

COMPLETING MODIFIED WATER DELIVERIES TREE ISLANDS AS A PERFORMANCE INDICATOR FOR COMBINED OPERATIONS PLANNING



Jed Redwine¹, Troy Mullins¹, and Carlos Coronado-Molina²

¹South Florida Natural Resource Center – National Park Service, Homestead, FL, USA

²South Florida Water Management District – West Palm Beach, FL, USA

Rationale



Regional condition

- Tree island decline across WCA3A, WCA3B, and ENP has been extensively documented by Fred Sklar and Ted Schall (SFWMD and USACE respectively)
- There has been a ~10% reduction in the number of tree islands larger than 1 acre each decade beginning 1952-2004.
- The rate of loss of tree island larger than 1 acre is different in different portions of the landscape (National Park Service in press).

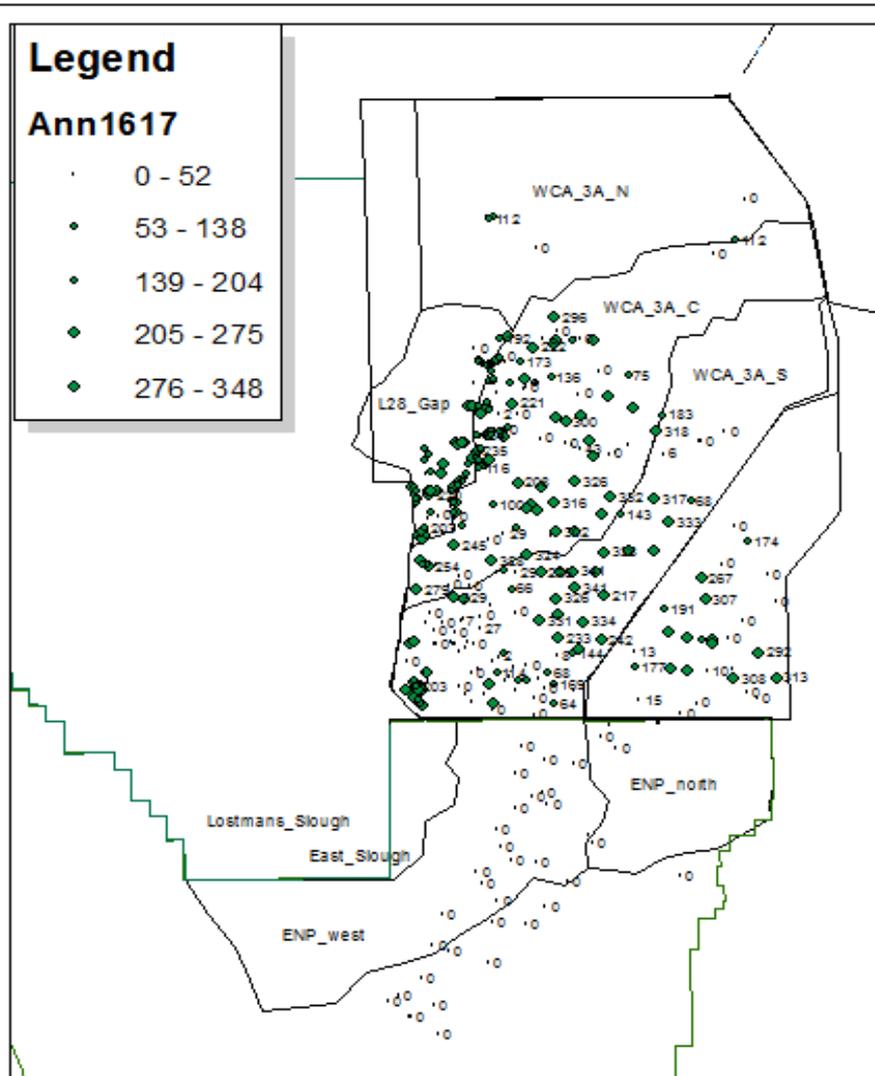
Localized conditions

- The central portion of Water Conservation Area 3A has the largest number of tree islands per square mile.
- This portion of the landscape also exhibits tree islands occurring adjacent to each other which have very different tendency to be inundated.
- Between May 1, 2016 and April 30, 2017 there were many examples of adjacent tree islands where the highest elevation portion of one tree island was never below the water surface while a tree island next to it had over 300 days of inundation.

Legend

Ann1617

- 0 - 52
- 53 - 138
- 139 - 204
- ◆ 205 - 275
- ◆ 276 - 348



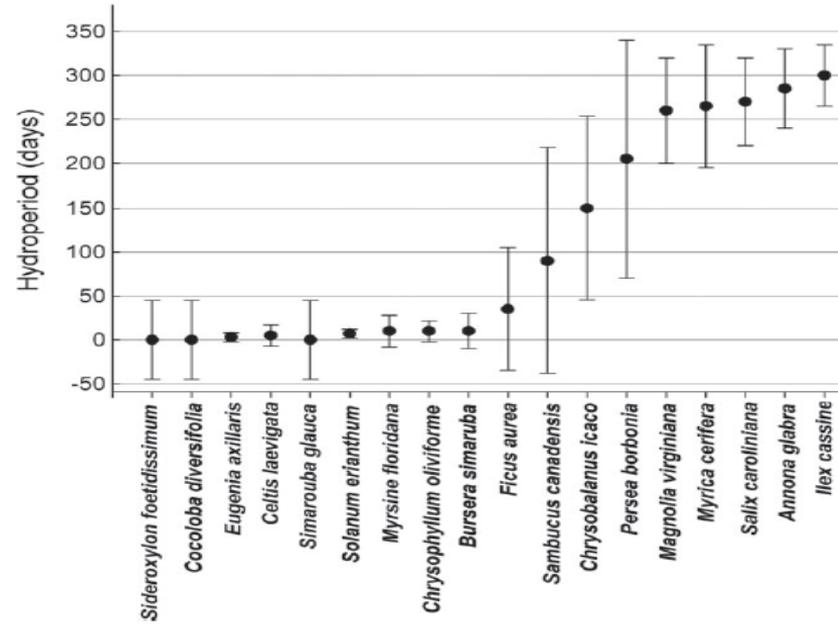
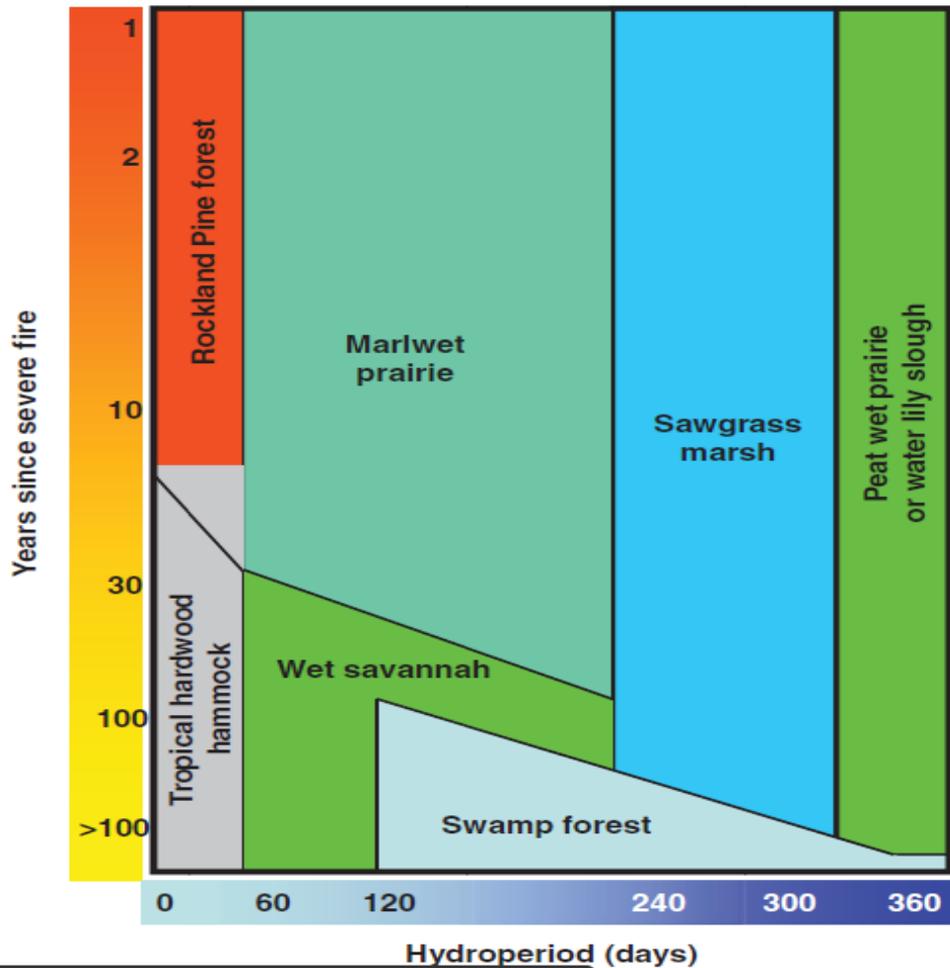


Figure 4. Mean annual (optima) and range of hydroperiods (tolerance) of 18 common tree species found on tree islands in the central and southern Everglades. From Sah (2004).

Total days inundated in 25 years 378 Tree Islands

0 2000 4000 6000 8000

0 2000 4000 6000 8000

WCA3AC

WCA3AN

WCA3AS

WCA3B

WCA3AC 730

WCA3AN 6

WCA3AS 110

WCA3B 29

15

10

5

0

ENPN

ENPS

ENPW

Gap

ENPN 4

ENPS 14

ENPW 18

Gap 67

15

10

5

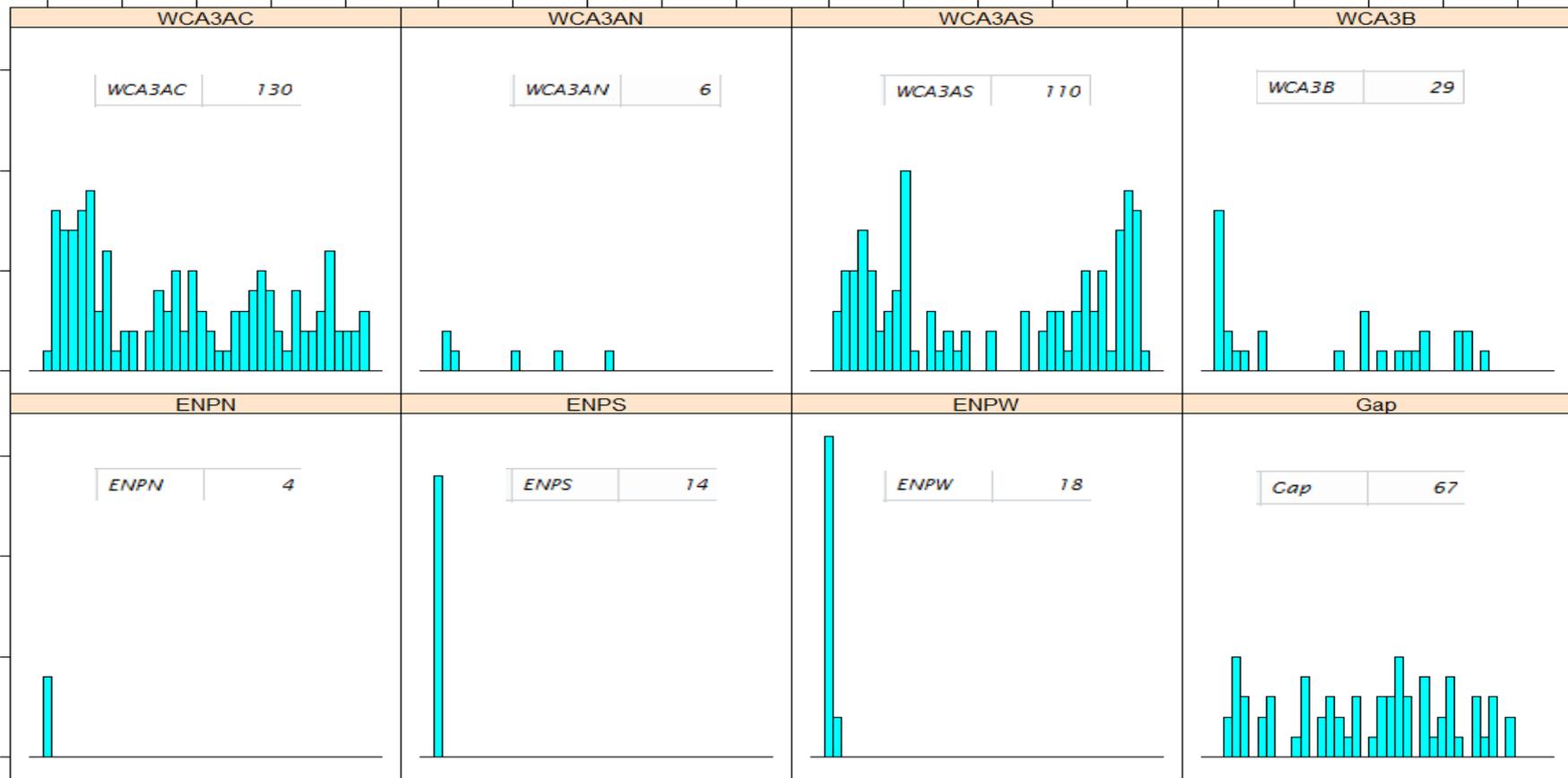
0

0 2000 4000 6000 8000

0 2000 4000 6000 8000

Number of days, max = 9131

Count of Tree Islands



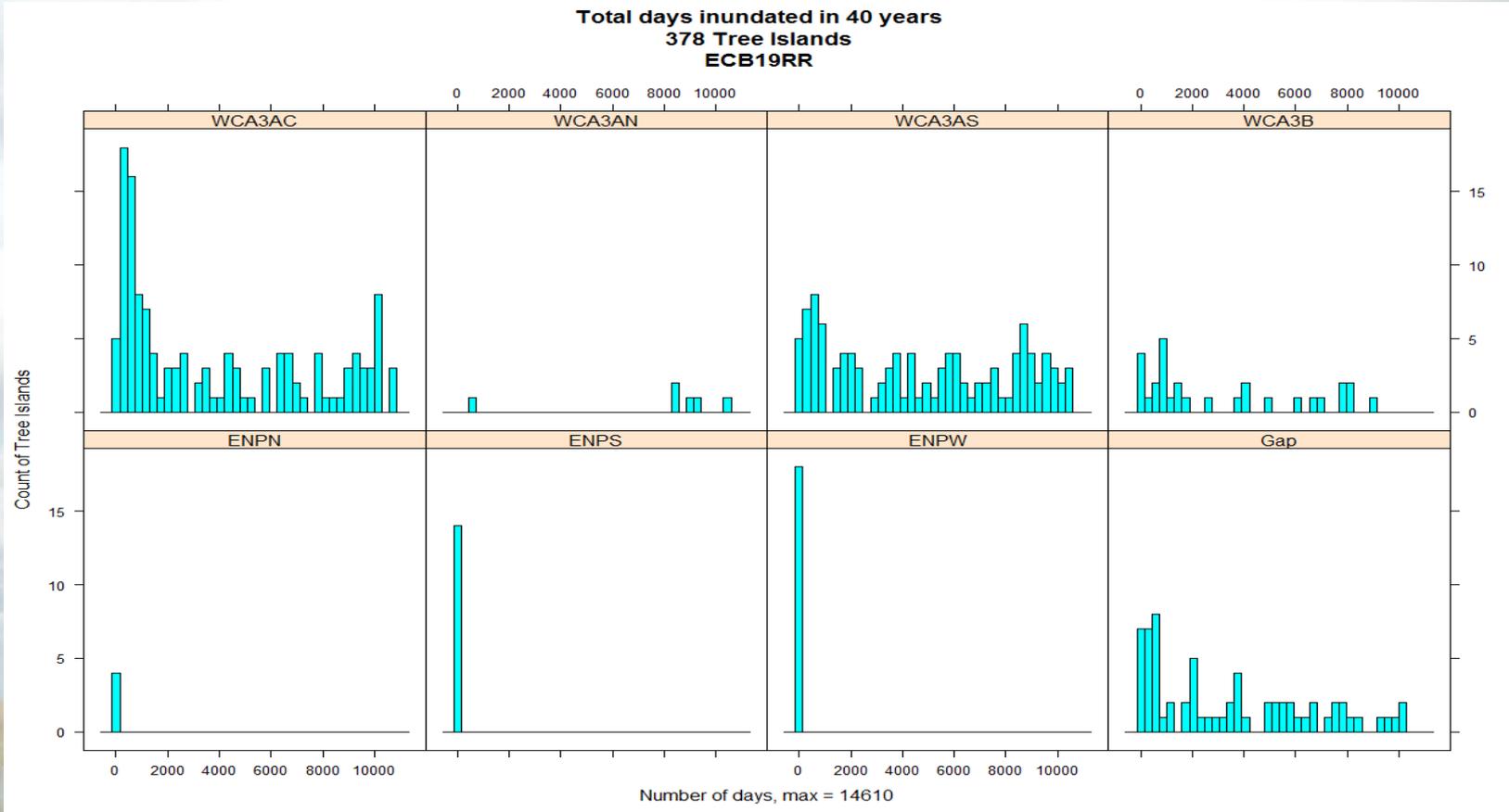


Figure 3. Histogram of mapped tree islands across the regions of interest in WCA3A, WCA3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of the Existing Condition Baseline 19RR (ECB19RR).

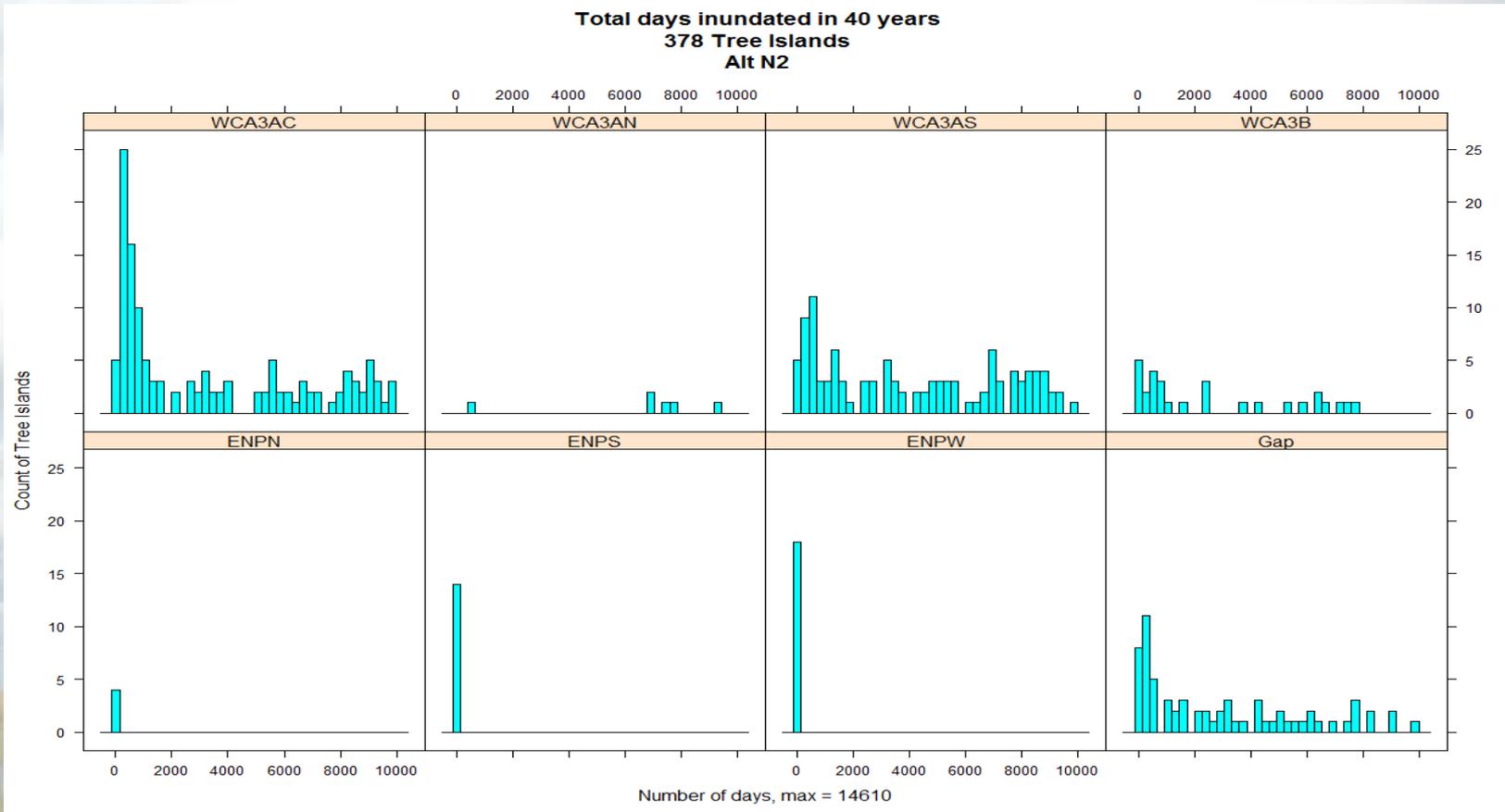


Figure 4. Histogram of mapped tree islands across the regions of interest in WCA3A, WCA3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of the Alternative N2 (ALTN2).

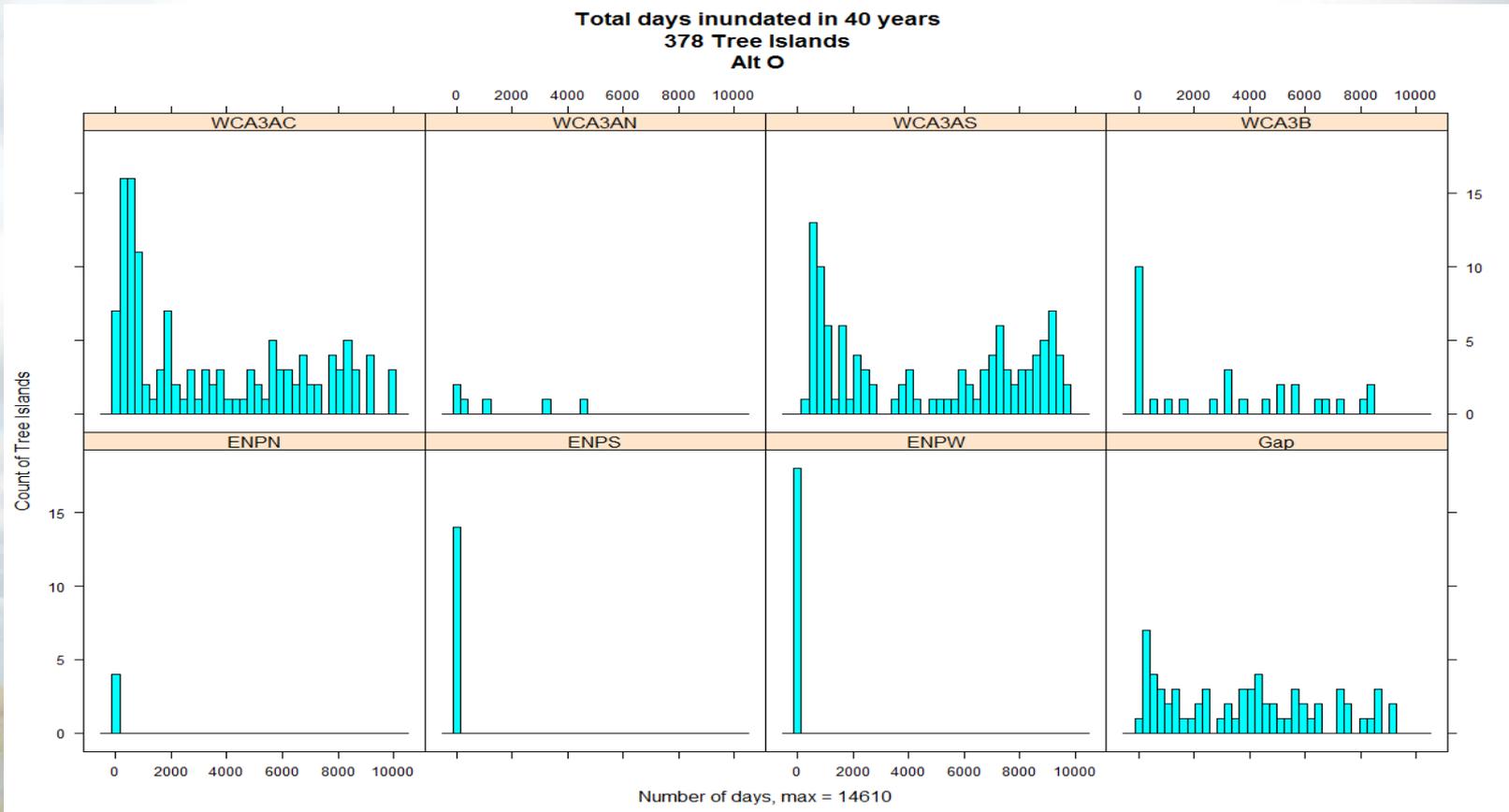


Figure 5. Histogram of mapped tree islands across the regions of interest in WCA3A, WCA3B, and ENP. These are counts of inundation over a 41 year period of simulating the operations of Alternative O (ALTO).

Alternative	WCA3AC	WCA3AN	WCA3AS	WCA3B	ENPN	ENPS	ENPW	Gap	Sum
Observed	16	3	19	11	4	14	18	6	91
ECB19RR	45	1	24	9	4	14	18	23	138
Alt N2	61	1	34	15	4	14	18	27	174
Alt O	52	4	30	12	4	14	18	19	153

Table 1. Total number of tree islands inundated less than 10% of time period. For Observed this = 950 days over 26 years (1991 – 2017), for ALTs this = 1461 days over 40 years (1965 – 2005).

Alternative	WCA3AC	WCA3AN	WCA3AS	WCA3B	ENPN	ENPS	ENPW	Gap	Total
Observed	12%	50%	17%	38%	100%	100%	100%	9%	24%
ECB19RR	35%	17%	22%	31%	100%	100%	100%	34%	37%
Alt N2	47%	17%	31%	52%	100%	100%	100%	40%	46%
Alt O	40%	67%	27%	41%	100%	100%	100%	28%	40%

Table 2. Percent of mapped tree islands inundated less than 10% of time period. For Observed this = 950 days over 26 years (1991 – 2017), for ALTs this = 1461 days over 40 years (1965 – 2005).

Combined Operations Plan performance testing

- Alt N2 consistently produces the most tree islands that are inundated less than 10% of the total time period in all portions of WCA3A and WCA3B.
- None of the mapped tree islands are ever inundated in ENP.
- Alt O and N2 have more tree islands inundated less than 10% of the time than ECB19R.

Implications and future development opportunities



Proposed development of integrated Tree Island Performance
Measure and Assessment procedure

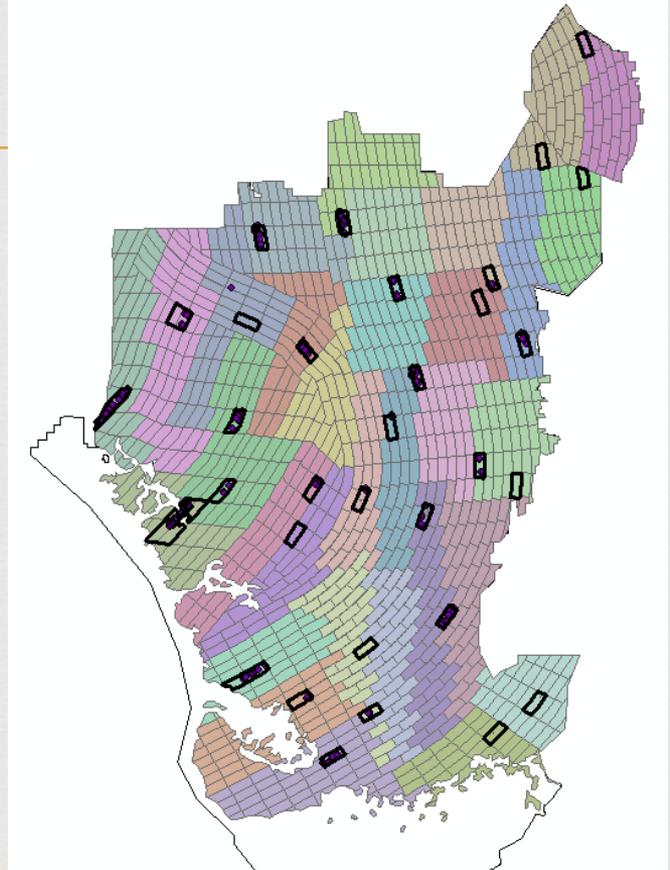
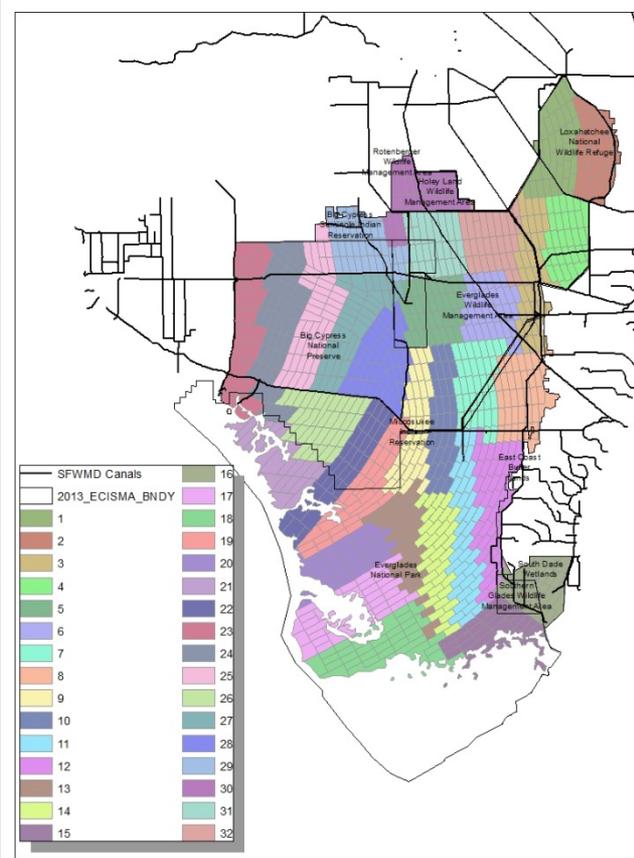
Developmental Goals



- ☞ The Seminole Tribe requested that tree islands less than 1 acre in size to be incorporated into the analysis.
- ☞ Formalize into a performance measure for CERP – including associated monitoring/assessment

Goal	Monitoring Effort					
	EDEN/Hydrology	BICY/EVER Soil Inventory	BICY/EVER Vegetation Map	Exotic Plant Monitoring	CERP Landscape change	Small mammal, songbirds, herpetofauna
Increased Precision	x	x	x	x	x	x
Continuity	x			x	x	
Compatability	x	x	x	x	x	x
	CENSUS monitoring (daily hydro estimates for all possible sampled locations)	Proposed use of GRTS for some aspects	Proposed Adapt to GRTS for ground truthing and mapping sequence	can use GRTS	USES GRTS	Proposed double stratified design (spatial and habitat stratification)

Proposed Expanded Landscape monitoring design



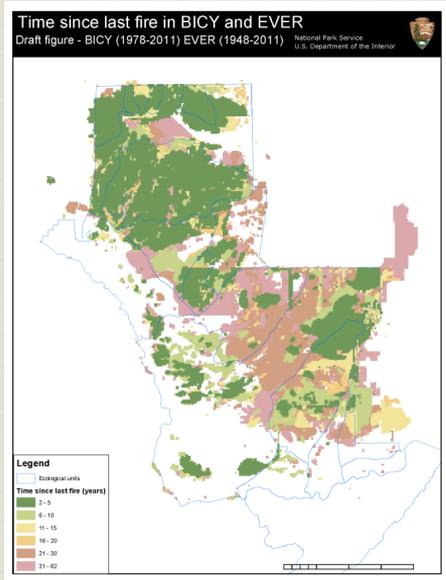
32 regions = entire ECISMA

Key hypotheses



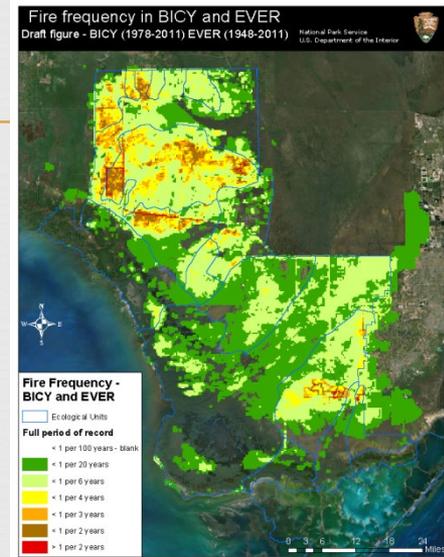
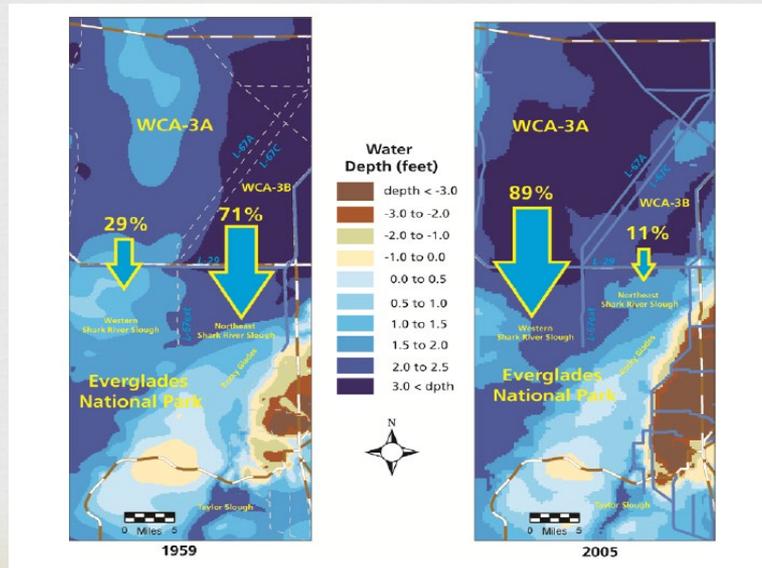
- ❧ Ridge-slough-tree island landscape health is linked to exotic plant presence/absence, and health of faunal communities
- ❧ Everglades Restoration (COP and next CERP) will meaningfully improve the condition of the landscape and it's faunal inhabitants
- ❧ Integrated system monitoring is cost-effective and provides conclusive evidence of system-level conditions

Proof that drivers are patchy



Time since last fire

Change in water deliveries to Everglades since 1959 (World Heritage Report, 2013)



Fire frequency over in BICY and EVER for lifespan of these NPS units

References



- ❧ Wetzell, P.R., J.P. Sah, M.S. Ross. 2016. Tree islands: the bellwether of Everglades ecosystem function and restoration success. *Restoration Ecology*. September 2016. pg 1-15.
- ❧ National Park Service. In press. A natural resource condition assessment for Everglades National Parks. Natural Resource Report NPS/EVER/NRR – in press. National Park Service, Fort Collins, Colorado.

Special Thanks!

