

European Pavilion

Digital Ocean

Nice | France
2 - 13 JUNE 2025

Nature-based
solutions to increase
coastal resilience



Inspire
sea level rise



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sea level rise



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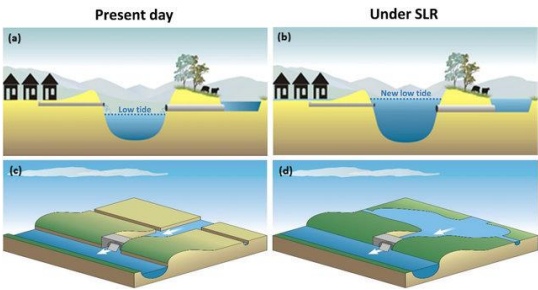
Coasts & Estuaries: impacts of sea-level rise

Sea level changes are expected to play a dominant role in many estuarine environments. They can lead to:



Sources: <https://www.umweltbundesamt.de/>

Coastal Erosion



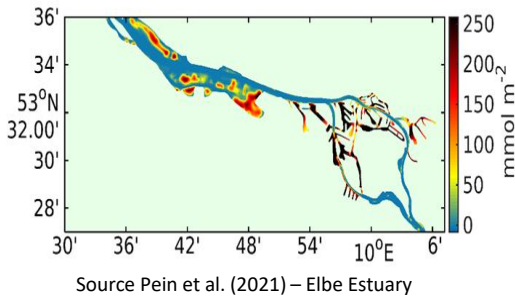
Sources: DOI: 10.1016/j.scitotenv.2021.146470

Reduced drainage and prolonged inundation



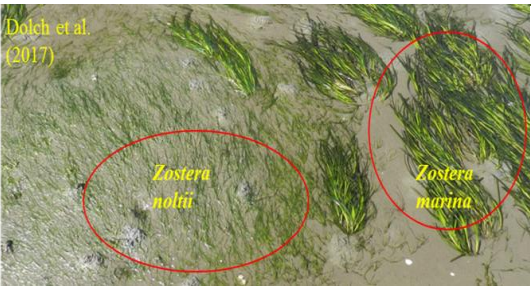
Photo: Alex Berger, Flickr, CC BY-NC 2.0)

Salt water intrusions



Source Pein et al. (2021) – Elbe Estuary

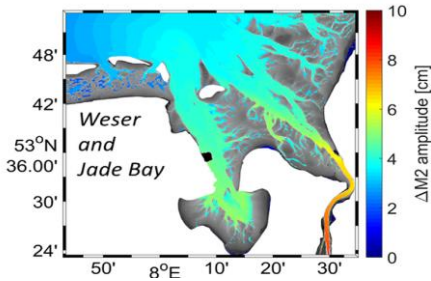
Changes to nutrient dynamics



Dolch et al. (2017)

Zostera noltii

Zostera marina



Source Stanev et al (2019)

Altered tidal range and circulation patterns



Source J Stanev Photo

Altered sediment transport regimes



Changes to ecosystem habitat distribution and land use



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Nature-Based Solutions for Biodiversity & Coastal Hazards

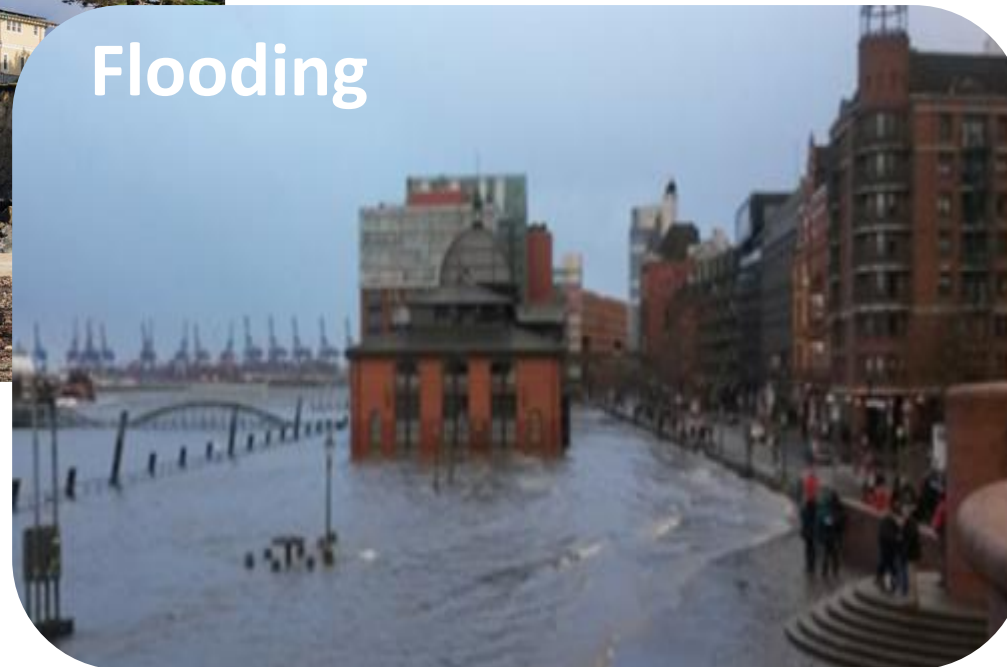
Problem



Coastal erosion



Flooding



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Vegetation as a Nature Based Solution



Traditional "grey" solutions



Impact of vegetation



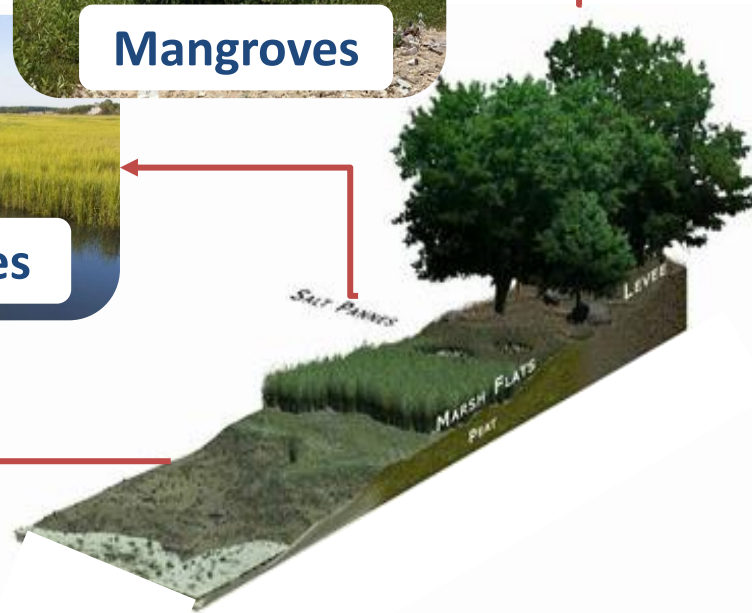
Mangroves



Salt marshes



Seagrass



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Nature-Based Solutions for Biodiversity & Coastal Hazards

Enhanced Need for Effective Coastal Protection



Benefits:

- Dampens waves and currents
- Stabilises beaches - less erosion and flooding
- Environment-friendly

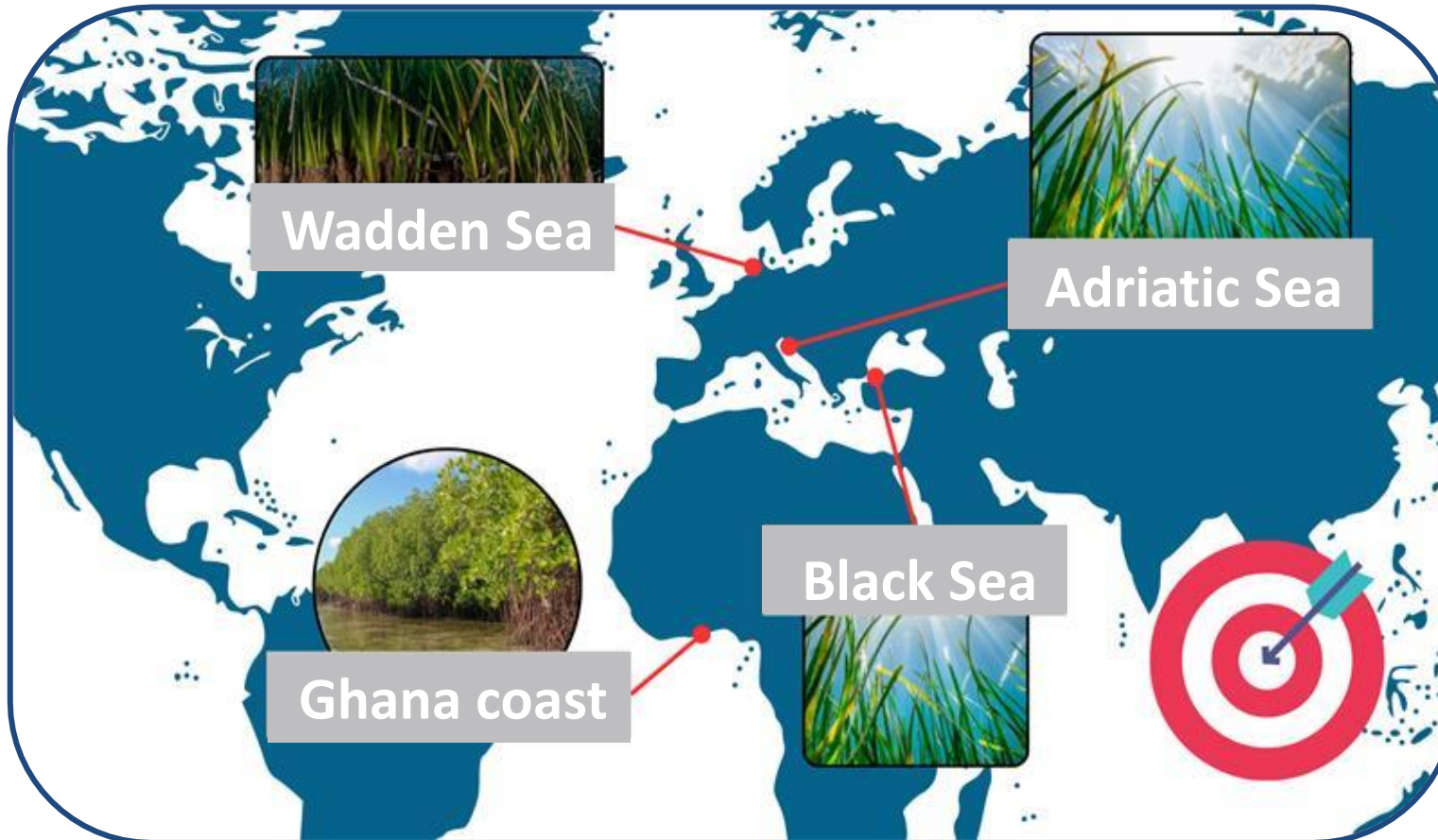


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Regional Applications



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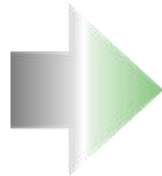


Sea Level Rise in the Wadden Sea

- **UNESCO World Heritage**
 - 73% are protected area
 - 10,000 faunal species
 - 40 fish species
 - 6 million migratory birds
- **Main challenge:** Coastal protection with NBS under rising climate uncertainty



Traditional engineering



Nature based Solutions



- **Objectives**
 - A transferable modeling and framework for coastal risk analysis (erosion) that simulates the complex multi-compartment system.
 - Potential improvements for Ecosystem Services (ESS) in the German Wadden Sea.



Sea level rise: more than rising water



Future challenges: Climate change (SLR) and coasts and estuaries (DTO: multi-scale trans-disciplinary tools hydrology-wind waves-hydro and sediment dynamics-ecosystems)

feedback loop

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Thank you!



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