Rooted Floating Aquatic Vegetation Project

Matt Powers

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sfwmd.gov

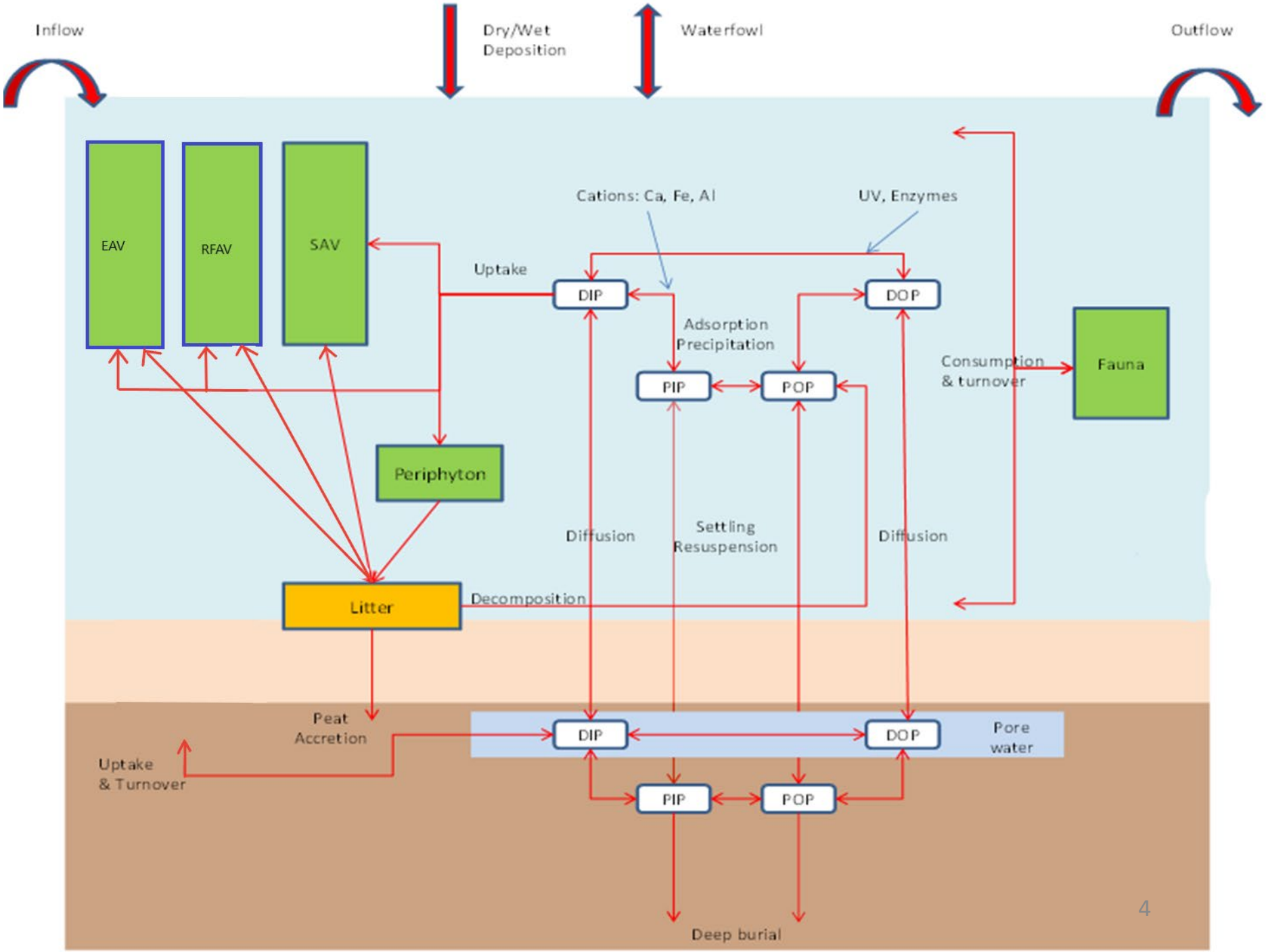
Study Origins

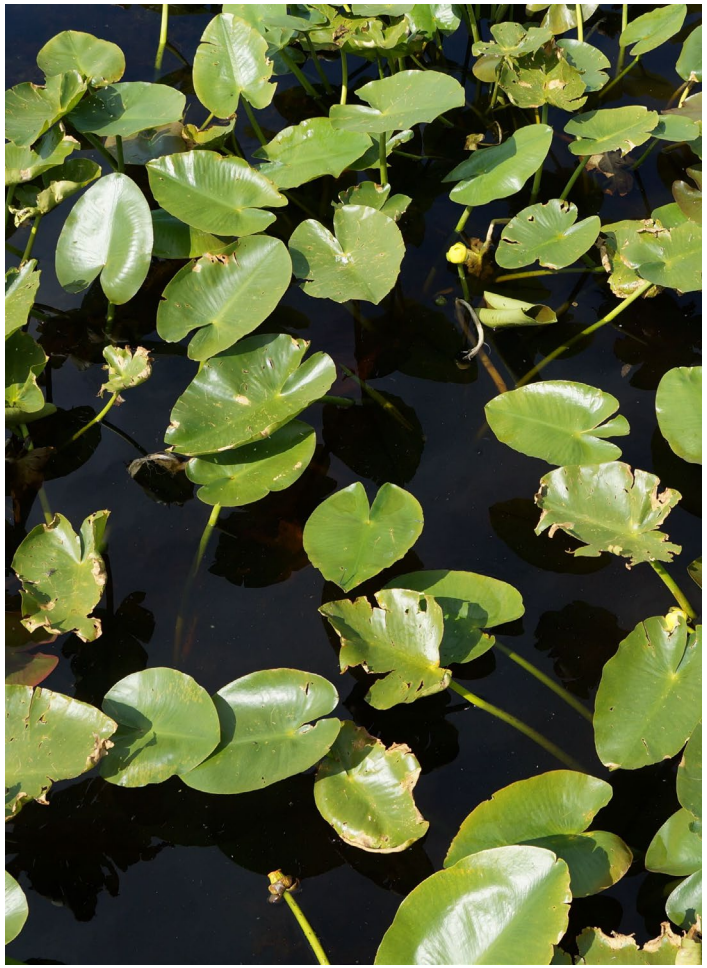
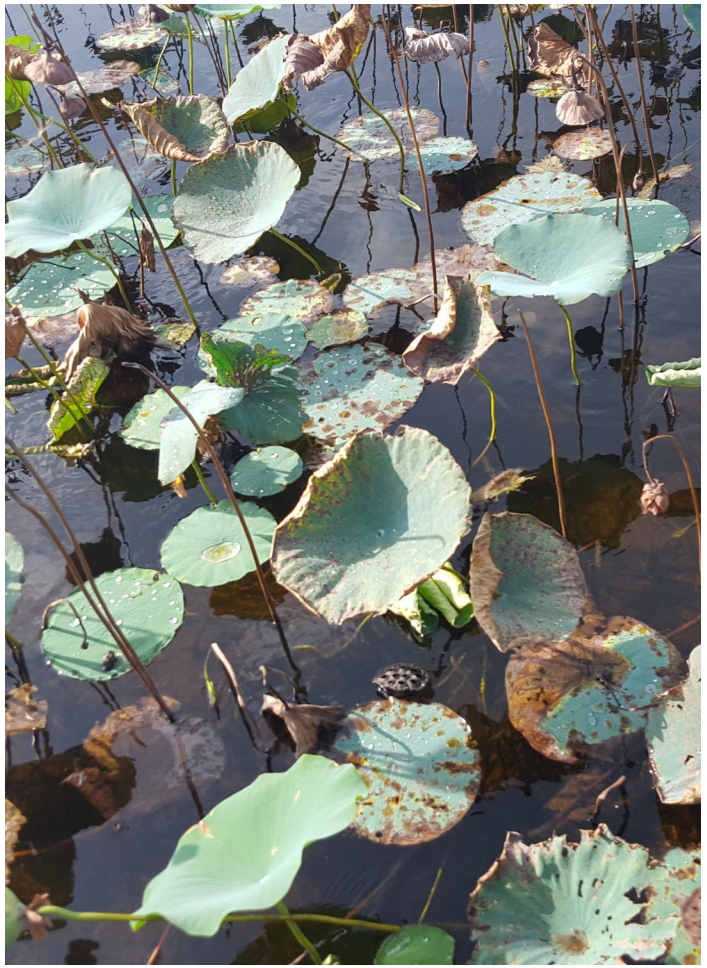
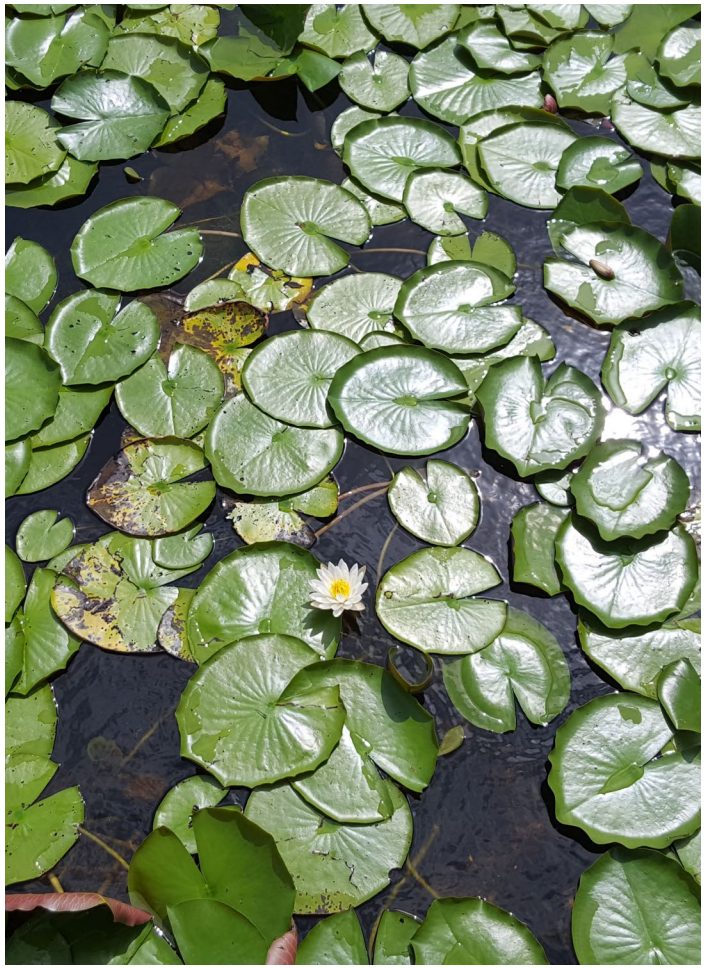
- The large rhizomes and high ratios of below- to aboveground biomass of RFAV (Chapin 1980, Chapin et al. 1982, Miao and Zou 2012) could increase belowground transfer and burial of removed P, compared to SAV.
- The rhizospheres of the large rhizomes and roots of RFAV are thought to oxygenate surface soil strata, thereby inhibiting the upward diffusion of dissolved P (Dacey 1980, Caraco et al. 2006, Mawson et al. 1983)
- P uptake by the roots and storage in the large rhizomes of RFAV are hypothesized to reduce porewater P concentrations, thereby lessening the concentration gradient across the sediment-water interface and reducing the upward diffusion of dissolved P.
- Mesocosm study found water lily to have superior performance over other vegetation types for a period of time (Mitsch et al. 2014)

Objectives

- Do RFAV species enhance performance in the backend of the STAs?
- What P reducing mechanisms are effected by RFAV?

Conceptual Model

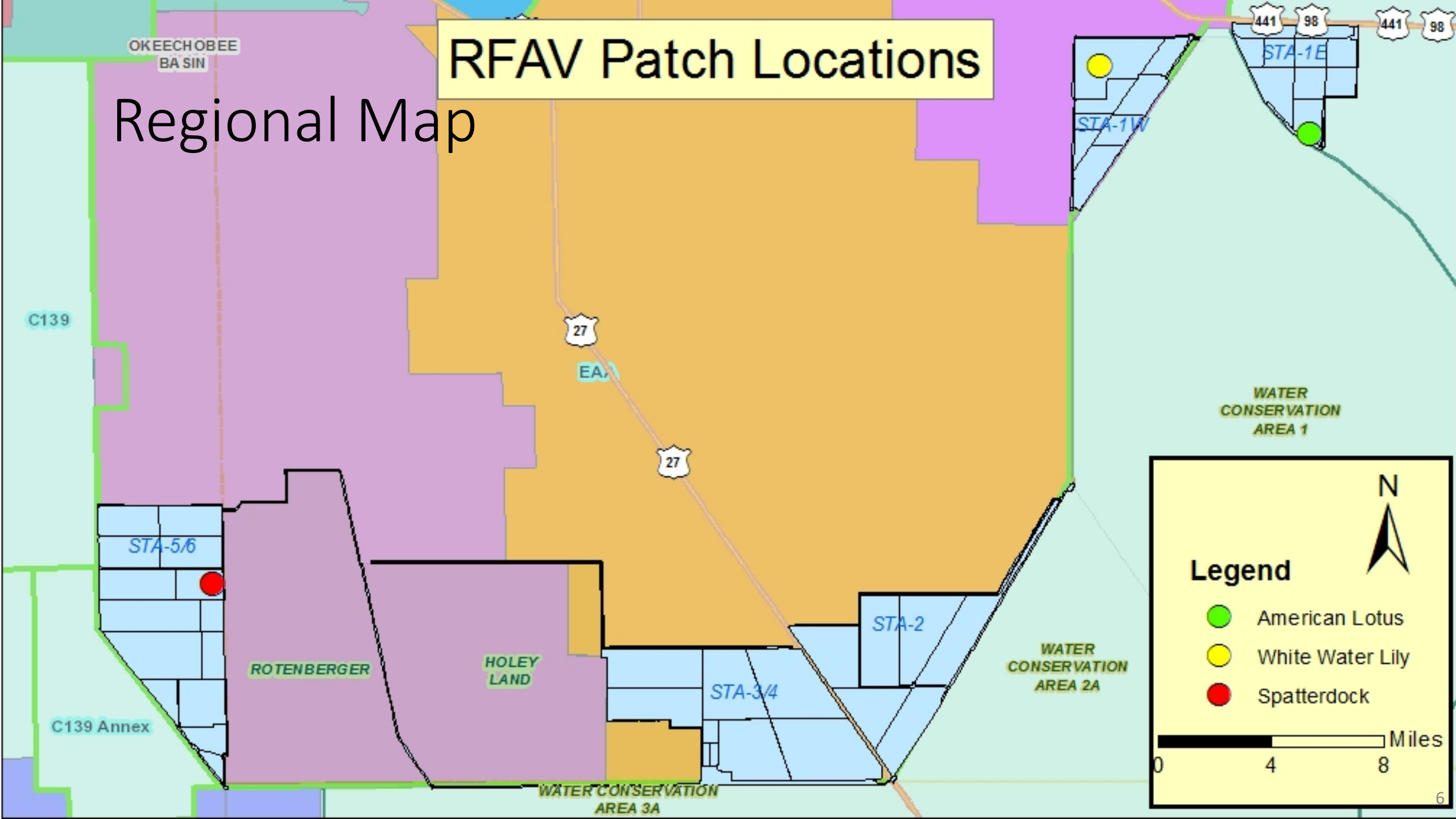


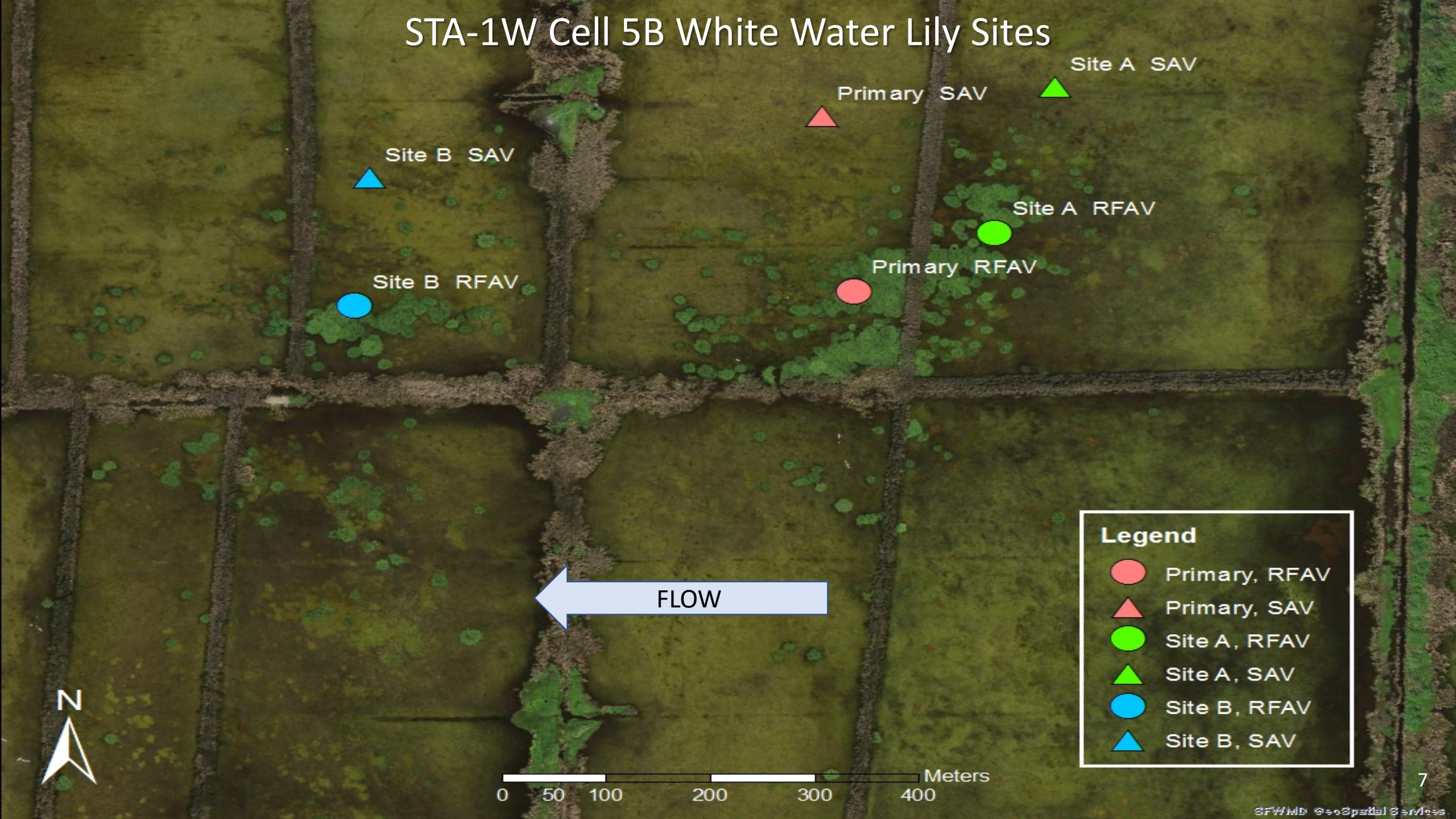
RFAV Species

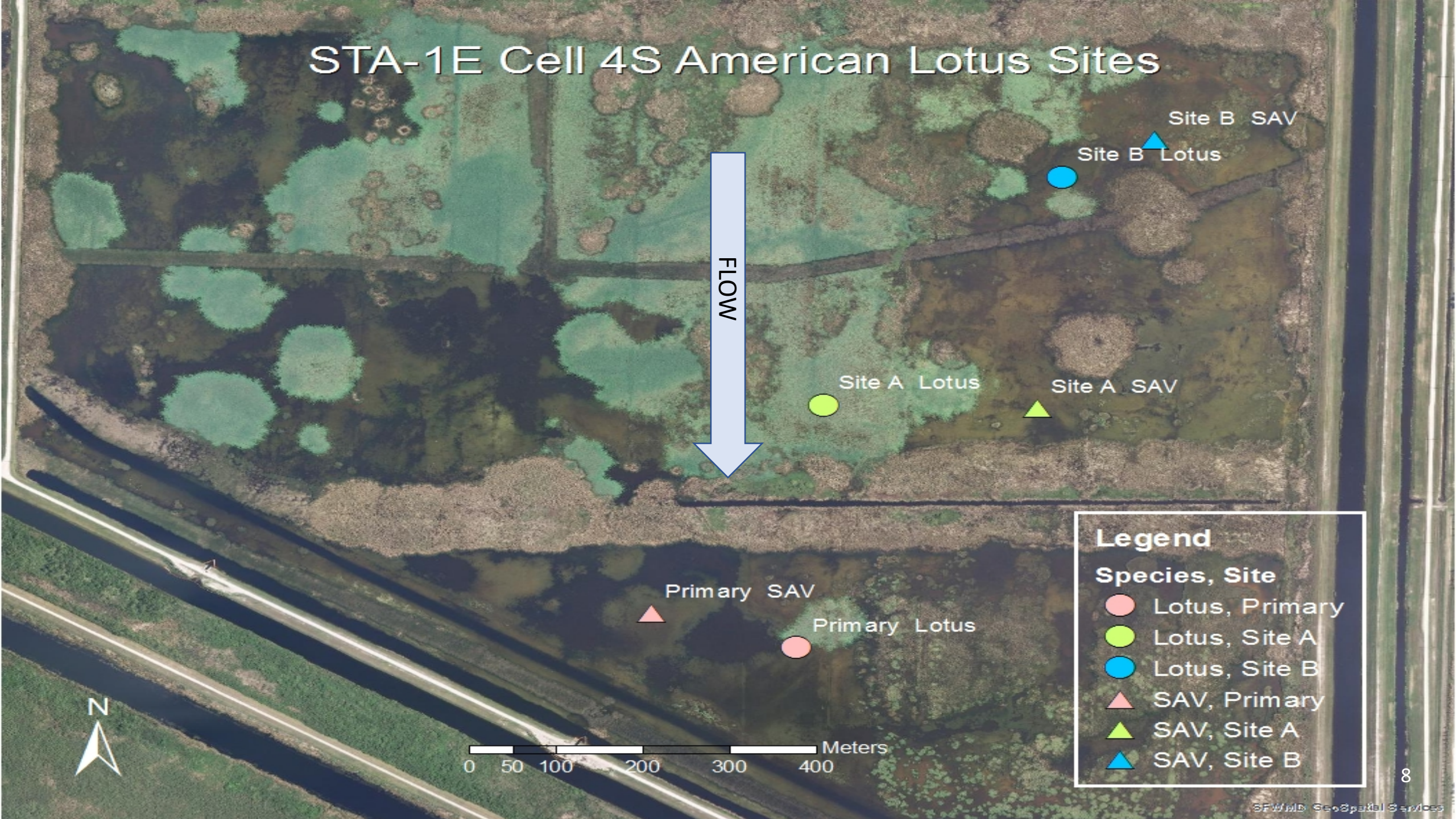
RFAV Patch Locations

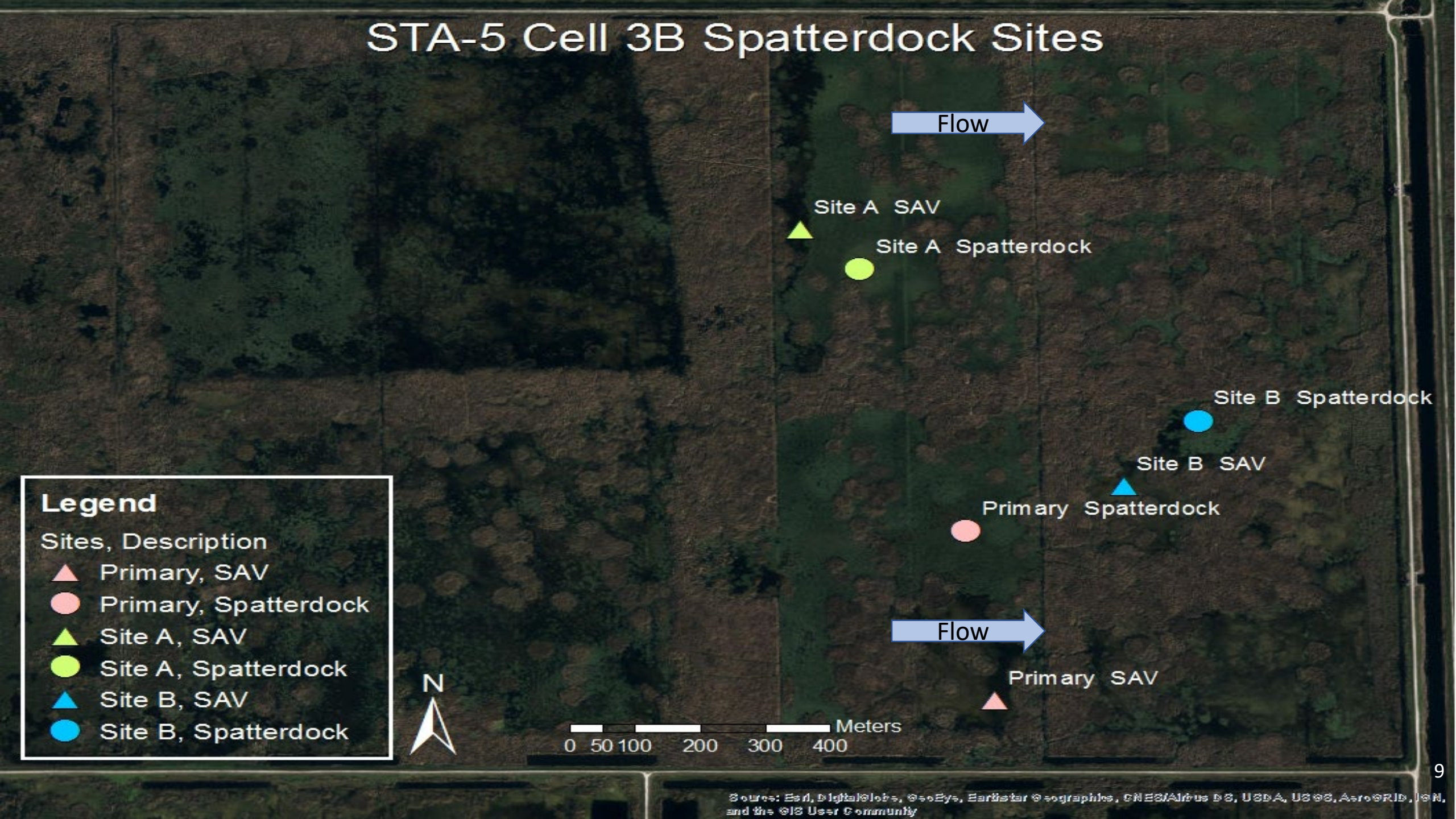
Regional Map

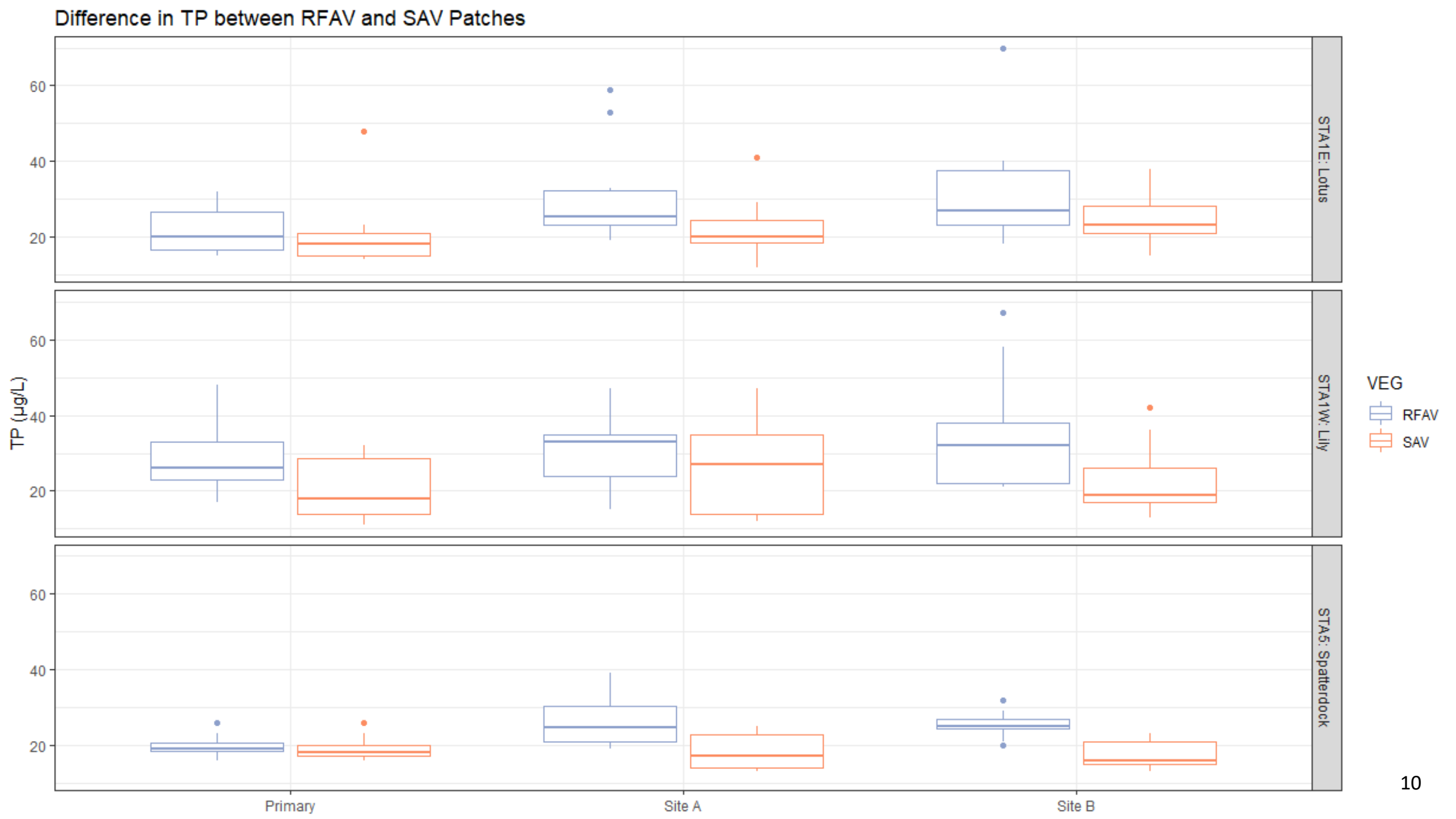


STA-1W Cell 5B White Water Lily Sites

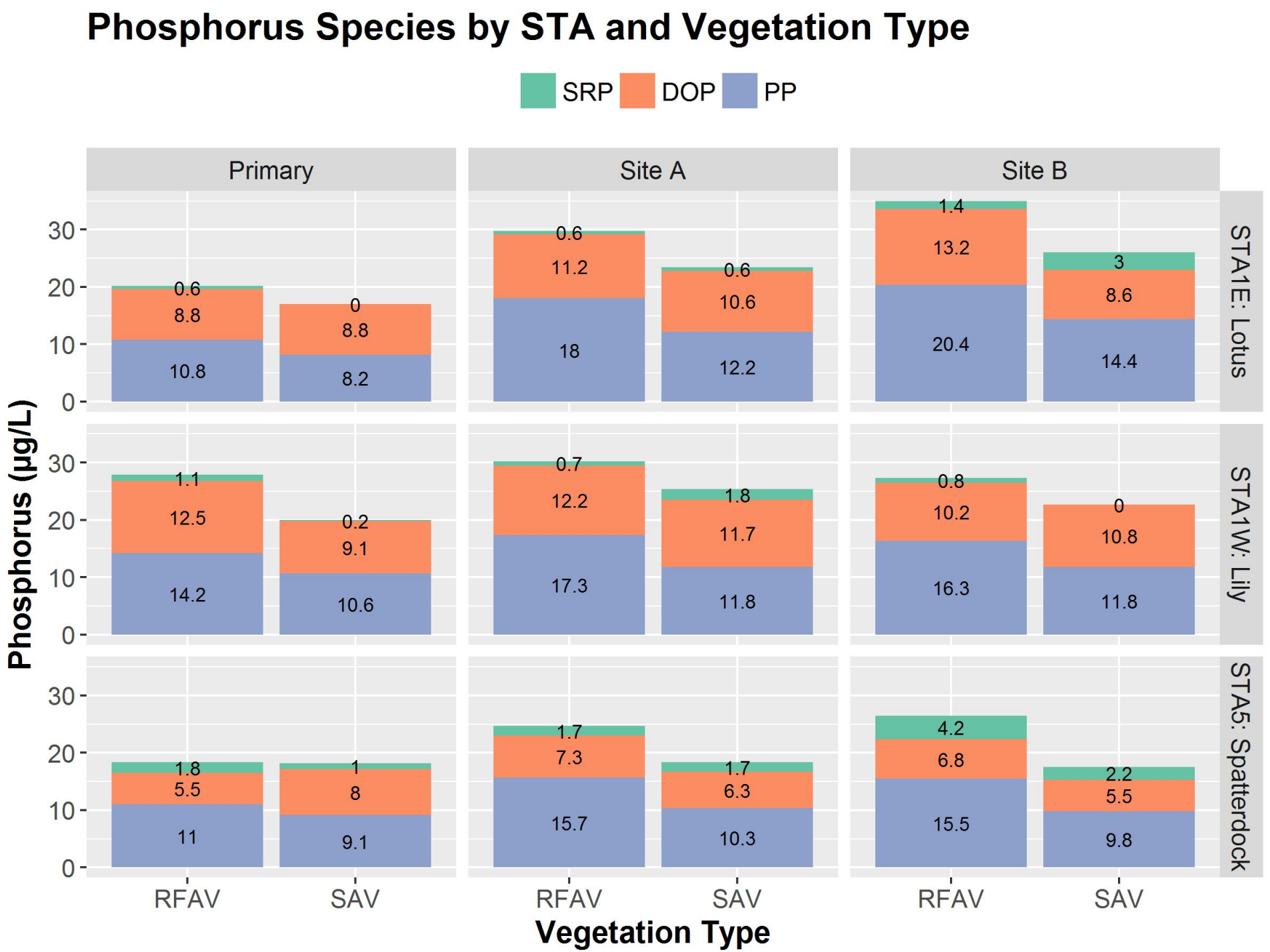



STA-1E Cell 4S American Lotus Sites
Site B SAV
Site B Lotus
FLOW
Site A Lotus
Site A SAV
Primary SAV
Primary Lotus
Legend
Species, Site
Lotus, Primary
Lotus, Site A
Lotus, Site B
SAV, Primary
SAV, Site A
SAV, Site B
N
0 50 100 200 300 400
Meters

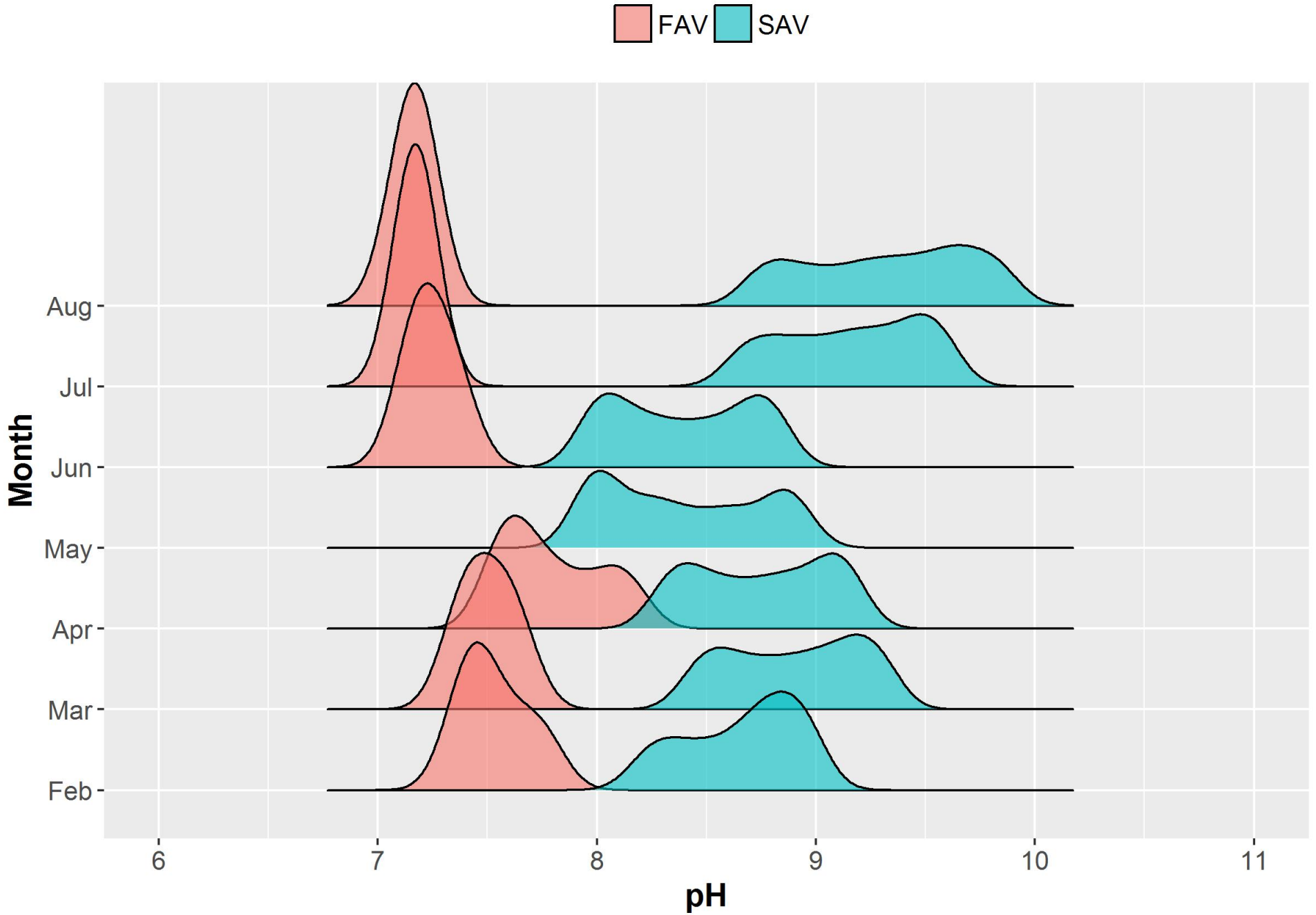

STA-5 Cell 3B Spatterdock Sites
Flow
Site A SAV
Site A Spatterdock
Site B Spatterdock
Site B SAV
Primary Spatterdock
Flow
Primary SAV
Legend
Sites, Description
Primary, SAV
Primary, Spatterdock
Site A, SAV
Site A, Spatterdock
Site B, SAV
Site B, Spatterdock
N
Meters
0 50 100 200 300 400
Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

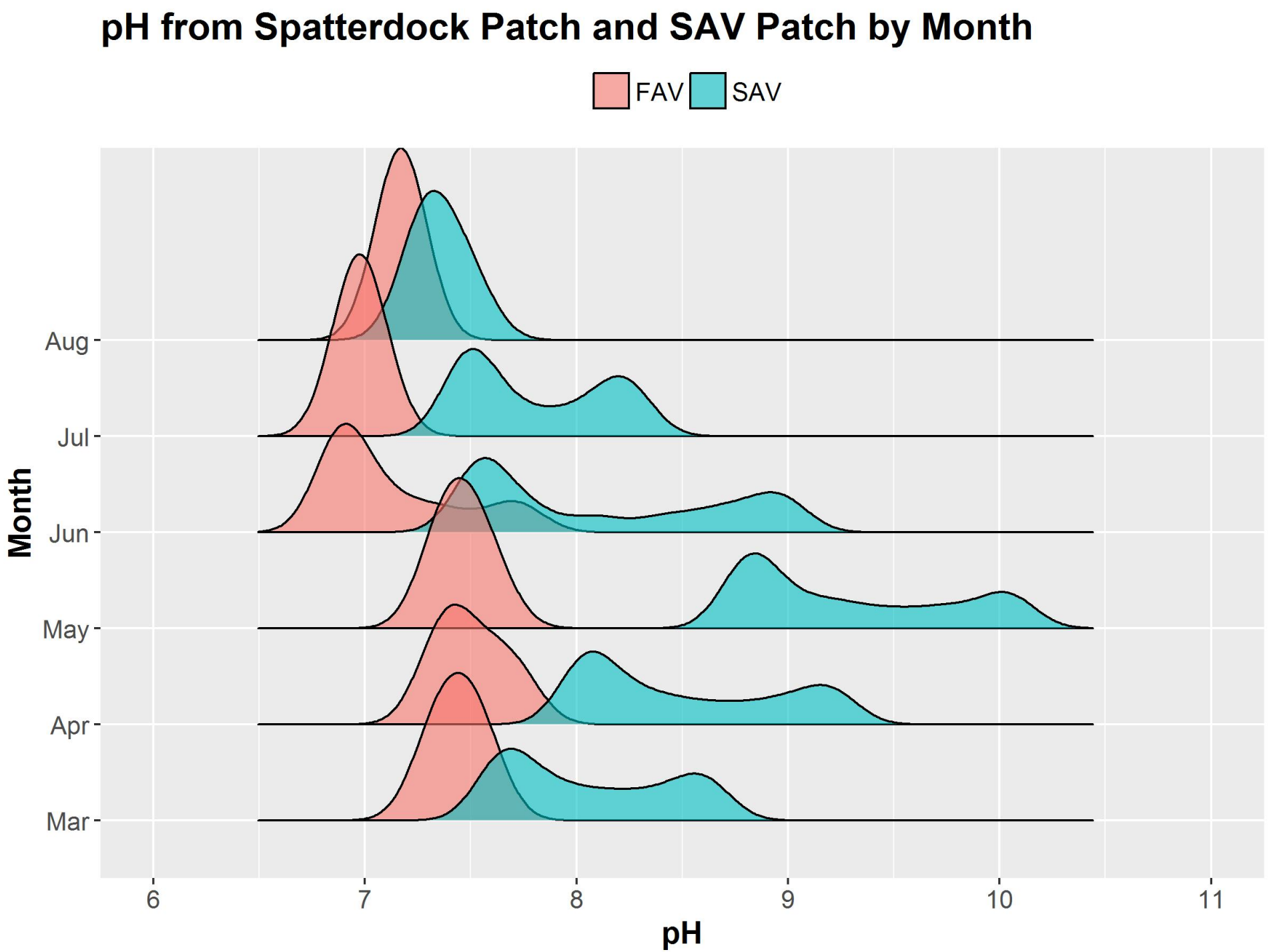

Difference in TP between RFAV and SAV Patches
TP (µg/L)
60
40
20
STA1E: Lotus
STA1W: Lily
STA5: Spatterdock
Primary
Site A
Site B
VEG
RFAV
SAV

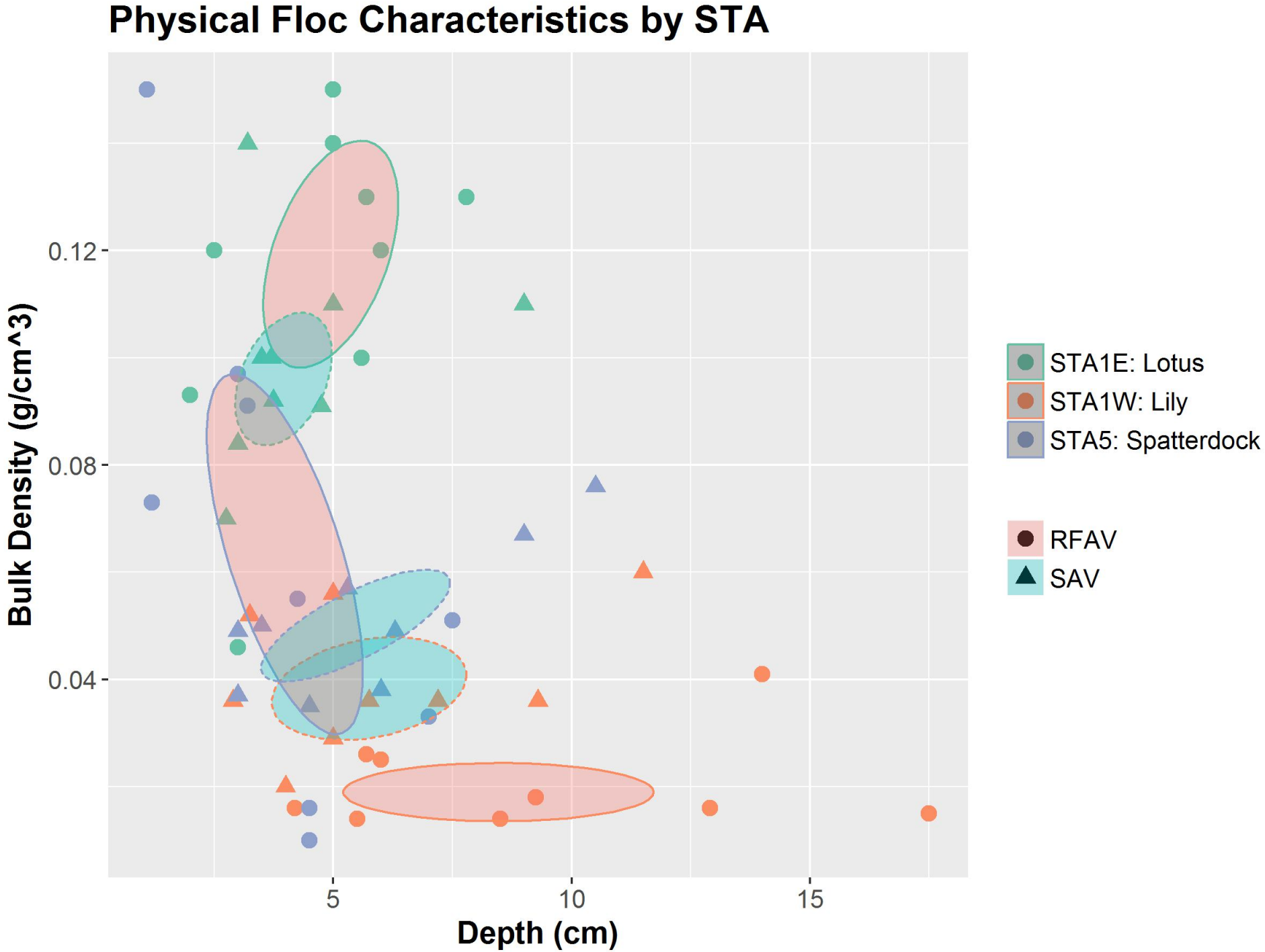
STA	SITE	Collection Method	n	Mean Difference TP (µ/gL)	Median Difference TP (µ/gL)	P-Value Wilcoxon Ranked Sign Test	Mean RFAV TP (µ/gL)	Mean SAV TP (µ/gL)
STA1W: Lily	Site B	Grab	13	-10.9	-8	0.0016	34	23
STA1E: Lotus	Site A	Grab	10	-8.9	-7	0.0053	31	23
STA1W: Lily	Primary	Grab	15	-8.8	-5	0.0023	29	20
STA5: Spatterdock	Site B	Grab	10	-8.7	-10	0.0058	25	17
STA5: Spatterdock	Site A	Grab	10	-8.1	-6.5	0.0058	26	18
STA1E: Lotus	Site B	Grab	10	-7.1	-5	0.0092	32	25
STA1W: Lily	Site A	Grab	13	-5.7	-8	0.1074	31	25
STA1E: Lotus	Primary	Grab	10	-0.5	-1	0.3832	22	21
STA5: Spatterdock	Primary	Grab	11	-0.2	-1	0.8574	20	20

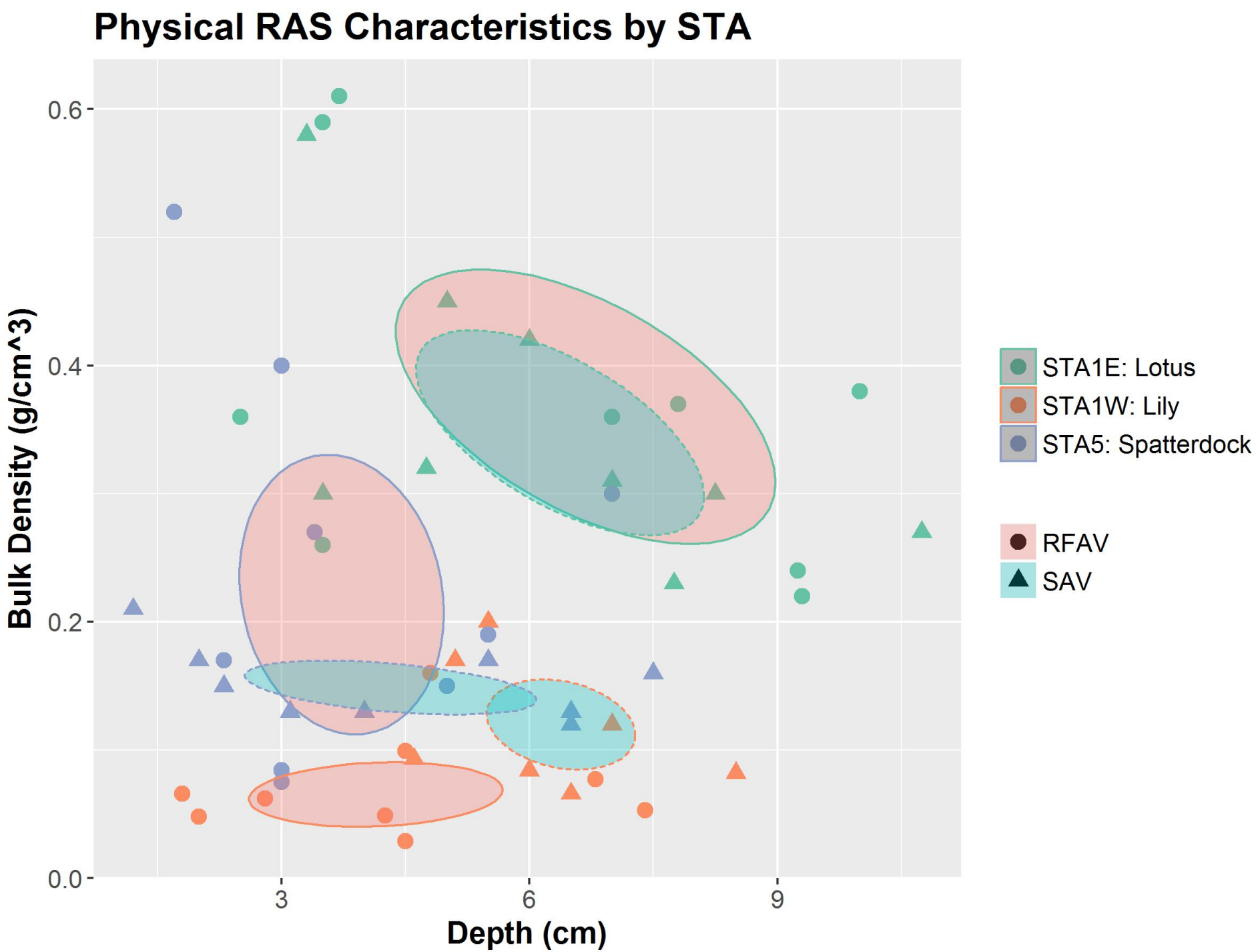

Phosphorus Species by STA and Vegetation Type
SRP
DOP
PP
Primary
Site A
Site B
STA1E: Lotus
STA1W: Lily
STA5: Spatterdock
Phosphorus (µg/L)
0
10
20
30
0.6
8.8
10.8
0
8.8
8.2
0.6
11.2
18
0.6
10.6
12.2
1.4
13.2
20.4
3
8.6
14.4
1.1
12.5
14.2
0.2
9.1
10.6
0.7
12.2
17.3
1.8
11.7
11.8
0.8
10.2
16.3
0
10.8
11.8
1.8
5.5
11
1
8
9.1
1.7
7.3
15.7
1.7
6.3
10.3
4.2
6.8
15.5
2.2
5.5
9.8
RFAV
SAV
RFAV
SAV
RFAV
SAV
Vegetation Type

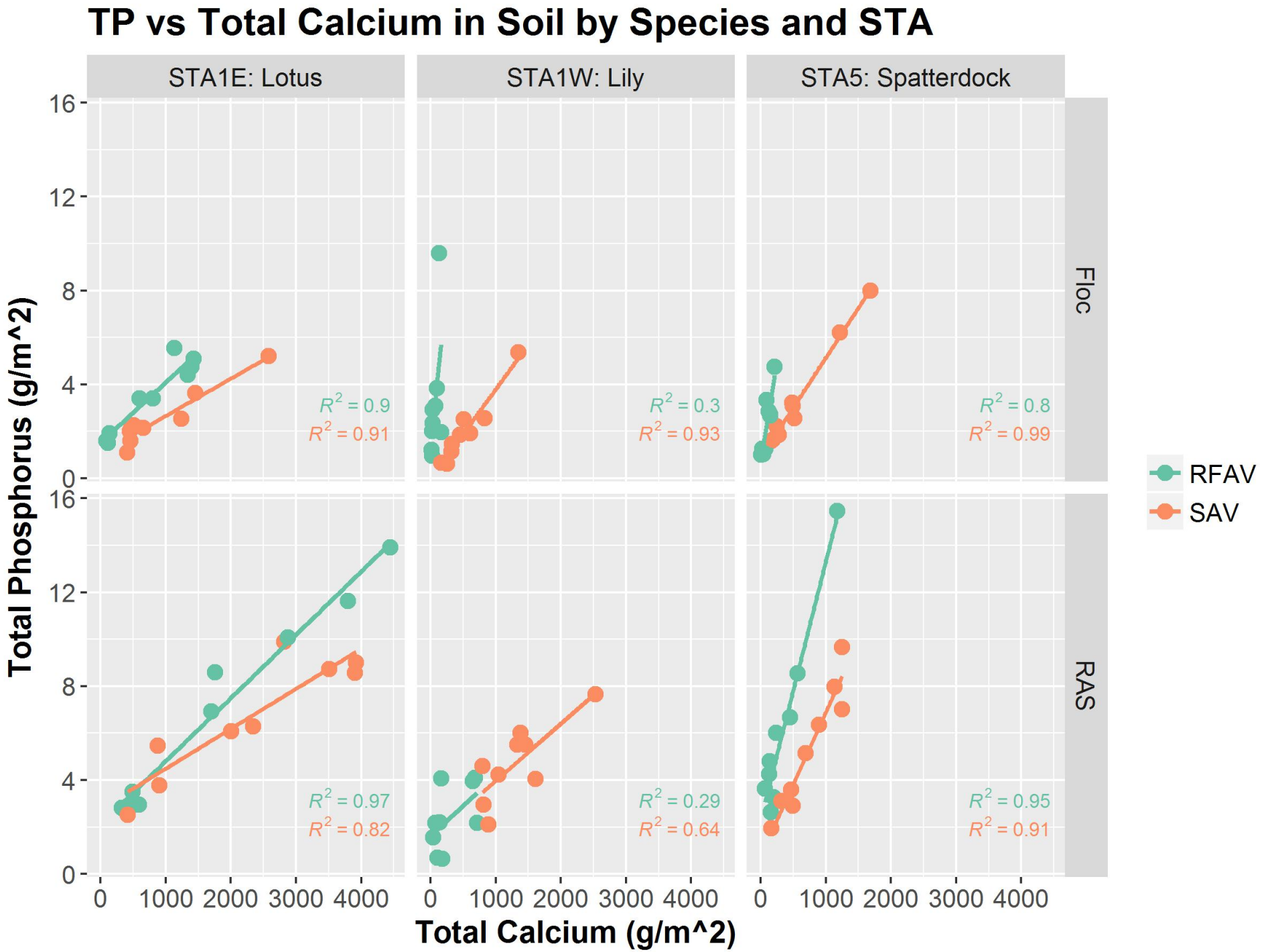
pH from White Water Lily Patch and SAV Patch by Month




pH from Spatterdock Patch and SAV Patch by Month
FAV
SAV
Month
Aug
Jul
Jun
May
Apr
Mar
6
7
8
9
10
11
pH

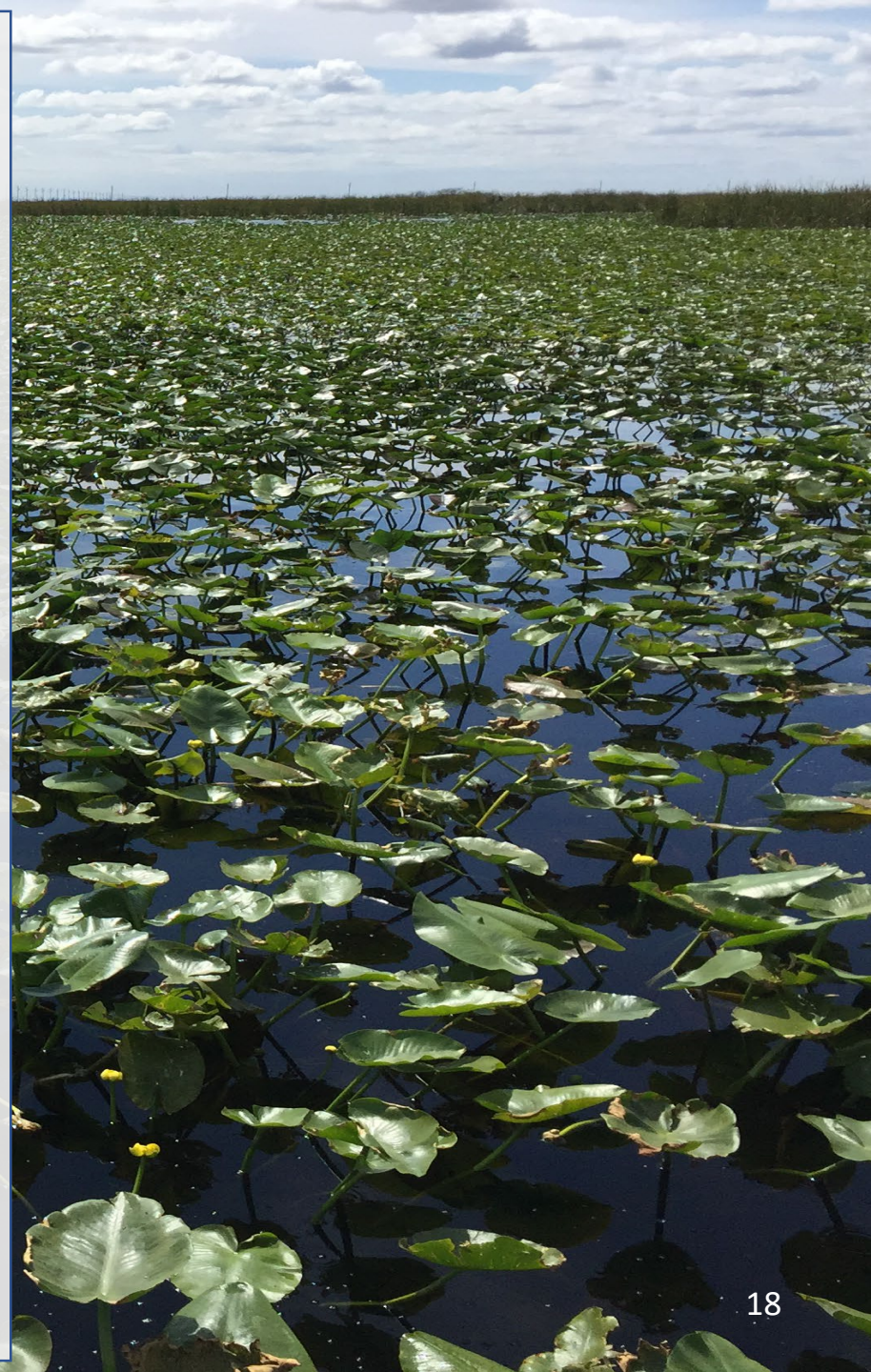

Physical Floc Characteristics by STA
Bulk Density (g/cm^3)
0.12
0.08
0.04
5
10
15
Depth (cm)
STA1E: Lotus
STA1W: Lily
STA5: Spatterdock
RFAV
SAV


Physical RAS Characteristics by STA
Bulk Density (g/cm^3)
0.6
0.4
0.2
0.0
3
6
9
Depth (cm)
STA1E: Lotus
STA1W: Lily
STA5: Spatterdock
RFAV
SAV


TP vs Total Calcium in Soil by Species and STA
STA1E: Lotus
STA1W: Lily
STA5: Spatterdock
Floc
RAS
Total Phosphorus (g/m^2)
Total Calcium (g/m^2)
0
4
8
12
16
0
1000
2000
3000
4000
R^2 = 0.9
R^2 = 0.91
R^2 = 0.3
R^2 = 0.93
R^2 = 0.8
R^2 = 0.99
R^2 = 0.97
R^2 = 0.82
R^2 = 0.29
R^2 = 0.64
R^2 = 0.95
R^2 = 0.91
RFAV
SAV

Findings

- White water lily, Spatterdock, and Lotus provide no enhancement of P removal at back-end of cell compared to SAV
- RFAV species alter the physical and biogeochemical mechanisms of P-removal
  - Water chemistry
  - Flocculent physical and chemical makeup



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