

Cross-curricular integration of the Florida Gulf Coast University campus as a “living laboratory”

Brian Bovard and Win Everham
Department of Marine and Ecological Sciences



Cross-curricular integration of the Florida Gulf Coast University campus as a “living classroom”

Mary I. Abercrombie, Kathy Byrne-Bailey, Noemi Creagan, Dean A. Croshaw, Randall E. Cross, Nora E. Demers, Chad Evers, **Laura Frost**, Anna Goebel, Charles W. Gunnels IV, **John Herman**, Rhonda Holtzclaw, Joseph Kakareka, **Simeon Komisar**, **Kara Lefevre**, **Katie Leone**, **James H. MacDonald**, Vikki McConnell, **Jessica Phillips**, Ricky Pires, Mike Savarese, Heather Skala-Acosta, Brenda Thomas, **Serge Thomas**, S. Greg Tolley, Haruka Urakawa, Hidetoshi Urakawa, & **Mary Voytek**



What is the role of higher education?

The Setting



- Site: ~800 Acres of a mixture of upland and wetlands
- Active restoration/mitigation program
- Diversity of available habitats: marshes, lakes, swamps, hardwood hammocks, pine uplands, a food forest & urbanized novel landscapes
- Location: One of the fastest growing populations in the country – including our campus!
- From ~2500 students in 1997 to ~15,000 today

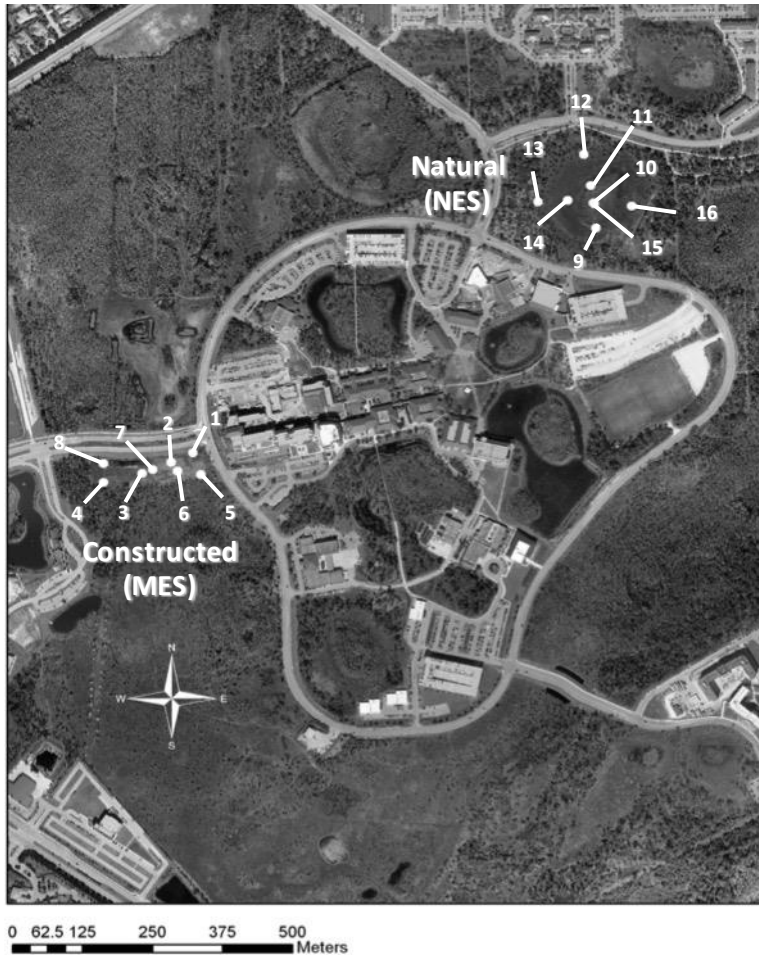
The Setting



- Auxillary Campuses:
 - Vester Marine and Environmental Science Research Field Station, Bonita Springs
 - Naples Botanical Garden Kapnick Center (Everglades Wetland Research Park), Naples
 - Emerging Technologies Institute, Fort Myers

Comparison of soil quality of constructed wetlands vs. enhanced natural wetlands at FGCU

Test Site Locations

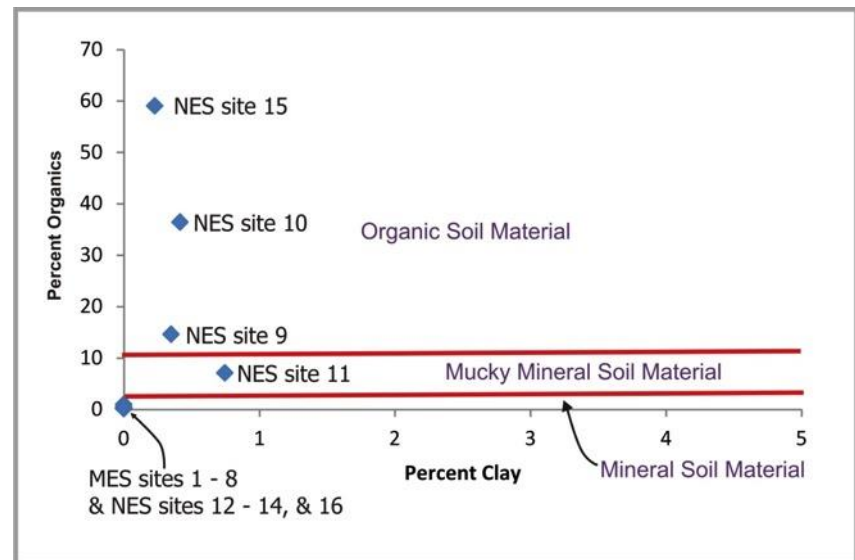


Alligator flag (left) and organic soil sample (right) from the middle of the natural site (NES)



Exposed soil (left) and oxidized, organic deficient mineral soil sample (right) from the constructed wetland site (MES)

Soil quality of the constructed wetlands on the FGCU campus are poor compared to natural wetlands (Foster et al., 2008). Constructed wetland soils are organic deficient “mineral soils” at the studied site.



Wetland Soils Graph Modified From Mitsch and Gosselink (2000; after NRCS 1998)

Environmental Chemistry

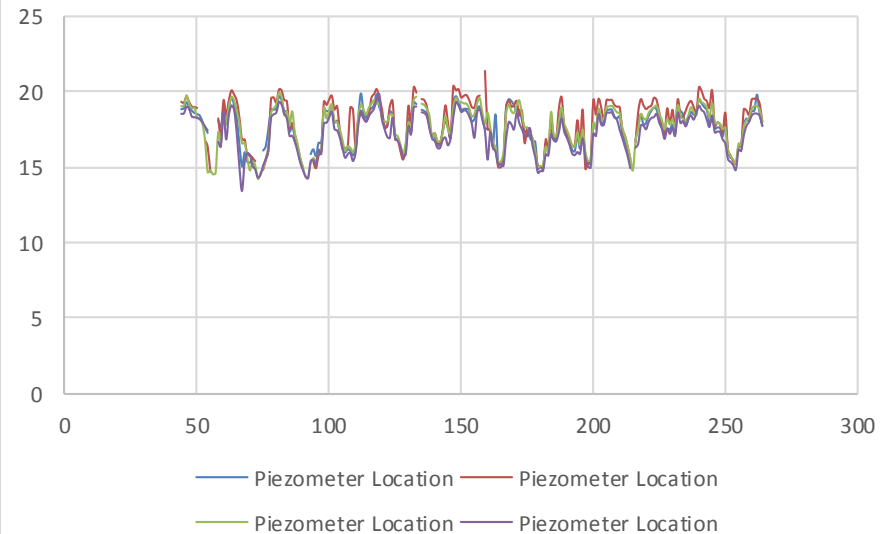


Limnology: Bathymetry



Hydrology & Ecohydrology:

Piezometers 13, 16, 17, 21



Long Term 1-Ha Study Plot



Study Site



0 500 ft
The study site was located to the north of the 1-ha campus study plot on the campus of Florida Gulf Coast University.

Legend

- Study Site
- 1-ha Campus Plot

Quantitative Water-use Comparison of an Invasive Tree Species, *Melaleuca quinquenervia*, and two Native Tree Species, *Taxodium distichum* and *Pinus elliotii*

T. M. Knight¹, R. M. Leisure III, and B.D. Everham III, and B.D. Bovard²

¹e-mail: tmknight@fgcu.edu, ²e-mail: bbovard@fgcu.edu, Department of Marine and Ecological Sciences Florida Gulf Coast University, 10501 FGCU Blvd S., Fort Myers, FL 33965, United States

Poster B31-0280



1. Abstract:

Melaleuca quinquenervia, an invasive tree species in southern Florida, is generally thought to have higher transpiration rates than the native vegetation. However, little empirical data is available to support this claim. In this study, thermal dissipation probes were used to measure transpiration rates of the three species growing in a hydric ecotone in southern Florida. Transpiration rates of *Melaleuca*, slash pine (*Pinus elliotii*), and bald cypress (*Taxodium distichum*) were compared to determine seasonal variability between the wet and dry seasons. Individually, trees of both slash pine and bald cypress showed significantly higher water fluxes than *Melaleuca* (p<0.05). However, when combined the fluxes were similar for the ecosystem-level. *Melaleuca* contributed 21% of the water flux and bald cypress contributed 74% during the wet season. *Melaleuca*'s increased contribution at the landscape-level results from higher tree densities at our study site. Following leaf senescence in the early dry season, bald cypress continues to be a significant water user at the landscape level. With higher atmospheric demands for water, bald cypress was the most conservative of the three species with respect to water use, whereas slash pine with low atmospheric demands for water the three species function similarly. These results do not support the hypothesis that *Melaleuca* uses more water than the native Florida tree species, however, they suggest the density of *Melaleuca* at the landscape-scale is important in our understanding of its role in the hydrologic cycle.

2. Introduction:

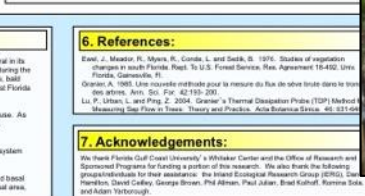
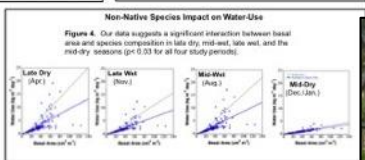
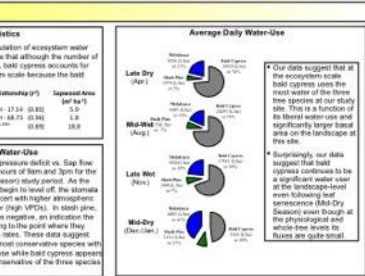
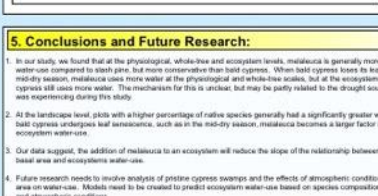
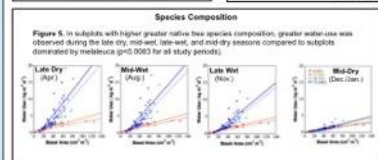
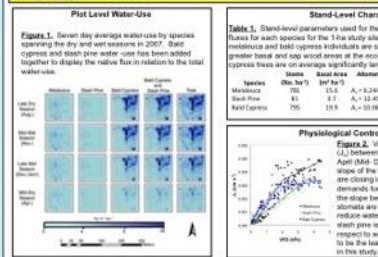
- *Melaleuca quinquenervia* transpiration rates are thought to be greater than bald cypress (*Taxodium distichum*) and slash pine (*Pinus elliotii*) in southern Florida, leading to reductions in wetland groundwater levels (Ewel et al. 1976).
- While some disagreement exists on *Melaleuca* seedlings and seedlings (Ewel et al. 1976), little empirical evidence is available regarding whole tree water-use in mature, unmanaged *Melaleuca* trees, and as a result, our understanding of *Melaleuca*'s impact on local hydrology is insufficient.
- This study provides a better understanding of *Melaleuca*'s role in its contribution to local ecosystem water-use by comparing its water-use with native tree species, bald cypress and slash pine.
- The data obtained from this study are important for understanding the role native and invasive trees play in the Greater Everglades' hydrology. Such an understanding is paramount if we are to accurately assess and manage local, regional, and global water resources.

3. Methods:

- Our study site was located on the campus of Florida Gulf Coast University within a hydric ecotone composed of *Melaleuca*, slash pine and bald cypress.
- Five individuals of each species (15 trees total) with a DBH ≥10cm were selected for study.
- Tree increment core samples from each species were obtained to determine species specific allometric relationship between DBH and sapwood area.
- Water fluxes (ΔL) were measured with thermal dissipation probes (TDP) (Granier 1985, Lu et al. 2004).
- Water fluxes were measured every minute and 30-minute averages were recorded using a CR-1000 datalogger (Campbell Scientific, Logan, UT).
- Average relative humidity, temperature and PAR (photosynthetically active radiation) were recorded at 30-minute intervals to determine their roles in controlling tree water-use.
- Using stand-level characteristics for our 1-hectare study site, we estimated ecosystem water-fluxes for each tree species during four 1-day periods spanning the dry and wet seasons in 2007.
- The 1-hectare study site was divided into a hundred 100 m² subplots.
- ArcGIS (ArcGIS 9.2, ESRI, Redland, CA) was used to generate water flux per species during the four study periods.



4. Results:



FGCU
at 20

5. Conclusions and Future Research:

1. In our study, we found that at the physiological, whole-tree and ecosystem levels, *Melaleuca* is generally more liberal in its water-use compared to slash pine, but more conservative than bald cypress. When bald cypress loses its leaves during the mid-dry season, *Melaleuca* uses more water at the physiological and whole-tree scales, but at the ecosystem scale, bald cypress still uses more water. The mechanism for this is unclear, but may be partly related to the drought southwest Florida has experienced during this study.
2. At the landscape level, plots with higher percentage of native species generally had a significantly greater water-use. As bald cypress undergoes leaf senescence, such as in the mid-dry season, *Melaleuca* becomes a larger factor in the ecosystem water-use.
3. Our data suggest, the addition of *Melaleuca* to an ecosystem will reduce the slope of the relationship between ecosystem basal area and ecosystem water-use.
4. Future research needs to involve analysis of genetic cypress seedlings and the effects of atmospheric conditions and basal area on water-use. Models need to be created to predict ecosystem water-use based on species composition, basal area, and atmospheric conditions.

6. References:

1. Ewel, J., Meador, R., Myers, R., Condit, L. and Seale, S. 1976. Studies of vegetation changes in south Florida. Part. 1. U.S. Forest Service, Res. Agreement 16-402, Univ. Florida, Gainesville, FL.
2. Granier, A. 1985. Using naturally induced and/or remote data flux to determine basal area from the air. Ann. Sci. For. 42:193-200.
3. Lu, P., Urban, L. and Png, Z. 2004. Granier's Thermal Dissipation Probe (TDP) Method for Measuring Sap Flow in Trees. Theory and Practice. Asia-Pacific J. Water, 41: 131-144.

7. Acknowledgements:

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Snake Radio Tracking Bird Diversity





Fungus Foray

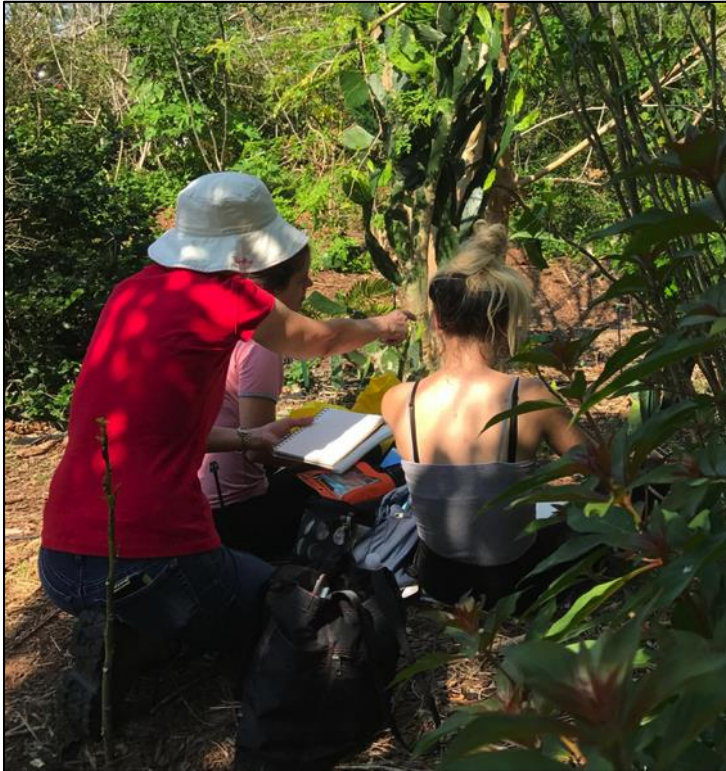
Ceramics Program

Ceramic Stepping Stones

- Tied to the Earth Charter
- Plants from campus used to create textures in the clay.
- Informal Teaching

Observational Drawing In the Food Forest

Permaculture



Runway Earth Fashion Show at FGCU Earth Day Festival



**Plastic Grocery
Bags**



Tires



**Plastic Garbage
Bags**



**State Park
Posters**

Service Learning with the Environmental Health and Safety Dept.

Earth Day Earth Charter Kites





Fungus Foray



Whitaker Center

for Science, Technology, Engineering and Mathematics Education

Girls in Engineering, Math, and Science (GEMS)



FGCU
at 20

Other Whitaker Center STEM Activities

Using our campus as a classroom:

K-12 Programs:

- Middle School Summer Research Opportunity (SRO) Lee/Charlotte & Collier County
- High School Summer Research Opportunity (SRO)
- STEM@Work-*Forensic Anthropology & WCE*
- SunChase - FGCU High School Solar Go-Kart Challenge
- SunChase - Elementary and Middle School Solar Car Challenges



K-12 Educator Programs:

- Schulze Summer STEM Institute Workshop for K-12 Teachers



Colloquium Class: Weigh the Waste Activity



<https://www.youtube.com/watch?v=mSAkCK4Qfns>

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Students on the Value of Using our Campus as a Classroom:

“... it demonstrates what conditions you will potentially be working under in the future and gives you **experience.**”