Deltas in Depth scientific sessions		
Deltas in Depth Theme 4. Coastal systems and wetlands		
DD 4.5 Building with Nature		
Chair	Prof.dr. Peter Herman, Netherlands Institute of Ecology / Royal Academy of Sciences, the Netherlands	
Presentations	•	Tom Ysebaert, Royal Netherlands Institute for Sea Research (NIOZ), the Netherlands
	•	Brenda Walles, Wageningen UR, the Netherlands
	•	Prof.dr. Johan C. Winterwerp, Deltares, the Netherlands
	•	Dr. M. Shahadat, Hossain Institute of Marine Sciences and Fisheries, University of Chittagong, Bangladesh
	•	MSc Mindert de Vries, Deltares, HZ U. of Applied Sciences, the Netherlands

This scientific session focused on the use of natural processes in interventions aimed at managing coastal systems and wetlands. We enjoyed five presentations and lively discussions followed each one. The research settings included the Netherlands, Indonesia, and Bangladesh.

Ecomorphological effects of human interferences in estuaries and their consequences for management, Tom Ysebaert, Royal Netherlands Institute for Sea Research (NIOZ), the Netherlands
We start in Zeeland, the Netherlands, with Tom Ysebaert describing the impacts of human action on two estuaries that have experienced very different changes over the last thirty years. The Eastern Scheldt estuary was partly closed off by a storm surge barrier that caused a significant loss of intertidal flats. In contrast, the Western Scheldt has been deepened for navigation, which has caused an increase in height of the intertidal flats. Tom presented results of habitat modelling of macro-benthic (bottom-dwelling) animals in both estuaries. Changes and feedback mechanisms between hydrodynamics, sediment dynamics, and ecological processes were highlighted, linking management to consequences for the local animals and plants. Maintaining the intertidal flats is vital because they sustain coastal food webs and dampen wave action on dikes, and some innovative approaches to management are relocating dredged material, sand nourishments, and living reefs. Challenges to the future management of the area include the following questions: on what scale do we manage the estuaries? How can we reach maximum benefit for minimal interference? A greater understanding of the systems is needed. Discussion included clarification that his calculated erosion rates included climate change considerations.

The role of biogenic reefs for coastal adaptation and conservation, Brenda Walles, Wageningen UR, the Netherlands
Next up is Brenda Walles, who has almost finished her PhD research on the effects of ecosystem engineers. Brenda's presentation followed logically on from Tom's, by looking in more depth at the use of oyster reefs to maintain intertidal flats in the Eastern Scheldt estuary, south-west Netherlands. Ecosystem engineers are organisms that change the physical structure of their habitat, with consequences for their own and other species' fitness. For instance, benefits of oyster reefs include the

shoring up of sand (thereby boosting the intertidal flats), providing a habitat for benthic species, retaining their structure (no need for maintenance), and sequestering carbon in the oyster life cycle. Brenda's research tested the extent of these effects, and findings included notable sedimentation of sand behind the oyster reefs and reduced hydrodynamic stress; evidence of a self-sustaining structure with oysters settling on the structure (a "recruitment event"); and burial of CaCO3 (as shell waste) under a natural reef. The third finding is particularly interesting for climate adaptation, as it contributes to carbon sequestration. Questions revolved around whether the reefs caused erosion elsewhere (they did, a little around the reef); whether they had introduced sub-tidal oysters into an intertidal area (yes, but they were dead sub-tidal oysters); and what considerations are important if someone wants to set a reef up (ensure oysters are suited to conditions, able to feed, and understand sediment dynamics).

Restoring eroding coasts by stimulating sediment trapping, prof.dr. Johan C. Winterwerp, Deltares, the Netherlands

The third speaker was Han Winterwerp, presenting research into sediment trapping that he conducted in Indonesia. Han started by explaining how conventional erosion prevention along coastlines has failed, and he produced some rather damning photo evidence of examples in Suriname, British Guyana, and Thailand- we're talking up to 30m/year! In order to achieve successful coastal restoration, it must be understood that on mangrove-mud coasts, hard structures (such as dikes etc.) amplify the problem, not solve it. An alternative approach is to understand the system and let nature do the work. As well as noticing the erosion, it is also important to recognise the role of sedimentation and how little of the sediment that is pulled up to the shore remains there. The solution is to try and retain more sediment using structures that mimic mangroves, salt marshes, or brushwood (a tested method in the Netherlands). Discussion revolved around whether oysters can be used (no) and how they hold up against storm events (not very well, unsurprisingly).

Oyster reefs for coastal defense and food production: Experience from Bangladesh, dr. M. Shahadat, Hossain Institute of Marine Sciences and Fisheries, University of Chittagong, Bangladesh

Next up was M Shahadat Hossain from Bangladesh who presented results of a project that tested the use of oyster beds as a proper sustainable solution that simultaneously meets both social and ecological objectives. Substrates are built that will attract oyster spat, which will in turn attach, grow, and maintain a structure that shores up sediment along the coast. The team is measuring sediment deposition behind the reef using tools they developed. Added benefits of this research are that oyster production provides the local community with extra income, and biodiversity measurements contribute to scientific knowledge. During a conference at the end of the year the final findings will be presented, which assess the impacts of the project and how workable it is as a solution for climate adaptation.

Integration of ecology and engineering in cost-effective nature-based flood defences, MSc Mindert de Vries, Deltares, HZ U. of Applied Sciences, the Netherlands

The final speaker was Mindert de Vries, bringing us back to the Netherlands with examples of how ecology and engineering can be integrated as nature-based flood defences that can be effective from both a functional and cost perspective. Some examples include sand nourishments, oyster reefs, reed

beds, and willow trees. These building-with-nature solutions have three advantages over traditional flood defence: 1. they are adaptable- in that they are self-sustaining and function despite rising sea-level; 2. they reduce costs- e.g. compared to traditional hard structures construction costs are lower; however, maintenance costs are somewhat higher although over time they grow self-sustaining; and 3. they provide ecosystem services- such as carbon sequestration, breeding grounds, increased biodiversity, and water retention.