A Study on the Correlation Between Mangrove Height and Exoenzymatic Hydrolysis

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Characteristics of the Mangrove System

- Highly productive Tropical or Sub-Tropical environments
- Characterized by gradation of tree height
Twin Cays, Belize
Exoenzymes

- Bacteria can transport compounds < 600 Da through Membrane
- Bacteria needs method to access larger particles—primarily organic molecules
- Exoenzymes exist outside the cell
Factors Affecting Rates of Hydrolysis

- **Bacterial Association**
  - Pore water or Particulate

- **Vertical Profile**
  - Decreased enzyme and substrate with depth

- **Substrate Quality**
  - refractory, labile, affinity for enzymes

- **Substrate presence**
Reason for Release of Exoenzymes

- Response to Presence in environment, need, or both?
- Requires energy expenditure.
  - Not evolutionarily sound to release if there is no need
  - Also not efficient to release large amounts when nutrient is not present
- Hypothesis: Bacteria release exoenzymes when there is a need and nutrients are present. This would likely involve a positive feedback mechanism or receptors in the cell membrane
Methods

• Utilize a flourogenic substrate to measure the amount of hydrolysis that occurs in 30 minutes

\[ \text{Muf-S + enzyme} \rightarrow \text{Muf + S + enzyme} \]
The Goals

• Develop a method for measuring rates of hydrolysis of P, C and N substrates
• Establish points of saturation for each of the chosen substrates
What Weight Data Means

• Ratio of Dry to Wet.
  – Lowest ratio in Flocc, followed closely by Dwarf
  – This indicates flooding. Flooding is typically indicative of higher concentration of nutrients

• Ratio of Ash to Dry
  – Highest ratio Flocc, followed by Dwarf
  – This shows highest carbon content. It does not take into account nature of the carbon
Weights

<table>
<thead>
<tr>
<th>Weight (grams)</th>
<th>Fringe</th>
<th>Transition</th>
<th>Dwarf</th>
<th>Flocc</th>
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<tbody>
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- **Fringe**: Fringe
- **Transition**: Transition
- **Dwarf**: Dwarf
- **Flocc**: Flocc
Phosphorus Data (MUF-Phosphate Substrate)

![Graph showing Phosphorus Data for Fringe, Transition, Dwarf, and Flocc categories. The graph plots the amount of [\text{M}^3\text{M}-\text{Phosphate}] cleaved/g wet sed. across a range of values.]
Nitrogen (MUF-Leucine Substrate)

- Fringe
- Transition
- Dwarf
- Flocc

[µM of MUF-Leucine cleaved/g wet sed. vs. [µM of MUF-Leucine added to sediment] plot]
Carbon (MUF-Glucose and Galactose Substrates)

<table>
<thead>
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<th>[µM of MUF-β-D-Glucose] cleaved/g wet sed.</th>
<th>Fringe</th>
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<th>[µM of MUF-β-D-Glucose] added to sediment</th>
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<th>Flocc</th>
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[Graphs showing data for different substrates and conditions]
Future Plans

• Find saturation points for Leucine, Glucose and Phosphorus (already in progress)
• Run incubation experiments with a cellulase, fatty acid reductase?
• Pick favorites and design experiment
Bibliography