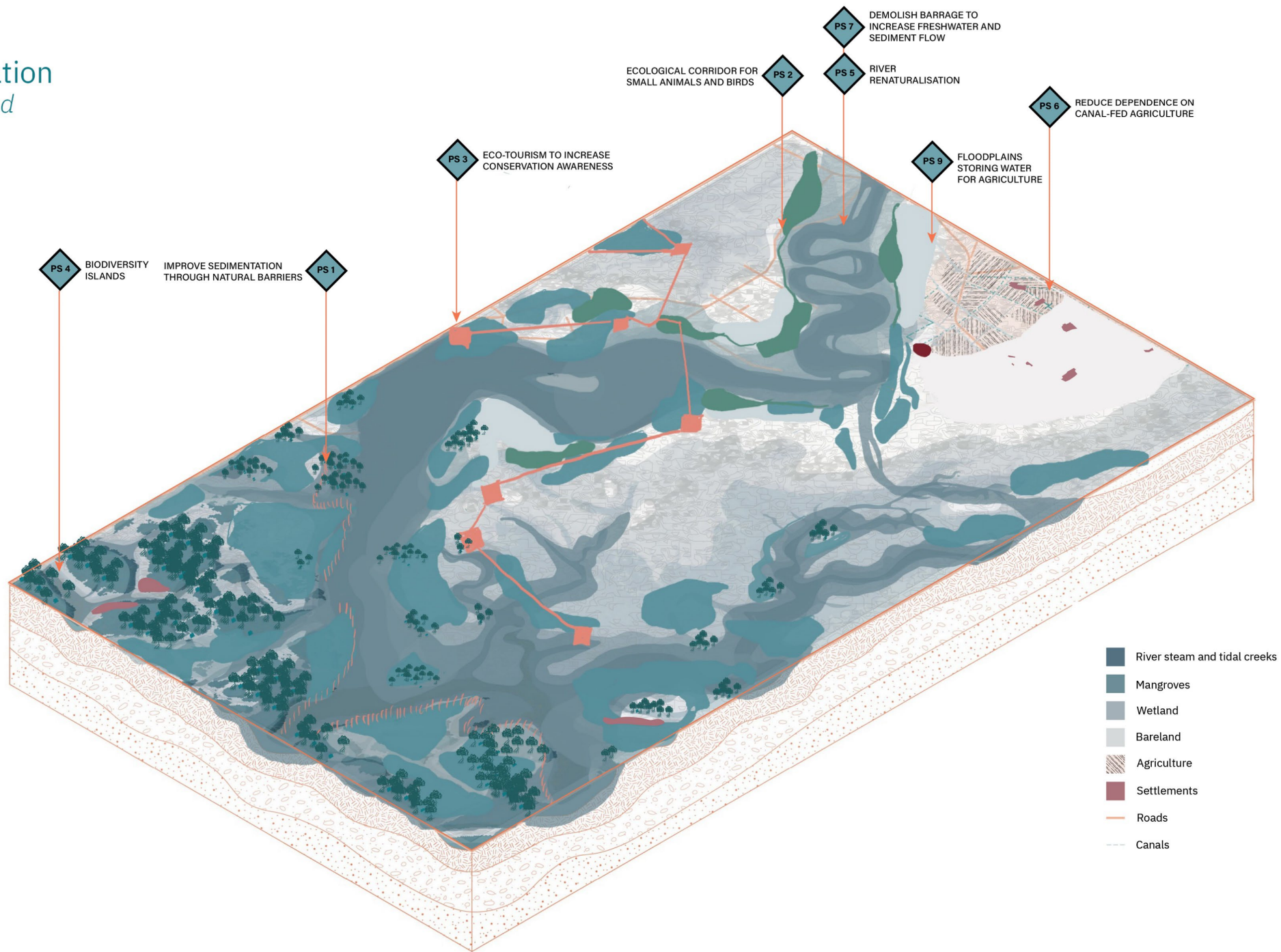


Network of Preservation
Zoom-in Area 2: Existing

Remote Settlements



Network of Preservation
Zoom-in Area 2: Proposed







RECREATION



Reconnecting mangroves
with urban life

PRESERVATION



Restoring natural flows and
sedimentation processes

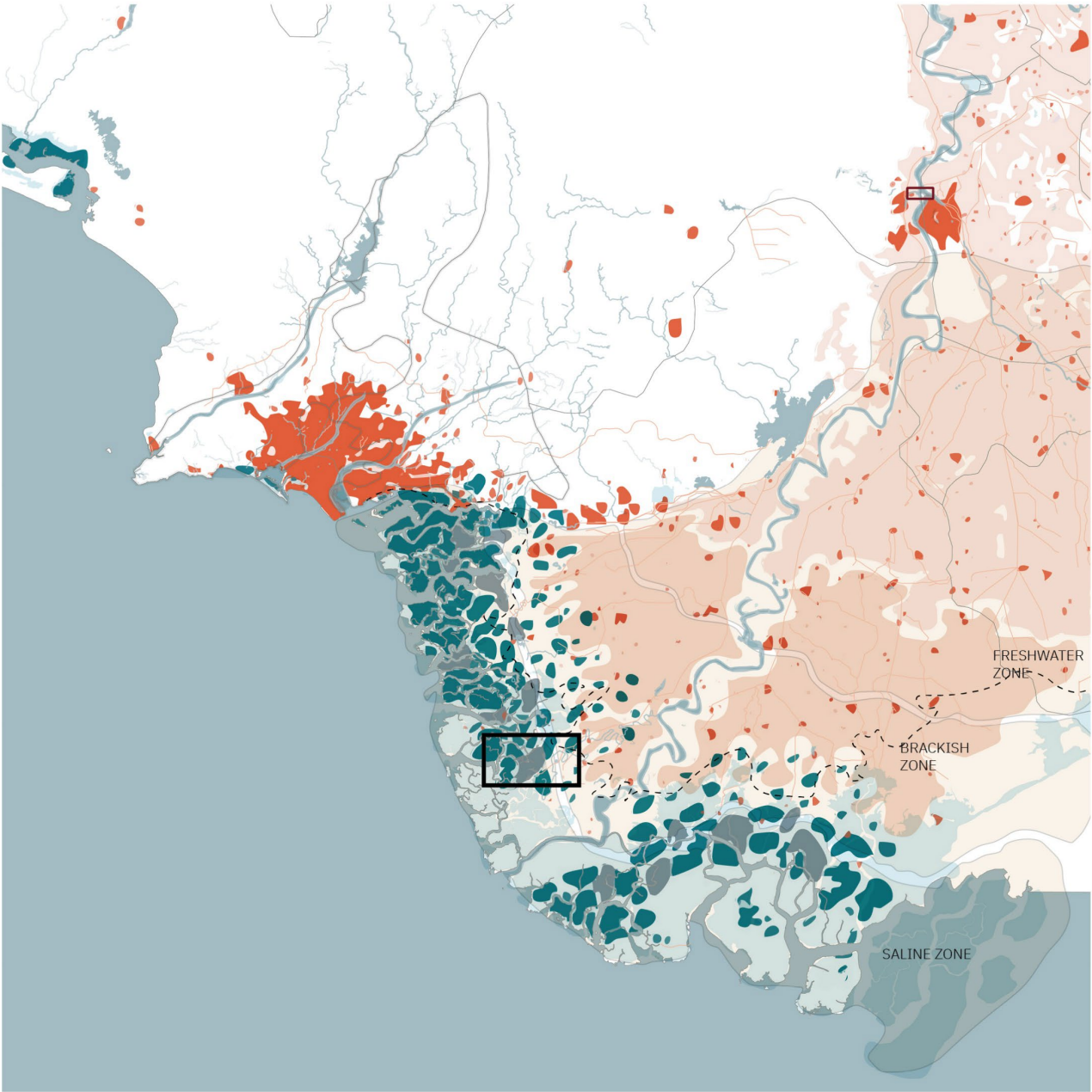
PRODUCTION



Creating adaptive livelihoods
through agricultural gradients.

Network of Production

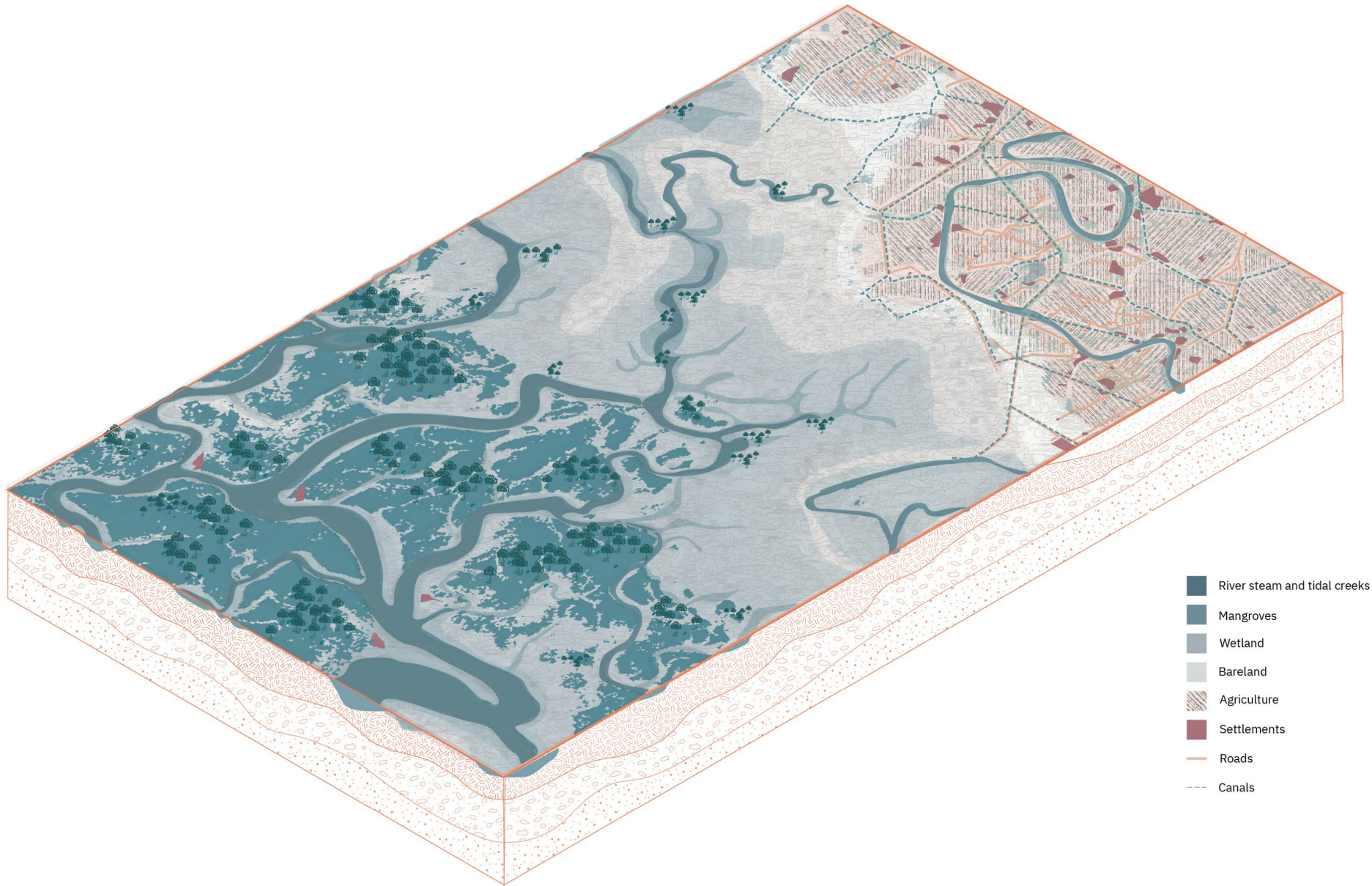
- District Boundary
- Built-up
- Agriculture
- Grassland
- Shrubland
- Wetlands
- Mangroves
- River Network
- Sea
- Dam/ Barrage
- Canal
- Ditch
- Stream
- Tidal channel
- Marsh
- Reservoir
- Lake
- Shrimp aquaculture
- Shrimp and Salt tolerant fruits and vegetables
- Freshwater fruits and vegetables
- Predicted 2050 shoreline



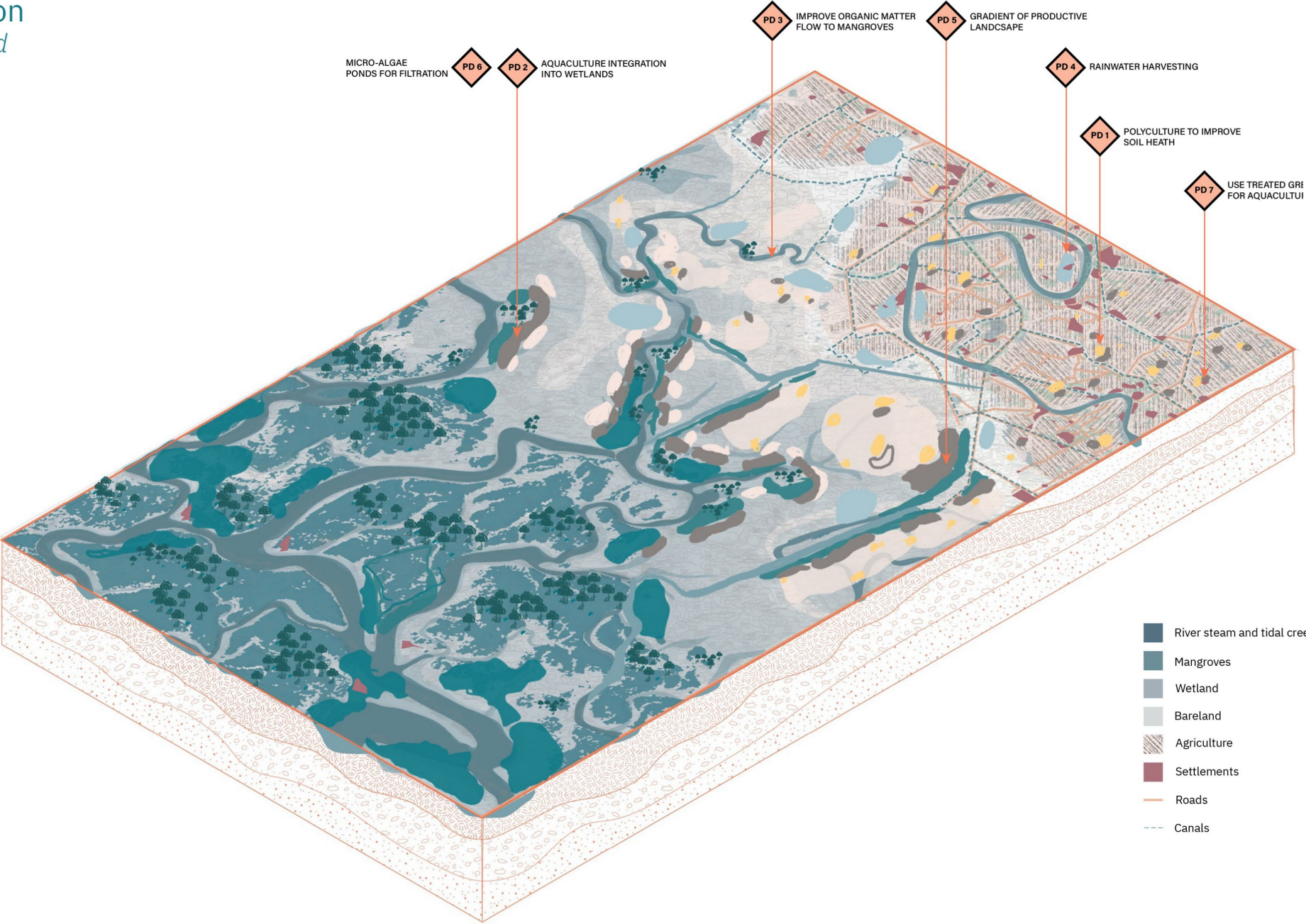
Network of Production

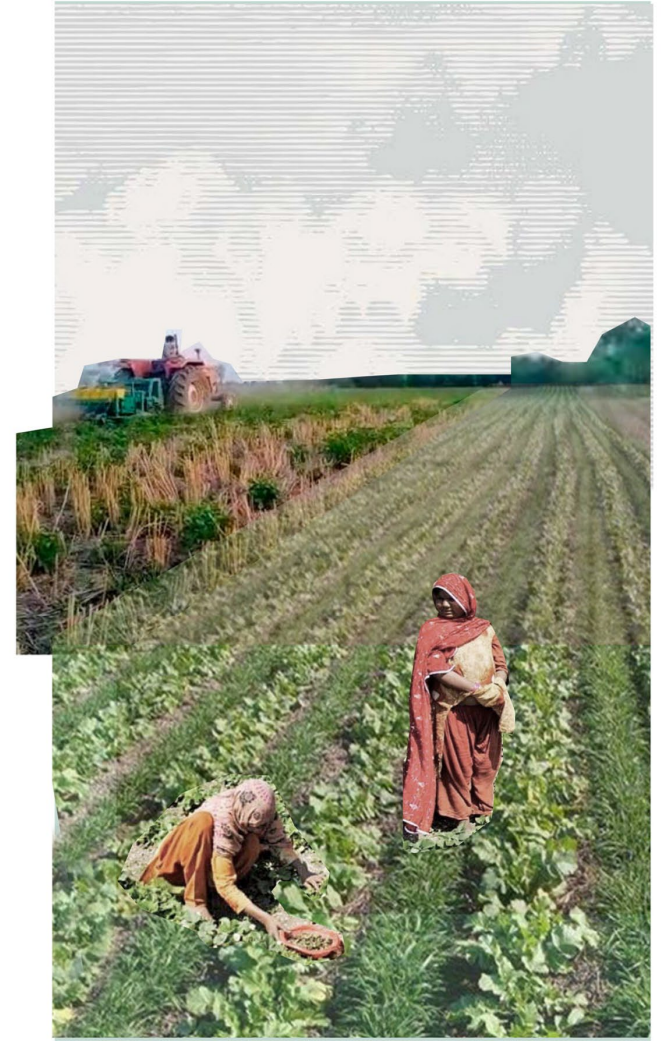
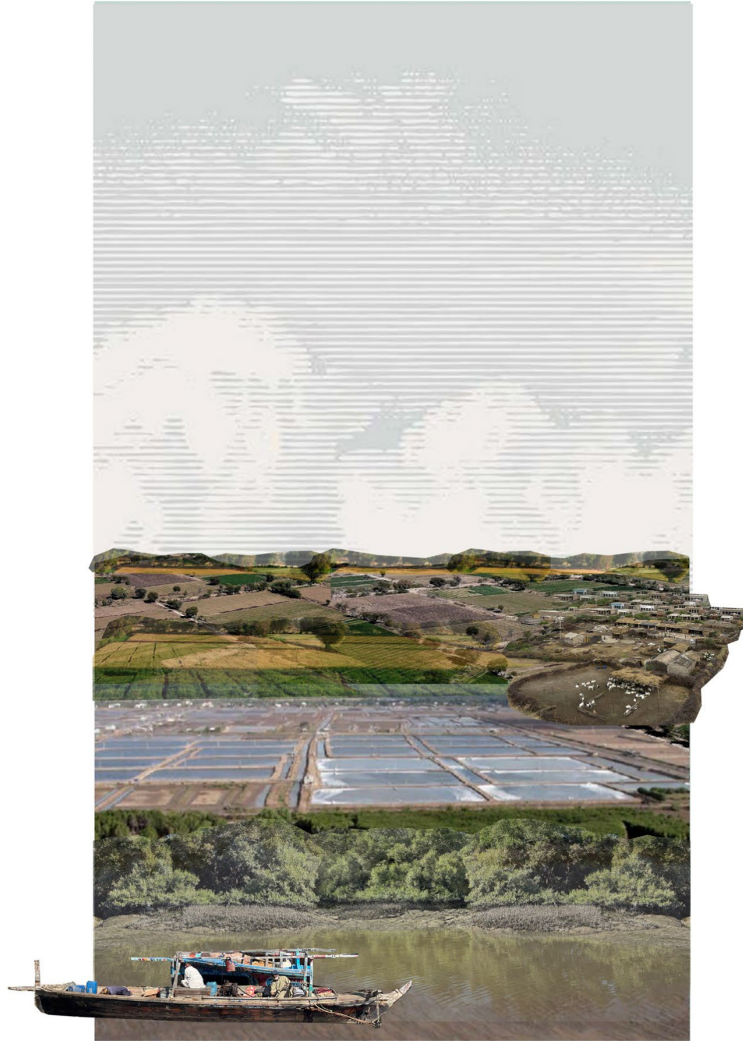
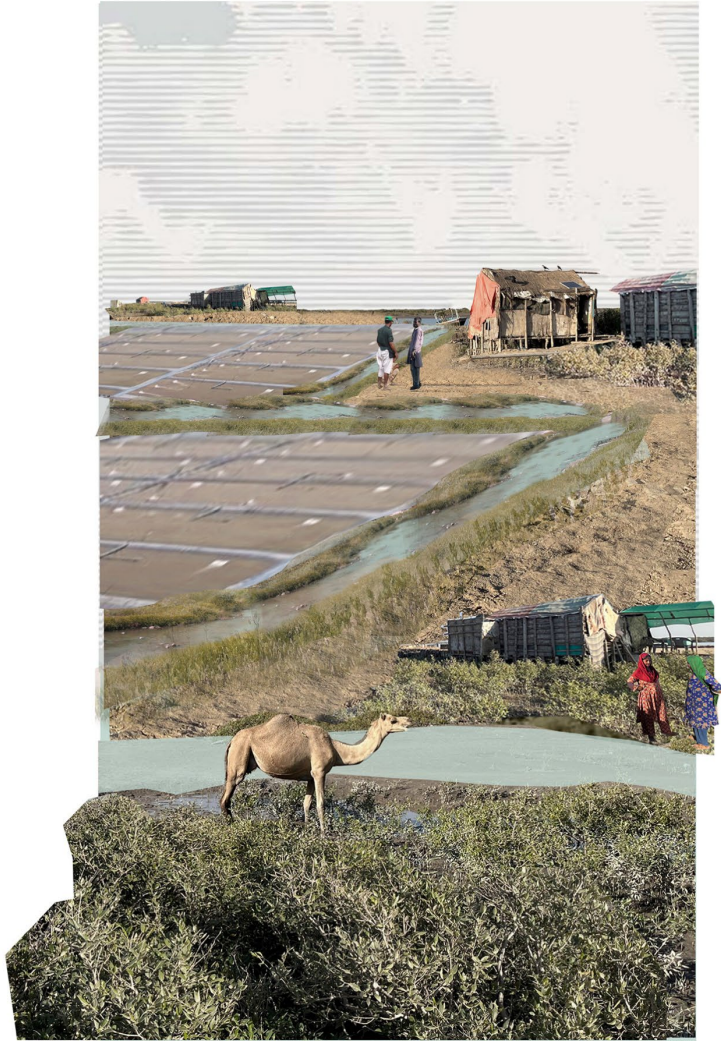
Zoom-in Area 3: Existing

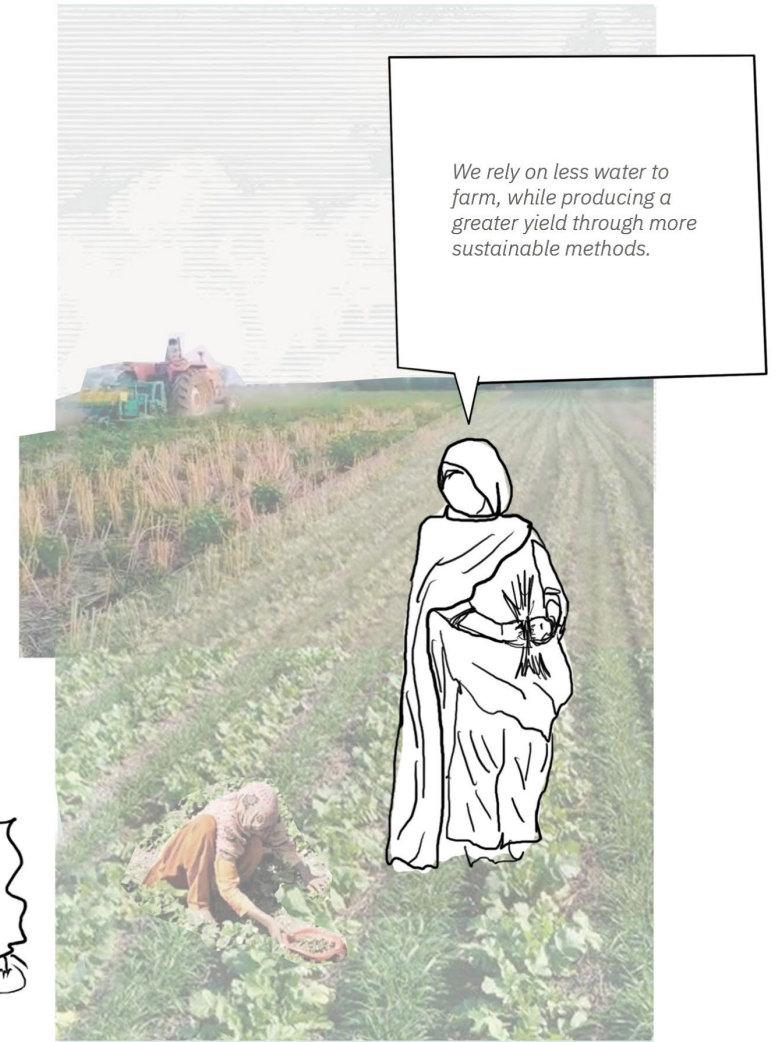
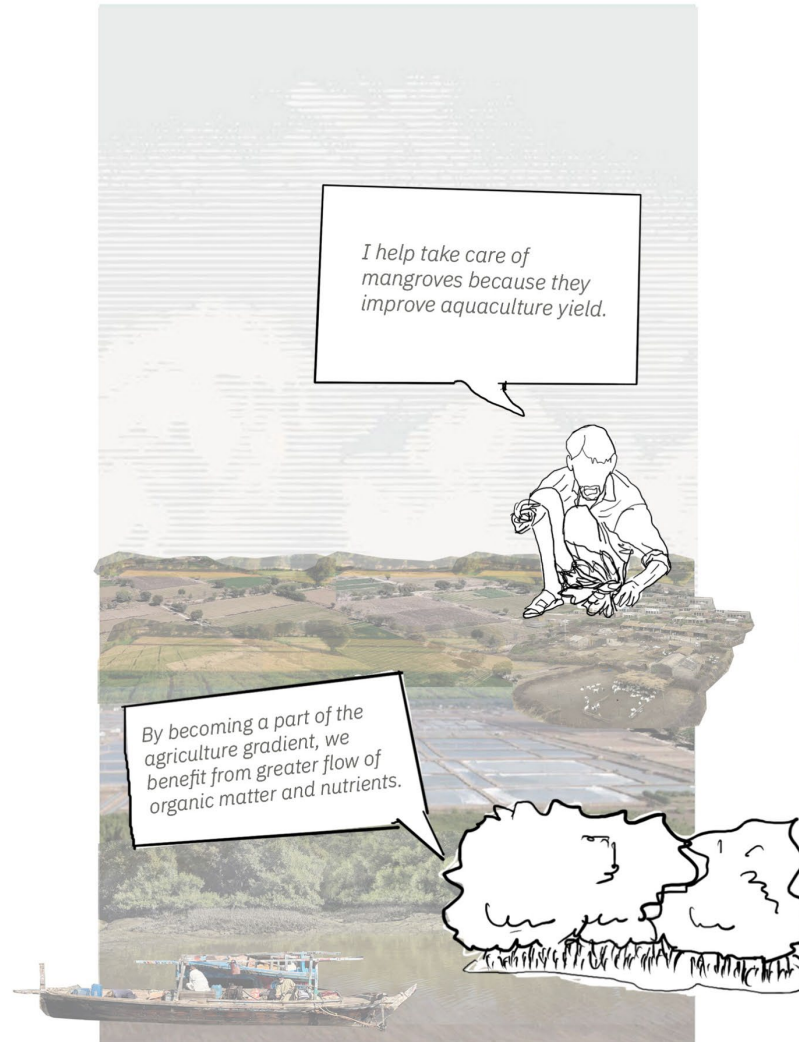
Dense Agriculture and
Mangrove Islands



Network of Production
Zoom-in Area 3: Proposed







Network of Recreation Toolkit of Strategies - Evaluation

PS 1

SEDIMENTATION THROUGH NATURAL BARRIERS

Before

After

PS 2

EXTEND EXISTING CANOPY

Before

After

PS 3

ECO-PARK TRAIL

Before

After

PS 4

BIODIVERSITY ISLANDS

Before

After

PS 5

RIVER RENATURALISATION

Before

After

PS 6

REDUCE CANALS

Before

After

PS 7

DEMOLISH BARRAGE

Before

After

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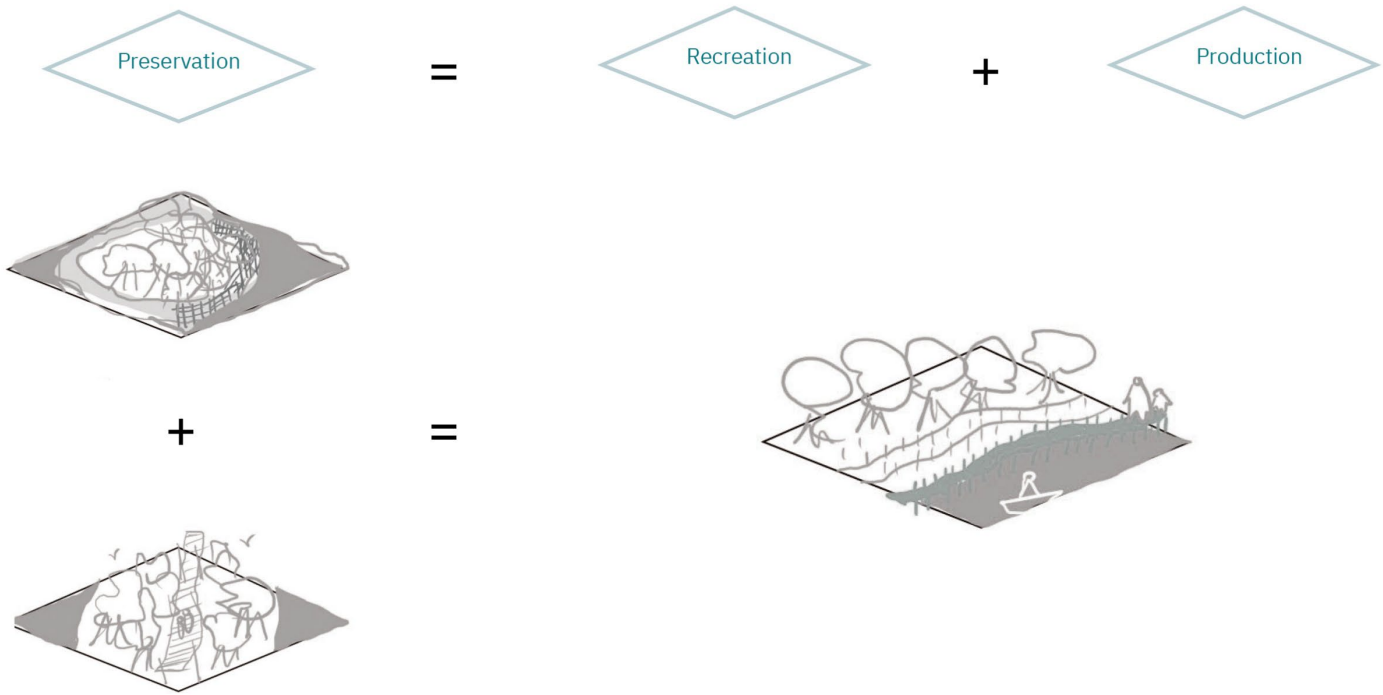
Vision for the Indus Delta



Re-evaluation of Toolkit Strategies

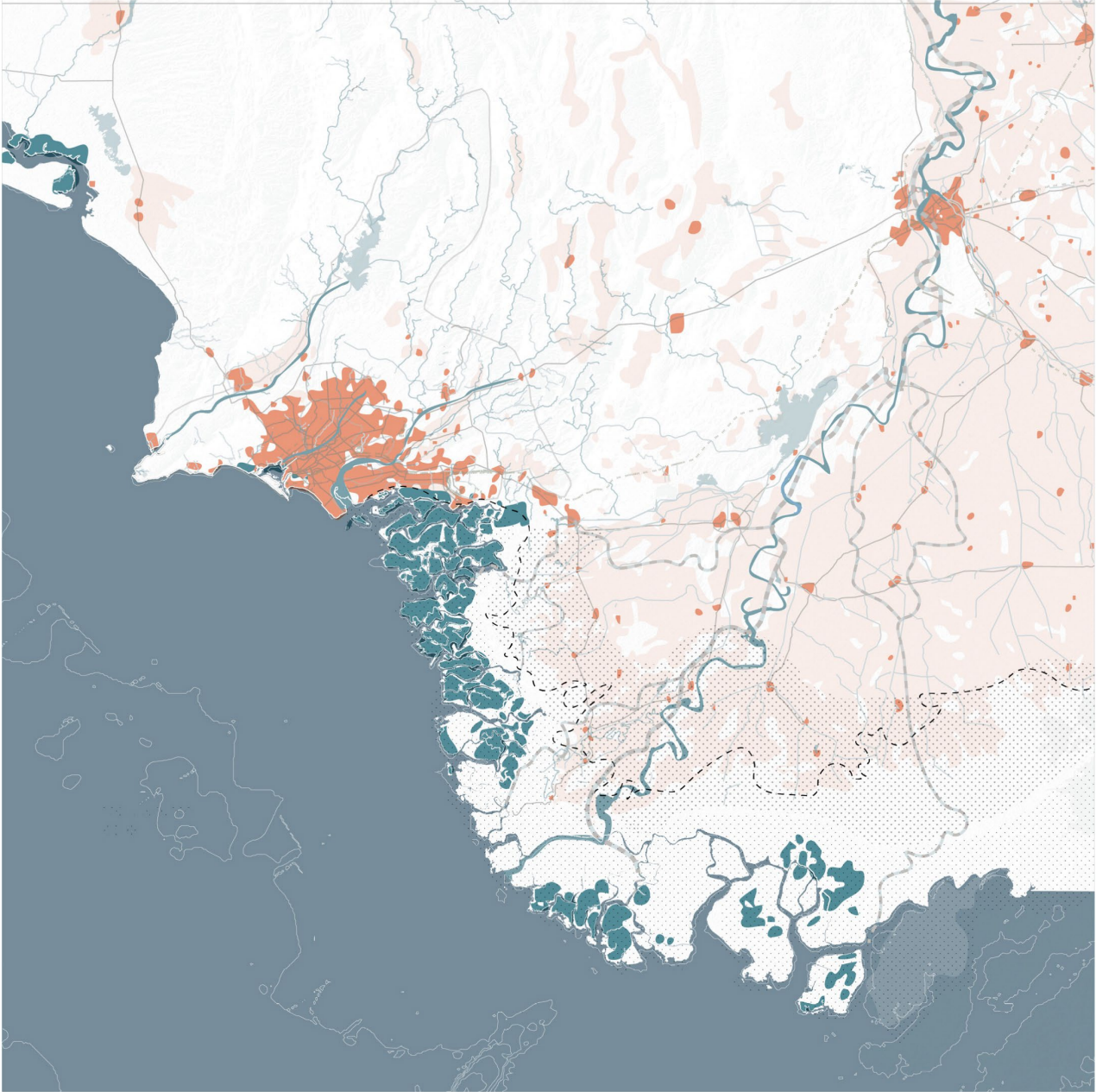
1. Improve sedimentation through natural barriers

3. Create a nature trail/ eco park to increase awareness for conservation



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



Delta Vision - Green/ Blue Network

Recreation and Preservation



Delta Vision - Agricultural Gradient

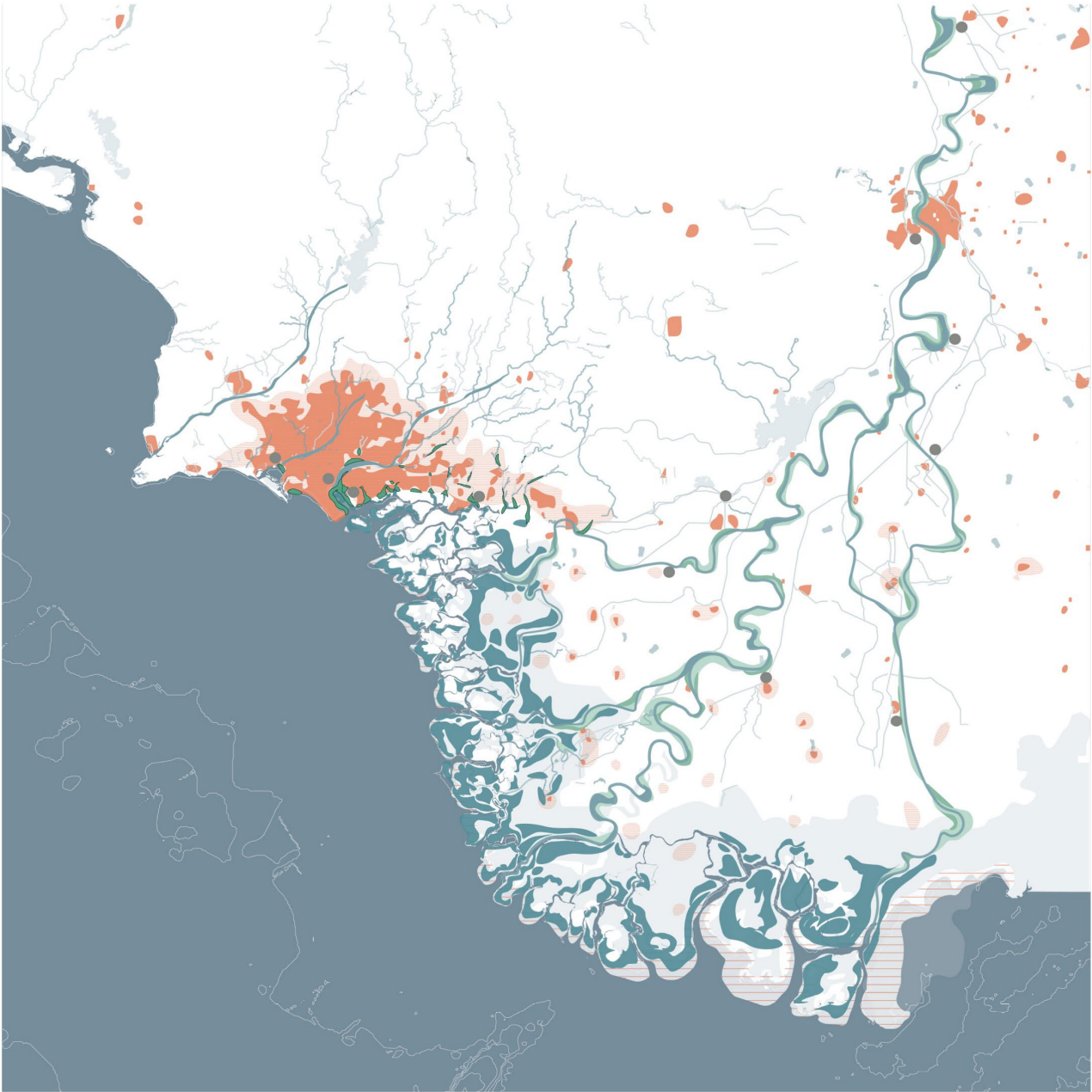
Production and Preservation

- 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



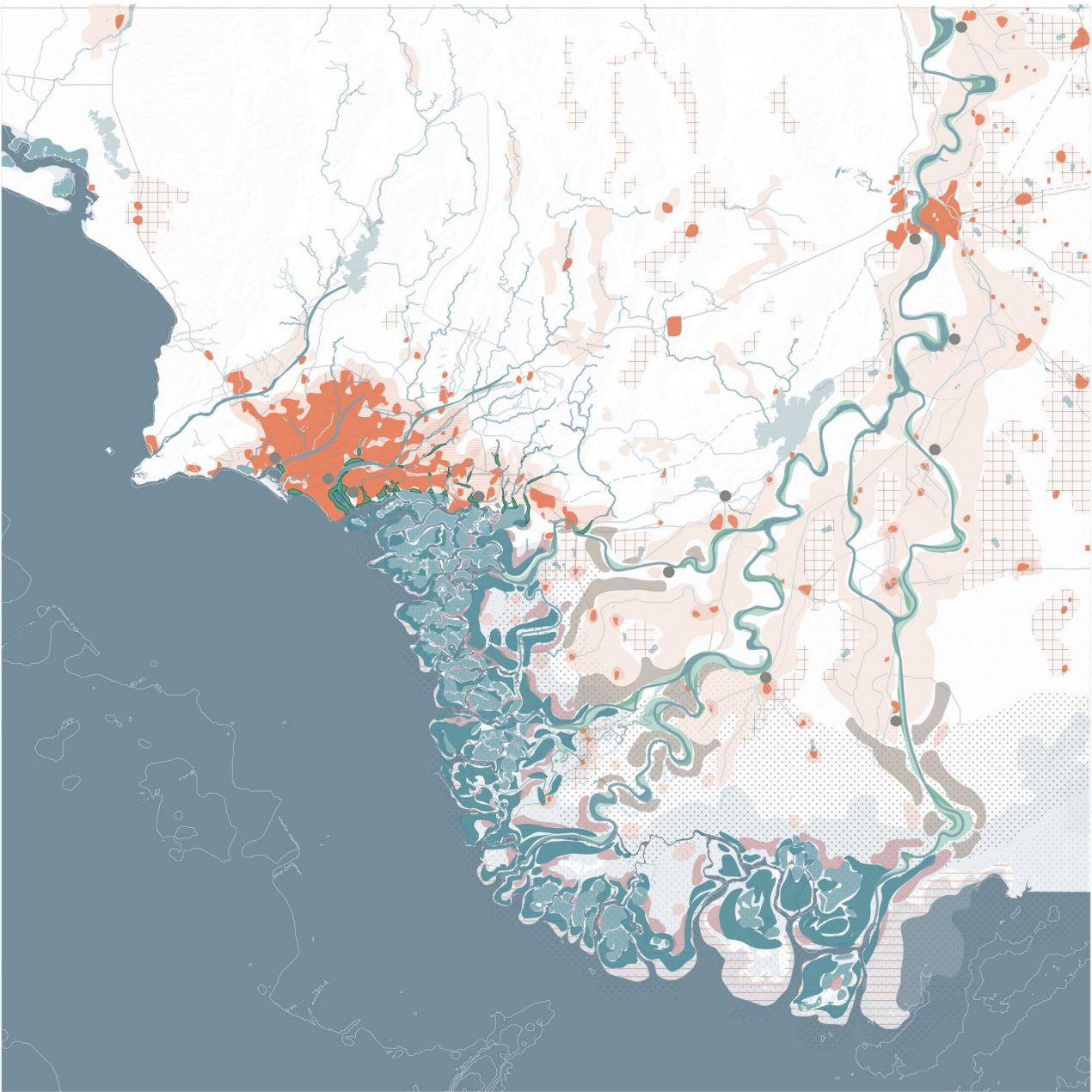
Delta Vision - Urban to Rural Migration

Recreation and Production



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

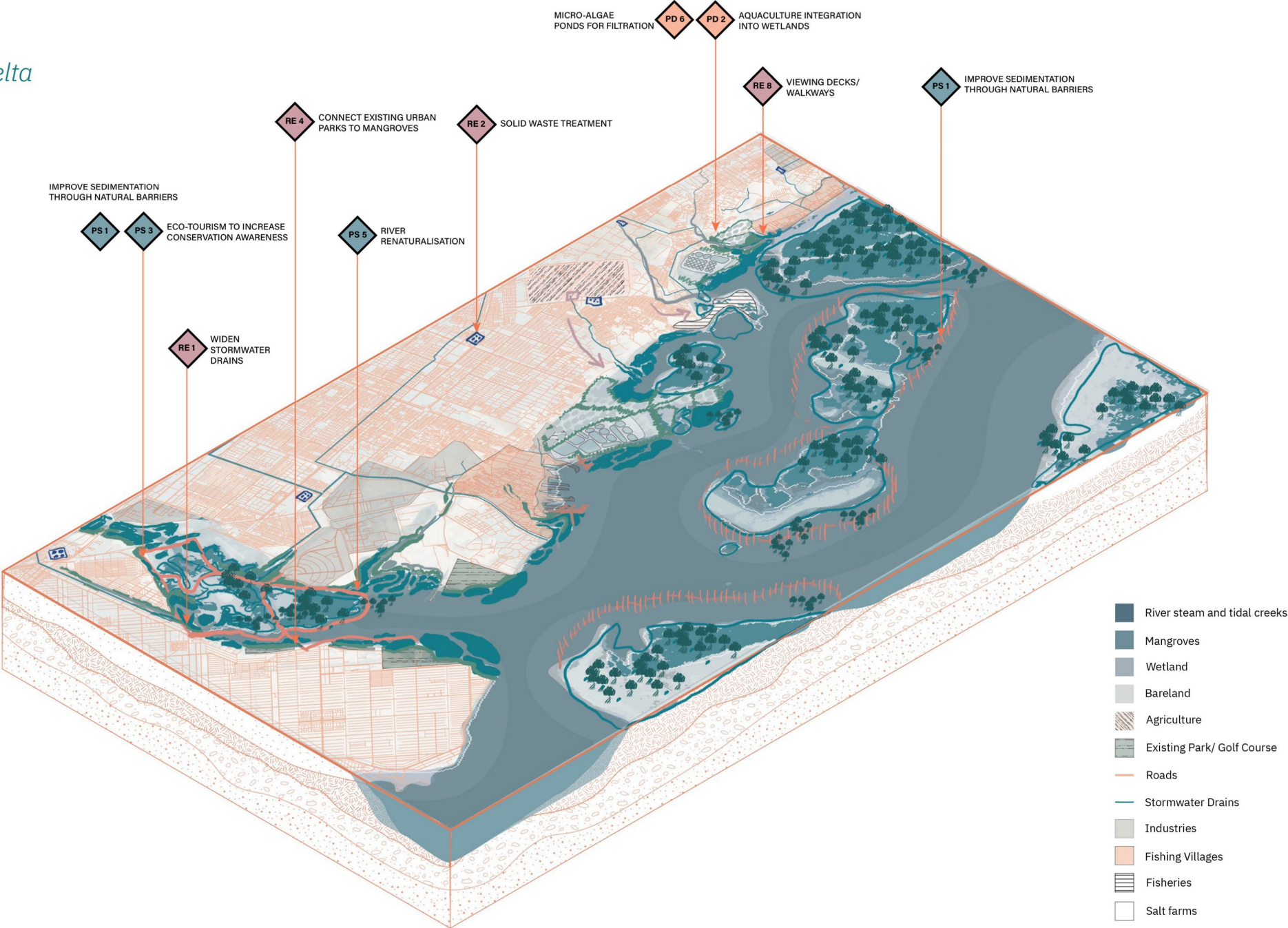


Combined Delta Vision 2050 - Zoom-Ins

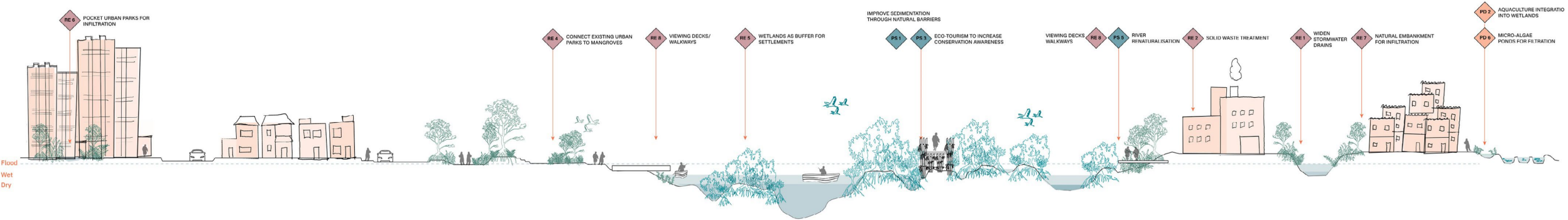
- District Boundary
- Built-up Current
- Built-up Increase 2050
- Canal-fed Agriculture
- Rain-fed Agriculture
- Aquaculture and Salt-tolerant farming
- Aquaculture
- New Mangroves
- Existing Mangroves
- Canal
- River
- Stream/ Stormwater Drains
- Lake/ Reservoir
- Wetland
- Flood plains
- Natural Embankments
- Urban Parks
- Extended Shoreline
- Saline Zone
- Brackish Zone



Zoom-in Area 1:
Karachi Coast and the Delta



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

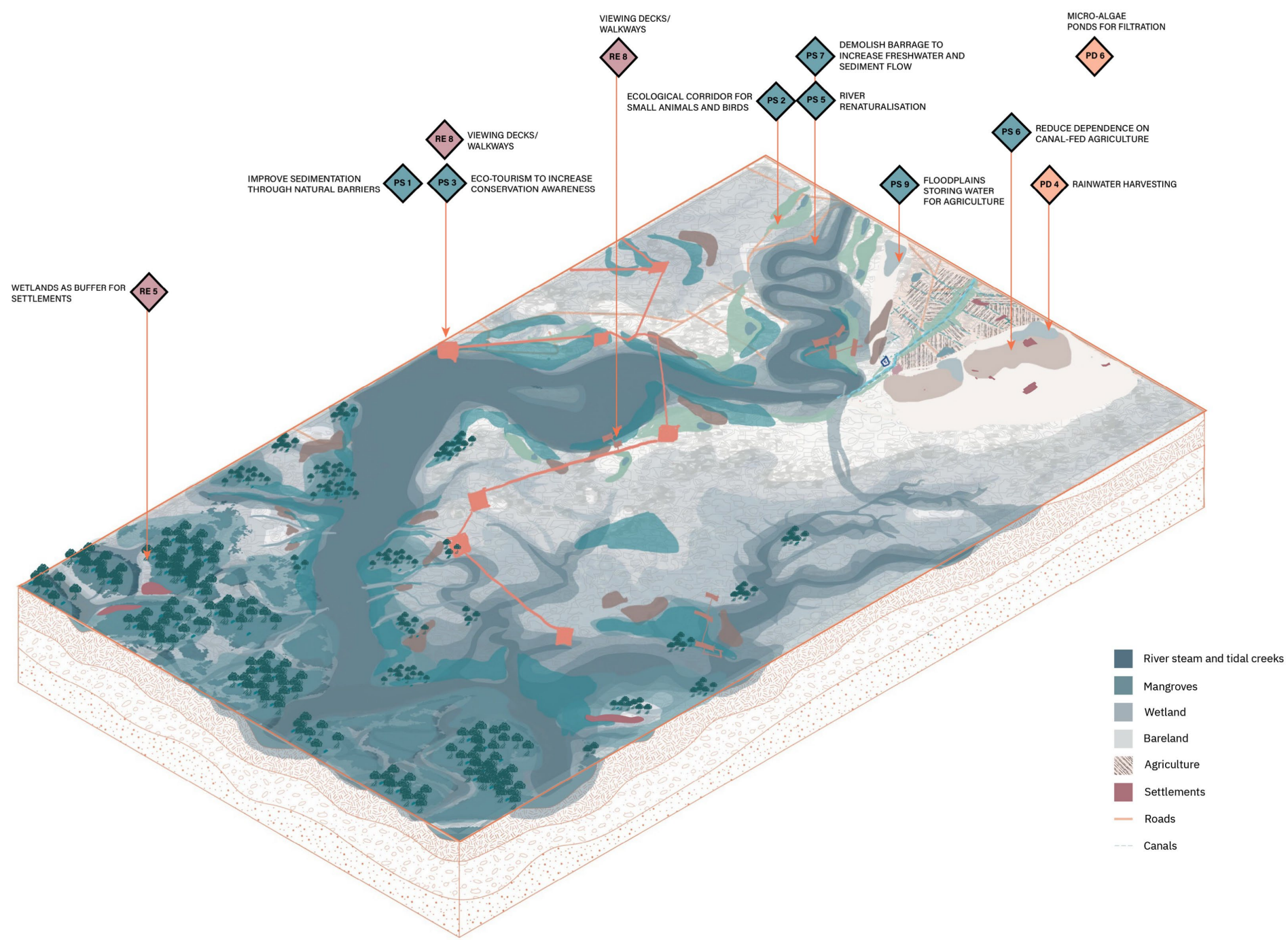


Combined Delta Vision 2050 - Zoom-Ins

- District Boundary
- Built-up Current
- Built-up Increase 2050
- Canal-fed Agriculture
- Rain-fed Agriculture
- Aquaculture and Salt-tolerant farming
- Aquaculture
- New Mangroves
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- Canal
- River
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- Wetland
- Flood plains
- Natural Embankments
- Urban Parks
- Extended Shoreline
- Saline Zone
- Brackish Zone



Zoom-in Area 2:
Remote Settlements

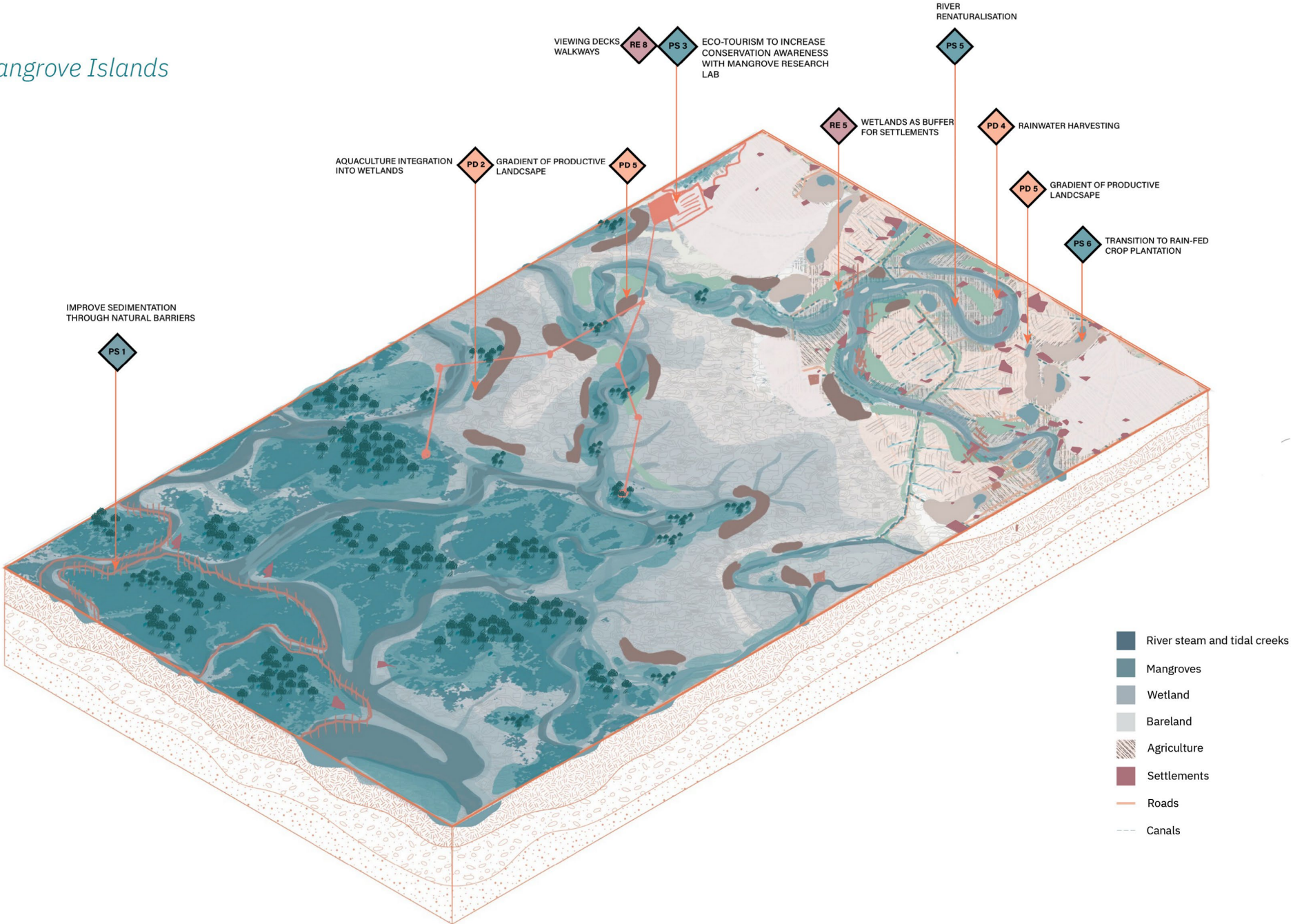


Combined Delta Vision 2050 - Zoom-Ins

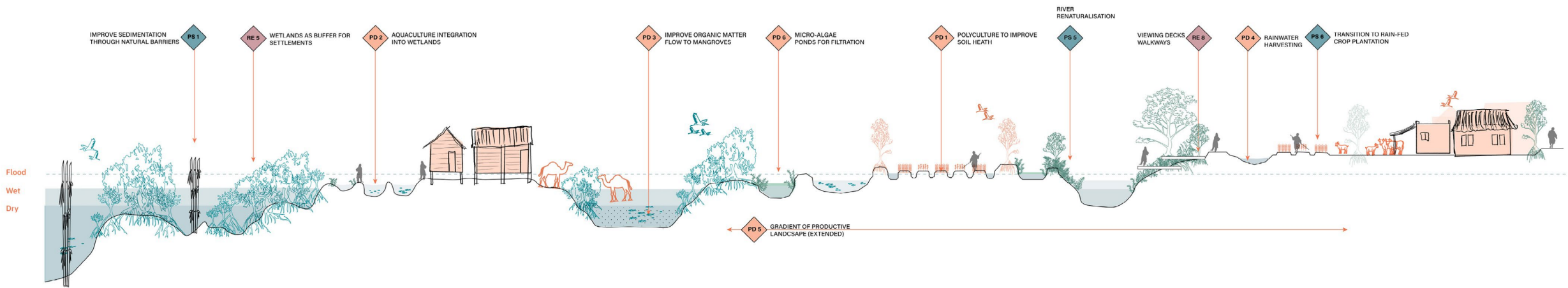
- District Boundary
- Built-up Current
- Built-up Increase 2050
- Canal-fed Agriculture
- Rain-fed Agriculture
- Aquaculture and Salt-tolerant farming
- Aquaculture
- New Mangroves
- Existing Mangroves
- Canal
- River
- Stream/ Stormwater Drains
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- Flood plains
- Natural Embankments
- Urban Parks
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- Saline Zone
- Brackish Zone



Zoom-in Area 3:
Dense Agriculture and Mangrove Islands



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



Phasing and Implementation

Phase		Priotity Actions	Focus Areas	Stakeholders Engaged
1.	Urgent (Years 2-5)	<ul style="list-style-type: none"> • Ensure clean water reaches the delta (e.g. treated wastewater, improved storm drains) • Set aside and protect mangrove zones along coast and creek edges • Launch low-cost production pilots (e.g. community aquaculture, polyculture, etc.) 	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"> • Restore degraded wetlands and convert flood-prone farmland into buffers • Support livelihood diversification (shrimp ponds, salt-tolerant crops, eco-tourism pilots) • Enforce no-fishing zones in key regeneration sites 	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"> • Formalize recreation networks (urban mangrove parks, eco-trails) • Build governance partnerships (water-sharing, zoning, community monitoring) • Scale up productive mosaics based on ecological performance 	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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