

THE SAND MOTOR: A NATURE-BASED RESPONSE TO CLIMATE CHANGE

FINDINGS AND REFLECTIONS OF THE INTERDISCIPLINARY
RESEARCH PROGRAM NATURECOAST

EDITED BY
Arjen Luijendijk
Alexander van Oudenhoven



Arjen Luijendijk (right) was active in the NatureCoast program as a postdoctoral researcher at Delft University of Technology from the start in 2013 until the end in 2018. He focused on setting up the interaction between the PhD researchers and end-users, as well as integrating the research findings. He worked on developing integrated model forecasts and developed the world's first global beach erosion map. He is currently working as a Specialist at Deltares and as a researcher at the Delft University of Technology on predicting the future behavior of the world's beaches.

Alexander van Oudenhoven (left) was active in the NatureCoast program as postdoctoral researcher at Leiden University between 2015 and 2018. He focused on integrating the program's scientific findings, thereby looking at the potential benefits that nature-inclusive coastal management can generate and how these are perceived. He is currently working as an assistant professor at the Institute of Environmental Sciences at Leiden University, working on the interface between biodiversity, ecosystem services and societies' quality of life. In the spring of 2018, he became Co-Editor in Chief of Ecosystems and People, an interdisciplinary open access scientific journal.

THE SAND MOTOR: A NATURE-BASED RESPONSE TO CLIMATE CHANGE

FINDINGS AND REFLECTIONS OF THE INTERDISCIPLINARY
RESEARCH PROGRAM NATURECOAST

Edited by

Arjen Luijendijk
Alexander van Oudenhoven





Jaap Kwadijk – Deltares

LEARNING FROM NATURE-BASED SOLUTIONS

END-USER PERSPECTIVE

Jaap Kwadijk is Director of Science at Deltares, the Dutch institute for applied research in the field of water, subsurface and infrastructure. He is also a part time professor of Modeling Water Management and Climate at the University of Twente.

In view of the recent discussions on sea-level rise, I think the publication of this book is “just in time.” Over the last two years it has become increasingly clear that the possibility of accelerating sea-level rise may become the greatest challenge for low-lying coastal areas like The Netherlands. If this rise occurs, solutions to cope with it need to be found quickly. Engineering approaches that make maximum use of natural processes, such as the Building with Nature approach, seem to have the largest potential. However, our experience with these solutions is limited. NatureCoast, the research program that studied the Sand Motor, one of the largest experiments with Building with Nature, has added to our knowledge. Such experiments and knowledge are urgently needed.

Pollard and DeConto published a paper in *Nature* in 2016 that woke the scientific community to the issue of sea-level rise. Their results suggested that global warming could cause large parts of the ice sheet of Antarctica to become unstable and slip into the sea more rapidly than has been anticipated. This slipping would increase the contribution of Antarctica to sea-level rise to more than a meter this century. And once this mechanism has started, it will probably prove to be irreversible.

For many years, the debate about global sea-level rise had focused on differences in the order of decimetres, and the contribution of Antarctica was expected to be quite small during the century. Today, the uncertainty regarding sea-level rise during the century is in the order of a meter, or even more, with Antarctica possibly becoming the largest contributor.

On top of that, a recent paper published in *Nature* (Trusel et al. 2018) concluded that the Greenland ice sheet is also melting faster than ever before. In October 2018 a special report of the United Nations’ Intergovernmental Panel on Climate Change concluded that the remaining time window to cut greenhouse gas emissions so that global warming is limited to 1.5 degrees Celsius is now disturbingly narrow, 12 years. Unfortunately, we are not yet on track to reach these goals, as the recent figures on emissions show that global carbon emissions in 2018 have jumped to an all-time high. So my message is crystal clear, we need to accelerate adaptation.

Over the last two centuries, engineering has been extremely successful in sustaining human life in deltas by learning from countless failures and making subsequent improvements. The need to keep pace with increased urbanisation, rapid climate change, and sea-level rise makes the sustainability of deltas an immense challenge. This represents such a large challenge that we need to rethink the capacity of our classical engineering approaches to keep deltas liveable in the 21st century.

The concept of nature-based solutions is often mentioned as the silver bullet solution. And there are good reasons for that. They can be cost-effective ways of reducing vulnerability, and they offer multiple benefits to the environment and local communities. Think of sustaining livelihoods, improving food security and sequestering carbon. This explains why nature-based solutions are also attracting the attention of green investors. But our understanding of these solutions and our experience with them is still very limited. Initiatives are often undertaken without a sound scientific basis. Pilots are also generally too small to judge whether the solutions are applicable for larger areas. This is unfortunate, as the importance of learning by doing can hardly be overrated. It took us 200 years of trial and error with traditional engineering to arrive at the high level we currently have. We do not have another 200 years to learn.

When designing these nature-based solutions, we need to seek multiple benefits. Climate change solutions will never be done exclusively to deal with climate change, but only where they also meet other societal goals. We urgently need to identify how adaptation using nature-based solutions can help societies achieve their wider sustainability goals – for health, well-being, regeneration, equity, and so on. In this way, we can make the societal relevance of responding to climate change clear. To maximize their impact, experiments need to bring together climate science, earth system science, and environmental science. This will improve the ability of scientists to make integrated predictions about the impact of large-scale nature-based solutions. This will also create a generation of scientists with more experience with multidisciplinary research.

NatureCoast delivered much of this. It evaluated a full-scale experiment, not only addressing engineering aspects, but also providing guidance for implementing nature-based solutions at this large scale. The stories about this research experiment are spectacular and will attract young scientists. The many kite surfers and walkers show the pleasure that nature-based solutions can bring.