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USGS coastal wetland surface elevation change studies in the Greater Everglades

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Support

Greater Everglades Priority Ecosystem Science (PES) Program

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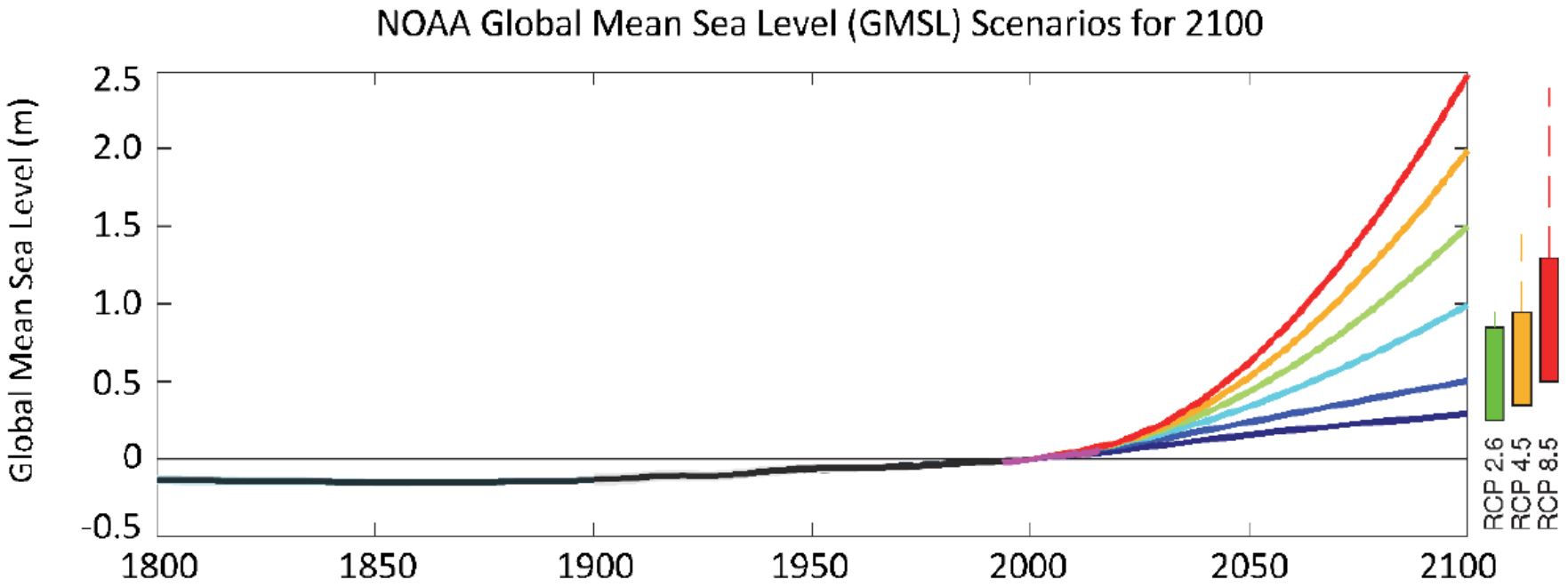
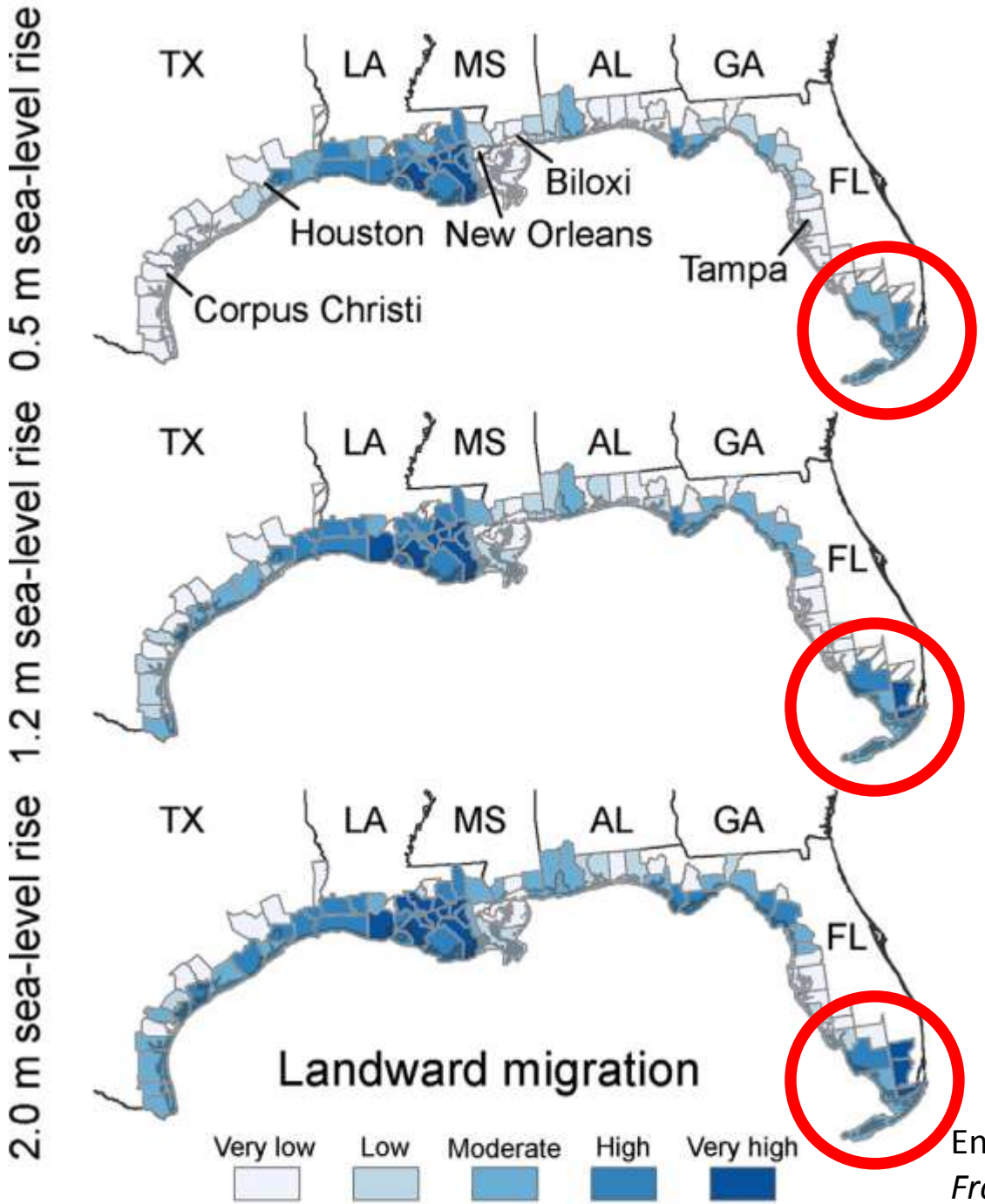


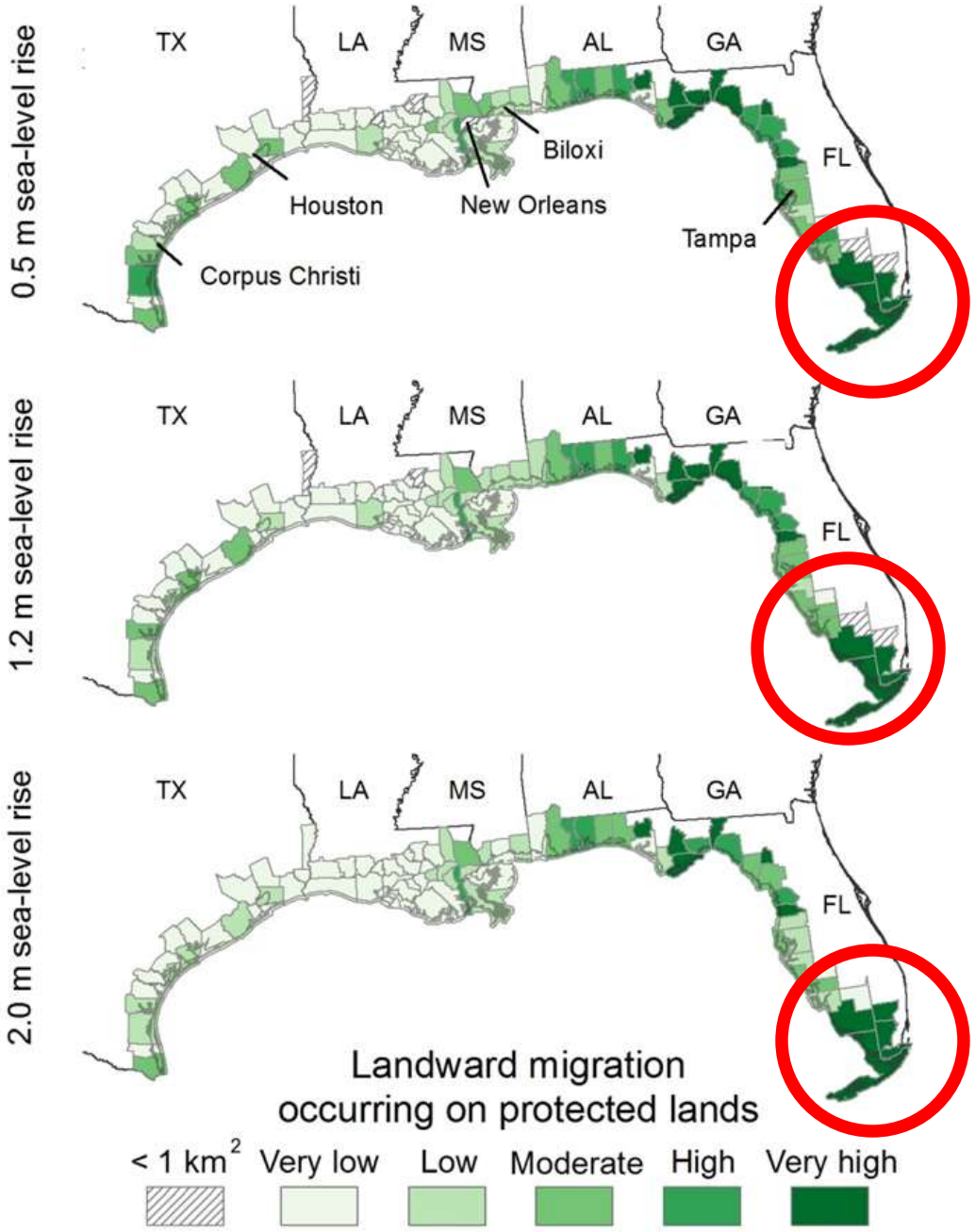
Scenario	SLR by 2100 (m)
Low	0.3
Intermediate-Low	0.5
Intermediate	1.0
Intermediate-High	1.5
High	2.0
Extreme	2.5

Sweet et al. 2017, Global and Regional Sea Level Rise Scenarios for the United States



Landward migration of wetlands in response to sea-level rise

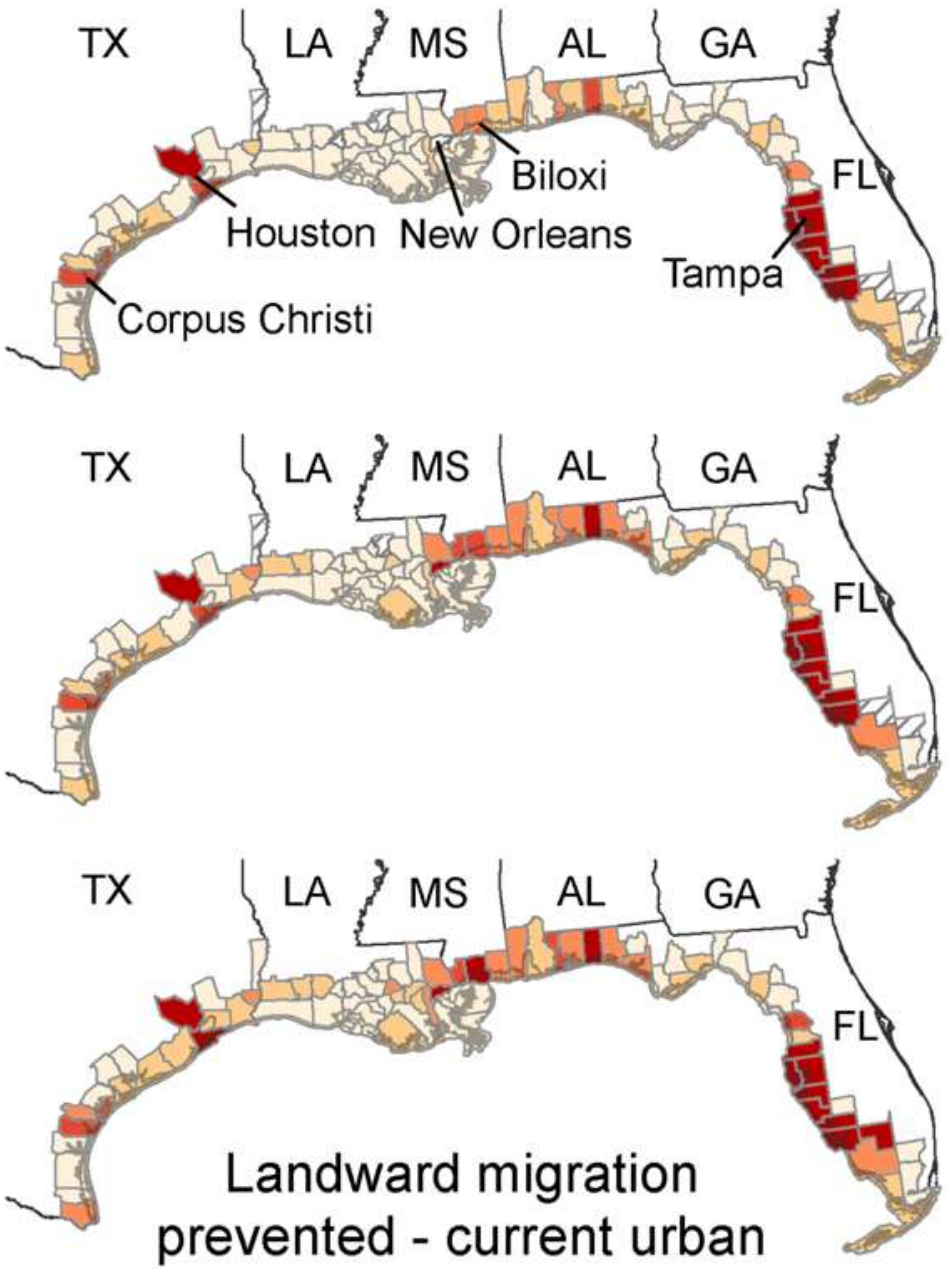
Enwright et al. 2016
Frontiers in Ecology and the Environment

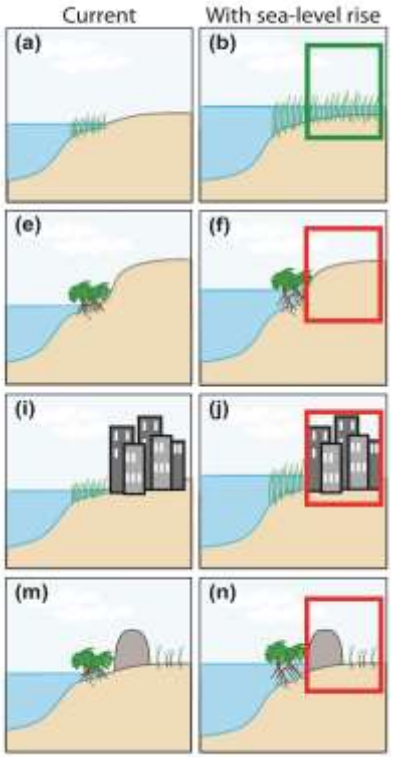


Landward migration of wetlands on protected lands

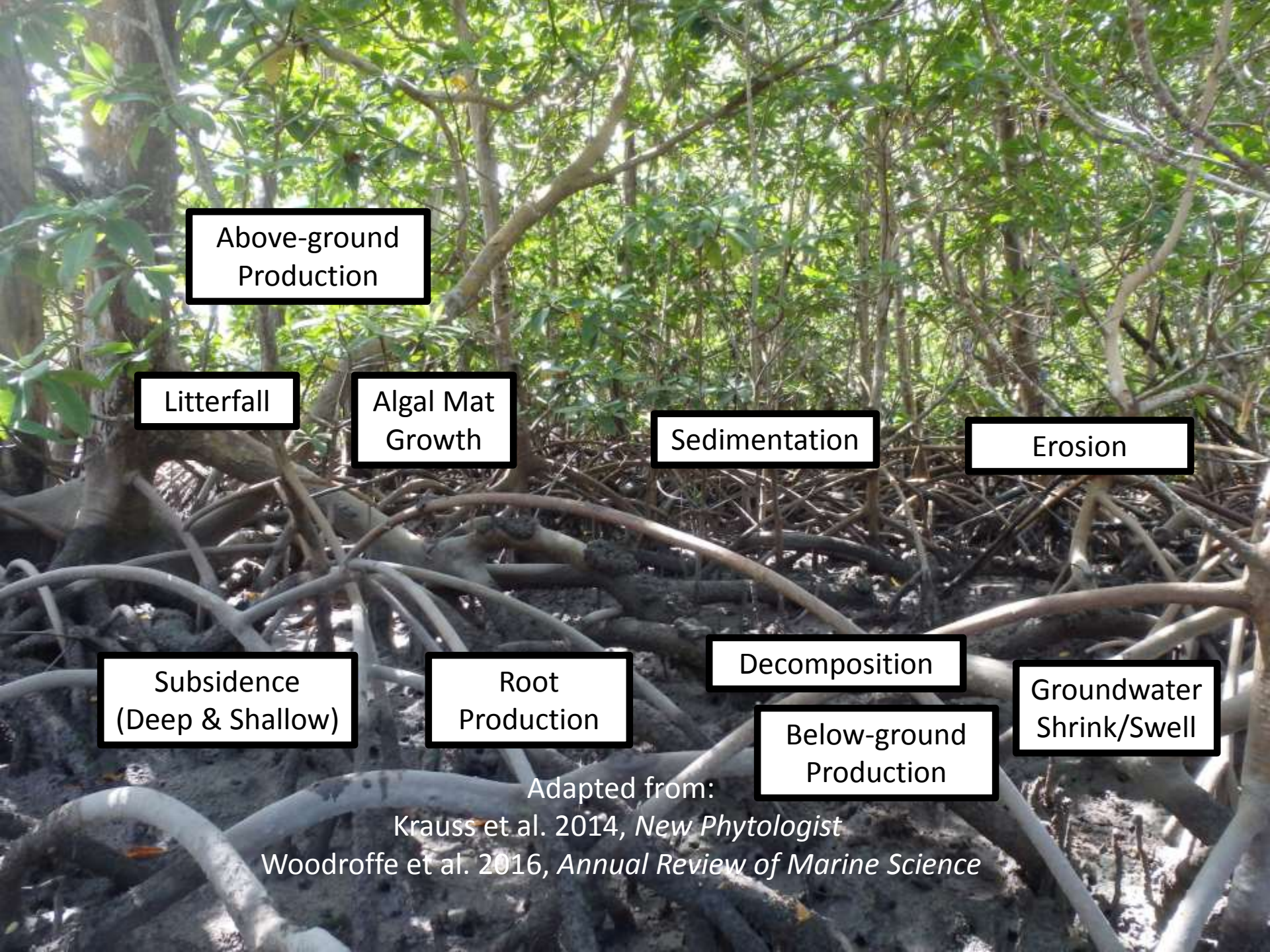
Enwright et al. 2016
Frontiers in Ecology and the Environment

Urban barriers to landward migration of wetlands





Enwright et al. 2016
Frontiers in Ecology and the Environment



Adapted from:
Krauss et al. 2014, *New Phytologist*
Woodroffe et al. 2016, *Annual Review of Marine Science*

Surface Elevation Table- Marker Horizon (SET-MH) Approach

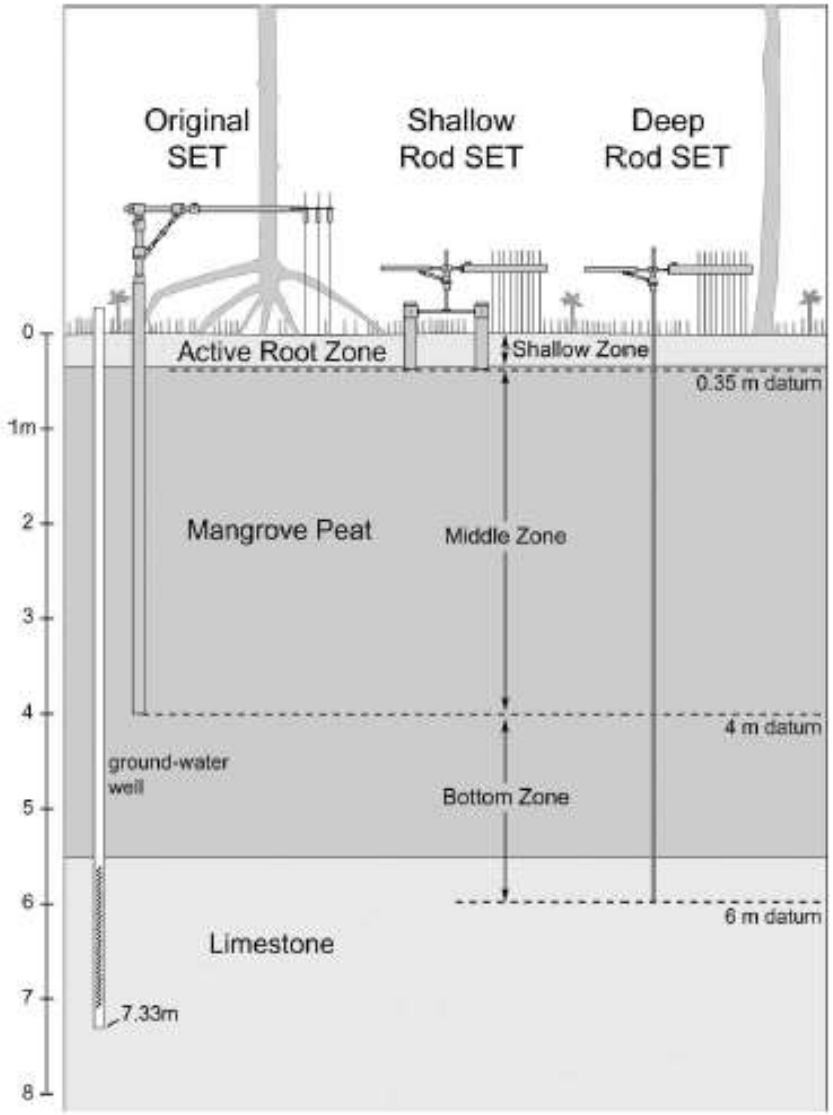
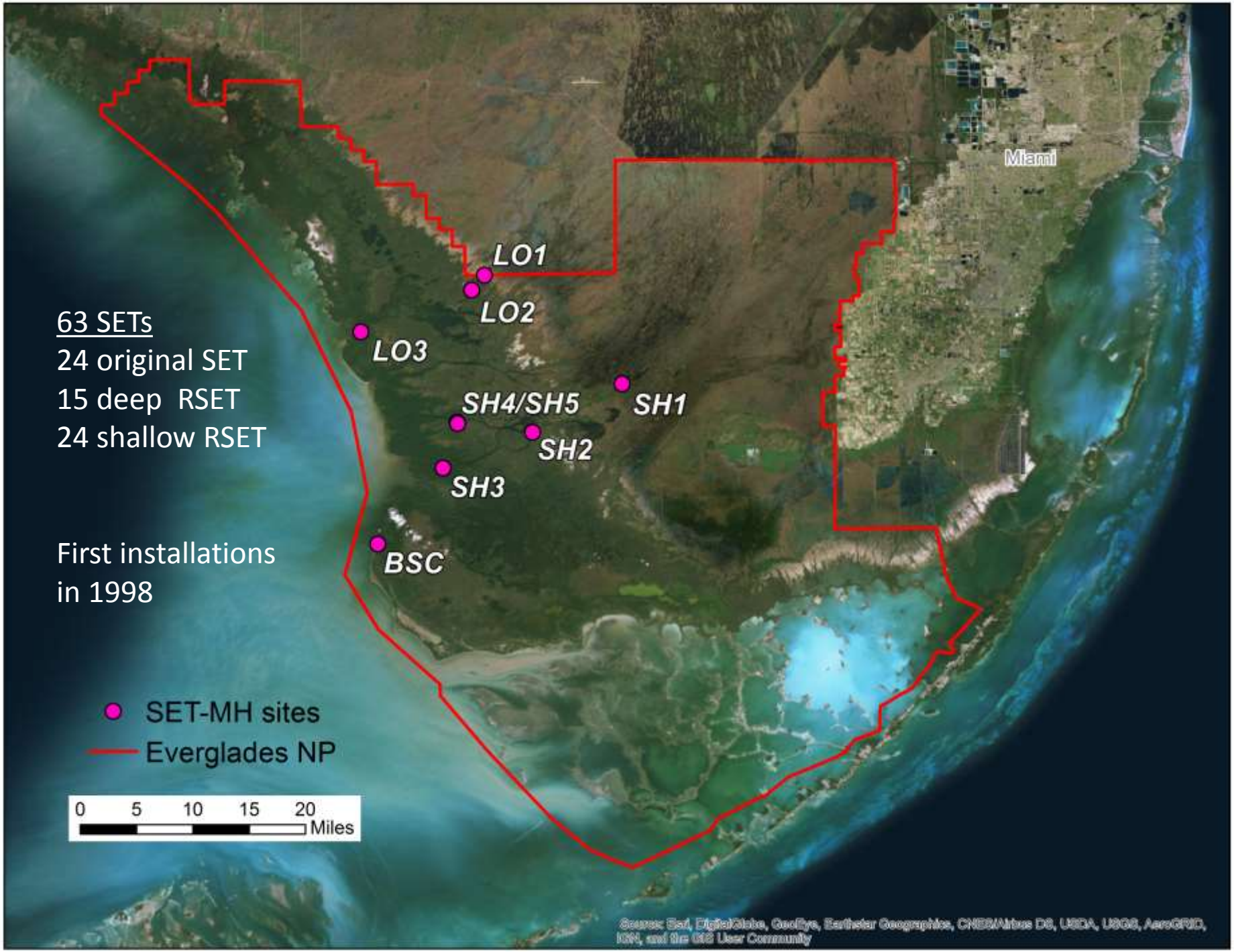
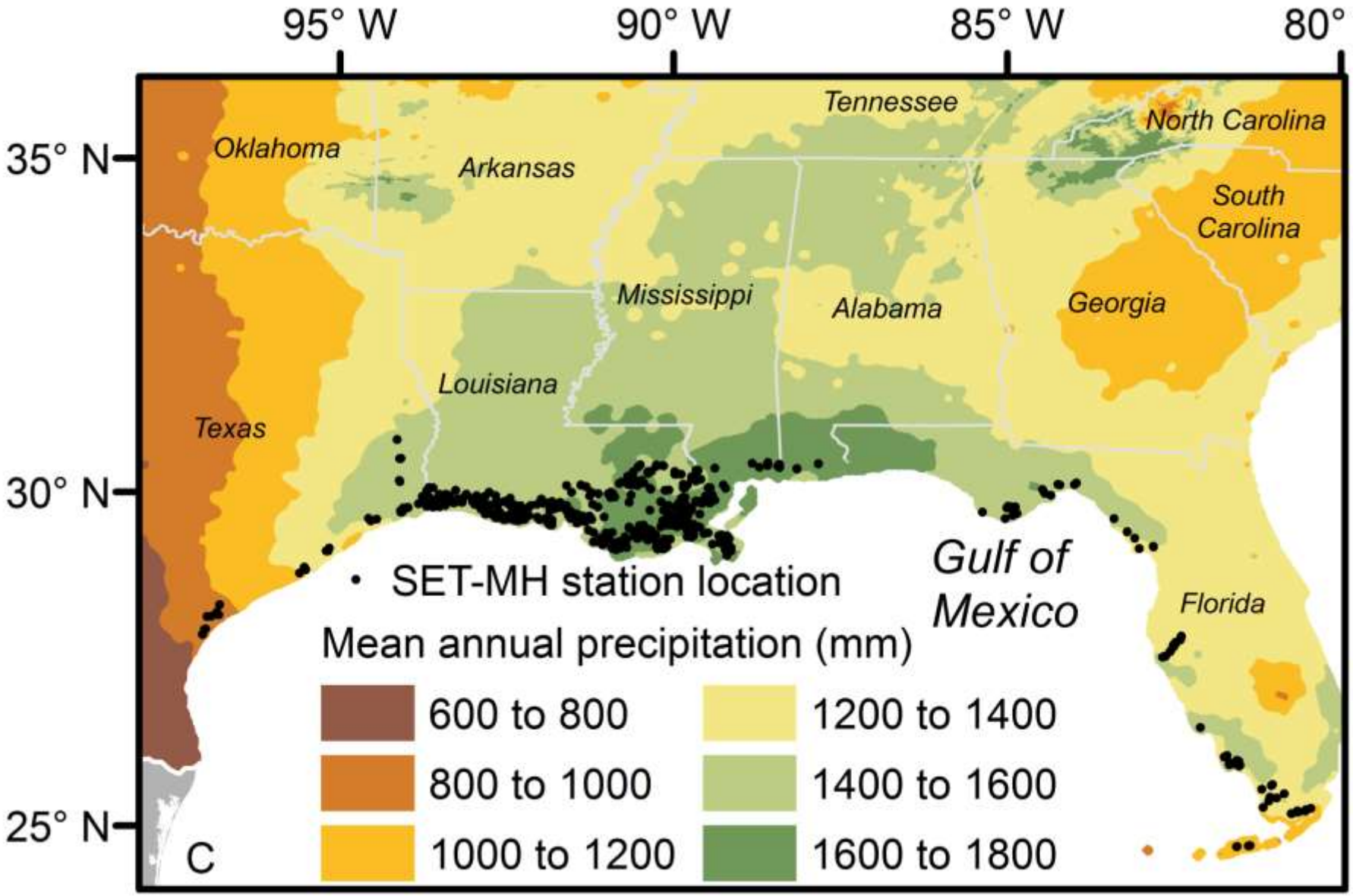


Figure 1. Illustration (1:24 scale) of a Shark River soil profile showing accretion, shallow, middle, and bottom soil zones, and placement depths of Original SETs, Deep, and Shallow-RSETs and a groundwater well (adapted from Whelan et al. 2005, with permission).

Figure from Whelan et al. 2009, *Wetlands*

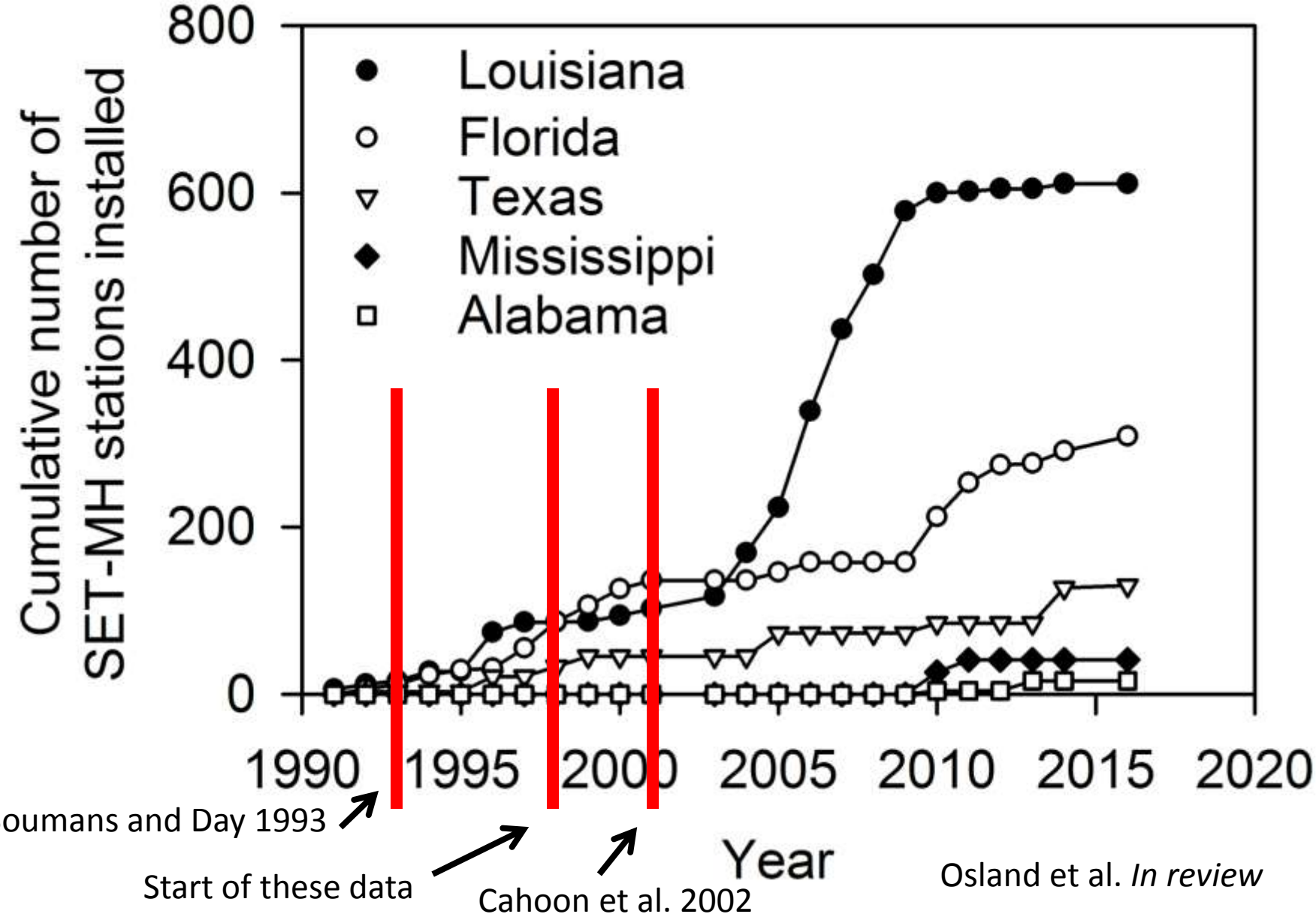

Miami
LO1
LO2
LO3
SH4/SH5
SH1
SH2
SH3
BSC
63 SETs
24 original SET
15 deep RSET
24 shallow RSET
First installations
in 1998
SET-MH sites
Everglades NP
0 5 10 15 20
Miles

SET-MH Stations in the northern Gulf of Mexico



Osland et al. *In review*

Temporal installation of SET-MH Stations in the northern Gulf of Mexico



ORIGINAL

Date:
Time Start: Finish:
Tide:
Recorded by:
Read by:
Feldspar measured by:
Ruler used:

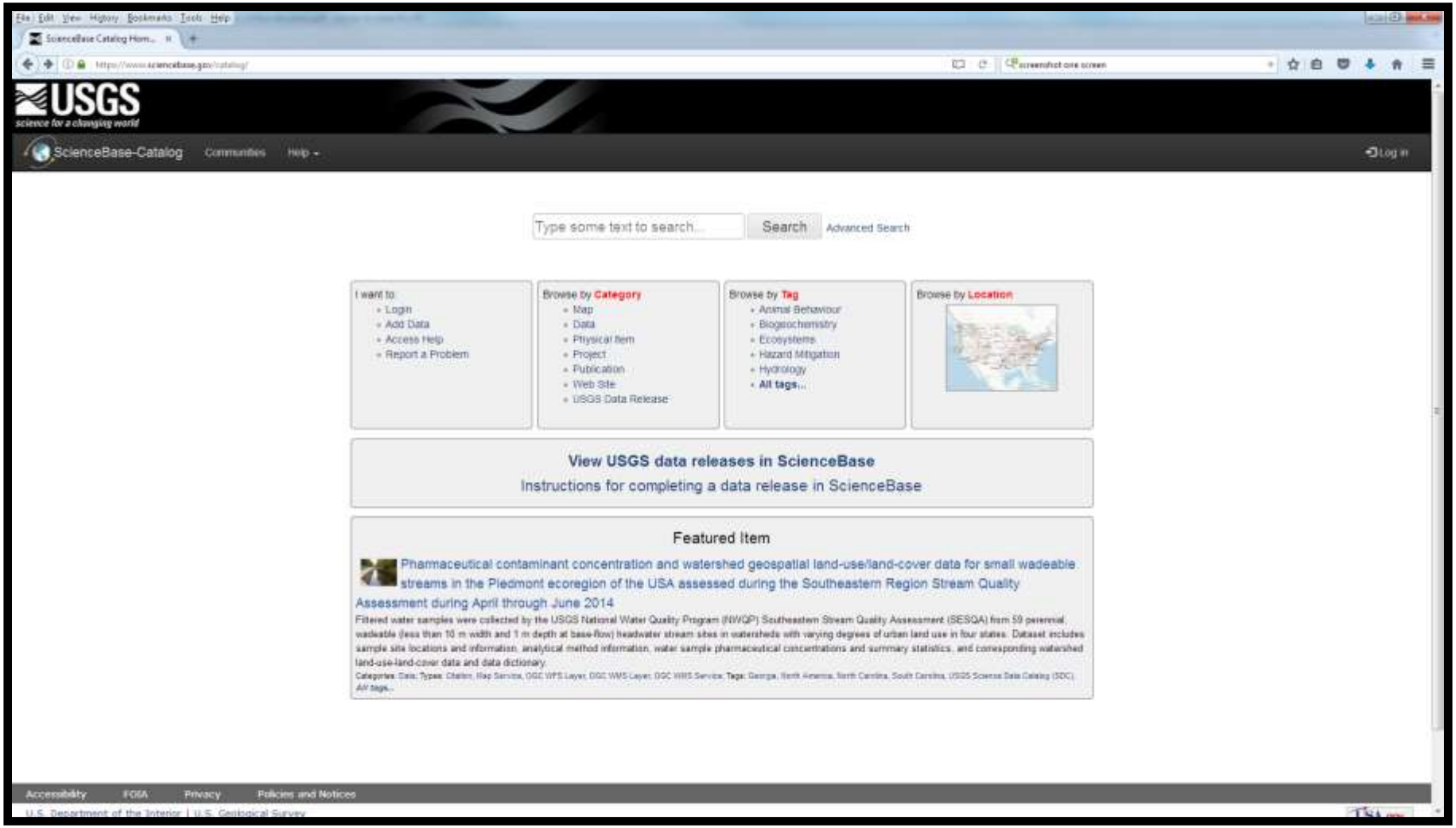
Read from TOP of plate

O-1	115	160	350	340	Feldspar mm	1	2	3
1					N:			
2					O:			
3					P:			
4								
5								
6								
7								
8								
9								
H_2O								

O-2	20	65	155	240	Feldspar mm	1	2	3
1					N:			
2					O:			
3					P:			
4								
5								
6								
7								
8								
9								
H_2O								

O-3	220	265	305	358	Feldspar mm	1	2	3
1					N:			
2					O:			
3					P:			
4								
5								
6								
7								
8								
9								
H_2O								

Data under review and will be made available as a USGS Data Release on Sciencebase.gov



SETs over time..

2002

2014

Estuaries Vol. 28, No. 6, p. 833–843 December 2005

Groundwater Control of Mangrove Surface Elevation: Shrink and Swell Varies with Soil Depth

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[4] *U.S. Geological Survey, Florida Integrated Science Center, c/o Everglades National Park Field Station, 40001 State Road 9336, Homestead, Florida 33034*

Questions

- What is the influence of hydrologic variability on soil elevation?
- What are the relative contributions of four components of the soil profile:
  - Surface
  - Shallow (0-0.35 m)
  - Middle (0.35-4 m)
  - Bottom (4-6 m)

USGS

From: Whelan et al. 2005 *Estuaries*

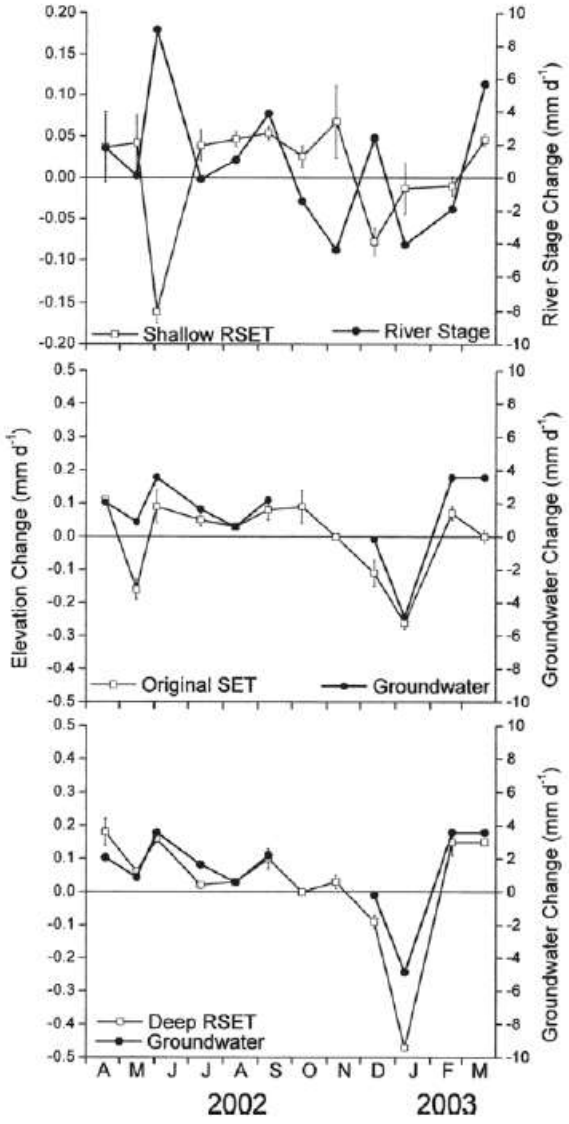
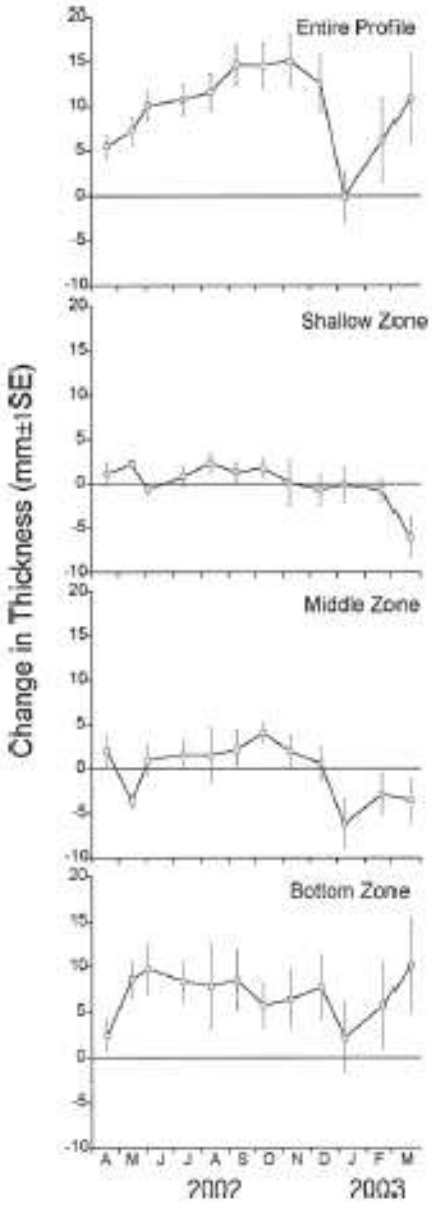


Fig. 4. Mean (±1 SD) rate of change for the three shallow-RSETs and the rate of change in river stage, three original-SETs and rate of change in groundwater piezometric head, and three deep-RSETs and rate of change in groundwater piezometric head.



CUMULATIVE IMPACTS OF HURRICANES ON FLORIDA MANGROVE ECOSYSTEMS: SEDIMENT DEPOSITION, STORM SURGES AND VEGETATION

Thomas J. Smith III[1], Gordon H. Anderson[2], Karen Balentine[2], Ginger Tiling[3], Greg A. Ward[4], and Kevin R. T. Whelan[5]

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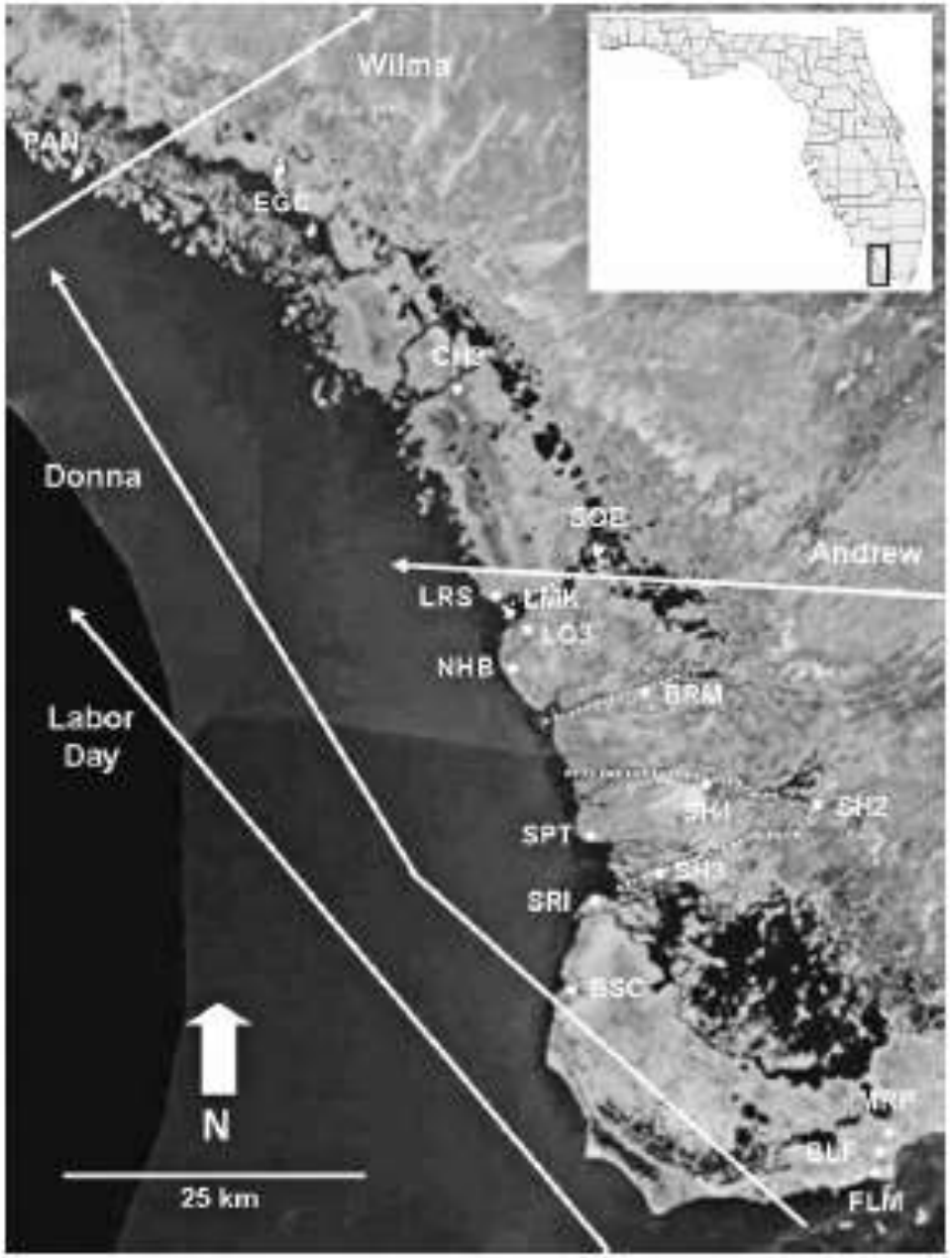
[5]*U.S. National Park Service, South Florida – Caribbean Inventory and Monitoring Network, 18001 Old Cutler Road, Suite 419, Palmetto Bay, Florida, USA 33157*

From: Smith et al. 2009 *Wetlands*



From: Smith et al. 2009 *Wetlands*

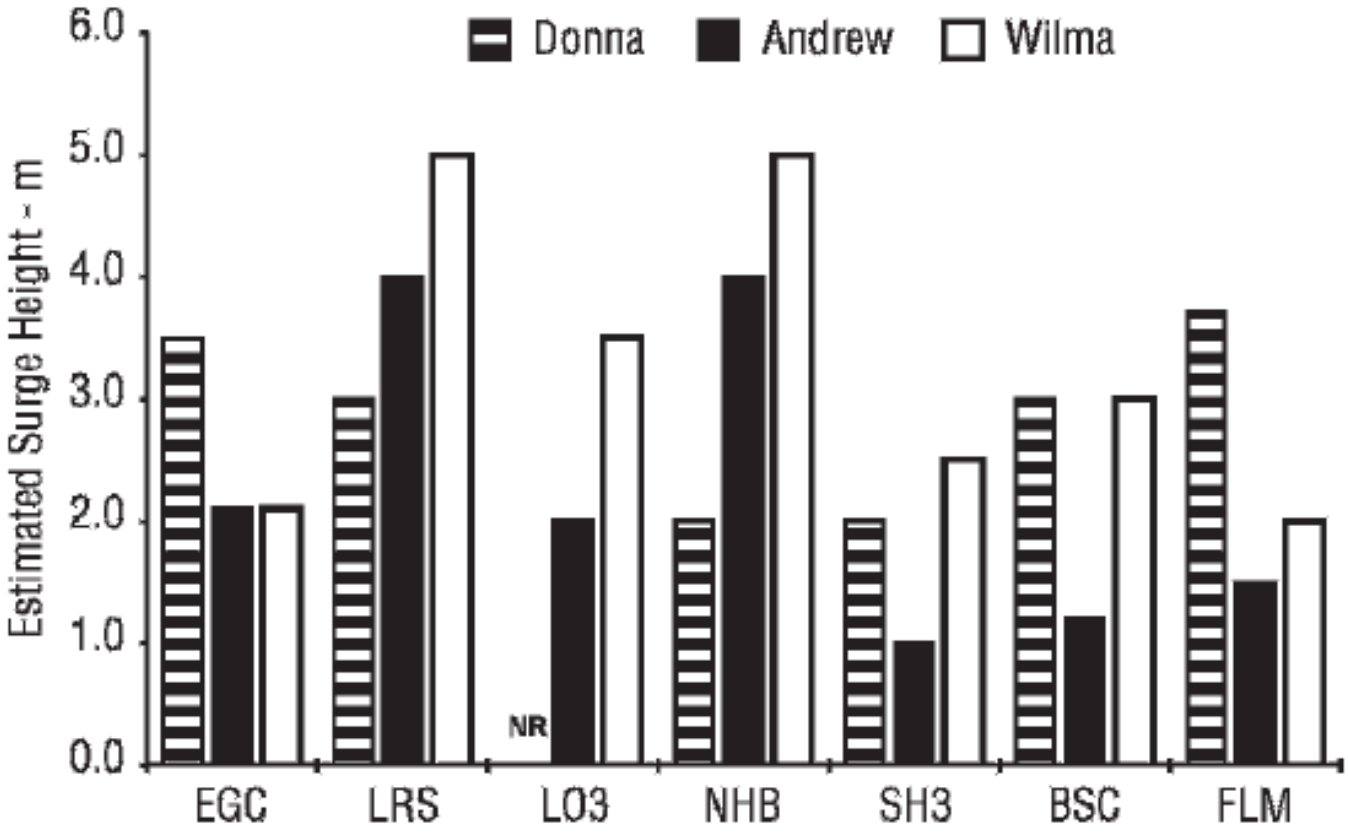


Figure 5. Estimated storm surge heights from Hurricanes Donna, Andrew and Wilma for seven locations along a north to south transect on the southwest Florida coastline. NR = Not reported.

From: Smith et al. 2009 *Wetlands*

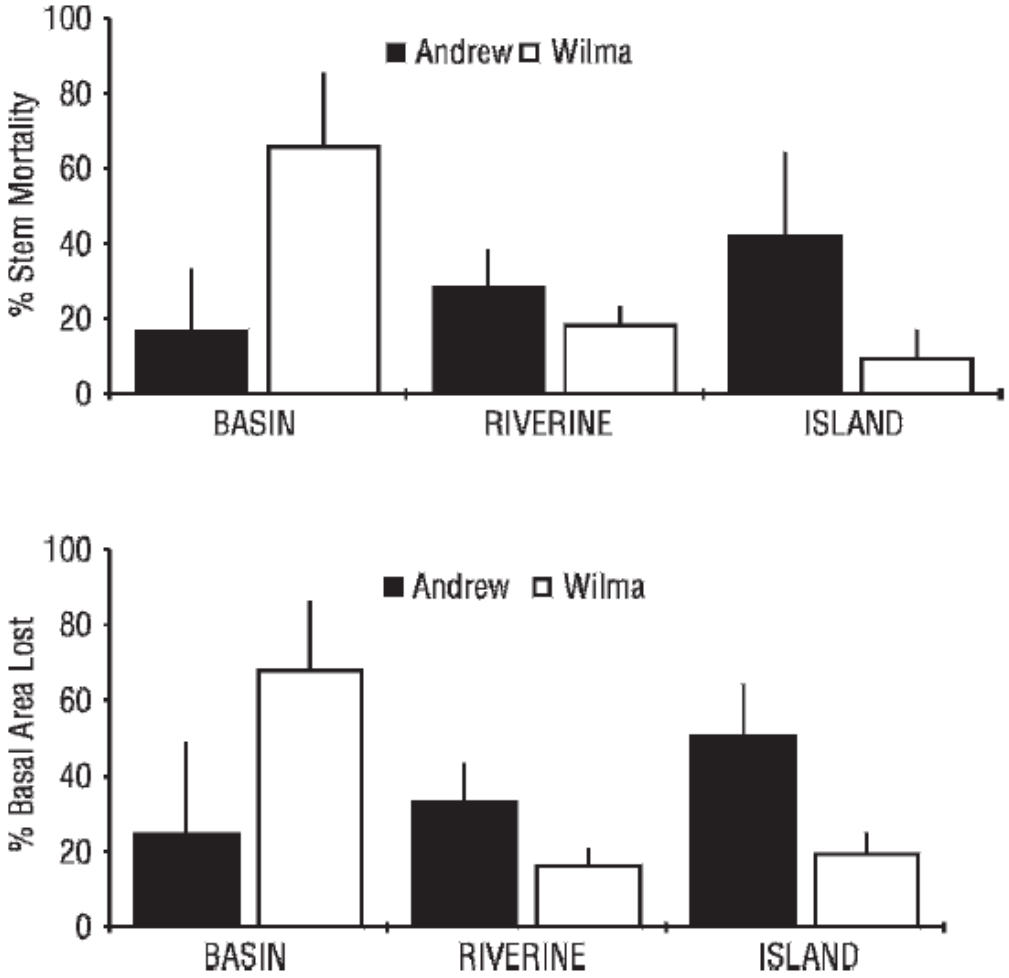
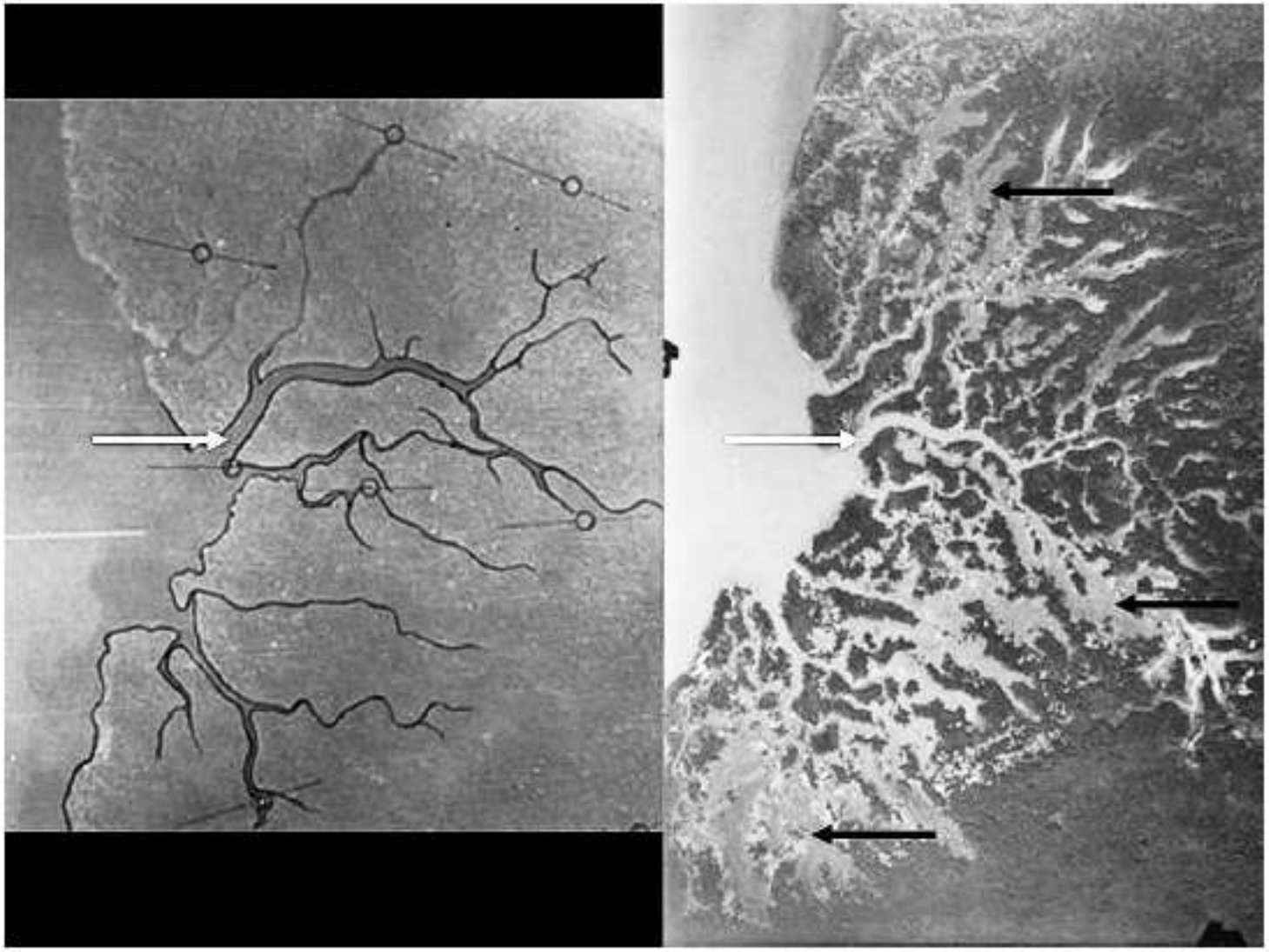


Figure 8. Graphic representation of the Forest Type by Hurricane interaction for % stem mortality (upper) and % basal area lost (lower). The data have been averaged over the three species of mangrove. Values are $\bar{X} \pm 1SE$.

From: Smith et al. 2009 *Wetlands*



From: Smith et al. 2009 *Wetlands*

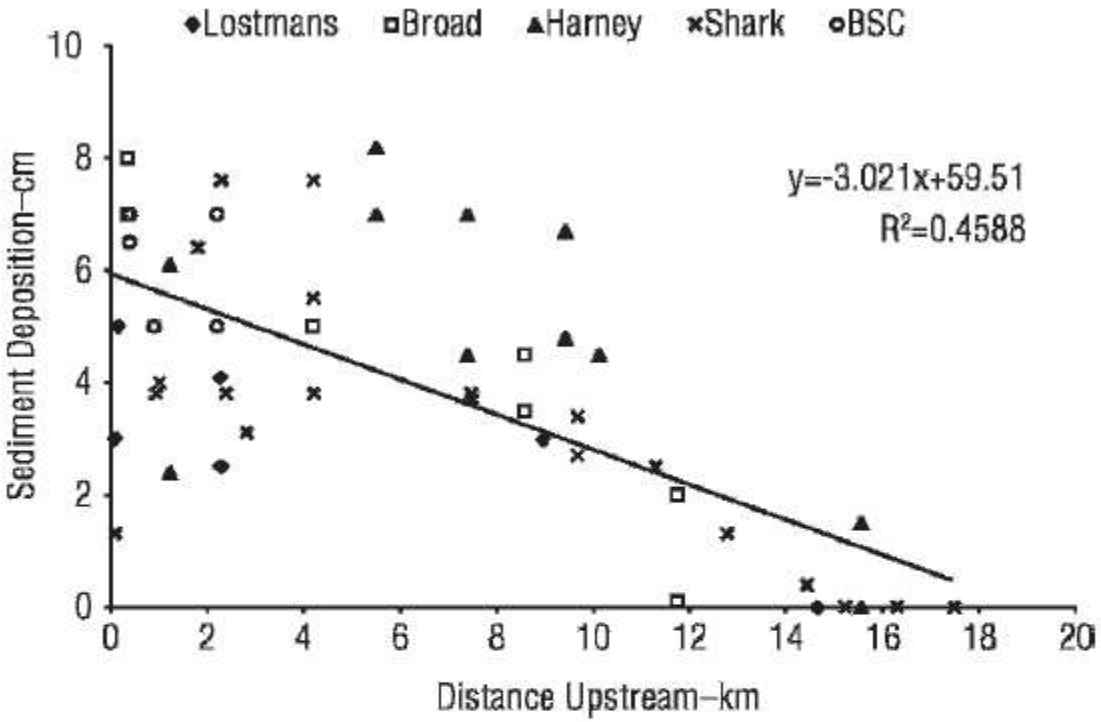


Figure 6. Sediment deposition (cm) from Hurricane Wilma as a function of distance upstream from the Gulf of Mexico (km) for five tidal rivers and creeks in Everglades National Park. There were no differences between rivers so a single regression line is given. Key for symbols: Lostmans (◆), Broad (□), Harney (▲), Shark (X) and Big Sable Creek (O).

WETLANDS, Vol. 29, No. 1, March 2009, pp. 16–23

HURRICANE WILMA'S IMPACT ON OVERALL SOIL ELEVATION AND ZONES WITHIN THE SOIL PROFILE IN A MANGROVE FOREST

Kevin R. T. Whelan[1], Thomas J. Smith III[2], Gordon H. Anderson[3], and Michelle L. Ouellette[4]

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Questions

- What is the affect of storm deposits from Hurricane Wilma on surface elevation and subsurface soil processes?
- What are the relative contributions of four components of the soil profile:
  - Surface
  - Shallow (0-0.35 m)
  - Middle (0.35-4 m)
  - Bottom (4-6 m)

From: Whelan et al. 2009 *Wetlands*

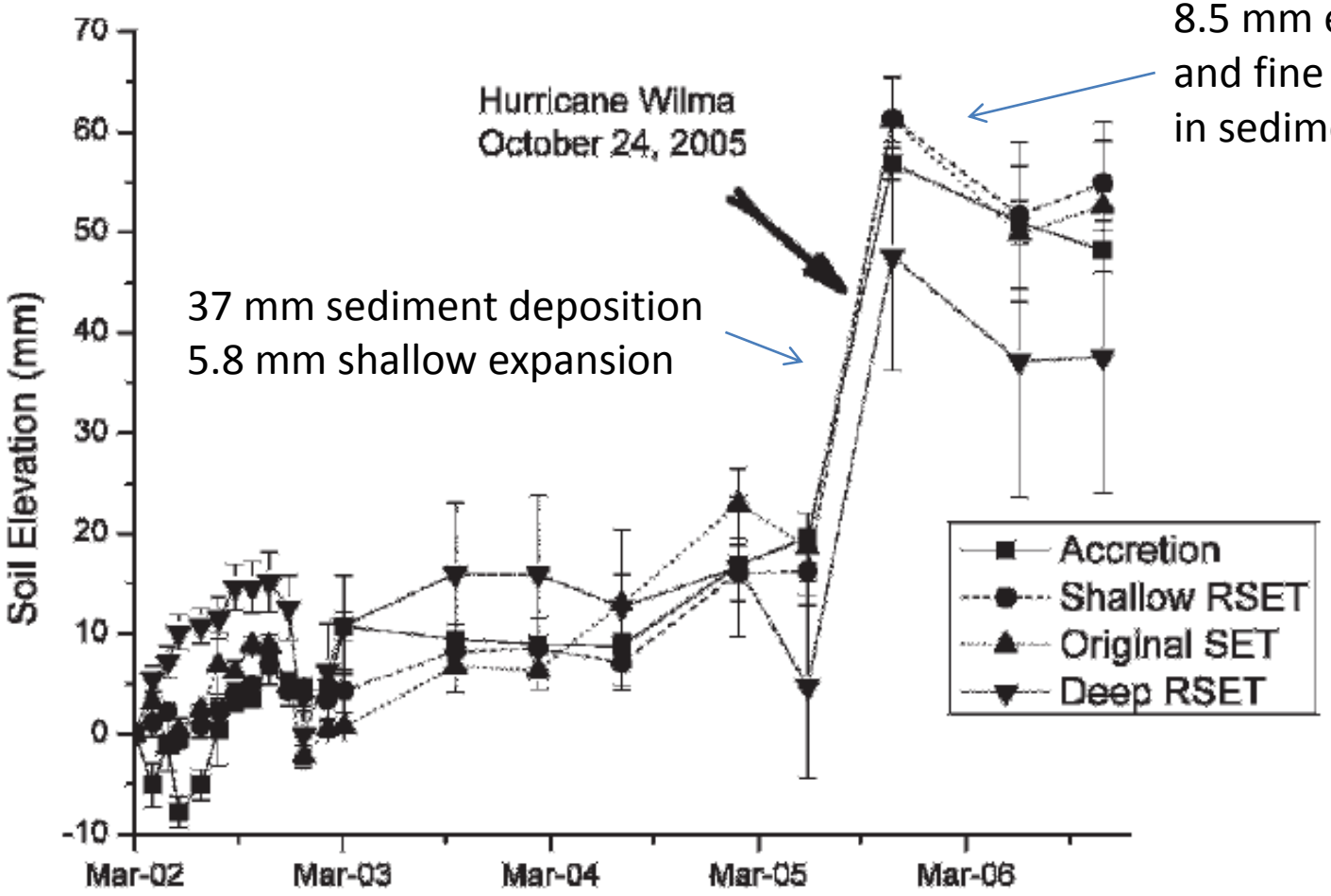

Figure 2. Long term mean (± 1 SD) absolute soil surface elevations for Accretion, Shallow-RSET, Original-SET, and Deep-RSET at a mangrove forest on the Shark River capturing the impact of Hurricane Wilma.

From: Whelan et al. 2009 *Wetlands*

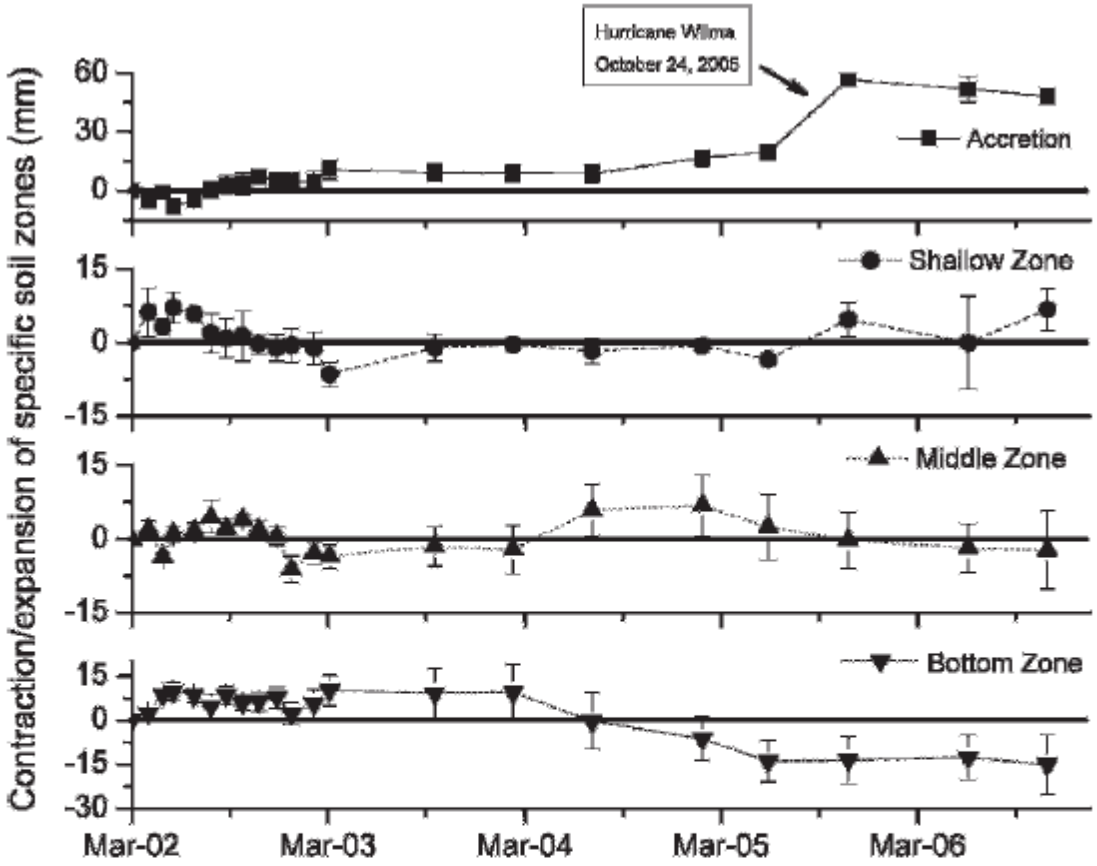

Figure 3. Absolute mean (± 1 SD) contraction/expansion of the four constituent soil zones: accretion zone, shallow zone, middle zone, and bottom zone relative to the contraction/expansion of the entire soil profile as measured by the Deep RSET (calculations are based on Equation 2, Whelan et al. 2005).

Data are under review and will be made available as a USGS Data Release on Sciencebase.gov