



# *North Carolina's Barrier Islands*

Ken Richardson – NC Division of Coastal Management  
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# Outline:



Overview of North Carolina's Coast

Barrier Island Evolution

Living on a Barrier Island

Benefits of a Healthy Barrier Island

# There's No Place Like North Carolina's Barrier Islands:

**...where change is guaranteed**

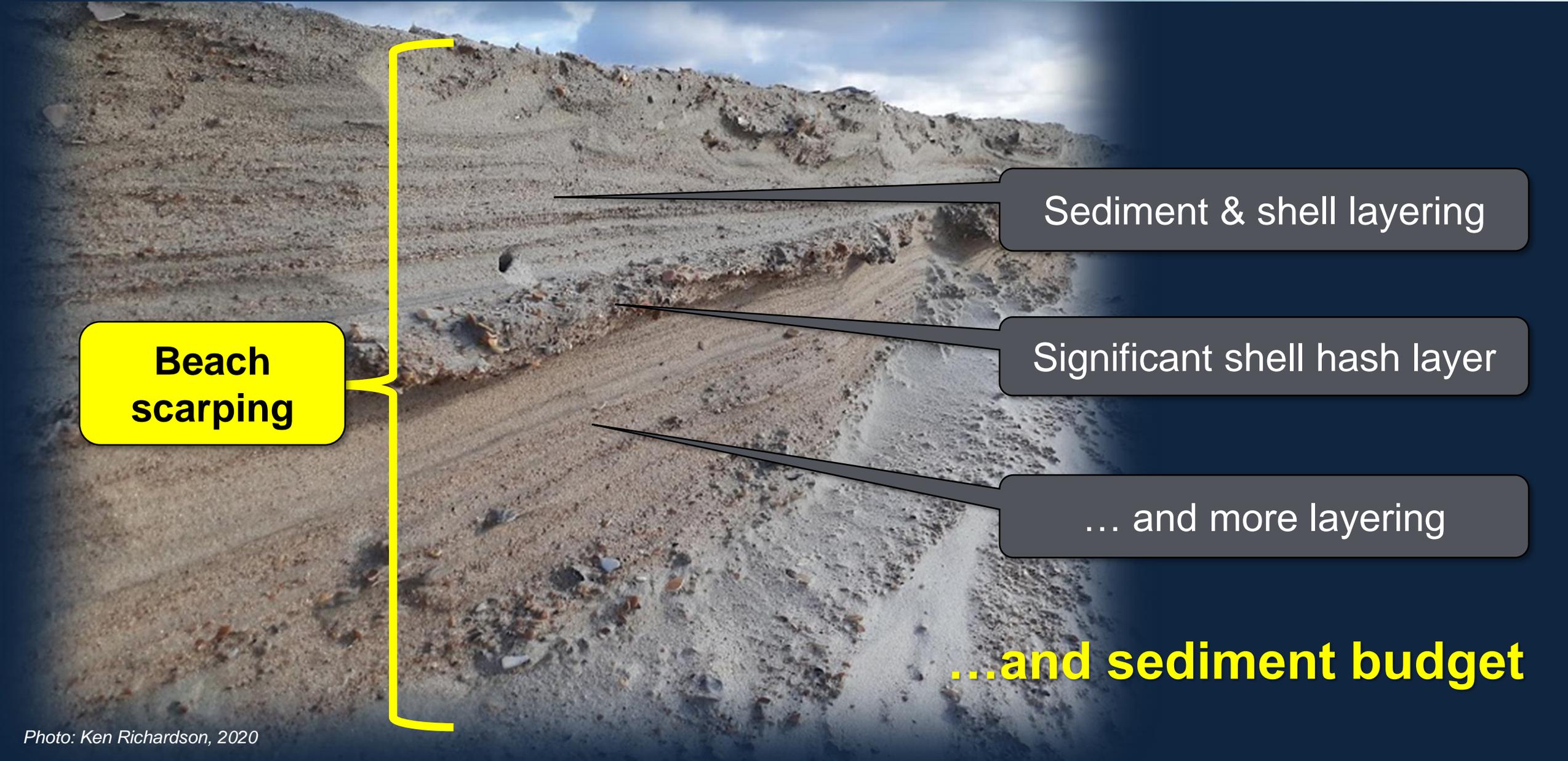


**7:44 AM**



**7:54 AM**  
(10 minutes later)

... and change is relative to **Time & Scale**



**Beach  
scarping**

Sediment & shell layering

Significant shell hash layer

... and more layering

**...and sediment budget**

# Overview of North Carolina's Coast Today

- **23 Barrier Islands**

- Oceanfront Shoreline (~320 miles)
- Estuarine Shoreline (~10,657 miles)

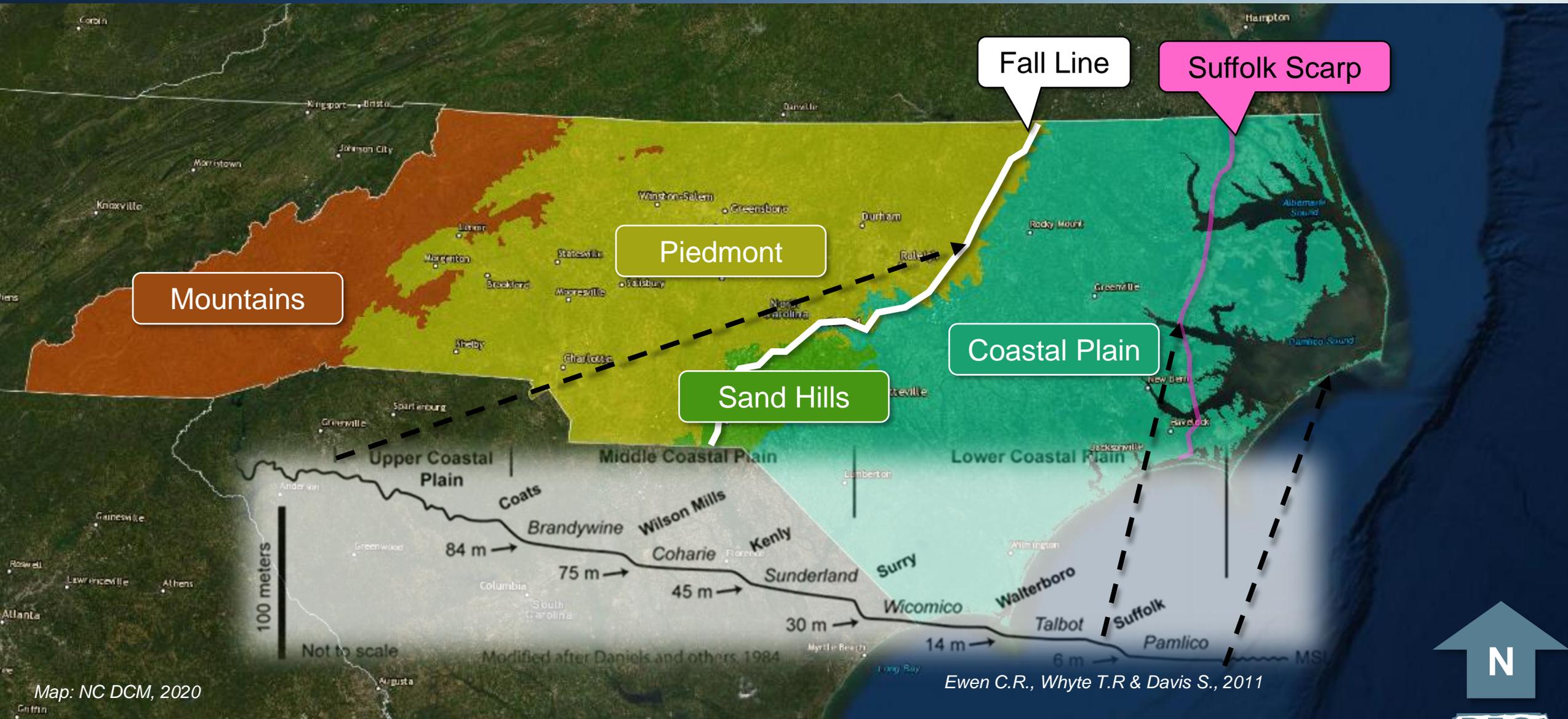
- **3 Capes**

- Cape Fear
- Cape Lookout
- Cape Hatteras

- **19 Active Ocean Inlets** •



# How Did We Get Here?



Map: NC DCM, 2020

Ewen C.R., Whyte T.R & Davis S., 2011



# Barrier Island Evolution: Time & Scale



Map: NC DCM, 2020

# Barrier Island Evolution: Forces At Work

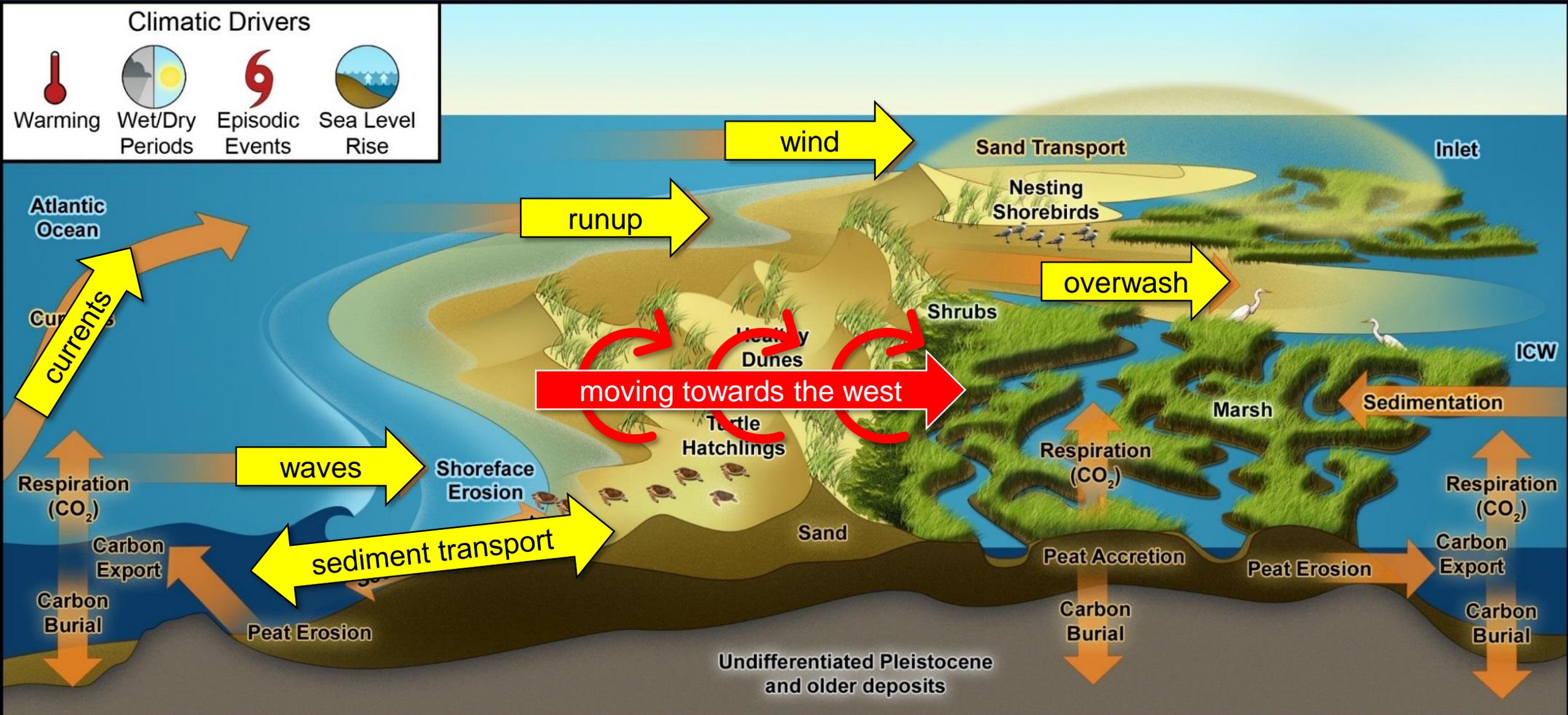


Map: NC DCM, 2020

# Barrier Island Evolution: Response to Sea Level Rise

**Climatic Drivers**

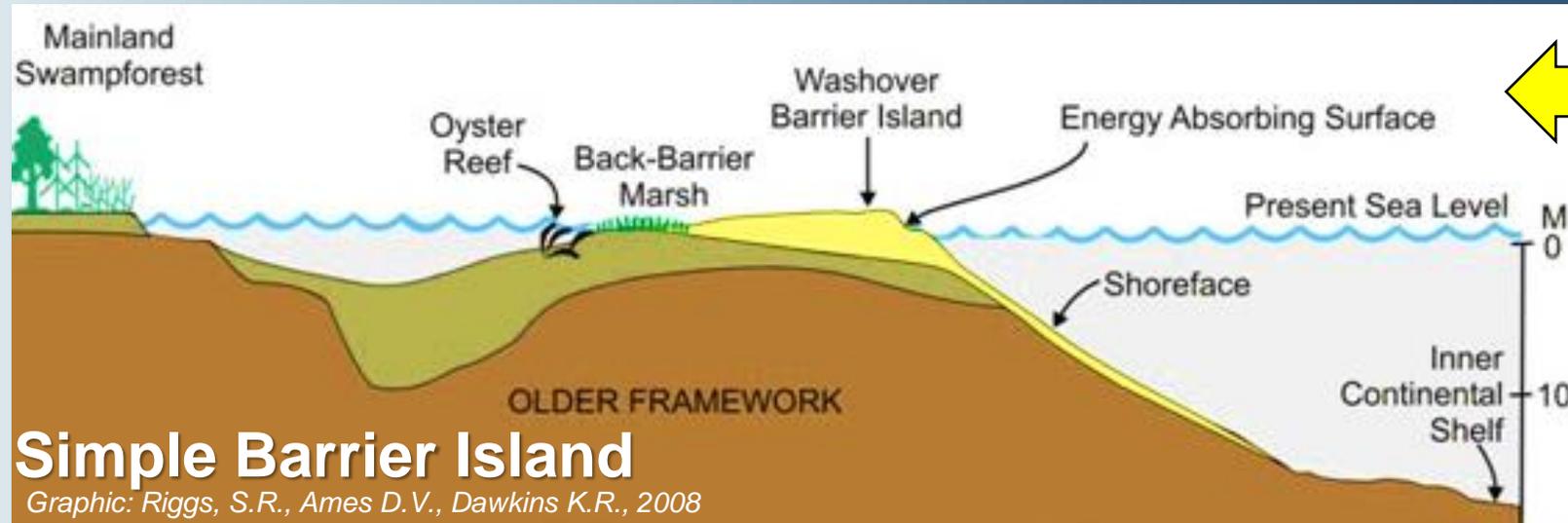
- Warming
- Wet/Dry Periods
- Episodic Events
- Sea Level Rise



# Barrier Islands: Components of a Complex System

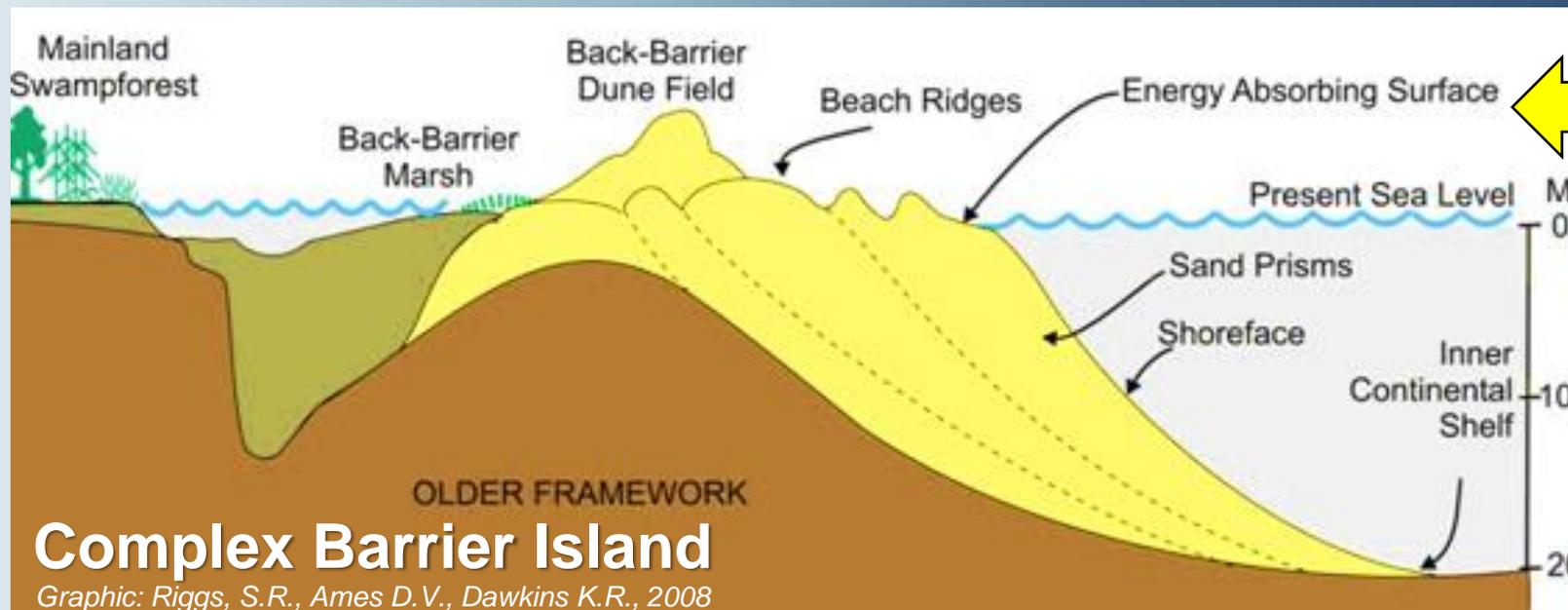


# Barrier Islands: “Simple” vs. “Complex”



## Simple:

- Sediment poor
  - Narrow
  - Low elevation
  - Minimal dune system
  - Less storm protection
  - Less diverse landcover

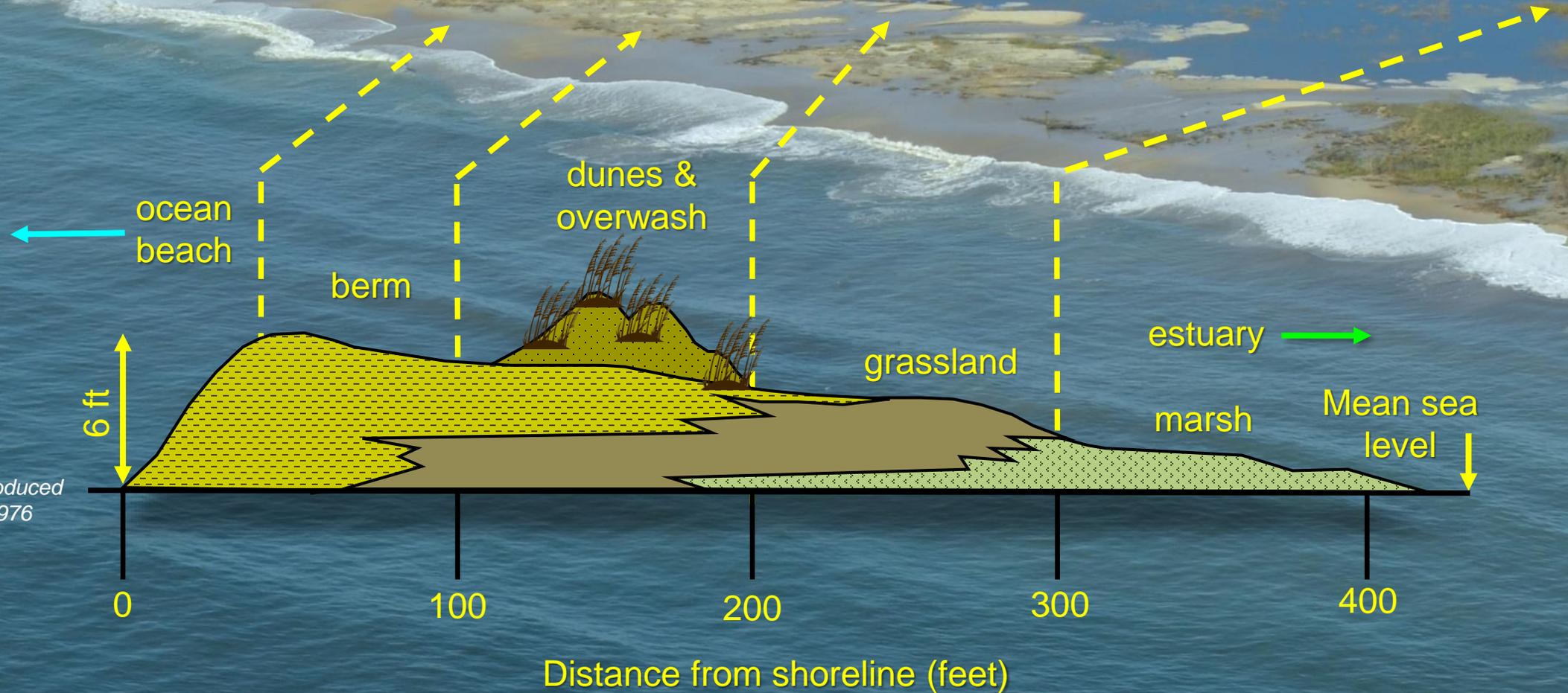


## Complex:

- Sediment Rich
  - Wider
  - Higher elevations
  - Greater storm protection
  - Healthy dune system
  - Diverse landcover

# Barrier Islands: Example at Masonboro Island

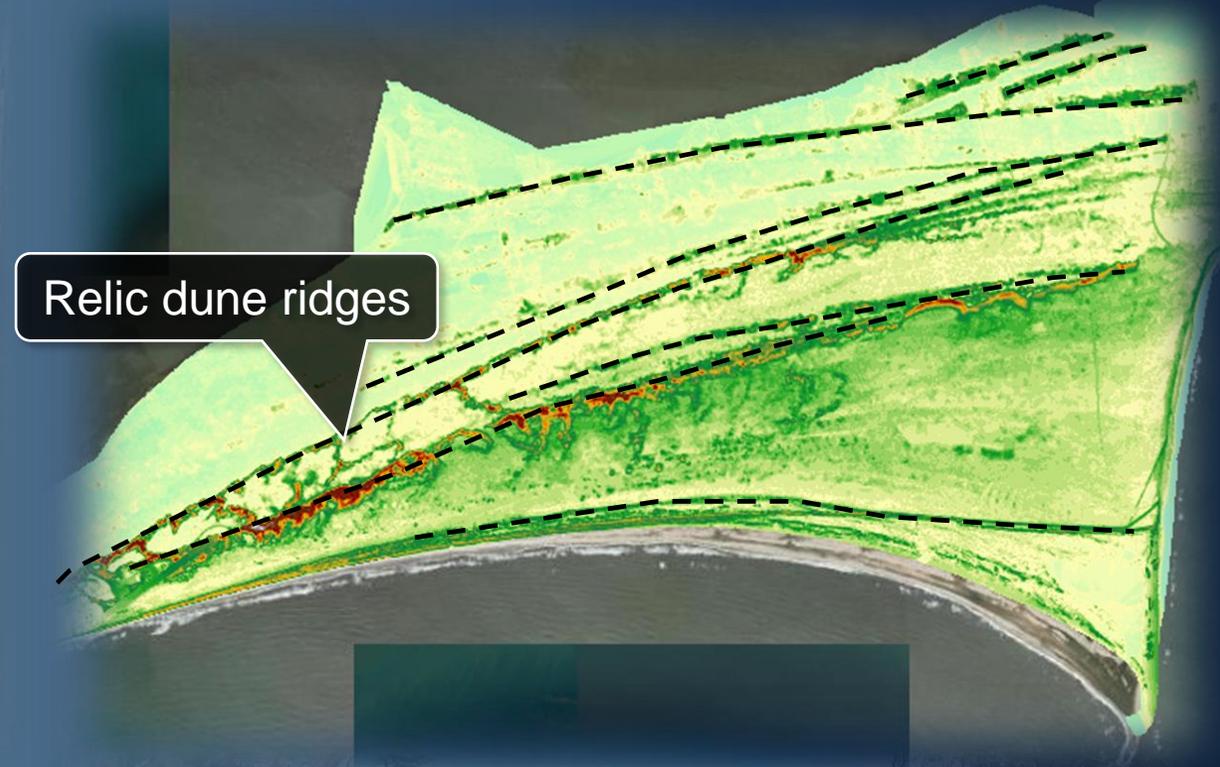
## Simple Barrier Island:



Cross section reproduced  
from Godfrey, 1976

# Barrier Islands: Example at Cape Hatteras

## Complex Barrier Island:



# Barrier Islands: Inlets

## Inlets:

### 1. Oscillating

Back & forth

### 2. Migrating

One direction

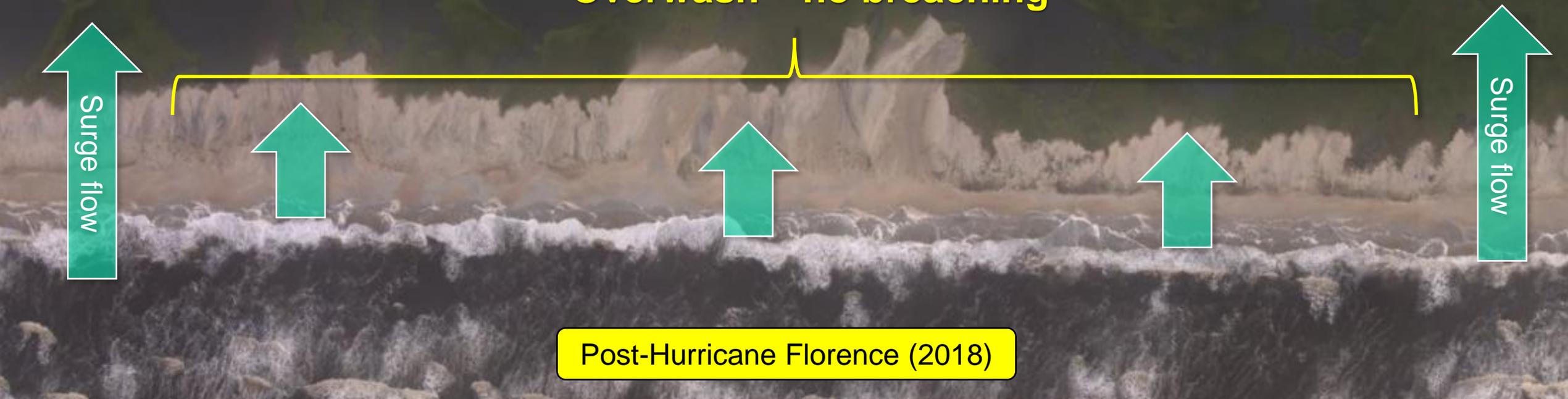
- Deep & Shallow Draft
- Open & Close
- Engineered
  - Dredged
  - Channel alignment
  - Erosion control structure

shorelines

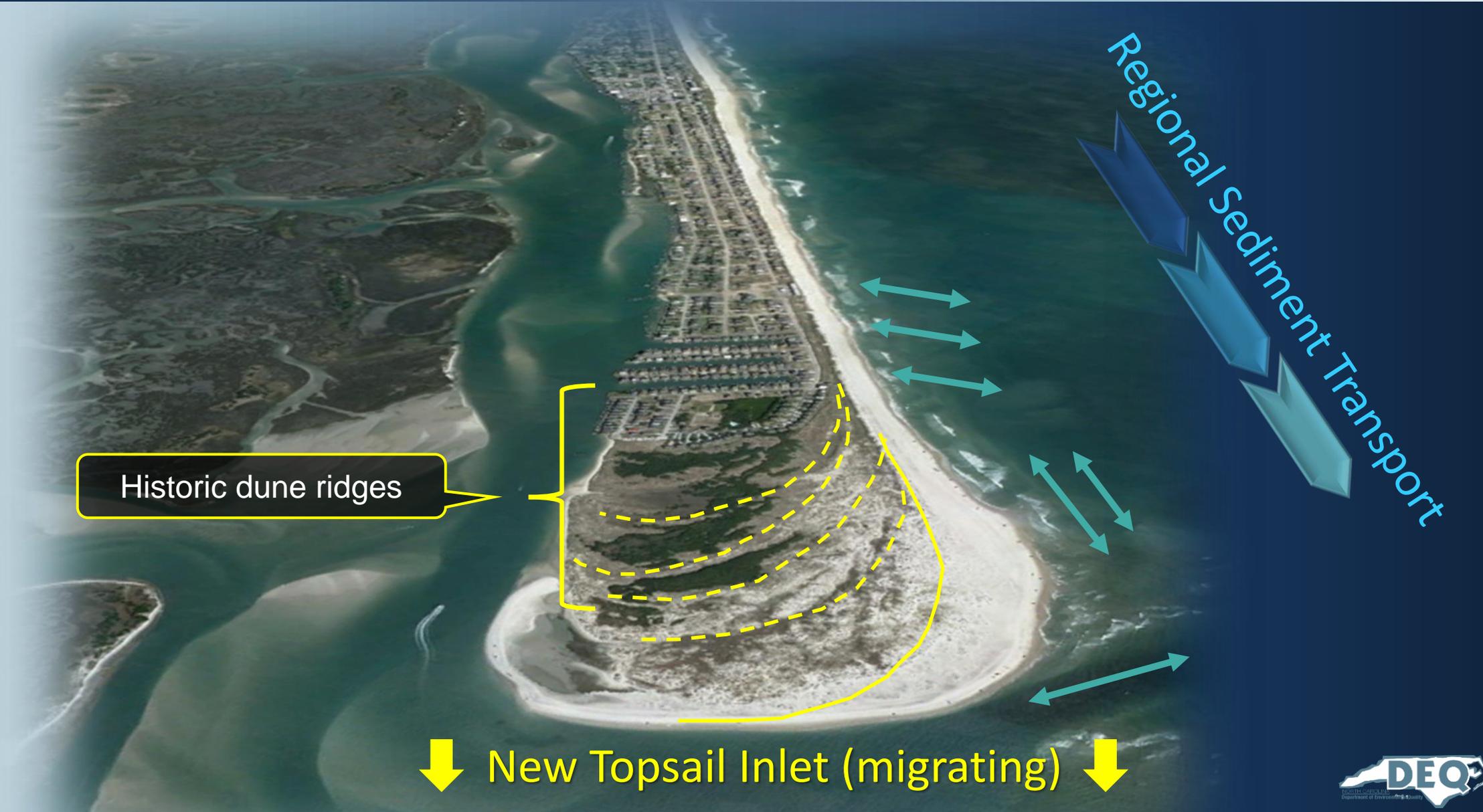
## Breaching – no ocean side overwash



## Overwash – no breaching



# Barrier Islands: Sediment Transport



Historic dune ridges

Regional Sediment Transport

↓ New Topsail Inlet (migrating) ↓

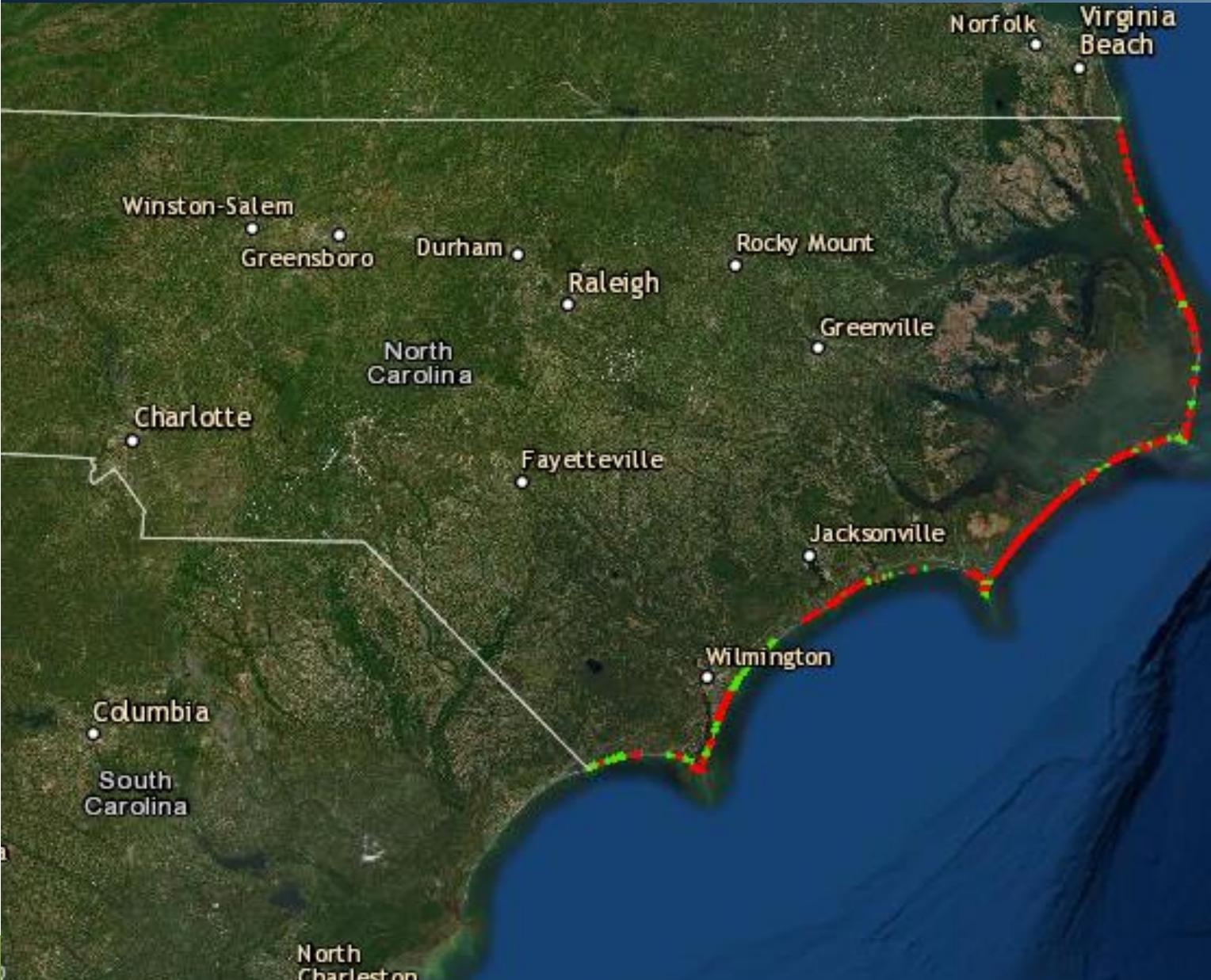
# Barrier Islands: Sediment Transport (wind)



Wind driven sediment transport



# Living on a Barrier Island: Nature vs. Human



## Oceanfront Erosion Rates

- Calculated ~ 5 years
- Ocean Erodible Area
- Oceanfront Construction Setbacks
  - Average erosion rate ~ 2 feet/year
  - Higher rates at inlets & Capes

— Erosion  
— Accretion

# Living on a Barrier Island: Extreme Changes

## Beaufort Inlet – Shackleford Banks

- Accretion: 87 Years (1933 to 2009)
- Erosion: 10 Years (back to 1933 location)



2020 Photo

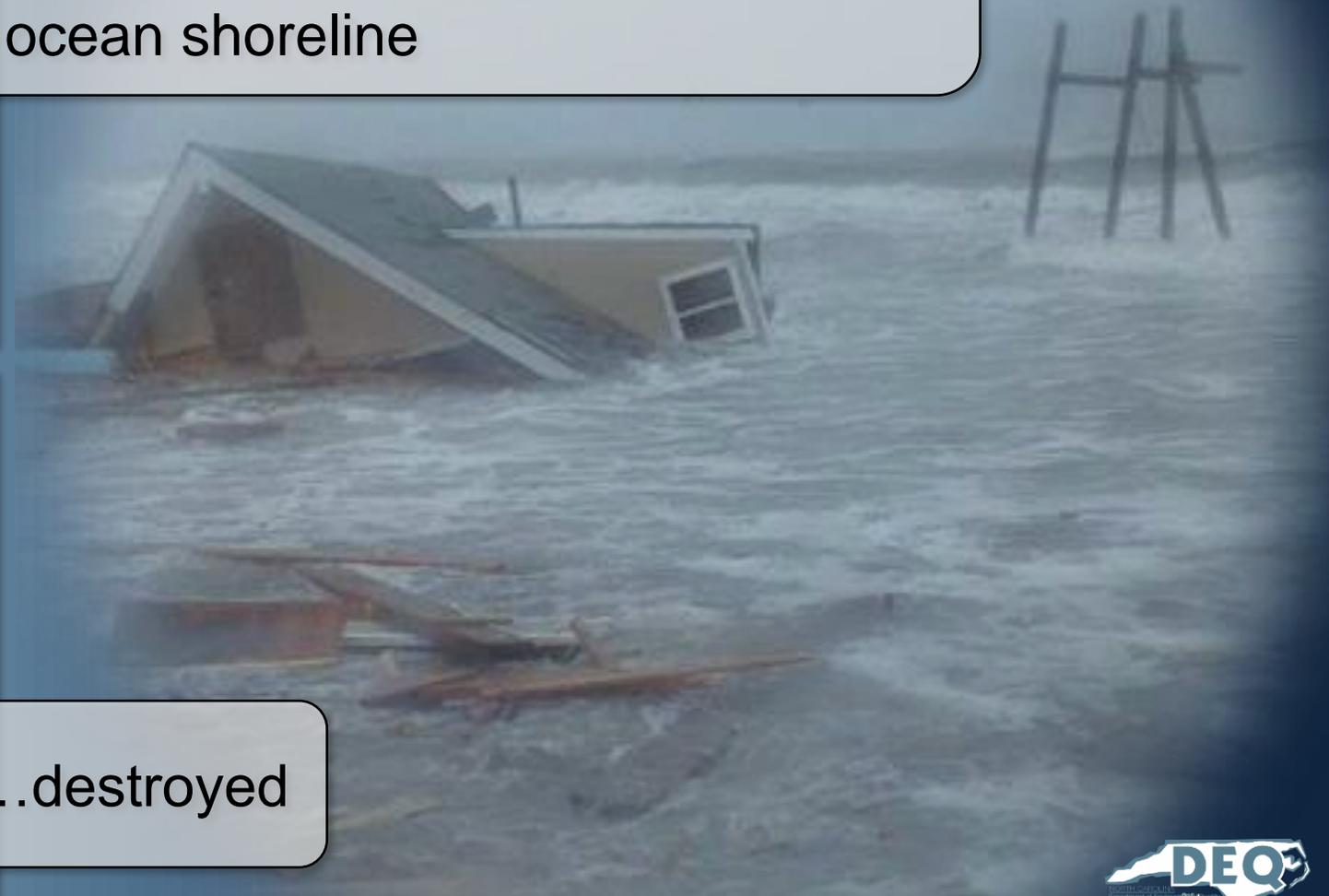
# Living on a Barrier Island:



When constructed on Lea-Hutaff Island in 1990, this house sat 500 feet from the ocean shoreline



25 years later...destroyed



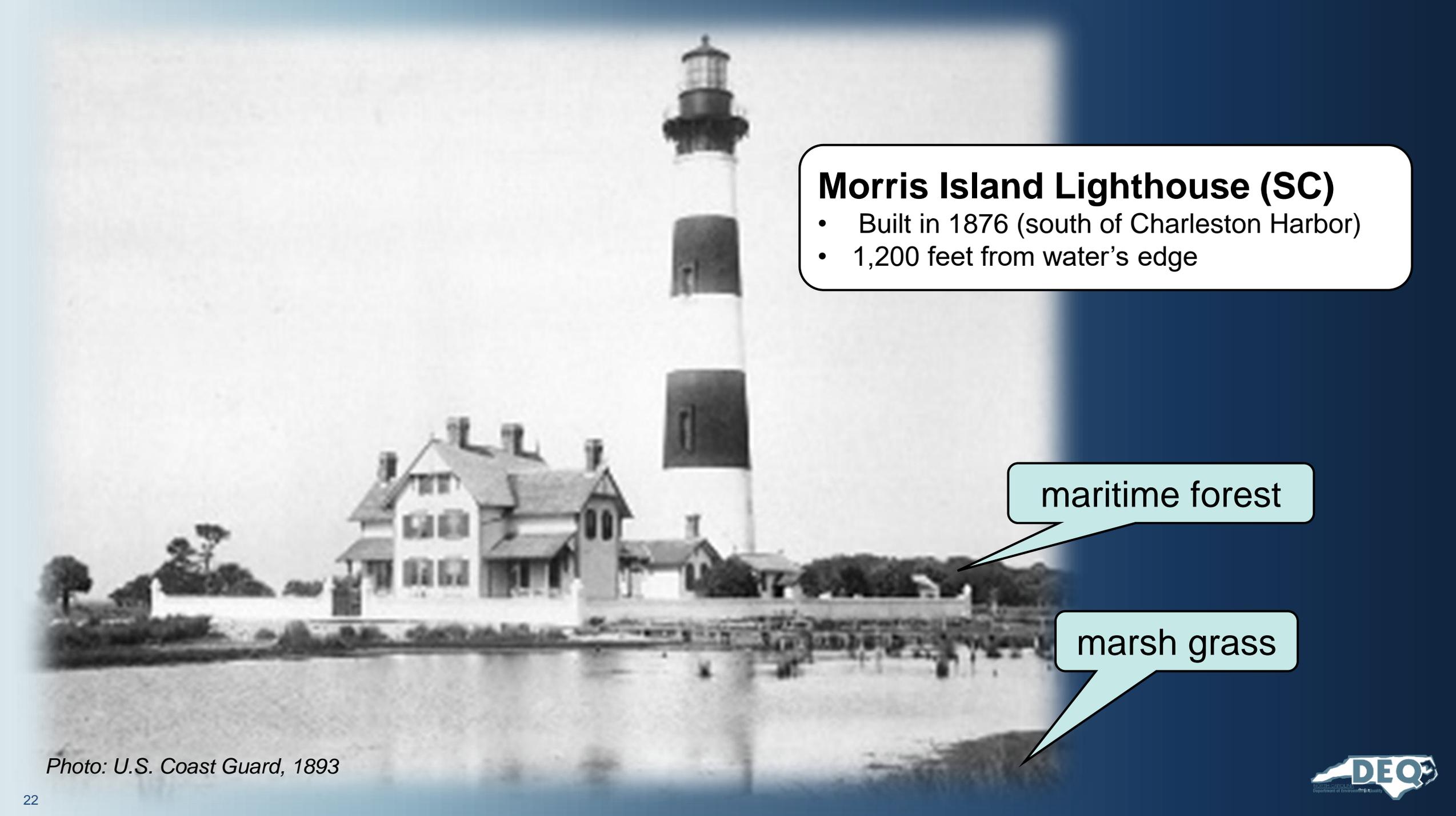


**1,500 Feet**

**1870 Shoreline**

**Cape Hatteras Lighthouse**

*Photo: circa 1970 U.S. Park Service*



## Morris Island Lighthouse (SC)

- Built in 1876 (south of Charleston Harbor)
- 1,200 feet from water's edge

maritime forest

marsh grass

Photo: U.S. Coast Guard, 1893

## Morris Island Lighthouse (SC)

- Built in 1876 (south of Charleston Harbor)
- 1,200 feet from water's edge

Jetty

Sediment Transport

1,300 feet

1,200 feet

Lighthouse  
(current location)

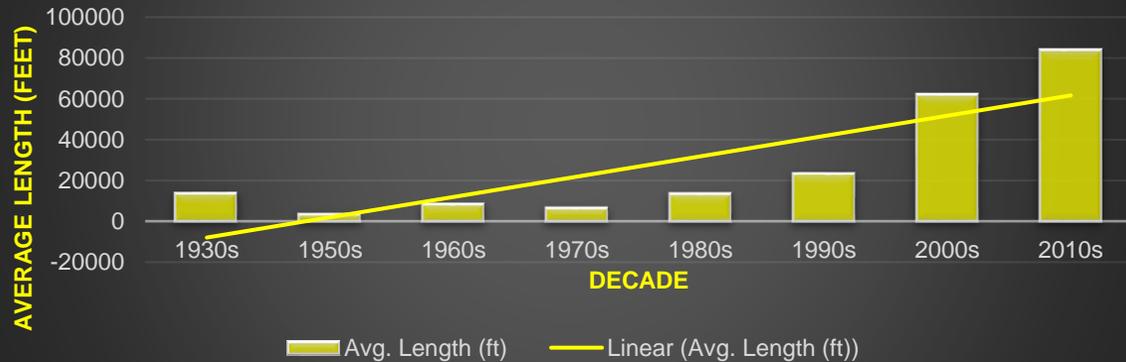
1876 Shoreline

# Living on a Barrier Island: Erosion Management

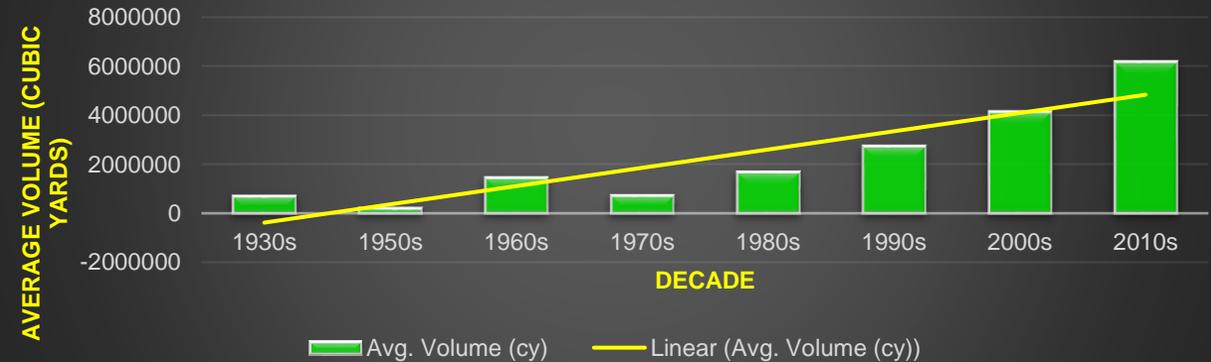
- ✓ **None**
- ✓ **Soft** (beach nourishment, sandbags, dredging)
- ✓ **Hard** (groin, breakwater, jetty, seawall)
- ✓ **Retreat**
- ✓ **Combination** (all the above)



Average **Length** (ft) per Decade  
(all projects)



Average **Volume** (cy) per Decade  
(all projects)



# Living on a Barrier Island: Erosion Management

**Bulkheads**



**Revetments**



**Living Shorelines**





Image: North Topsail Beach



Image: coastalreview.org

- **Tropical storm events**
- **Coastal erosion**
- **Erosion control & mitigation**
- **Population** (nationwide)
- **Recovery cost** (nationwide)

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Image: NC DCM



Image: USGS

# Benefits of a Healthy Beach

**Tourism**

**Recreation**

**Employment**

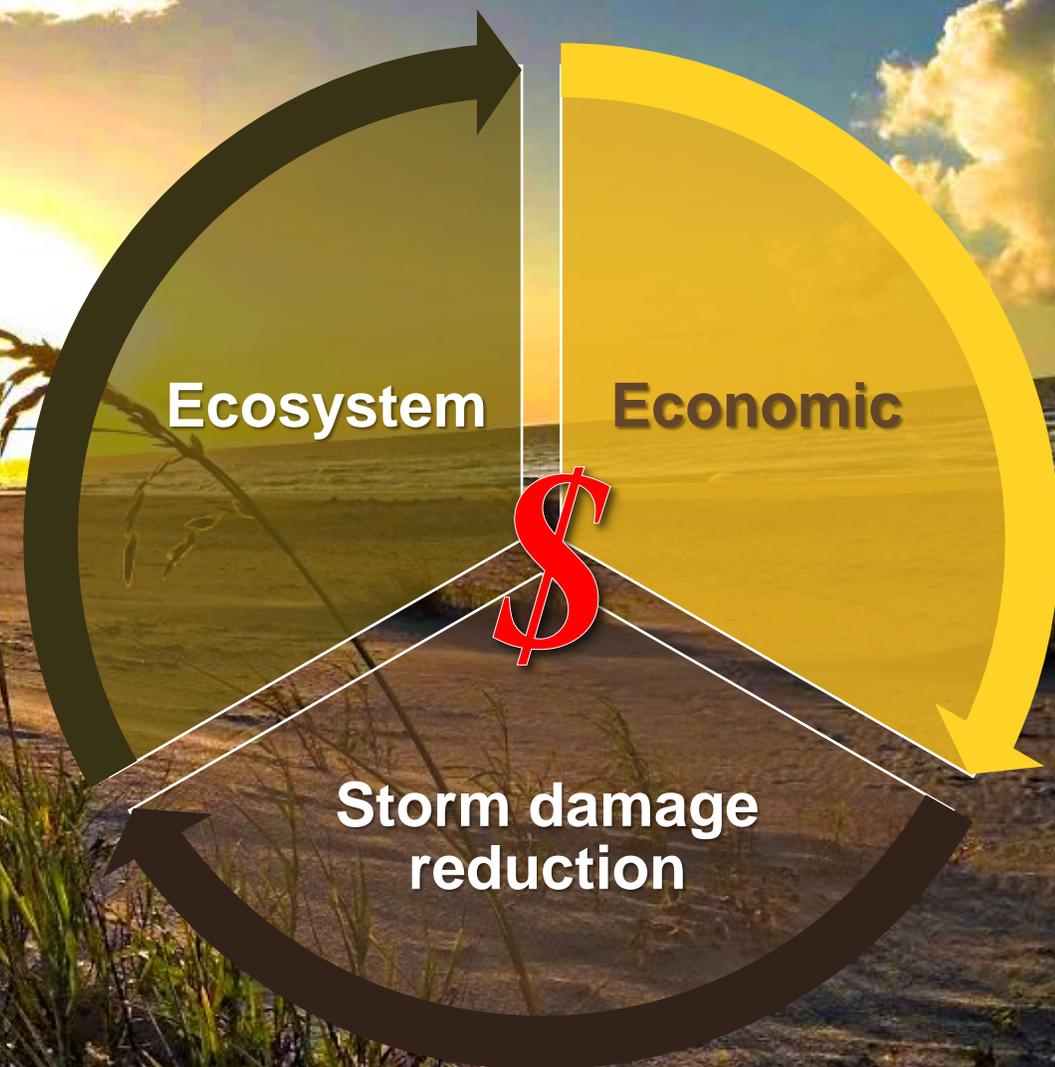
**Critical habitat**

**Less storm damage**

**Property value**

**Commercial**

**Tax revenue**





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