Soil Elevation-dependent soil accretion: Implications for tree island persistence in the Water Conservation Area 3

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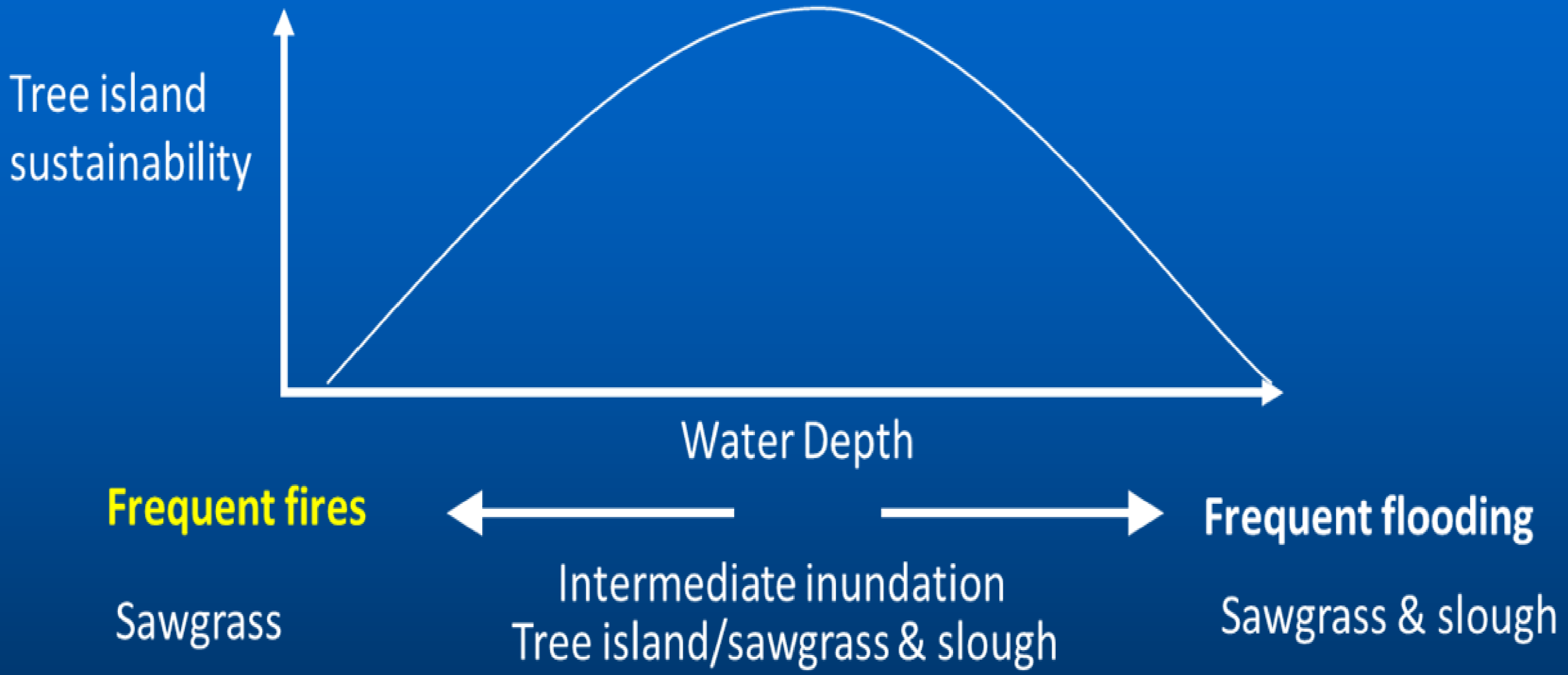
Subsidy – Stress Hypothesis (E.P. Odum)



We are testing the hypothesis that periodically flooded environments generally have higher soil accretion and positive elevation change than either dry or permanent flooded environments.

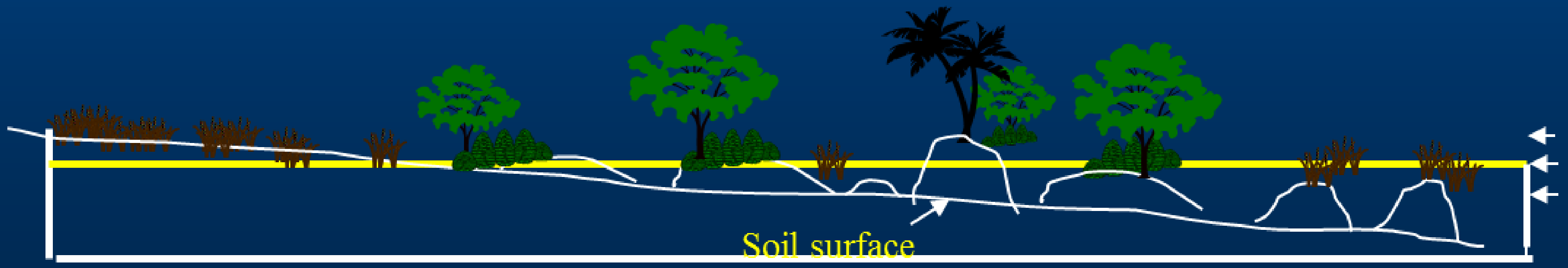
Research Goals

This presentation highlights the effects of changes in hydroperiod on soil accretion and elevation on tree islands experiencing contrasting hydropatterns.

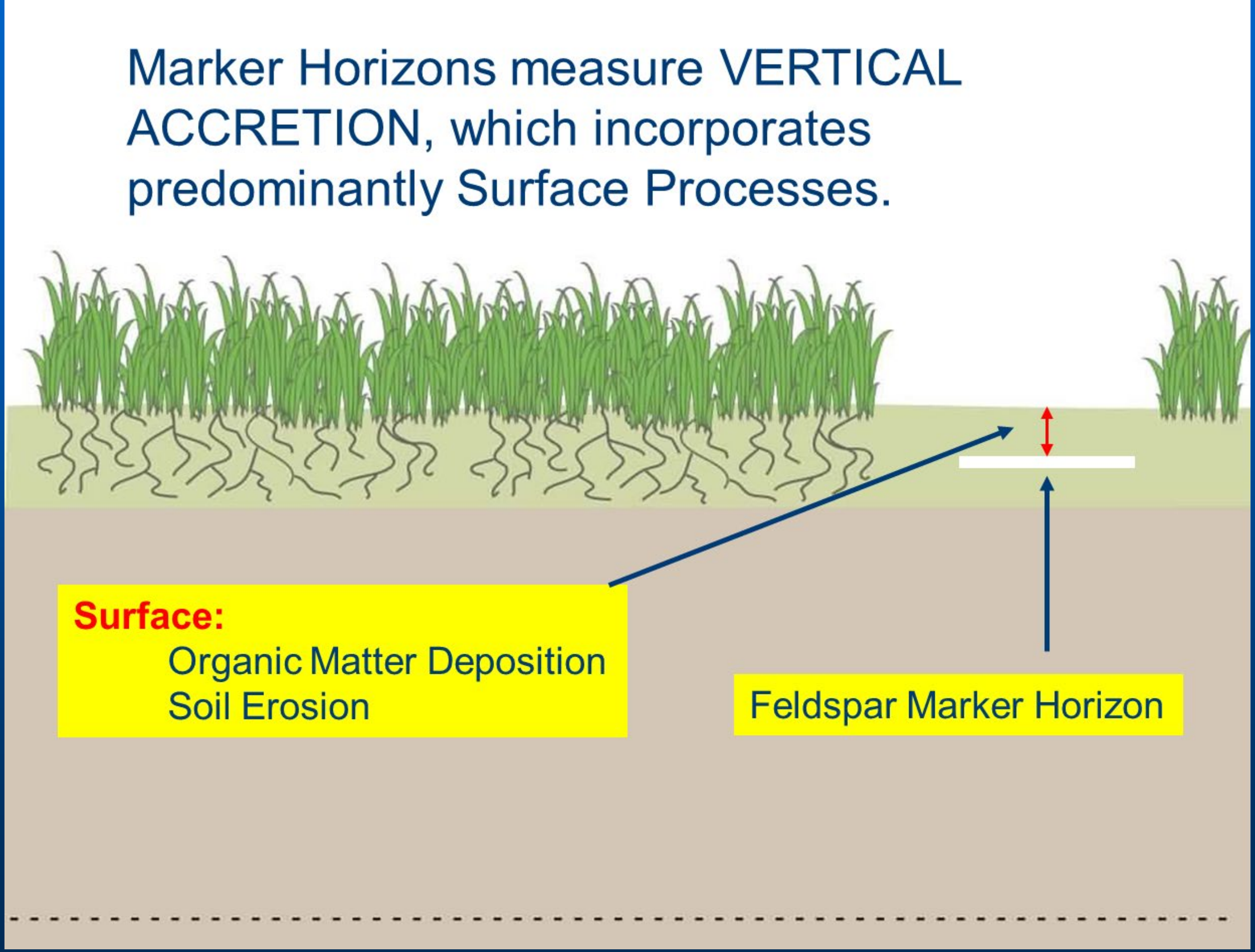
The main questions are:

a) Are tree islands in equilibrium with increasing water levels?

b) Do they accrete material and gain elevation at rates that allow tree islands to experience less frequent inundation?

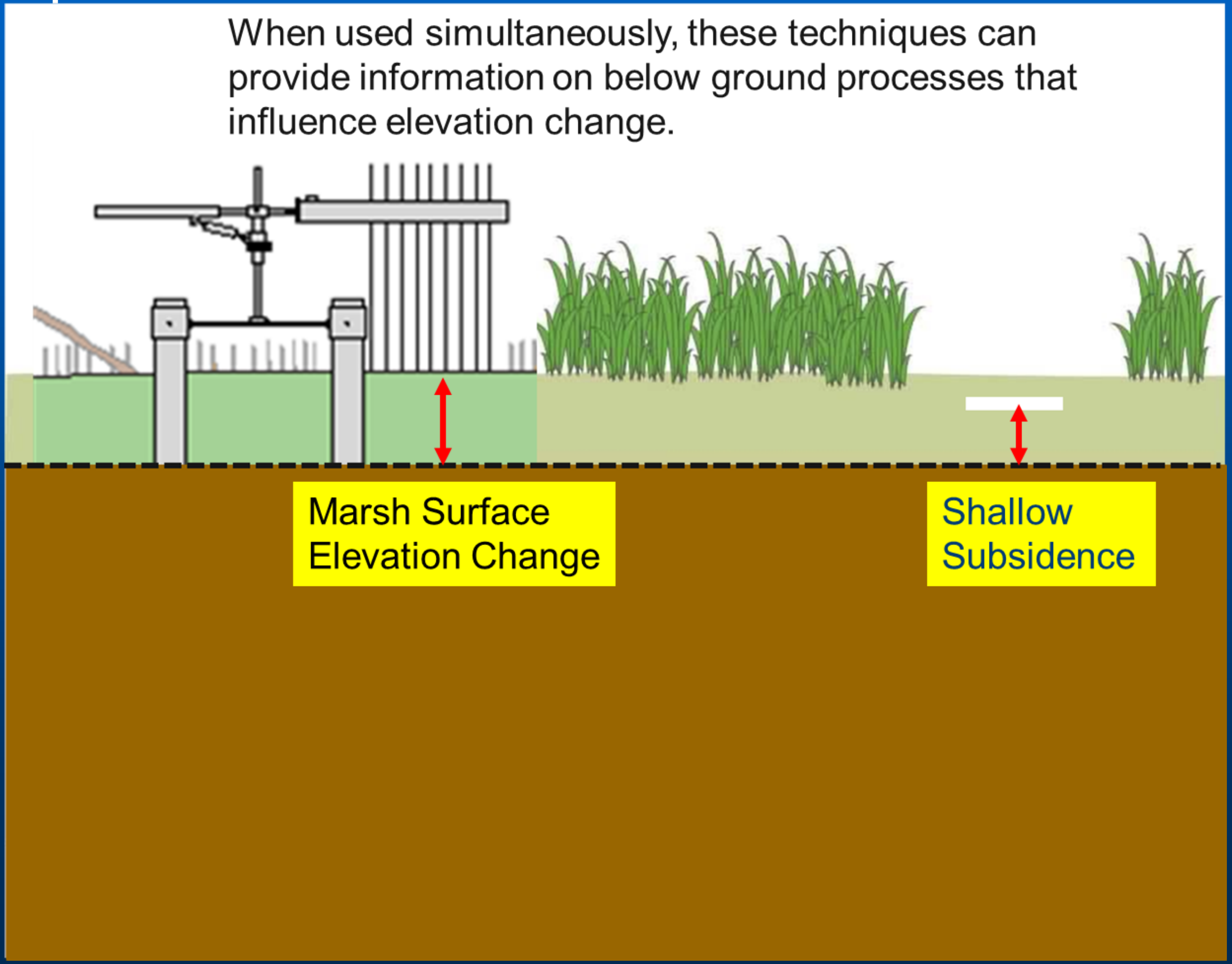


Methodological Approach



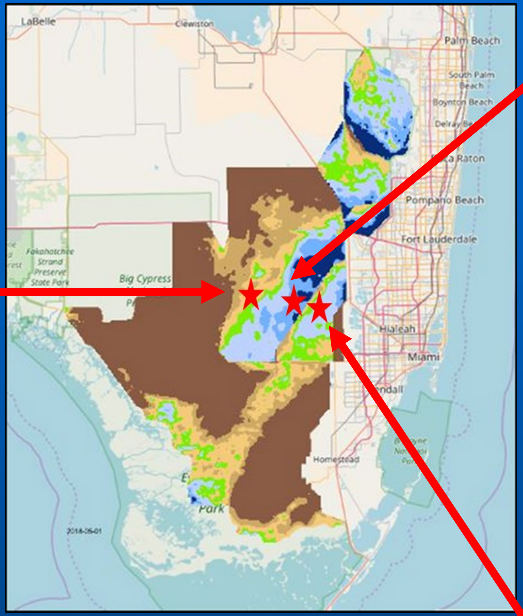
Methodological Approach

We installed shallow rod SET (0.40 m), which accounts for processes that occur within the root zone



Study Tree Islands

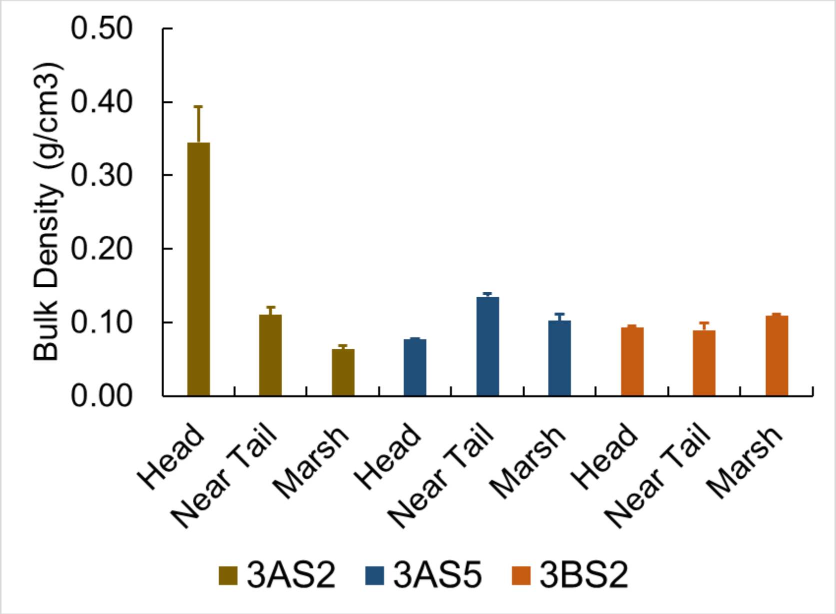
Tree Island 3AS2

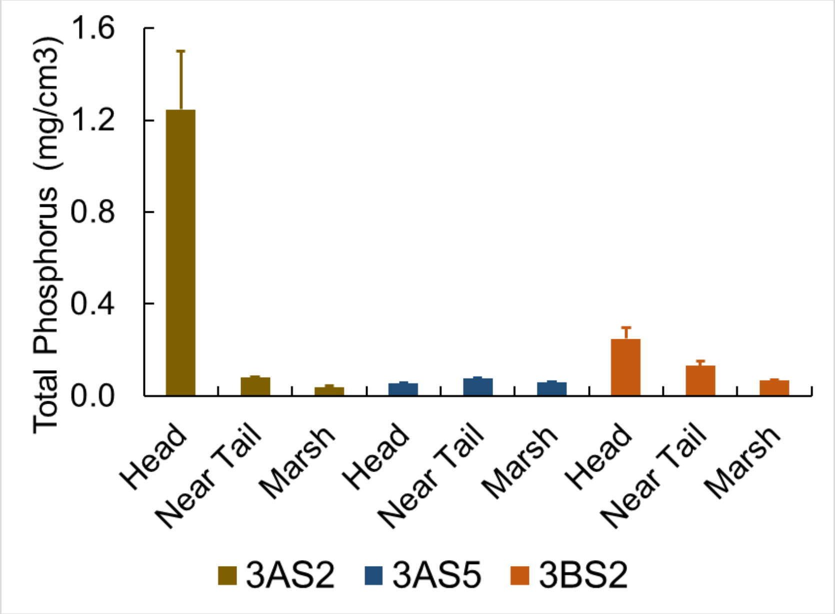


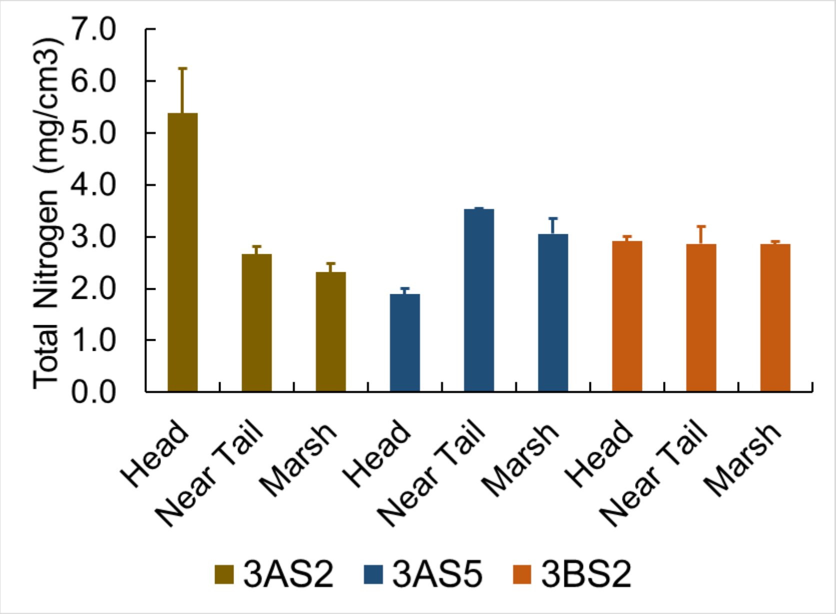
Tree Island 3AS5

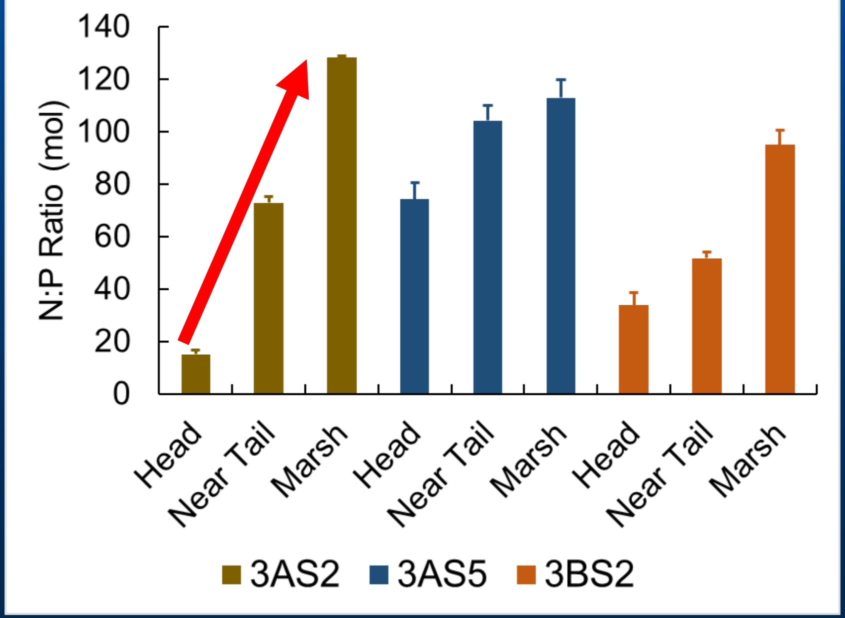
Tree Island 3BS2

Soil Properties (0-4 cm) n=3



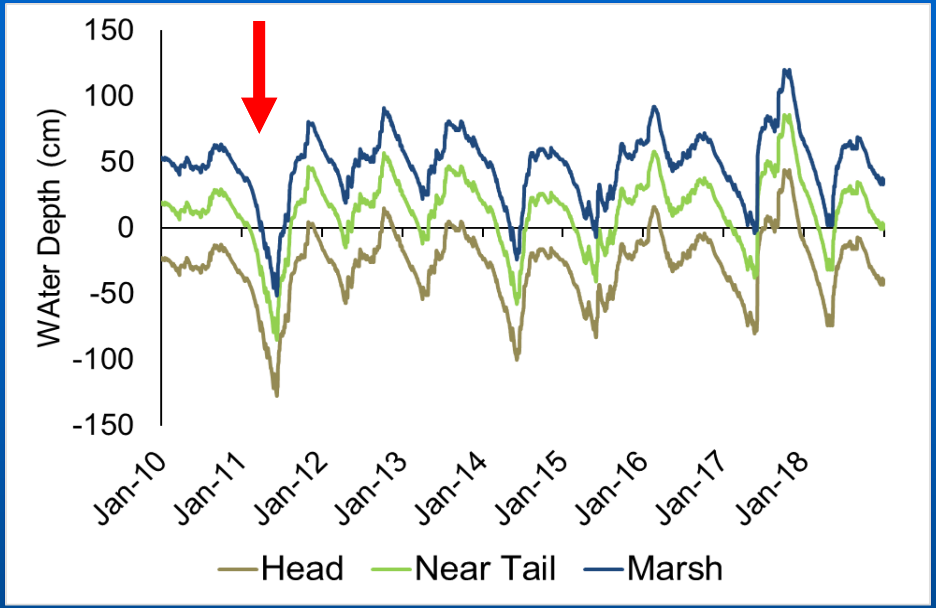


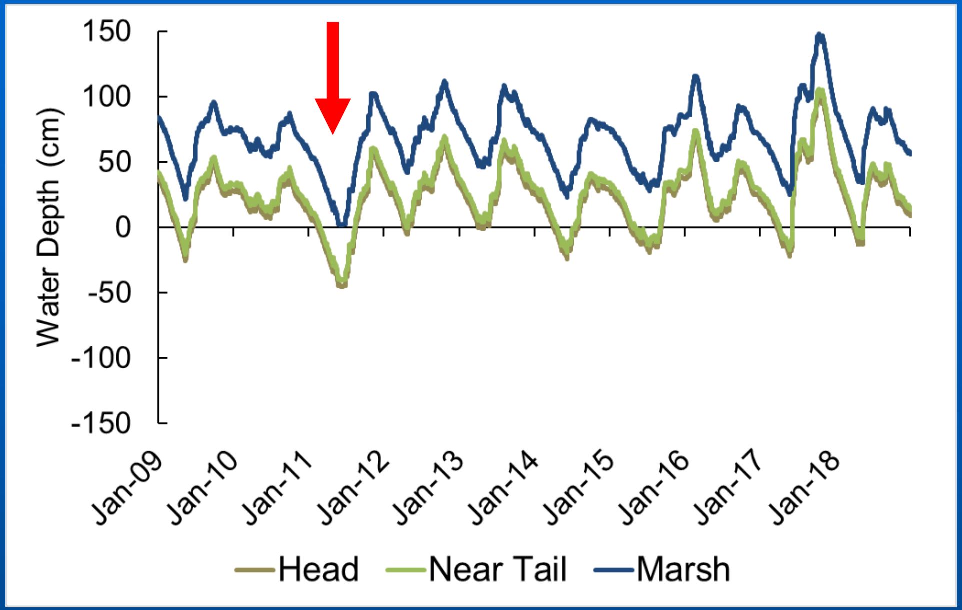




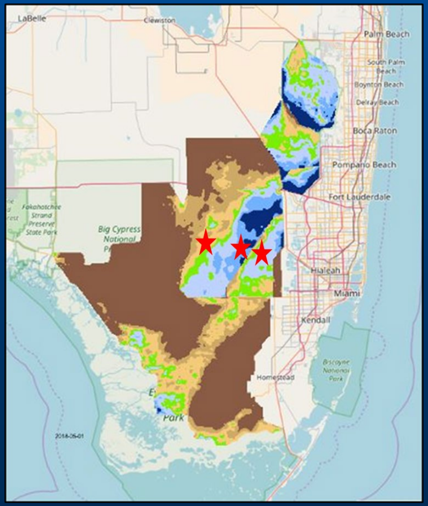
Water Depths & Hydroperiods (2009-2018)

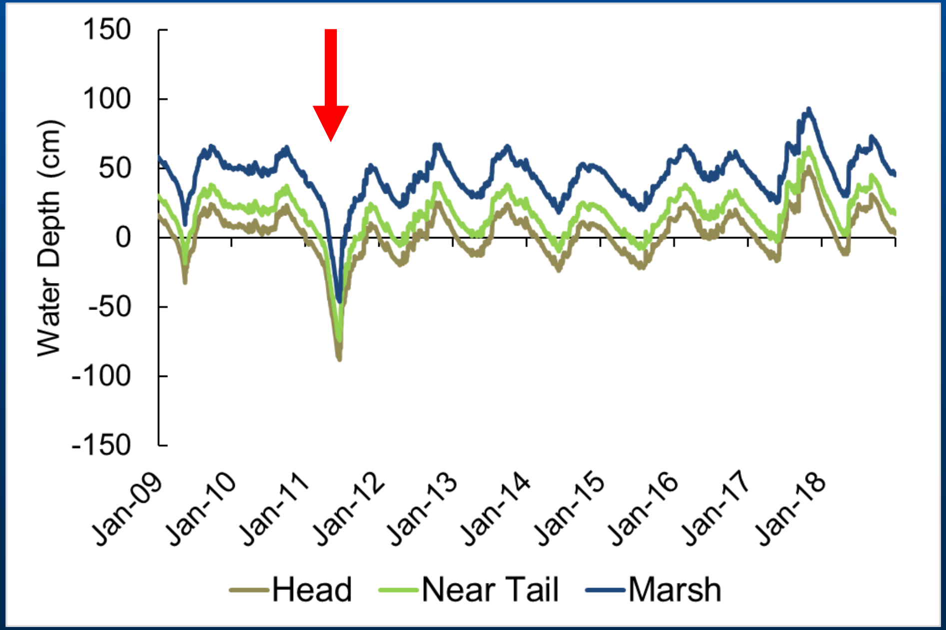
3AS2





3AS5



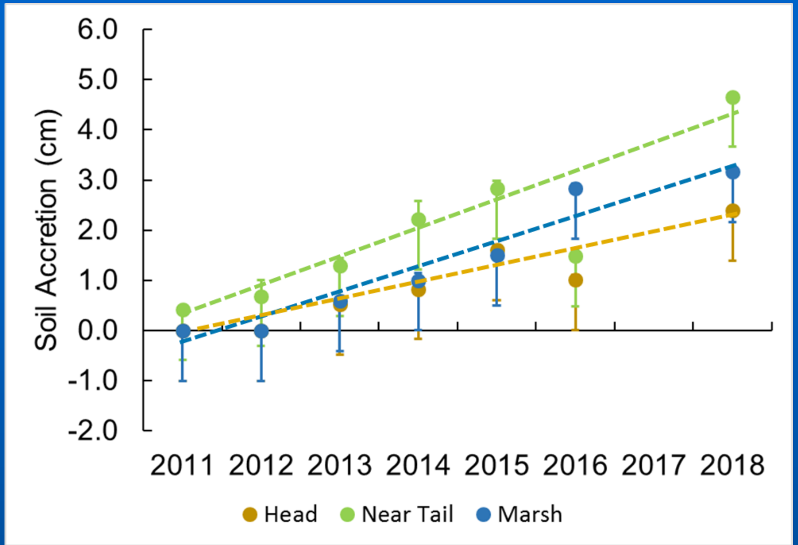


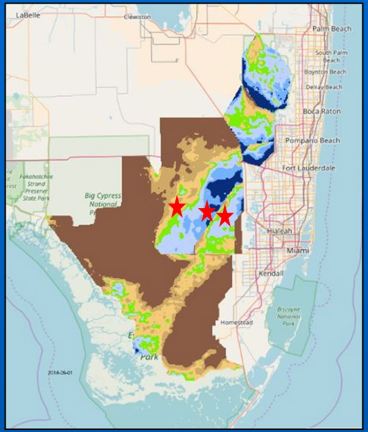
3BS2

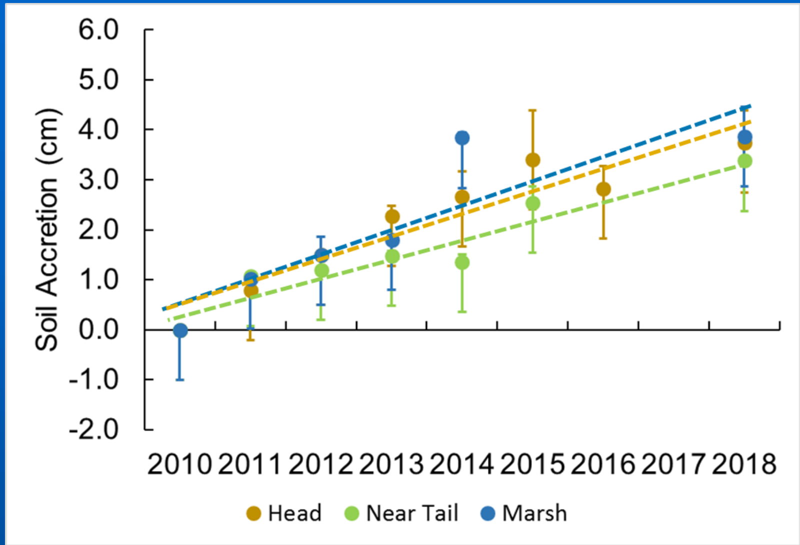
Head Near Tail Marsh

Annual Soil Accretion (feldspar) (2009-2018) n=3

3AS2





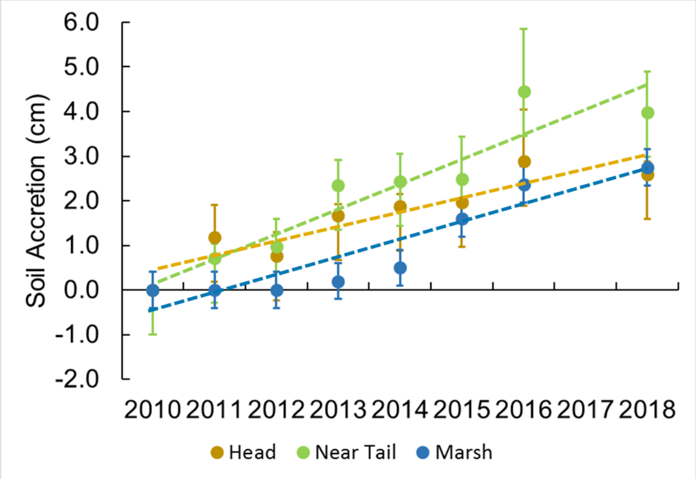


3AS5

Accretion Rates (cm/yr.)

Head	0.30
Near Tail	0.51
Marsh	0.45

3BS2



Accretion Rates (cm/yr.)

Head	0.49
Near Tail	0.38
Marsh	0.49

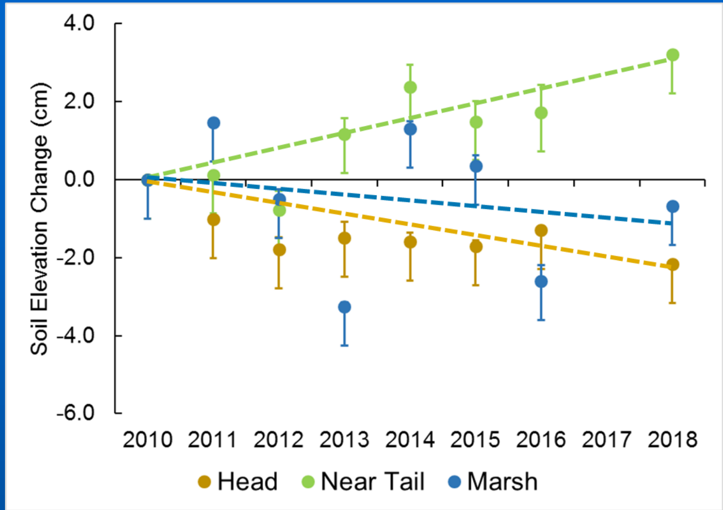
Accretion Rates (cm/yr.)

Head	0.33
Near Tail	0.52
Marsh	0.34

Head Near Tail Marsh

Annual Soil Elevation Change (2009-2018) n=2

3AS2



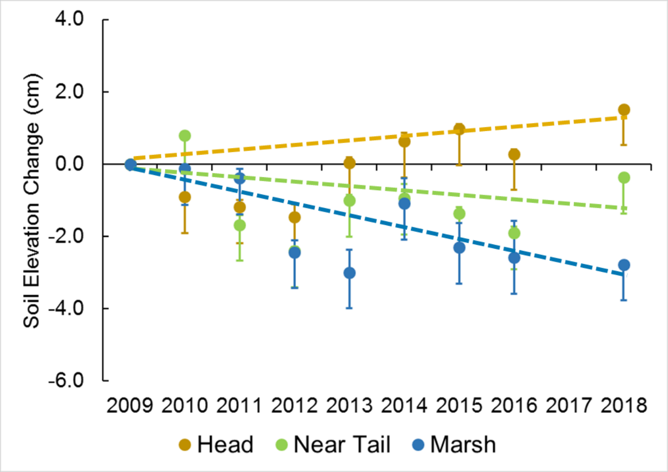
Soil Elevation Rates (cm/yr.)

Head -0.18

Near Tail 0.42

Marsh -0.18

3BS2



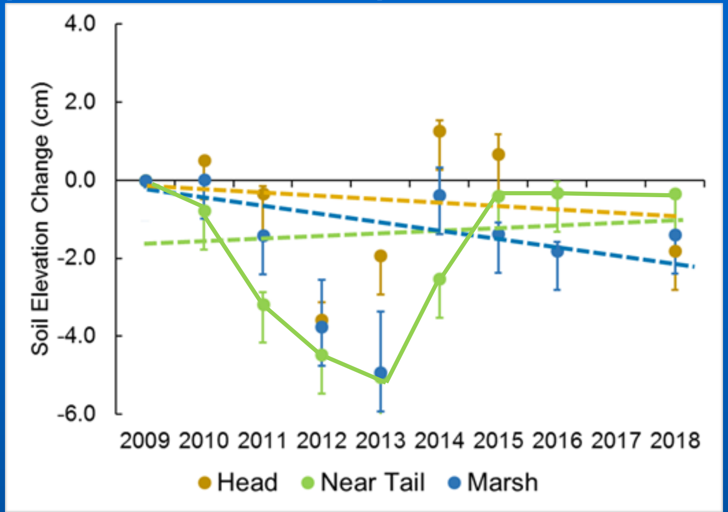
Soil Elevation Rates (cm/yr.)

Head 0.25

Near Tail -0.10

Marsh -0.32

3AS5



Soil Elevation Rates (cm/yr.)

Head -0.08

Near Tail 0.13

Marsh -0.11

Head Near Tail Marsh

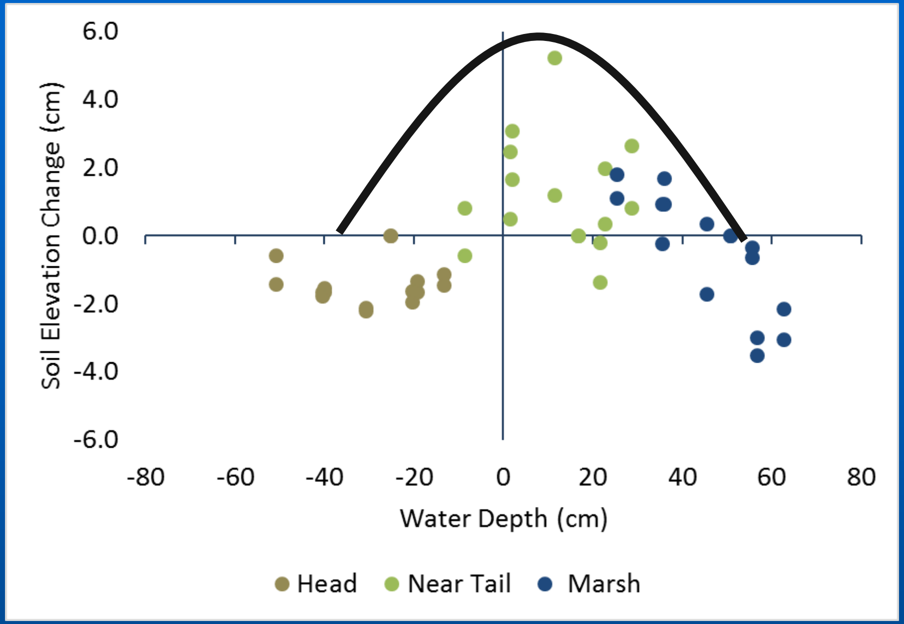
Subsidence Rates in the Root Zone cm year^{-1}

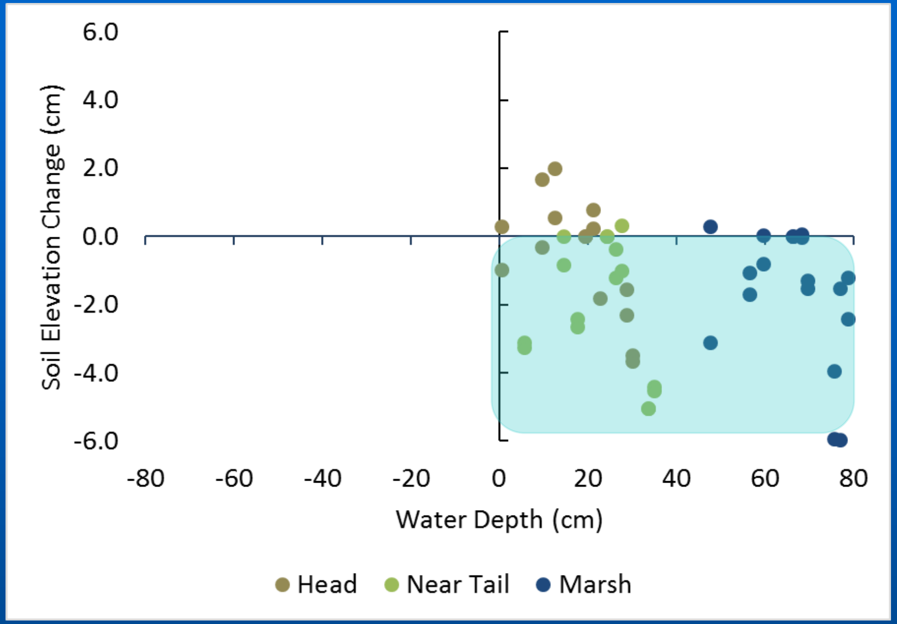
Tree Island	Environment	Rates	Hydrology
3AS2	Head	0.48	Very Short
3AS2	Near Tail	**0.08**	Dry-Wet Cycle
3AS2	Marsh	0.63	-
3AS5	Head	0.54	Very Long
3AS5	Near Tail	0.25	Very Long
3AS5	Marsh	0.60	-
3BS2	Head	**0.08**	Dry-Wet Cycle
3BS2	Near Tail	0.62	Long
3BS2	Marsh	0.66	-

Subsidence = vertical accretion – surface elevation

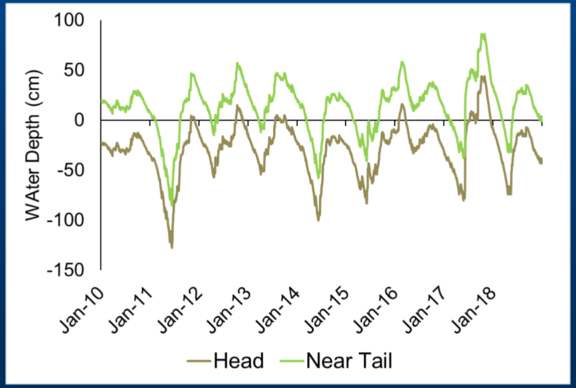
Management implications: Soil Elevation-Water Depth

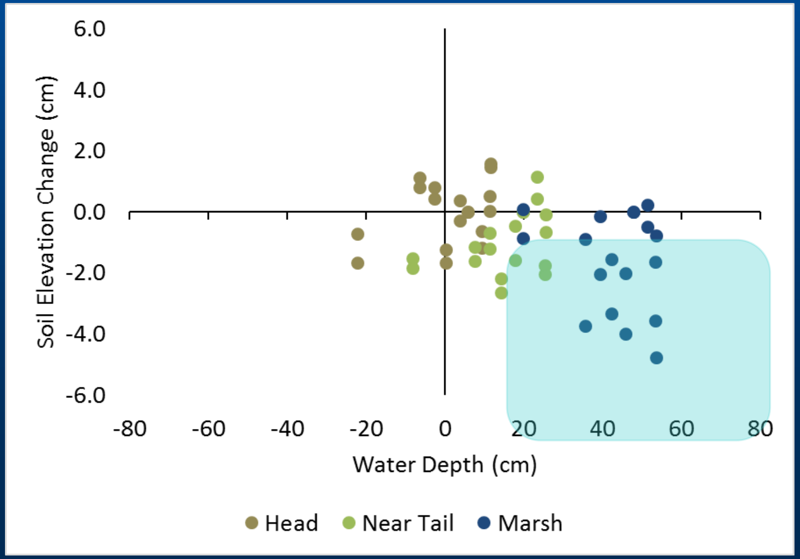
3AS2





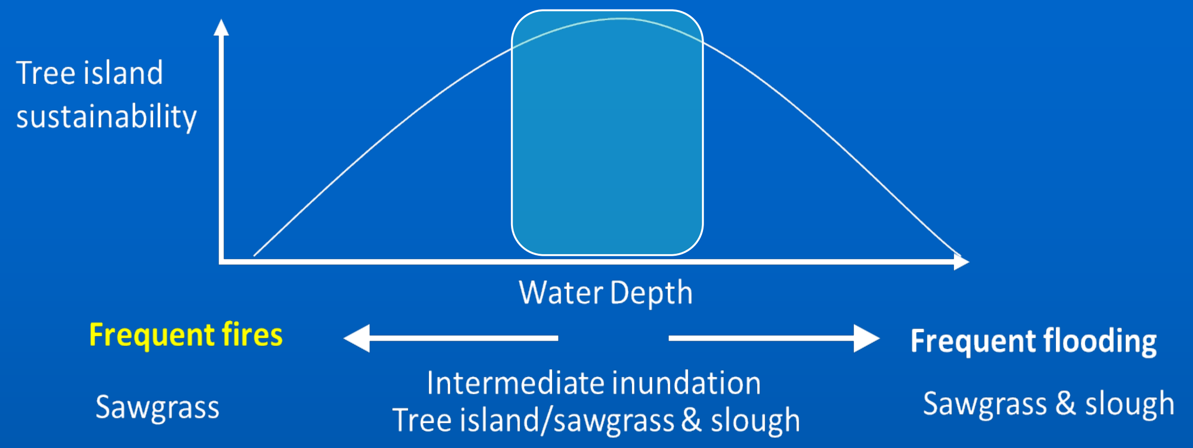
3AS5





3BS2

Summary



- Tree islands with decreasing soil elevation and subsidence are experiencing compaction/shrinking of the soil matrix, which is driven mainly by long periods of inundation.
- Tree islands that experience short hydroperiods are also losing soil elevation; however the main process associated with elevation loss is soil oxidation.
- Increasing soil elevation can be achieved on Tree Islands when a distinct wet-dry cycle is maintained.


Thank You
Questions?