Impacts to Submerged Aquatic Vegetation Associated with Hydrologic Changes in the St. Johns River Estuary, Florida

Dean R. Dobberfuhr

Kenneth Moore
Objective

Develop a tool to assess potential effects of environmental forcings on submerged aquatic vegetation (SAV)
Lower Basin of the St. Johns River

- St. Johns River Watershed
- 500 km
- Low gradient
- Shallow
- Wetland dominated
- Blackwater
St. Johns River Salinity at 58 km

- Dynamic flow regime (tide, drought/flood)
- Reverse flow events
Environmental Forcing Factors

- Surface Water Withdrawals
- Sea level rise
- River channel dredging
Workflow for Salinity Effects

SAV Salinity Exposure Model

Hydrodynamic Model Salinity Data

GIS

Spatially explicit salinity effects on SAV

\[ \Delta \text{ Frequency of stress events} \]
Salinity-Duration Exposure Model for *Vallisneria americana*

Salinity duration model derived from:
- Literature review
- Salinity exposure experiments
- 12 years of SAV and WQ monitoring
- Intensive weekly monitoring
- Stress Enzyme experiments
### Model Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Withdrawal</th>
<th>Landuse</th>
<th>Rediversion Projects</th>
<th>Sea Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Condition</td>
<td>0</td>
<td>1995</td>
<td>No</td>
<td>Current</td>
</tr>
<tr>
<td>Full Withdrawal</td>
<td>11.5 m³ s⁻¹</td>
<td>1995</td>
<td>No</td>
<td>Current</td>
</tr>
<tr>
<td>Sea Level Rise</td>
<td>0</td>
<td>2030</td>
<td>Yes</td>
<td>+ 28 cm</td>
</tr>
<tr>
<td>Channel improvement</td>
<td>0</td>
<td>2030</td>
<td>Yes</td>
<td>+ 14 cm</td>
</tr>
</tbody>
</table>

- Not all model permutations were run
- Some effects can be inferred from comparing scenarios that were run
1995 Landuse

Legend
Littoral_zone
base
- 0-2%
- 2-4%
- 4-6%
- 6-8%
- 8-10%
- 10-12%
- 12-14%

Legend
Littoral_zone
full
- 0-2%
- 2-4%
- 4-6%
- 6-8%
- 8-10%
- 10-12%
- 12-14%

Base Condition
Full Withdrawal
2030 Landuse + Rediversion Projects

Legend

Littoral_zone

sea_level

0-2%
2-4%
4-6%
6-8%
8-10%
10-12%
12-14%

Legend

Littoral_zone

channel

0-2%
2-4%
4-6%
6-8%
8-10%
10-12%
12-14%
Summary

- We developed a tool to estimate physiological stress of *V. americana* in the estuarine reach of the St. Johns River.
- The tool generates spatially explicit relative risk of increased stress conditions.
- The greatest risk of any single forcing was associated with channel improvement.
- Increased stress risk was confined to the most downstream areas.
Summary cont.

- Sea level rise, as modeled, was attenuated by channel morphology, future land use, and upstream rediversion projects.
- The addition of surface water withdrawals will exacerbate the effects of sea level rise.
- Future sea level rise will cause a “tipping point” where extant conditions can no longer attenuate increased salinity.
Yes! We’re CLOSED

Questions?