



Restoring Ecosystem Function in the P-Enriched Everglades

Creating an Alternate Regime

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Everglades System Assessment, SFWMD

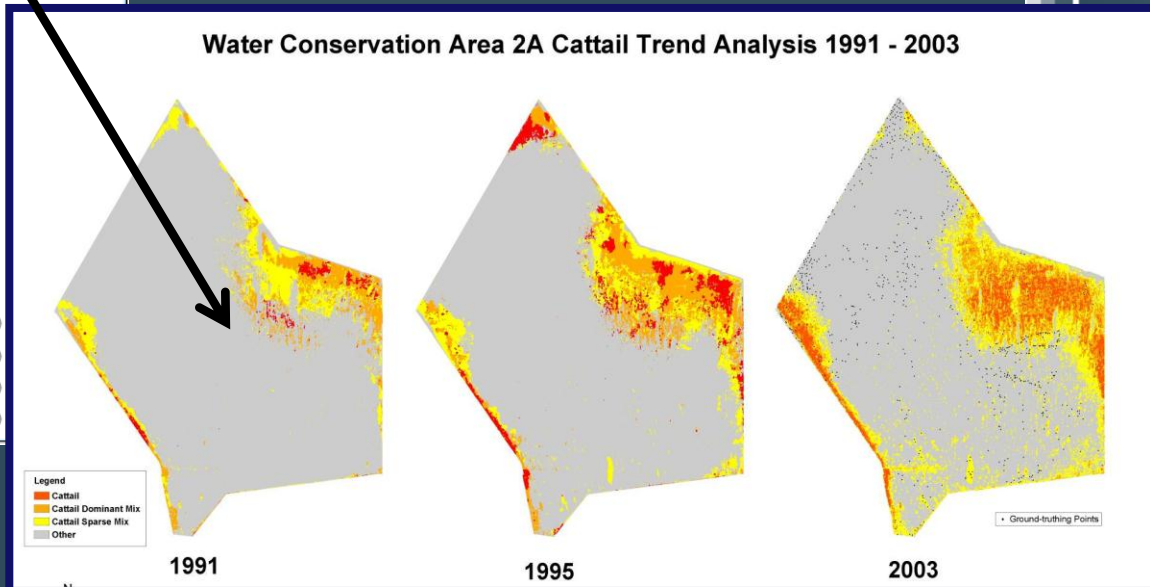
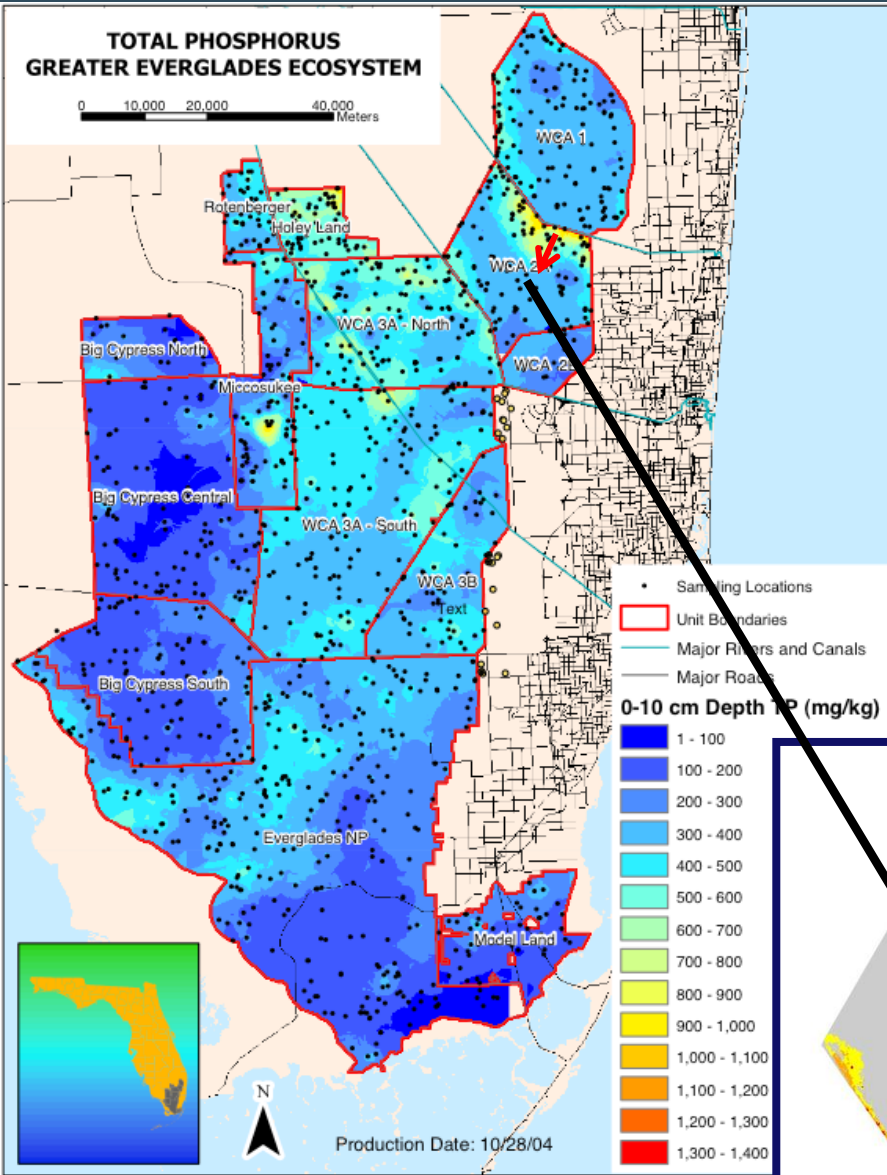
** Current: National Center for Environmental Assessment, EPA*

**International Wetlands
Conference (INTECOL)
June 3-8, 2012**

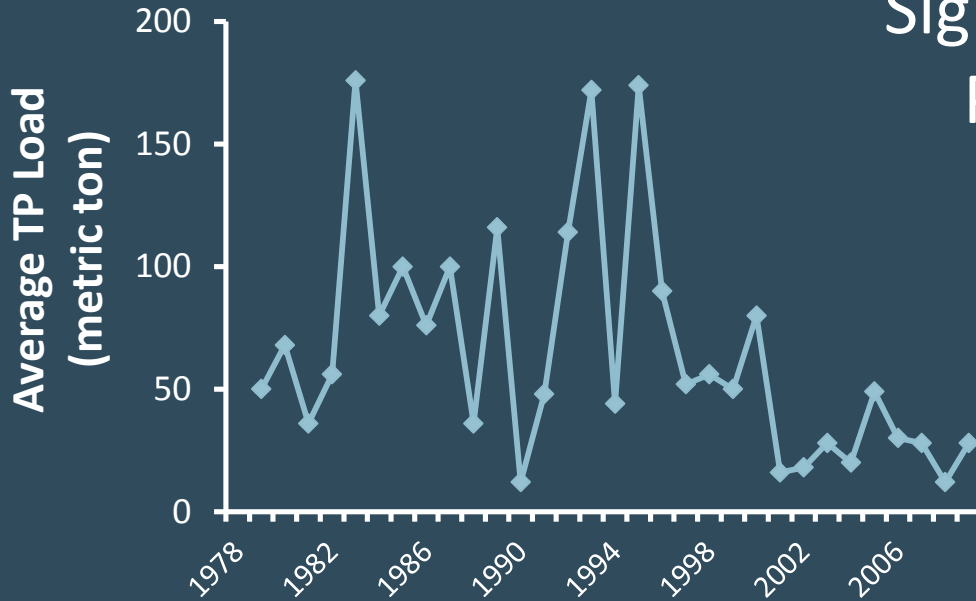


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Everglades Phosphorus Enrichment

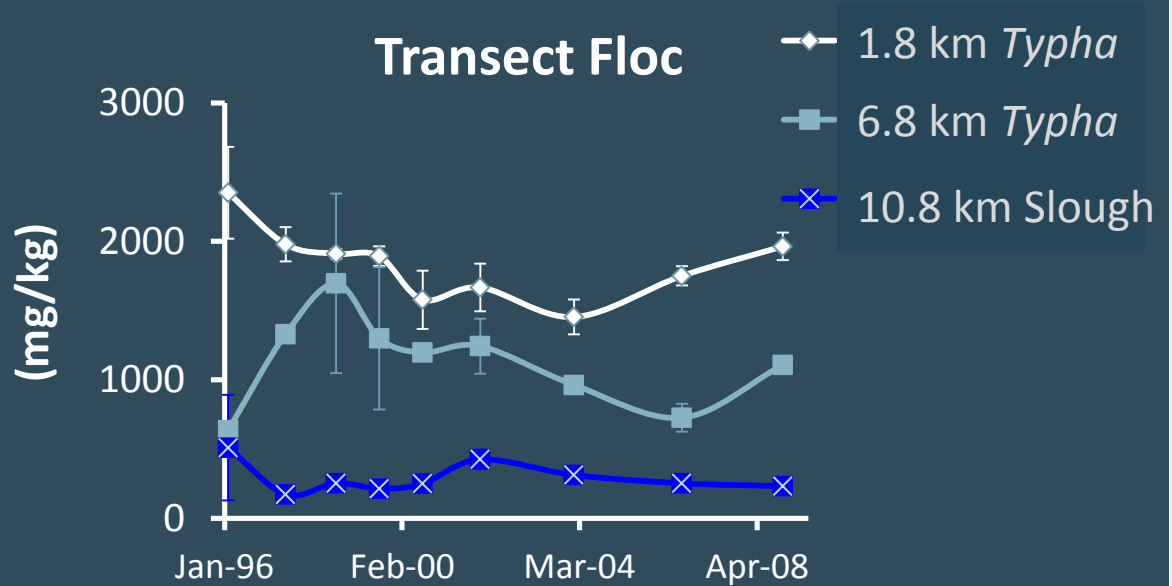


Significant Reduction in Phosphorus Loads (WCA2)



But ecosystem downstream is resilient

Transect Floc



Current Environmental Conditions

Dense Emergent Vegetation
& Phosphorus Storage

Create openings → increased habitat complexity
and quality → simulate ridge and slough?



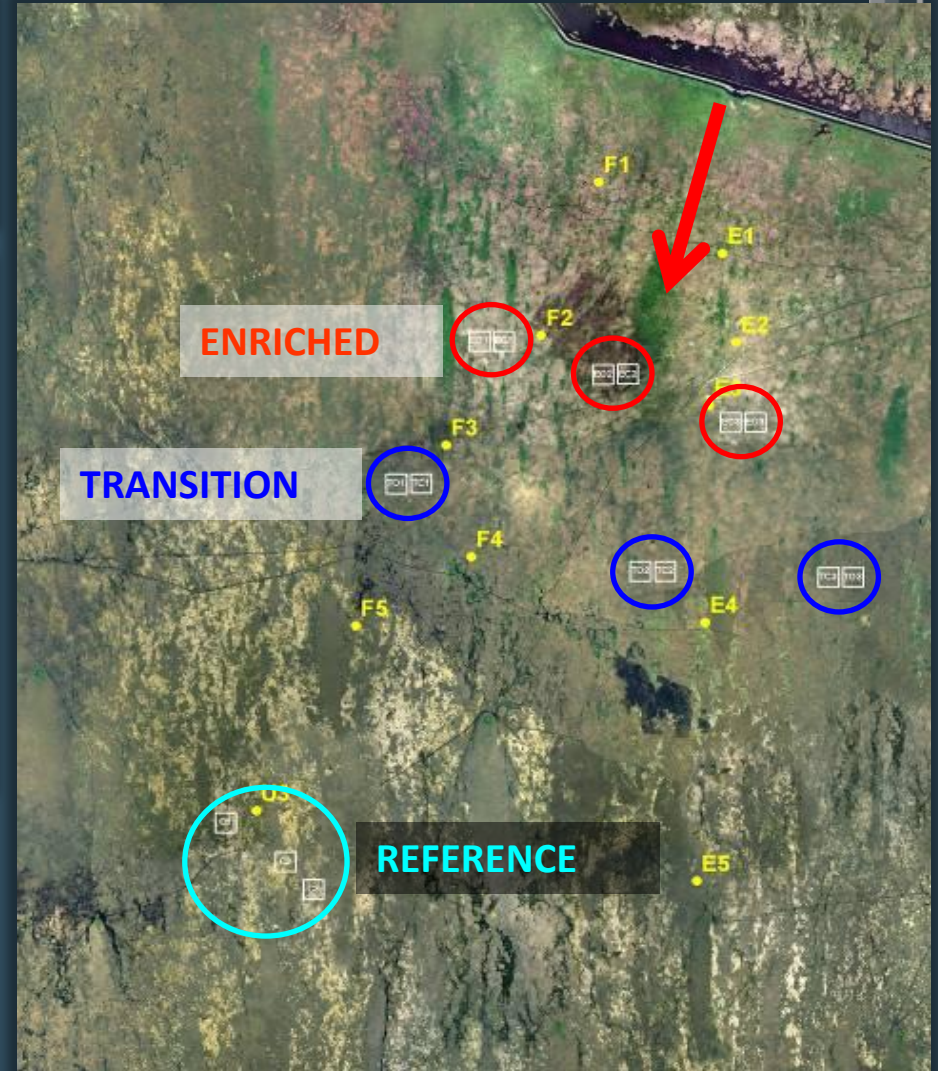
Jump start restoration towards Everglades
sawgrass ridge and slough landscape?

Cattail Habitat Improvement Project (CHIP)



Timeline

- May 2006- glyphosate
- July 2006- burn
- Aug 2006 – glyphosate + imazapyr
- Mar 2007- glyphosate + imazapyr
- Nov 2007- glyphosate + imazapyr
- April 2011 - imazamox



Project Objectives

1. Test whether creating openings within densely vegetated areas will sufficiently alter trophic dynamics such that wildlife diversity and abundance is increased
2. Assess to what extent the structure and function of these created open areas compare to the natural Everglades

Hypotheses -Open and Control Plots

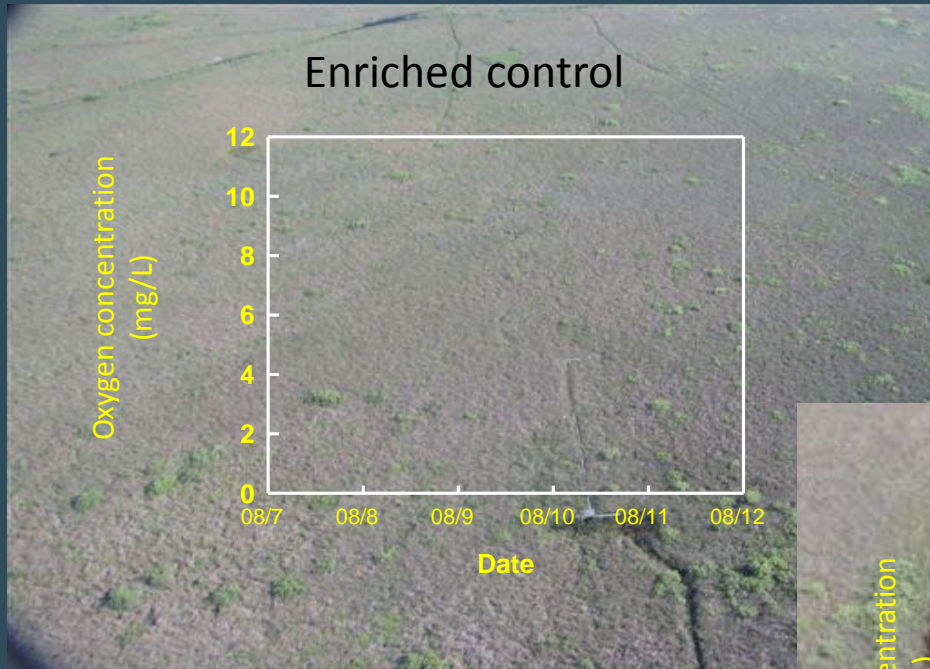
OPEN plots will be comprised of more nutritional plants (i.e., algae compared to emergent macrophytes)

Therefore, compared to **CONTROL** plots,

- channel lower percentages of production as detritus
- experience faster decomposition rates
- experience greater nutrient flux
- store smaller amounts of carbon and nutrient
- lose a higher percentage of production to herbivores
- support higher wading bird foraging

A sustainable alternate regime will be created

Rapid Increase Daily Oxygen Concentrations in Open Plots



Algae and submerged vegetation



Percent cover of vegetative groups (mean \pm S.D., Sept 2009)

Vegetation treatment resulted in ecosystem
dominated by SAV/openwater

Species	Enriched Control	Enriched Open	Transitional Control	Transitional Open
Woody Species	4.30 \pm 0.92	0.03 \pm 0.05	2.14 \pm 1.94	0 \pm 0
Emergent	96 \pm 0.9	5.2 \pm 4.7	96 \pm 1.5	7.5 \pm 8.6
SAV	0 \pm 0	91 \pm 9.7	1.2 \pm 1.1	92 \pm 9.0
Openwater	0 \pm 0	3.5 \pm 5.1	0.33 \pm 0.38	0.94 \pm 0.52

Mass and nutrient storage (WY2010, mean g/m² ± S.D.)

Parameter	Enriched Control	Enriched Open	Transitional Control	Transitional Open	Treatment p
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Mass and nutrient storage (WY2010, mean g/m² ± S.D.)

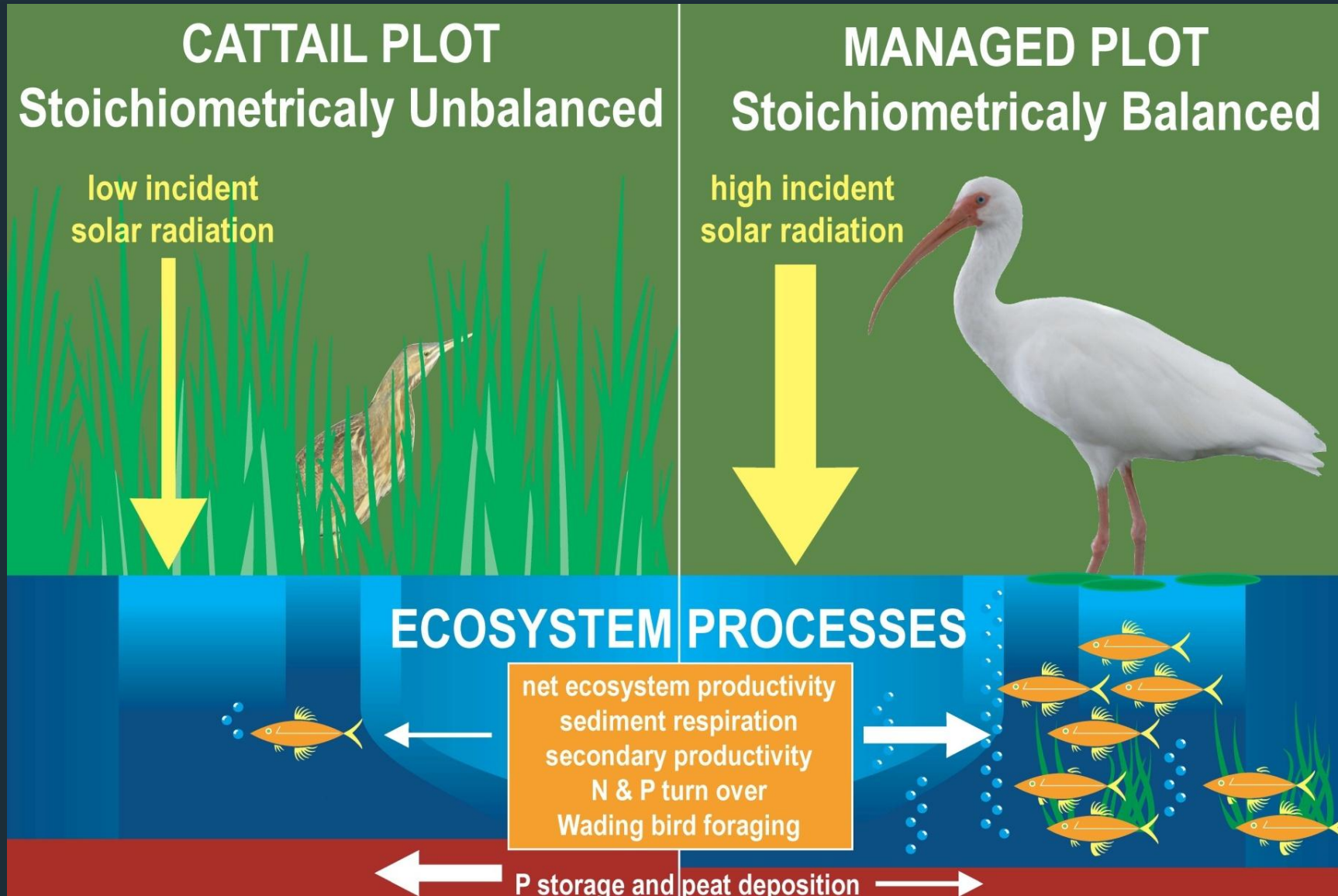
Parameter	Enriched Control	Enriched Open	Transitional Control	Transitional Open	Treatment p
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Wading bird usage greater in open versus control plots (WY2010 dry season)

	Enriched Control	Enriched Open	Transitional Control	Transitional Open
Mean birds per week \pm S.D. (all species pooled)	0.5 \pm 1.4	36 \pm 36	0.2 \pm 0.6	21 \pm 26
Total # birds	26	2,024	9	1,218
Total # species	4	9	4	10
Number of weeks \geq 1 bird observed (n=19)	6	17	5	18

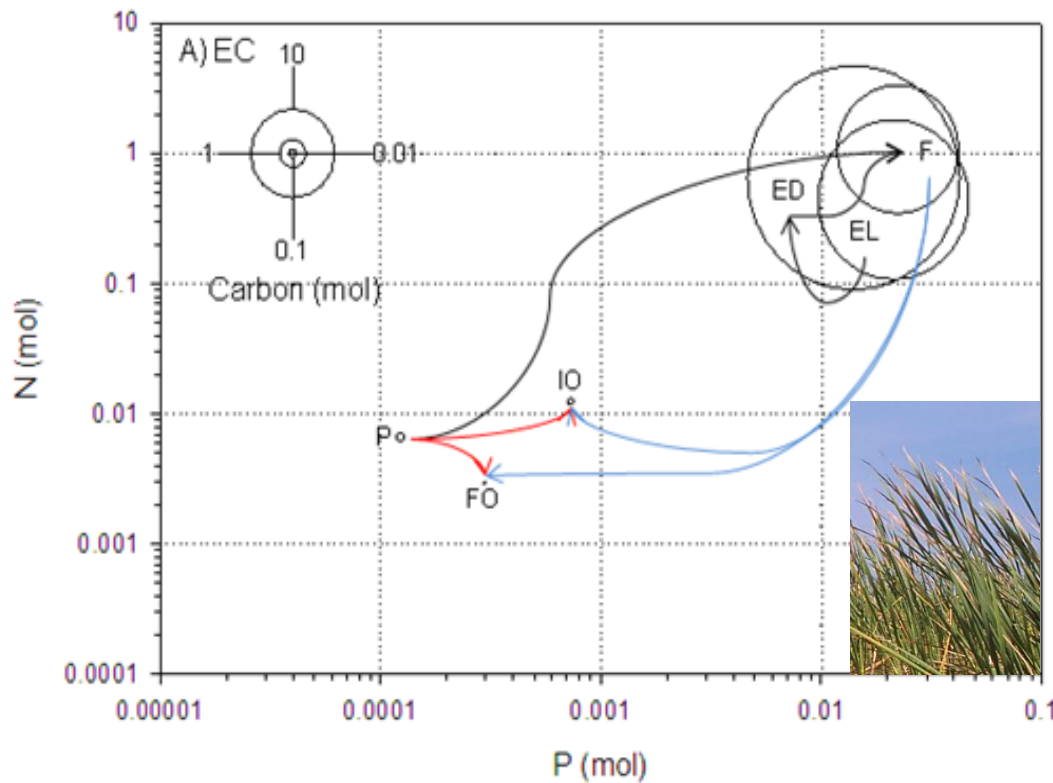


Create an Aquatic Habitat Where There Was Once Dense Emergent Vegetation



Carbon pools and N:P and simplified trophic linkages in enriched control plots

Detrital pool dominates C cycling



Fluxes

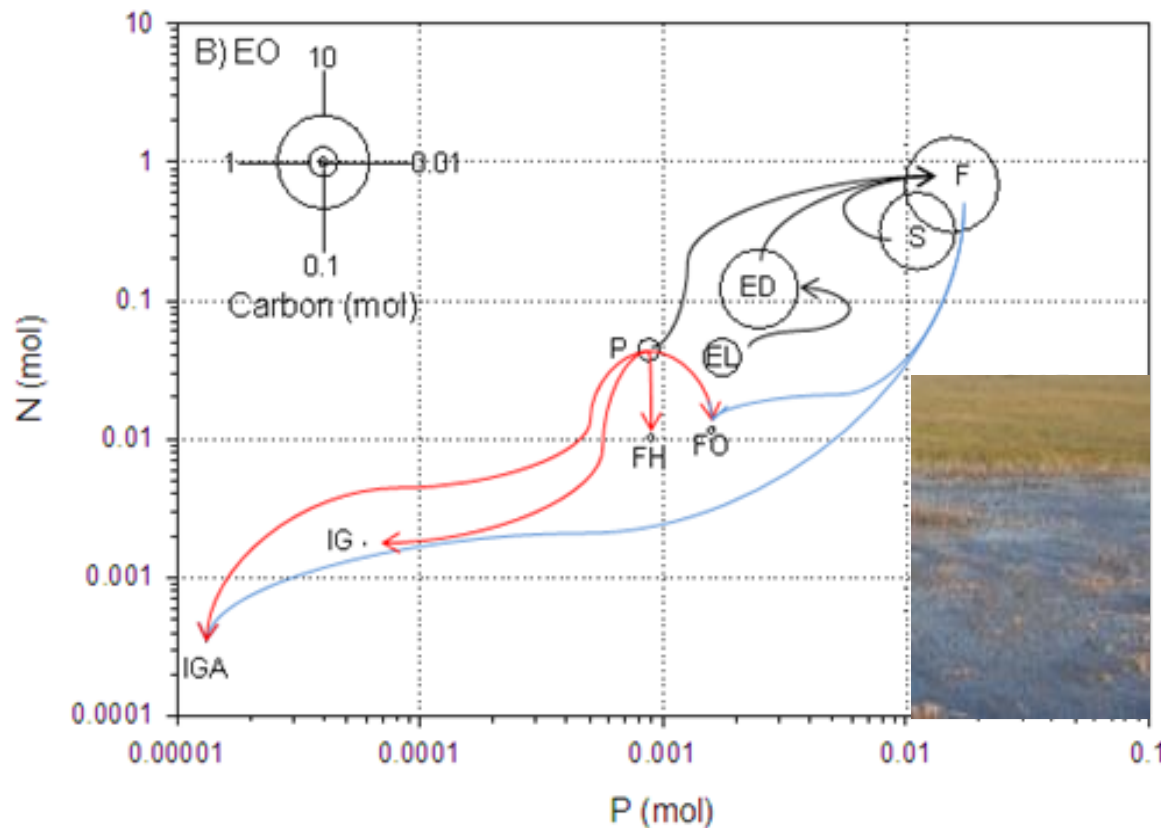
- To floe (detritus)
- Floe to primary consumers
- Primary production to consumers

	C:N:P
EL	1505:21:1
ED	4515:46:1
F	933:48:1
P	781:54:1
IO	70:17:1
FO	45:10:1

ED= emergent dead, EL=emergent live, F=floe, S=SAV, P=periphyton, FO=fish omnivore, IO=invertebrate omnivore

Carbon pools and N:P and simplified trophic linkages in enriched open plots

Increased role of SAV and periphyton in C cycling



Fluxes

- To floc (detritus)
- Floc to primary consumers
- Primary production to consumers

	C:N:P
EL	916:22:1
ED	2869:49:1
F	666:44:1
S	603:28:1
P	693:50:1
FH	62:11:1
FO	33: 7:1
IG	183:29:1
IGA	142:26:1

ED= emergent dead, EL=emergent live, F=floc, S=SAV, P=periphyton, FH=fish herbivore, FO=fish omnivore, IG=invertebrate grazer, IGA=invertebrate gatherer, IO=invertebrate omnivore

Hypotheses -Open and Control Plots

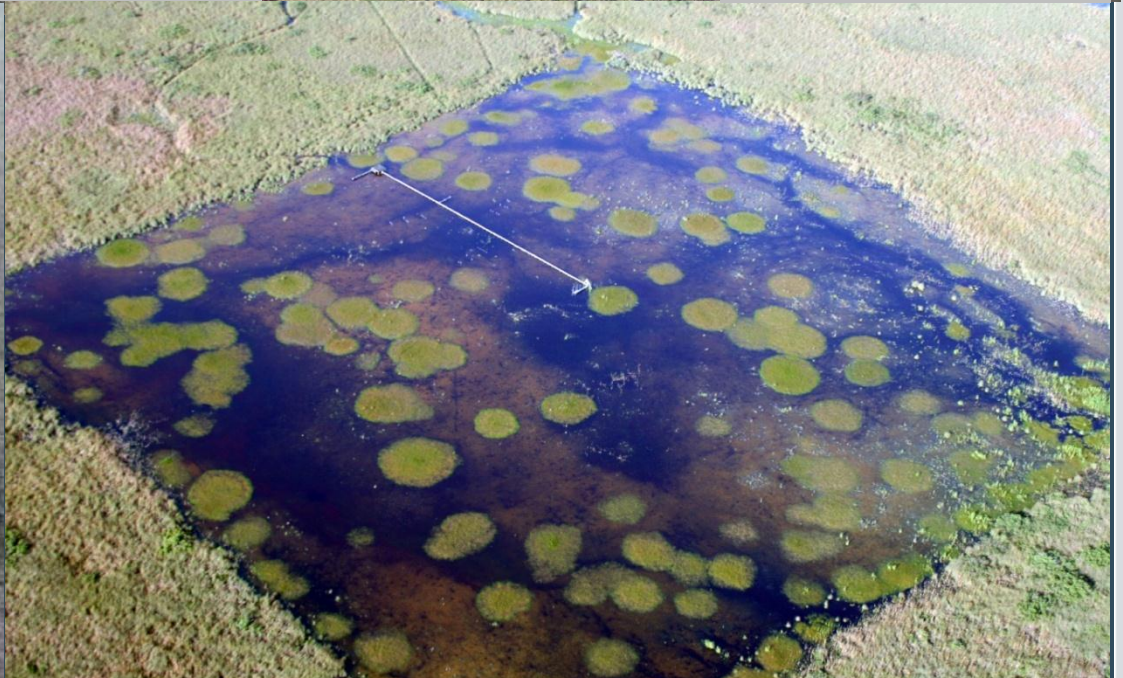
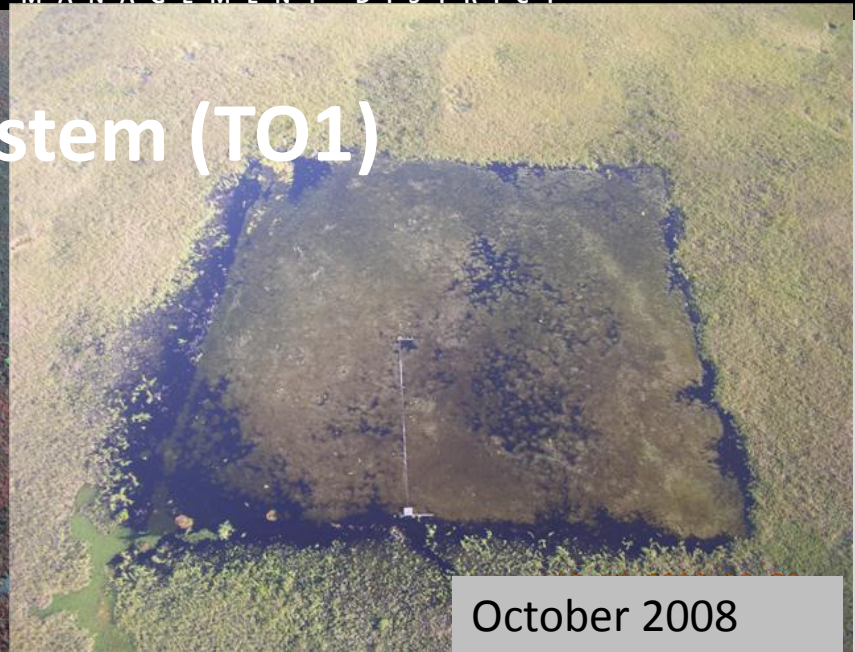
OPEN plots will be comprised of more nutritional plants (i.e., algae compared to emergent macrophytes)

Therefore, compared to **CONTROL** plots,

- channel lower percentages of production as detritus
- experience faster decomposition rates (**Yes**)
- experience greater nutrient flux (**Yes**)
- store smaller amounts of carbon and nutrient (**Yes-floc, No-soil**)
- lose a higher percentage of production to herbivores
- support higher wading bird foraging (**Yes**)

An alternate regime has been created- (long-term sustainability?)

Succession of the Ecosystem (T01)





Acknowledgements

Staff and Contractors over the years:

Everglades- J. Beerens, B. Bellinger, R. Bennett, E. Call, J. Faye, H. Herring, S. Hohner, P. Holowecky, M. Jacoby, M. Kobza, M. Manna, K. Seitz, R. Shuford, J. Zimmerman

Veg. Management- F. Laroche, L. Rodgers, S. Smith
SFWMD, Aircoastal and Helicopter Applicators Inc., for aerial support
Florida Fish and Wildlife Conservation Commission- fire

UF- A. Wright

And all other conscripts too numerous to name!

