



# Gute Küste Niedersachsen

Reallabore für einen ökosystemstärkenden Küstenschutz

## Towards a better coast - how restored ecosystems can improve coastal protection in Lower Saxony

NABU-Workshop on best practices:  
restoration in the German Wadden Sea for climate, coast and nature  
15th June 2023

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# Introduction to the project

- „Gute Küste“ - „What is a good coast?“
- 3 universities, 7 departments,  
5 professors, 8 PostDocs, 15 PhDs of
  - coastal oceanography
  - coastal engineering
  - social science
  - environmental planning
  - ecological economics
  - landscape architecture
  - marine biology
  - and everything in between!
- 5 years of funding until 2024



Ludwig-Franzius-Institute (LuFI)  
Institute of Environmental Planning (IUP)  
Institute of Open Space Planning and Design (IF)



Leichtweiß-Institute for Hydraulic Engineering  
and Water Resources (LWI)  
Institute of Geoecology (IGÖ)



Institute for Chemistry and Biology of the  
Marine Environment (ICBM)  
Ecological Economics (ÖÖ)



Niedersächsisches Ministerium für  
Wissenschaft und Kultur



**Niedersachsen**



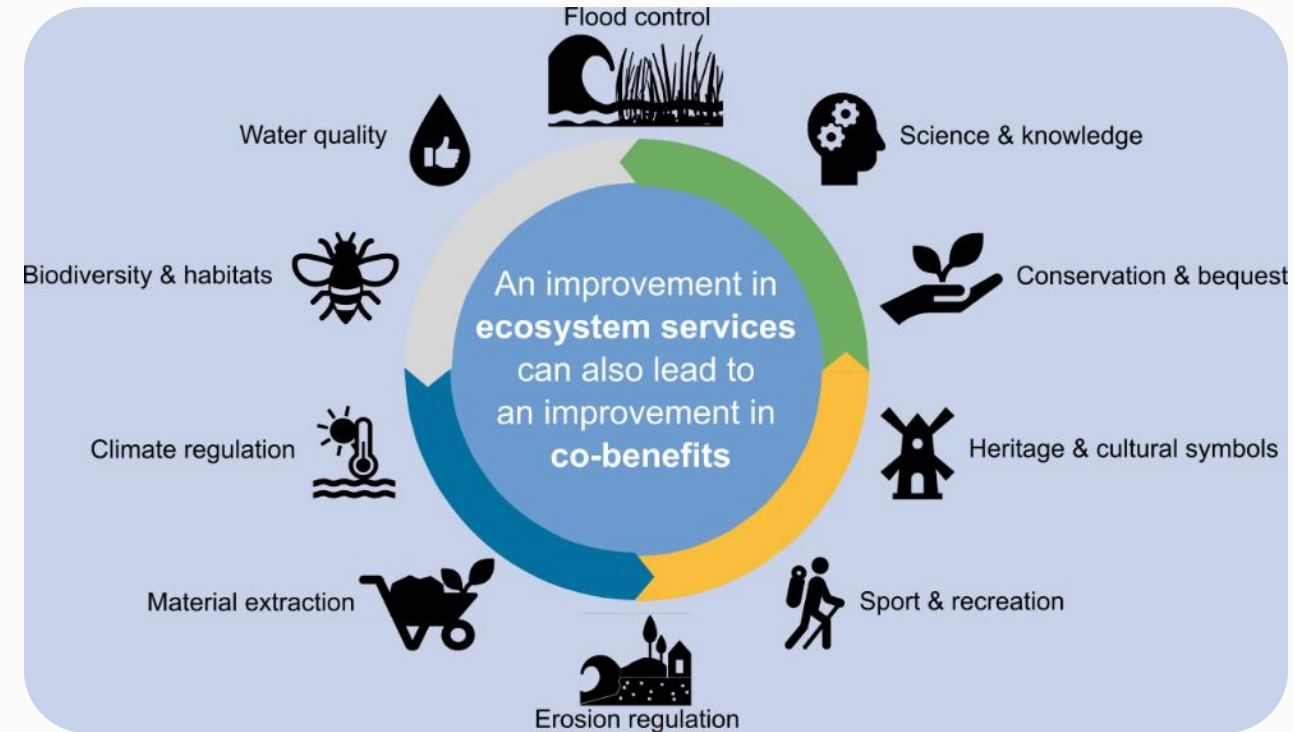
**SENCKENBERG**  
world of biodiversity

Associated partners:



# Aims and Methods

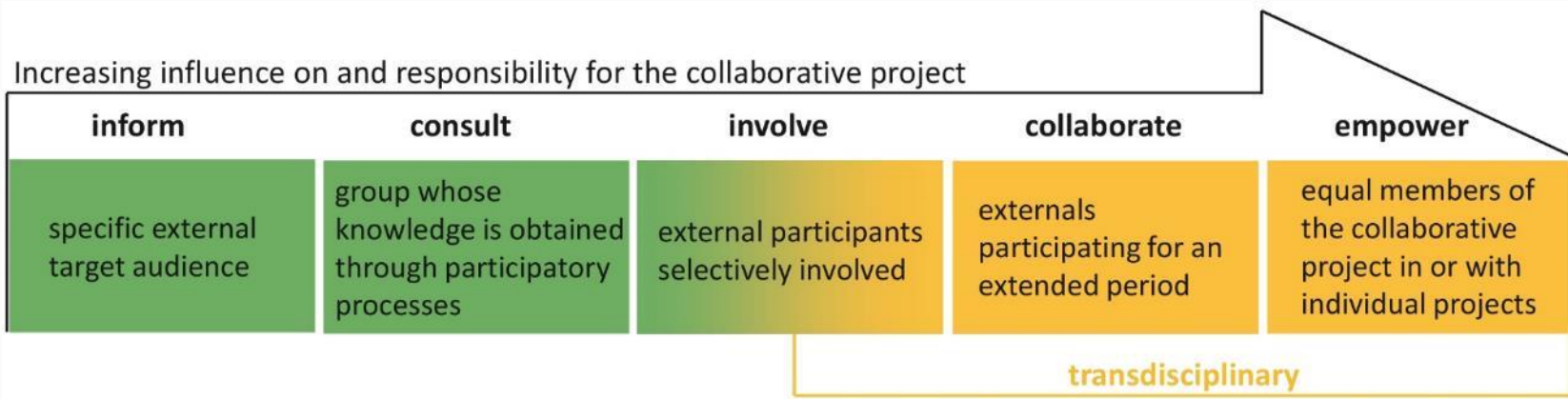
1. Enhancing Coastal Protection: Understanding the processes and benefits of a stronger ecosystem.
2. Collaborative Research for Effective Solutions: Real-world labs and experiments for interdisciplinary insights.
3. Uniting Coastal Experts: Lower Saxony's coastal research institutes and local actors working together.
4. Adapting to Climate Change: Co-Developing knowledge and practical options for managing the changing signals.



*Future-oriented coastal protection measures that strengthen the ecosystem, offer additional benefits, and maintain the current level of protection.*

# Real-world laboratory concept

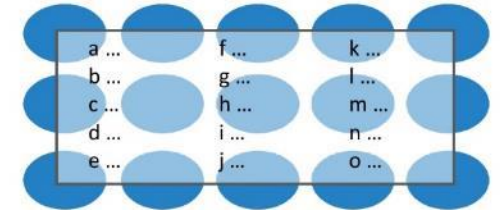
- Novel approach in coastal protection context
- Stakeholder involvement from day 0
  - collaboration potential
  - site selection process
  - research questions...
- Ongoing exchange



## Selection Process of RwL Sites

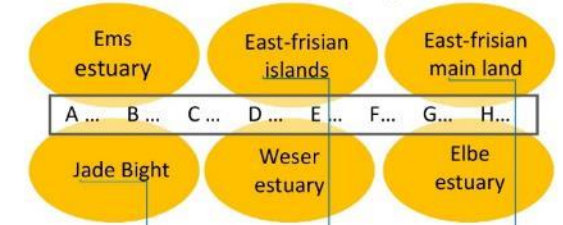
### Step 1: Pre-Selection and Assessment Design

15 locations  
18 valuation parameters



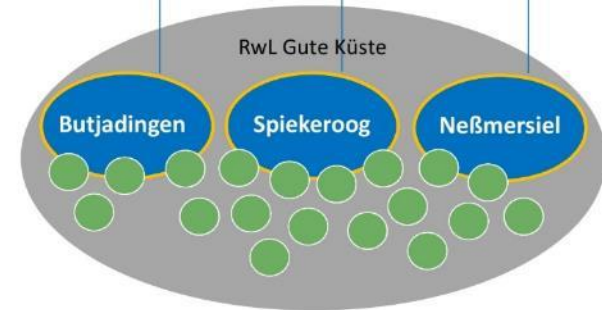
### Step 2: Refinement & Reduction of Complexity

6 regions  
8 key parameters for valuation

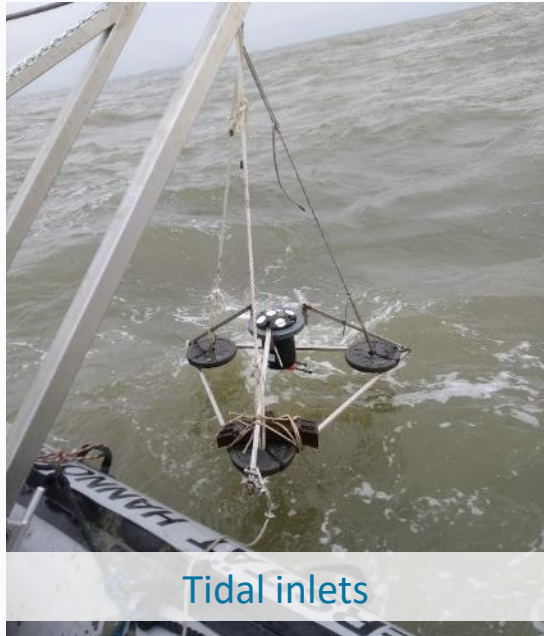


### Step 3: Assessment & Aggregation

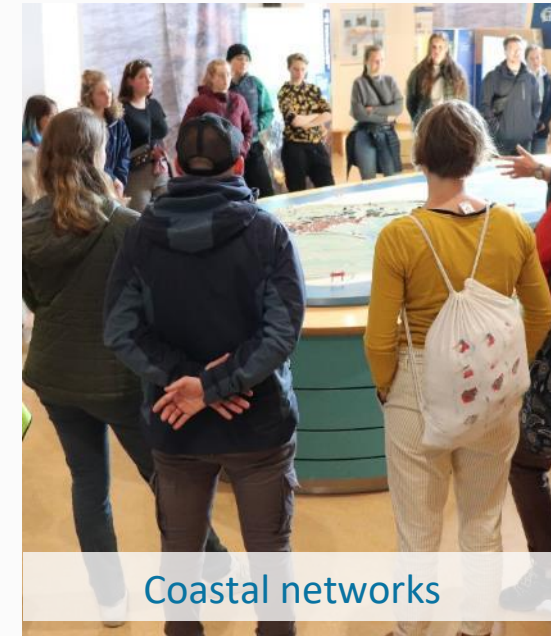
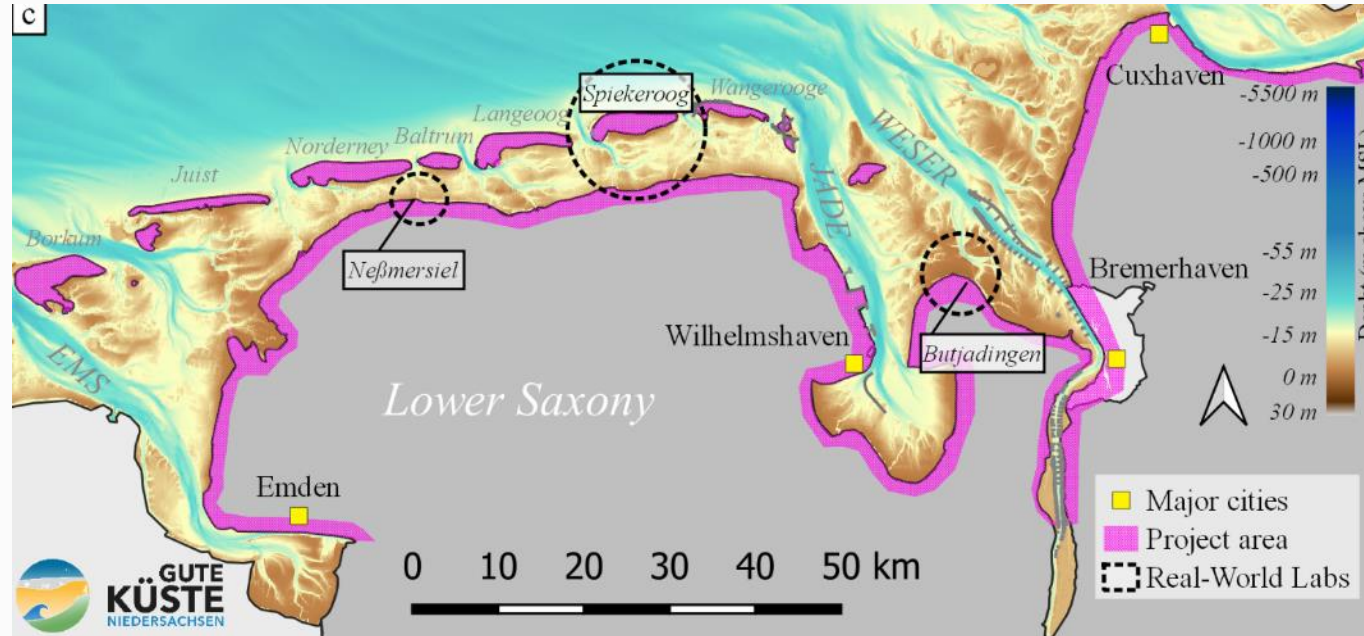
RwL Gute Küste  
3 RwL sites with several experiments



# RWL research overview



Tidal inlets



Coastal networks



Salt marsh restoration



Dunes & beachgrass



Tidal marsh & flats



Dike vegetation

# Tidal marsh vegetation

## Plant-Environment-Interactions (in the pioneer zone) and its role in marsh evolution

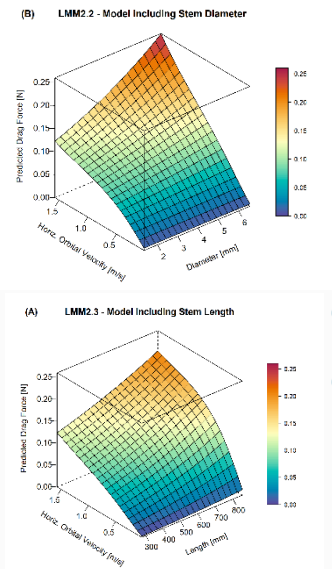
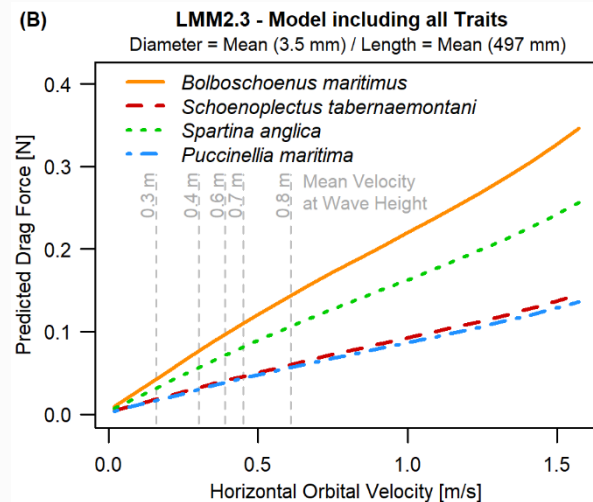
\* Steinigeweg et al. (2023) *Conquering New Frontiers: The Effect of Vegetation Establishment and Environmental Interactions on the Expansion of Tidal Marsh Systems*. *Estuaries and Coasts*: 1-21.

## Plant responses and effects by inter- und intraspecific trait variations

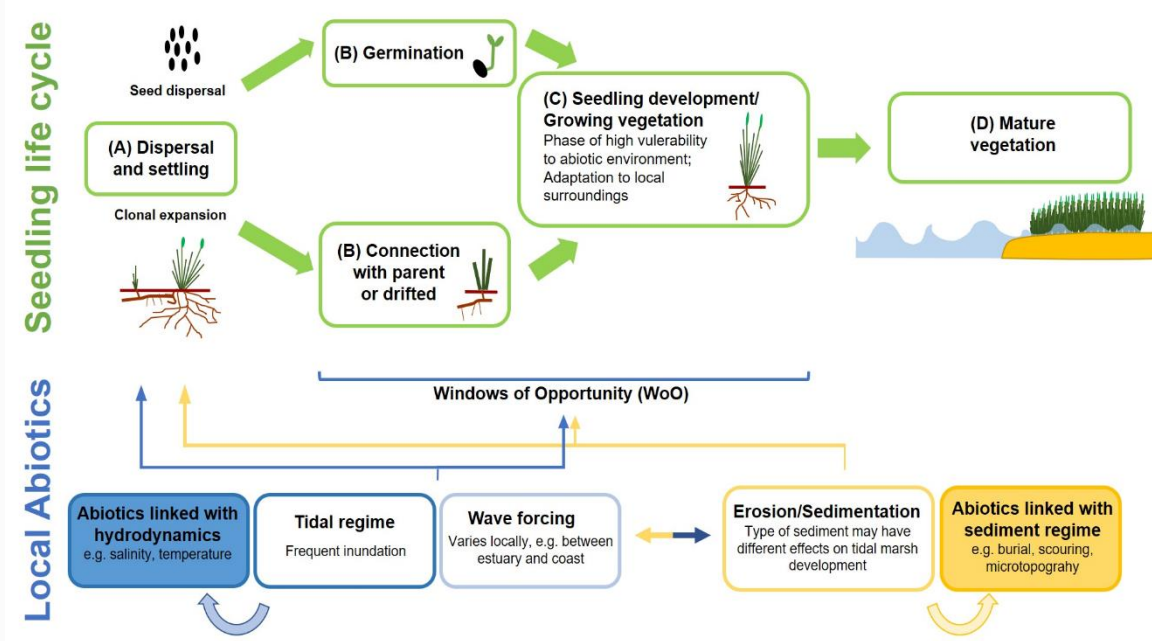
\*\*Steinigeweg et al. (2023) Plant trait-mediated drag forces on seedlings of four tidal marsh pioneer species" *Frontiers in Marine Science*, 10: 1-13.

## Community composition as a result of abiotic surroundings and interspecific interactions in pioneer zones of Spiekeroog

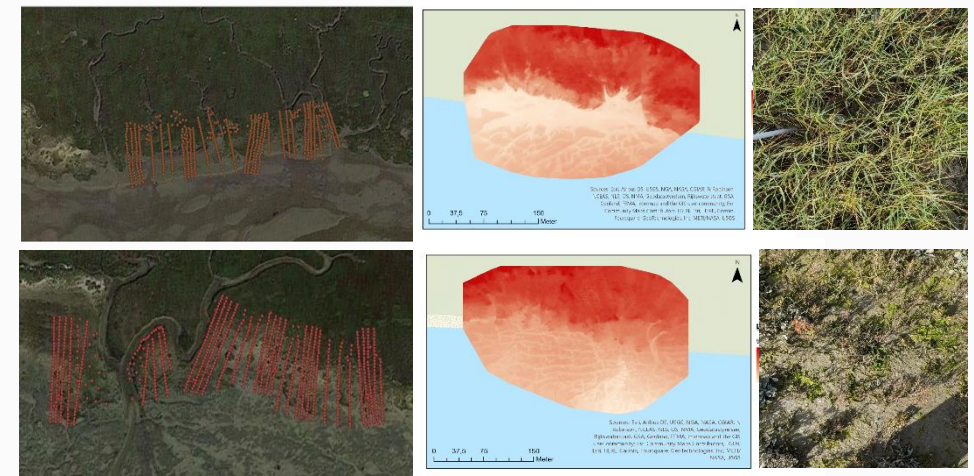
\*\*\*In Prep.



\*\*Steinigeweg et al., 2023



\*Steinigeweg et al., 2023



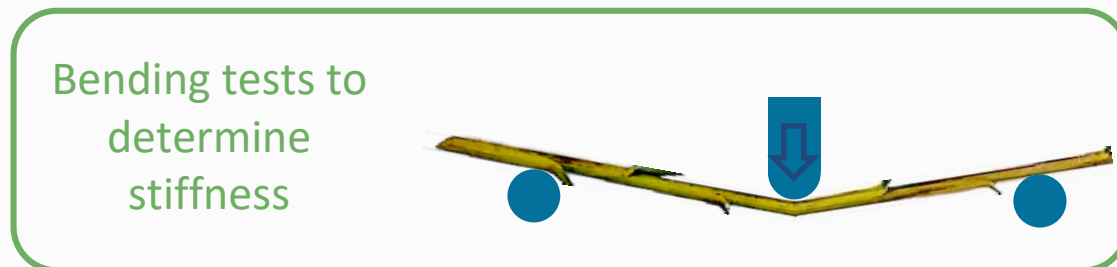
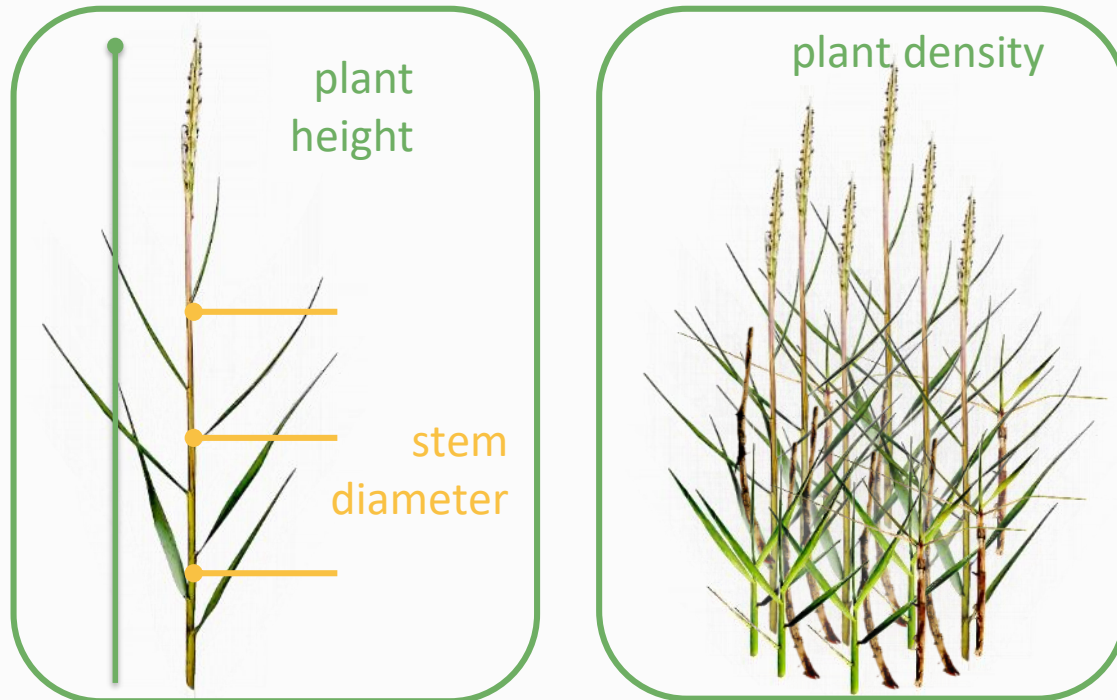
\*\*\*Steinigeweg et al., in prep.

# Tidal marsh vegetation II

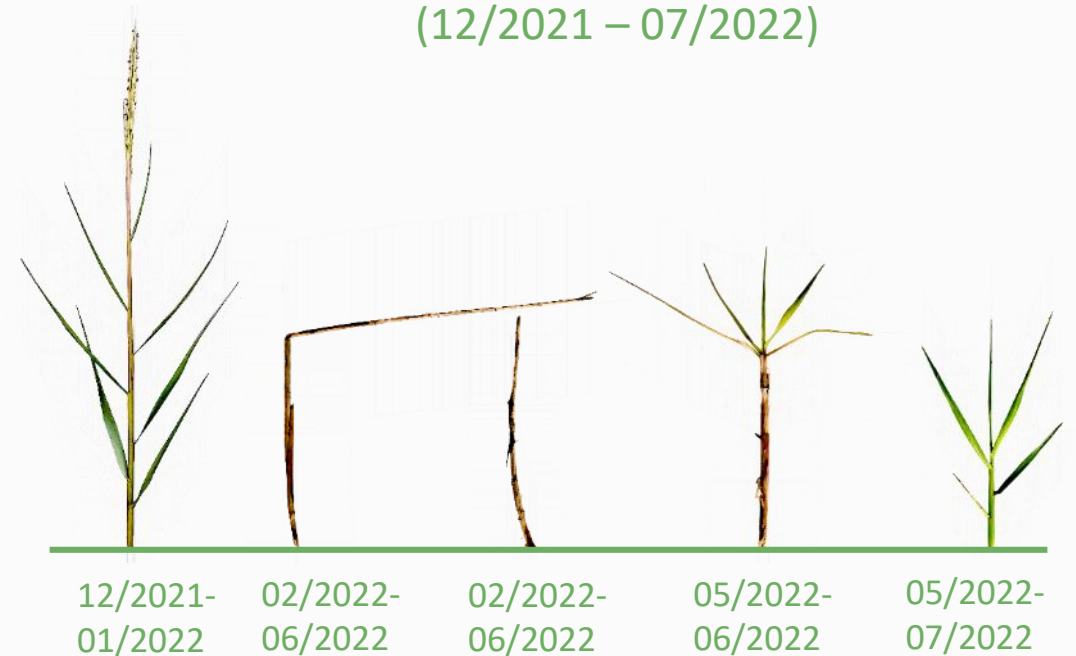
Monthly field surveys from Dec 2021 to Dec 2022

→ *Spartina anglica* and *Elymus* spp. (*Elymus repens*/*Elymus athericus*)

→ In total 1746 + 1390 = **3136 single Plants** analyzed



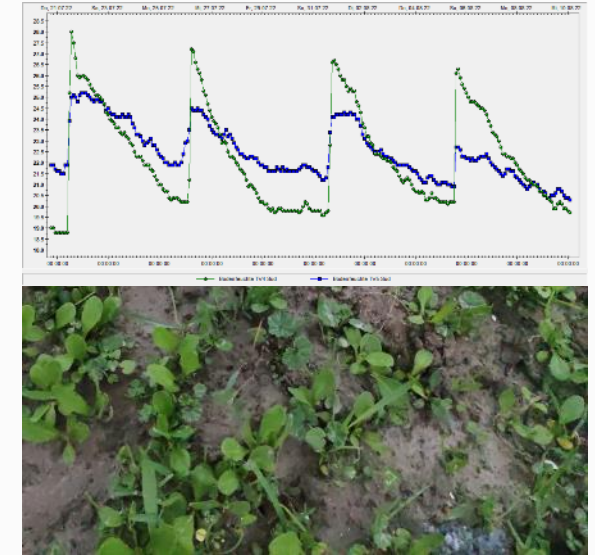
Classification of seasonality considering the phenotypes and biomechanical properties of *Spartina anglica* (12/2021 – 07/2022)



Keimer et al. (2023) – Proposing a novel classification of growth periods based on biomechanical properties and seasonal changes of *Spartina anglica*. *Frontiers in Marine Science*.

# Dike Vegetation Langwarder Groden

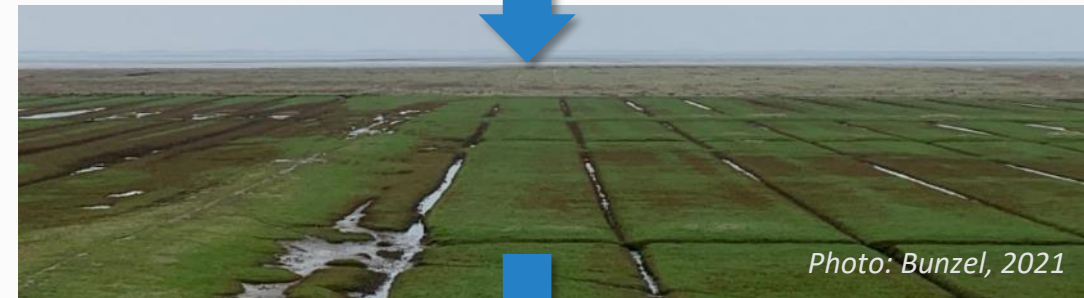
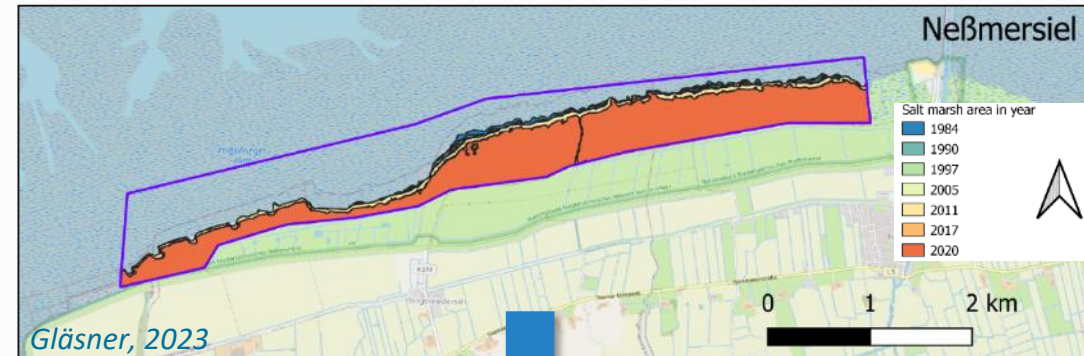
- How does species-rich dike vegetation perform compared to classic grass?
- Open air experiment with different seed compositions and measuring methods
- Stability and wave damping potential in real conditions



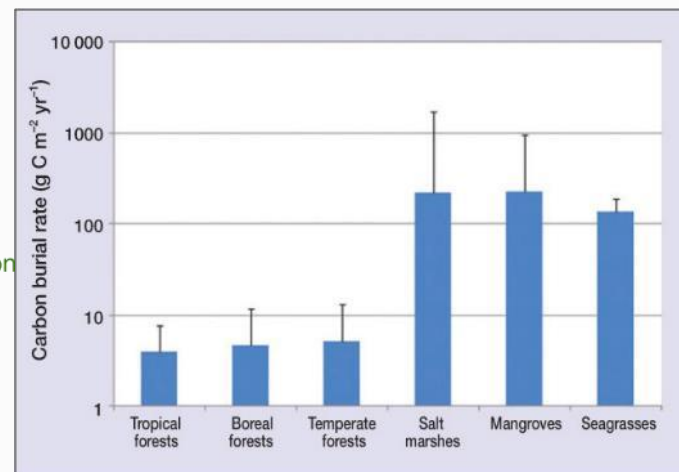
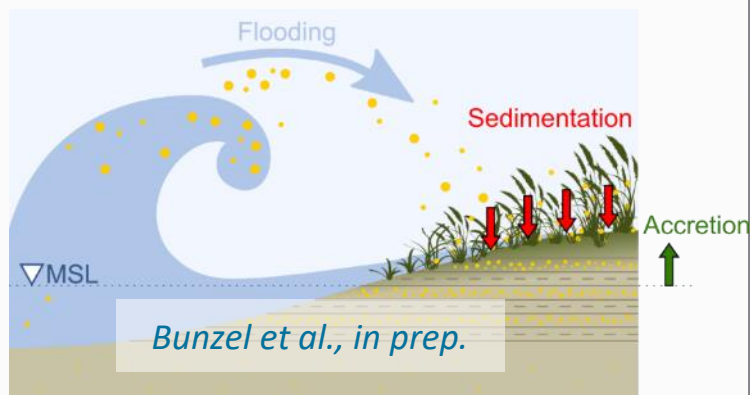


# Marsh restoration

- Baseline: cat. C habitat, recessing front
- Concept before/after restoration:
  - Vegetation mapping
  - Soil sampling and cont. measurements
- Aim: amount and origin of organic matter to assess carbon storage potential related to ESS and restoration



Bunzel et al., in prep.



Mcleod et al., 2011

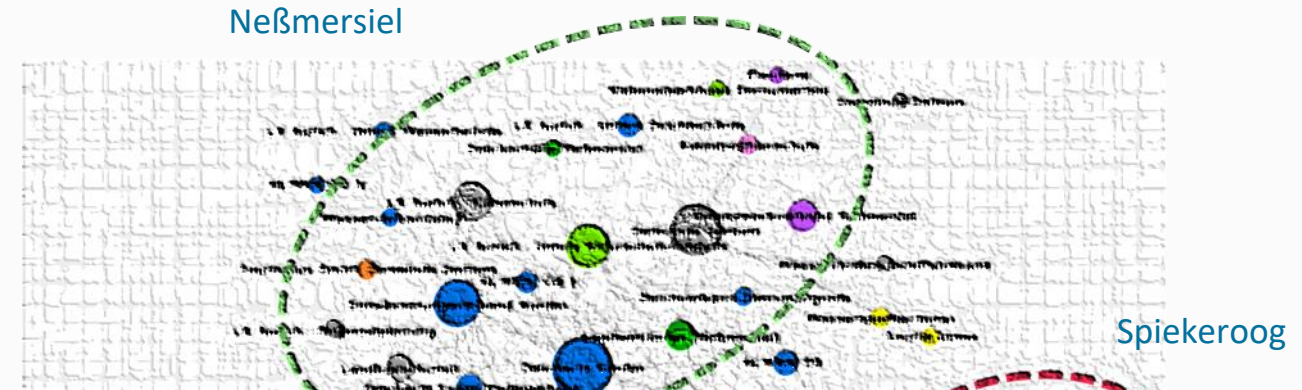
# Actor constellation and decision making process

- Involvement of actors and cooperation processes become more common
- But: coastal protection is in parts still locked in traditional thinking

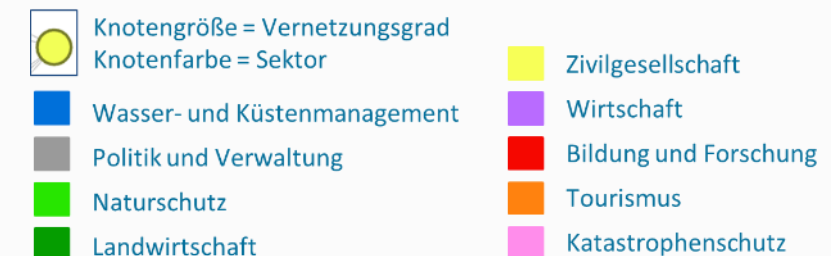
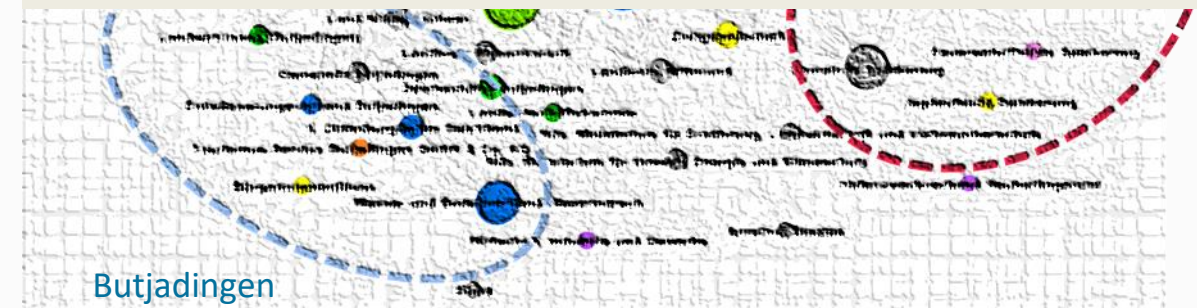
Actors' involvement is crucial to incorporate ecosystem services in coastal protection management

Involve all fields of action in participation processes to

- foster exchange of information and knowledge
- reduce skepticism and conflicts
- develop shared knowledge and values



*Schulte-Guestenberg et al., in prep.*



# Involvement and Outreach:



Interdisciplinary teaching



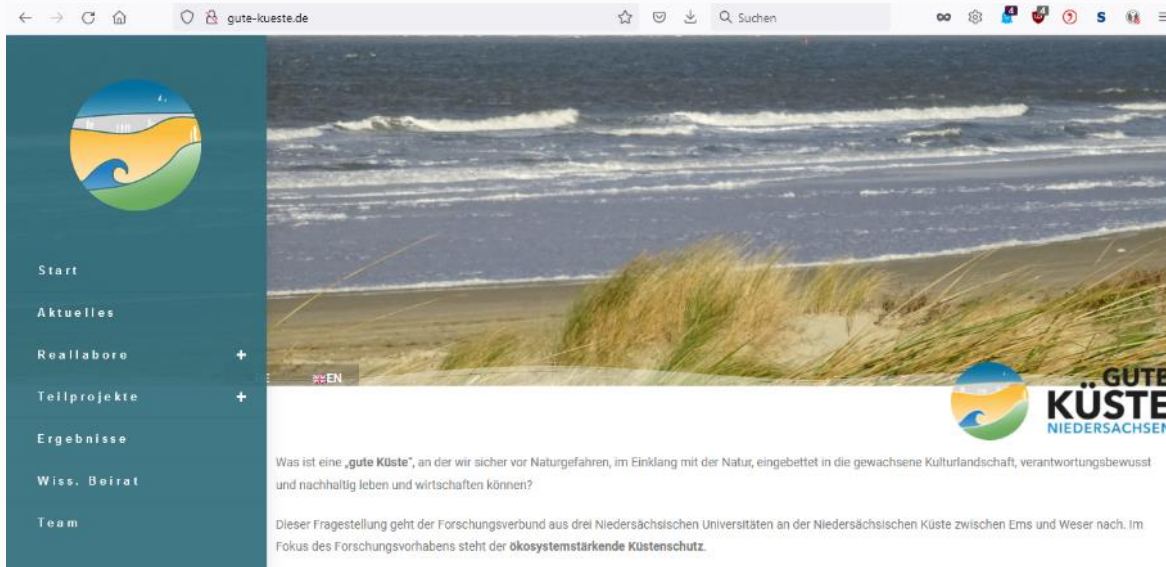
LEGO model wave flume



„Coast Snap“  
Citizen Science approach

plus: exhibitions, workshops, talks, open lab days, etc...

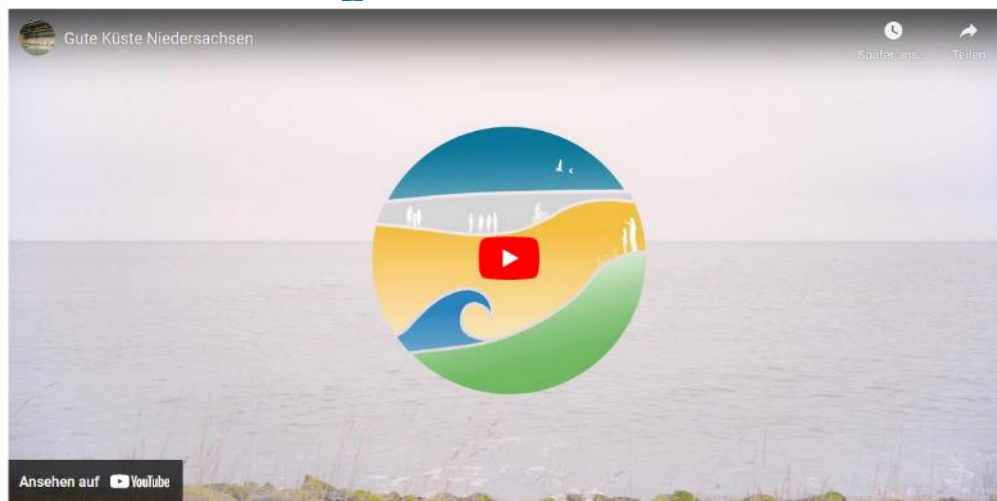
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<https://youtu.be/NIAMsCGElAQ>

# Thank you!



Feedback is welcome! [visscher@lufi.uni-hannover.de](mailto:visscher@lufi.uni-hannover.de)



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