

# Deltares



 enabling delta life



## NBS 2.0 – next generation of Nature-Based Solutions

Bregje van Wesenbeeck

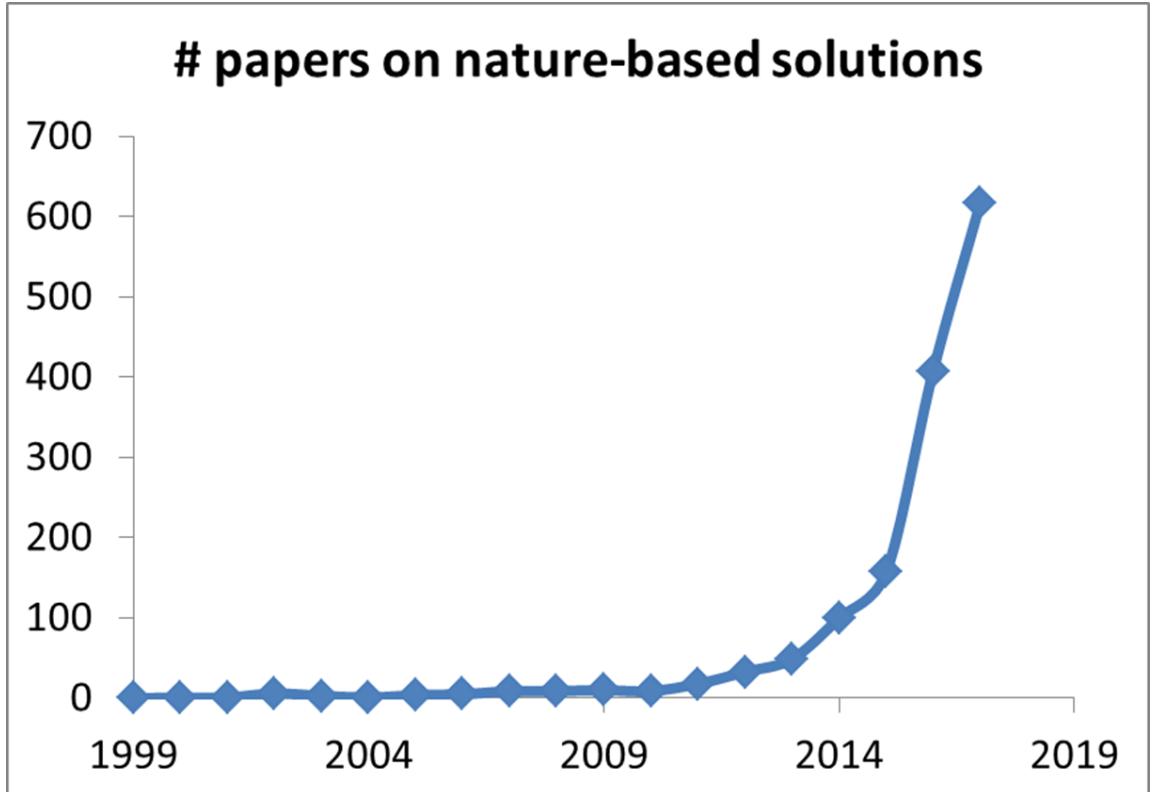


@BregjevW



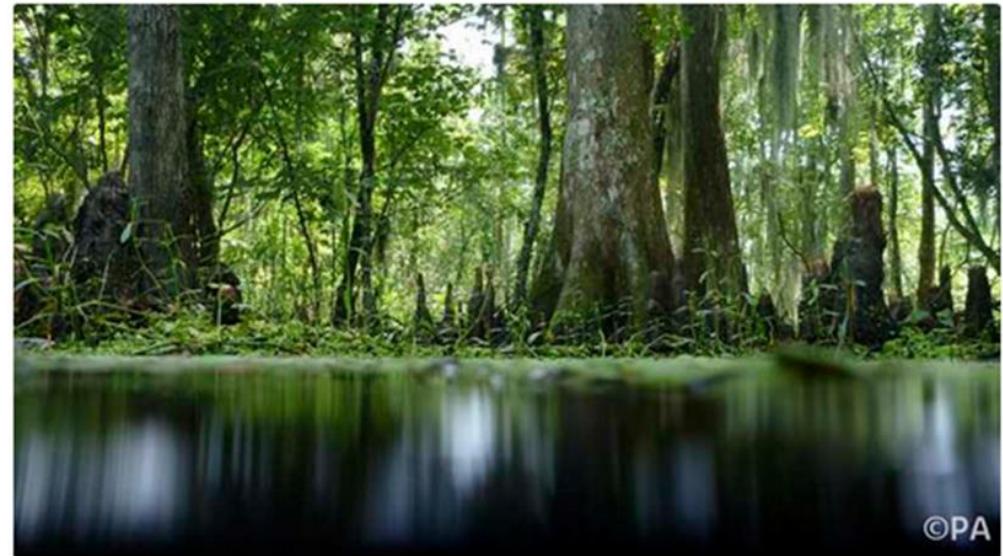
bregjevanwesenbeeck

# Putting NBS into perspective



4 December 2013, 5.31pm AEST

**Mangroves, nature's shield  
against typhoons and tsunami**



# Putting infrastructure into perspective



# First generation NBS



Houtrib Dike Pilot Project



Sand Motor Delfland Coast



Hondsbossche Dunes



Sand engine lake IJssel



Interreg VB North Sea Region project Building with Nature



NatureCoast



Salt marsh development Marconi Delfzijl



Mud Motor Koehoal salt marsh development



Marker Wadden KIMA



Room for the Rivers



Wave dampening floodplain forests



Alternative vegetation management



Werven Park Dordrecht



Tidal park Rotterdam



CityDeal Klimaatadaptatie



Dike in Dune - parking garage Katwijk



# Scalability



# Reliability



# Biodiversity



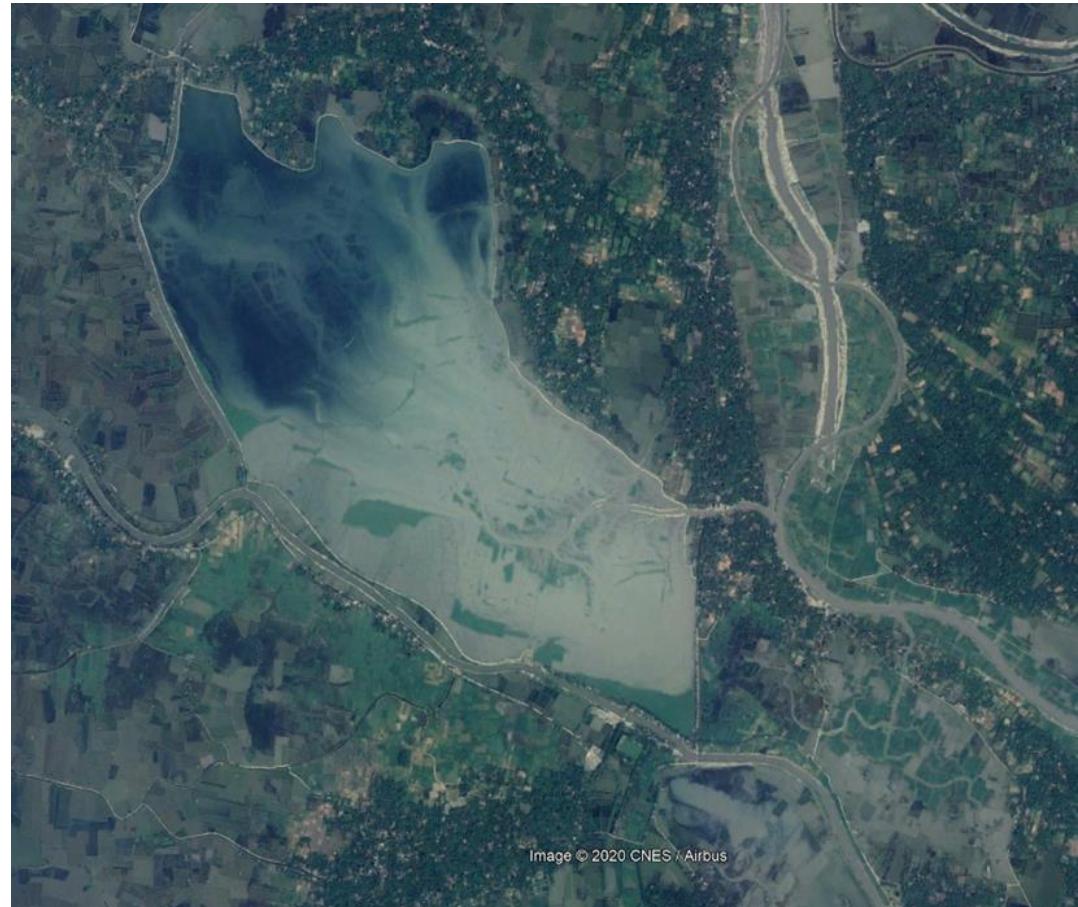
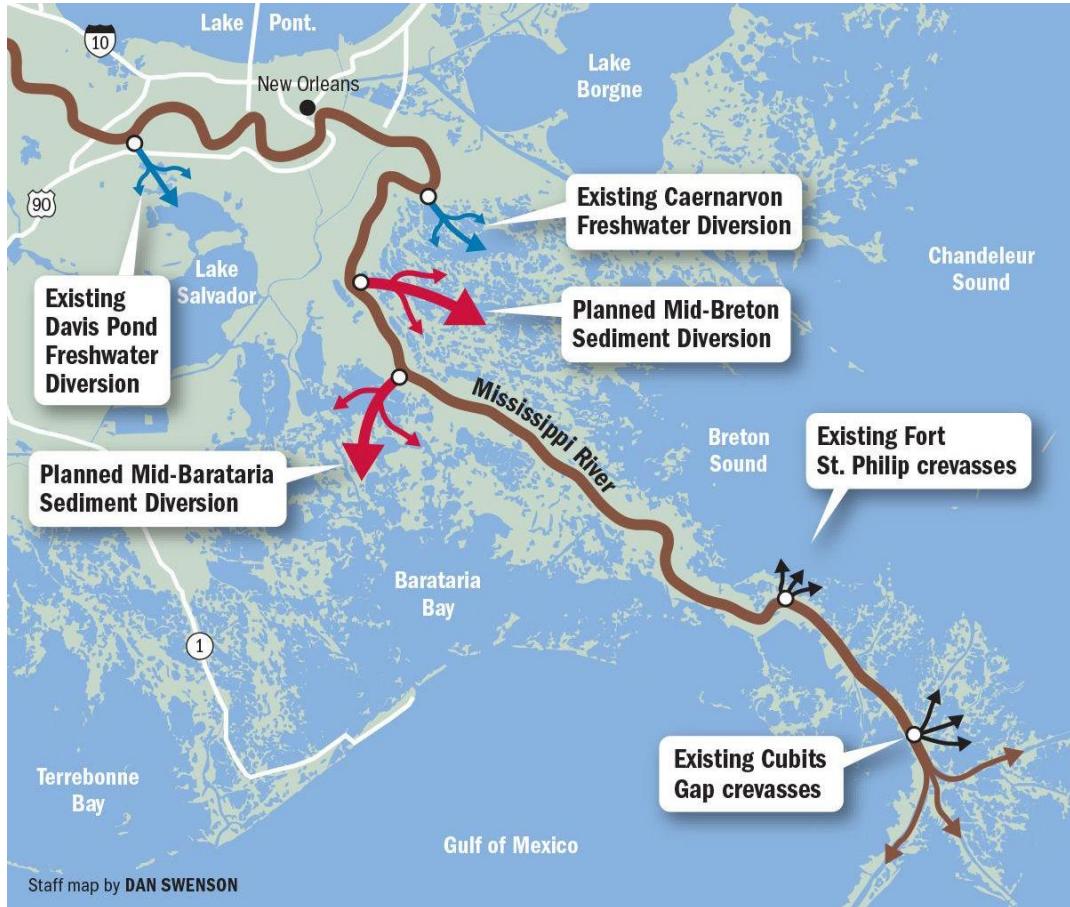
# Successful NBS approaches



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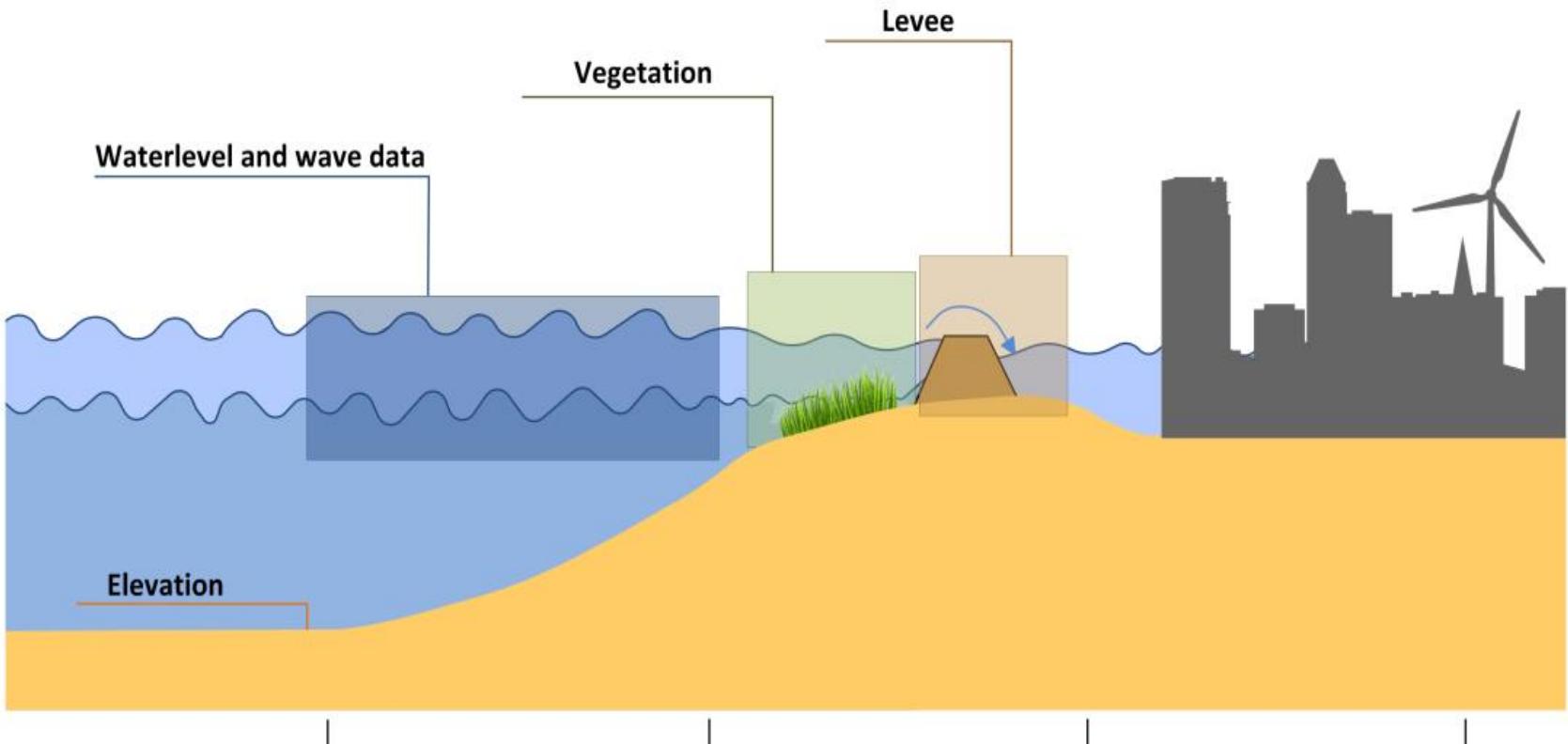


# NBS at scale

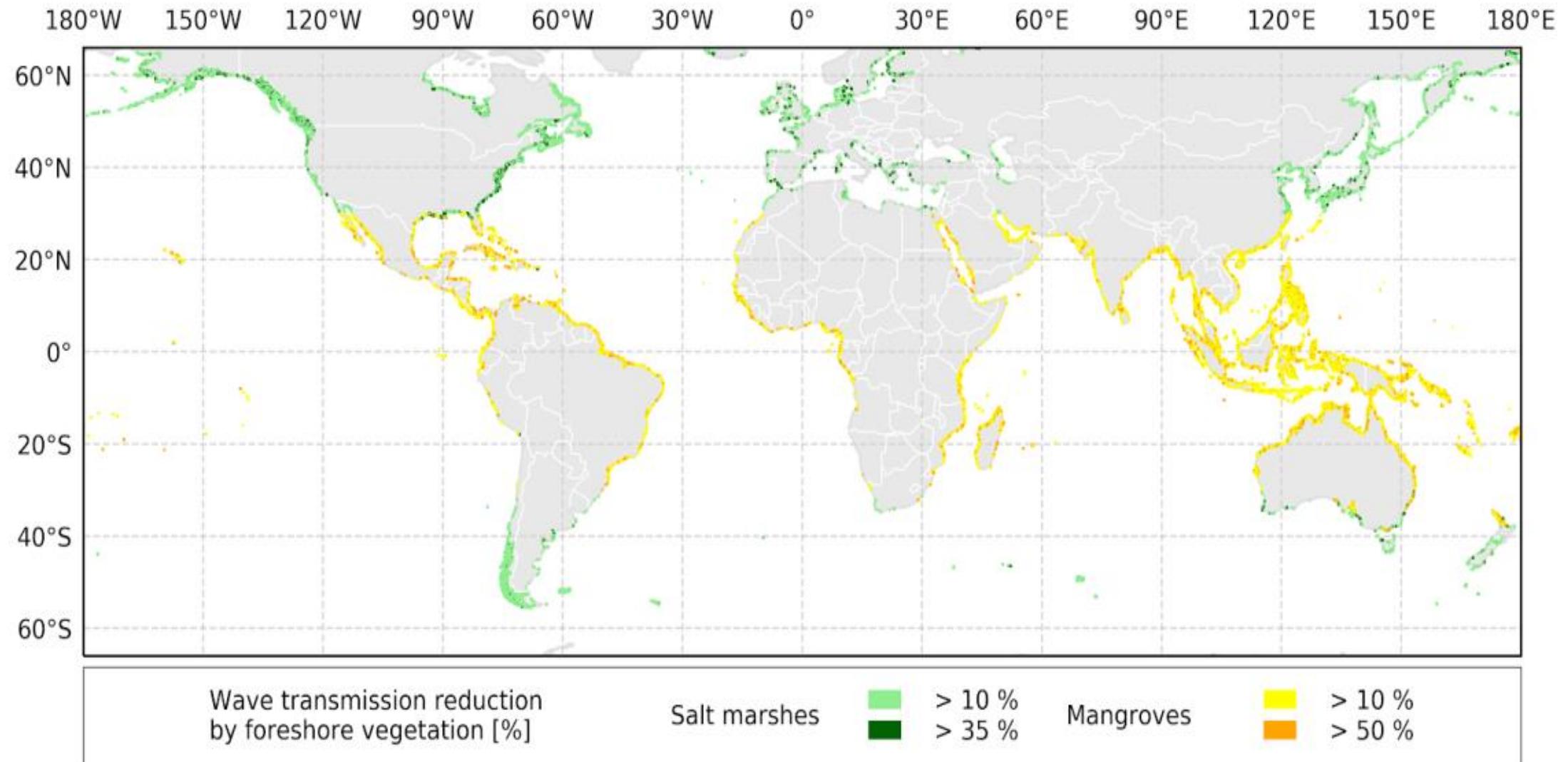
- 1. Combination of engineering and ecological knowledge
- 2. Focussing on larger scale abiotic conditions for ecosystem presence



# Hybrid options

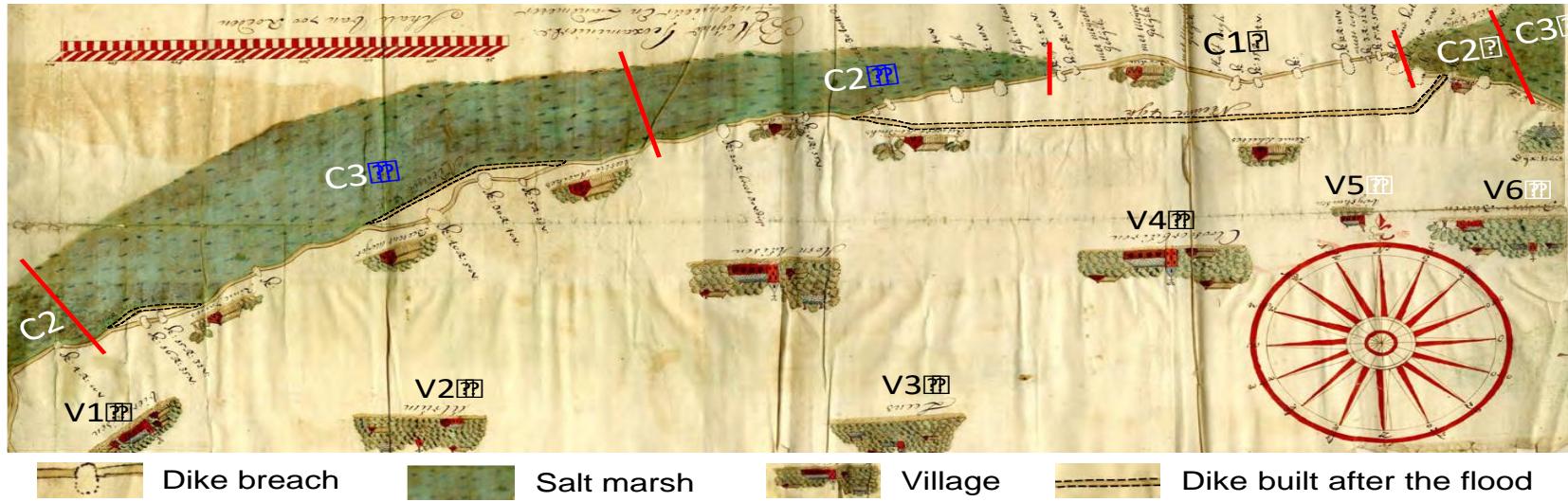


# Where does vegetation reduce wave heights?

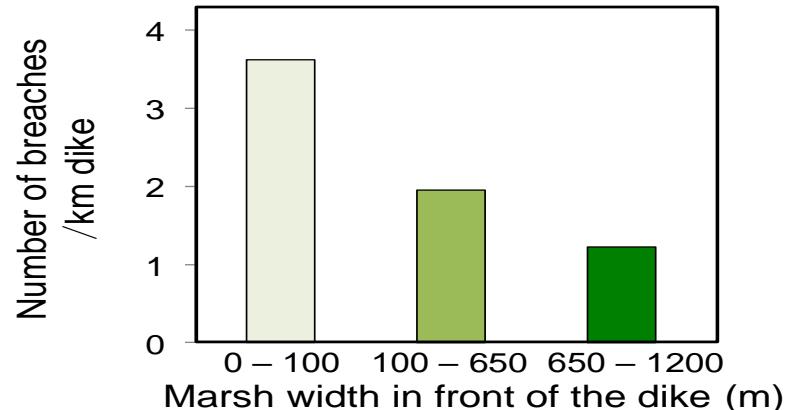


# Do foreshore systems matter at smaller scales?

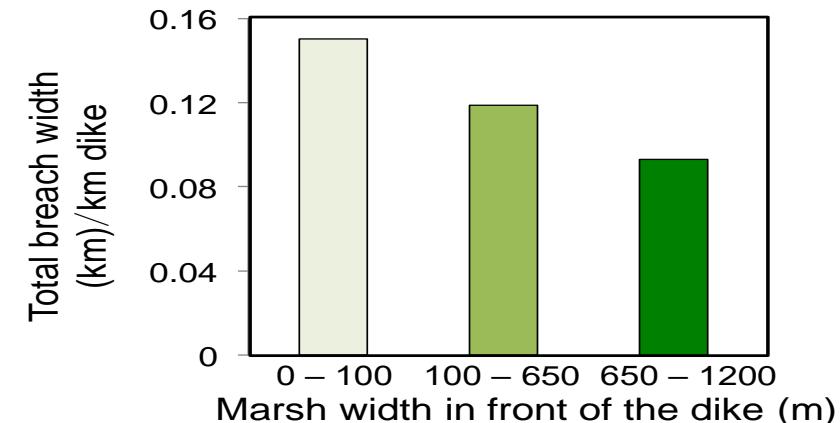
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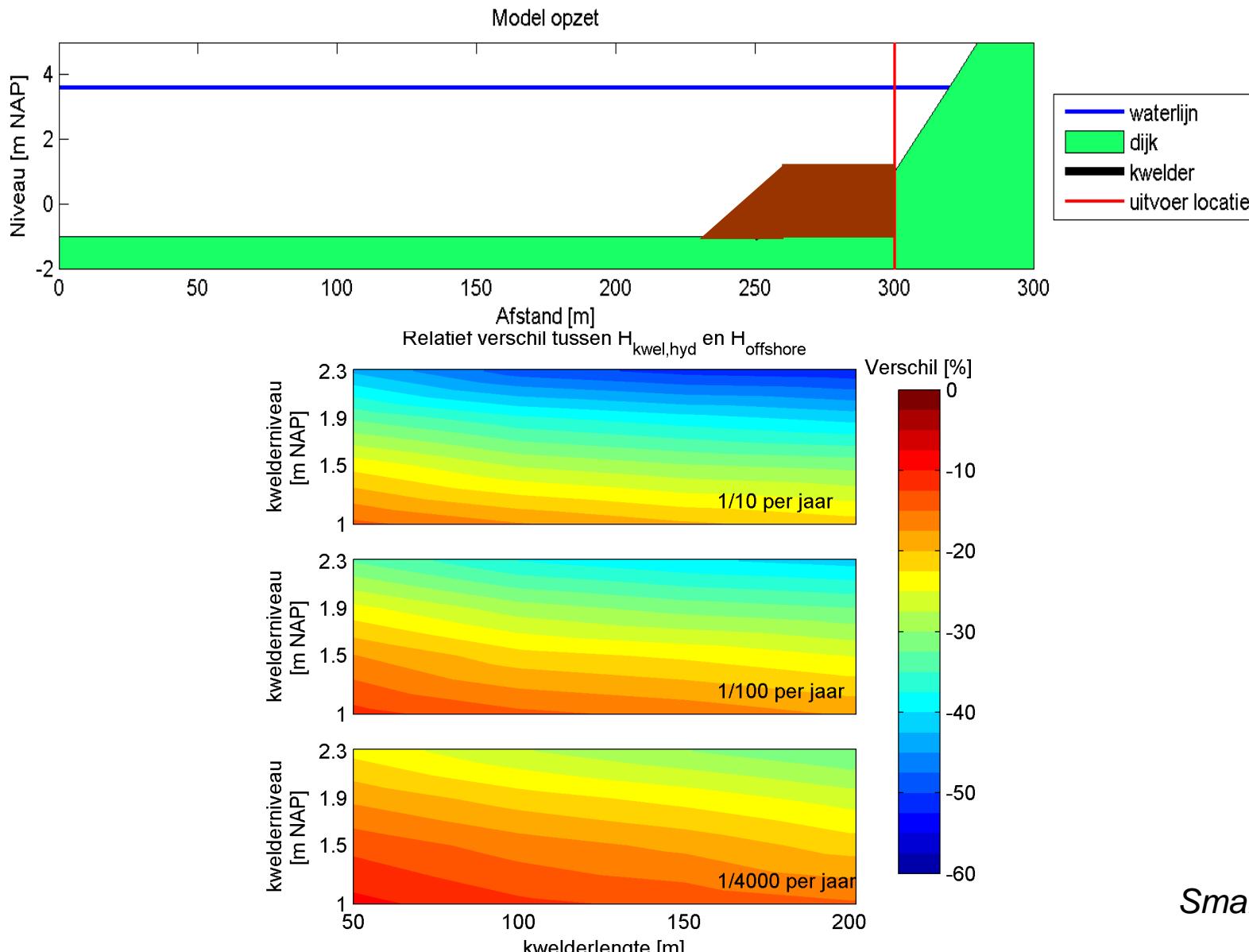
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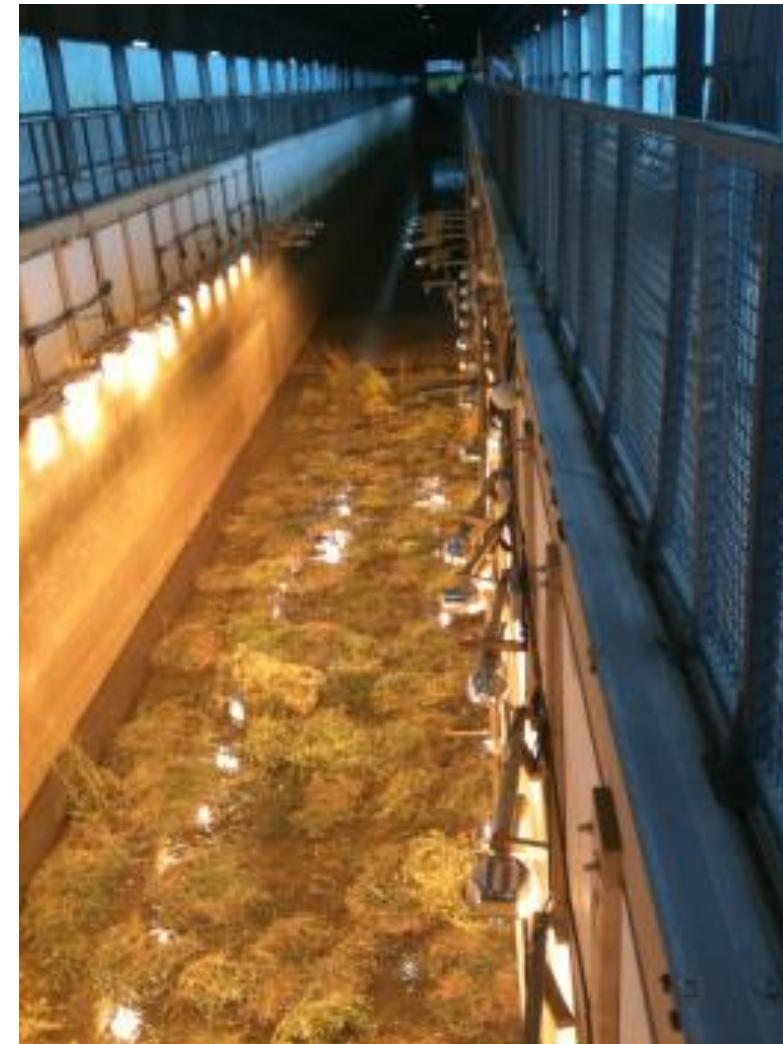
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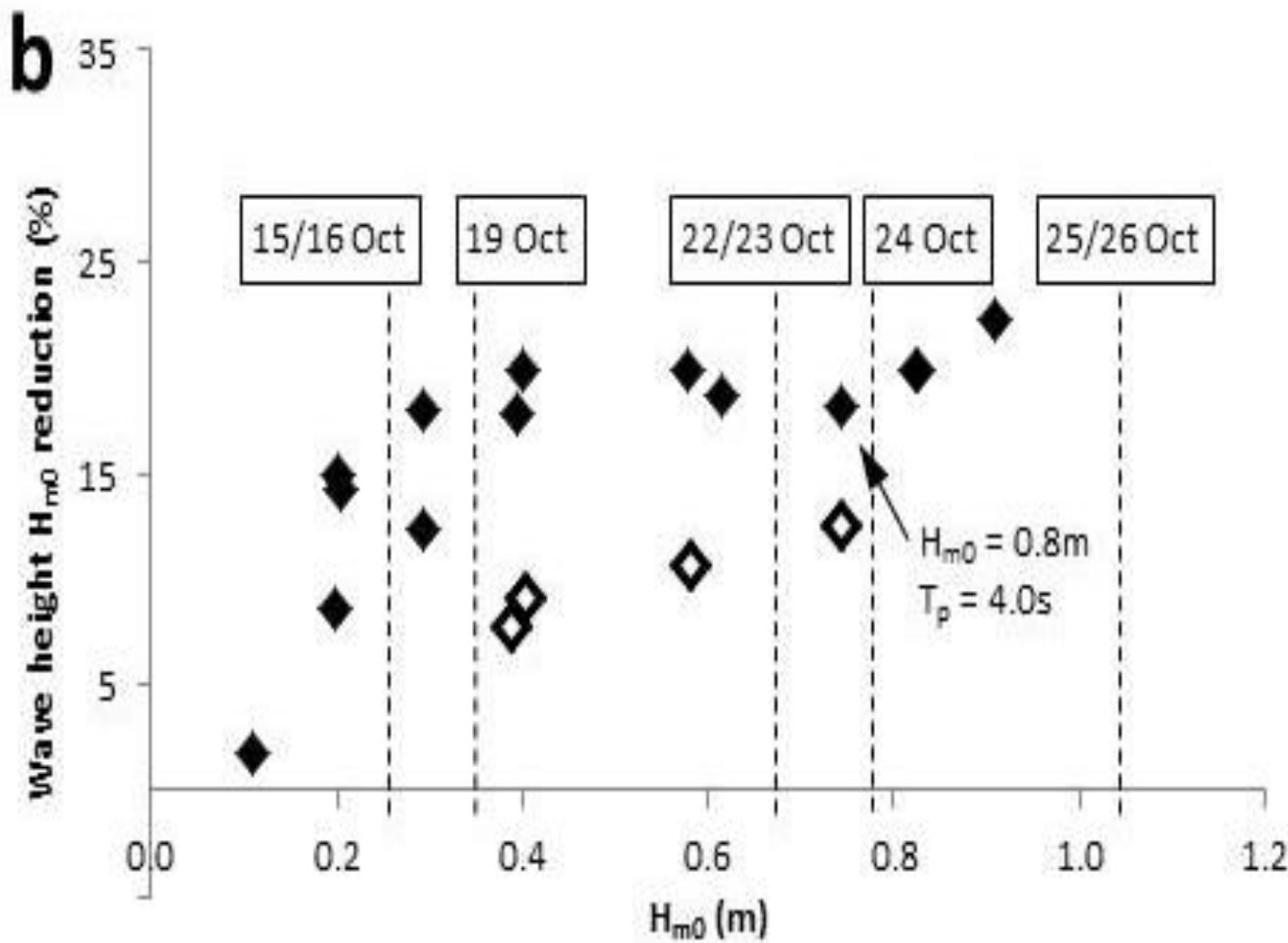
# Modelling marsh vegetation and wave reduction



# Testing marshes under extremes



# Testing marshes under extremes



# Mangrove and willow forest performance under extremes

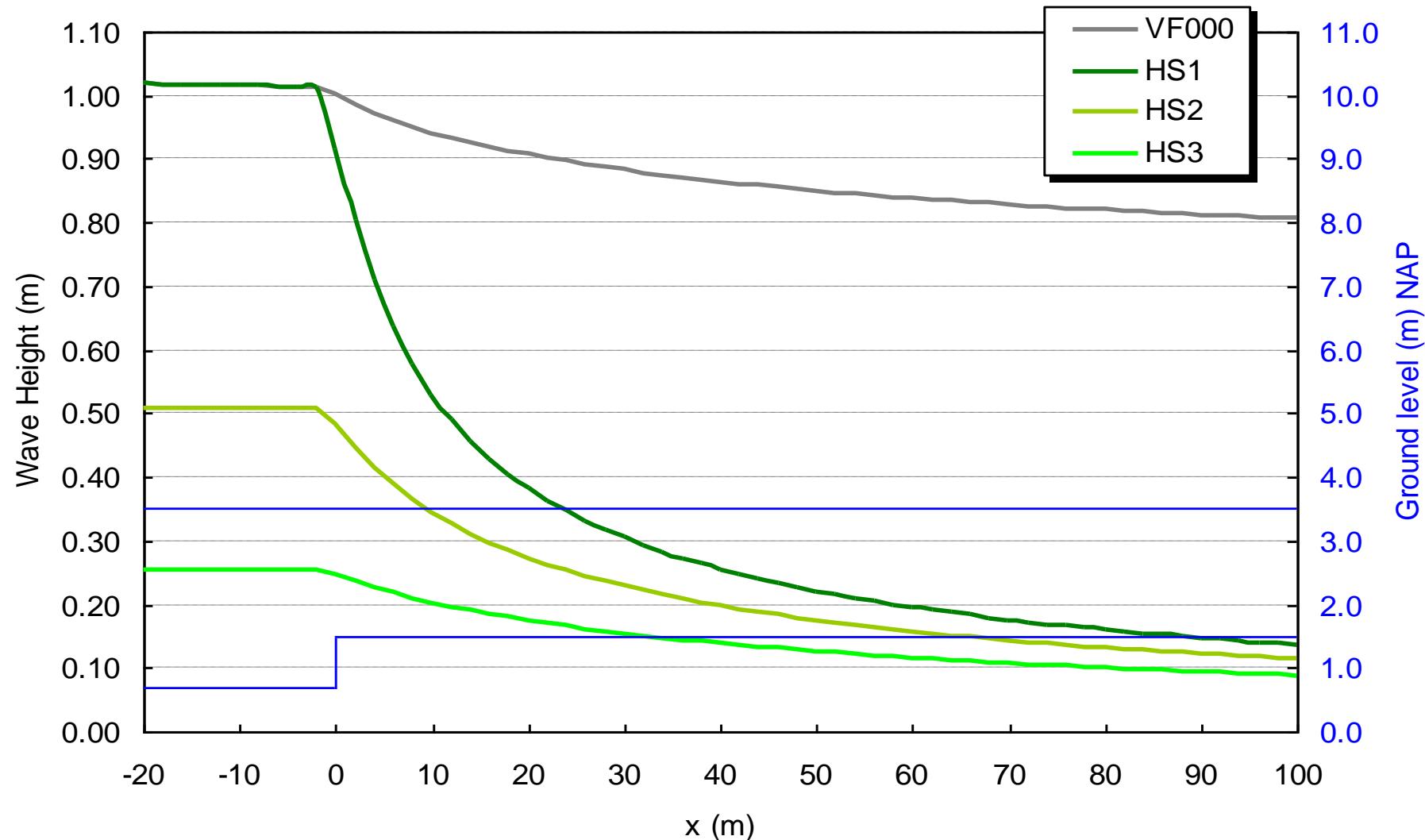


# For woody vegetation: implemented

- >70% reduction of wave height in healthy willow forest



# Modeling forests and wave reduction



# Testing forests under extremes



# Testing forests under extremes



# Testing forests under extremes



# Testing forests under extremes



# Results

- Wave reduction is strongly dependent on wave height, wave length and on the water level/biomass/surface area
- No breaking of trees with waves up to 3 metres
- Representation of surface area of vegetation is key
- Tree surface is underestimated in numerical model



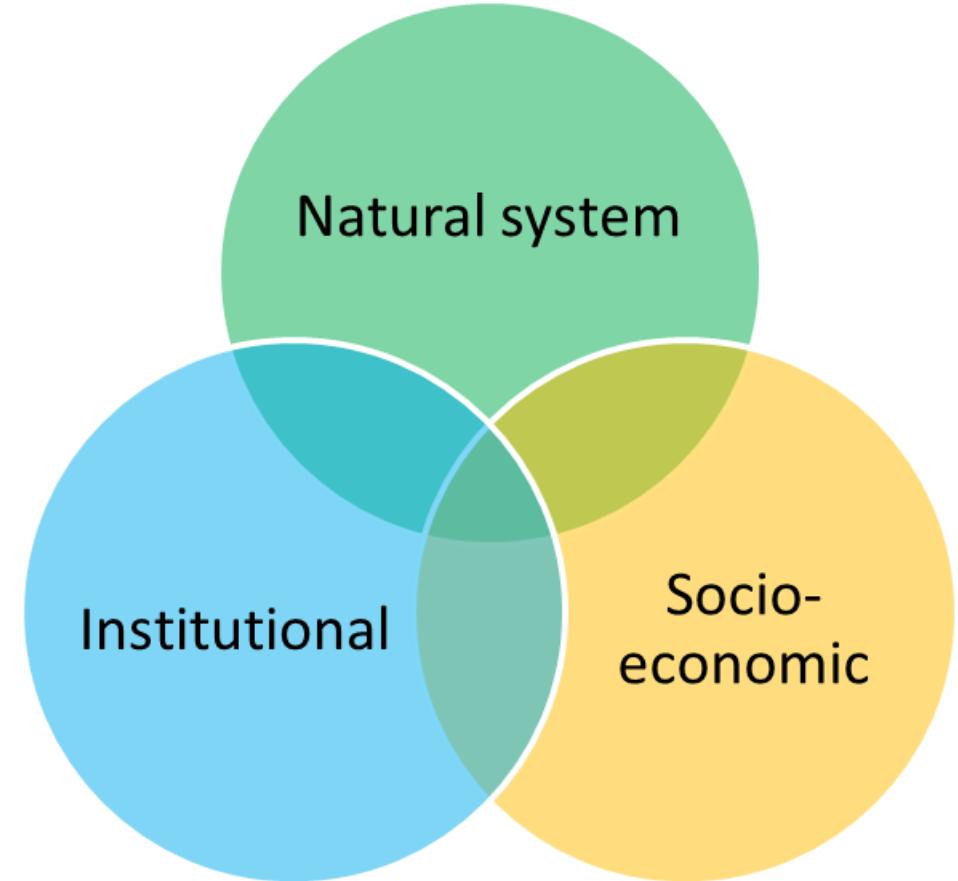
Scaled to 1:10



# Future work

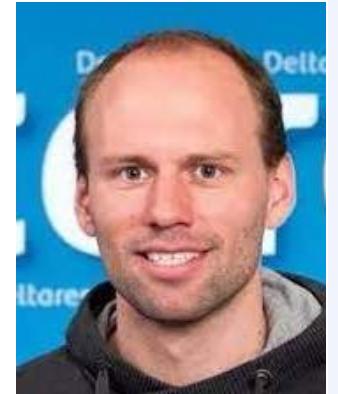
# Take home

- Understand the natural system
- Include engineering perspectives and risk thinking
- Consider institutional and socio-economic prerequisites
- Adaptive mindset: Prepare to collaborate, innovate and learn!



# The team

- Su Kalloe
- Vincent van Zelst
- Celine van Bijsterveldt
- Wiebe de Boer
- Alejandra Gijon Mancheno
- Corrine van Starrenburg
- Tjeerd Bouma
- Bas Hofland
- And many more



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