

Nature lends a hand



‘Oysters grow faster than the sea level rises’

An oyster reef to protect the coast and willows in front of the dyke. Slowly but surely a new insight is gaining ground: hard civil engineering interventions by themselves are not a panacea. Nature seems willing to help us keep the upper hand over the advancing waves and rising sea levels. TEXT RENÉ DIDDE ILLUSTRATION SCHWANDT INFOGRAPHICS

An extraordinary structure went up this spring off the Bangladesh coast between Chittagong and Cox's Bazar on the Gulf of Bengal. It consisted of 50 metres of concrete sewerage pipes open on top. 'Tests have shown that an open concrete structure provides the best substratum for very young oysters to grow into fully fledged specimens,' explains Arjo Rothuis of IMARES Wageningen UR.

This artificial oyster reef is all in a noble scientific cause. Not only does it break the rough waves from the sea, but it also causes sand and other sediment to pile up between the reef and the dyke behind it. An earlier trial showed that this sediment widens the seaward-facing bank of the dyke, thus helping to combat coastal erosion.

FISH NURSERIES

This intervention should help Bangladesh, an impoverished country in the East Asian delta, to reduce the costs of coast maintenance, says Rothuis, who collaborates intensively on the project with researchers from Royal HaskoningDHV. And that is not the only advantage it offers. The broad bank flanking the dyke could be a step towards replanting mangroves along the coast. This would contribute both to further improving the sea defences and to nature and economic development. Mangrove swamps are nurseries for tropical marine fish. The oyster reef can play a supporting role in this as well: 'Mature oyster reefs attract fish, crabs and shrimps. That is good for biodiversity and for fisheries. The local population can also harvest oysters from the reef, as long as they do so in moderation,' says Rothuis.

Using oysters as an alternative form of coastal protection was first trialled in the Netherlands in the Oosterschelde estuary. The construction of a large storm surge barrier in the nineteen eighties may have constituted the most impressive part of the delta works, but it also had the effect of reducing the influx of sand from the sea. 'The gullies in the Oosterschelde then drain sand away from the shelves and mud flats,' explains Martin Baptist, a marine ecologist at IMARES

Wageningen UR on the island of Texel: 'This tendency to draw away all the sand is a harmful side effect of the storm surge barrier and bad news for the many migrating birds that use the waters of Zeeland as foraging grounds.'

Baptist's office is strewn with project proposals and studies on natural forms of coast protection. In spite of the storm surge barrier, even a slight south-westerly wind still sends waves from the Oosterschelde crashing onto the coast, on the Tholen peninsula for example. In the interests of both nature and safety, the plan was to use local materials to hold back the water. 'Thanks to the oyster cultivation in Yerseke, there are plenty of empty oyster shells around,' says Baptist. In 2010, oyster shells were poured into long stretches of iron mesh gabions, or cages. Unlike mussels, oysters have a useful tendency to stick to each other powerfully. The idea is that the metal cages will gradually rust away in the salt water leaving behind a natural reef that can check the leaching away of sand, explains Baptist, who was involved in the Zeeland trial.

REEF GROWS

A reef made up of old shells eventually becomes a living reef: small oysters clamp onto the dead shells and grow to maturity there. This enables the reef to grow with the rising sea levels caused by climate change. 'Better still,' says Baptist, 'oysters grow a lot faster than the sea level rises. And the nice thing is their morphological plasticity – they are quick to adapt their shape to their conditions. At locations with a lot of sedimentation I see specimens of up to 30 centimetres high.'

'Building with nature' is the name of the concept launched in the nineteen eighties by Ronald Waterman. His Waterman Plan involved building an island off the coast of South Holland to form a breakwater as well as housing pig farms, a second national airport, recreation facilities and wind turbines. The Waterman Plan never got off the ground, but the ideas behind it are now widely accepted: do not battle with the elements but get nature on your side. The range >



of possibilities seems endless. You can dissipate wave energy using willows, natural reefs, swamps that retain water, mangrove forests and mud flats that absorb rising sea levels.

This not only makes life safer along the coasts, but also benefits nature and offers opportunities for recreation and even for aquaculture, as illustrated by the oyster reef in Bangladesh.

SOFT AND HARD

‘Building with nature is not a substitute for hard civil engineering works such as dykes, dams and sea defences,’ believes Baptist. ‘It is more that making use of the natural dynamics of the ecosystem complements classic water management interventions.’ A kind of synthesis between Wageningen’s ‘soft’ green disciplines and Delft’s ‘hard’ grey civil engineering.

The entire Dutch water sector is collaborating in a consortium called Ecoshape to implement ‘building with nature’ projects and develop the concept further. Knowledge institutions such as IMARES, NIOZ and Deltares are involved, and dredgers such as Boskalis and Van Oord are pitching in, as are consultancy firms such as Royal HaskoningDHV, Arcadis and Witteveen+Bos. Wageningen UR and the universities of Delft and Twente all have a prominent role in the consortium.

Building with nature often turns out to be cheaper than, for instance, raising dykes in the time-honoured way. ‘In Delfzijl the original sea defences can only be raised and widened if the chemical industry is moved and houses in the town are demolished,’ says Baptist. ‘A seaward mud flat that breaks the waves is an effective alternative.’

WAVE-BREAKING DYKE

The approach offers yet another significant advantage. It can speed up the often sluggish decision-making process. Or so Baptist expects: ‘By involving stakeholders such as environmental organizations, fisheries associations, farmers, leisure businesses and the general public in the planning from the early stages, letting them contribute to the thinking and designing, managers can sidestep delays to planning permission caused by objections and rounds of consultation.’

As an example, the creation of a wave-breaking dyke in the Noordwaard polder at Werkendam could be speeded up. Willows break the wave, making it unnecessary to raise the dyke and spoil the residents’ view. There were no written objections to the willow dyke. ‘These governance aspects are going to play an increasingly important role in densely populated deltas such as the Netherlands, and others parts of the world as well.’

One example is the already ten-year-long discussion about partially opening the sluices on the Haringvliet dam. If these sluices are partially opened, tides in the Haringvliet inlet will create more natural dynamics upstream at the Biesbosch nature reserve, fish will be freer to migrate and the blue algae in the currently fresh water may bite the dust.

But this decision has remained a paper tiger. ‘The effect of salt on the water raises objections from farmers and market gardeners as far inland as Boskoop, because they fear for the impact of salinization of soil and groundwater on their crops. Drinking water companies that collect surface water are none too happy about the salt water, either,’ says Baptist. Together with the consultancy firm Grontmij and landscape architecture bureau Waterarchitect, IMARES has come up with a building-with-nature solution in the form of a seaward-lying Balance Island. Baptist: ‘This island can create a gradual transition between salt and fresh water on the seaward side of the Haringvliet dam, so that the sluices could be partially opened without creating problematic levels of salt in the Haringvliet.’ The plan won several design awards but still awaits practical follow-up.

ARCHIPELAGO FOR NATURE

But nice plans or trials on a postage-stamp scale are not the end of the story. Next year in the Markermeer lake, a start will be made on a swampy area of 1000 hectares, eventually to become 14,000 hectares of archipelago along the Houtrib dyke at Lelystad. The first island is being created using dredged up sediment. The idea behind these ‘Marker Wadden’, an initiative of nature trust Natuurmonumenten, is to combine new nature creation with dyke protection in one plan. The concept of building with nature seems to be striking a chord all around the world, Martin Baptist observes. ‘Safety is especially at stake in vulnerable, heavily populated deltas with a lot of economic activity,’ he says. Monitoring of the catastrophic consequences of Hurricane Katrina in 2005 showed that the areas where the salt marshes of the Mississippi delta in Louisiana were intact suffered less damage than areas which lacked these buffers. ‘Since then hard work has been going on to restore the salt marshes,’ says Baptist. No doubt the recent change of course in development cooperation towards more market-oriented aid will play into the hand of building with nature, too. As illustrated by the oyster reef in Bangladesh, this concept has the potential to develop into a win-win export product with which the Dutch water management sector earns money while clients cut the costs of coastal protection. ■

‘A mud flat that breaks the waves is an alternative to raising the dykes’

Natural coast protection

The *Building with Nature* principle offers a range of possibilities for benefitting both coastal safety and nature.

