

Towards a trilateral research agenda of the Wadden Sea Area

The importance of international co-operation

This document is the result of intensive discussions between the Dutch Wadden Academy, the Common Wadden Sea Secretariat in Wilhelmshaven and the members of the workshop of the Wadden Academy with 24 German and Danish institutions on 4 December 2009 in Hamburg.
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Introduction

The Wadden Sea Area is a unique man-made landscape. The islands and districts have a long shared history which dates back to the late prehistoric period and which is partly determined by the fact that a similar segmentation of the landscape is recognisable everywhere along the coast. The region lost its prominent political and economic position in the 19th and 20th centuries and became an agricultural – and later also a tourist – area on the periphery of the new nation states of Denmark, Germany and the Netherlands. Despite these common aspects of the region’s historical development, the island communities and the coastal districts have a distinctive character of their own (see **figure 1**). The present economic structure and development of the Wadden Sea Region shows major differences but also similarities.

The Wadden Sea Area as a unique region has to be treated with extreme care. This realisation has gained in influence at local, regional, national and international level. In the Netherlands, over a quarter of a million people live, work and spend their leisure time in the Wadden Sea Area. The number of people who feel involved in the natural tidal flat system is many times that figure. The increasing realisation of the region’s unique value has resulted in legislation and regulations, the guiding principle of which is to preserve the natural value and cultural-historic value of the Wadden Sea Area, allowing shared human use where this is sustainable.

The international Wadden Sea has evolved over the last 8,000 years, and is therefore a very young ecosystem in geomorphological and evolutionary terms. It is one of the world’s most beautiful examples of a temperate-climate sandy barrier coast that developed with the rising sea level in the Holocene (see **figure 2**). The present Wadden Sea is unique in that it consists entirely of a tidal system with sandy-muddy sedimentation and only minor riverine influences on morphodynamics. The Wadden Sea ecosystem is characterised by a system of tidal flats and barrier islands with extensive salt marshes. The Wadden Sea is also the only depositional system of this scale and diversity in the world. The tidal flats in the Wadden Sea form the largest unbroken stretch of sandflats and mudflats worldwide, accounting for 60% of all tidal areas in Europe and North Africa. As such it is ‘the only one of its kind’ and a textbook example of an intertidal habitat and the rich and diverse flora and fauna it sustains. Many examples of biogeomorphological processes can be found in the coastal dunes, the salt marshes, and on the tidal flats with mussel beds and eel grass meadows. This transitional environment between land and sea is characterised by the constant change of flood and ebb tides, great fluctuations in salinity, high temperatures during summer and occasional ice cover in winter. These circumstances have created numerous ecological niches, colonised by species that are adapted to these extreme environmental conditions.

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The trilateral Wadden Sea Area (see **figure 3**) has a prominent and special role in the global ecosystem. The Area represents unique natural values, the protection of which is laid down in legislation and regulations. The Wadden Sea Area also represents great value for the people

who make their living from it. In addition, the movable and immovable heritage is an important force in creating identities and communities. An interdisciplinary perspective on value(s), valuing practices and value creation is therefore an obvious item on a trilateral research agenda. A trilateral research agenda has to set itself the goal of compiling knowledge on the way in which the natural and cultural values of the trilateral Wadden Sea Area are experienced and formed and how they can be incorporated into innovative and sustainable use by residents and visitors.

Trilateral Wadden Sea research has for many years been dominated by the natural sciences. Socio-economic research and, to a lesser extent, historical research is grossly under-represented in terms of volume and importance. The Wadden Sea Area should figure more prominently on the research agenda of economists, historians, sociologists,

psychologists, anthropologists and cultural scientists. They can identify those who feel involved in the Wadden Sea Area and in what way, how this involvement is justified in history, what interests are at stake, what reference images of the landscapes are used and how this will affect the future of the area.

There is a great deal of professional knowledge about the trilateral Wadden Sea Area but existing knowledge and expertise is, to a large extent, fragmented and compartmentalised. The lack of an interdisciplinary approach is a limiting factor when it comes to understanding how the Wadden Sea Area functions as a system, e.g. in terms of shared human use, climate change (including sea-level rise) and nature restoration measures (Wadden Academy 2009).

In a system approach, different elements, features and processes of a (linked natural/socio-economic/cultural) system are explicitly brought into contact with each other. The emphasis is on the following aspects: feedbacks between and within different subsystems, consistency of the descriptions, coherence of different process descriptions on several scales, completeness of the descriptions and verifiability of the descriptions and the availability of the necessary data and/or experiments.

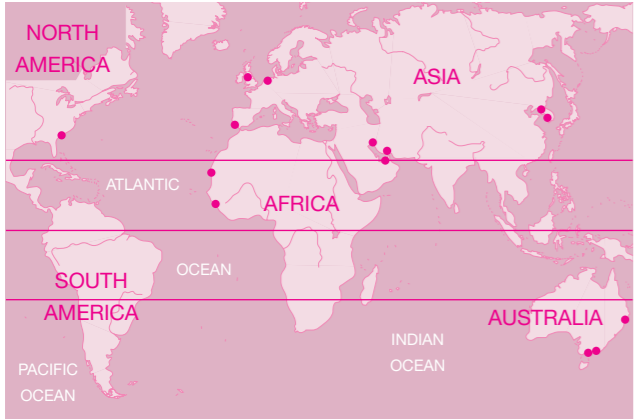


figure 2 A few important coastal zones with barrier islands and tidal flats.

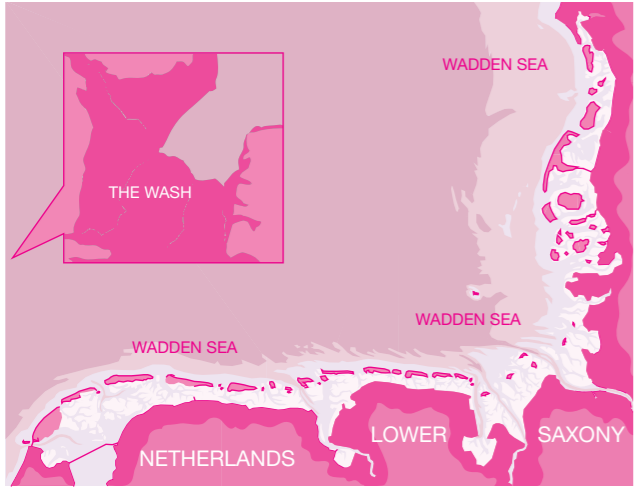


figure 1 The island communities and coastal districts of the Wadden Sea Region (Lancewad).

A new boost for scientific cooperation in the Wadden Sea Area

The lack of an integrated interdisciplinary approach calls for a major improvement in coordinating research on the international Wadden Sea Area across national boundaries. The keywords here are *change* and *scale*.

Major *changes* are occurring in the global environment, human activities, the legal regime and the socio-political situation. All of these changes have an impact on the Wadden Sea system and none is restricted to one country only. These changes require new international research which focuses not only on ecology and the consequences of human activities but also on the socio-economic, legal and cultural-historical dimensions of the Wadden Sea Area.

The *scale* of the system that undergoes these changes and reacts to it is the whole Wadden Sea Area in its relations with the rest of the world. Reasons for organising research at the trilateral level are manifold. To name a few: the common responsibility for the Wadden Sea as a key element in the world ecosystem; the important exchanges within the (international) Wadden Sea and between the Wadden Sea as a whole and the surrounding area; the existence of substantial and interesting gradients within the Wadden Sea; the diversity of management issues and instruments in the region; the need to continuously update policy instruments to take account of new needs and common legislation.

Need for a shared infrastructure for science and monitoring

At the trilateral level, much has already been achieved regarding common monitoring and assessment via TMAP (Trilateral Monitoring and Planning). However, more is needed. Recently, initiatives have been started to intensify and computerise the monitoring of nature and the environment and to extend this to the monitoring of social impacts. This will create completely new possibilities for gaining an insight into processes that previously escaped ‘standard’ monitoring systems. The harmonisation and integration of these efforts could create a ‘shared workspace’ for the Wadden Sea as a whole which will be an additional stimulus for all participants to perform excellent research. In addition, common European legislation makes it necessary to develop common, scientifically sound preservation objectives and assessment methods. A particular challenge in this respect is the expected changes in the ecosystem as a result of climate change and species invasions.

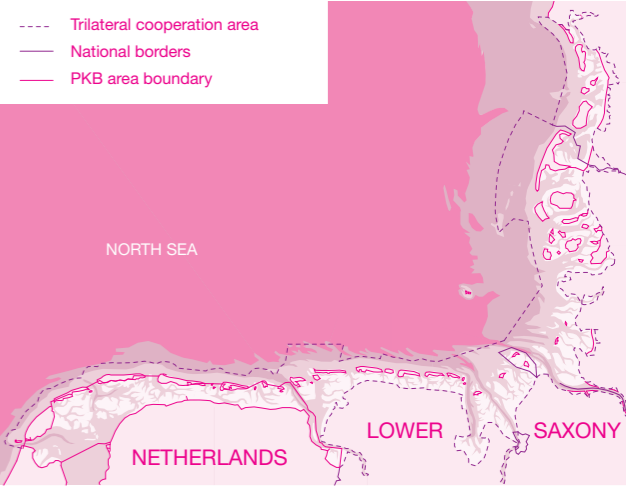


figure 3 the international Wadden Sea Area
‘The international Wadden Sea Area’ is used to denote the entire area that borders on the international Wadden Sea from the western Netherlands to western Denmark. This mainly coincides with the PSSA (Particular Sensitive Sea Area).

Trilateral research perspective

The domain areas for which a trilateral research agenda is urgently needed are listed below:

1. Geosciences

For many decades now there has been effective coordination and cooperation in relation to geoscientific data, information and cross-border mapping programmes relating to the soil/subsurface of countries in the European Union (via EuroGeoSurveys). However, the cross-border geoscientific data and information with regard to the Wadden Sea Area is incomplete. The responsible parties are the Geological Surveys of the Netherlands, the relevant German federal states, and Denmark, which parties also handle the implementation.

There are three subjects in which – in addition to the existing programmes – closer international cooperation has an added value. They are (1) research into processes, the interaction between these processes and the properties of rocks, faults and fluids deep below the earth and close to and at the surface, (2) transnational reconstructions of the development of the Wadden Sea Area from about 8000 BC till present and (3) the development of hydrodynamic and geomorphological modelling tools for the entire trilateral Wadden Sea Area with an emphasis on modelling sediment balances.

Reconstruction of the geomorphology and ecology of the area over the past millennia is a very important tool to develop our understanding of how a region reacts to relative sea level rise. Recorded changes in ecosystems as well as sediment balances and the development of geomorphological features will allow prediction of ‘natural’ responses to climate change.

It will be an excellent test bed for models predicting geomorphological adaptation, but will also permit to evaluate the relative merit of different mitigation strategies (e.g. sand suppletion, managed realignment, innovative coastal defence) for climate change.

An essential element in our understanding of geomorphological adaptations is the availability of state-of-the-art hydrodynamic and geomorphologic models for the area. Country boundaries do not correspond to natural boundaries in this region that shares water, currents, sand and fine sediment. A consistent approach for the large-scale development of the area requires the availability of common tools allowing future scenarios to be modelled and able to take into account different mitigation strategies and their cross-boundary effects.



2. Ecological interactions within the Wadden Sea ecosystem and between the Wadden Sea, the North Sea and the rivers

The dominant sources of nutrients, mud and organic matter for the Wadden Sea are the English Channel and the Rhine and, to a lesser extent, the Elbe and smaller rivers. The dominant residual current runs from southwest to northeast. Because of this, the region has a natural gradient in concentrations of mud and nutrients and therefore also in the extent to which they determine the dynamics of the ecosystem. Research must take maximum advantage of the existence of these gradients to establish causality.

The existence of these gradients means that the options for natural development are not the same all over the Wadden Sea. For example, although it has not been possible to reintroduce eel grass in the Dutch Wadden Sea for years, eel grass is doing reasonably well in the north-eastern part of the German Wadden Sea. Then again, the reverse seems to be true for mussels. An international perspective may lead to a situation where a regional approach to organisation and management is taken with regard to those elements of the ecosystem that have the best chances, particularly if compromises are not the best solution for any individual element. Maximum biodiversity in the region as a whole is not by definition the same as maximum diversity within each subregion, although such considerations will have to be handled with great care.

Important populations in the Wadden Sea, e.g. marine mammals and birds, move freely within the international Wadden Sea, but their numbers have been observed to show different trends in different parts of the Wadden Sea. Identifying the reasons for this may provide insight into the factors that are the most relevant to maintaining or boosting these populations, or into the factors that relate to global change phenomena and are beyond (local) management.



3. Comparative research between the Wadden Sea and estuaries elsewhere; research into the global importance of the Wadden Sea

Comparative research between the Wadden Sea and estuaries elsewhere in the world should be explicitly regarded as Wadden Sea research. There is also the possibility of studying the management of the Wadden Sea and the connection between human and natural values in the region as an example that is valid for other ecosystems of global importance. Tensions between preserving and developing internationally important natural values on the one hand and the regional or subregional development of a sustainable and just society on the other hand are a typical aspect of this problem. There are considerable differences between areas in terms of population density, human pressure and methods for managing them. To a varying extent, exploitation and habitat loss have resulted in the ‘decapitation’ of the food web or altered the biogeomorphology. As such, an international comparison could produce a ‘chronosequence’ of human impacts and form the basis for a broader perspective on the management of such internationally important ecosystems.

For those studies that take place on a global scale it is imperative to take the perspective of the Wadden Sea as a whole. This implies that this research should be organised in conjunction with international colleagues involved in Wadden Sea research. Moreover, the logistics of such studies requires parties to combine forces to the maximum extent. It also provides an excellent platform for exchanging and supplementing scientific expertise.

4. Regional research into the causes and effects of climate change

The smallest scale at which it is possible to make a reasonable judgement on climate change is smaller than the scale of the international Wadden Sea. Within that area it is therefore possible to make judgements on new gradients and differences. It is an obvious move to combine and coordinate efforts aimed at regionalising climate models. In addition, many of the effects of climate change will be similar (e.g. sea-level rise, migration of populations, temperature change, acidification, etc.) and it is essential to conduct common research into these effects. The possibility of combined mitigation measures may also be of interest in this (largely sand-sharing) system.

5. Comparative research into cultural history and socio-economic characteristics of society within the Wadden Sea Region

The man-made landscape of the Wadden Sea Region is a rich, complex and irreplaceable entity. It has great potential both with regard to its intrinsic value and its role in economic development. From an economic perspective the landscape of the Wadden Sea Region is, as with many other man-made landscapes today, changing from a production area into a consumption landscape. There is a growing need for distinctive and unique landscapes, for places with stories and histories that offer inhabitants and visitors new perceptions and experiences of life and reflection and that offer inhabitants and entrepreneurs new opportunities in income production. The question is: where will new forms of human use of the region conflict with the preservation of the Wadden Sea Area as a nature reserve? To answer this question, it is essential to know how residents of the area live their lives and earn their living

and how visitors regard the region and make use of it. And how did this way of living in and making use of the region develop historically? With its unity in regional diversity, the Wadden Sea Area offers interesting options for comparison in this regard. It is interesting to study the factors in history and in the current world economy which have contributed and are contributing to differences in political and social development of the various regions and differences in the way in which the inhabitants of different regions within the Wadden Area deal with the natural environment and natural resources. Different answers to common questions obtained via trilateral comparative research could also be a source of inspiration and innovation for policy makers.

6. Economic trends, developments and planning from an international perspective

Regional and national economies are becoming ever more closely interwoven because the specialisation of production processes is taking place on a global scale in locations where the greatest benefit can be derived from economies of scale or cost advantages. As a result, international trade and transport flows have increased and also affect the ports in the Wadden Sea Region. Economic activities like fishing, agriculture and tourism are also subject to international competition. When deciding whether the Wadden Sea Area is to play a part in the production or distribution of goods, it is essential to make an overall assessment from a trilateral perspective of the costs and benefits

of alternative locations inside and outside the Wadden Sea Area that serve the same sales market and of locations all over the world when the production of transportable goods is involved. International planning can also highlight important aspects of scale. For example, concentrating wind farms in a particular area can produce both economies of scale in terms of the maintenance and transport of electricity and diseconomies of scale if the barriers to bird migration become too high.

Interesting trilateral research questions come up such as: How can endeavours to create work, income and quality of life for the residents of the trilateral Wadden Sea Area be put into effect in a sustainable manner? What demographic trends can be expected in the trilateral Wadden Sea Area and what will be the consequences for the quality of life in the coastal villages? How can the trilateral Wadden Sea Area adapt to global trends in the economy and external developments such as climate change? How resilient is the Wadden Area to shocks such as the credit crisis? Much research into sustainable development has been conducted at the national level. Given the common fate of the area, there is a need for common trilateral sustainability standards, based on a common vision for the whole Wadden Sea Area. The Wadden Sea Forum (WSF) has already made a start in 2005 with its report 'Breaking the Ice'.

7. Comparative research into policy, management and methods

Most research into management in the Wadden Sea is done at national level and the research area is confined within national boundaries. However, there is a pressing need for comparative analysis. For example, the evaluation of Dutch shellfish fishery policy (EVA II), would certainly have gained added value if there had been a parallel and comparative study in other parts of the Wadden Sea. Also, comparison with Wadden Sea-like ecosystems in other parts of the world could provide added value, e.g. in the case of sustainable fishing. Another important challenge for tri-lateral research is to gain more insight in the economic and monetary valuation of the natural and scenic assets in the Wadden Area. This can be used for the further development of the social cost-benefit analysis (SCBA) as a policy and decision-making tool for assessing whether or not interventions in the Wadden Sea Region can be allowed.

Moreover, all three Wadden Sea states are subject to the legal EU framework regime (N2000, Water Framework Directive) and have, to a great extent, the same requirements regarding monitoring, assessment and reporting. Harmonising the approach (e.g. evaluation systems, profile documents, etc.) and monitoring would provide significant advantages in this case, both in practical terms and with regard to consistency.



The Wadden Academy

Devising a sustainable future for the Wadden Sea Region requires new knowledge and expertise concerning the natural, economic and socio-cultural condition and development of the region. For that reason, the Dutch government decided in 2008 to set up the Wadden Academy, an institute belonging to the Dutch Royal Academy of Arts and Sciences (KNAW). The Wadden Academy has the task of providing a sound scientific basis for the management of the natural and social values represented by the Wadden Sea Region.

On 30 May 2009, the Wadden Academy presented the integrated research agenda ‘Knowledge for a sustainable future of the Wadden’ to three members of the Dutch government. The research agenda provides an overview of the gaps in knowledge and the most pressing scientific questions.

In the course of 2009, the Wadden Academy has established contacts with German and Danish scientists, with the aim of reinforcing scientific co-operation across boundaries in the Wadden Sea Region, and to establish a common international research agenda. There is a strong common feeling that international research programmes are called for, given the closely-knit relationships between the different parts of the Wadden Sea and the fact that research efforts must be adapted to the scale of natural processes of interest. For more information: www.waddenacademie.knaw.nl

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