Evaluation of Inundation Depth and Duration Threshold for Cattail Sustainability

In-situ Study – Cattail Monitoring

Orlando Diaz and Kristin Vaughan

April 24, 2019
Overall Study Objective

- Identify field conditions such as water depth, duration, and frequency of inundation affecting Cattail (*Typha domingensis*) sustainability in the STAs.
Hypotheses

- There is an inundation duration threshold for cattail sustainability at a specific inundation depth, in terms of survival, growth, and propagation.
- The inundation period threshold is longer at a relatively shallow inundation depth than at deeper inundation conditions.
- Longer inundation durations than the threshold result in a decline in plant density, biomass, and the ability to propagate.
STA-3/4 Cell 2A – Plot Location
Monitored Parameters

- Water Depth
  - DBHYDRO Stage Data

- Cattail Monitoring Parameters
  - Plant density (adults, juveniles, adults with flower, and dead)
  - Photosynthesis
  - Leaf Elongation

- Plant Biomass
  - Samplings: November 2014, October 2015, and November 2017
  - Biomass components: Leaf, shoot base, root, rhizome and dead
Cattail Density Monitoring

- NW: 1.5 m
- SW: 1.5 m
- NE: 1 m
- SE: 1 m

N↑ 3 m

2 m W

Restoration Strategies for clean water for the Everglades
Plant Biomass Processing

Sorted Cattail Components

- Live shoot bases
- Live roots
- Live rhizomes
- Live leaves
- Dead CT leaves
- Dead below (roots, rhizomes, shoot bases)
STA-3/4 Cell 2A - Water Depth Data

Cattail Monitoring
Inflow Region WD
Outflow Region WD
Target Depth
<table>
<thead>
<tr>
<th>Water Year</th>
<th>Water Depth Range Categories (cm)</th>
<th>Days within Each Depth Range Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 38</td>
<td>38–61</td>
</tr>
<tr>
<td><strong>Inflow</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WY2015</td>
<td>0 (0%)</td>
<td>155 (43%)</td>
</tr>
<tr>
<td>WY2016</td>
<td>0 (0%)</td>
<td>20 (5%)</td>
</tr>
<tr>
<td>WY2017</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>WY2018</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Outflow</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WY2015</td>
<td>53 (14%)</td>
<td>263 (72%)</td>
</tr>
<tr>
<td>WY2016</td>
<td>0 (0%)</td>
<td>286 (78%)</td>
</tr>
<tr>
<td>WY2017</td>
<td>0 (0%)</td>
<td>227 (62%)</td>
</tr>
<tr>
<td>WY2018</td>
<td>0 (0%)</td>
<td>143 (50%)</td>
</tr>
</tbody>
</table>

*a Water depth ranges are based on stages at inflow and outflow structures.

*b Number of days per range category with their respective percentage in parenthesis.
Cattail Density Parameters

STA-3/4 Cell 2A, 2015 Season

STA-3/4 Cell 2A, 2016 Season

STA-3/4 Cell 2A, 2017 Season
Leaf Elongation Rate

STA-3/4, Cell 2A

Inflow
Outflow
Photosynthetic Rate

STA-3/4, Cell 2A

Inflow  Outflow
Cattail Biomass

<table>
<thead>
<tr>
<th>Zone</th>
<th>Nov-14</th>
<th>Oct-15</th>
<th>Nov-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflow</td>
<td>0.84</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td>Outflow</td>
<td>1.31</td>
<td>0.57</td>
<td>0.68</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biomass Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf</td>
</tr>
<tr>
<td>Nov-14: 52%</td>
</tr>
<tr>
<td>Oct-15: 73%</td>
</tr>
<tr>
<td>Nov-17: 65%</td>
</tr>
<tr>
<td>Belowground</td>
</tr>
<tr>
<td>Nov-14: 48%</td>
</tr>
<tr>
<td>Oct-15: 27%</td>
</tr>
<tr>
<td>Nov-17: 35%</td>
</tr>
</tbody>
</table>
Summary

- Total cattail densities (adult and Juvenile) significantly decreased in the deeper inflow region of the cell after the 2015 wet season.

- Cattail decline in the inflow region was likely caused by the prolonged deep water conditions during the 2016 and 2017 wet seasons.

- Leaf elongation rates were consistently higher in the inflow region, with higher rates measured early in the wet season (June-July).
Summary

- Aboveground biomass differences between the inflow and outflow region was not significant, but biomass values were consistently higher in the inflow region, suggesting that cattail plants from the inflow region grew larger to escape the deeper water condition.

- A noticeable decrease in the belowground biomass:leaf ratio in the inflow over the three-year period suggests the root and rhizomes of the cattail population were likely stressed more than shoots.

- Notable change in the biomass distribution in terms of aboveground and belowground biomass over time; with belowground biomass significantly decreasing at the end of the study.
Questions

Everglades National Park