REstoration, COordination, VERification (RECOVER): Tree Island Performance Measure

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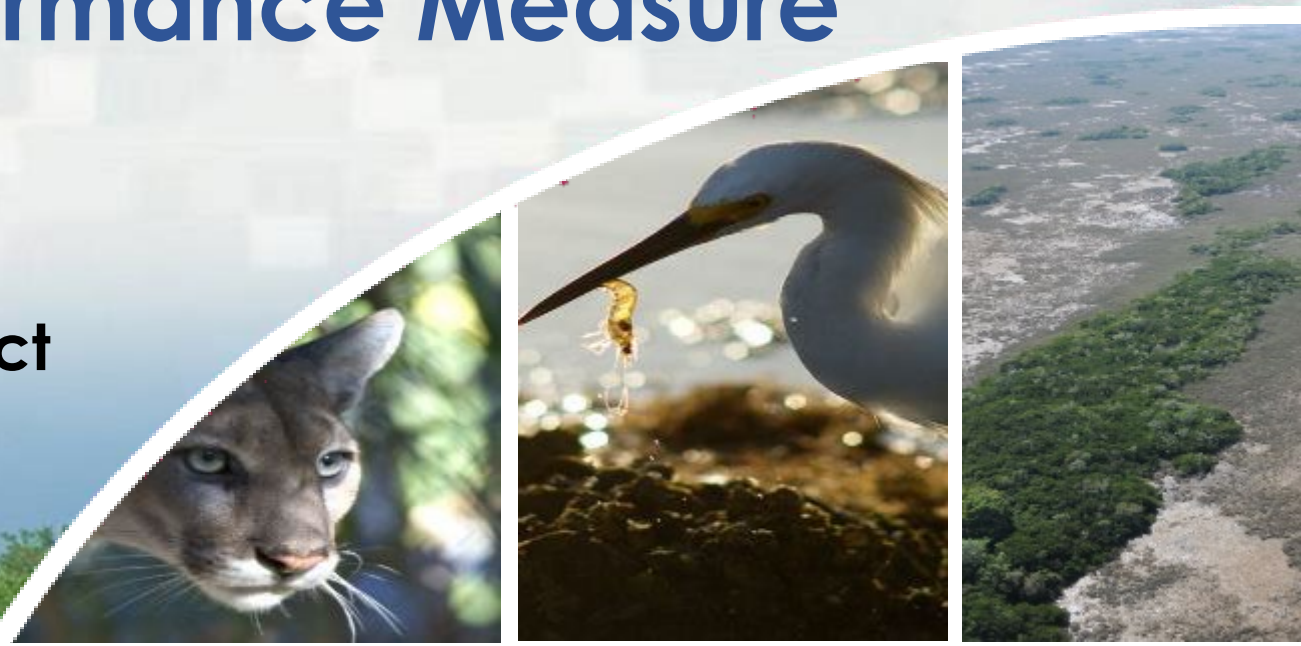

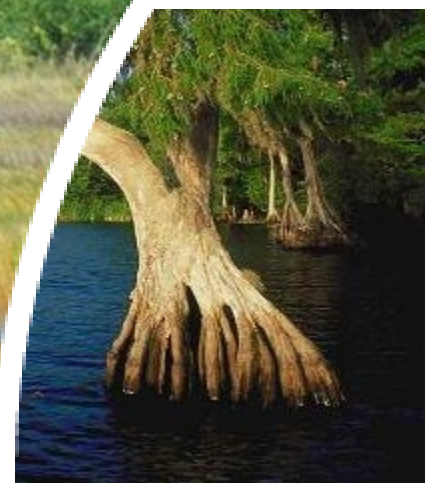

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Greater Everglades Ecosystem Restoration Conference

TREE ISLAND WORKSHOP SERIES

Forum for tree island specialists to integrate current science, monitoring, and modeling efforts to develop a RECOVER Tree Island Performance Measure and Adaptive Management Plan. The information gained from these workshops will advise ***CERP evaluation and assessment*** *and will* ***inform water management decisions****.*

TREE ISLAND ECOLOGICAL PERFORMANCE MEASURE PURPOSE

- PROVIDE A BIOLOGICAL AND ECOLOGICALLY-DRIVEN METRIC FOR PREDICTIVE EVALUATION AND ASSESSMENT OF IMPROVED WATER DEPTHS AND HYDROPERIOD IN THE ENP AND WATER CONSERVATION AREAS 3A AND 3B
- CREATE DESIRED TARGETS BASED ON HYDROLOGIC REQUIREMENTS NECESSARY TO MEET EMPIRICAL OR THEORETICAL ECOLOGICAL THRESHOLDS
- ADVISE CERP EVALUATION AND ASSESSMENT AND INFORM WATER MANAGEMENT DECISIONS

TREE ISLAND ECOLOGICAL PERFORMANCE MEASURE DEVELOPMENT

Goal 1: Identify the types and characteristics of tree islands that will be included in the development of tree island tools, applications, performance measure, monitoring, and adaptive management plan.

Goal 2: Identify tree island data available for incorporation into tree island tools, applications, and performance measure development.

TREE ISLAND DEFINITION

"Spatially discrete patches of woody vegetation embedded in a wetland landscape of contrasting vegetation type in Water Conservation Area 3 (WCA 3)and Everglades National Park (ENP)."

PATH TO A RECOVER TREE ISLAND PERFORMANCE MEASURE

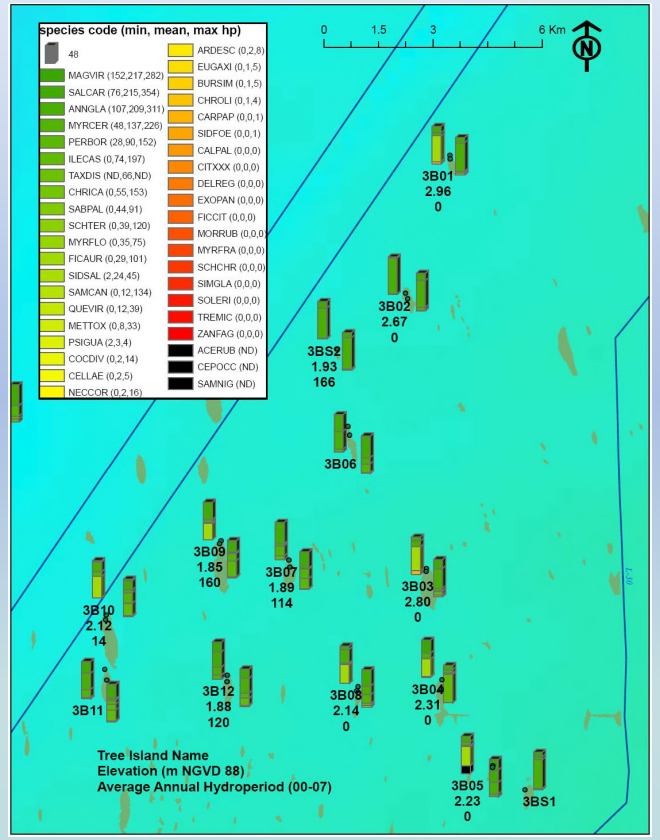
STEP 1: IDENTIFY VEGETATION ON TREE ISLANDS

Sources of Information:

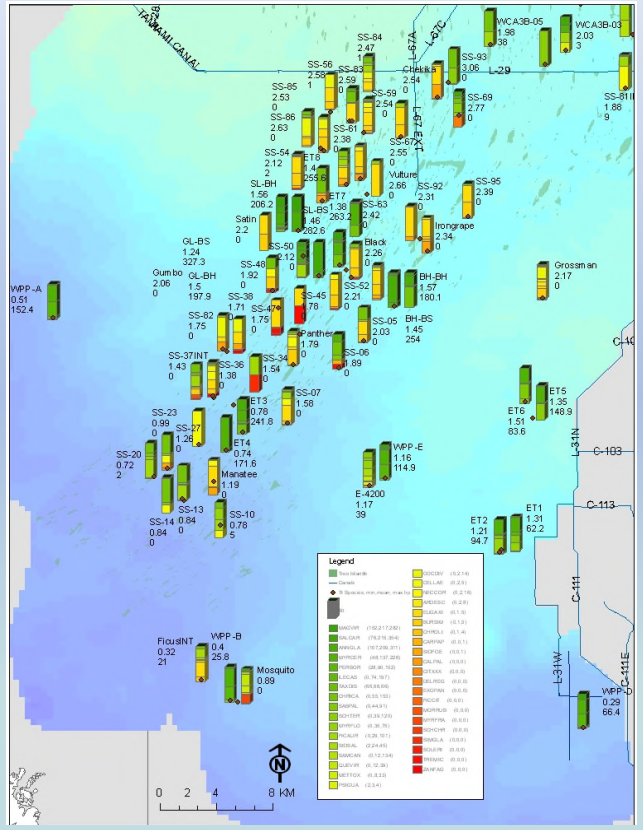
- FIU
- SFWMD
- FWC
- Miccosukee Tribe

Tools:

- E-Tree
- RSM Tool



SFWMD



FIU

Tree islands in ENP surveyed by the SFWMD and FIU. The color codes on the stack graphs correspond to the hydrologic tolerance of the dominant tree species on the island and the height corresponds to their relative Importance Value (IV). The island elevation and the mean annual hydroperiod 2000-2007 are shown next to each island.

Optimum Hydroperiod (Opt_HYDRO) and tolerance values (S.D.) for tree species in the Everglades.

Weighted-averaging (WA) regression was used to determine hydrological niches of tree species*

Species name	SPPCODE	Opt_HYDRO	Tol_HYDRO	
Magnolia virginiana	MAGVIR	217	65	Bayhead species
Salix caroliniana	SALCAR	215	139	
Annona glabra	ANNGLA	209	102	
Myrica cerifera	MYRCER	137	89	
Persea borbonia	PERBOR	90	62	
Ilex cassine	ILECAS	74	123	
Taxodium distichum	TAXDIS	66		
Chrysobalanus icaco	CHRICA	55	98	
Ilex cassine	ILECAS	74	123	Bayhead swamp species
Taxodium distichum	TAXDIS	66		
Chrysobalanus icaco	CHRICA	55	98	
Sabal palmetto	SABPAL	44	46	
Schinus terebinthefolius	SCHTER	39	81	
Myrsine floridana	MYRFLO	35	40	Hammock species
Ficus aurea	FICAUR	29	72	
Sideroxylon salicifolium	SIDSAL	24	21	
Sambucus canadensis	SAMCAN	12	122	
Quercus virginiana	QUEVIR	12	28	

***Engel et al. 2009. Tree island composition, elevation, and hydrologic tolerances of the dominant species: Implications for the DECOMP Physical Model. In: SSR 2009**

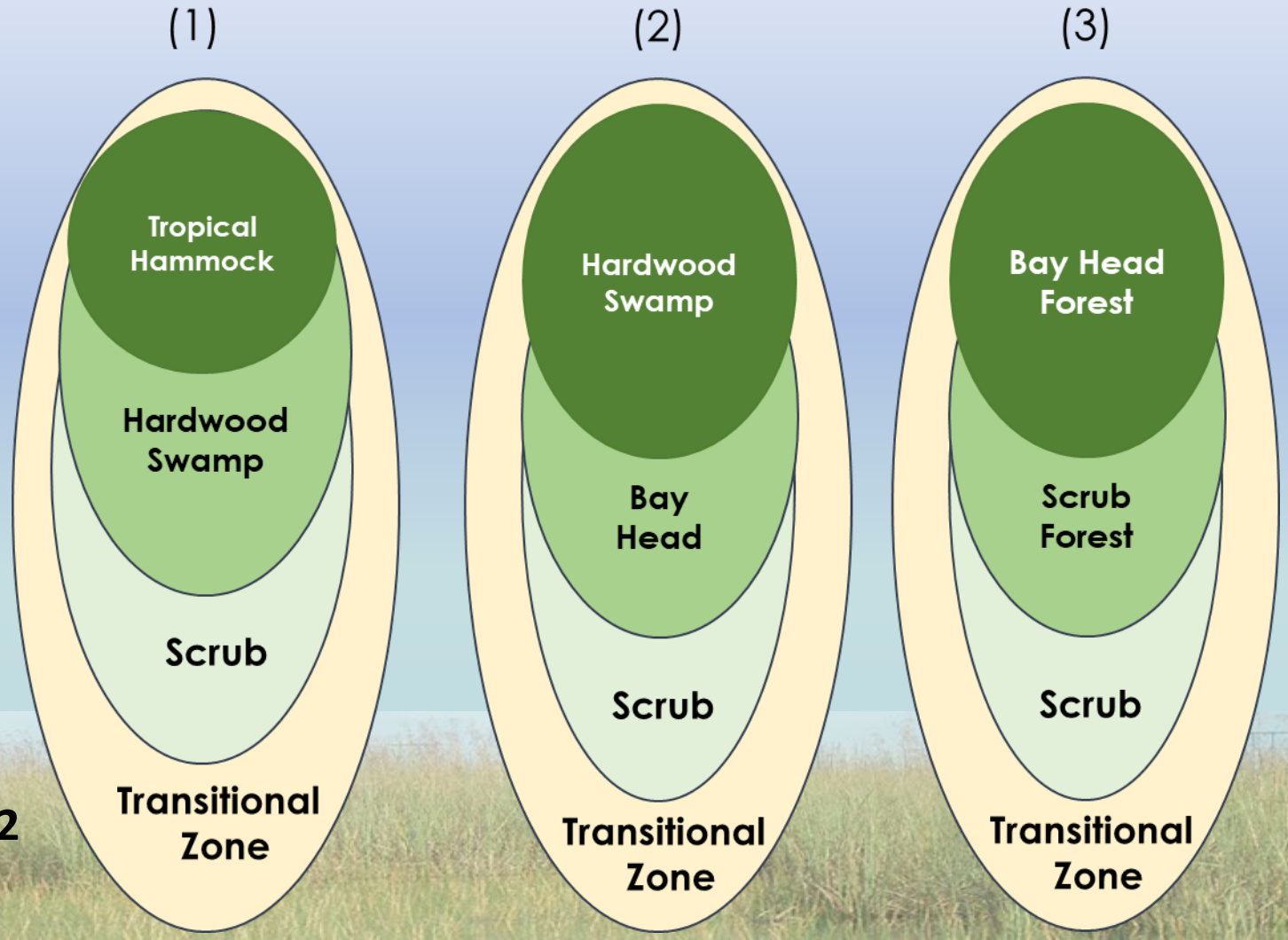
PATH TO A TREE ISLAND PERFORMANCE MEASURE

STEP 2: CLASSIFY TREE ISLANDS INTO BINS*

(1) Tropical Hardwood Hammocks: Head rarely inundated.

(2) Hardwood Swamp: Regular drydowns during the dry season and inundated for much of wet season.

(3) Scrub/Bay Head Forest: Periodic drydowns during the dry season and inundated for the entire wet season.

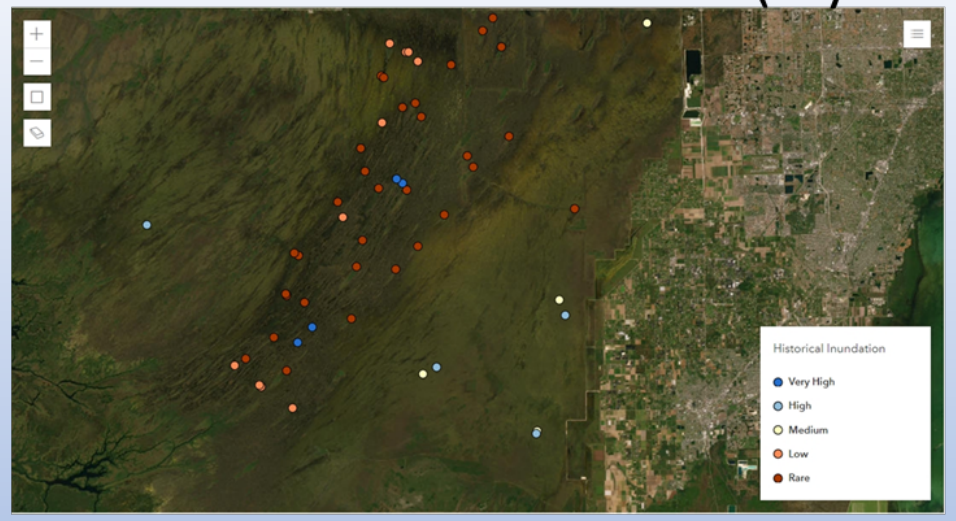


***Importance Value (IV)**

IV = (Relative Basal Area + Relative Density)/2

Data from 74 Tree Islands located in the ENP (Jay Sah & Michael Ross)

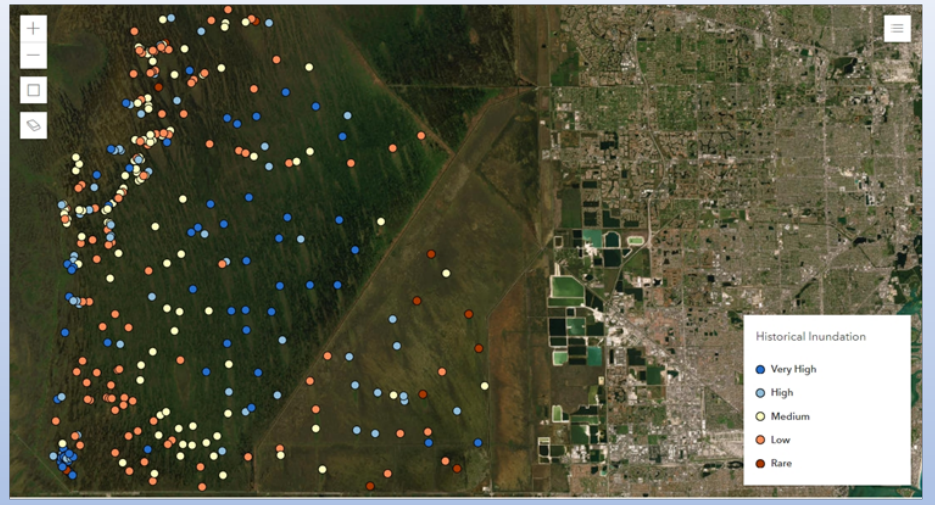
	Hardwood Hammock
	Bayhead (Near Tail) Plots on islands with big HH Head
	Bayhead ? - Based on Species composition
	Bayhead Swamp
	HH/BH
	Prairie (BH)
	Degraded



Bin	Island	ANNGLA	ARDESC	BURSIM	CALPAL	CARPAP	CELLAE	CHRICA	CHROLI	CITXXX	COCDIV
Hardwood Hammock	Black	0.0	0.0	30.7	0.0	8.5	5.7	3.9	0.0	0.0	0.0
Hardwood Hammock	Chekika	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.4	0.0
Hardwood Hammock	E-4200	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	11.5
Hardwood Hammock	FicusINT	0.0	2.9	13.7	0.0	0.0	0.0	5.8	0.2	0.0	1.8
Hardwood Hammock	Grossman	0.0	11.5	25.7	1.5	0.0	0.3	0.1	1.1	0.0	34.8
Hardwood Hammock	Gumbo	0.0	0.0	31.6	0.0	0.0	12.4	0.0	0.0	0.0	0.0
Hardwood Hammock	Irongrape	0.0	0.0	5.5	0.0	7.6	3.1	0.0	0.0	0.0	0.0
Hardwood Hammock	Manatee	0.0	0.0	2.6	0.0	0.0	17.0	0.1	0.0	0.0	0.0
Hardwood Hammock	Mosquito	0.6	0.8	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardwood Hammock	Panther	0.0	0.0	44.5	0.0	0.0	28.5	0.0	0.0	0.0	5.4
Hardwood Hammock	Satin	0.0	0.0	36.4	0.0	0.0	1.8	2.1	6.3	0.0	1.2
Hardwood Hammock	SS-37INT	1.5	0.0	14.3	0.0	0.0	22.6	2.5	0.0	0.0	16.3
Hardwood Hammock	SS-81INT	2.5	0.0	0.0	0.0	0.0	67.9	0.0	0.0	0.0	0.0
Hardwood Hammock	Vulture	0.0	0.0	18.9	0.0	1.6	12.0	1.7	0.1	0.0	0.4
Bayhead	BH-BH	29.4	0.0	0.0	0.0	0.0	0.0	58.6	0.0	0.0	0.0
Bayhead swamp	BH-BS	77.3	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Bayhead	GL-BH	26.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Bayhead swamp	GL-BS	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bayhead	SL-BH	31.3	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0

Use of Importance Value IV to assign Tree Island into Bins

Data from 46 tree islands located in the WCA 3A & 3B



Tree Island Bin	Tree Island ID	ACERUB	ANNGLA	BURSIM	CARPAP	CEPOCC	CHRICA	CHROLI	EUGAXI	FICAUR	ILECAS	MAGVIR	MYRCER
Bayhead	3A22-7 HEAD	0.0	43.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bayhead Swamp	3A22-7 NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	13.6
Bayhead	3A22-2 HEAD	0.0	8.6	0.0	0.0	0.0	56.2	0.0	0.0	0.0	1.3	0.0	0.0
Bayhead Swamp	3A22-2 NT	0.0	8.1	0.0	0.0	0.0	25.5	0.0	0.0	0.0	2.8	0.0	0.0
Bayhead	3A17-1 HEAD	0.0	70.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	5.0	0.6
Bayhead Swamp	3A17-1 NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	7.0
Bayhead	3A17-5 HEAD	7.5	33.5	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	39.7	2.0
Bayhead Swamp	3A17-5 NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	28.4
Bayhead	3AN1 HEAD	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.9
Bayhead Swamp	3AN1 NT	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0
Bayhead	3AN2 HEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	34.8
Bayhead Swamp	3AN2 NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0
Bayhead	3A9-5 HEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.2
Bayhead Swamp	3A9-5 NT	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	26.3
Hammock	3A16-5 HEAD	0.0	0.0	15.4	0.0	0.0	3.4	22.6	49.8	0.0	0.0	0.0	0.0
Bayhead Swamp	3A16-5 NT	0.0	0.7	0.0	0.0	0.0	3.2	0.0	0.0	2.8	7.9	0.0	12.2
Bayhead	3A19-1 HEAD	0.0	6.8	0.0	0.0	0.0	71.2	0.0	0.0	0.0	6.9	0.0	0.0

	Hardwood Hammock
	Bayhead
	Bayhead Swamp

Importance Value IV

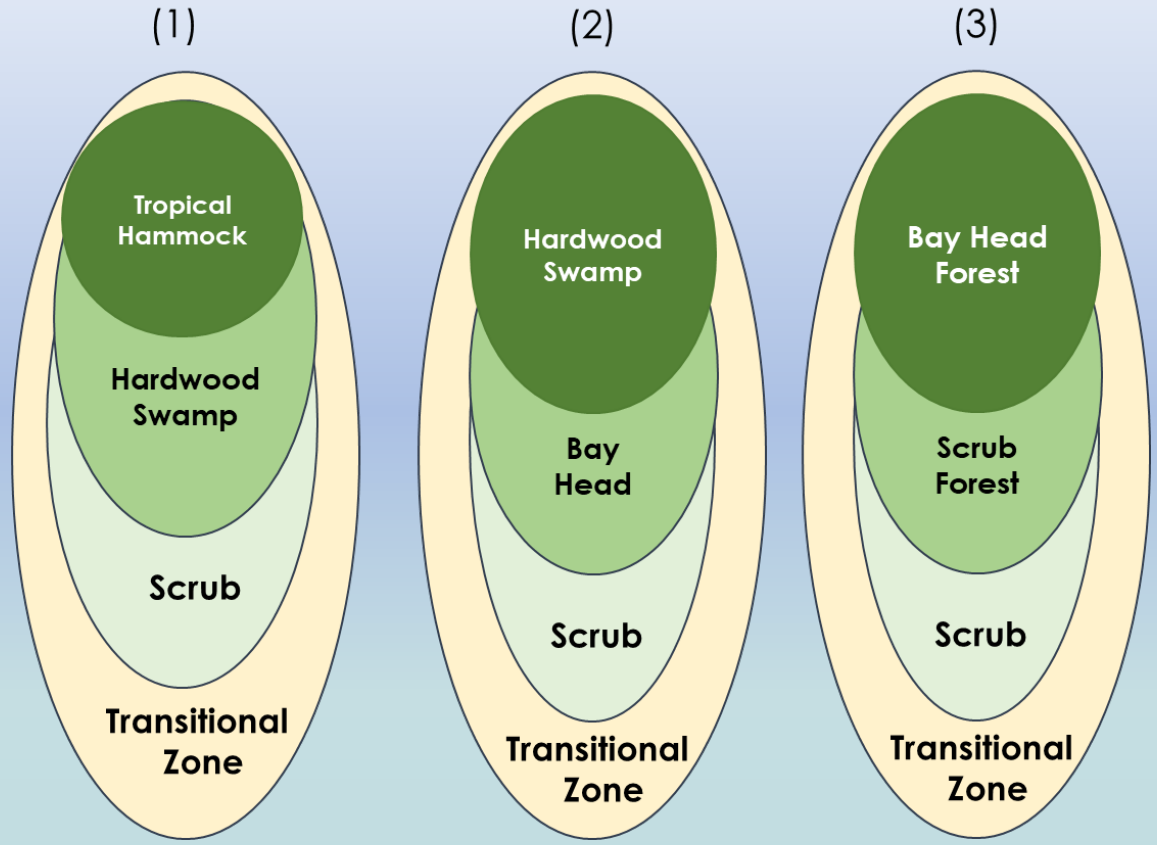
IV = (Relative Basal Area + Relative Density)/2

TREE ISLAND BINS: PARTIAL RESULTS

(1) Tropical Hardwood Hammocks: Head rarely inundated.

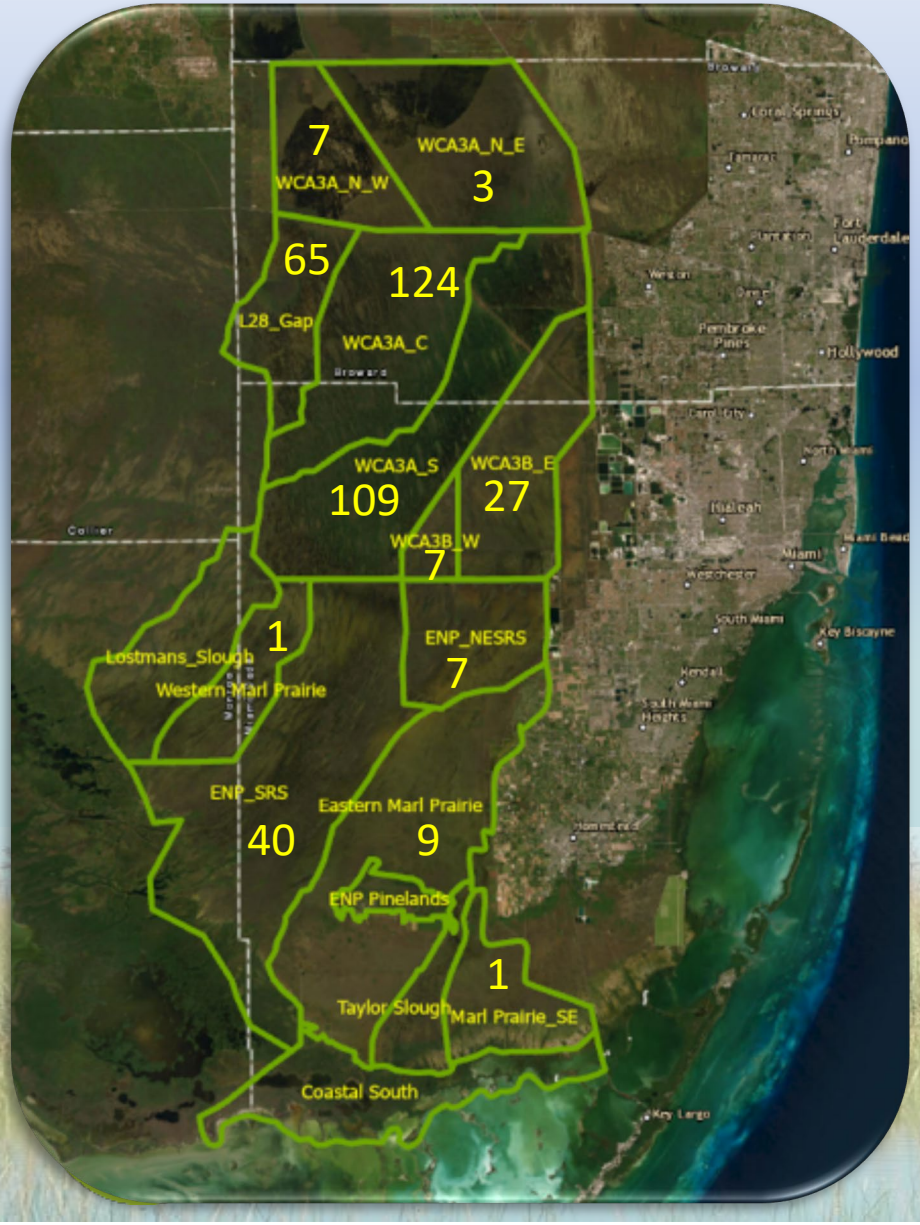
(2) Hardwood Swamp: Regular drydowns during the dry season and inundated for much of wet season.

(3) Scrub/Bay Head Forest: Periodic drydowns during the dry season and inundated for the entire wet season.



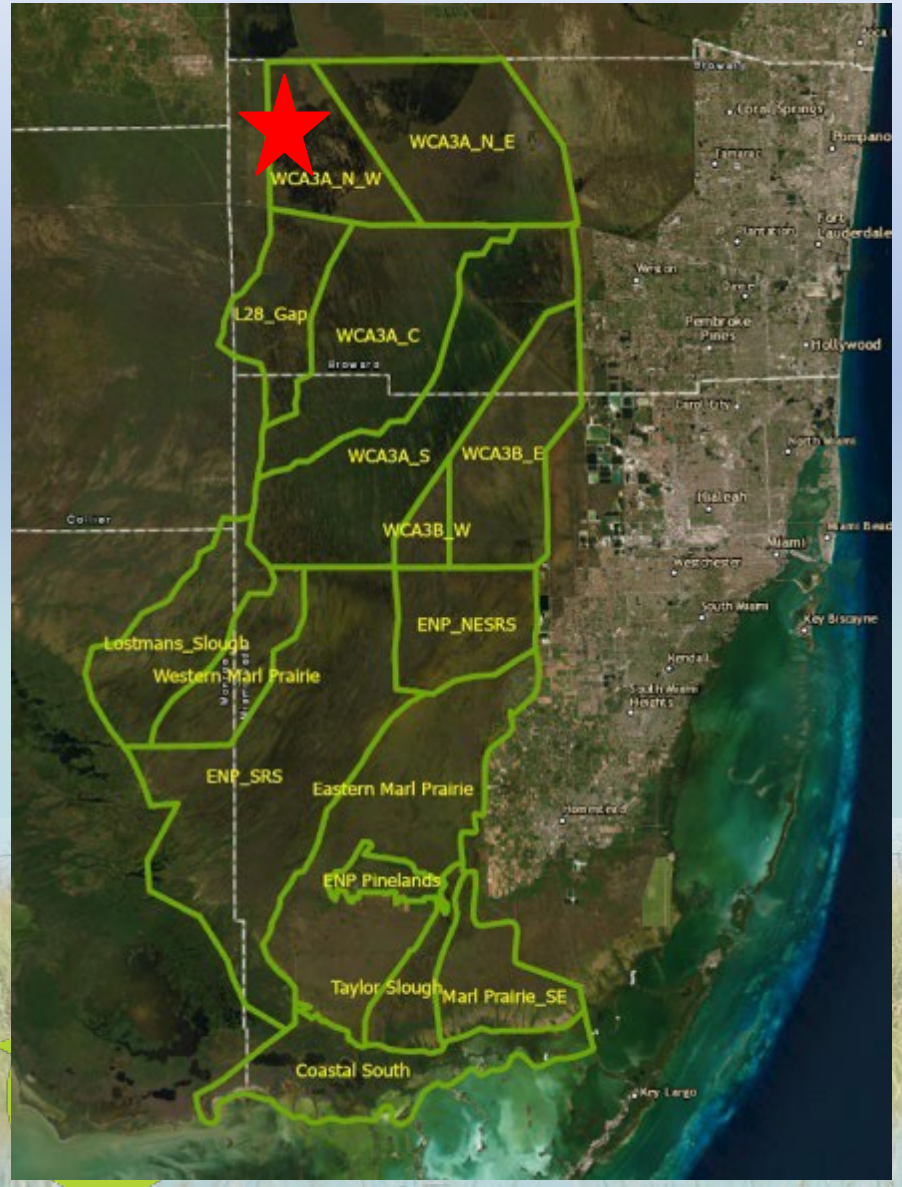
ENP	**50**	**24**
WCA's	**1**	**45**

PATH TO TREE ISLAND PERFORMANCE MEASURE
STEP 3: ASSIGN TREE ISLANDS TO REGIONS



- ✓ **HOW MANY TREE ISLANDS ARE WITHIN THE REGION?**
- ✓ **WHAT IS THE HIGHEST & LOWEST RELATIVE ELEVATION TREE ISLAND IN THE REGION? MEDIAN (±STD) RELATIVE ELEVATION ACROSS ISLANDS?**
- ✓ **WHAT IS THE DISTRIBUTION OF ISLANDS ACROSS ELEVATIONS?**
- ✓ **WHAT IS THE MEDIAN (±STD) WATER DEPTH (WET SEASON/DRY SEASON) ACROSS THE EDEN PERIOD OF RECORD?**

PATH TO TREE ISLAND PERFORMANCE MEASURE
STEP 3: ASSIGN TREE ISLANDS TO REGIONS

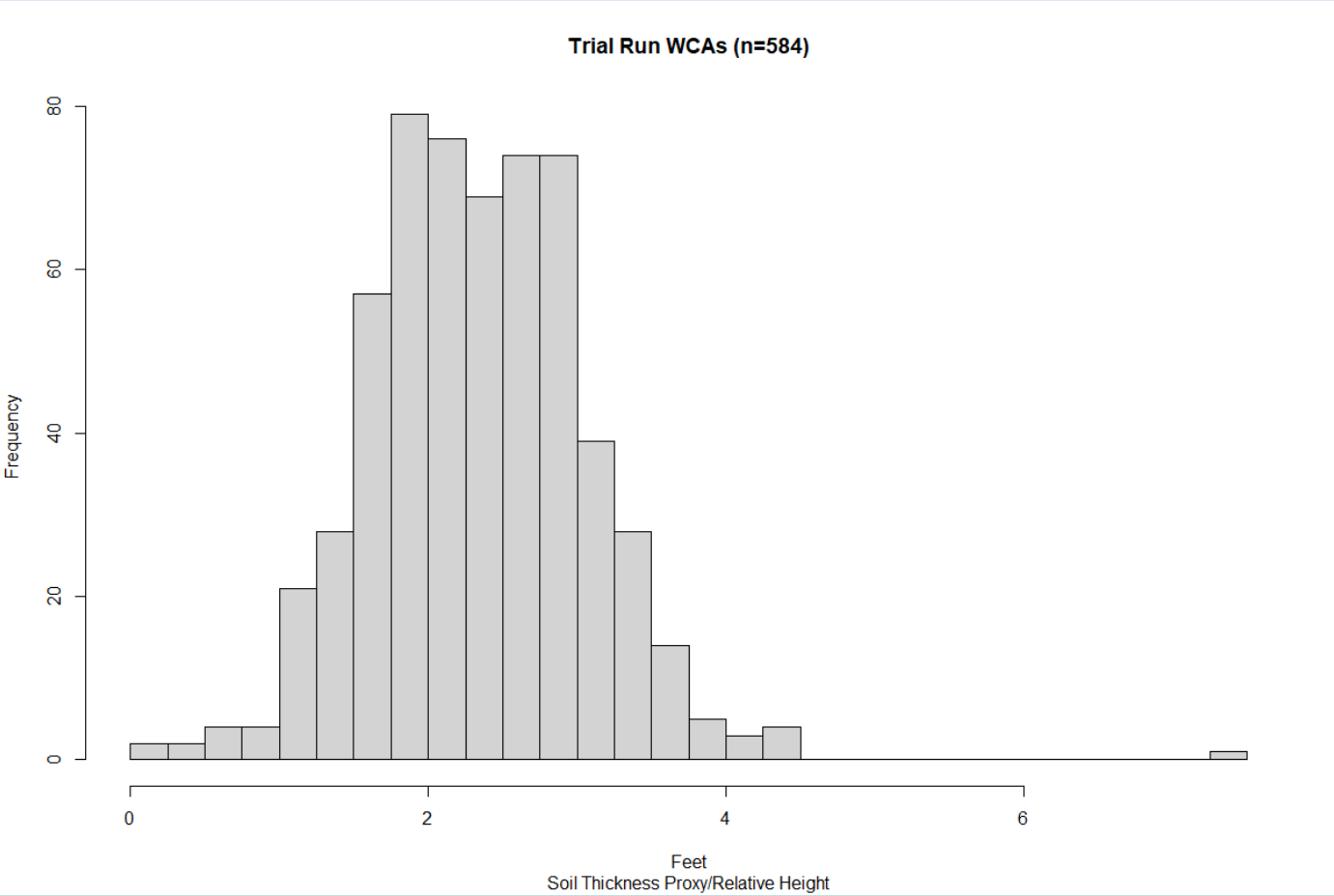


WCA_3A_N_W

- ✓ Projects: LOSOM, CEPP
- ✓ Anticipated Change:
  - ✓ + flow
  - ✓ + depth
  - ✓ + hydroperiod

Number of Islands: 7
Highest Elevation Island: 12.9’
Lowest Elevation Island: 10.7’
Median Elevation Across Islands: 11.6’
Water Depth Range: Mean Annual Max/Mean+ STD/Min
JAN-JUN: 1.1’/0.1’± 0.5’/-0.9’
APR: 0.2’/-0.2’± 0.2’/-0.5’
JUL-DEC: 1.7’/0.8’± 0.4’/0’
OCT: 1.4’/1.1’± 0.2’/0.8’

PATH TO TREE ISLAND PERFORMANCE MEASURE
STEP 4: IDENTIFY RELATIVE ELEVATION OF EACH TREE ISLAND

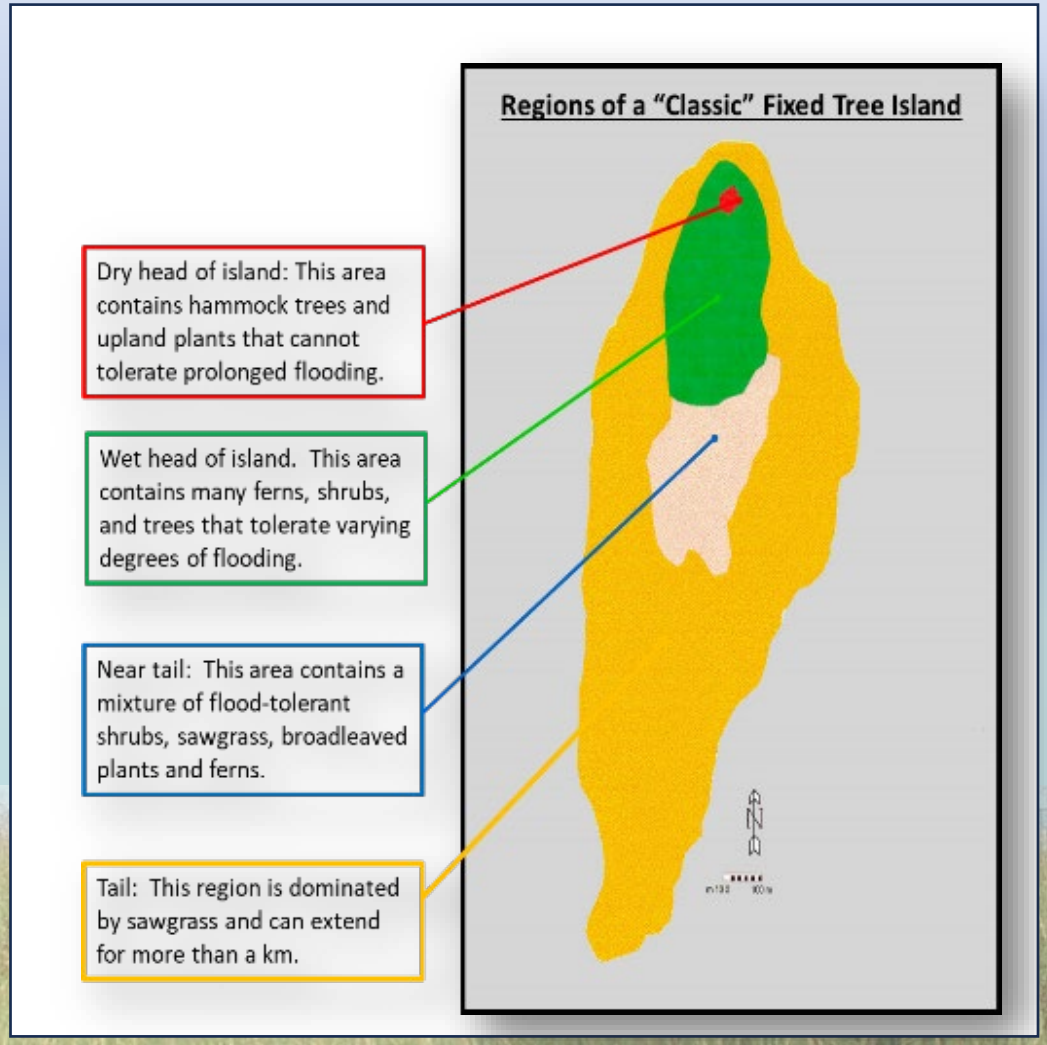


- Relative elevation/soil thickness proxy for 584 tree island locations across the WCAs shown in this histogram
- The mean and median both round to 2.3 feet, but visually can see “peaks” on either side of this value

Chris Altes, 25 September 2024

PATH TO TREE ISLAND PERFORMANCE MEASURE
STEP 5: DEFINE HYDROLOGIC TARGETS FOR EACH REGION

- ✓ **WHERE DO WE ANTICIPATE CHANGE? (i.e., CERP/SLR)**
- ✓ **WHAT IS THE DESIRED RESTORATION CONDITION FOR TREE ISLANDS WITHIN REGION? (i.e., HISTORIC? CURRENT? FUTURE?)**
- ✓ **WHAT IS THE HYDROLOGIC TARGET (RANGE)?**



Sklar 2022, RECOVER Workshop

TREE ISLAND PERFORMANCE MEASURE METRICS

1 LOCATION

+

2 ELEVATION

=

3 HYDROLOGY: DEPTH & DURATION (TARGETS)

Cultural

- Access 1, 2, 3
- Archaeological Artifacts 1, 2, 3
- Ceremonial Uses 1, 2, 3
- Species of Cultural Significance 1, 2, 3

Biological/Ecological

- Accretion 3
- Calcite Layer
- Canopy Height 3
- Fire Regimes 3
- Hydroperiod 3
- Invasives vs. Natives 3
- Length of Dry Down 3
- Nutrient Concentration 1
- Microbiome Functional Capacity 3
- Significant Wildlife Uses (Nesting, Birds, Mammals, Herps) 2, 3
- Vegetation (Density, Structure, Species Composition) 3
- Water Depth 3
- Wildlife (Rookeries) 1, 2, 3
- Wildlife (Indicators, Occupancy, Reproduction) 1, 2, 3

Landscape

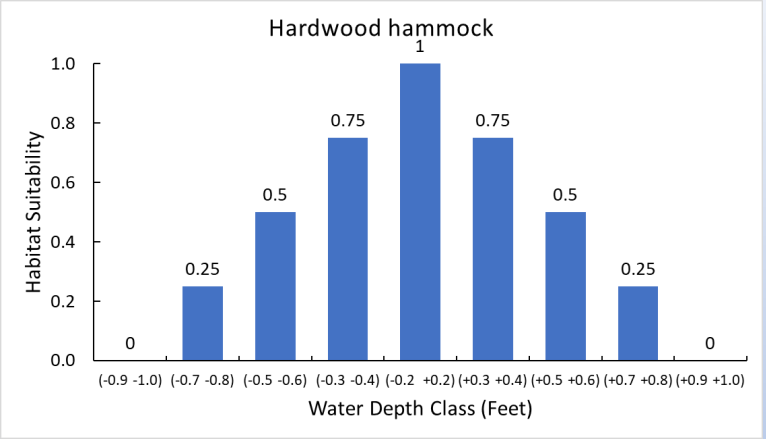
- Condition of Surrounding Marsh 1, 2
- Distribution in Landscape 1
- Flow 1, 3
- Ground Elevation (Relative/Absolute) 2
- Hydrologic Variability 3
- Hydrology (Depth/Duration) 3
- Location 1
- Portion of Different Types of Communities within Individual Islands 2 , 3
- Size of Island
- Water Depth versus Soil Surface Elevation 3
- Wildlife Use 1, 2, 3

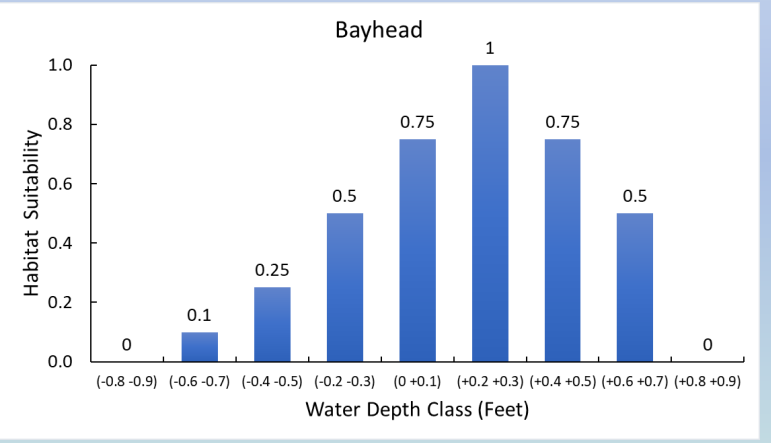
PERFORMANCE MEASURE SCORING PROPOSAL

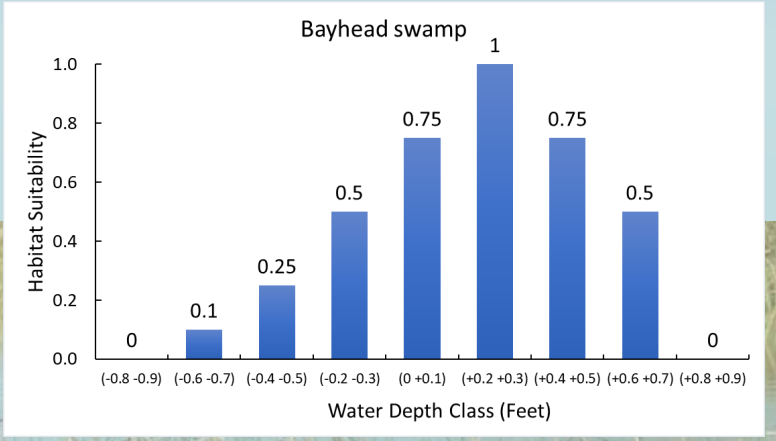
TREE ISLAND FOREST DENSITY HSI

1. Identify optimal water depth ranges for each tree island bin (Slide 4, Step 2).
2. Translate optimal water depth ranges into a Habitat Quality Score.
   a. Habitat Quality Score: 0-1
   b. Optimal water depth range will receive a score of 1.
   c. Sub-optimal water depth ranges will provide fewer benefits and thus receive a lower score relative to ideal in a linear fashion.
3. Apply Habitat Quality Score to each geographic region.
   1. Evaluation PM: Use Percent Period of Inundation from RSM-GL
   2. Assessment PM: Use EDEN Values/ETree

HSI Examples from BBSEER







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