



Innovative Nature-Based Solution:

”Seabale” Dunes

Jens Figlus, Ph.D.

German-American Nature-Based Solutions Exchange (GANBASE)

Workshop

Galveston, Texas

October 6-7, 2025



OCEAN ENGINEERING
TEXAS A&M UNIVERSITY





OUTLINE

Intro

1. INTRODUCTION

Motivation, Project Idea, Benefits, Background

Field

2. FIELD SITE

Layout, Dune Design and Construction, “Seabales”

Data

3. DATA COLLECTION & RESULTS

Profiles, Sediment, Vegetation, Wave Flume

Future

4. FUTURE OUTLOOK

Work Continuation, Further Development

Discuss

5. DISCUSSION

So What?



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.



Galveston Seawall Sargassum Landing
(video taken by J. Figlus on 5-11-2014)

MOTIVATION

INTRO

Field

Data

Future

Discuss



Sargassum



Lack of Dune Protection

Heavy Sargassum Landings



Management Practice



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

PROJECT IDEA

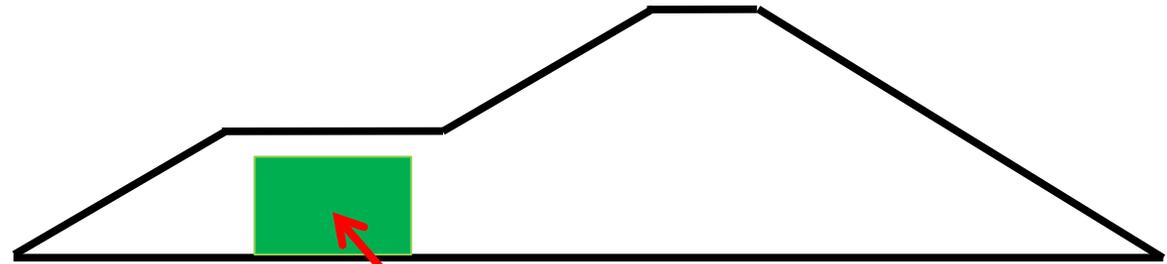
INTRO

Field

Data

Future

Discuss



SEABALES (Compacted Sargassum)



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS®

POTENTIAL BENEFITS

INTRO

Field

Data

Future

Discuss

Short -Term (days & months)	Long -Term (years & longer)
Remove Sargassum from beach (reduced smell, easier access)	Spur vegetation growth
Reduce Sargassum volume through compaction	Grow dunes through repeated application and capture of aeolian transport
Increase erosion resistance of dunes	Increase dune resilience
New beach management option	



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

BACKGROUND

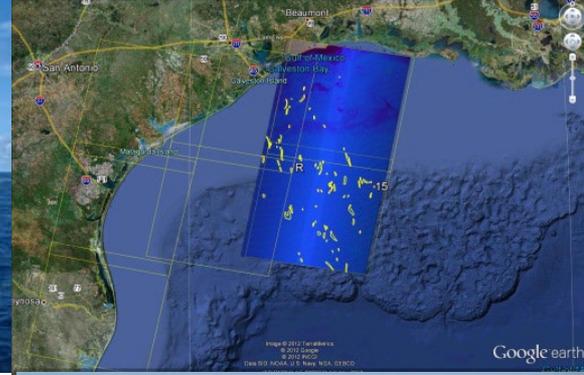
INTRO

Field

Data

Future

Discuss



- Sargassum detection and tracking (SEAS Program)
- Arrival predictions
- Wrack removal improvement
- **Final resting place?**



GALVESTON
* ISLAND *
Park Board of Trustees



ATM | TEXAS A&M
UNIVERSITY

GALVESTON CAMPUS®

FIELD SITE

Galveston East Beach (Apffel Park)

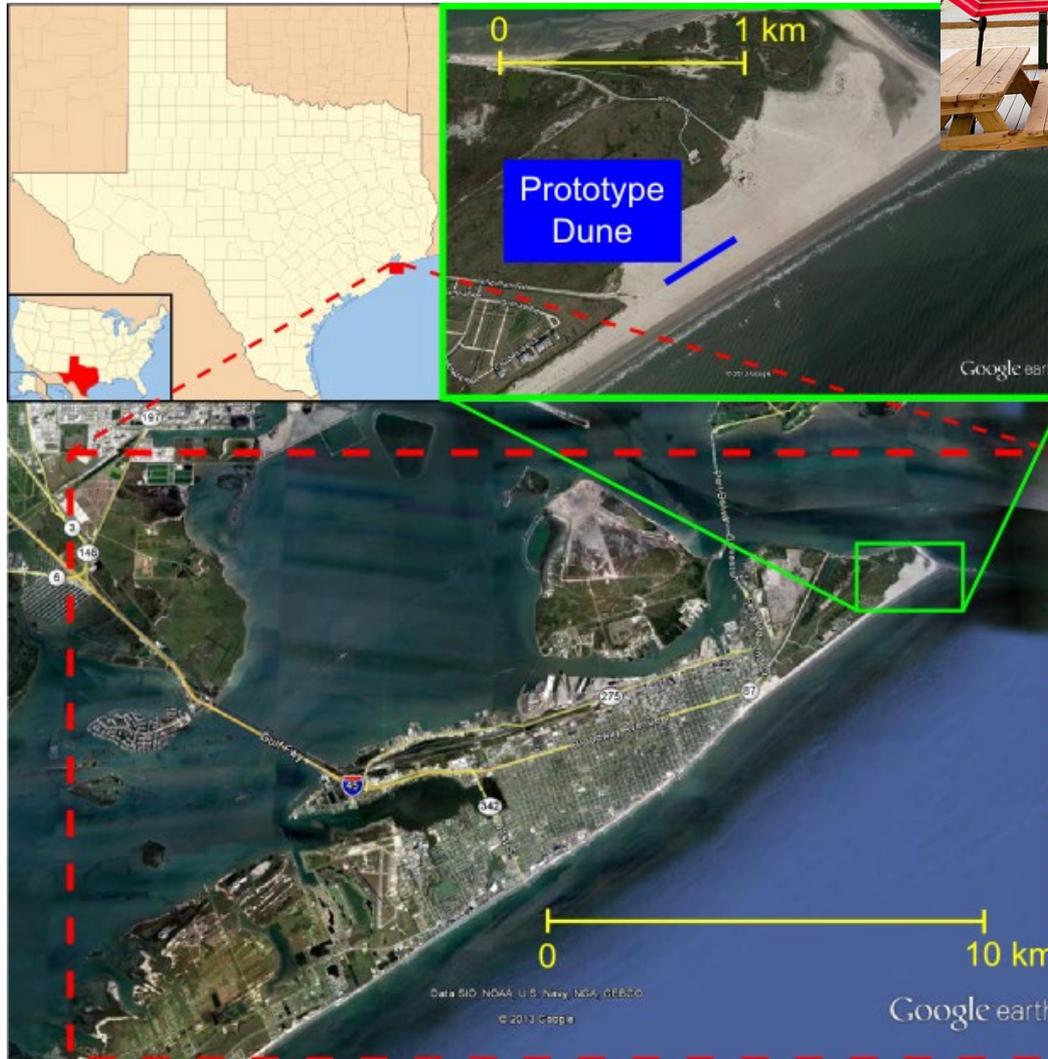
Intro ✓

FIELD

Data

Future

Discuss



Existing Infrastructure:

- Space
- Material
- Access
- Internet
- Equipment



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

DUNE DESIGN & LAYOUT

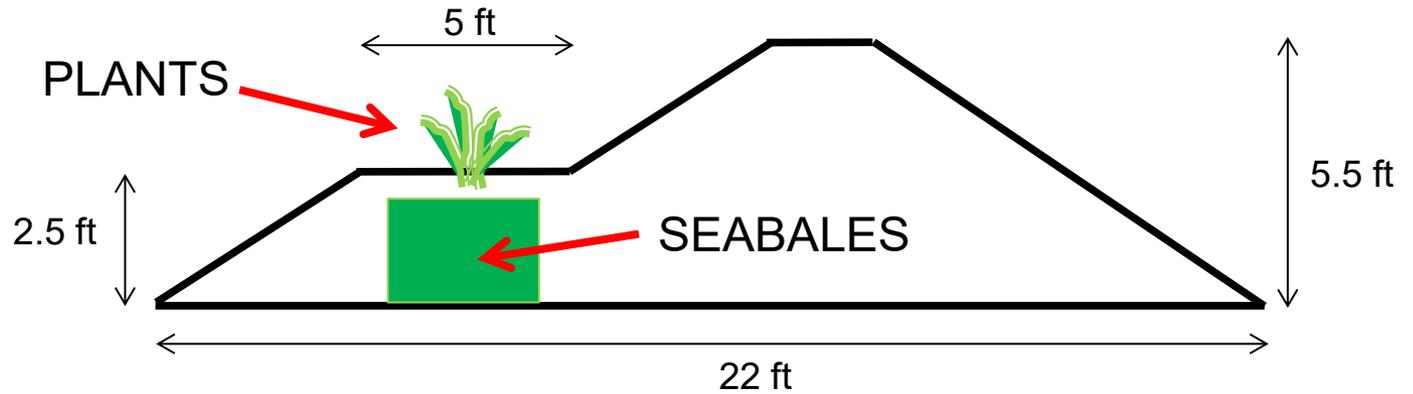
Intro ✓

FIELD

Data

Future

Discuss



4 DUNE SEGMENTS (200 ft each)

Dune	Type
1	Plants & Seabales
2	Plants
3	Seabales
4	Control



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

DUNE & SEABALE CONSTRUCTION

Intro ✓

FIELD

Data

Future

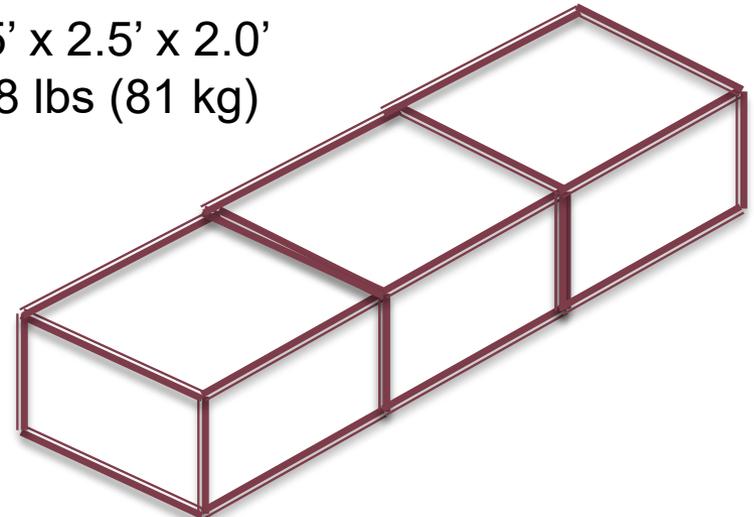
Discuss



Vertical compaction-style baler



Seabales:
2.5' x 2.5' x 2.0'
178 lbs (81 kg)



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

VIDEO MONITORING

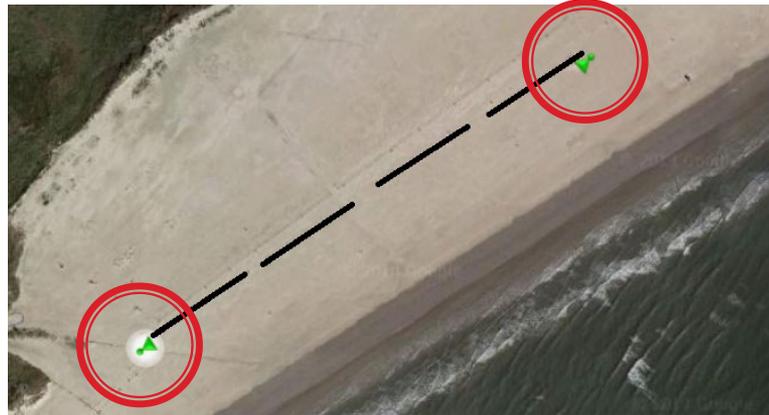
Intro ✓

FIELD

Data

Future

Discuss



- 2 wireless cameras (incl. IR)
- Live-stream available
- Monitor vegetation cover
- Detect and capture wave-induced erosion

12'
3.6m



PROFILE SURVEYS

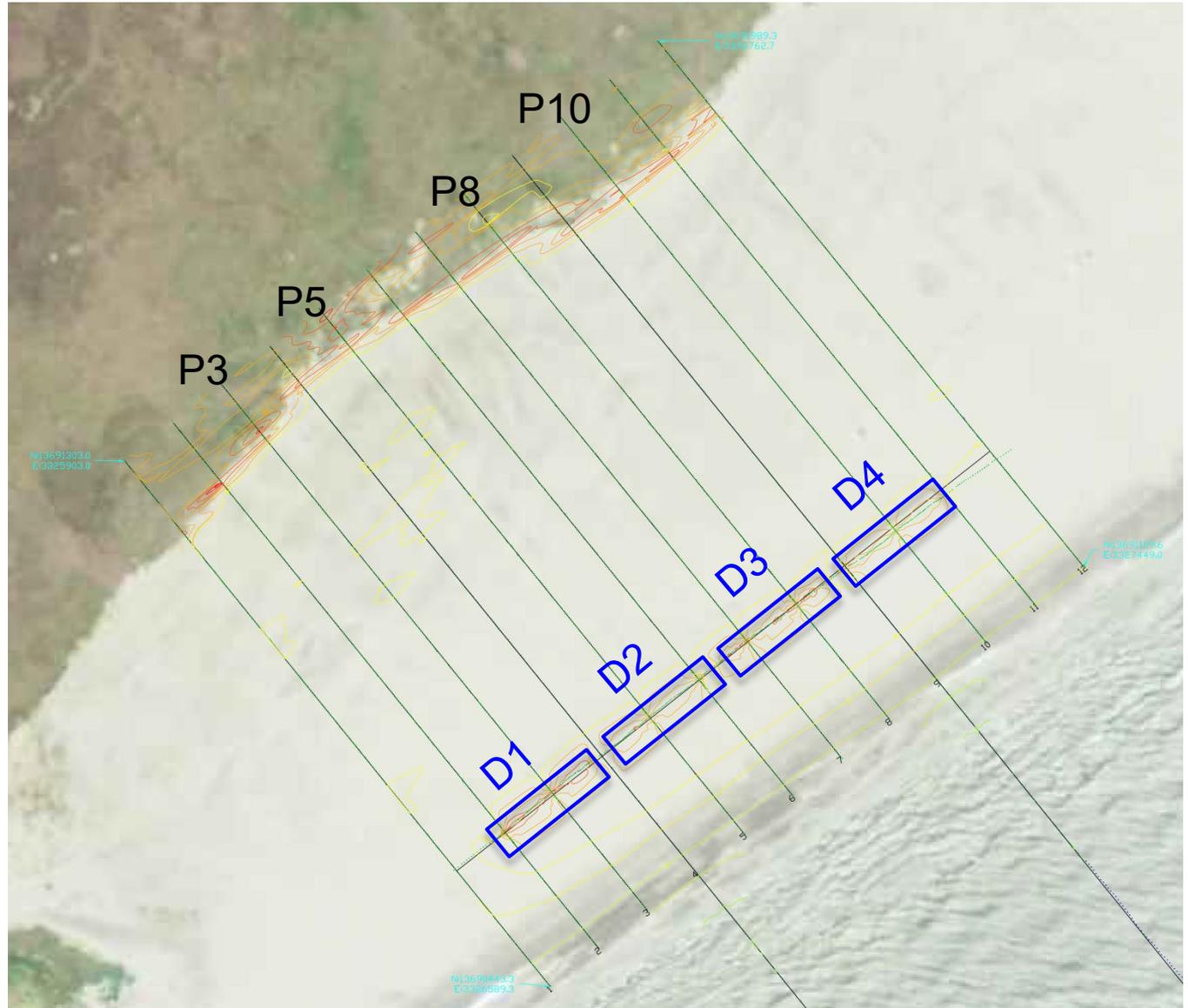
Intro ✓

Field ✓

DATA

Future

Discuss



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS®

Tropical Storm "BILL (June 16, 2015)"



PROFILE SURVEYS

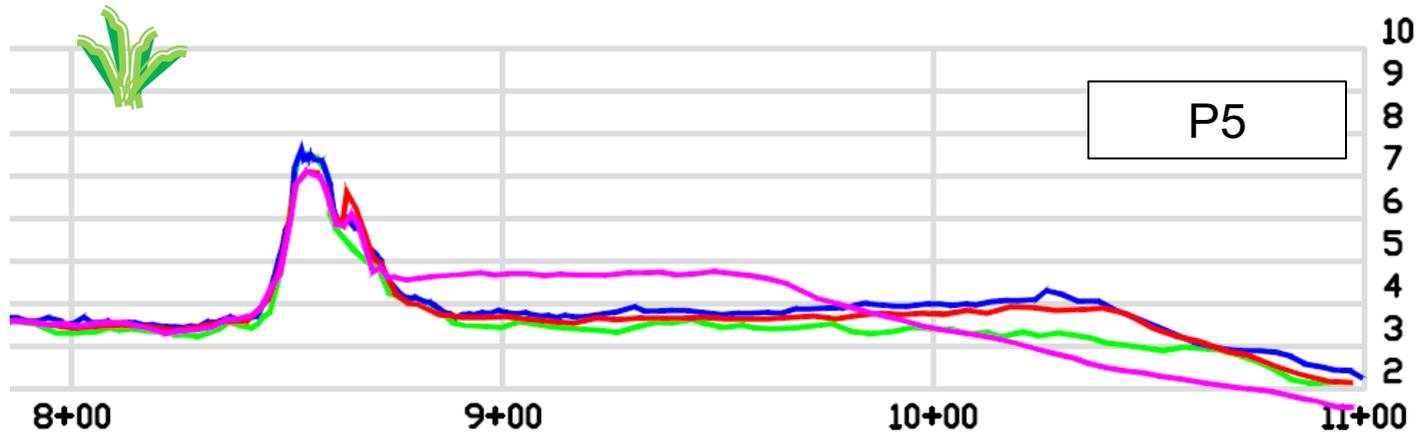
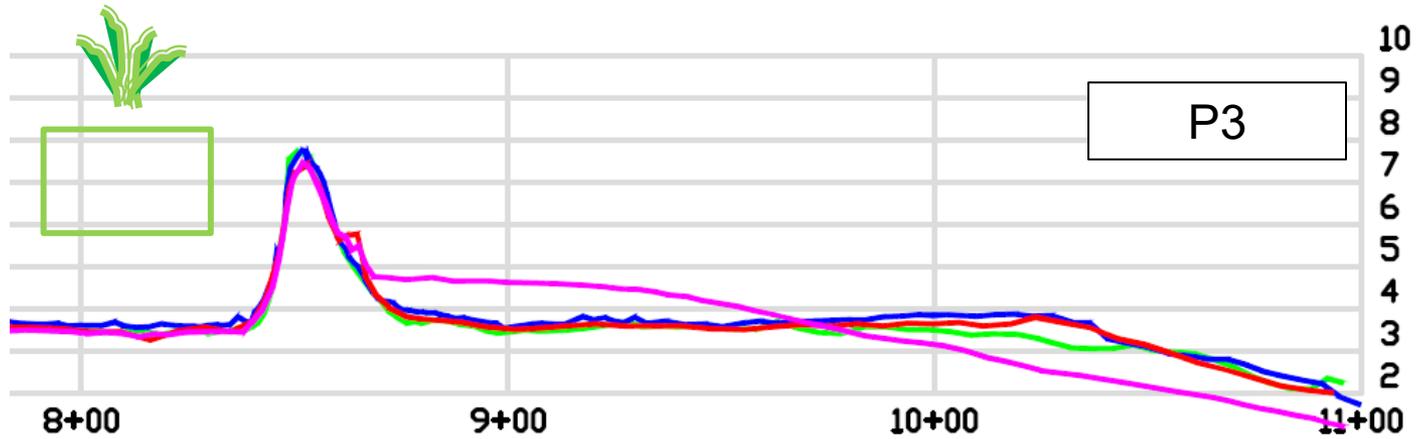
Intro ✓

Field ✓

DATA

Future

Discuss



Green: September 2014

Blue: December 2014

Red: March 2015

Magenta: June 2015 (post Bill)

Units: feet



PROFILE SURVEYS

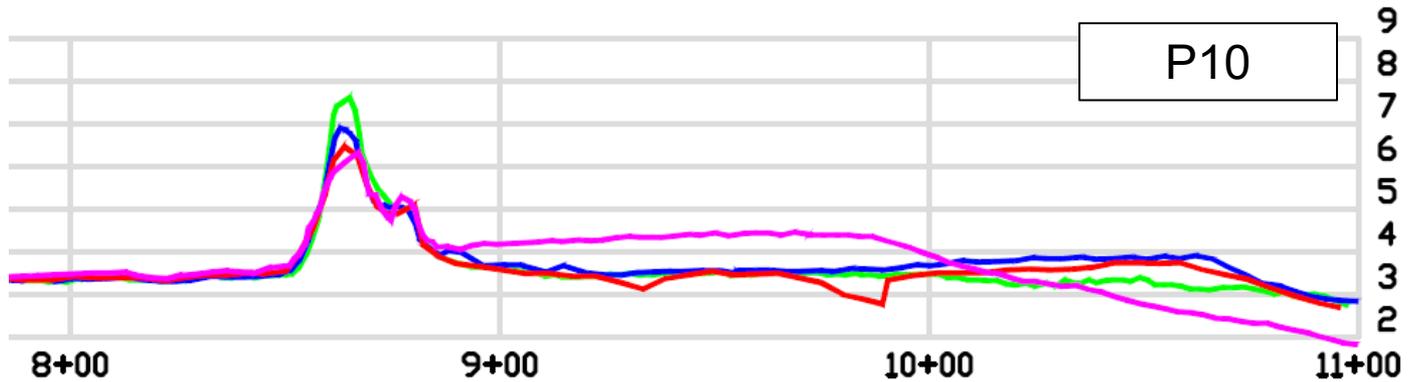
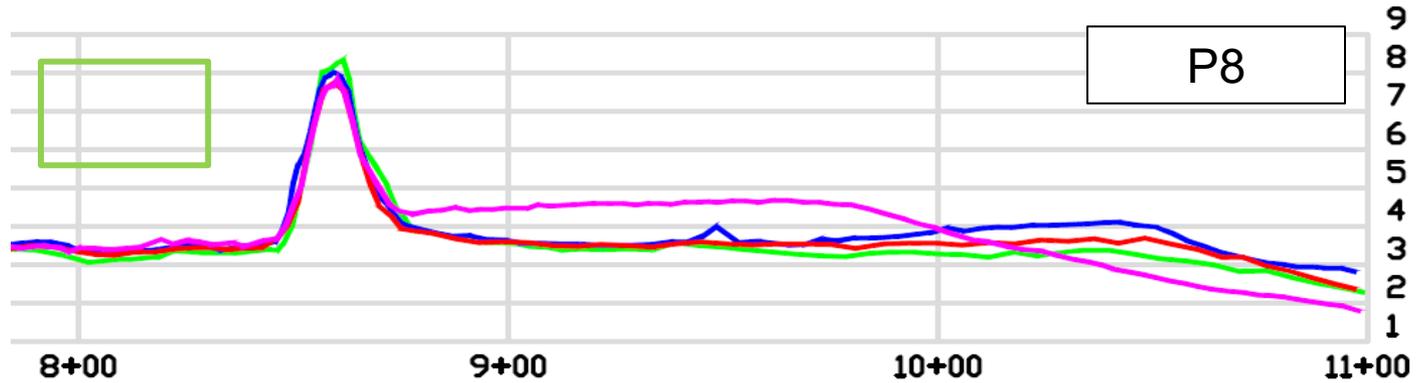
Intro ✓

Field ✓

DATA

Future

Discuss



Green: September 2014

Blue: December 2014

Red: March 2015

Magenta: June 2015 (post Bill)

Units: feet



PENETROMETER TESTING

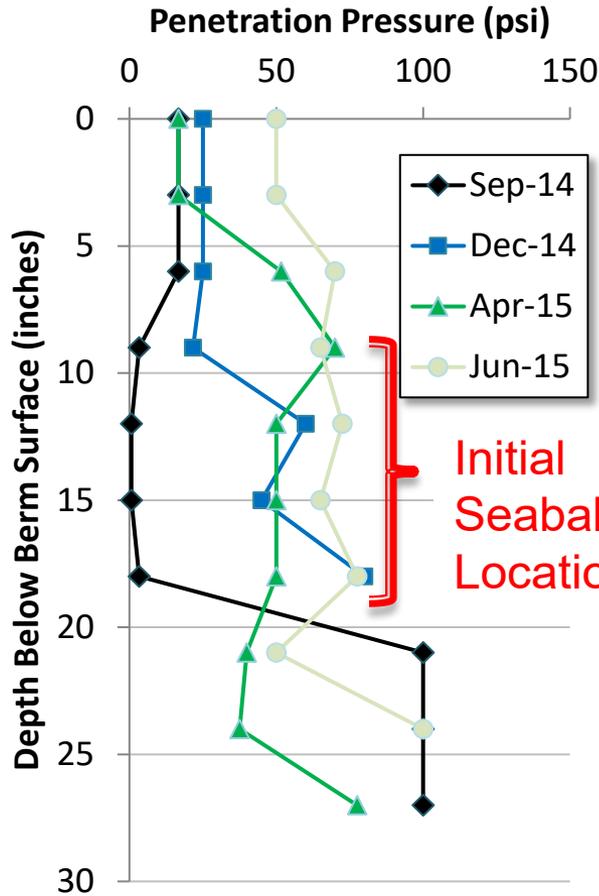
Intro ✓

Field ✓

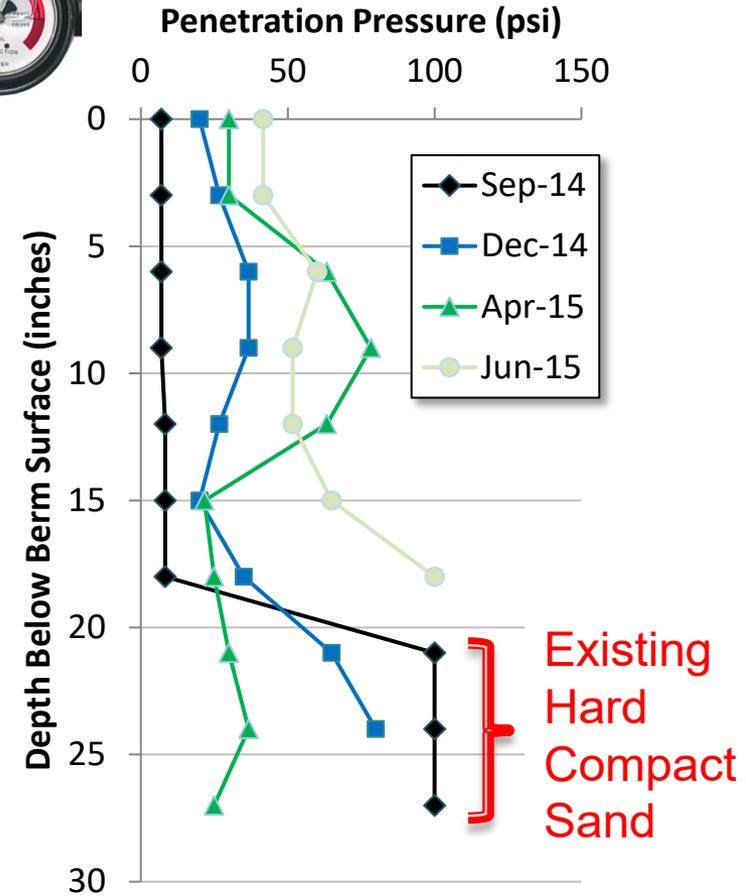
DATA

Future

Discuss



DUNE 1



DUNE 2



PENETROMETER TESTING

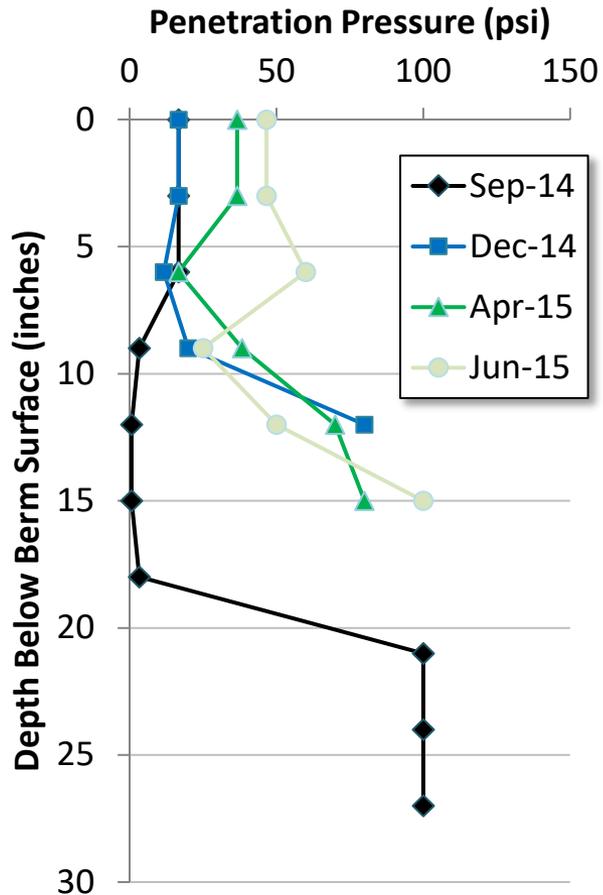
Intro ✓

Field ✓

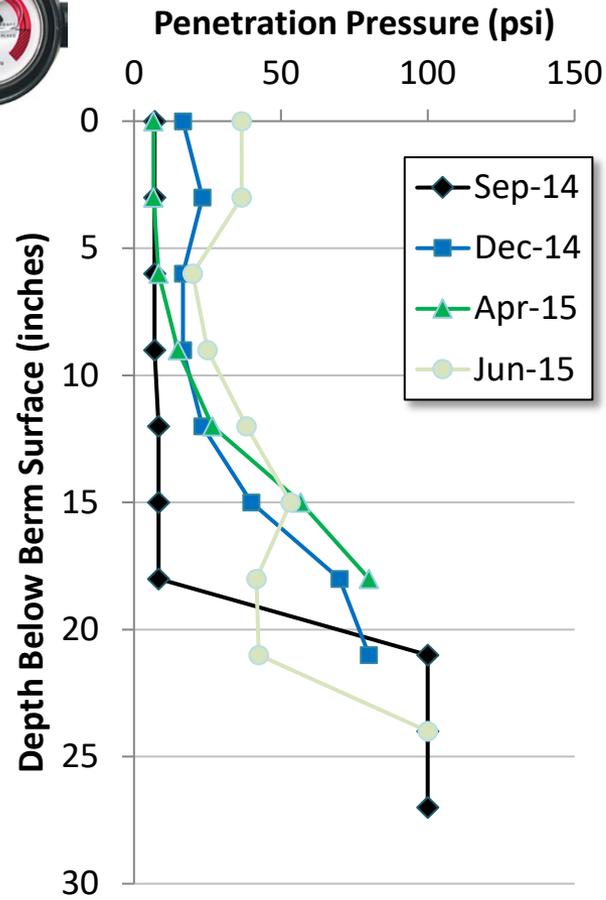
DATA

Future

Discuss



DUNE 3



DUNE 4

SEDIMENT ANALYSIS ($D_{50} = 0.12$ mm)

Intro ✓

Field ✓

DATA

Future

Discuss

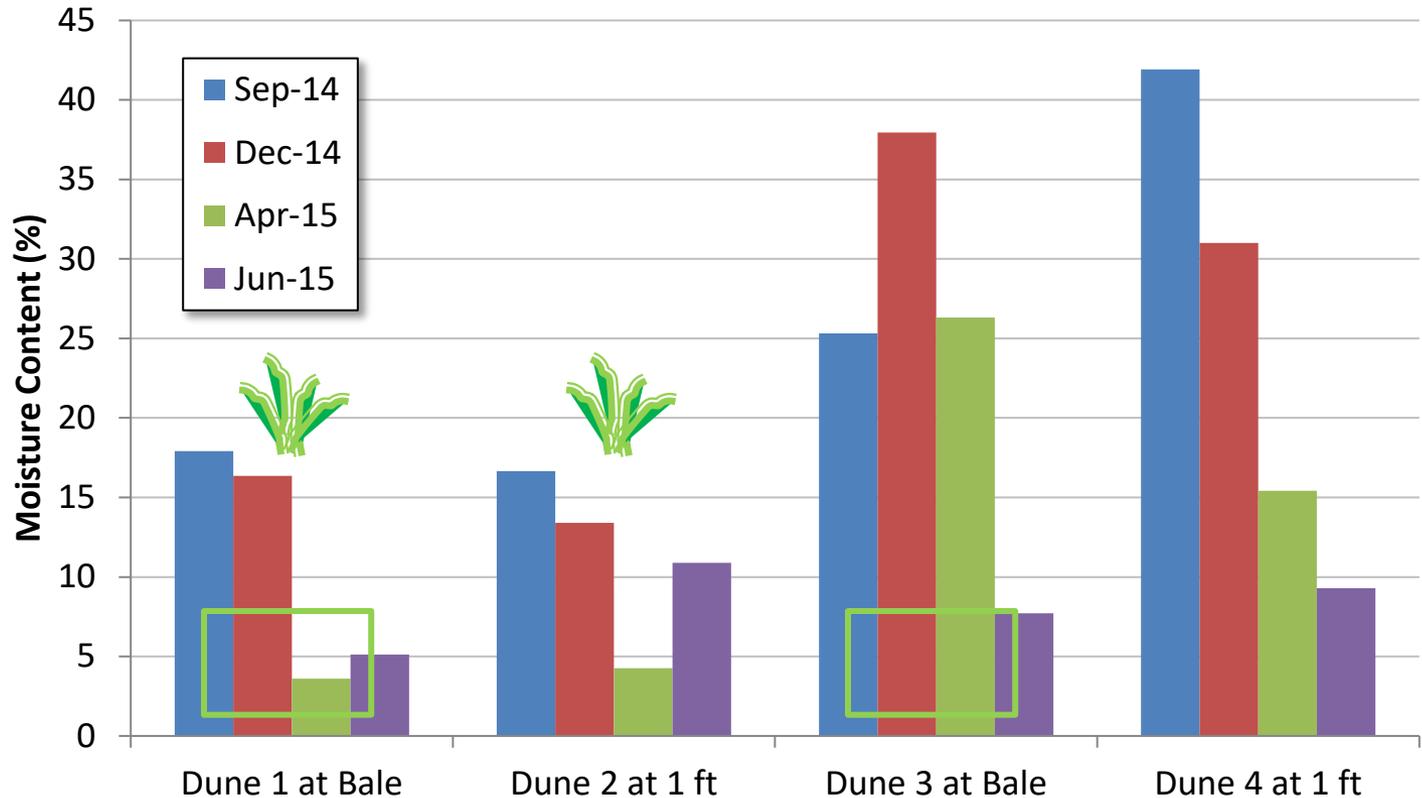


GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS®

Moisture Content inside Berm



- Sargassum retains moisture in dunes
- Plants take up moisture from dunes
- Potential for increased resilience against drought

SEDIMENT ANALYSIS ($D_{50} = 0.12$ mm)

Intro ✓

Field ✓

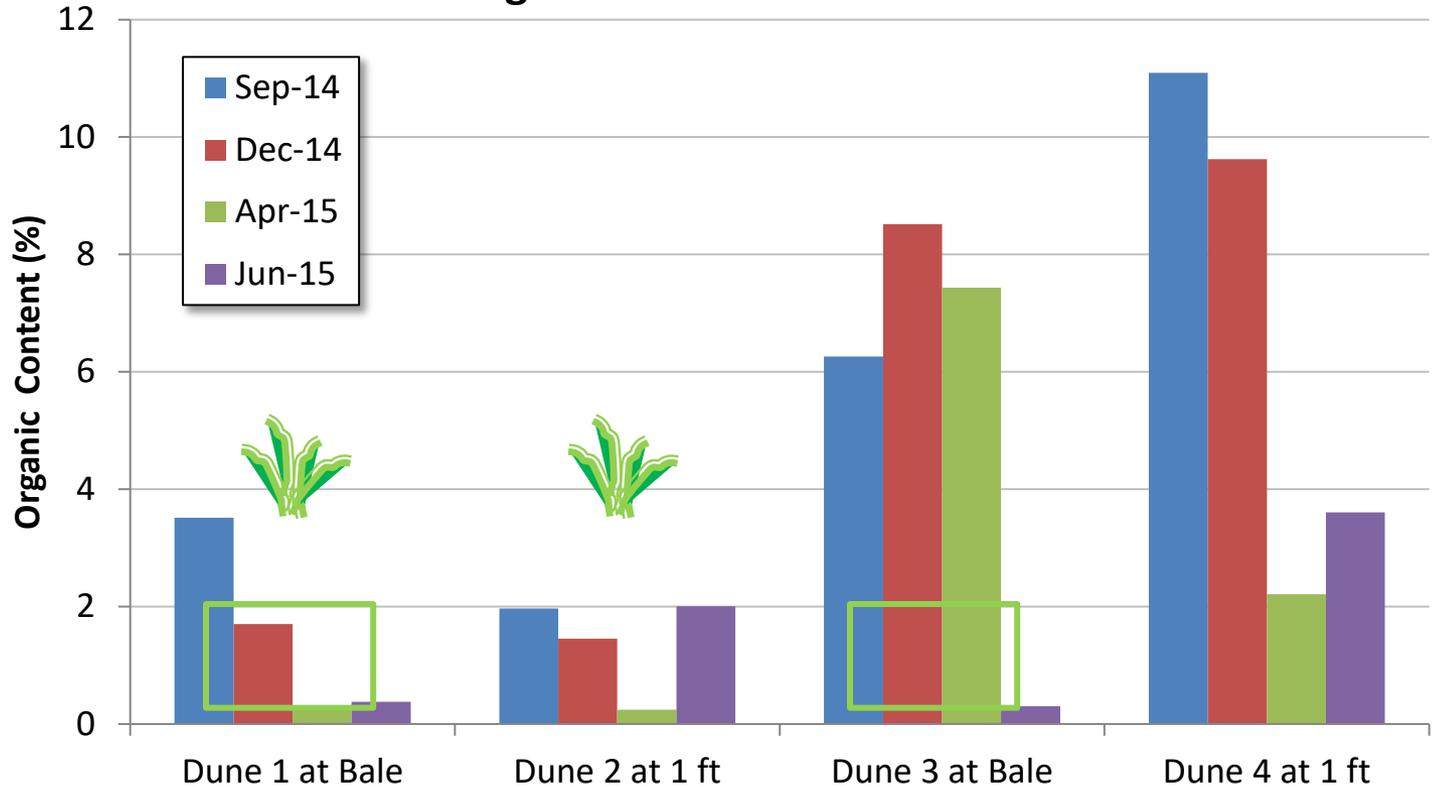
DATA

Future

Discuss



Organic Content inside Berm



- Plants utilize organic content in dunes for their growth
- After 1 year seabale dunes show most organic material has been utilized

WAVE FLUME TESTING

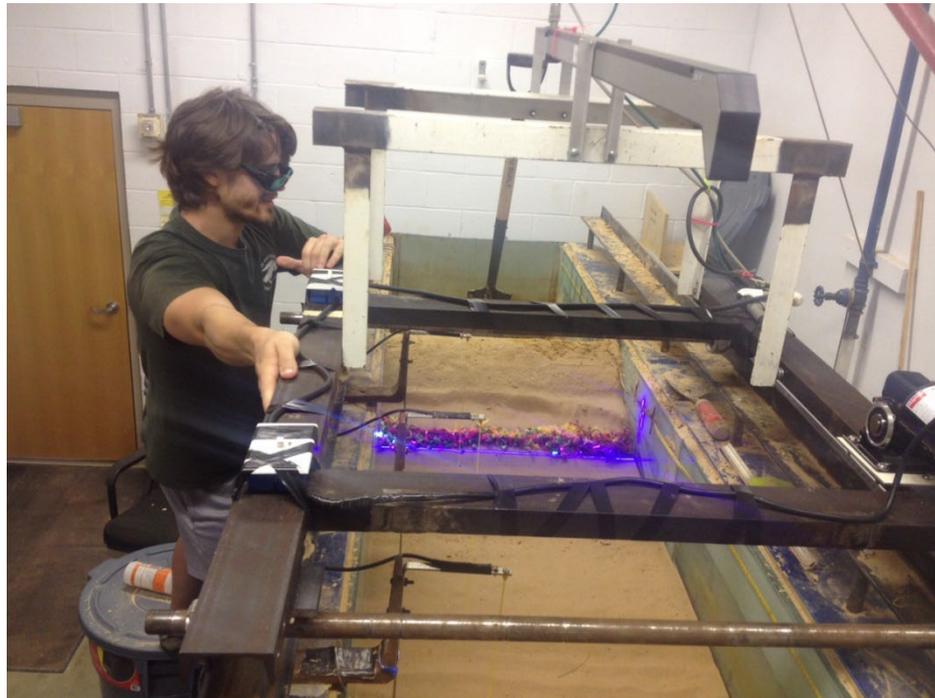
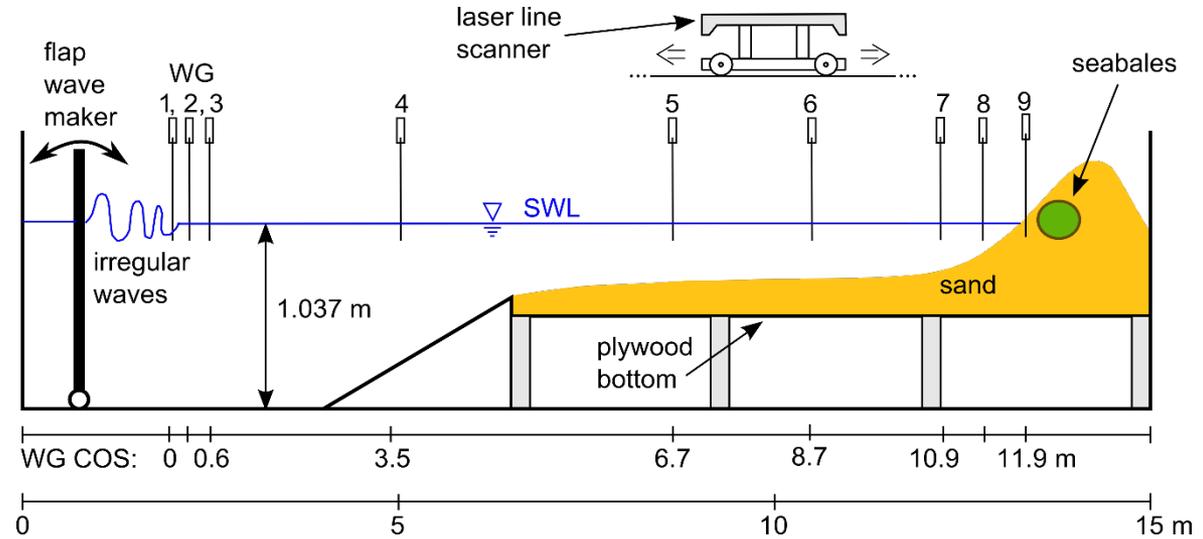
Intro ✓

Field ✓

DATA

Future

Discuss



GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS.

ARTIFICIAL SEAWEED

Intro ✓

Field ✓

DATA

Future

Discuss



Off-the-shelf plastic aquarium plants are used to simulate fresh seabeds in the flume.



FLUME TEST PROFILES

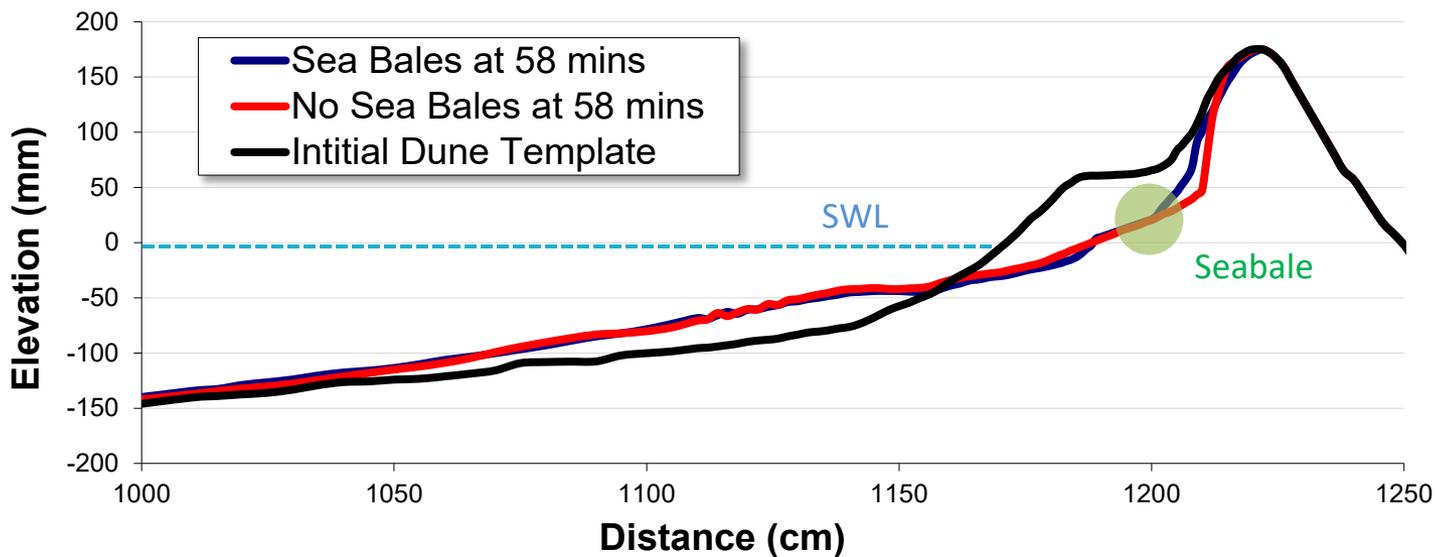
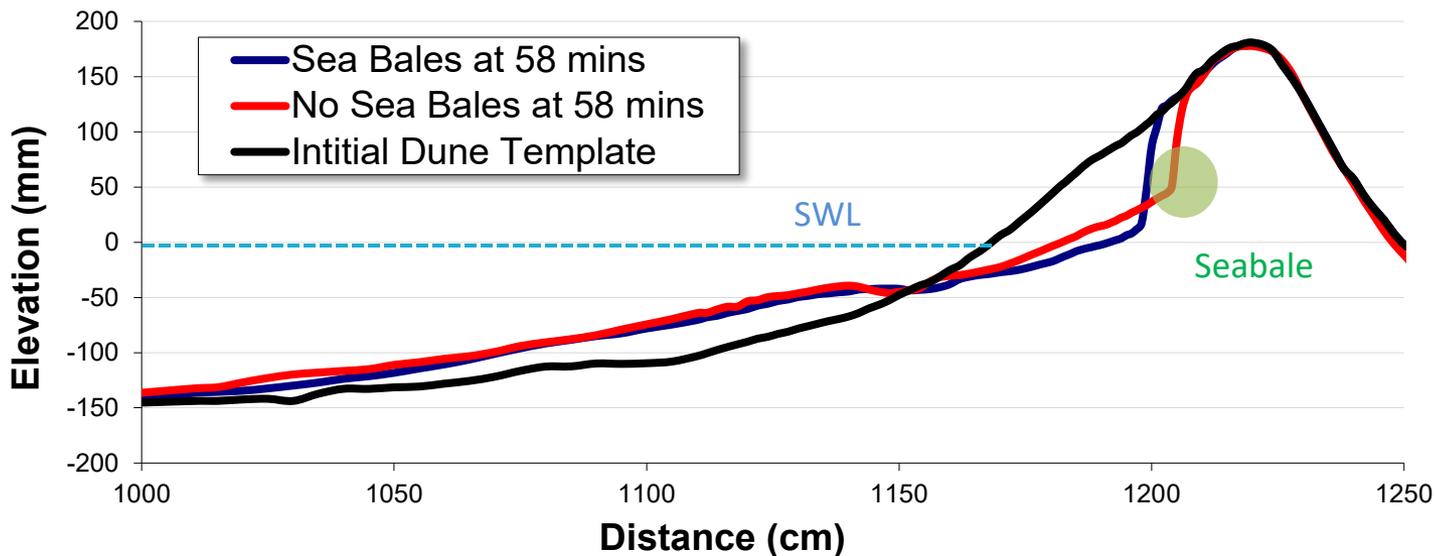
Intro ✓

Field ✓

DATA

Future

Discuss



TO BE CONTINUED ...

Intro ✓

Field ✓

Data ✓

FUTURE

Discuss

- Seek continuation funding
- Monitoring and data collection
- Automated horizontal baler system development
- Other use investigation (beer, food, energy, bio-char material, etc.)
- Re-application of seabales to same dune



SUMMARY & DISCUSSION

Intro ✓

Field ✓

Data ✓

Future ✓

DISCUSS

- Innovative way to handle heavy Sargassum landings & promote sustainable dune building
- Provide beneficial beach management option for upper Texas coast and beyond



- How would pure sand to cover seabales instead of sand/Sargassum mix change findings?
- What are the long-term effects of this practice?
- How would seabale-enhanced dunes perform on an eroding beach?
- Can we automate the baling process?

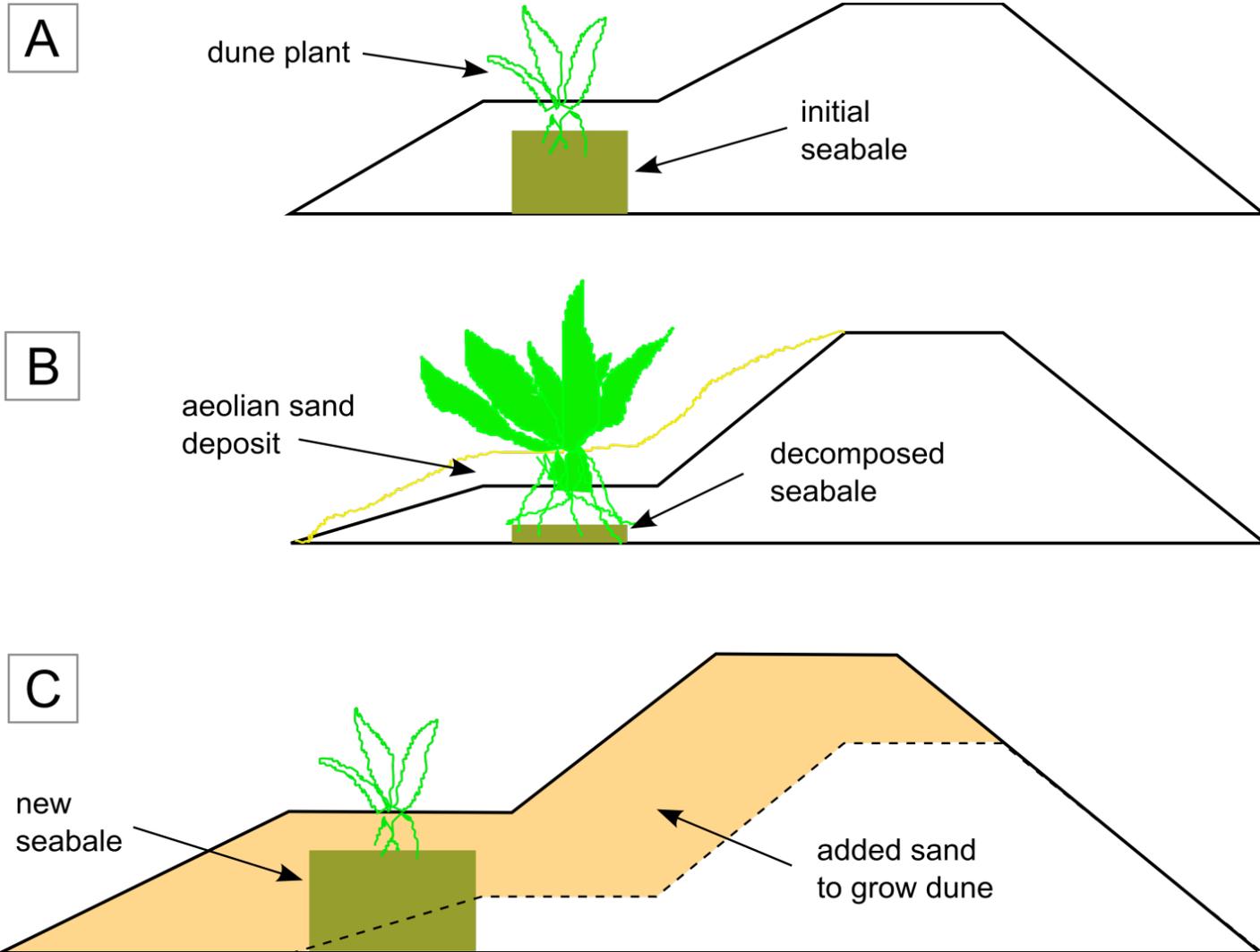


GALVESTON
* ISLAND *
Park Board of Trustees



GALVESTON CAMPUS®

Re-Application of Seabales for Sustained Dune Growth



2015

Google Earth

Image © 2025 Airbus



300 ft



2023

Google Earth

Image © 2025 Airbus

300 ft





OCEAN ENGINEERING
TEXAS A&M UNIVERSITY

THANKS TO:

- Texas General Land Office (GLO) Coastal Erosion Planning and Response Act (CEPRA) Program
- Leaders, members, and staff of the Galveston Park Board of Trustees
- Beach Maintenance Advisory Committee (BMAC)
- Captain Robert Webster, Dr. Tom Linton, Jake Sigren, Robert Cory Tyler, Dillon Goggans, Matthew Power, Hunter Myres



Questions?



Contact Info:

Jens Figlus, Ph.D.

Associate Professor

Department of Ocean Engineering

Texas A&M University

figlusj@tamu.edu | 409-741-4317

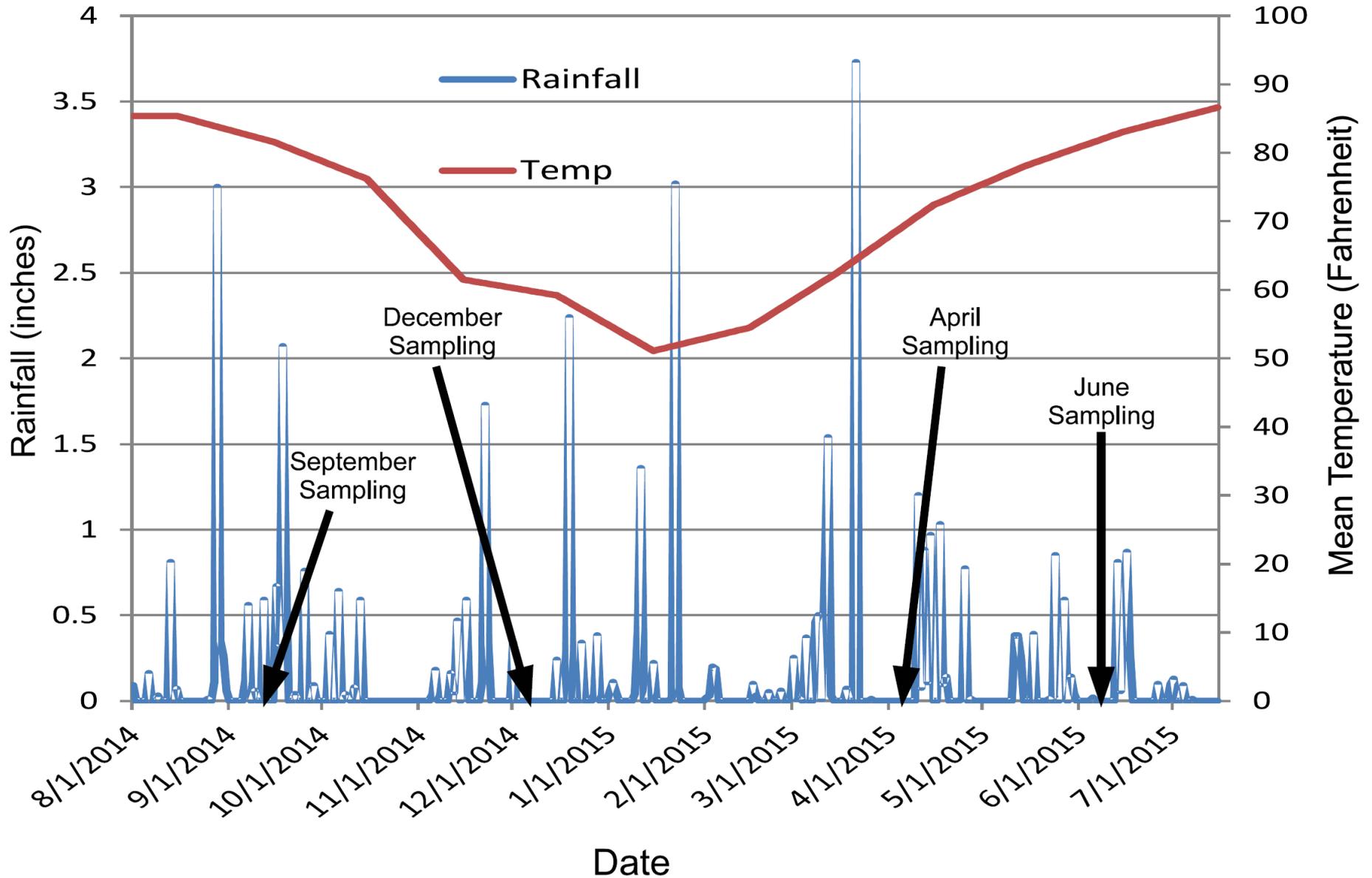
<http://figluscoast.tamu.edu>



OCEAN ENGINEERING
TEXAS A&M UNIVERSITY

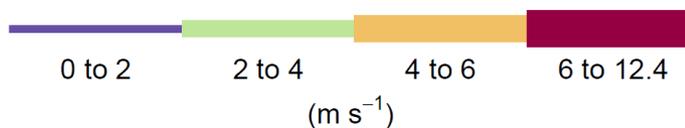
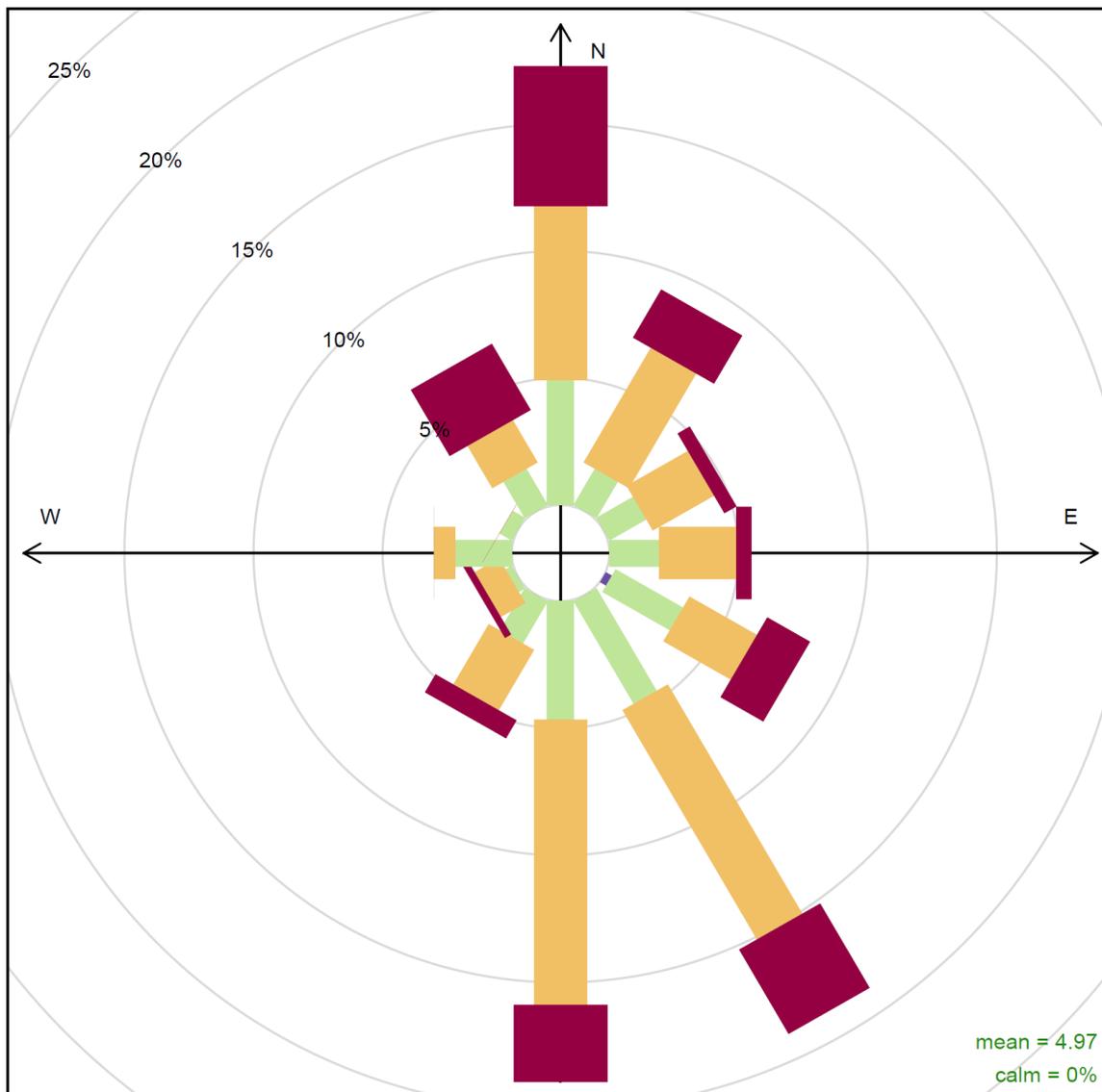
Figlus, J., Sigren, J., Webster, R., and Linton, T. (2015). [Innovative technology seaweed prototype dunes demonstration project](#). Final Technical Report for CEPRA Cycle 8 Project 1581 to the Texas General Land Office, pp. 47, Department of Ocean Engineering, Texas A&M University, Texas A&M Engineering Experiment Station (TEES), Galveston, TX.

Time History of Daily Precipitation and Temperature for Galveston Island



Galveston Island Wind Rose (entire project duration)

Ideal conditions for
dune growth via aeolian
sediment transport
along North-South axis
(beach and parking area
sources)



Frequency of counts by wind direction (%)