Nutrient Storages in the Everglades Stormwater Treatment Areas

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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
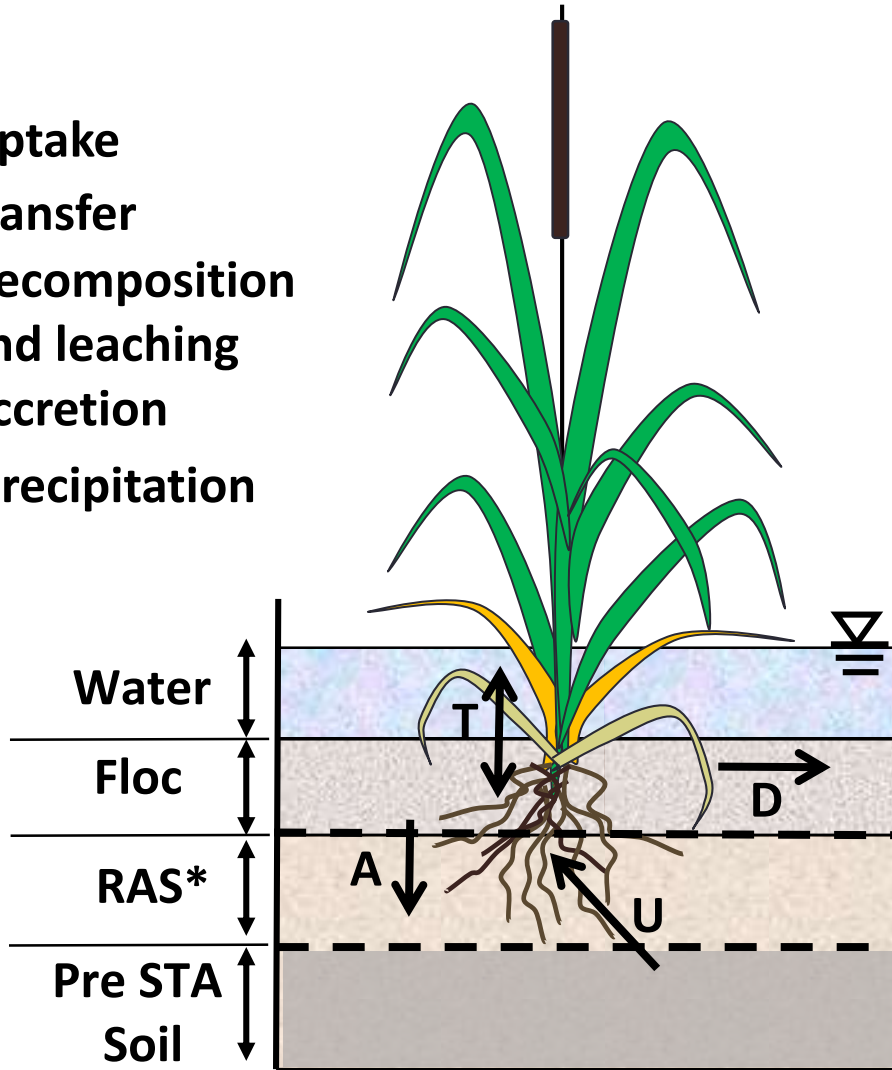
Key Question
- Can internal loading of P to the water column be reduced or controlled, especially in the lower reaches of the treatment trains?
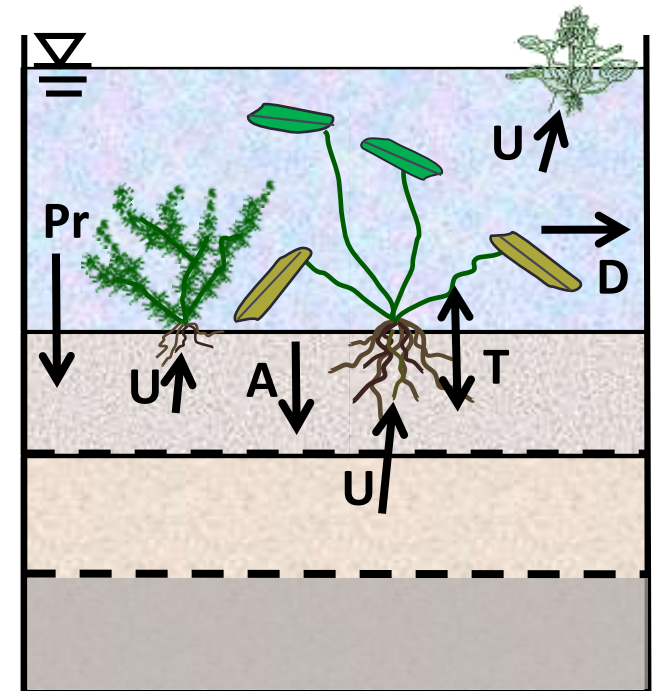
Objectives
- Determine existing nutrient (P) storages in STA soils
- Compare the differences in soil nutrient storages between emergent and submerged vegetation

Emergent Aquatic Vegetation (EAV)

Submerged Aquatic Vegetation (SAV)

U = Uptake

T = Transfer

D = Decomposition and leaching

A = Accretion

Pr = Precipitation

Water

Floc

RAS*

Pre STA Soil
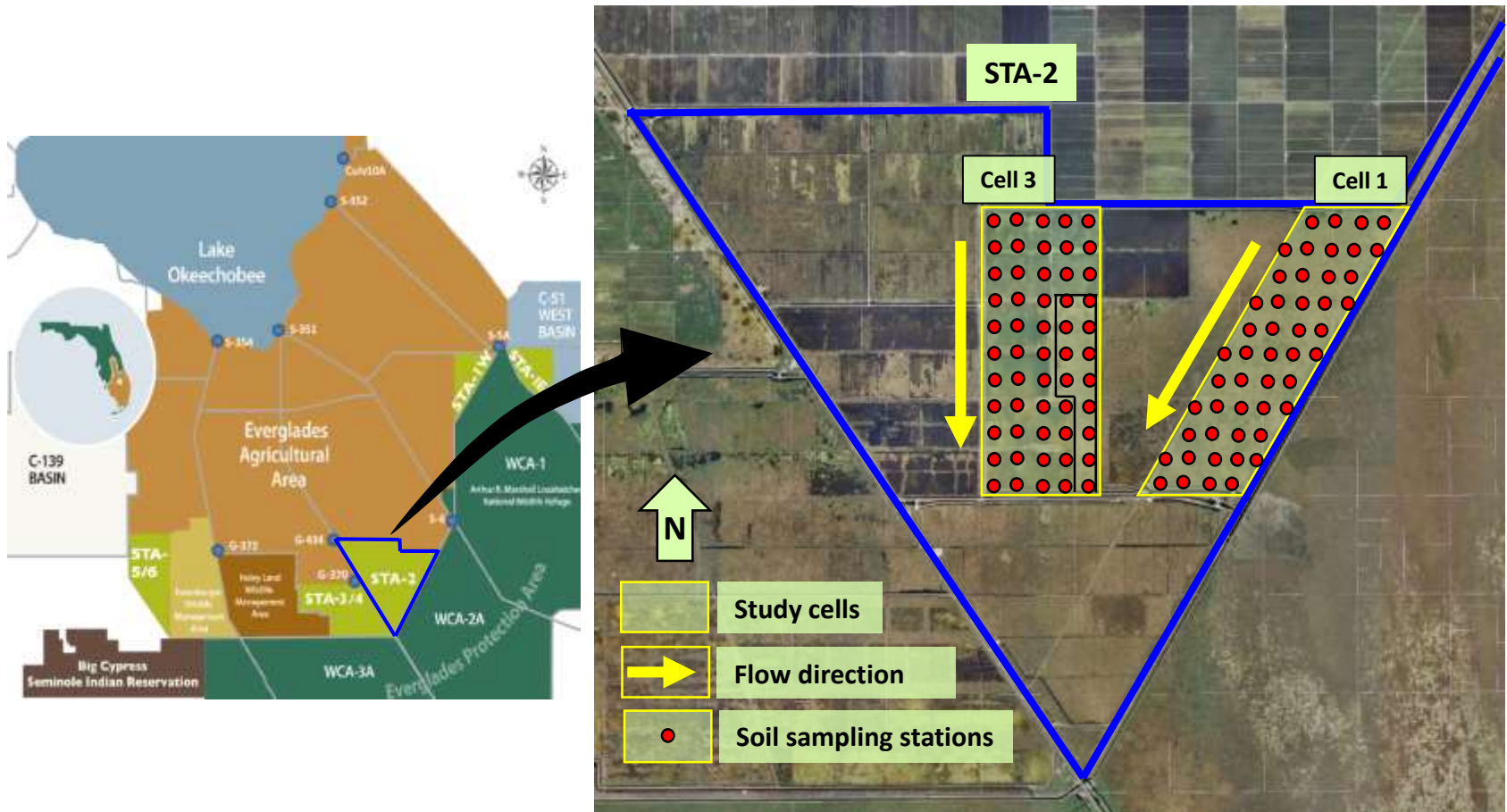
T

D

A

U

Pr

U

A

T

U
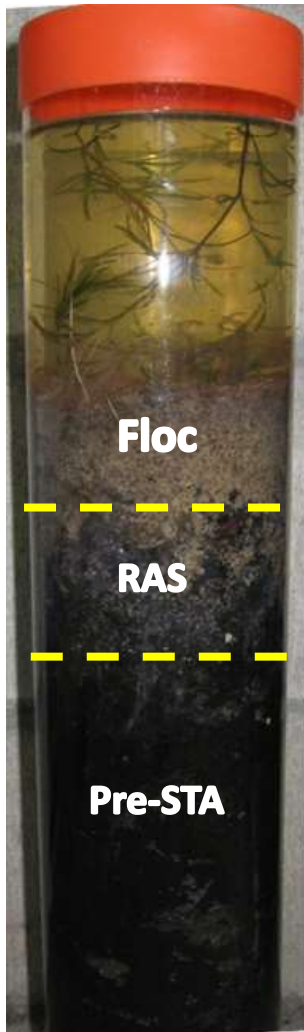
D

*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
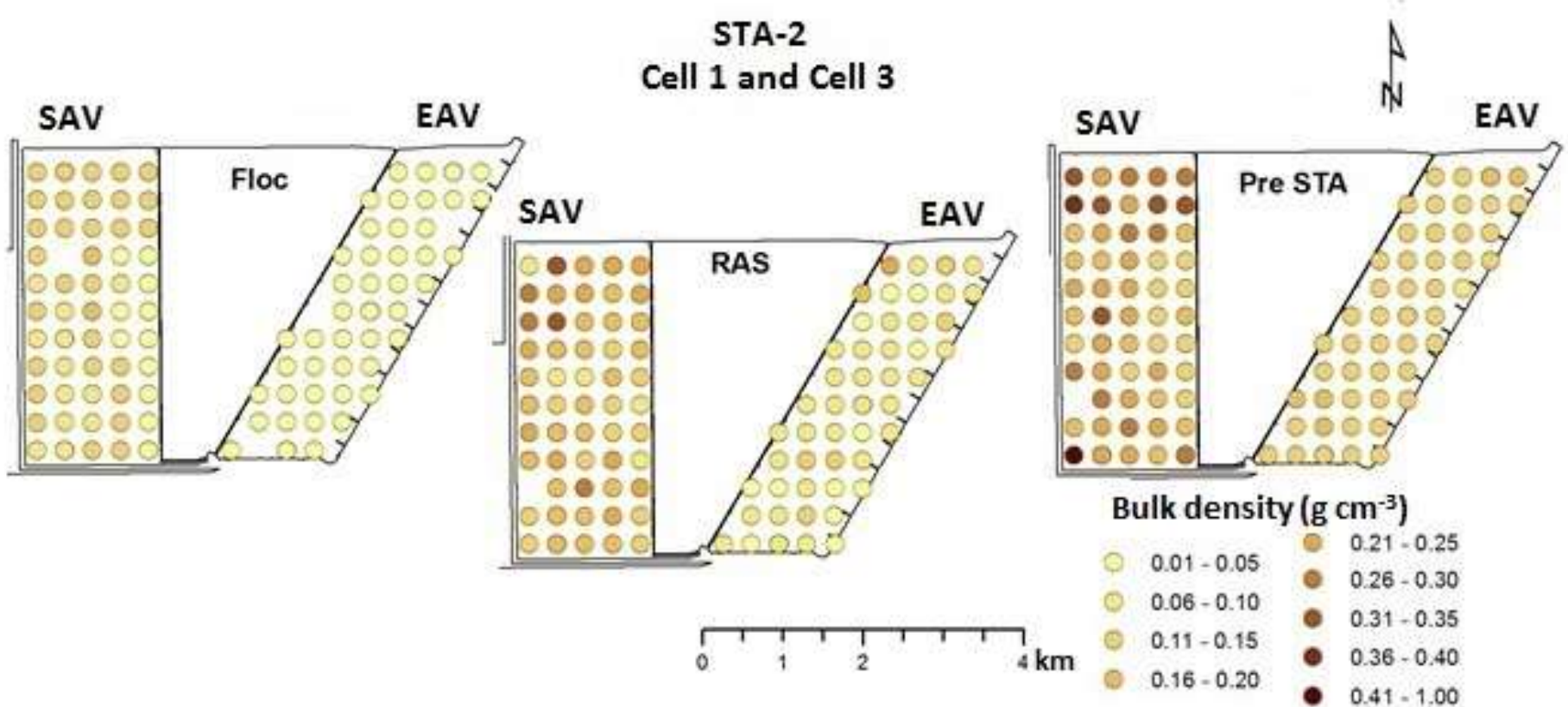
SAMPLING AND ANALYSIS

Floc

RAS

Pre-STA

- 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

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

$$= \frac{\text{Nutrient conc.} \left(\frac{\text{mg}}{\text{Kg}}\right) \times \text{BD} \left(\frac{\text{g}}{\text{cc}}\right) \times \text{depth (cm)}}{100}$$
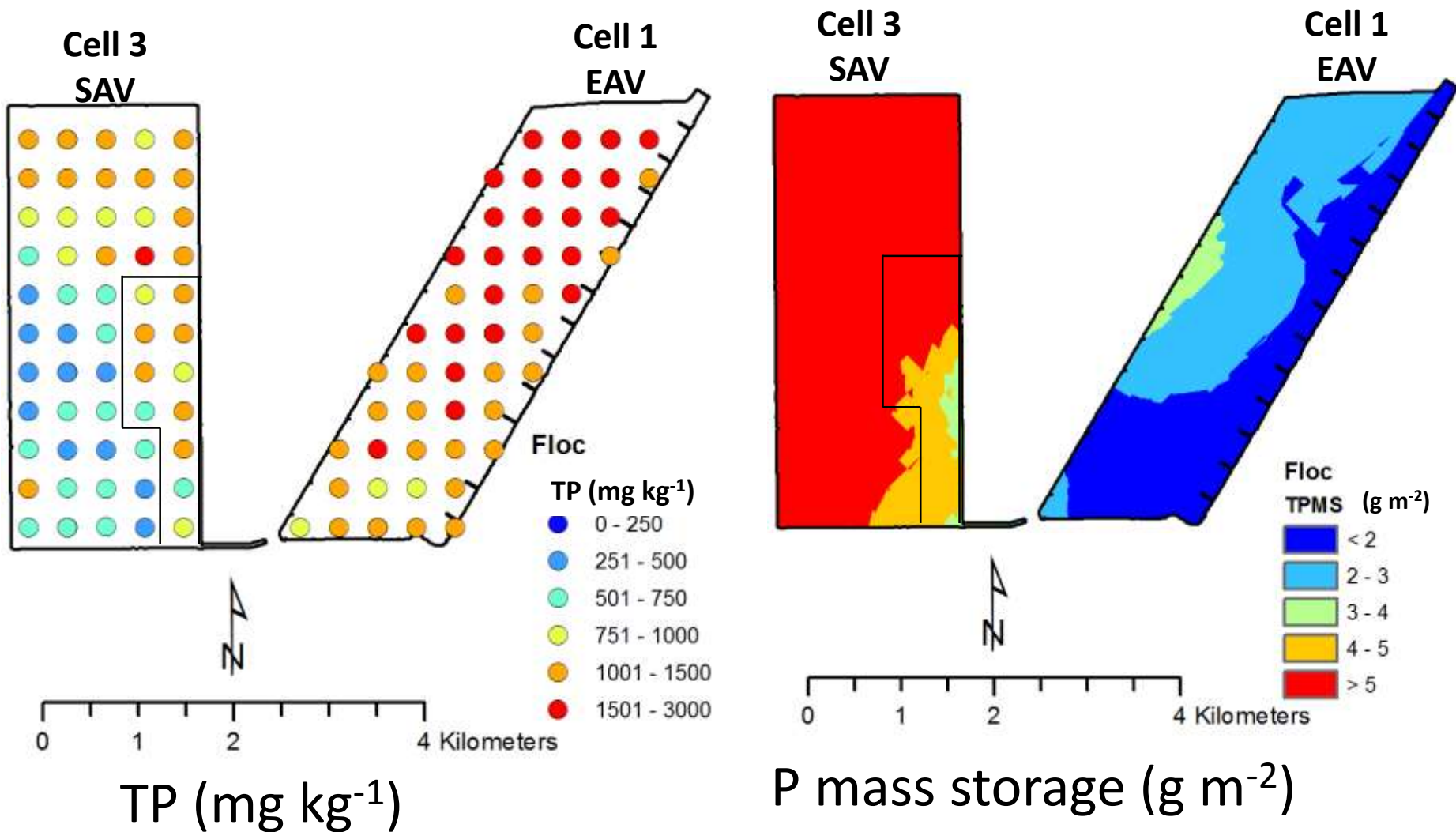
RAS = Recently Accreted Soil
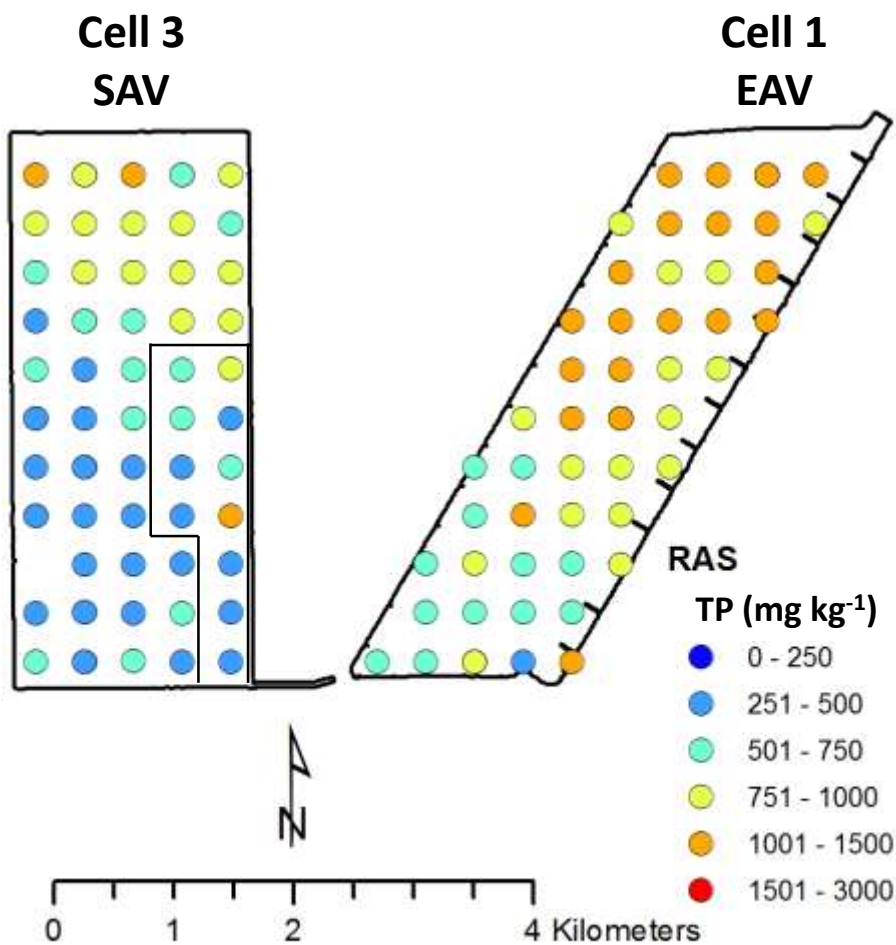
SPATIAL TRENDS – Bulk Density

STA-2
Cell 1 and Cell 3

Bulk density (g cm^{-3})

- 0.01 - 0.05
- 0.06 - 0.10
- 0.11 - 0.15
- 0.16 - 0.20
- 0.21 - 0.25
- 0.26 - 0.30
- 0.31 - 0.35
- 0.36 - 0.40
- 0.41 - 1.00

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

SPATIAL TRENDS – Phosphorus in Floc

TP (mg kg^{-1})

P mass storage (g m^{-2})

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

SPATIAL TRENDS – Phosphorus in RAS

TP (mg kg^{-1})
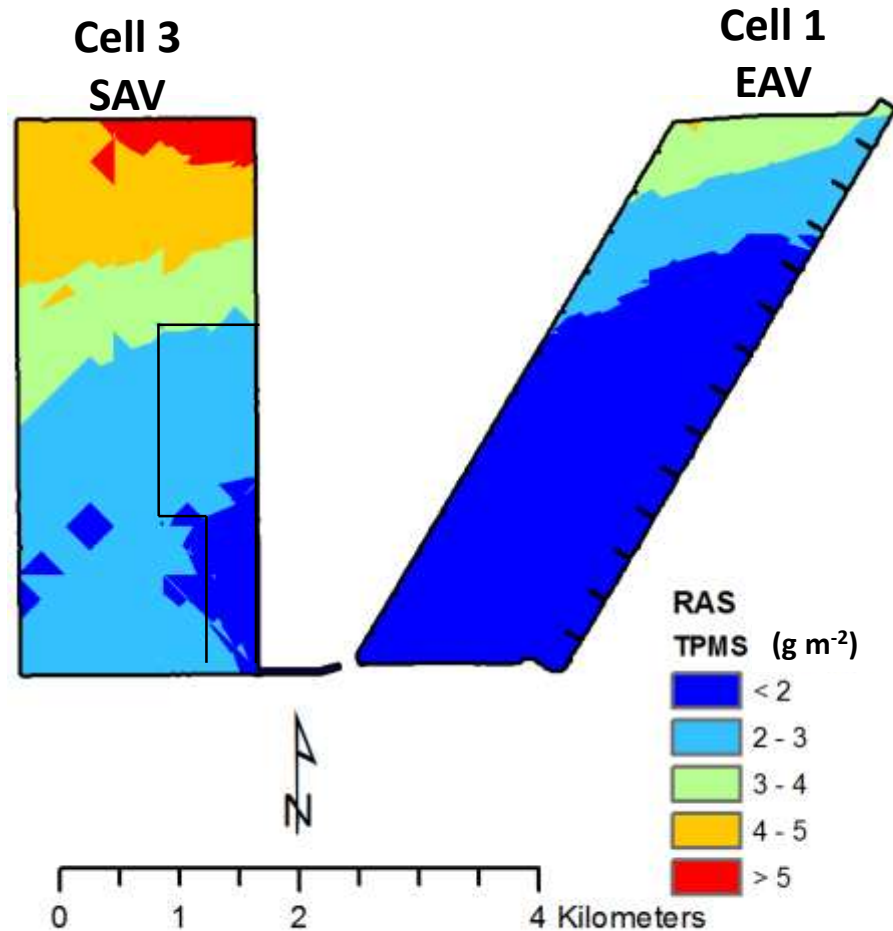
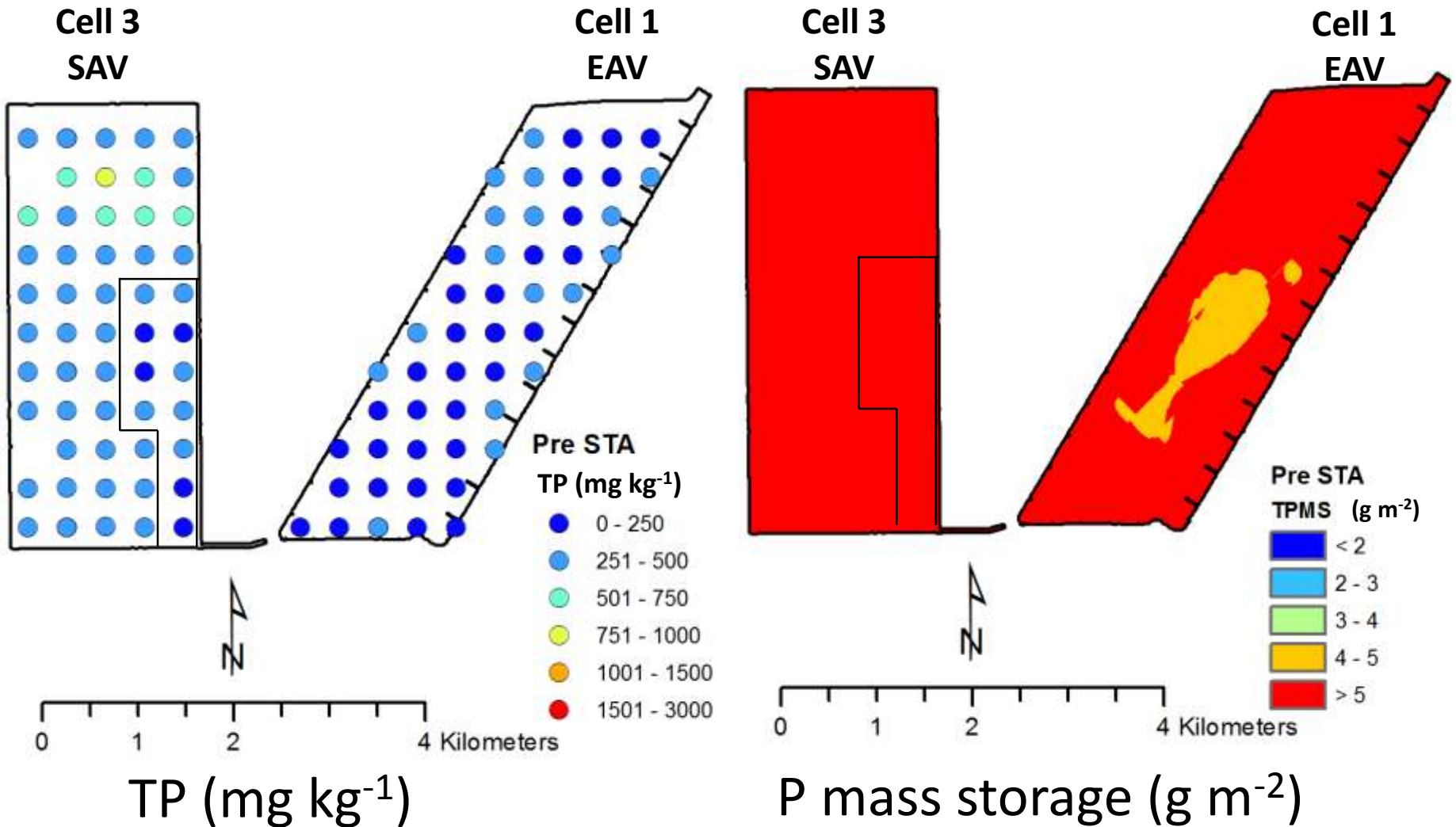P mass storage (g m^{-2})

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

SPATIAL TRENDS – Phosphorus in pre-STA soils

TP (mg kg^{-1})

P mass storage (g m^{-2})

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

SOIL NUTRIENT STORAGES

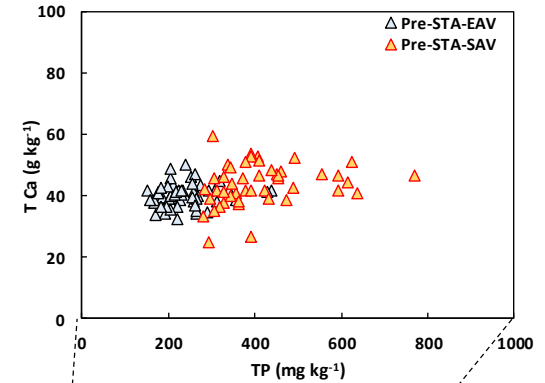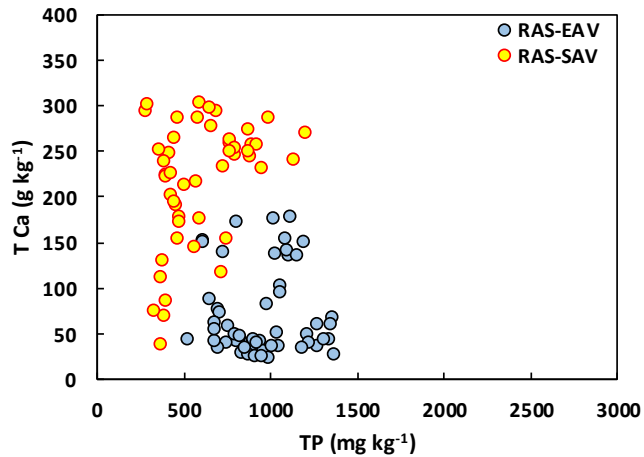| STA-2	Type	Depth	P	N	C	S
Cell-1		cm	g m^{-2}			
EAV	Floc	7.7 ± 0.4	<u>2 ± 0.1</u>	38 ± 2	487 ± 28	13 ± 1
	RAS	2.5 ± 0.2	1.7 ± 0.2	47 ± 3	680 ± 50	20 ± 2
	Pre-STA	19.1 ± 0.3	6.1 ± 0.3	787 ± 28	12641 ± 433	225 ± 10
Cell-3						
SAV	Floc	10.7 ± 0.5	<u>8.5 ± 0.8</u>	124 ± 9	2313 ± 161	44 ± 3.6
	RAS	3 ± 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
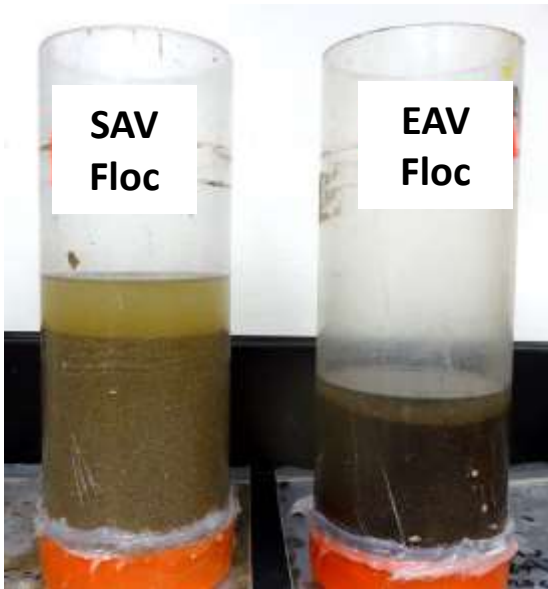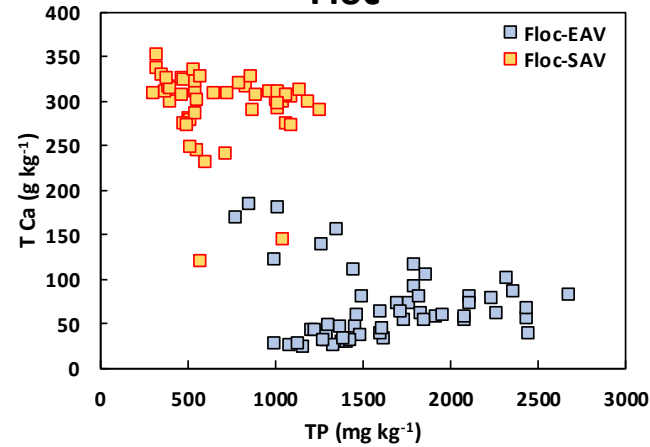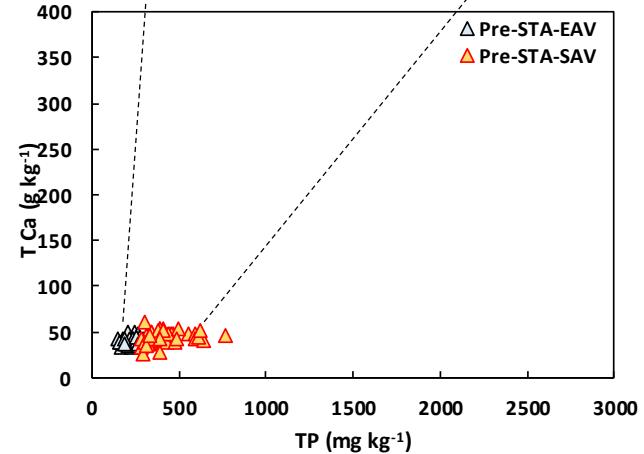
DIFFERENCES – Phosphorus forms
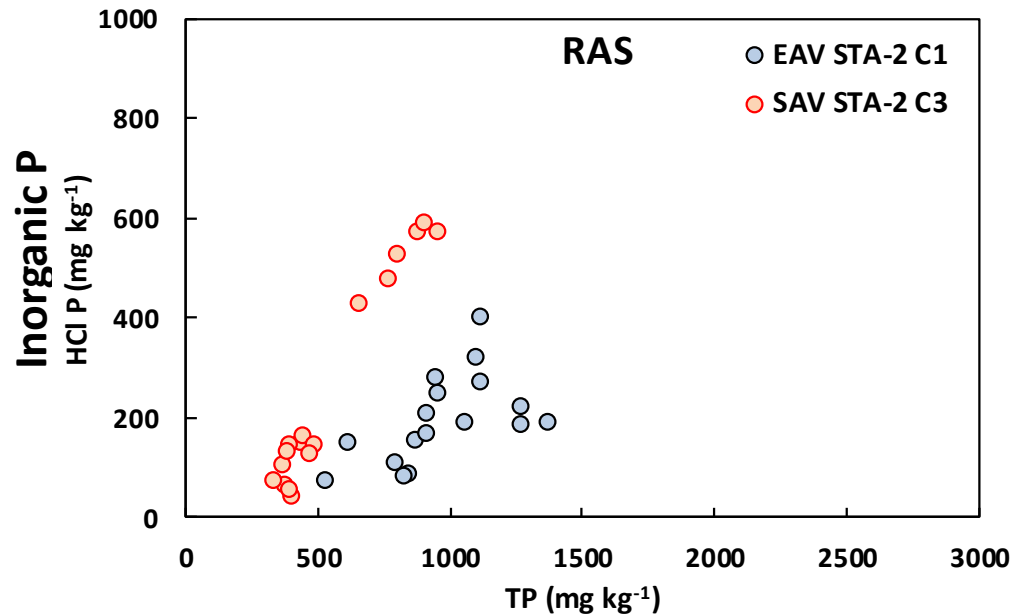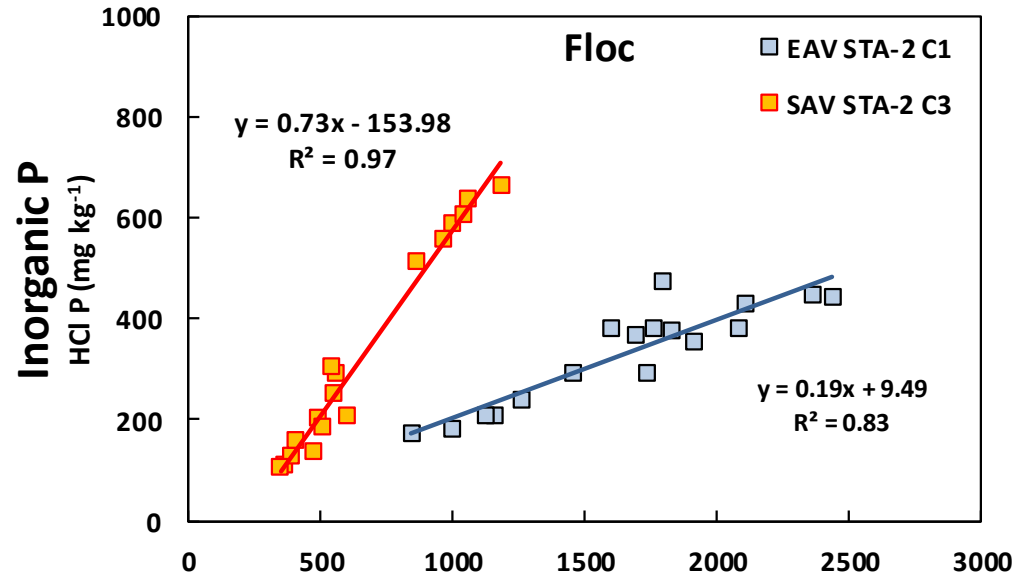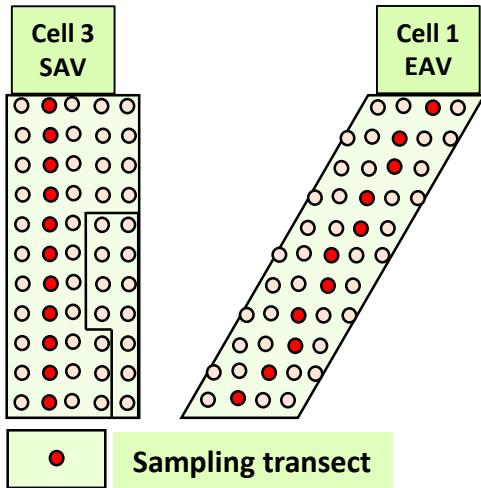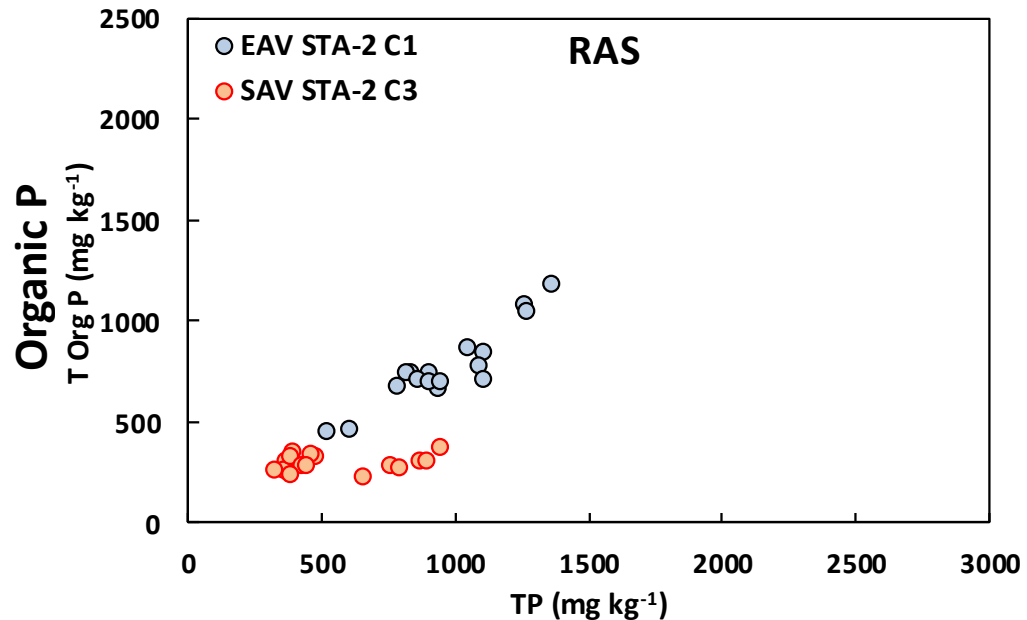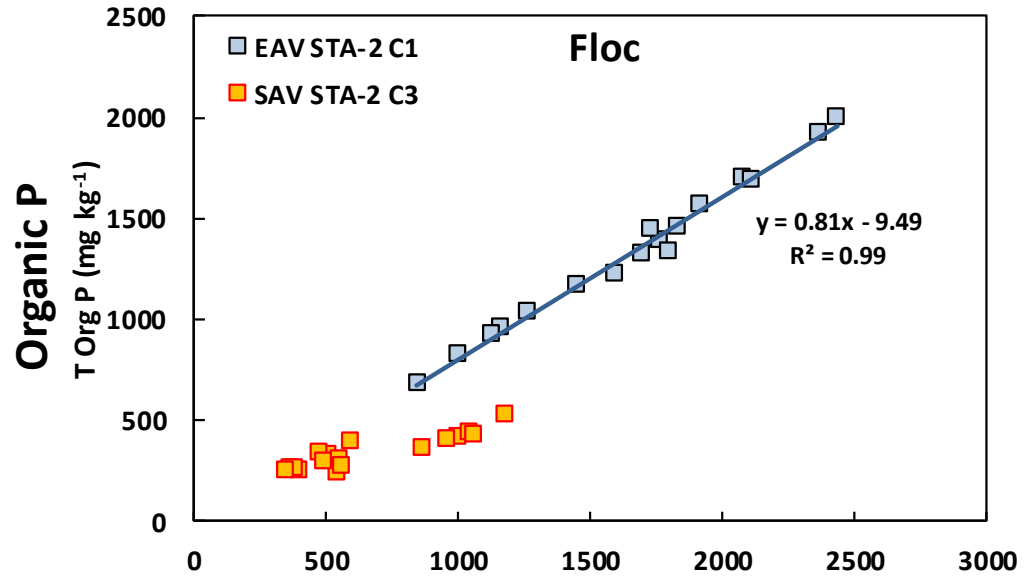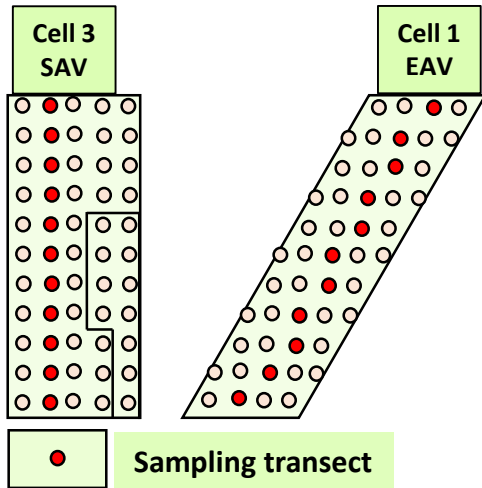
VEGETATION DIFFERENCES– Phosphorus forms

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!!!