



# Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

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Office of Resilience and Coastal Protection  
Florida Department of Environmental Protection

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Guana Preserve, St. Johns County





# Florida's dunes are valued natural resources

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

“It shall be the policy of the state to conserve and protect its natural resources and scenic beauty.” Florida Constitution, Article II, Section 7

“The Legislature finds and declares that the beaches in this state and the coastal barrier dunes adjacent to such beaches, by their nature, are subject to frequent and severe fluctuations and represent one of the most valuable natural resources of Florida and that it is in the public interest to preserve and protect them from imprudent construction.”

Dennis L. Jones Beach and Shore Preservation Act, s. 161.053 (1)(a)

Beacon Hill, Gulf County





# Resilient and Sustainable Dunes

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

### Three keys for success

“It’s Alive!” – Dunes are Regenerative Systems

“Keep Off the Dune!” – Protect Dune Resilience Functions

“Building Back the Dunes” – Follow Nature’s Lead







# It's Alive! Dunes are Living Systems

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



North Captiva Island, Lee County

### What is a Dune?

- sand dune, sea dune, **beach dune**,
- sloped mound, ridge or bluff immediately upland of the beach,
- typically composed of windblown sand,
- vegetated with beach dune plants, typically treeless, and
- subject to fluctuations in shape and location by wind and waves.





# Beach Dune Natural Community

Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



St. George Island, Franklin County





**Flora Dunes: regionally significant natural features**

## Sea Islands – Multiple Parallel Ridges



## Gulf Islands – Low, Irregular Dunes



## Atlantic Coastal Barrier – Single Ridge



## Panhandle Mainland Barrier – Wavecut Bluffs







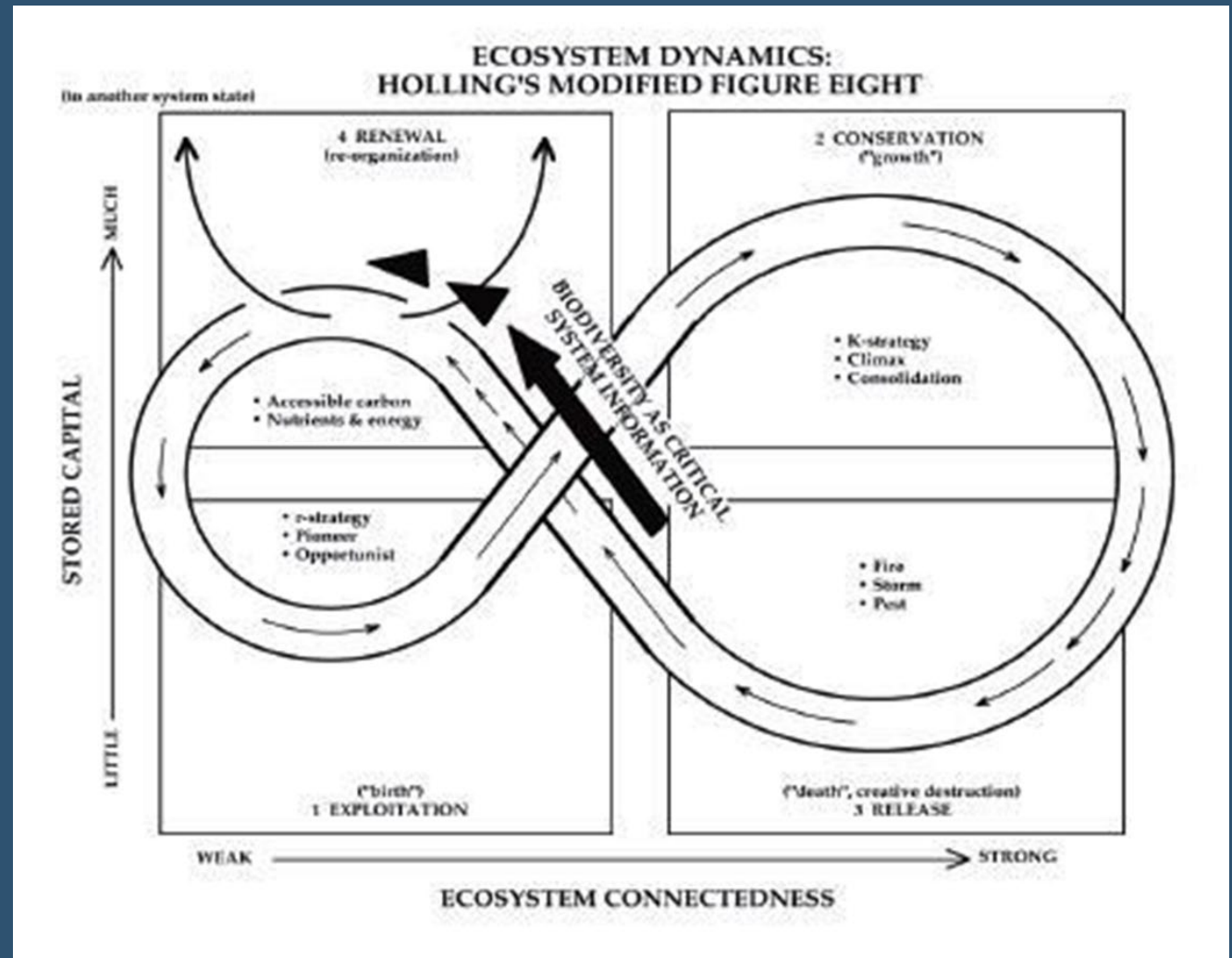
# Beach Dune Resilience Model

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

### Resilience Model

#### Stages of dune regeneration

- Birth – sand trapping agent
- Growth – accumulating sand mass and plant energy
- Storm destruction – release of sand and plant propagules
- Renewal – re-assembly from sand and plants sources







# Stages of Beach Dune Regeneration

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



Wrack/Seeds



Sprouts



Baby Dunes



Mature Dunes



Transformation



Renewal





# It's Alive! connected coastal system

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

### Coastal System

No Beach...No Dune!

- fluid, interconnected system
- sand is its basic material, its lifeblood
- beach erosion is a deficit of sand in the system
- no beach – no sand to feed, support dunes

*Before beach nourishment*

S. 14<sup>th</sup> Street 08/28/95



*After beach nourishment*

S. 14<sup>th</sup> Street 03/15/10



Federal Shoreline Protection Project, Brevard County





# It's Alive! – Recap of Dune Life

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



Fort Myers Beach, Lee County

### Beach Dune

- adapted to harsh coastal environment
- self-sustaining systems
- regenerative

### Coastal System

- Interconnected beach dune system
- require positive sand budget
- no beach...no dune

*Hurricane Ian destroys Estero Island dunes and leaves materials for growing the future dune systems.*





# Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

**Don't Tread on Me!**

Dog Island, Franklin County





# Flora Dunes Protected Status – G3/S2 (FNAI)



Coastal  
Scrub

Florida Coastal Uplands (areas surveyed)	Est. Acres
Pre-development barrier island habitat (USGS)	200,000
Undeveloped barrier island habitat -1975 (USGS)	96,000
State Beach Parks, National Seashores and Military Bases – 2004 (FNAI)	77,525
Area Seaward of CCCL (Florida Beaches HCP)	32,100
Beach Dune – natural areas in private ownership (FNAI)	12,700

Guana Preserve  
South Ponte Vedra, St. Johns County  
Imagery Date: 2011





# Flora Dunes Coastal Squeeze



- Method A: all sand beach & dune included
- Method B: sand beach excluded outside CZM
- Method C: sand beach & dune included only within CZM

Florida Coastal Uplands (areas surveyed)	Est. Acres
Pre-development barrier island habitat (USGS)	200,000
Undeveloped barrier island habitat -1975 (USGS)	96,000
Natural managed lands – 2004 (FNAI)	77,525
Area Seaward of CCCL (Florida Beaches HCP)	32,100
Beach Dune natural areas in private ownership-2021 (FNAI)	12,700

Guana Preserve  
South Ponte Vedra, St. Johns County  
Imagery Date: 2021





# Beach Dunes +/- 12,700 ac. privately held



Google Earth

NOAA, U.S. Navy, NGA, ©EBCO

9 mi





# Protective Value – Coastal Setback

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

### Coastal setbacks

- informed by dune erosion model of coastal impact zone
- buffer storm effects
- give “breathing room” for dune recovery
- create open space and protected corridors



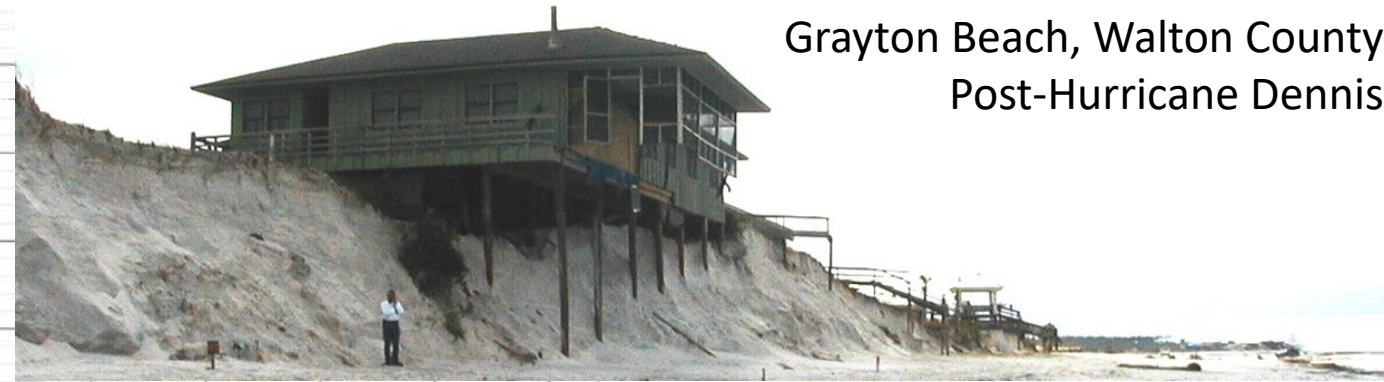
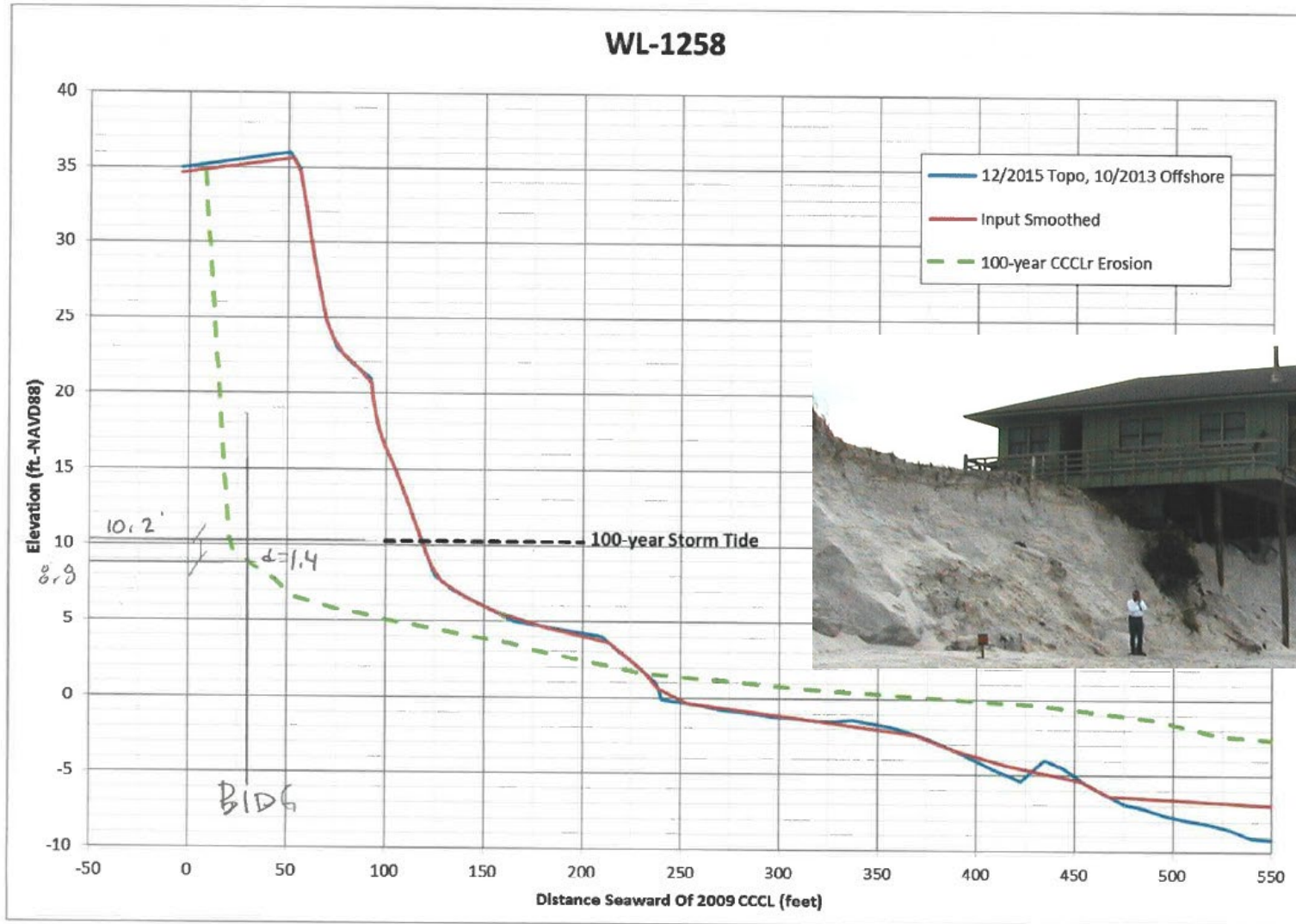
South Amelia Island, Nassau County





# Protective Value – Dune Erosion Model

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



Grayton Beach, Walton County  
Post-Hurricane Dennis

- Dean-Chiu Model results confirmed by storm impact
- dune height prevented overtopping

- dune sand sacrificed to protect upland
- dune sand returned to beach, kept in system

$$W_b = 0.78(1.4) = 1.1', \text{ Use } 3' \Rightarrow W_e = 10.2 + 3 = 13.2'$$





# Protective Value – Elevation

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

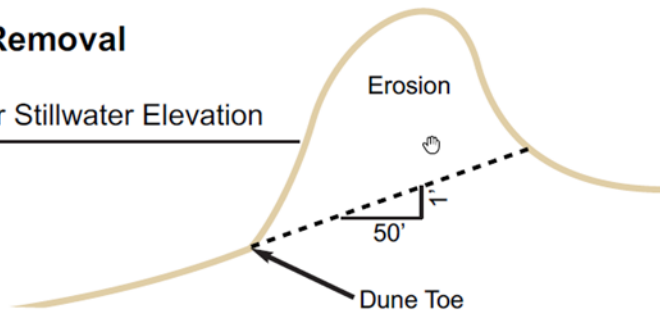
*Top right, low dune elevation was overtopped by storm tide and waves and dune “rolled over.”*



*Washington Oaks dune elevation +13-feet (NGVD)  
Hurricane Matthew washover*

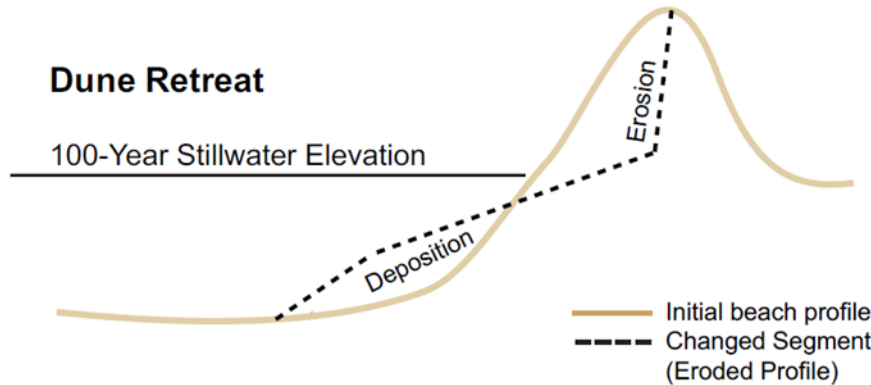
### Dune Removal

100-Year Stillwater Elevation



### Dune Retreat

100-Year Stillwater Elevation



— Initial beach profile  
- - - Changed Segment (Eroded Profile)

Figure 10A. FEMA's current determination of dune retreat and removal.

*Bottom right, dune bluff elevation was greater than storm tide elevation. Storm creates high dune scarp.*



*Ormond Beach dune elevation +16-feet (NGVD)*





# Call Before You Dig! ... for dune permits

Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

## Joint Coastal Permit

Coastal Construction

State Lands Authorizations

Environmental Resource  
Permits (ERP)

## CCCL Permit Types

Individual Permits

General Permits

Areawide Permits

Emergency Permits

Field Permits







# Call Before You Dig! ...and know the regs

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

Beach and Shore  
Preservation Act,  
Chapter 161, Florida  
Statutes

Storm Protection



Coastal Construction  
Control Line  
Regulations,  
Chapters 62B-33,  
34, 56, Florida  
Administrative Code

Beach Access



Beaches and Dunes



Sea Turtle Nesting







# Don't Tread on Me – Call Before You Dig

Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes



[not exactly]

Navarre Beach, Santa Rosa County



The Retreat, Walton County

## Don't Tread on Me!

- Status and Trends
- Coastal Setbacks
- Dune Erosion Model
- Elevation

## Call Before You Dig!

- Coastal Construction Regulations
- Fight Plant Blindness
- Protected Species





# Building Back the Dunes

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

### Restoration Tips

- It's not rocket science
- Follow nature's lead
- Give it breathing room
- Remember the short game
- Remember the long game
- Design with nature and people in mind

### Shout Outs

- Sustainable, resilient dunes
- Good people

*Artificial dune (2022) constructed as part of a large 2004 beach restoration project (see inset).*



Anastasia Island State Park, St. Johns County





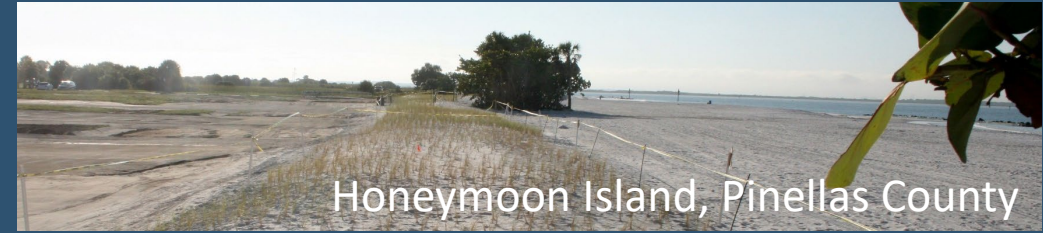
# It's Not Rocket Science!

## Flora Dunes: Building Back the Dunes

### High, Medium and Low Dunes

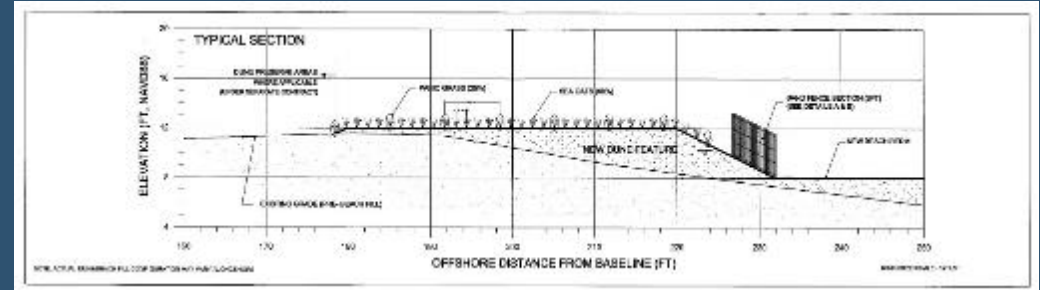
- Low profile dune:
  - Sand stabilization, runup protection.
  - <10-ft. mean sea level (msl).
  - +/- 5 cubic yards/linear foot (cy/lf).
- Medium profile dune:
  - Post storm restoration, erosion protection.
  - b/10 - 15-ft (msl)
  - >5 to 20 cy/lf.
- High profile dune and dune bluff
  - Post storm restoration, storm risk reduction, flood protection.
  - >15-ft msl.
  - 10 cy/lf. to >20 cy/lf.

Low

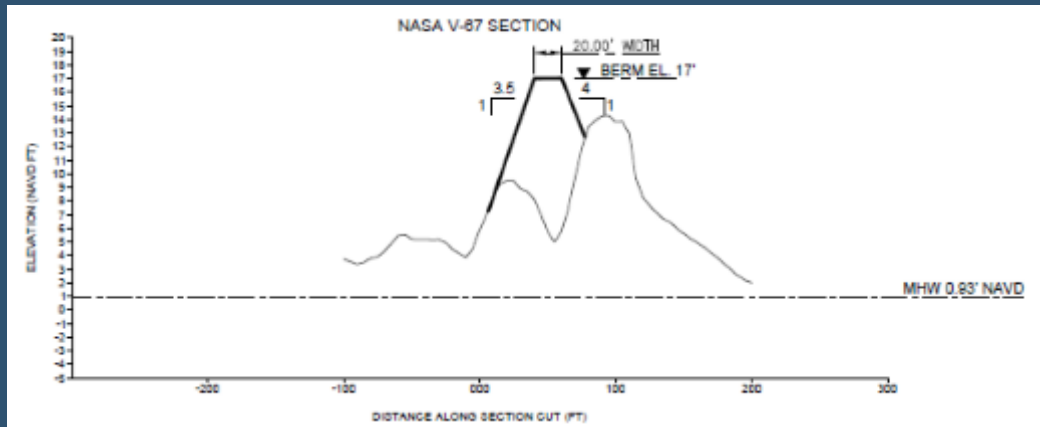


Honeymoon Island, Pinellas County

Medium



High







# Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

## Building Back the Dunes



*Hurricane Sally dune erosion*

Walton County

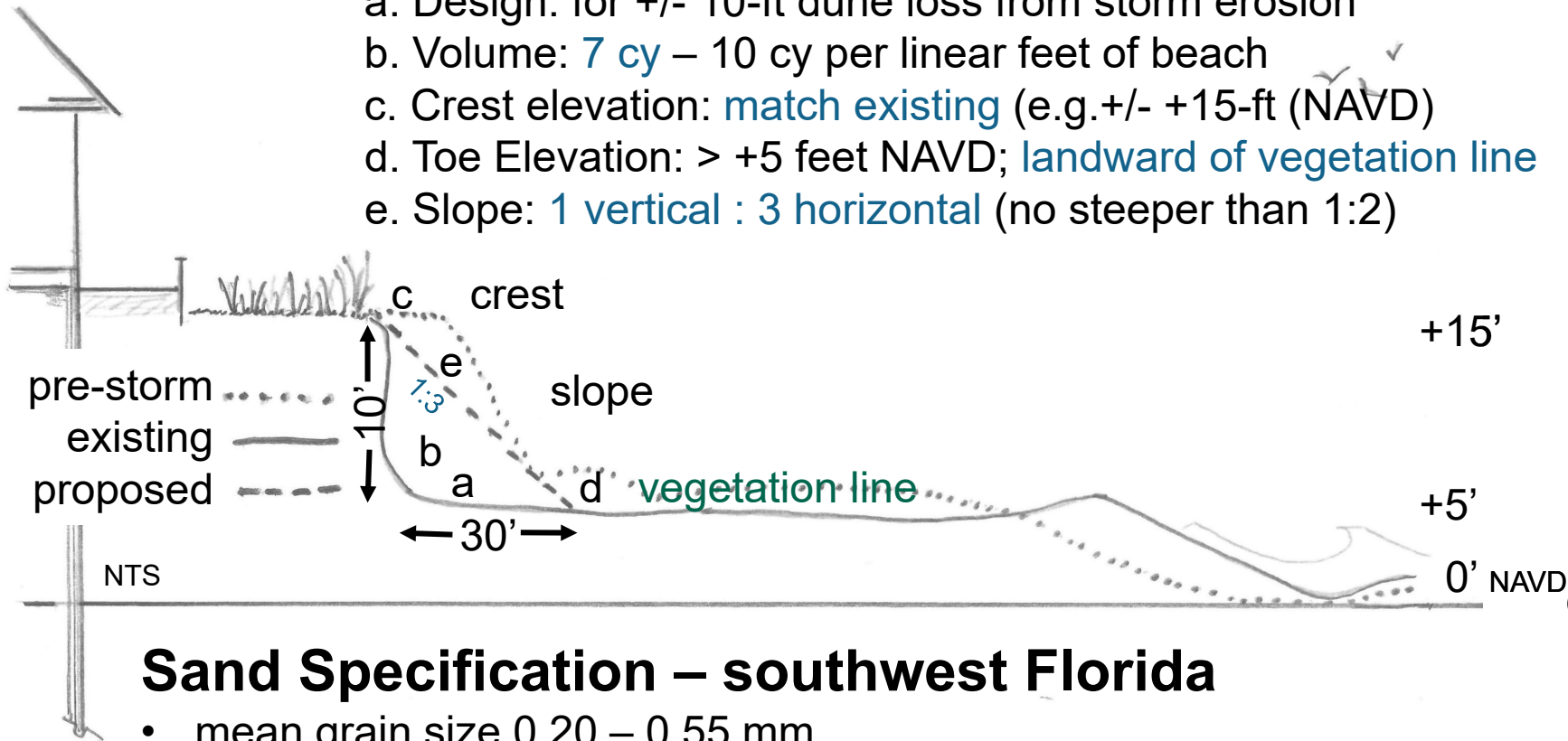




# Follow Nature's Lead Building Back the Dunes

## CCCL General Permit Dune Template\*

- a. Design: for +/- 10-ft dune loss from storm erosion
- b. Volume: 7 cy – 10 cy per linear feet of beach
- c. Crest elevation: match existing (e.g. +/- +15-ft (NAVD))
- d. Toe Elevation: > +5 feet NAVD; landward of vegetation line
- e. Slope: 1 vertical : 3 horizontal (no steeper than 1:2)

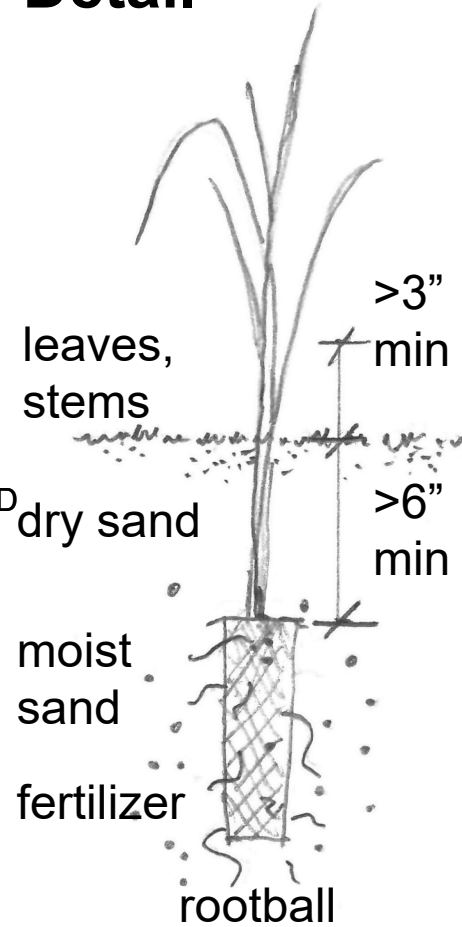


### Sand Specification – southwest Florida

- mean grain size 0.20 – 0.55 mm
- Munsell color value/chroma 6/1 or lighter (moist sample)
- < 10 % shell; no rubble, clay balls, rocks or debris
- imported from sand pit, not scraped from beach

\*Projects (max 700 cy) consistent with green highlighted items are eligible for a streamlined CCCL General Permit, with a \$100 fee and maximum 30-day turnaround.

## Planting Detail







# Give it Breathing Room (setbacks)

## Flora Dunes: Building Back the Dunes



Post-Ian Turner Beach, Lee County

### **Seaward setback**

locate fill and plantings  
landward of the higher  
high tide (SHWL)

### **Landward setback**

landward buffers allow  
space to recover  
washover sand and  
reduce upland  
encroachments





# Play the Short Game! salvage the wrack

## Flora Dunes: Building Back the Dunes

### Plants adapted to quickly recolonize beach sands following storms

Sea rocket, *Cakile* spp., beach orach, *Atriplex pentandra*, seaside evening primrose, *Oenothera humifusa*, beach umbrellas, *Hydrocotyle bonariensis*

- Multiple propagation strategies
  - Water and wind dispersed seeds
  - Storm dispersed live stem, root fragments
  - Rooting spurred from burial by sand
- Fast growing (just add water), weed-like
- Succulent, salt tolerant (halophytic)
- Most not commercially grown
- Rake, salvage from storm debris wrack line







# Play the Short Game!

## Flora Dunes: Building Back the Dunes

### UF test plots for Bitter panicum, *Panicum amarum*, and Sea oats, *Uniola paniculata*.

- Plant scientists are breeding cultivars of native dune plants for restoration.
- Florida ecotypes of sea oats perform better than plants from Louisiana or South Carolina.







# Play the Long Game – plan for succession

## Flora Dunes: Building Back the Dunes



Mexico Beach, Bay County

### **Adapted to sand burial**

- Bitter Panicum (1-5 yr.)
- Sea Oats (1-15 yr.)

### **Adapted to secondary, protected dunes**

- Little Bluestem (5-25 yr.)
- Gulf Mulhygrass
- Marshhay cordgrass
- Semi-woody shrubs

*Mexico Beach 2-yr old dune planting*





# Design with Nature and People in Mind

## Flora Dunes: Building Back the Dunes



Lauderdale-by-the-Sea, Broward County





## Beach Restoration with Dune (U.S. Army Corps of Engineers)



Miami Beach, Dade County

## Dune Restoration Project (FEMA Recovery)



Beacon Hill, Gulf County

Flora Dune - Shout Outs  
Sustainable, Resilient Dunes





# FEMA Berm

Flora Dune - Shout Outs  
Sustainable, Resilient Dunes



*Hurricane Michael storm impacts*

Mexico Beach, Bay County





# Flora Dune – Shout Outs

## Sustainable, Resilient Restored and Managed Dunes



Pre-Hurricane Ian Knight Island, Charlotte County



Post-Hurricane Ian Knight Island, Charlotte County



# Flora Dune - Shout Outs Sustainable, Resilient Dunes



## Private Residential Slope Restoration



South Walton County





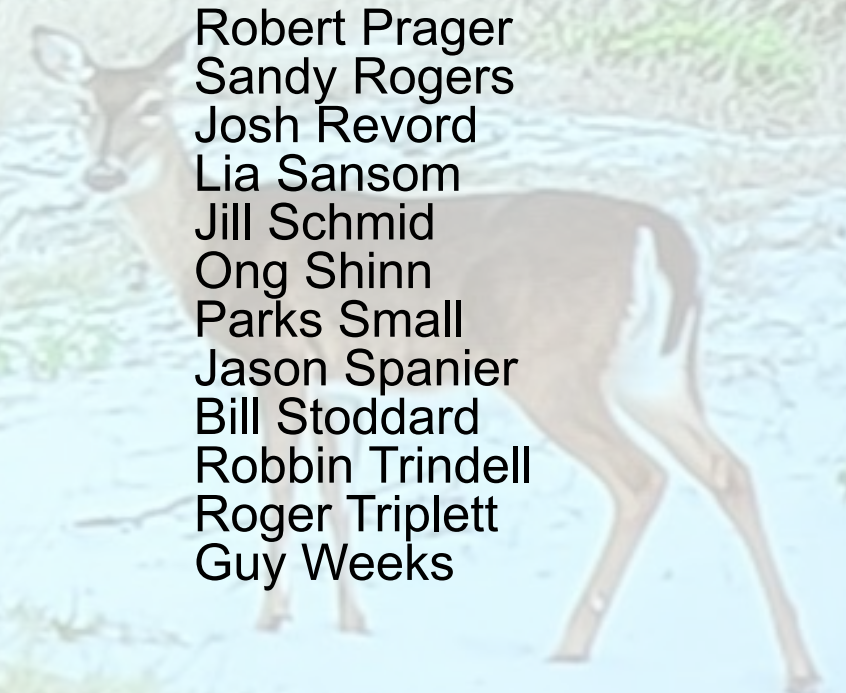
# Shout Outs and Thank You's

## Flora Dunes: Ecology, Protection and Restoration of Florida's Dunes

Doug Aarons  
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Al Browder  
Jon Bruckner  
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Eric Charest  
Chadd Chustz  
Ralph Clark  
Kelly Cramer  
Greg Curry

Tim Day  
Jason Depue  
Tara Dodson  
David Drylie  
Scott Eastman  
Lainie Edwards  
Laura Gibson  
James Gray  
Jim Haeger  
Rick Harter  
Trey Hatch  
Frank Hopf  
Craig Huegel  
Fara Ilama  
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Amy Knight  
Keith Laakkonen  
Erin Luaces  
Jim Martinello  
Mike McGarry  
Tony McNeal

Holly Milbrandt  
Andy Miller  
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Allix North  
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Parks Small  
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Robbin Trindell  
Roger Triplett  
Guy Weeks







# THANK YOU

**Fritz Wettstein**

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