

# Dune and Coastal System Resiliency using EWN

Panel Discussion on Related Research and Applications

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Western Dredging Association (WEDA)

**Dredging Summit & Expo**

Norfolk, VA

June 26, 2018

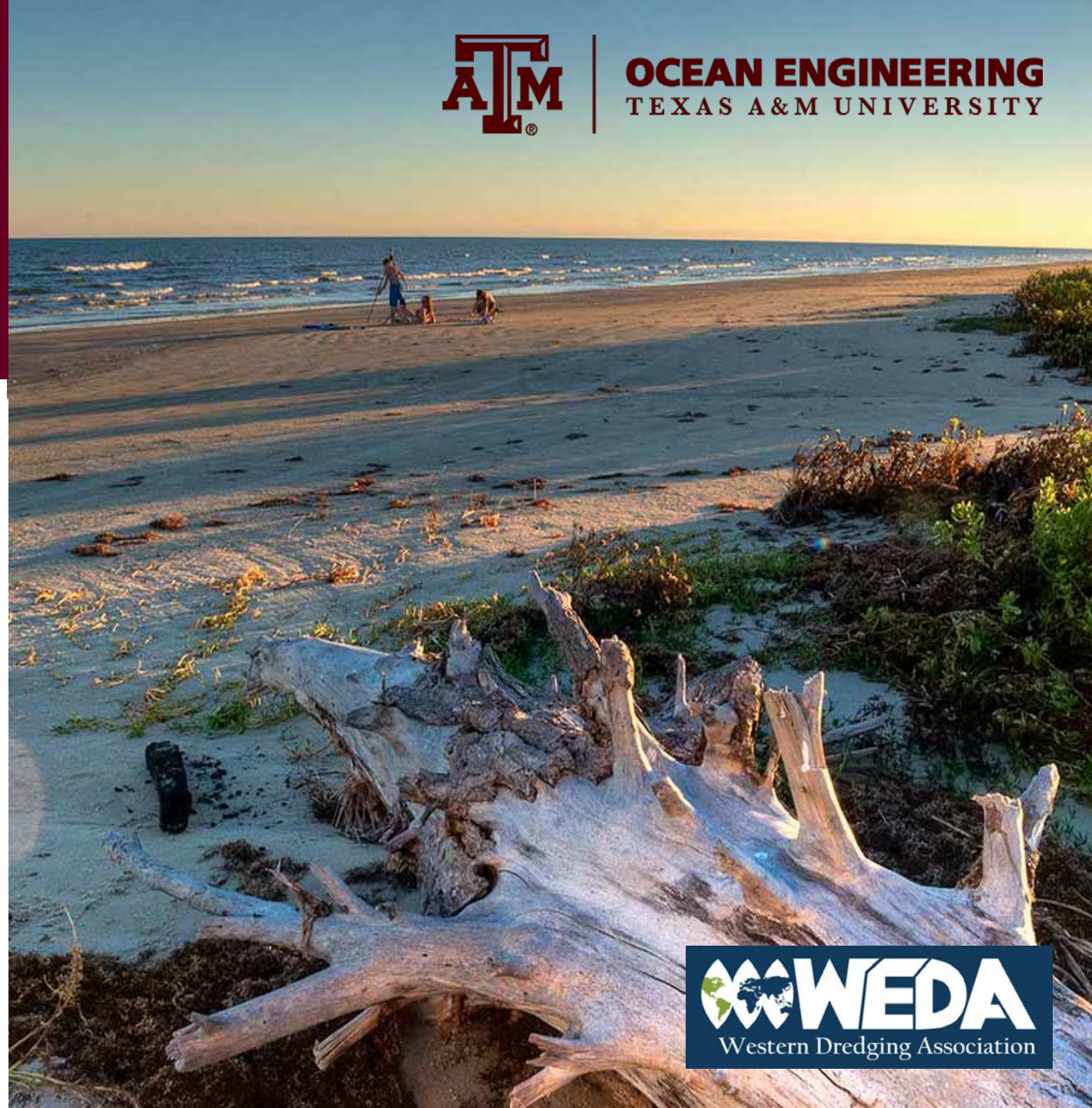
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Coastal  
Engineering  
Laboratory



**OCEAN ENGINEERING**  
TEXAS A&M UNIVERSITY



## Motivation:

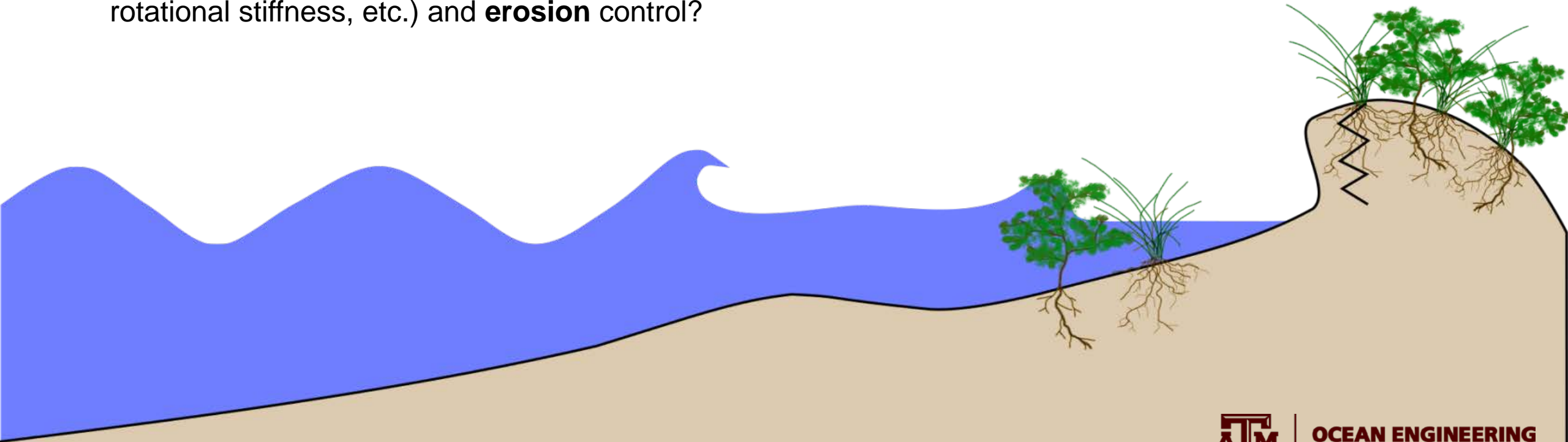
- Dredged material needs to be viewed as a **viable source** for engineered dune and embankment construction (BUDM - projects)
- Dunes **add value** to a coastline
- Benefits include increased **resistance** to storm-induced erosion, **ecological** value, **aesthetical** value, and potentially increased **tourism** activity
- Innovative approaches utilize dunes to **improve coastal systems** (engineering-with-nature approaches, hybrid coastal structure concepts, multi-functional coastal defense ideas)
- Push to use **clay dredged materials** in shallow bay erosion protection schemes

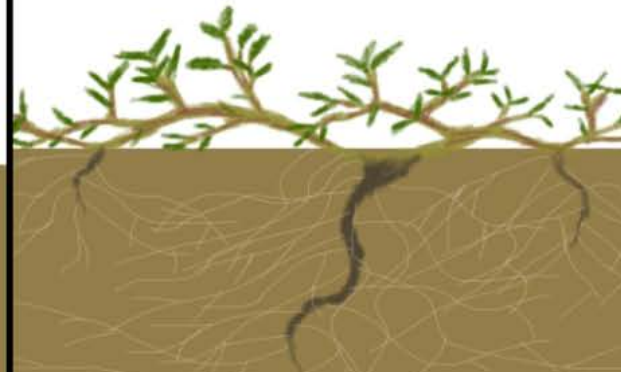
# Vegetated Dunes Research

## Research Questions:

**RQ1:** Can erosion resistance in dunes be optimized via specific plant traits?

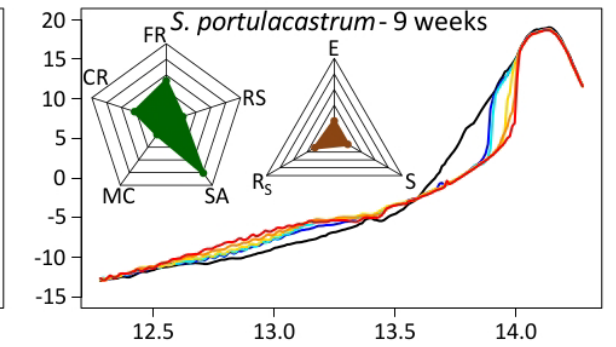
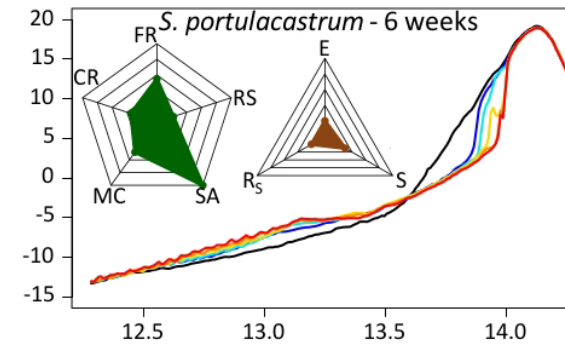
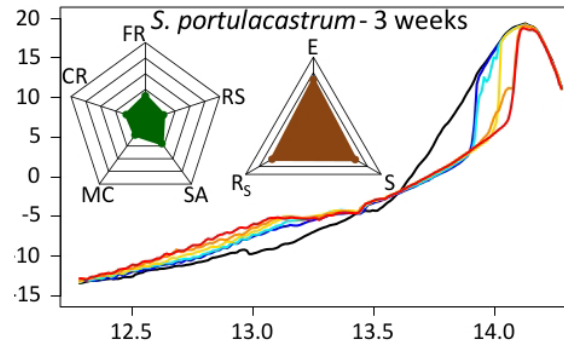
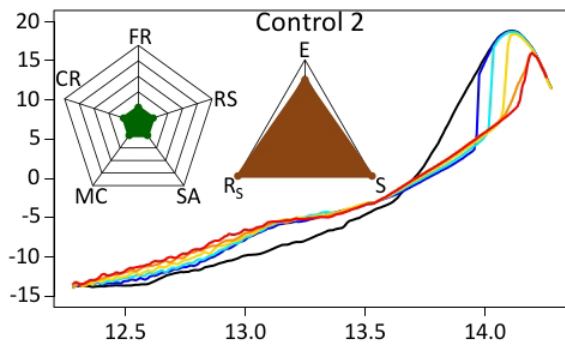
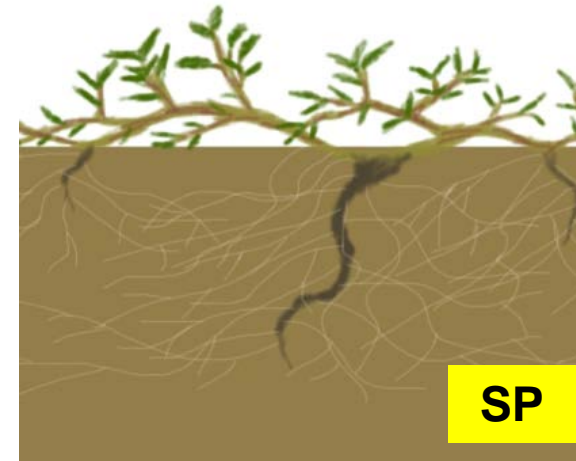
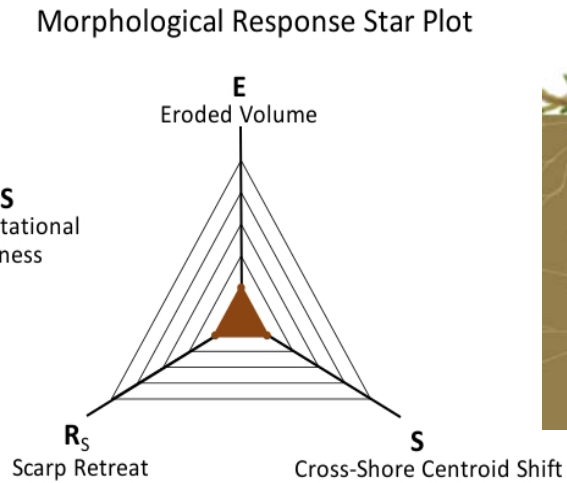
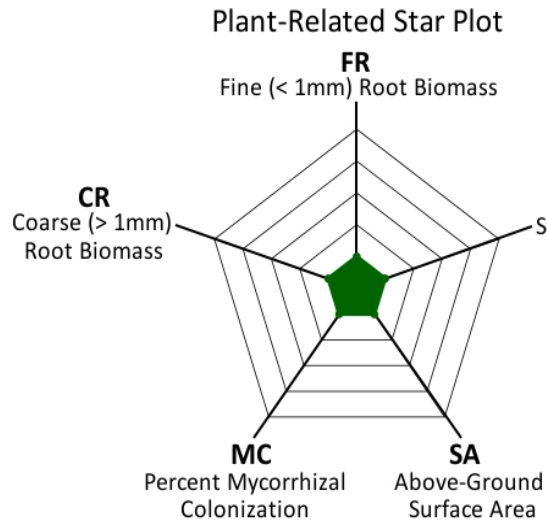
**RQ2:** What are the links between **above-ground** and **below-ground** biophysical **plant characteristics** (root mass, surface area, stem rotational stiffness, etc.) and **erosion** control?



**A****PA***Panicum amarum***Tall grass****B****RP***Rayjacksonia phyllocephala***Short shrub****C****SP***Sesuvium portulacastrum***Spreading vine****D****SV***Sporobolus virginicus***Short grass**

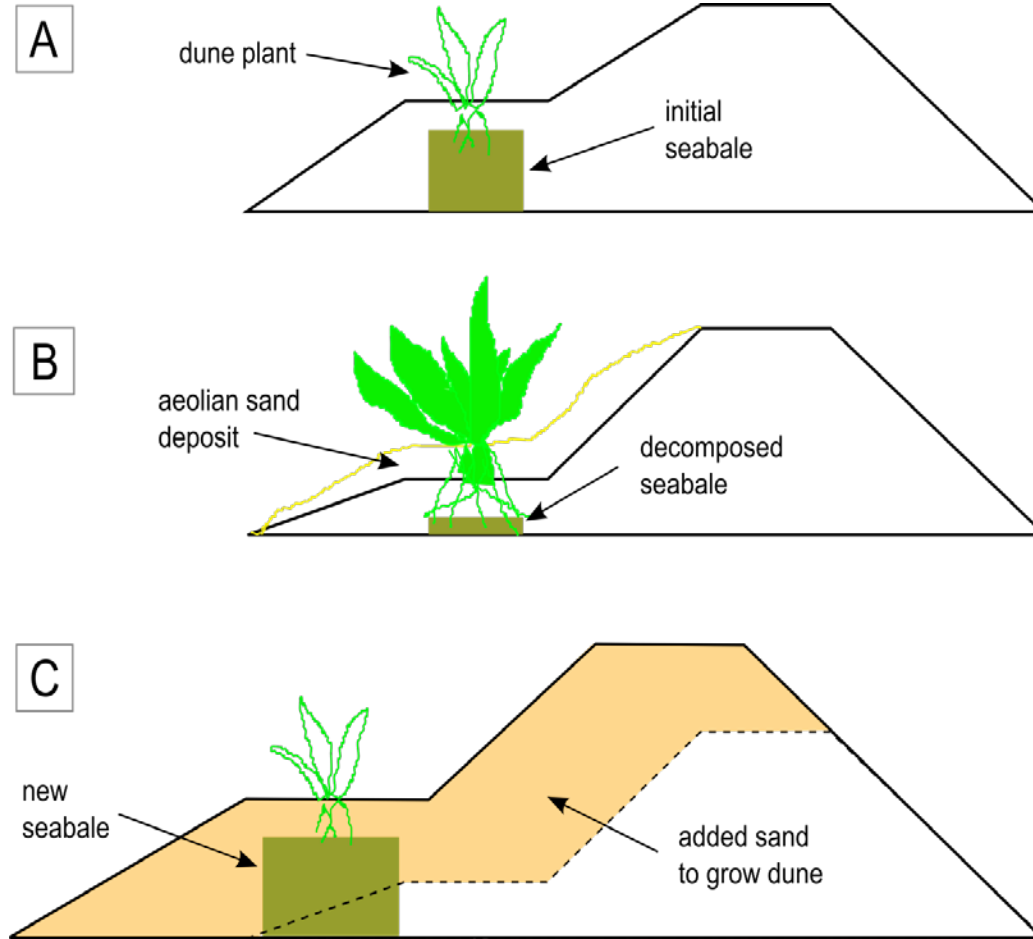
# Vegetated Dunes Research

## Dune Erosion and Vegetation Parameters



Figlus, J., Sigren, J. M., Power, M. J., and Armitage, A. R. 2017. Physical Model Experiment Investigating Interactions Between Different Dune Vegetation and Morphology Changes Under Wave Impact. In *Proceeding of Coastal Dynamics 2017*. Helsingor, Denmark.

# “Seabale” Dune Research



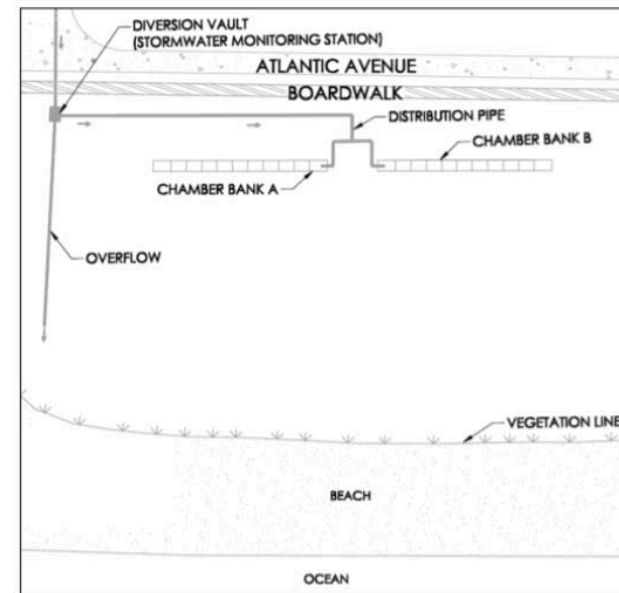
# Engineered Dunes for Coastal Runoff Control on Urbanized Beaches

**Erosion and contamination** from rainwater runoff is a big problem for many coastal communities.



## Rainwater runoff solutions:

Dune Infiltration System (Price et al., 2013) installed at Kure Beach, NC



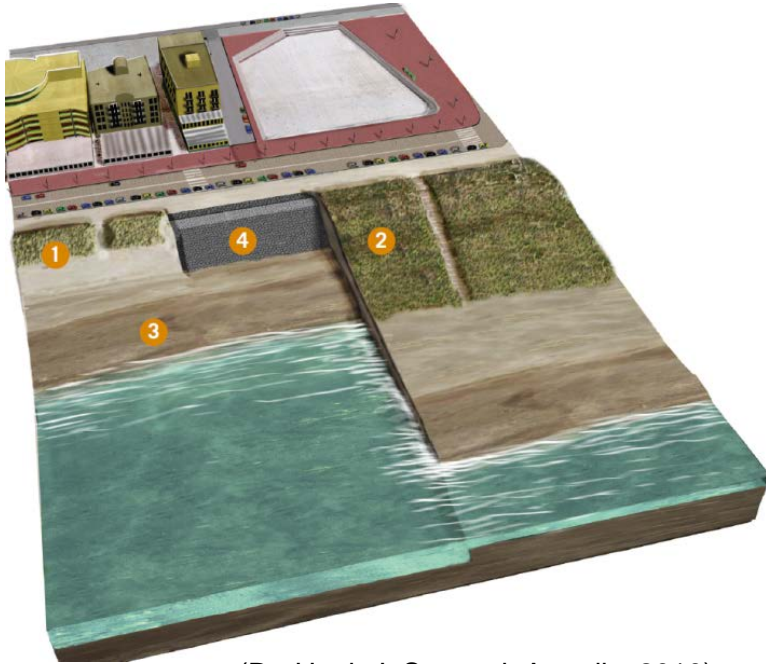
## Current Galveston Investigation:

- Quantify runoff problem for Galveston Island beaches
- Investigate potential solutions for runoff treatment
- Suggest feasible mitigation strategies

Successful solutions limit runoff-induced beach erosion and improve coastal water quality in the wake of rain events.

# Hybrid Coastal Structures Including Dunes

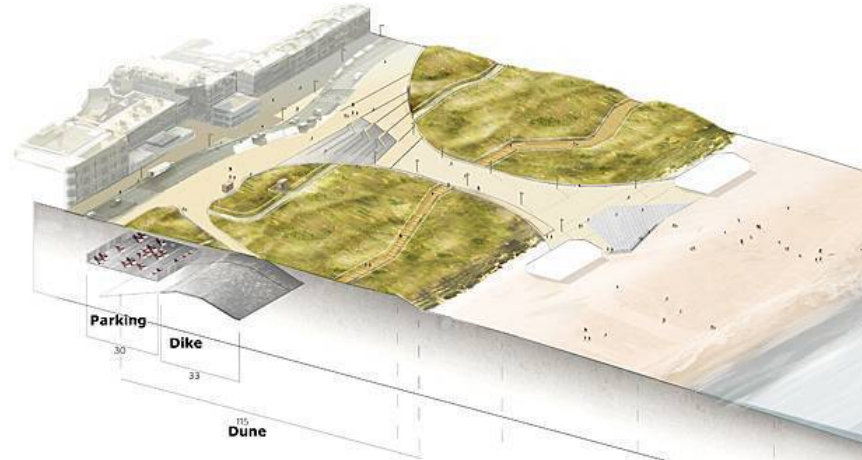
Noordwijk, NL



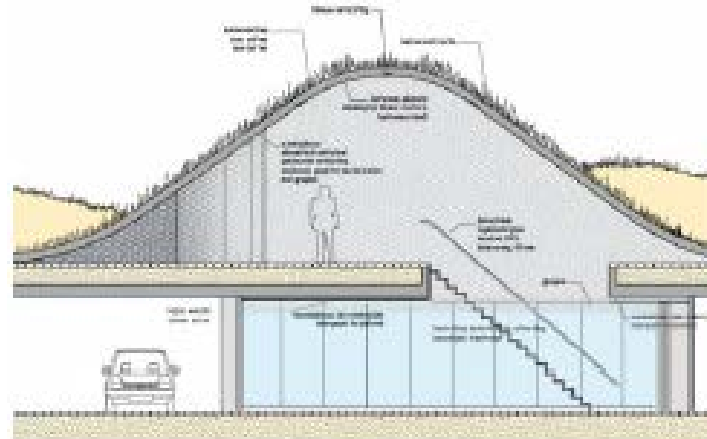
(Dr. Henk J. Steetzel, Arcadis, 2010)

Dike-in-Dune concept  
(rock-protected sand  
core covered with dune)

Katwijk, NL



(www.government.nl)



Multi-use coastal defense  
concept (car parking in dunes)

Scheveningen, NL



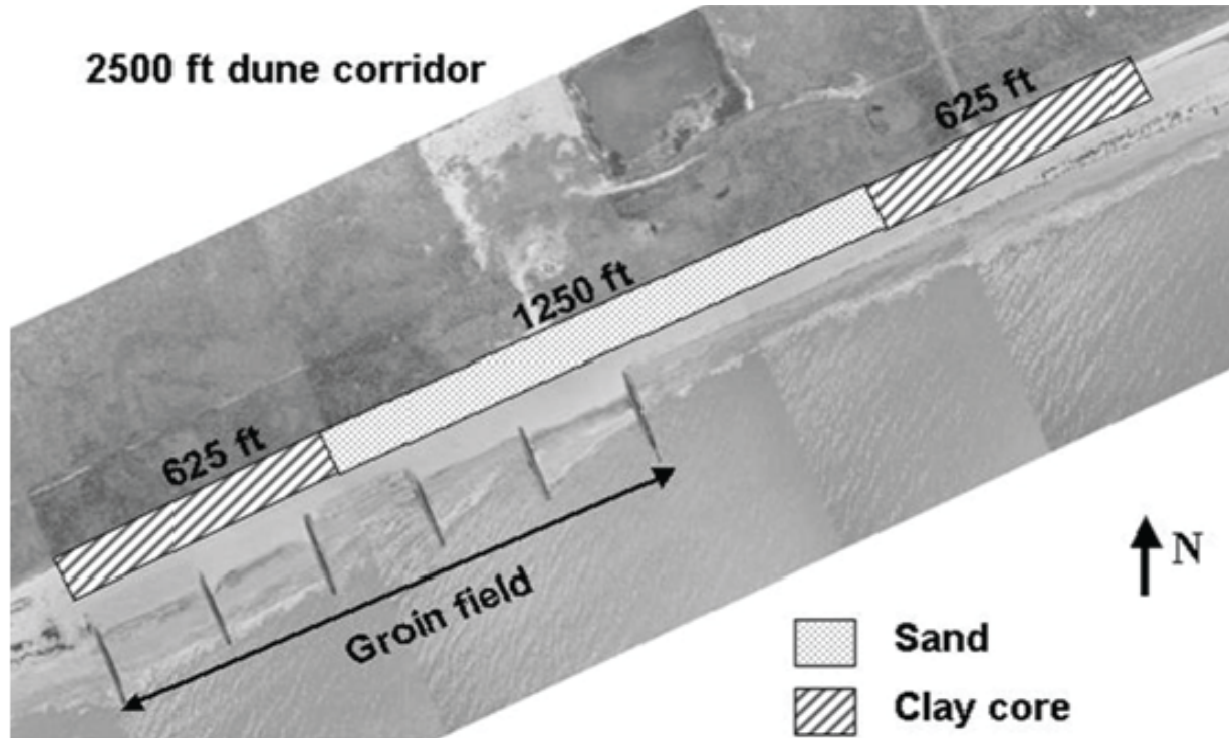
(Dr. Henk J. Steetzel, Arcadis, 2010)

Concept: Dike-in-Boulevard +  
additional beach



# Hybrid Coastal Structures Including Dunes

Jefferson County, TX, USA



USACE experimental low-volume beach nourishment with clay core dunes (Wamsley et al. 2011)

During Hurricane Ivan (2004) clay core dunes showed only 10% erosion compared to 50% for regular sand dunes

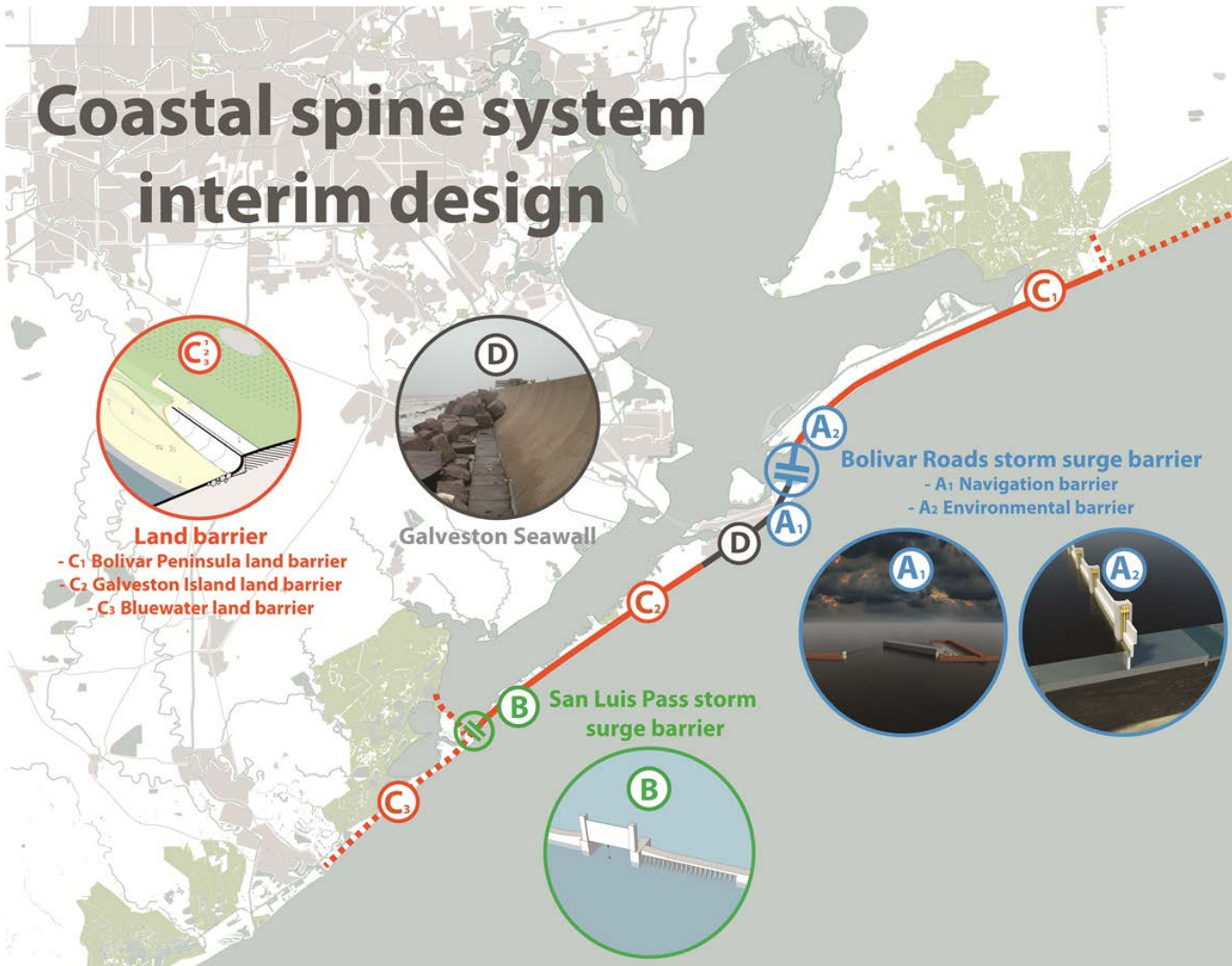
Bay Head, NJ, USA



Relic rock seawall exposed by Superstorm Sandy afforded superior protection to homes and infrastructure compared to other locations (Irish et al. 2013)

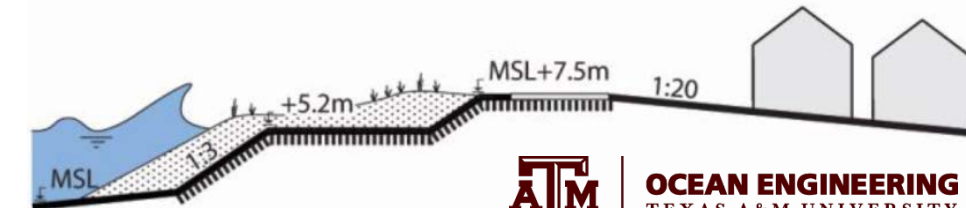
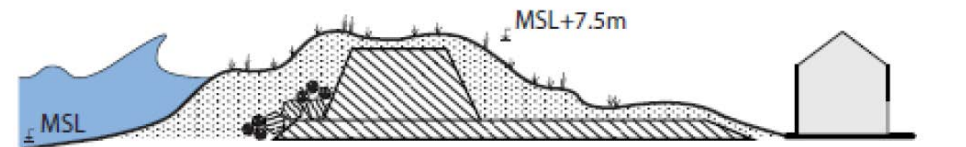
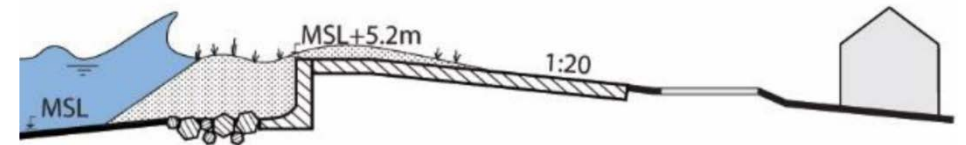
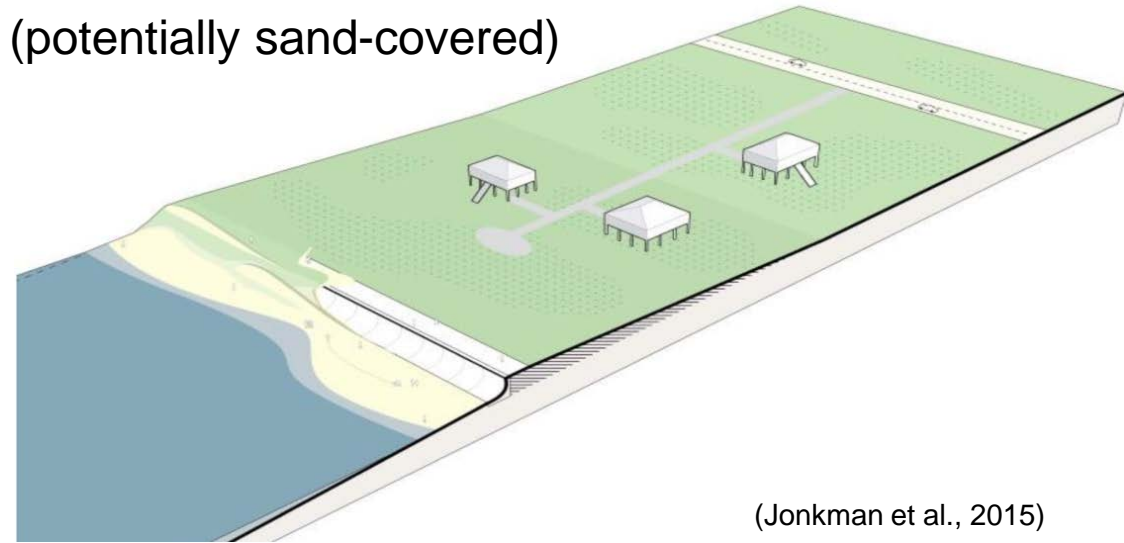
# Hybrid Coastal Structures Including Dunes

## Coastal spine system interim design



## LAND BARRIER

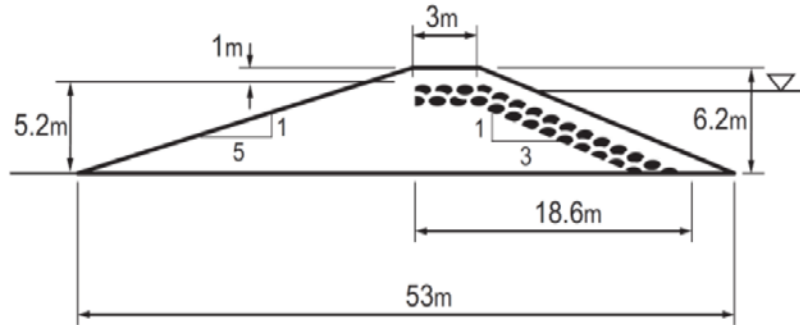
(potentially sand-covered)



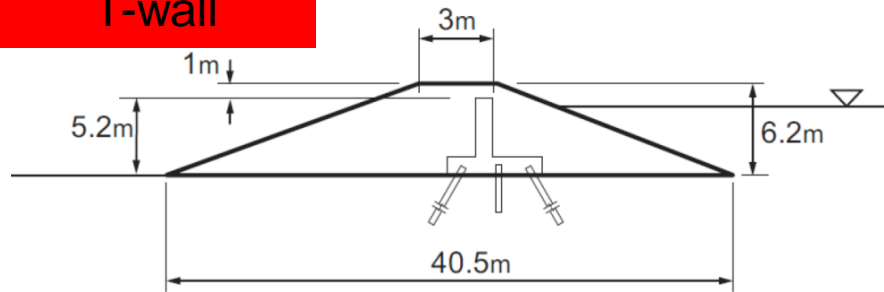
# Hybrid Coastal Structures Including Dunes

## LAND BARRIER (CORE-ENHANCED DUNE CONCEPT)

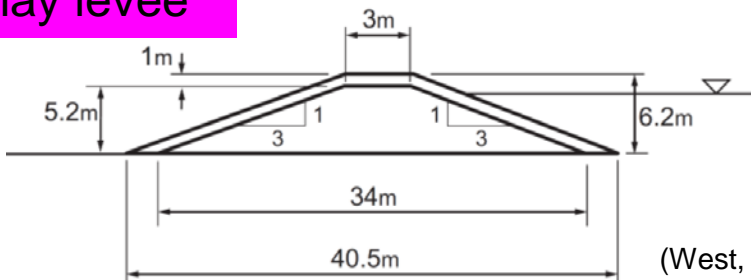
Armor stone revetment



T-wall



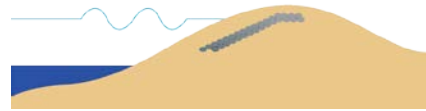
Clay levee



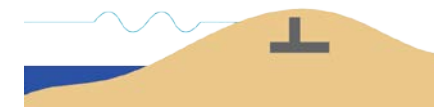
(West, 2014)

## WAVE FLUME EXPERIMENT

DC1:  
Armor Stone Core



DC2:  
T-Wall Core



DC3:  
Clay Levee Core



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Questions?

