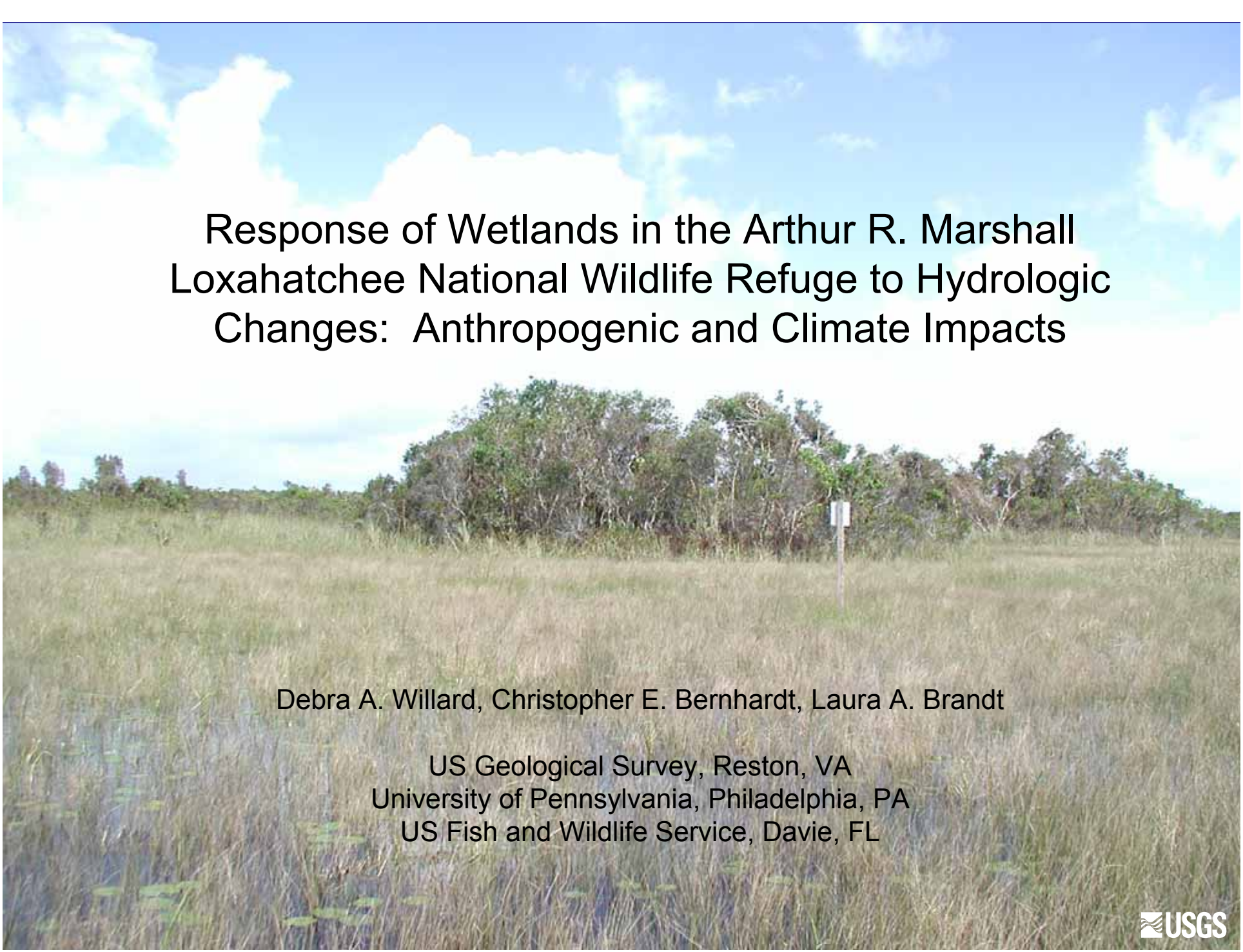
Response of Wetlands in the Arthur R. Marshall Loxahatchee National Wildlife Refuge to Hydrologic Changes: Anthropogenic and Climate Impacts



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US Geological Survey, Reston, VA
University of Pennsylvania, Philadelphia, PA
US Fish and Wildlife Service, Davie, FL

USGS

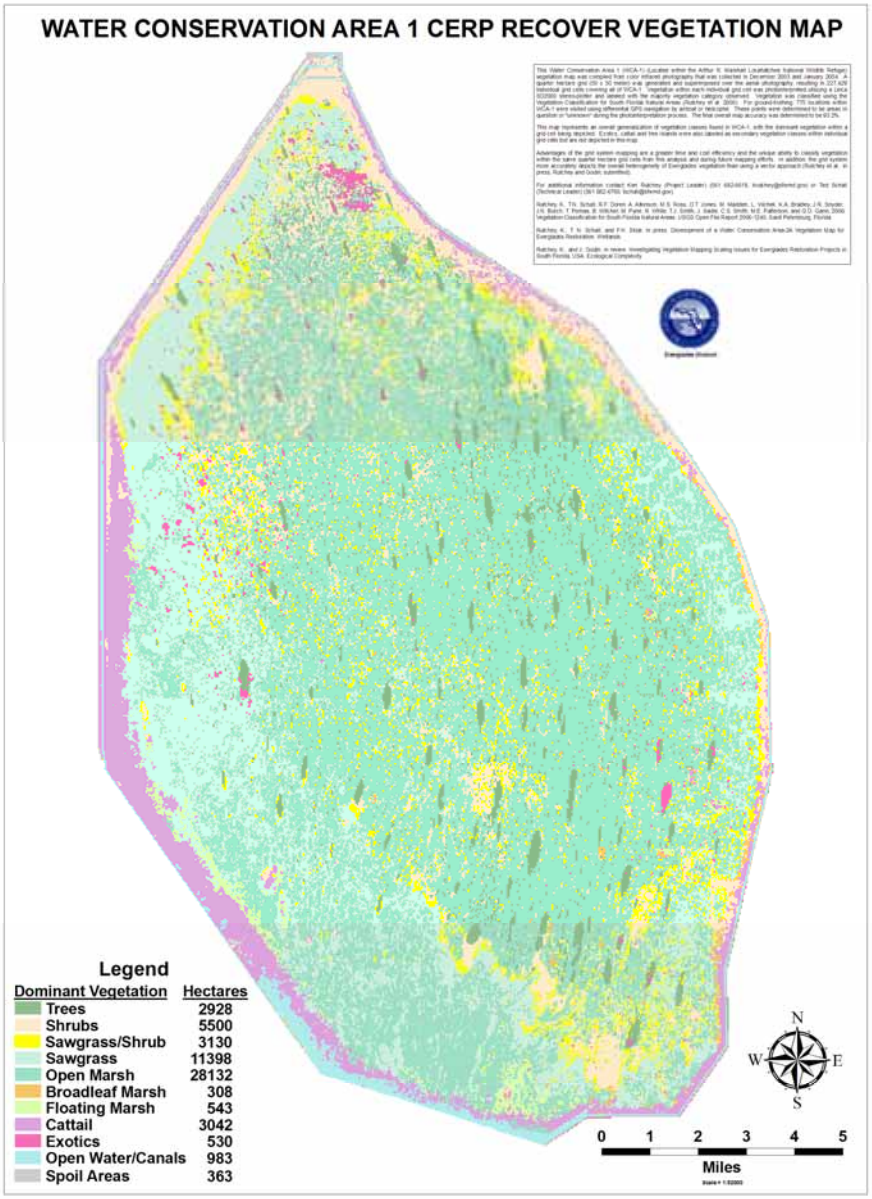
Management Issues: ARM Loxahatchee NWR

Under regulation schedules beginning in 1960:

Invasion of shrubs in tree islands and sawgrass marshes in northern Refuge

Reduction in tree-island size in southern Refuge

Use retrospective studies to determine historic hydrology and vegetation as guide for restoration targets



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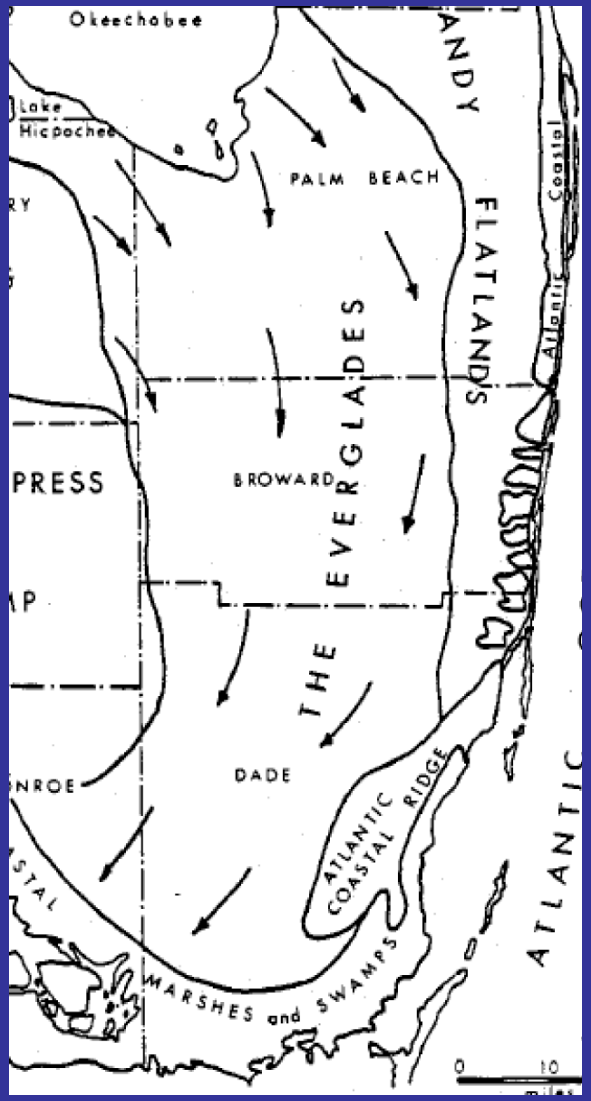
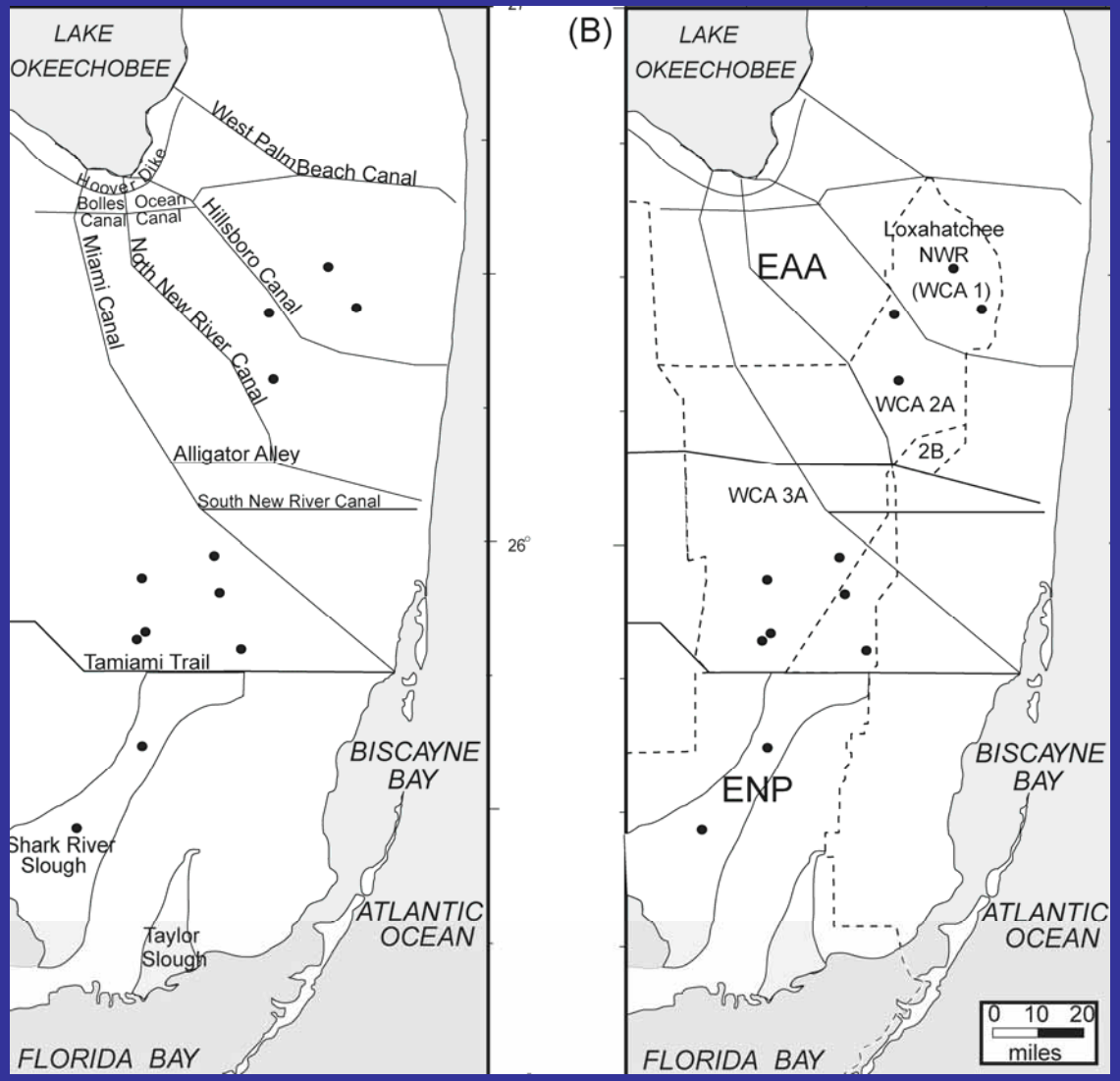
Historic flow across Everglades



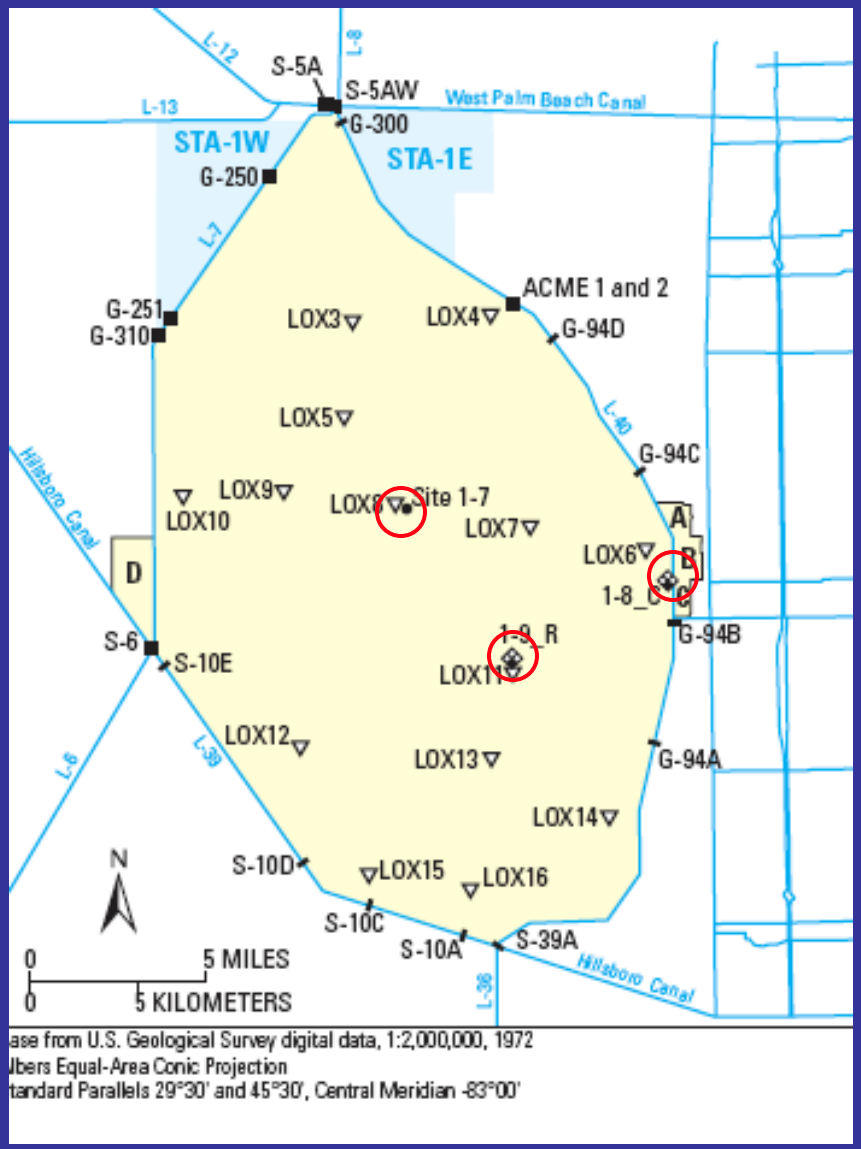
Water management structures

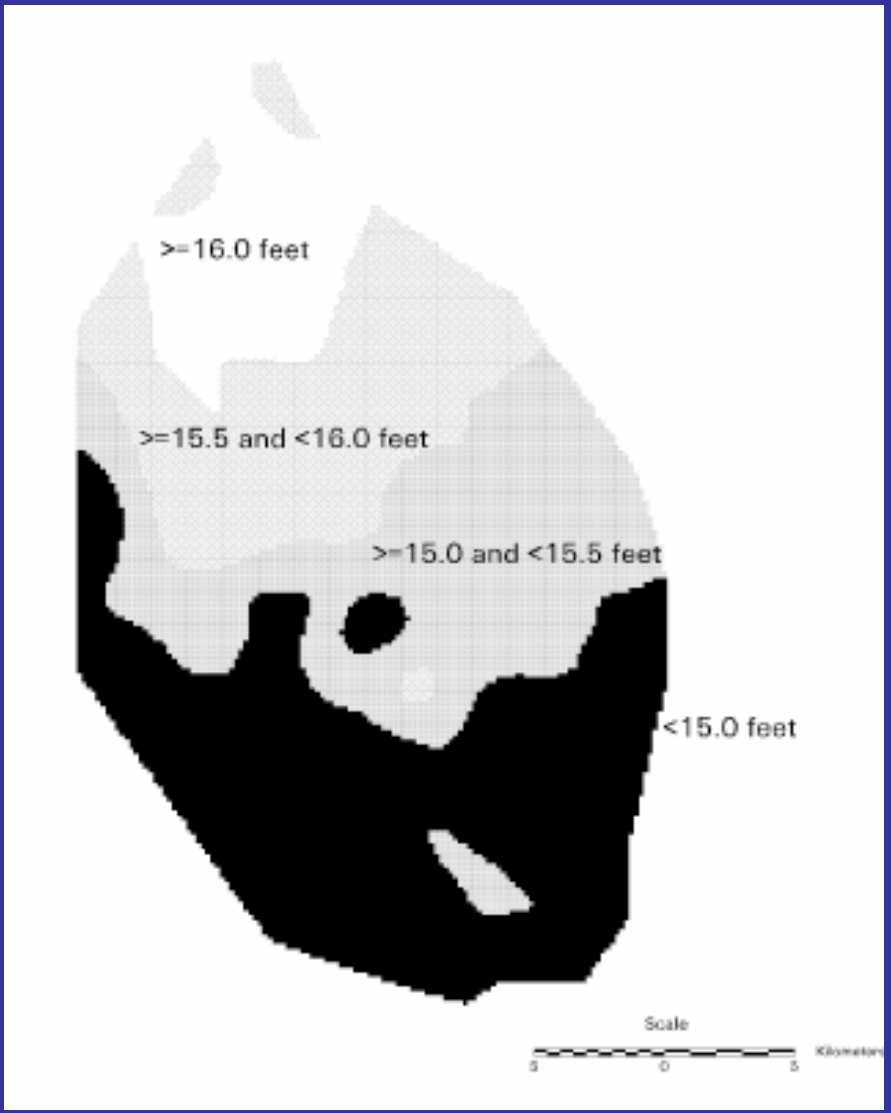


1930 present

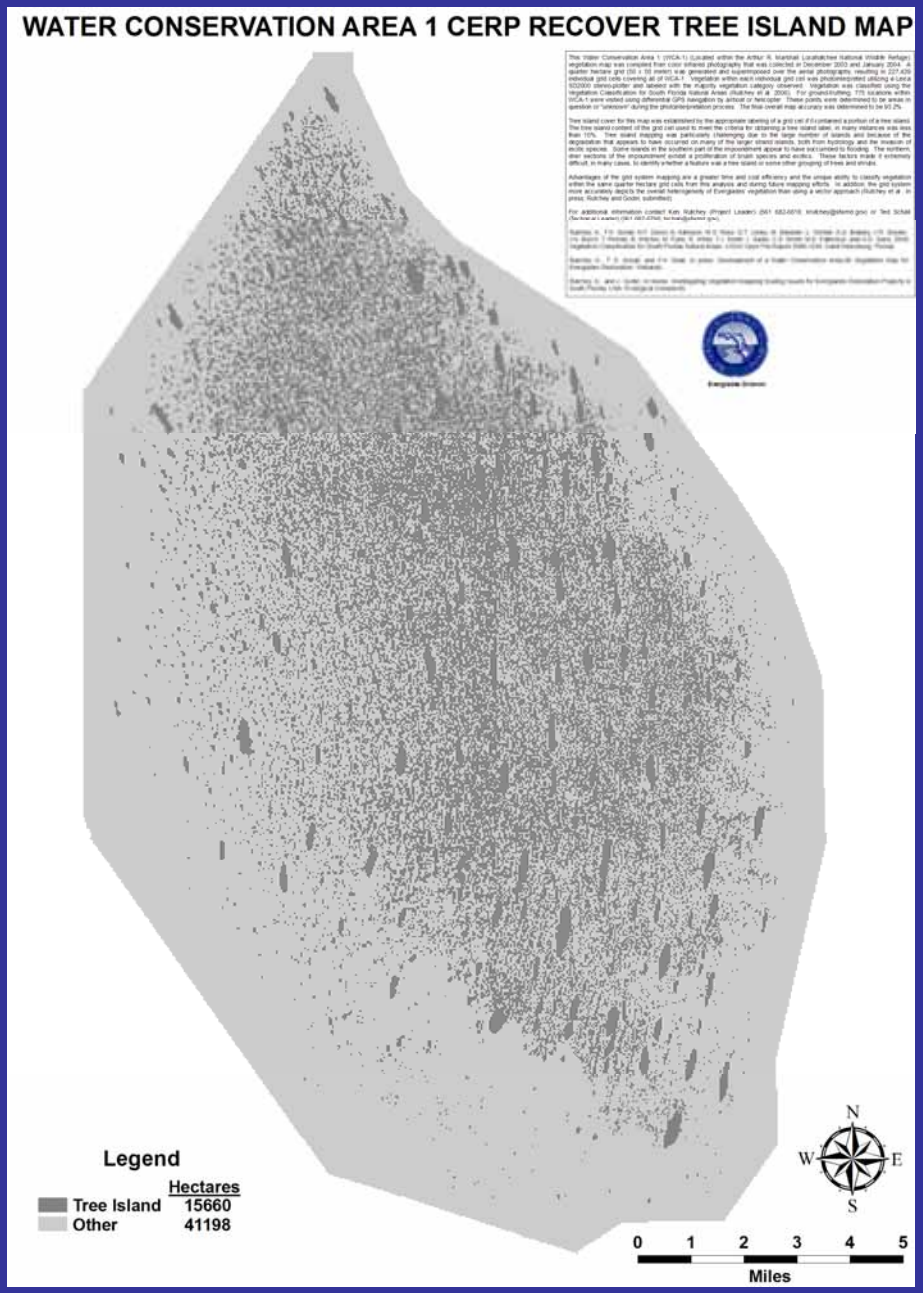
USGS

Loxahatchee Water Control Structures and Elevations





-Brandt (2005)



Loxahatchee Tree Islands

Dense distribution of pop-up and strand islands throughout Refuge

Paleoecological study designed to:

Evaluate response of Loxahatchee tree islands and marshes to water management practices of 20th century

Reconstruct predrainage distribution of vegetation

Assess response time of plant communities to past hydrologic changes

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Methodology

- Collection of surface samples for calibration dataset
- Collection of sediment cores
- Core description
- Geochronology
- Analysis of downcore pollen assemblages and calibration with modern analogs

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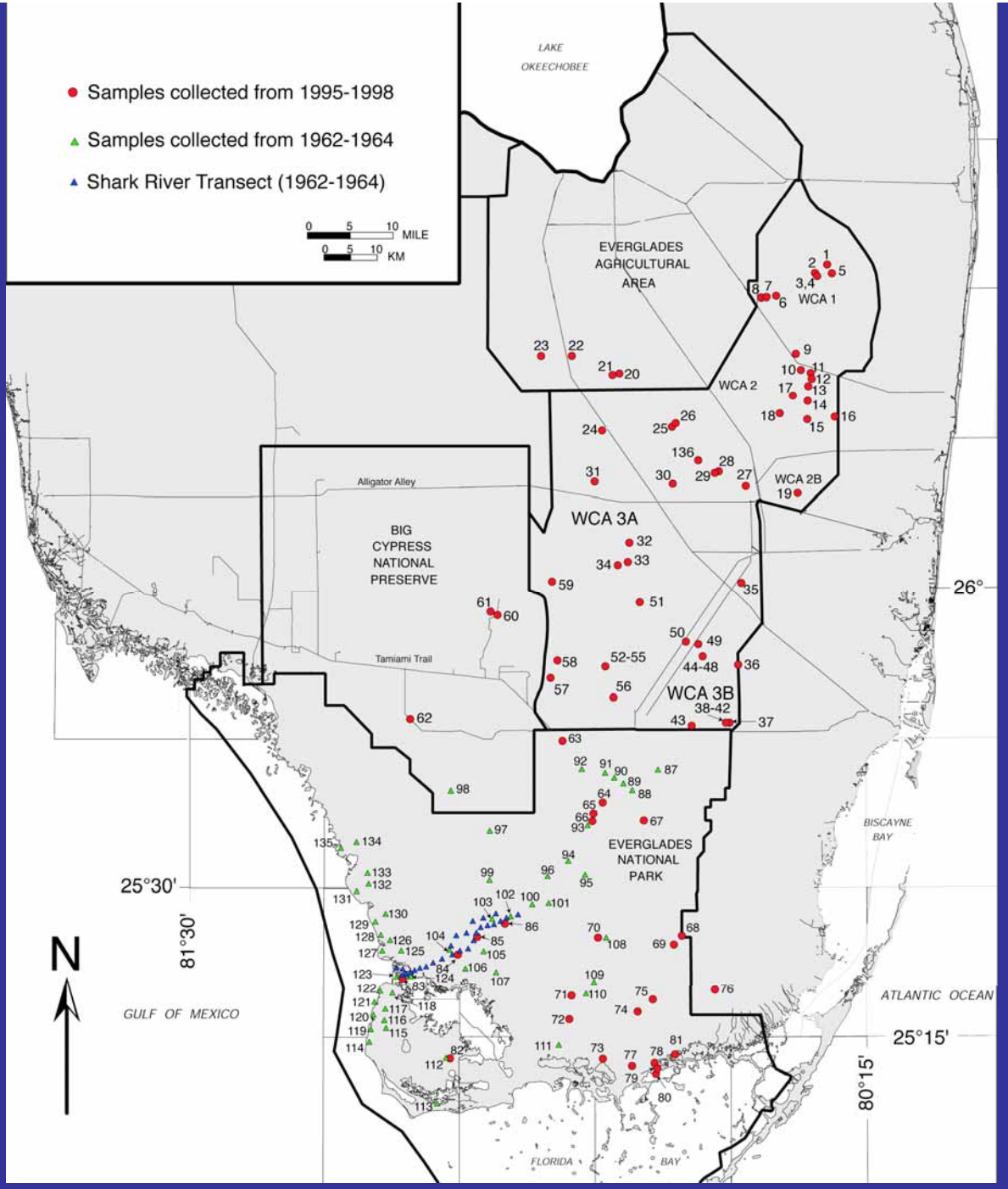
Age Model Development for Everglades Peat Cores

^{14}C	Modern “bomb” carbon (post-1950) and Late Holocene dates
^{137}Cs	Produced by atmospheric testing of thermonuclear devices in late 1950’s and early 1960’s; peak in US is 1962-1963
Pollen biostratigraphy	First occurrence of *Casuarina* pollen in early 20th century

Location of Everglades Surface Samples



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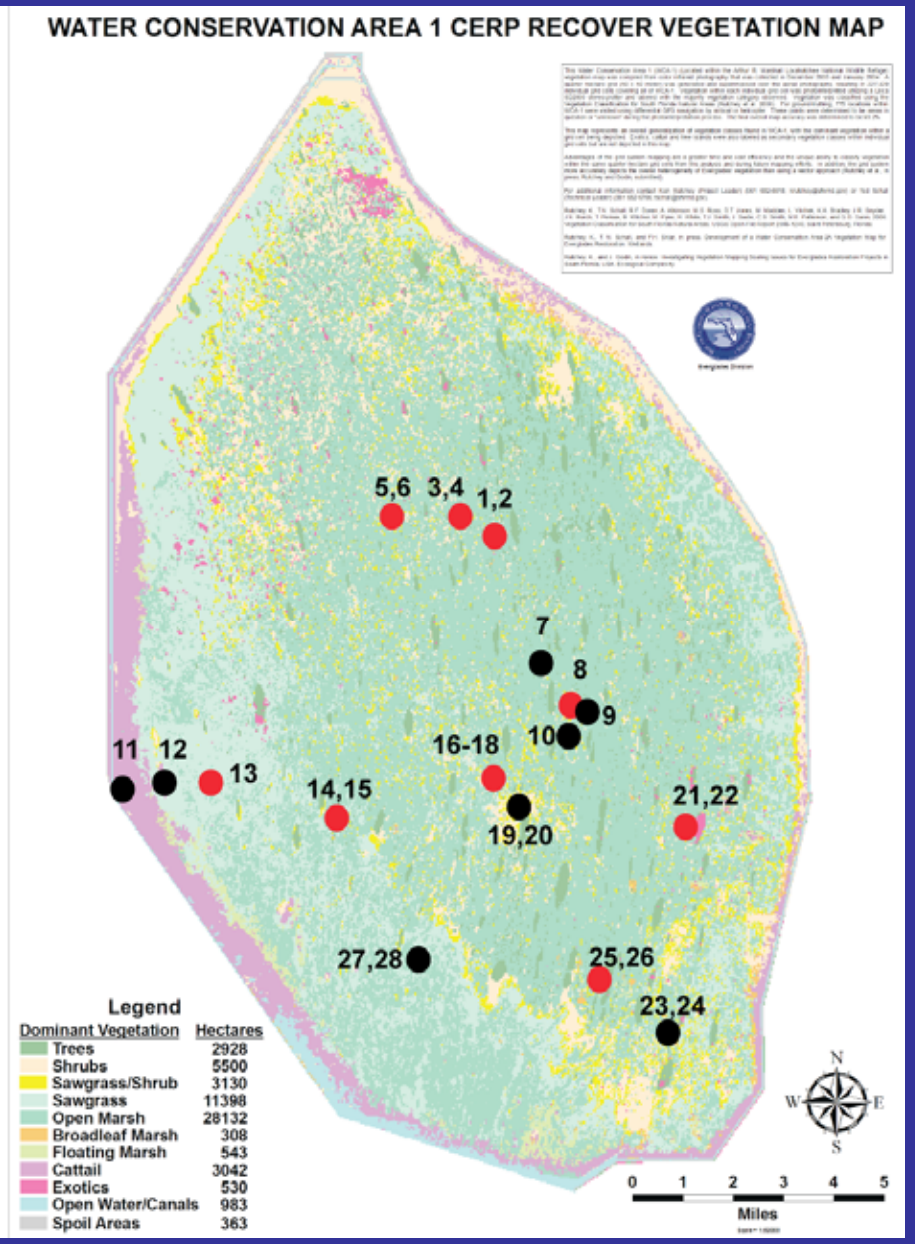
Willard, Weimer, and Riegel, 2001

Tree-island and Marsh Cores, ARM Loxahatchee National Wildlife Refuge

Core Number

1 = 04-9-20-1
2 = 04-9-20-2
3 = 04-9-20-3
4 = 04-9-20-5
5 = 04-9-20-6
6 = 04-9-20-7
7 = 00-3-7-4
8 = 00-3-7-1
9 = 00-3-7-2
10 = 00-3-7-3
11 = 95-4-21-1
12 = 95-4-20-1
13 = 95-4-21-2
14 = 04-9-21-1
15 = 04-9-21-2
16 = 02-05-20-2
17 = 02-05-20-3
18 = 02-05-20-4
19 = 04-9-21-3
20 = 04-9-21-4
21 = 05-7-25-1
22 = 05-7-25-2
23 = 05-7-26-1
24 = 05-7-26-2
25 = 05-7-26-3
26 = 05-7-26-4
27 = 05-7-26-5
28 = 05-7-26-6

● Collected
● Analyzed



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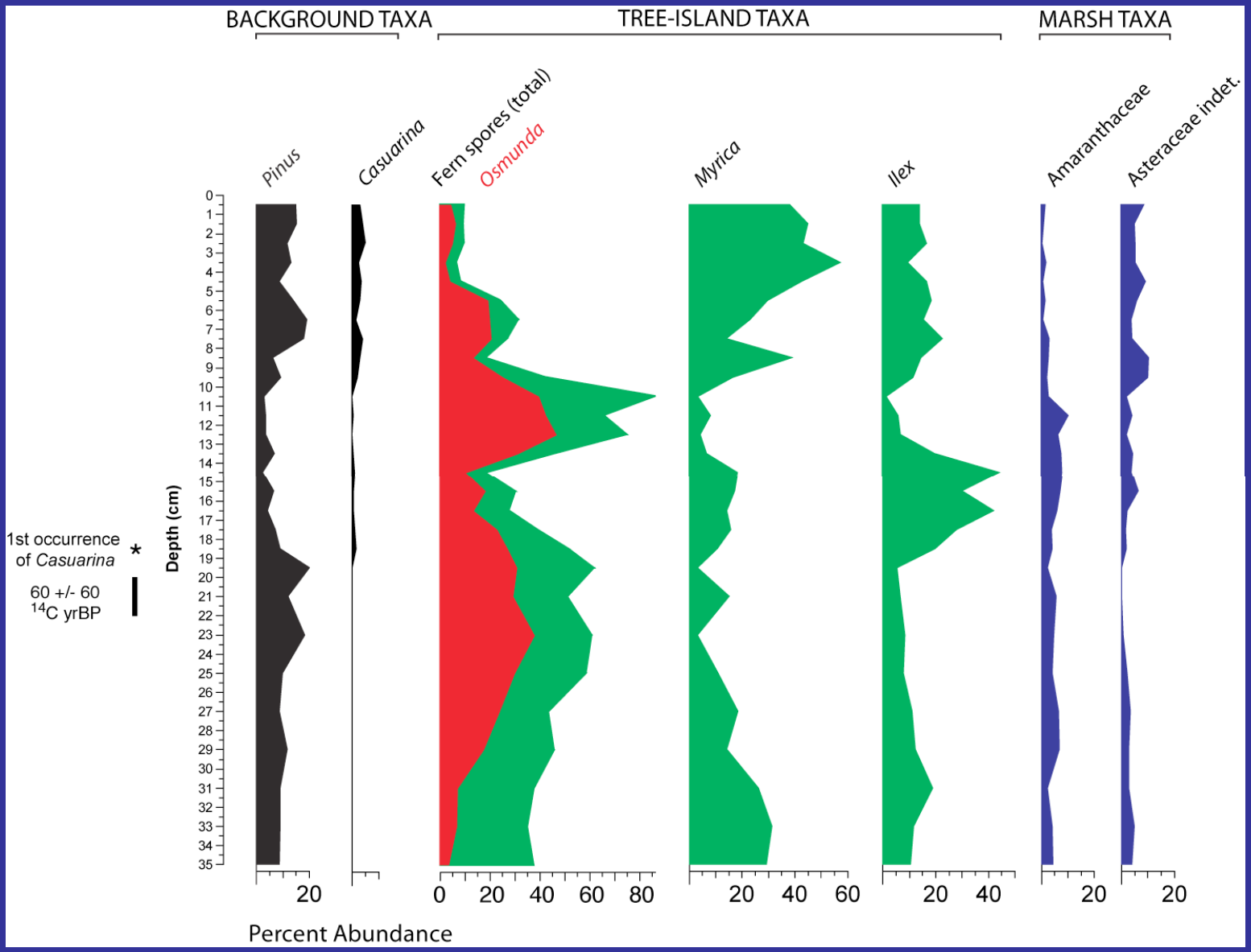
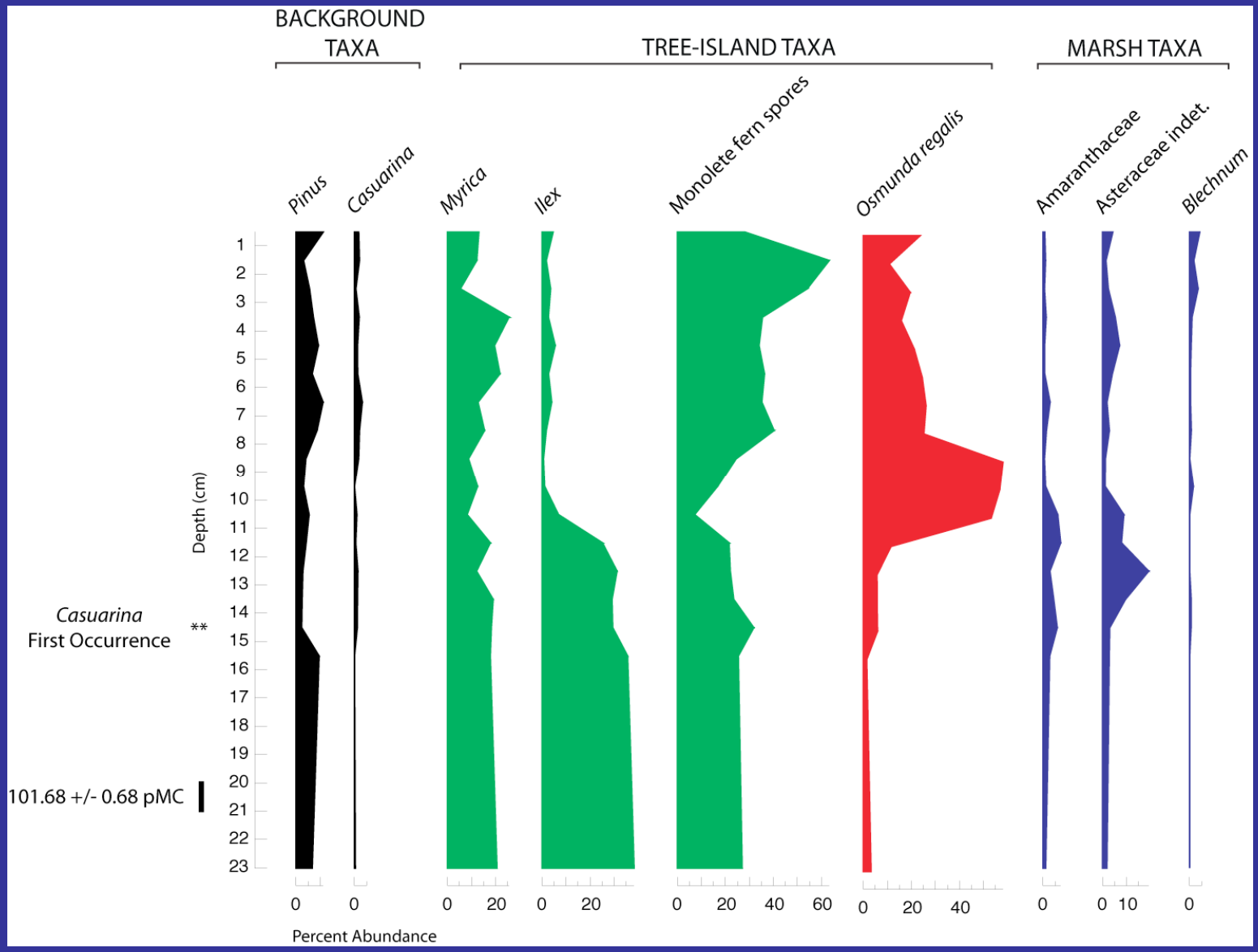
Pollen of Major Plant Groups, Core 04-9-20-1, Pop-Up Island, northeastern Loxahatchee NWR



Pollen of Major Plant Groups, Core 04-9-20-4, Pop-Up Island, north-central Loxahatchee NWR



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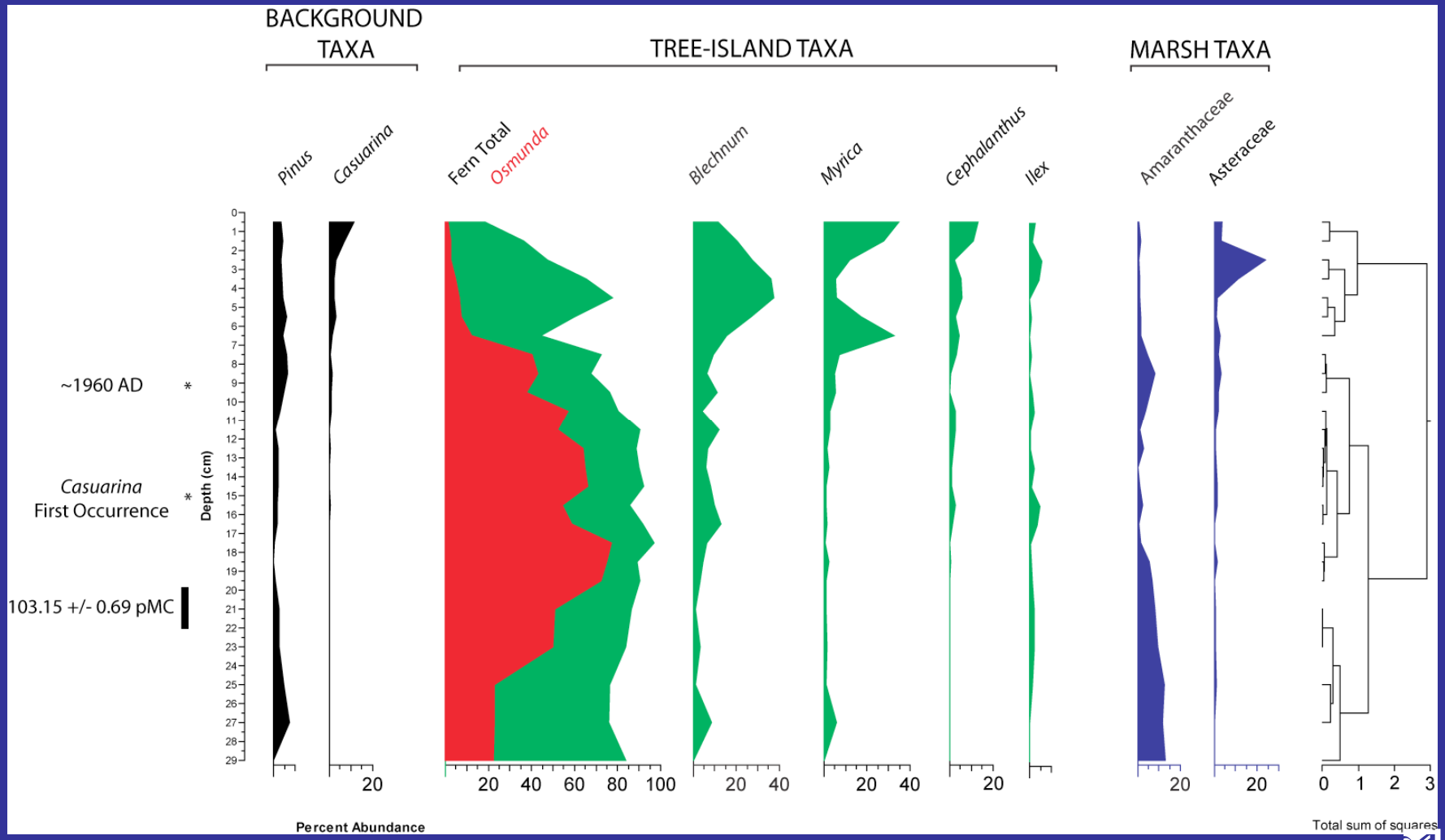
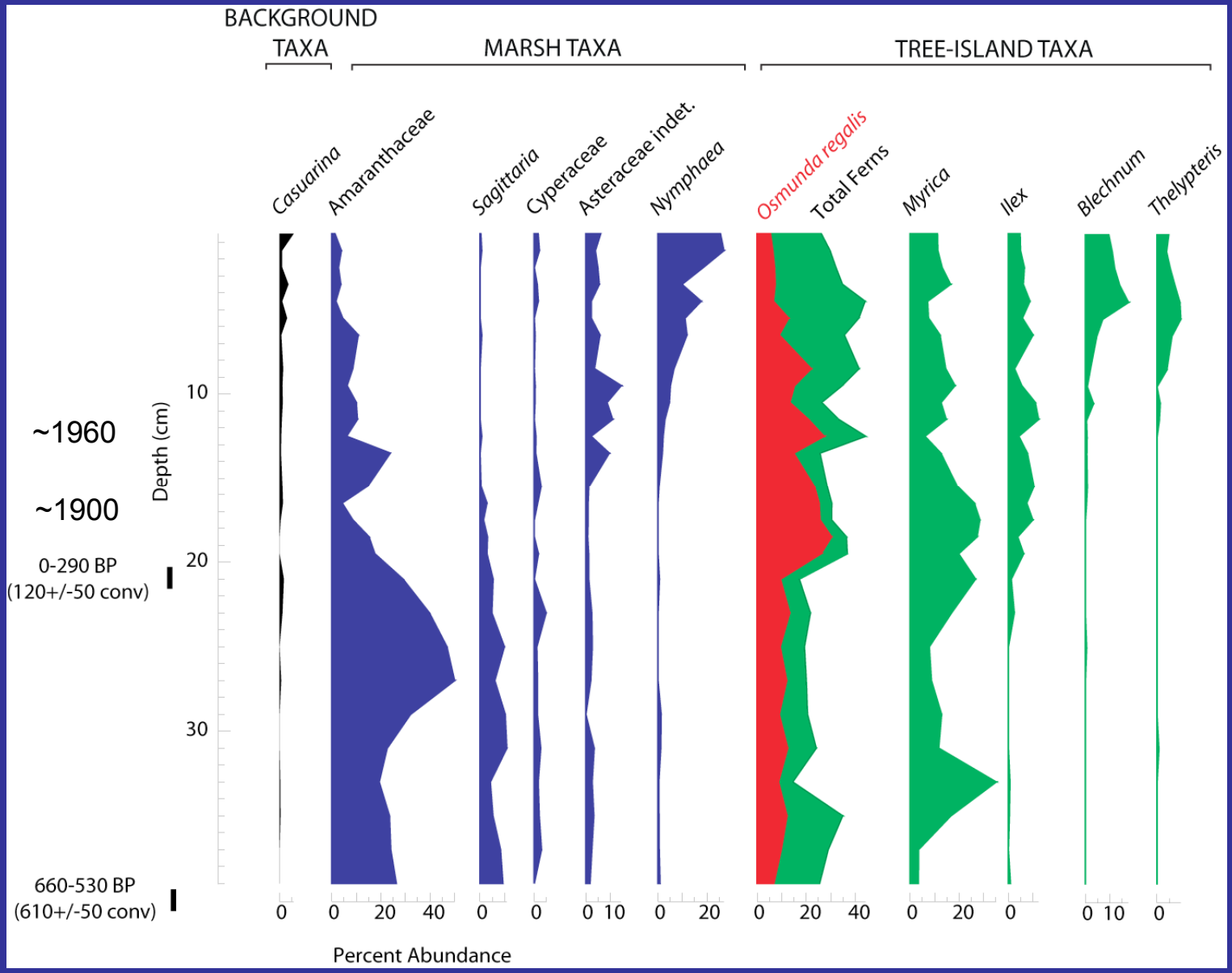
Percent Abundance of Pollen of Major Plant Taxa, Strand Island, core 04-9-21-1, west-central Loxahatchee NWR



Pollen of Major Plant Groups, Core 5-7-26-4, Marsh Adjacent to Strand Island, southwestern Loxahatchee NWR



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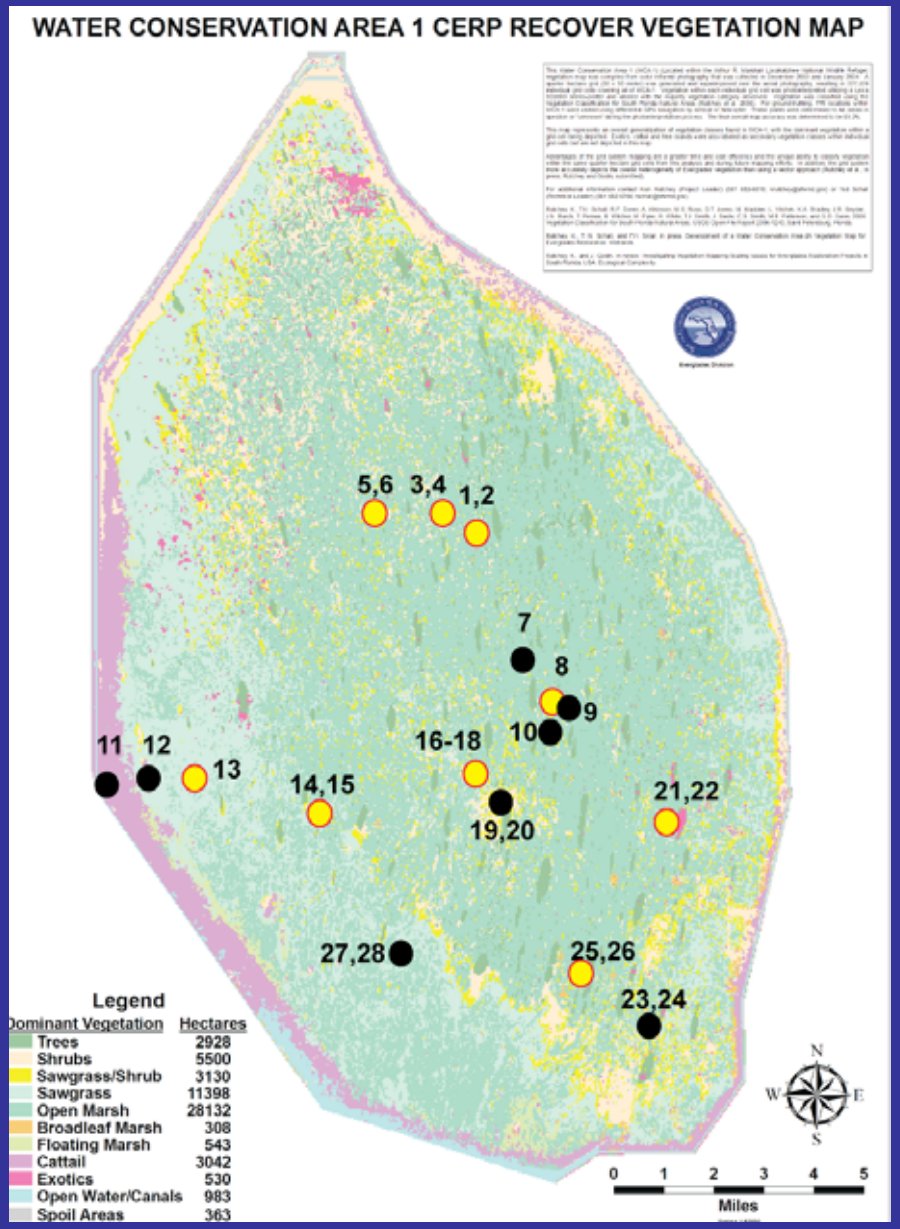
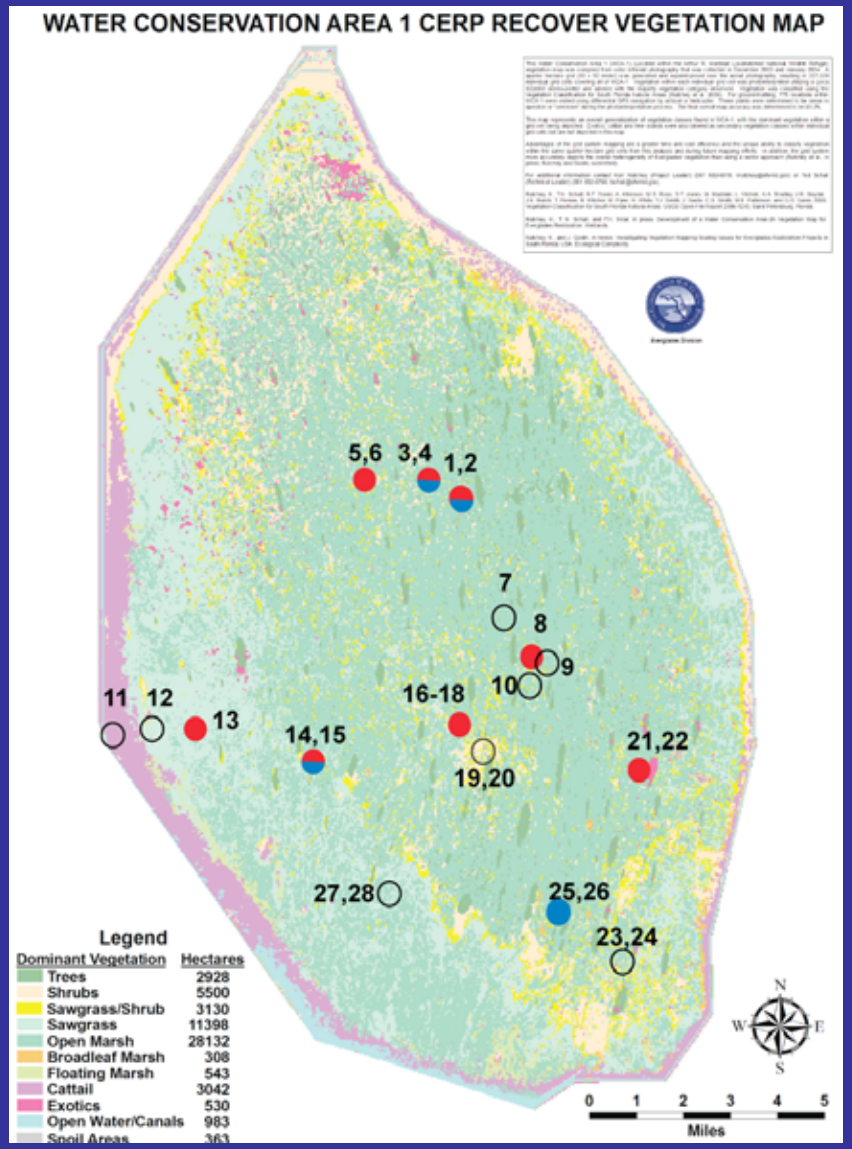


Vegetation Response to Early 20th Century Water Management Changes

Consistently drier

Increased abundance of asters and shrubs (primarily *Myrica*)

USGS



Vegetation Response to Water Management Changes of the Mid-20th Century

Variable throughout the Refuge

Generally drier in the north and central transect, but fluctuations between drier and wetter conditions are evident at some sites

In the southeastern Refuge, much wetter conditions are indicated by high abundance of *Nymphaea* pollen

USGS

CONCLUSIONS

Tree islands have been prominent features in ARM Loxahatchee NWR for much of the last few thousand years, and their plant communities and spatial extent have evolved in response to natural hydrologic fluctuations.

Water management practices of the 20th century have had significant impacts on community composition within tree islands. Generally drier conditions as early as the 1920's resulted in greater abundance of weedy species and shrubs in most islands and marsh sites studied.

Regulation schedules since 1960 have affected tree-island communities throughout the Refuge differently, depending on location, elevation, and water depth. Pollen evidence indicates observable responses to regulation changes within less than a decade.

Completion of analyses on remaining sites should facilitate reconstruction of changes in Loxahatchee plant communities on decadal scales for the last century and for the last few hundred years as baseline evidence for predrainage vegetation.

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ACKNOWLEDGMENTS

USGS Everglades Priority Ecosystem Studies
ARM Loxahatchee NWR Quick Response Program

USGS