# Trilateral Climate Change Adaptation Strategy
## Monitoring Report

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The Wadden Sea World Heritage Site since 2009

WADDEN SEA WORLD HERITAGE

Common Wadden Sea Secretariat

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## Content

# 1. Introduction

In the 2010 Joint Declaration, the three responsible governments adopted a **common vision** for the Wadden Sea:

***The Wadden Sea is a unique, natural and dynamic ecosystem with characteristic biodiversity, vast open landscapes and rich cultural heritage, enjoyed by all, and delivering benefits in a sustainable way to present and future generations.***

Climate change and increasing sea level rise may seriously impact the structure, functions and the characteristic biodiversity of the Wadden Sea ecosystem as well as the safety of the inhabitants of the region. As a long-term impact, it is possible that not enough sediment will be available to balance increasing sea level rise. As a result, the Wadden Sea may start to drown, i.e., evolve from an intertidal to a lagoon ecosystem. Further, without proper measures, higher storm surge water levels will lead to increased flood risk.

The Trilateral Wadden Sea Cooperation therefore aims to achieve resilience[1] to climate change. At the 12th Trilateral Governmental Conference on the Protection of the Wadden Sea in 2014, a trilateral Climate Change Adaptation Strategy (CCAS) to enhance and promote policies and measures necessary for increasing resilience of the Wadden Sea to impacts of climate change was adopted. The objective of the trilateral cooperation in implementing the strategy is to achieve optimal added value by focusing on activities with the highest trilateral relevance, in particular the exchange of knowledge and best practice between experts and policy makers, as well as the support of trilaterally coordinated studies and pilot projects covering sites across the entire Wadden Sea. The Task Group Climate (TG-C) was assigned to monitor the implementation of the Climate Change Adaptation Strategy.

In the CCAS, it is stated that, under the precondition that the safety of the inhabitants is guaranteed, resilience to climate change in the Wadden Sea region may best be achieved by implementing an adaptation strategy that consists of seven basic elements: Natural dynamics, Interconnectivity, Integration, Flexibility, Long-term approach, Site specific approach and Participation. For each element, priorities for implementation that will contribute to a more resilient Wadden Sea region with respect to climate change are listed in the CCAS.

In this report, the seven elements are assessed with respect to their general status and priorities. Monitoring is mainly based on an inventory of projects and policies within the Wadden Sea. This information was collected by the TG-C in a Wadden Sea Climate Change Adaptation Information Platform in the framework of the EU Interreg project "Building with nature". The platform is hosted and publicly available under the CWSS website (CWSS, *www.waddensea-secretariat.org*).

[1] The terms resilience and adaptability have a similar meaning. The IPCC has defined resilience as follows:
"The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change." (IPCC Fourth Assessment Report - Climate Change 2007: Synthesis Report; Annex II; Glossary)

Further, recommendations for each of the elements are given. To monitor the implementation of the CCAS, TG-C organized a trilateral workshop together with the EU Interreg project “Building with nature” on 26 - 27 September 2017. Main findings of the workshop are incorporated in this report. The report ends with a summary and recommendations. The main findings will also be fed into the Ministerial Declaration 2018.

# 2. Monitoring and Recommendations

In this chapter, the seven basic elements: Natural dynamics, Interconnectivity, Integration, Flexibility, Long-term approach, Site specific approach and Participation, are assessed with respect to their general status and priorities. Finally, general and specific recommendations are given for each element. The first two elements of CCAS, Natural Dynamics and Interconnectivity, are intended as strategic objectives for the Wadden Sea (eco)system. The other five elements are guiding principles for climate change adaptation plans, projects, policies and strategies.

## 2.1. Natural Dynamics

### Description of objective (from CCAS)

The Wadden Sea ecosystem is more than 5,000 years old and has already endured periods of strong sea level rise as well as more frequent and severe storms. In a natural state, sediment redistribution maintains a dynamic equilibrium that makes the Wadden Sea quite resilient to external changes. Thus, allowing and restoring natural dynamics can increase the resilience of the Wadden Sea to climate change.

### General status

In large parts of the Wadden Sea natural dynamics are present and dominant in shaping the area. Nevertheless, numerous human activities influence the natural dynamics. In most cases, the impact of human interference is relatively low with respect to natural dynamics themselves. For instance, the volumes of dredged material or sand nourishment are usually (very) small compared to the natural transport of sand and silt. In the past, more substantial interventions were made to the natural system. The most prominent examples are land reclamations and closure dams. Most of these were completed some decades ago, but still have significant impact on the (morphological) development of the Wadden Sea. Human influence – even minor – is by definition not part of natural dynamics and may alter the natural development of the system. Due to a lack of insight into the highly complex system, it is difficult to precisely determine the anthropogenic impact. The lower Ems estuary is one example where various forms of human influence have led to a problematic situation.

Sometimes human activities make use of natural dynamics, for instance by supplying additional sediment (instead of applying hard techniques) and removing (old) barriers to maintain the coastline. Some parts of the coastal dunes, as part of the coastal protection system, are maintained by means of sand supply on foreshore and beach. Natural dynamics transport the sediment into the dune, sometimes combined with sand accumulation measures (e.g., sand fences).

Monitoring the general status of natural dynamics is a challenge, as objective parameters are missing or at least not harmonized within the trilateral region. In addition, a clear definition of

natural is hard to develop given the fact that human activities have already influenced the developments and dynamics of the system for a long time. Present legislation in general effectively prevents a strong disturbance of natural dynamics. Natura2000 legislation is a dominant factor in this. However, there is general concern regarding cumulative effects of ongoing human activities on the natural dynamics of the Wadden Sea and several organisations campaign to further limit activities. Conflicts between different interests and activities continuously need to be handled. Furthermore, it is essential that more knowledge is gained on the effect of human activities on the complex natural dynamics.

### Monitoring of the priorities

- *"Evaluate the effects of different measures (e.g., for coastal risk management) on natural dynamics"*
  Under present EU-legislation, artificial measures that may significantly impair the ecosystem are to be preceded by an environmental impact assessment (EIA). In these EIAs, the possible impact on natural dynamics is inherently considered. Several research projects have looked into the effect of activities in the Wadden Sea and their influence on the Wadden Sea morphological and ecological system. Due to the lack of a clear definition of natural dynamics, there is no general overview on how present management of the Wadden Sea is influencing natural dynamics. Sufficient information is available to be able to make good assessments of impacts of initiatives on natural dynamics on smaller time scales. However, in the long term this is much more difficult, due to large uncertainties in morphological developments and subsequent effects.

- *"Promote and support management measures that consider, allow and/or support natural dynamics"*
  There is a movement towards working with nature in the Wadden Sea area. In the EU Interreg project "Building with Nature" different approaches in building with nature techniques are compiled and assessed according to their applicability and performance in achieving different goals, such as safety and climate proof morphological dynamics in the Wadden Sea area. All three Wadden Sea countries as well as CWSS cooperate in this project. WWF Germany developed an overview of best practice projects to inspire other projects. All presented examples contain the element of natural dynamics (WWF, *www.wwf.de/watt/KliAnpGlobal*) and show that it is possible to solve problems by working with nature.

- *"Limit measures that induce negative sediment budgets in the Wadden Sea"*
  In the Netherlands all sediments must remain in the system in accordance with present policies. It is not allowed to mine sand, and dredged sediments are to be disposed within the system itself. New activities that cause subsidence are to be compensated by sediment input by additional sand nourishment. In Schleswig-Holstein, the strategy "Wattenmeer 2100" aims to limit activities that induce negative impact on sediment budgets. Sediment should not be extracted from the system. If unavoidable, the extraction should be

compensated by sediment input from outside the system. A Dutch-Lower-Saxon bilateral agreement provides for the establishment of an ecological sediment management concept for the Ems estuary based on the Ems-Dollart-environmental protocol.

- *"Evaluate legislation and suggest improvements in relation to this objective"*
  Legislation has not been evaluated at the trilateral level. In the Netherlands the PKB (planologische kernbeslissing) Waddenzee was evaluated as part of the process of developing the next spatial plan for the Wadden Sea. It was concluded that protection of the Wadden Sea and its values, amongst others the value of undisturbed natural processes, is generally effective. It was also concluded that there is a need for an integral approach aiming at further improving the quality of the Wadden Sea and supporting sustainable economic development, and an approach that also deals with the dilemma between strict (sectoral) protection legislation and integral quality improvements.

## Recommendations

Natural dynamics are a leading objective of the CCAS. Since they are one of the most important qualities of the Wadden Sea, it is recommended to continue to strive for natural dynamics to the greatest possible extent. Many governments and other actors working in the Wadden Sea support and use the idea of working with, or restoring, natural dynamics. However, especially with respect to flood safety, natural dynamics can, of course, also cause a threat. It is a logical response to then limit natural dynamics in order to safeguard human interests. Continuous dialogue is required on this delicate balance. It is recommended to continue exchanging knowledge and experience on this dilemma, a.o. in a trilateral task group.

Further, it is recommended to

- Continue to limit measures that induce negative sediment budgets in the Wadden Sea and enhance the trilateral cooperation on sediment budget studies;
- Investigate whether (objective) parameters can be introduced to monitor the status of natural dynamics (e.g., sediment budgets, morphological states of tidal basins and ebb tidal deltas, species distribution). Such parameters might also be used in reporting to UNESCO on the status of the world heritage;
- Discuss how to deal with the scenario that natural dynamics are not responding in a self-sustaining manner to sea level rise or cause unwanted effects. This can be large scale issues, such as drowning of tidal flats, but also on smaller scales. In effect, if negative impacts occur, should we intervene or let natural dynamics occur?

## 2.2. Interconnectivity of habitats

### Description of objective (from CCAS)

The trilateral Wadden Sea forms a central element within the European Green Infrastructure (COM/2013/0249 final) along the south-western North Sea coast. It provides the necessary interconnectivity of habitats to allow species and communities to follow shifts according to climatic conditions in easterly and northerly directions, thereby preventing species extinction and securing adaptation of characteristic biodiversity far beyond its original borders.

### General status

Interconnectivity between habitats is an important feature with respect to climate change, especially in the Wadden Sea region. A broad understanding of connectivity in (landscape) ecology concerns the possibility of organisms to move (actively or passively) from one resource patch to another. For example, birds are able to change their breeding site by moving from one saltmarsh to another on a different island, or certain fish species are able to move from marine habitat to fresh water habitat upstream an estuary.

Species migration due to rising temperatures is already taking place, e.g., thermophile fish species like sardines, anchovies and mullets migrate into the warming Wadden Sea. Furthermore, accelerated sea level rise may seriously impact the specific habitat structure, functions and the characteristic biodiversity of the Wadden Sea. A climate change related increase in frequency of higher floods during summer may cause additional clutch losses for coastal birds breeding in the saltmarshes. Currently, the interconnectivity between marine and fresh water habitats is in many places artificially interrupted by dams, dikes, gates and sluices. In most cases, removing these barriers to restore interconnectivity is hard given other interests. However, an improvement of water management means, such as (temporal) openings or fish traps is more feasible to reconnect these habitats.

The objective of interconnectivity should not be misinterpreted to mean that all habitats should be interconnected. As an example, islands are, normally, effectively separated from each other and from the mainland for non-flying terrestrial animals. In the long-term, specific (endemic) assemblages of species and habitats may result from this isolation. This aspect should also be considered in the preparation of measures to further interconnectivity.

## Monitoring of the priorities

- *"Secure and enhance the interconnectivity of habitats, both marine and terrestrial"*
  Habitats, such as tidal flats, salt marshes, beaches and dunes are frequently influenced by human activities that restrict interconnectivity. In particular, the interconnectivity between marine and freshwater habitats is frequently interrupted by human constructions. Coastal flood defences block the migration of vertebrate as well as invertebrate species, such as a number of fish species, between these habitats. Due to an increasing sea level rise, these defences will have to be strengthened. Integrated and innovative solutions can offer opportunities to (partly) restore interconnectivity (see also integration). Further, the trilateral "Swimway" – which is still in the initial phase – may serve as a good example to overcome insufficient interconnectivity. As such, this initiative could be considered priority also from the climate adaptation point of view.

- *"Provide, as much as possible, space for the restoration of habitats lost due to climate change"*
  There is a significant demand to protect existing habitats and restore those that were lost in the past, in particular salt marshes and natural dune habitats. However, restoration is time-consuming, including the negotiation in multiple-stakeholder processes. Examples for restoration sites are the salt marsh restoration projects in Noord-Friesland Buitendijks (NL), Langwarder Groden (GER), Langeoog Sommerpolder (GER). There are also examples of dune restoration projects allowing dunes to develop in a more natural and dynamic way. A number of case studies on climate adaptation along soft coasts also from outside the Wadden Sea region have been collected in a WWF-report (WWF, *www.wwf.de/watt/KliAnpGlobal*).

- *"Exchange and communicate practical field experience with restoration measures"*
  There has been a continuous information exchange within the TG-C. The task group, together with the EU Interreg project "Building with Nature", organized a workshop on Best Practices in Climate Change Adaptation in the Wadden Sea region, including nature restoration projects.

## Recommendations

While the existing protection regime in the Wadden Sea is already a remarkable asset with regard to the ability of its biodiversity to survive in the future under a changing climate, there are some highly relevant improvements to be recommended:

- Reduce man-made barriers between habitats as much as possible or make them more permeable. In this context, strengthening campaigns for flood defenses due to stronger sea level rise may be utilized to restore or optimize interconnectivity where possible;
- Regularly exchange knowledge and experiences between the climate adaptation and nature restoration projects all over the Wadden Sea region and beyond;
- Increase (passively or actively) the naturalness of habitats (contributing to interconnectivity) wherever possible, as this may, in many cases also be the best way to increase the resilience against climate change, including sea level rise;

- Maintain islands separated from each other and from the mainland and avoid human-induced movements and introductions of species to islands. This is especially valid for terrestrial predators that severely impair breeding bird populations. Reverse previously occurred introductions/invasions where possible;
- Encourage the further implementation of an environmentally sound approach in coastal protection, e.g., based on sediment management and the philosophy of "Growing with the Sea" as well as on Building with Nature principles that may significantly contribute to the maintenance and strengthening of the interconnectivity of habitats.

## 2.3. Integration

### Description of principle (from CCAS)

Climate change may have an impact on many different Wadden Sea ecosystem features and elements, human activities and interests, at various spatial and temporal scales. It is important to recognize that climate change is a cross-cutting theme. Therefore, dealing with impacts of climate change requires an integrative approach across borders, disciplines, sectors and administrative layers (Integrated Coastal Zone Management - ICZM). It concerns, first of all, the sectors and disciplines dealing with coastal risk management, nature protection and spatial planning. For measures that may have an impact across national borders, e.g., large-scale sand extraction and suppletion, trilateral cooperation and coordination are a necessity.

### General status

The Trilateral Wadden Sea Cooperation with all its components and associated activities is an example of (partly) integrated management. Yet, an integrated and trilateral climate change adaptation management approach where climate change resilience is assessed based on needs, options, opportunities, constraints, limits, and other aspects associated with adaptation across the entire Wadden Sea region, is not in place. Of course, the CCAS and the work of TG-C are steps towards such an approach.

However, integrated adaptive measures are increasingly embedded in sectoral planning processes and different sectors and administrative layers are increasingly cooperating to deal with climate change issues. The challenges resulting from climate change for coastal risk and water management are more and more dealt with in integrated approaches where other interests, such as nature, landscape, culture and tourism are also considered.

At a trilateral level, the Trilateral Wadden Sea Cooperation has a broadened scope, i.e., considering cultural and risk management aspects as well. Furthermore, integrated adaptation experience is accumulating across regions in the public and private sector and within communities. Governments at various levels are starting to develop integrated climate adaptation plans and policies and to integrate climate change considerations into broader development plans.

Adaptation planning and implementation can be enhanced through integrated and complementary actions across levels, from individuals to governments. National governments can coordinate adaptation efforts of local and subnational governments, for example by protecting vulnerable groups, by supporting economic diversification, and by providing information, policy and legal frameworks, and financial support. Also local governments, ad-hoc groups working in bottom up initiatives and the private sector are increasingly contributing to climate change adaptation by scaling up adaptation of communities, households, and civil society.

## Monitoring of the priorities

- *"Promote and support trilateral pilot projects on integration of disciplines and sectors, including administrative layers"*
  The Trilateral Cooperation on the Protection of the Wadden Sea with all its components and associated activities may be seen as a best-practise example of integrated management. Both initiatives deploy a number of cross-sectoral and multilevel working groups that deal with varying management aspects. Almost all interests and interest groups (including science) are represented in these initiatives.

- *"Promote and support integrative measures for increasing the Wadden Sea resilience"*
  At the 14th International Scientific Wadden Sea Symposium on 8 - 11 May 2017 in Tønder, a first draft for appropriate future trilateral research, was discussed regarding the Wadden Sea World Heritage. It has one focus on interdisciplinary research including the topic of climate change.

- *"Continue and further strengthen TG-C activities, including exchange of best practice"*
  TG-C activities have been continued in the period 2014-2018. The work contained the monitoring of the implementation of the Trilateral Climate Change Adaptation Strategy, exchange of best practice on relevant spatial planning and a workshop on climate change adaptation measures. A workshop on exchange of best practices was organised in September 2017.

## Recommendations

- Further support inclusion of the integration objective of CCAS into ICZM approaches where those already exist and promote implementation of ICZM approaches as an optimum base for climate change adaptation;

- Investigate to what extent national and regional policies and legislation in the three Wadden Sea countries stimulate integrative approaches across borders, disciplines, sectors and administrative layers.

## 2.4. Flexibility

### Description of principle (from CCAS)

There is considerable uncertainty about climate change and its impacts regarding direction, timing and magnitude (e.g., variability in plausible sea level rise projections). These uncertainties require a flexible approach with regard to Wadden Sea policy and management, as well as close contacts with the scientific community. So called no-regret-measures may contribute to a flexible approach that considers uncertainty. An adaptive management consisting of such measures should be beneficial even if the expected development does not occur, for instance if sea level rise turns out to be lower (or higher) than anticipated. No regret should also be applied concerning the natural values and the integrity of the Wadden Sea. Furthermore, flexible approaches contribute to the ability to respond adequately and in a timely manner to new information regarding current and future changes in drivers and impacts (adaptive management). Finally, flexibility means that measures should be adaptable to new circumstances. It is important to improve insight into possible tipping points in time. These tipping points require fundamental choices, and that may influence our opinion on no-regret measures that we plan in the short term.

### General status

Awareness of the importance of flexible approaches has increased in coastal flood defense, policies and water management. Flexible approaches in the form of no-regret measures may optimally deal with the uncertainties inherent to climate change. Sand replenishment is seen as one of the no-regret measures that can easily and promptly be adjusted to the actual rate of sea level rise. Furthermore, it is seen to be more sustainable in comparison to otherwise needed hard measures. If hard technical measures, such as strengthening sea walls become necessary in Germany, building reserves are considered in the design of the constructions. This no-regret measure allows for relatively simple adjustments of the constructions if sea level rise becomes stronger than anticipated. The Dutch Delta Programme promotes adaptive Delta Management in which flexibility with respect to uncertainty is a key item.

From a scientific point of view there is still a considerable lack of insight into possible future developments of the Wadden Sea (e.g., tipping point discussion). Besides sound monitoring, this requires further improvement of the scientific basis for possible future developments. The focus should be on the full spectrum of climatological impacts (further regionalization of global scenarios, morphological and ecological impacts) as well as the development and evaluation of measures to deal with those.

## Monitoring of the priorities

- *"Develop policy guidance for adaptive management under different climate change scenarios, focused on each tidal basin of the Wadden Sea"*

  In all three countries climate change adaptation strategies with a focus on the Wadden Sea region exist. They all contain principles of adaptive management and deal with different climate change scenarios. These strategies do, however, not focus on individual tidal basins but usually deal with administrational units.

- *"Optimize and secure the Trilateral Monitoring and Assessment Program (TMAP) for rapid feedback regarding climate change issues"*
  The present Trilateral Monitoring and Assessment Programme (TMAP) covers a broad range of physical and biological parameters. This provides a sound basis to evaluate the present state of the Wadden Sea ecosystem. As it not well known how the hydro-morphological and ecological system responds to climate change – especially in the long term - the first step in optimizing TMAP for rapid feedback regarding climate change issues is identifying the key processes and determining the appropriate parameters to monitor.

- *"Support trilateral scientific and planning cooperation on climate change adaptation (drivers, impacts and no-regret measures) as part of adaptive management"*
  The Trilateral Cooperation has initiated the establishment of a Trilateral Research Agenda that defines common research questions with respect to a sustainable management of the World Heritage Site. One main focus area is climate change and its impacts. The Trilateral Research Agenda will serve as a common base for scientific research on the trilateral Wadden Sea.

- *"Evaluate to what extent legislation may limit climate change management"*
  The possible limitations to climate change management through legislation have not been evaluated at the trilateral level. The protection of the Wadden Sea region is highly regulated at various levels (EU, national, regional) and in various sectors (nature, landscape, etc.). Present legislation generally aims to preserve certain situations or sectoral goals such as habitats, species or the landscape. Climate change adaptation requires an integrated approach in which trade-offs can be made between interests. Sectoral legislation is sometimes not flexible enough to allow for initiatives or projects even if they have broad support. Evaluation of the present Dutch spatial plan for the Wadden Sea showed that (nature) protection is well regulated, but that attention needs to be given to restoration and sustainable development of the area.

## Recommendations

The TMAP monitoring relies on information gathered by several different (local) administrative organizations and – to a smaller extent – scientific projects. It is recommended to optimize the existing monitoring program towards the aims of climate change adaptation. Appropriate (explicit, meaningful) parameters for monitoring the impact of climate change need to be developed first.

Cross-border monitoring of climate change impacts should then be adequately implemented in TMAP.

Furthermore, it is recommended to:

- Investigate whether present EU, national and regional legislation in the three Wadden Sea countries is sufficiently flexible to support climate change adaptation by natural dynamics. Such an evaluation should also assess whether legislation may hinder adaptive measures if these seem necessary. The focus should be on the principle that natural dynamics, such as erosion and sedimentation, and natural development of habitats are the best way to adapt to a changing climate (see 'natural dynamics');
- Scientific insight on the Wadden Sea Ecosystem is still insufficient to properly assess possible impacts of climate change, especially on larger time and spatial scales. This increases uncertainty concerning the effectivity of adaptation measures. It is recommended to continue to stimulate joint trilateral research.

## 2.5. Long-term approach

### Description of principle (from CCAS)

Climate change and accelerated sea level rise are gradual processes that need a long-term management approach. Furthermore, adaptation measures include infrastructural work and management related to the ecosystem, both of which generally require long-term planning and have long life-spans. Finally, adaptation measures may interfere with traditional coastal defense or water management policies and thus raise public concern. Changing traditional views and feelings probably requires at least one generation of communication and dialogue. Long-term policy and strategy horizons should not lead to static approaches. With reference to flexibility, the chosen instruments should be able to adapt to new knowledge and diverging natural and cultural developments. Hence, periodic updating should be undertaken with the possibility of adapting policies and strategies to new knowledge and developments.

### General status

With respect to the relevance of a long-term management approach for the Wadden Sea as described above, no significant changes have occurred since the adaptation of the trilateral CCAS in 2014. Also, major parts of the implementation of long-term approaches are covered in the integration section.

Current temperature projections do not show a tendency to change in magnitude and/or bandwidth. Research on future sea level rise has one focus on the so called high-end scenarios of the Intergovernmental Panel on Climate Change (IPCC), i.e., concentrating on the possible consequences of collapses of the ice caps on Greenland and in the Antarctic (e.g., Grinsted et al. 2015; Le Bars et al. 2017). Collapse of the ice caps (Heinrich-Events) would induce significantly stronger sea level rise, as projected by IPCC in its latest report and would reduce the time frame for adaptation. As stated above, these investigations only deal with the worst-case scenario, not with the entire band width of emission (Representative Concentration Pathways -RCP) scenarios. Most studies cover global scenarios. Studies covering localizations of those global scenarios are the necessary basis for local/regional impact evaluation. These are, in fact, follow-ups of the global scenarios and are being further developed at the moment.

For the entire Wadden Sea region, national and regional climate change adaptation strategies are in place. Acknowledging the gradual process of man-made climate change and subsequent sea level rise, they all show a clear long-term perspective and commitment.

## Monitoring of the priorities

- *"Promote the inclusion of climate change adaptation management as a central issue in long-term spatial planning and relevant policies and legislation"*
  As the national and regional climate change adaptation strategies have been adopted by the respective governments, they should, in consequence, be integrated and considered in relevant policies and legislation (including the long-term perspective). This process, which naturally takes time, seems to be partly under way and partly implemented. ;

- *"Investigate and promote the implementation of so called benchmarks for action with respect to future developments in long-term planning"*
  The topic of benchmarks for action with respect to climate change adaptation in long-term planning in the Wadden Sea region is, so far, only dealt with in the Netherlands. In the Delta Programme adaptive pathways have been developed in which benchmarks for action are included. Defining benchmarks and establishing meaningful indicators to monitor where such benchmarks are exceeded is challenging. This may be one reason why this topic is not considered in detail in the other countries.

- *"Support the option to promptly enhance long-term policies as appropriate"*
  At a national and regional level, it is common practice to regularly update laws, policies and strategies in order to consider new knowledge and developments. For example, spatial and sectoral master plans that cover the Wadden Sea region are usually updated every five to 15 years. With reference to the timescales of climate change and sea level rise, this frequency seems appropriate.

- *"Provide advice on the implementation of the Wadden Sea Plan regarding these priorities"*
  The Trilateral Wadden Sea Plan (WSP) was established in 1997 and updated in 2010. In the WSP2010, climate change is recognized as an overarching theme and resilience to climate change is defined as one of the trilateral aims for the cooperation area. The trilateral CCAS was developed based on the WSP2010.

## Recommendations

As outlined in the latest IPCC-report, the challenges of climate change and sea level rise will continue in the centuries to come. Hence, adaptation to climate change and stronger sea level rise is a long-term and continuous endeavour and the principle of long-term approaches remains relevant within the scope of the trilateral CCAS. Moreover, climate change adaptation measures that are executed today mostly have a long lifetime (decades to centuries), or take long preparation (e.g., spatial adaptation) and should be planned accordingly. Finally, the arguments for flexible planning (and no-regret measures) also remain valid, as new knowledge may lead to prompt adjustments.

Recommended regarding the priorities:

- Implementation of climate change adaptation in long-term policies and strategies for the Wadden Sea region seems to be well in progress but not finished. Further monitoring of this priority is recommended;
- The relevance of bench marks and the definition of meaningful indicators seem to be relevant topics of scientific research and should be followed up accordingly;
- The priority field “enhancement of long-term policies as appropriate” seems to be well taken into account. The need for further monitoring of this priority should be discussed;
- The WSP2010 duly considers climate change. With respect to the priorities listed above, it is recommended to update the WSP in the early 2020s.

## 2.6. Site-specific approach

### Description of principle (from CCAS)

Both the challenges of climate change and optimal adaptation may differ throughout the Wadden Sea region. For example, a northward shift in storm wind direction may lead to higher storm surges in the Netherlands and Lower-Saxony, but to lower storm water levels in Denmark and Schleswig-Holstein. Further differences may result from locally varying historical perspectives and cultural heritage. In order to ensure local resilience on the basis of a common knowledge base, site-specific tailor-made solutions should be developed.

### General status

The notion of applying and implementing site-specific approaches is widespread throughout the Wadden Sea area. Several examples can be found where the knowledge and lessons learnt on site-specific approaches are subjected to a continuous process of knowledge exchange between the three participating countries. For instance, the Wadden Sea Forum (WSF) applies the Sustainable indicator tool which was previously invented for Dutch application, but is now adapted and applied to municipalities in Germany. To support an implementation of site-specific approaches, the Wadden Sea Region Climate Atlas (WSF, *www.waddensea-forum.org/en/topical-issues/wsr-climate-atlas*) was published as a tool to visualise the status and effects of climate change in the Wadden Sea area based on regional climate scenarios, provided by the Norddeutsches Klimabüro (North German Climate Office). A hydromorphological and sedimentological information system for the German North and Baltic Sea based on the Marine Strategy Framework Directive (MSFD) is being set up to provide site-specific morphological and sedimentological information in future.

Site-specific solutions are implemented according to the cultural and legal boundary conditions of each country. It is important to exchange the lessons learnt by planning and implementing site-specific solutions at the national level throughout the Trilateral Cooperation area. Despite the fact, that each country faces similar impacts posed by climate change and sea level rise, the pathways of mitigating or adapting the existing infrastructure to changing circumstances differ from country to country. For example, in Schleswig-Holstein the Wadden Sea Strategy 2100 was developed as a comprehensive and broadly applied participation process to develop a strategy for the Wadden Sea to adapt to the impacts of climate change and sea level rise. Lower Saxony implemented a CCAS (with a focus on coastal protection) and currently establishes an ecological sediment management concept for the Ems estuary based on the Dutch-German Ems-Dollart-environmental protocol. In the Netherlands, dikes are being strengthened according to the strategy and new safety standards as adopted in the Delta Programme. For the Wadden Sea region it was decided to choose solutions that improve the Wadden Sea area and benefit other interests as much as possible. The project “projectoverstijgende verkenning Waddenzeedijken” is investigating integral solutions and innovations and their feasibility depending on site-specific conditions. In Denmark, for example, an assessment is conducted to estimate the vulnerability and the costs of the adaption of port

infrastructure to climate change. These are distinct examples which do not overlap at first glance, but in line with the aim of promoting and supporting site-specific approaches these projects and approaches will serve to make the Wadden Sea are more climate proof and better prepared for a changing climate and its impacts.

### Monitoring of the priorities

- *"Promote and support the development of a common knowledge base that can be drawn upon locally and communicate these solutions broadly for eventual application at other sites"*
  The promotion and supporing of a common knowledge base has been conducted in the past years by establishing a joint information data base on the website of the Common Wadden Sea Secretariat (CWSS, *www.waddensea-secretariat.org*). Therein, a variety of documents and information is compiled to support the dissemination of site-specific approaches within the Trilateral Cooperation. The permanent Working Group on ICZM of the WSF meets regularly to exchange knowledge and information between the three countries. An excellent example of adapting tailor-made approaches across different countries is the modification and application of the sustainable indicator tool which was previously developed in the Netherlands and is now applied (with slight modification) at German municipalities in the Wadden Sea Region;

- *"Promote and support the development of site-specific "tailor-made" solutions, evaluate site-specific solutions from the trilateral perspective of the strategy"*
  The TG-C, together with the Interreg project "Building with Nature" organised a workshop on 26- 27 September 2017 to exchange knowledge on climate adaptation projects across Denmark, Germany and the Netherlands, (Ch. 3). During this workshop several projects were presented and discussed from the perspective of the climate change adaptation strategy. The general conclusion was that applying the principles helps to investigate weak and strong points from site specific solutions with respect to climate change adaptation goals.

### Recommendations

The principle of a site-specific approach is working well in the light of the Trilateral Cooperation.

Recommendations regarding the priorities:

- Maintain the principle, but given the fact that its application is common practice, a further promotion of this principle is not required;
- Continue cooperation between the three countries to exchange knowledge on how to reach best site specific solutions together with involved stakeholders and learn from the different approaches.

## 2.7. Participatory Approach

### Description of principle (from CCAS)

Participation of stakeholders by providing information and securing active involvement is one prerequisite for the successful introduction of climate change adaptation measures. This is due to the sensitivity of issues dealing with the safety and well-being of the inhabitants of the Wadden Sea region. This sensitivity, combined with traditions and the need for long-term planning of adaptation measures, call for communication and participation strategies, instruments and processes, such as the WSF and many others at the local or regional level. Active involvement should lead to awareness for the challenges of climate change and acceptance of adaptation measures (common ownership).

### General status

Participation is commonly implemented in the management of the Wadden Sea. Legislation provides for reactive participation (i.e., consultation). Informal pro-active participation is being implemented as well. A good example is the trilateral Wadden Sea Forum. The WSF is an independent forum of stakeholders, NGO representatives and representatives of municipalities and districts of the Danish, German and Dutch Wadden Sea region. The WSF aims to elaborate advice for the Trilateral Wadden Sea Cooperation with regard to sustainable and environmentally friendly developments in the Wadden Sea region. Beside the WSF, there are also many examples of stakeholder involvement at the local or the regional level. For example, most water authorities usually actively interact with inhabitants on dike strengthening campaigns.

Although the principle seems well implemented in the Wadden Sea region, it still needs attention. Due to increasing time constraints of public administration (resulting from increasing tasks and reduced personnel capacities), there seems to be a risk that pro-active and informal participation activities are no longer being taken into account appropriately in planning CCAS measures.

### Monitoring of the priorities

- *"Strengthen the cooperation with the Wadden Sea Forum on communication and participation regarding climate change adaptation"*
  Since 2010, the WSF is represented in an advisory capacity in the Wadden Sea Board and is member of the TG-C. The results of TG-C are introduced to the WSF plenary by presentations and are further discussed. The cooperation is well established and beneficial to both sides. The WSF has worked on risk management and climate change in the ENHANCE project.
- *"Include climate change adaptation in the overall trilateral communication strategy"*
  Climate issues are to some extent already part of the trilateral communication strategy. The Quality Status Reports encompass chapters concerning climate change adaptation as well

as changes in geomorphology due to climate change-relatedimpacts. Also, the sustainable tourism strategy takes climate change into account and aims at climate friendly tourism development. It is envisaged to inform about climate adaption on the new CWSS website at a prominent place.

- *"Support the International Wadden Sea School (IWSS) in developing relevant education material"*
  Awareness rising about climate change, its causes and consequences is also a matter of education. The IWSS is an excellent body for developing the necessary material. Expert information is being transformed into easy and understandable language for various target groups. Work on this priority can and must be further strengthened.

### Recommendations

Planning of measures as well as management requires a sound integration of stakeholders from the very beginning in order to achieve public acceptance and the best integral solutions. Time constraints, however, may increasingly put a limit on the actual extent of participation. Thus, it is generally recommended that the principle "participatory approach" should remain one central aim of trilateral, national and regional management of the Wadden Sea, including climate change adaptation.

Recommendations regarding the priorities:

- Climate change and adaptation is mostly understood as a matter of sea level rise and coastal protection. Communication and participation should be extended to all aspects of climate change which concerns society in the entire Wadden Sea region;
- It is recommended to consider organizing a joint workshop or symposium on the climate issue to demonstrate broad cooperation on strengthening the Wadden Sea region;
- Besides activities about the culture and history of the inhabitants of this region as well as activities regarding the regional and international protection of the Wadden Sea, programmes regarding climate change and adaptation can be offered. School classes are excellent target groups for IWSS activities introducing issues of climate change and its consequences;
- The Trilateral Communication Strategy has integrated climate change issues within different themes, such as quality status or tourism. In the future, climate change should be a topic of its own to raise the necessary awareness.

# 3. Syntheses of the workshop

In cooperation with the Interreg project “Building with Nature”, TG-C organized a two-day workshop in Wilhelmshaven, Germany, on 26 - 27, September 2017 on best practices in climate change adaptation. Aims of the workshop were to:

i) Exchange knowledge;

ii) Enhance awareness on the Climate Change Adaptation Strategy (CCAS) amongst professionals from policy and science;

iii) Obtain input for this monitoring report on the implementation of the CCAS.

The focus was put on presenting cases of ongoing or recently completed projects in the Wadden Sea countries. Three types of projects were assessed: coastal flood defense and protection, nature conservation and integral projects.

During the workshop approximately 60 participants mostly from the three Wadden Sea countries (but also from beyond) discussed relevant climate effects and societal consequences and assessed to what extent and why the seven principles of the CCAS apply to a number of projects in Denmark, Germany and the Netherlands. The main results and conclusions from the workshop are presented in this section.

(1) Many of the seven principles from the trilateral climate change adaptation strategy were recognizable in the projects that were presented and discussed during the workshop. This emphasizes the applicability of the CCAS-principles also at the practical level of projects. However, it was apparent that the majority of the participants was not familiar with the Trilateral Climate Change Adaptation Strategy. This leads to the conclusion that communication on the strategy could be improved.

(2) General insights from the Building with Nature project so far revealed that sand nourishment may present a feasible and sustainable tool for keeping up with sea level rise in the Wadden Sea. The behaviour of the coast, effectivity and environmental impacts of sand nourishment at different locations are, however, not yet fully understood. The same holds true for optimal locations and techniques. More research is needed and ongoing.

(3) The participants of the workshop were invited to reflect on societal opportunities and threats for the Wadden Sea area related to climate change. The following points were raised:

| Threats | Opportunities |
|---|---|
| Increased risk of flooding due to sea level rise, changing climatic zones due to higher temperatures, extinction of species due to shifting climate zones and too little opportunities for species to migrate due to artificial barriers, lack of fresh water supply for islands due to longer periods of drought. | Increasing tourism due to warmer summers, salt-tolerant crops due to higher salt intrusion |

(4) General insights from the discussion about the projects are:

The seven principles were recognized in the presented projects. Discussion about the principles led to sometimes critical remarks on the contribution of the projects to the aim of the Climate Change Adaptation Strategy.

The following questions were addressed: “How to define system boundaries (level of integral approach)?”, “How to determine the level of participation (extent)?” and “How to map future options by using decision-making support systems (flexibility and long-term approach)?”.

Most discussed projects showed that site-specific approaches lead to good solutions for climate change adaptation. However, for a few projects, it was discussed whether the solution really dealt with the issue of climate adaptation on the higher (spatial and temporal) scale, or if it was in fact more a local solution to mitigate effects of climate change or other local problems. A number of projects were not triggered by climate change, but by other motivations, such as nature conservation. These projects may, nevertheless, contribute to achieving climate change adaptation goals.

Finally, it was concluded that using the principles can help in plans and projects. They are well designed from the perspective of dealing with climate change adaptation. They should, however, not be applied as a formal checklist, but rather as guidance in the design process.

# 4. Summary and recommendations

### Main findings on the monitoring of the implementation of the trilateral Climate Change Adaptation Strategy and recommendations

Climate change and increasing sea level rise may seriously impact the structure, functions and the characteristic biodiversity of the Wadden Sea ecosystem as well as the safety of the inhabitants of the region. The Trilateral Wadden Sea Cooperation therefore aims to achieve resilience to climate change. At the 12th Trilateral Governmental Conference on the Protection of the Wadden Sea in 2014, a Trilateral Climate Adaptation Strategy on increasing resilience to climate change (CCAS) was adopted. In the CCAS, it is stated that, under the precondition that the safety of the inhabitants is guaranteed, resilience to climate change in the Wadden Sea region may best be achieved by implementing an adaptation strategy that consists of seven elements: Natural dynamics, Interconnectivity, Integration, Flexibility, Long-term approach, Site specific approach and Participation. A Task Group Climate (TG-C) was assigned to monitor the implementation of the climate change adaptation strategy. This report presents the results of the monitoring by TG-C, carried out between June 2015 and December 2017. Main findings and recommendations of this monitoring report will be fed into the 2018 Ministerial Declaration.

The monitoring and subsequent discussion within TG-C led to a general conclusion that the strategic objectives and principles of CCAS are being applied in a wide range of projects and policies. However, it also concluded that this was not only due to CCAS. The principles are well known from other policy-making theories. This was confirmed by the workshop organized by TG-C together with the Interreg project “Building with Nature” in September 2017, where participants recognized having applied elements from the strategy in projects while not knowing CCAS itself. This leads to a general recommendation to **continue working with the CCAS** but to **strengthen communication** on the need for climate change adaptation in the Wadden Sea area and the objectives and principles in the strategy. Communication should certainly not be limited to the Trilateral Wadden Sea Cooperation itself, but target all organizations working in the Wadden Sea on policies and projects that may contribute to the aims of CCAS.

TG-C concludes that the need for climate change adaptation is receiving increasing attention by all government bodies active in the Wadden Sea. Most governments have climate change adaptation policies, which are sometimes implemented sectorally, sometimes more integrally. However, in most cases these policies do not link to CCAS and the aims of the Trilateral Wadden Sea Cooperation. It is advised to encourage all government bodies to further **implement CCAS objectives and principles in their national and regional strategies** and to commit and contribute to the joint responsibility of making the Wadden Sea more resilient to climate change.

CCAS contains 23 priorities for implementing the strategy for working on climate change adaptation in the trilateral Wadden Sea. Each of these priorities has been described and evaluated in this report. The overall picture is that much work that contributes to the aims of CCAS is being done and ongoing in the Wadden Sea countries. For most priorities it is concluded that work is

ongoing but that they are not yet completed. For some priorities work is still in an early phase. This leads to the conclusion that work on **implementing the priorities needs to be continued** in the next period of the Trilateral Wadden Sea Cooperation. Preferably this work should be supported at the trilateral level. It is advised to continue monitoring the implementation.

The Wadden Sea ecosystem is a complex natural system. Although there are a lot of data and knowledge, research is ongoing to better understand the system. Knowledge is still insufficient to predict how the Wadden Sea will respond and change due to climate change, especially on larger time scales. In addition it is uncertain to what extent the climate will change. These are complicating factors for climate change adaptation projects and plans. The need and priority for measures will always be subject to debate and effectivity of measures is uncertain. TG-C recommends that the Trilateral Wadden Sea Cooperation strives to further **improve knowledge on the Wadden Sea Ecosystem** and its response to climate change and **supports trilateral cooperation** and joint efforts and research projects.

### Recommendations following from the monitoring of the priorities

Based on the monitoring of the priorities per principle in the strategy the following recommendations are made by TG-C.

With respect to **natural dynamics**, it is recommended to:

- Maintain this element as one of the guiding principles of the strategy, and one of the most important qualities of the Wadden Sea. Many governments and parties working in the Wadden Sea support and use the idea of working with natural dynamics. However, especially in the context of flood safety, natural dynamics can of course also cause a threat. In such cases, it is a logical response to limit natural dynamics in order to safeguard human values. Continuous dialogue is required on this delicate balance. The exchange of knowledge and experience on this dilemma should be continued;
- Continue to limit measures that induce negative sediment budgets in the Wadden Sea and enhance trilateral cooperation on sediment budget studies;
- Investigate whether (objective) parameters can be introduced to monitor the status of natural dynamics. Such a parameter might also be used in reporting to UNESCO on the status of the World Heritage;
- Discuss how to deal with the scenario that natural dynamics do not respond in a self-sustaining manner to sea level rise or cause unwanted effects. This can be large scale issues, such as drowning of tidal flats, but also concern smaller scale problems. In effect, the question is whether we should intervene if negative impacts occur, or let natural dynamics run their course?

With respect to **interconnectivity**, it is recommended to:

- Reduce man-made barriers between habitats as much as possible or make them more permeable. In this context, strengthening campaigns for flood defences against stronger sea level rise may be utilized to restore or optimize interconnectivity;
- Regularly exchange knowledge and experience between the climate adaptation and nature restoration projects all over the Wadden Sea region and beyond;
- Increase (passively or actively) the naturalness of habitats wherever possible, as this may in many cases also be the best way to increase the resilience against the effects of climate change, including sea level rise;
- Keep islands separated from each other and from the mainland and to avoid human induced movements of species to islands. This is especially valid for terrestrial predators that severely impair breeding bird populations on islands. Reverse previously occurred introductions/invasions where possible;
- Encourage the further implementation of an environmentally sound approach in coastal protection, e.g., based on sediment management and the philosophy of "Growing with the Sea", that might significantly contribute to the maintenance and strengthening of the interconnectivity of habitats.

With respect to **integration**, it is recommended to:

- Further support inclusion of the integration objective of CCAS into ICZM approaches where those already exist and promote implementation of ICZM approaches as an optimum basis for climate change adaptation;
- Investigate to what extent national and regional policies and legislation stimulate integrative approaches across borders, disciplines, sectors and administrative layers.

With respect to **flexibility**, it is recommended to:

- Optimally gear the existing TMAP monitoring program towards the aims of climate change adaptation. Appropriate (explicit, meaningful) parameters for monitoring the impact of climate change need to be developed first. Cross-border monitoring of climate change impact should then be adequately implemented in TMAP;
- Investigate whether present EU, national and regional legislation in the three Wadden Sea countries is sufficiently flexible to support climate change adaptation by natural dynamics. Such an investigation should also assess whether legislation may hinder adaptive measures if these seem necessary. The focus should be on the principle that natural dynamics (such as erosion and sedimentation) and natural development of habitats are the best way to adapt to a changing climate (see 'natural dynamics');
- Continue to stimulate joint trilateral research as scientific insights on the Wadden Sea ecosystem are still insufficient to properly assess possible impacts of climate change, especially on larger time and spatial scales. This increases uncertainty the effectiveness of adaptation measures.

With respect to the **long-term approach**, it is recommended to:

- Monitor this priority further  although implementation of climate change adaptation in long-term policies and strategies for the Wadden Sea region seems to be well in progress;
- Define relevant benchmarks and meaningful indicators, as they seem to be relevant topics of scientific research;
- Discuss the need for further monitoring of this priority, as the priority field "enhancement of long-term policies as appropriate" seems to be well taken into account;
- Update the WSP 2010 with respect to the priorities listed above in the early 2020s, as it duly considers climate change.

With respect to the **site-specific approach**, it is recommended:

- Maintain the principle, but not to further promote it, as it is widely implemented in the processes and structures of the Trilateral Cooperation;
- Continue cooperation and exchange of knowledge between the three countries on how to reach best site-specific solutions together with involved stakeholders.

With respect to the **participatory approach**, it is recommended:

- Maintain the principle as one central aim of trilateral management of the Wadden Sea, including climate change adaptation;
- Extend communication and participation to all aspects of climate change which concerns society in the entire Wadden Sea region;
- Consider organizing a joint workshop or symposium on the climate issue to demonstrate broad cooperation on strengthening the Wadden Sea region;
- Offer programmes regarding climate change and adaptation, besides activities about the culture and history of the people living in this region, as well as activities concerning the regional and international protection of the Wadden Sea;
- Select climate change as a topic of its own in the Trilateral Communications Strategy instead of integrating it within different themes. This helps to raise the necessary awareness.

Finally, with respect to future activities, it is recommended that the existing or a new task group should continue to monitor the Trilateral Climate Adaptation Strategy and embed the results in long-term trilateral climate change policies and, furthermore, to stimulate trilateral knowledge exchange on best practices for adapting to climate change. This task group can also advise on implementing the recommendations above, and provide advice on updating the priorities in CCAS if needed.

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