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Fluid Soils

(Co)Designing for the Wadden Sea Landscapes

edited by Laura Cipriani

Colophon

Fluid Soils
(Co)Designing for the Wadden Sea Landscapes

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Sea dike.
Photo: Heather Wong, 2022.

1 | Fluid Soils

(Co)Designing the Future of the Wadden Sea Landscapes

Laura Cipriani | TU Delft

The relationship between soil and water is at the center of interest now more than ever. Like many other littoral areas around the globe, such as lagoons, wetlands, islands, and their inland areas, the Wadden Sea territories struggle between two opposing forces: permanence and transformation. The war between man and nature is waged on various fronts (i.e. geo-morphological, climatic, ecological-environmental, architectural, and landscape) and in urban settlements. Despite being a UNESCO World Heritage Site of extraordinary environmental value and beauty, the Wadden Sea, its territories, and its people now face an uncertain future while wrestling with latent climatic, economic-productive, and social crises. Subsidence increased by gas extraction and peat oxidation, soil erosion, saltwater intrusion, eutrophication, and agricultural water pollution testify to a territory in the throes of long-term repossession by the sea. Unlike large coastal conurbations, these areas are marginal territories with low levels of urbanization that are characterized by crises and territorial fragility. Notably, these are predominantly rural regions where the countryside becomes the frame within which cities are located. Lands reclaimed from the sea over the centuries now require the radical transformation of agricultural practices and an urgent response to climate change.

Discussing the Wadden Sea landscapes means talking about *soil* and *water*. Better yet, we could even try to mint the binomial *fluid soils* to describe this land. The word *wad* is a Frisian and Dutch term that means ‘mud flat.’ From its etymological root, this intertidal land, which embraces the countries of the Netherlands, Germany, and Denmark, is described as tidal flats, gullies, and salt marshes that have always characterized these places. Which are halfway between land and water.

The coastal lagoon is a dynamic natural ecosystem shaped over the centuries by natural phenomena and ongoing anthropic interventions. Studying geological structure shows us how the Wadden Sea as we know it today most likely took shape 8,000 years ago. The last three glacial periods and their interglacial phases led to a landscape that evolved from large tidal flats into islands of dunes, sand banks, and salt marshes (Vos and Knol, 2015). Around 2,000 BC,

the deceleration of sea level rise allowed salt marshes to expand seaward and coastal peat bogs to increase in size (Vos and Knol, 2015). Between 500 BC and 1500 AD, inland wetlands subsided, reducing the peat landscape, and clay soils were deposited on the coast, leading to further subsidence inland (Vos and Knol, 2015). Starting from the Middle Ages and in the centuries that followed, human actions modified the original geological configuration. For example, the reclamation of the territory with the construction of dams and the closure of the Zuiderzee and the Lauwersezee changed the coastal structure and formed the coastline as we know it today.

Therefore, the soil of the Wadden lands is a complex system of *sand*, *peat*, and *clay* that have been deposited over time. The soil structure of Friesland and Groningen corresponds to that of the sea due to them sharing the same geomorphological characteristics. The belt of marine clay soil extends along the Wadden coastline and lies much higher than the yielded Wadden hinterland. Sand is encountered on the barrier islands and inland areas. Despite their decline over the last century, the peats are located after the coastal clay soil, which provides solid evidence of their geological evolution.

This soil-water fluidity is a geomorphological characteristic that has extended to urban settlements for centuries. To protect from the recurrent floods, starting from 300 BC until around the 10th century AD, the local populations created the first terps—artificial dwelling mounds upon which raised villages were built (Schroor et al, 2017). Instead of interrupting the sea flow with dam construction, the first settlements adapted to the water action by transforming into raised islands during the tidal period. However, with the arrival of the first dams around the 13th century and the subsequent reclamation of salt marshes for agricultural purposes, the villages and their surrounding landscapes suddenly lost their relationships with the sea. Thus, the adaptive dynamism at the basis of the continuous exchange between soil and water was interrupted forever.

Today, the evidence and data collected indicate that the Wadden Sea, like many other coastal areas of the planet, will be one of the places affected by climate change. Referring to studies by the Intergovernmental Panel on Climate Change (IPCC 2014, IPCC 2022) and assuming, for example, an increase in temperature of 1.5 °C, maps indicate that the coastline will consistently retreat. Sea level rise scenarios related to elevations and topographies (see figure page 59) make us question the existence of these landscapes in 2070 and 2100. Eustatism, salinization, and soil subsidence are all phenomena that make us reconsider how much longer these territories will be protected by water. Even more worrying is

understanding what measures to implement when water is scarce and how the ‘great thirst’ can also bring landscapes and economies to their knees.

If the landscape transformations occurring by 2030, 2050, or 2100 are known, the medium-term project scenarios and the decisions underlying these choices are less known. What plans and interventions exist for retreat, adaptation, and resistance? What will happen if we plan interventions for the future now and then implement them? What will happen instead if we start implementing interventions only after some catastrophic events? Will we still have sufficient time to fix the issues? Will we rely on emergency proposals or reasoned choices? Which lands will we preserve? How will we accept or reject the water that will come?

Discussing soils and water also means opening possibilities for tackling climate change. Soils, particularly moist soils, constitute a promising solution to the climate crisis, playing a crucial role in the carbon cycle by absorbing and releasing carbon dioxide. After the ocean, the soil is the most critical carbon deposit. If this is combined with water, the fluid soil of wetland areas or peatlands can absorb carbon in quantities that are much higher than a forest can absorb.

Therefore, the challenge is to intervene along coastlines and within the internal soil areas of the territories. Here, soil and water also serve central roles not only in climate change mitigation but also in the rethinking of entire economies and supply chains linked to the agricultural world. Monoculture practices, water pollution due to pesticides, and the lack of biodiversity in agricultural spaces have exacerbated the climate crisis and made a paradigm shift necessary. In the summer of 2022, the Dutch government provided measures for reducing nitrogen emissions in the provinces of Friesland and Groningen, including restoring peatlands to the detriment of spaces dedicated to agriculture. This top-down approach, which was adopted without the necessary participation processes with the local population, has sparked protests among farmers and fomented political uncertainty.

Can we (co)design the Wadden Sea landscapes instead? How can we transform this crisis into an opportunity? As designers and educators, can we sow hope through the project in its various scales of intervention, from the regional to the most minute? Based upon applied research work in regional scenario-making and local design projects, we attempted to imagine the present and future of the Wadden Sea and its hinterland. The projects developed during the laboratory originated from the belief that the landscape is not only an environmental resource but that it can also become an economic resource—an essential driving force for alternative development and the transition of the territory, its cities,



Mudflat along the Wadden Coast.
Photo: Heather Wong, 2022.

and its people.

Through accurate and concrete plans, we attempt to give life to renewed economies aimed at proposing ideas to close environmental and economic cycles. Starting from the project, the intention is to promote tiny seeds of hope to trigger change. Peatlands, agriculture, energy, and heritage all intersect to encourage economies and social inclusion projects where the landscapes of soil and water become the driving force to overcome the crises.

Book Structure

This publication is the fruit of the Graduation Studio *Water Landscapes of Crisis and Hope* I guided and held during the 2021-22 and 2022-23 academic years at TU Delft, Section of Landscape Architecture with the precious help of colleagues coming from hydraulic engineering, marine ecology, spatial planning, and urban design and in collaboration with multiple local stakeholders such as the Province of Fryslân and Wetterskip Fryslân, the Friesland water authority.

The first part of the work—‘Atlas of Knowledge’—intends to investigate the territories of the Wadden Sea through the development of territorial maps that range from their historical development to current issues: from the geological system of the soil to the water systems, from agriculture to ecological networks, from terrestrial and marine environmental systems to energy networks, from the historical remains of raised villages (terps) to the urban fabric and infrastructure systems of cities. The presented maps constitute a critical operation of data and cartography collections and interpretations from different sources.

What emerges is that the Wadden Sea territory is partly the product of a lengthy geological process of interchange between sediments and water and a relatively recent anthropic process of defense and reclamation when the land is reclaimed from the sea. It is a territory that has long been dominated by a dynamic interchange between land, sea, and sediments, which, starting from the 13th century with the construction of the first dams, transformed into a static landscape due to man’s hydraulic defense works. Historical maps have represented a fundamental step in imagining the future territory since many of these lands, today below hygrometric zero, could be reconquered by water in the future.

Beyond the rich remains of the villages built on the mounds, the present territory presents significant challenges: rising sea levels, soil salinization, subsidence due to gas extraction and drainage practices lowering the water table, sediment dredging, and dumping. These factors have modified the natural dynamic processes of coastal morphology and ecosystems, the urbanization of marine-

based energy infrastructure, and the coming and going of ships, which threatens one of the most delicate ecological ecosystems—the agricultural industry—with its internal water pollution and indifference to ecological networks.

The second part of the work—‘Atlas of Ideas’—is the product of a work initially shared by the entire design studio class aimed at producing—thanks to a series of participatory techniques—shared scenarios and projects over the short, medium, and long terms.

The adopted approach is focused on design as a research method by addressing global-scale challenges through regional-, local-, and small-scale interventions. Territories and cities affected by several climatic, environmental, and economic crises require a holistic approach: from ecological design to resilient planning, from the water management of extreme events to water quality issues and sea intrusion phenomena, and rural-urban landscapes to cultural landscapes and related economic-productive systems.

The design studio included several participatory phases involving the students and some institutional and non-institutional stakeholders to exchange knowledge and ideas. The workshop, entitled *Wet Sand. Wet Mud. Wet Land*, included a co-design session with the Province of Friesland, Wetteskip Fryslân, and experts from multiple interdisciplinary fields. The working group highlighted effective short- and medium-term solutions whose effects could be extended to a long-term time horizon. Looking to the future is necessary to guarantee possibilities that make the territory productive, even in the short term.

All of the proposed plans are based on simple elements and aim to redevelop the landscape by strengthening existing micro-economies or establishing latent economies that can become seeds of potential development. Each project starts mainly from the site specificities of the territory to embrace possible futures and design possibilities.

Following the research and project phases, the work was presented at a symposium and exhibition in Leeuwarden to propose small steps of collective action to narrate and promote the territory, its specificities, its crises, and the possibilities for change. The event, *Embracing the Future of the Wadden Sea Landscapes: Voices and Imageries from Students and Educators*, aimed to propose a moment of reflection and exchange between landscape architecture schools, institutions, and associations. How do young generations and educators envision the future of the Wadden Sea territories? How will these landscapes be modified in the years to come? How do we embrace the past and present and imagine the future? The event focused on landscape design as a catalyst for change. Students and educators



Saltmarsh, Friesland.
Photo: Xinjian Jiang, 2022.

presented design results and ideas on the future of the Wadden Sea coasts and landscapes, from the sea to the beach to the rural and urban inland areas. The hope is to focus on the future of these places, on *fluid soils* and their ecological and climatic transitions, without forgetting how the hope for change starts constructing a *landscape thinking* in the minds of younger generations. Collective work is a way to encourage the construction of transdisciplinary education to tackle today's unprecedented uncertainties and challenges. As in a geological process, I hope that changes to existing practices will take root in the minds and actions of these future professionals. As American soil scientist Charles Kellog once said: '*Nature has endowed the earth with glorious wonders and vast resources that man may use for his own ends. Regardless of our tastes or our way of living, there are none that present more variations to tax our imagination than the soil, and certainly none so important to our ancestors, to ourselves, and to our children*' (Kellog, 1941).