

# Development of adaptation strategies of marshland water management to regional climate change

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## 1 Background and motivation

→ Current water management problems in the Wesermarsch County, Germany: too much water in winter time (intense drainage required), too little water in summer time (watering required), too high salt concentrations of surface and groundwater in summer time;  
 → Current water management solutions for low lying areas: Pumping out water in winter time, watering the county in summer time using water from Weser river, interruption of watering in case of too high salt concentration (2.5 mg/l);  
 → Expected worsening of those problems due to future climate change: sea level rise, wetter winters, dryer summers;  
 → Is an adaptation to climate and hydrological necessary? If yes, what kind of adaptation is reasonable?

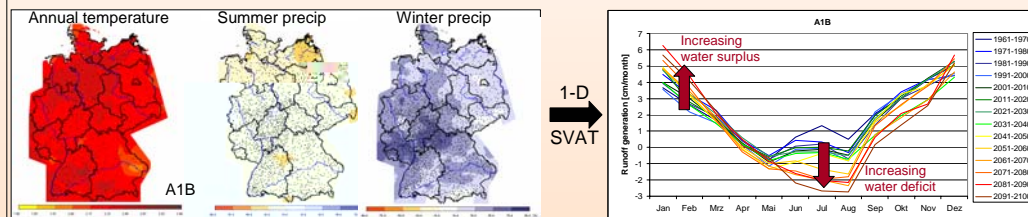
## 2 Characteristics of the Wesermarsch region

→ Coastal marsh area along the North Sea and the Weser River estuary (elevation mainly -2 to 3 m above sea level);  
 → Agriculturally used area, grassland dominating (diary cattle);  
 → Predominantly marsh and bog soils;  
 → Dense network of ditches and channels (drainage, watering);  
 → Low lying areas can be artificially drained, only;  
 → Area is encircled by salt water (Jade bay, North Sea).



## 3 Expected climate and hydrological change

→ IPCC scenario based analysis of climate change effects on hydrological regime;  
 → Quantified by the physically based, 1D hydrological SVAT model SIMULAT, driven by regional climate scenarios from weather conditions based WETTREG model (precipitation, temperature, sunshine, vapour pressure, wind speed);  
 → Simulated effects on the regional scale water balance: hardly differences between A1B, A2, B1 scenarios until 2050.

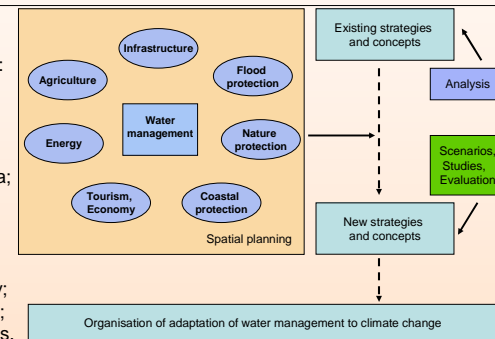


## 4 Adaptation required!

→ Hydrological modelling shows increasing necessity for water management in future: surplus in winter, deficit in summer time.

### Stakeholder driven adaptation process

→ Participatory and integrative approach considering multifunctional use of the area;  
 → Stakeholder: Water boards, dike boards, municipalities, districts, drinking water supply and sewage disposal company nature protection organizations (GOs, NGOs), chamber of agriculture, peasantry;  
 → Round tables, expert meetings, interviews;  
 → Problem analysis; strategies, ideas, visions.



## 5 Results

### Stakeholders vision of the world in 2050:

Maintain the status quo!  
 → Conservation of the current picture of the landscape;  
 → Intensive agricultural use if required;  
 → Safe life behind the dike;  
 → Safe employment;  
 → Attractive tourism.

### Adaptation strategy developed by local stakeholders

Measures are dominated by technical solutions:  
 → New and enlarged channels (drainage, watering);  
 → Additional, enforced pumping stations;  
 → Barriers, heightened dikes;  
 → Parallel drinking water supply system for dairy cattle;  
 → Better cooperation between existing water boards.



versus



### Alternative vision (international experts): Sustainable development

Living with changing environmental conditions.  
 → Adapting land use while guaranteeing safety, as well;  
 → Learning from nature (e.g., floating coastal protection).

### Alternative adaptation proposed by an international expert committee:

Realised by alternative land use concepts and technical solutions  
 → Alternative land use concepts: crops instead of dairy cattle in dry (elevated) areas, re-wetting of low-lying areas;  
 → Water logging in low lying areas: lakes, wetlands, polders;  
 → Barriers for coastal protection, but also alternative coastal protection strategies (second dike line, wave overtopping resistant dikes, floating structures in the wadden sea);  
 → Aquaculture on land;  
 → Merging water boards.



## 6 Questions

- What next, Wesermarsch?
- How to decide how to adapt?
- Whom to decide how to adapt?
- What's the value of cultural history?
- Adaptation of land use or technical solutions?
- May there be a compromise?
- What are the development goals of the region Wesermarsch?
- Who pays for adaptation?

## Acknowledgements

Thanks for the EU Interreg IVb for funding "Climate Proof Areas",  
 Thanks to all stakeholders for their active participation,  
 Thanks to our international project partners for their ideas.  
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