FRANZIUS-INSTITUTE
for Hydraulic, Waterways
and Coastal Engineering

Leibniz
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Hannover

TWIN - SEA

An Overview of Ecosystem-Based Low-Regret Coastal Protection Measures in Indonesia

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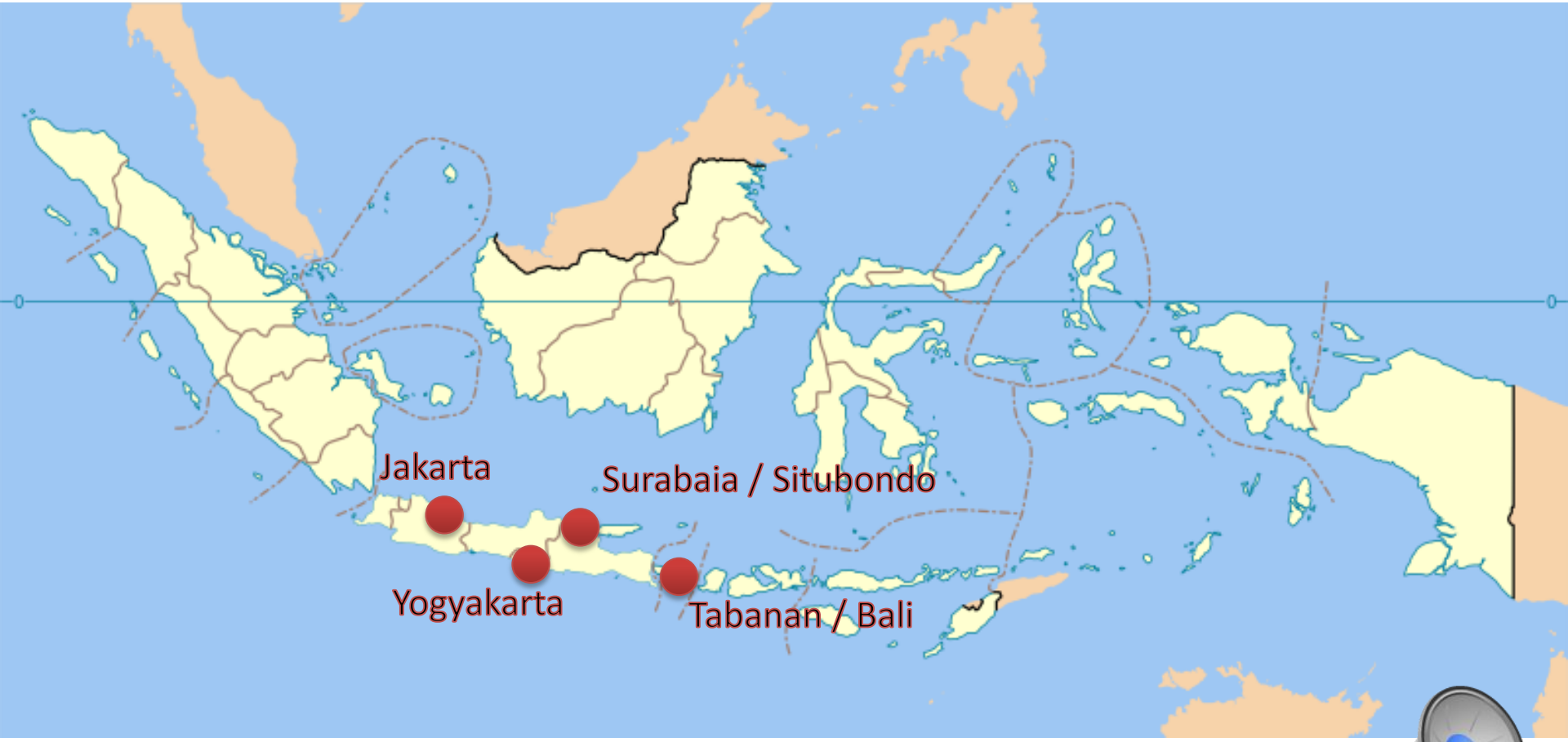
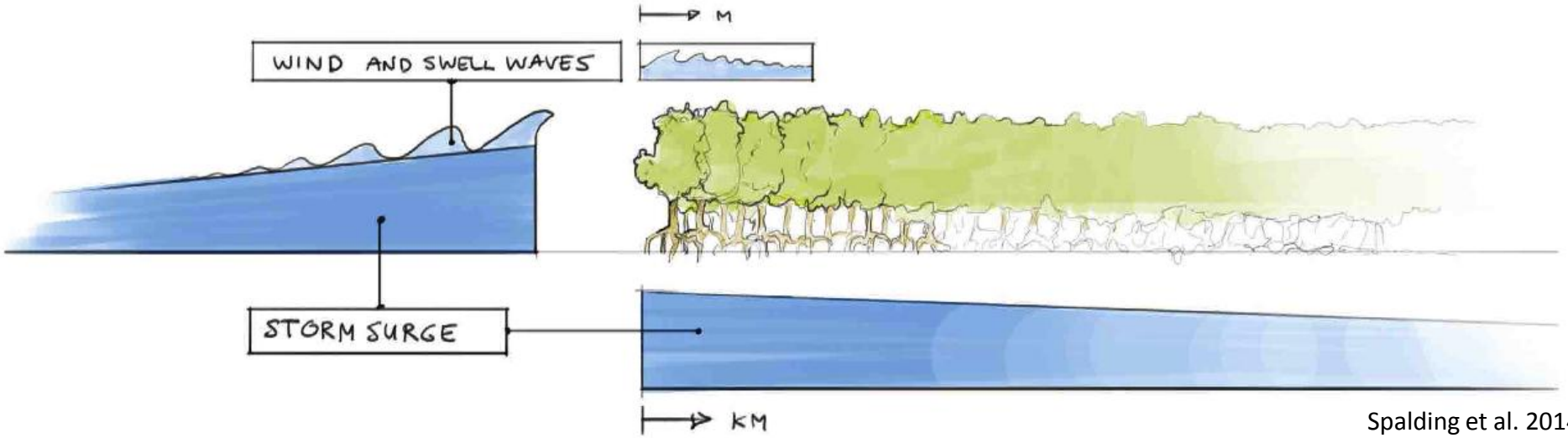
TWIN-SEA



TWIN-SEA CONTENTS

- Mangroves
- Artificial Reefs
- Natural Fiber Geotextiles

TWIN-SEA MANGROVES

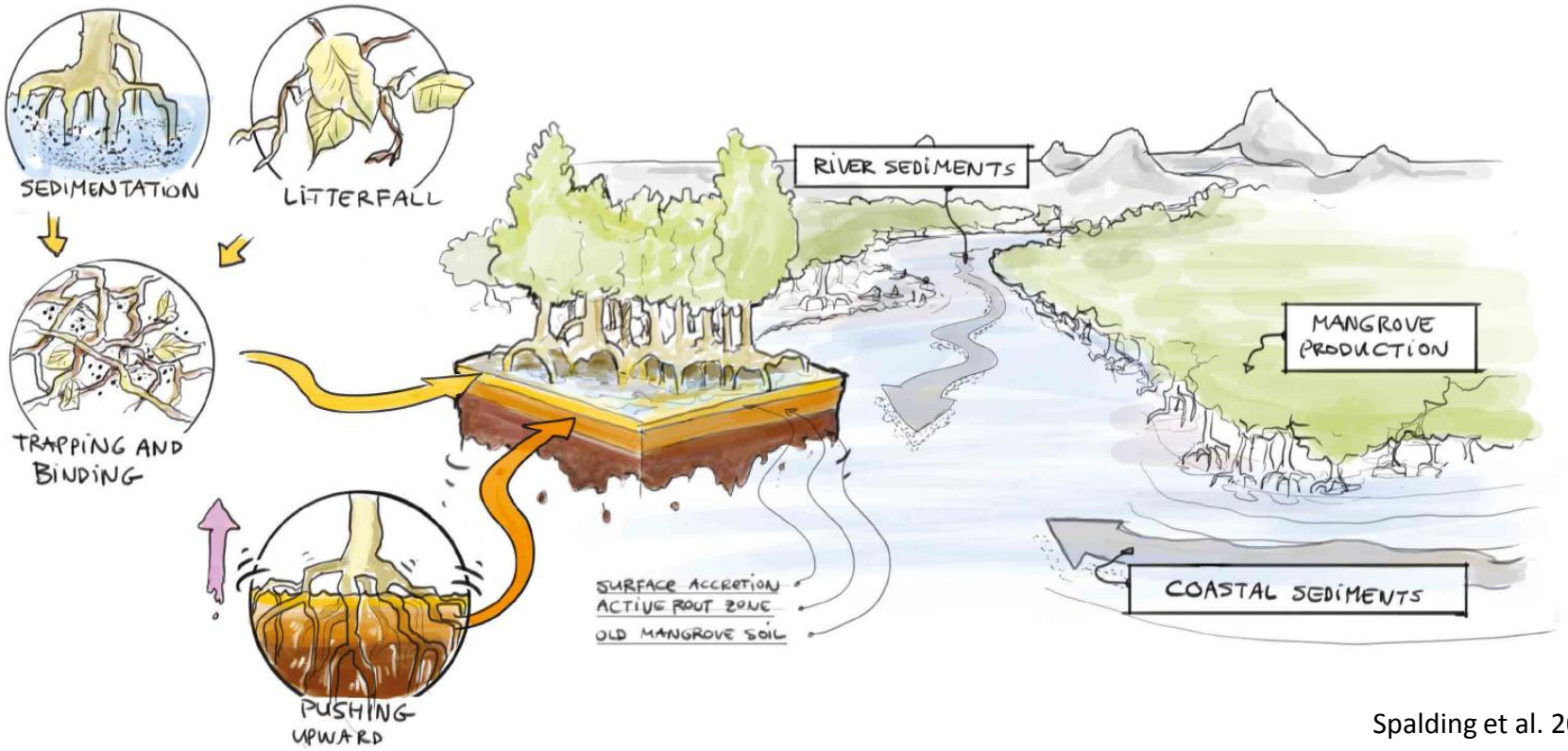


Spalding et al. 2014

TWIN-SEA MANGROVES

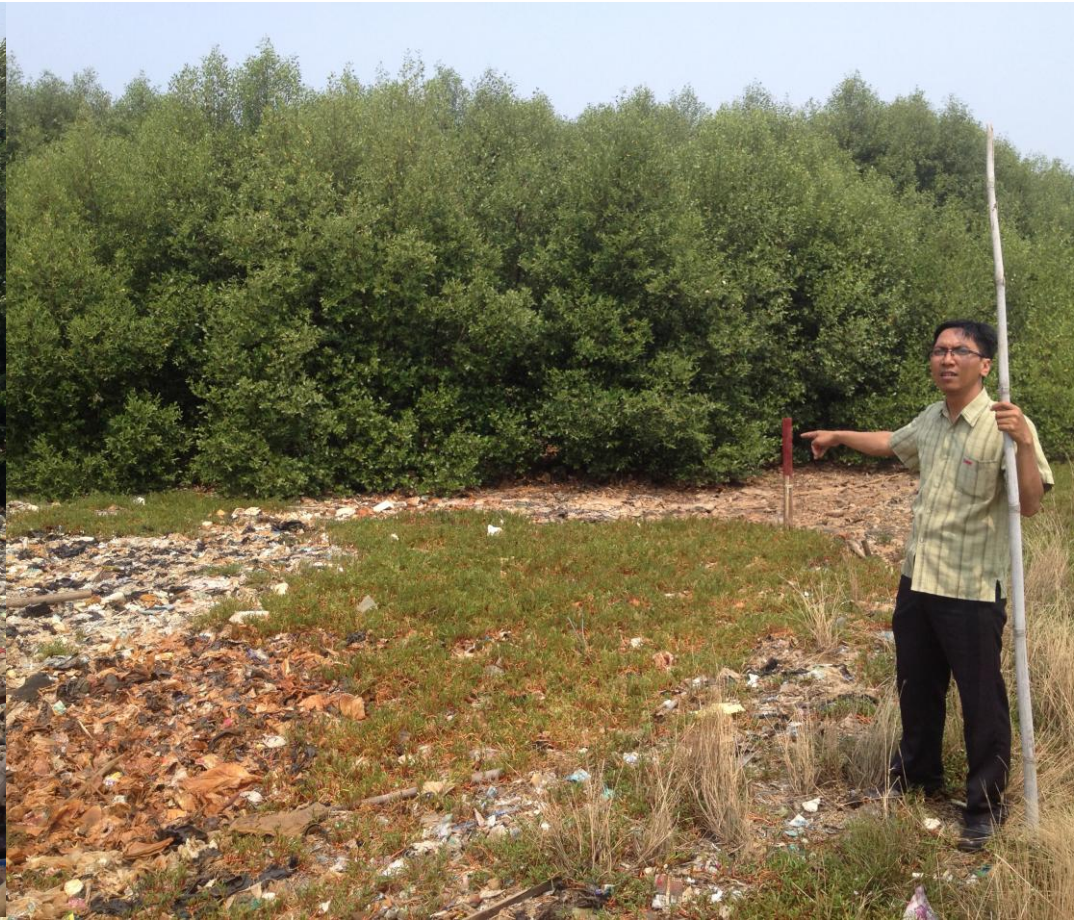
Source	Effect	Condition
Mazda et al. (1997)	significant decrease for offshore wind waves	width: 1500m belt, type: Kandelia Candel mature (5-6 years)
Quartel et al. (2007)	wave height reduction between 5 to 7.5 times larger than plain seabed	
Tuyen and Hung (2009)	80% wave height reduction	width: 200m or twice the wavelength
		densly planted
McIvor et al. (2012)	5 - 50 cm of peak water level per kilometer mangrove forrest	planted in over large areas
	wind and swell waves reduction greater than 75%	1 km width of mangrove

TWIN-SEA MANGROVES



Spalding et al. 2014

TWIN-SEA MANGROVES



TWIN-SEA CONTENTS

- ~~Mangroves~~
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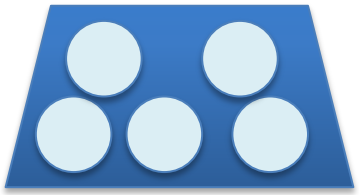
TWIN-SEA SUBMERGED BREAKWATER

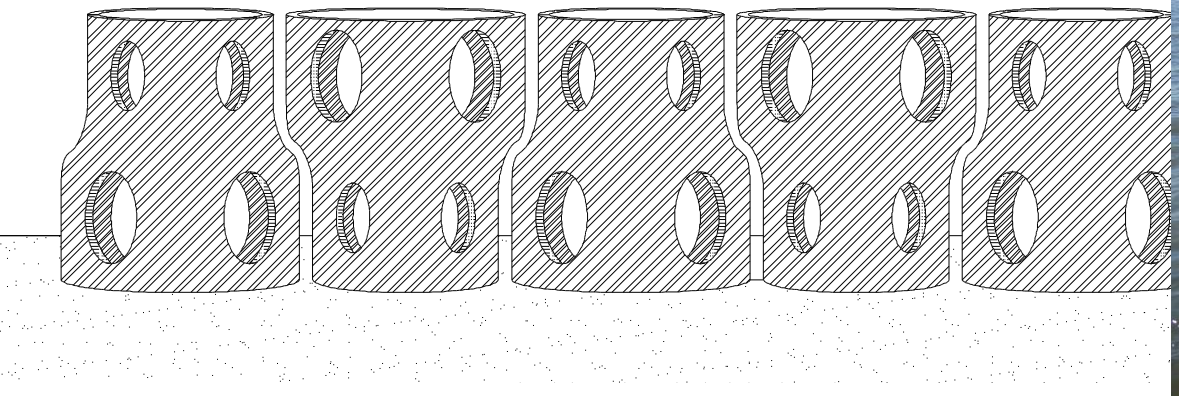
Artificial Reef:



TWIN-SEA ARTIFICIAL REEFS | 1

OPTION 1

- Submerged concrete structures, mimicking a coral reef.
- Examples: Reef Ball, Bottle Reef (Dr. Ruhdy Akhwady; KKP-P3TKP)



TWIN-SEA ARTIFICIAL REEFS | 2

OPTION 2

- electrolysis of minerals dissolved in seawater
- supports coral growth rates
- BioRock patented by Prof. W. Hilbertz

TWIN-SEA ARTIFICIAL REEFS

- Possible Benefit:

Wave attenuation, erosion protection and improvement of marine environment are verified in physical, numerical and practical studies

- Challenges:

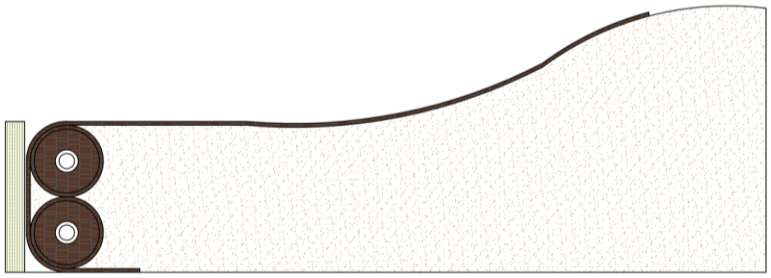
lower armour stability

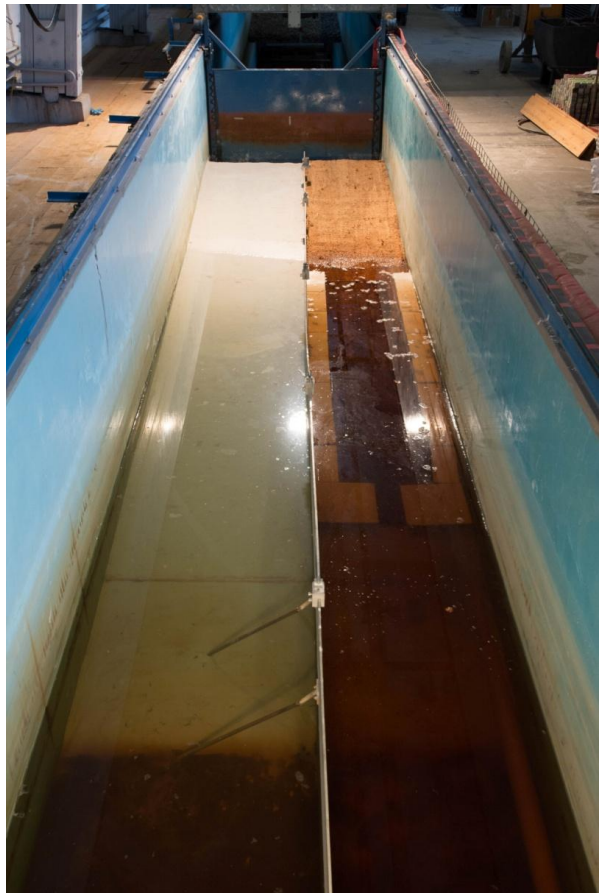
complex theoretical principle
missing long time experience

TWIN-SEA CONTENTS

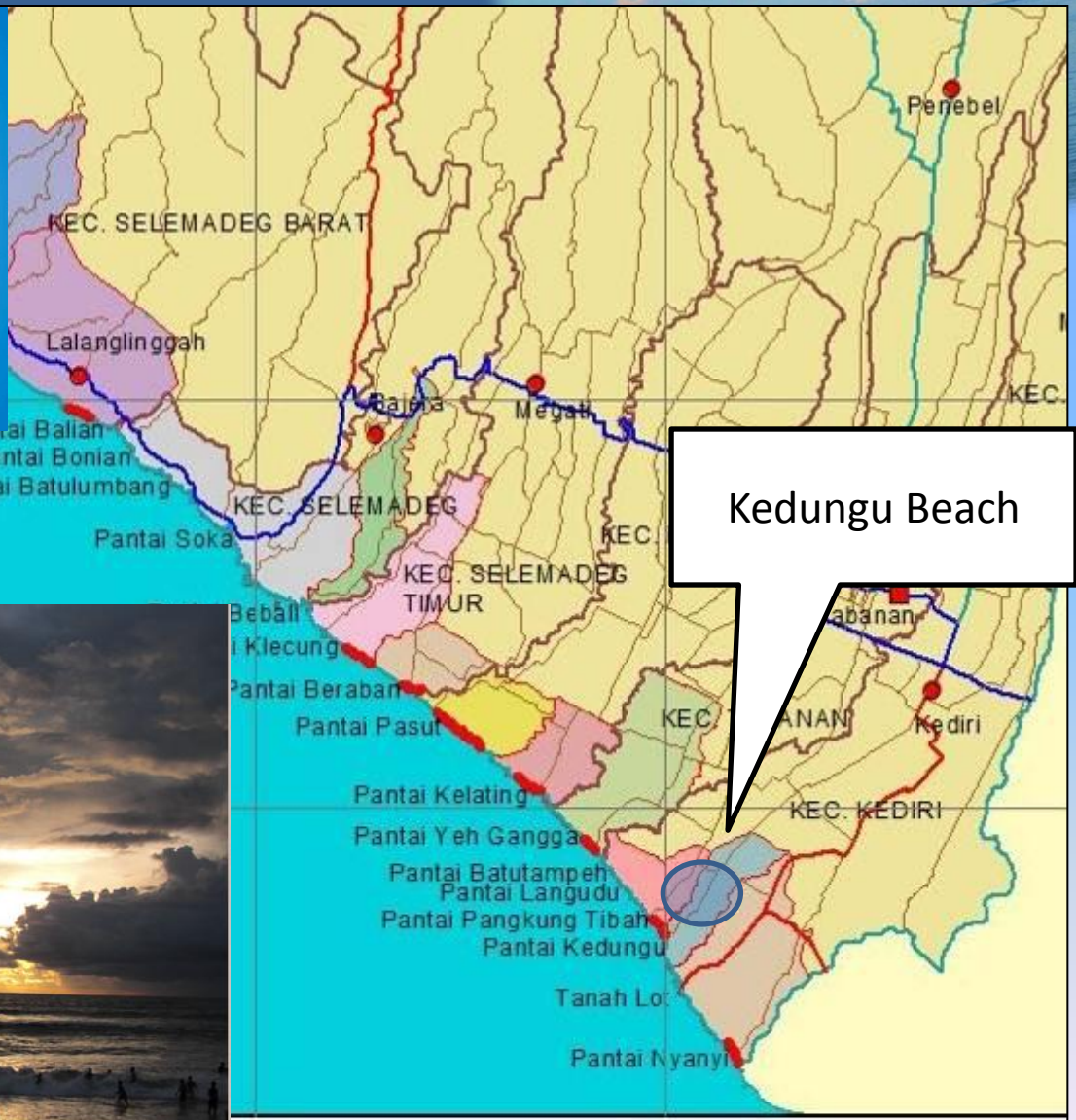
- ~~Mangroves~~
- ~~Artificial Reefs~~
- Natural Fiber Geotextiles

TWIN-SEA COIR FIBER GEOTEXTILE



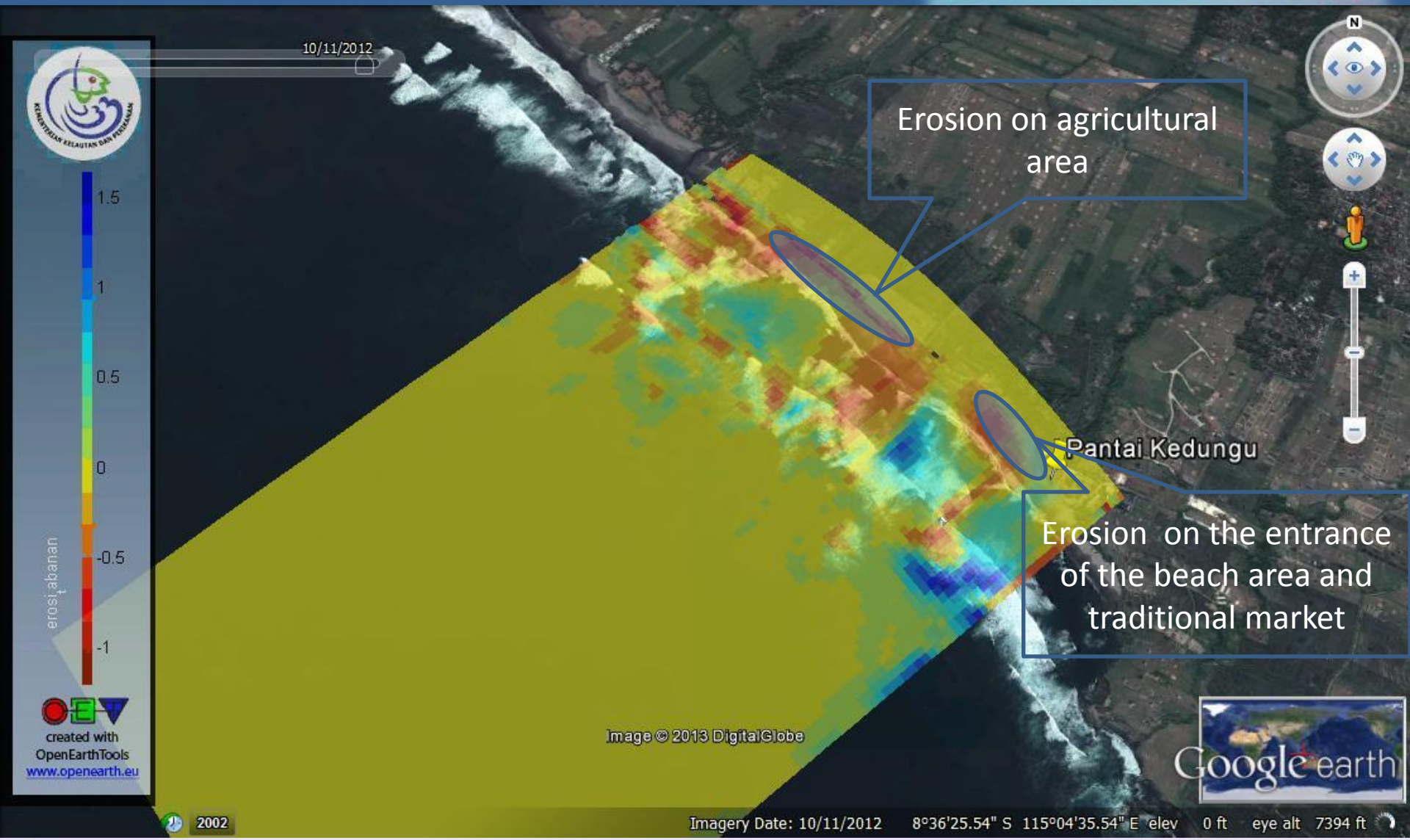



Lombok Strait
Bali Strait
INDIAN OCEAN
Badung Strait
Pemuteran
Gilimanuk
Cekik
Singaraja
Kintamani
Ubud
Sanur
Kuta
Tuban
Jimbaran
Nusa Dua
Tanah Lot

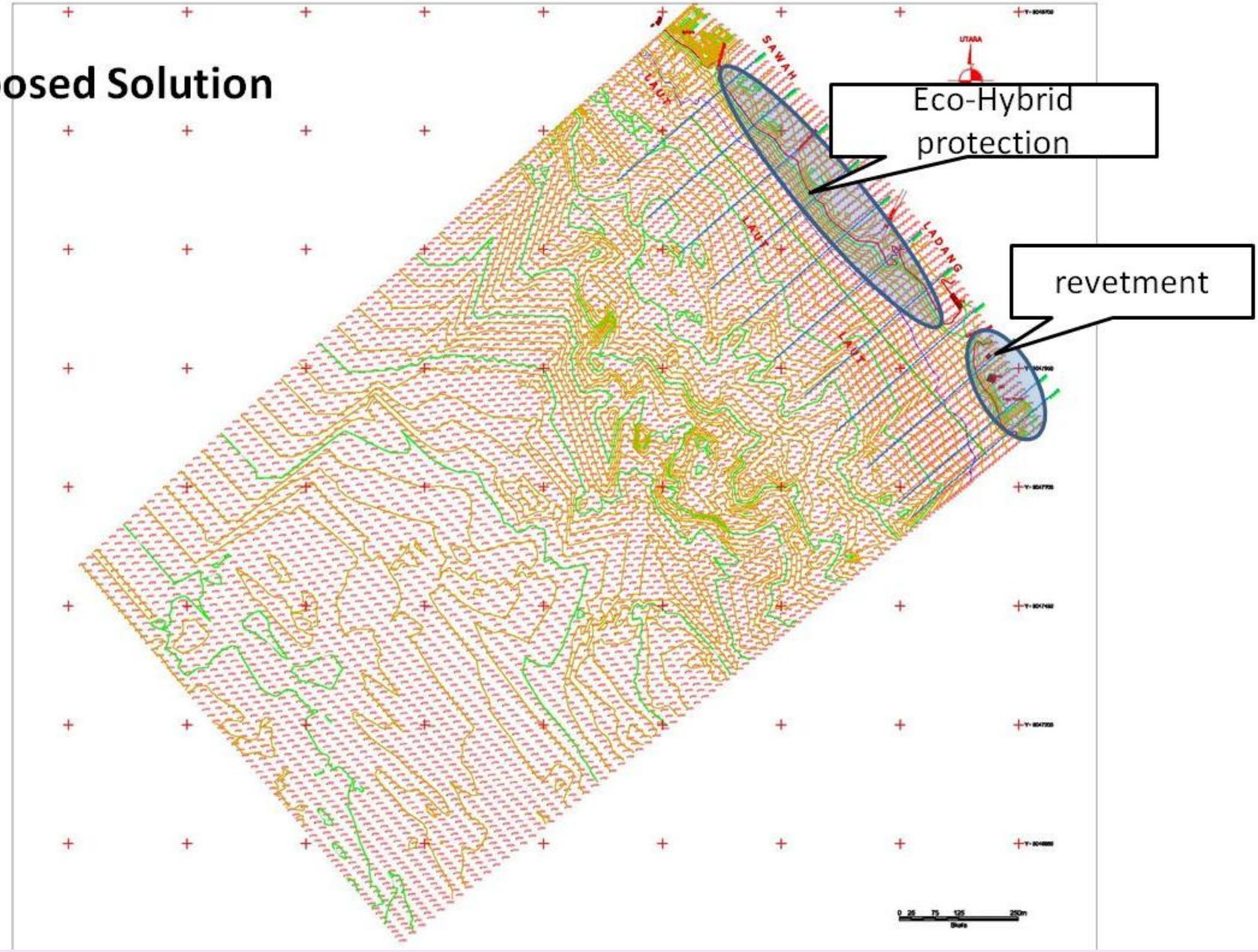

Penebel
KEC. SELEMADEG BARAT
Lalanglinggah
Bajera
Megati
KEC.
Pantai Balian
Pantai Bonian
Pantai Batulumbang
KEC. SELEMADEG
Pantai Soka
KEC.
KEC. SELEMADEG TIMUR
Kedungu Beach
Bebali
Klecung
Pantai Beraban
Pantai Pasut
KEC.
Kediri
Pantai Kelating
KEC. KEDIRI
Pantai Yeh Gangga
Pantai Batutampeh
Pantai Langudu
Pantai Pangkung Tibah
Pantai Kedungu
Tanah Lot
Pantai Nyanyi
115°00'
115°5'

- Natural Groynes
- Cross shore transport dominant

MODEL RESULT (XBEACH)



Proposed Solution



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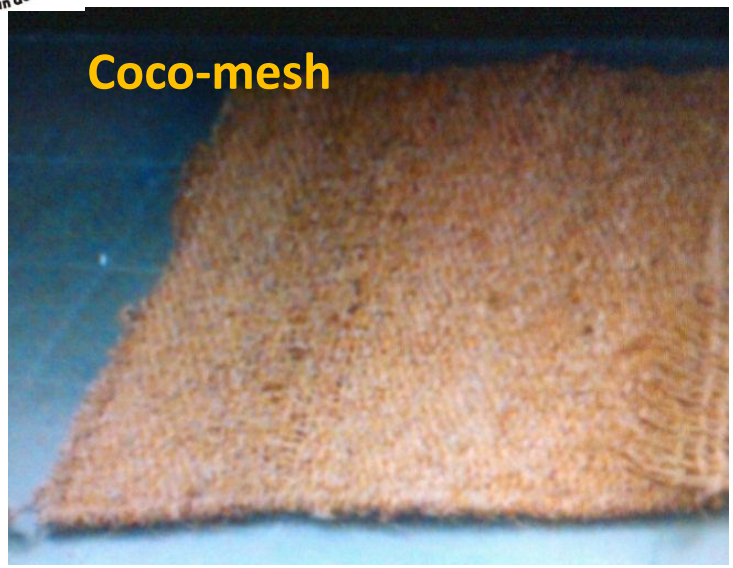

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Vetiver

- Vetiver will not become a weed
- Perennial grass that grows only permanent burial place
- Forming a solid permanent fence and thick top layer of soil to prevent erosion
- Forming a dense root system and a strong entry into the soil up to 5 meters or more
- Can grow in all types of soil regardless of fertility, pH, acidity, salinity, etc;
- Do not disturb the plants were protected
- “fire resistant”
- Herbal and handycraft

Source: Vetiver presentation

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R&D AGENCY FOR MARINE AND FISHERIES
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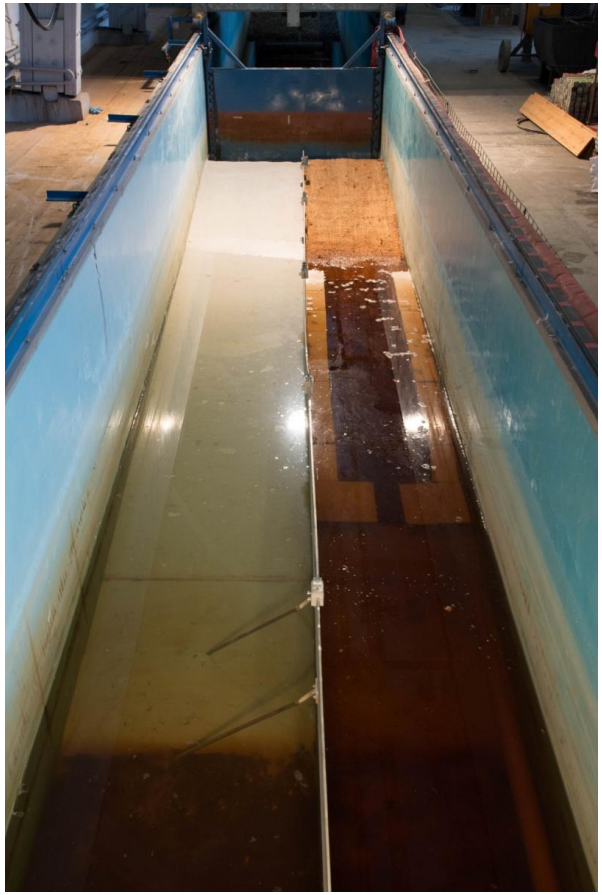
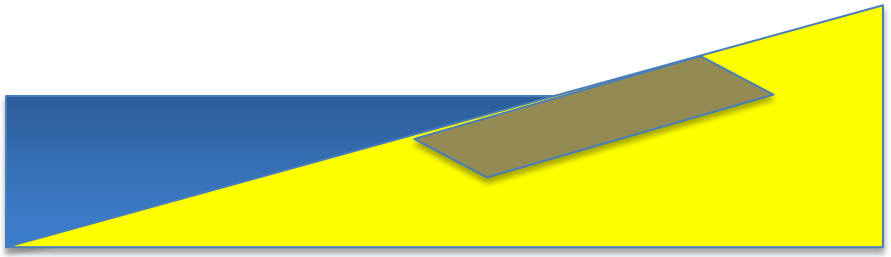
TWIN-SEA COIR FIBER GEOTEXTILE

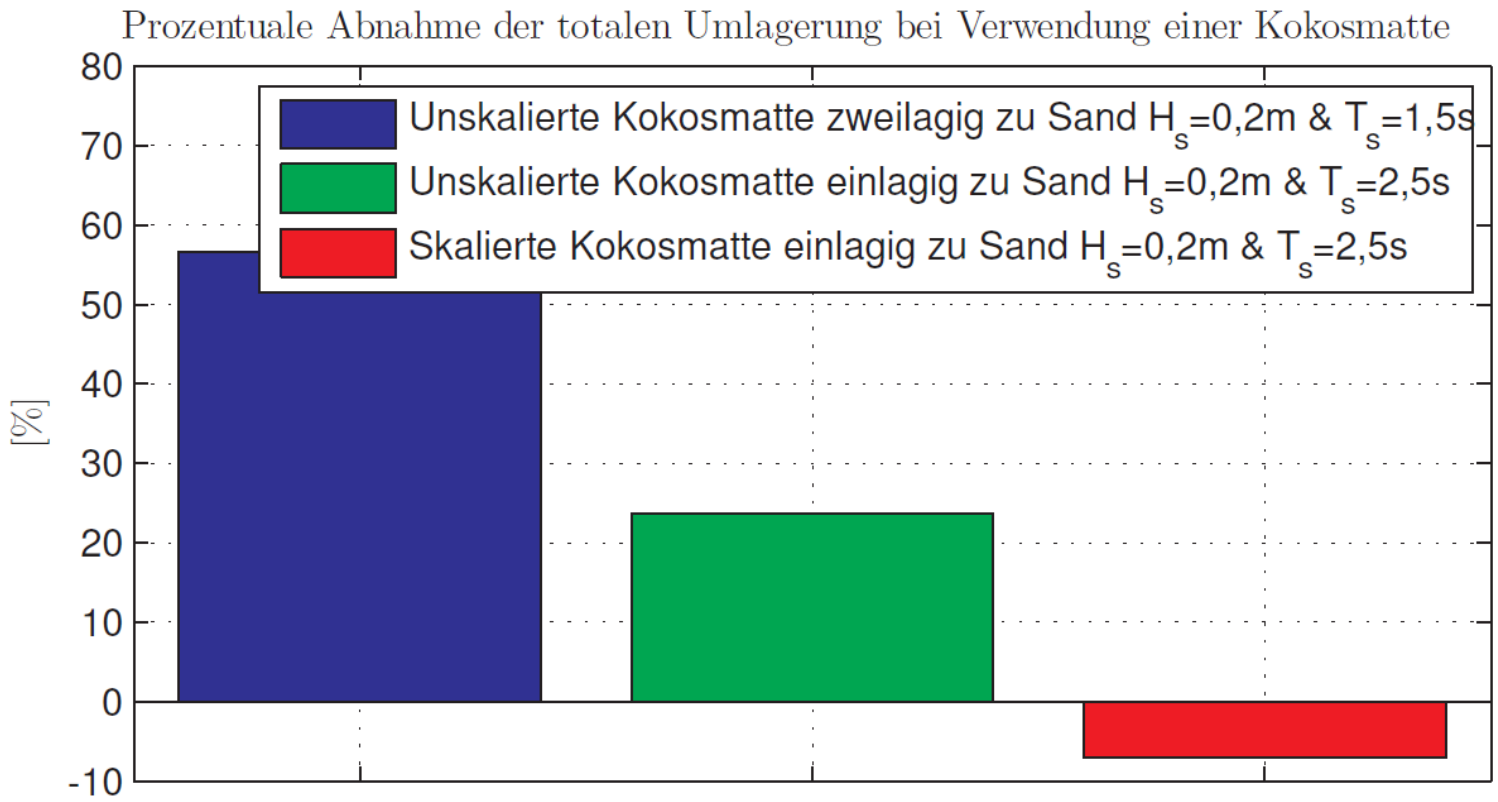


TWIN-SEA COIR-FIBER GEOTEXTILES

- 3 hydraulic model tests with 3000 waves (max. H=20cm) each:
  - Geotextile unscaled
  - Geotextile “scaled”
  - reproduction of the Balinese test field



TWIN-SEA COIR-FIBER GEOTEXTILES



TWIN-SEA COIR-FIBER GEOTEXTILES

NEXT STEPS:

- implement lessons learned from physical modelling for practical application
- material parameters
- large scale physical model

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Terima Kasih / Thank you

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TWIN-SEA ADAPTATION MEASURES

NEXT STEPS:

- identify further structures („complete the catalogue“)
- close research gaps jointfully with TWIN-SEA partners
- build up expertise and present best practice examples
- (...)