Escambia RESTORE Act Advisory Committee

Coastal Flood Protection /Resiliency

July 15, 2013

Presented by:

Rick Harter

What is “Resiliency”

Definition of “resilience” (from Merriam-Webster)

1. the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress
2. an ability to recover from or adjust easily to misfortune or change

For this presentation:

- Endure adverse conditions
- Adapt to change
- Recover from damage

When development is threatened by coastal flooding/erosion:

- Erosion/flooding
  - Adapt
    - Elevate
    - Stabilize
      - “Hard” structure
      - “Living Shoreline”
  - Retreat

Current Status

- 100% of the developed Gulf-front beaches in Escambia are classified by the FDEP Bureau of Beaches & Coastal Systems as "Critically Eroded"

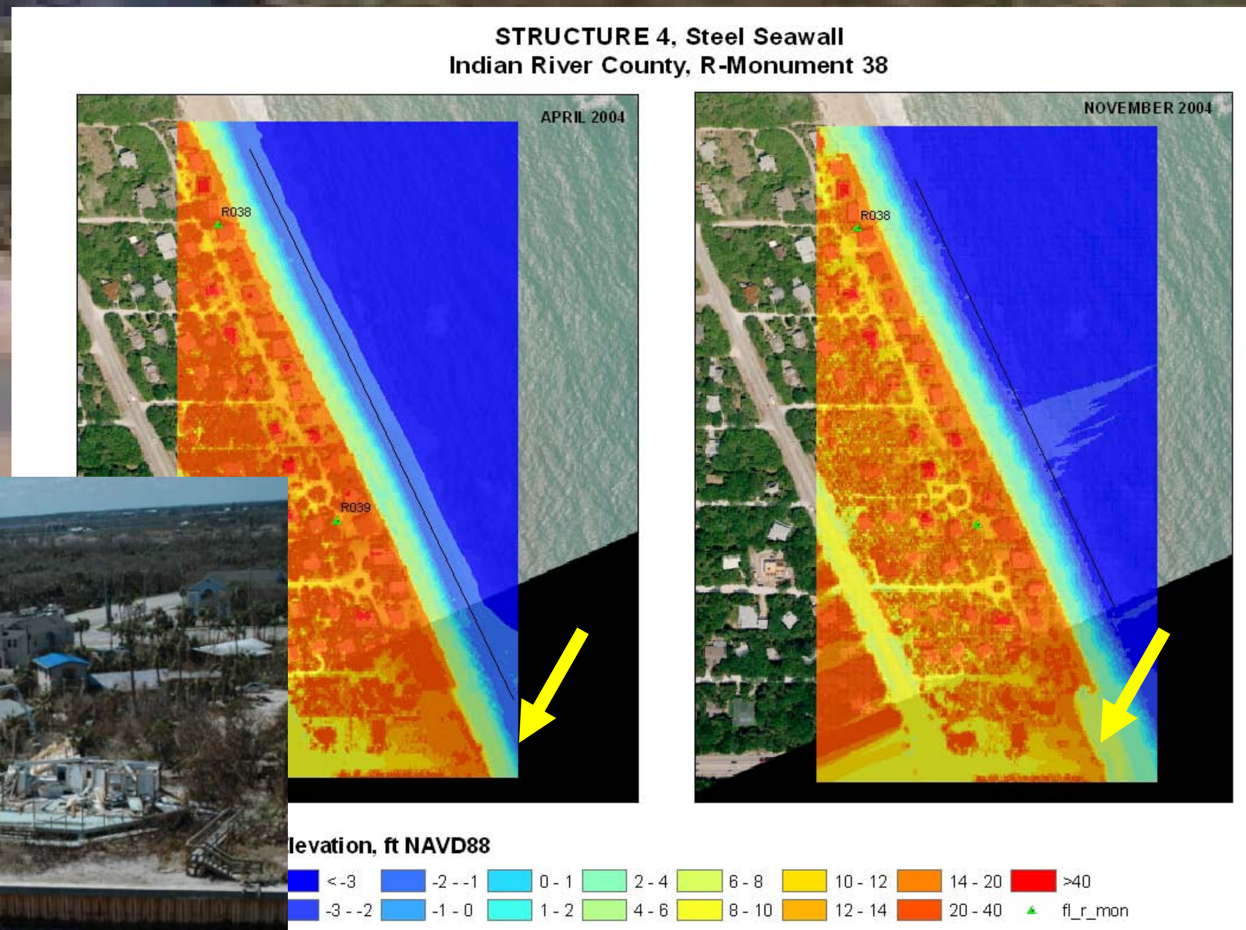
"Critically eroded area is a segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that <u>upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost</u>. "

Shoreline armoring trends

- Bulkheads, seawalls, rip-rap, etc.
- Mobile Bay: > 38% of shoreline is hardened *(Jones, et al. 2012)*
- Puget Sound > 25% or shoreline is armored *(WA Department of Fish and Wildlife)*
- San Diego Bay: almost ¾ is armored *(Davis, et al, 2002)*

Drawbacks of hard structures

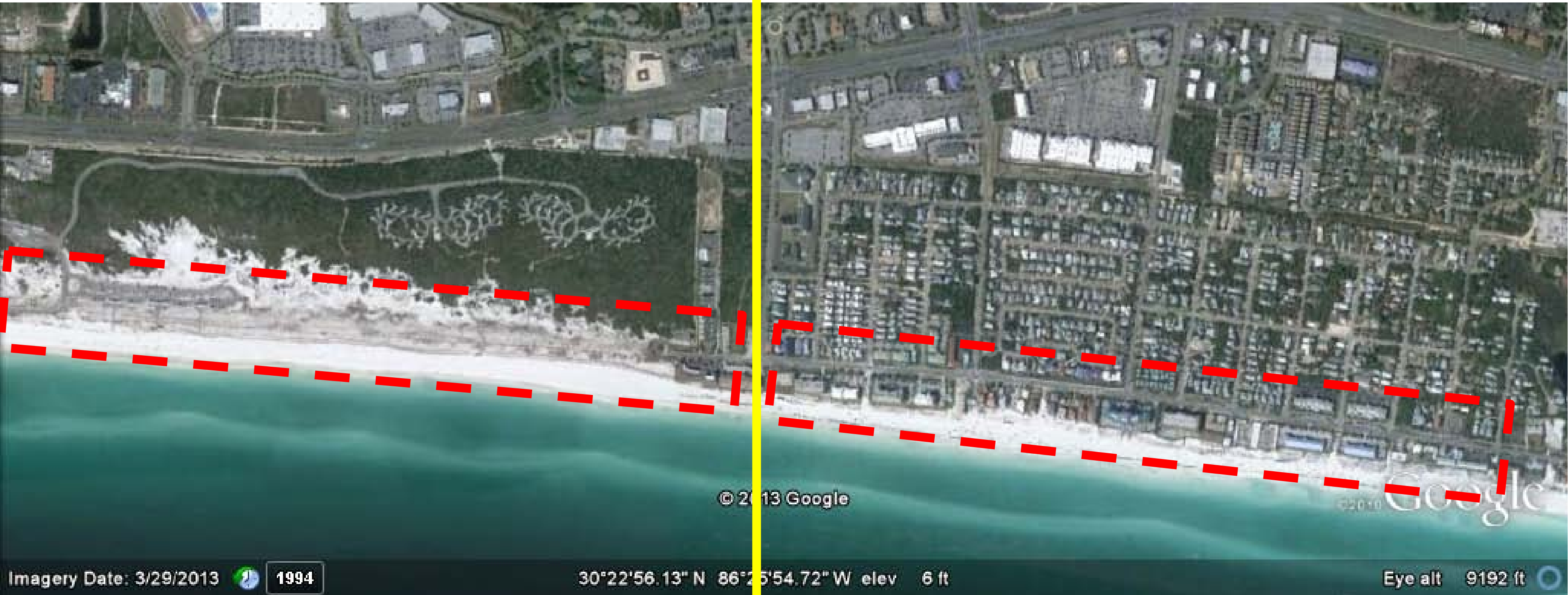
End scour



Resilient vs. Non-Resilient

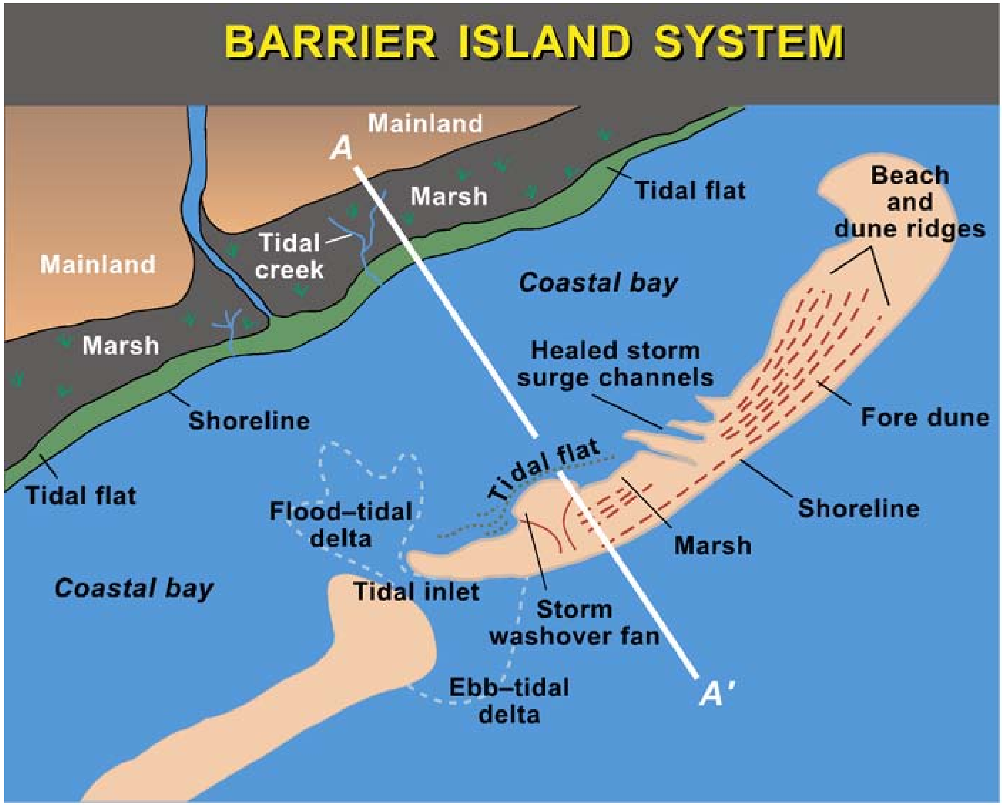
- Dynamic dune system is intact and will "self-recover" from storms
- Public use/access

- Dune system is non-existent
- Damage to property is imminent
- Limited public use



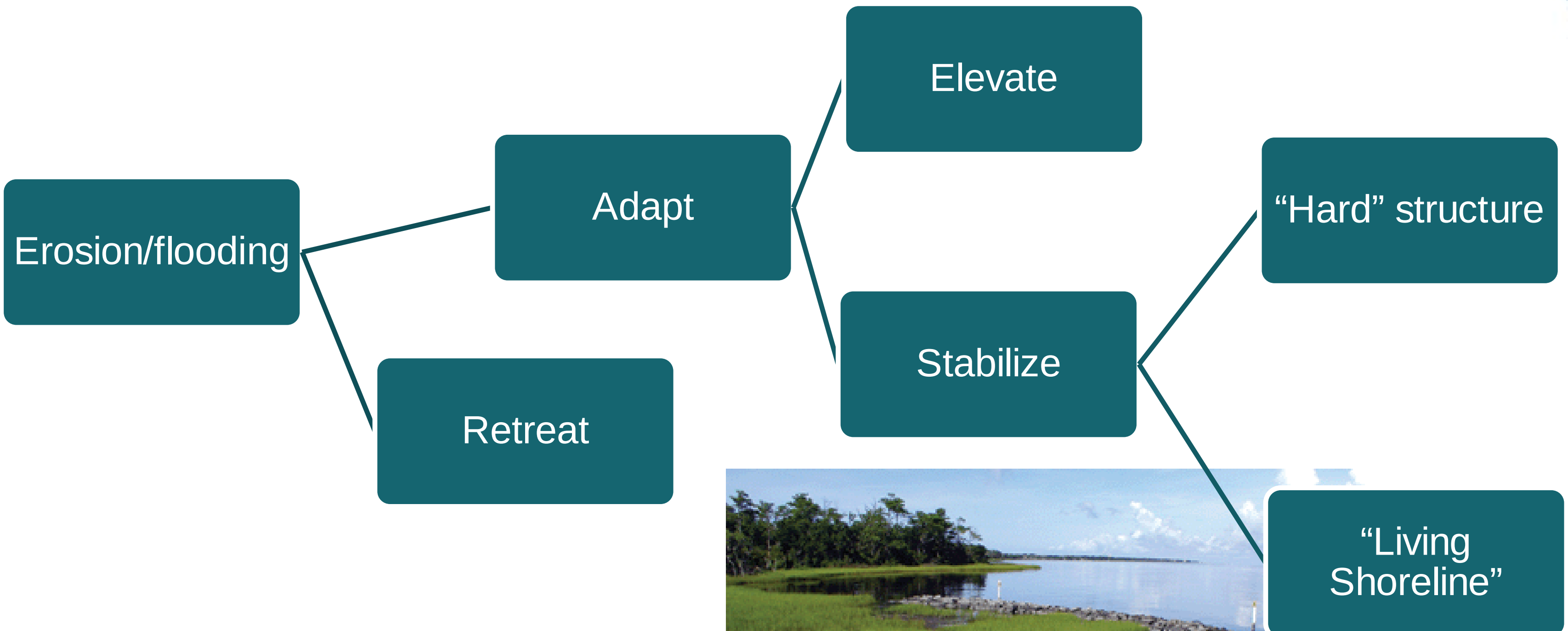
Retreat

- Land acquisition = very $$$$
- Easements
- Transfer of Development Rights
- Setbacks
- Rolling setback



Oceanfront

When development is threatened by coastal flooding/erosion:



What is a “living shoreline”

“Living Shorelines” are soft armoring projects that seek to control erosion by recreating natural habitats, usually including emergent (marsh) vegetation and/or oyster reefs.

Why choose "living shorelines"

- **Resilient/self-sustaining**
  - Can grow upward as sea level rises
  - Often repair themselves after storms
- **Habitat**
  - Provide nursery habitat for important seafood species
  - A healthy oyster reef supports 24,000 organisms /m^2
- **Water quality**
  - Plants capture/stabilize fine sediment
  - Oysters filter water: up to 50 gal/day x 20 oysters/ft^2= 1,000 gal/ft^2
- **Aesthetics**
  - More natural look
- **Permitting**
  - Easier to permit than habitat-destroying structures. MD actually requires LS, unless not feasible.
  - Opportunities to provide mitigation credits
    (ICE , *The Role of Coastal Engineers in Delivering No Net Loss through Biodiversity Offsetting*, May 2013)

Are "living shorelines" effective?

- Aboveground, coastal wetland plants are in direct contact with seawater and waterborne sediment. Plant stems and leaves slow water velocity, reduce turbulence, and increase deposition (Redfield 1972; Christiansen et al. 2000).

Storm/Flood Protection from Marshes

- Additional evidence that coastal wetlands protect shorelines comes from a number of studies that indicate that coastal wetlands have had a statistically significant impact in reducing economic damages and deaths associated with major storm events (Badola and Hussain 2005; Barbier 2007; Costanza et al. 2008; Das and Vincent 2009).
- Wamsley et al. (2010) modeled several storms approaching the Louisiana coast across present wetland cover and a predicted future coast with reduced wetland cover and found that wetlands can play a large role in attenuating storm surge (up to 16.6 cm attenuation per kilometer of wetland), but that this effect is dependent upon the characteristics of the wetland and the storm. Field based observations of storm surges traversing wetlands also indicate a dampening effect (Lovelace 1994; Day et al. 2007; Krauss et al. 2009; Wamsley et al. 2010).

From USACE CEM:

(a) Tidal creeks with fetch exposures less than 0.5 nautical miles and low wave-energy environments can naturally sustain a sufficiently wide marsh fringe. Also, they generally have little or no problem with upland bank erosion because the established marsh fringe absorbs most of the wave energy before it can impact the upland area (Hardaway and Byrne 1999). On the Chesapeake Bay, Hardaway and Anderson (1980) found that low, upland banks erode almost twice as fast as marsh shorelines with similar fetch exposures and nearshore depths.

(b) Some recent field and laboratory research has focused on wave attenuation by wetland vegetation (Kobayashi, Raichle, and Asano 1993; Wallace and Cox 1997; Tschirky, Turke, and Hall 2000). Wave heights are typically reduced by 50 percent and the peak spectral period also drops as the spectrum becomes more broad banded with higher frequency components. No significant design guidance on allowable wave heights or currents for wetlands presently exists. The Wetlands Engineering Handbook (Olin, Fischenich, and Palermo 2000) provides a wealth of valuable information for the restoration and creation of wetlands.

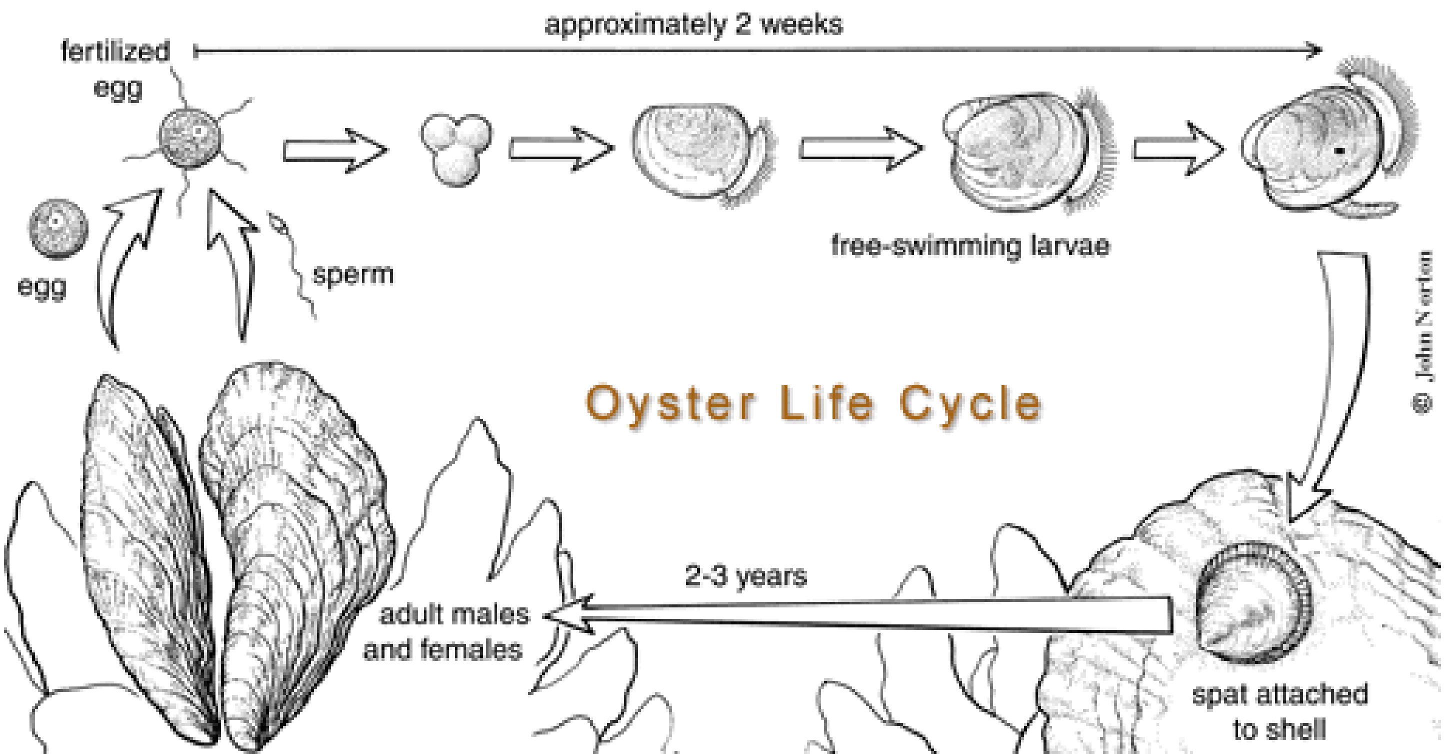
- Oyster reefs can exist in much colder, brackish water conditions of lagoons, bays and estuaries. They are found along both coasts and in the Gulf of Mexico. They are wave-resistant structures that can biologically adapt to rising sea levels. Their maximum elevation is related to the minimum time of inundation in the middle range of the intertidal zone.

Habitat Restoration

- Oyster reefs
- Salt marsh
- Seagrasses

Oyster biology

- Predators are a problem in high salinity (>25ppt)
- Chesapeake: limited by availability of larvae ("veligers")
- Southeast U.S.: limited by substrate (shell, rock/gravel, concrete, etc)




PROJECT
GreenShores

Current Strategies

ATKINS

Local:

- Wetland buffer
- Marine/Estuarine/Riverine Setback (MERS)

State:

- Coastal Construction Control Line (CCCL) = jurisdictional line
- 30-Year Erosion Projection Line (EPL) = a “soft” setback line

Federal:

- FEMA Special Flood Hazard Areas (SFHAs) = disincentives for building in flood prone areas

What more can we do?

- Educate the public about the consequences/opportunities
- Retreat where/when appropriate and feasible
- Create more “living shorelines” (oyster reefs/wetlands)
- Adopt flexible/innovative regulations that allow (and create incentives for) better design

Questions?

Thanks very much!

Rick Harter
rick.harter@atkinsglobal.com, 850.580.7956

Photo by Pat Farley
(kids by Rick & Amy Harter)