

NbS Capacity Building – Session 1

Approaching Nature-based Solutions (NbS) in Riverine, Coastal and Marine Ecosystems

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Technical Assistance Facility to the Green Team Europe Initiative (TAF-GTEI)

TAF-GTEI is a project funded by the European Union in partnership with ASEAN



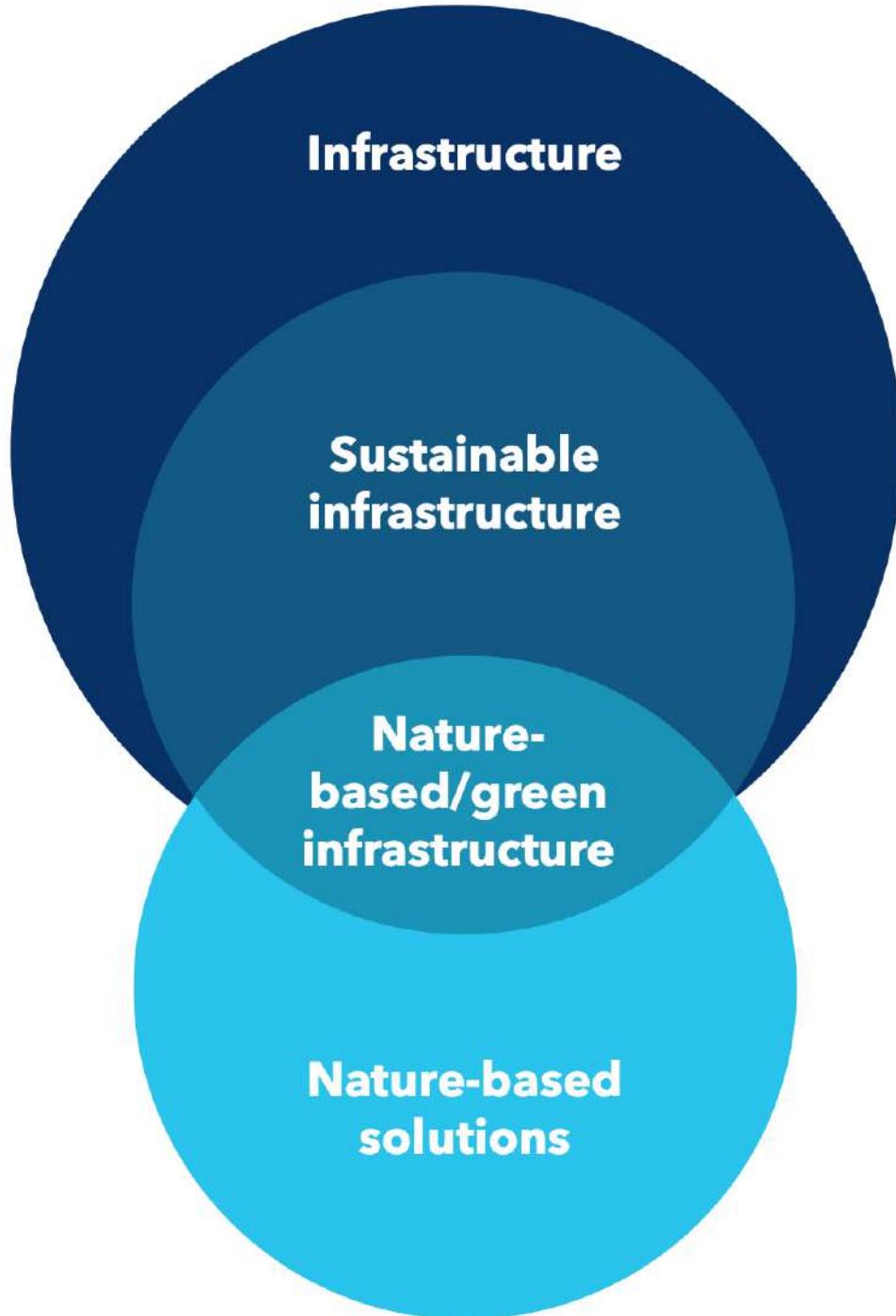


Nature-based Solutions (NbS) are

“Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”

IUCN





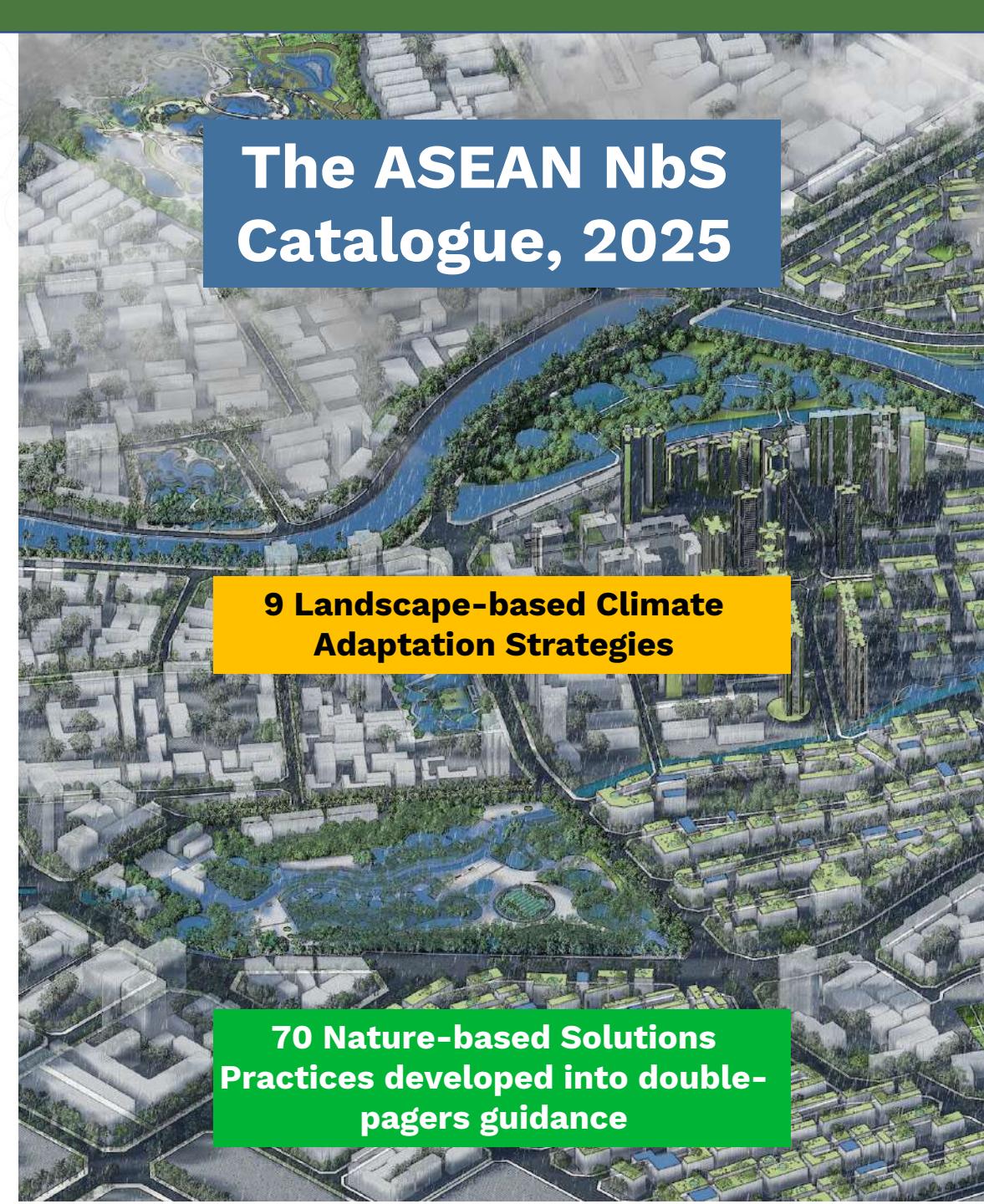
The “Grey to Green Transition”

“Green Infrastructure (GI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services.

It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings.”

European Commission, 2013





The ASEAN NbS Catalogue, 2025

9 Landscape-based Climate Adaptation Strategies

70 Nature-based Solutions Practices developed into double-pagers guidance

PUBLICATION SET

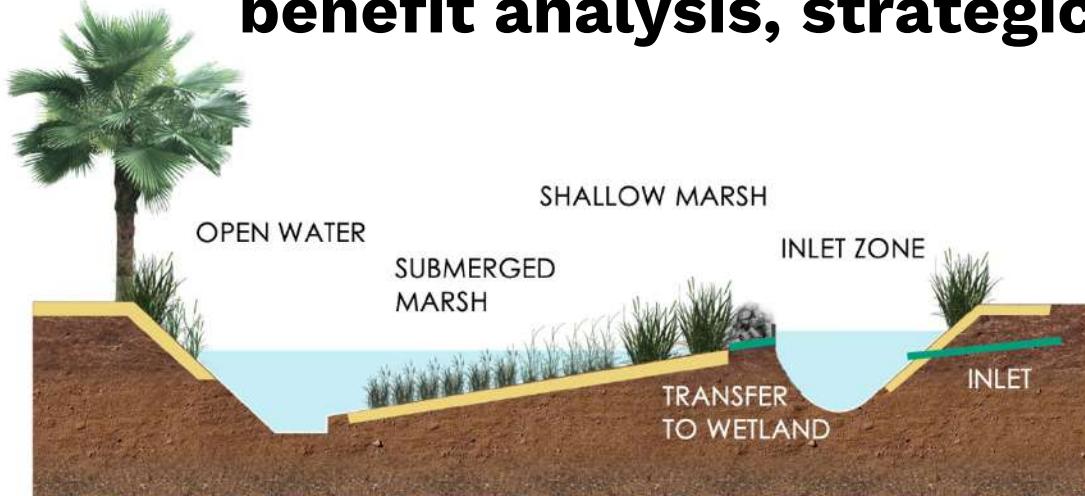
Nature-based Solution Studies in ASEAN Member States



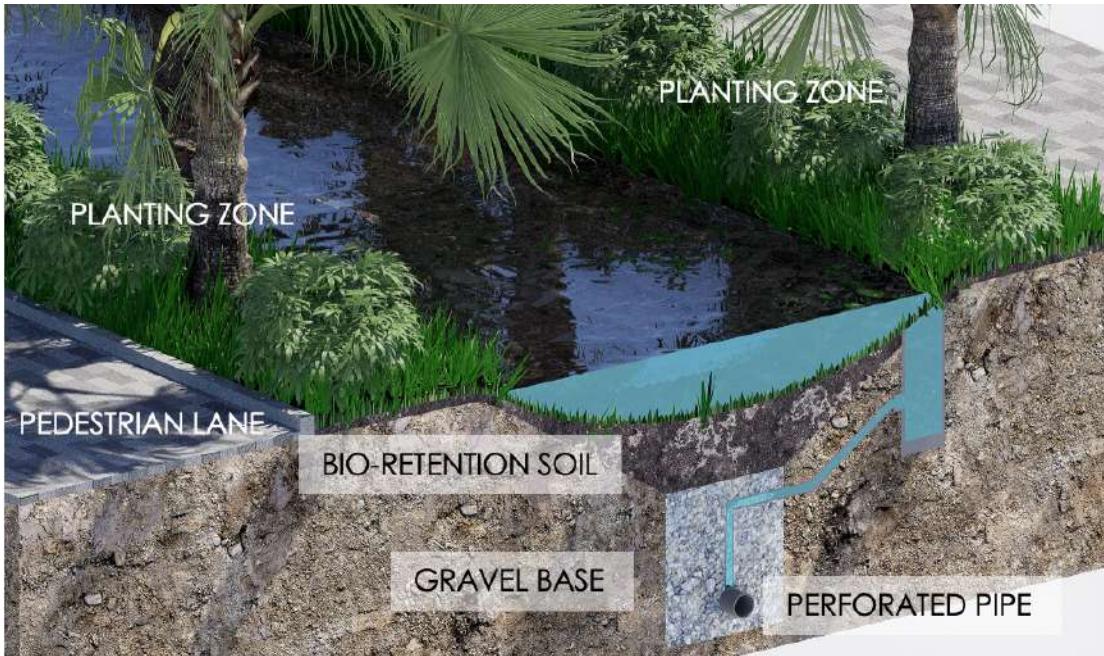
Access reports here



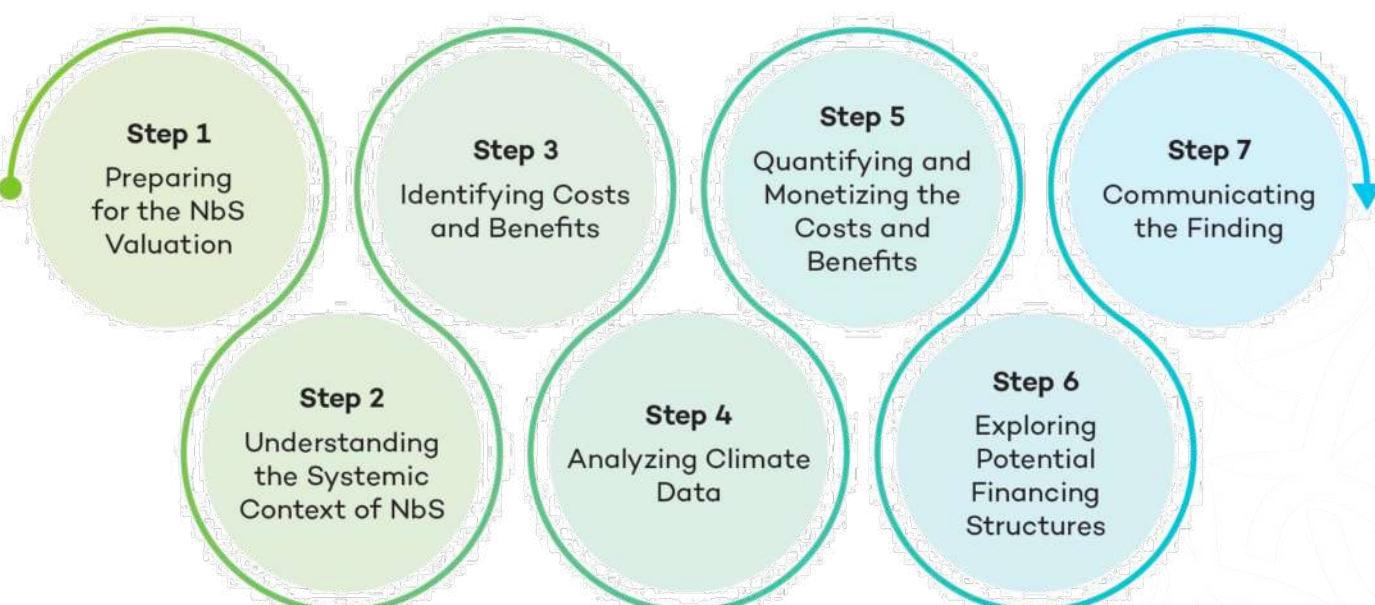
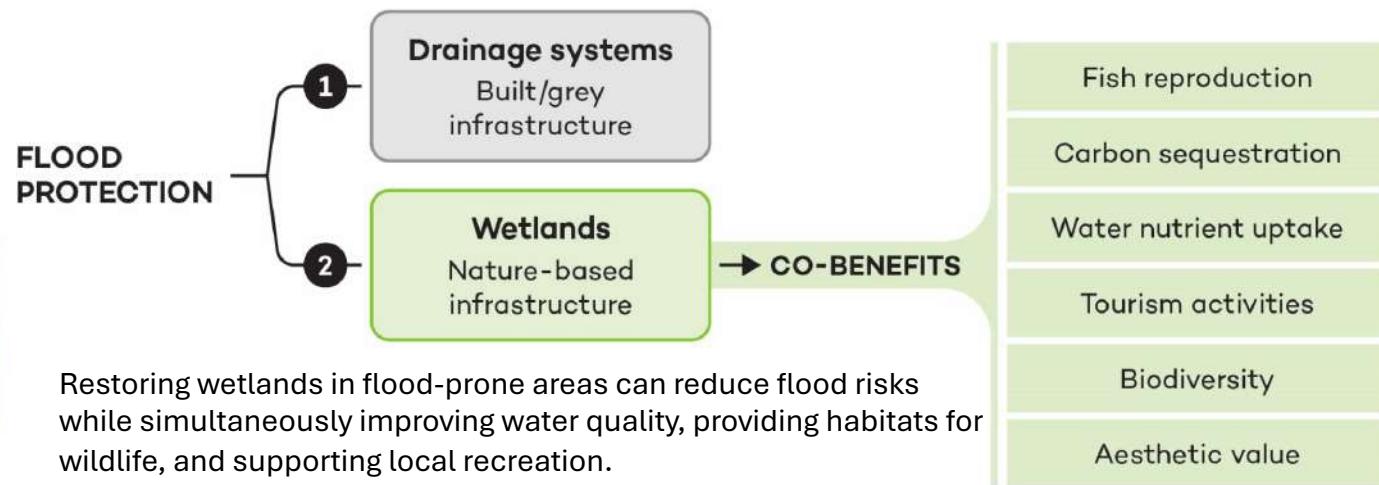
Approaching an NbS Project: Identifying co-Benefits, Conducting a cost-benefit analysis, strategic roadmap and scaling-up phases



Constructed wetland for storm water management - section



Bioswale typical section. Source: Cililinks



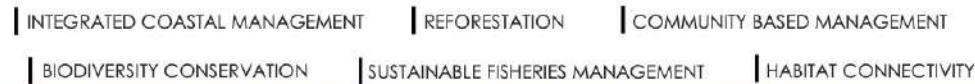
NbS-35: MANGROVE AS PROTECTIVE SHIELD FOR AQUACULTURE



LANDSCAPES SUPPORTED



EbA (ECOSYSTEM-BASED APPROACHES)



MAIN PROBLEMS ADDRESSED



The Coastal Mangrove Shield in synergy with Sustainable Fisheries acts as a natural barrier against tidal waves, coastal erosion, and storms, reducing the energy of incoming waves and stabilizing shorelines through their dense root systems. This NbS not only protects vulnerable coastal aquaculture sites, villages, and towns from severe weather impacts but also boosts biodiversity by providing habitat for fish and shellfish, which are crucial for local fisheries. Mangroves support sustainable fishing practices by offering nursery grounds and shelter for marine life, increasing fish stocks, and supporting the livelihoods of coastal communities.

ECOSYSTEM SERVICES AND ACTIONS

SUPPORTING

- Supports critical habitats for fish, crustaceans, and birds
- Nursery grounds for fisheries, protected by the mangrove

REGULATING

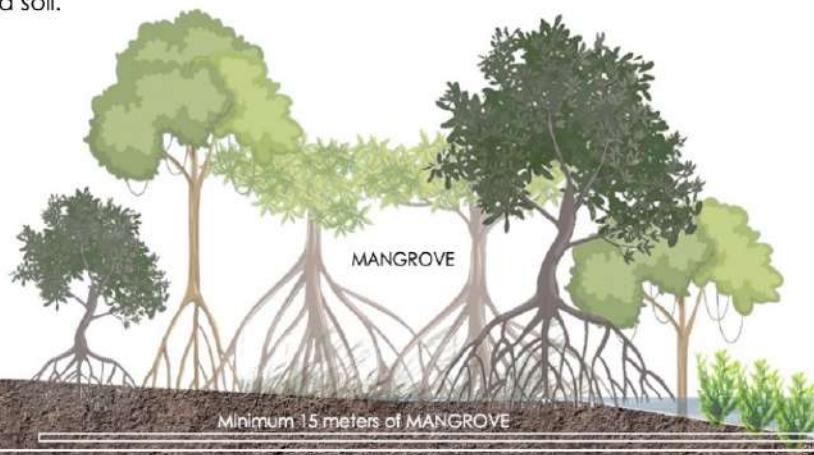
- Acting as a natural buffer, reducing wave energy, stabilizing sediment, and protecting shorelines from erosion and storm surges.
- Carbon Sequestration by absorbing and storing large amounts of carbon in biomass and soil.

PROVISIONING

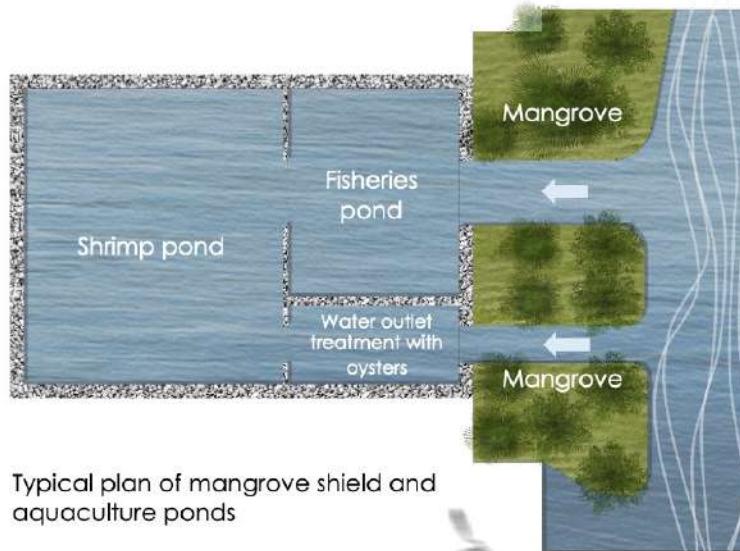
- Supplying wood, honey, and medicinal plants, balancing extraction with ecosystem health.

SOCIAL BENEFITS

- Maintaining local economies and improve resilience for local communities.
- Mangroves lower disaster risk for nearby towns and villages, reducing infrastructure damage.



NbS-35: MANGROVE AS PROTECTIVE SHIELD FOR AQUACULTURE



Typical plan of mangrove shield and aquaculture ponds



PROJECT'S CHALLENGES & RISKS

- ❖ **Funding Gaps:** Long-term maintenance and monitoring often lack sustained funding.
- ❖ **Land Use Conflicts:** Due to potential competing interests (e.g., agriculture, aquaculture).
- ❖ **80% of Mangrove Restoration fail:** As the soil characteristics, density of plantations and rhythm of plantation will determine the success of the project.
- ❖ **Scaling up Coastal Fisheries:** Requires adequate land management and governance to avoid intensive coastal land pressure from the agricultural sector.

NbS co-BENEFITS AND THEIR INDICATORS

● Biodiversity Conservation

Species richness and abundance of key species (fish, crustaceans, birds).

● Climate Resilience

Reduction in shoreline erosion rates, frequency, and intensity of flooding in nearby communities.

● Carbon Sequestration

Carbon stock assessment in above-ground biomass and sediment ($t\text{CO}_2/\text{ha}$).

● Water Quality Enhancement

Levels of nitrates, phosphates, heavy metals, and sedimentation in water samples.

● Livelihoods and Economic Benefits

Increase in sustainable fishery yields, in income from ecotourism, local jobs.

● Social Resilience and Community Engagement

Number of community members involved in mangrove protection initiatives .

COST ANALYSIS

● Direct Costs

Restoration (0.40 USD/m²), infrastructure (fencing, access points), maintenance and monitoring.

● Indirect Costs

Opportunity costs if land is repurposed from other uses.

● Time Horizon and Discount Rate

10-30 years to capture full ecological and economic benefits, adjusted to account for long-term environmental and social benefits.

● Direct Benefits

Reduced storm damage costs, revenue from sustainable fisheries, carbon credit revenue.

● Indirect Benefits

Increased biodiversity, improved water quality, reduced health costs due to cleaner environment.

● Risk Assessment

Evaluation of factors such as climate change impacts on growth rates, potential for disease, and community engagement level.

REFERENCES:

Indonesia, Bogorame-Timbusloko Mangrove Shield, Demak.
Indonesia, Bedono Village Mangrove Regrowth.

IMPLEMENTATION OPPORTUNITIES:

Thailand, Western coastlines of Mekong Delta.

Vietnam, Ca Mau Peninsula.

Indonesia, Borneo, Java, Papua, Sumatra coastlines.

9 Climate-sensitive Landscape Categories ready for NbS Application and Scale-up in Synergy



1 Flood responsive Riverine and Deltaic Landscapes



2 Adaptive Sandy Shorelines



3 Adaptive Coastal Mangroves



4 Climate-smart and Resilient Cities



5 Green & Blue Eco-Industrial Areas and Ports



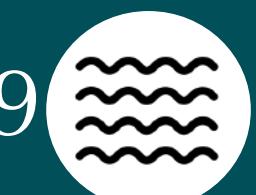
6 Regenerative Agriculture



7 Healthy Forests and Natural Habitats



8 Wildlife Corridors for Ecological Connectivity



9 Regenerative Seascapes and Marine Habitats

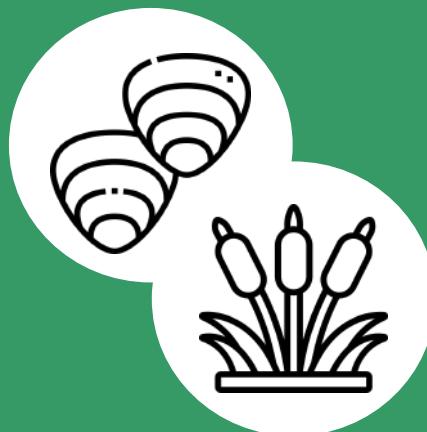
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**Water-Sensitive
Riverscapes :
Integrated River
Management Through
Nature-based Solutions**



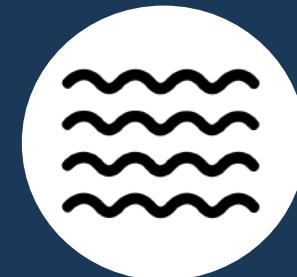
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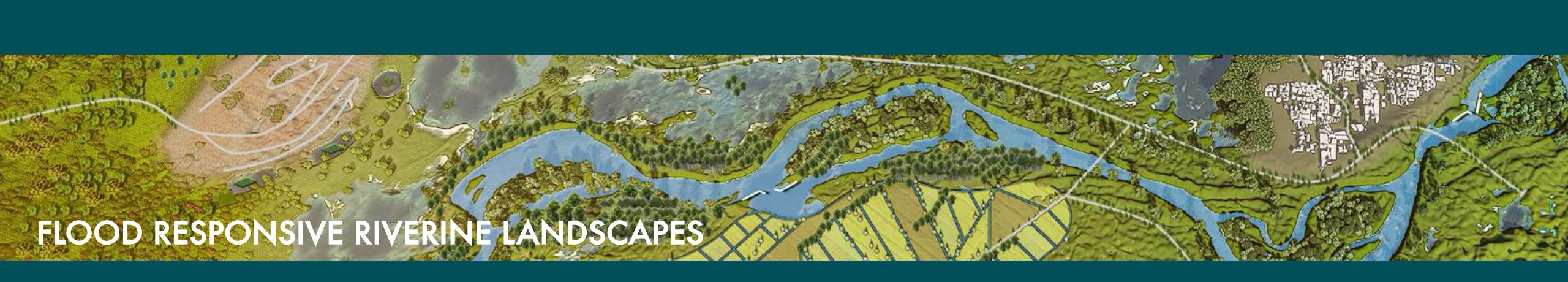
**Nature-based
Solutions supporting
Integrated Coastal
Management (ICZM)**



3

**Nature-based Marine
Restoration:
Designing and
Scaling NbS for
Regenerative
Seascapes and Blue
Carbon Systems**





FLOOD RESPONSIVE RIVERINE LANDSCAPES



COASTAL MANGROVES



SANDY SHORELINES



REGENERATIVE SEASCAPES & MARINE HABITATS

(37 of 70) Waterscape-based NbS Practices presented in the ASEAN NbS Catalogue

NbS supporting mainly Inland and Freshwater Systems

1. Inland Natural Wetlands
2. Constructed Wetlands
3. River Levee Setbacks
4. Reconnecting Oxbow Lake and River
5. Riverbank Stabilisation
6. Sediment Capture Traps
7. Riparian Buffer Zone, Bed Renaturation
8. Gully Plugging
9. Plastic Waste Capture Biofence
10. Managed Aquifer Recharge (MAR)
11. Bioretention Ponds and Swales
12. Phytofiltration Basins & Water Bunds
13. Small Sand Dams
14. Terraced Green Riverfronts
15. Log Terracing (Water-Delay Infrastructure)
16. River Stream Restoration and Daylighting

NbS supporting mainly Coastal and Marine Systems

17. Salt Marsh Restoration
18. Tidal Flat Nourishment
19. Artificial Seagrass Meadows
20. Mangrove Forest Restoration
21. Paludiculture Associated Peatland
22. Planting Mats and Rich Revetments
23. Coral Reef Restoration and Nurseries
24. Coastal Reforestation (Shield)
25. Artificial Oyster Reefs

NbS supporting mainly Coastal Protection and Sediment Management

35. Coastal Mangrove Shield and Fisheries
36. Grassed Waterways
37. Beach Nourishment
38. Frontal Dune
39. Constructed Perched Beach
40. Natural Timber Groyne
41. Constructed Nature Island
42. Sand Trapping Fences
43. Windbreaks and Shelterbelts

NbS supporting mainly Marine and Deep-Sea Solutions

67. Vertical Dock Reefs
68. Artificial Floating Reefs
69. Marine Sedimentation Basins for Bioturbation
70. Mesopelagic Fauna Deep-Sea Sequestration

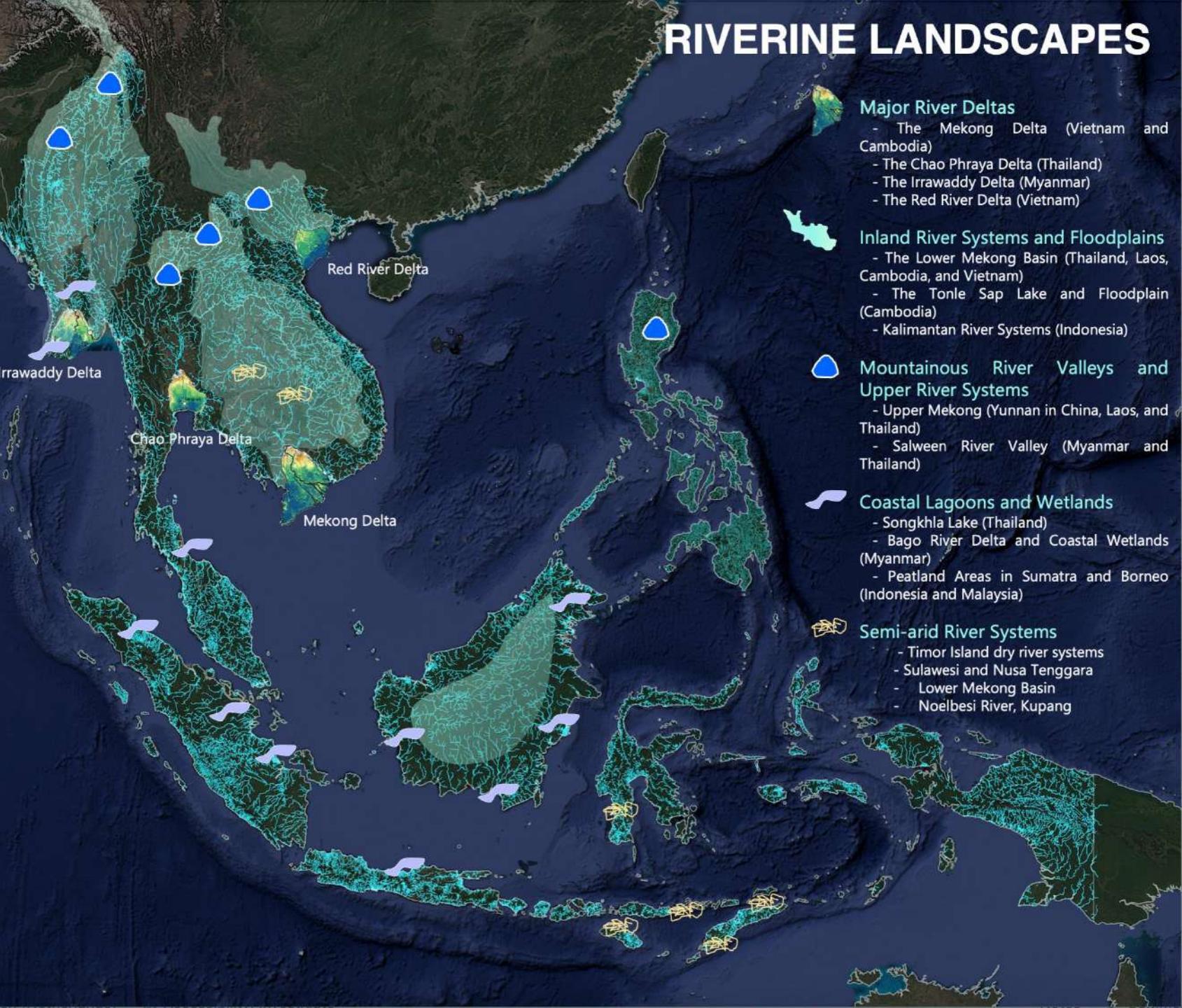
Water-Sensitive Riverscapes : Integrated River Management Through Nature-based Solutions



CSL01a Flood responsive Riverine and Deltaic Landscapes

CSL01b Dry Riverine Landscapes

RIVERINE LANDSCAPES



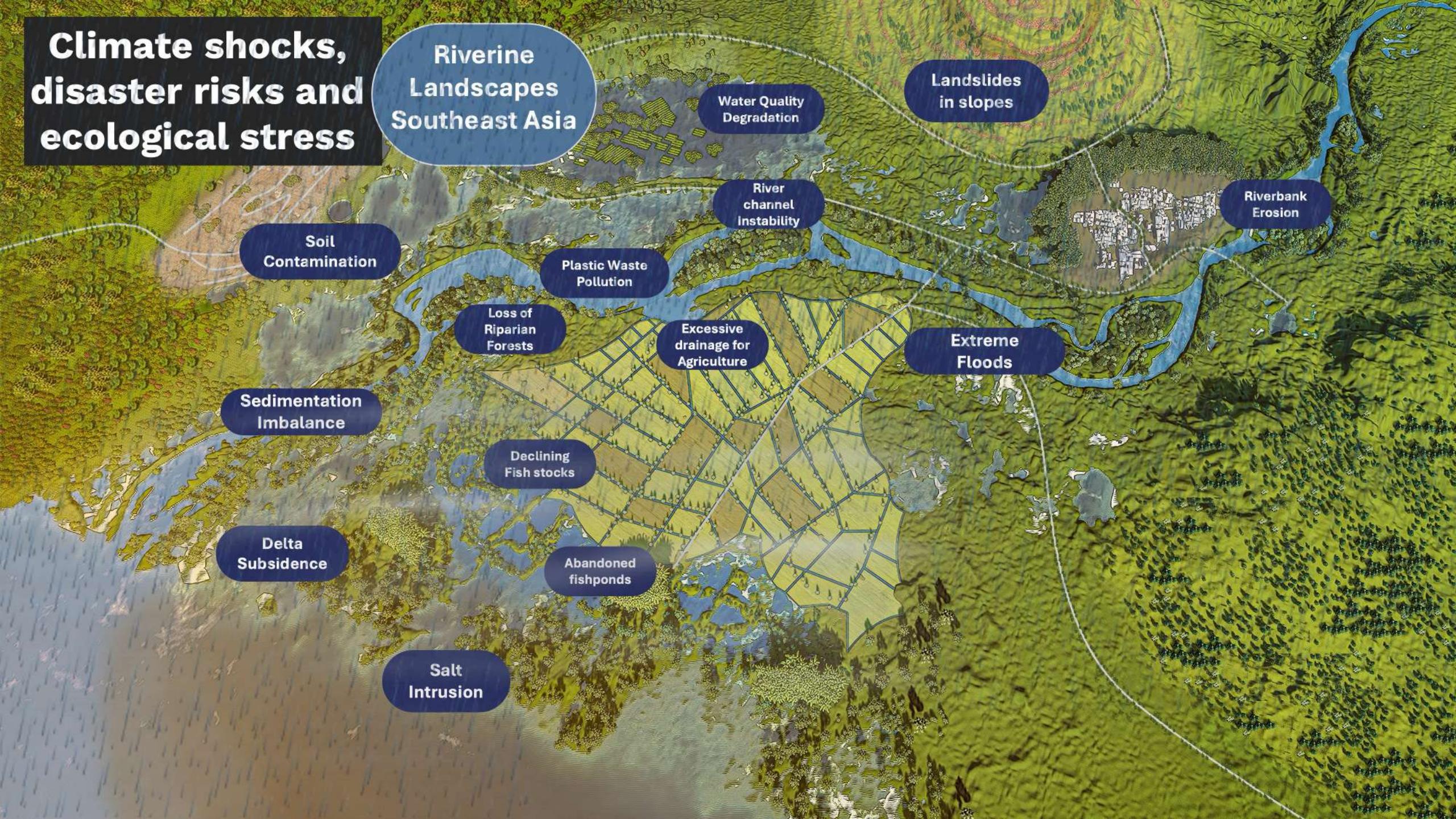
Water-Sensitive Riverscapes : Integrated River Management Through Nature-based Solutions



Mekong River, Vietnam

Climate shocks, disaster risks and ecological stress

Riverine Landscapes Southeast Asia



Riverscape Integrated NbS in Synergy



River-based Ecosystem Services supported by NbS

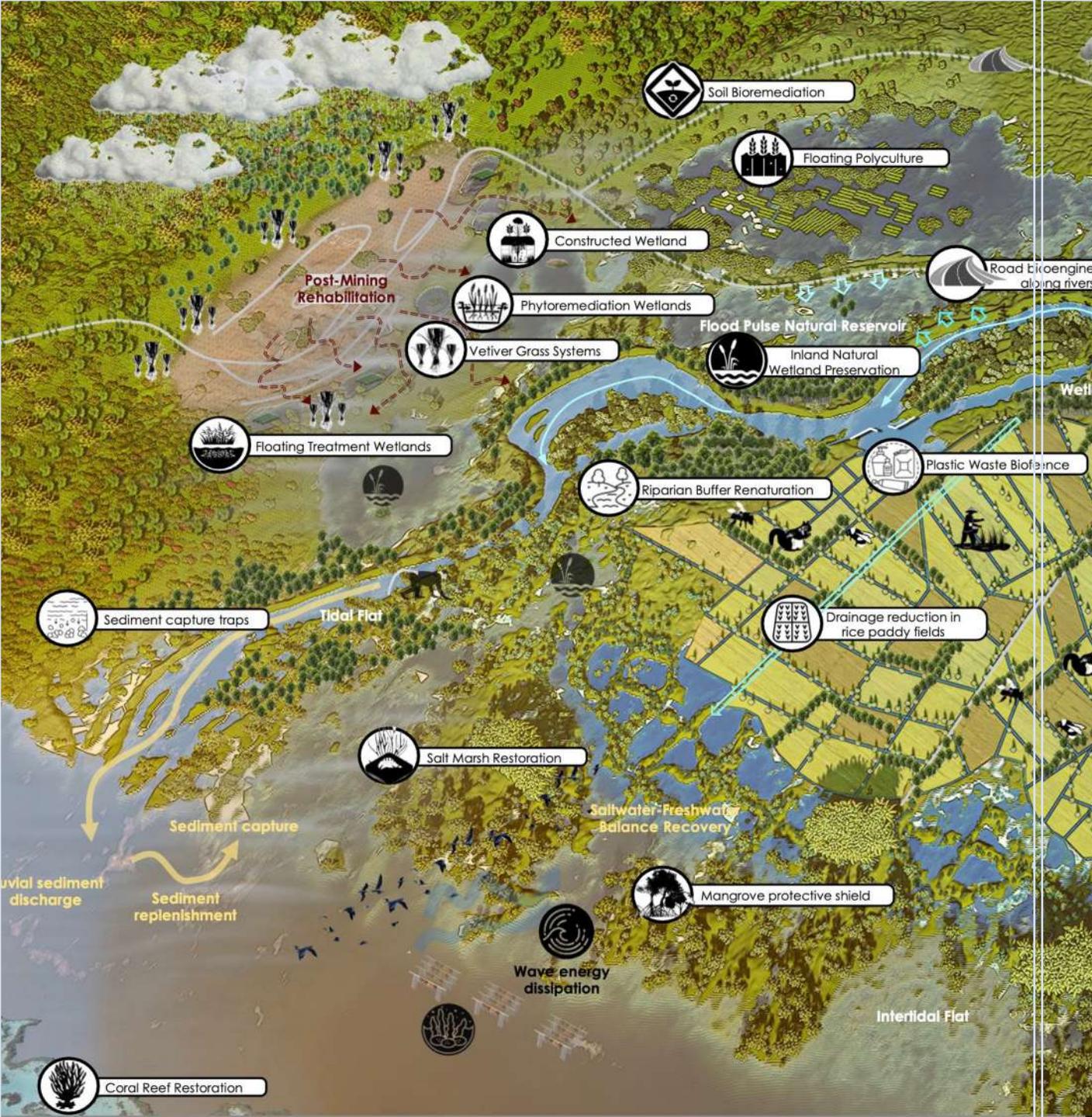
Restoring Hydrology and Ecosystems

Delta Resilience

Water Storage, Delay & Erosion Control

Flood-based & Regenerative Agriculture





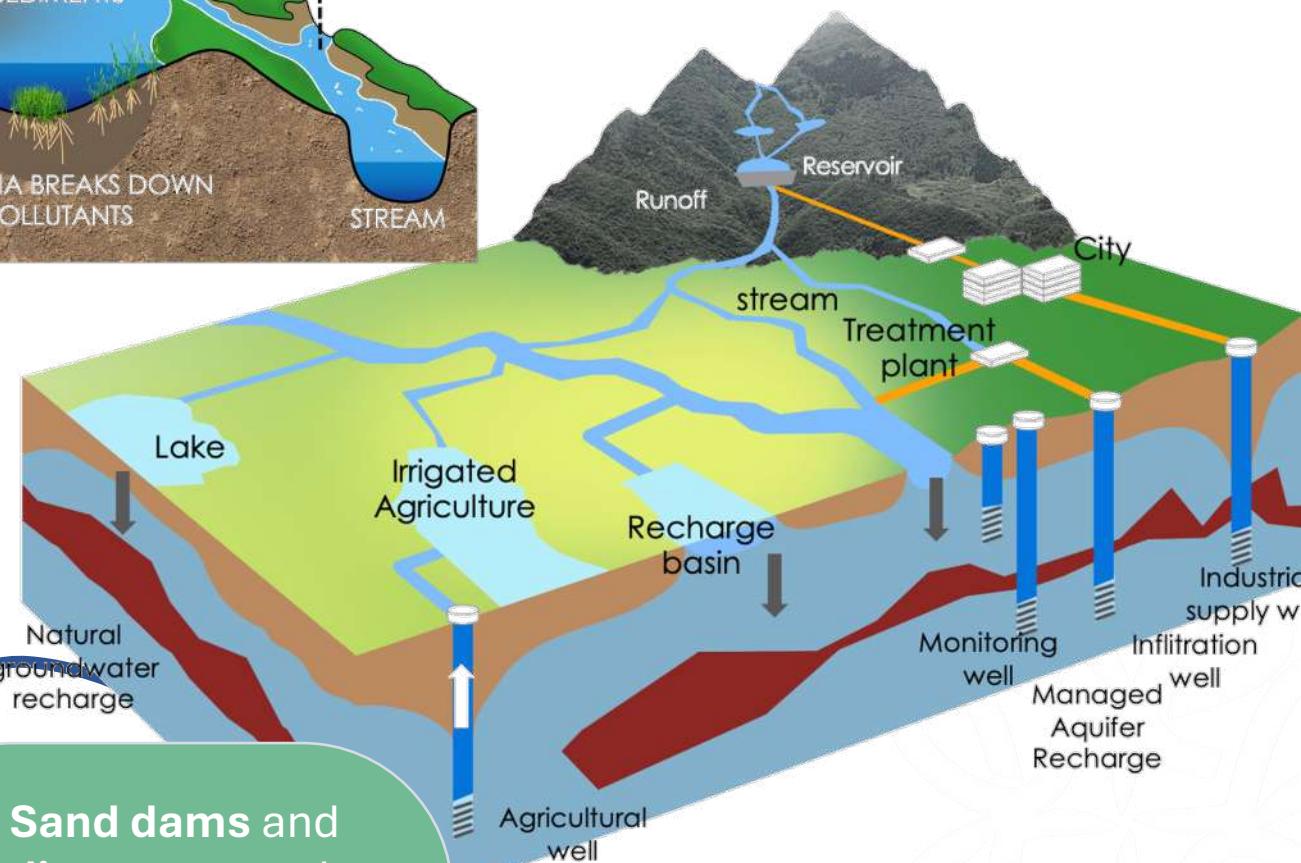
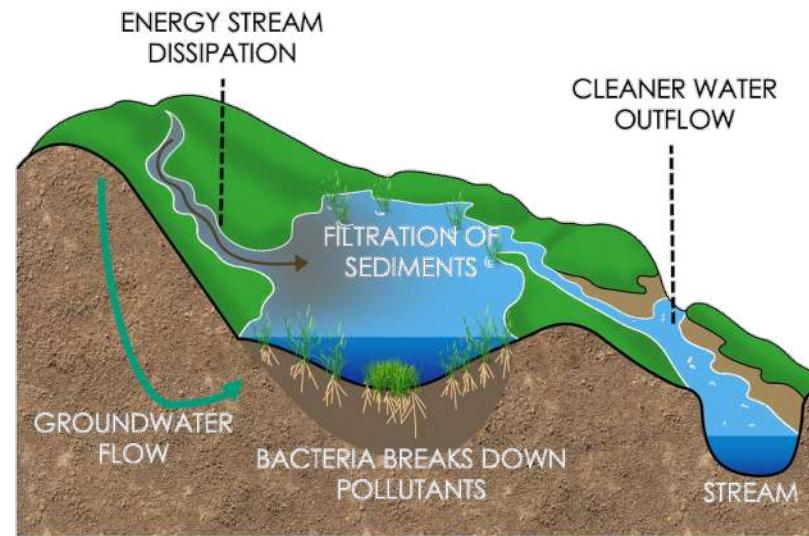
River-based Ecosystem Services supported by NbS

1 Restoring Hydrology and Ecosystems

→ Restore **riparian forests** and **wetlands** to reduce erosion and store floodwater.

→ Manage **seasonal floodplains and capture water surpluses** for groundwater aquifer recharge, fisheries, and agriculture.

→ Use **check dams** and **re-vegetation** in dry zones to prevent sediment loss and retain water.



→ **Sand dams** and **sediment traps** slow runoff and increase infiltration

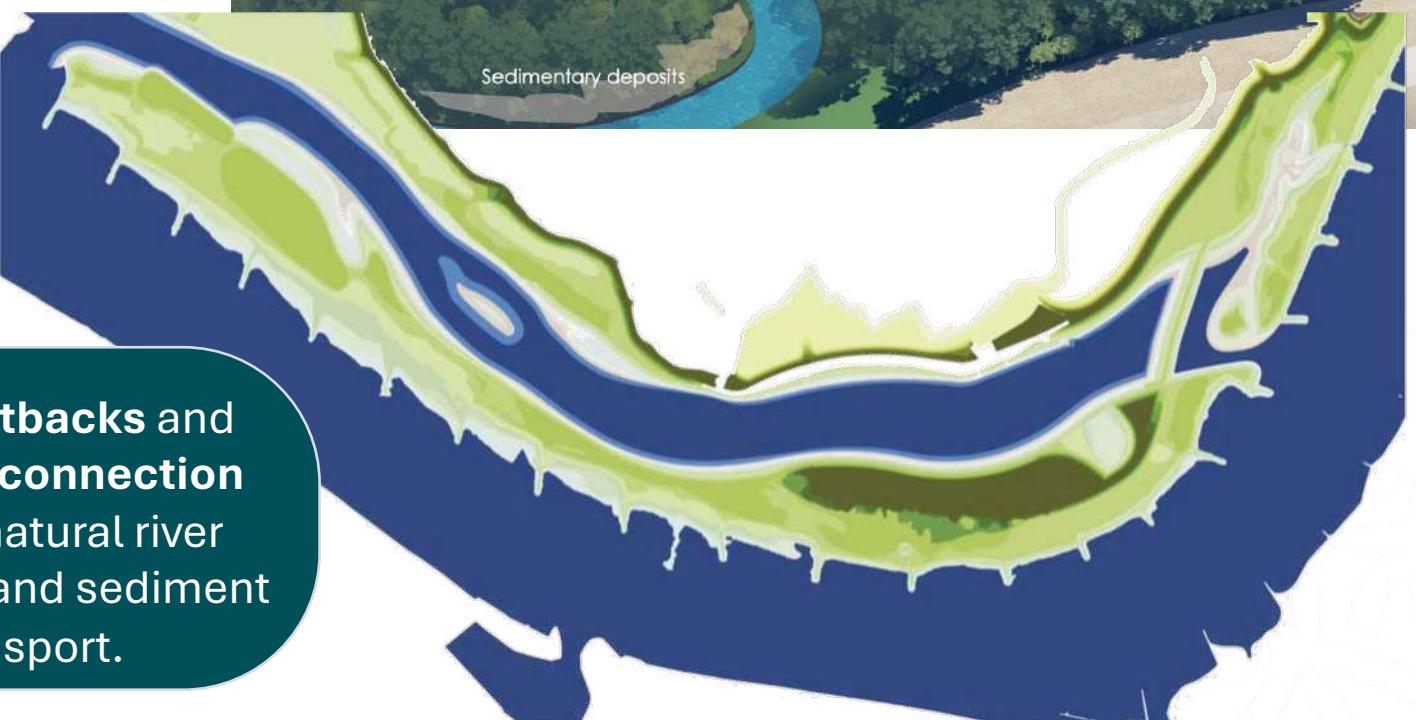
River-based Ecosystem Services supported by NbS

Restoring
Hydrology and
Ecosystems

2 Delta Resilience

Wetland restoration mitigates floods, supports biodiversity, and improves water quality.

Levee setbacks and oxbow reconnection restore natural river dynamics and sediment transport.



River-based Ecosystem Services supported by NbS

Restoring
Hydrology and
Ecosystems

Delta Resilience

Water Storage,
3 Delay & Erosion
Control



Bioretention ponds, swales, and aquifer recharge zones balance flood and dry-season water needs.

Integrate freshwater-saltwater management to support agriculture and aquaculture.

Implement riparian buffers, brushwood mattresses, log terracing.

Plastic-waste biofences reduce pollution and stabilise riverbanks.

River-based Ecosystem Services supported by NbS

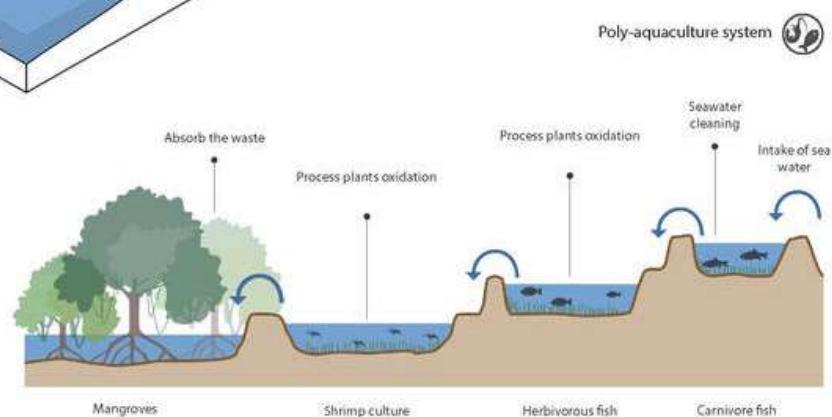
Restoring
Hydrology and
Ecosystems

Delta Resilience

→ Floodplain farming,
Riparian Sylviculture,
Small Sand Dams,
Drainage reduction

4
Flood-based &
Regenerative
Agriculture

→ Phytofiltration
(basins), water bunds,
sediment traps, log
terracing and levee
setbacks



Nature-based Solutions supporting Integrated Coastal Management (ICZM)

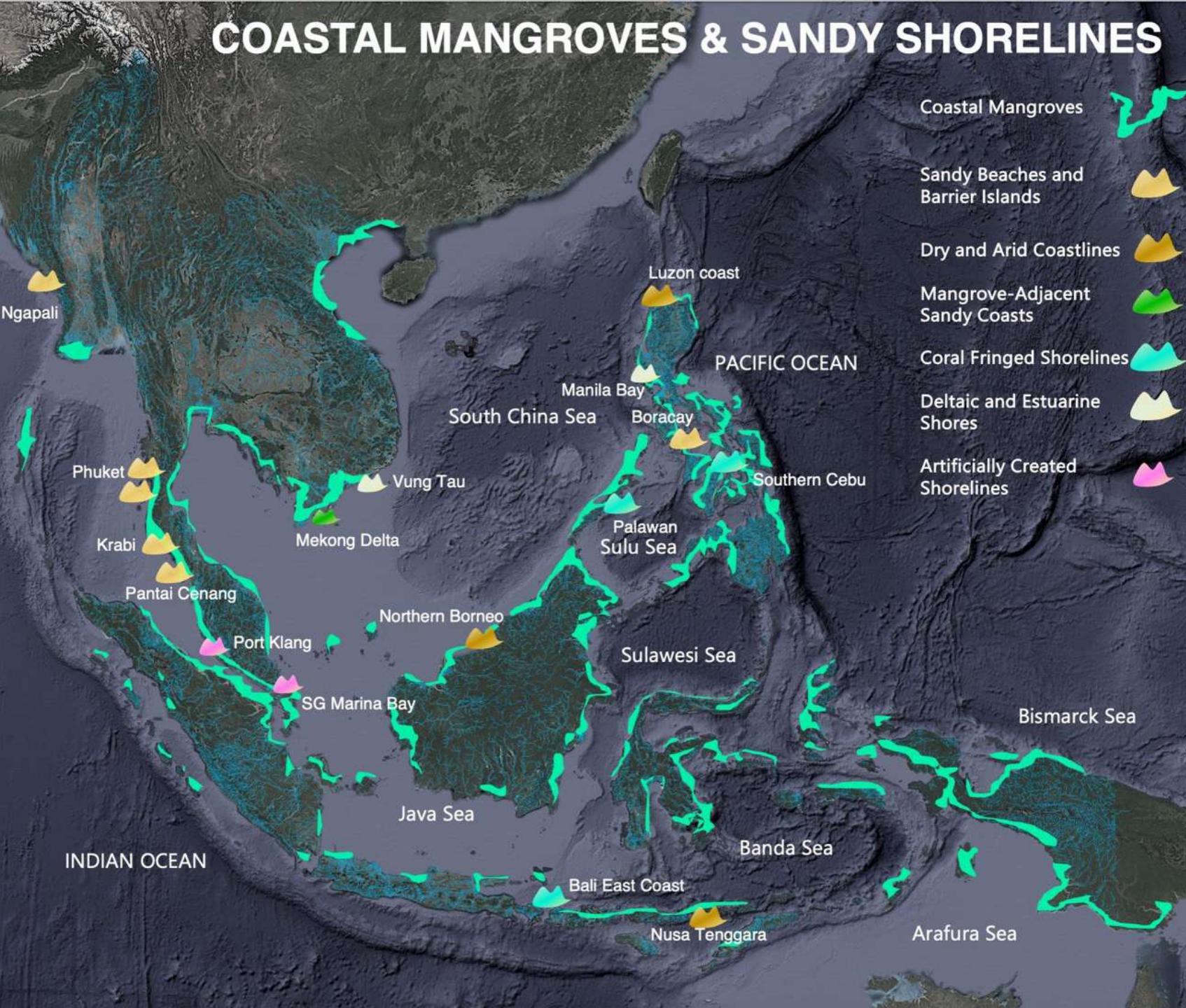


CSL02/ Adaptative Sandy Shorelines

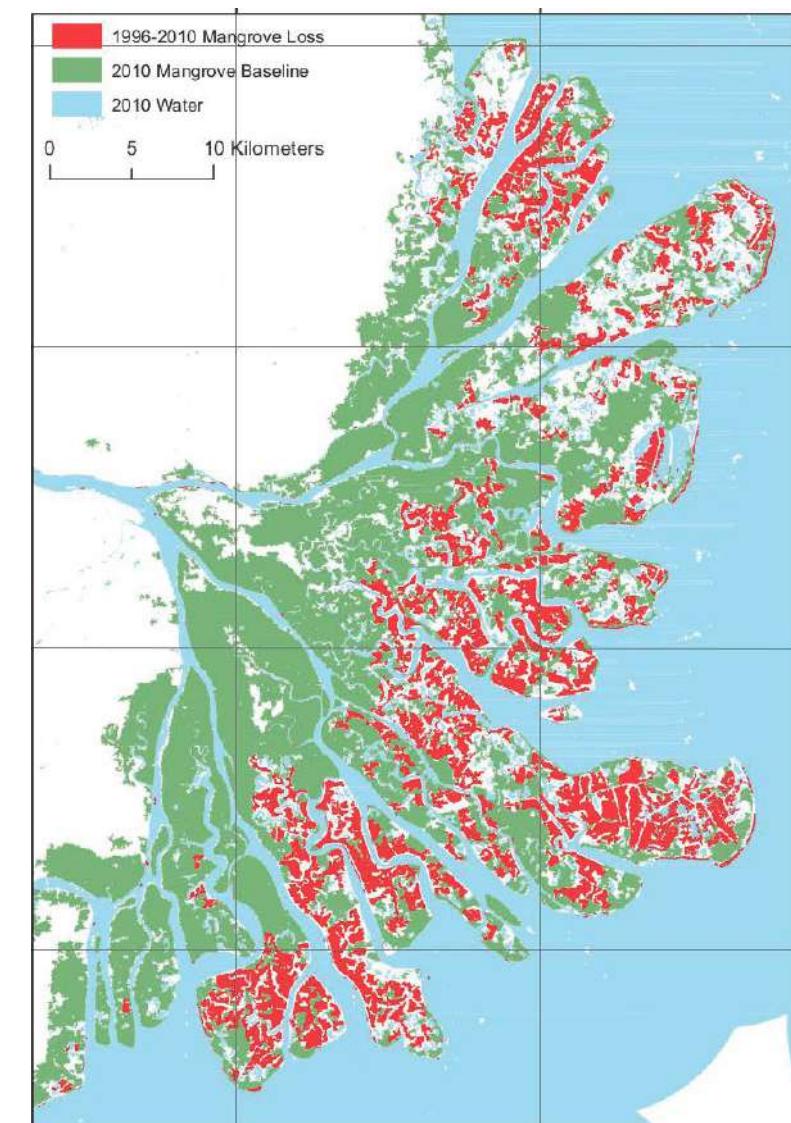


CSL03/ Adaptative Coastal Mangroves

COASTAL MANGROVES & SANDY SHORELINES

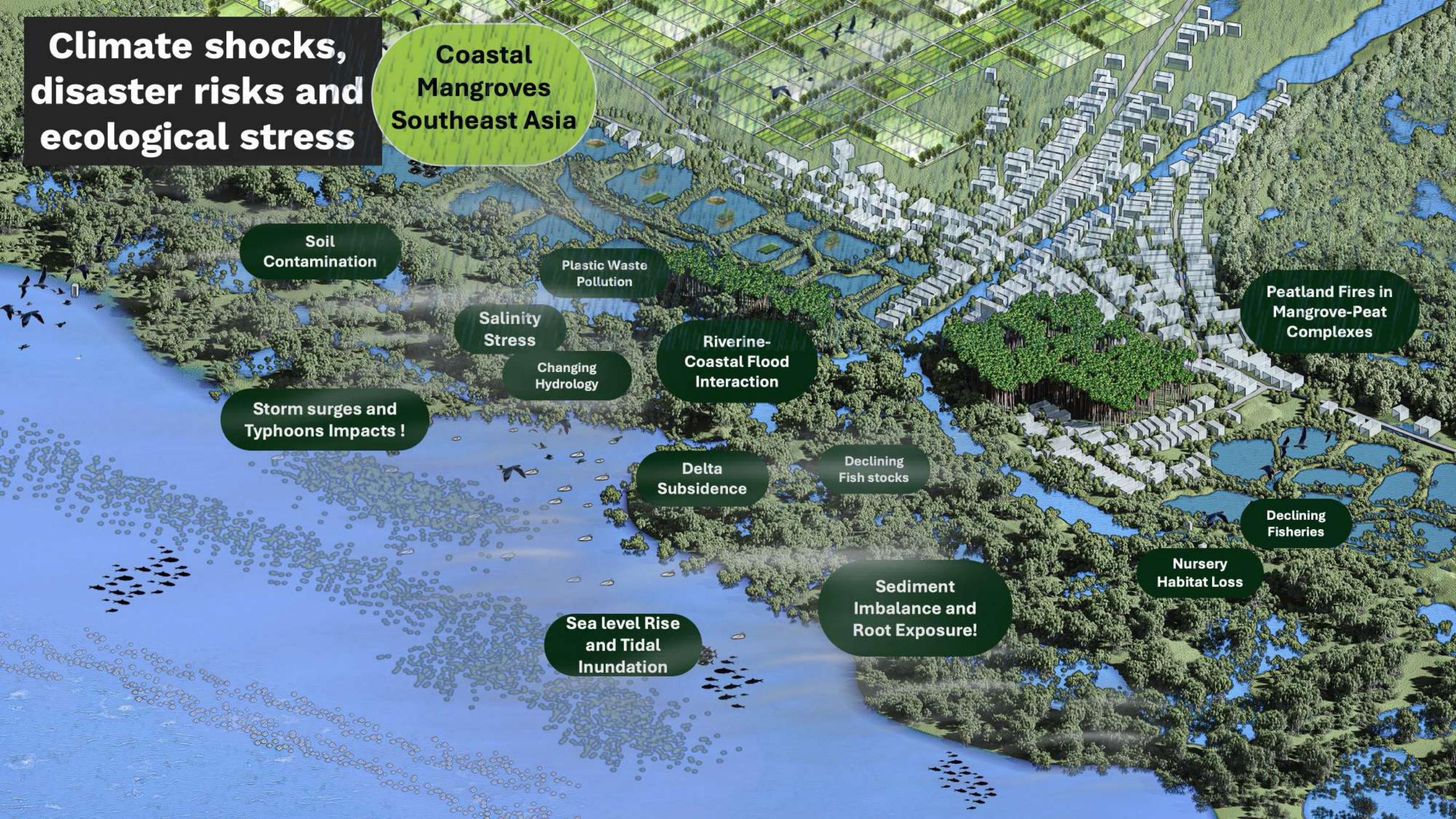


Nature-based Solutions supporting Integrated Coastal Management (ICZM)



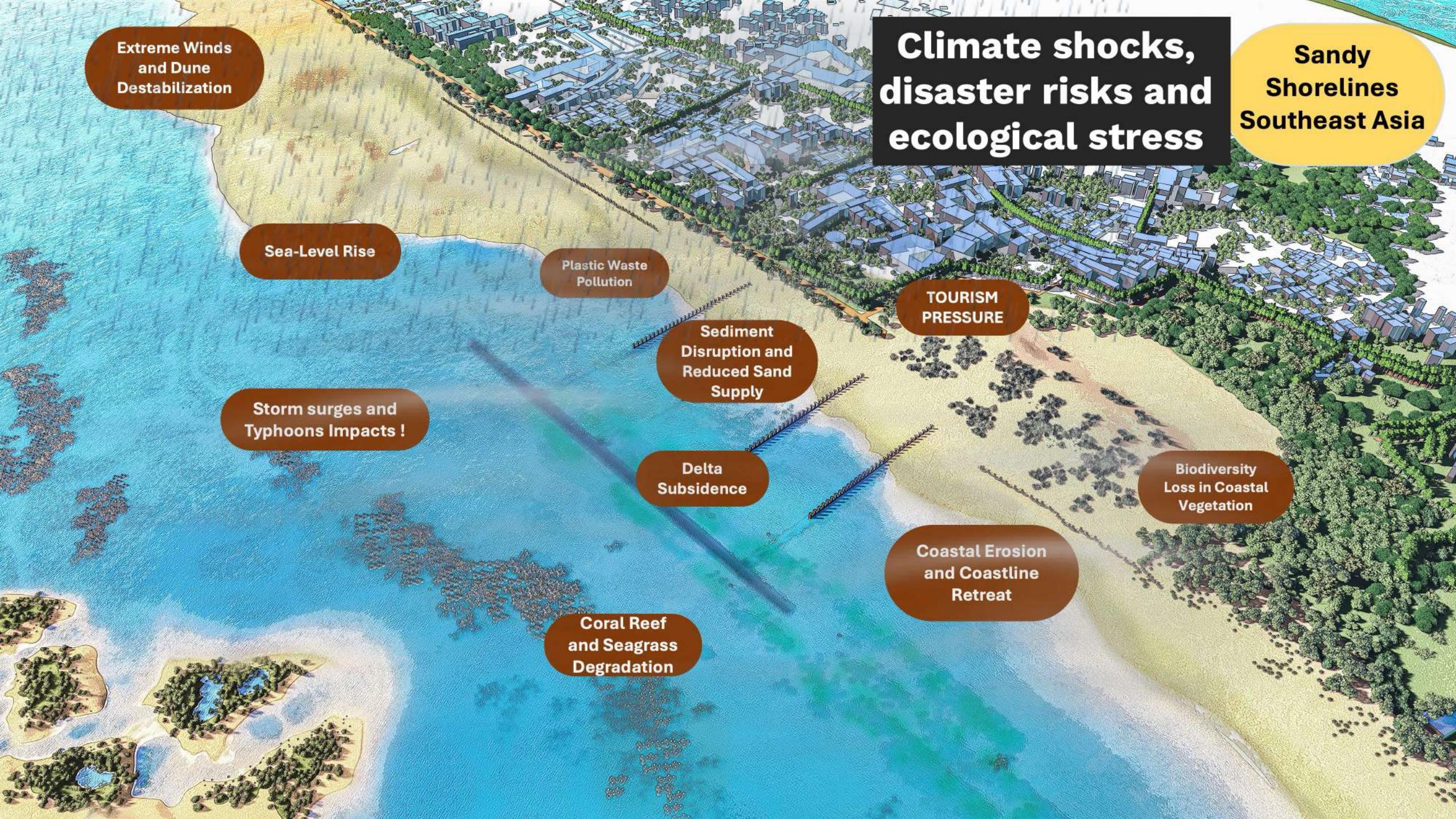
Climate shocks, disaster risks and ecological stress

Coastal Mangroves Southeast Asia



Restoring Mangroves with NbS in Synergy





Extreme Winds
and Dune
Destabilization

Sea-Level Rise

Storm surges and
Typhoons Impacts !

Plastic Waste
Pollution

Sediment
Disruption and
Reduced Sand
Supply

Delta
Subsidence

Coral Reef
and Seagrass
Degradation

Climate shocks, disaster risks and ecological stress

Sandy
Shorelines
Southeast Asia

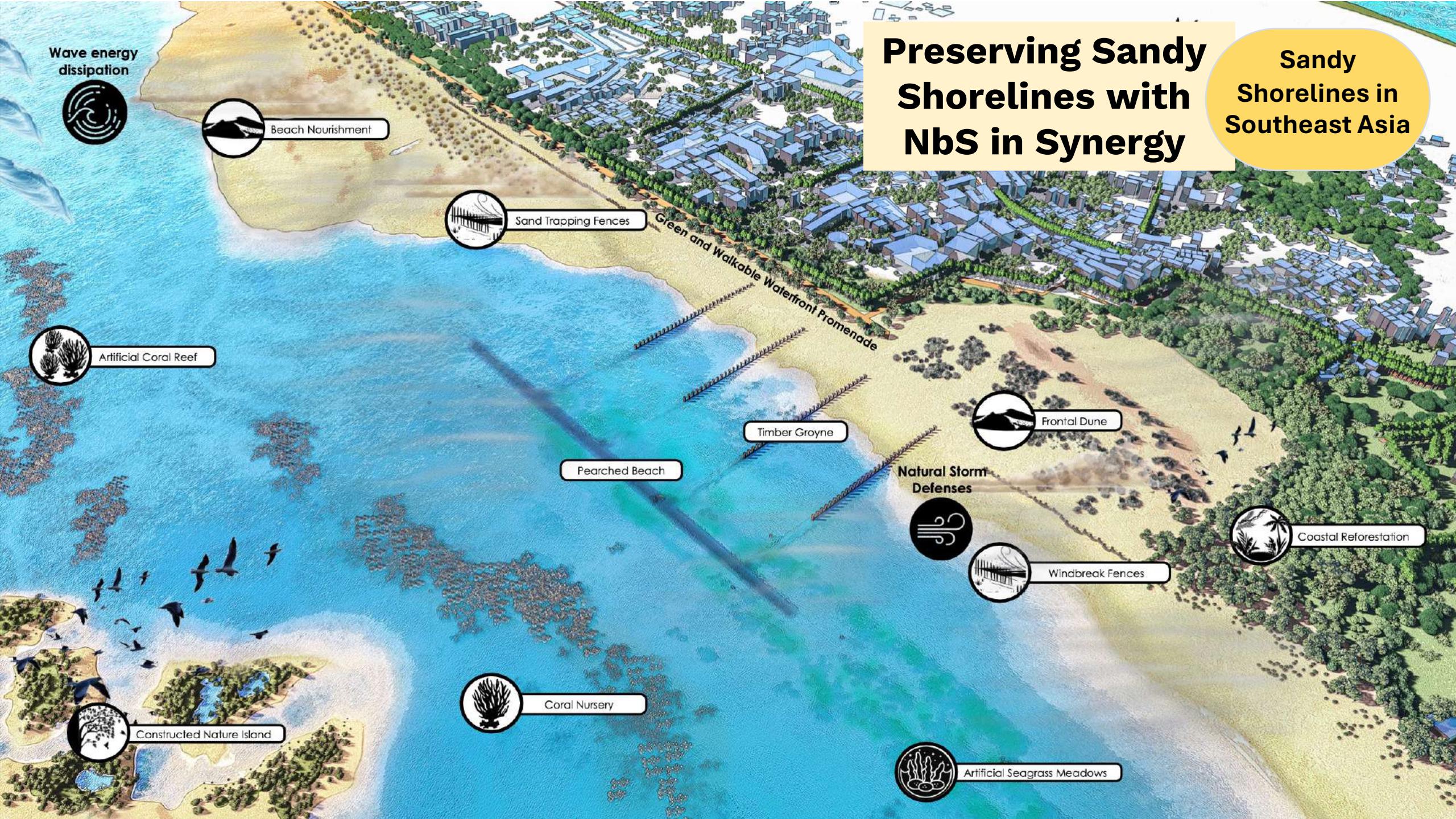
TOURISM
PRESSURE

Coastal Erosion
and Coastline
Retreat

Biodiversity
Loss in Coastal
Vegetation

Preserving Sandy Shorelines with NbS in Synergy

Sandy Shorelines in Southeast Asia



How NbS support Coastal Resilience in Southeast Asia



Wave energy dissipation
Beach Nourishment

Coastal Protection & Wave Attenuation

Sediment Stabilisation & Shoreline Recovery

Biodiversity Support & Habitat Restoration

Climate Mitigation & Livelihood Support



Constructed Nature Island



Sand Trapping Fences

Green and Walkable Waterfront Promenade

Timber Groyne

Frontal Dune

Natural Storm Defenses



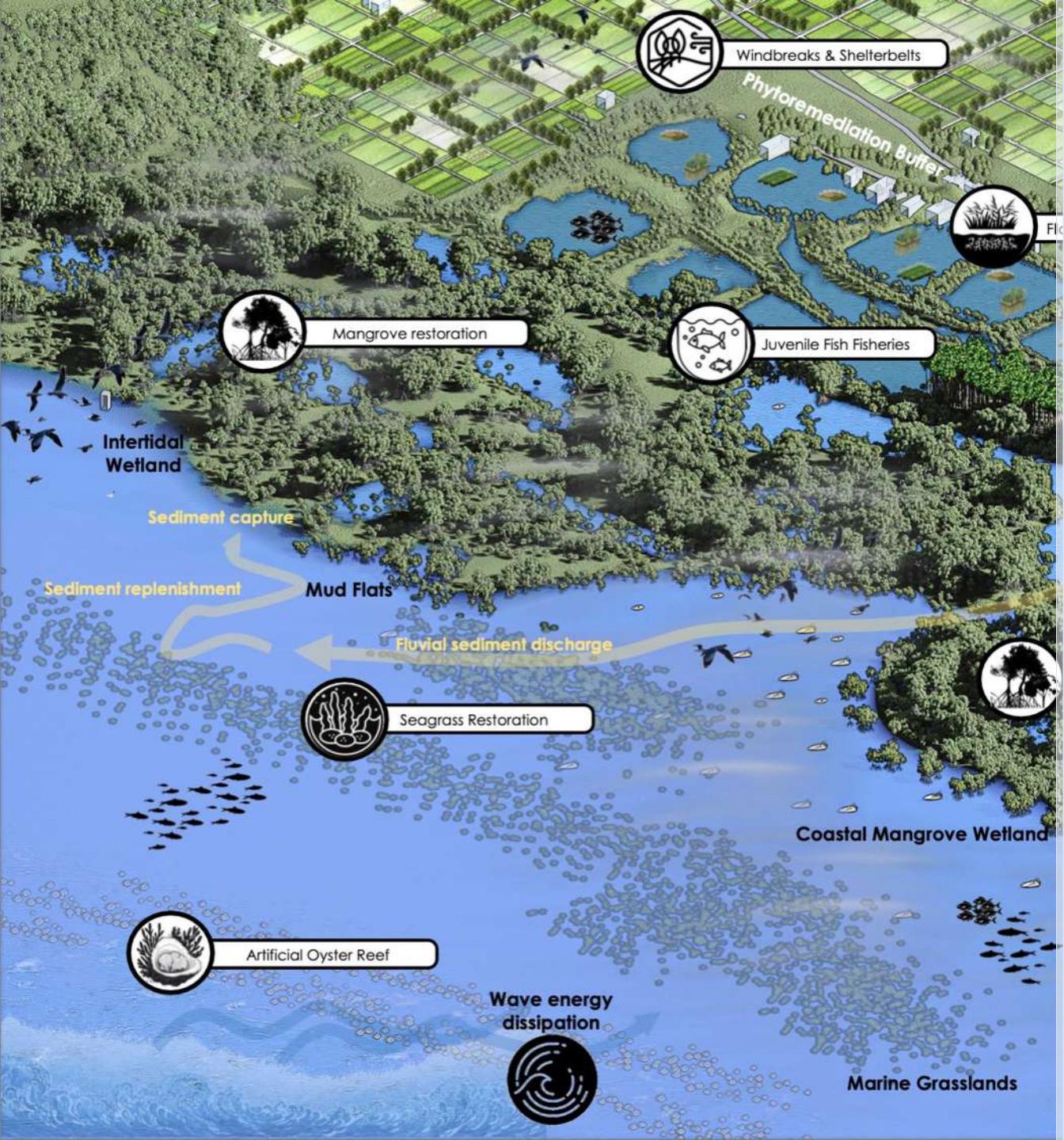
Windbreak Fences



Coastal Reforestation



Artificial Seagrass Meadows



Enablers

Integrated Coastal Governance

Long Term Planning

Institutional Capacity

Community Engagement

Economic Instruments & Sustainable Finance

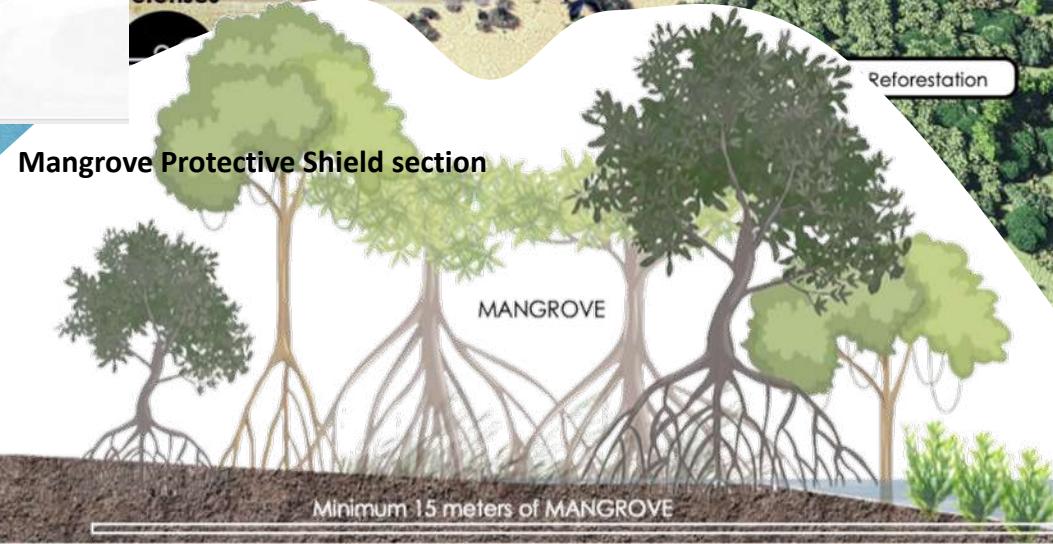
Cross-border Cooperation

How NbS support Coastal Resilience in Southeast Asia

Coastal Protection & Wave Attenuation

→ Mangrove protective shields, salt marshes, seagrass meadows

→ Perched beaches, oyster reefs and artificial coral reefs reducing wave energy and buffering storm surges.



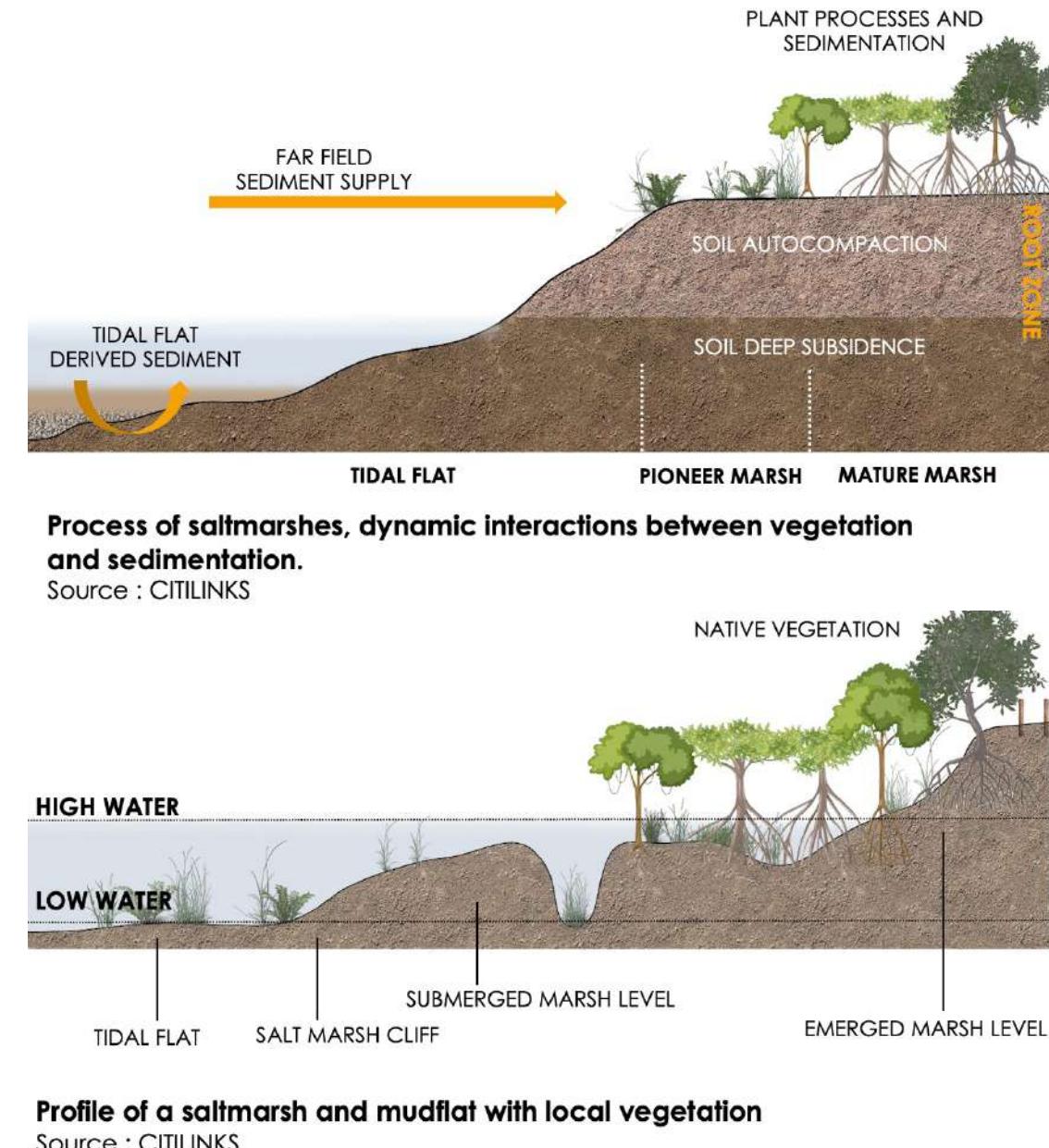
How NbS support Coastal Resilience in Southeast Asia

Coastal Protection & Wave Attenuation

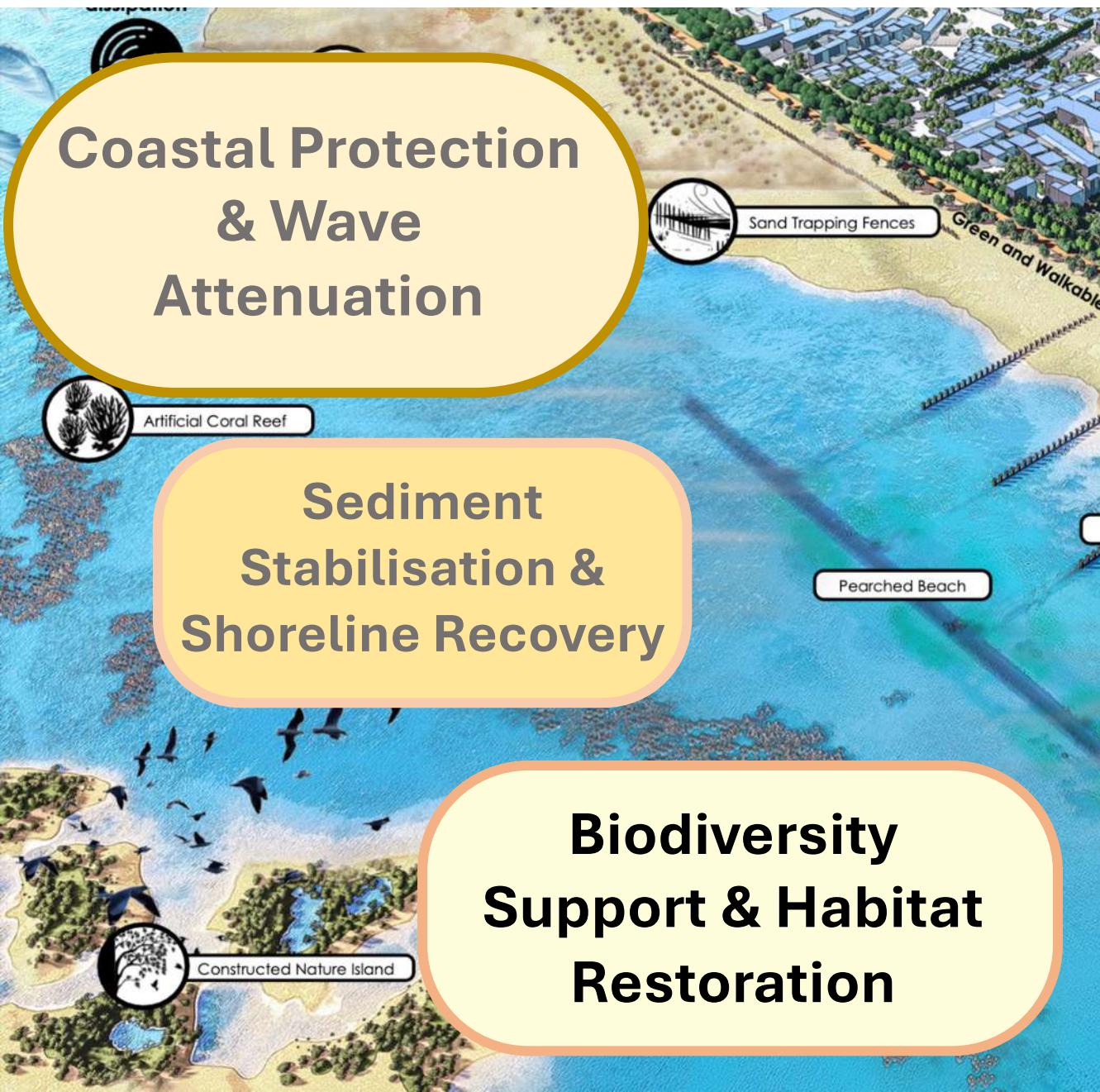
→ Tidal flat nourishment, sediment traps and fine sediment capture and replenishment for mangroves

Sediment Stabilisation & Shoreline Recovery

→ Sand fences, dune restoration and timber groynes to maintain natural sediment cycles



How NbS support Coastal Resilience in Southeast Asia



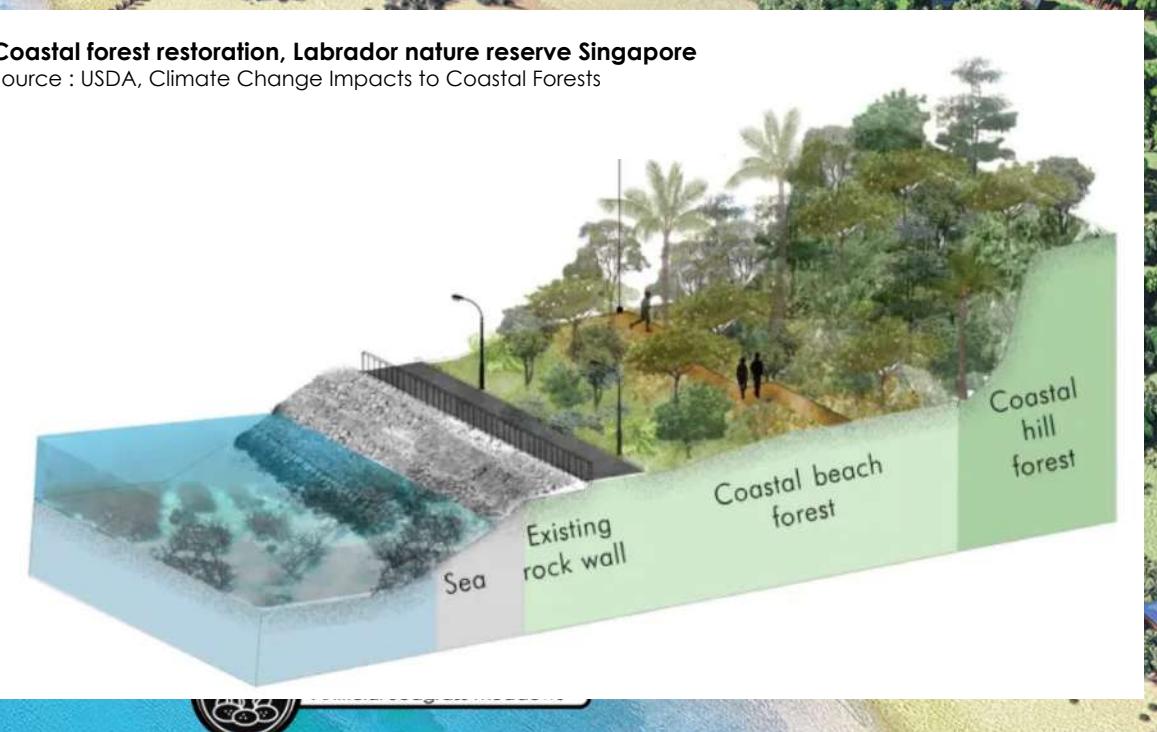
**Coastal Protection
& Wave
Attenuation**

**Sediment
Stabilisation &
Shoreline Recovery**

**Biodiversity
Support & Habitat
Restoration**



Coastal forest restoration, Labrador nature reserve Singapore
Source : USDA, Climate Change Impacts to Coastal Forests



How NbS support Coastal Resilience in Southeast Asia

Coastal Protection & Wave Attenuation

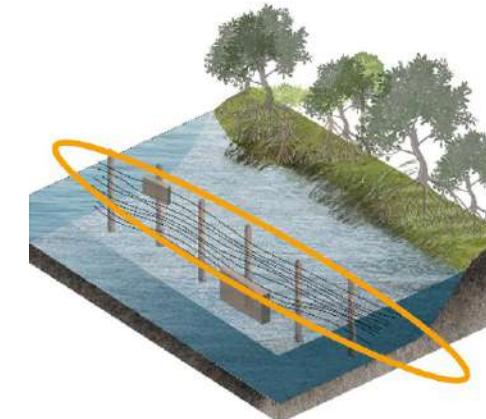
Sediment Stabilisation & Shoreline Recovery

Biodiversity Support & Habitat Restoration

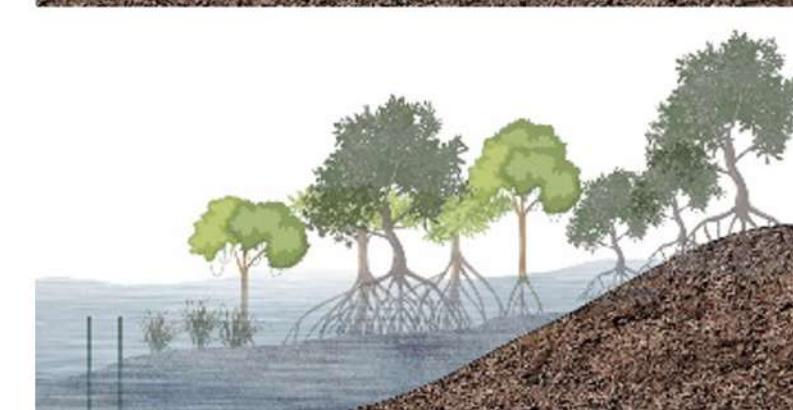
Climate Mitigation & Livelihood Support

→ Integrated Mangrove-Aquaculture Systems, Nina palm production, Eco-Tourism

→ Blue carbon sequestration by mangroves, peatlands, seagrass systems; Strengthening of climate adaptation



Permeable wooden dam



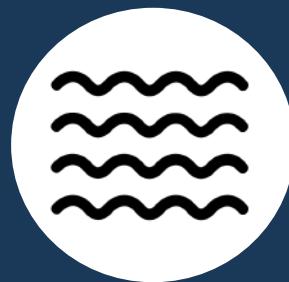
Over time, there is sediment deposition regain that allows mangrove to grow and expand. The mature mangrove belt can then better protect the coastline.

Mangrove forest restoration and growth.

Source : Citilinks

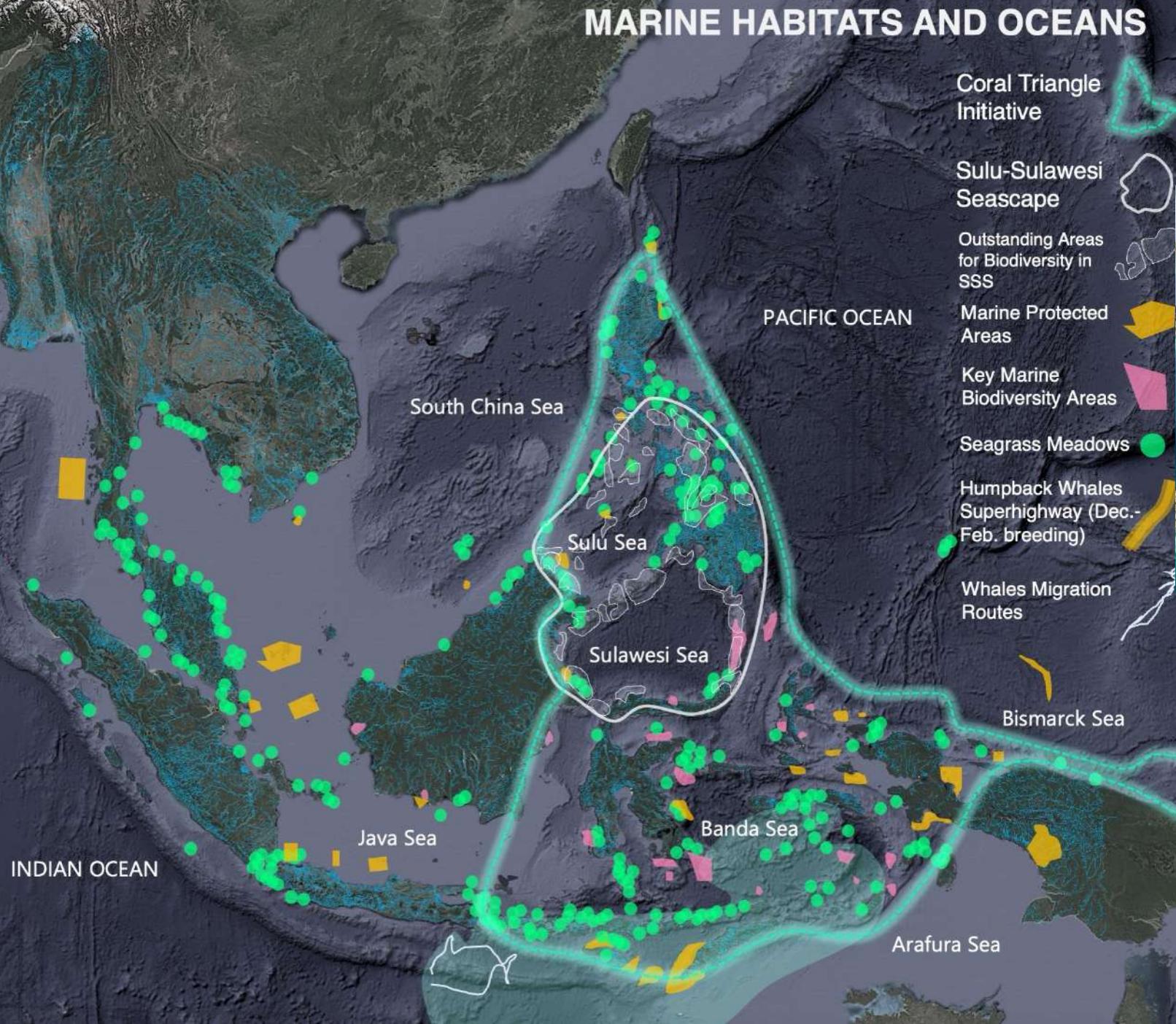
Small water permeable dams filter sediment creating a fertil environment for mangrove trees to grow and develop. They are semi permeable and made from wooden pole and mesh.

Nature-based Marine Restoration: Designing and Scaling NbS for Regenerative Seascapes and Blue Carbon Systems



CSL09/ Regenerative Seascapes and Marine Habitats

MARINE HABITATS AND OCEANS



Nature-based Marine Restoration: Designing and Scaling NbS for Regenerative Seascapes and Blue Carbon Systems



Climate shocks, disaster risks and ecological stress

Marine Ecosystems Southeast Asia

Coastal and
Offshore
Erosion

Invasive Marine
Species

Marine
Pollution

Dead Zones &
Eutrophication

Typhoons and
Extreme Storm
Events

Overfishing
Practices

Seagrass Loss &
Decline of Blue
Carbon Ecosystems

Coral
Bleaching from
Marine
Heatwaves

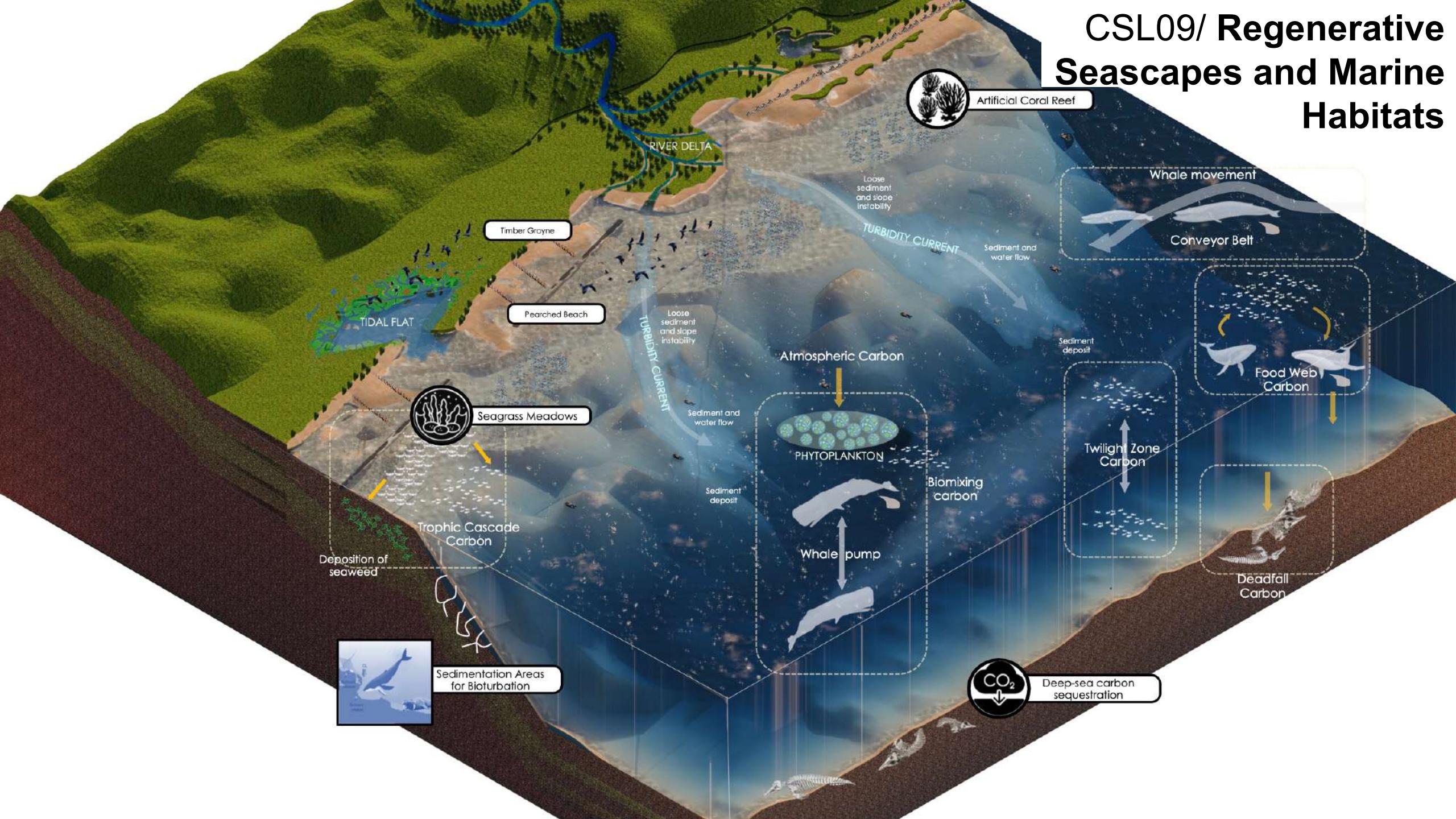
Habitat
Fragmentation

Ocean
Acidification

Coral Reef
and Seagrass
Degradation



CSL09/ Regenerative Seascapes and Marine Habitats



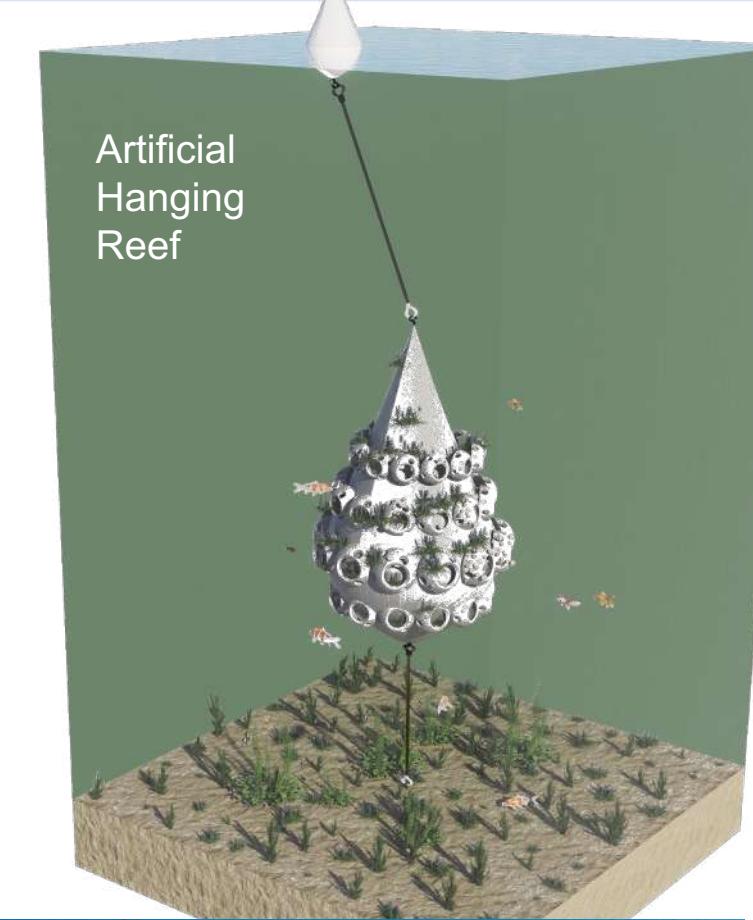
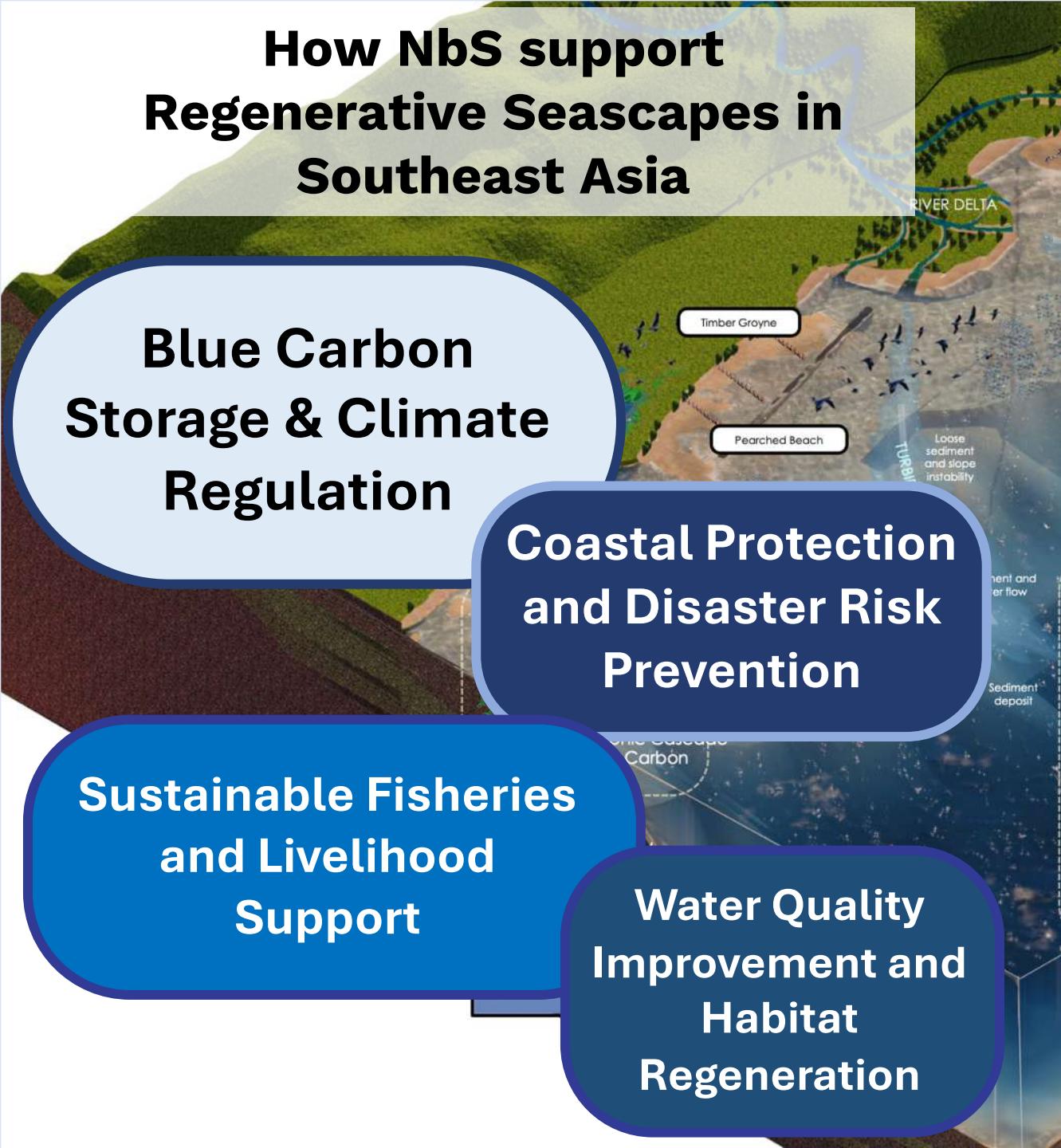
How NbS support Regenerative Seascapes in Southeast Asia

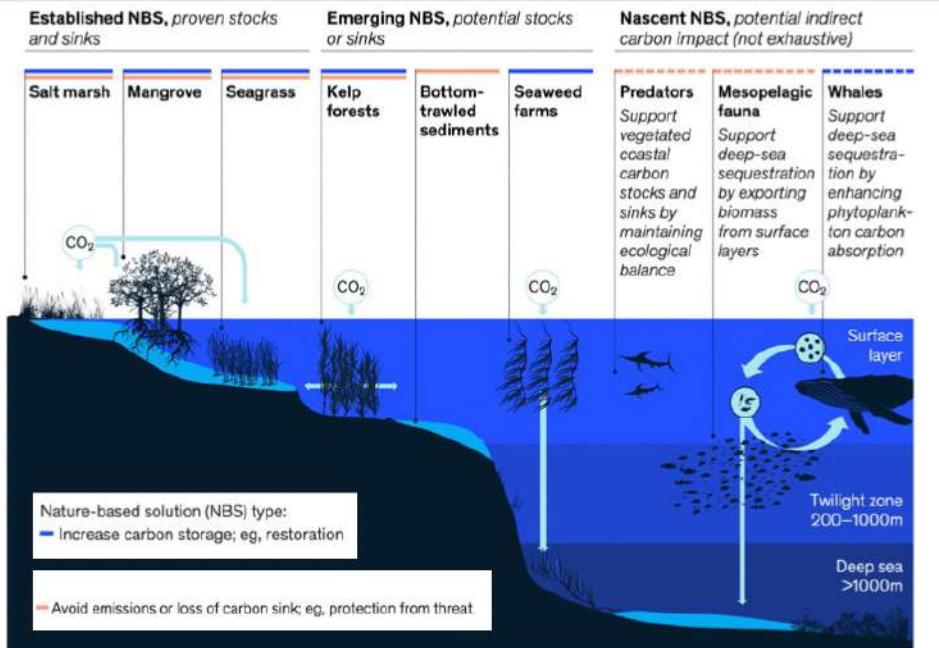
Blue Carbon Storage & Climate Regulation

Coastal Protection and Disaster Risk Prevention

Sustainable Fisheries and Livelihood Support

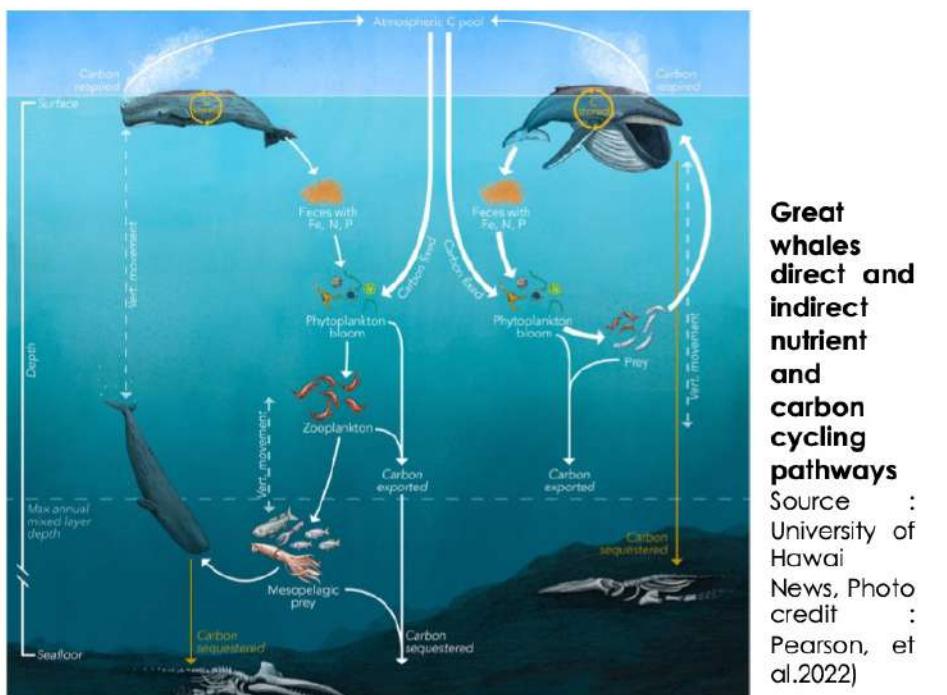
Water Quality Improvement and Habitat Regeneration





Blue Carbon : The potential of coastal and oceanic climate action

Source : McKinsey



Thank you for your attention!

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