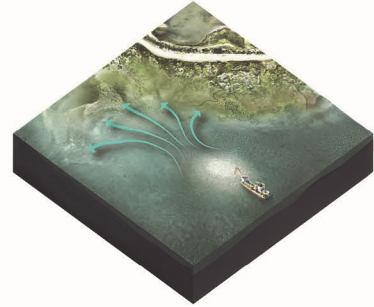


# Building with Nature



**Creating,  
implementing,  
and upscaling  
Nature-based  
Solutions**



**Editors**

**Erik van Eekelen  
Matthijs Bouw**

# Building with Nature



# Building with Nature

Creating, implementing, and  
upscaling Nature-based Solutions

<b>Editors</b>
<b>Erik van Eekelen</b> <b>Matthijs Bouw</b>

# From the editors

With this volume, we aim to inspire the application of Building with Nature. The interdisciplinary design approach creates sustainable development solutions for our coasts, rivers, deltas, and cities. It harnesses the forces of nature to add value for both nature and humans. Building with Nature responds to the urgent challenges of rising sea levels, heat stress, drought, and biodiversity loss.

This book distills the range of Building with Nature concepts that have been tested and refined through two EcoShape knowledge-development programs. Nearly thirty concepts are positioned and integrated within six fictional landscapes. Through visualization, description, and examples of worldwide application, we propose this resource as a point of departure for further study and engagement. Our goal is to introduce the potential of Building with Nature. While this work is neither an overview of current scientific research nor an engineering manual, we provide further resources in each landscape chapter as well as technical guidelines for a deep dive into these materials on EcoShape's online platform.

Interviews, roundtables, and local stories are interspersed among the landscape chapters to give context and personal insight into the Building with Nature project. People with firsthand experience in creating, implementing, and upscaling Nature-based Solutions discuss the current state of knowledge development as well as challenges for science, governance, and multidisciplinary collaboration, emphasizing the critical role of local communities. The book concludes with a presentation of six categories of tools, or "enablers," that emerged over the course of twelve years of EcoShape research, pilots, and projects. The enablers provide focus for future research as well as foundational guidance to designers of Nature-based Solutions.

Erik van Eekelen and Matthijs Bouw



To find more specific resources, guidelines, and general information, visit [ecoshape.org](https://ecoshape.org)

# Table of contents

7		Foreword
8		Introduction
14		What is Building with Nature?
20		Learning from place
35	A	Sandy Coasts
57		Designing, Engineering, and Building with Nature: interview
67	B	Muddy Coasts
89		Community: roundtable
107	C	Lowland Lakes
129		Science: roundtable
139	D	Rivers and Estuaries
161		Teamwork: roundtable
179	E	Cities
201		Implementation: roundtable
211	F	Ports
233		Leadership: interview
242		Enablers of Building with Nature
259		Postscript
264		Building with Nature II projects
266		Building with Nature concepts
270		Contributors
274		Photography credits
280		Colophon



# Foreword

The climate extremes of yesterday are today's new normal. We must adapt to a world in which the climate is less predictable and, in many cases, less favorable than it has been in the past. Unless we dramatically scale up adaptation actions, we will face immense human and social costs: a further 100 million people driven into poverty by 2030 and losses from flooding in coastal cities rising to \$1 trillion per year by the middle of the century. Protecting and improving the natural environment will be an essential part of responding to these threats. Wetlands can soak up heavy rains to reduce the risk of inland flooding. Urban green space and waterways help to moderate the impact of heatwaves. In coastal areas, healthy coral reefs can reduce wave forces during extreme events, mitigating the impact of storm surges and sea level rise for more than 100 million people today. However, 99 percent of the world's coral reefs would be at risk with an average temperature increase of less than two degrees Celsius. There is an urgent need to protect and promote the natural environment in a changing climate.

This book contains inspiring examples of how Building with Nature can strengthen resilience. The challenge that remains is to take best practices and make them our standard practices. There are significant benefits: every dollar invested in Nature-based Solutions can yield up to ten times that in savings, according to the Global Commission on Adaptation. To achieve this potential, we need to reconsider the relationship between the natural and the built environment. Historically, the emphasis has been on managing conflicts between people and ecosystems. Now, there is a need to look at how these systems can instead work together, recognizing that healthy societies rely upon healthy ecosystems. The Global Center on Adaptation is committed to upscaling Building with Nature strategies. Although appropriate solutions are context dependent, we are working with a diverse range of partners to mobilize the technical ingenuity, political leadership, and tailored financing mechanisms needed to better invest in nature. We hope that this publication serves to motivate and inform the broader application of Building with Nature in the years to come.

**Jaehyang So** Director of the Global Commission on Adaptation

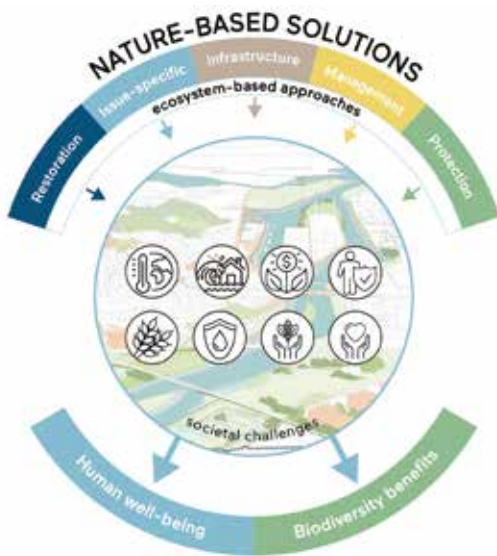


Beach nourishment, Eastern Scheldt storm surge barrier



# What is Building with Nature?

Building with Nature is a conceptual approach to creating, implementing, and upscaling Nature-based Solutions for water-related infrastructure. Shifting the development paradigm toward Building with Nature requires not only redefining *what* to do, and which design steps to follow, but also *how* to do so; that is, a complete change in thinking, acting, and interacting. A philosophy rooted in hydraulic engineering, Building with Nature continues to broaden its applicability for sustainable development.



Nature-based Solutions approaches and outcomes (diagram inspired by IUCN)

## ← Building with Nature and Nature-based Solutions

According to the International Union for Conservation of Nature, Nature-based Solutions 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.”<sup>1</sup> Building with Nature aims to embed natural processes in engineering solutions. It is a knowledge base for an approach to delivering Nature-based Solutions. Building with Nature meets “society’s infrastructural demands by starting from the functioning of the natural and societal systems in which [the] infrastructure is to be realized.”<sup>2</sup>

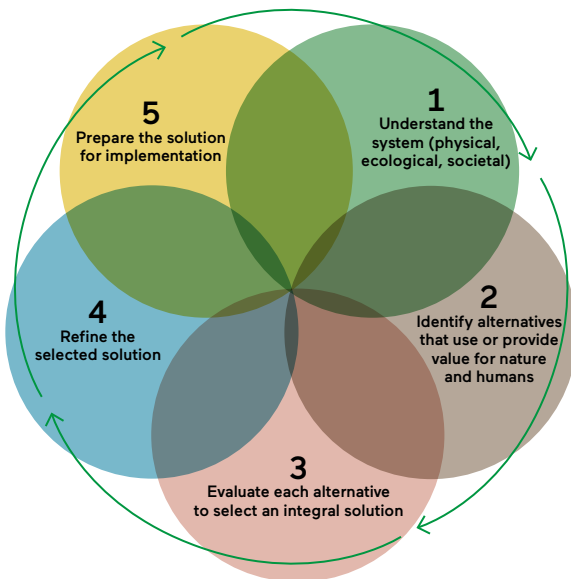
1. Cohen-Shacham, E. et al. (Eds). (2016). *Nature-based Solutions to address global societal challenges*. IUCN.
2. De Vriend, H. J. et al. (2015). *Sustainable hydraulic engineering through Building with Nature*. *Journal of Hydro-environment Research*, 9(2), 159–171.

## Principles

Building with Nature means working with rather than against nature. It goes beyond nature development or nature compensation to integrate natural processes as an essential part of the design. For example, developing a mangrove forest or a wetland in front of traditional coastal defenses can decrease the impact of wave energy on the infrastructure. This combination green (mangrove/wetland) and gray (traditional/hard) solution allows for the reduction of gray infrastructure while providing additional benefits such as increased biodiversity. Building with Nature is not only green—it is the optimal combination of green and gray that best fulfills primary engineering objectives within the local physical, ecological, and societal system.

## ↓ Building with Nature approach

The Building with Nature approach starts from understanding how adjacent natural and societal systems function; utilizes natural materials, forces, and interactions; and creates opportunities for nature to develop. Designing with natural materials and processes helps achieve cost-effective and resilient solutions. The approach encourages sustainable and innovative practices, often producing multifunctional solutions that benefit many stakeholders. Building with Nature designs typically follow five steps of development, outlining a creative process that can be followed at any phase of project realization.



The five Building with Nature design steps

### Step 1

- Map the natural, physical, and societal systems and the value, services, and benefits they can deliver to both nature and humans.
- Determine how system function influences project goals and objectives.
- System information is derived from many sources (historical, academic, local experience).
- The temporal and spatial boundaries of the system under consideration depend on project objectives.

### Step 2

- Identify alternatives that harness nature proactively to make optimal use of value-generating processes.
- Promote transdisciplinary work: involve academic experts, practitioners, community members, business owners, decision-makers, and other stakeholders.

### Step 3

- Dare to embrace innovative ideas, test them, and demonstrate how they work in practice.
- Identify uncertainties and address them in the integral solution.
- Develop a business case that includes all natural and human co-benefits.
- Involve stakeholders in valuation and selection.

### Step 4

- Consider the conditions and restrictions that come from the practicability and governance of the project.
- Recognize that implementation requires the involvement of a network of actors and stakeholders.

### Step 5

- Make key elements of the solution explicit to facilitate further uptake, funding, and stakeholder involvement.
- Prepare project documentation, including action plans, risk analyses, contingency plans, contracts, and permit applications.
- The development process is cyclical; later phases will optimize the solution further.

















# A

# Sandy Coasts



Hondsbosse Dunes, Camperduin to Petten

## Keywords

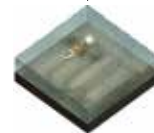
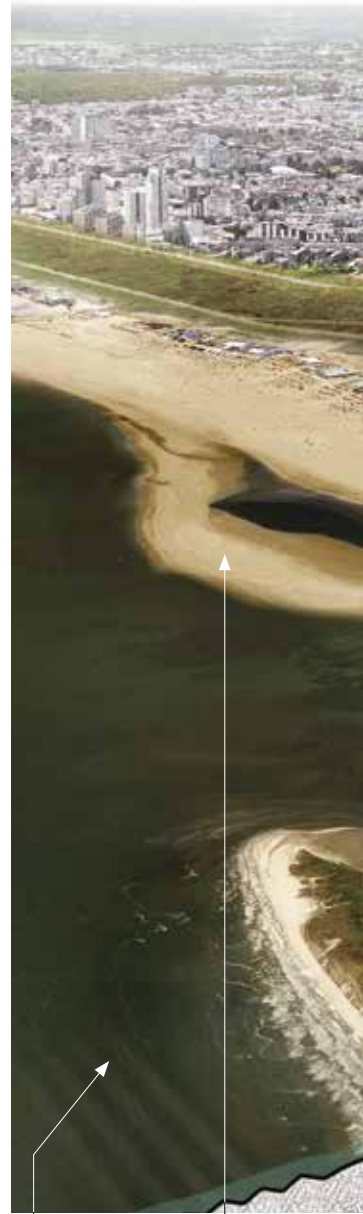
- Dune development
- Beach erosion and accretion
- Sand dynamics and transport
- Dynamic land-water gradient
- Sand nourishment
- Groundwater filtration
- Coastal defense
- Tourism and recreation
- Institutional embedding (enabler)

# The landscape

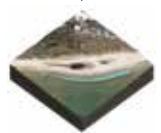
Since ancient times, sandy coasts have attracted human activity. They provide natural coastal defenses, form attractive living environments, protect potable water resources, and accommodate economic activities including ports, commercial fisheries, and recreation. Sandy coasts are highly dynamic environments with a unique range of habitats. They typically occur as beaches in enclosed bays between rocky headlands or as long stretches of sand within beach-dune systems. Waves, winds, and currents transport sand to the coast, while sea level rise, subsidence, and interruptions in longshore drift create new demands for sediment. The morphological development of the coast thus depends on the balance of the supply and demand for sediment and creates the conditions for dune and foreshore habitats.

Robust sandy coasts provide a natural barrier against storm surges and enhance climate resilience. Yet many shores experience significant pressures from coastal squeeze: they lie in the shrinking zone between growing urban populations and retreating shorelines, impacted by sea level rise and human intervention. Sustaining and supporting sandy coasts is an urgent issue, while in many places fragmented beach management poses an additional hindrance to coordinated regional strategies.

Building with Nature in sandy coastal landscapes focuses on interdisciplinary collaboration in sand management and nourishment strategies. These approaches prioritize minimizing the environmental impact of nourishment and developing coastal management alternatives through preserving beaches, growing dunes as coastal barriers, and enhancing habitats, by for instance using new techniques of sand borrow and placement.

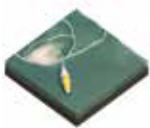


Landscaping the seabed

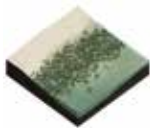


Applying mega-nourishments

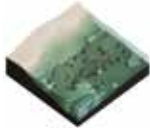
→ Fictional sandy coastal landscape depicting Building with Nature concepts



Constructing nature islands



Restoring seagrass meadows



Facilitating coral development



Developing double dike systems



Constructing perched beaches



Enhancing dune dynamics



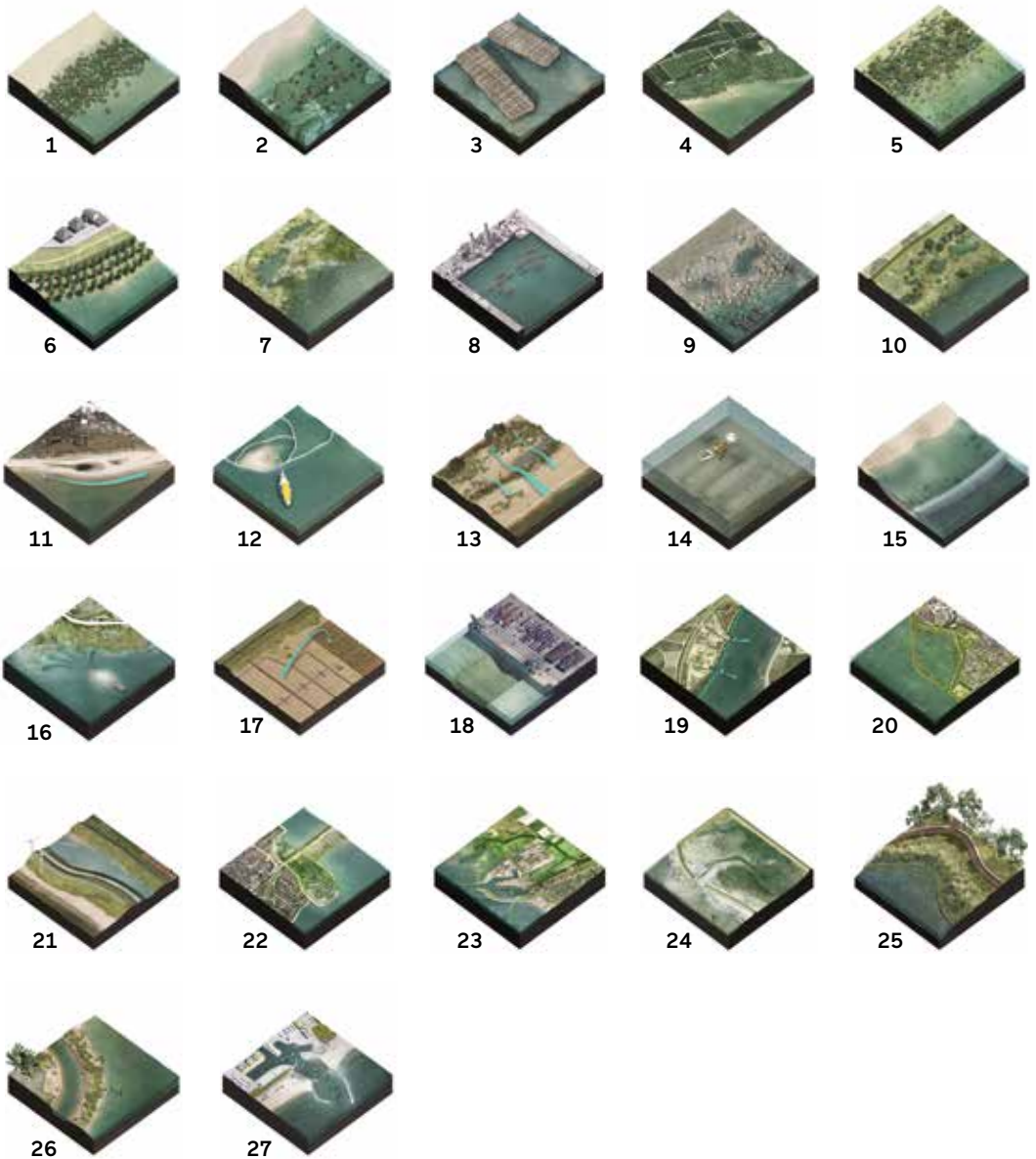
Marker Wadden, Lake Marken





# Building with Nature concepts





- General applicability
- Potential applicability
- Limited or no applicability

- ⊙ Growing system feature
- Featured concept in chapter
- Depicted concept in chapter

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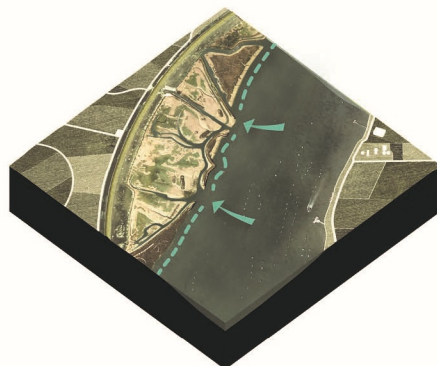
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Building with Nature offers a proven, innovative approach to creating Nature-based Solutions for water-related infrastructure that harnesses natural forces for the benefit of the environment, the economy, and society. EcoShape is a consortium of contractors, engineering firms, research institutes, NGOs, and governmental authorities. In the past decade, it has conceptualized, implemented, and analyzed Building with Nature projects in several countries. These projects demonstrate the capacity to build Nature-based Solutions at scale so as to create sustainable flood protection and cultivate resilient, ecologically rich living and working environments. Building with Nature, therefore, is the ideal approach for climate change adaptation and mitigation.

In this book, EcoShape introduces Building with Nature methodologies and outcomes. Dialogues with experts and stakeholders show there is an urgent and compelling case for further implementation. Key concepts are described, illustrated, and linked to six landscape types and their underlying ecological, economic, and social systems. This volume captures the imaginative potential of Building with Nature, and seeks to inspire readers and policy-makers across disciplines.



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