



Wesermarsch, rural areas (DE)

The county of Wesermarsch is affected by storm surges and river floods as well as by groundwater salinisation due to its peninsula-like situation. The county is surrounded by the Jade Bay, the North Sea and the Weser River. As part of the EU Interreg IVB project “Climate Proof Areas”, a detailed regional climate change impact analysis was performed with respect to the regional hydrological regime, soil functions and the regional water management system. In a comprehensive participation process, relevant regional stakeholders developed a joint landscape vision for the year 2050. These stakeholders jointly developed and agreed on common principles for water management (on drainage and watering), which were used as the basis for the development of future water management adaptation options. The main results of the process were an inventory of possible rural adaptation measures for climate change adaptation of regional water management in terms of drainage and watering. For example, the group suggested the extension of the existing canal system to supply the northern part of the county with fresh water. For this idea advantages and draw backs were compared to those of flood polders and the installation of a parallel drinking water supply system for dairy farms. Finally, all stakeholders contributed to and agreed on a joint vision for water management in the county in 2050 and declared their interest to continue the contribution to a county wide, cross-sectoral adaptation process.



Wesermarsch Water Cycle

Historically, the regional water cycle of the Wesermarsch is dominated by the diurnal, tidal inundation of the North Sea. Constructing dikes was the reaction of the population in order to get the Wesermarsch protected for a permanent colonisation. As a consequence, drainage of the landscape was necessary due to the positive water balance of the region (precipitation is larger than evapotranspiration).

Therefore, in the Wesermarsch a water management system has been developed over the last centuries, consisting of a network of canals and ditches, sluices and pumping stations. This drainage system guarantees drainage in wet periods as well as the watering in dry summer periods using water from the Weser River when the water level in the ditches and canals is too low.

Wesermarsch

The county of Wesermarsch is located in North Northwest Germany and has approximately 91,000 inhabitants. Large parts of the area (822 km² in total) are below mean sea level (up to -2.5 m below sea level) and therefore are potentially at risk with respect to flooding. A dense network of canals and ditches was established to be able to permanently colonise the Wesermarsch region. Low lying areas can be artificially drained by pumping stations, only. However, except a few cities (e.g., Brake, Nordenham), the county is sparsely populated.

The physical region is characterised by coastal marshland between Jade Bay in the West, North Sea in the North and Weser River in the east. The Wesermarsch is therefore encircled by salt water. The predominant marsh and bog soils are mainly used for agriculture. Grassland is dominating the area, feeding dairy cattle. From an economic point of view, the harbours of Brake and Nordenham are of regional importance for trade and industrial development.

In order to study the impact of climate change on the Wesermarsch and to develop adaptation options for rural areas, the water boards of the municipalities Butjadingen and Stadland were selected (see figure).



Problem definition

Due to current climate conditions and climate variability, the county of Wesermarsch already faces water management problems in terms of a water surplus in winter time, requiring an intense drainage, and partly serious water deficits in summer time, requiring a transfer of fresh water from Weser River into the marsh water bodies over the entire summer period. While extremely wet conditions would reduce the productivity of the soils, extremely dry conditions in summer would reduce the possibility to water the cattle from ditches and to use the ditches as natural barrier instead of fencing. In summer time, additionally, high salt concentrations of surface and groundwater bodies would occur, causing water quality problems.

Current water management options of the regional water boards are

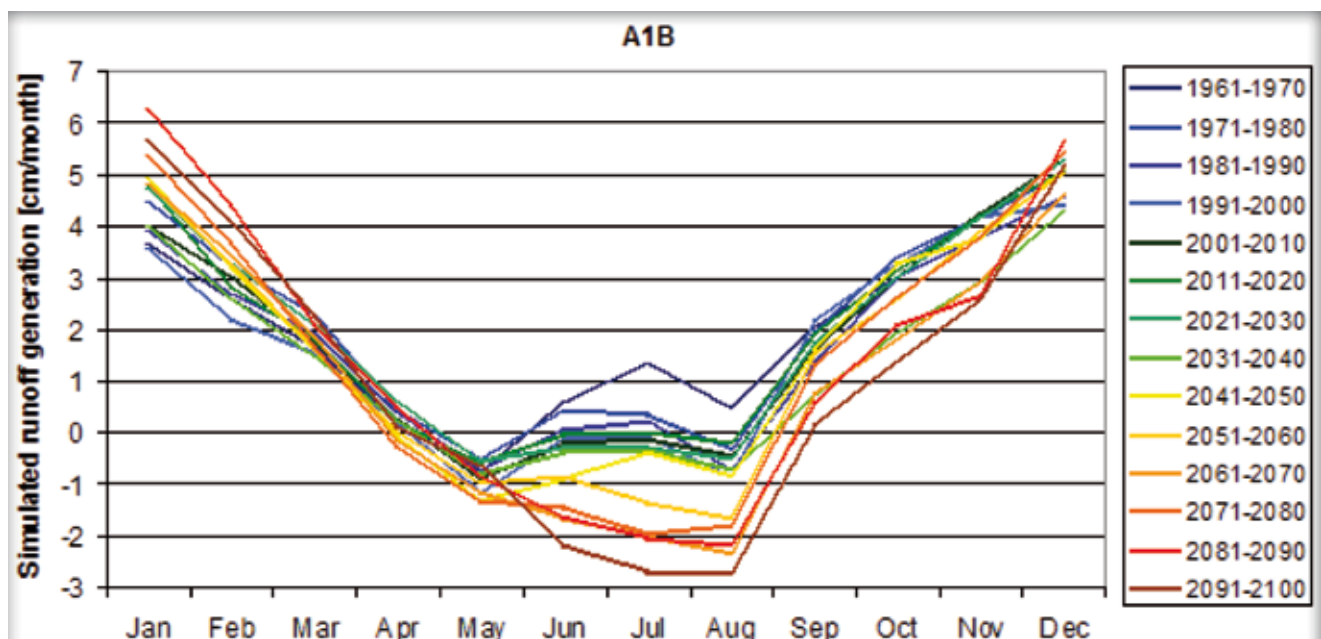
- ▶ To pump out exceeding water in winter time,
- ▶ To water the county in summer time using water from Weser river,
- ▶ And to interrupt watering in case of salt concentration exceeding 2.5 mg/l.

It can be expected that the above mentioned problems will be worsened due to future climate change. Sea level rise, an expected increase in winter precipitation and a likely decrease in summer precipitation will induce an increase in runoff generation in winter, an increase in summer water deficit in summer (see figure) and an increase in frequency and intensity of

flood generating precipitation events over the year. Hence, it can be expected that the climate vulnerability of the region will increase in the future in the case of taking no adaptation measures.

Process and stakeholder engagement

The integration of regional stakeholders into the development and the implementation of adaptation measures are essential for rising awareness, informing the public, considering local knowledge (on problems and possible solutions) and for improving the acceptance of possible adaptation measures. Therefore, a participatory and integrative approach was chosen for the Wesermarsch pilots in order to take care of the local people's interest and the multifunctional use of the area. The following stakeholder groups were involved in the process: water boards, dike boards, the county administration, municipalities, a drinking water supply and sewage disposal company, nature protection organizations (GOs, NGOs), the chamber of agriculture and the peasantry. Stakeholders were involved in all phases of this process of developing adaptation options (problem analysis, development of a landscape vision (see figures), collection of possible water management adaptation options) by means of interviews, expert meetings and round tables (regional fora).



Change in simulated runoff generation for the Wesermarsch region (scenario A1B, Wettreg model)

Concept and methods

Main work was done in the Wesermarsch pilots on the first three steps of the problem solving cycle used for the development and implementation of climate change adaptation measures:

1. Problem identification

One-to one interviews with all members of the regional stakeholder forum and discussions within the regional forum involving all water related stakeholders of the Wesermarsch region identified the main current (and probably also future) water related problems. To complement available information, a detailed literature review on climate change impact studies was carried out.

2. Problem analysis

Several actions were taken in order to specify the available information on expected regional water management related issues. Results from the literature review on climate change impact studies in similar regions described the general hydrological trends to be expected. A hydrological model application based on SRES scenarios of the IPCC, downscaled to the Wesermarsch region, gave insight into likely regional climate change impacts. Finally, the group of stakeholders developed a future landscape vision for the year 2050 in order to define boundary conditions for possible climate change adaptation options.

3. Elaboration of adaptation options

A focus group, delegated from the regional forum, developed adaptation alternatives with respect to future water management in the rural parts of the Wesermarsch. The focus group also analysed the advantages and disadvantages of these different options. Their suggestions are described in the joint Wesermarsch vision (Ahlhorn et al., 2011). For comparison, an international group of water management experts developed alternative adaptation options focusing on a sustainable development of the region in terms of "living with water" in the framework of a partner meeting of the "Climate Proof Areas" project.



Products and results

A first important result for the rural pilot region in the county of Wesermarsch is that all stakeholders agreed that adaptation to climate change is necessary. However, within the joint landscape vision for the year 2050 they stated that they urge to keep the Wesermarsch region as it is now. Therefore, they developed an inventory of different climate change adaptation options within the expert group which mainly focuses on technical adaptation measures (within the limits of an agreement on general recommendations for a sustainable water management, developed by the regional forum) rather than on adapting the land use in the region to a changing climate, e.g., the extension of the existing watering canal system, the implementation of a separate drinking water supply for dairy farming, an improved cooperation amongst water boards with respect to water drainage and flood protection.

These results are partly contrasted by the adaptation options suggested by the expert group (international "Climate proof Areas" experts). Assuming the necessity of a sustainable development ("living with water") they recommended to adapt not only the technical part but also to adapt the land use according to climate change in terms of establishing wetlands, developing new adapted branches (such as aquaculture) and freshwater lakes / polders. The results of the stakeholder based development of an adaptation strategy are summarised in the Wesermarsch vision (Ahlhorn et al., 2011) and in several publications (Bormann et al., 2009, Bormann et al., 2010, Bormann et al., submitted). In addition to the bunch of technical solutions emerging from the focus groups, we realised an increasing awareness and interest amongst the stakeholder community for the climate change adaptation issue. Most of the stakeholders are interested in continuing the discussions within the framework of the regional forum and in extending the water management issue in an integrated way.



Policy Recommendations

Within the Wesermarsch pilots we integrated the regional stakeholders and therefore the public in all stages of the climate change adaptation process which were performed. We learned that stakeholder participation...

- ▶ increases the awareness of the climate change problem,
- ▶ provides a wider range of possible solutions,
- ▶ increases acceptance of possible solutions,
- ▶ increases willingness to compromise and therefore
- ▶ accelerates the implementation of suitable measures.

Based on these experiences we strongly recommend to

- ▶ integrate stakeholders at an early stage in a participatory process of climate change adaptation.

We also learned that stakeholders know very well their region and the problems they already have today managing the water system. We therefore recommend to

- ▶ use current problems to raise awareness for climate change related problems in the future.

Based on the discussions to the stakeholders we recognised that climate change is an important issue but – of course – not the only important issue affecting water management activities. For example, water management is interacting with the development of industrial and commercial zones, but mostly in a reactive way.

Based on these experiences, we recommend to

- ▶ integrate water management (adaptation) directly into spatial planning processes and, as an example, to
- ▶ integrate new infrastructure (e.g., motorways/highways) into coastal defence plans (2nd dike line).

Due to their vision on the future landscape the stakeholders focused on technical adaptation measures. However, they also admitted that possibilities of technical solutions are limited in the long run. In agreement with the group of international water management experts we therefore recommend to

- ▶ try to combine technical adaptation options with adapting land allocation and land use in a sustainable way to changing climate conditions and
- ▶ try to develop joint solutions for urban and rural areas in order to increase the flexibility of the entire water management system.



Background documents

- ▶ Ahlhorn, F., Bormann, H., Giani, L., Klaassen, K., Klenke, T., Malsy, M., Restemeyer, B. (2011): Klimasichere Region Wesermarsch - Die Zukunft der Wasserwirtschaft. Erste Schritte auf dem Weg zu einer Klimaanpassungsstrategie für den Landkreis Wesermarsch. (in German)
- ▶ Bormann, H., Ahlhorn, F., Giani, L. & Klenke, T. (2009): Climate Proof Areas - Konzeption von an den Klimawandel angepassten Wassermanagementstrategien im Norddeutschen Küstenraum. Korrespondenz Wasserwirtschaft, 2 (7), 363-369. DOI: 10.3243/kwe.2009.07.002. (in German)
- ▶ Bormann, H., Ahlhorn, F., Giani, L., Klaassen, K. & Klenke, T. (2010): 'Climate Proof Areas': Anpassung von Wassermanagement-Strategien im Küstenraum an den Klimawandel. In: Meon, G. (Hrsg.): Nachhaltige Wasserwirtschaft durch Integration von Hydrologie, Hydraulik, Gewässerschutz und Ökonomie. Beiträge zum Tag der Hydrologie 2010. Forum für Hydrologie und Wasserbewirtschaftung 29.10, 151-159. (in German)
- ▶ Bormann, H., Ahlhorn, F., Klenke, T. (submitted): Adaptation to regional climate change in a coastal region - hydrological change vs. community perception and strategies. Submitted to Regional Environmental Change.

You can find these documents on www.climateproofareas.com

EU inspiration

- ▶ Comcoast project (Combining functions in Coastal Defence Zones): EU-Interreg IIIB North Sea Programme (www.comcoast.org)
- ▶ TiDE project (Tidal River Development): EU-Interreg IVB North Sea Programme (www.tide.eu)
- ▶ C2CI - Cradle to cradle islands project: EU-Interreg IVB North Sea Programme (c2cislands.org)
- ▶ SAWA (Strategic Alliance for integrated Water Management Actions): EU-Interreg IVB North Sea Programme (www.sawa-project.eu)

What is Climate Proof Areas?

Climate is changing and Europe needs to adapt. Scientists and civil servants from Belgium, England, Germany, Sweden and the Netherlands united in one project: Climate Proof Areas, funded by European North Sea Region Program. Their goal? Creating safer, more natural and more prosperous land use options for future development.

Thirteen partners from these five different countries joined forces to develop new and innovative methods and help render threatened areas 'climate proof'.

Since 2008, the team has gained insights on:

- ▶ the regional effects of climate change on the North-Sea Region
- ▶ the implementation of innovative measures in 8 pilot sites
- ▶ recommendations for gaining political support
- ▶ the necessary tools for building your own climate proof area

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Time to adapt!

Colophon

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