

Pressure on deltas and coastal areas throughout the world is increasing. In 2050, approximately 70% of the world's population will live and work in these locations. The ecosystems here are vital for nature, economy and our well-being. Climate change will put even more pressure on these areas. How can we manage the impacts of land subsidence, sea level rise, more water in our rivers and the depletion of groundwater? How can we cope with more intensive rainfall, heat stress, drought and salinisation? And how do we keep our environment sustainable, habitable and natural?



#### BUILDING WITH NATURE KNOWLEDGE PROGRAMME

Researchers from EcoShape have been developing knowledge about the application of Building with Nature since 2008. They use pilot projects to test the concept in practice. The research is structured as themes: Resilient Delta Cities, Ecosystem Restoration, Nature-Based Flood Defences and Sustainable Port Development.

#### RESILIENT DELTA CITIES

Climate change and a growing population are putting pressure on our cities worldwide. Smart solutions are needed to keep cities habitable and to prevent flooding. EcoShape researches ways of organising the water infrastructure in the city better and structuring it in ways that are climate-robust, focusing on 'stepping stones' for animal and plant species on a relatively small scale. Tidal parks and greener riverbanks improve the water management system and restore habitats for birds, fish and insects. Parks reduce heat stress and host leisure activities. EcoShape provided knowledge for tidal parks in Rotterdam and Dordrecht and for natural banks with willows at Kop van 't Land. We are also a partner in the Climate Adaptation City Deal.

#### ECOSYSTEM RESTORATION

The balance of many ecosystems on coasts and in lakes has been disturbed by human activities. For example due to the disruption of the sediment balance or the destruction of habitats. A sediment surplus makes water turbid, and that has a serious negative impact on everything that lives in the water. Food supplies for people, animals and plants are threatened and the quality of recreational areas is affected. In other places, the problem may actually be a shortage of sediment, which puts ecosystems such as salt marshes at risk. Building with Nature provides excellent opportunities for ecosystem restoration by creating the optimal conditions that allow nature to recover itself, for example by re-using sediment. EcoShape is developing this knowledge with partners in the Living Lab for Mud, which includes the scientific research programme KIMA Marker Wadden, the Clay Ripening Pilot project in the Ems-Dollard and Building with Nature (mangrove restoration) in Indonesia.

#### NATURE-BASED FLOOD DEFENCES

Climate change and sea level rise, whether or not in combination with land subsidence, lead to coastal erosion in many places. Smart solutions are needed to improve coastal defences while, at the same time, creating space for other user functions. Building with Nature designs are ideal for this purpose: examples include sand dunes and sand nourishment structures that serve as leisure facilities and nature areas while, at the same time, maintaining the coast. Other examples are salt marshes on the Wadden Sea coast and foreshores to protect dikes. EcoShape is investigating how Building with Nature works on sandy coasts near the Hondsbossche Dunes and in the Houtrib Dike and Sand Motor pilot projects. In addition, we support fundamental research into the contribution of foreshores to flood risk management in the BE SAFE project.

#### SUSTAINABLE PORT DEVELOPMENT

Ports are indispensable for the economy, trade and employment. Traditionally, however, ports have often had negative effects on the ecosystem as a result of changes in the use of space and the disruption of the sediment balance. One of the problems is that ports are obstacles on coasts or riverbanks that interfere with the natural transport of sand and sediment. Sediment accumulates in the port and frequent dredging is therefore needed. Even though valuable ecosystems near the port suffer from a shortage of sediment. EcoShape develops knowledge about reducing silting up in ports and about how to re-use sediment for salt marsh development or dike upgrade operations. This research is being conducted in the Marconi Salt Marsh Development, Mud Motor and Clay Ripening pilot projects.

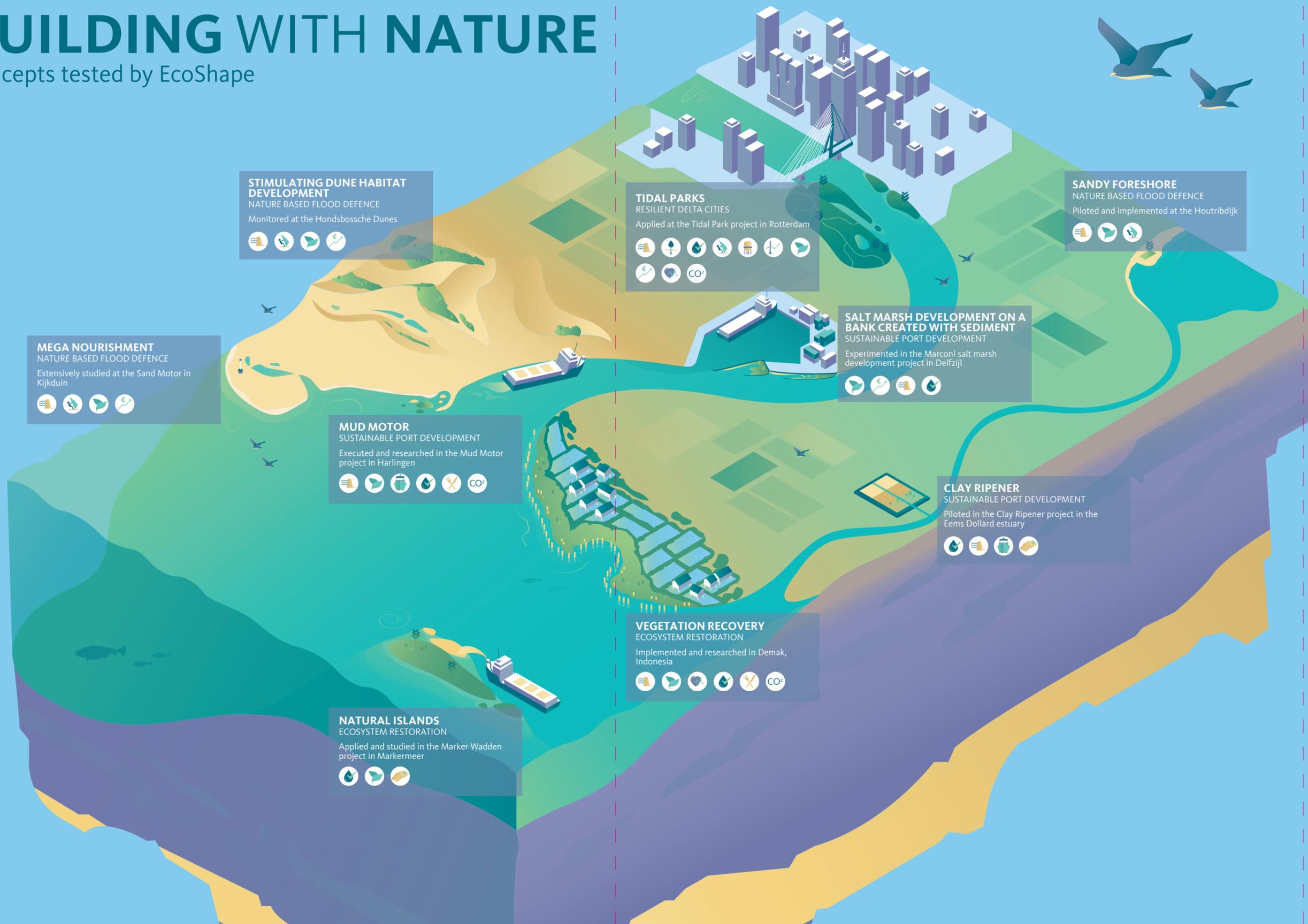


# EcoShape Building with Nature



# BUILDING WITH NATURE

Concepts tested by EcoShape



**STIMULATING DUNE HABITAT DEVELOPMENT**  
NATURE BASED FLOOD DEFENCE  
Monitored at the Hondsbossche Dunes



**TIDAL PARKS**  
RESILIENT DELTA CITIES  
Applied at the Tidal Park project in Rotterdam



**SANDY FORESHORE**  
NATURE BASED FLOOD DEFENCE  
Piloted and implemented at the Houtribdijk



**MEGA NOURISHMENT**  
NATURE BASED FLOOD DEFENCE  
Extensively studied at the Sand Motor in Kijkduin



**MUD MOTOR**  
SUSTAINABLE PORT DEVELOPMENT  
Executed and researched in the Mud Motor project in Harlingen



**SALT MARSH DEVELOPMENT ON A BANK CREATED WITH SEDIMENT**  
SUSTAINABLE PORT DEVELOPMENT  
Experimented in the Marconi salt marsh development project in Delfzijl



**CLAY RIPENER**  
SUSTAINABLE PORT DEVELOPMENT  
Piloted in the Clay Ripener project in the Eems Dollard estuary



**VEGETATION RECOVERY**  
ECOSYSTEM RESTORATION  
Implemented and researched in Demak, Indonesia



**NATURAL ISLANDS**  
ECOSYSTEM RESTORATION  
Applied and studied in the Marker Wadden project in Markermeer



**BUILDING WITH NATURE**  
Hydraulic engineers are increasingly being asked to produce designs that are sustainable and adaptable to changing circumstances. The Building with Nature philosophy, an approach to sustainable and flexible hydraulic design, provides an answer. It takes the ecosystem as the starting point and integrates the natural processes, species and materials in place. The result is a design that delivers extra functions and added value, that is adaptable to changing circumstances and that has a better business case throughout the life cycle than traditional methods.

**ECOSHAPE**  
EcoShape is a consortium of hydraulic engineering companies, engineering firms, research institutes, NGOs and government authorities that develops knowledge about Building with Nature through pilot projects.

- ECOSHAPE CONSORTIUM**  
The EcoShape consortium includes:
- Boskalis
  - Van Oord
  - Wageningen Marine Research
  - Witteveen+Bos
  - Deltares
  - Arcadis
  - Royal Haskoning DHV
  - HKV Lijn in Water
  - Wetlands International
  - Vereniging van Waterbouwers
  - The Dutch Ministry of Infrastructure and Water Management

In addition to these organisations, EcoShape also has numerous national and international partners.

Would you like to know more about the whole EcoShape network? [www.ecoshape.org/en/community](http://www.ecoshape.org/en/community)

**BUDGET**  
The programme is established in a bottom-up approach. Financing for pilot projects is arranged on a project-by-project basis in collaboration with partners such as stakeholders, governments and financiers.

**Budget for 2008-2012 € 30 million**  
**Budget for 2013-2020 € 47 million**

This project has a positive effect on

Flood risk management	CO2 sequestration
Recreation	Climate regulation
Biodiversity / Nature development	Water infiltration
Local economy	Water storage
Health and well being	Navigability
Water quality	Building material
	Food (shrimp/fish)