

# Did flooding kill the ghost tree islands? Evidence from healthy Everglades tree islands and the LILA experimental platform



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## Tree islands Importance

Tree islands play a pivotal role in the Everglades system:

- Biogeochemistry of the Everglades landscape
- Keystone habitats that increase overall biodiversity
- Important anthropological sites.

In spite of their importance, over the twentieth century, the number and total area of tree islands have been roughly halved in Water Conservation Areas (Brandt et al. 2000 and Patterson and Finck 1999;) as well as in Shark River Slough in Everglades National Park (Sklar et al 2013).

## Tree islands loss

Tree island “loss” is one endpoint in a dynamic in which woody and herbaceous plants vie for dominance under the influence of environmental stresses.



Mechanisms underlying tree islands losses are not completely known, but are likely to involve direct or indirect responses of trees to the local water regime

# Did flooding kill the ghost tree islands?



# Study Approach

How trees respond to spatial variation in water depth in tree islands



Ghost Tree Islands  
in WCA-2A  
(Ewe et al 2009)

Healthy Tree Islands  
in Shark River  
Slough-ENP  
(Sah et al 2012)

Tree Islands at Loxahatchee  
Impoundment Landscape  
Assessment (LILA)  
experimental site



Tree occurrence under different  
water conditions



Young trees survival response  
to flooding at constructed  
tree islands

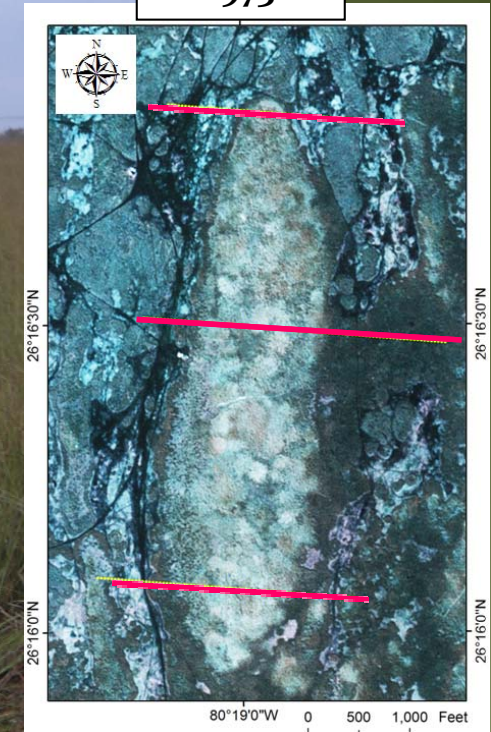
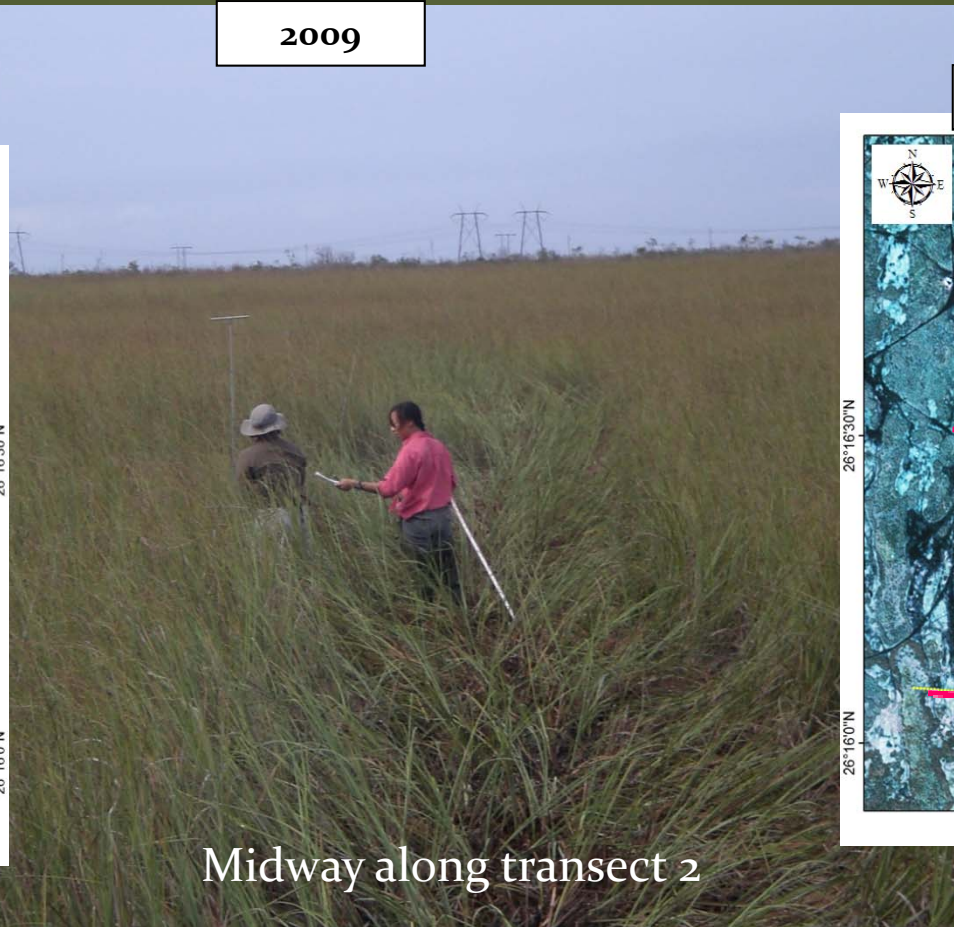
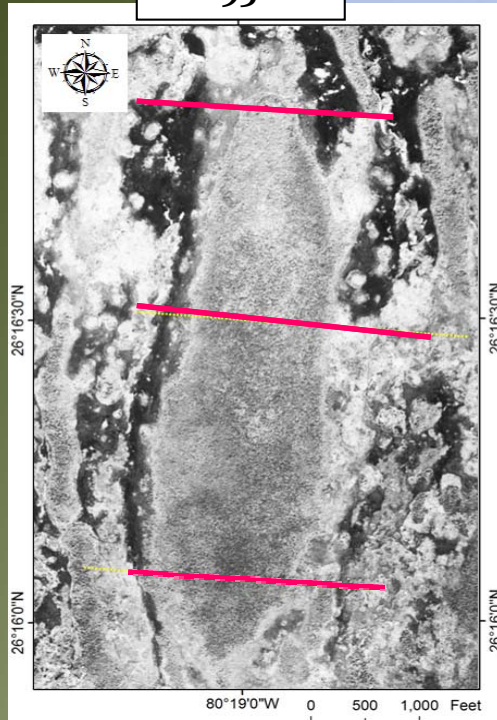
# Ghost Tree Islands Study

Wooded in mid-50's, mostly treeless by 1970's, and till today.

2009

1952

1973

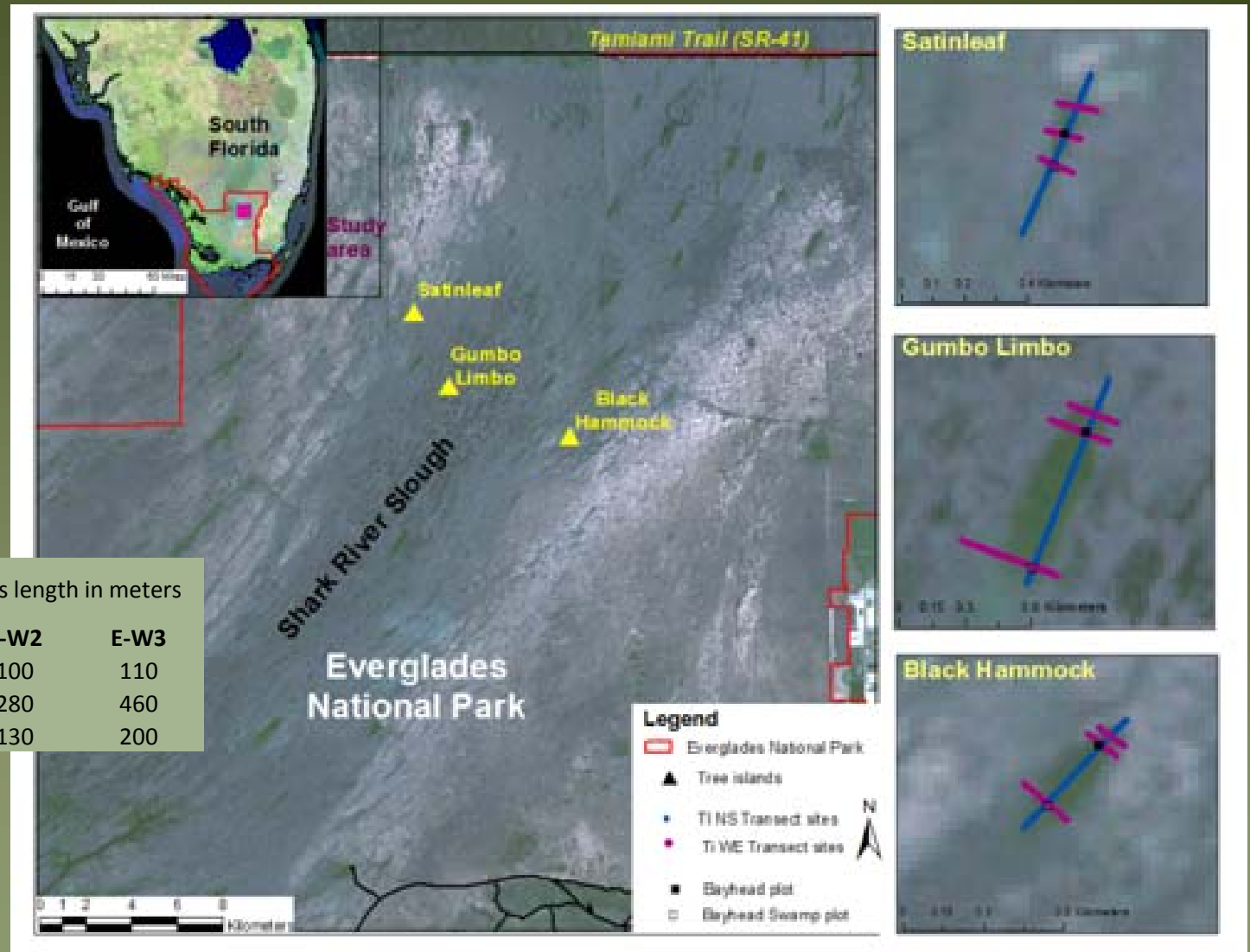


Midway along transect 2

## Tree Islands

Tree islands transects length in meters		2A-11-1	2A-12-6	2A-14-2	2A-15-6	2A-16-1	2A-17-2	2A-22-4	2A-22-18	2A-22-27	2A-22-28
<b>Head-T</b>		350	290	330	540	300	450	500	450	480	130
<b>Mid-T</b>		660	450	660	880	600	900	1150	900	450	170
<b>Tail-T</b>		790	400	440	760	430	800	850	850	460	170

# Healthy Tree Islands Study

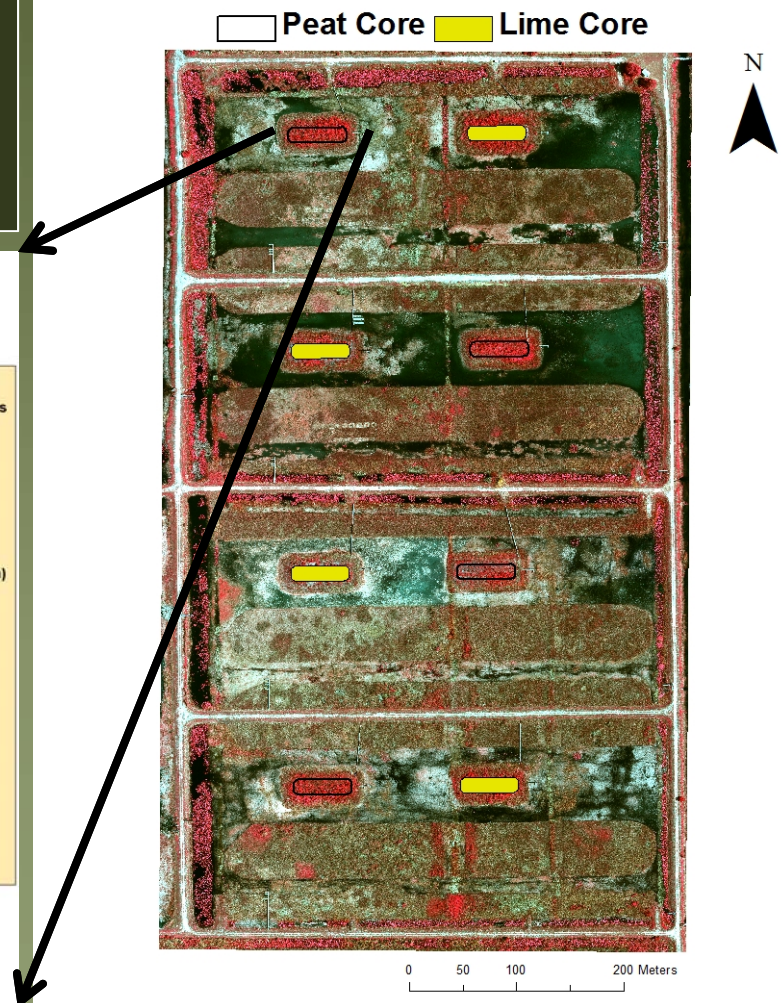
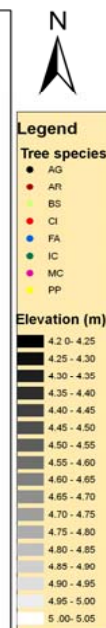
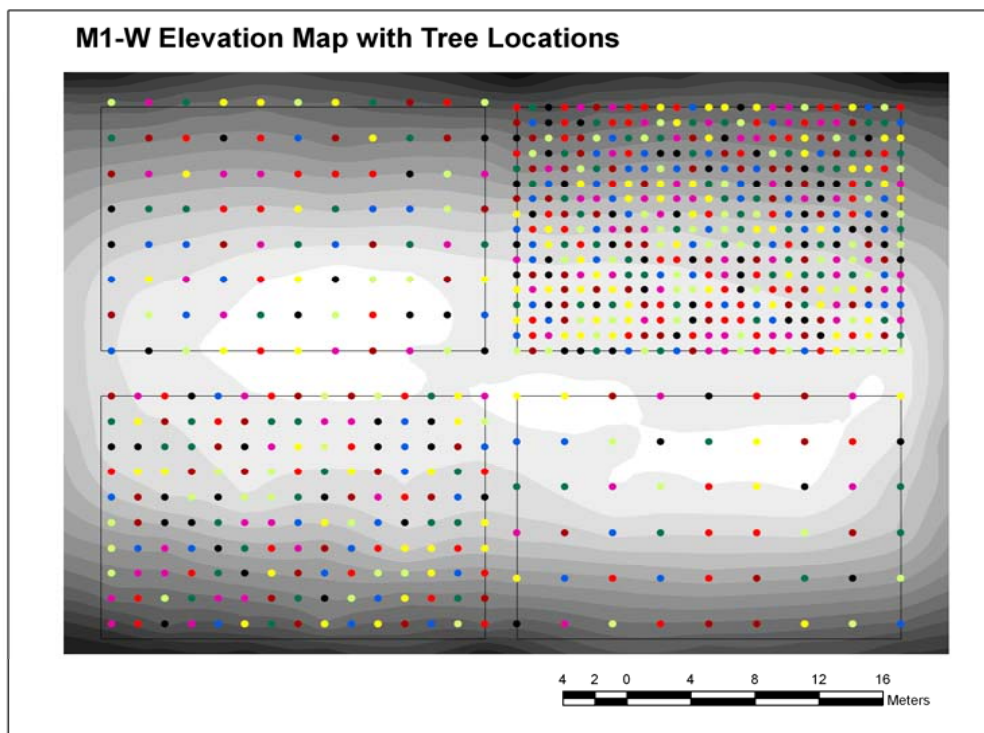


Shark Slough tree islands transects length in meters

Tree Islands	E-W1	E-W2	E-W3
<i>Satinleaf</i>	130	100	110
<i>Gumbo Limbo</i>	230	280	460
<i>Black Hammock</i>	110	130	200

1. Primary treatments for tree islands were: **elevation (hydrology)**, **substrate type**, and **planting density (spacing)**.
2. Eight (8) species were planted at random locations within the grid on each island in 2006 and 2007; total trees planted = 5736

# LILA Tree Islands Experiment



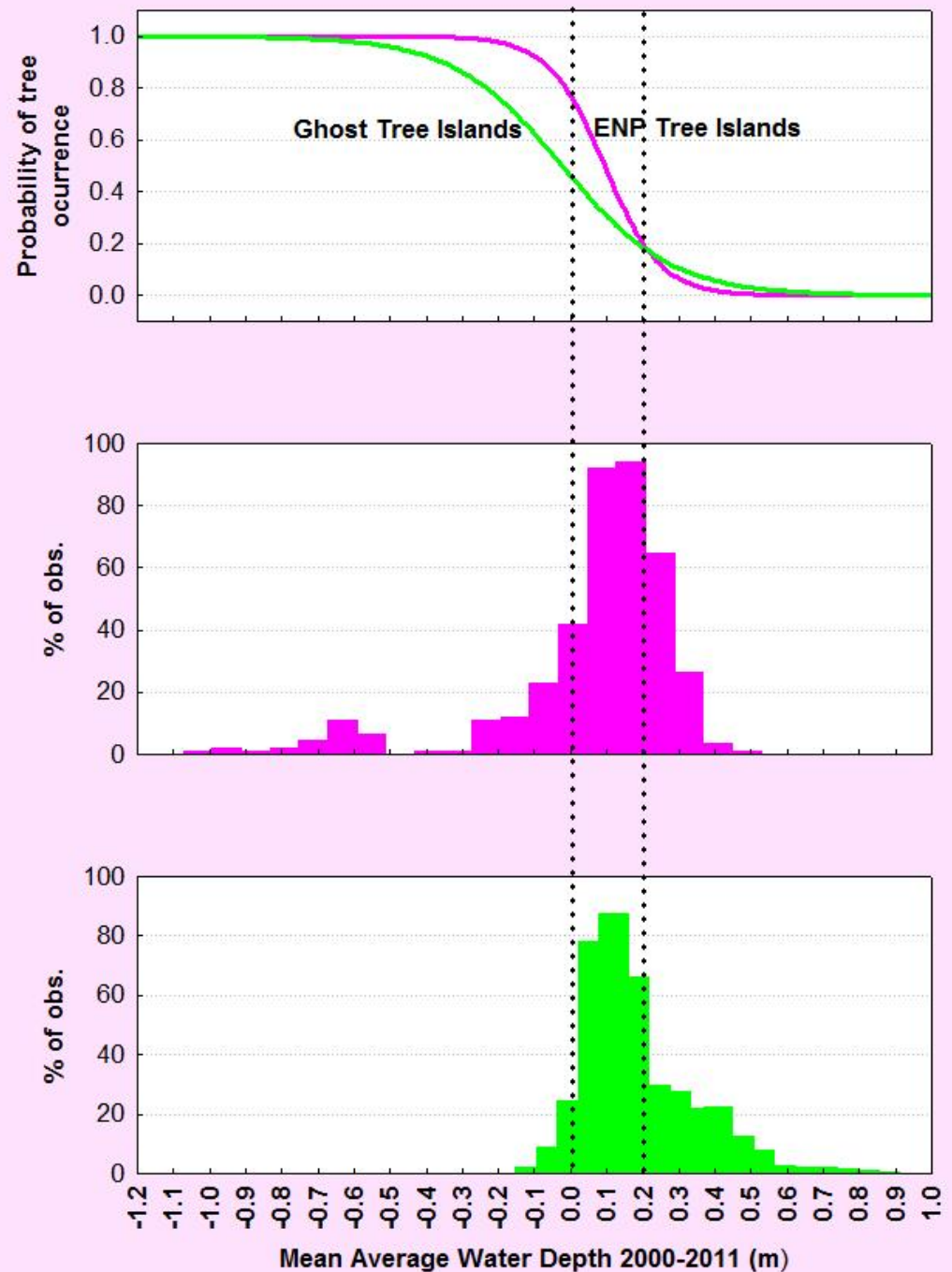


# Tree Islands Data Summary

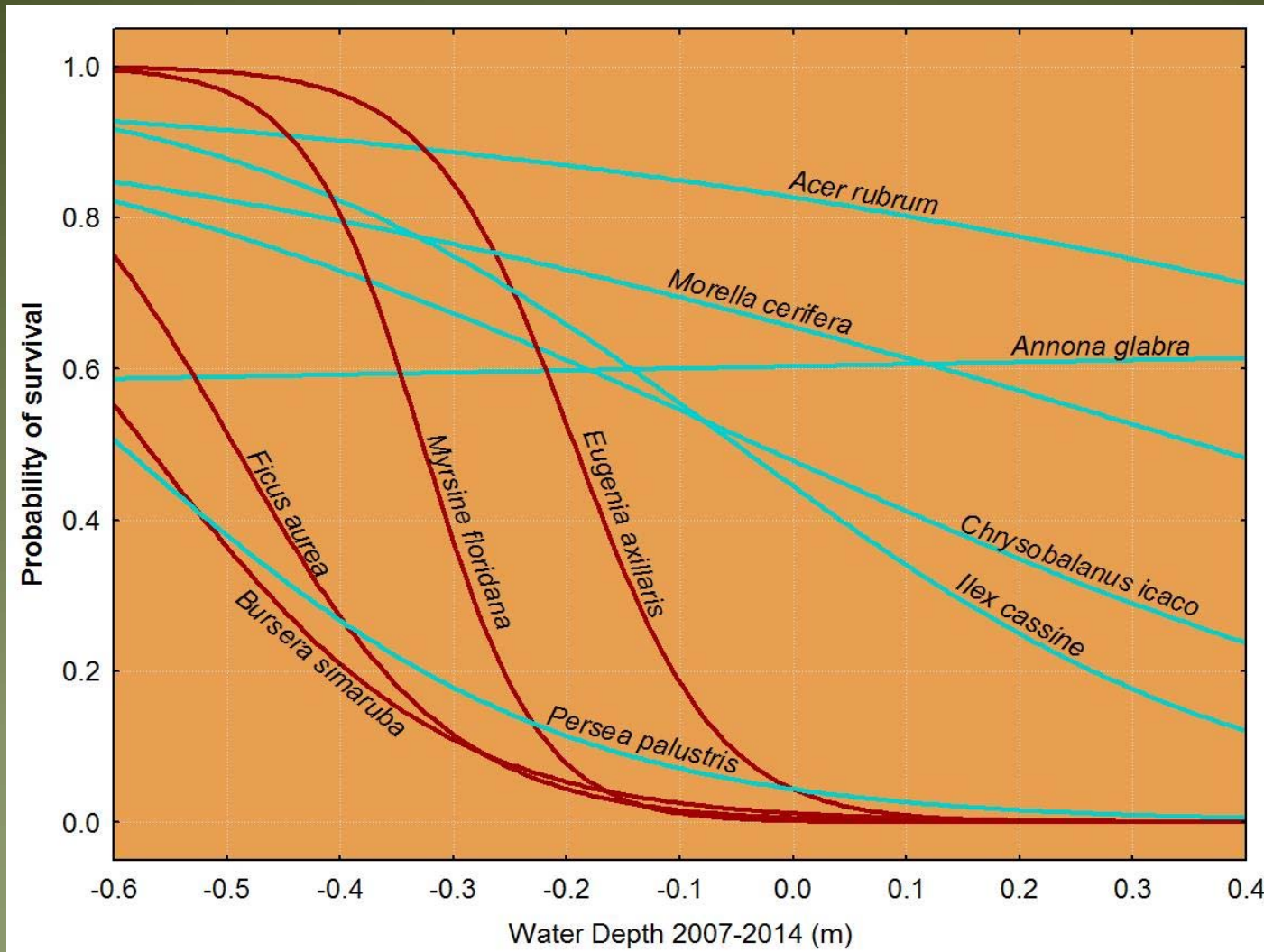
Tree Islands Studies	Tree Data	Elevation data	Water Depth Data	Analysis
<b>Ghost Tree Islands in WCA-2A</b>	Tree occurrence in 2-m radius plots	Ground elevation by subtraction of measured water depth from stage estimates from EDEN network	Mean Average Water Depth (MAWD) 2000-2011 based on EDEN daily stage estimates	Logistic Regression
<b>Healthy Tree Islands in Shark River Slough-ENP</b>	Tree occurrence in 2-m radius plots	Ground elevation survey from SFWMD benchmarks	MAWD 2000-2011 based on nearest USGS stage recorders	Logistic Regression
<b>LILA Tree Islands</b>	Tree species survival in 2006/2007-2014	Ground elevation survey from SFWMD benchmarks	MAWD 2007-2014 based on local SFWMD stage recorders	Species Logistic Regressions

# Woody plant occurrence: “healthy” islands and ghost islands

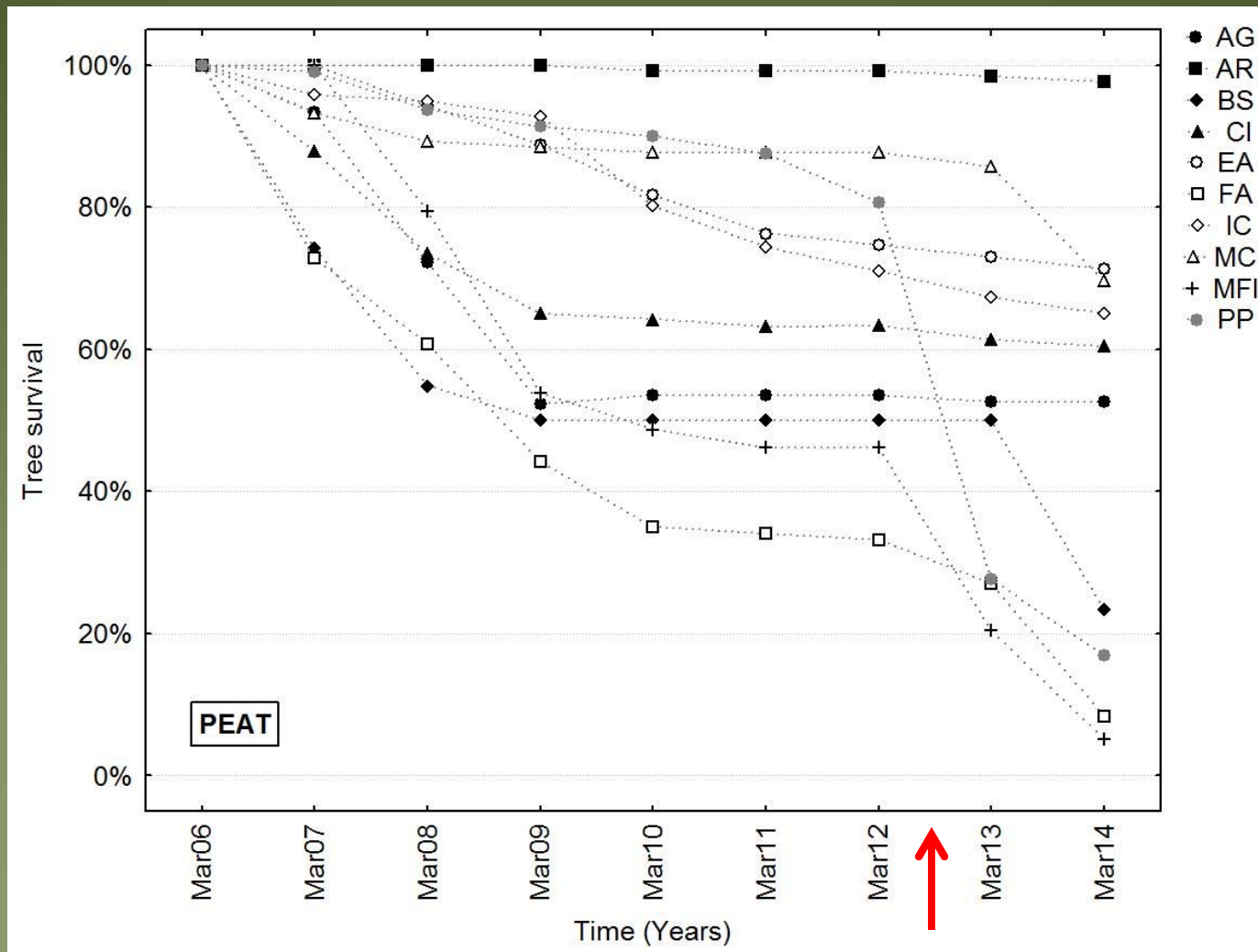
1. Woody plants are likely to occur in either healthy tree island or ghost island when mean water table is below the surface.
2. However, mean water level is above the surface in almost all ghost island locations.



In terms of survivability, upland species (**red curves**) were generally more sensitive to water depth than wetland species (**blue curves**)



Species decline in survival after March 2012 is likely related to high water levels present at LILA for more than 4 months, i.e., from late August 2012 till the beginning of January 2013



## Conclusions

- Tree occurrence tend to be higher in both healthy and ghost tree islands when water table is below the ground surface.
- Mean water level is above the surface in nearly all ghost island locations.
- Across all species at LILA, survival decreases with increasing water depth nevertheless there is a group of flood-tolerant species that are less sensitive to water depth conditions.
- Flooding events that last for long periods of time could drastically affect tree survival.

**Thank you**

