Adsorption and desorption processes in shallow groundwater of mangrove ecotone, Taylor Slough

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How does the balance of fresh and marine water supply affect soluble reactive phosphorus (P) availability?
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How does the balance of fresh and marine water supply affect soluble reactive phosphorus (SRP) availability?
SRP: Soluble Reactive Phosphorus is the bioavailable form.
SRP-Ions

Adsorption

--- Equilibrium ---

SRP

Desorption
Taylor Slough Field Waters
## Taylor Slough Field Waters

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>Salinity, psu</th>
<th>SO$_4^{2-}$, µM</th>
<th>HCO$_3^-$ Alkalinity µM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fresh</strong></td>
<td>7.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>Ecotone</strong></td>
<td>6.7</td>
<td>16</td>
<td>11</td>
<td>17</td>
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<tr>
<td><strong>Seawater</strong></td>
<td>8.2</td>
<td>31</td>
<td>28</td>
<td>3</td>
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</table>
How do sediment P sorption reactions in the three endmember water types affect SRP availability in the mangrove root zone?

Fresh Groundwater  Ecotone Groundwater  Florida Bay Seawater
Sorption Experiments

1. Shake 24 hours
2. Filter and analyze for P

Δ P = Initial – Final
More adsorption

$\Delta P$ ↑

Saturation: $\Delta P$ at Inflection

Sorption efficiency: Slope

Higher SRP
Strong “P sink.”

- Fresh Groundwater
- Florida Bay Seawater
- Ecotone Groundwater

ΔP

Final SRP, µM
Final SRP, $\mu$M

$\Delta P$

Strong “P sink.”

Fresh Groundwater

Florida Bay Seawater

Ecotone Groundwater

“P source” (Very weak sink)
Strong “P sink.”

“P source”

“P sink”

“P source”

(Very weak sink)

Final SRP, μM

Fresh Groundwater

Florida Bay Seawater

Ecotone Groundwater
Snapshot of P Variability
in Taylor Slough Mangrove Ecotone

SRP µM

Groundwater

Surface water

Ecotone
Fresh Seawater
Equilibrium SRP

Snapshot of P Variability in Taylor Slough Mangrove Ecotone

Ecotone Groundwater will result in P desorption earliest.

Ecotone

Fresh Seawater

Equilibrium SRP

**SRP **
μM

<table>
<thead>
<tr>
<th>Date</th>
<th>Groundwater</th>
<th>Surface water</th>
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</table>
Snapshot of P Variability in Taylor Slough Mangrove Ecotone

Ecotone Groundwater will result in P desorption earliest.

"P source"

Ecotone Fresh Seawater

Equilibrium SRP
Conclusion:

Sediment P sorption reactions in the mangrove root zone cause SRP availability to change depending on water type:

- Ecotone Groundwater
- Florida Bay Seawater
- Fresh Groundwater
Acknowledgements

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