Saltwater Intrusion in the Everglades: Microbial Community Composition and Carbon Dynamics Under New Salinity Regimes

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Saltwater intrusion drastically changes soil biogeochemistry.

“chemical, physical, geological, and biological processes and reactions that govern the composition of the natural environment”
The Everglades are experiencing the effects of saltwater intrusion.
Microbial communities differ in marshes vs. mangroves.
Question and hypotheses

Question: Does the response of soil microbial communities to increases in salinity depend on original vegetation community?

$H_0$: All soil microbial communities will respond the same to increases in salinity regardless of original vegetation community.

$H_A$: Microbial community response to increases in salinity will differ based on place of original vegetation community.
Study location – Fakahatchee Strand Preserve State Park

Herbaceous

Transition

Mangrove
Introduction Objectives

Methods

Results

Conclusions

Next Steps

Soil biogeochemistry was assessed before the 2.5 month incubation.

Bioavailable nutrient pools

- $\text{NH}_4^+$
- $\text{PO}_4^{3-}$
- $\text{NO}_3^-$

Total nutrient pools

- $\text{TN}$
- $\text{TP}$

Microbial characteristics

August 2018

August 2018
During the incubation, salinity was increased and CO$_2$ flux was measured biweekly.

High tide = 5 cm

Low tide = 0.5 cm

August - October 2018
All of the same parameters were measured after incubation as before.

- Bioavailable nutrient pools
  - \( \text{NH}_4^+ \)
  - \( \text{PO}_4^{3-} \)
  - \( \text{NO}_3^- \)

- Total nutrient pools
  - TN
  - TP

- Microbial characteristics
Did the salinity treatments change anything?

As of yet, no

Elevation, organic matter, microbial biomass carbon all decreased but responses were not different with treatment
Instantaneous CO$_2$ flux did not differ between treatments.
Average CO$_2$ flux did not differ between treatments.
These results are vastly different from other studies.

Chambers et al. 2011

Short-Term Response of Carbon Cycling to Salinity Pulses in a Freshwater Wetland
The site is accustomed to exposure to high salinity.
Future work includes a qPCR method that tests for viability.
Based on these results, do I predict change in microbial community composition?

Unlikely
Thank you!
Extra slides
Florida’s coasts are particularly vulnerable to sea level rise.

Permanent Service for Mean Sea Level

~ 2-3 mm/yr
Most treatments lost height, likely from transport out of the core through the sides.
Sea level rise is not the only culprit.