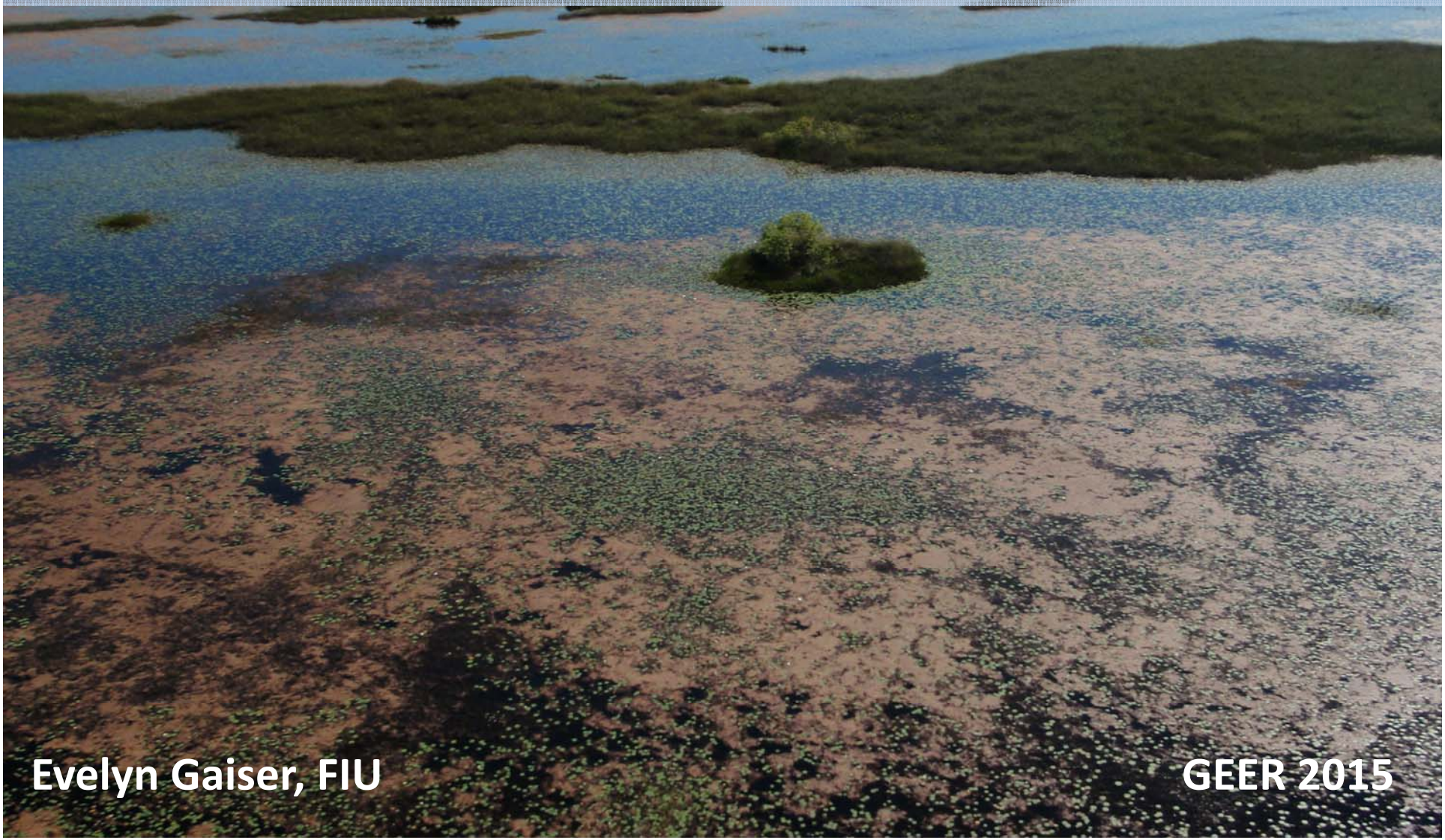
Periphyton responses to flow restoration: Distribution, Community Composition, and Edibility



Evelyn Gaiser, FIU

GEER 2015

T H E S E R E S P R O J E C T

Synthesis of Everglades Research and Ecosystem Services

AN ANALYSIS OF FIVE OPTIONS FOR RESTORING THE EVERGLADES ECOSYSTEM:

Goal: **To identify a plan that best achieves restoration of the remaining ecosystem through the utilization of engineering technology that has proven to be feasible.**

Restoration Options*:

Option A: existing conditions

Option B: CERP

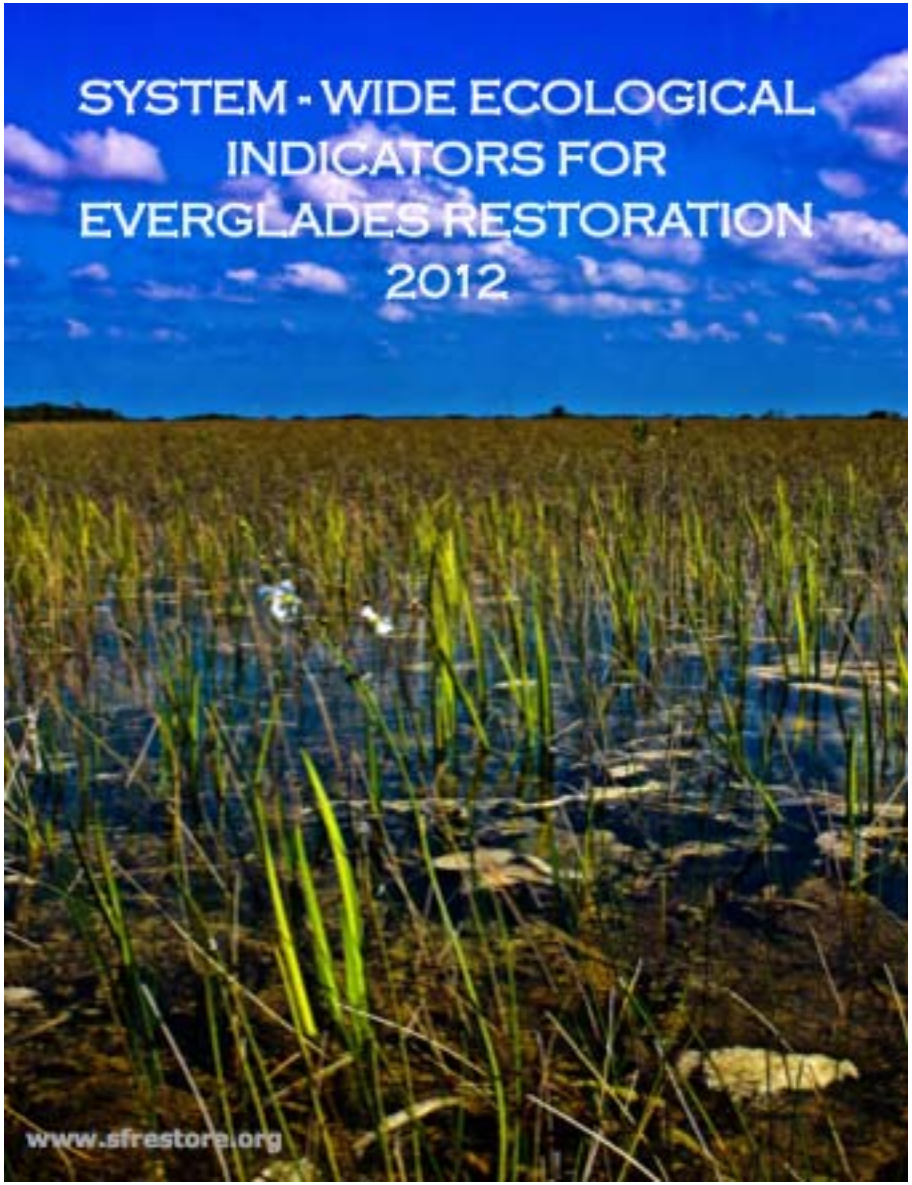
Option C: scaled-back version of CERP

Options D: CERP + above-ground water storage in the EAA

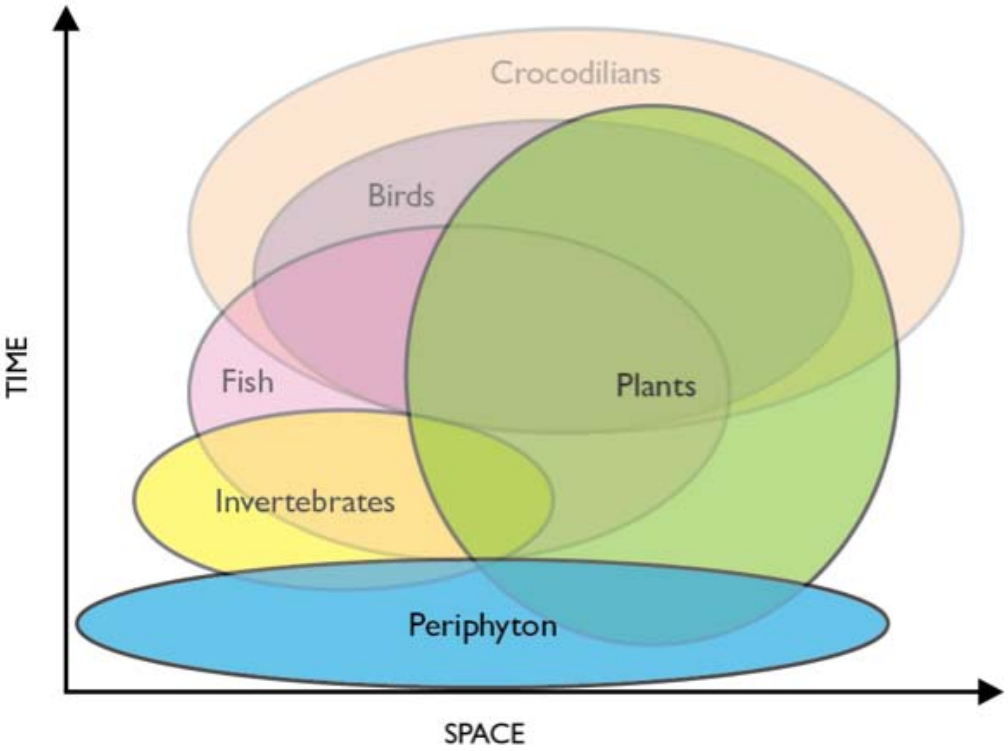
Option E: CERP + DECOMP

****Including STA expansions necessary for achieving mandated water quality criteria.***

System-Wide Ecological Indicators for Everglades Restoration

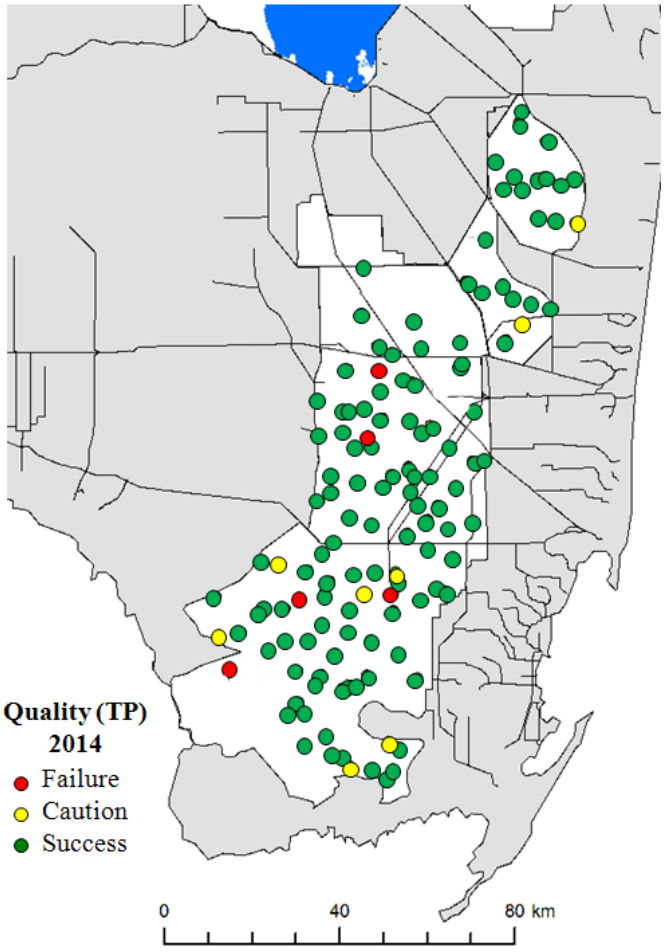


Periphyton biomass, quality and composition used in biennial reports to U.S. Congress



Periphyton biomass, quality and composition assessed annually and compared to baselines

	2006	2007	2008	2009	2010	2011	2012	2013	2014
SYSTEM-WIDE									
Quality (TP)	Y	Y	G	Y	G	G	Y	Y	G
Biomass	Y	Y	Y	Y	Y	Y	Y	Y	Y
Composition	R	Y	Y	Y	Y	Y	N	N	N
WCA 1									
Quality (TP)	Y	G	G	Y	G	G	Y	Y	G
Biomass	G	G	G	G	G	G	G	G	G
Composition	R	Y	Y	Y	Y	Y	N	N	N
WCA 2A									
Quality (TP)	Y	Y	Y	G	G	Y	Y	Y	G
Biomass	R	Y	Y	Y	Y	Y	Y	Y	G
Composition	R	R	R	Y	Y	Y	N	N	N
WCA 3A									
Quality (TP)	Y	Y	Y	Y	G	G	Y	Y	G
Biomass	Y	Y	Y	Y	Y	Y	R	Y	Y
Composition	R	G	Y	Y	Y	Y	N	N	N
SRS									
Quality (TP)	Y	Y	G	Y	G	G	G	Y	G
Biomass	Y	Y	Y	Y	Y	Y	Y	Y	Y
Composition	Y	G	Y	Y	G	Y	N	N	N



Periphyton Indicator Attributes and Drivers

<u>Production</u> – Ash-free dry biomass

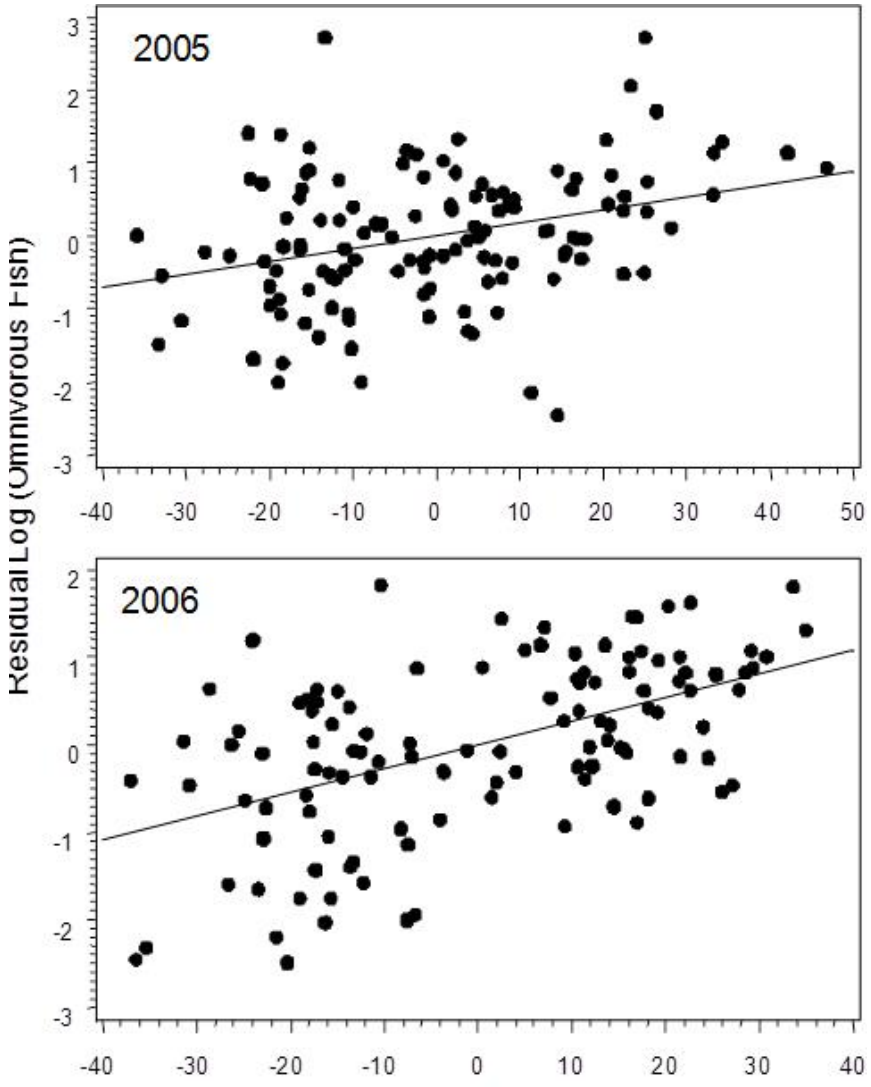
TP

<u>Quality</u> – Total Phosphorus

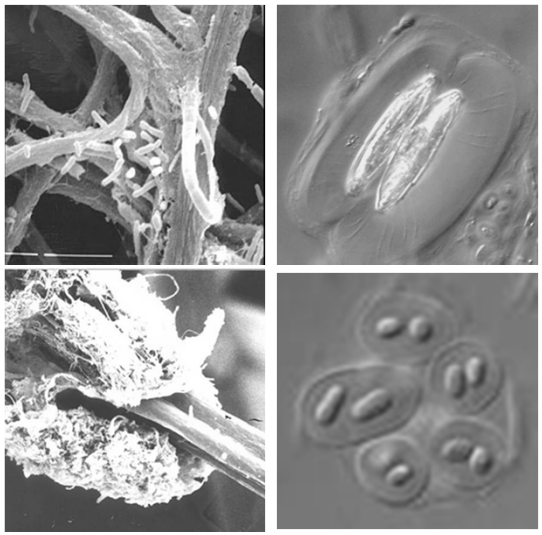
<u>Composition</u>- Edibility, Endemism

<u>Drivers:</u>
Water Depth, Hydroperiod (EDEN), Soil Depth, Soil TP (REMAP)

Periphyton Edibility and Secondary Production



Increases in algal palatability results in increased standing stocks of primary consumers

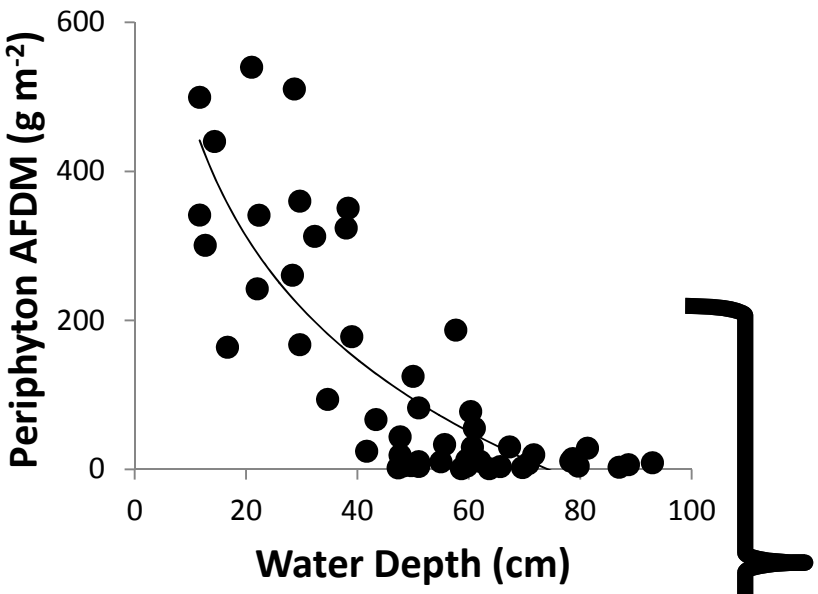


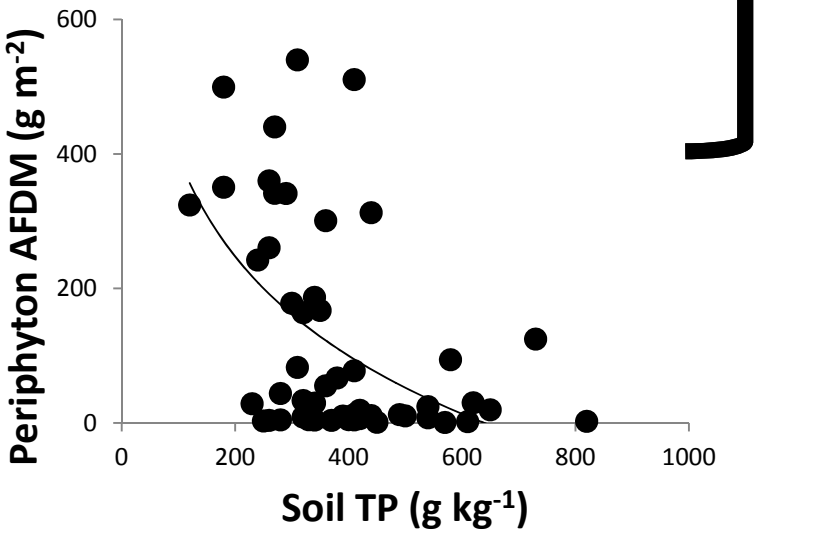
Unpalatable Toxic

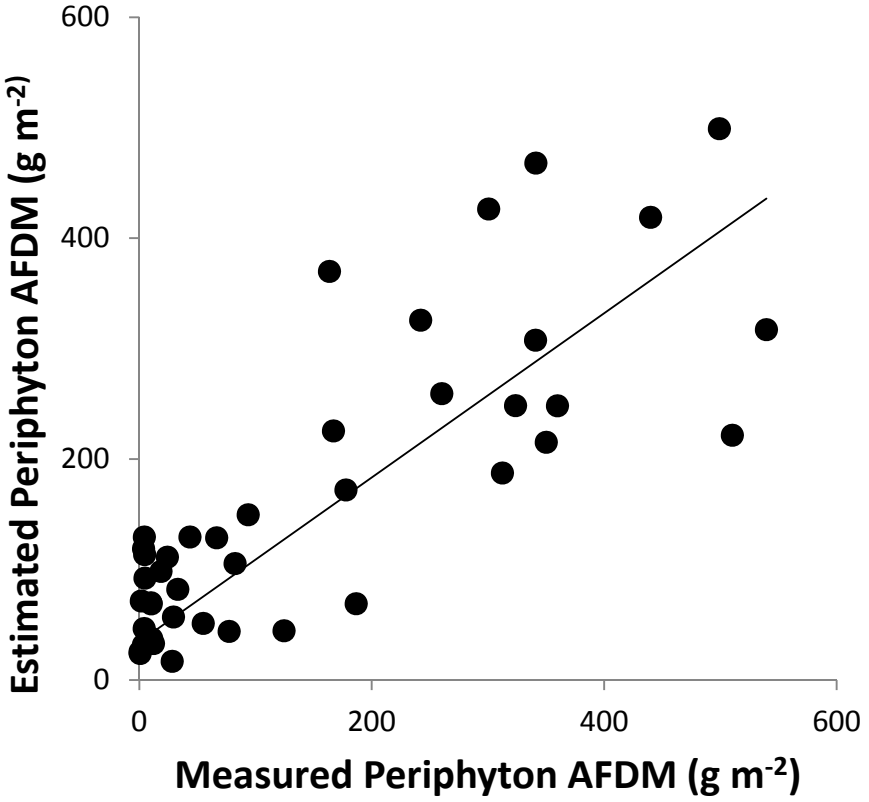
Palatable Non-Toxic

Sargeant et al. (2012) *Freshwater Biology*

PERIMOD: Periphyton Biomass

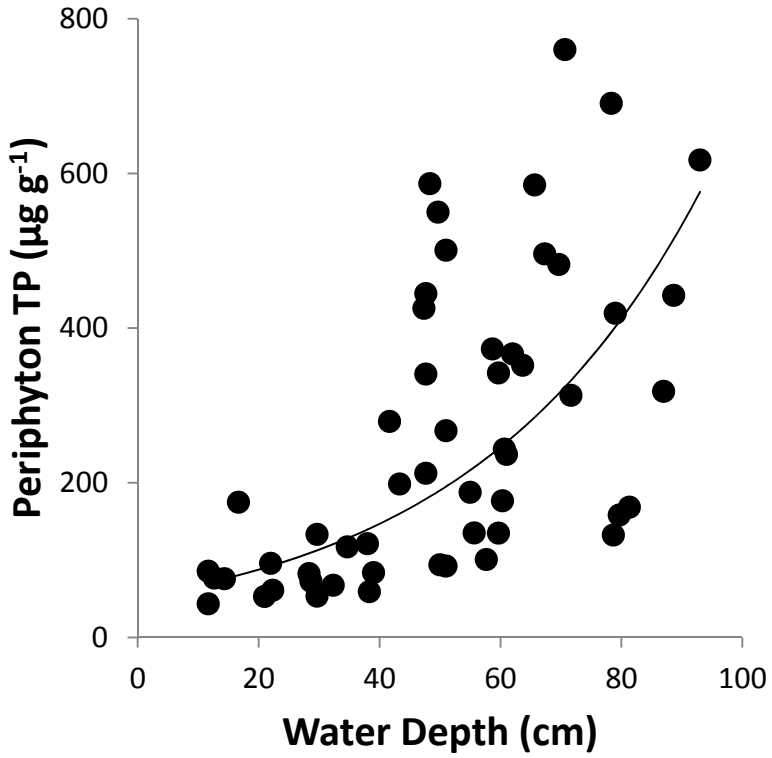


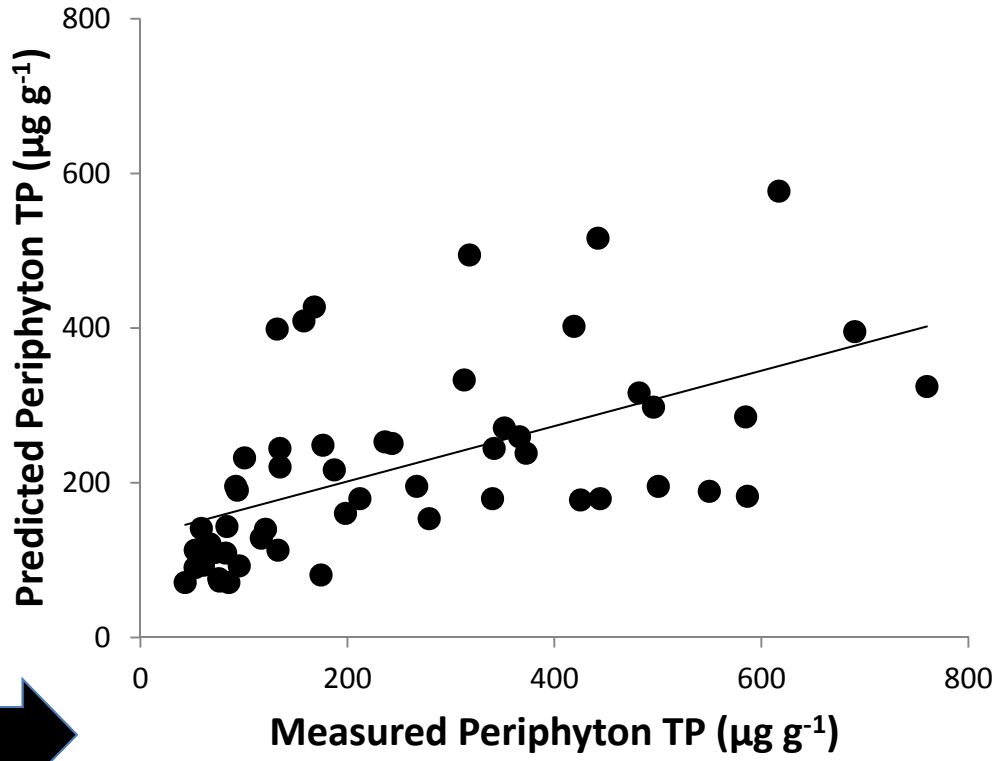




Periphyton AFDM = -239 * ln (water depth) – 77 ln (soil TP) + 1481 (R^2 = 0.69)

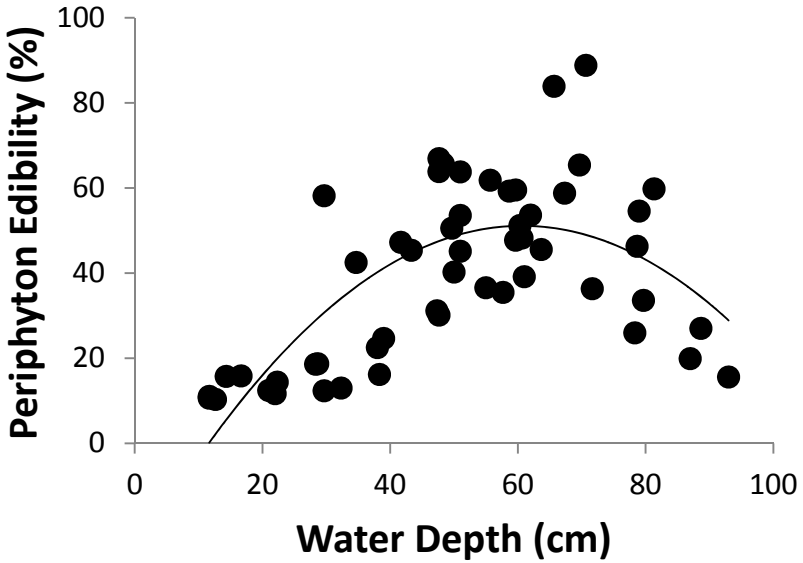
TP PERIMOD: Periphyton Quality

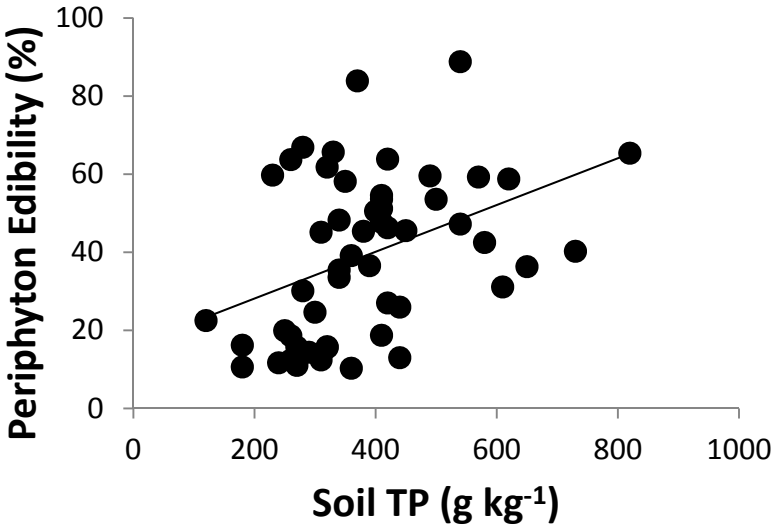


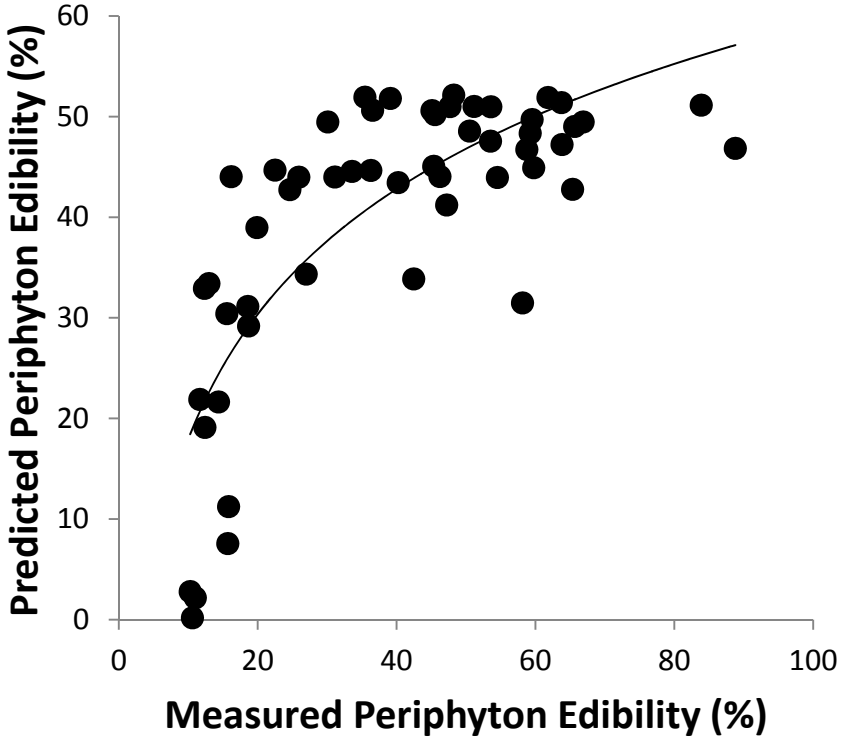


Periphyton TP = 52 e $^{(0.23*\text{water depth})}$ (R^2 = 0.31)

PERIMOD: Periphyton Edibility

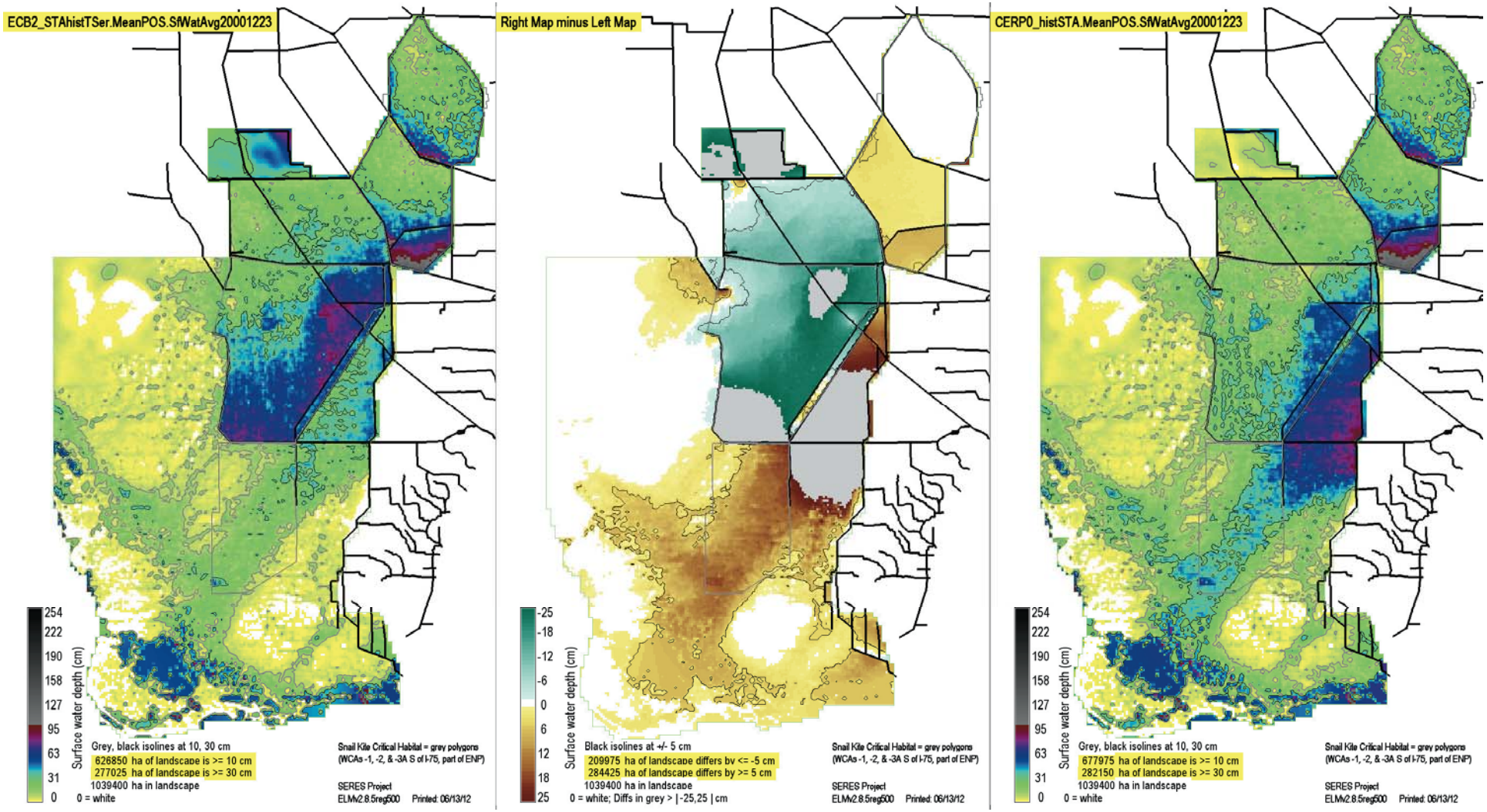






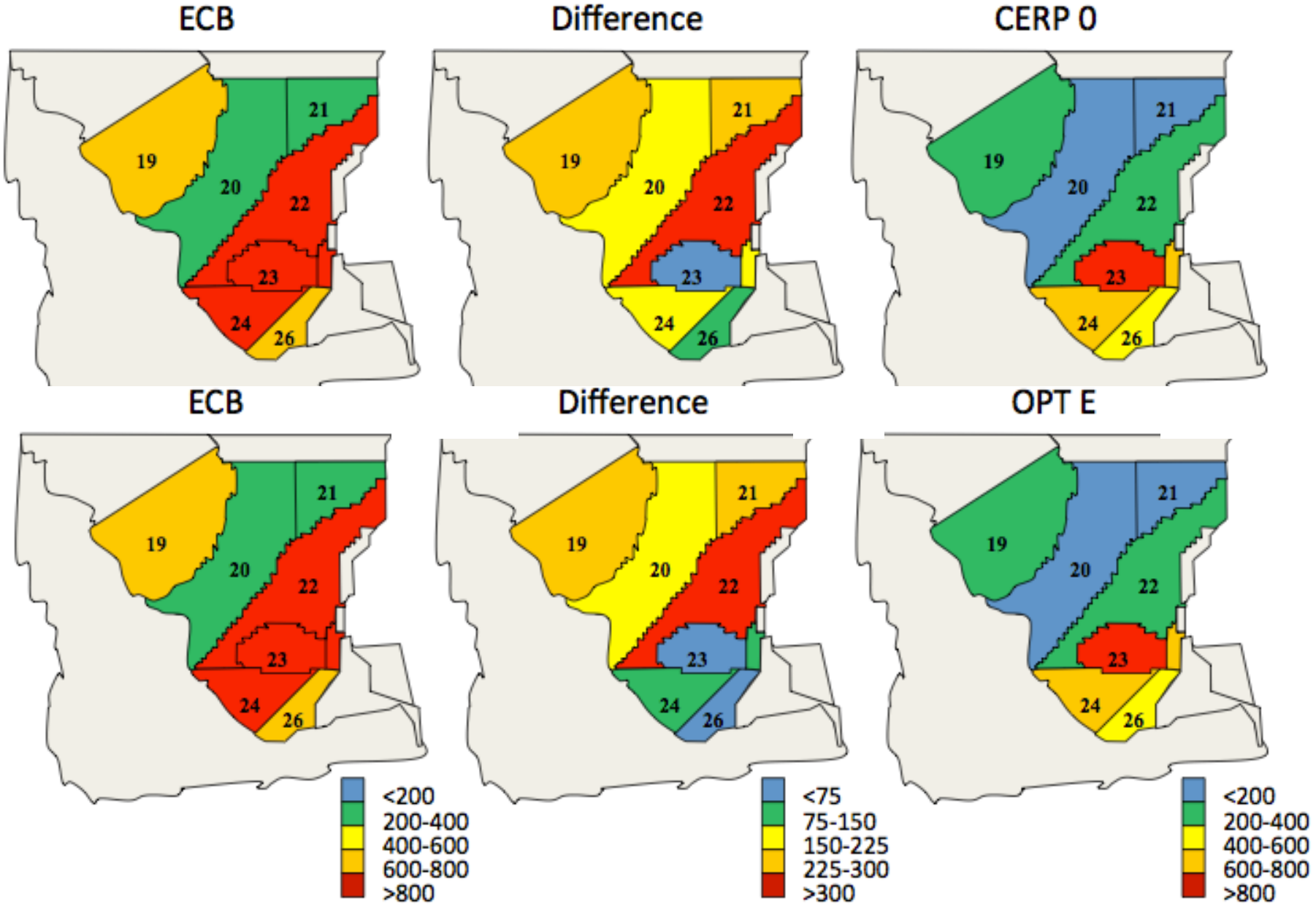
Periphyton TP =-0.02*(water depth)^2 + 3*(water depth) - 0.016*soil TP – 20 (R^2=0.62)

Everglades Landscape Model

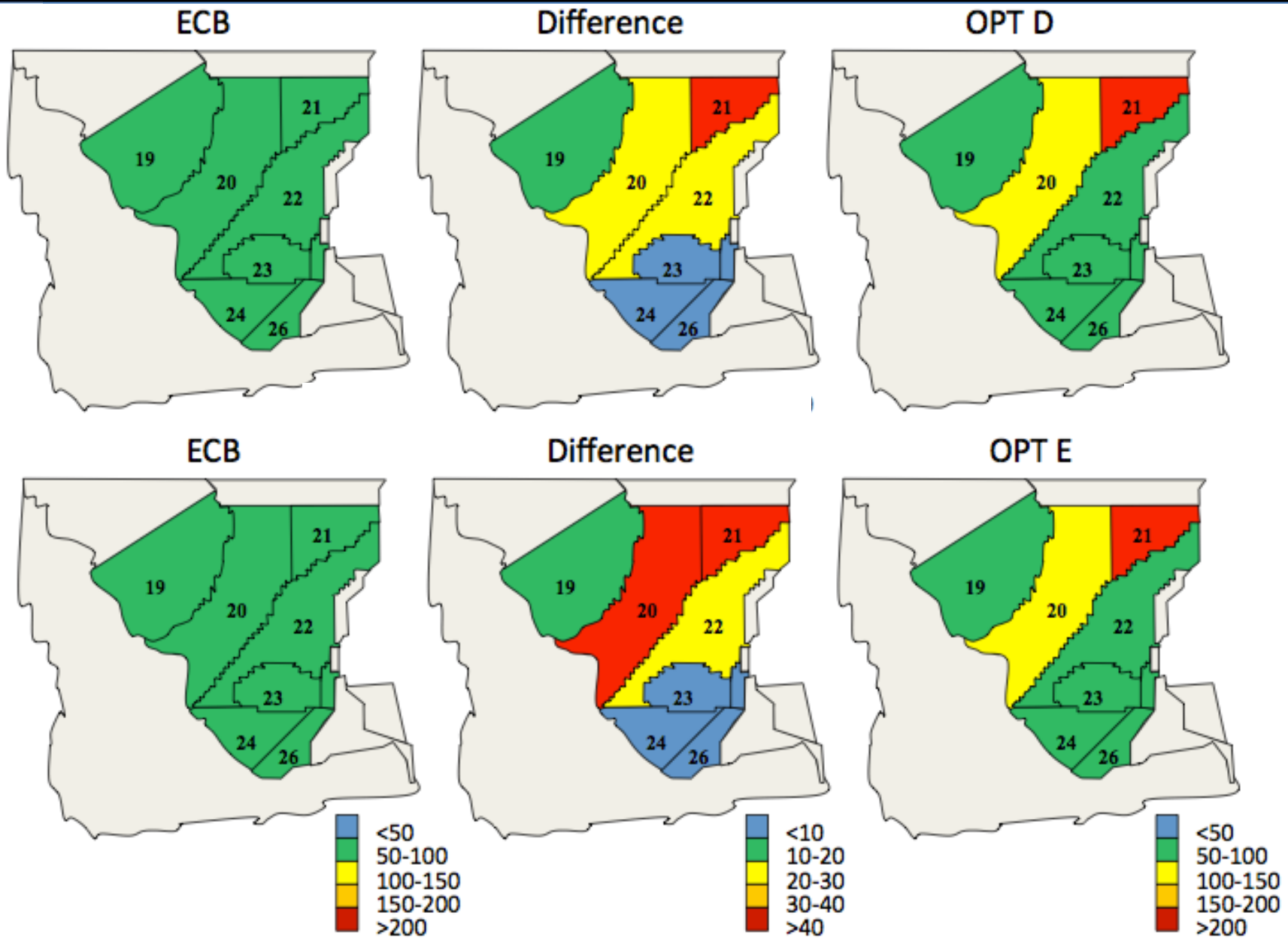


Outputs include the key drivers of PERIMOD

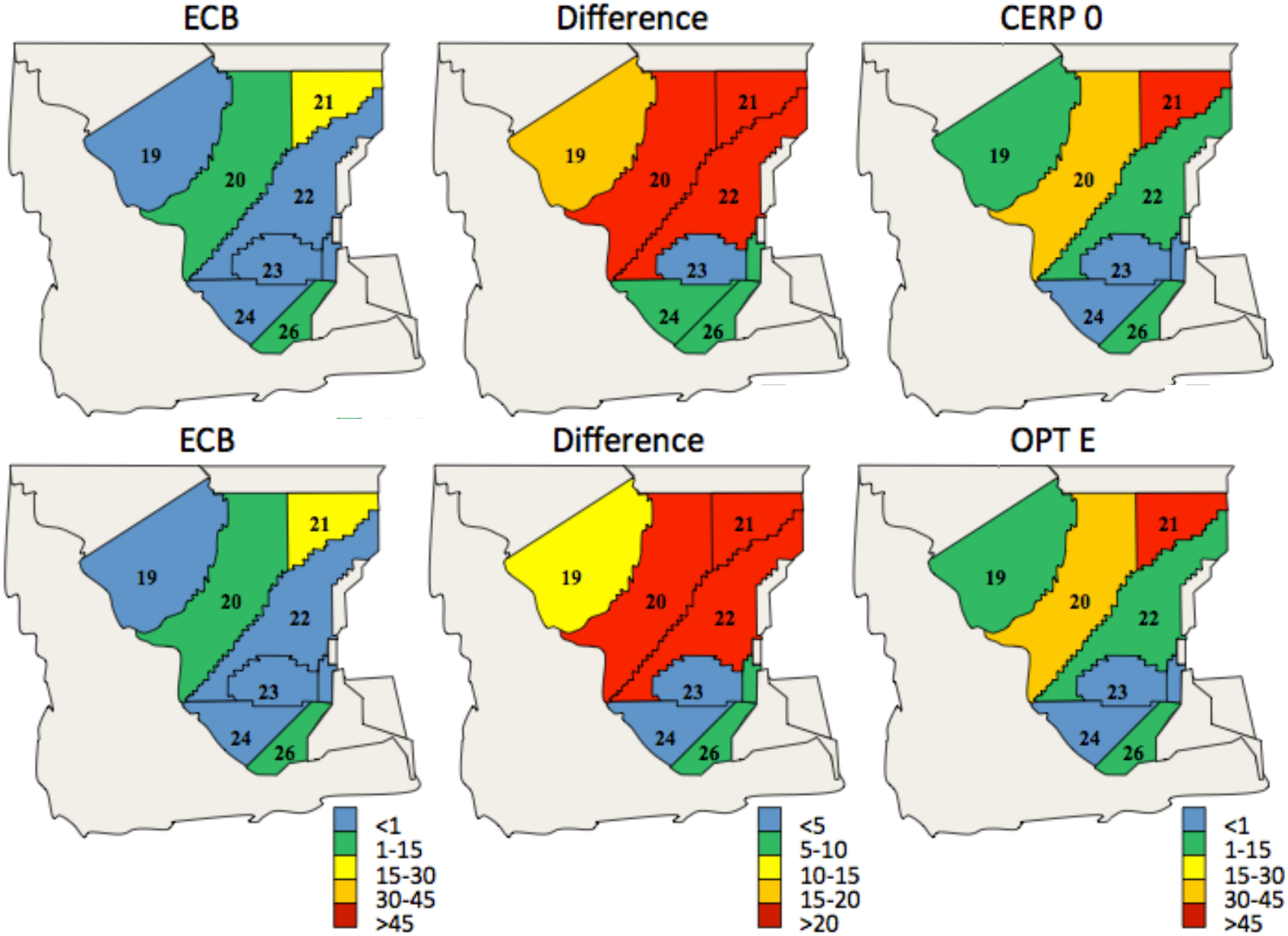
SCENARIOS: Periphyton Biomass



TP SCENARIOS: Periphyton Quality



SCENARIOS: Periphyton Edibility



Conclusions

- **Periphyton performance measures can be predicted from the Everglades Landscape Model to interpret ecological outcomes of restoration scenarios**
- **Periphyton abundance, composition and TP content are reliable water quality condition metrics – especially when employed in combination.**
- **Periphyton biomass decreases and edibility increases in ENP as water depth increases under the restoration scenarios. Periphyton P content is lowest under Option D but highest under Option E, suggesting a potential problem of eutrophication within the Park under Option E.**

CERP MAP SUPPORT: SOUTH FLORIDA WATER MANAGEMENT DISTRICT, U.S. ARMY CORPS OF ENGINEERS

REMAP SUPPORT: ENVIRONMENTAL PROTECTION AGENCY

SCENARIOS EFFORT: EVERGLADES FOUNDATION, EVERGLADES NATIONAL PARK, FIU