

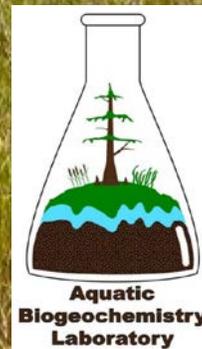
# Are carbon burial rates in the coastal everglades higher now than they were a century ago?

Joshua L. Breithaupt<sup>1,2</sup>, Joseph M. Smoak<sup>2</sup>, Lisa G. Chambers<sup>1</sup>,  
Evan Duga<sup>1</sup>, and Christian J. Sanders<sup>3</sup>

<sup>1</sup>University of Central Florida

<sup>2</sup>University of South Florida

<sup>3</sup>Southern Cross University



# Slow and steady sea-level rise has produced deep peat soils.

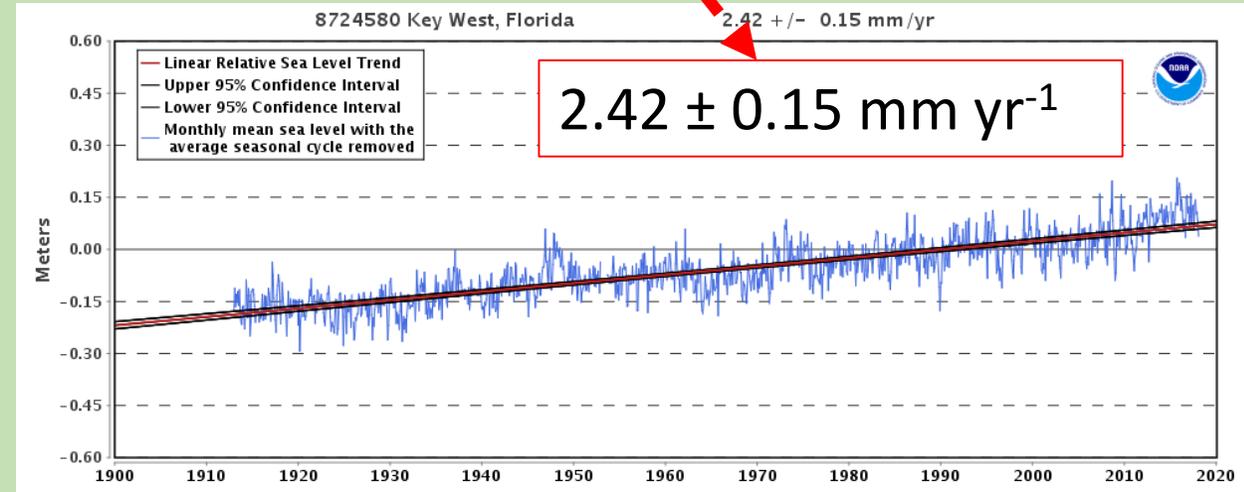
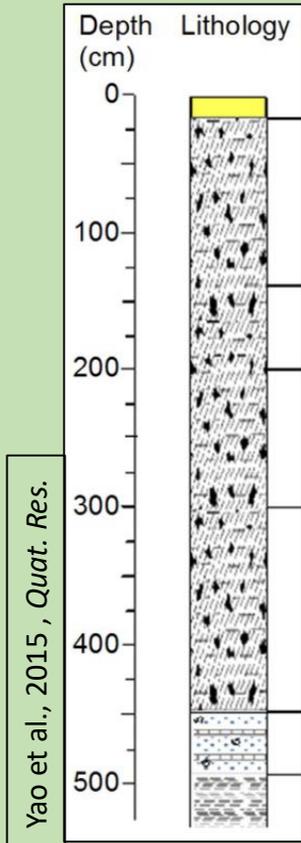
Past 5,000 years

Peat Accretion:  
 $\sim 0.9 \text{ mm yr}^{-1}$

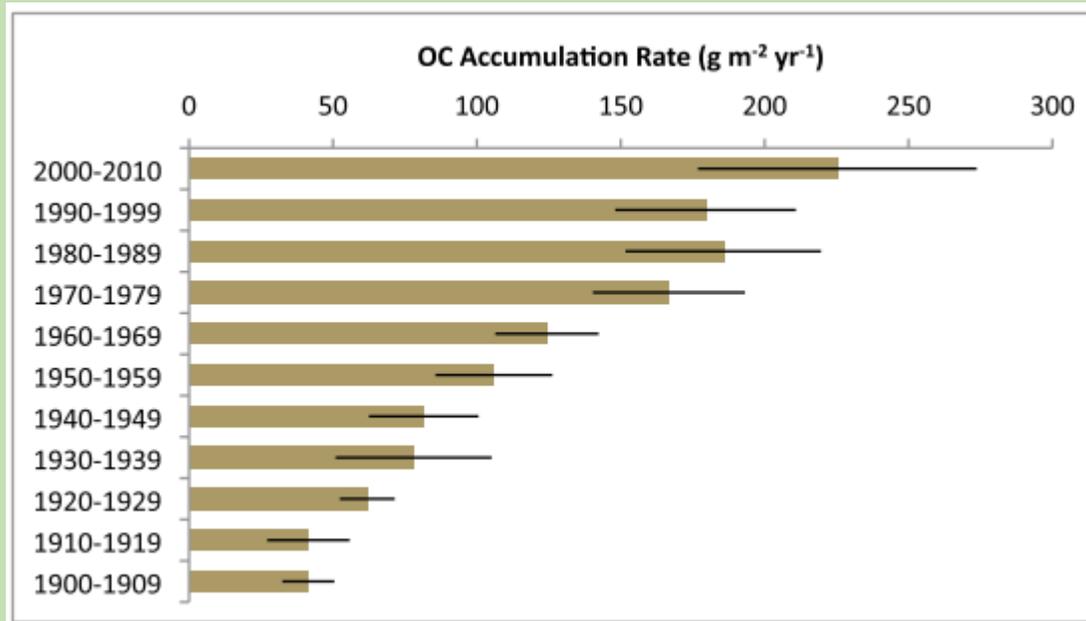


S. FL SLR Trend:  
 $0.7 \pm 0.3 \text{ mm yr}^{-1}$

$\times 3.5$



# Previous work shows apparent increase in OC burial rates in the last 100 years. Why?



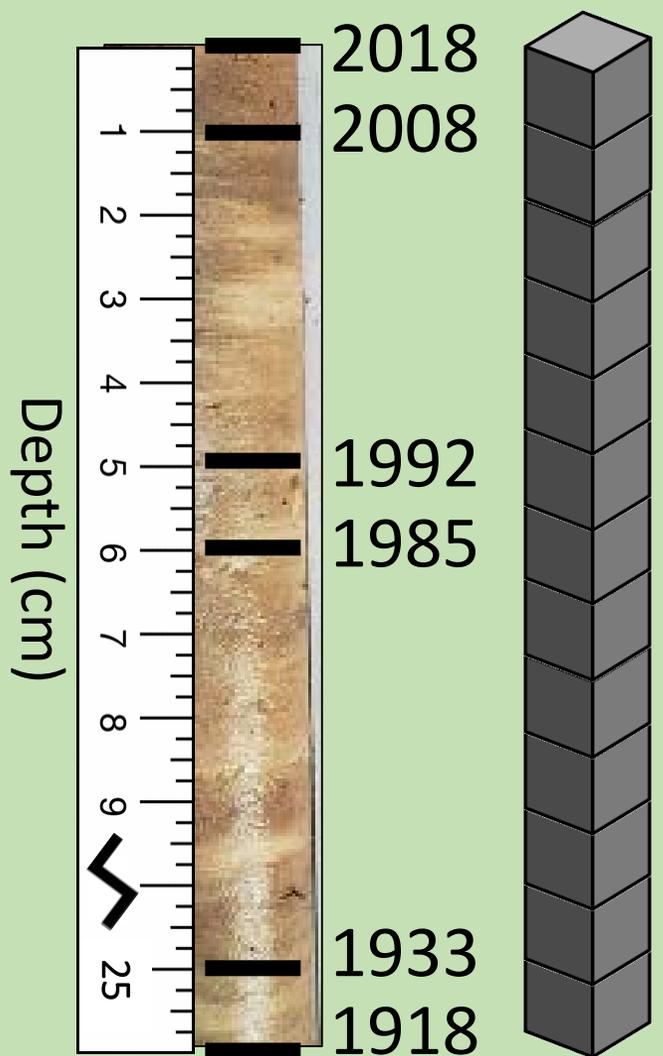
Breithaupt et al. 2014, JGR

- A. The increase is real.
- B. It's an artifact of the dating tool.
- C. Post-depositional change makes it look like an increase.
- D. Combination of the above.

OC burial rates were investigated at two mangrove-marsh encroachment sites in ENP, FL.



Burial rates were calculated using dry-bulk density and age-depth measurements using  $^{210}\text{Pb}$ .



DBD

$$\frac{g}{\text{cm}^3}$$



Burial Rate

$$\frac{1g}{\text{cm}^2 \ 10 \ \text{yrs}} = \frac{0.1g}{\text{cm}^2 \ \text{yr}}$$



$$\frac{1 \ \text{kg}}{\text{m}^2 \ \text{yr}}$$

- % Org. Carbon
- % Lignin

Multi-interval Avg.

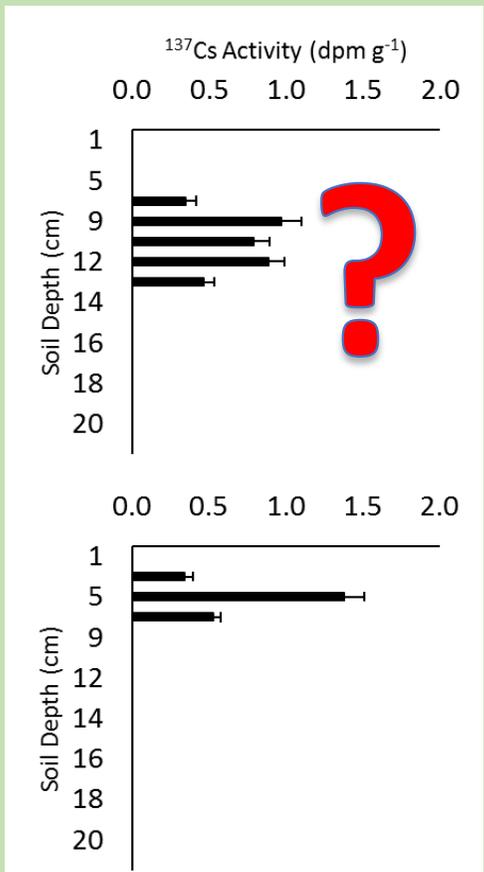
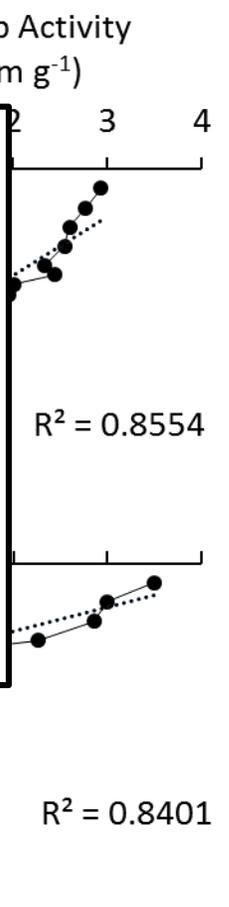
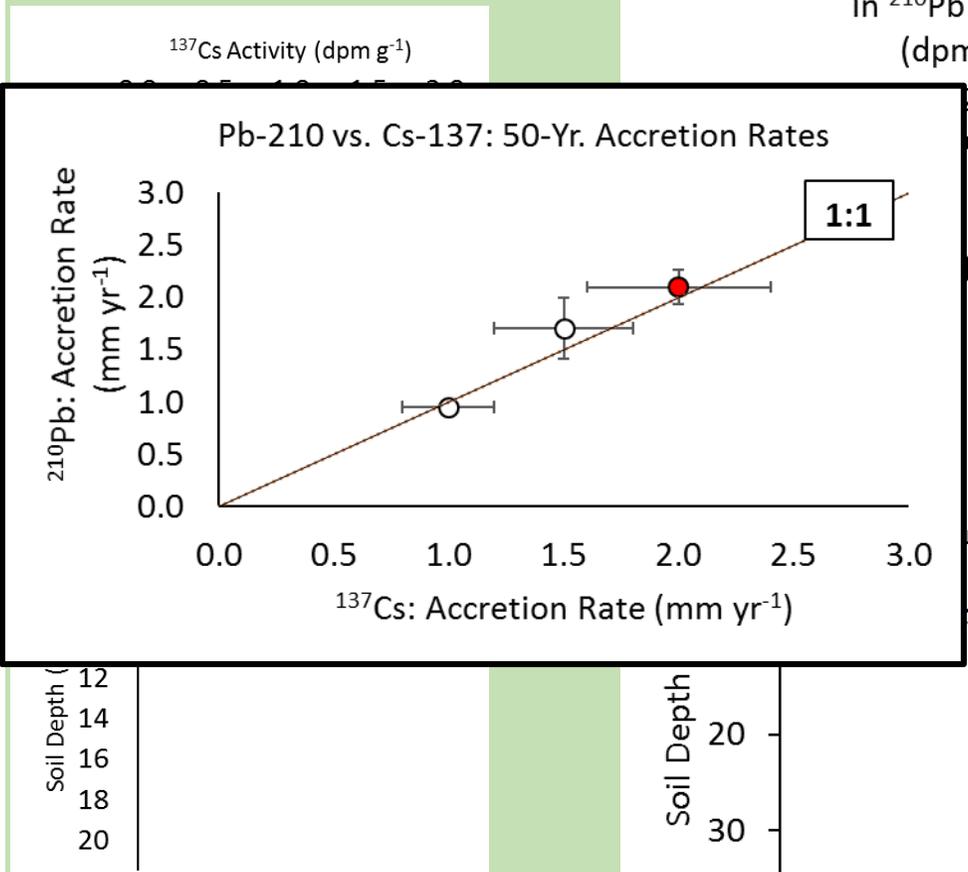
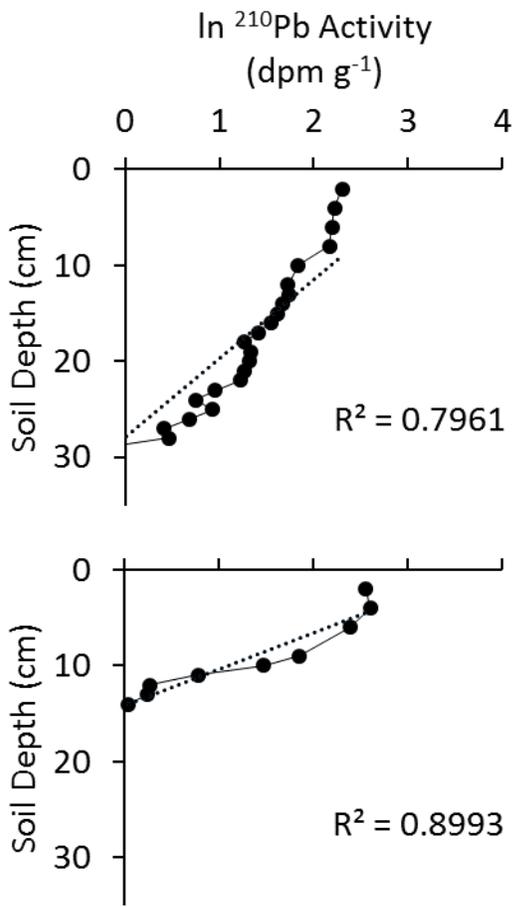
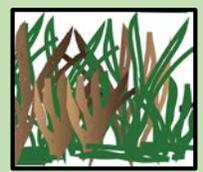
$$\frac{\Sigma g}{\text{cm}^2 \ n \ \text{yrs}}$$

$^{210}\text{Pb}$  was used to calculate soil ages; good agreement with  $^{137}\text{Cs}$  rates in the freshwater marsh cores.

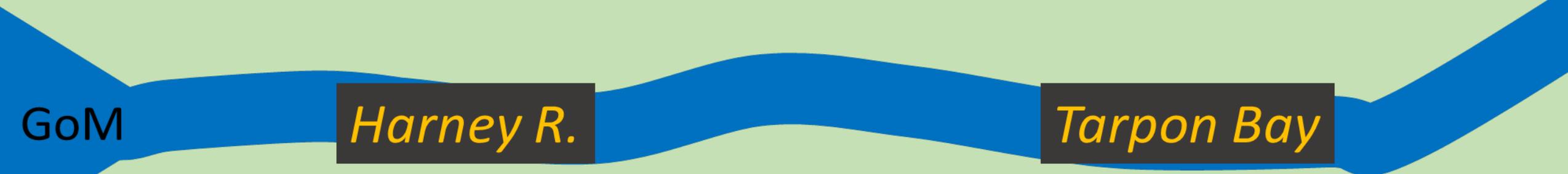
GoM

*Harney R.*

*Tarpon Bay*



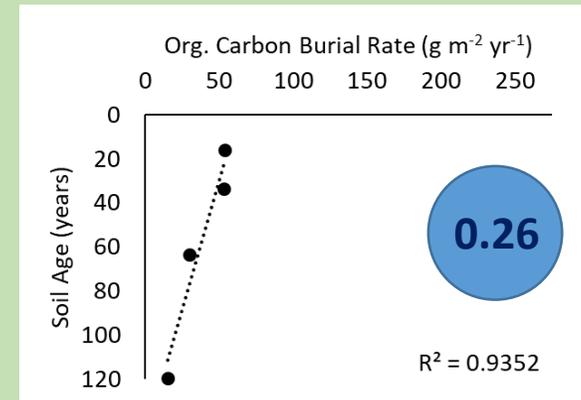
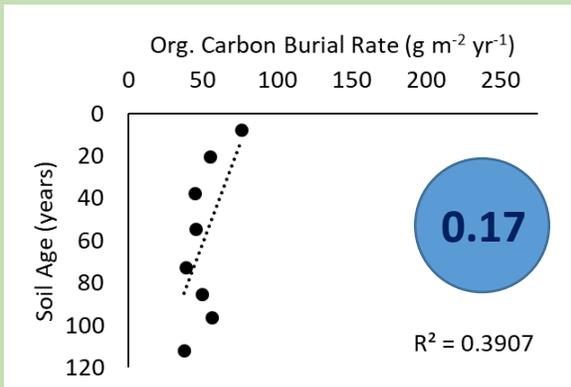
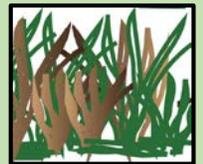
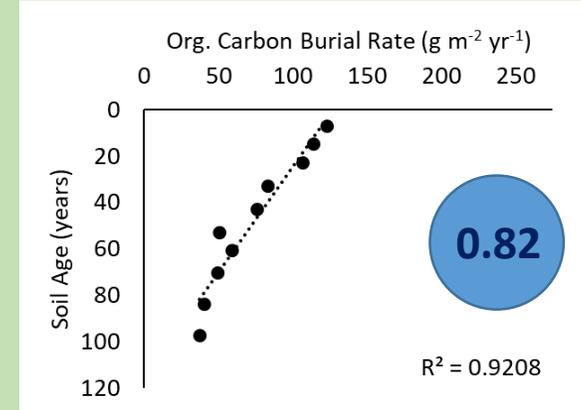
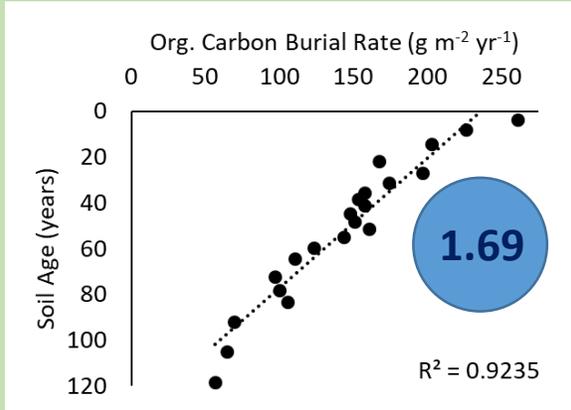
OC burial rates are higher in mangrove than in marsh, and appear to have accelerated in the past century.



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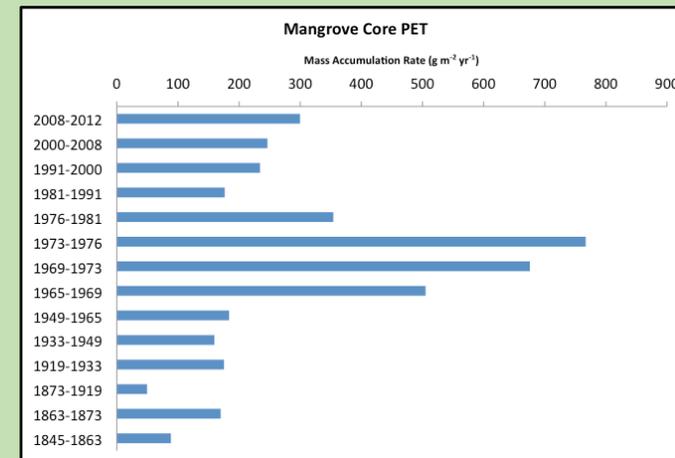
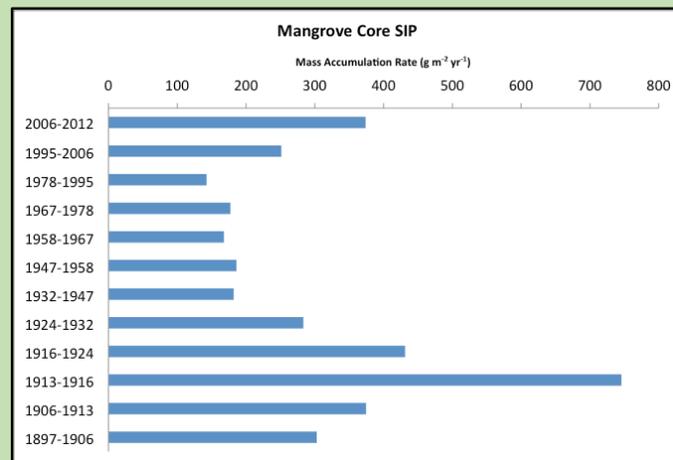
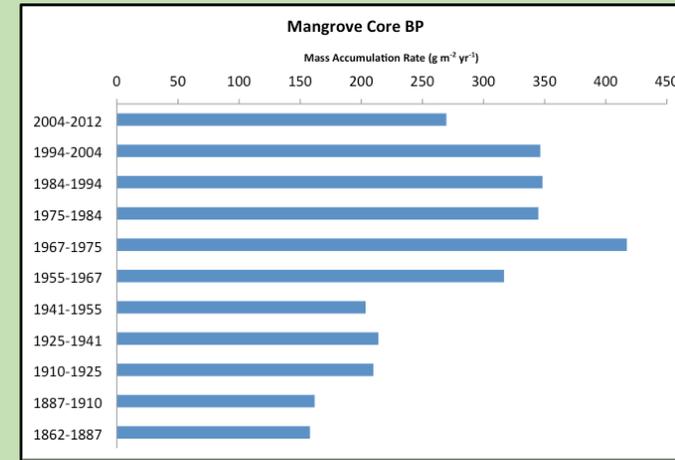
*Tarpon Bay*



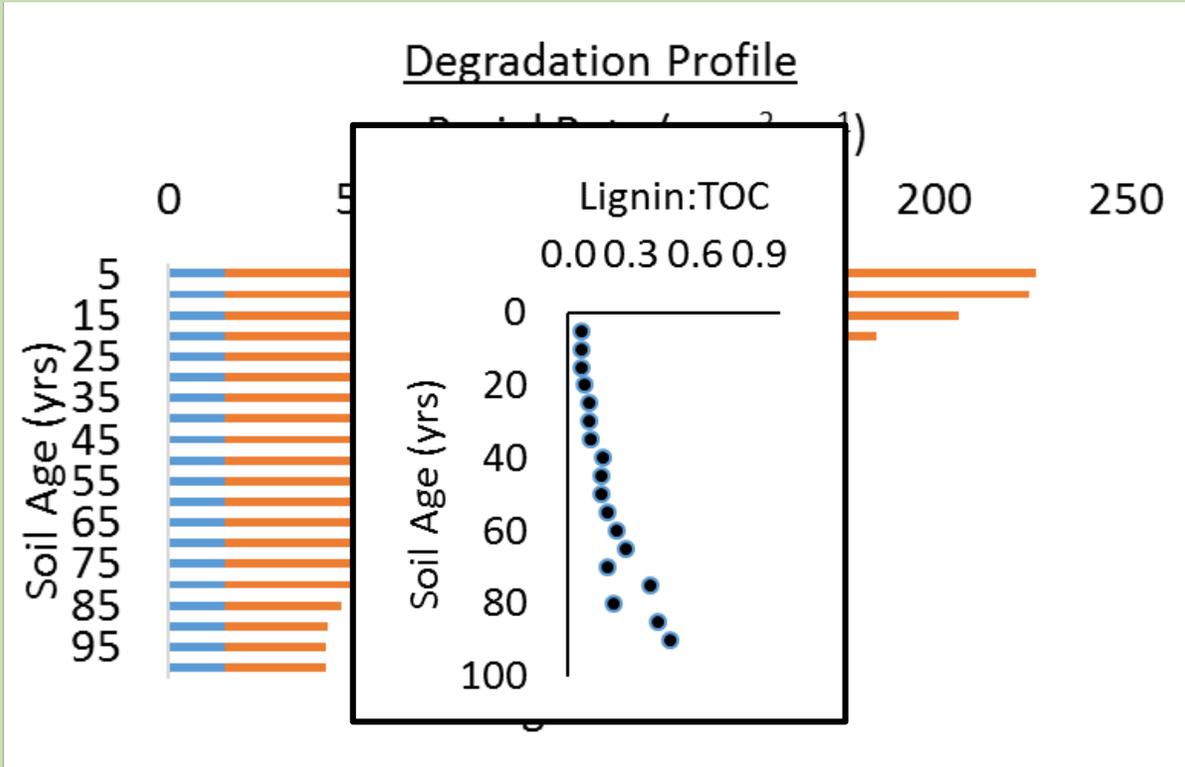
Acceleration  
 $\text{g m}^{-2} \text{yr}^{-2}$

Surface:Depth

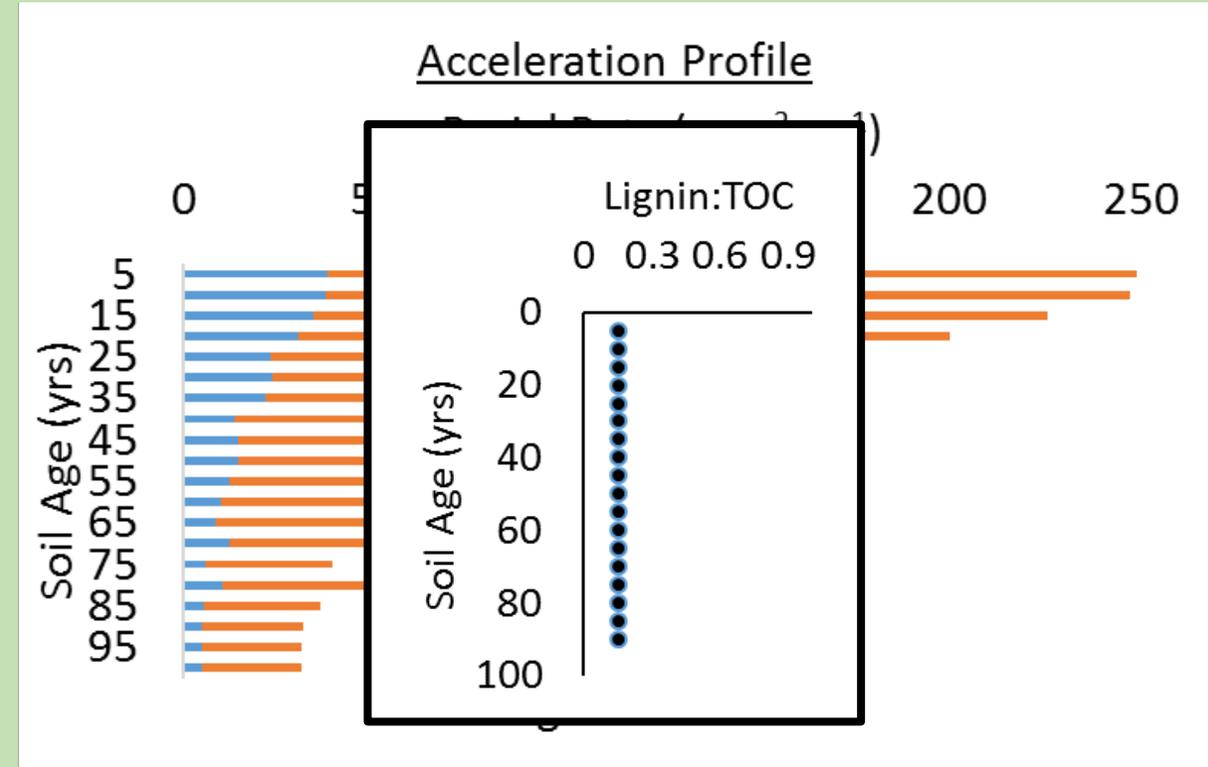
# Is rate increase an artifact of the dating method?



# Is rate increase caused by post-depositional change?

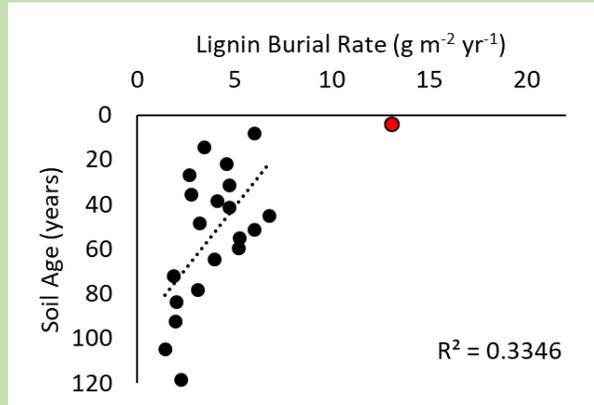
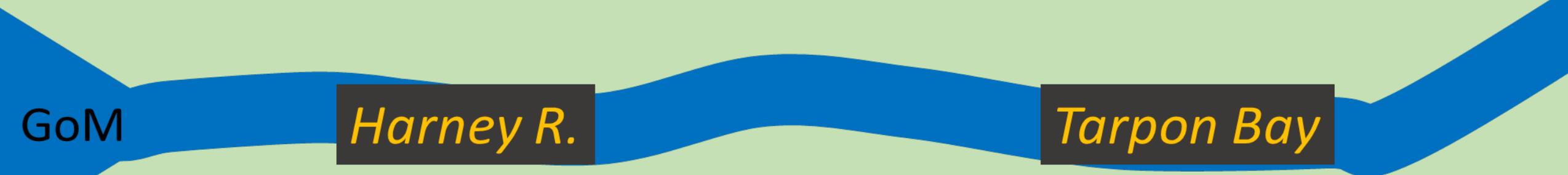


Downward increasing  
Lignin:TOC

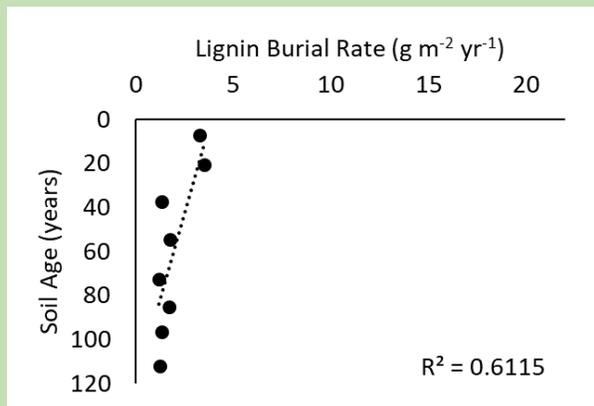
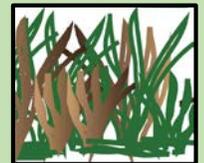


Constant Lignin:TOC

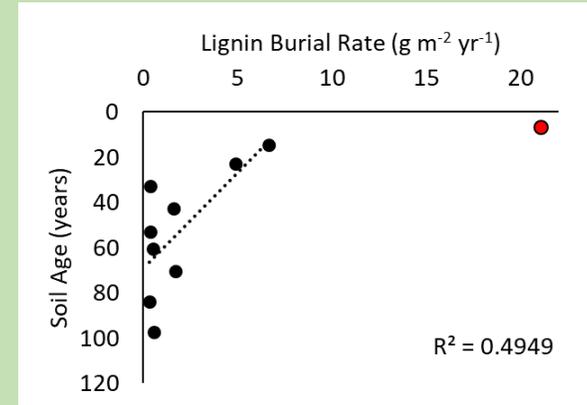
# Lignin burial rates have increased in the past century.



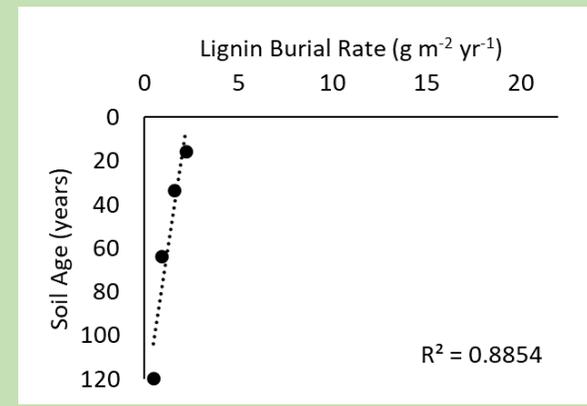
3.2



2.7



13.1



2.9

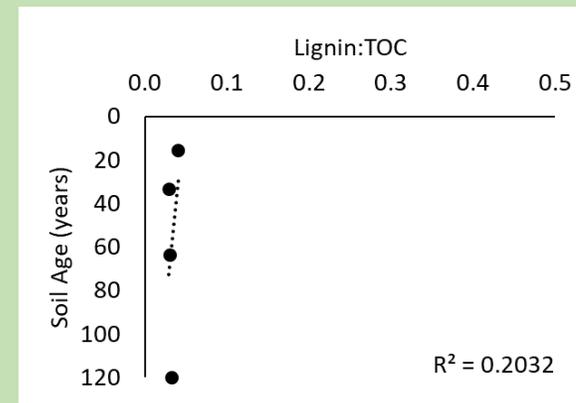
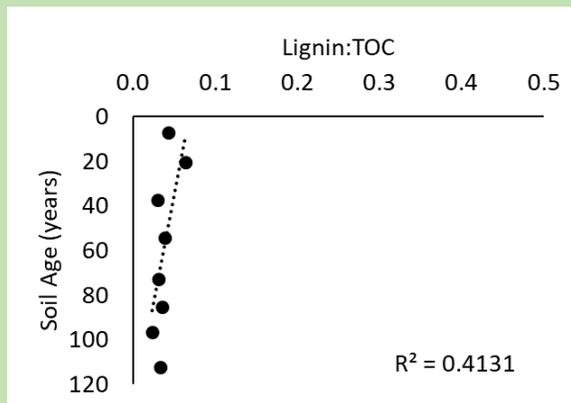
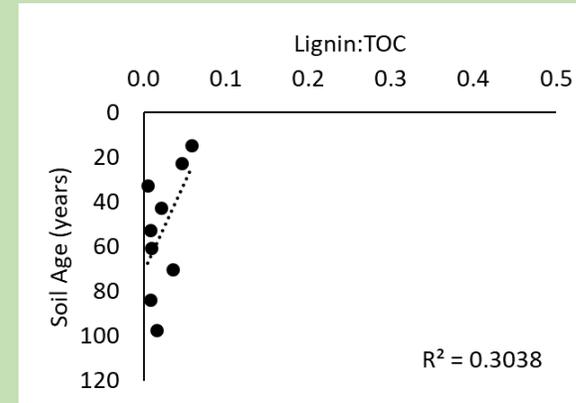
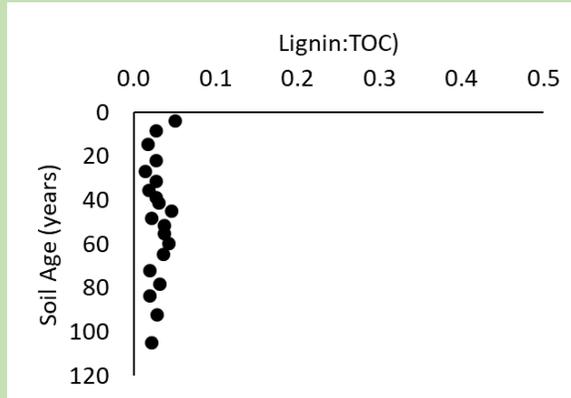
Surface:Depth

Lignin:TOC is constant or increases towards the surface suggesting little/no post-depositional change.

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*Tarpon Bay*

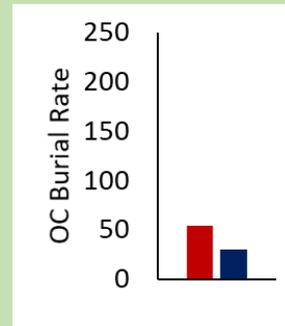
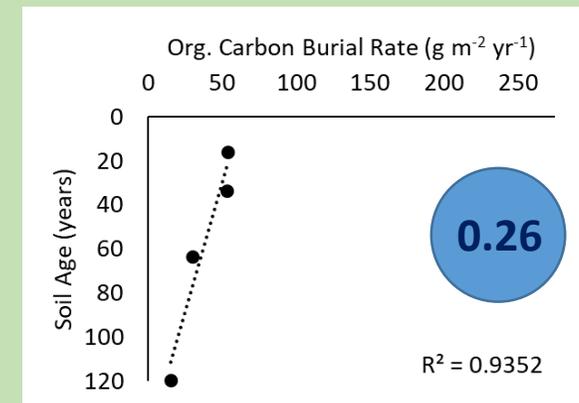
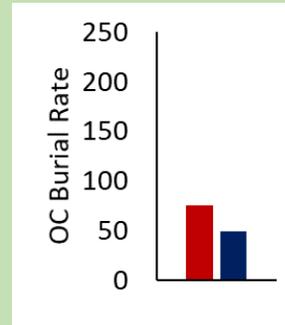
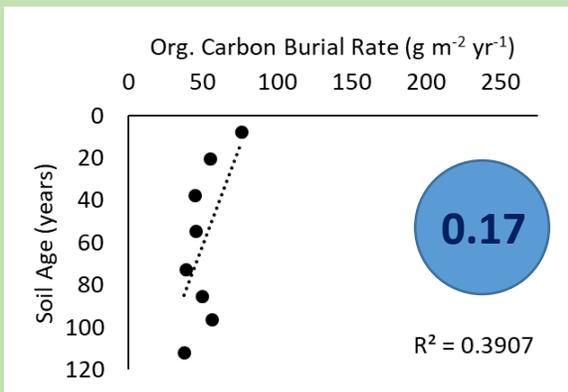
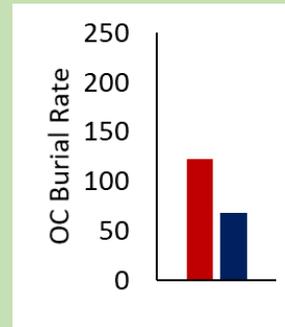
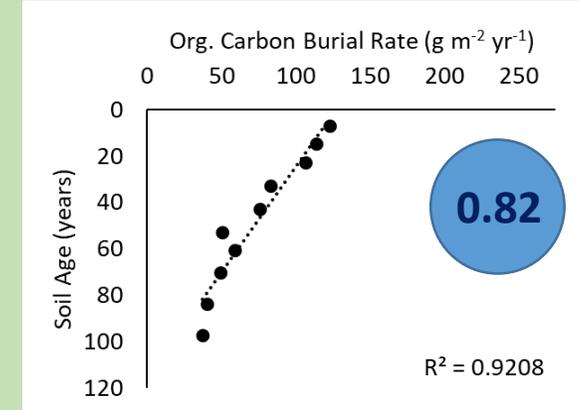
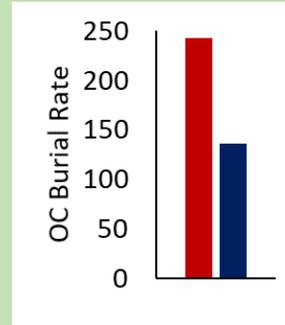
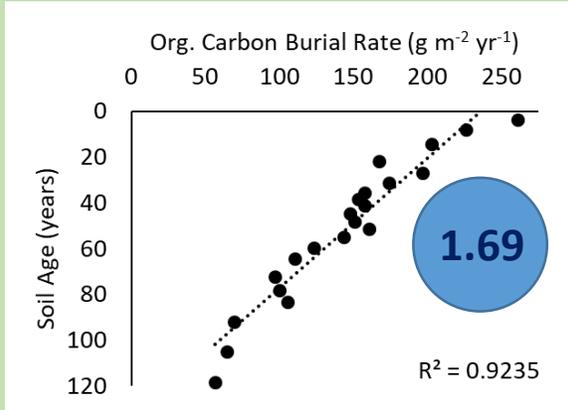
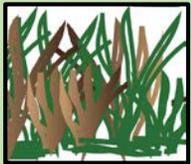


# Continued acceleration of OC burial will have important implications for regional C budget.

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*Tarpon Bay*



■ 10-yr avg.  
■ 100-yr avg.

**Acceleration**  
 $\text{g m}^{-2} \text{yr}^{-2}$

# Acknowledgements

South Florida Water Sustainability and Climate Grant:  
EAR-1204079

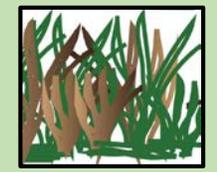
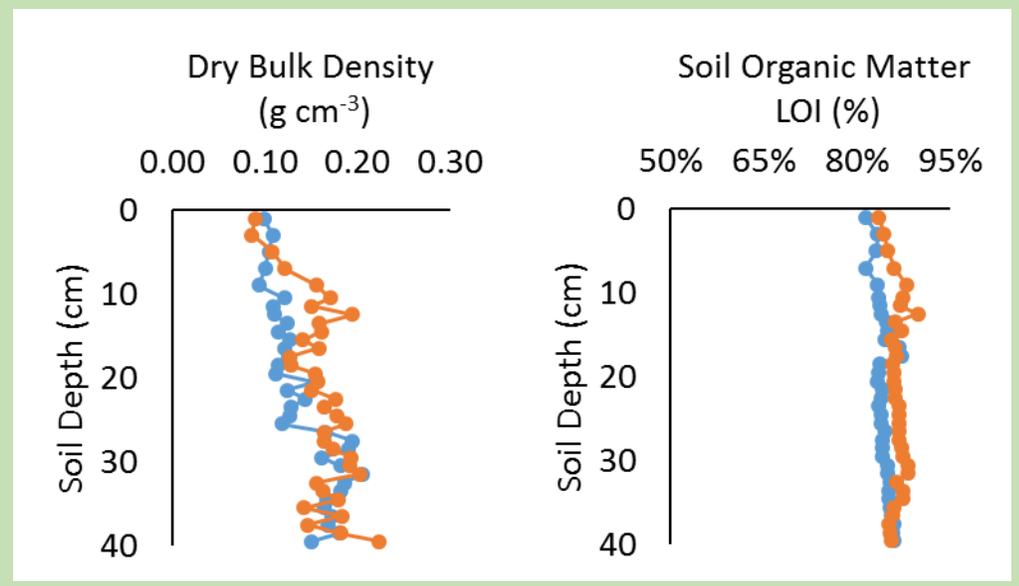
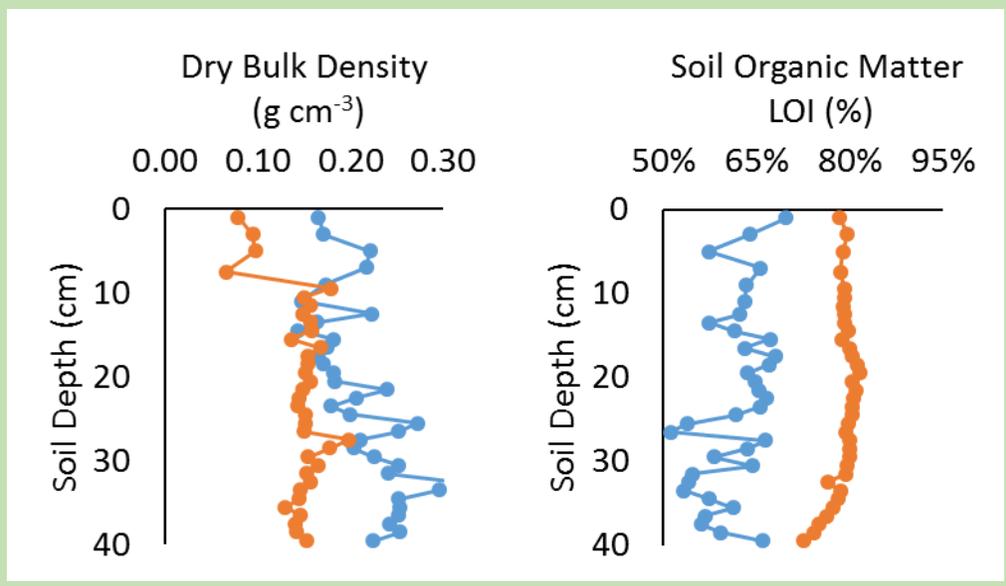
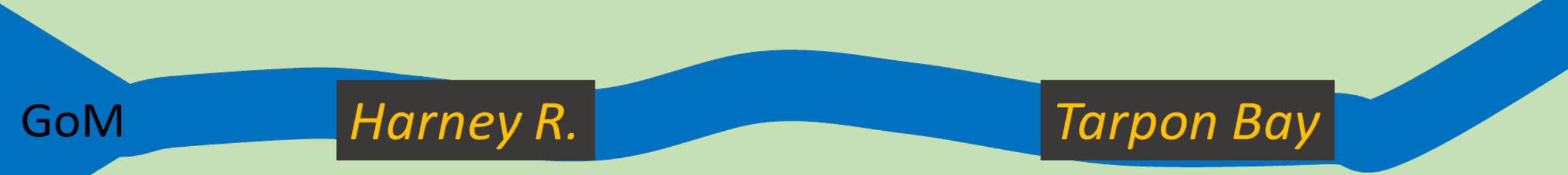


U.S. EPA STAR Fellowship Assistance Agreement: F13B20216

University of Central Florida  
Post-doctoral Funding



Rates of change cannot be inferred without a dating method of some kind. Neither LOI or DBD profiles suggest increases in the surface layers without an age-depth understanding.

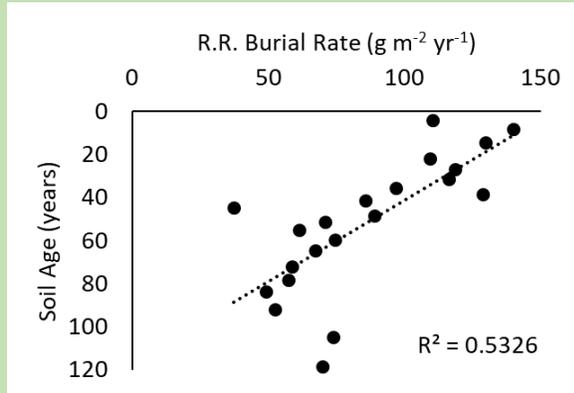


Mineral burial rates  $[1-(\text{SOM}+\text{CaCO}_3)]$  indicate increased allochthonous deposition.

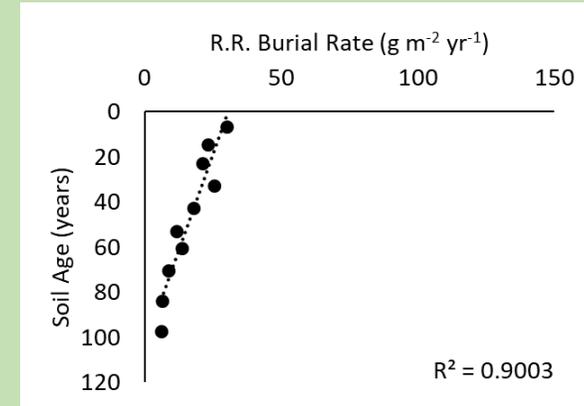
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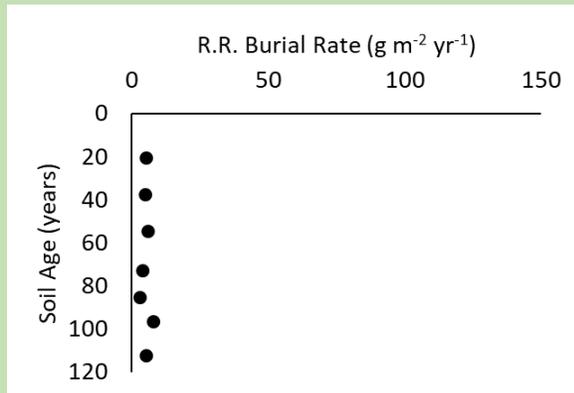
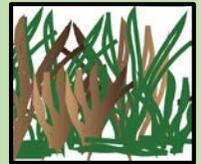
*Tarpon Bay*



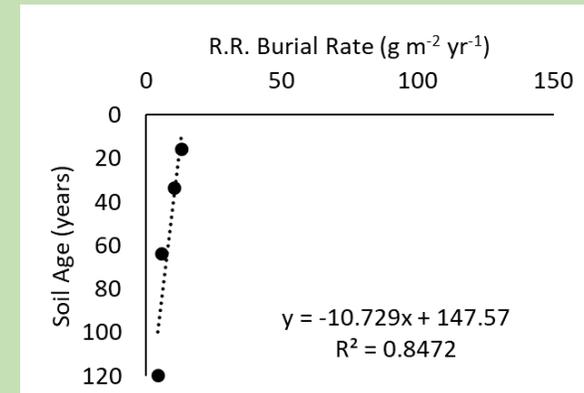
0.71



0.21



0.00



0.05

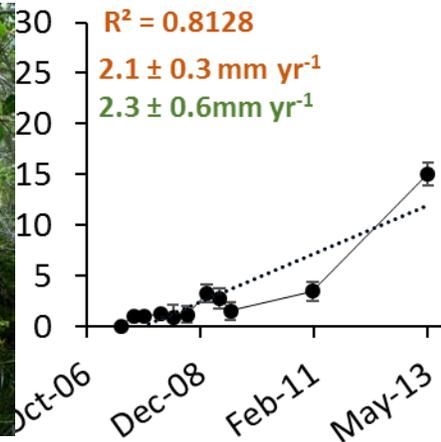
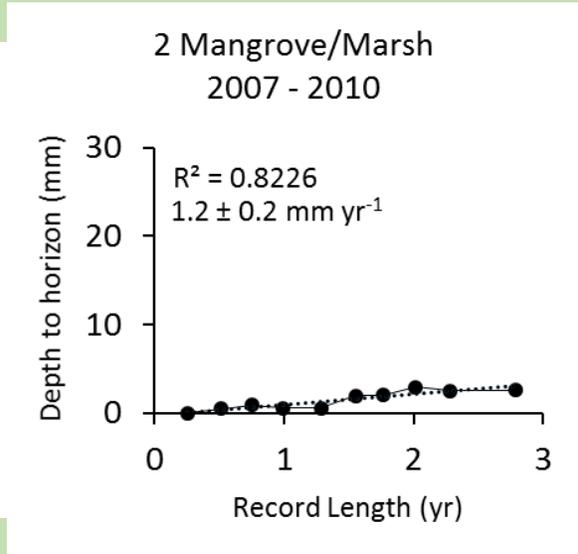
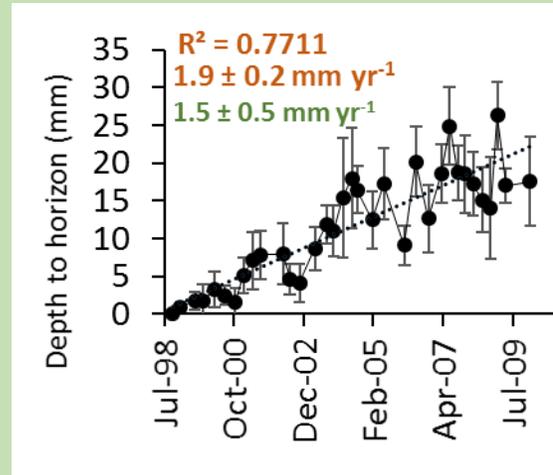
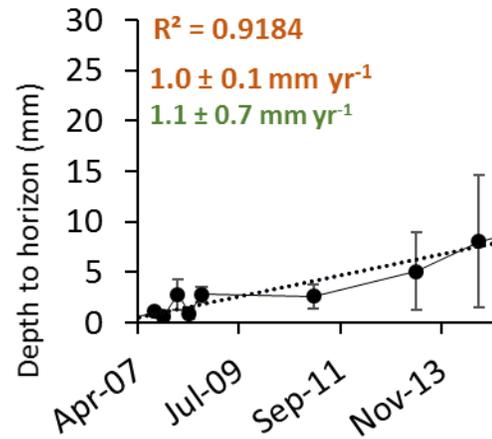
Acceleration  
 $\text{g m}^{-2} \text{yr}^{-2}$

# $^{210}\text{Pb}$ and Marker Horizons

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*Harney R.*

*Tarpon Bay*



Feher, L.C., Osland, M.J., and Anderson, G.H., 2017, Everglades National Park sediment elevation and marker horizon data release: U.S. Geological Survey data release, <https://doi.org/10.5066/F7348HNP>.



# Nutrient ratios

