

Nutrient Storages in the Everglades Stormwater Treatment Areas

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Advancing Science, Restoring the Everglades

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RATIONALE

Understand wetland biogeochemical processes that regulate phosphorus (P) removal efficiency and dictate long-term stabilization of P in Everglades STAs

Key Question

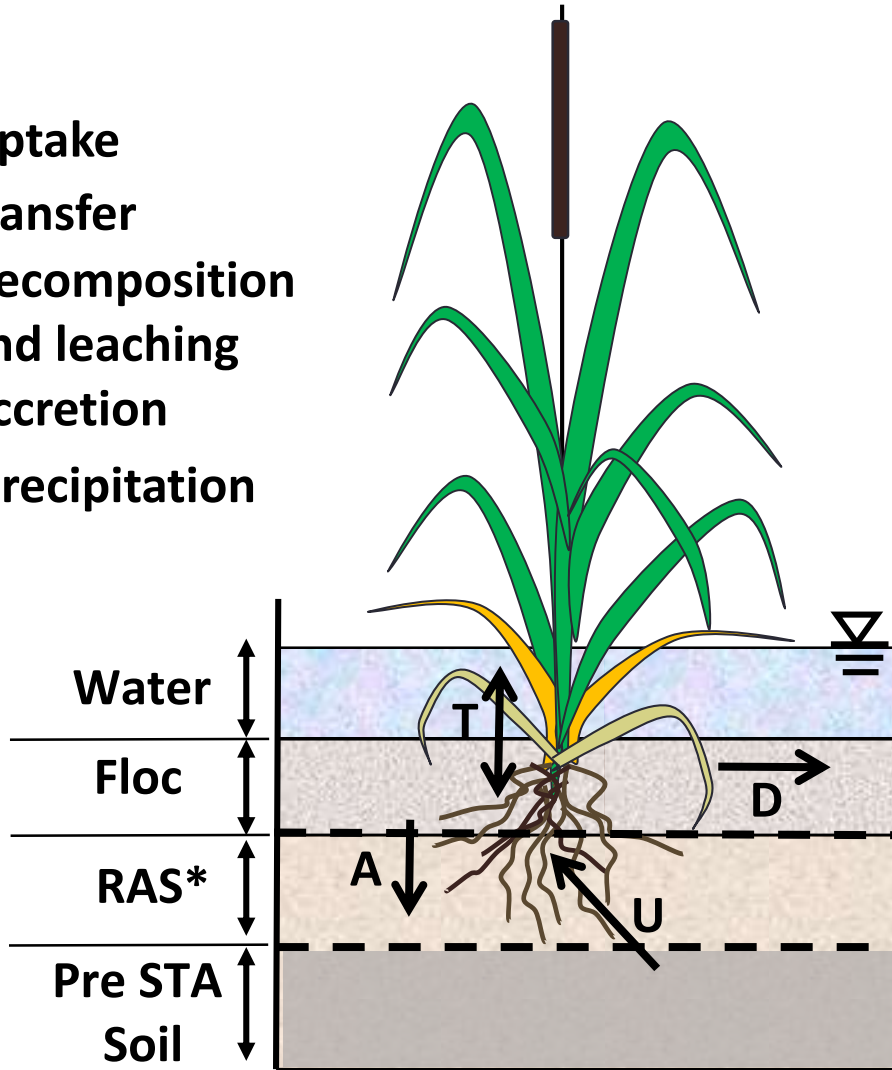
- Can internal loading of P to the water column be reduced or controlled, especially in the lower reaches of the treatment trains?

Objectives

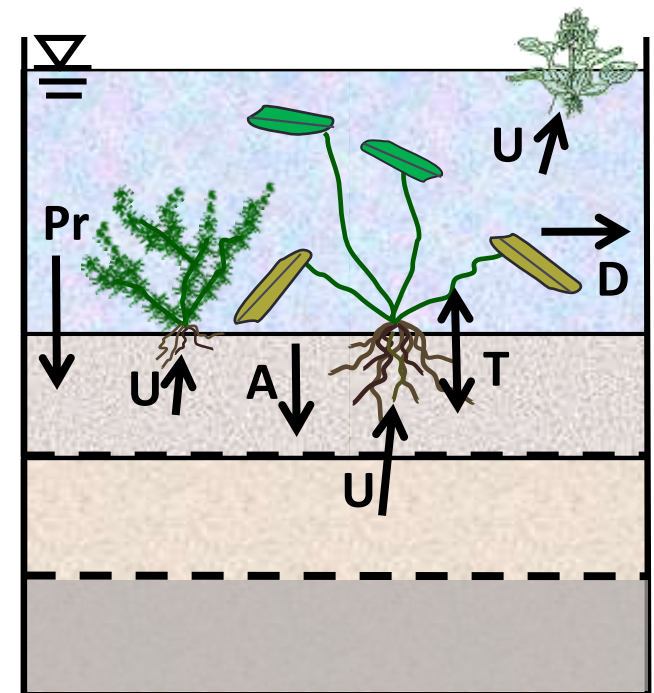
- Determine existing nutrient (P) storages in STA soils
- Compare the differences in soil nutrient storages between emergent and submerged vegetation

Emergent Aquatic Vegetation (EAV)

U = Uptake
 T = Transfer
 D = Decomposition
 and leaching
 A = Accretion
 Pr = Precipitation



Submerged Aquatic Vegetation (SAV)

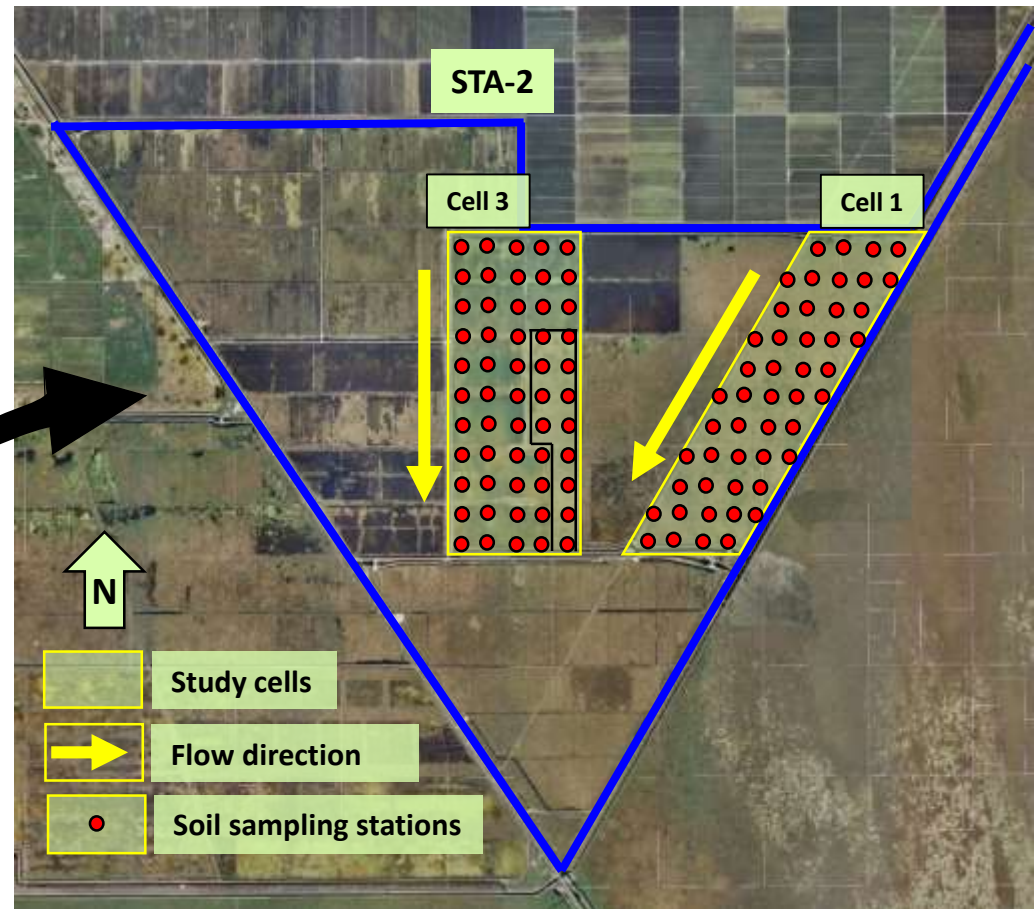


*RAS = Recently Accreted Soil

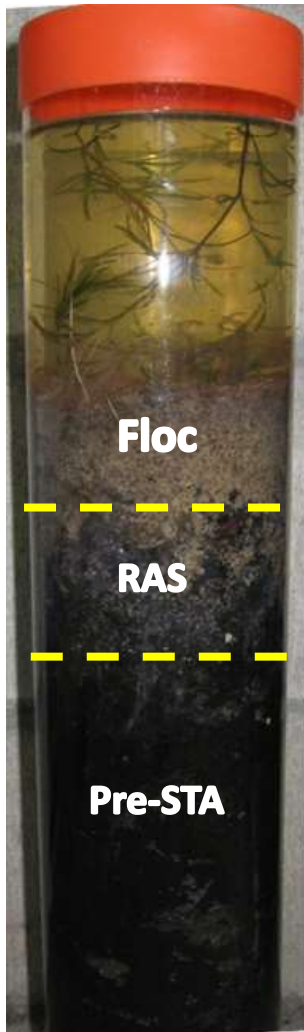
STUDY LOCATION

Two treatment flow ways (cells) in STA-2

- Cell 1 (EAV) → Treatment area = 744 ha
- Cell 3 (SAV) → Treatment area = 930 ha



SAMPLING AND ANALYSIS



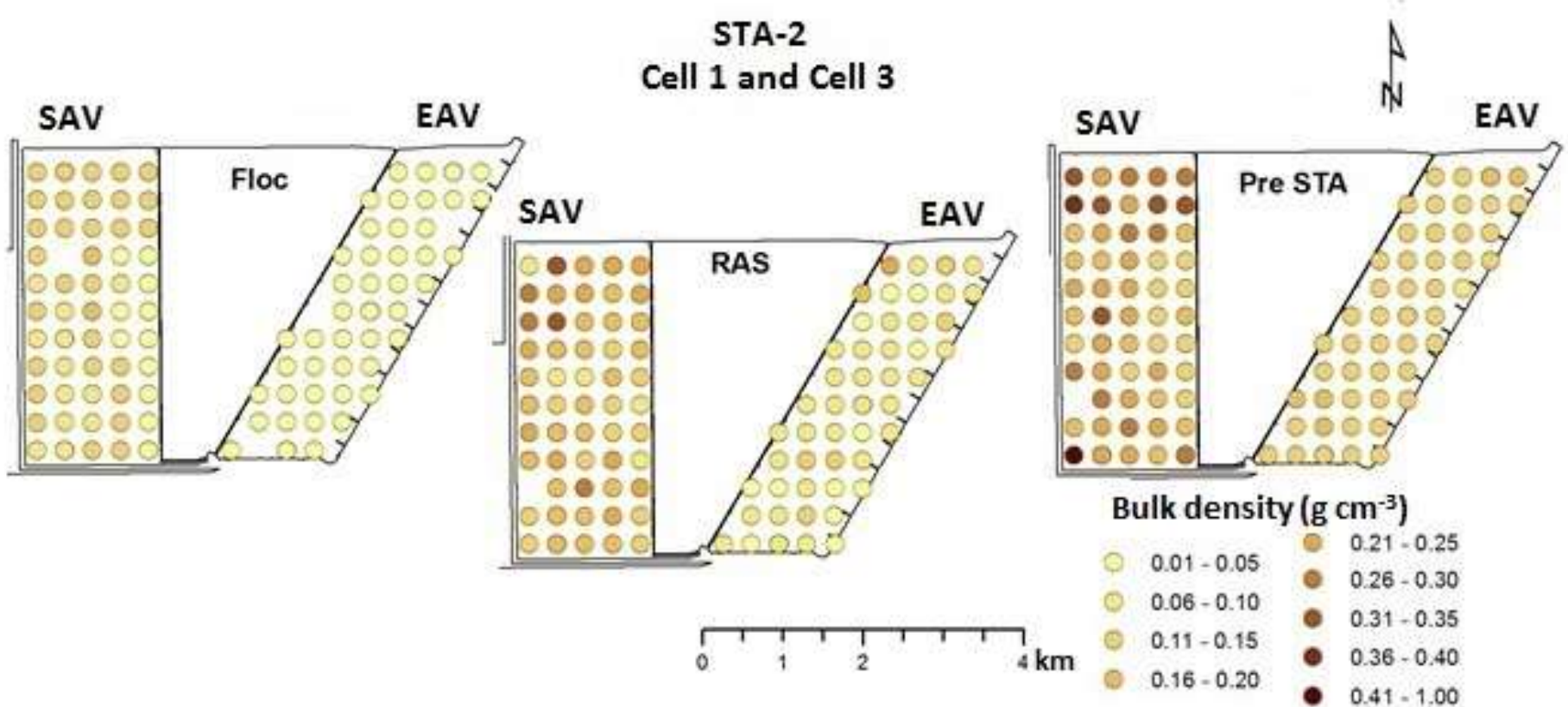
- Floc – comprised of unconsolidated material
- RAS – determined based on color and texture
- Pre-STA – layer representing antecedent soils (before STAs began operations)
- Bulk density (BD) and nutrient (P, C & N) concentrations
- Nutrient storages were calculated for each layer

Soil nutrient storage $\left(\frac{\text{g}}{\text{m}^2}\right)$

$$= \frac{\text{Nutrient conc.} \left(\frac{\text{mg}}{\text{Kg}}\right) \times \text{BD} \left(\frac{\text{g}}{\text{cc}}\right) \times \text{depth (cm)}}{100}$$

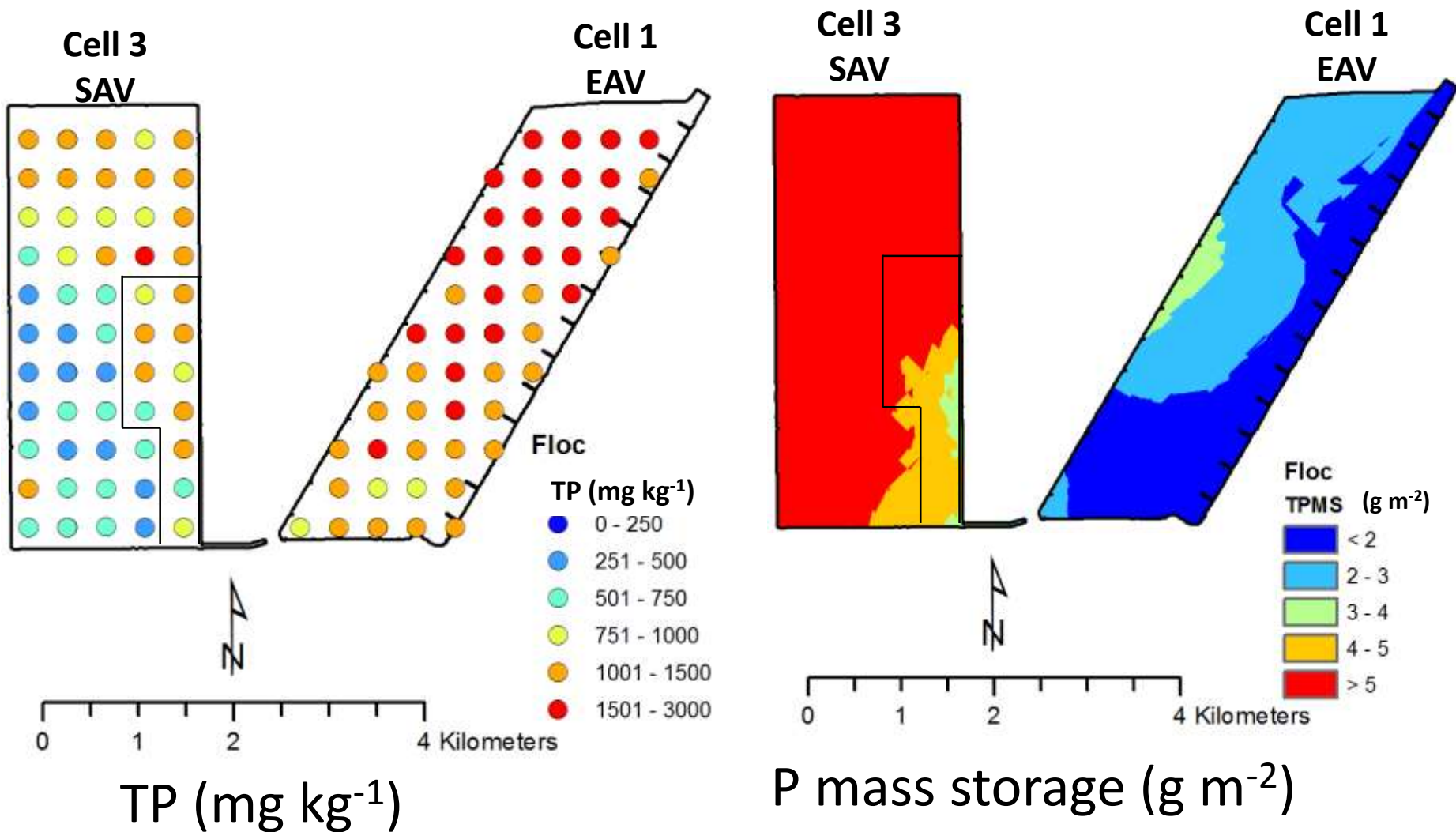
RAS = Recently Accreted Soil

SPATIAL TRENDS – Bulk Density



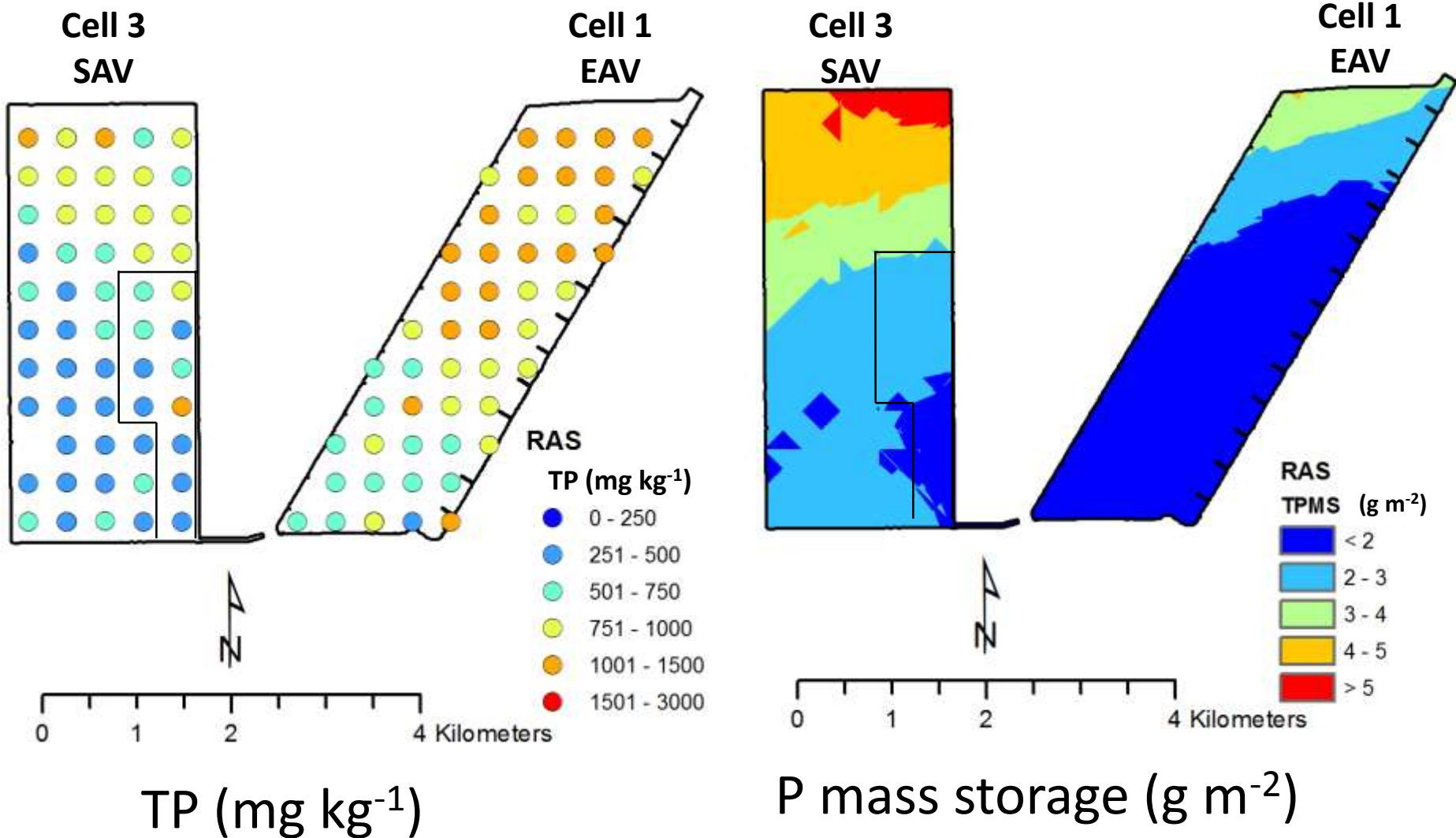
Higher bulk density in SAV than EAV cells, in all soil sections

SPATIAL TRENDS – Phosphorus in Floc



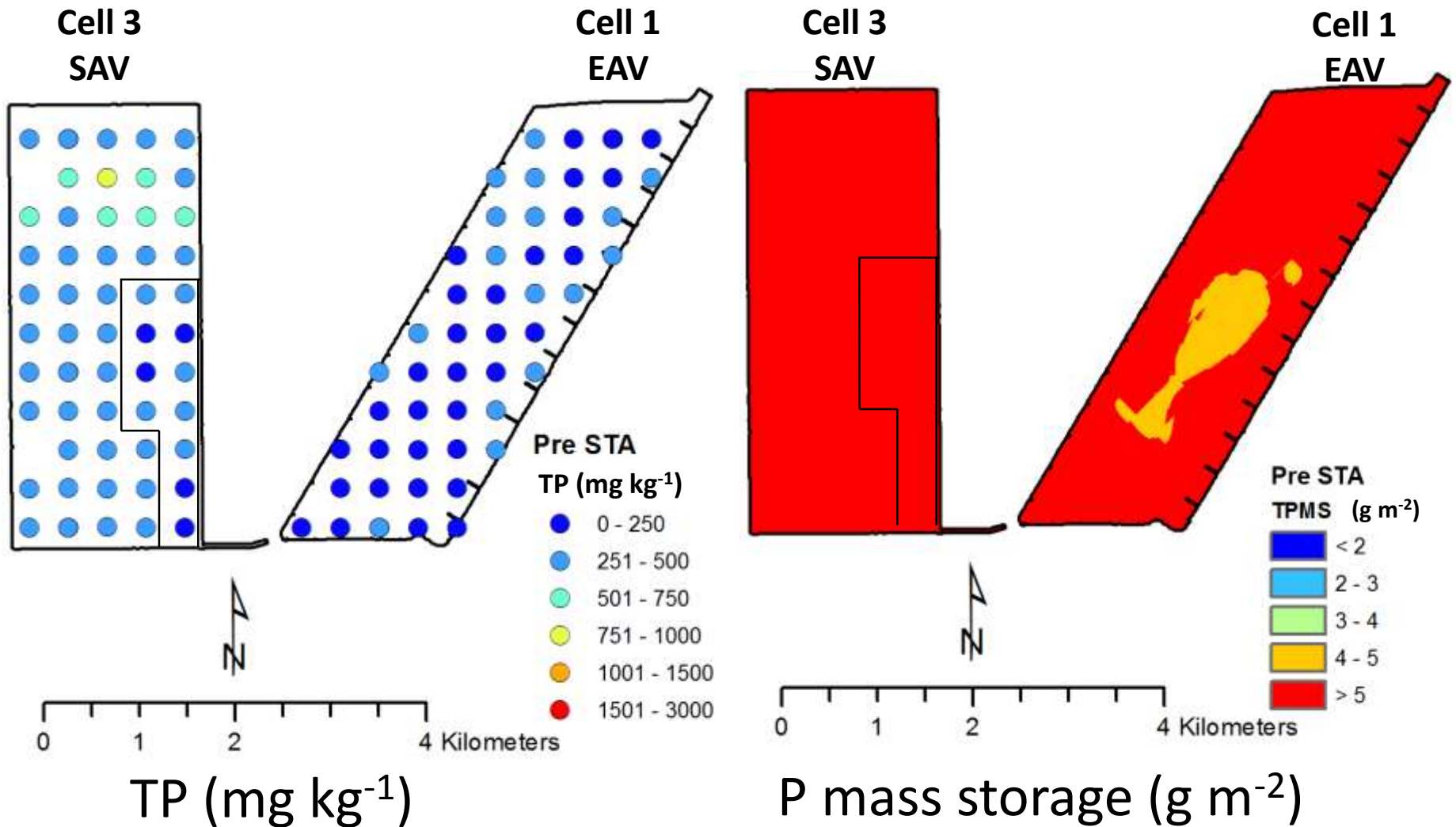
Avg. depth (cm) – EAV- 7.7 and SAV- 10.7

SPATIAL TRENDS – Phosphorus in RAS



Avg. depth (cm) – EAV- 2.5 and SAV- 3.0

SPATIAL TRENDS – Phosphorus in pre-STA soils



Avg. depth (cm) – EAV- 19.1 and SAV- 16.4

SOIL NUTRIENT STORAGES

STA-2	Type	Depth	P	N	C	S
Cell-1		cm	g m ⁻²			
EAV	Floc	7.7 ± 0.4	<u>2 ± 0.1</u>	38 ± 2	487 ± 28	13 ± 1
	RAS	2.5 ± 0.2	1.7 ± 0.2	47 ± 3	680 ± 50	20 ± 2
	Pre-STA	19.1 ± 0.3	6.1 ± 0.3	787 ± 28	12641 ± 433	225 ± 10
Cell-3						
SAV	Floc	10.7 ± 0.5	<u>8.5 ± 0.8</u>	124 ± 9	2313 ± 161	44 ± 3.6
	RAS	3 ± 0.2	3.3 ± 0.3	78 ± 8	1452 ± 134	30 ± 3
	Pre-STA	16.4 ± 0.7	17.5 ± 2	1128 ± 42	18098 ± 735	278 ± 14

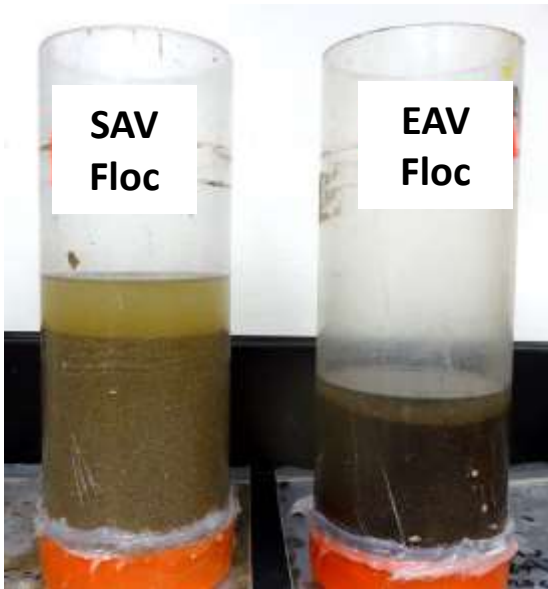
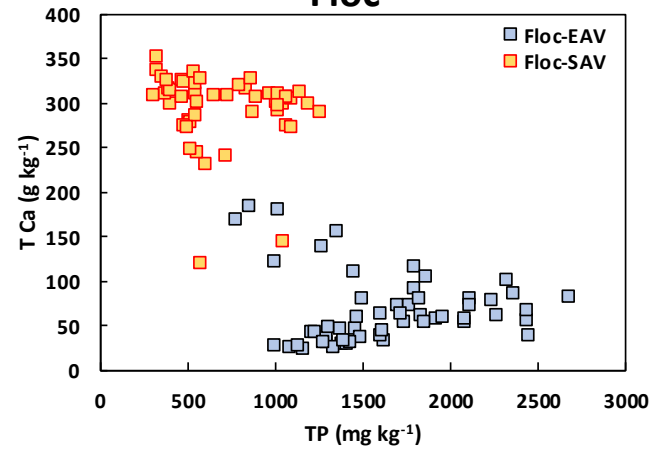
Phosphorus storage in vegetation biomass

EAV ~ 3 - 4 g P m⁻²

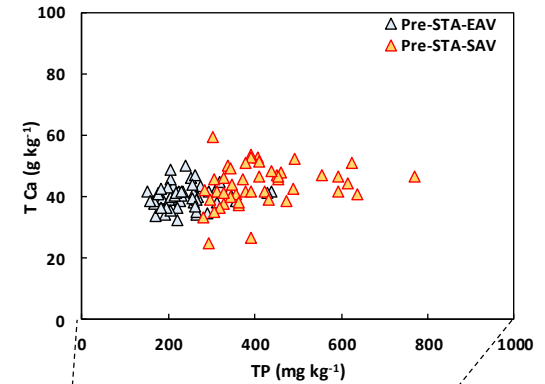
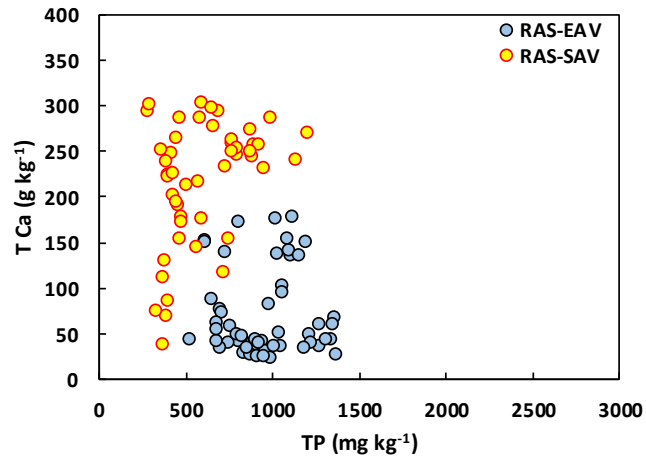
SAV ~ 0.5 – 1.5 g m⁻²

VEGETATION INDUCED DIFFERENCES

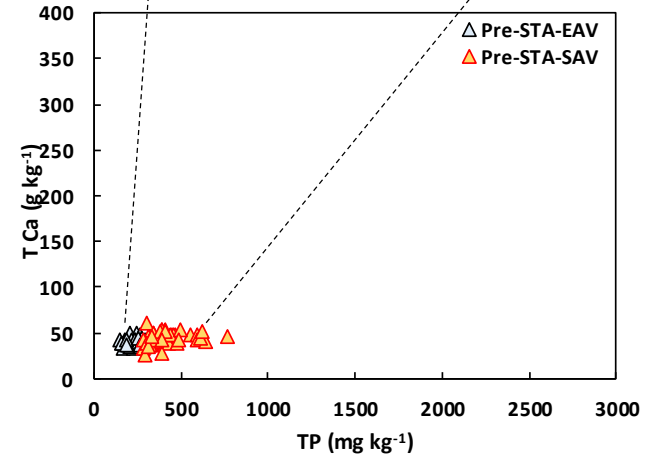
Floc



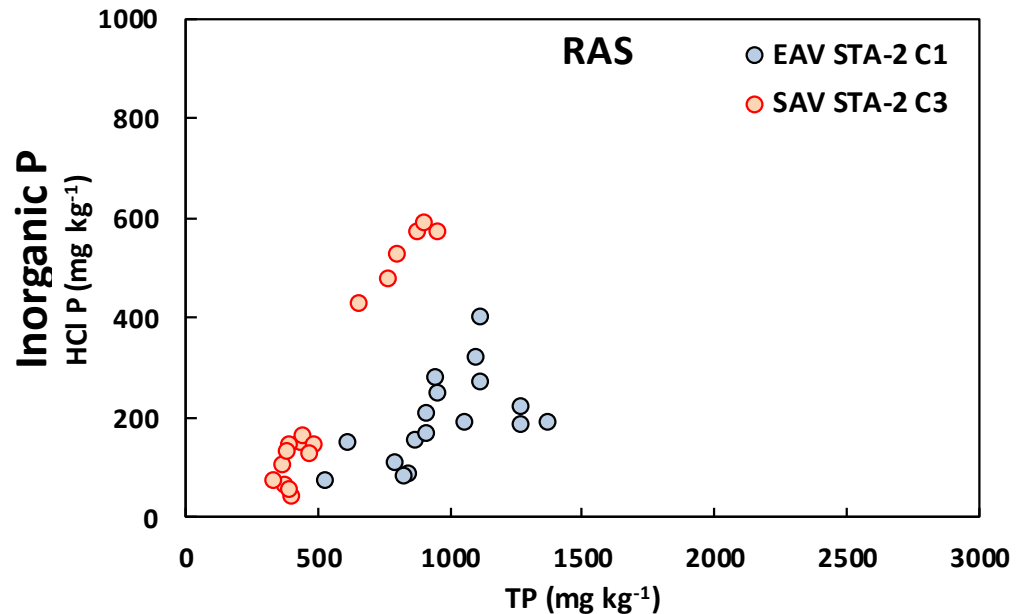
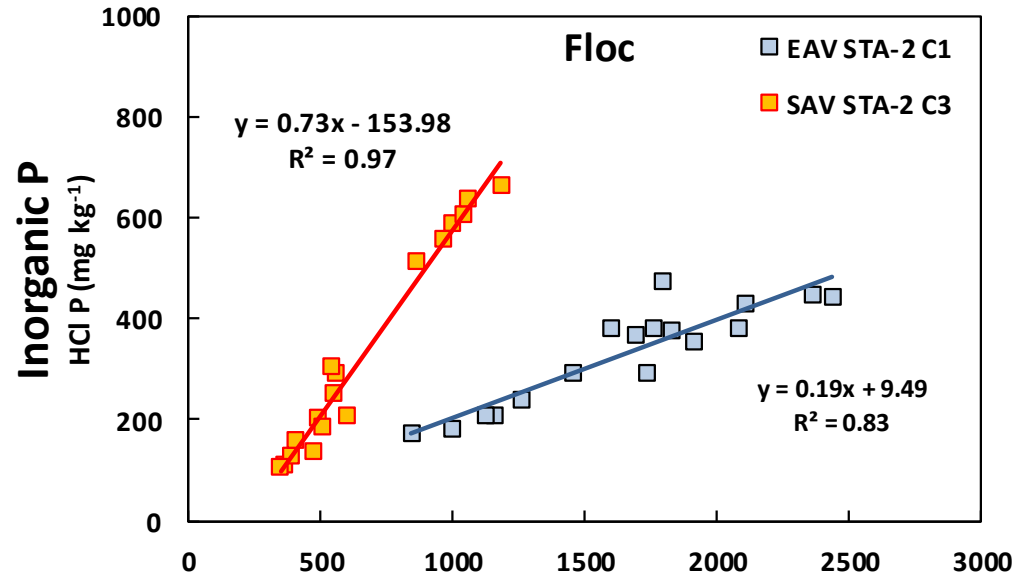
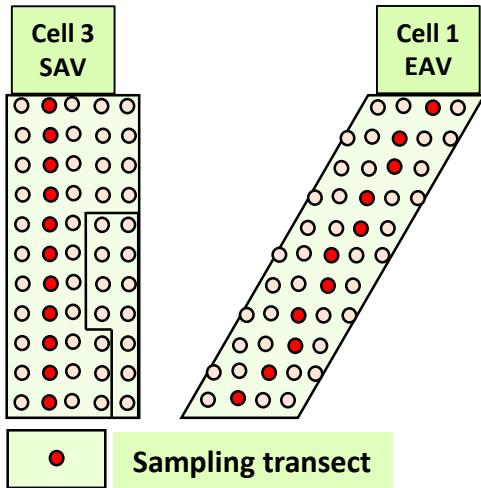
RAS



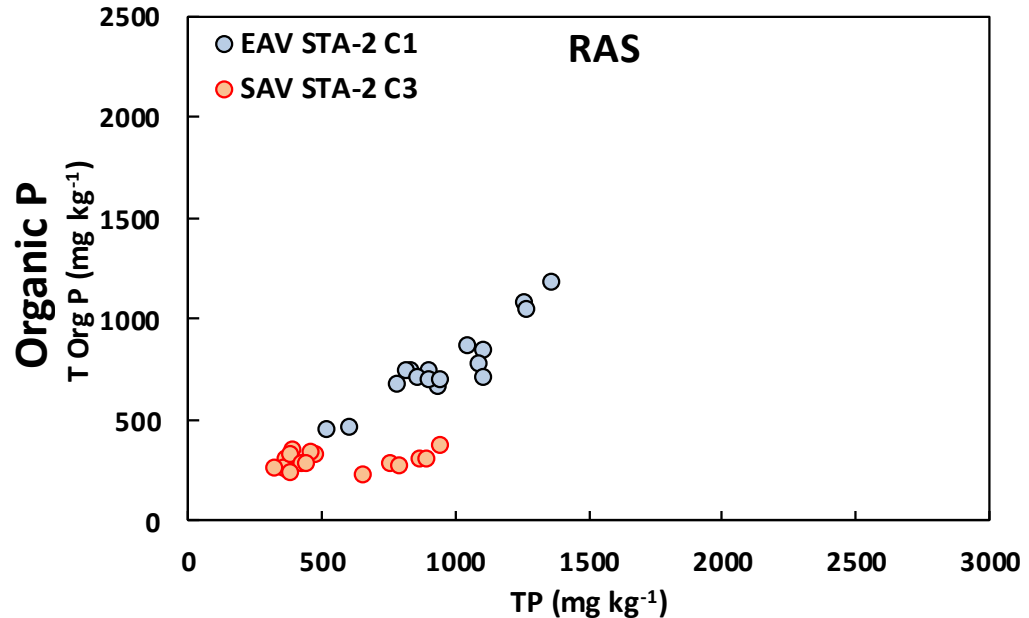
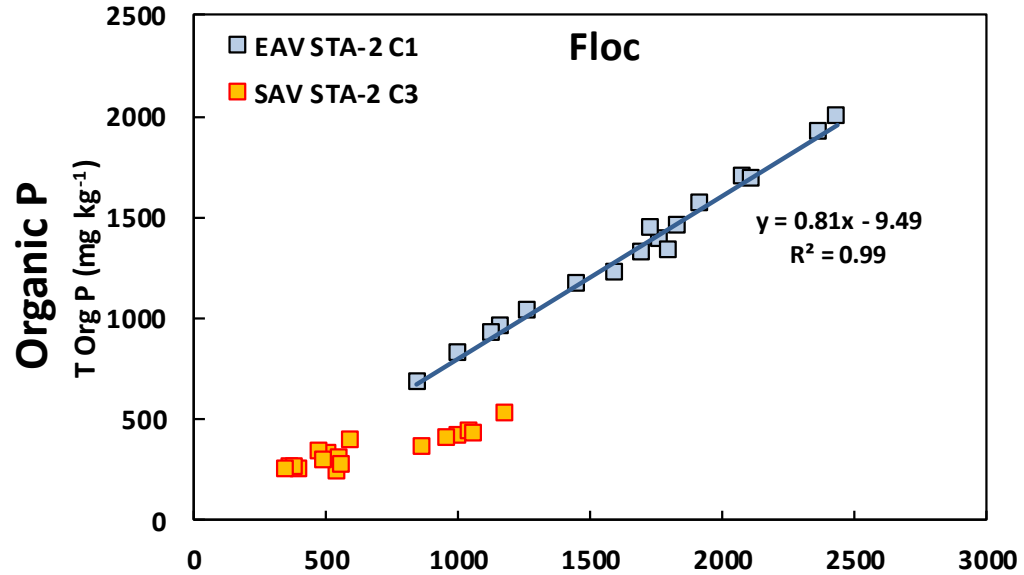
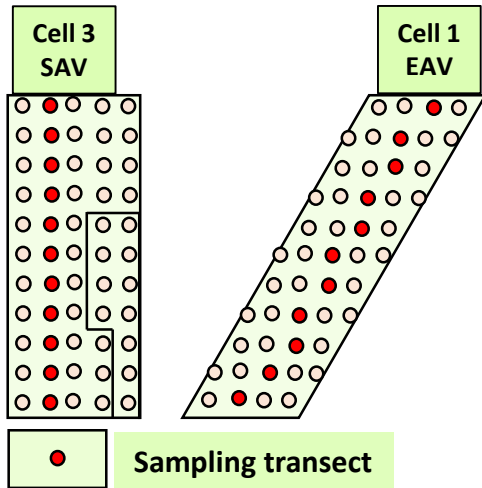
Pre-STA



DIFFERENCES – Phosphorus forms



VEGETATION DIFFERENCES– Phosphorus forms



SUMMARY

- Significant P enrichment in floc near inflows with concentrations diminishing towards outflows
- Floc P enrichment in EAV (Cell 1) was greater & spatially extensive compared to SAV (Cell 3)
- Nutrient (P, C, N, S) storages were typically higher in SAV (Cell 3) in comparison to EAV (Cell 1)
- SAV floc had higher percentage of TP as inorganic P (up to 55%) in comparison to EAV floc (20%)
- EAV floc had higher percentage of TP as organic P (up to 80%) in comparison to SAV floc (30-35%)

THANK YOU!!!



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