# Detailed flood risk assessment of Langeoog island,  Lower Saxony - DE

## 1. Policy Objective & Theme

- ADAPTATION TO RISK: Managing impacts of climate change and safeguarding resilience of coasts/coastal systems
- ADAPTATION TO RISK: Preventing and managing natural hazards and technological (human-made) hazards
- ADAPTATION TO RISK: Integrating coherent strategies covering the risk-dimension (prevention to response) into planning and investment

## 2. Key Approaches

- Integration
- Participation
- Knowledge-based
- Socio-economic
- Technical

## 3. Experiences that can be exchanged

The type of input-data can be copied and adjusted to other regional conditions. Considerations of climate change in different temporal and spatial scenarios in similarly structured areas. Exchange of ideas, strategies and methods on prevention of flooding and coping with flooding.

## 4. Overview of the case

Detailed risk assessment studies were done for the sand barrier island Langeoog and the north western part of mainland East Frisia bordering the Wadden Sea and the mouth of the river Ems. The results were discussed with regional and local experts and adequate feedback was used to feed into the model. Several recommendations resulted from the study, however, stating uncertainties. The results can be used for evacuation plans and to develop long-term plans of integrated development.

## 5. Context and Objectives

### a) Context

The German North Sea coastal zone is characterized by the Wadden Sea (UNESCO world heritage, national parks, biosphere reserves) and islands. The economy is dominated by agriculture and tourism. Tourism may pose a growing pressure due to climate change. Global sea level rise due to climate change is estimated from several centimetres up to more than a meter within the next 100 years. For the design of dykes a sea level rise of 50 cm per 100 years is used to determine the design water level in Lower Saxony and Bremen. In the new Master Plan for Lower Saxony and Bremen from 2007, a sea level rise of 1 metre per 100 years is considered for the design of foundations of hard structures. The total protected flood prone area of Lower Saxony covers about 6,600 km2 and is inhabited by about 1.2 million people.

The island of Langeoog is protected by dykes on the Wadden Sea side and by dune belts on the northern and western coast. The protected area (10.6 km length) covers 6.62 km2. About 2,000 people live on Langeoog and it is an important sea resort with a strong tourist economy. The dykes have a height of 5.4-8 metres above sea level. The mainland study side is bordered by the North Sea (north and west) and the river Ems and Sauter canal in the south. The Ems-Jade canal with high embankments divides the study area. The entire coastline is protected by dykes (109 km). The considered area covers 1292

km2 with 305,000 inhabitants.

### b) Objectives

The aim was to identify additional threats posed by climate change and to identify the threats according to various scenarios. New approaches were used for modelling flood risks and to assess probable damage affecting the area until the year 2100. Communication with local and regional stakeholders and the public was an integral part of the project. The work was carried out between July 2005 and June 2008.

## 6. Implementation of the ICZM Approach (i.e. management, tools, resources)

### a) Management

Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (NLWKN) carryied out the study.

### b) ICZM tools

Flood simulations were done depending of various flooding scenarios. Potential breach locations were defined to create flooding scenarios. Simulations were based on a 50 cm sea level rise per century, and carried out for the years 2007 (present), 2050 (25 cm), and 2100 (50 cm). Flood simulations were based on numerical hydro-dynamic models, enabling time-dependent flood propagation modelling. Stream networks, mostly drainage channels, were included in 1-D representation (for better spatial resolution). Lowlands are characterized by many drainage channels. They greatly influence flood propagation. Damage assessment was based on direct damage categories (private buildings and inventory, fixed assets, gross value), affected inhabitants, and the value of affected soil. The expected sea level rise increased the damage in all categories in the simulations.

Recommendations were aimed at further foreland management to reduce hydraulic loads on dykes, maintenance of embankments in the hinterland, including second dyke lines, streets, dams, etc. as flood risk mitigation measures. However, such measures influence flow paths, therefore, areas that used to be safe may be flooded. And, if flooding occurs from an unexpected direction, the “wrong” area may be flooded and under higher danger than before. The results were discussed with local and regional experts and stakeholders. A local contact group was established to raise stakeholder and public awareness, and to get feedback to improve the recommendations as output of the project.

## 7. Cost and resources

The detailed budget is not known but ERDF funding was used (50%).

## 8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The integration of the drainage channel system lead to a better representation of flood propagation.

## 9. Success and Fail factors

The communication process with the public increased knowledge about climate change and flood risks. Applying several scenarios for simulations was a way to take into account uncertainties. The prediction of future economical changes in flood prone areas and therefore the assets at risk are highly uncertain. Uncertainties are present in all parts of the risk analysis. Level of expertise and the related existing awareness on flood risks was very heterogeneous in the public. The demand for information on climate change and flood risks was high.

## 10. Unforeseen outcomes

None so far.

## 11. Prepared by

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## 13. Sources


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- Flood risk assessment at two pilot sites - methods and measures, Action 5B, final report (2008). Niedersächsicher Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz - Betriebsstelle Norden-Norderney (NLWKN)
- Project website: http://www.safecoast.org


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