Blue Carbon Sequestration Within a Northeastern Florida Intertidal Wetland - Response to Climate Change and Holocene Climate Variability

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Introduction

Carbon sequestration in northern Florida wetlands

Methods

Study site and proxies

Results and Discussion

Discussions of the top portion of cores and entire cores

Future Work

Comparing cores between coasts

Conclusions

What are the cores telling us so far?
Carbon Sequestration in Northern Florida Wetlands

- Terrestrial sequestration is a natural way to reduce CO$_2$ emissions.
- Blue carbon habitats bury more carbon per unit area compared to any other terrestrial system.
- The destruction and conversion of these habitats via anthropogenic activity and sea-level rise results in the conversion of previously stored carbon into CO$_2$ (Pendleton et al., 2012).
- Increase in mangrove extent with climate change may alter carbon storage.
Goals of This Study

- Do we see differences in carbon being stored in the top 20 cm between marsh, mangrove, and transition sites in northern Florida wetlands?

- Have there been any significant changes to carbon storage over a longer interval (down to 300 cm)?

- If there have been changes, are those driven by changes in Florida’s climate and can that be linked to changes in vegetation?

- Could there be any anthropogenic influences on carbon storage?
Study Site - Anastasia Island (St. Augustine, Fl)
Methods:

- Split vibracores in 2 cm intervals
- 100 year record
  - Presented with Pb$^{210}$/Cs$^{137}$ dating
  - Used CRS model
- Long-term Holocene record
  - Will be dated using $^{14}$C

Biomarkers

Shown today: Lignin
Will also include alkanes and sterols

Carbon Isotopes

% TOC
$\delta^{13}$C: Indicator of organic carbon sources (C3 vs. C4 vs. algal)
**Top Core**

<table>
<thead>
<tr>
<th>Organic Carbon Stock</th>
<th>100 years (g/cm²)</th>
<th>100-year depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsh</td>
<td>0.372</td>
<td>10</td>
</tr>
<tr>
<td>Mangrove</td>
<td>0.874</td>
<td>16</td>
</tr>
<tr>
<td>Transition</td>
<td>2.370</td>
<td>20</td>
</tr>
</tbody>
</table>

C Sequestration Rates (g m⁻² yr⁻¹) Anastasia Island (This study) Mean global carbon burial rates (McLeod et al. 2011)

<table>
<thead>
<tr>
<th></th>
<th>Anastasia Island (This study)</th>
<th>Mean global carbon burial rates (McLeod et al. 2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsh</td>
<td>37.24076805</td>
<td>218.000</td>
</tr>
<tr>
<td>Mangrove</td>
<td>87.39927998</td>
<td>226.000</td>
</tr>
<tr>
<td>Transition</td>
<td>237.0190943</td>
<td></td>
</tr>
</tbody>
</table>

Geldenhuys et al. 2016
TOC Profile - Does the OC get stored?

Pbc history online
Recording Shifts in Plant Communities?

Hawkes et al. 2016

\[
\delta^{13}C \text{ (‰)}
\]

-28 -26 -24 -22 -20 -18

\[
\text{C3} \quad \text{C4-like}
\]

\[
\text{Depth (cm)}
\]

0 10 20 30 40 50

Relative Sea Level (m)

St. Mary’s Nassau River (Kemp et al., 2014)

ICE6G-C VM6 Rot ICE6G-C VM5a Rot

EIV-IGP model (median, 68% and 95% credible intervals)
Comparing Coasts

Waccasassa Bay State Preserve

USGS
Conclusions

 The transition zone between mangrove and marsh currently sequesters the most carbon. Carbon sequestration rates are likely influenced by tides and vegetation structure.

 There were no recognizable changes in carbon amount or signatures with recent (100 years) vegetation community shifts.

 The large increase in TOC near 1 meter demonstrates that this carbon can be stored over long periods of time and may represent a former mangrove expansion.

 Shifts in vegetation communities over time are likely due to combination of gradual sea-level rise, increasing temperatures, and anthropogenic influences.
Thanks!

Questions?
North Florida Wetlands - Edge of Mangroves Northernmost Extent

Rodriguez et al., 2016