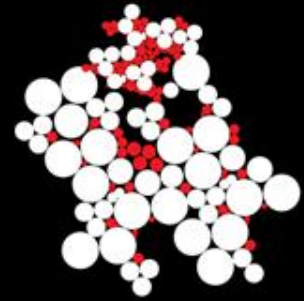# BE SAFE

Bio-Engineering for Safety using vegetated foreshores

BE SAFE – NWO ALW (copied form the call)

- Building with Nature is a NWO research program that aims to provide and strengthen **multidisciplinary scientific knowledge** for innovative **infrastructure projects** which make use of **natural structures** and **processes**.
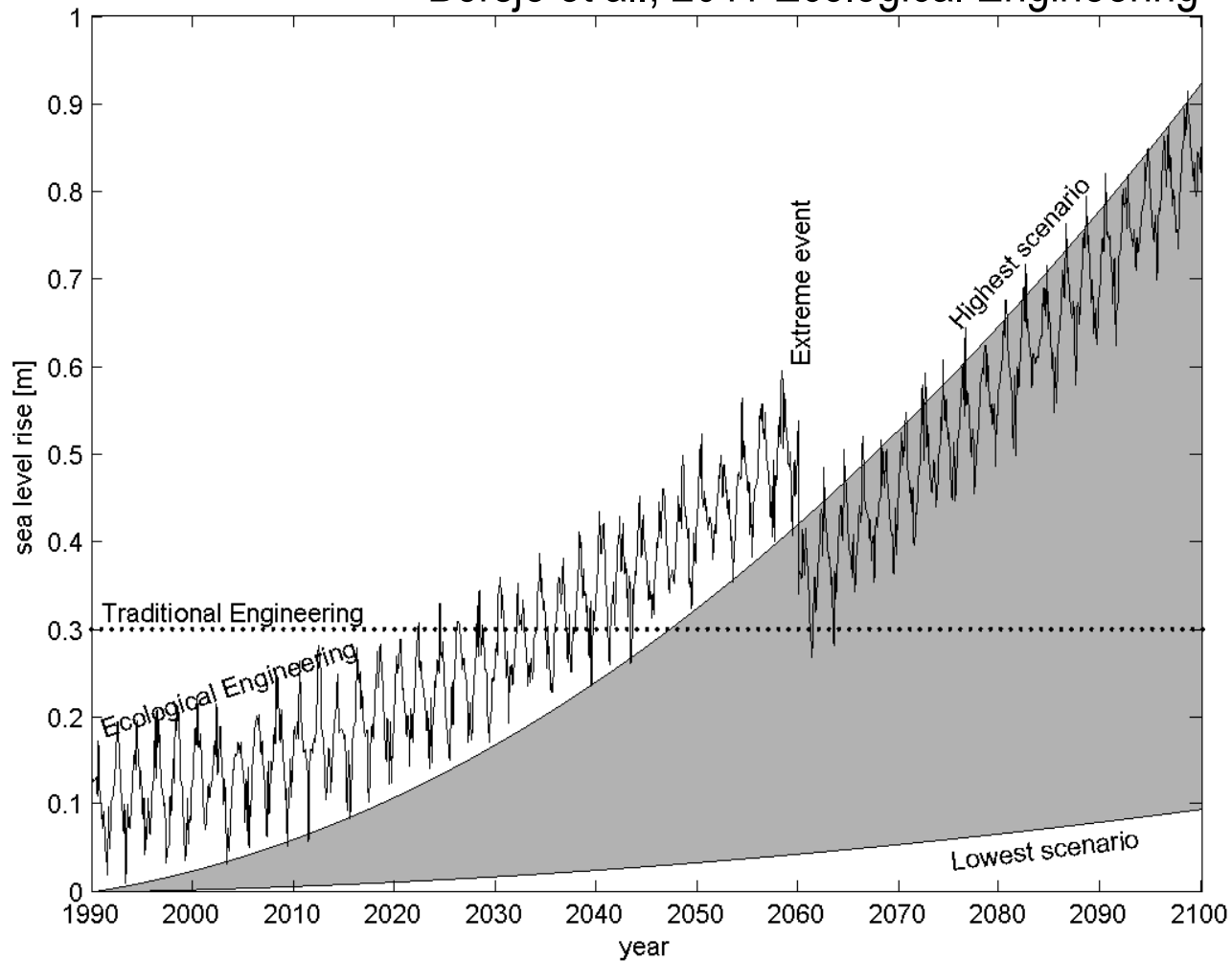
BE SAFE – The main aim

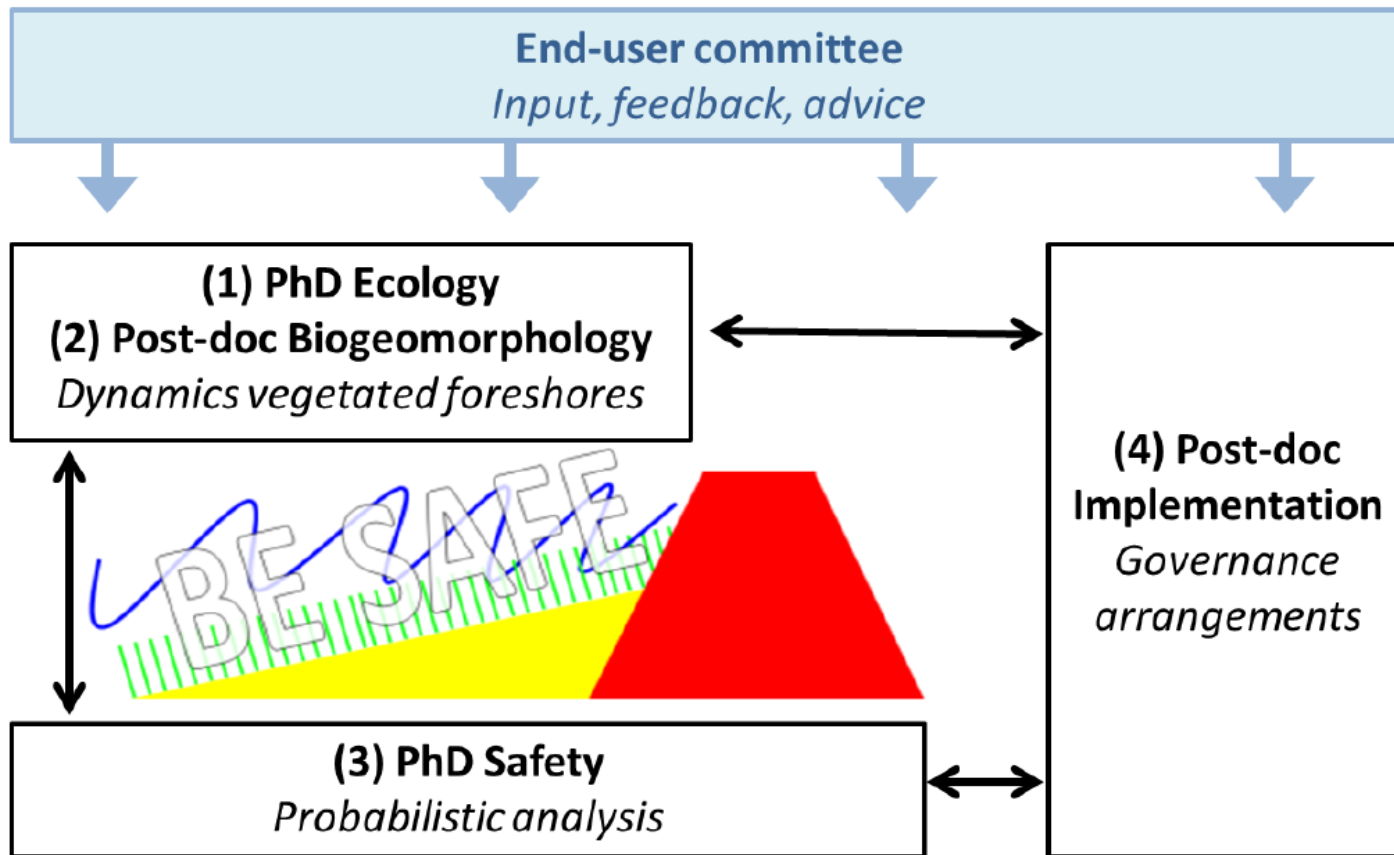- We aim to develop new methods to assess how, and how much vegetated foreshores can contribute to flood risk reduction.

BE SAFE – Conceptual framework

Borsje et al., 2011 Ecological Engineering

BE SAFE in a nutshell

BE SAFE – field, flume & model

species	*Spartina anglica*	*Scirpus maritimus*	*Phragmites australis*	*Salix alba*
Common name English	cordgrass	grassweed	reed	willow
Common name Dutch	slijkgras	zeebies	riet	wilgen
Typical environment	salt	brackish	brackish / fresh	fresh
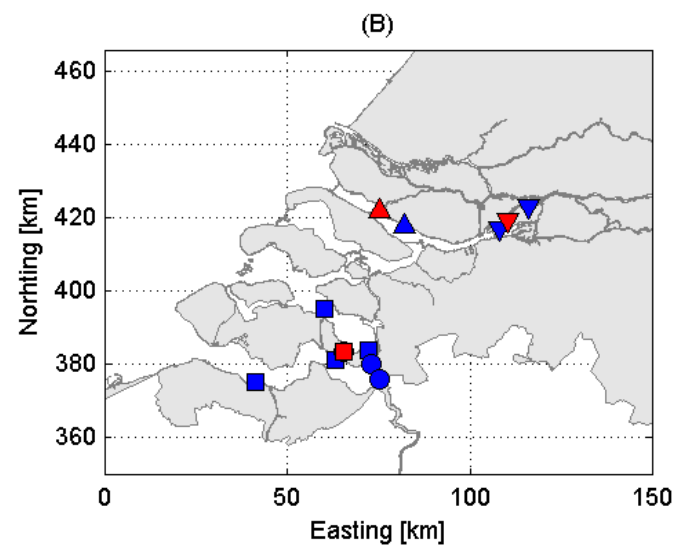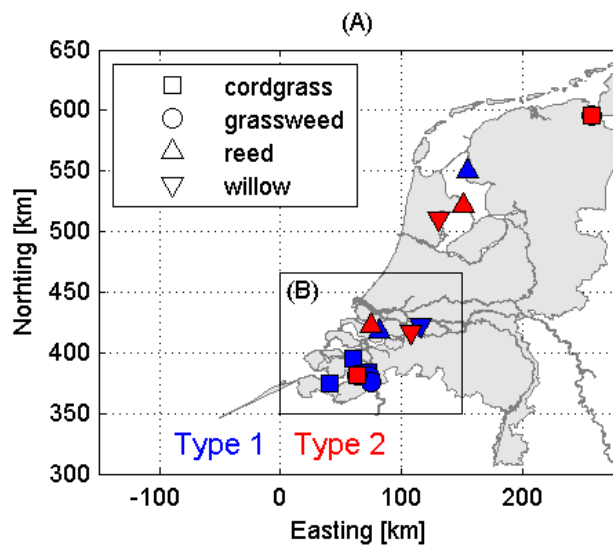
BE SAFE - Utilisation Partners

- **Total costs: € 960k   (2 x PhD & 2 x Post-Doc)**
- NWO: € 540k
- Cash: € 315k
- In-kind   € 105k

Ecology – NIOZ Yerseke; dr. Tjeerd Bouma

- **Title**: The ecology of vegetated foreshores: understanding thresholds driving long-term dynamics & trade-offs in ecosystem services.

1. *Ecological knowledge needed to enable modelling of long-term development (wetland degradation, creation and management)*

2. *Ecological knowledge needed to maximise both flood defence values and biodiversity*

UNIVERSITY OF TWENTE.

Biogeomorphology – University of Twente; dr. Bas Borsje

- **Title**: Uncertainty in long term biogeomorphological dynamics for vegetated foreshores

- *1. What is the uncertainty in long-term morphological development for given growth rules of vegetation and a variation in physical forcing?*

- *2. What is the uncertainty in long-term morphological development for a known physical forcing and a variation in growth rules of vegetation and type of maintenance?*

- *3. What is the uncertainty in wave attenuation for different types, configurations and maintenance strategies of vegetation?*

- *4. What is the combined (Q1-Q3) uncertainty?*

- *5. How can we set-up an interactive design tool (Maptable) in order to communicate the results of this research?*

Safety – Delft University; prof. Bas Jonkman

- **Title**: Probabilistic analysis of vegetated foreshore systems

1. *What is the change in hydraulic loads for the initial situation?*

2. *What is the probabilistic distribution for this initial situation?*

3. *What is the probability of failure for longer time scales?*

4. *What is the optimal design and management strategy wrt flood reduction?*

UNIVERSITY OF TWENTE.

Implementation – Delft University; dr. Jos Timmermans

- **Title**: Governing Implementation: Institutional arrangements for the design, implementation and management of Building with Nature solutions.

1. *Understanding: What elements from innovative institutional arrangements used in recent BwN flood defence initiatives in the Netherlands may be useful for vegetated foreshores?*

2. *Design: How to support the design of effective institutional arrangements for the design, implementation and long-term adaptive management of new BwN-solutions, in particular for vegetated foreshores?*

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