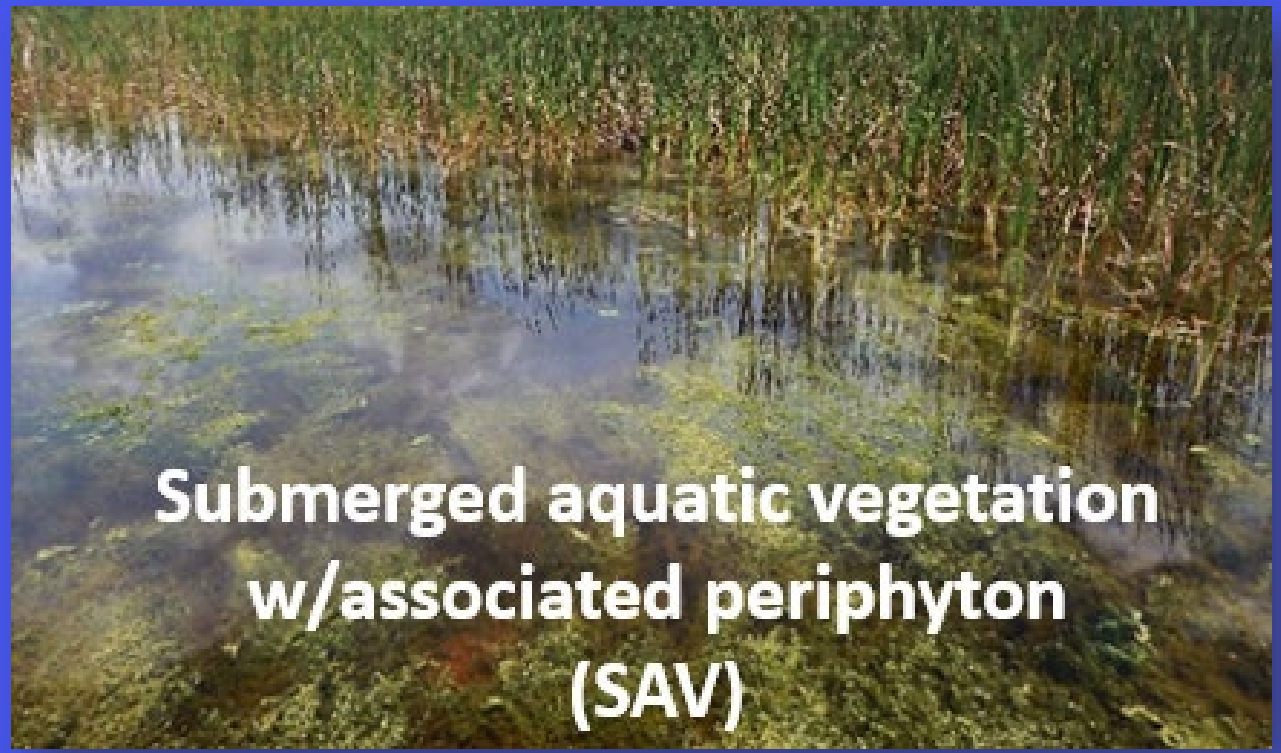
Is there an Effect of Flow on Periphyton Enzyme Activity in the Everglades Stormwater Treatment Areas (STAs)?

Kathleen Pietro
kpietro@sfwmd.gov
Applied Sciences Bureau
Greater Everglades Ecosystem Restoration Conference
April 23, 2019

sfwmd.gov

Decreasing nutrient gradients from Inflow to Outflow and extensive coverages of vegetation communities are found in the flowways of well-performing STAs.

Typha, spp.

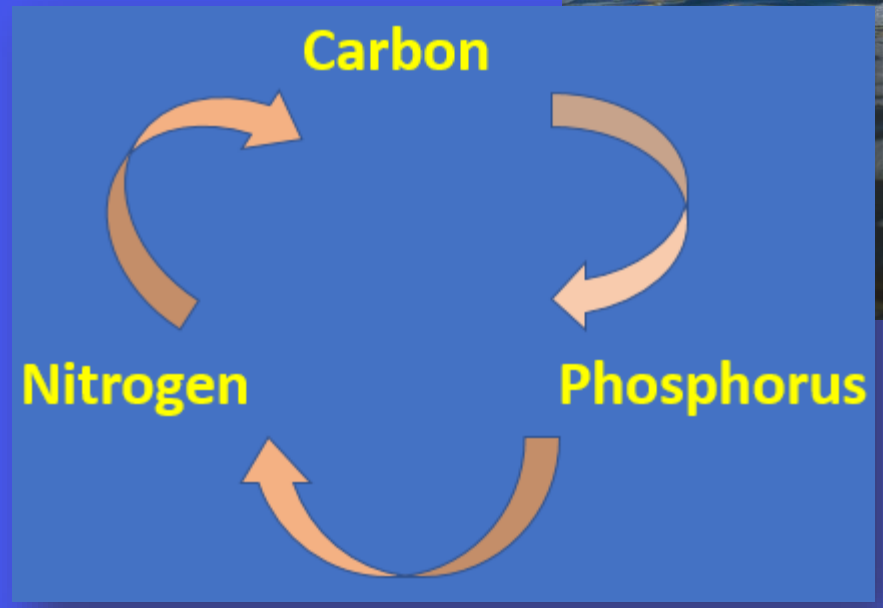


Chara, spp.

Flows & associated loads can affect nutrient cycling

Inflows influence:

- Water movement & residence time
- Water depths
- Nutrients



Enzymes produced by the periphyton component are indicators of nutrient conditions within the flowways

Enzymes assayed:

Carbon (C) acquiring Enzyme

- β-Glucosidase

Phosphorus (P) acquiring Enzymes

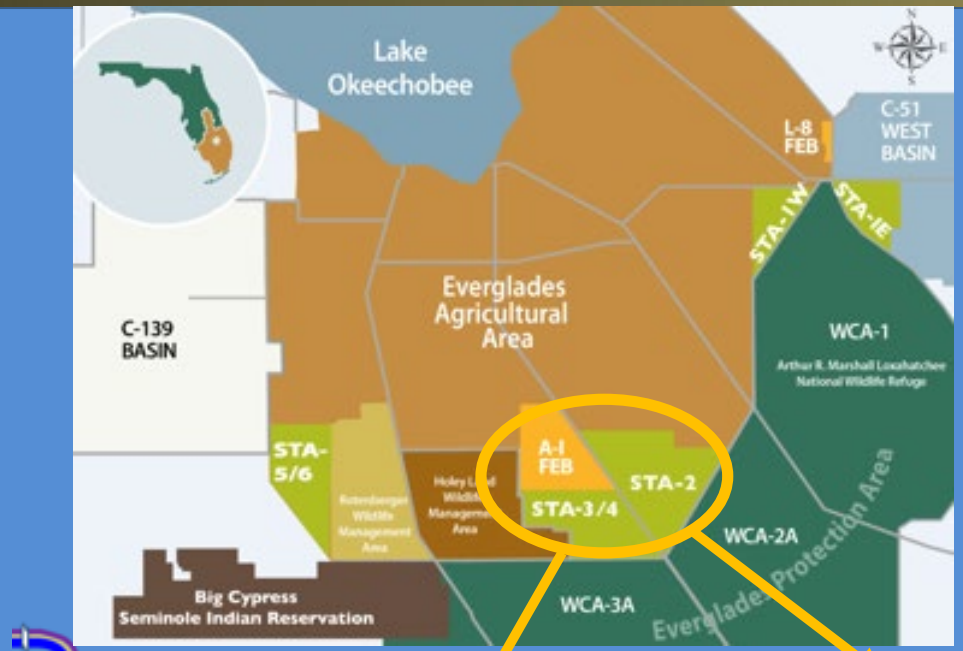
- Alkaline Phosphatase
- Bis-Phosphodiesterase

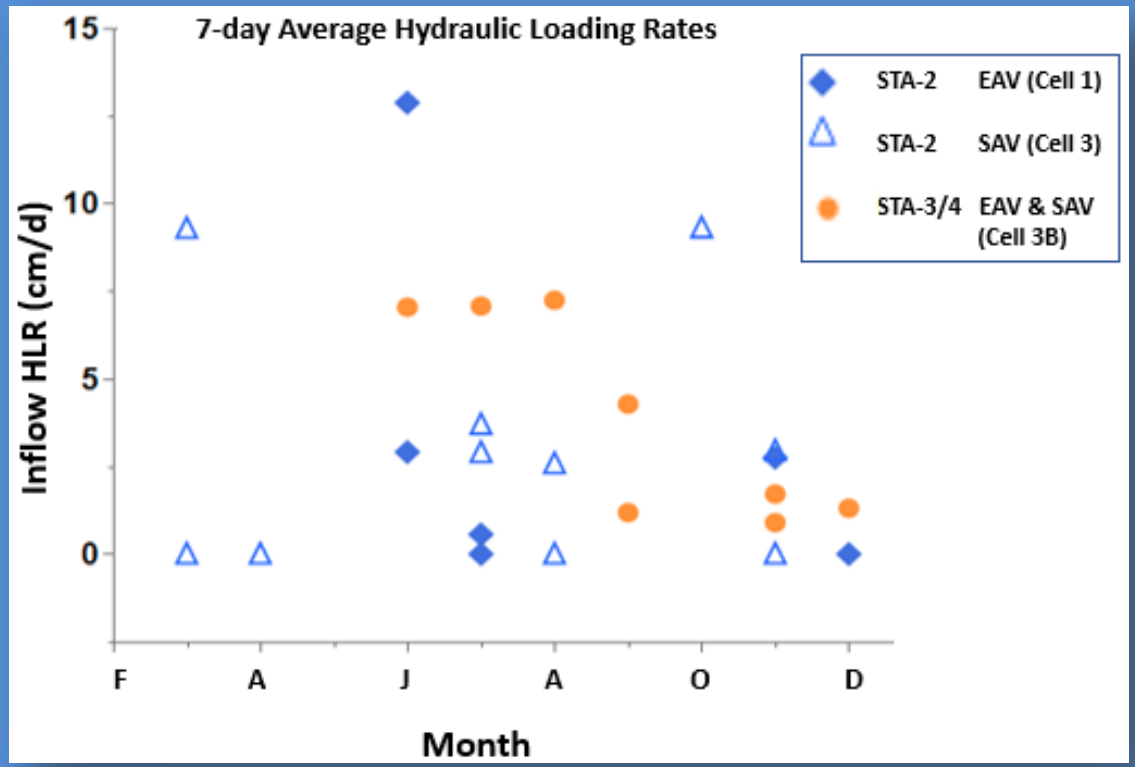
Nitrogen (N) acquiring Enzyme

- Leucine aminopeptidase

Periphyton established on acrylic dowels deployed for 7-days

Hydraulic loading rates during our multi-year study were variable over space and time.





Sampling sites

Emergent Aquatic vegetation

Submerged Aquatic vegetation

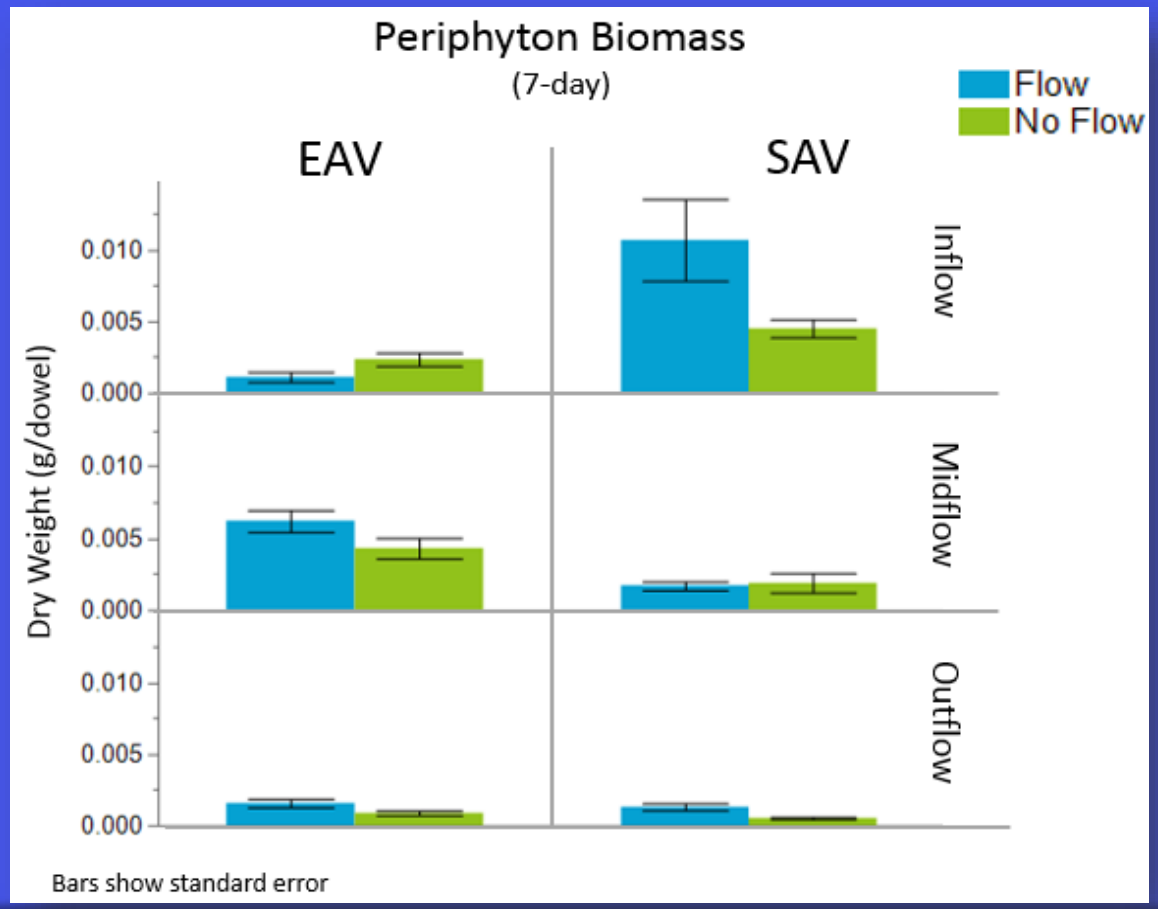
Emergent & Submerged Aquatic vegetation

The effects of flow conditions on periphyton biomass & enzyme activity are evaluated in three ways.

Trends presented by:

- Flow/No Flow
- Dominant vegetation communities
- Along the nutrient gradient

Periphyton biomass was generally increased during Flow but there were variable responses among vegetation types & along the transect.

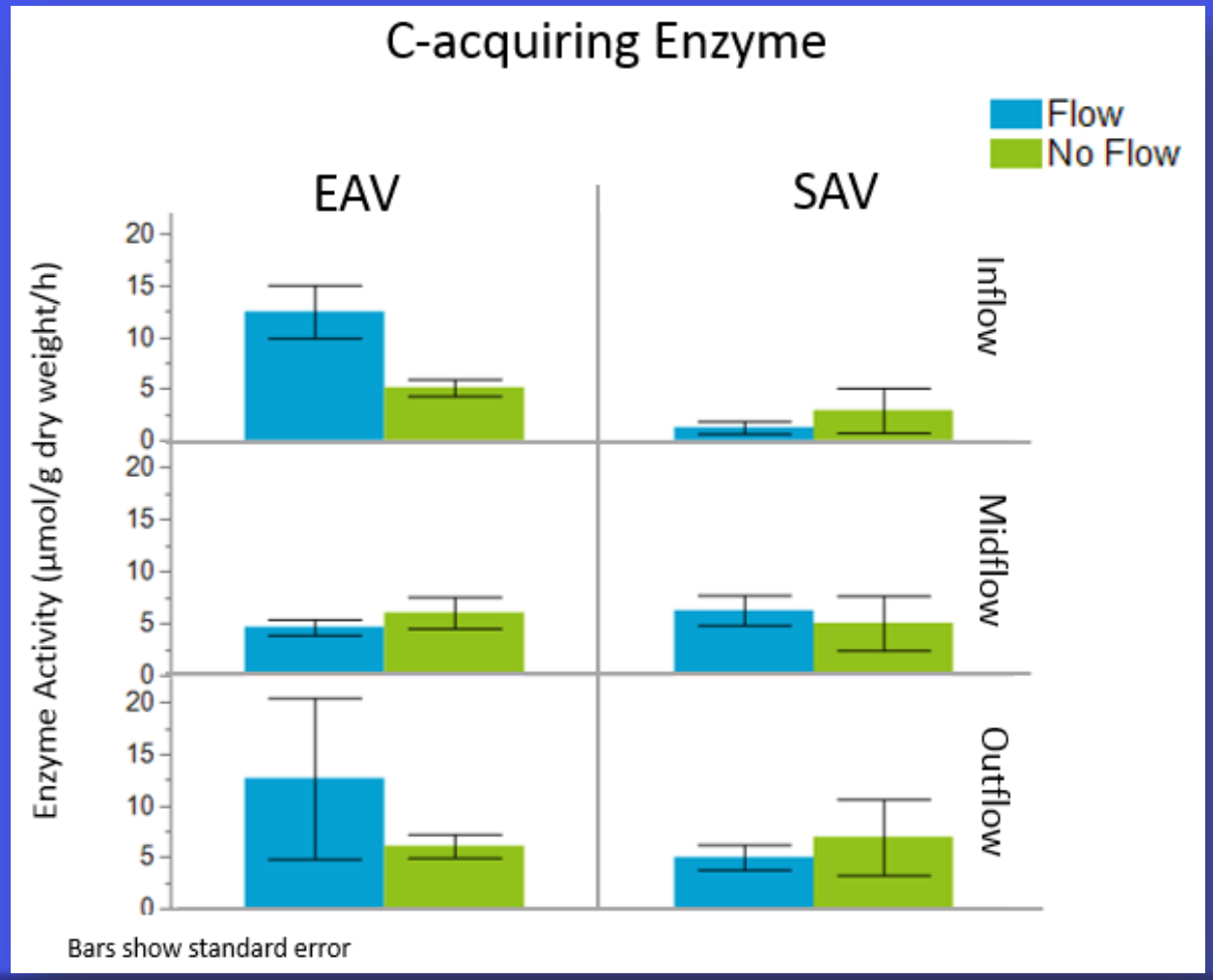


During Flow:

- Greatest biomass accumulation at Inflow in SAV; Midflow for EAV
- Lowest accumulation at Outflows regardless of vegetation types

EAV sites had more organic matter (60 – 65%) compared to SAV (50 – 55%)

Carbon-acquiring enzyme activity also varied among the vegetation types in response to flow conditions.

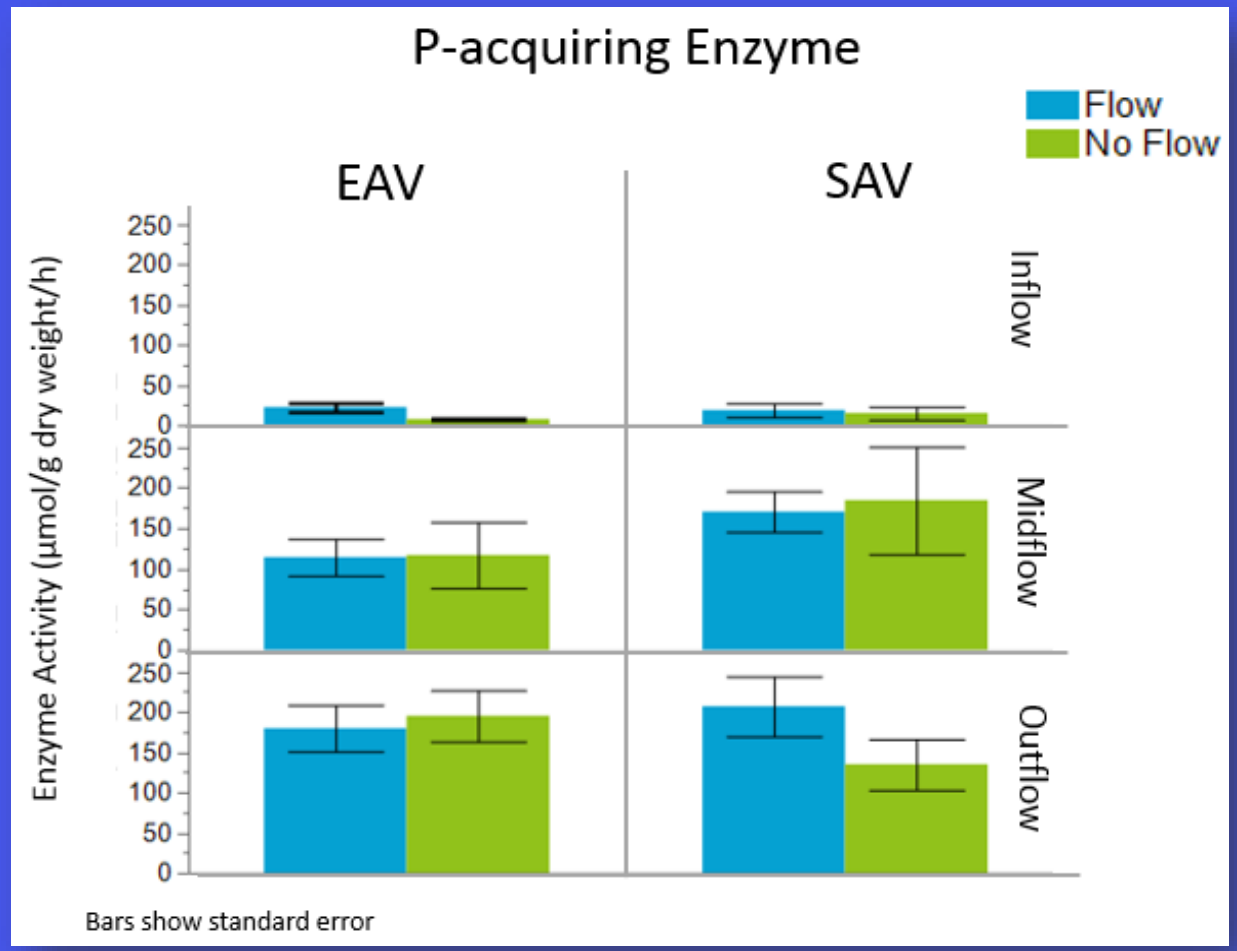


During Flow:

- Activity in EAV sites was increased (at Inflow & Outflow)
- Opposite response in SAV

  Activity was highest during No Flow

Phosphorus-acquiring enzyme activity at the Outflow was most effected by flow conditions.



Activity increased along the nutrient gradient in both vegetation communities

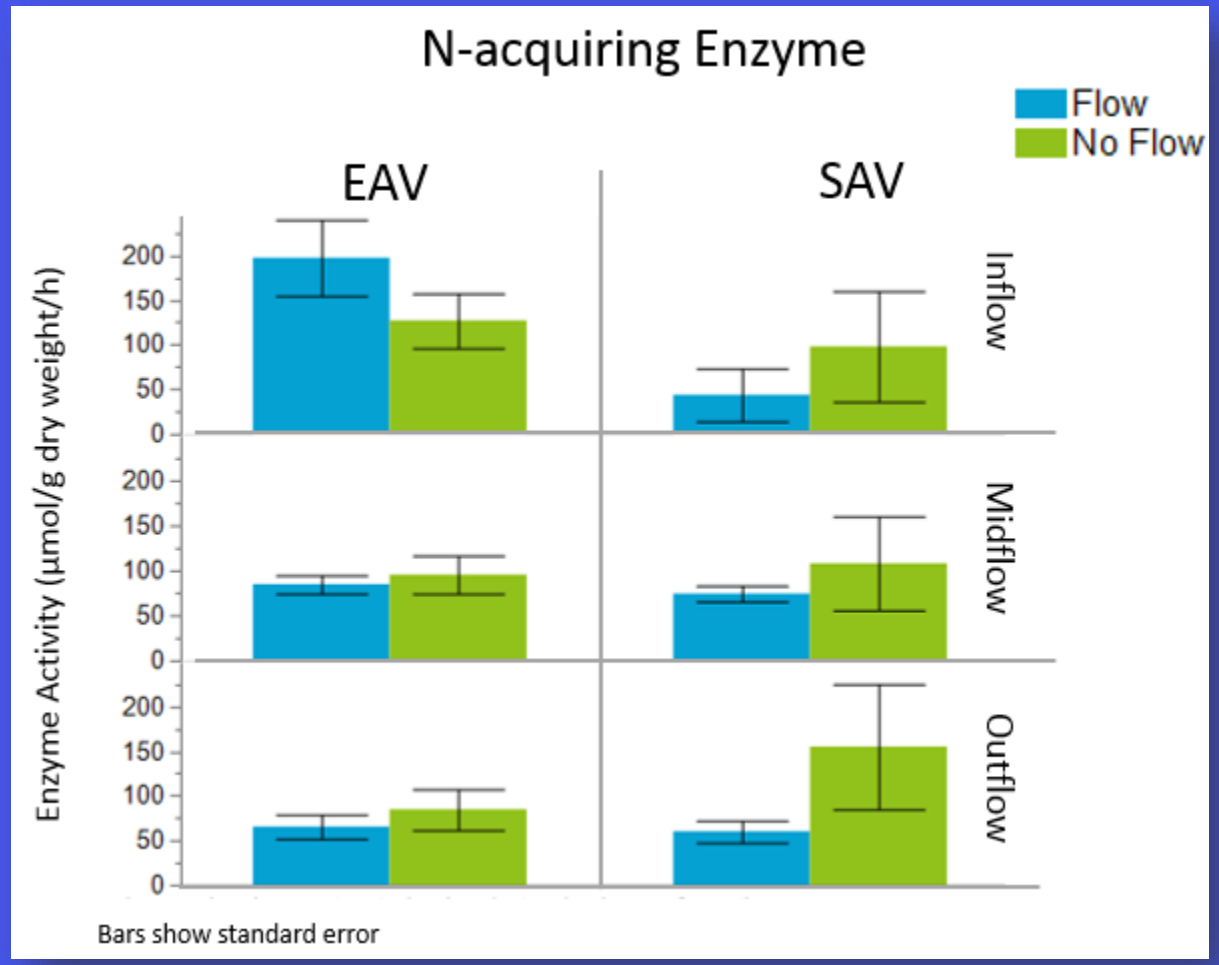
During Flow:

- SAV sites had higher activity compared to EAV sites

During No Flow:

- Activity in the SAV sites decreased at Outflow but increased in EAV sites

Nitrogen-acquiring enzyme activity decreased under flow conditions (except for EAV Inflow sites).



During Flow:

- EAV sites at Inflow had highest activity
- Similar activity among vegetation types at Midflow and Outflow sites

During No Flow:

Activity in SAV increased along the gradient & opposite response observed at EAV sites

Summary

Parameter	Transect Location	*Change in activity during Flow compared to No Flow	
		EAV	SAV
Biomass	Inflow	↓	↑
	Midflow	↑	↔
	Outflow	↔	↔
C-acquiring enzyme	Inflow	↑	↓
	Midflow	↓	↑
	Outflow	↑	↔
P-acquiring enzymes	Inflow	↔	↔
	Midflow	↔	↔
	Outflow	↔	↑
N-acquiring enzyme	Inflow	↑	↓
	Midflow	↔	↓
	Outflow	↓	↓

*Arrow direction indicates increase, decrease, or similar activity during Flow compared to No Flow relative to site location along the transect

Enzyme activity was variable with mixed responses to flow conditions

- Among the enzymes
- Along the nutrient transect
- Among the vegetation communities

Further analysis is under-way to examine relationships with hydraulic loading rates, water quality, and between STAs

Appreciation to the Microbial Team!

South Florida Water Management District:

Delia Ivanoff, Jill King, Sue Newman, Matt Powers, Jake Dombrowski, Jessica Wilson, Odi Villapando, Luis Canedo, Richard Walker, Meifang Zhao, Water Quality Laboratory

University of Florida:

Ramesh Reddy, Patrick Inglett, Kanika Inglett, Alan Wright, Amy Dubois, Baris Tecimen

DB Environmental Laboratories, Inc.:

Dawn Sierer-Finn, Sam Colios, Aubrey Frye, Cassandra Cummins, Tom Prevratil

Thank-you! Questions?