Floodplain Nutrient Retention along the Tangipahoa River

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Driving Questions

- What influence do floodplains have on riverine N loads and speciation?

- When are floodplains a source or sink for N? What forms of N and what N reactions are involved?
Abundance of active, forested floodplains in Southeastern US
Majority of water & nutrient flux occurs when river & floodplain waters are connected!
When does connectivity occur?
Retention: $f(\text{biogeochemistry, hydrology})$
Deposition

- Multiple tiles distributed across floodplain
- Measuring net deposition
- $3.2 - 23.4 \text{ g m}^{-2} \text{ yr}^{-1}$ of N
deposited components

g/m²/yr

- total
- mineral
- organic
- carbon
- nitrogen
Single stage samplers
Retention: $f(\text{biogeochemistry, hydrology})$
N-biogeochemistry

- N mass balance during floods

<table>
<thead>
<tr>
<th>Slough</th>
<th>DON</th>
<th>NH$_4^+$</th>
<th>NO$_3^-$</th>
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<td>Slough A</td>
<td>-136</td>
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<td>-278</td>
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<td>Slough B</td>
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$U_{\text{event}}$ [mg m$^{-2}$ d$^{-1}$]
N-biogeochemistry

- N mass balance during floods
- High removal rates, suggests importance of:
  Coupled mineralization – nitrification - denitrification

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N-biogeochemistry

- N mass balance during floods
- High removal rates
- $\text{NO}_3^-$ primarily lost through denitrification

Results from mesocosm experiments
N-biogeochemistry

- N mass balance during floods
- High removal rates
- NO₃⁻ primarily lost through denitrification
- Removal rates are not limiting: NO₃⁻ availability is...
Retention: \( f(\text{biogeochemistry, hydrology}) \)
Hydrologic Connectivity

• Connectivity = $f$(stage, topography)
• Physical measurements:
  • Water level sensors

Floodplain water level in 2 sloughs
Hydrologic Connectivity

- Connectivity = \( f(\text{stage, topography}) \)
- Physical measurements
- Developed GIS-based model: combines stage, topography to obtain inundation
What is annual removal along reach?

- Apply flood removal rates to estimated inundated area along reach for each day of 30-year flow record
- Daily N-fluxes estimated from NWIS measurements
- Quantify net removal

Highlights high N-flux when river & floodplain connected
What is annual removal along reach?

- N-retention largely depends on connectivity. Along this river 8 to 14% retention
What is annual removal along reach?

- But we need to understand N-fate during both wet & dry periods!
Unknown biogeochemical ?’s

-Fate of particulate organic matter
-What happens between floods?
Current Focus & Next steps

- Identify water sources over range of flood magnitudes
- Examine fate of particulates deposited on floodplain
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• Develop metric of river floodplain connectivity for stream network
  o Apply to stream network
  o Quantify connectivity
  o Potential use in floodplain valuation
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Plot showing the importance of floodplains in streams of different size & physiographic region: Floodplains are important!