



EcoShape
building with nature

Society will benefit through ecodynamic design

With over 80% of the world's large population centres in vulnerable coastal, delta and river areas, the construction challenge in these areas is extraordinary. Trade and industry require new ports and infrastructure, citizens require housing, rivers require space to flood, and all will have to be protected from and harmonised with nature and the effects of climate change and sea-level rise.

The challenge demands many talents; research and technology; effort and experience; planning and finance; ambition and sympathy. Input is essential from all stakeholders; from owners, residents and policymakers to designers, contractors and project administrators. Ecological and economic interests have to be responsibly balanced. We are faced with the need to learn to build with nature, so that the natural and human world can sustainably co-exist.

The Dutch national programme Building with Nature targets discovering and developing all the know-how and expertise required to allow this to happen. To create state-of-the-art models for ecodynamic design. To permit the aims to be realised. Society will benefit in many ways: from improvements to administrative and policy-making processes, development of new business opportunities, establishing new positions in technological and scientific excellence, to provision of new and innovative design tools and consolidation of skills.

EcoShape is a consortium of Dutch specialists with a rich history of solving coastal infrastructural challenges in the Netherlands and abroad. As custodians of this knowledge inheritance of past land reclamation, sea and river defences, dike building, dredging and protecting nature, EcoShape will provide its knowledge resources for the benefit of sustainable coastal development - anywhere in the world it may be needed.

Ambitious plans for rivers, and coastal or delta areas can be best achieved if man treats nature not as an enemy but as an ally, so that nature itself works in support of man's intentions - Building with Nature.

The new knowledge imperative

Building with Nature is an innovative, long-term research programme aimed at developing new design concepts for the layout and sustainable exploitation of river, coastal and delta areas. Its special feature is the synergy and cooperation that will allow natural ecosystems and human intervention to reinforce each other. Ecology and technology are involved at all phases of a project: design, assessment, selection, construction and management. The primary goal is ecologically, technically and socially sustainable development.

Whereas in the past infrastructural plans were mainly assessed for ecological threats (to assure minimal environmental degradation), the new design approach will lay emphasis on the opportunities an ecosystem offers, yet obviously without ignoring infrastructural and economic conditions. Here, nature's status will serve as the starting point for the design process.

The research programme *Building with Nature* aims to provide objective, scientific knowledge and tools, technical and managerial, to help designers, builders and leaders develop areas in such a way that the economic and living environment evolves safely, prosperously and harmoniously in the long term.

Ecodynamic design leads to creating and building what we the human race require, but in close harmony with nature. It utilises the strengths of the natural system as pillars in infrastructural and hydraulic construction. As we better understand the natural dynamics, then we can increase our capacity to incorporate natural behaviour - under human influence - into the design process. With the help of new insights, nature itself is used as an 'engine' for strengthening ecosystems.



Prof. dr ir Huib de Vriend
Programme director

Programme ambitions

The programme Building with Nature seeks to:

- **Develop multidisciplinary knowledge** at the interface of life and natural sciences and technology;
- **Test** new knowledge in **practical situations**;
- Develop **best practices** for building with nature;
- Ensure that **society benefits optimally** from the new knowledge;
- Exploit **Nederland - Deltalab** as a domestic market and large-scale experimental region;
- **Encapsulate new knowledge for international use:** Nederland Waterland.

The programme Building with Nature seeks to enable authorities and business to:

- **Create space** for man and nature, also in densely populated areas and also with a changing climate;
- **Offer manageable frameworks** for policy-making, and design, construction and management of infrastructure;
- Develop **efficient and transparent administrative procedures** and **skilled entrepreneurship**;
- Ensure a **shorter time-to-market** and **faster return on investment** for infrastructural projects.

Working and building with nature

Building with Nature is an initiative of Dutch industry, engineering consultants, specialist institutes and universities. It is intended to pull down the expertise of traditional Dutch land protection activities to the service of other of the world's deltaic or riverine areas needing such know-how.

A key objective is to share new design and assessment methods based on scientific insights in the working of ecosystems with parties involved in the assessment, development, realisation and utilisation of hydraulic engineering projects in fresh, brackish and salt water zones.

Ultimately, better insight into natural dynamics, whether or not affected by the hand of man, will provide ever more valuable contributions to sustainable, socially-responsible, physical development. Where nature and construction integrate and combine from the very beginning to strengthen and reinforce each other.

Building with Nature as programme

Key elements of *Building with Nature* are:

- A. **Gaining knowledge:** ecologists and hydraulic engineers will be researching and designing together;
- B. **Case studies:** inventory of observed effects and learning in practice;
- C. **Develop and assess** 'green-blue' design scenarios.

A. Gaining knowledge

The multi-disciplinary character of this programme requires ecologists, scientists and technical specialists to work, design and create together, with nature as the 'foundation'. This requires joint research to gain new knowledge on effectively developing and using ecosystems. Missing elements in the existing technologies and design frameworks will be addressed together, whereby the different, joint perspectives must lead to optimal synergy. The new knowledge must be usable for society. That is why the users of the new knowledge are involved in this research from the onset, to collectively conduct research and to ascertain the applicability of the new insights. Collaboration will be realised through the extensive use of design studios or ateliers, where parties will meet to exchange and discuss ideas and results of the research programme.

B. Case studies

The **IJsselmeer and Markermeer lakes:** examples of new functions in a lake environment through human intervention. Preserve and improve the spatial quality of this area. While learning from the system's response to past human intervention, the country can now replicate the benefits achieved in the Netherlands to other societies.

Holland Coast: facing accelerated sea level rise. Sand nourishment is an environmentally friendly and flexible method of coastal maintenance, making use of nature's forces. Can mega-nourishments be an attractive form of pro-active maintenance, at the same time boosting nature and recreation?

Southwest Delta: a complex area with valuable natural resources, important agricultural functions and access to Belgium's port of Antwerp. Safety, accessibility and nature are being carefully preserved in this complex and dynamic natural system of sea arms and estuaries with channels, banks, mud flats and salt meadows.

Singapore land reclamation: with the help of Dutch expertise this small tropical nation invested extensively in land reclamation and new coastline. As national wealth expands, so do the pressures for further expansion for both space-challenged Singaporeans and their natural resources.

C. Design scenarios

There is a vast resource of relevant hydro-engineering know-how in the Netherlands. Improving its documentation and collation, and combining this with today's visions will lead to yet more workable scenarios for the ecologists, engineers and managers of the future. *Building with Nature* focuses on themes such as:

- **Integrated planning development** (improved safety, living conditions and prosperity);
- Development and recovery **of the natural dynamics of ecosystems;**
- **Protection** against flooding from rivers and the sea;
- **Climate adaptation.**

Building with Nature wants ecodynamic design and building to be the driving force for the future sustainable development of river, delta, and coastal areas. Design challenges that *Building with Nature* seeks to make possible include:

Sand nourishment; Mega-replenishments may provide an innovative approach to traditional beach nourishments, by allowing natural wave and tidal motion to spread the sand to where it is needed along the coast. This will create safe, natural and sustainable coastlines.

The City of Dordrecht hosts EcoShape - Building with Nature, by providing an inspiring working location with facilities for design ateliers and workshops. Participants of the programme come and work together at this central location. While the programme perfectly fits with Dordrecht's core values water, cultural history and innovation, it also allows Dordrecht to position itself as a worldwide, innovative centre for sustainable water engineering and ecology.

Intelligent redevelopment of the Southwest Delta from predominantly agriculture to combined aquaculture, agriculture, wilderness and coastal protection according to the latest methods offers prospects of solving spatial planning and environmental issues in deltaic areas around the world.

Natural coast and shore defences will be sustainably preserved and reinforced in a low-maintenance way by making use of natural systems (for example mangroves). Spin-offs will include strengthening the natural system, local economic development, and enrichment of fish stocks.

Many practical pilots are currently taking place whose findings are feeding the knowledge resource. They include Bio-builders, ComCoast, artificial reefs, the 'Eco-dike', the sand engine, research into sea grasses and soft natural shore defences. Building with Nature aspires to progress such pilots by understanding and utilising area-specific characteristics of local ecosystems.

Southwest Delta

Holland Coast

IJsselmeer

Singapore

Returns on Building with Nature

Specific results

- The design of hydraulic works (ports, land reclamation, coastal and river defences and offshore) and maintenance strategies will ensure that natural local, area-specific characteristics are stimulated to develop on their own strengths. Projects will no longer form threats to existing habitats.
- New knowledge will enable policymakers to formulate better and nature-friendly assessment criteria, instead of those based on generic, statistical assessment criteria; this will lead to customisation;
- Better insight in the dynamics of aquatic ecosystems will enable new functions to be created, such as aquaculture in estuarine areas.

Generic results

Next to theme or area-specific results, work on these topics will provide generic results for application elsewhere through:

- **Gaining knowledge:** we gain more knowledge and insight in the systems, their response to intervention, their strengths and the possibilities that they offer; these are laid down in transferable knowledge products (methods, software);
- **Gaining expertise:** knowing how to deal with these kind of systems; this expertise is laid down in transferable best practices and where necessary and possible in expert systems;
- **Tools:** measuring and monitoring methods, data processing methods, databases, etc.;
- **Increase in competence:** a living network of researchers and innovative appliers, that form the breeding ground for further innovation;
- **Better policy and management:** the new insights from *Building with Nature* mean that policy and regulations can be based on more and more in-depth knowledge and insights than is currently the case. This makes the policy and regulations more effective, with as end result more opportunities for the ecology and economy.

Building with Nature is harnessing the powers of multiple centres of technical excellence to provide new knowledge, new tools, new assessment methods and new ideas for hydraulic engineering projects in river, delta and coastal areas. This knowledge is making possible new ecosystem design and optimal use of opportunities the system offers. Building with Nature thus provides contributions to sustainable management and development of densely populated river, delta and coastal areas world-wide, for the betterment of all.





The initiators

Koninklijke Boskalis Westminster nv - International organisation with leading position in world dredging. Core activities are the construction and maintenance of ports and waterways, creating land in water, and protecting coasts and shores;

Van Oord Dredging and Marine Contractors bv - Internationally operating company with leading position in world dredging. Core activities are land reclamation projects, construction and maintenance of ports and waterways, coastal protection activities and offshore rock supply and placement services;

IHC Merwede - The world's largest designer and builder of dredging equipment and components; Underwater earth movers extraordinary with more specialist vessels, slurry pumps, cutter heads, and miles of delivery lines than any other;

Deltares - A new independent institute for applied research and specialist consultancy on low-lying, densely populated delta areas; based at the heart of one of the world's centres of technological expertise and research, it encompasses the former institutes WL/Delft Hydraulics (hydraulics, water management, aquatic ecology), GeoDelft (soil mechanics, foundation engineering, geo-ecology), part of TNO Built Environment and Geosciences (shallow subsurface geology, groundwater, geo-ecology) and parts of the specialist departments of Rijkswaterstaat (Ministry of Transport, Public Works and Water Management);

Wageningen IMARES - Advisory and engineering consultants for projects in the water, infrastructure, environment and construction sectors across the world;

SHELL Global Solutions - Operating subsidiary of the world's leading raw materials extractor offers advisory and technology services for the development and upgrading of international petrochemical and process industries;

Witteveen + Bos - Advisory and engineering consulting services for projects in the water, infrastructure, environment and construction sectors across the world;

DHV - International advisory and engineering firm providing services and sustainable solutions to the construction, industrial, mobility, airport, spatial layout and environment, and water sectors;

Royal Haskoning - Consultants, architects and engineers. Active worldwide in the broad field of sustainable interaction between man and his environment;

Technical University Delft - Water Research Centre, in particular coastal hydraulic engineering and dynamics, river hydraulics and morphology; source of advanced expertise on river behaviour;

Wageningen University - In the field of life sciences: food, health, nature and the living environment, provides fundamental knowledge needed to understand ecosystems, water quality and environmental policy;

University of Twente (UT) - The Centre for Clean Technology and Environmental Policy, Water Management;

Astron (Lofar) - The national Foundation for Astronomical Research ASTRON, conducts a technological development programme aimed at supplying innovative instrumentation for applications in observation and signal processing;

RWS-Bouwdienst, Rijkswaterstaat building division - For wet and dry infrastructure the Directorate's Civil Engineering Division is the primary service in building technology, purchase and project management;

NIOZ - Royal Netherlands Institute for Sea Research; one of Europe's oldest Oceanographic institutions, targeting society-driven multidisciplinary marine research;

NIOO-CEME - Centre for Estuary and Marine Ecology (CEME) in Yerseke; addresses ecosystem studies, marine microbiology, and spatial ecology;

VBKO - The national Dutch Association of Water Builders in Dredging, Coastal and River Bank Structures, represents many of the interests of companies in hydraulic engineering.

City of Dordrecht - Located in the Holland Delta, Dordrecht has close and long lasting relationships with water and the maritime sector. Building on this tradition and focusing on innovation, the city houses EcoShape - Building with Nature.



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