Spatio-temporal Dynamics of Vegetation Species Abundance in Response to Hydrologic Changes in the Ridge and Slough Landscape of the Everglades Ecosystem

Deusdedith Rugemalila
Winston-Salem State University, NC

Jay P. Sah, Michael S. Ross and SOFTEL
Institute of Environment
Florida international University, Miami, FL

James B. Heffernan
Duke University, Durham, NC

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WINSTON-SALEM STATE UNIVERSITY

US Army Corps of Engineers.

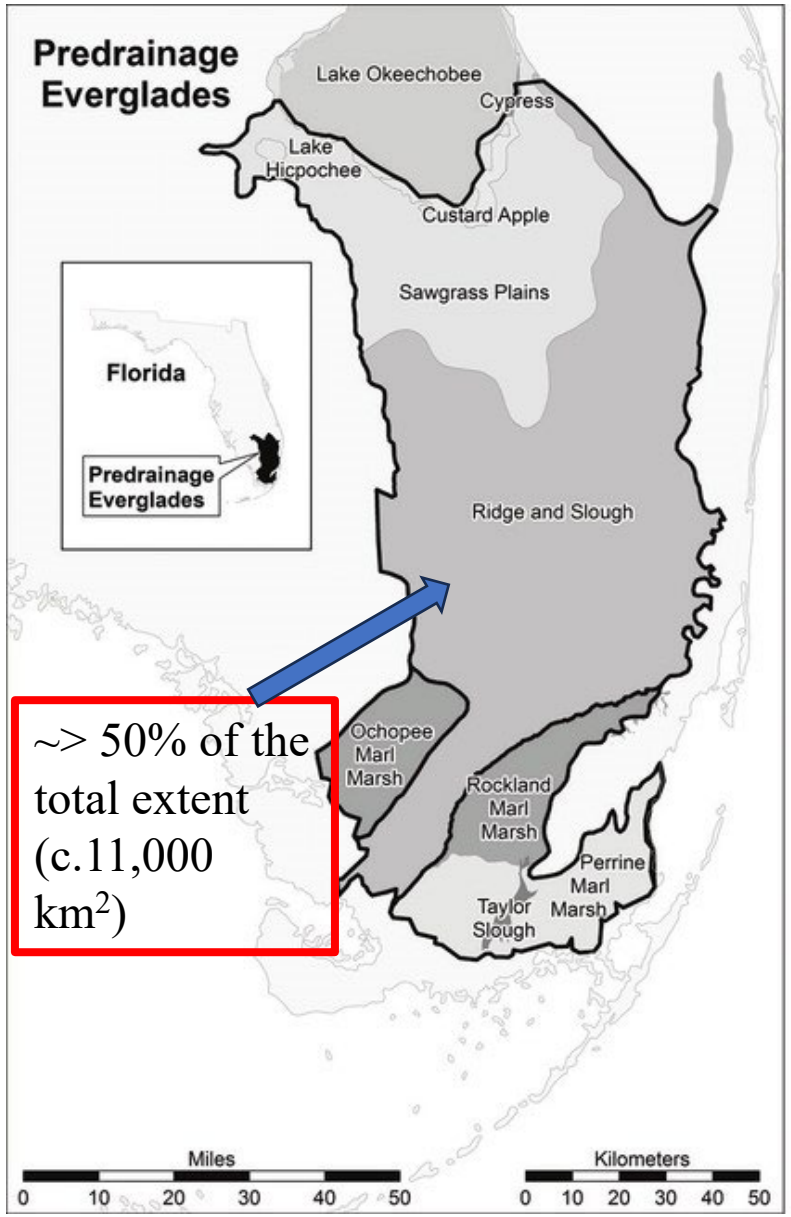
NATIONAL PARK SERVICE

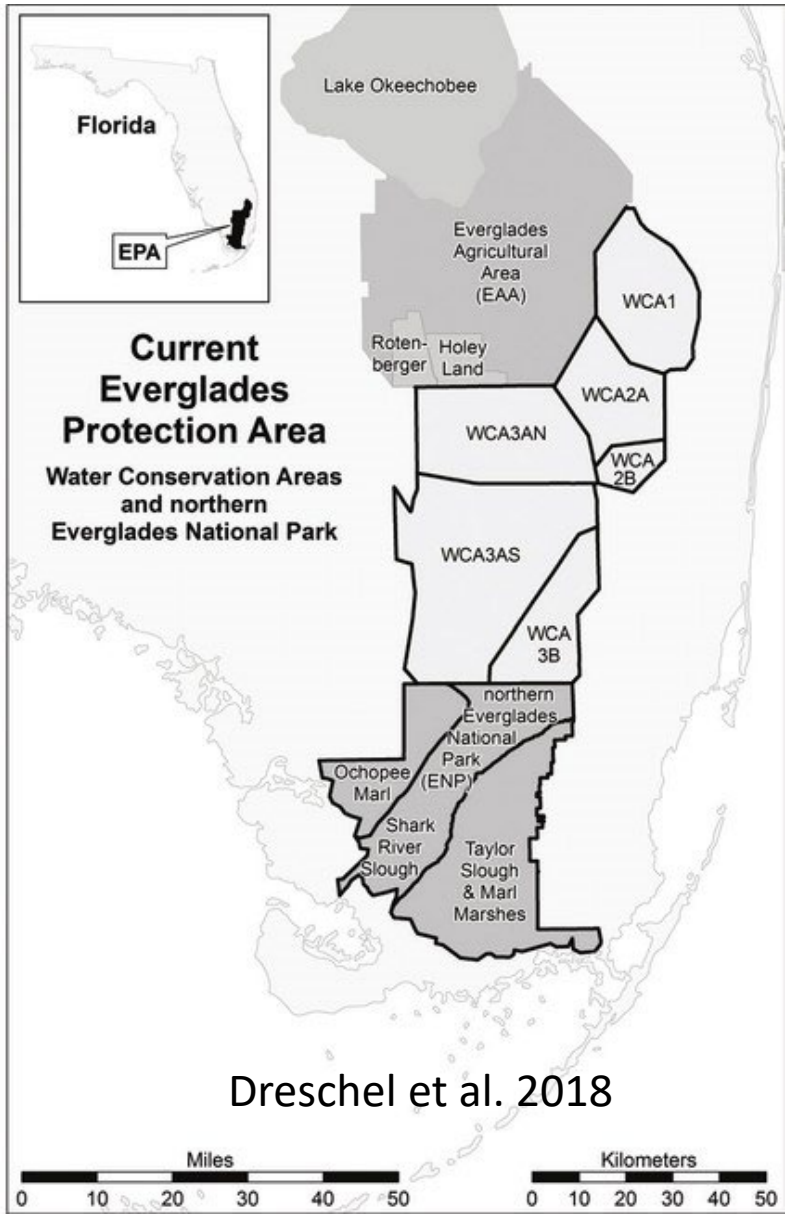
FIU FLORIDA INTERNATIONAL UNIVERSITY

The Everglades Ridge & Slough Landscape

Major Historic Landscapes:

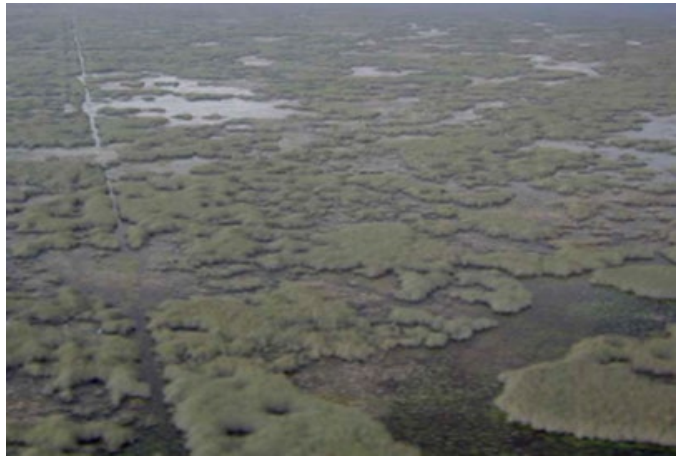
- Custard Apple Swamp
- Sawgrass Plains,
- **Ridge and Slough,**
- Peat Transverse Glades,
- Rockland Marl Marsh,
- Marl Transverse Glades,
- Perrine Marl Marsh and the
- Ochopee Marl Marsh.

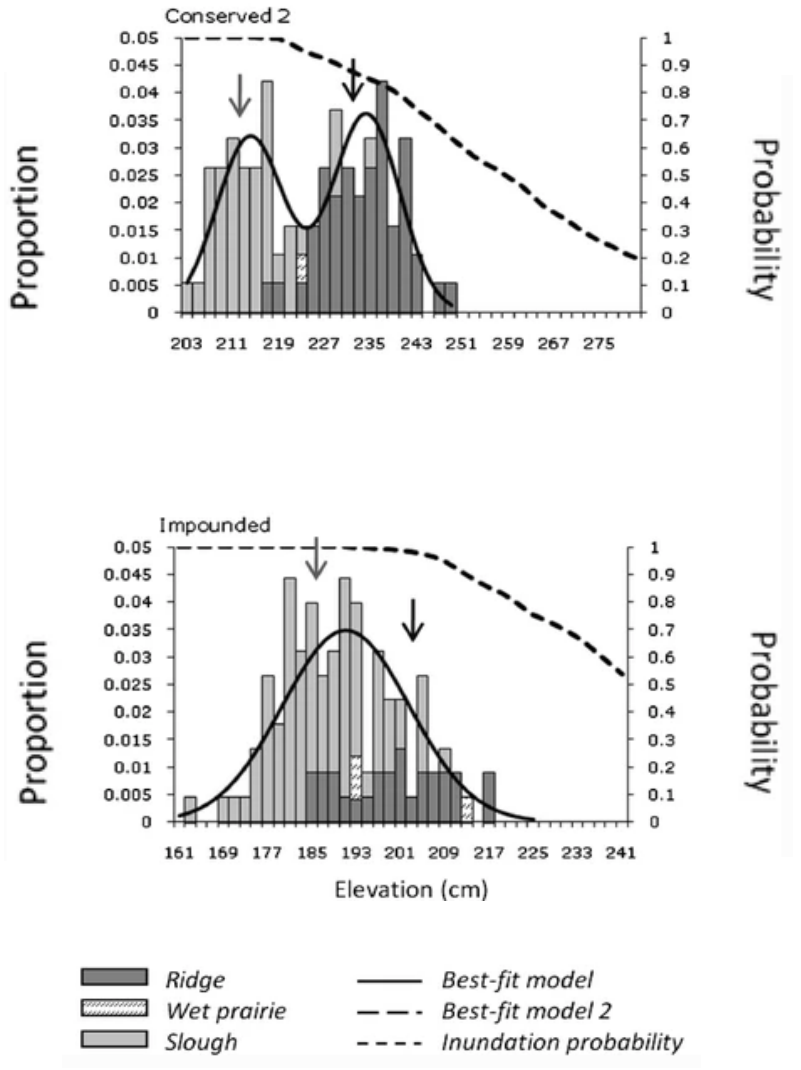




Dreschel et al. 2018

The Ridge and Slough Landscape



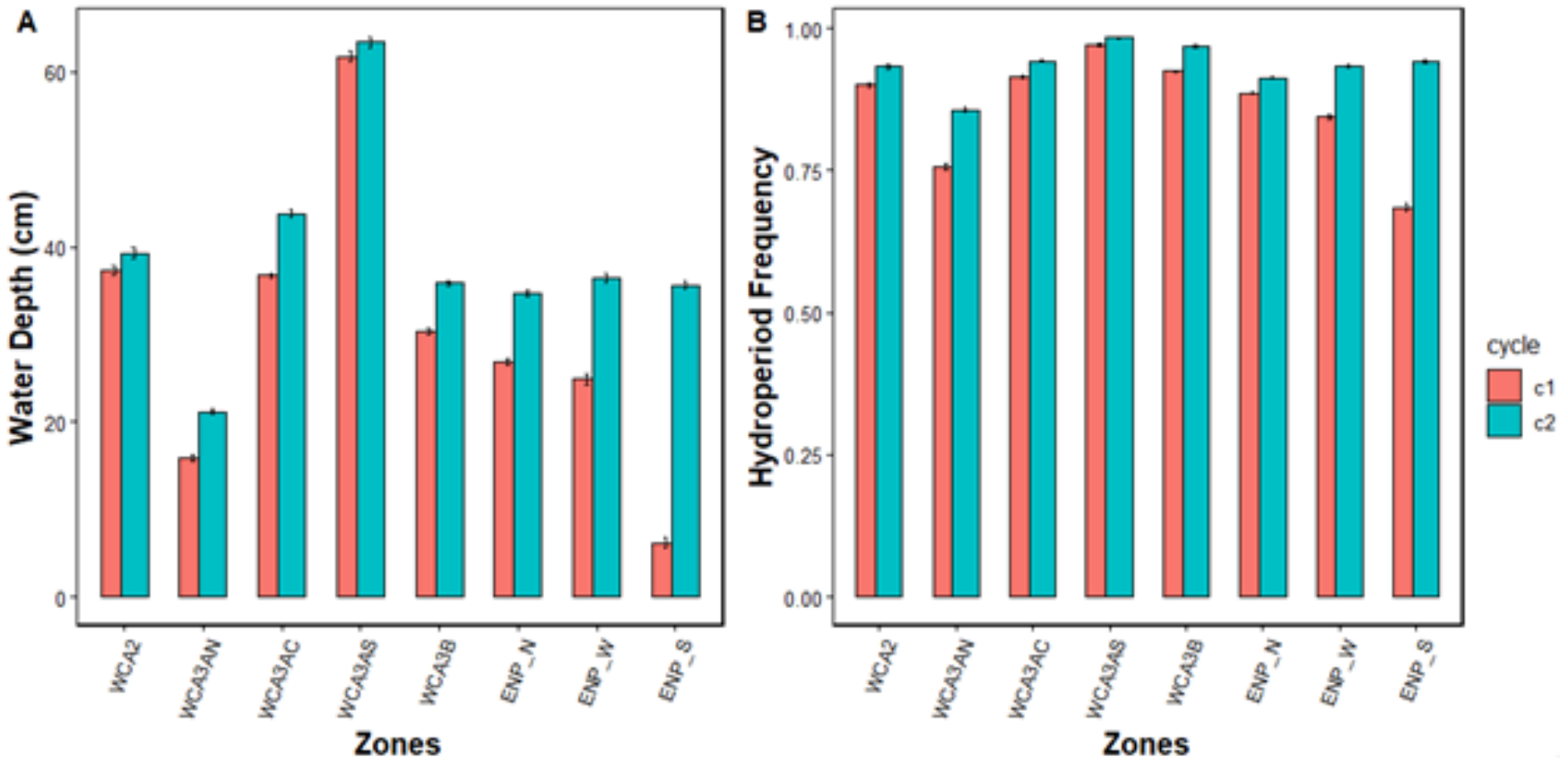


Conserved R&S topographic heterogeneity and bimodal elevation distributions.

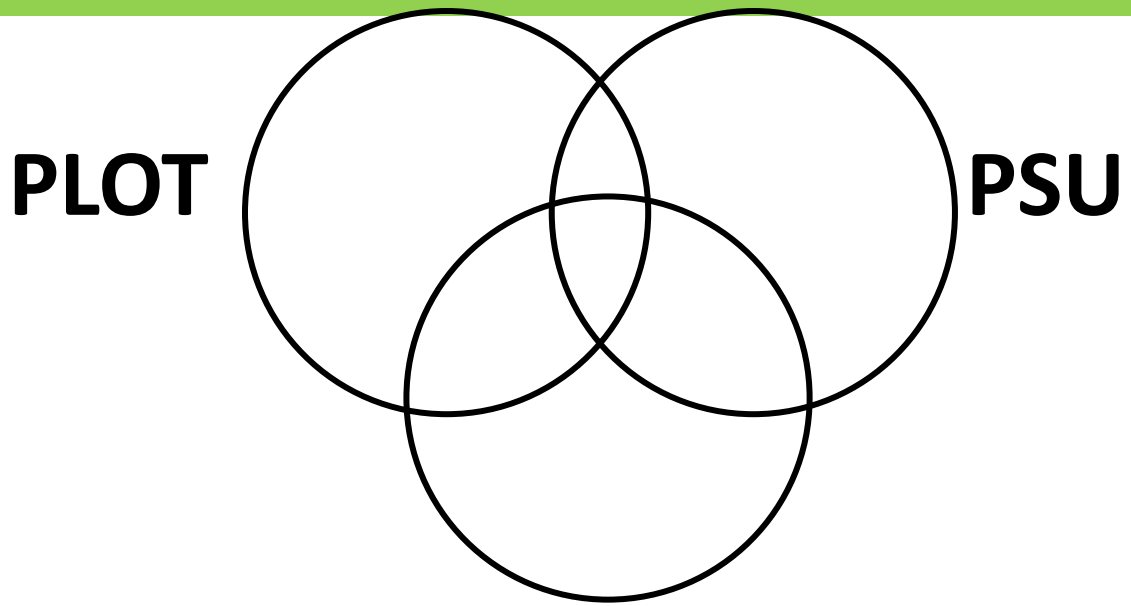
Degraded R&S landscapes have lost bimodal distributions.

(Source: Watts et al. 2010)

Temporal variation in hydrology



Influence of Scale



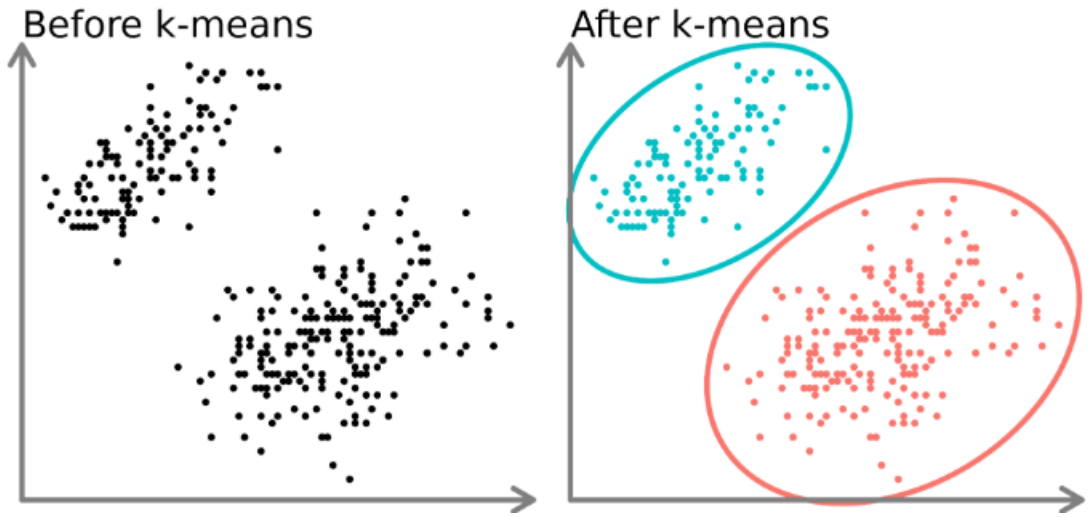
- Hydrology
- Fire
- Nutrients
- Soil Depth

Vegetation

Data Analysis

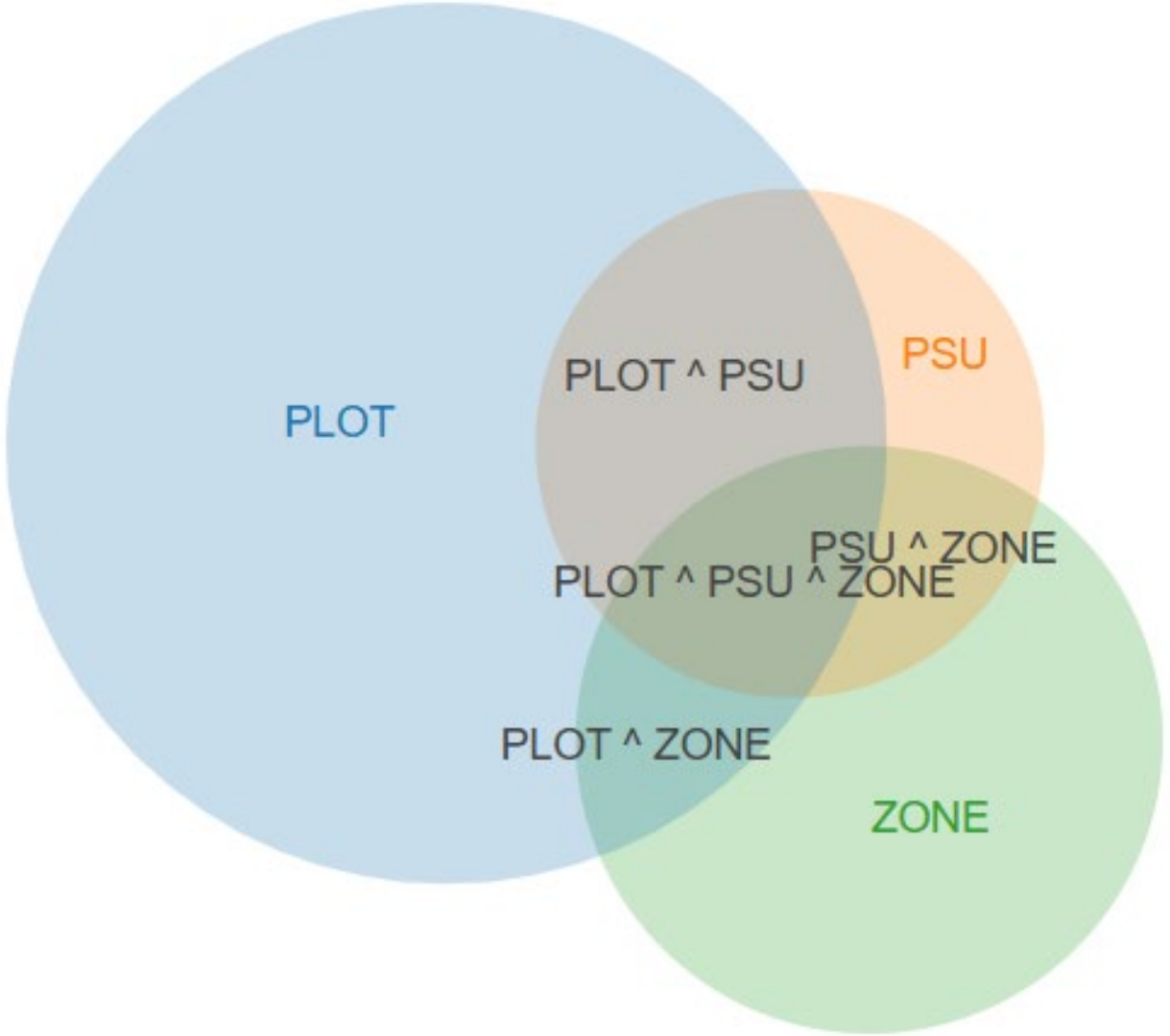
- Vegetation community composition: Non-metric Multidimensional Scaling (NMDS) Ordination

- K-means clustering – cluster veg. communities into two clusters (a proxy for R&S landscape)



https://www.datacamp.com/

Strong Effect of Local Factors on Vegetation



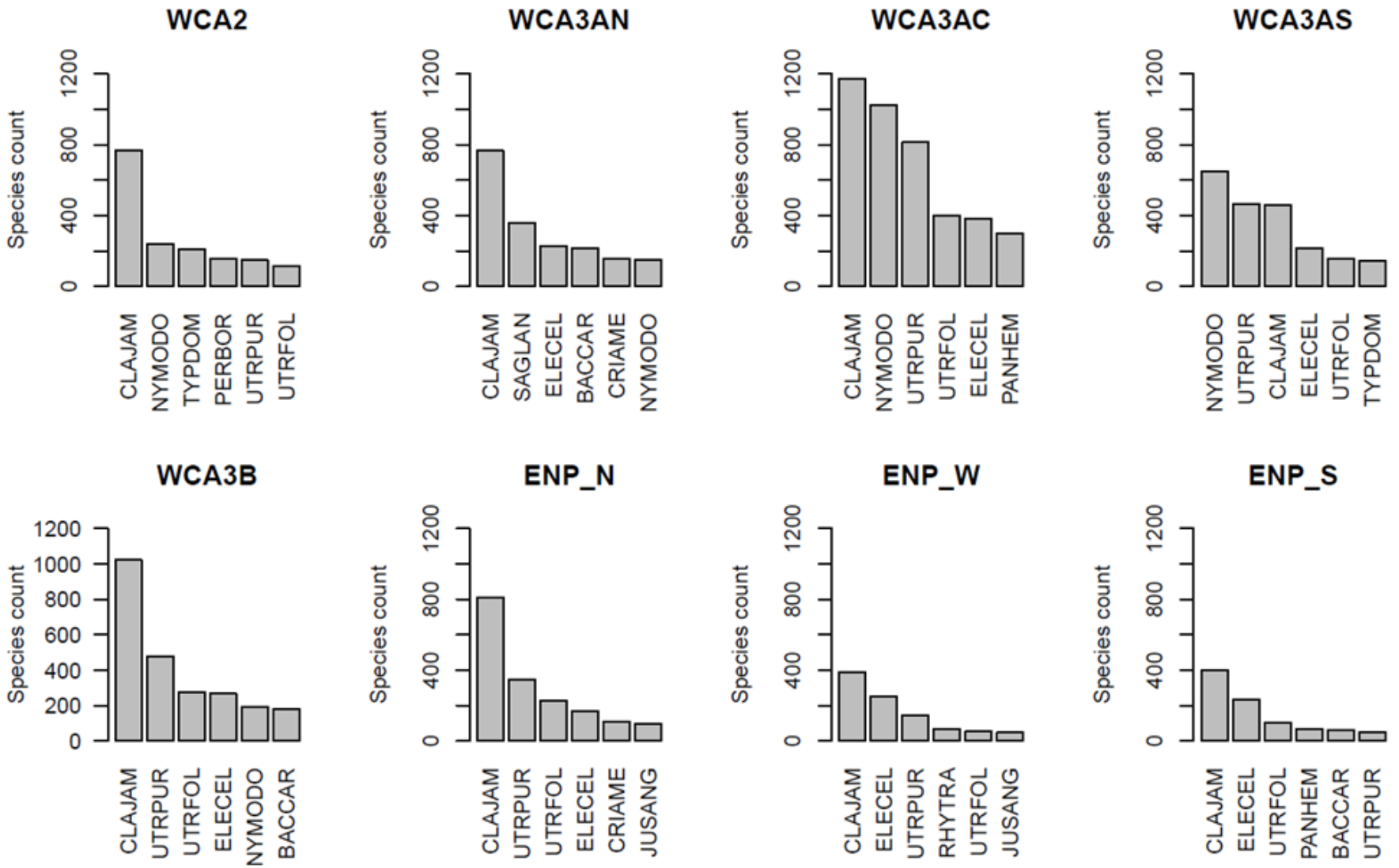
Strong Effect of Local Factors on Vegetation

Spatial Level	Explained variation (%)	R^2	Relative
Pure Plot	9.0	0.09	34.62
Pure PSU	3.0	0.03	11.54
Pure Zone	4.0	0.04	15.38
Joint: PLOT + ZONE	1.0	*0.01*	3.85
Joint: PLOT + PSU	2.0	0.02	7.69
Joint: PSU + ZONE	1.0	0.01	3.85
Joint: PLOT+PSU+ZONE	6.0	0.06	23.08
Total	**26.0**	**0.26**	**100**

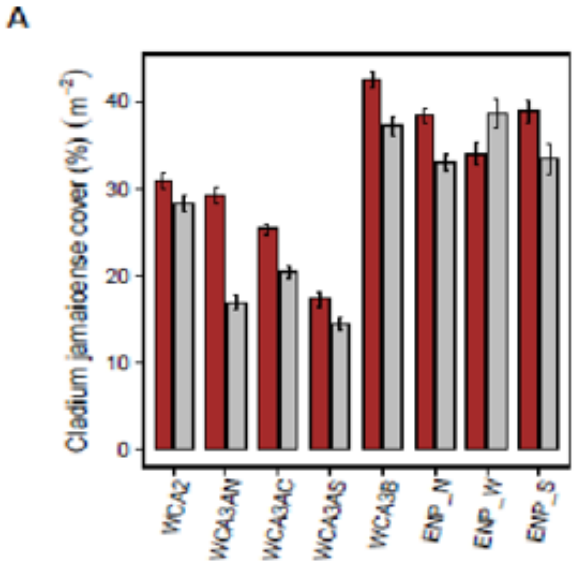
Strong Effect of Local Factors on Vegetation

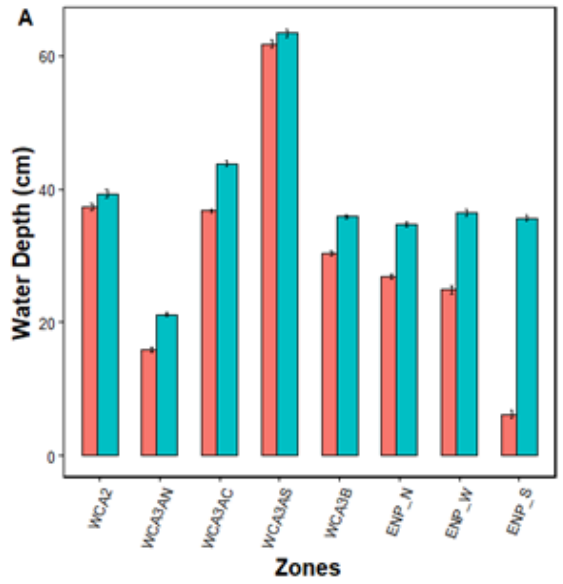
PLOT LEVEL ENVIRONMENTAL VARIABLES						
Variable	**Variance**	**F**	***P value***	**Significance**	**Relative Variance (%)**	**Cummulative variance (%)**
Mean Water Depth (cm)	0.0648	942.9	0.001	***	70.51	70.51
Soil TP	0.0104	151.1	0.001	***	11.30	81.81
TSLF (Years)	0.0042	61.4	0.001	***	4.60	86.41
Wet Season WD-Range (cm)	0.0027	38.8	0.001	***	2.90	89.31
Days Dry (WD < -20 cm)	0.0028	40.0	0.001	***	2.99	92.30
Fire Frequency	0.0022	31.8	0.001	***	2.37	94.67
Dry Season WD-sd	0.0016	23.6	0.001	***	1.76	96.43
Days (5 cm to 20 cm)	0.0014	20.8	0.001	***	1.56	97.99
Hydroperiod (WD> 0 cm)	0.0010	14.4	0.001	***	1.08	99.06
Days Dry (WD btn -10cm to 0 cm)	0.0004	6.0	0.001	***	0.45	99.51
Days Dry (WD btn - 20 cm to -10 cm	0.0003	4.1	0.003	**	0.30	99.82
Days (WD btn 0 cm to 5 cm)	0.0002	2.4	0.041	*	0.18	100.00

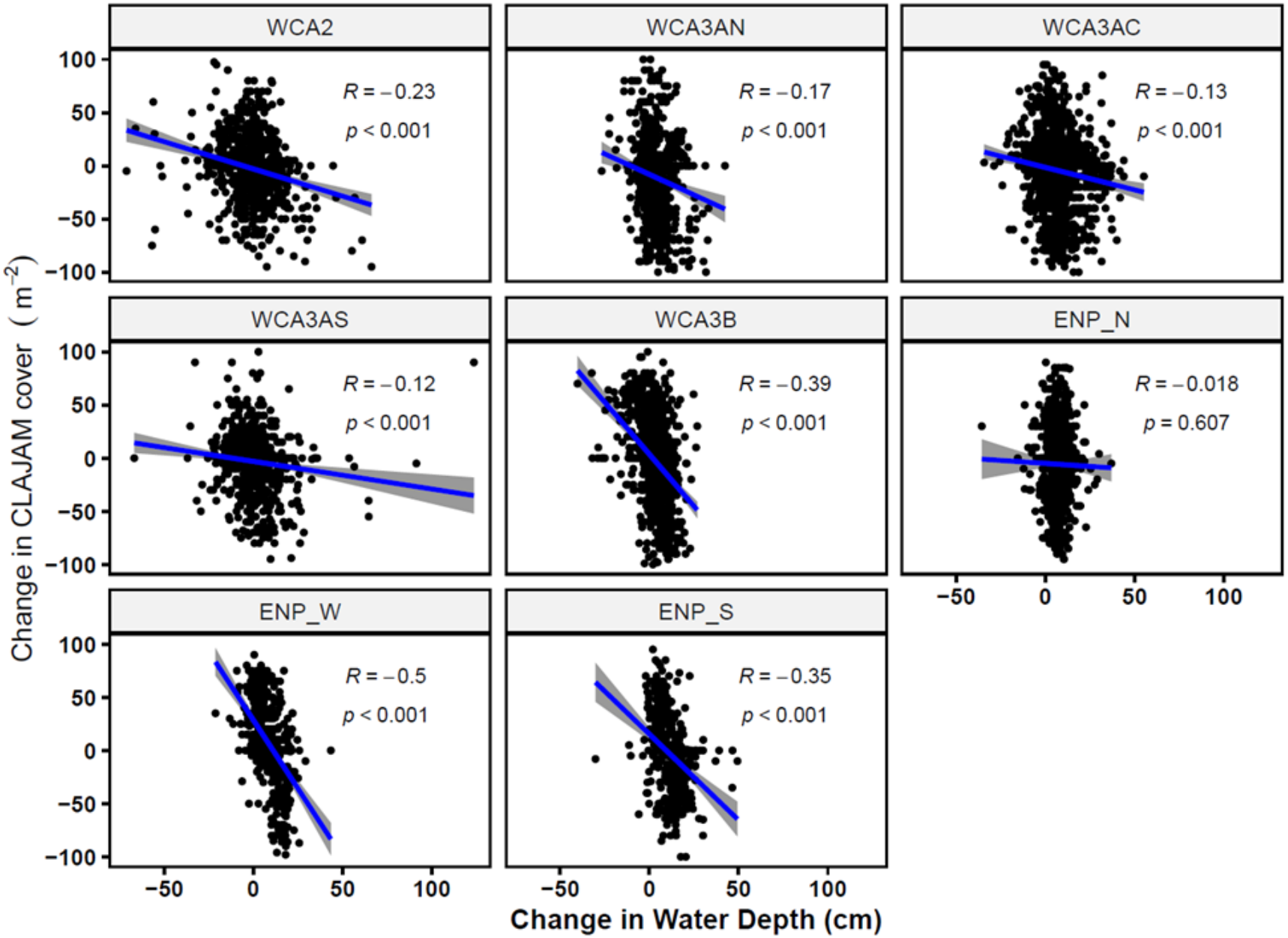
Species Abundance



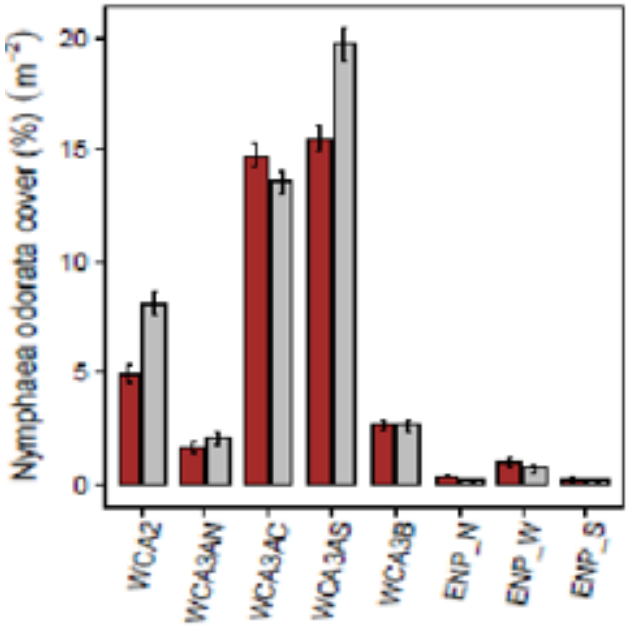
Temporal Change in Sawgrass vs Water depth

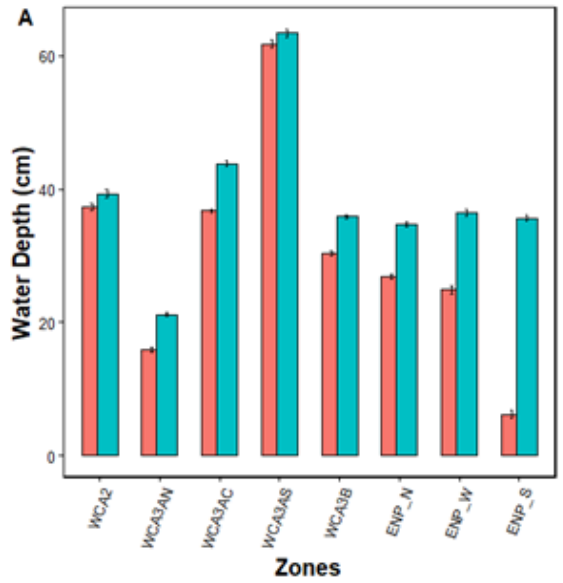


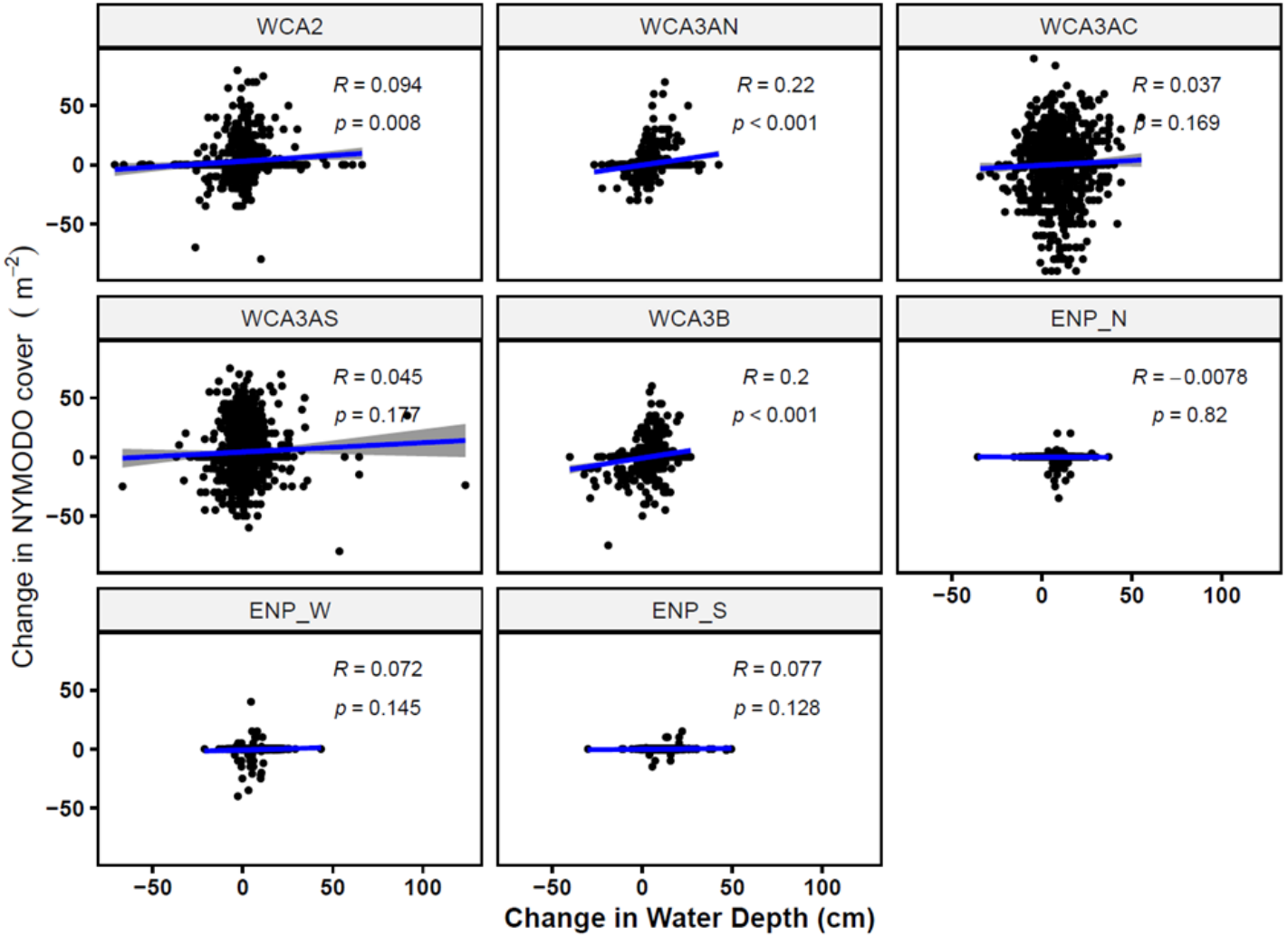




Temporal Change in Water-lily vs Water depth







Conclusion

- Critical environmental variables of the Everglades ecosystem are heterogenous across the water management zones
- Hydrological parameters at a local scale have strong explanatory power on vegetation species composition than landscape aggregates
- Temporal change in Water depth has variable strengths in explaining change in key species abundance