

Comparison of Sediment Accumulation and Accretion in Impounded and Unimpounded Marshes of the Delaware Estuary

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Delaware Estuary Science & Environmental
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Questions

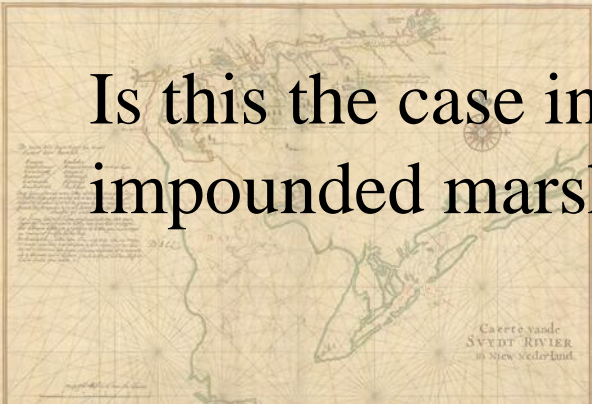
**Marshes migrate
landward and upward
through periods of sea
level rise...**

Is the case in
unimpounded marshes of
Delaware?

Is this the case in
impounded marshes?



Sommerfield and Walsh unpublished data



Outline

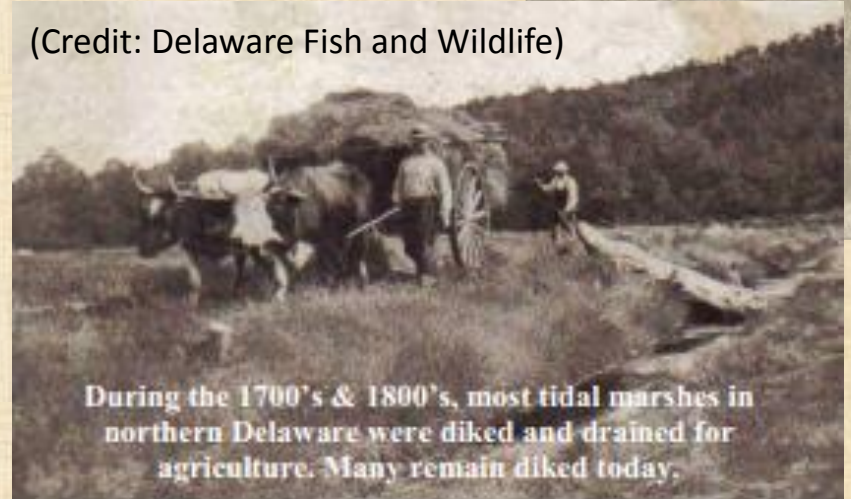
- Impounded Marshes
- Accumulation and Accretion Conceptual Model
- Accumulation and Accretion Rates
- Conclusions



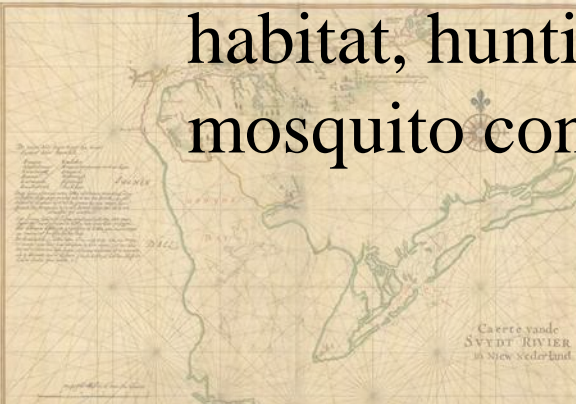
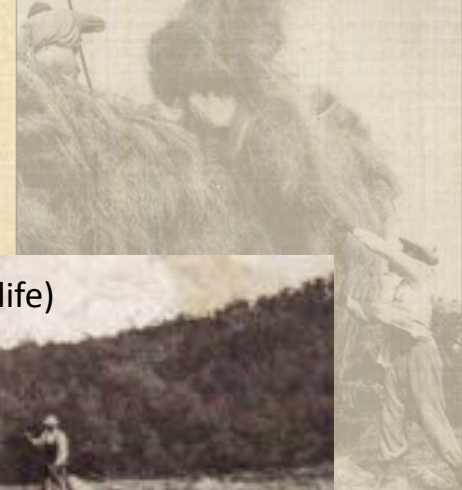
Impoundments

- Tidal restriction
- 12,000 – 15,000 acres in Delaware
- Salt hay farming dating back to 1600s
- Currently, managed for multiple uses: waterfowl habitat, hunting, mosquito control

(Credit: Delaware Fish and Wildlife)



(Credit: Delaware Nature Society)



Sediment Accumulation and Accretion

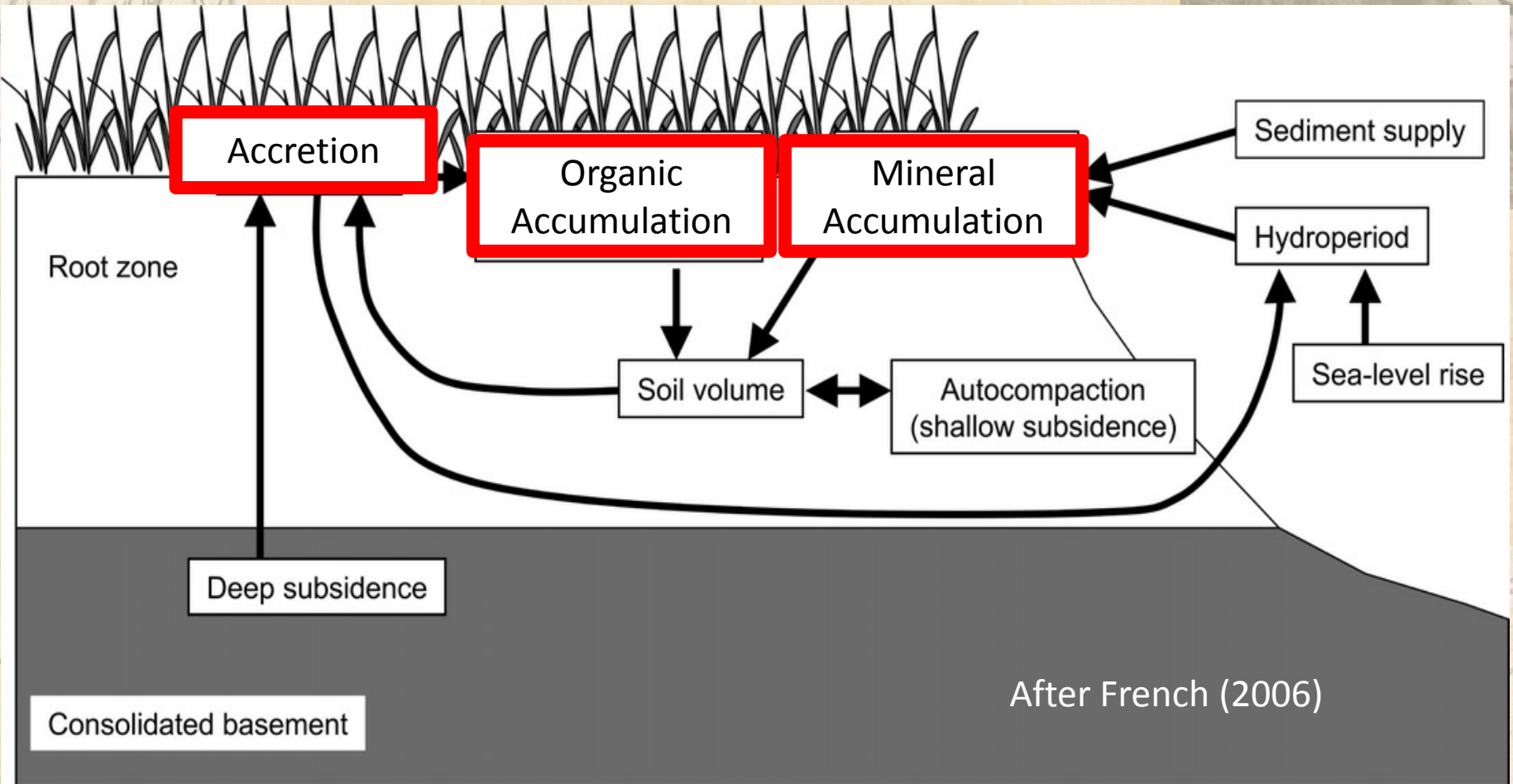
Spartina core from Nyman et al. 2006



Washed

Unwashed

Sediment Accumulation and Accretion

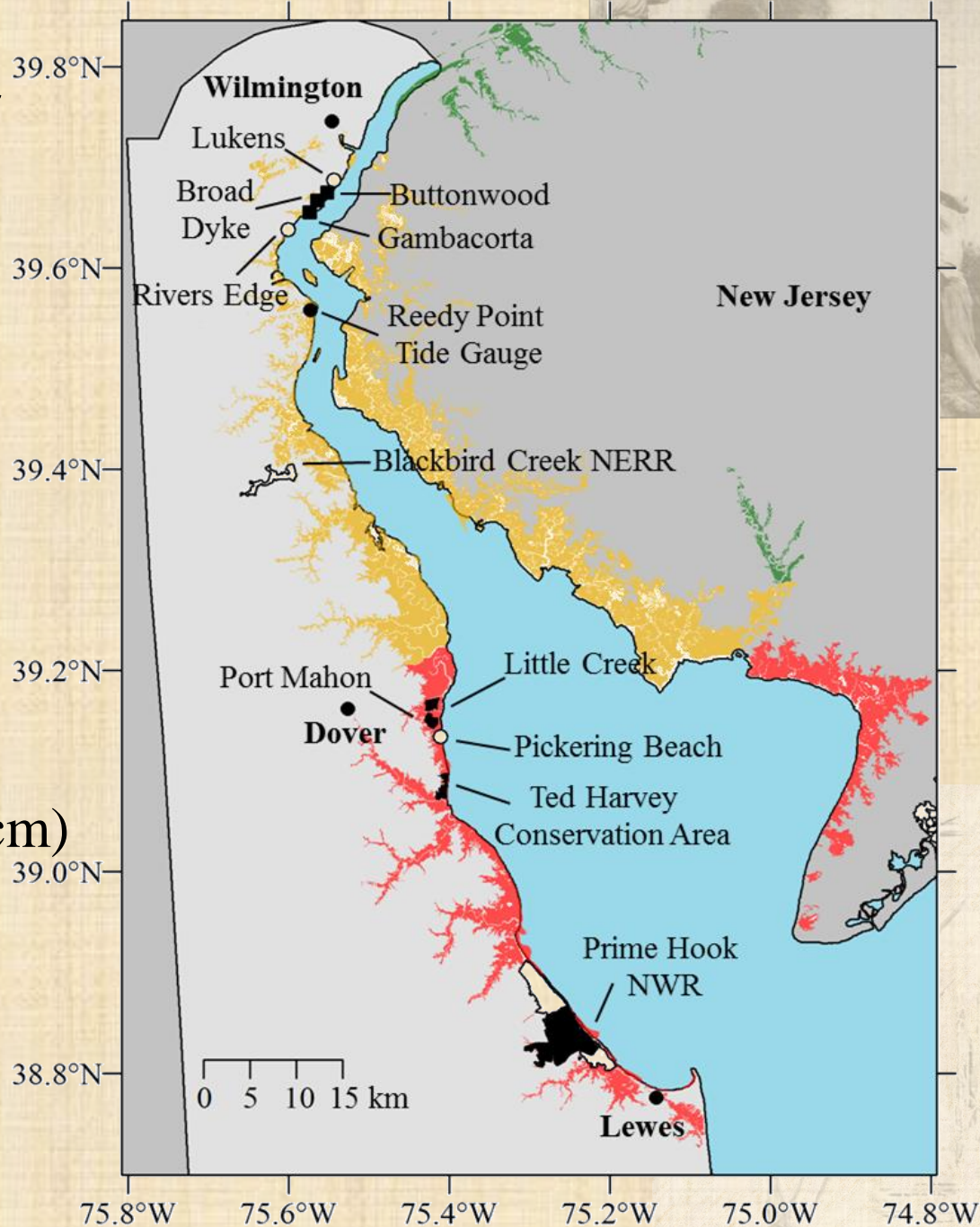


$$\text{Accretion} = \frac{MA_{org} + MA_{min}}{\text{Bulk Density}}$$

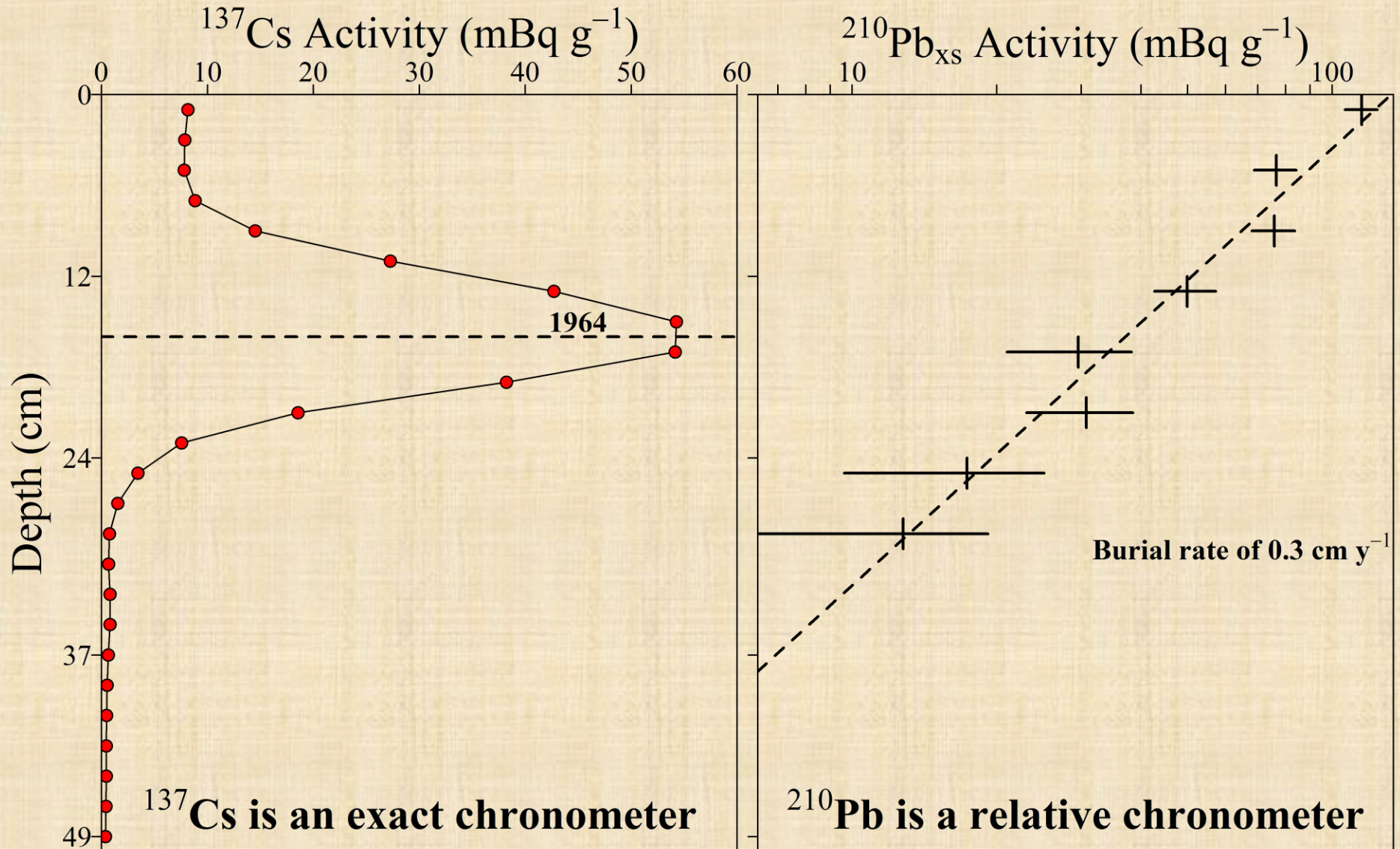
Study Site

Delaware Estuary

- 8 impounded marsh sites
- 6 unimpounded marsh sites
- 44 sediment cores (50 – 100 cm)

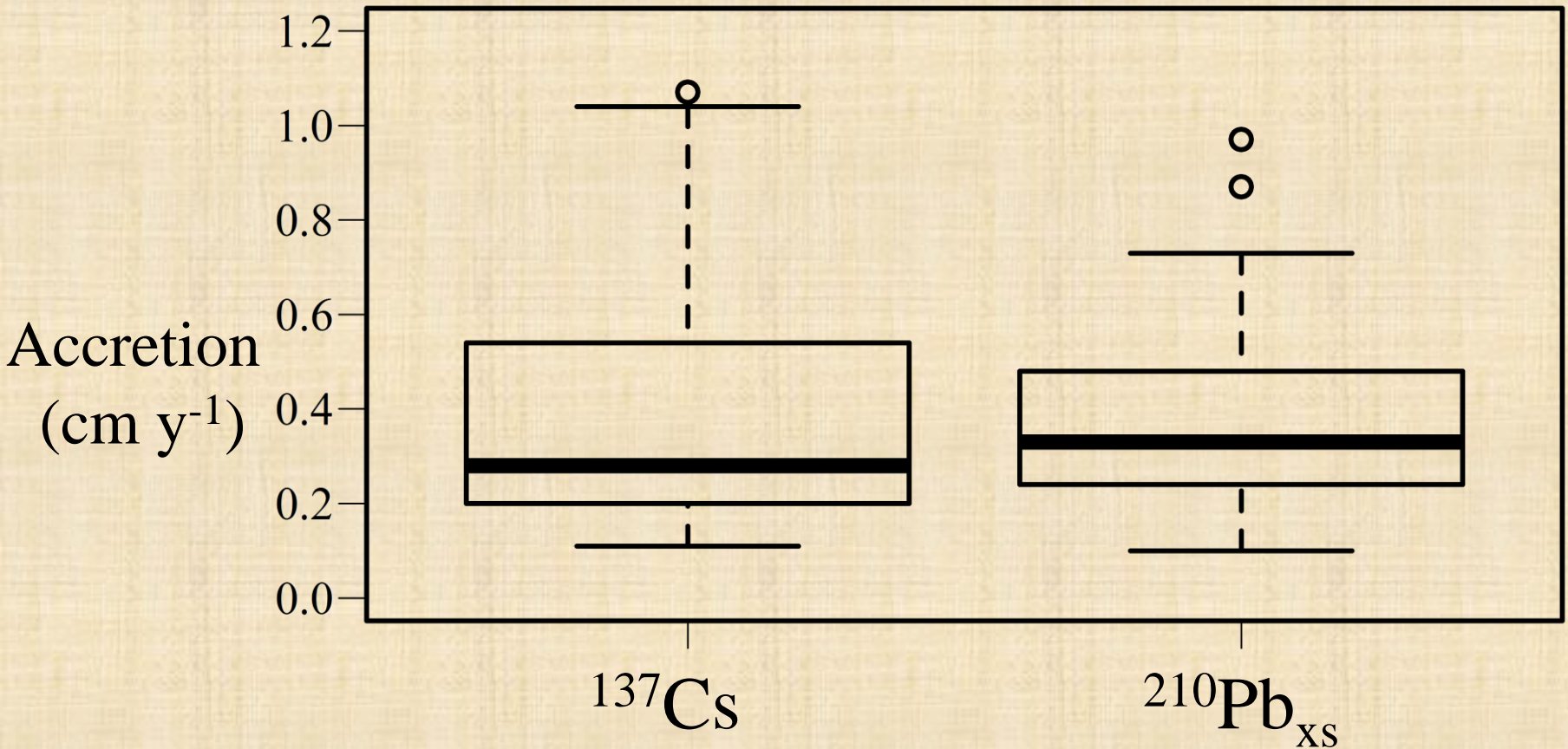


Radionuclide Properties



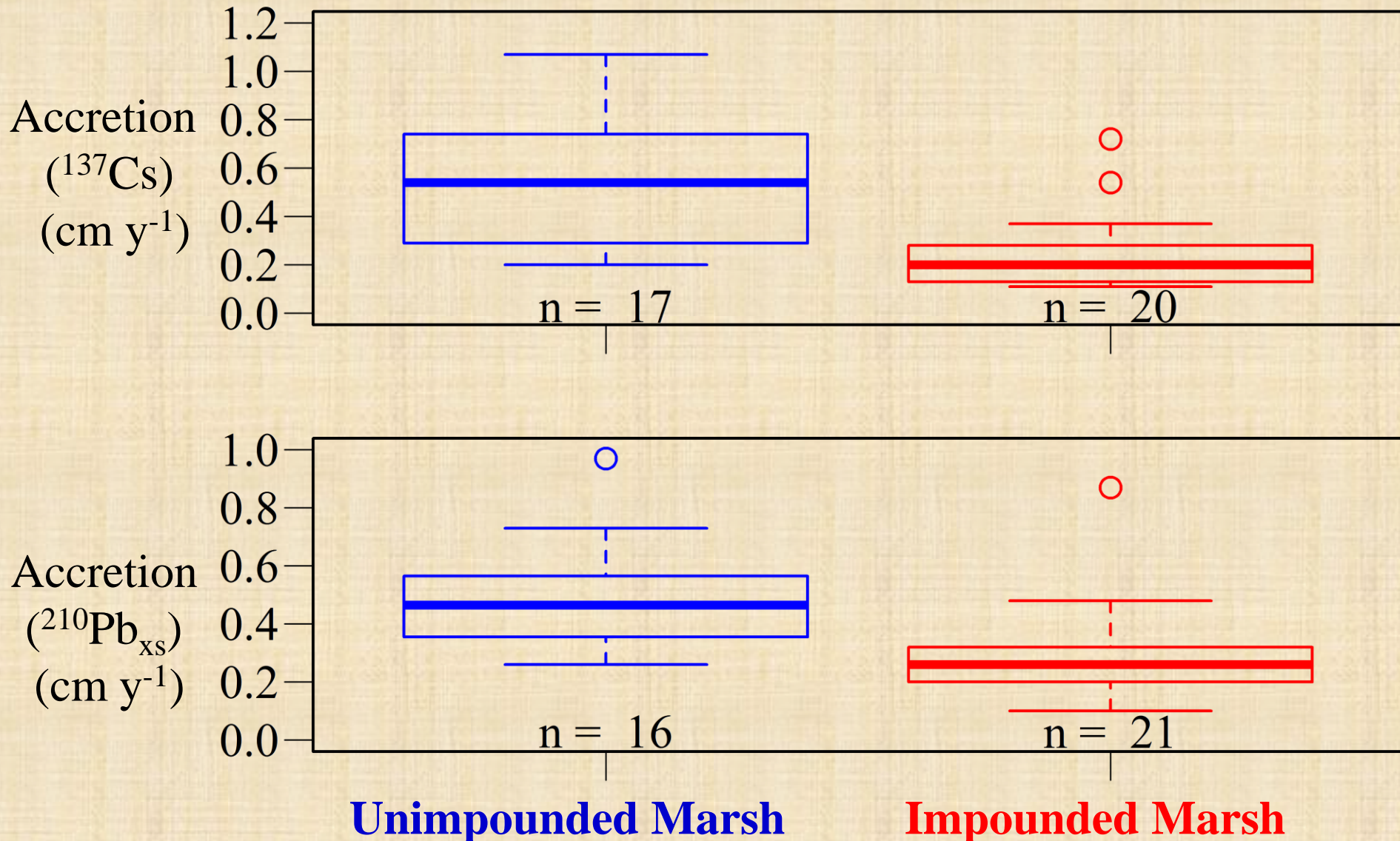
Ted Harvey Core 5

Comparison of ^{137}Cs and ^{210}Pb Methods

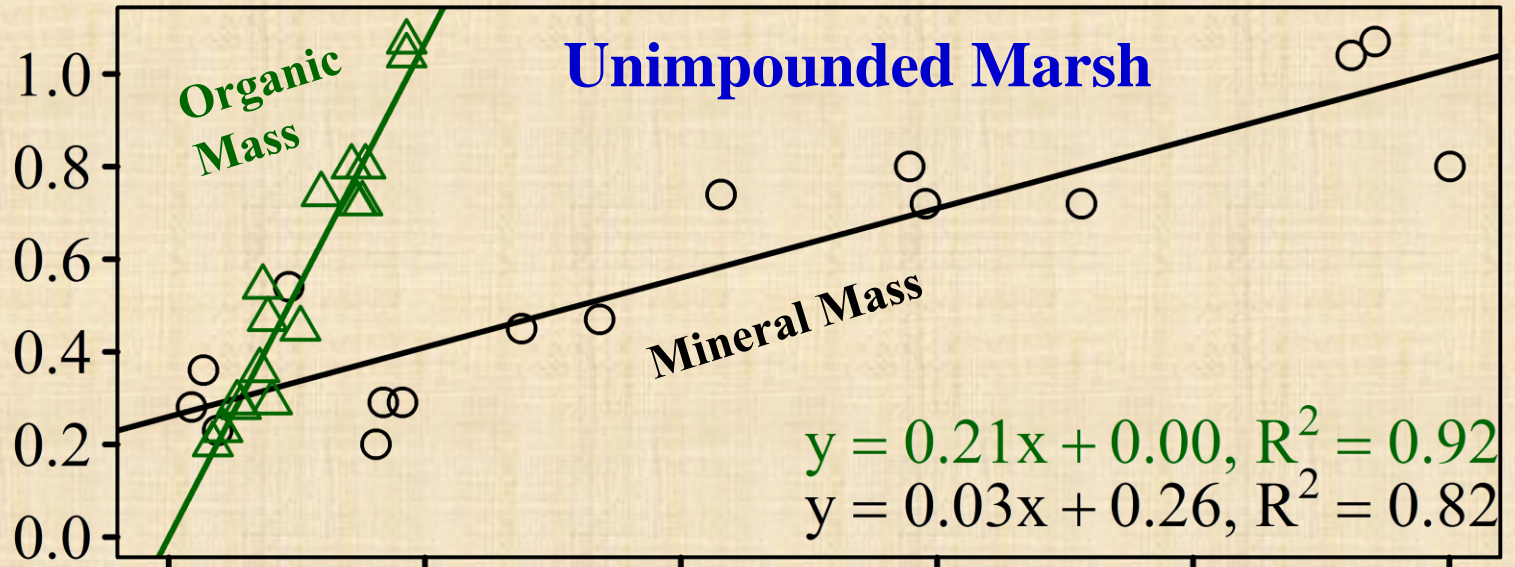


- $n = 37$ for both groups
- Supported by paired t-test, $p = 0.18$

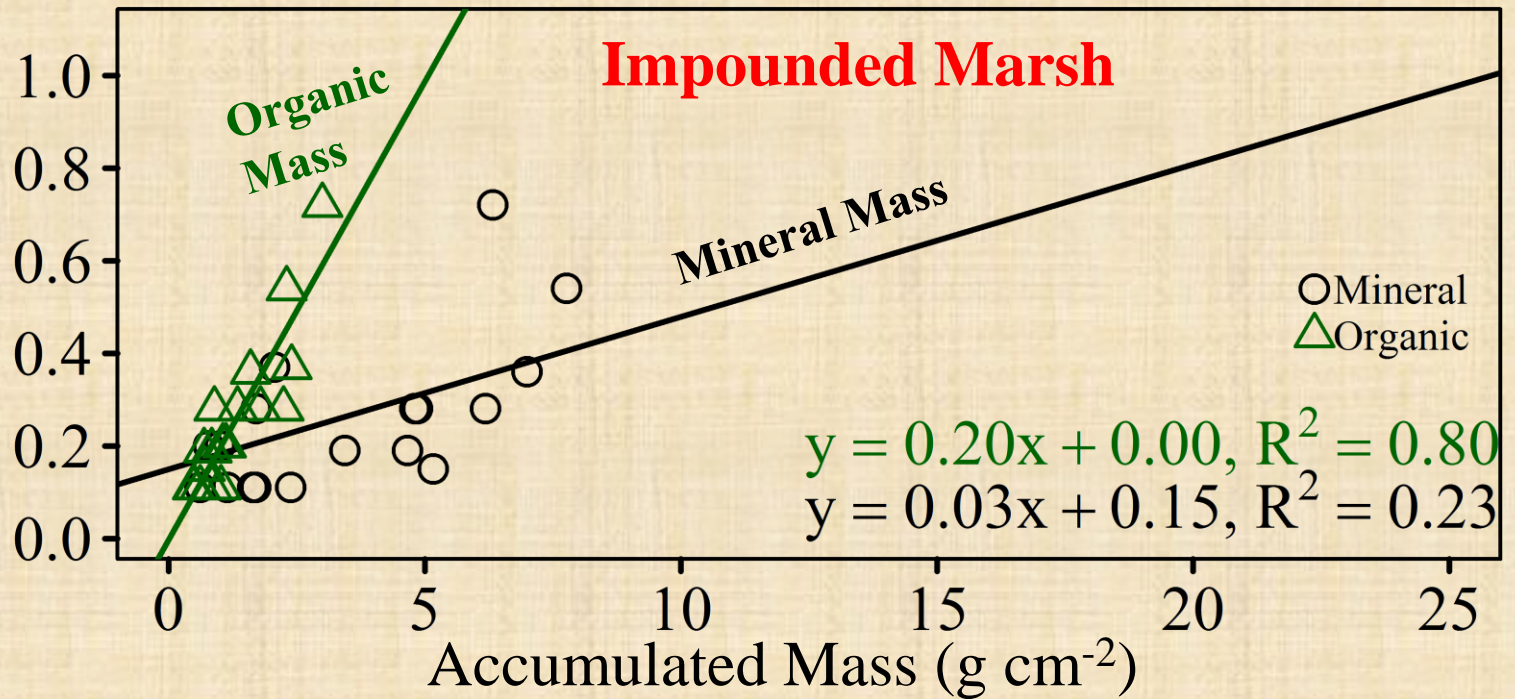
Accretion Rates



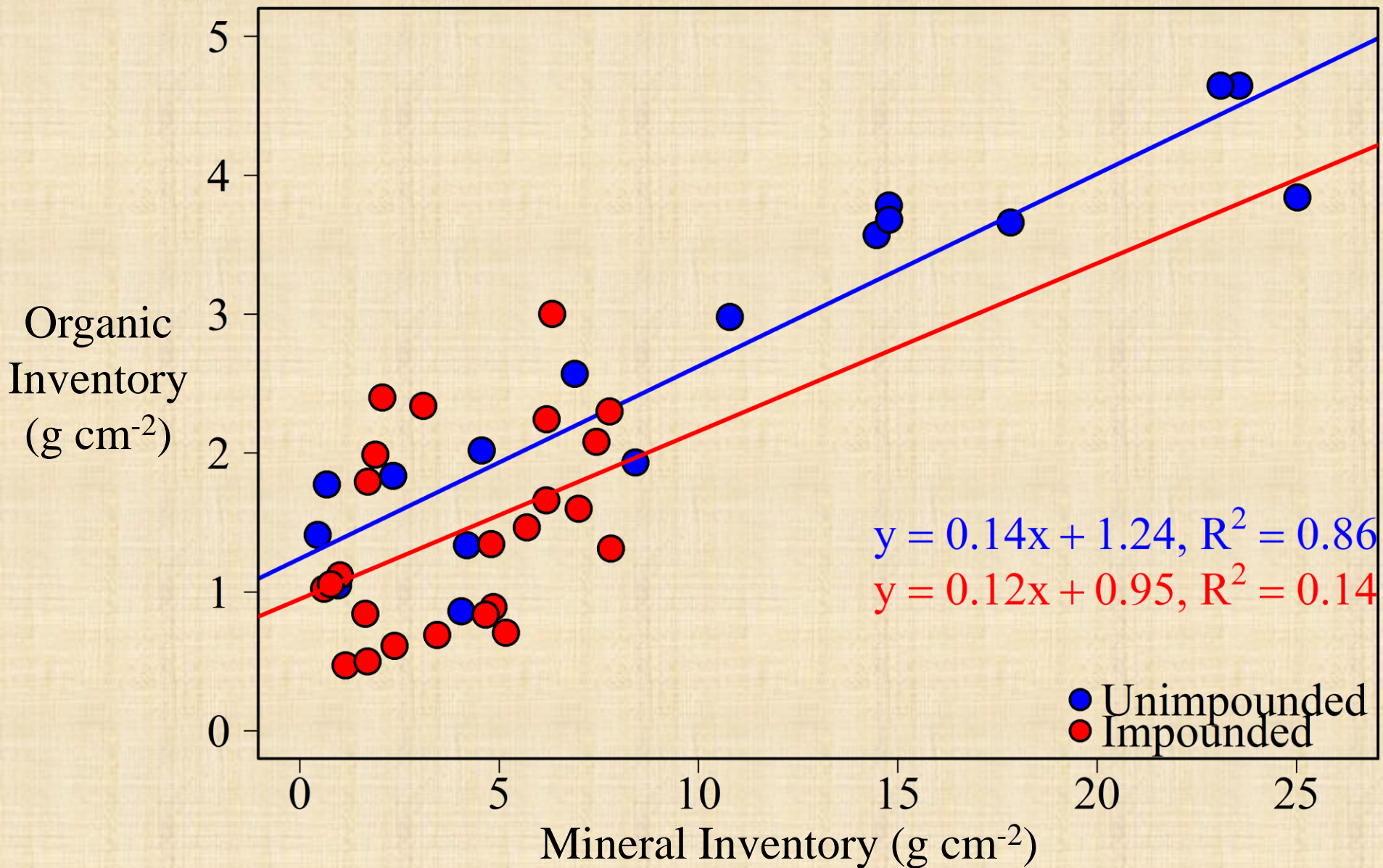
Contribution of Accumulation to Accretion



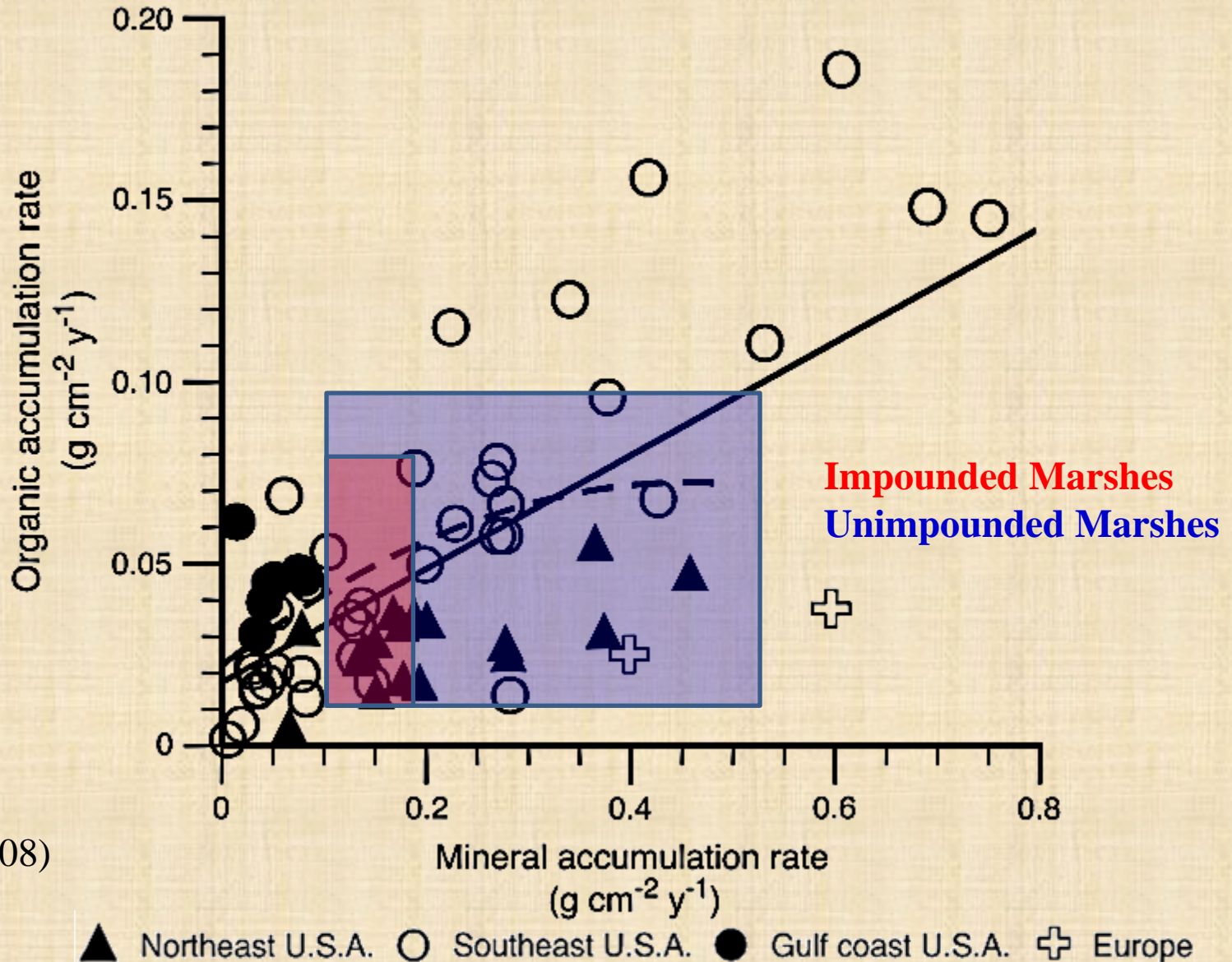
Accretion
(cm y⁻¹)



Contribution of Accumulation to Accretion

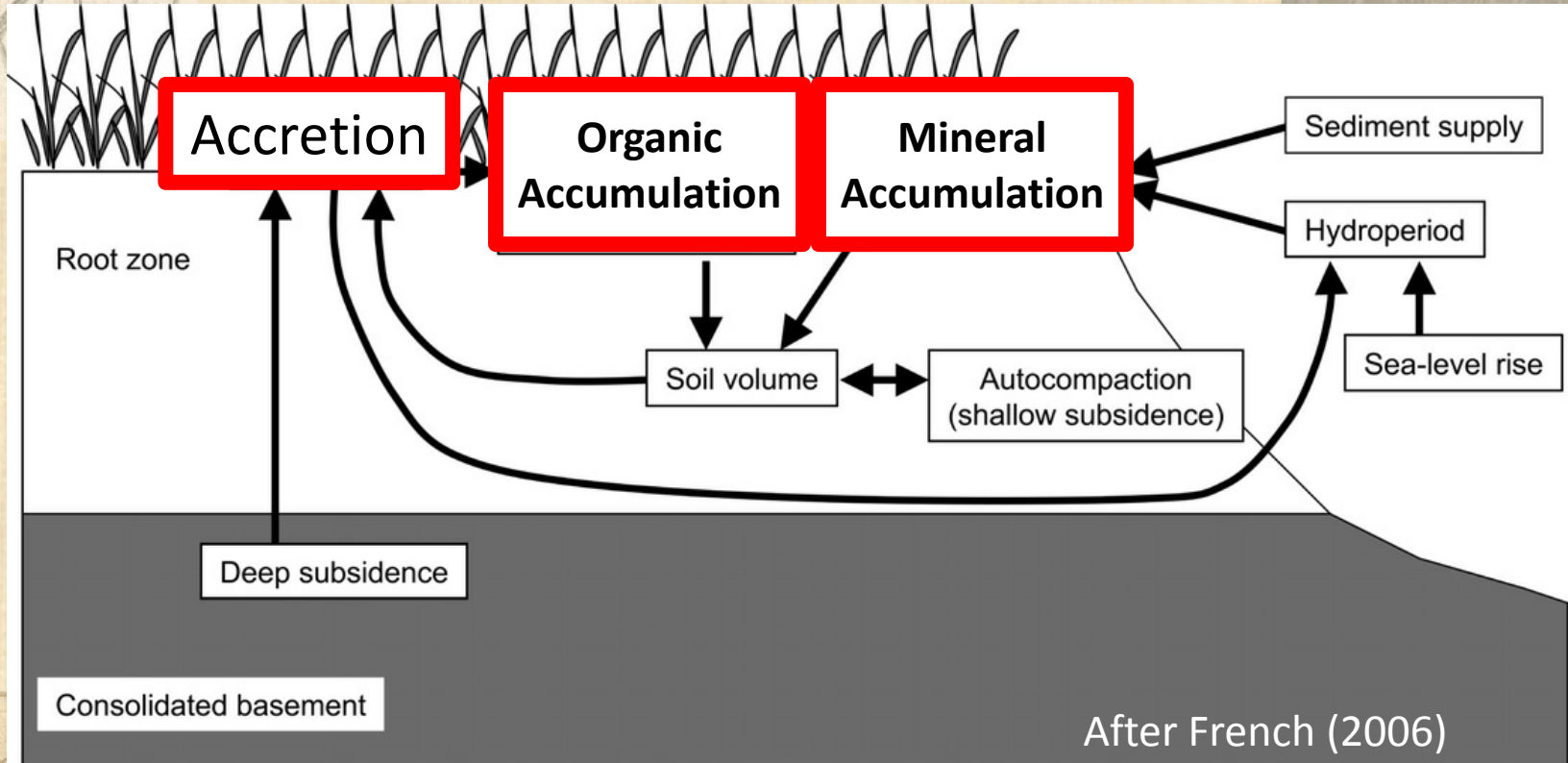


How do Delaware Rates Compare?



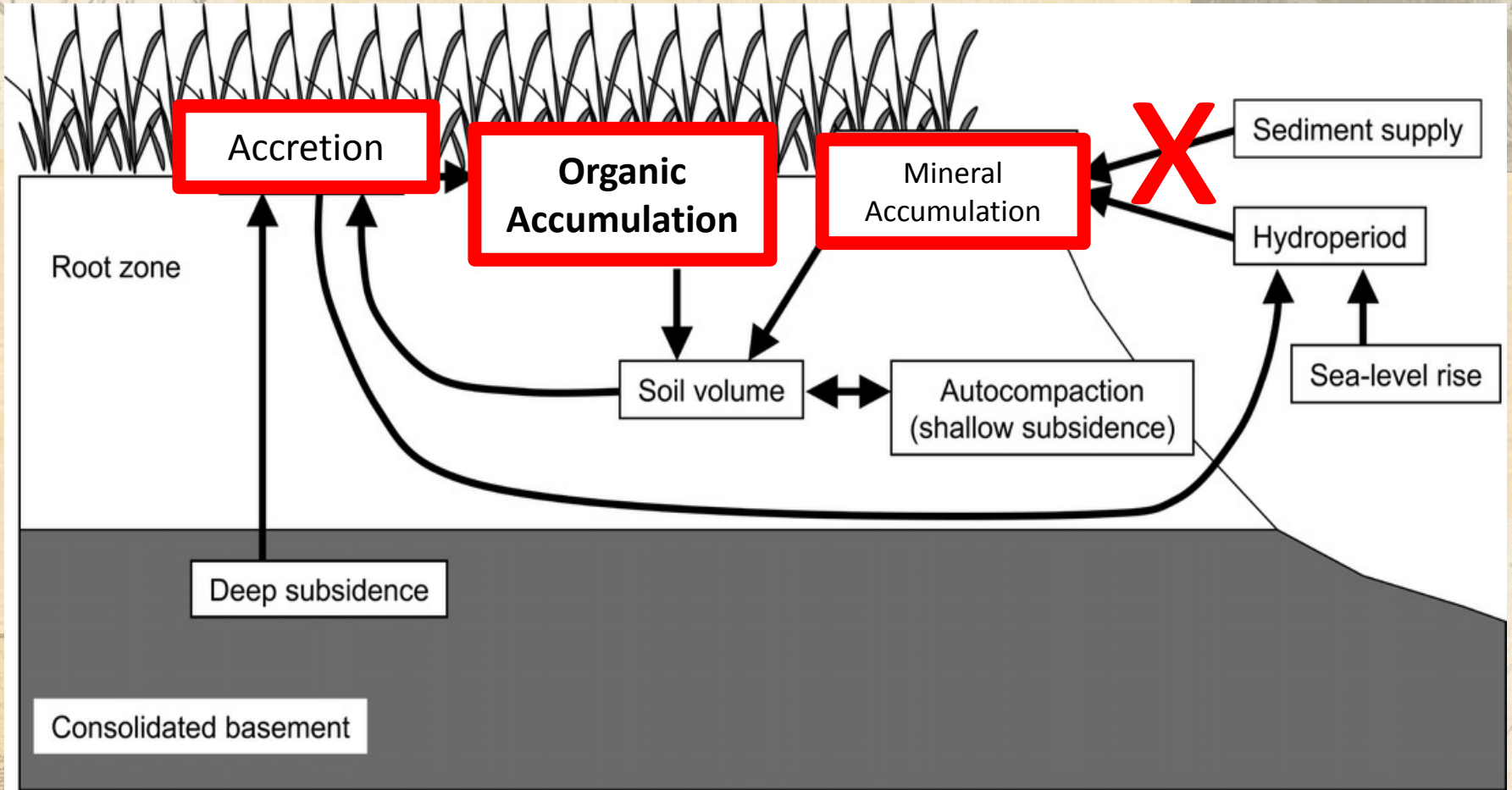
Neubauer (2008)

Unimpounded Marsh Interpretation



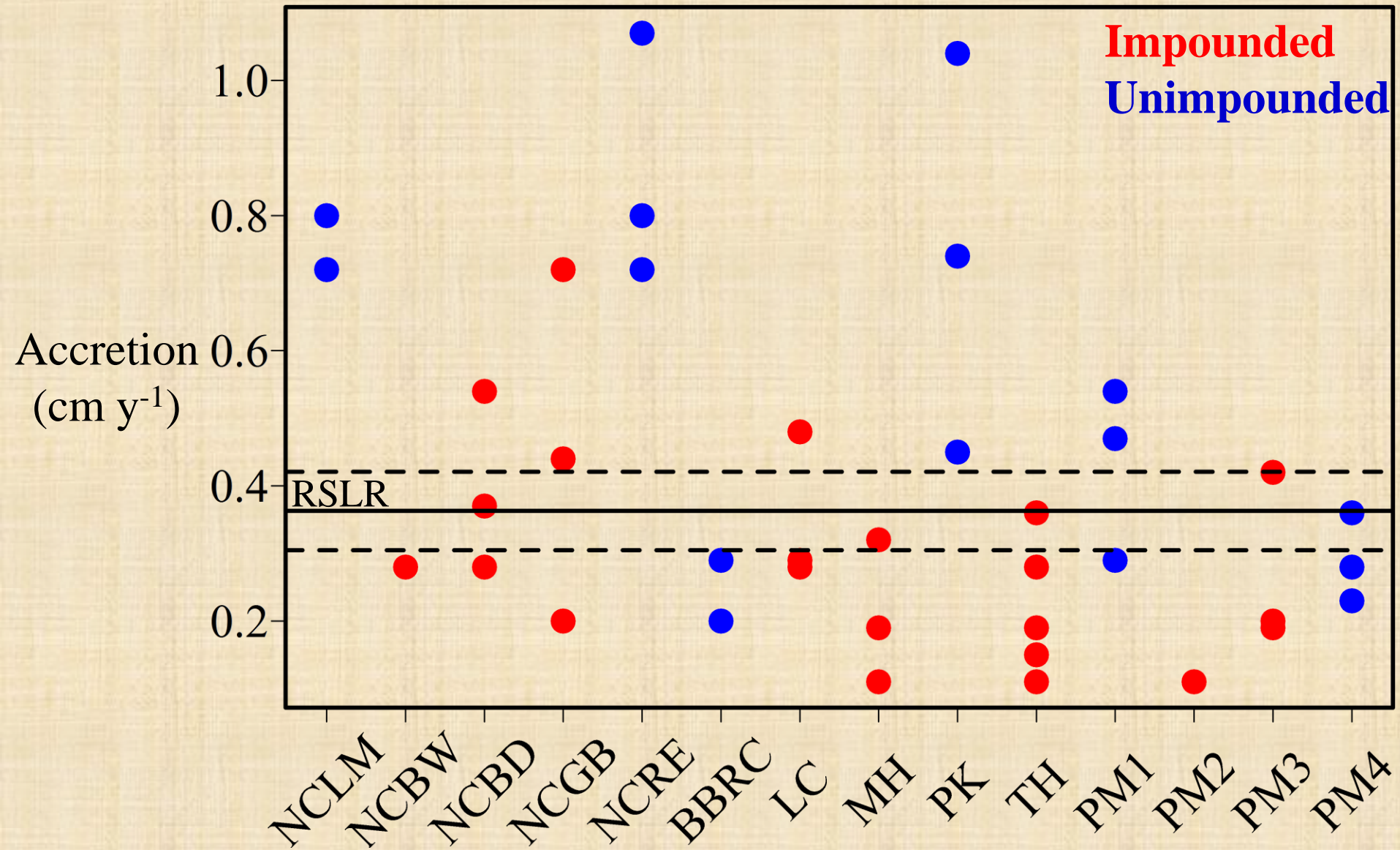
“...marsh soil indicates a gradual formation from the grasses, aided by the fine, rich sediment..” (Mudge 1862)

Impounded Marsh Interpretation



Mineral sediment deficit compared to tidal marshes

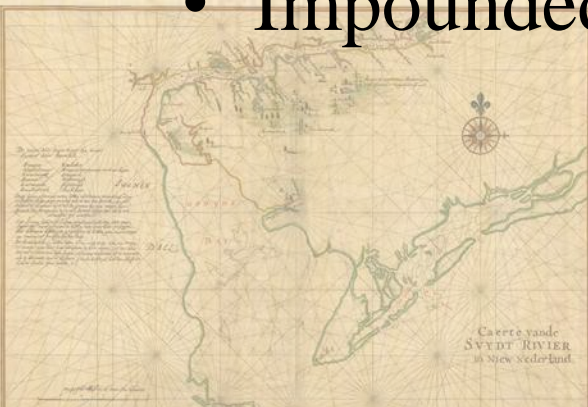
Accretion and Sea Level Rise



- Sea level rise trend from NOAA Reedy Point tide gauge (3.63 ± 0.58 mm/yr)

Conclusions

- ^{137}Cs and ^{210}Pb methods agree
- Accretion rates similar to other coastal marshes
- Impounded marsh accretion limited by mineral accumulation
- Rates lower in impounded marshes
- Impounded marshes are at risk of inundation



Acknowledgements

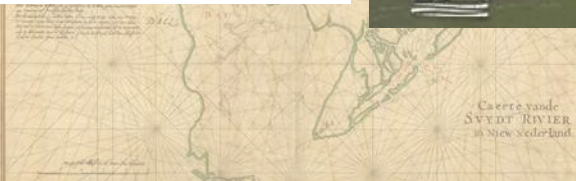


DNREC DCP/DNERR

- Dr. Bob Scarborough
- Bart Wilson
- Drexel Siok
- Christina Pinkerton
- Kenneth Smith



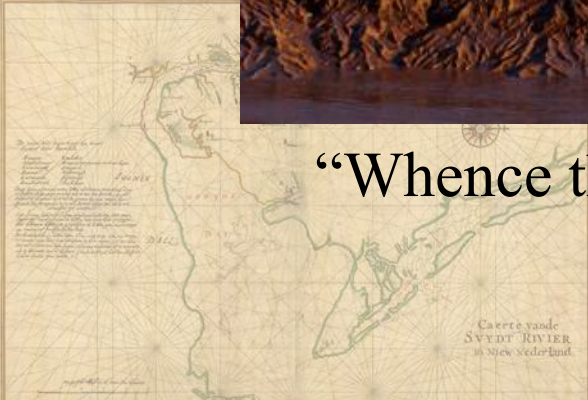
NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM



Sediment Accumulation and Accretion



“Whence then comes this great store of rich mud?”
(Ganong 1903)



Questions?



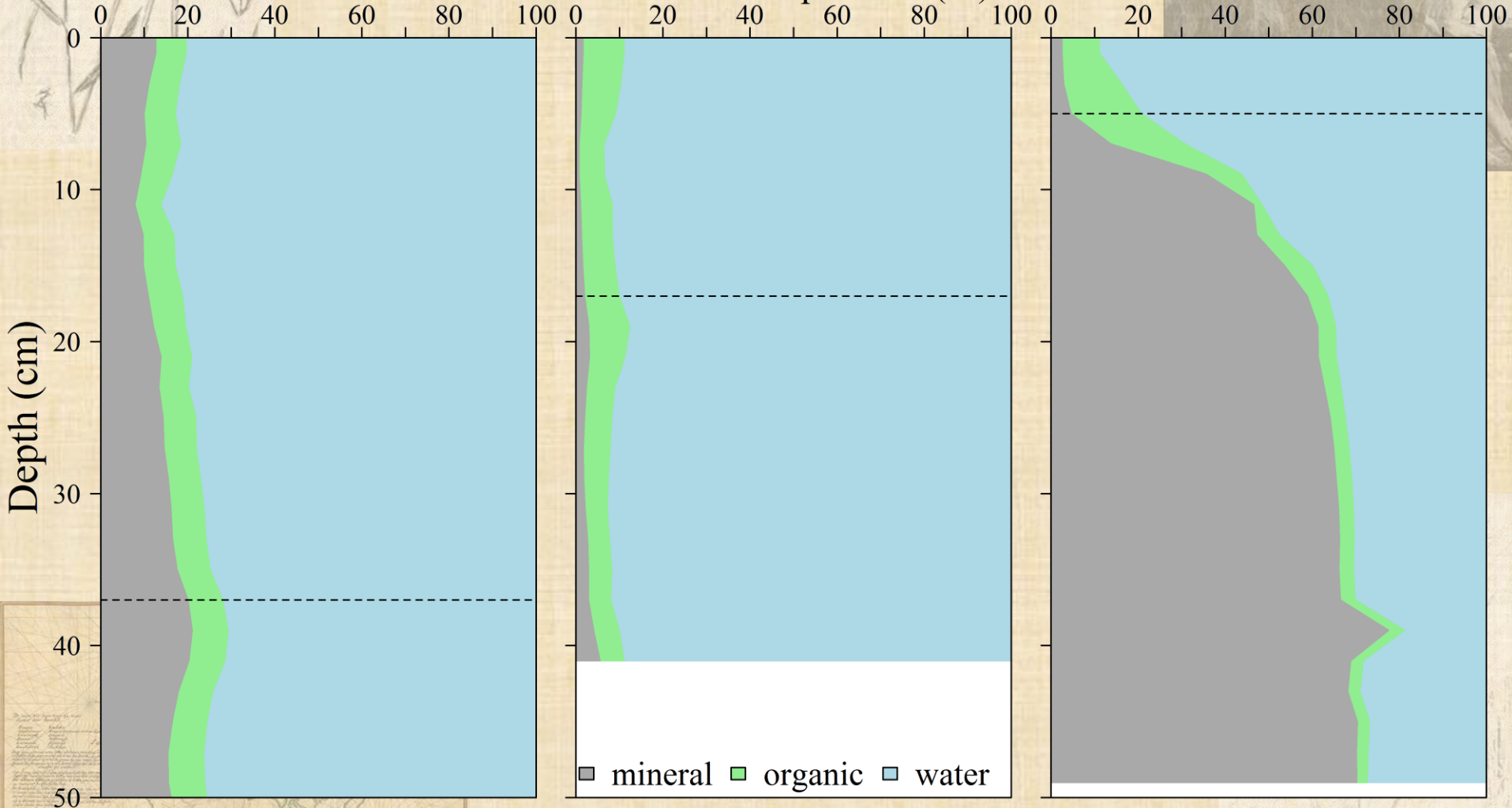
Physical Properties

Riveredge Core 2

Prime Hook Core 10

Prime Hook Core 4

Volume Composition (%)



Water content determined gravimetrically and organic content determined via LOI

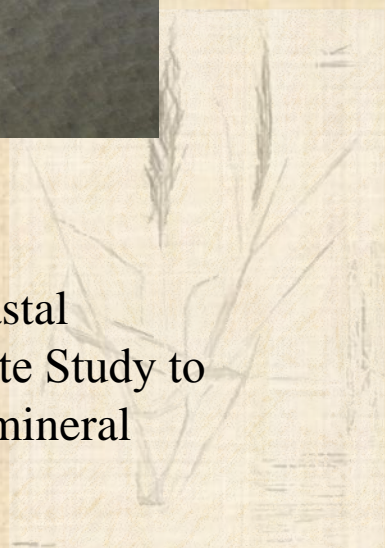


Credit: US FWS/ Prime Hook NWR

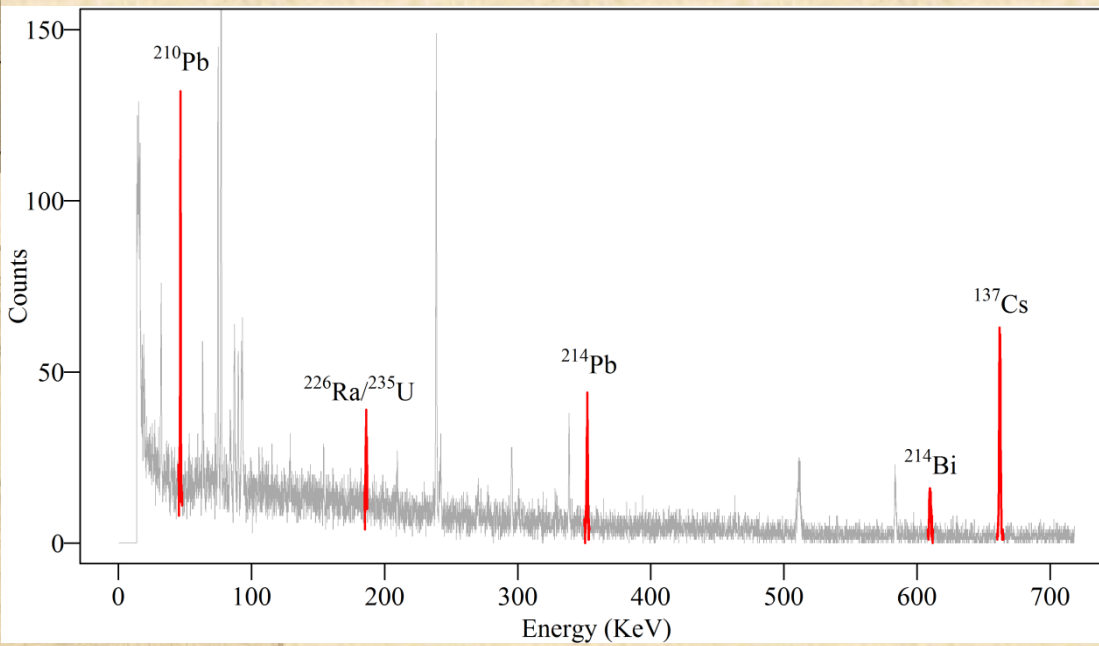
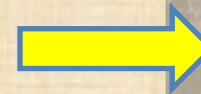
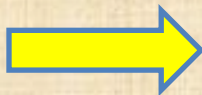


Purpose

Expand on the goals of DNREC Delaware Coastal Program's Coastal Impoundment Accretion Rate Study to address the specific influences of organic and mineral sediment accumulation



Gamma Ray Spectroscopy



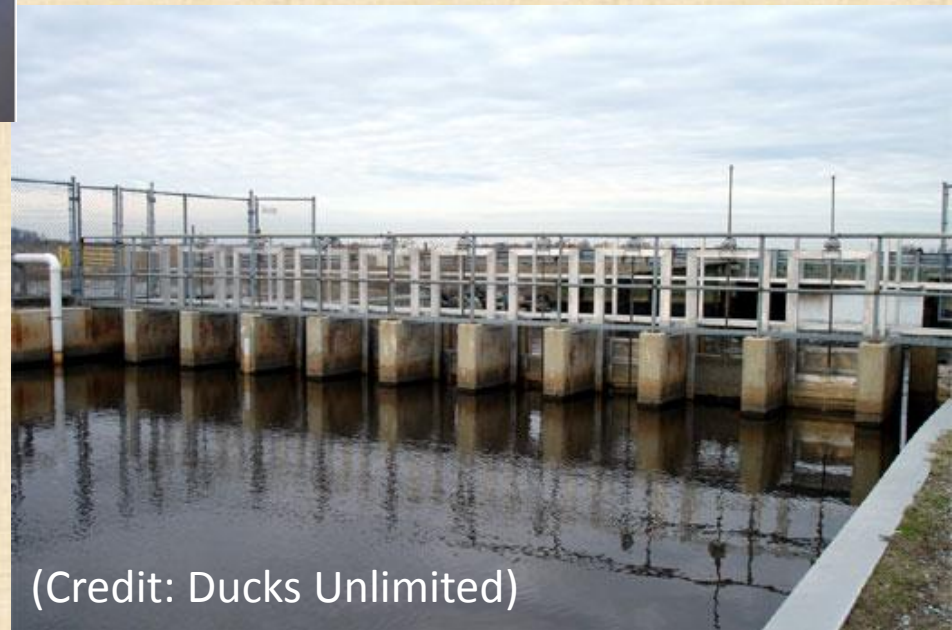
Impoundments



Broad Dyke Marsh water control structure



(Credit: Delaware Mosquito Control)



(Credit: Ducks Unlimited)



(Credit: Ducks Unlimited)
Weir-style water control structure
at Prime Hook NWR

Physical Properties

