Grass species Differ in their effect on Phosphorus Runoff from Phytoremediation Harvest Strips in a South-central Florida ranchland

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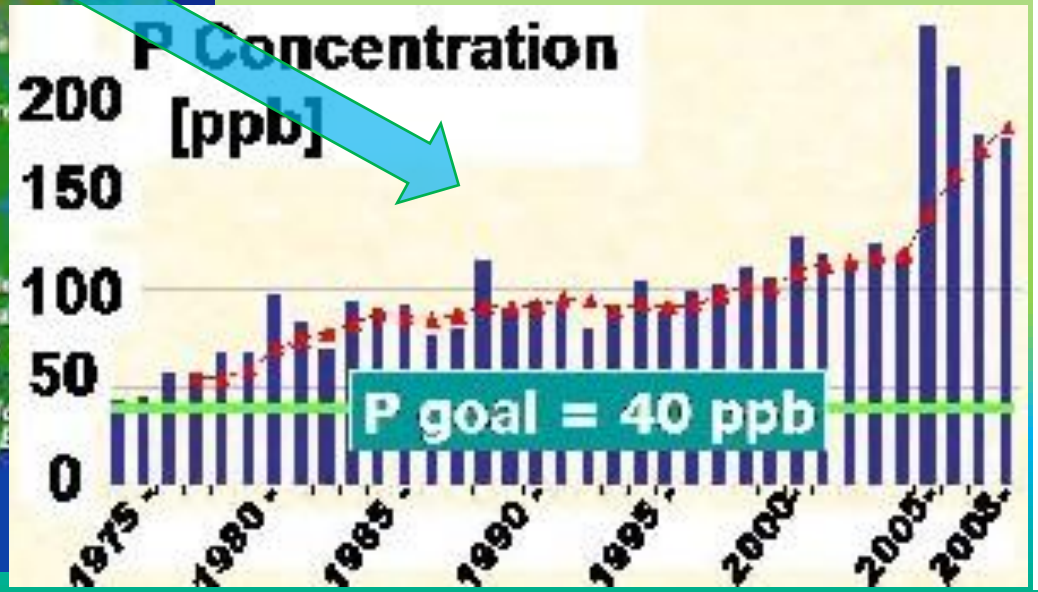
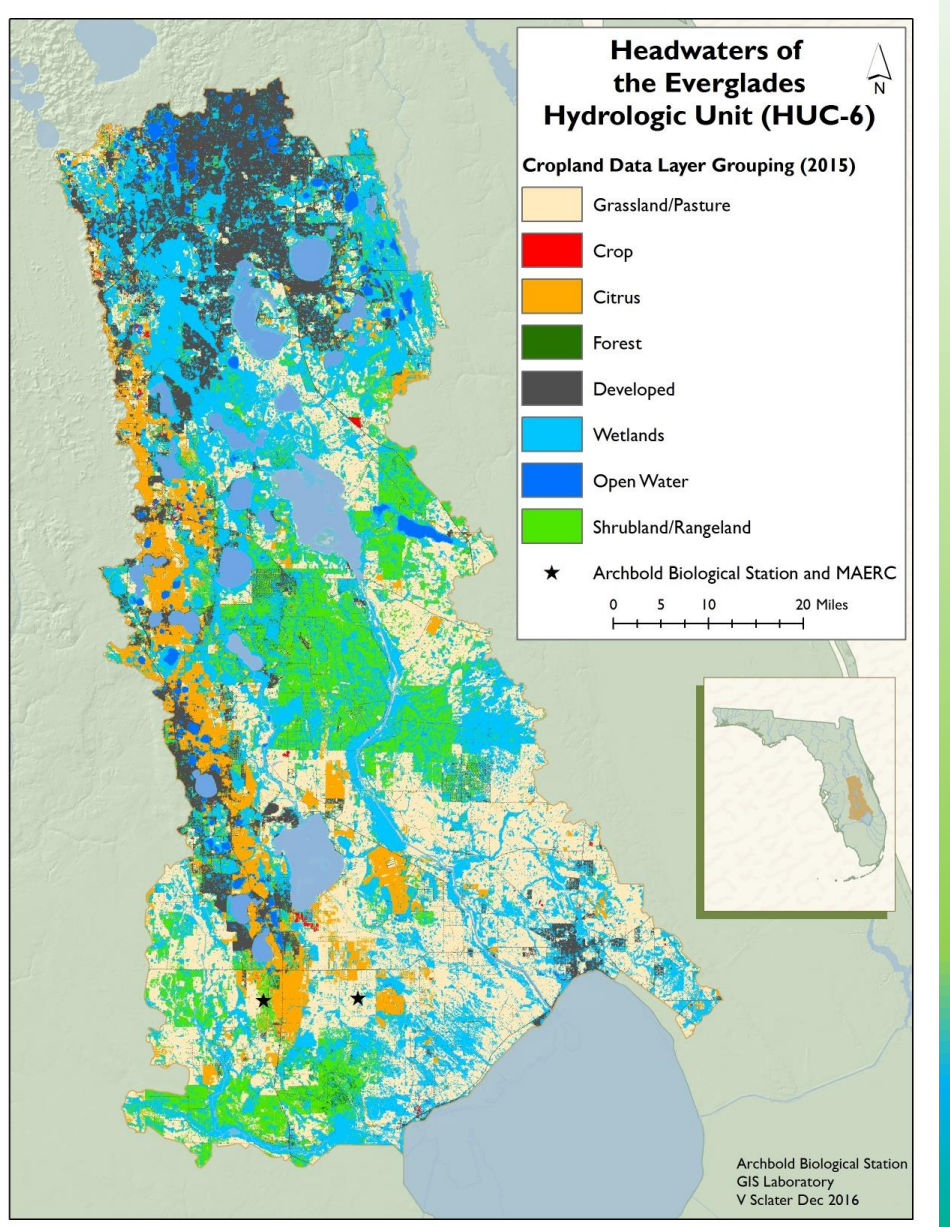
Introduction: Legacy P - harmful algal blooms in Lake Okeechobee and estuaries

Image credit: Florida Fish and Wildlife Conservation Commission – The Washington Post.

Introduction: Legacy P continues to runoff downstream to Lake O and estuaries

~ 1/3 of the Headwaters is ranchland
~1/6 of the state of FL is ranchlands



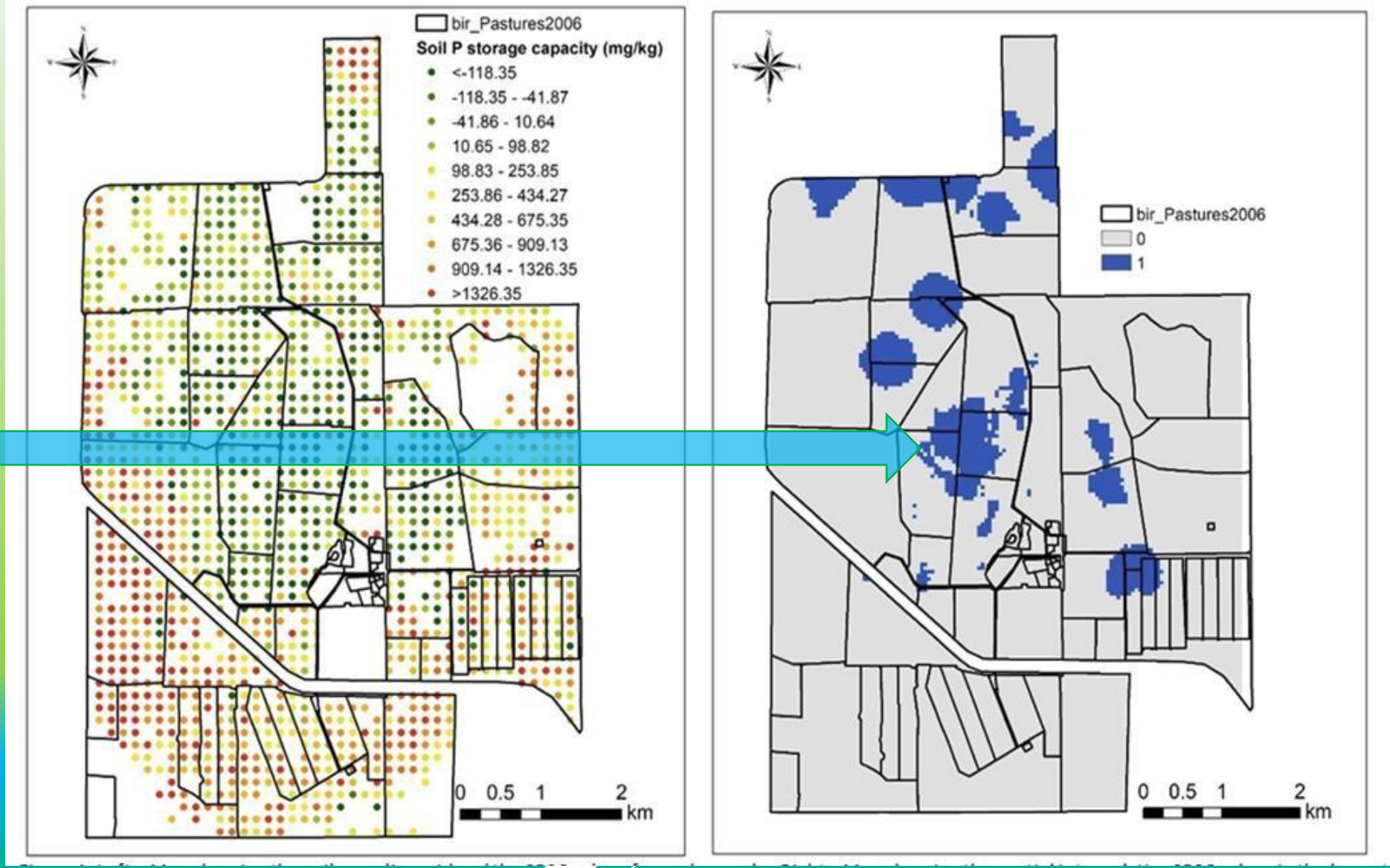


Introduction: Solutions to limit further entry into lake O:

Nutrient Retention Reservoirs	Phytoremediation on ranches/farms
○ wetland plant uptake, immobilization in decaying plant matter and sediment ○ Capacity fixed ○ can be a source if high rain or drought-drying	forage uptake and actual use of P instead of storage

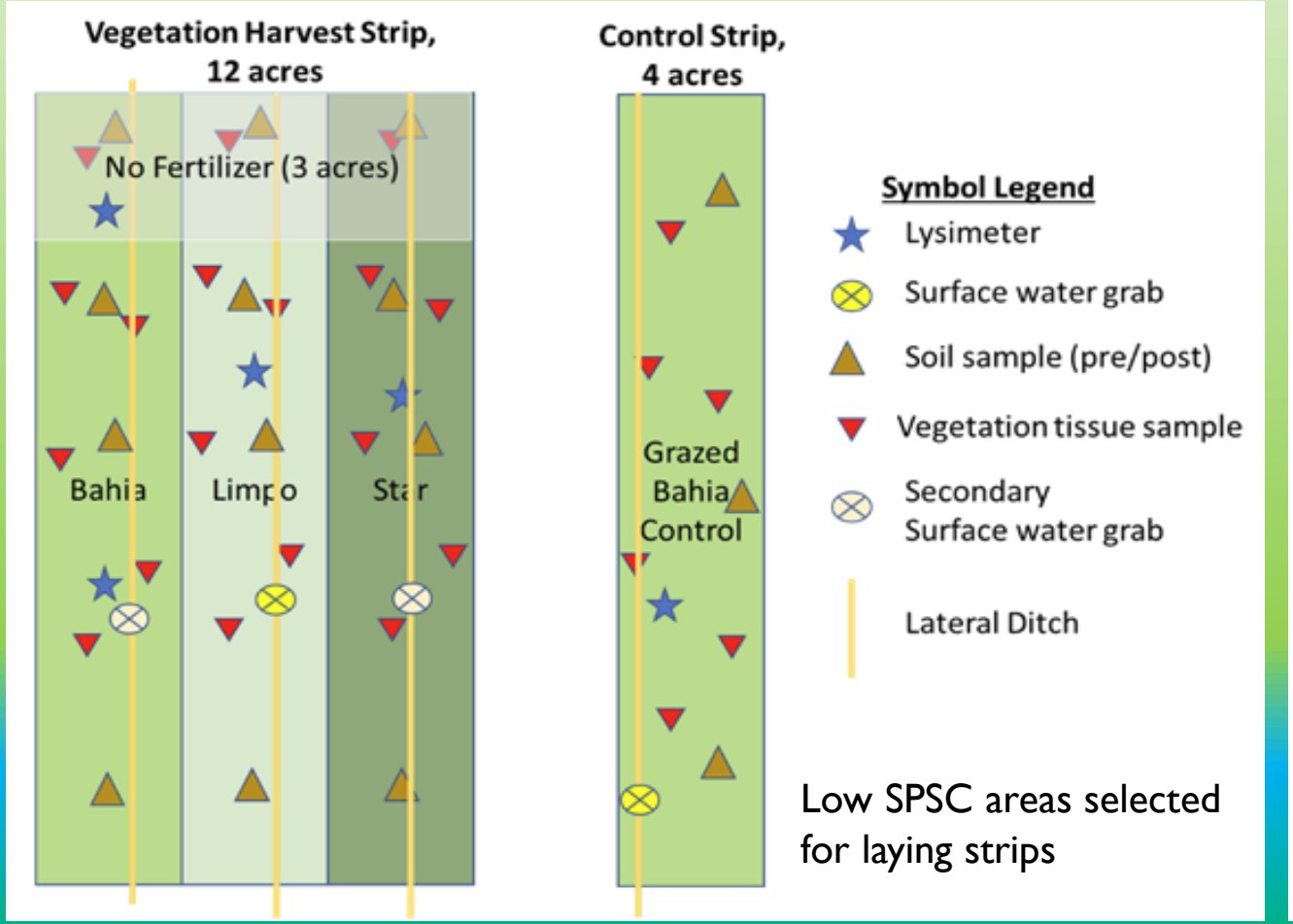
Methods: Phytoremediation study at Buck Island Ranch, Archbold Biological Station

Vegetation harvest strips
Installed in areas of low SPSC

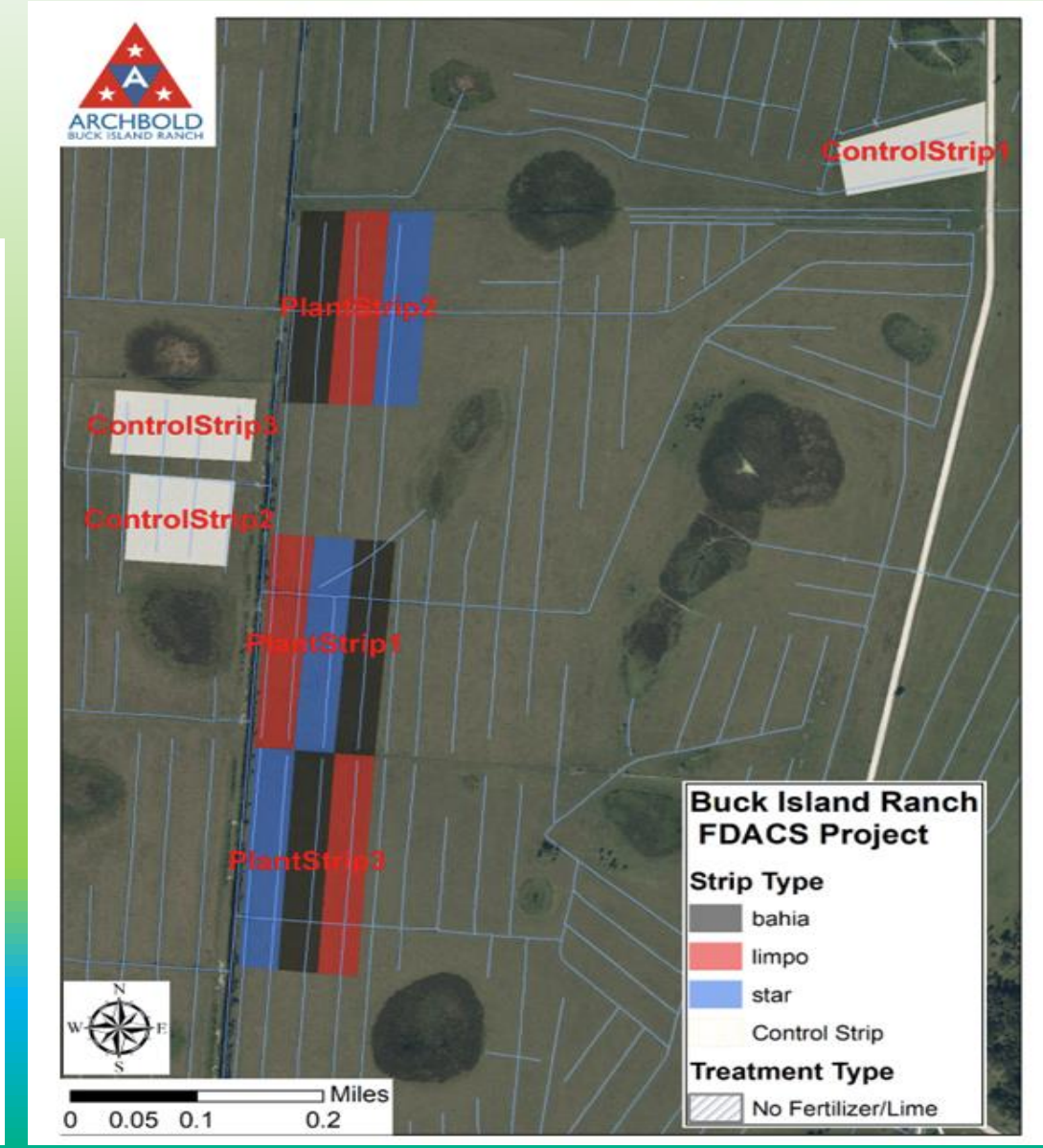


Methods: Phytoremediation study LAYOUT

Objective of this presentation:
Relate species strips to P in surfacewater runoff

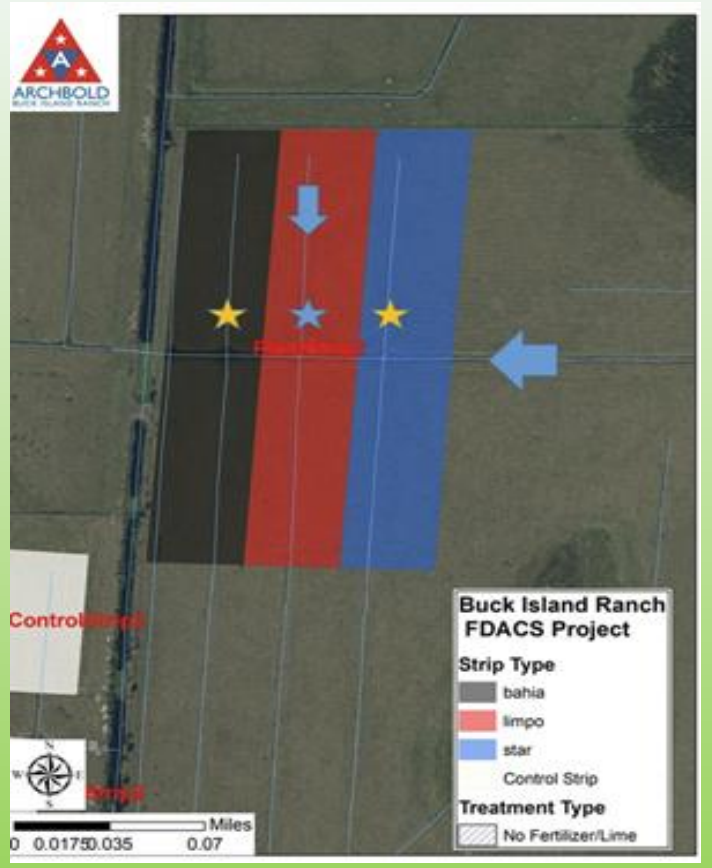


Low SPSC areas selected for laying strips



Map of 3 replicate Phytoremediation and Control strips

Methods: Phytoremediation vegetation strips – SURFACEWATER SAMPLING



2 year study (August 2021- May 2023)

12 sampling stations in all
Parameters: TKN, Nitrate and Total P (analyzed at UF/IFAS EWQL)

Stars : surface water sampling sites

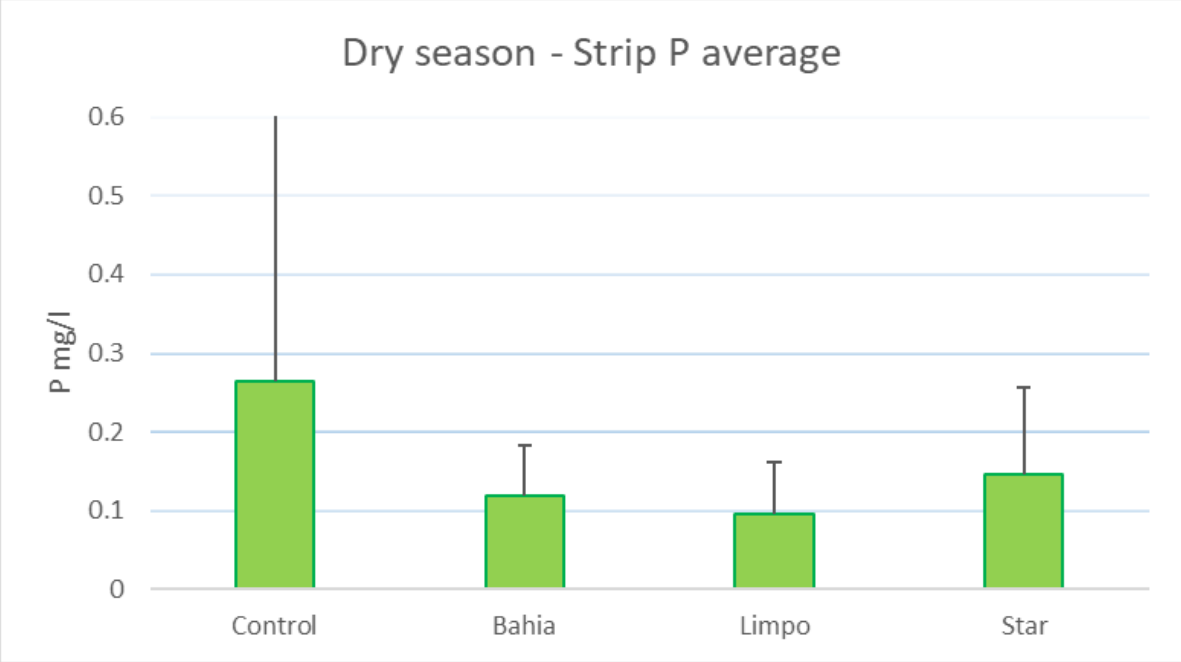
Water flow in ditches – first order ditches.
One sampling site per species strip
Three replicates for strips -> 12 sampling sites total

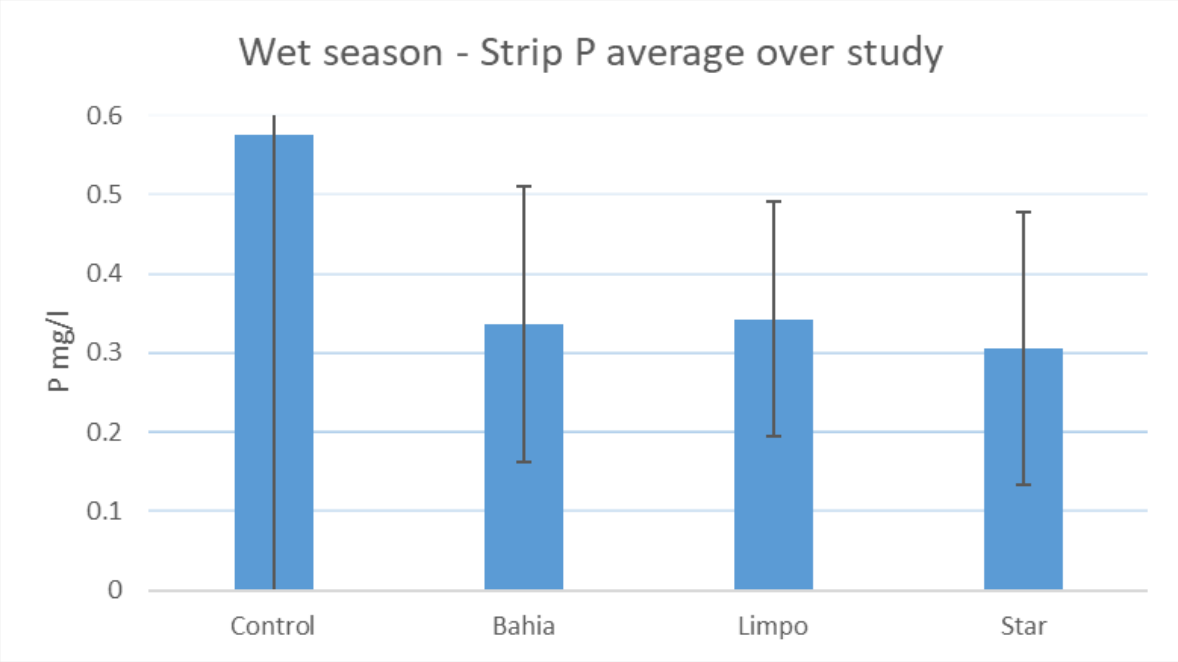
Wet season_ weekly
Dry season – bi-weekly (if water present)
NO sampling if water depth < 10 cm

Results: Slide 1 - Overall

Average over 2021-2023 for all strips

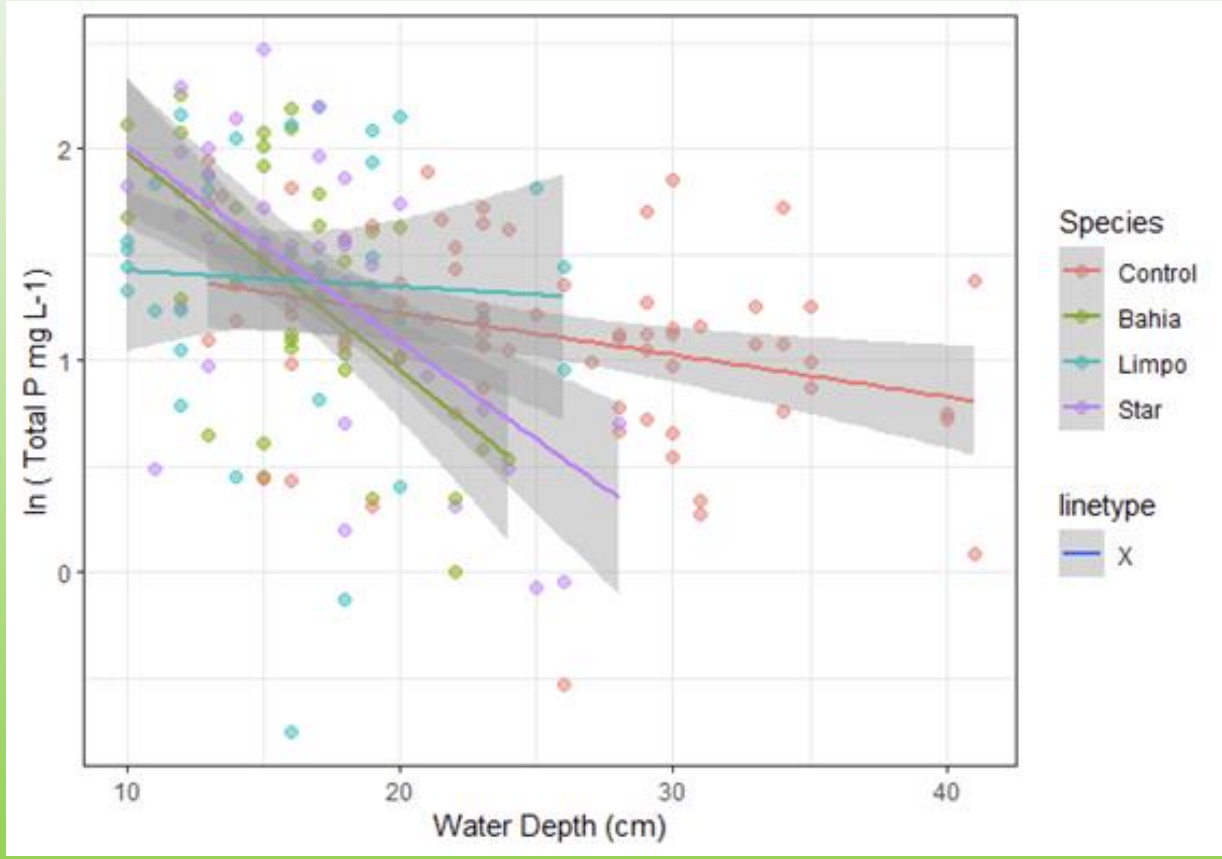
Parameter	Dry season	Wet season	Across 4 ranches in same area (other study over 3 years)
Total P	0.17 mg/l	0.41 mg/l	0.49 mg/l





lower P-runoff concentration in all vegetation strips as compared to control

Results: Slide 2 - P concentration and water depth in ditches

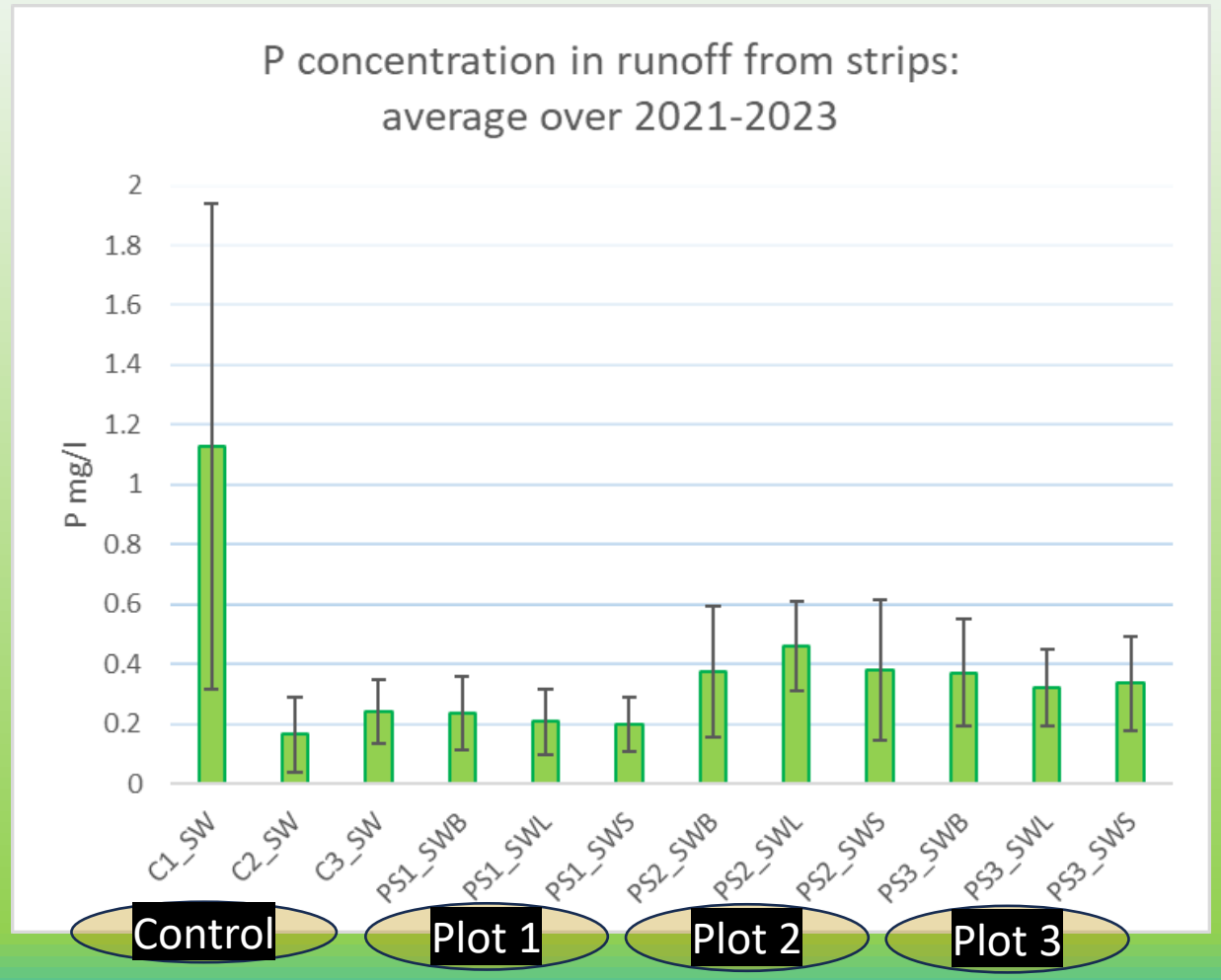


P concentrations decrease as the depth of water in ditches increase.

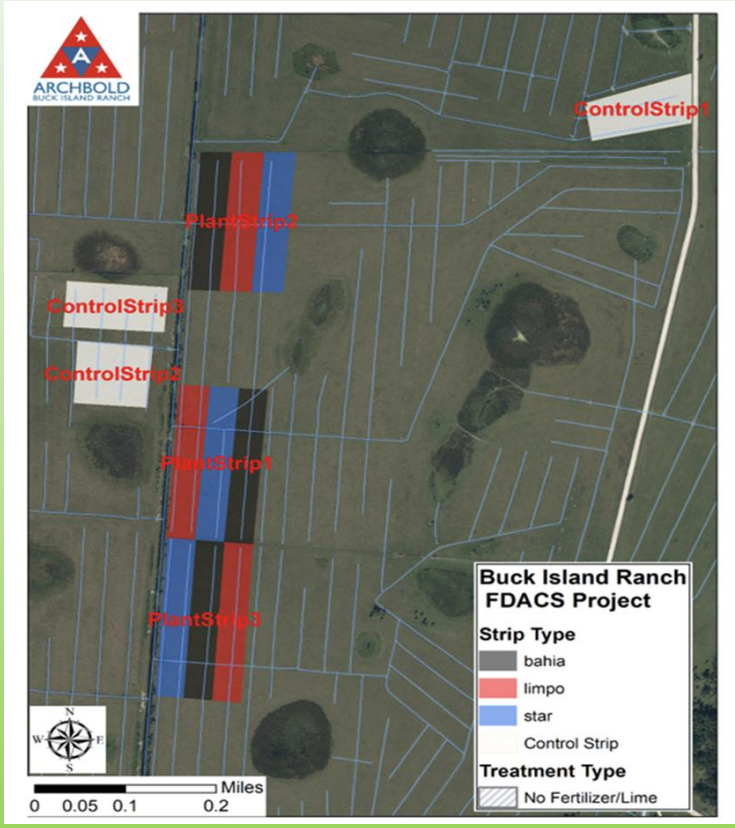
➔ Likely a dilution effect

➔ More pronounced in Bahia and Stargrass, suggesting higher P uptake by these species

Results: Slide 3 – high spatiotemporal variation in P-runoff concentration - challenge



C1_SW	Control
C2_SW	Control
C3_SW	Control
PS1_SWB	Bahia
PS1_SWL	Limpo
PS1_SWS	Star
PS2_SWB	Bahia
PS2_SWL	Limpo
PS2_SWS	Star
PS3_SWB	Bahia
PS3_SWL	Limpo
PS3_SWS	Star

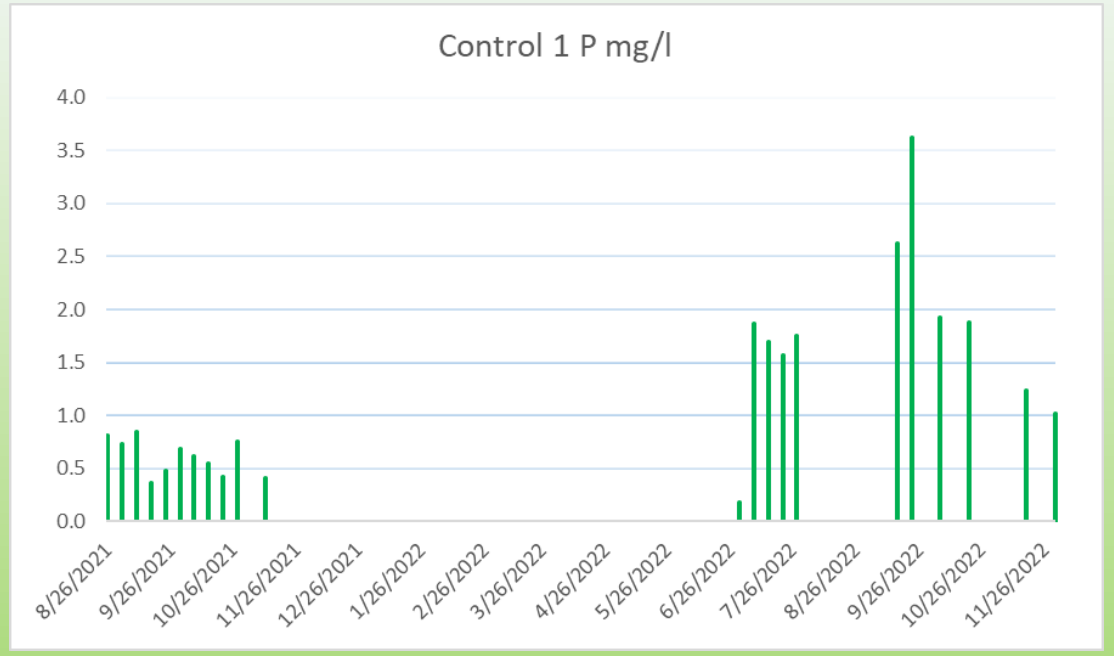


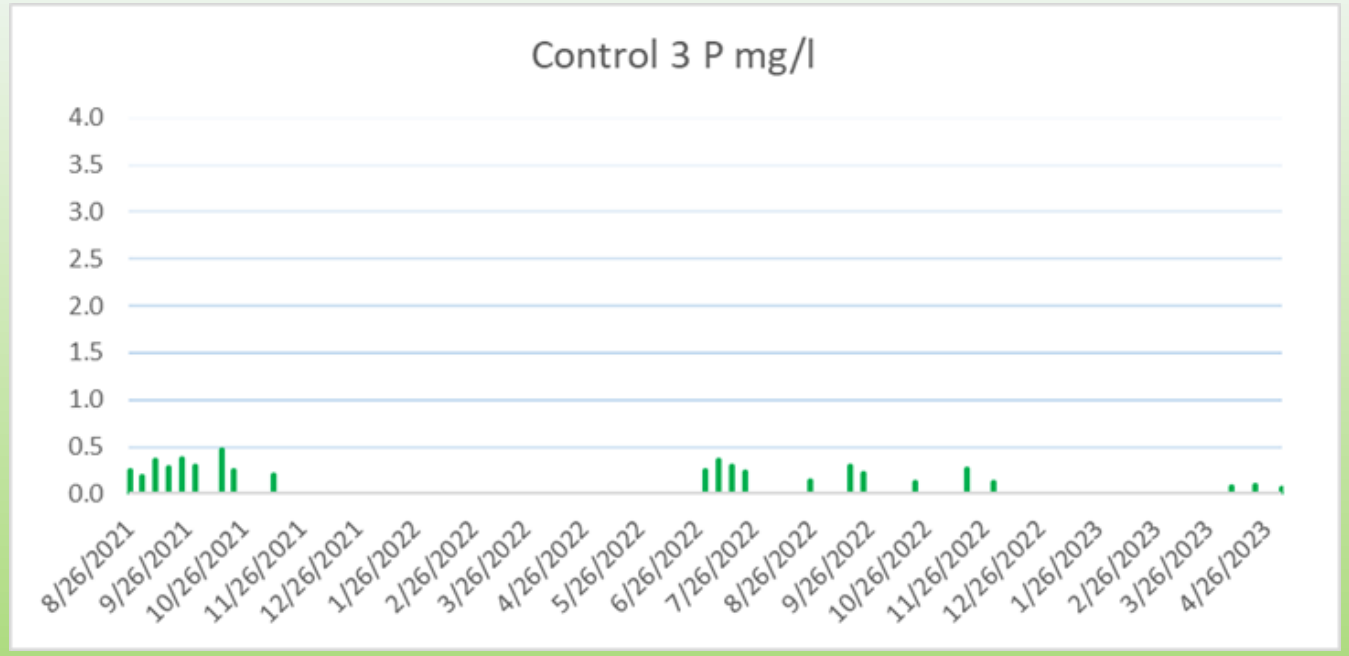
High variation within controls

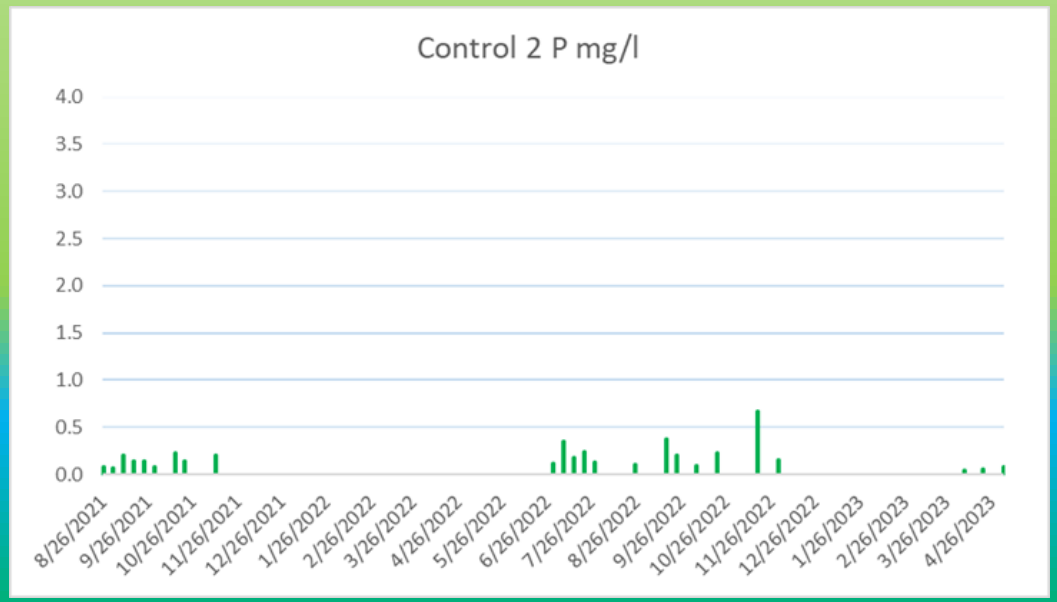
Plot location effect could be bigger than species differences on runoff – even within 1 square mile.

concentrations can vary spatially within/between ditches (vegetation, sediment) from differences in surrounding topography, point sources like dung/carcasses.

Results: Slide 4 – high spatiotemporal variation in P-runoff concentration – within the 3 control plots







Conclusions

- Species vegetation strips showed lower P concentrations in runoff as compared to controls (ungrazed Bahia pasture)
- Bahia and stargrass strips had a greater decrease in P concentration as ditches got fuller, as compared to limpo and control – maybe higher uptake

- Challenge – high spatial and temporal variation observed in P-runoff concentration
- Flashiness of both discharge and concentration indicates the drawback of discrete sampling – very easy to miss peaks in weekly samples.
- Hence the necessity of continuous monitoring – however to date no accurate sensors available for P

References
2021_Kohmann et al_Nutrient Cycling in Agroecosystems_Farm-scale phosphorus budgets of beef cow-calf

Upcoming analyses

Species differences in leachate P concentration

Species differences in biomass P uptake