Isotopic Values for Southern Everglades Marshes: C and N Natural Abundance Study

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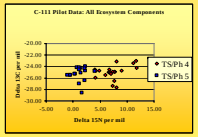
Abstract

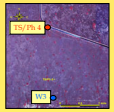
There is ongoing need for additional information and better understanding of the transformation, fate, and connectivity of nutrients in the Southern Florida Ecosystems. More specifically, research focusing on the manner in which Southern Everglades marshes process both nitrogen and phosphorus are of particular interest. The objective of this experiment was to characterize and quantify nitrogen cycling processes in the Southern Everglades marsh ecosystem. To do this, we 1) compared 15N natural abundances to N-cycling in mesocosms amended with 15N tracer and 2) compared natural abundance values for ecosystem components sampled from cross-slough transects. Nitrogen natural abundance analyses from this landscape wide transect study have shown that ecosystem components sampled in the C-111 basin at a near canal site (TS/Ph-4) possess a heavier, more enriched 15N signal (7.34‰± 2.27) than a downstream site (TS/PH-5) which has acquired a lighter, more depleted signal (1.17‰± 1.24). These data suggest that the marshes of the C-111 basin are acting as a sink for canal-borne dissolved inorganic nitrogen (DIN) and a source for "new" marsh derived DON to downstream ecosystems.

Project Rationale

Pilot data collected during the 2001 wetseason in the C-111 Basin (TS/Ph4 and W3) illustrated a clear shift in the isotopic signal between the near-canal and ecotone site. We built on these preliminary findings to create three cross-slough transects in the C-111 Basin, Taylor Slough, and Shark River Slough.



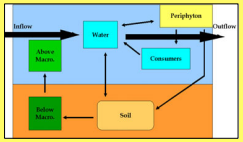
Pilot data from C-111 basin; scatter plot of all ecosystem components sampled: soil periphyton, and above- belowground macrophytes.



Map of C-111 basin illustrating study sites.

Long Term /Landscape Pattern Experiment

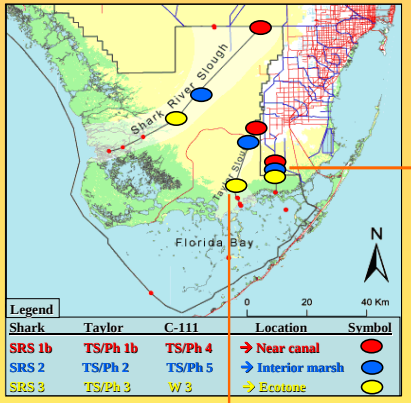
- **Temporally:** Long-term
- **Spatially:** Landscape level
- **Design:** Transect
- **Summary:** Broad landscape-scale natural abundance sampling, along inter-slough transects, will provide insight into the source of nitrogen to the marsh, its uptake and eventual downstream export.

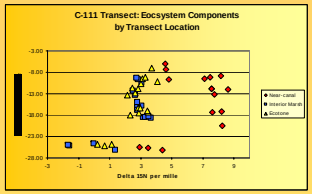


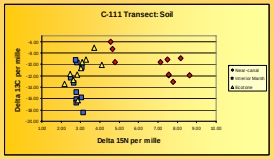
Conceptual diagram of the ecosystem components studied in this Project. Boxes represent component N pools and arrows represent flows of N between pools. Large arrows in and out of system represent N in the water Column moving downstream, through the study site.

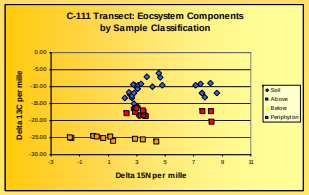
- The C-111 Basin and Taylor Slough are interesting study sites because:
  - Both possess northern boundaries anchored directly at the canal-marsh interface.
  - Approx. 10km of southern berm of the C-111was removed in 1997 to restore freshwater sheet flow to region; making it an ideal study site to examine the long-term effects of restored hydrological flow.

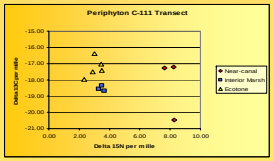
Results

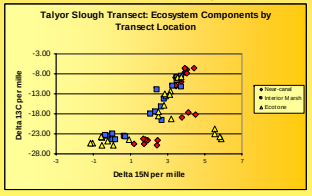


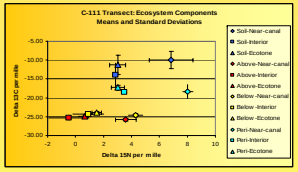


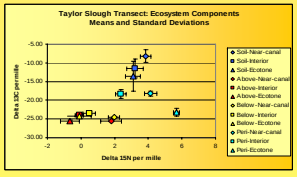


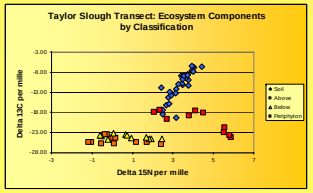


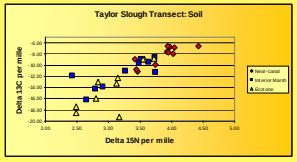


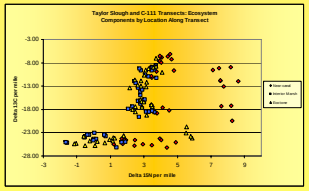


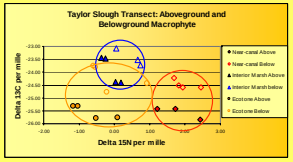












Acknowledgments

Thanks to everyone who has helped make this poster possible. Those listed have assisted with data analysis, research ideas, field logistics and sampling, and support: Bill Anderson, Dano Childers, Evelyn Gaiser, Jenny Richards, and Dave Rudnick, Varela High School: especially Nick Oehm and Susan Dailey, Wetland Ecosystem Lab: Damon Rondeau *et al.*, South Florida Water Management District, Florida Coastal Everglades LTER: Mike Rugge, SERC Stable Isotope Lab: Mark Kershaw *et al.*, EcoTank at FIU: Patrick Gibson and David Iwaniec

Summary

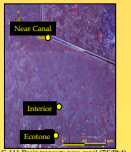
Near canal sites:

- Canal-borne N appears to be isotopically enriched or "heavy."
- This enriched N does not travel very far into the marsh.
- Near canal marshes may be acting as a sink (isotopically) for a "heavier" canal-borne N signal.

Interior marsh sites:

- Ecosystem components are isotopically depleted or "light."
- Dominant N source may not be canal-derived and could be atmospherically derived and/or…
- N source is from a lighter upstream source.

C-111 canal and near-canal Site, TS/Ph4.



C-111 Basin transect; near-canal (TS/Ph4), interior marsh (TS/Ph5), and ecotone (W3) sites are shown.

So What?

Previous research by Parker (2000) found that low P loads into an within the ecosystem inhibit organic transformations. The majority of the TN pool remains intact as it travels through the marsh (Parker 2000).

These data show:

- There is internal DIN cycling, which is leading to depleted isotopic values as you move downstream.
- N moving downstream has "spiraled" through ecosystem components.
- Near canal marshes are acting as a sink (isotopically) for a "heavier" canal-borne N signal.
- Interior marshes may be sequestering atmospheric N and converting it to organic N

Authors

Jeffrey Wozniak is a Ph.D. candidate in the Department of Biological Sciences at Florida International University. He has been at FIU since 2001 and currently serves as the FCE LTER student group president. He enjoys playing hockey and long walks on the beach. He plans on graduating in late 2006 and moving to Houston, TX., where he will continue his research as a post-doctoral associate.

Magaly Dacosta is a sophomore at Felix Varela Senior High School where she is active in the Varela FFA, Class of 2008, and Student Government. She hopes to attend college, and is still undecided in her major. Magaly enjoys taking care of her show rabbits and mixed breed rabbits. She has been participating in the FCE LTER Student Outreach Program since May of 2005.