Trends in Biogeochemical Processes Across the Greater Everglades Landscape: Results of R-EMAP III

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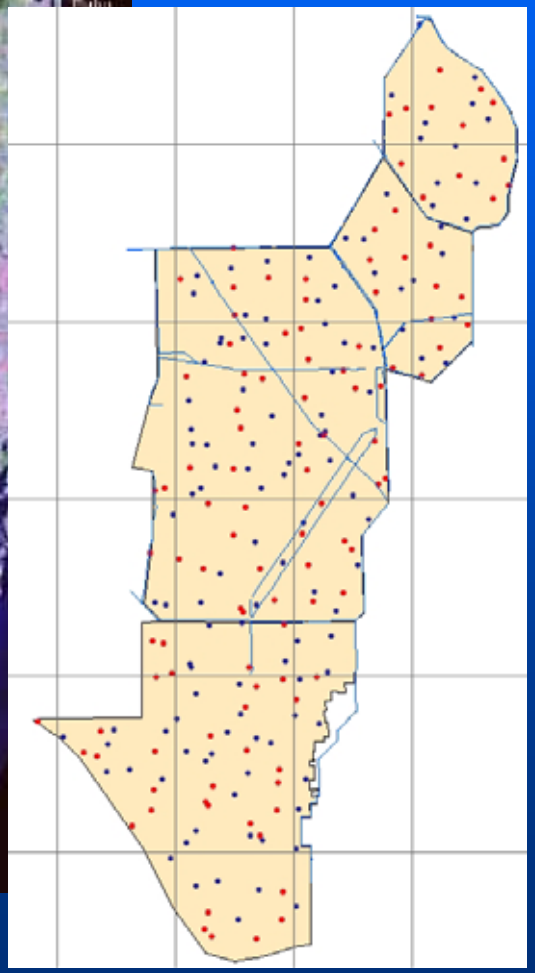
Everglades Protection Area

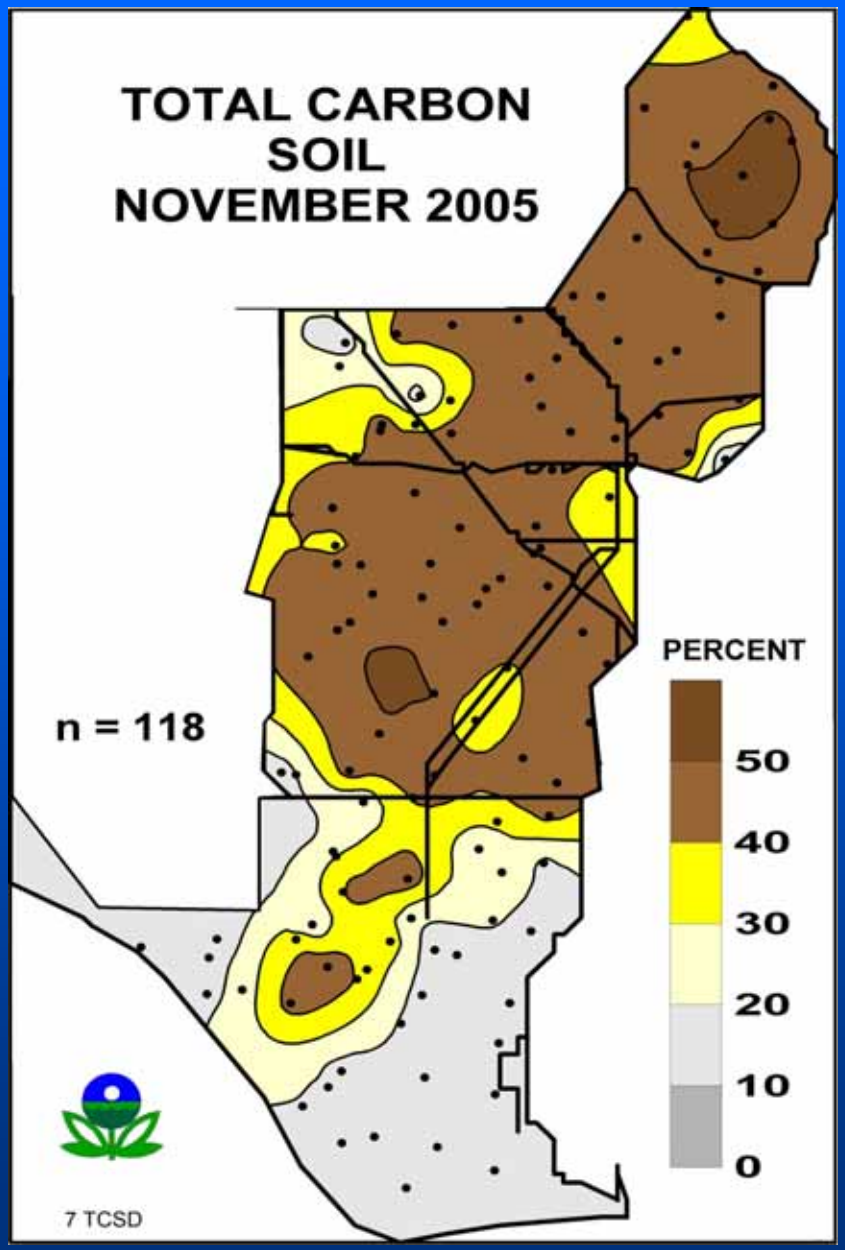
R-EMAP III



- Dry (109 sites) and Wet (119 sites) seasons 2005.
- 228 stations total sampling.
- Soil, porewater, Floc, surface water, periphyton, and mosquitofish sampled, vegetation studied.

R-EMAP III

- Generalized Random Tesselation Stratified (GRTS) sampling to provide a spatially balanced sample coverage and thus is efficient for contouring or determining broad spatial trends.
- Equal inclusion probabilities within subregions.
- A primary focus is on P and Hg.
- Contributes to CERP
- Identifies relationships between environmental stressors and parameters.
- Enzyme activities (MUFP and MUFC) and C-dynamics. (Sinsabaugh and Findlay 1995; Penton and Newman 2007; Amador and Jones 1993).

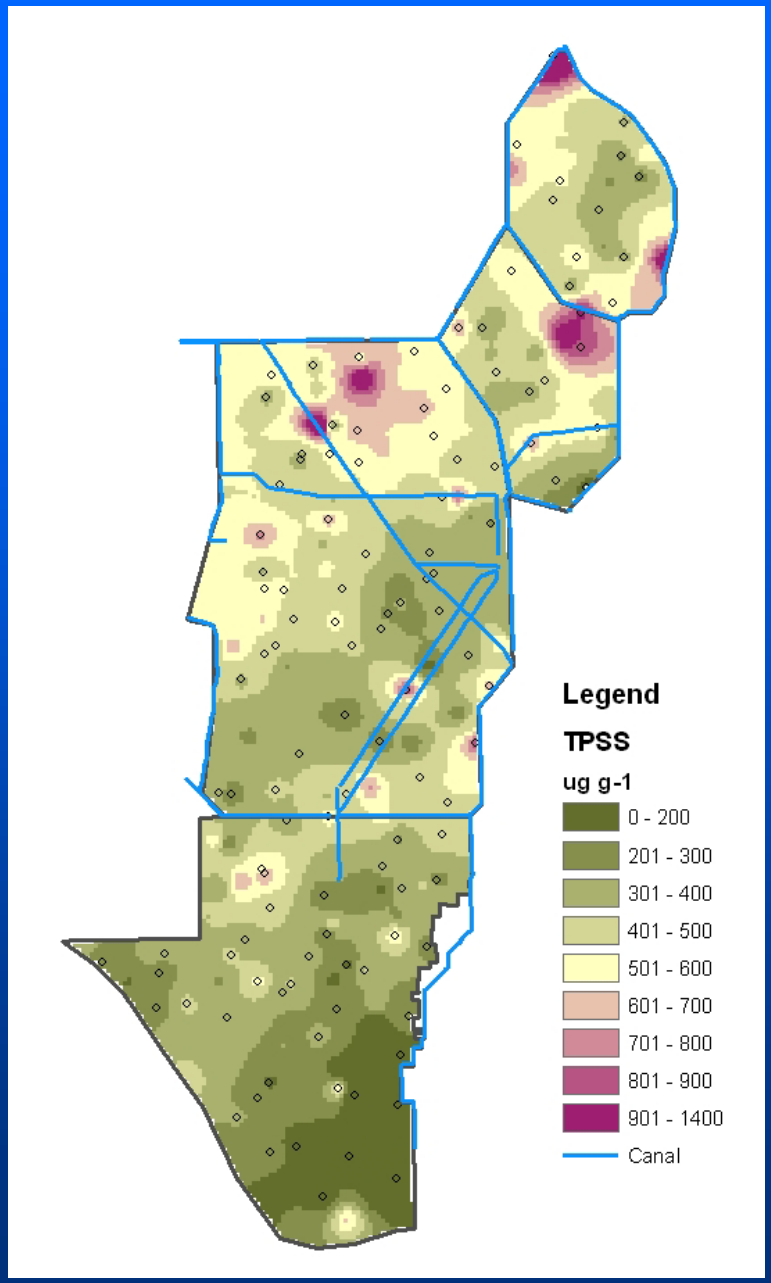


Soil TC

- No seasonally significant difference overall or by area, n = 226.

- Soil TP was strongly inversely correlated with TC in LNWR ($r = -0.814$, $p < 0.001$), positively correlated at WCA2 ($r = 0.459$, $p < 0.001$) and ENP ($r = 0.517$, $p < 0.001$) and not correlated in WCA3.

Area	Mean ± SD	n
	%	
LNWR	47.3 ± 4.0 a	25
WCA2	41.6 ± 9.7 ab	25
WCA3	42.1 ± 8.5 b	100
ENP	23.3 ± 10.6 c	76



Soil TP

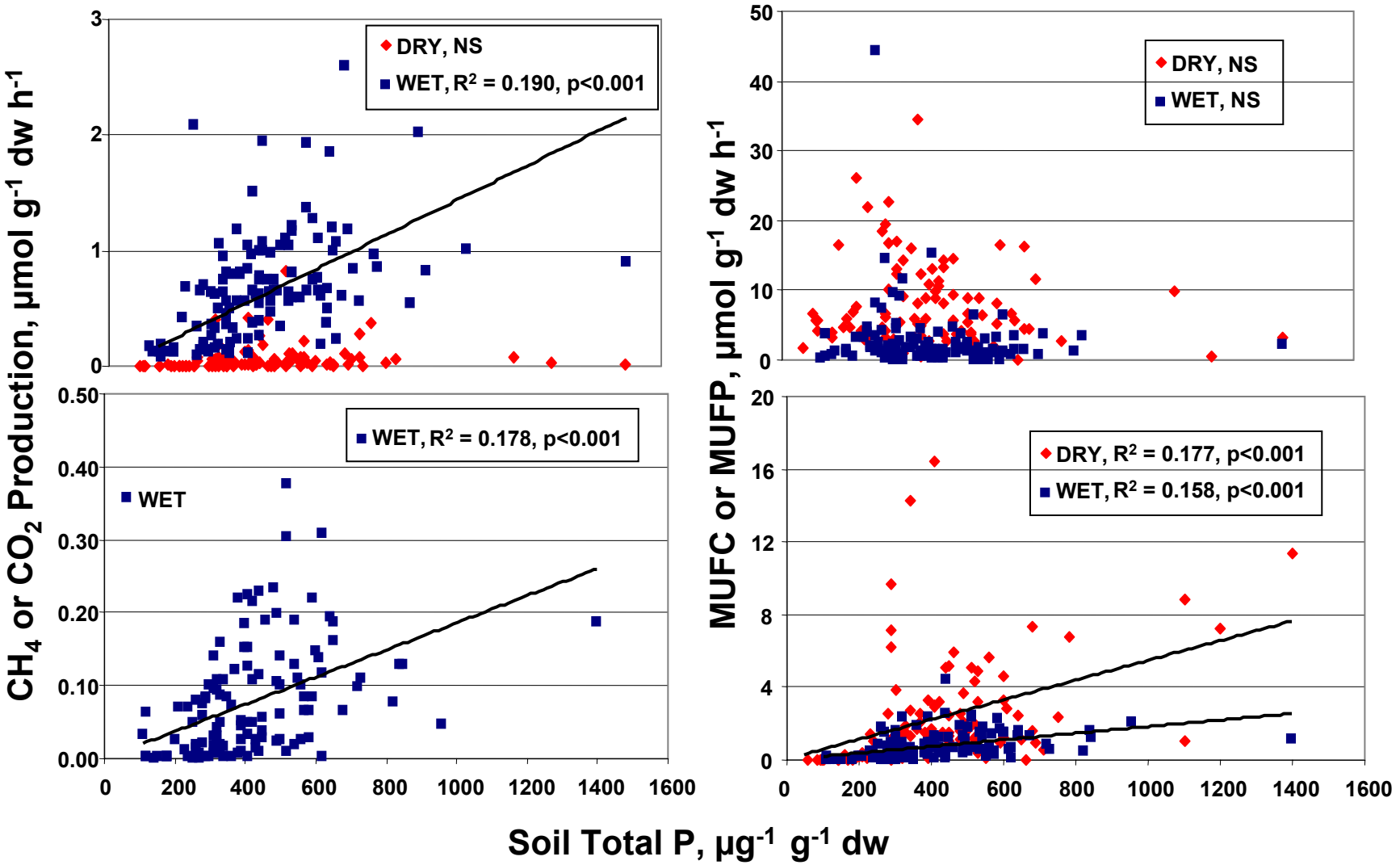
•No seasonally significant difference overall or by area, n = 228.

Area	Mean ± SD	n
	µg TP g^{-1} dw	
LNWR	520 ± 257 a	25
WCA2	489 ± 241 a	25
WCA3	461 ± 182 a	100
ENP	312 ± 149 b	78

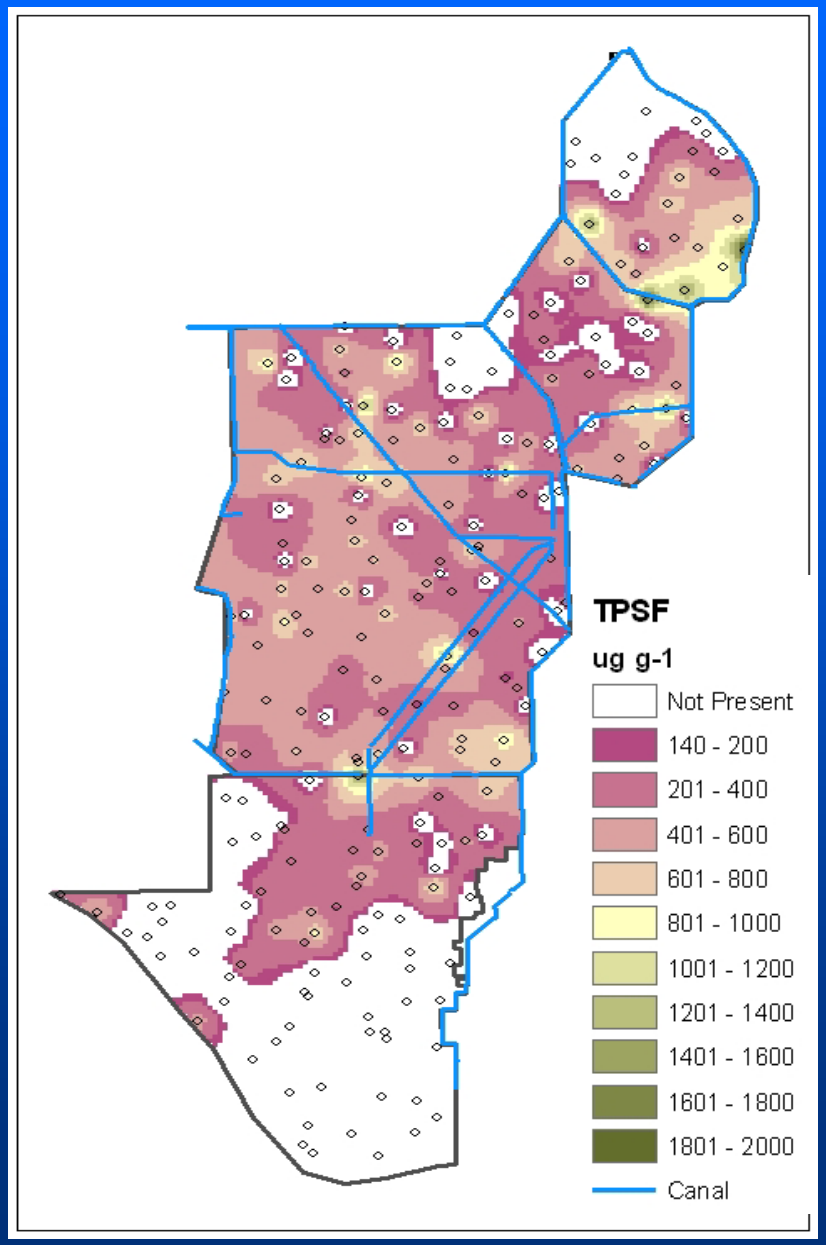
Historically P entering into the northern Everglades was estimated to be 129 metric tons per year. During the mid ’90s - 376 metric tons per year was coming from drained agricultural land (Davis 1994). Since implementation of BMPS in the 1990s some reduction in P loading (Walker 1999).

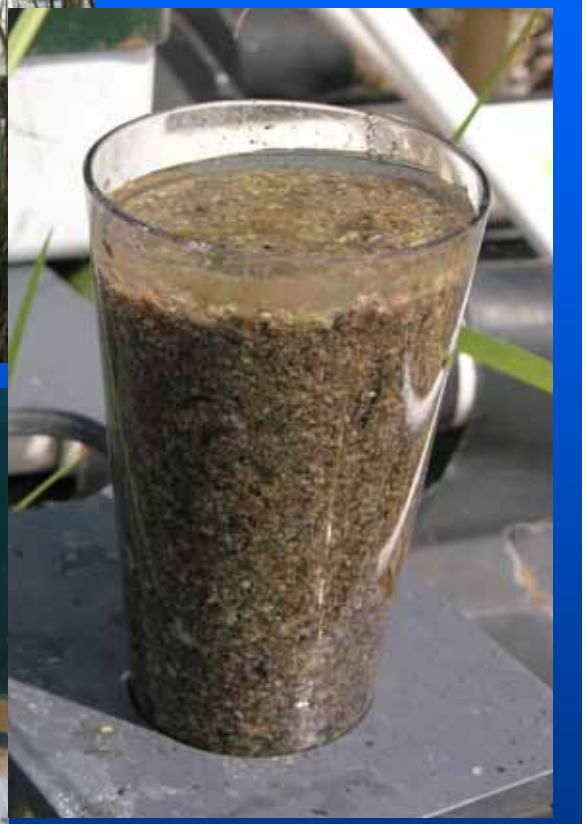
EAA < 280, 000 ha (or about 25% of the original Everglades)
80% of this is farmed in sugarcane. Also sod, vegetables, and rice.

Soil


DRY, NS
WET, R² = 0.190, p<0.001
WET, R² = 0.178, p<0.001
WET
DRY, NS
WET, NS
DRY, R² = 0.177, p<0.001
WET, R² = 0.158, p<0.001
CH4 or CO2 Production, µmol g-1 dw h-1
MUFC or MUFP, µmol g-1 dw h-1
Soil Total P, µg-1 g-1 dw

Floc


TPSF
ug g-1
Not Present
140 - 200
201 - 400
401 - 600
601 - 800
801 - 1000
1001 - 1200
1201 - 1400
1401 - 1600
1601 - 1800
1801 - 2000
Canal



Floc TC

Area	Mean ± SD	n
	%	
LNWR	44.4 ± 2.3 a	13
WCA2	39.0 ± 4.7 bc	13
WCA3	39.1 ± 7.0 b	68
ENP	34.1 ± 6.0 c	24

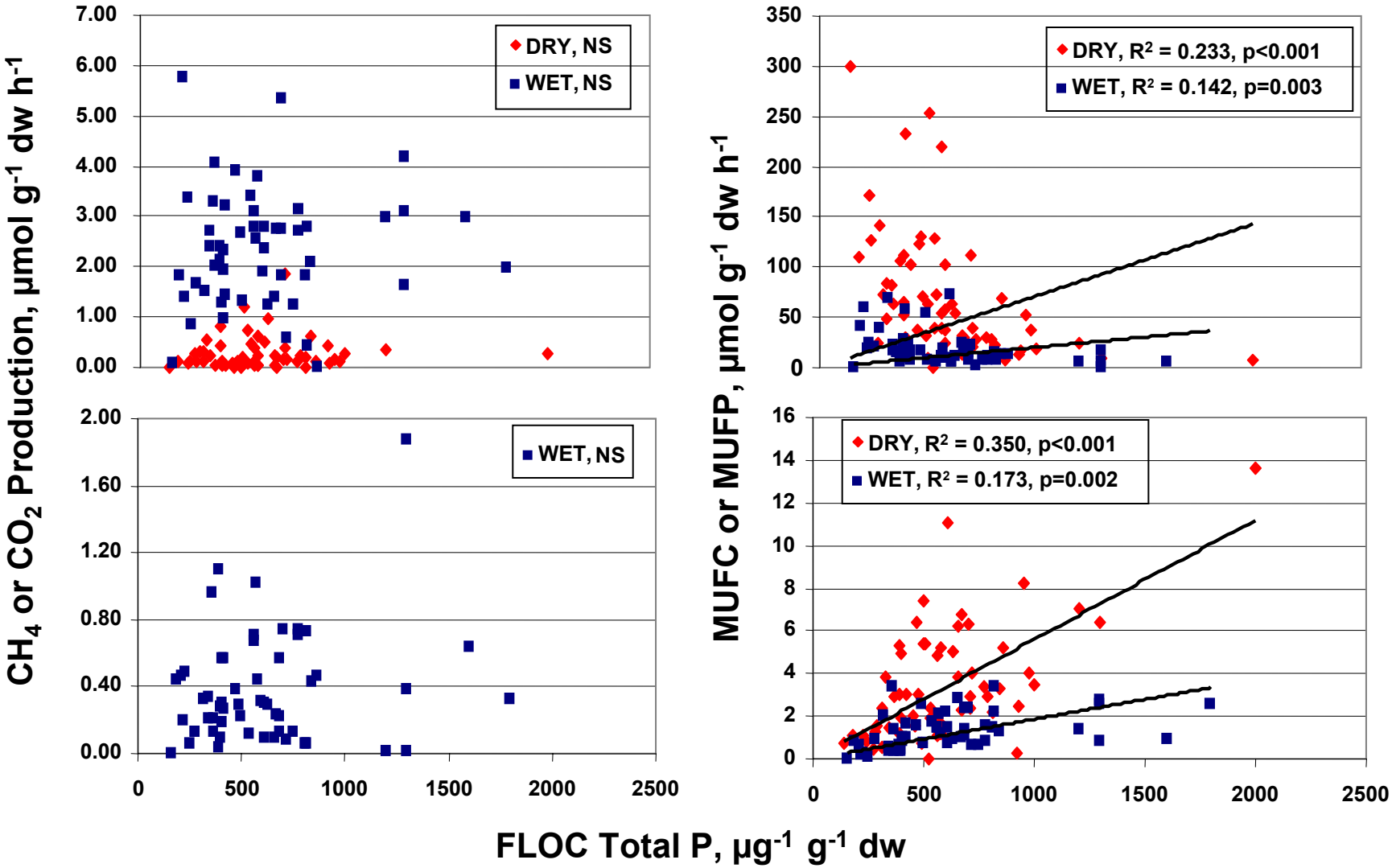
Floc TP contents varied significantly between sites (p = 0.008) but without power for post-hoc tests (Dunnets).

Floc TP

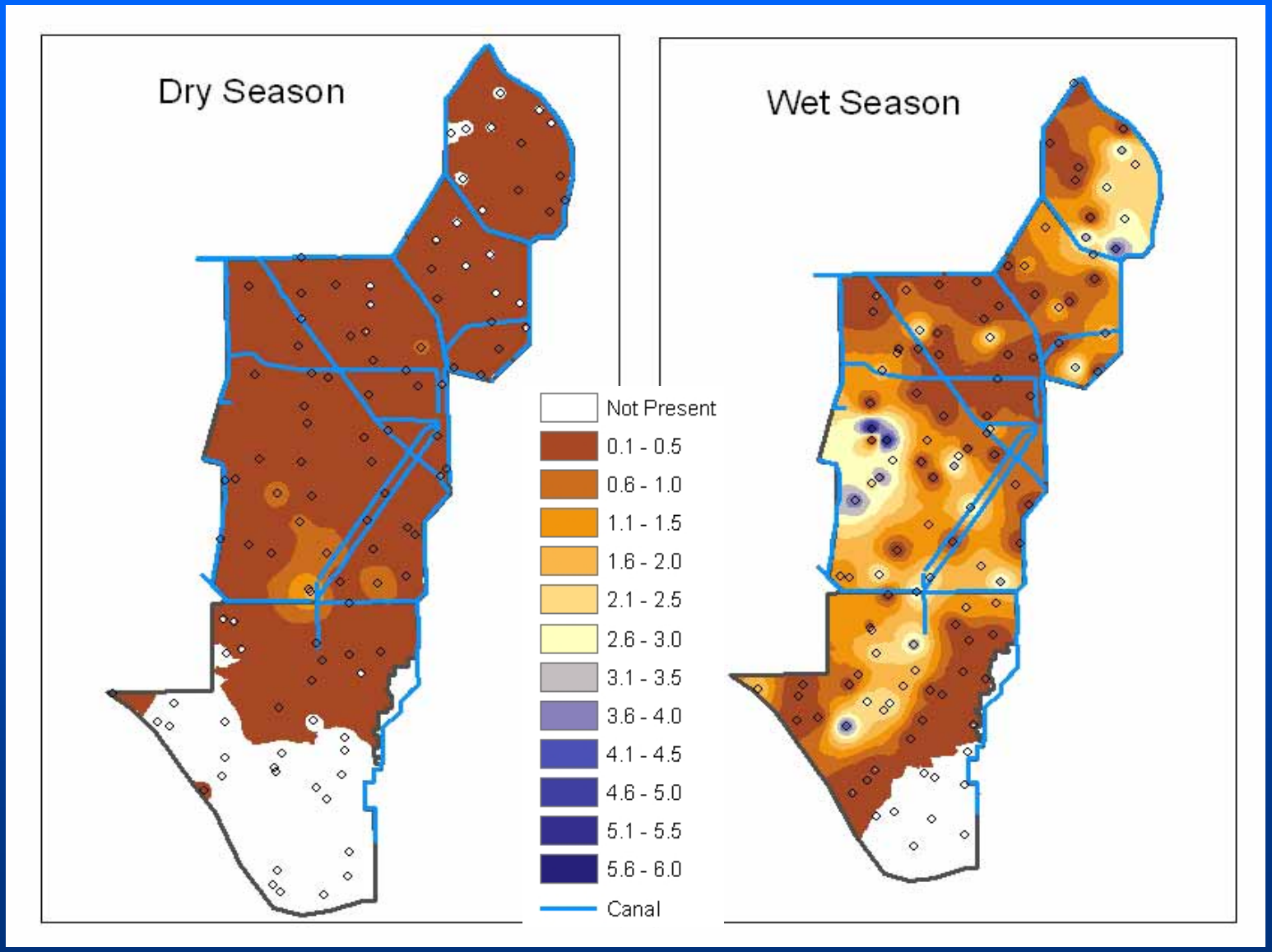
Area	Mean ± SD	n
	µg TP g^{-1} dw	
LNWR	836 ± 460	13
WCA2	721 ± 411	13
WCA3	585 ± 252	68
ENP	497 ± 300	24

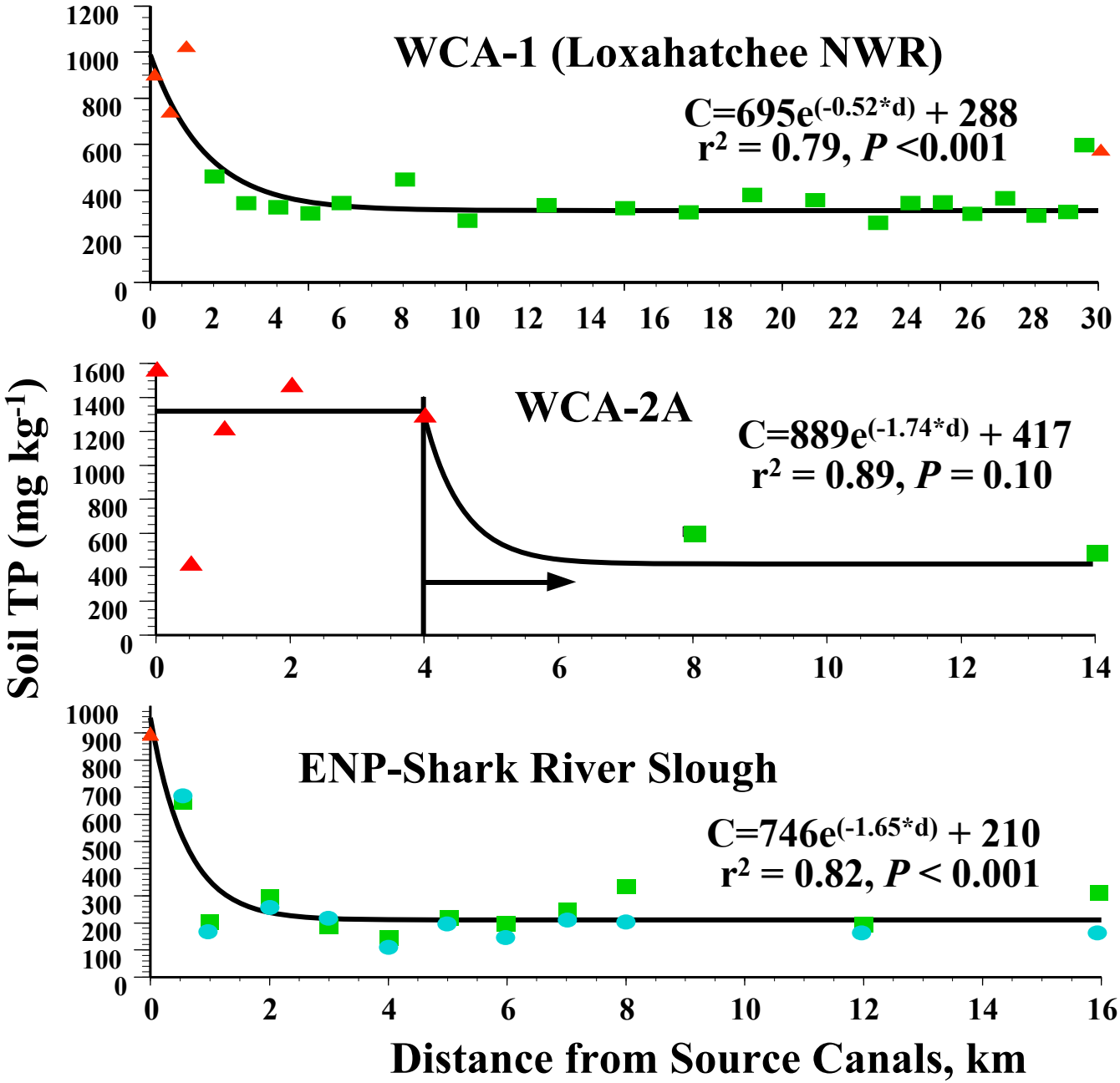
Neither Floc TC nor TP contents varied seasonally for all samples or by areas therefore n = 128.

Floc

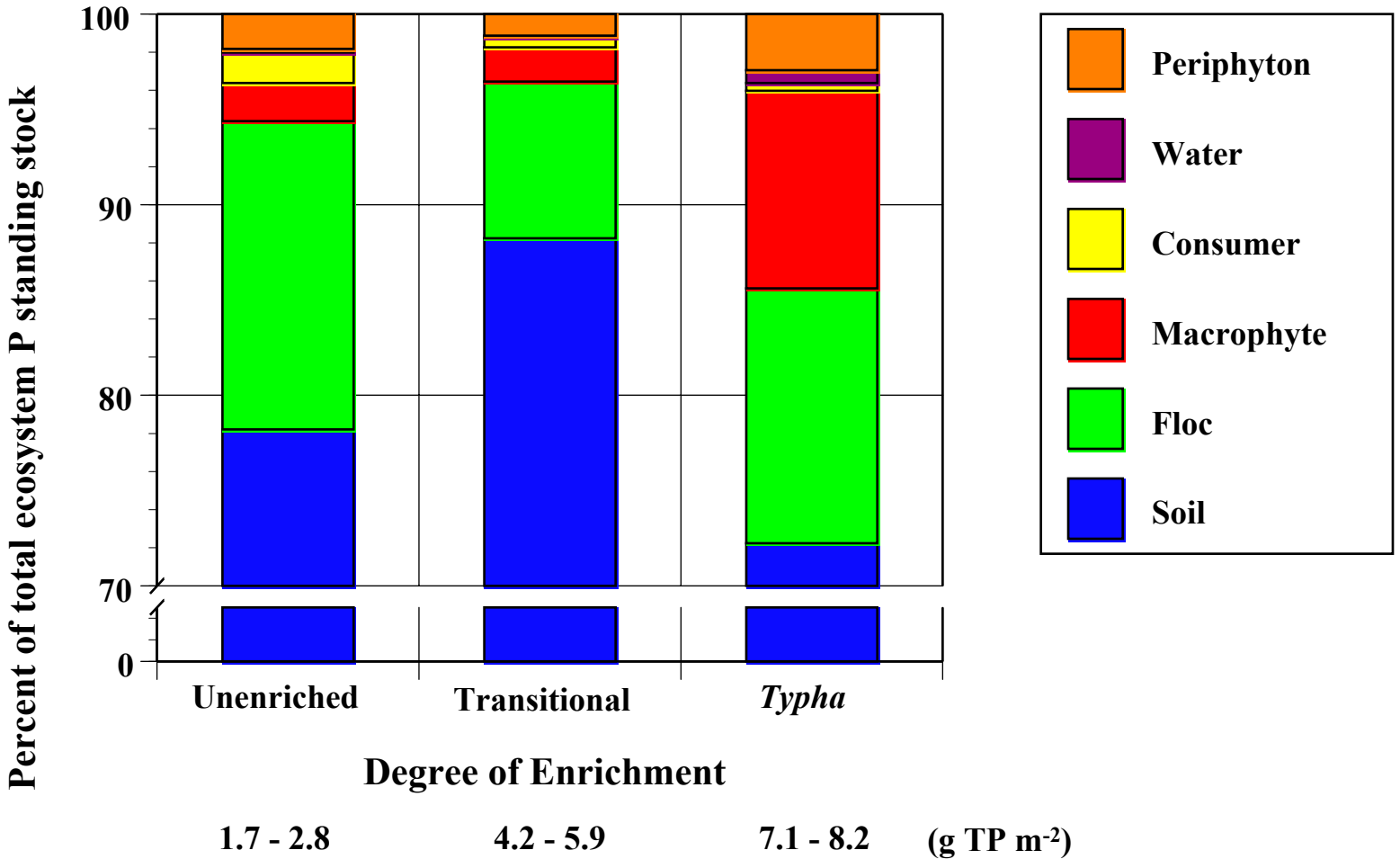

DRY, NS
WET, NS
WET, NS
DRY, R² = 0.233, p<0.001
WET, R² = 0.142, p=0.003
DRY, R² = 0.350, p<0.001
WET, R² = 0.173, p=0.002
CH4 or CO2 Production, µmol g-1 dw h-1
MUFC or MUFP, µmol g-1 dw h-1
FLOC Total P, µg-1 g-1 dw

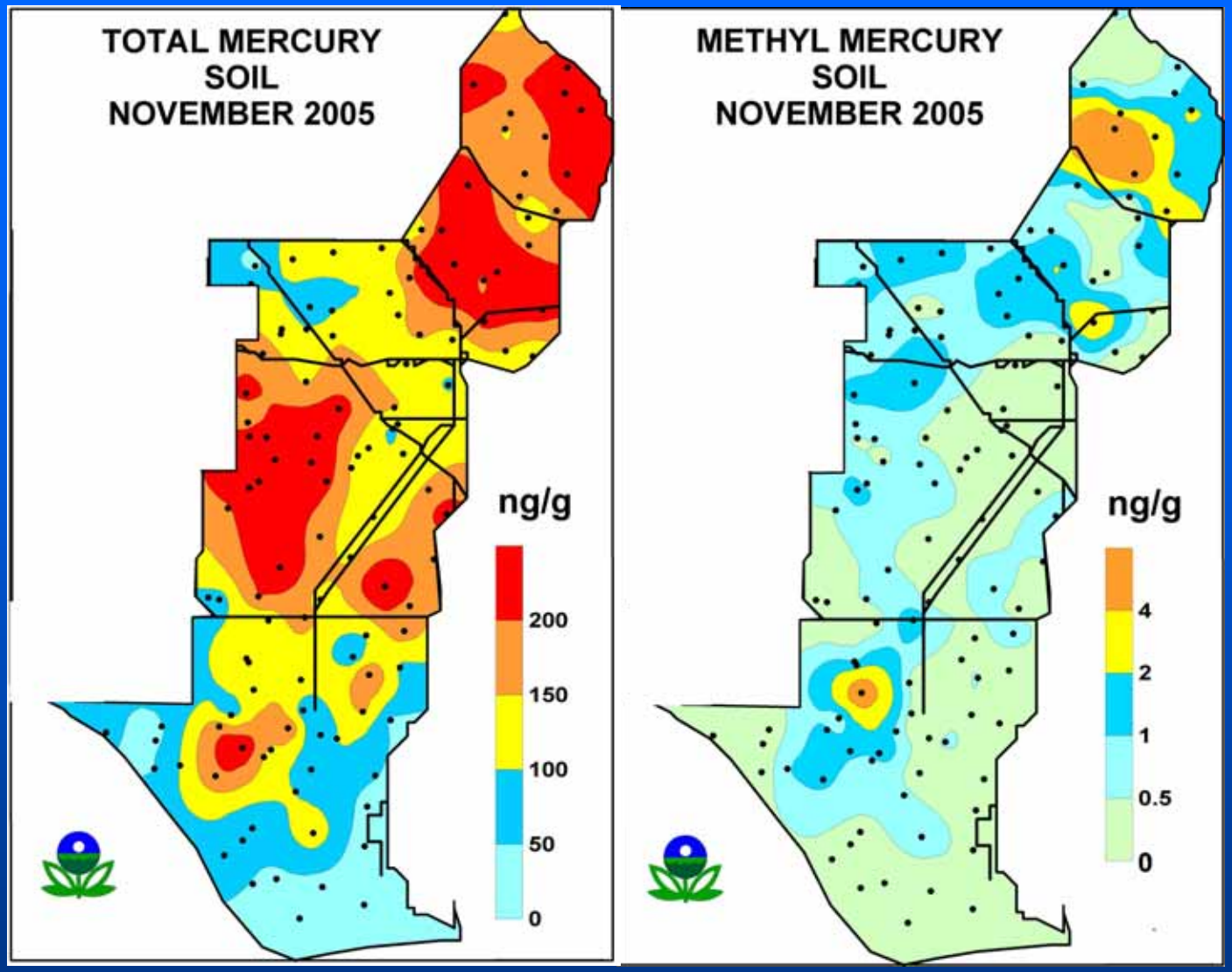
Floc CO_2 Production, µmol g^{-1} dw h^{-1}





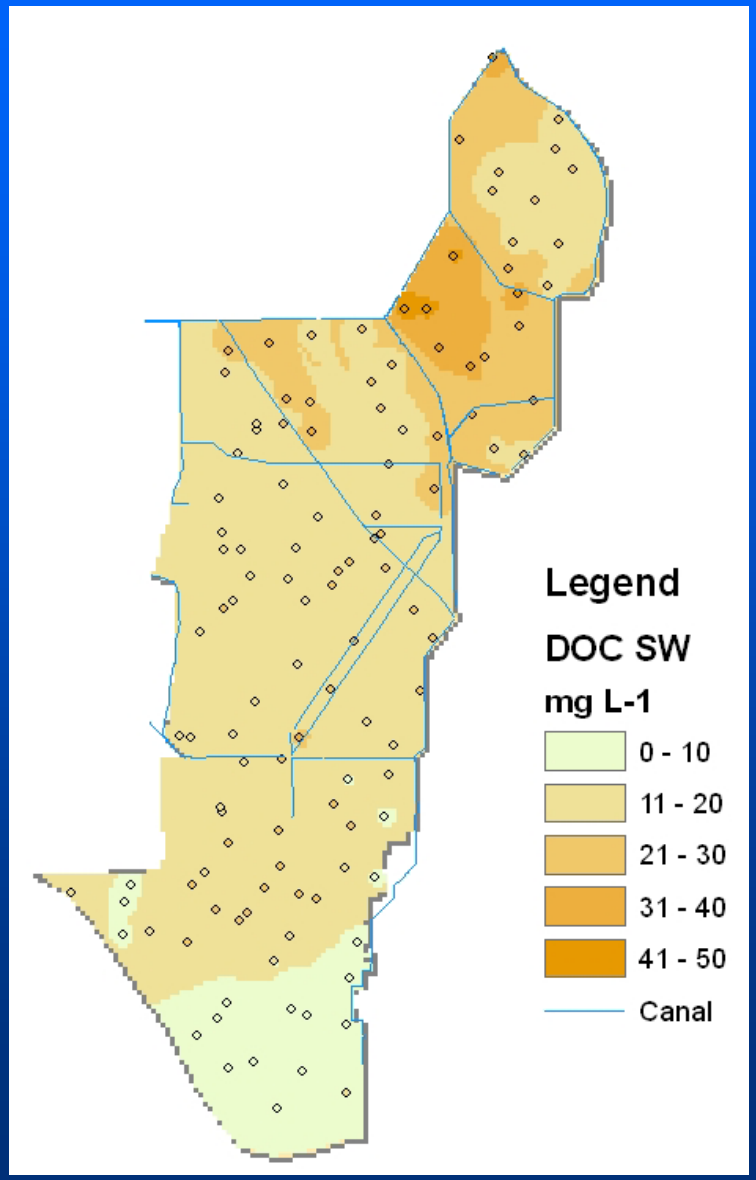
Childers et al. 2003 JEQ

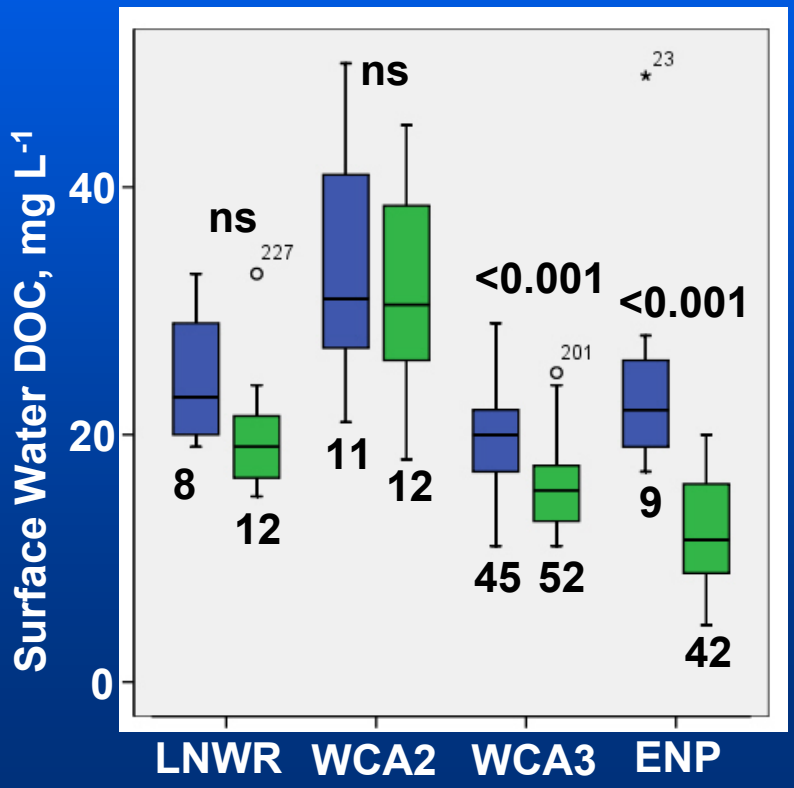

Percent of total ecosystem P standing stock
100
90
80
70
0
Unenriched
Transitional
Typha
Degree of Enrichment
1.7 - 2.8
4.2 - 5.9
7.1 - 8.2
(g TP m-2)
Periphyton
Water
Consumer
Macrophyte
Floc
Soil



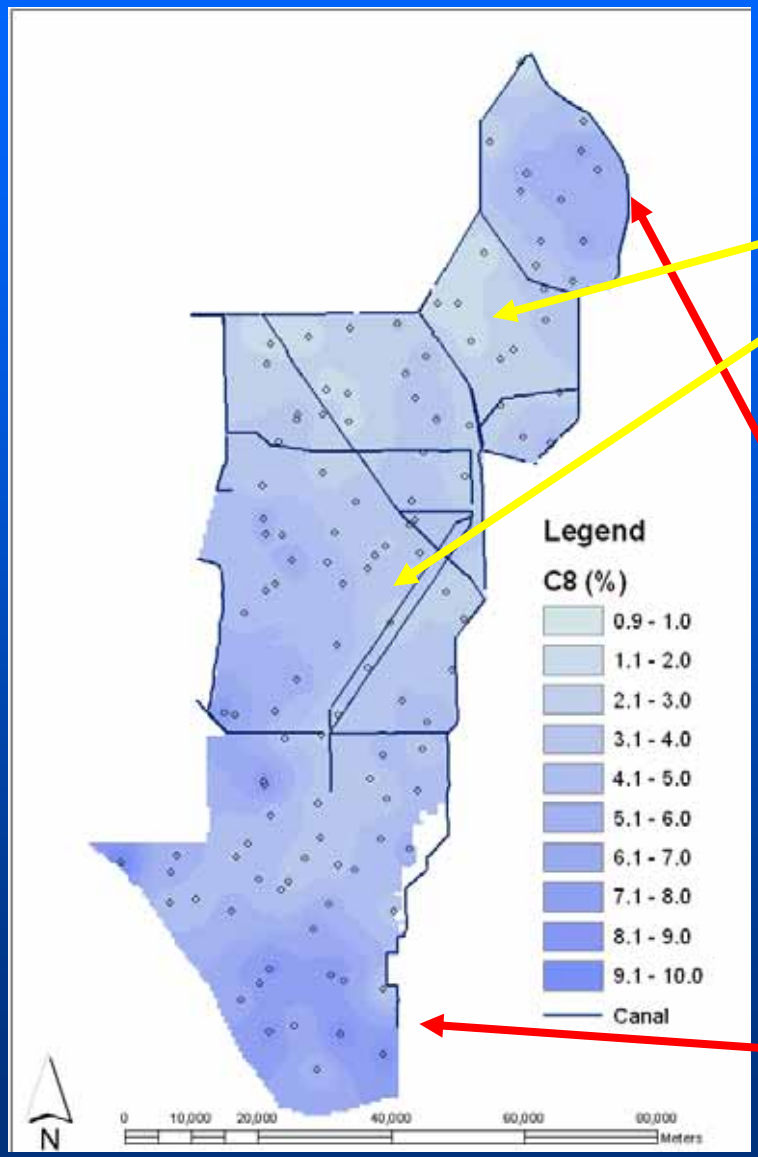
Soil Total and Methyl Hg positively correlated ($p < 0.001$) with Soil TP and Soil CH_4 production. Floc Total Hg positively correlated to Floc TP ($p = 0.02$) but Methyl Hg was not.

Surface Water Dissolved Organic C





Surface Water Dissolved Organic C Quality



"Less Biologically Active"

Rudolf Jaffe
Youhei Yamashita

"More Labile"

Summary

- Nutrient loading (P) influences rates of microbially-mediated processes which can effect ecosystem chemical processing on landscape scales.

- Soil and Floc CO_2 evolution rates were greater during the wet season than during the dry.

- The wet season CO_2 evolution from Floc averaged approximately 2 to 10 times that of soil on a dry mass per unit area basis.

- Generally CO_2 and CH_4 production and MUFP and MUFC activities were significantly correlated in soil and floc, that is, where activity is high for soils it is also for Floc.

Summary

- Seasonality in CO_2, CH_4, and DOC is likely a function of Wet and Dry cycles and this should therefore be considered in water management, i.e. will the short hydroperiod marsh be maintained.

- P demand, rapid recycling, and retention mechanisms allow strong chemical gradients to develop in the oligotrophic Everglades.

- Additionally, water management may change the character of DOC and other chemical constituents.