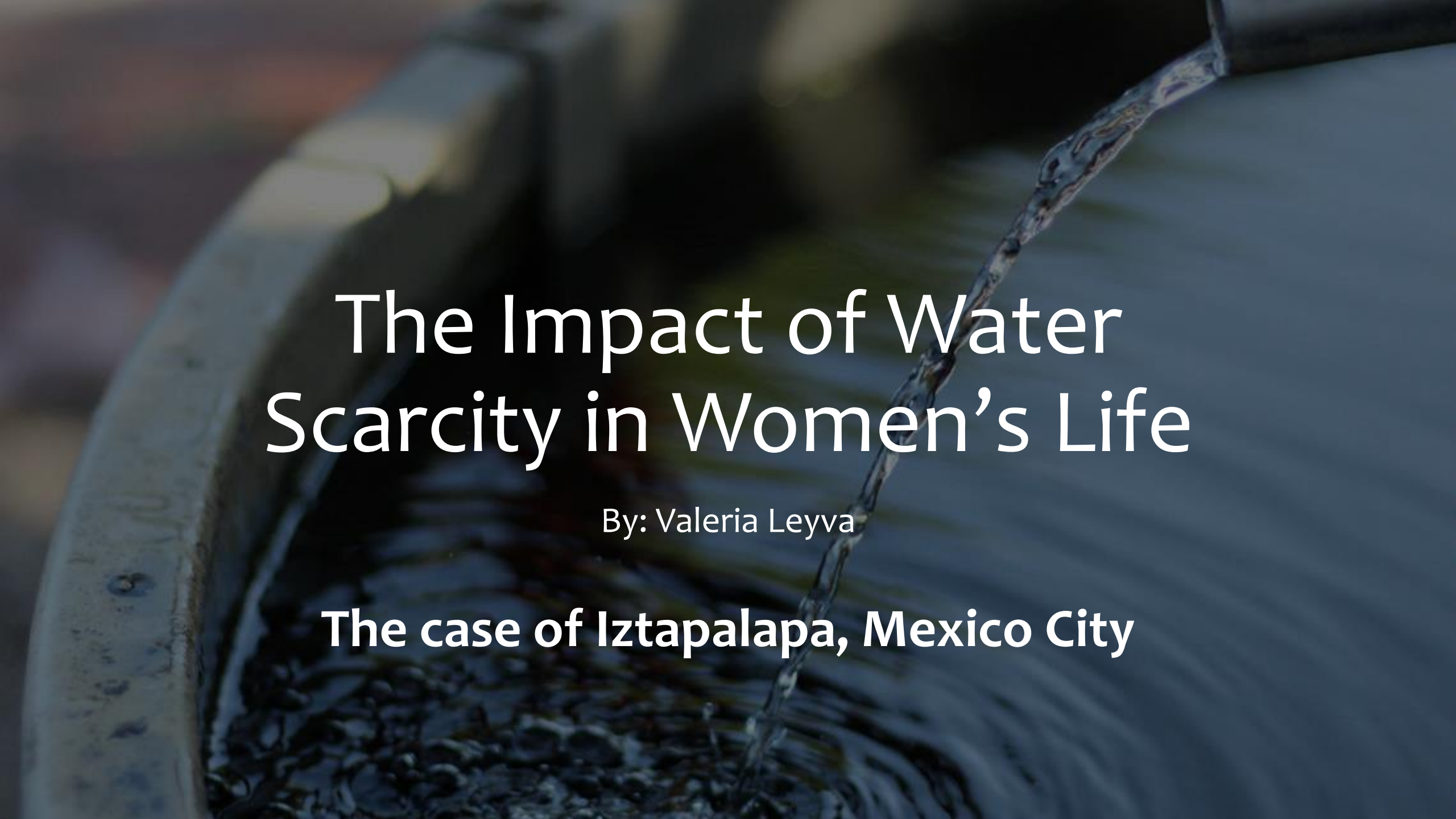


The Impact of Water Scarcity in Women's Life

By: Valeria Leyva

The case of Iztapalapa, Mexico City

CONTENT

- Water Scarcity
- Context – Iztapalapa
- Water Scarcity in Iztapalapa
- Social Inequality reflected in access to water
- For women, the water crisis is personal
- Why is the water crisis a women's issue?
- Life Conditions
- How is their quality of life affected?
- Conclusion
- Recommendations

WATER SCARCITY

Water is a source of life and a natural resource that supports the environment but it can also be the origin of risk and vulnerability.

Source: youmatter.com

Source: theguardian.com

According to the WHO and UNICEF (2012) the poor and the marginalized groups are the ones with lacking access.

Source: niiotocofie.wordpress.com

CONTEXT

Iztapalapa, Mexico City

INEGI data (2015)

- Almost 2 million inhabitants
- 116.67 km2
- Highest population density in the country.
- Less favourable socioeconomic indicators.
- Water supply systems: Lerma and Cutzamala System.

Water Scarcity in Iztapalapa

"Inefficient, unsustainable and inequitable"

(World Bank, 2013)

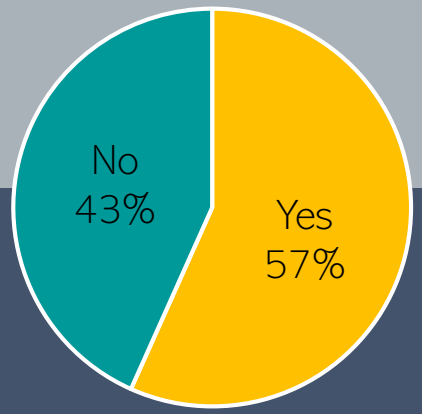
'Everything that has to do with water in this city is reduced to inequality'

Source:.nytimes.com

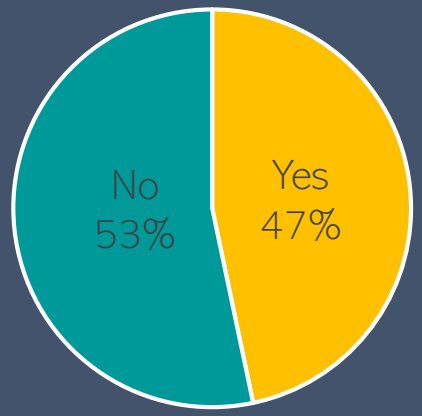
Water consumption = 28 liters per day per capita

Social Inequality reflected in access to water

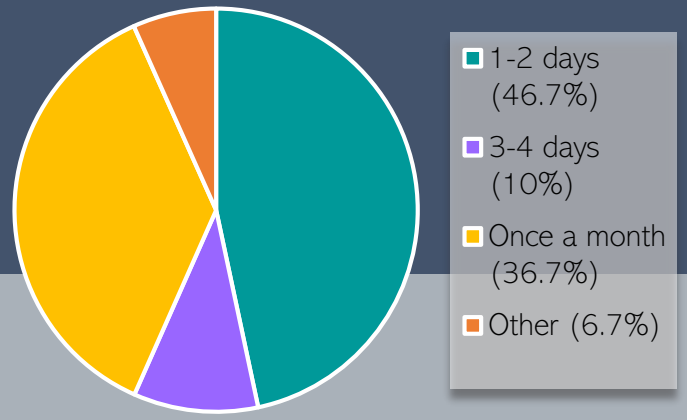
Do you have access to drinking water in your home?



In case your answer is yes, is the service constant?



How many days a week do you receive water?



They have lived all their life with the lack of this basic service, so they no longer perceive it as a deficiency. It became a way of life to only receive water 1 or 2 days and still think they have a constant service.

So, if there is no, or not enough, water coming out of the pipelines,

How do they get water for the daily use?

Source: sinembargo.mx

PROCESS

ROLE OF WOMEN

- Water bottles
- Capture rainwater
- Water trucks

  Not Free / Unregulated / Non-constant / Dangerous for women

For Women, the Water Crisis is Personal

Source: sinembargo.mx

Source: sinembargo.mx

How does the inequality in the distribution of drinking water affect the quality of life of women in Iztapalapa?

Why is the water crisis a women's issue?

'Women's lives all around the world are closely connected to water'

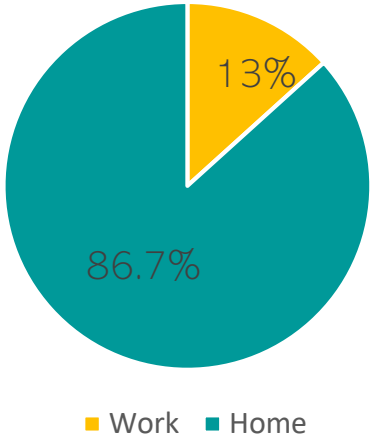
(United Nations Department)

Women are disproportionately affected by the water crisis.

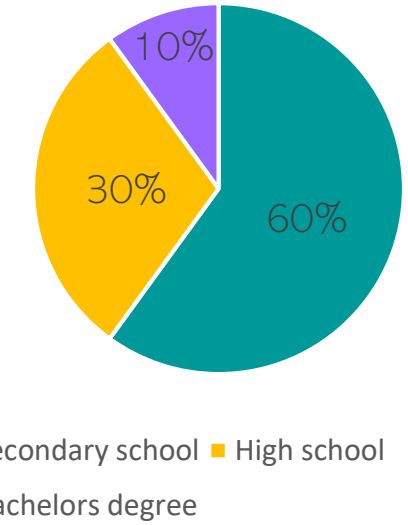
- Socio-cultural Construction -

- Consequences -

Occupation



Level of studies



'Women are trapped in a cycle of poverty due to the lack of water'

(UN-Water, 2013)

How women face the problem of not having access to drinking water?

LIFE CONDITIONS

*‘ I wake up at 5.30 am to prepare everything and take my kids to school. Once I come back, I **verify how much water** is left. In case there is still some, and as I don’t know when we are going to get more, I **prioritize the activities.** Most of the times, I use the water for the housework. For personal hygiene and cooking, we always **buy water bottles.** The other scenario is that when there is no water left, I **call the water truck**. Receiving this service could take from 3 days till two weeks. I **need to stay at home** waiting for the service […] If we do not receive water on time, I **walk long distances** trying to find a water truck. If I find one, I **pay an extra fee** and try convince the driver to deliver water in my home. I prefer to be in charge of this activity, rather than my daughter, because many times the drivers have asked me to ride with them until we get there, this situation is very **scary and uncomfortable**, but I do not have other option’*

HOW IS THEIR QUALITY OF LIFE AFFECTED?

Due to the lack of skills and knowledge (normally acquired during studies) is almost impossible to get a job in the labour market. That prevents them from being independent.

Health problems (personal hygiene, consumption of fast food, etc).

They are exposed to dangerous situations when trying to get water (fights, robbery, rapes).

They never had to give up a dream or a goal, because they never had it. Since they were little girls their life was already determined by the society.

CONCLUSION

It is a reality that the lack of water affects their life by the simple fact of not having access to this basic service for life, however, everything becomes more complicated when they are the only ones responsible for collecting it.

WORLD WATER PROVIDERS

Women are the water providers; however, they are excluded from all the decisions related to water management.

"This central role of women is often overlooked in efforts to improve management of water resources and extend access to adequate sanitation. Women often have no voice in decisions about the kind of services they receive"

(UN Water, 2005)

'Women are critical change agents in the global water crisis'

(Alix Lebec, 2018)

RECOMMENDATIONS

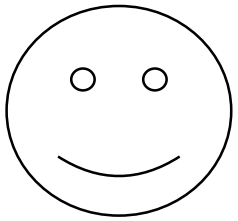
Start taking into account women, especially indigenous women. They have extensive traditional knowledge regarding water resources, this includes location, quality, management and storage methods.

Improve access to water for all. This will allow women and girls to use their time in other activities, such as, attending school, generating income, have other activities.

'Equal access for women to water and land are key factors in the fight against poverty and hunger. Equal rights for women means a secure nutritional base. An international water convention would give women of all countries a binding powerful instrument with which to enforce and demand fulfilment of their rights
(Advani, Poornima, 2005)

Target women and men equally in water education and training programmes. Including both of them in training programmes for the operation and maintenance of water facilities can help ensure sustainability of technologies and infrastructure.

THANK YOU!



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Building with Nature: Creating, implementing, and upscaling Nature-based Solutions

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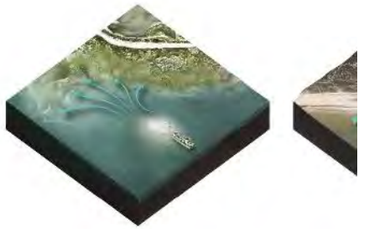
UNIVERSITY of PENNSYLVANIA

HUD - Rebuild by Design

BIG TEAM

Coastal Resilience Solutions East Boston

Building with Nature



Creating, implementing, and upscaling Nature-based Solutions

Editors

Erik van Eekelen
Matthijs Bouw

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Sand Motor

Sand Motor

Fig. A.5	Dredged sand is placed alongshore in a mega-nourishment.

Fig. A.6	Tides and currents begin to disperse the sand.

Fig. A.7	The sand continues to spread, creating an expanded beach.

Fig. A.8	The beach grows wider and dune plantings advance.

Sand Motor

Sand Motor

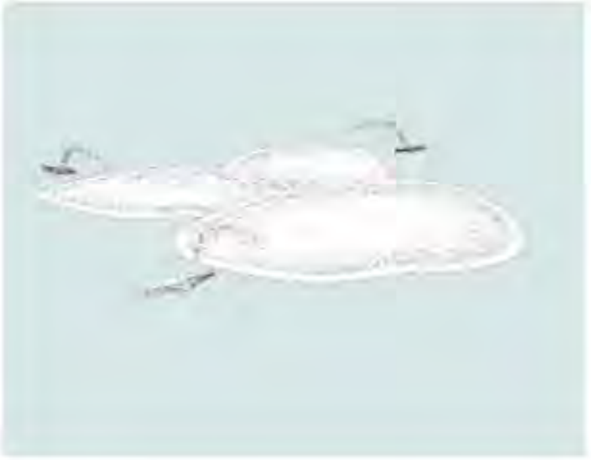
Sand Motor

Sand Motor

Marker Wadden

Marker Wadden

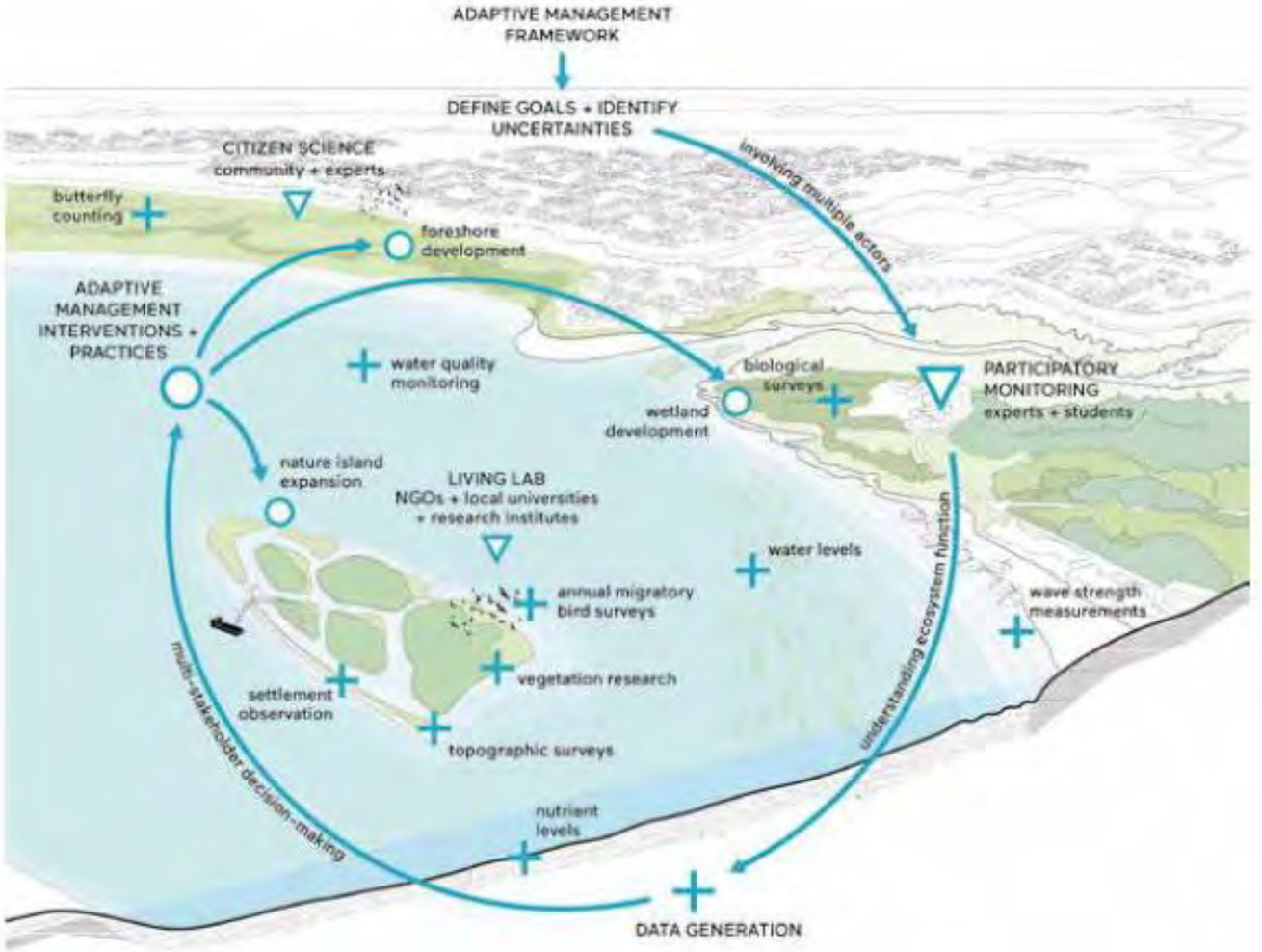
Fig. C.5	Dredgers construct a ring dike to contain dredged sediment.	Fig. C.6	Sediment is pumped into the ring dike, where it settles.	Fig. C.7	The new islands are planted; vegetation begins to emerge.	Fig. C.8	The nature islands mature and recruit plant and animal life.



Marker Wadden

Marker Wadden

Marker Wadden


ADAPTIVE MANAGEMENT FRAMEWORK
DEFINE GOALS + IDENTIFY UNCERTAINTIES
involving multiple actors
CITIZEN SCIENCE
community + experts
butterfly counting
foreshore development
ADAPTIVE MANAGEMENT INTERVENTIONS + PRACTICES
water quality monitoring
biological surveys
wetland development
PARTICIPATORY MONITORING
experts + students
nature island expansion
LIVING LAB
NGOs + local universities + research institutes
water levels
annual migratory bird surveys
wave strength measurements
vegetation research
settlement observation
topographic surveys
multi-stakeholder decision-making
understanding ecosystem function
nutrient levels
DATA GENERATION

Marker Wadden

Kleirijperij

Kleirijperij

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

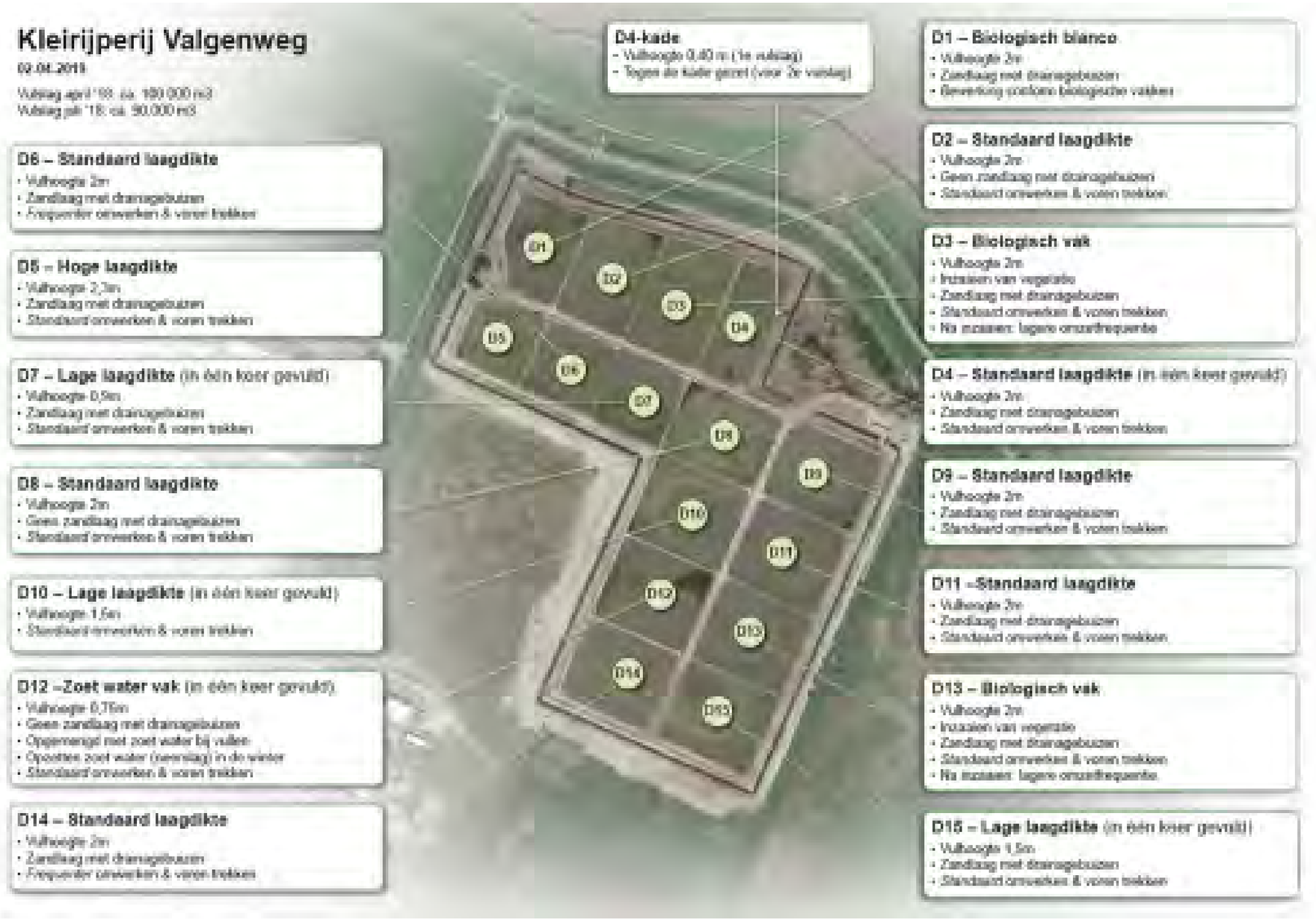
Fig. D.6	Fine, silty sediment is pumped into the ripener.

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

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

Kleirijperij

Kleirijperij


Kleirijperij Valgenweg
02.04.2019
Vulstag april '18: ca. 180.000 m3
Vulstag juli '18: ca. 90.000 m3
D4-kade
- Vulhoogte 0,40 m (1e vulslag)
- Tegen de kade gezet (voor 2e vulslag)
D1 – Biologisch blanco
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Bewerking voor/om biologische vakken
D2 – Standaard laagdikte
• Vulhoogte 2m
• Geen zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D3 – Biologisch vak
• Vulhoogte 2m
• Inzaaien van vegetatie
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
• Na inzaaien: lagere omzetfrequentie
D4 – Standaard laagdikte (in één keer gevuld)
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D6 – Standaard laagdikte
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Frequenter omwerken & voren trekken
D5 – Hoge laagdikte
• Vulhoogte 2,3m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D7 – Lage laagdikte (in één keer gevuld)
• Vulhoogte 0,5m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D8 – Standaard laagdikte
• Vulhoogte 2m
• Geen zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D9 – Standaard laagdikte
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D10 – Lage laagdikte (in één keer gevuld)
• Vulhoogte 1,5m
• Standaard omwerken & voren trekken
D11 –Standaard laagdikte
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
D12 –Zoet water vak (in één keer gevuld)
• Vulhoogte 0,75m
• Geen zandlaag met drainagebuizen
• Opgemengd met zoet water bij vullen
• Opvoeren zoet water (zeeslag) in de winter
• Standaard omwerken & voren trekken
D13 – Biologisch vak
• Vulhoogte 2m
• Inzaaien van vegetatie
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken
• Na inzaaien: lagere omzetfrequentie
D14 – Standaard laagdikte
• Vulhoogte 2m
• Zandlaag met drainagebuizen
• Frequenter omwerken & voren trekken
D15 – Lage laagdikte (in één keer gevuld)
• Vulhoogte 1,5m
• Zandlaag met drainagebuizen
• Standaard omwerken & voren trekken

Kleirijperij

Kleirijperij

Indonesia, Demak

Indonesia, Demak

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

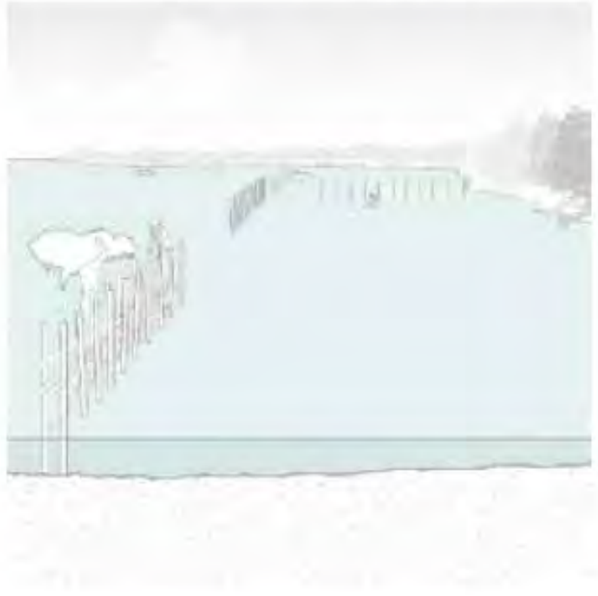


Fig. B.6	Permeable structures attenuate waves; sediment settles behind.

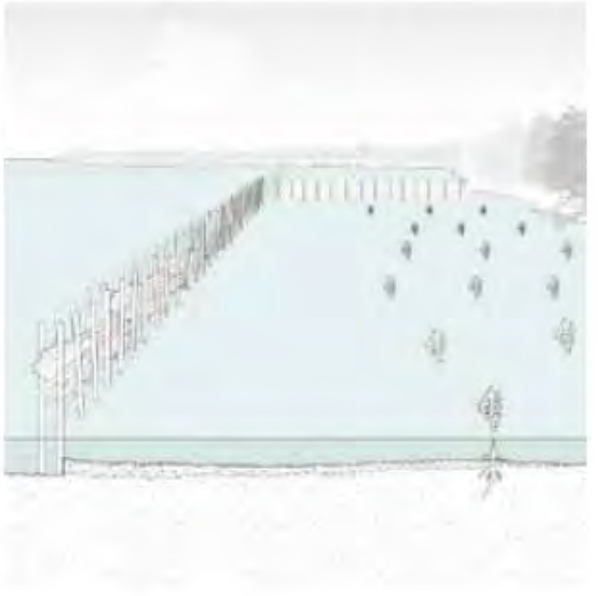
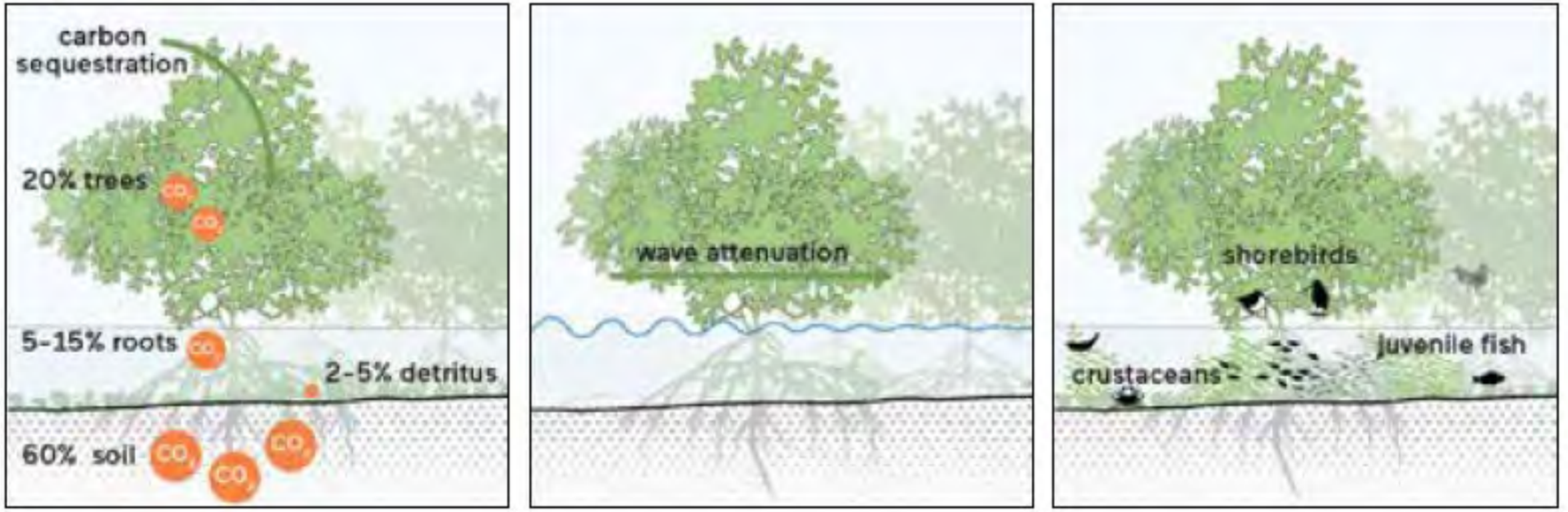


Fig. B.7	Mangroves regenerate and advance as seabed level rises.

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

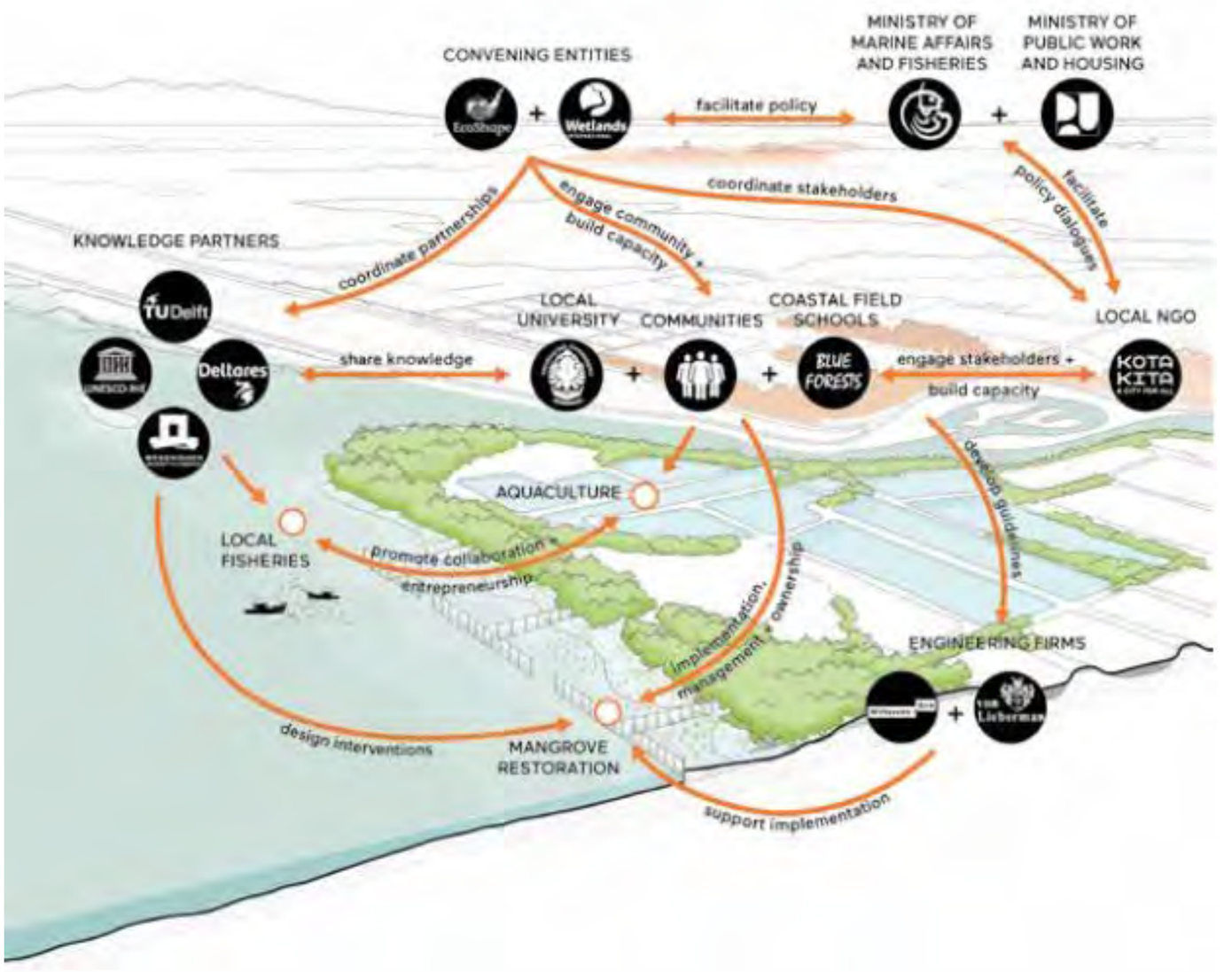
Mangrove benefits



Indonesia, Demak

Indonesia, Demak

Indonesia, Demak

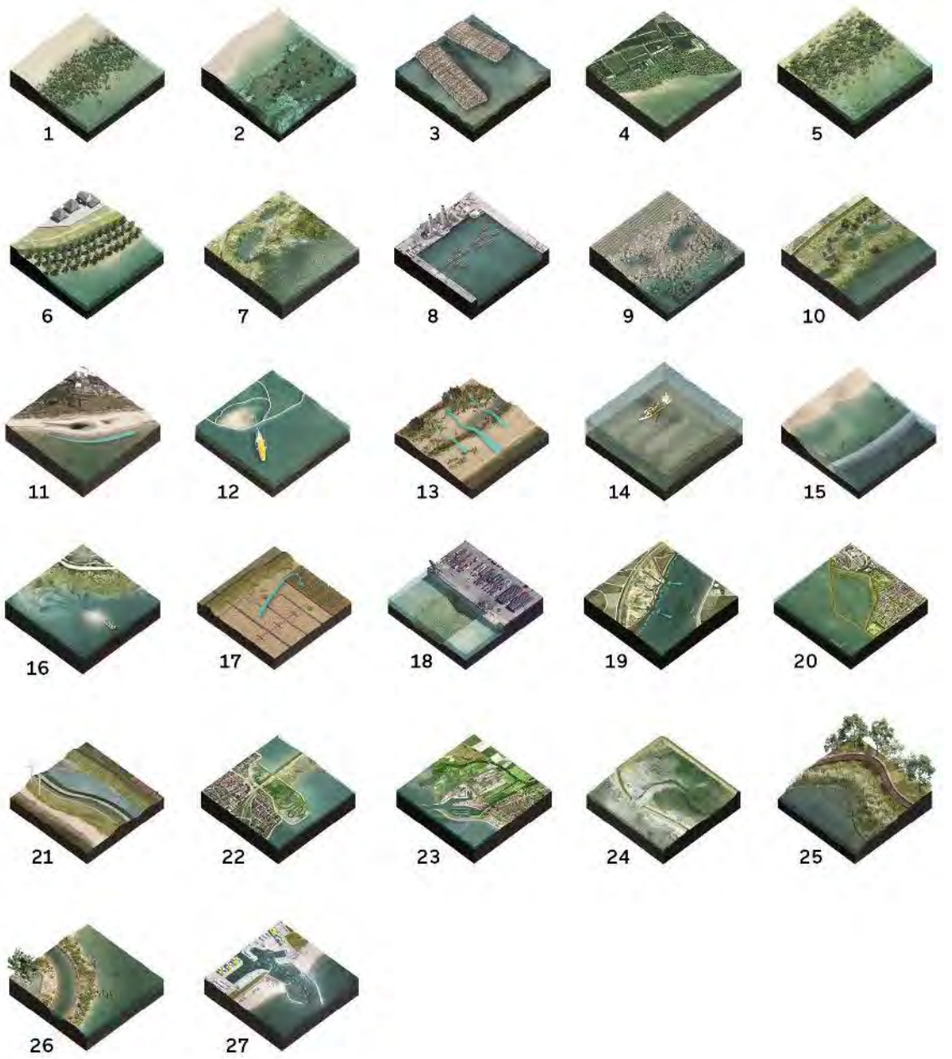

CONVENING ENTITIES
MINISTRY OF MARINE AFFAIRS AND FISHERIES
MINISTRY OF PUBLIC WORK AND HOUSING
facilitate policy
coordinate stakeholders
coordinate partnerships
engage community + build capacity
facilitate policy dialogues
KNOWLEDGE PARTNERS
LOCAL UNIVERSITY
COMMUNITIES
COASTAL FIELD SCHOOLS
LOCAL NGO
share knowledge
engage stakeholders + build capacity
AQUACULTURE
LOCAL FISHERIES
promote collaboration + entrepreneurship
develop guidelines
implementation, management + ownership
ENGINEERING FIRMS
design interventions
MANGROVE RESTORATION
support implementation

Indonesia, Demak

Indonesia, Demak

Building with Nature concepts

		Sandy Coasts	Muddy Coasts	Lowland Lakes	Rivers and Estuaries	Cities	Ports
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	○	○	○	○	○	○



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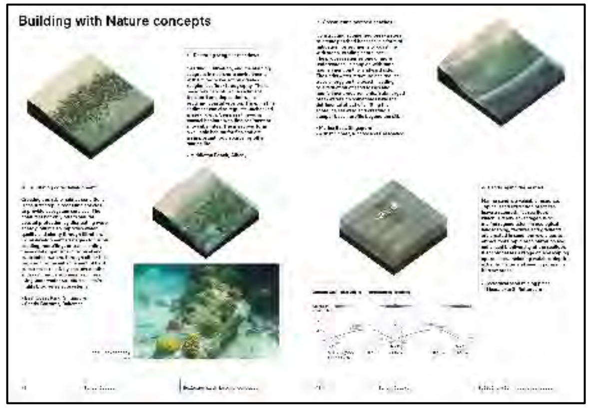
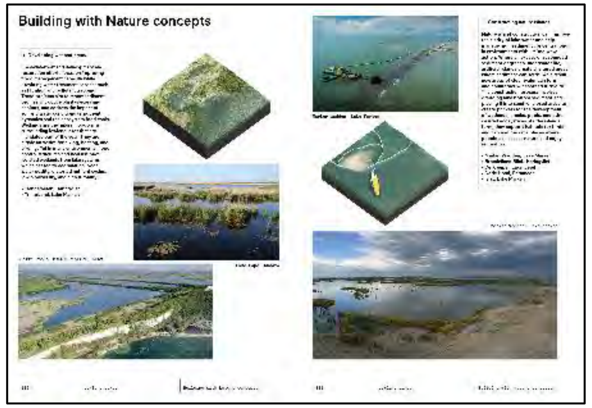
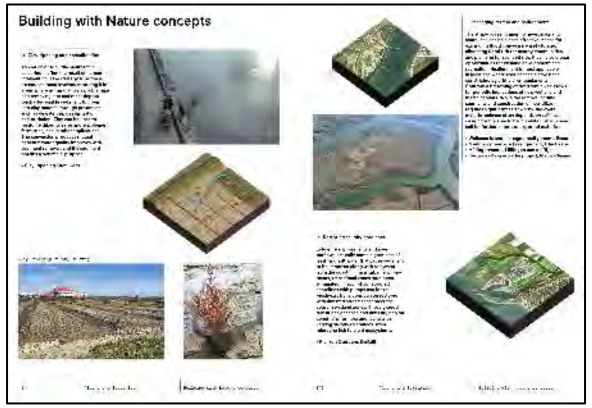
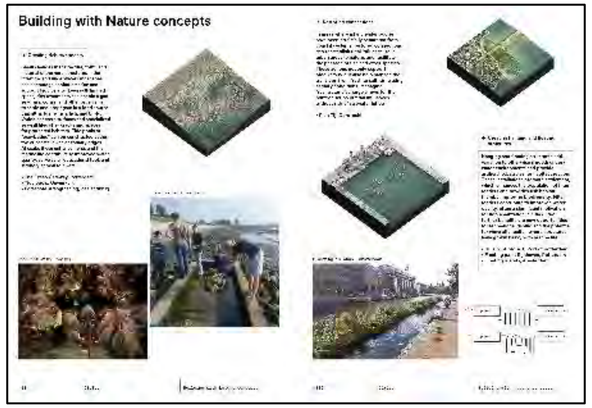
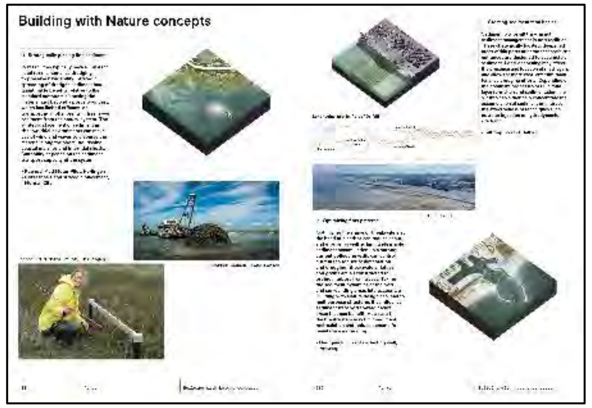
Building with Nature concepts











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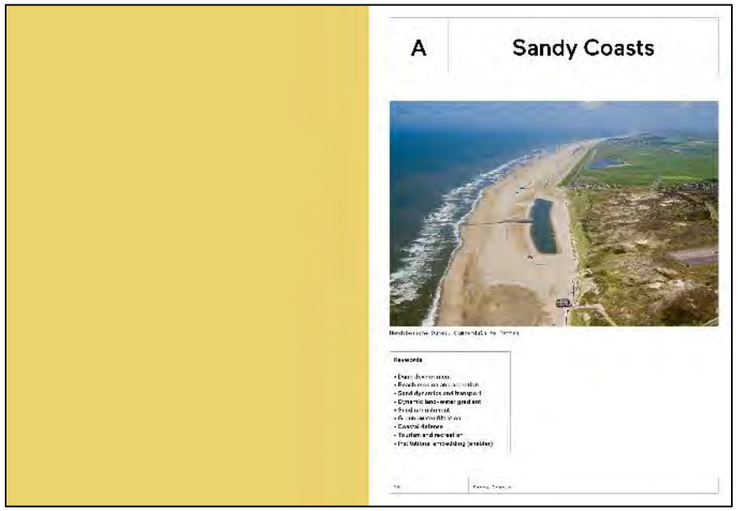
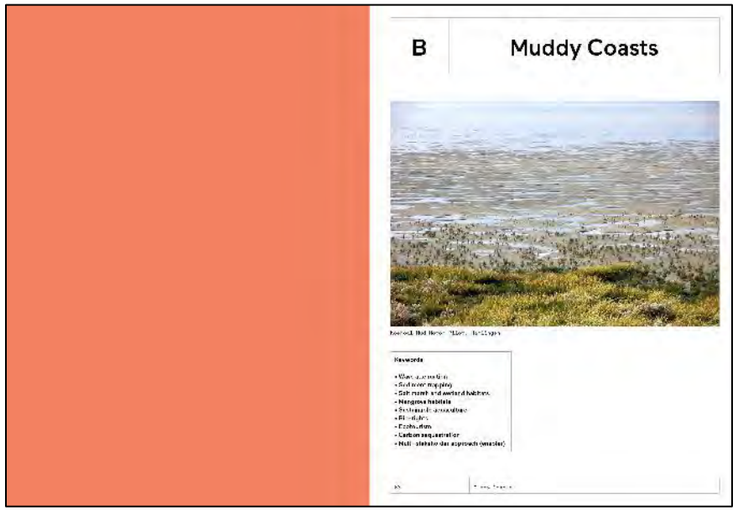
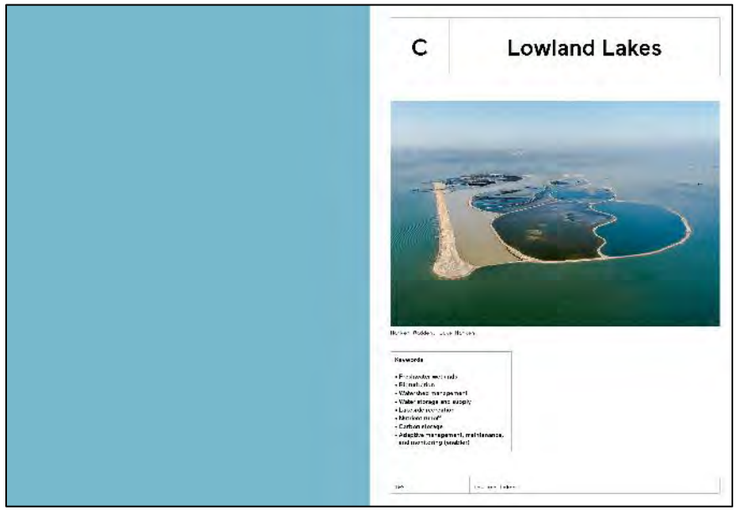
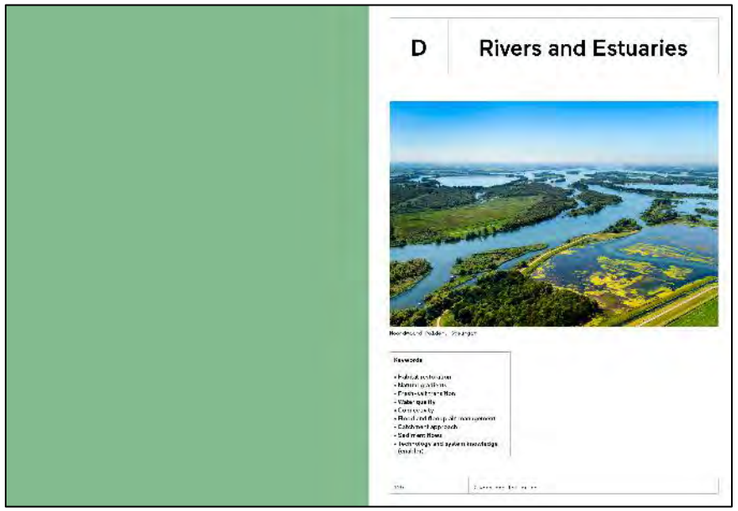
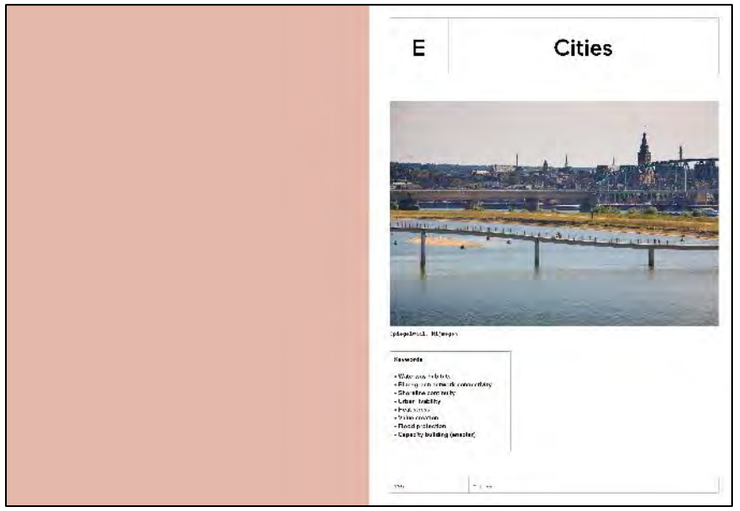
Building with Nature landscapes

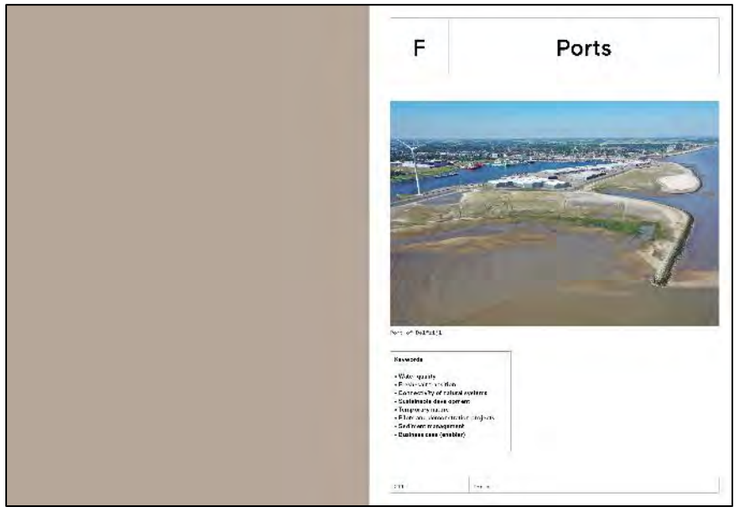












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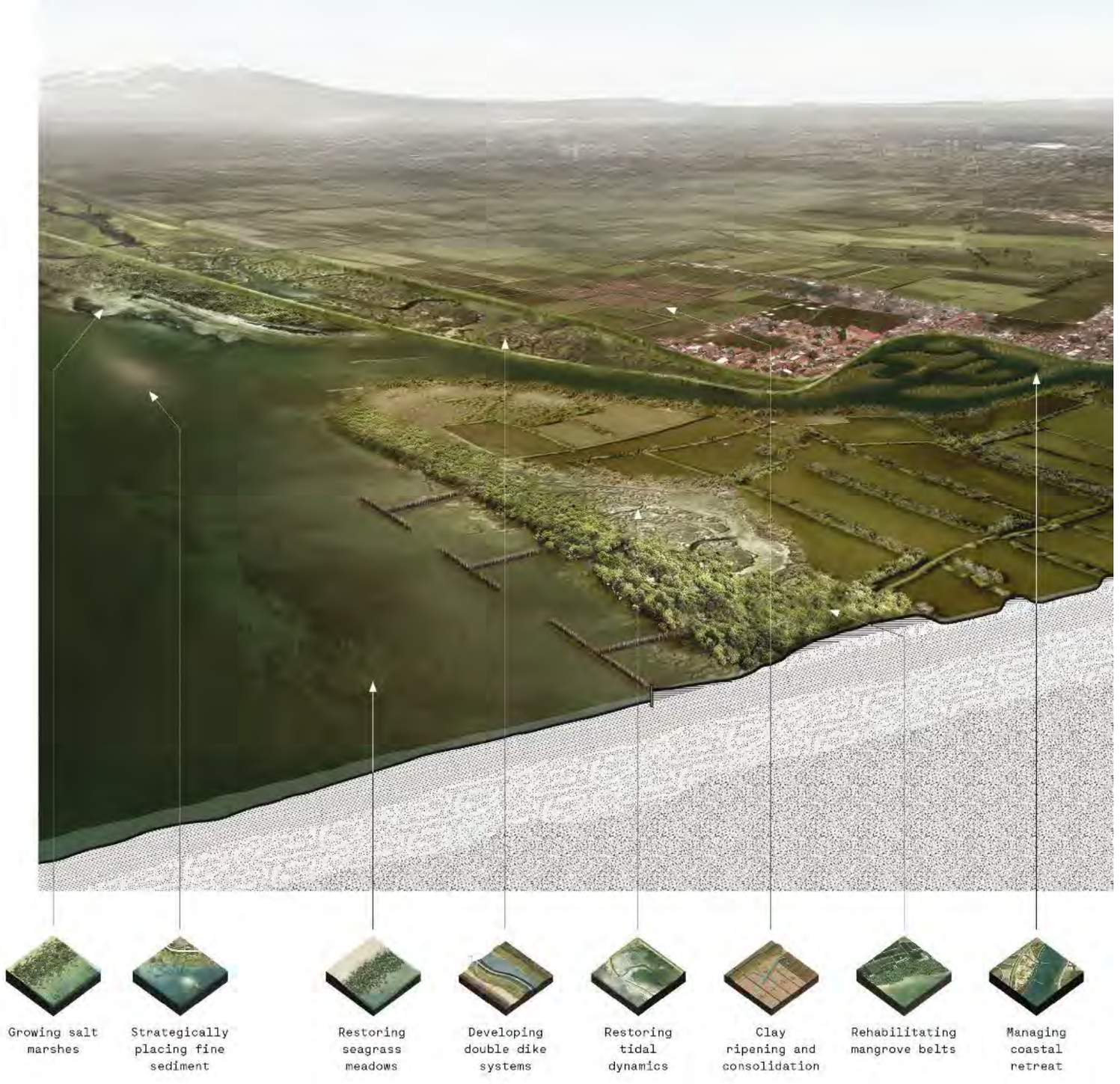
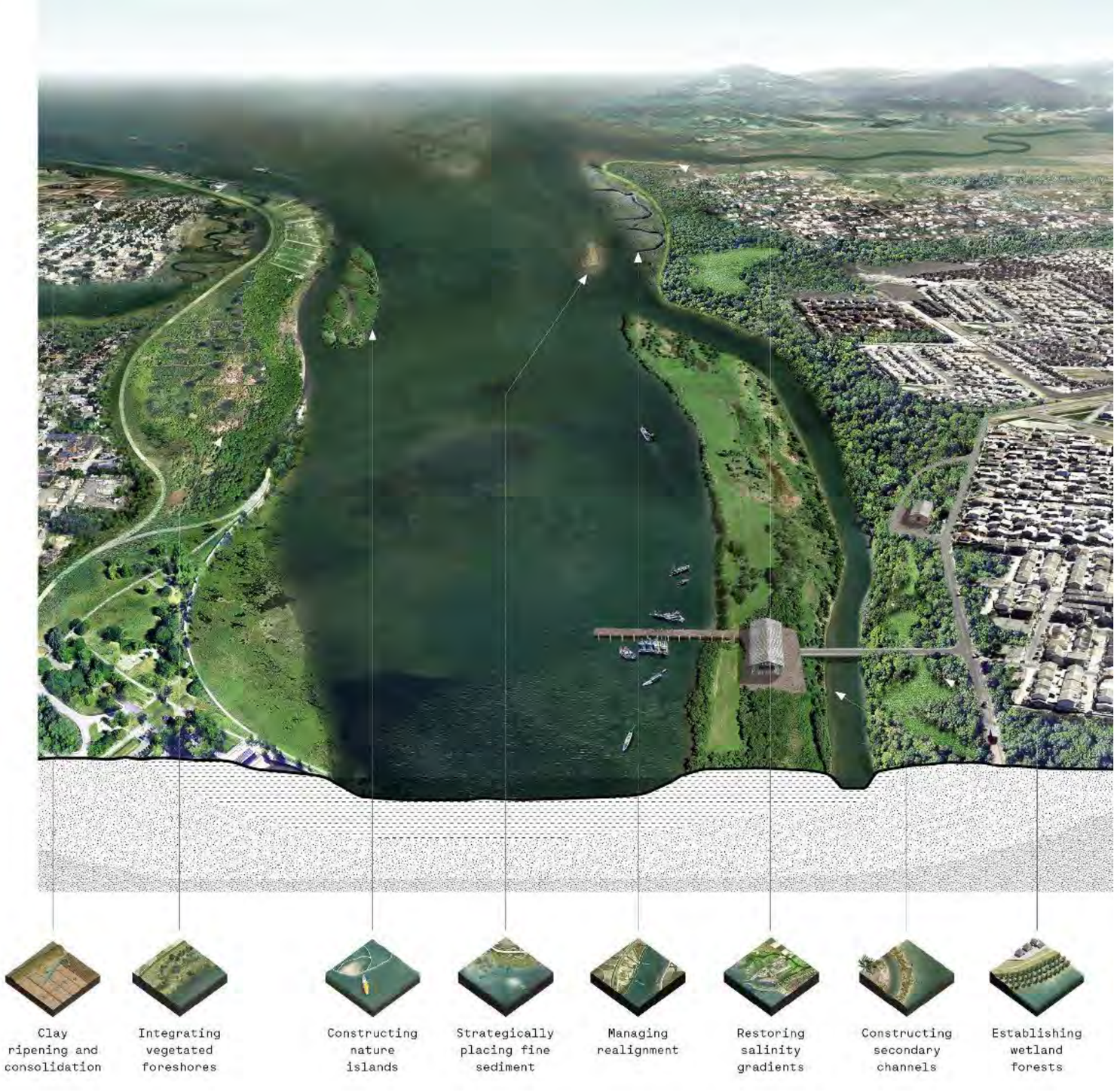
Sandy Coasts

Muddy Coasts

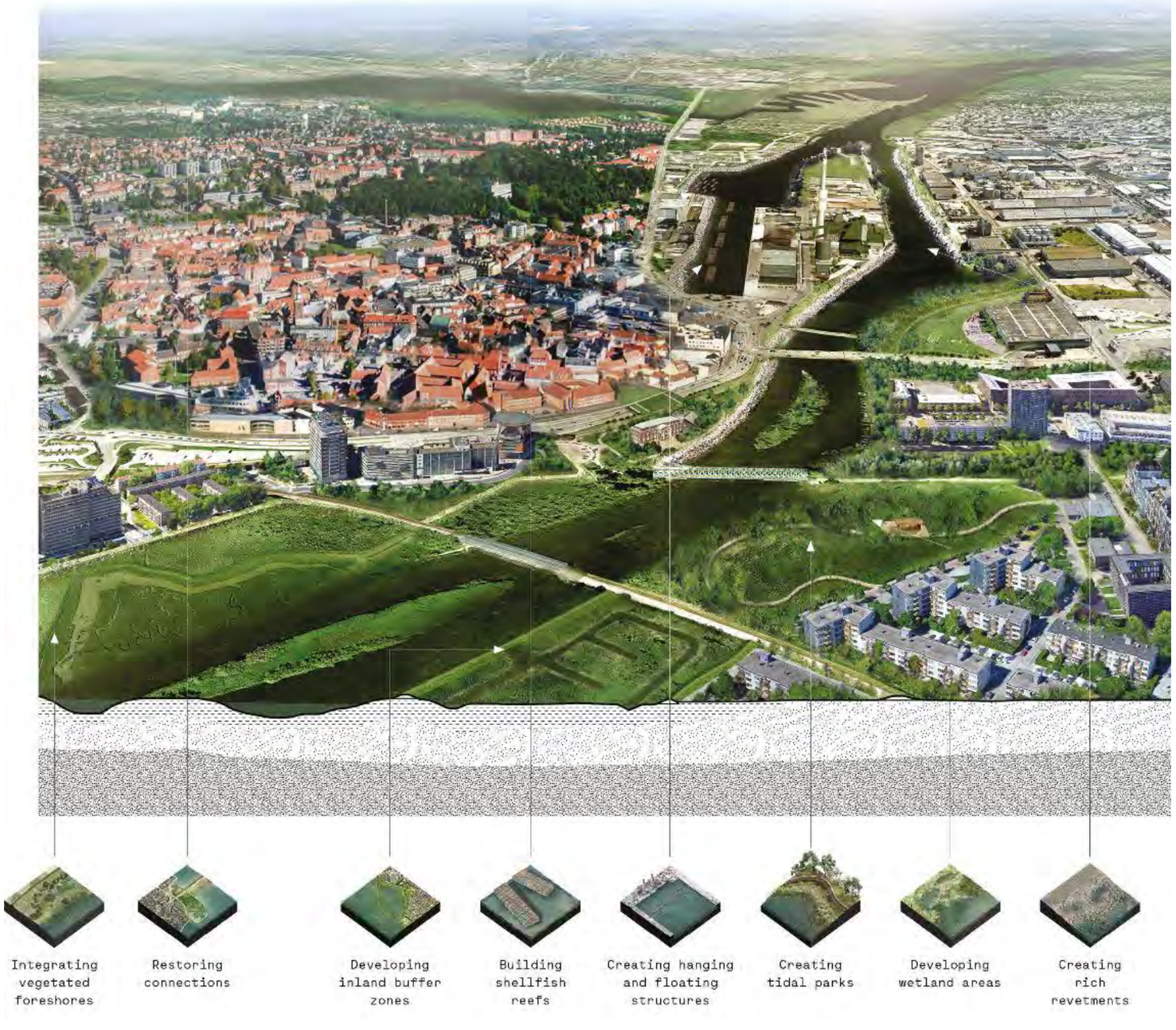


Lowland Lakes

Rivers and Estuaries



Cities


Integrating vegetated foreshores
Restoring connections
Developing inland buffer zones
Building shellfish reefs
Creating hanging and floating structures
Creating tidal parks
Developing wetland areas
Creating rich revetments

Ports


Growing salt marshes
Strategically placing fine sediment
Optimizing flow patterns
Creating rich revetments
Constructing sedimentation basins
Building shellfish reefs
Restoring salinity gradients
Creating hanging and floating structures

Ecological benefits

Rivers and estuaries are connected and productive environments with numerous habitat types. Habitats vary due to temporal and physical differences in water depth, flow velocity, and inundation frequency, as well as biological factors. Dynamics and gradients in nutrient concentration, sediment load, temperature, and salinity sustain diverse ecosystems. Structural interventions influence sediment and morphological characteristics, altering the river corridor ecosystem. In the upper reaches of river deltas, basin ecology determines the residence time of precipitation water before it enters river branches, whereas in lower reaches, tidal rivers facilitate the transition from fluvial to estuarine environments, with fresh water giving way to brackish.

→ Restoring river corridors

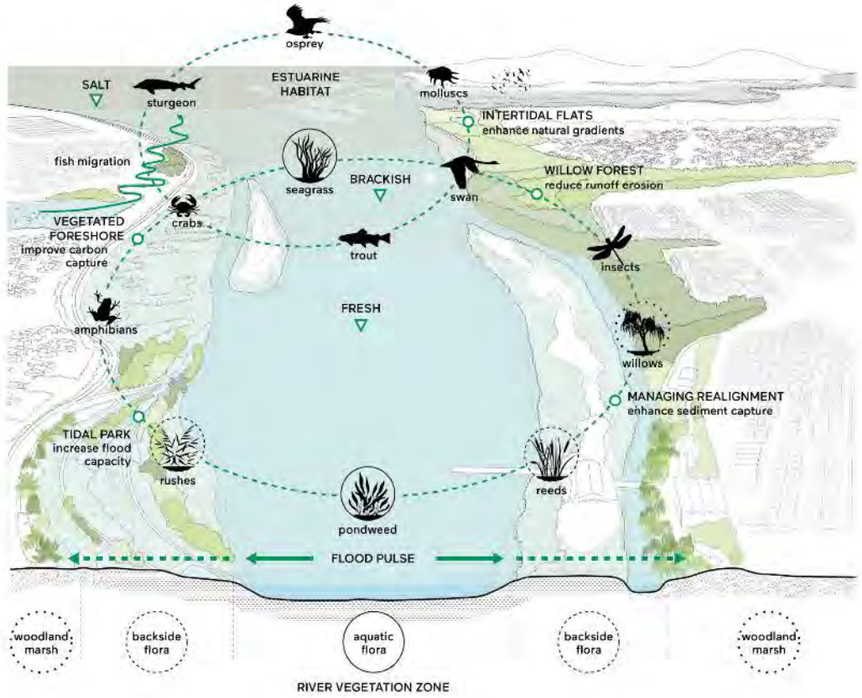
Building with Nature offers solutions aimed at improving connectivity along and across river corridors. Traditional infrastructure often applies artificial constraints on riverbanks to reclaim agricultural land, avoid ice jams, control flooding, improve navigation and transportation, eradicate malaria, and expand urban areas. This confinement not only increases water levels but also concentrates the flow of the main channel, leading to erosion of the river bed. The Room for the River initiative demonstrates the value of removing embankments, reconnecting river corridors to surrounding areas, and designing against erosion, which improves flood risk reduction and habitat.

← Enabling ecosystem processes

Estuarine and riverine ecosystems are constantly in flux. Enhancing natural gradients—including fresh-salt, land-water, sediment, nutrient, rainwater, and habitat—is essential for ecosystem processes. Building with Nature considers strategies for realigning river flows, developing wetlands, and constructing secondary channels and foreshores, all of which focus on averting discontinuities and structural disruptions to support the ecosystem processes necessary to sustain functioning habitats and encourage fish migration.

↓ Fig. D.1

Creating space for periodic flooding enhances riverine and estuarine habitats. Recurrent flood pulses transform the relationship between water and land, creating cycles of inundation and drying. Management of these landscapes must account for seasonal cycles, storm events, the connection between upland development and river corridor capacity, and climate change impacts.



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Places to live, work, and visit

Many lakes occur in the vicinity of urban areas and provide important services to sustain populations: supplying and storing potable and irrigation water, retaining precipitation and stormwater runoff (reducing flood risk), and providing food sources, transportation facilities, and recreational amenities. Furthermore, lakes have a significant influence on the identity of surrounding areas. The cultural heritage of the lakeside is often associated with history, serenity, and space, in contrast to the increasingly crowded and contested built environment.

A healthy lake ecosystem provides a shared public resource as a venue for outdoor recreation, including swimming, fishing, canoeing, kayaking, boating, and bird-watching. It is a source of respite for sunbathing, reading, and relaxing. Some lake environments are popular seasonal destinations for tourists.

Supplying drinking water

Urban populations often rely on lakes as reservoirs to ensure the supply of drinking water. Preserving and securing the supply requires active management of lake access and usage, as well as that of any developments or activities that occur in their drainage basins. As surface water supplies and storage areas, lakes are susceptible to contamination from human waste as well as precipitation, runoff, and groundwater.

Enabling climate adaptation

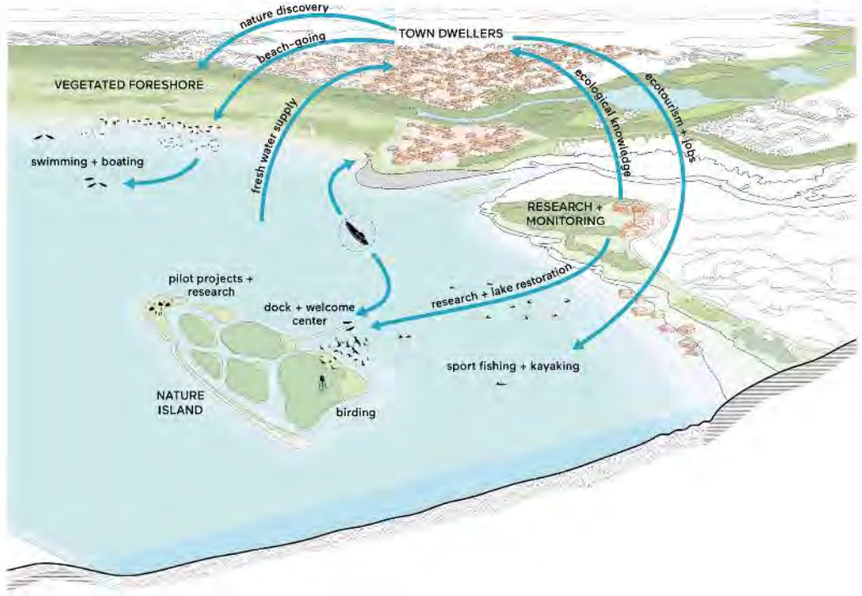
Lake restoration efforts can facilitate both climate adaptation and increased recreational value. For example, Building with Nature through projects for enhanced flood control typically focus on physical changes to the riparian zone, seeking opportunities to replace concrete edges with shallow-sloping, vegetated shores. These soft shores may double as recreational assets.

Discovering nature

The Marker Wadden nature islands provide essential habitats for many bird, fish, and plant species. As a result, they have become a regional destination for bird-watching and nature discovery since opening to the public in 2018. Visitors arrive daily via ferry to explore the islands, which can be traversed on raised wooden footpaths. Small structures, or "blinds," give space and shelter to birders. The islands also serve as a living laboratory for experimentation and research.

↓ Fig. C.2

Lakes are socio-ecological systems that reflect the dynamic relationship between humans and ecosystems, encompassing biological and abiotic processes on multiple scales. Scientific research focused on lake processes and systems is critical for understanding how to sustain lake environments and economies and is the starting point for any intervention.



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Resource flows

The material composition of sandy coasts reflects the cumulative effect of the forces acting on them since the last ice age: rivers that transport sand and gravel to the sea, gradual erosion of the coastal cliffs, and waves that carry debris, fragmented shells, and sand. Waves and wind continuously reshape, transform, and redistribute sediment within the landscape.

Part of the dynamism underpinning all sandy coasts comes from the materials that are supplied to and extracted from these environments. Sustaining coastal landscapes requires a nuanced understanding of the qualities and characteristics of local sediment and the finite availability of these resources. Additional sand, often extracted from the seabed at offshore borrow sites, is essential to the preservation of beaches and dunes, and demand for nourishment will grow more urgent as sea levels rise.

Wind, waves, and tides offer promise in the emerging market for renewable energy. Novel technologies seek to harness these dynamic forces for energy generation.

↑ Strategically deployed sand

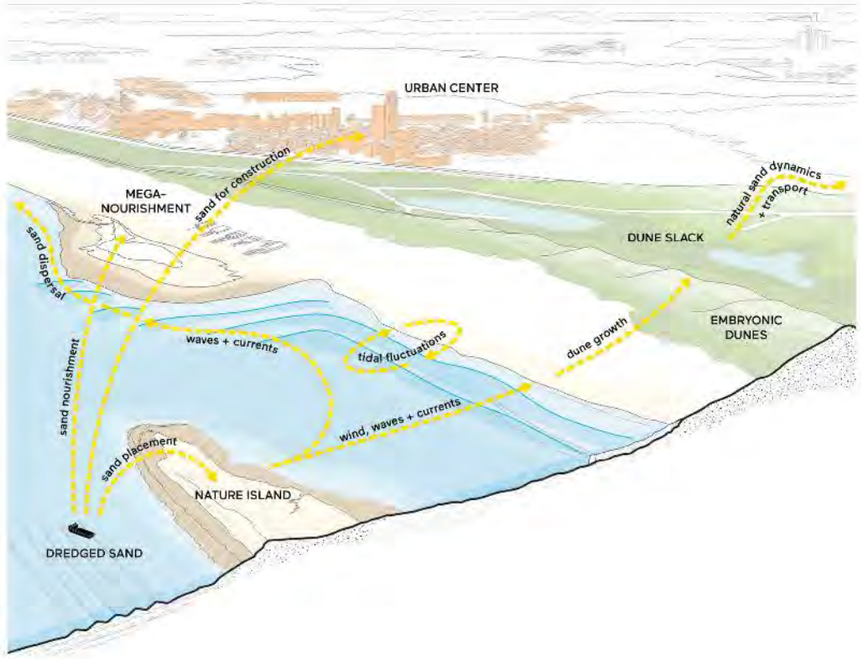
There is constant demand for sand to supplement and protect eroding coastlines. As rising seas and expanding coastal populations increasingly squeeze dune zones, sand nourishment has come to represent the alternative to retreat, flooding, or interference and destruction by hard defenses. Wherever a sand-borrow location can be developed with an acceptable environmental and economical impact, sand is dredged from the seafloor and spread alongshore to buffer waves and induce dune formation. However, as global pressures increase along with local availability constraints, nourishment projects must enforce smarter, more efficient design practices.

→ Managing groundwater

Integrated coastal management links strategies to expand fresh groundwater resources with ecosystem restoration efforts. Nourishing beaches and enhancing dune function can improve water infiltration, filter pollutants, and increase aquifer recharge. These actions may secure the water supply for consumption but must also consider the impact of changing groundwater levels.

↓ Fig. A.3

Large-scale sand transport leads to dune formation, a process that results from complex interactions between tides, waves, wind, and plant species. Pioneer species provide shelter from the wind and enable sand to accumulate, while their roots hold the sand in place. In this way, the first plants create small undulations on the flat beach, or embryonic dunes. When the sand transport is large enough, these dunes grow and the sandy substrate becomes less salty, thus enabling other species to survive and grow the landscape.



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Integrated approach

Muddy coasts are highly productive, resilient, and adaptive ecosystems that also pose numerous risks due to their fine sediment substrates. Community stakeholders derive benefits from the landscape in myriad ways: through agriculture, offshore fisheries, raw materials, ecotourism, research, and education. Therefore, any process advocating risk mitigation or change must include all stakeholders and provide opportunities for partnering at the community level.

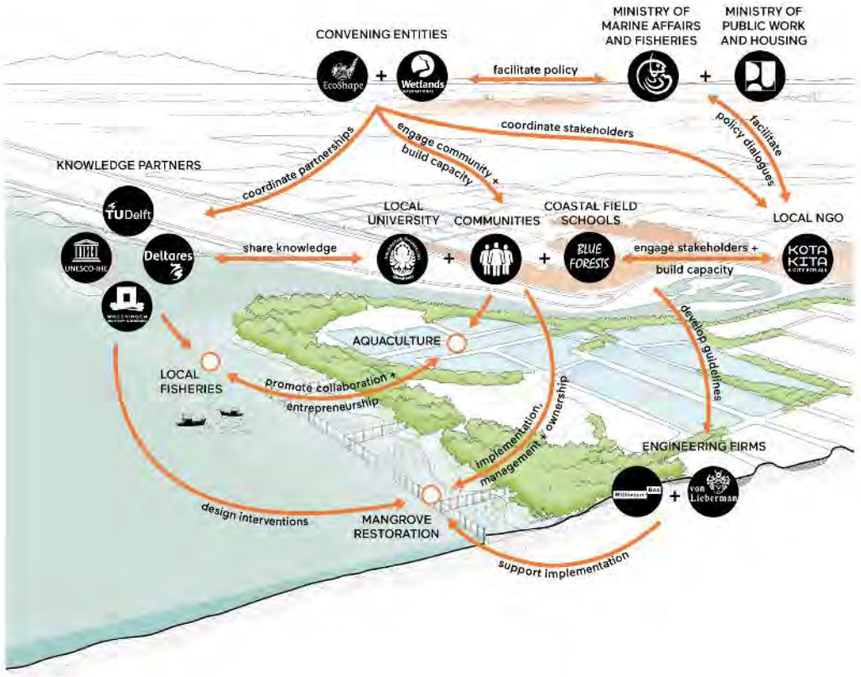
Building with Nature projects recognize partnership as the core of any successful initiative; each collaborator brings specific expertise and skill, which gives them a unique perspective and important role. Local stakeholders share deep knowledge of site conditions, community bylaws, and priorities; implementation and maintenance also often lie within their purview. A project can only succeed if it delivers community benefits. Government agencies set policy and are often responsible for marine infrastructure management, as well as creating the enabling environment through funding and legislation. NGOs help manage projects: they coordinate outreach and field activities, support local community leadership, facilitate policy and stakeholder dialogue, and contribute expertise. Research institutes bring technical insight and capacity to lead monitoring and data analysis to evaluate the impact of an intervention. Other specialists, engineering firms, and contractors facilitate on-the-ground implementation, develop guidelines for project replication, outline the business case, and offer practical advice.

→ Co-creating through partnerships

Every project is site specific; however, projects that are developed with local communities have a greater chance of continuity and success over the long term. Building with Nature approaches require deep site-specific and systems-based knowledge to harness dynamic processes; adaptive management and monitoring are essential to work with the systems at play. In Demak, the Bintoro ocean management forum comprises ten community groups in support of coastal restoration, resource management, and sustainable aquaculture.

↓ Fig. B.4

Building with Nature brings together an extensive network of participants with diverse expertise and interests. The participation of local governments, universities, and citizens is at the core of planning, implementation, and maintenance of coastal adaptation measures. In Demak, Coastal Field Schools enhance farmers' capacity to better manage resources by advising on sustainable aquaculture practices. Training and awareness programs partner with government and universities to upscale Building with Nature approaches.



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“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.

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"We have to overcome the fear that the harvest will be destroyed again this year. Being part of the Building with Nature Bio-rights community group, we feel supported. Knowledge and information are shared: the best time to stock seeds for milkfish and shrimp, how to maintain our fish pond to grow bigger fish, and other important points that we use to increase the quality of our harvests."

16

Musda'atun Aquaculture farmer, Surodadi village

17

Djaelani
Entrepreneur and shrimp farmer, Purworejo village

"Since 2003, I have elevated our house three times. I told my son that he will be doing it next, as I have neither enough energy nor money to do it again. But thanks to the support of the Building with Nature community officer, we have been able to increase the quality of our shrimp. We follow their advice and use the knowledge they share with us."

Khaidir
Member of Bedono Bangkit community group, Bedono village

"I started cultivating blood clams (*Anadara granosa*) in April 2019, when I planted three tons in 1.2 hectares of pond. By December 2019, I had partially harvested several times and made eighty million rupiahs. Ponds affected by abrasion can not only be used, but they can also create alternative livelihoods for villagers—an approach we learned at the Coastal Field School."

H. Jamaludin Malik
Village head of Wedung

18

"I hope this Building with Nature program can run smoothly. Alhamdulillah, the village is now clean. The river is clean, there is no waste, let alone plastic waste. God willing, we will be a good and useful people."

19

Bio-rights contracts create a mechanism for successful conservation and maintenance of the permeable structures to yield community grants.

16
Musda'atun at her farm.
17
Fisherman casting nets into the river in Purworejo village.
18
Cleaning and preparing fish for sale.
19
Fishing boats at the shore in Purworejo village.

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Peter Herman
Rotterdam,
The Netherlands, 2 p.m.
Professor of Ecological Hydraulic Engineering, Delft University of Technology; Senior researcher, Deltares

Stefan Aarninkhof
Delft,
The Netherlands, 2 p.m.
Head of Hydraulic Engineering Department; Professor of Coastal Engineering, Delft University of Technology

Kathelijne Wijnberg
Enschede,
The Netherlands, 2 p.m.
Professor and Chair of Coastal Systems and Nature-based Engineering, University of Twente

Nathalie Seddon
Oxford,
United Kingdom, 1 p.m.
Professor of Biodiversity; Director of the Nature-based Solutions Initiative, University of Oxford

How did your research lead to Building with Nature?

Peter Herman: Through Building with Nature, the landscape became more than an empty canvas. The design of a project is conceptualized as adding something to an already existing, already functioning landscape—functioning in the ecological, geomorphological, but also human sense. Building with Nature pays more attention to design and how it affects relations between nature and geomorphology, and also how it will be perceived by humans and affect the association of humans and the landscape. As an ecologist, of course, my attention is mostly focused on what it does to natural processes. A very important question for me is: how do these natural processes really work?

At the Sand Motor, if you examine the populations of benthic animals, you see higher diversity after construction. That is not because the number of species per sample is necessarily higher, but the difference between the samples has increased. Gradients and contrasts increase and create combinations of environmental factors that do not normally occur on the coast. Over time, the weird combinations tend to disappear, but it takes years for the sediment composition, physical forces, and animals to settle into a new equilibrium. I am interested in understanding and modeling these processes.

Stefan Aarninkhof: Every project has unique characteristics that require investigation of the underlying processes. This is crucial to enable the design and implementation of solutions. For example, the initial conditions at the Sand Motor were tremendously dynamic, and over time, change slowed. We came across a similar pattern in studying the natural foreshore dynamics at the Houtribdike, which shows surprisingly similar behavior.

Kathelijne Wijnberg: What I consider important in Building with Nature is using the coastal processes to solve coastal problems. Time scales are a crucial consideration here, because coastal processes take time. Each pilot project is the first effort to understand the processes that move sediment and the vegetation dynamics. I advocate following them through the end of their design lifetime to see whether they really deliver and whether we can make improvements or adjustments. To that end, I am interested in the development of monitoring techniques. Also, we have not paid enough attention to the role of people in how the solution evolves.

I have been involved in the Sand Motor project as well. We saw how the space was created: People built beach houses for the tourist economy, and they also raked the beach. Where they clean the beach determines where vegetation develops, which interacts with dune formation. We do not yet know

Sand Motor, The Hague (2011)

Sand Motor, The Hague (2018)

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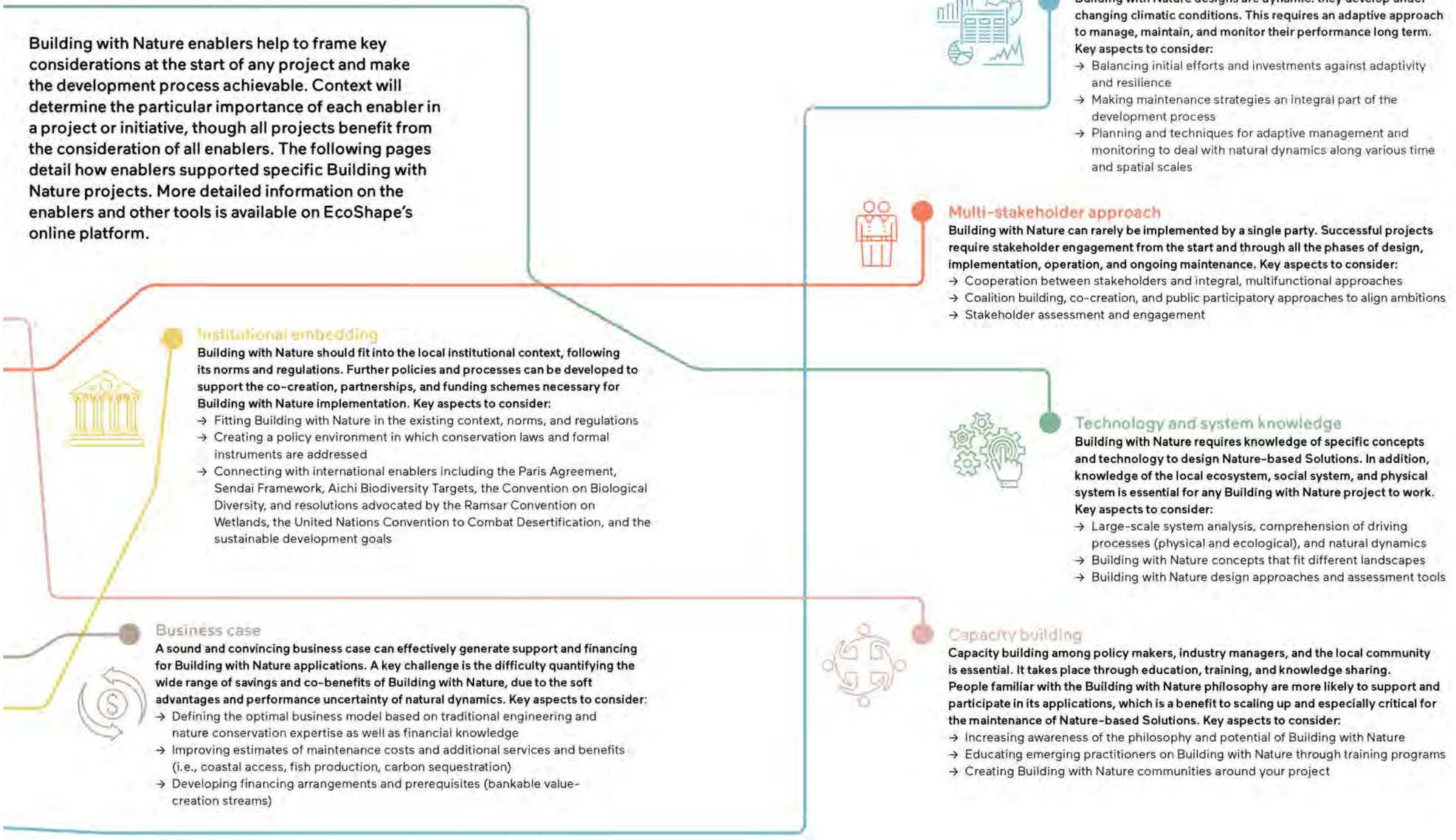
Getting started

Building with Nature enablers help to frame key considerations at the start of any project and make the development process achievable. Context will determine the particular importance of each enabler in a project or initiative, though all projects benefit from the consideration of all enablers. The following pages detail how enablers supported specific Building with Nature projects. More detailed information on the enablers and other tools is available on EcoShape's online platform.



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. Key aspects to consider:

- → Balancing initial efforts and investments against adaptivity and resilience
- → Making maintenance strategies an integral part of the development process
- → Planning and techniques for adaptive management and monitoring to deal with natural dynamics along various time and spatial scales

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. Key aspects to consider:

- → Cooperation between stakeholders and integral, multifunctional approaches
- → Coalition building, co-creation, and public participatory approaches to align ambitions
- → Stakeholder assessment and engagement

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. Key aspects to consider:

- → Fitting Building with Nature in the existing context, norms, and regulations
- → Creating a policy environment in which conservation laws and formal instruments are addressed
- → Connecting with international enablers including the Paris Agreement, Sendai Framework, Aichi Biodiversity Targets, the Convention on Biological Diversity, and resolutions advocated by the Ramsar Convention on Wetlands, the United Nations Convention to Combat Desertification, and the sustainable development goals

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. Key aspects to consider:

- → Large-scale system analysis, comprehension of driving processes (physical and ecological), and natural dynamics
- → Building with Nature concepts that fit different landscapes
- → Building with Nature design approaches and assessment tools

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. Key aspects to consider:

- → Defining the optimal business model based on traditional engineering and nature conservation expertise as well as financial knowledge
- → Improving estimates of maintenance costs and additional services and benefits (i.e., coastal access, fish production, carbon sequestration)
- → Developing financing arrangements and prerequisites (bankable value-creation streams)

Capacity building

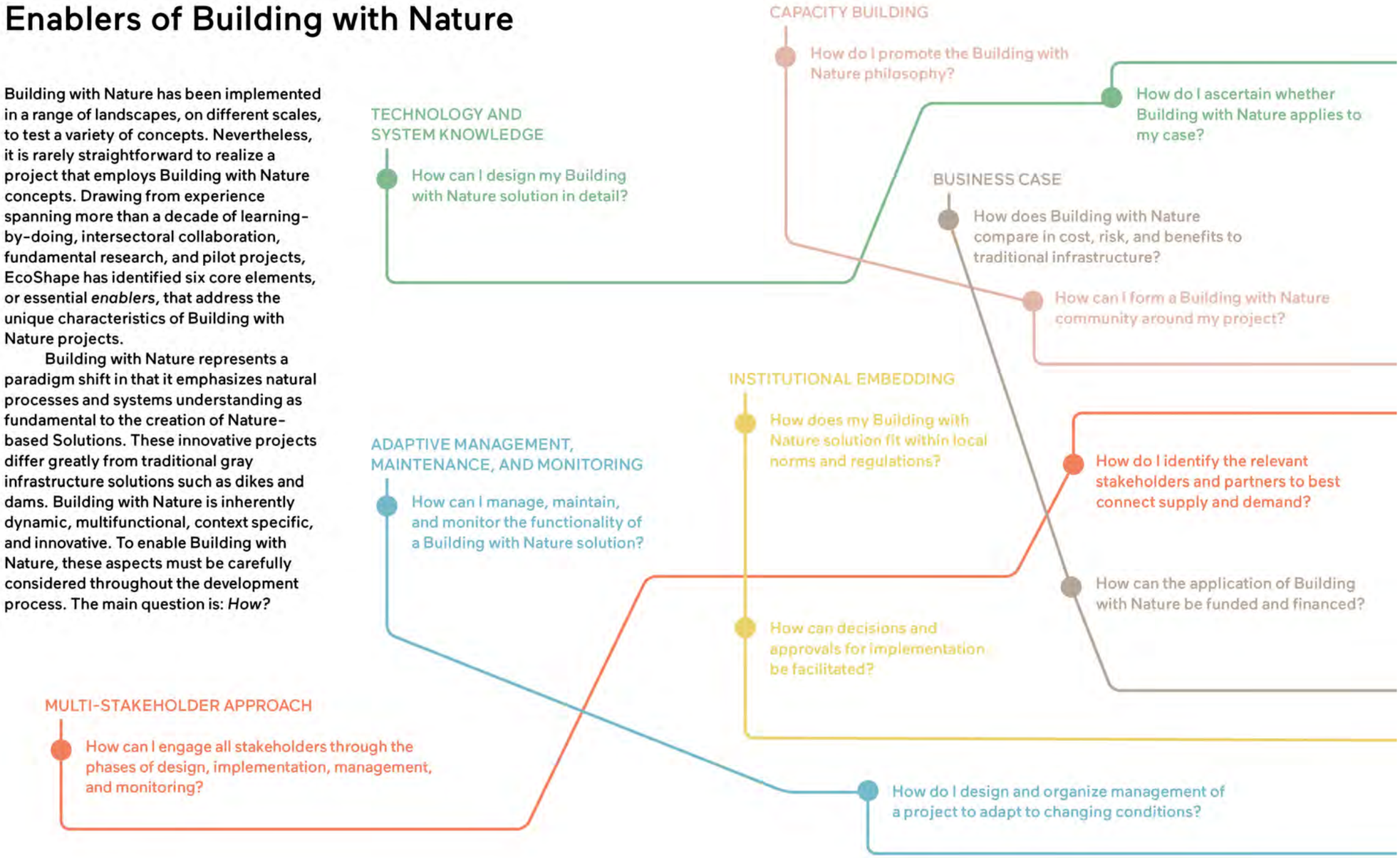
Capacity building among policy makers, industry managers, and the local community is essential. It takes place through education, training, and knowledge sharing. People familiar with the Building with Nature philosophy are more likely to support and participate in its applications, which is a benefit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

- → Increasing awareness of the philosophy and potential of Building with Nature
- → Educating emerging practitioners on Building with Nature through training programs
- → Creating Building with Nature communities around your project

Enablers of Building with Nature

Building with Nature has been implemented in a range of landscapes, on different scales, to test a variety of concepts. Nevertheless, it is rarely straightforward to realize a project that employs Building with Nature concepts. Drawing from experience spanning more than a decade of learning-by-doing, intersectoral collaboration, fundamental research, and pilot projects, EcoShape has identified six core elements, or essential *enablers*, that address the unique characteristics of Building with Nature projects.

Building with Nature represents a paradigm shift in that it emphasizes natural processes and systems understanding as fundamental to the creation of Nature-based Solutions. These innovative projects differ greatly from traditional gray infrastructure solutions such as dikes and dams. Building with Nature is inherently dynamic, multifunctional, context specific, and innovative. To enable Building with Nature, these aspects must be carefully considered throughout the development process. The main question is: *How?*



Dank u!

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