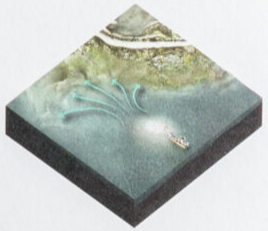
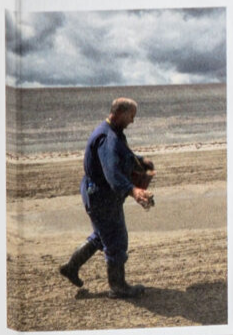
Building with Nature





Creating, implementing, and upscaling Nature-based Solutions

Editors

Erik van Eekelen
Matthijs Bouw

EcoShape

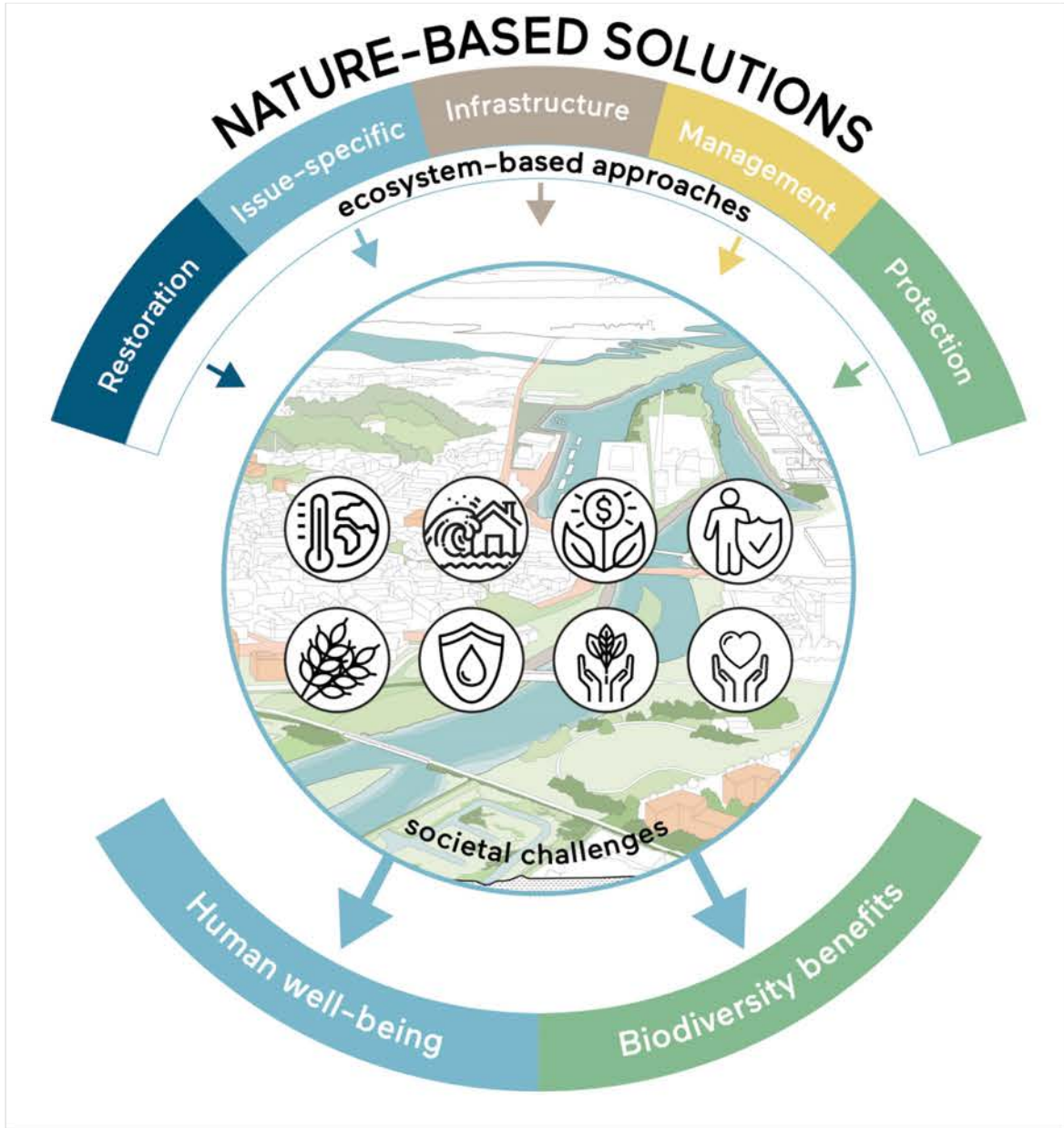
One Architecture

nai010 publishers

Building with Nature

Erik van Eekelen and Matthijs Bouw, editors

Climate adaptation is hard


NATURE-BASED SOLUTIONS
Restoration
Issue-specific
Infrastructure
Management
Protection
ecosystem-based approaches
societal challenges
Human well-being
Biodiversity benefits

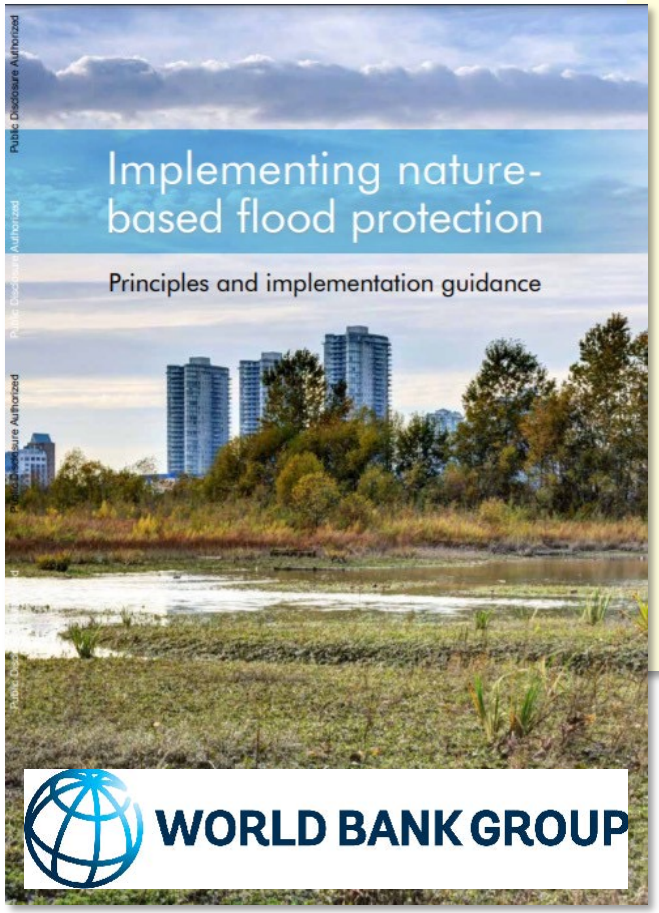
Leveraging our opportunity

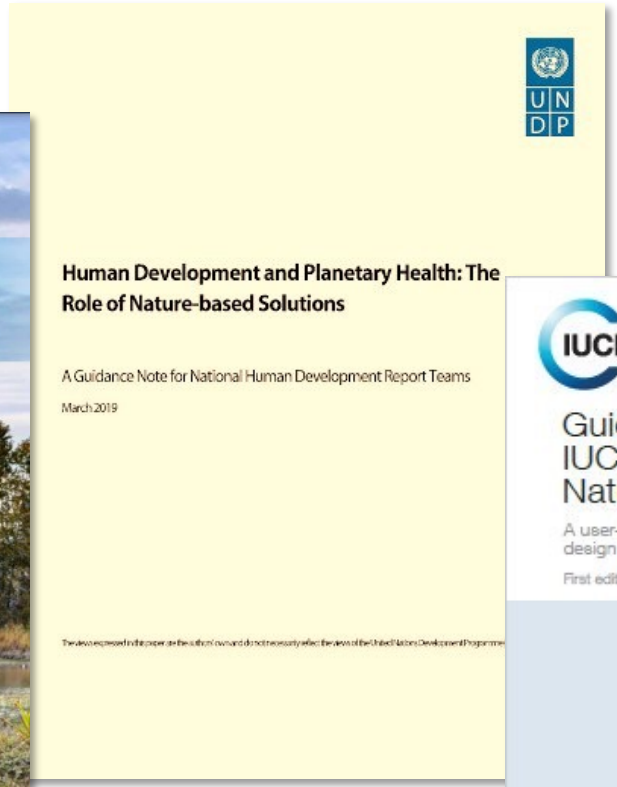
BwN total added benefits and avoided costs compared to conventional grey solutions:

~100M EUR on a 50 years horizon
(The Nature-Based Infrastructure Global Resource Centre, 2021)

From Building against Nature → To Building with Nature

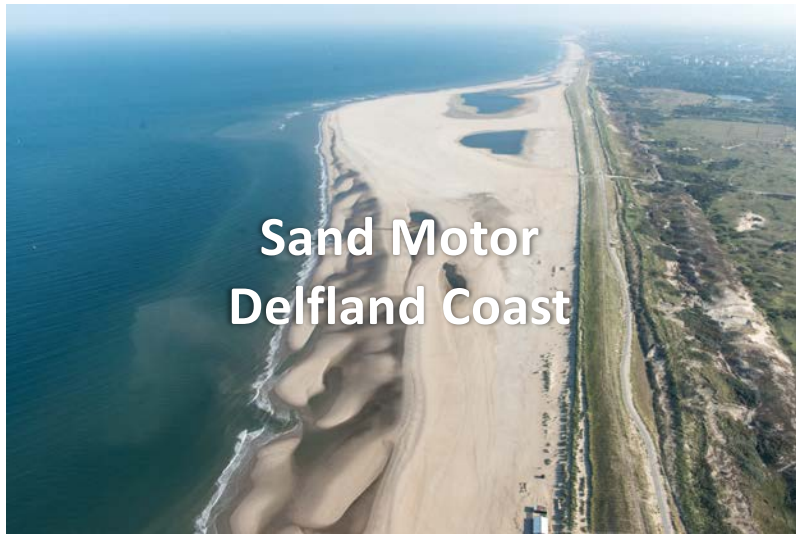
Global trend: Nature-based Solutions for climate resilient infrastructure





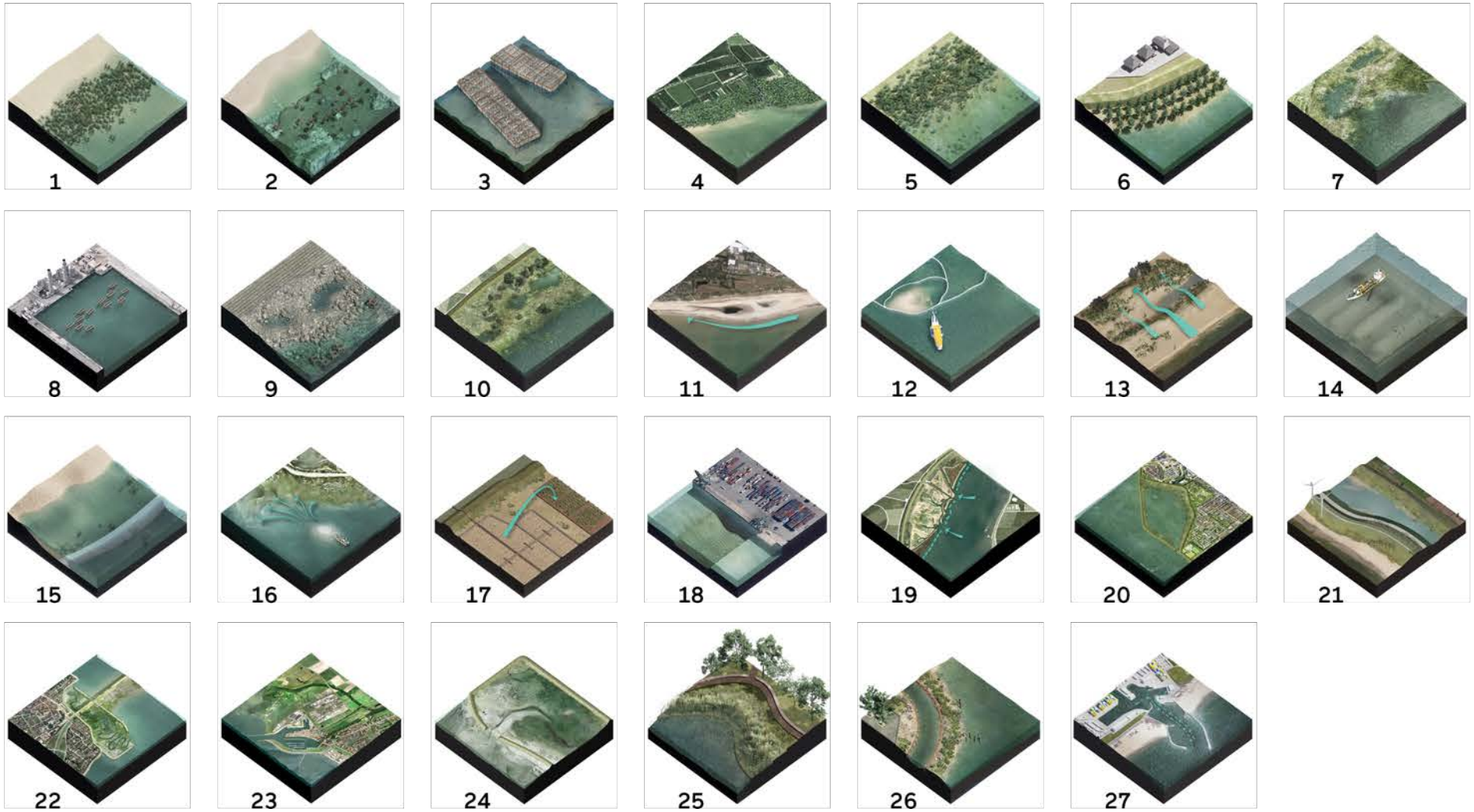
Expanding the success of Building with Nature

Select examples from around the globe



Building with Nature concepts

1 Restoring seagrass meadows
2 Facilitating coral development
3 Building shellfish reefs
4 Rehabilitating mangrove belts
5 Growing salt marshes
6 Establishing wetland forests
7 Developing wetland areas
8 Creating hanging and floating structures
9 Creating rich revetments
10 Integrating vegetated foreshores
11 Applying mega-nourishments
12 Constructing nature islands
13 Enhancing dune dynamics
14 Landscaping the seabed
15 Constructing perched beaches
16 Strategically placing fine sediment
17 Clay ripening and consolidation
18 Creating sedimentation basins
19 Managing coastal retreat/realignment
20 Developing inland buffer zones
21 Developing double dike systems
22 Restoring connections
23 Restoring salinity gradients
24 Restoring tidal dynamics
25 Creating tidal parks
26 Constructing secondary channels
27 Optimizing flow patterns



Foreshores

A growing system

Fig. C.9	The stability of an existing dike is judged to be compromised.

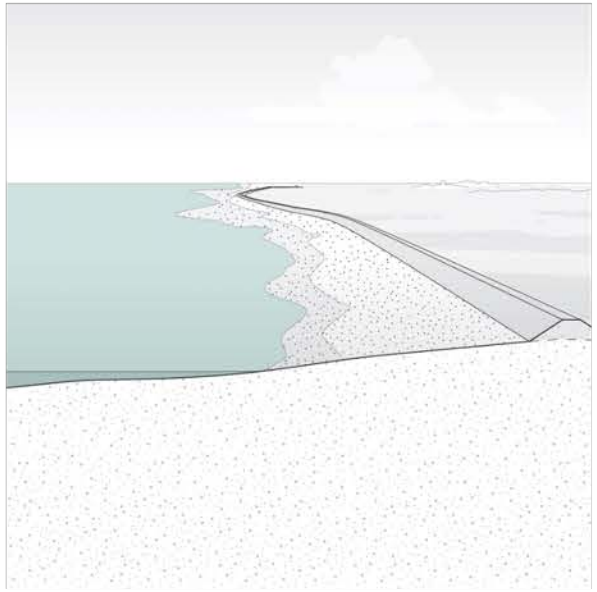


Fig. C.10	A contractor places soil in front of the dike, which adds stability.

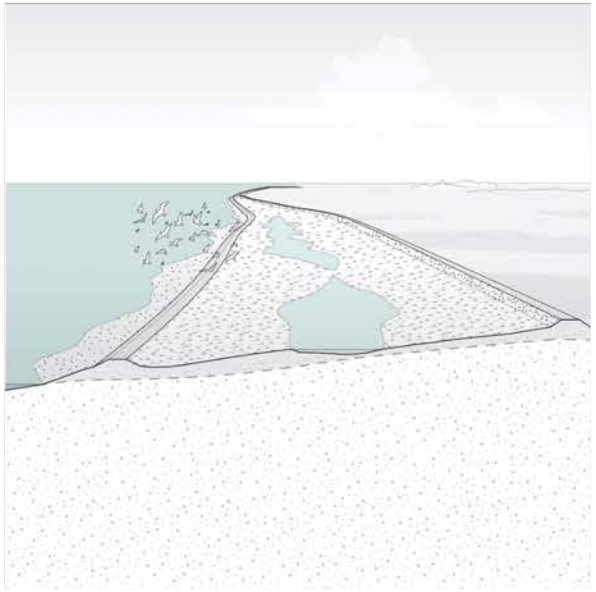
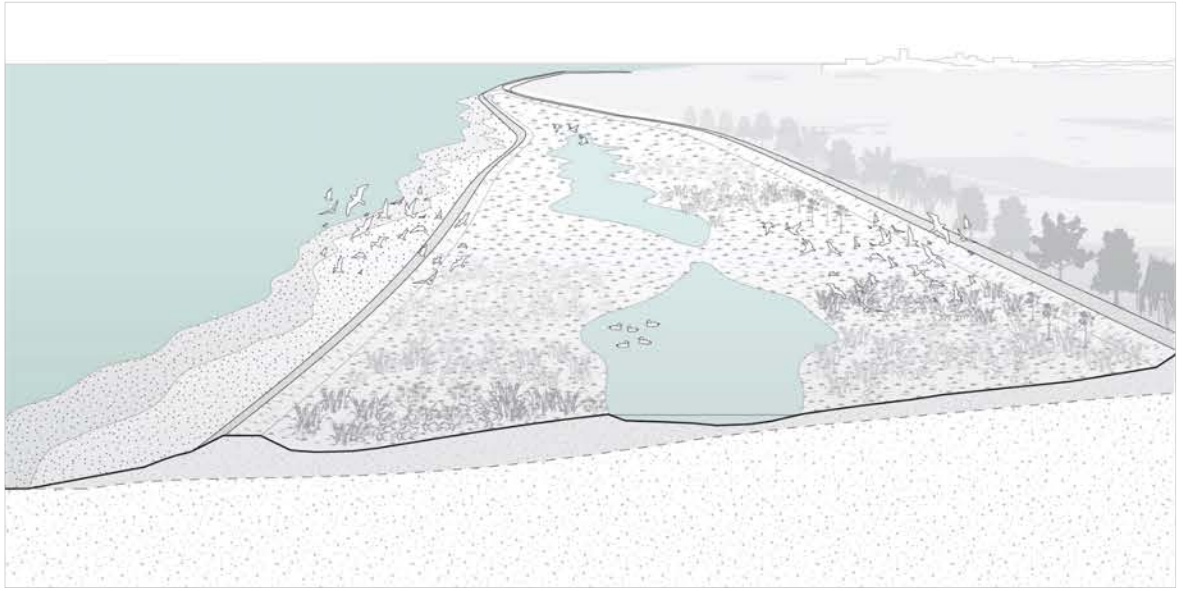


Fig. C.11	The foreshore is planted and habitat opportunities develop.

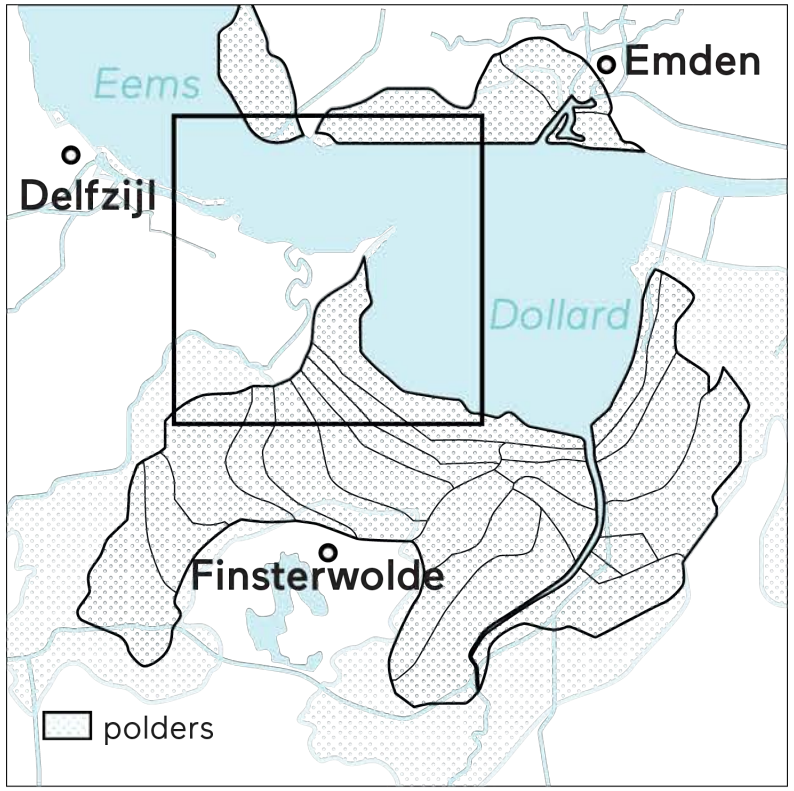


Clay Ripener

Clay Ripening Pilot, Delfzijl

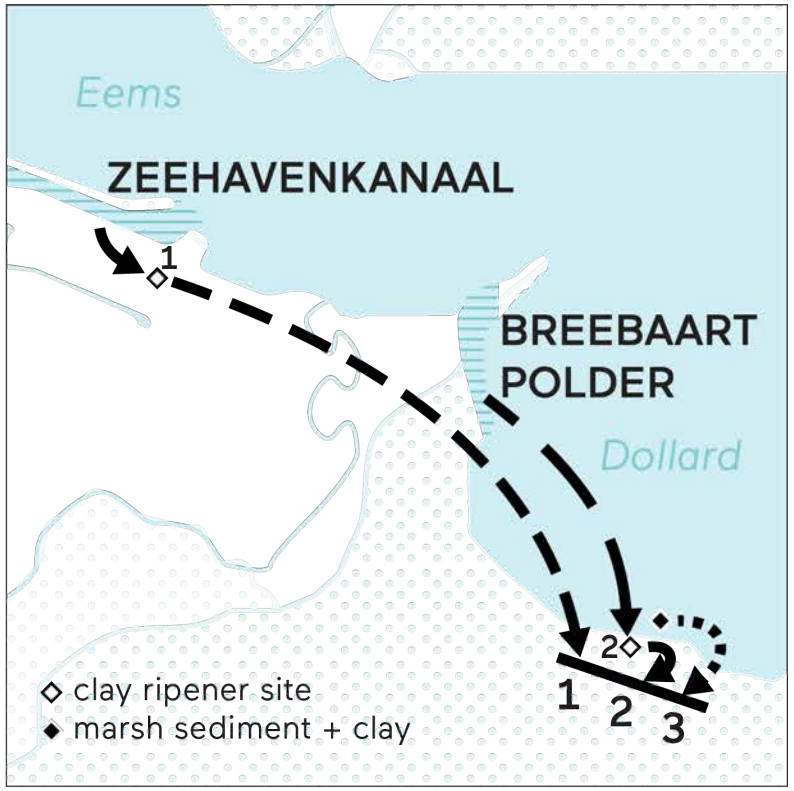
1

Historical composition of the Eems-Dollard estuary



2

Present day composition of the estuary, including polders created since 1486



3

Clay Ripening Pilot site plan

A growing system

Fig. D.5	Dredgers remove sediment from areas of problematic buildup.

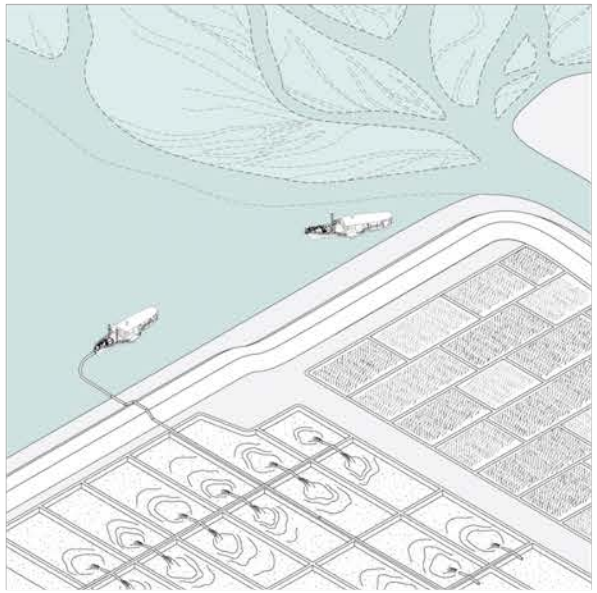


Fig. D.6	Fine, silty sediment is pumped into the ripener.

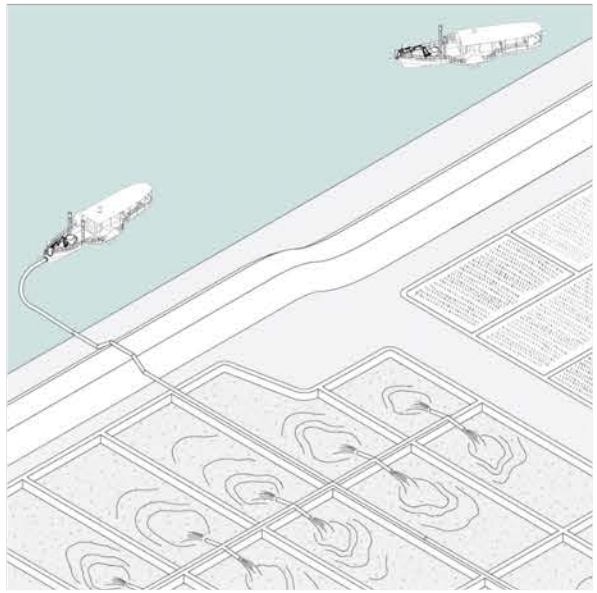


Fig. D.7	Dewatering, desalinization, and oxidation transform sediment.

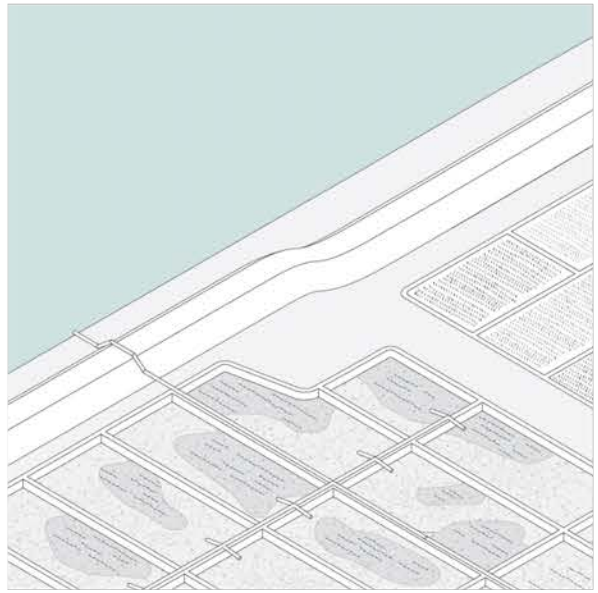
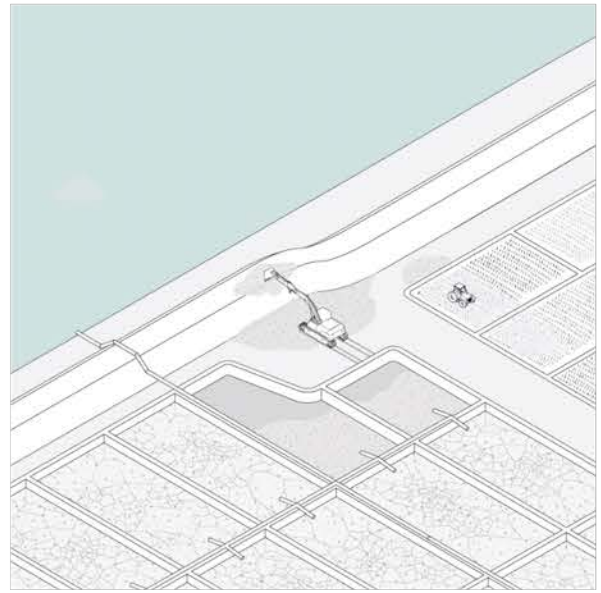


Fig. D.8	Clay is used to reinforce dikes and raise farmlands.



Delfzijl Ripener

Filling April 2018:
Approx. 100,000 m³

Filling July 2018:
Approx. 90,000 m³

Delfzijl Ripener plan view. The depot is divided into fifteen cells, with different ripening and reworking strategies for each. More detail is provided in the list below.

D1 Vegetation default
- Filling height 2 m
- Sand layer with draining pipes
- Reworking in line with vegetation cells

D2 Standard layer thickness
- Filling height 2 m
- No sand layer with draining pipes
- Standard reworking

D3 Vegetation cell
- Filling height 2 m
- Vegetation seeded
- Sand layer with draining pipes
- Standard reworking
- After seeding, lower reworking frequency

D4 Standard layer thickness (filled at once)
- Filling height 2 m
- Sand layer with draining pipes
- Standard reworking

D4' Ring dike
- Filling height 0.4 m (first filling)
- Placed against ring dike before second filling

D5 High layer thickness
- Filling height 2.3 m
- Sand layer with draining pipes
- Standard reworking

D6 Standard layer thickness
- Filling height 2 m
- Sand layer with draining pipes
- More standard reworking

D7 Low layer thickness (filled at once)
- Filling height 0.9 m
- Sand layer with draining pipes
- Standard reworking

D8 Standard layer thickness
- Filling height 2 m
- No sand layer with draining pipes
- Standard reworking

D9 Standard layer thickness
- Filling height 2 m
- Sand layer with draining pipes
- Standard reworking

D10 Low layer thickness (filled at once)
- Filling height 1.5 m
- Standard reworking

D11 Standard layer thickness
- Filling height 2 m
- Sand layer with draining pipes
- Standard reworking

D12 Freshwater cell (filled at once)
- Filling height 0.75 m
- No sand layer with draining pipes
- Mixed with fresh water during filling
- Standard reworking

D13 Vegetation cell
- Filling height 2 m
- Vegetation seeded
- Sand layer with draining pipes
- Standard reworking
- After seeding, lower reworking frequency

D14 Standard layer thickness
- Filling height 2 m
- Sand layer with draining pipes
- More standard reworking

D15 Low layer thickness (filled at once)
- Filling height 1.5 m
- Sand layer with draining pipes
- Standard reworking

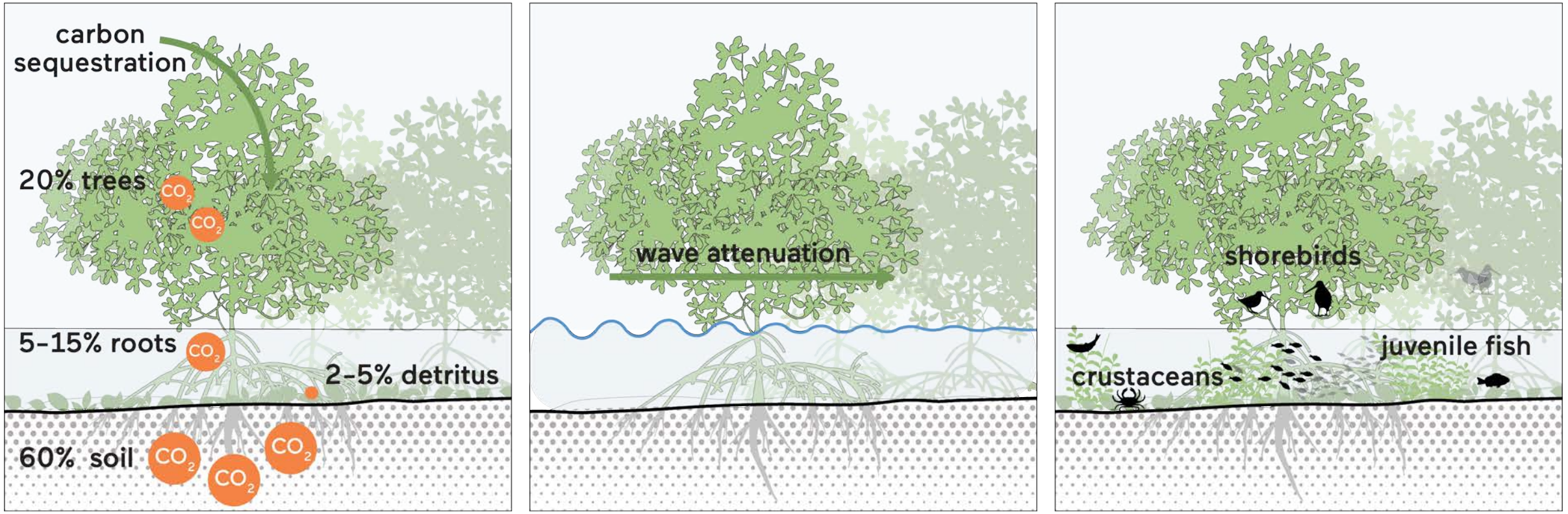
Mangrove restauration


Sediment transportation by rivers
Natural foreshores
(mangrove development)
Inland buffer zones
Mixed mangroves aquaculture practice
Retention areas

“Over thirty million people in Java are at risk. The agri- and aquaculture sectors, both engines for economic growth, have suffered multibillion-dollar losses. Conventional interventions failed; we cannot continue past practices.”

Fegi Nurhabni
Deputy Director for Disaster Mitigation and Climate Change Adaptation, Ministry of Marine Affairs and Fisheries

5
Subsidence and flooding affect daily life in Bedono village.



Mangrove benefits

Fig. B.5	Community builds permeable structures parallel to the shore.

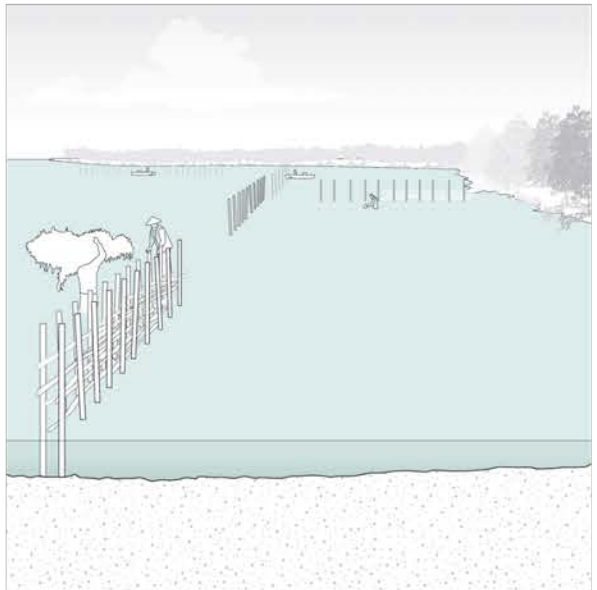


Fig. B.6	Permeable structures attenuate waves; sediment settles behind.

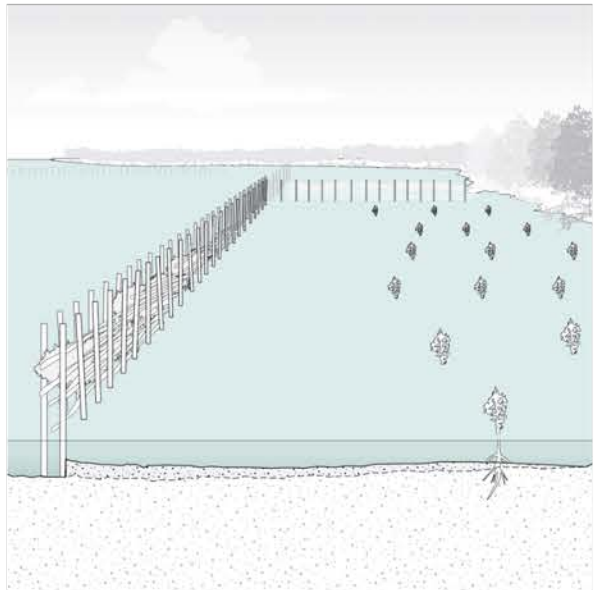


Fig. B.7	Mangroves regenerate and advance as seabed level rises.

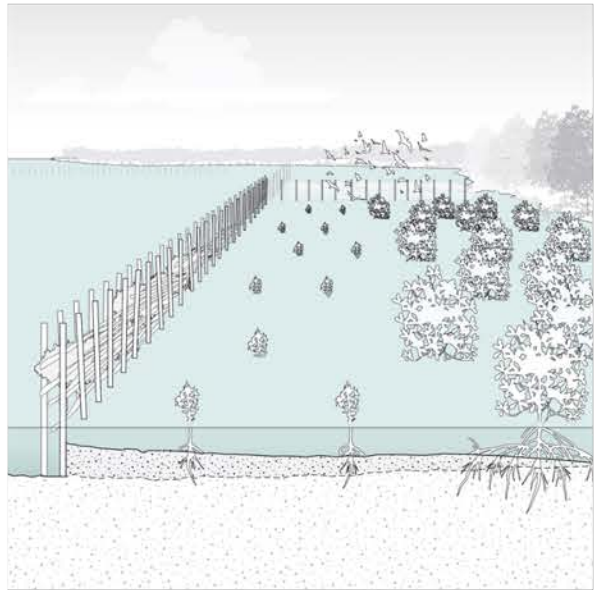
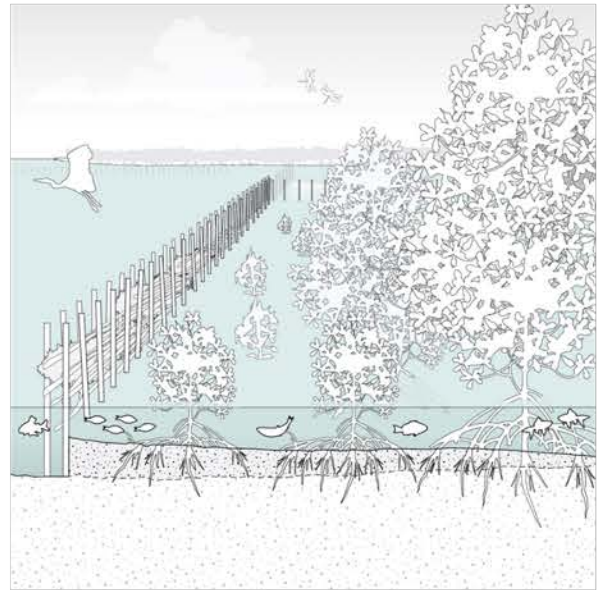
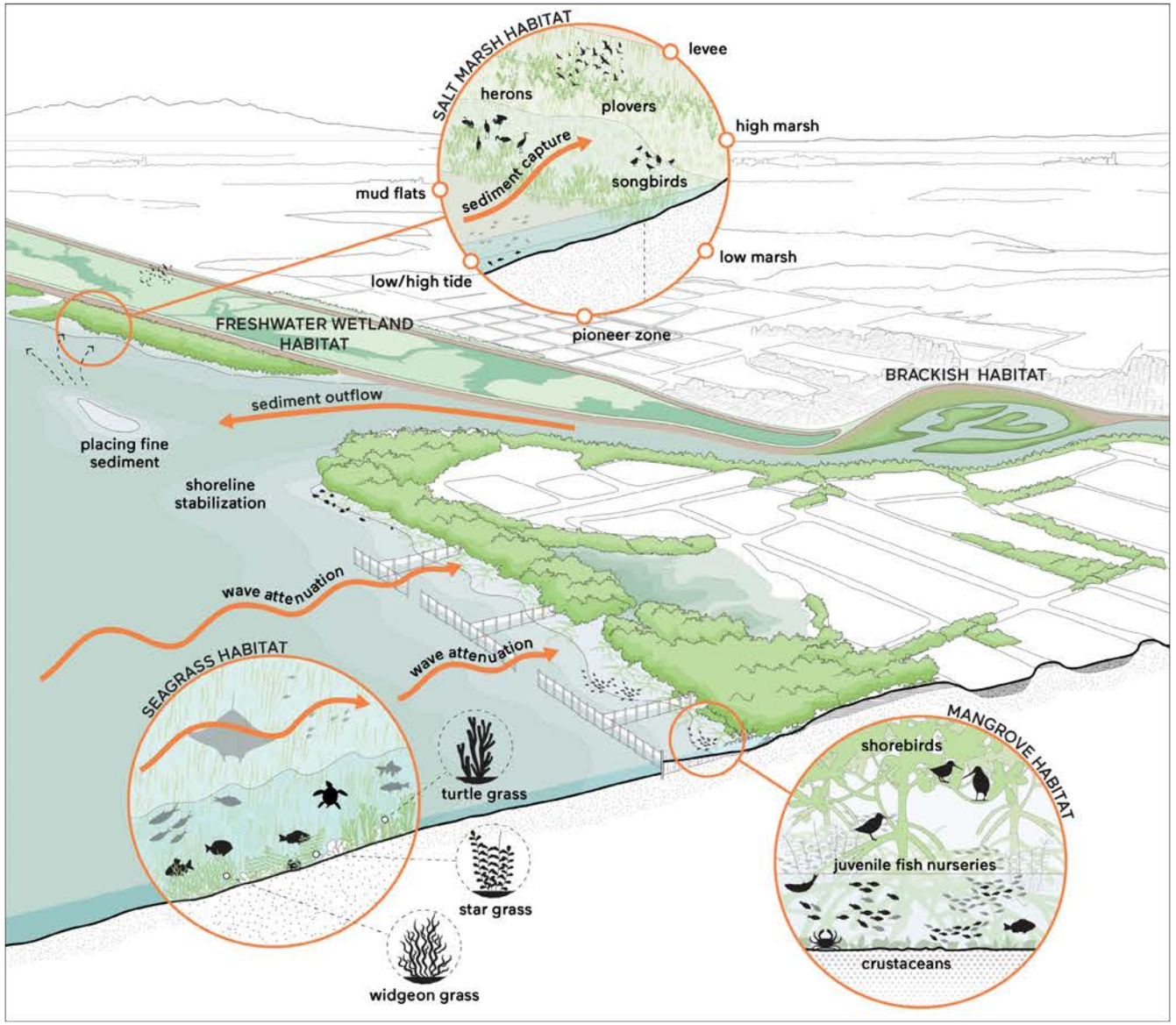


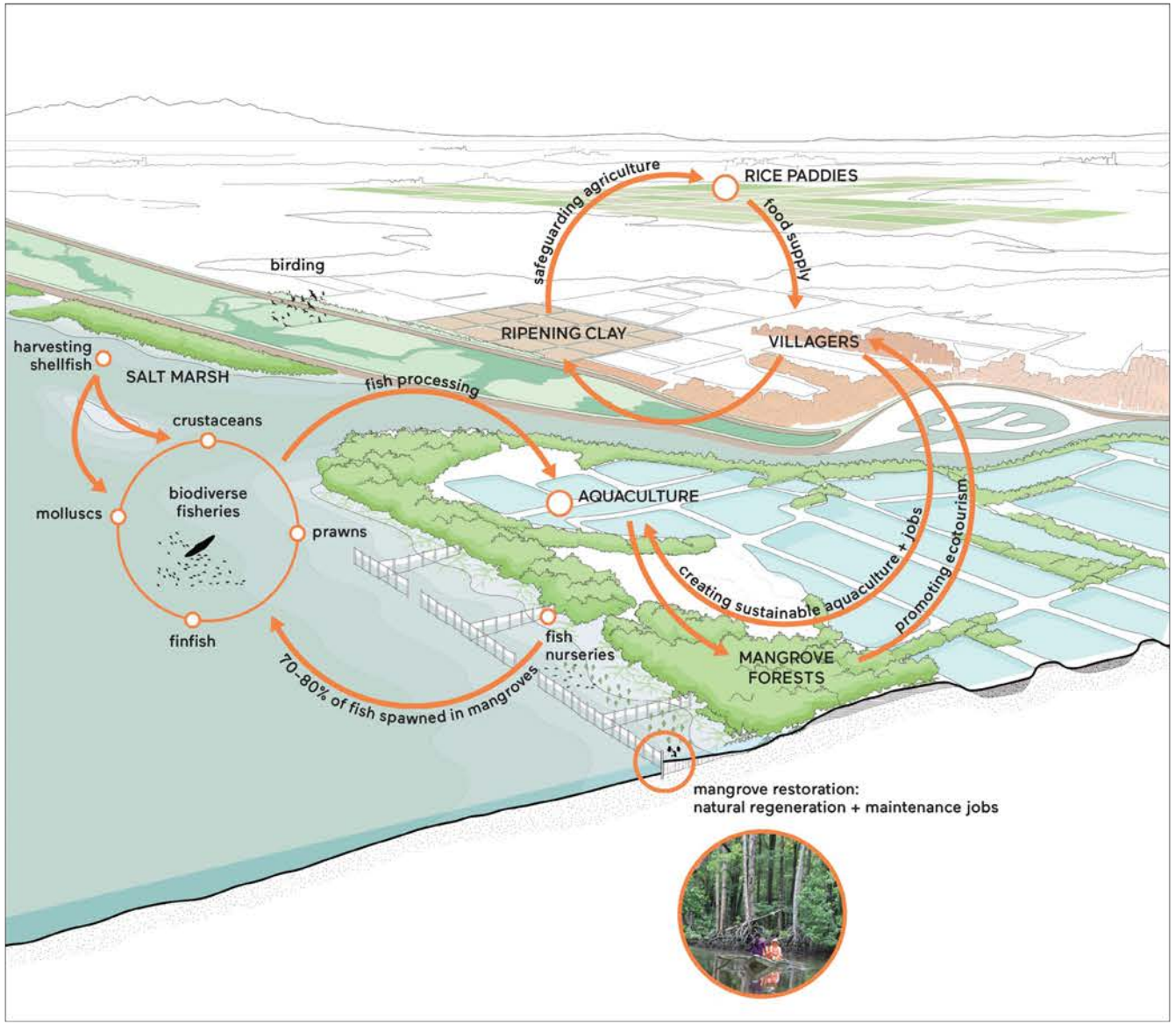
Fig. B.8	Mangroves mature; planning begins for new structures.



Ecosystem benefits



Economic Benefits



Multi-disciplinary collaboration

260
Community members

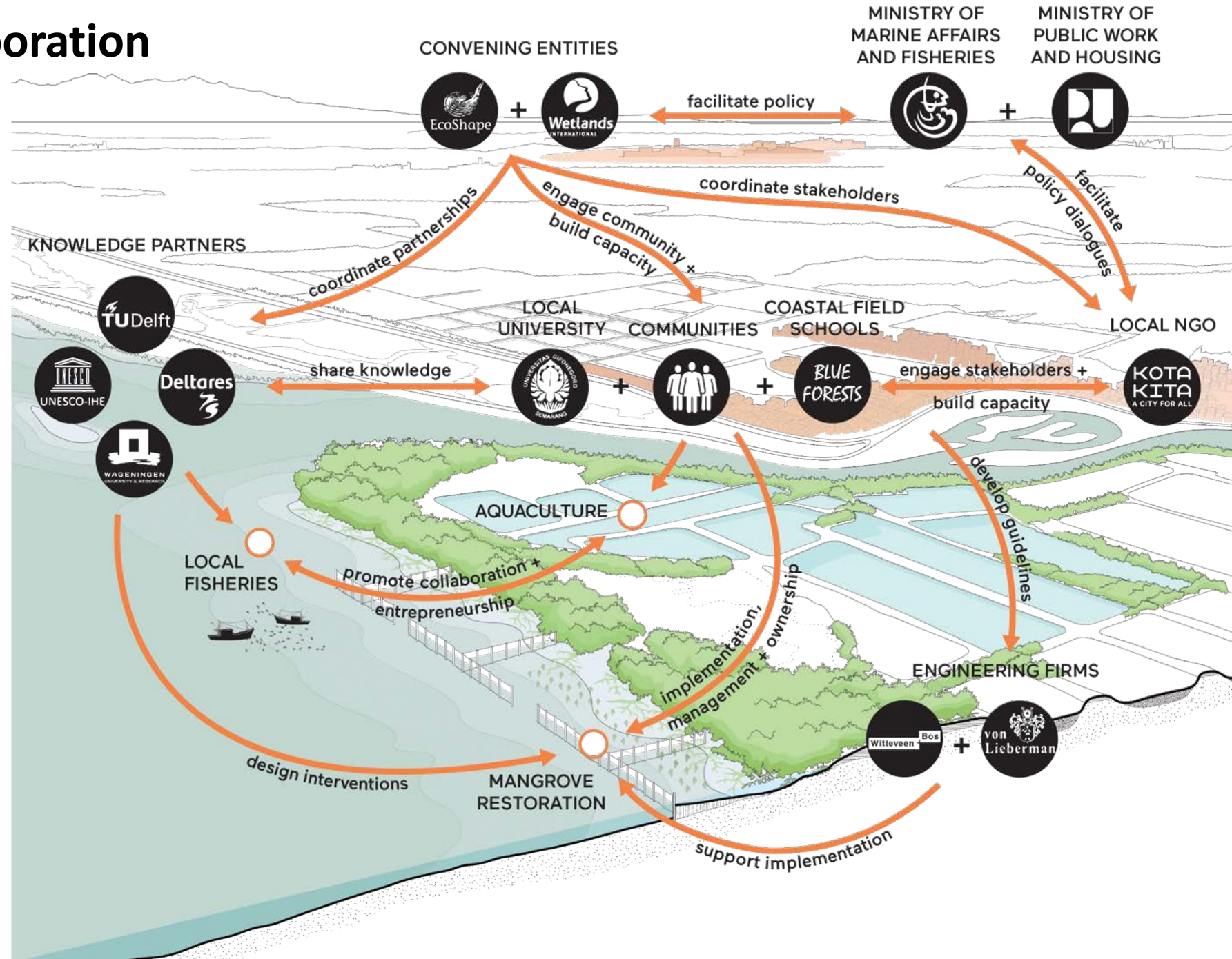
5
Research organisations

3
Non-profit organisations

3
Private sector partners

2
Government partners

1
Innovation network



Enablers

Technology and system knowledge

Multi-stakeholder approach

Management, monitoring and maintenance

Institutional embedding

Business case

Capacity building

EcoShape

building with nature

Institutional embedding

Building with Nature should fit into the local institutional context, following its norms and regulations. Further policies and processes can be developed to support the co-creation, partnerships, and funding schemes necessary for Building with Nature implementation.

Business case

A sound and convincing business case can effectively generate support and financing for Building with Nature applications. A key challenge is the difficulty quantifying the wide range of savings and co-benefits of Building with Nature, due to the soft advantages and performance uncertainty of natural dynamics.

Adaptive management, maintenance, and monitoring

Building with Nature designs are dynamic: they develop under changing climatic conditions. This requires an adaptive approach to manage, maintain, and monitor their performance long term.

Multi-stakeholder approach

Building with Nature can rarely be implemented by a single party. Successful projects require stakeholder engagement from the start and through all the phases of design, implementation, operation, and ongoing maintenance.

Technology and system knowledge

Building with Nature requires knowledge of specific concepts and technology to design Nature-based Solutions. In addition, knowledge of the local ecosystem, social system, and physical system is essential for any Building with Nature project to work.

Capacity building

Capacity building among policy makers, industry managers, and the local community is essential. It takes place through education, training, and knowledge sharing. People familiar with the Building with Nature philosophy are more likely to support and participate in its applications, which is a benefit to scaling up and especially critical for the maintenance of Nature-based Solutions.

one architecture
new york city amsterdam

EcoShape
building with nature

Matthijs Bouw
founding principal One Architecture & Urbanism
Professor of Practice, Director of Urban Resilience Program, Weitzman School of Design
bouw@onearchitecture.nl
@matthijsbouw