The Lake Vegetation Index and Select FLEPPC Taxa

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Water Quality Standards Program
April 6, 2018
Overview

• The Lake Vegetation Index (LVI)
  • What is it?
  • How is it used by DEP?
  • How is it conducted?

• Regional and temporal patterns of FLEPPC taxa presence and dominance in lakes sampled for the LVI, 2005-2016
Lake Vegetation Index (LVI)

- The LVI is a multi-metric tool which assesses how similar a lake plant community is to a minimally disturbed community.

- **Quality Assurance:**
  - DEP SOP LVI 1000
  - LVI Primer document
  - Required team field proficiency and plant identification testing

- Included in Chapters 62-302 (Water Quality Standards) and 62-303 (Impaired Waters Rule), F.A.C., as primary lake biological assessment tool.
Lake Vegetation Index (LVI)

- **LVI Metrics:**
  1. % Native Taxa
  2. % Sensitive Taxa
  3. Coefficient of Conservatism score for Dominant/Co-dominant Taxa
  4. % FLEPPC Category 1 Taxa

- Metric selection based on correlation with an independent human disturbance gradient
  - HDG includes measures of water quality, habitat alteration, hydrologic alteration, and land use disturbance (Landscape Development Intensity Index)
The LVI field method involves dividing a lake into 12 sections, and identifying the plant taxa in 4 of the 12 sections.
LVI Field Methods

- Plants are identified by visual “drive by” and 5 m belt transect
- Frotus is deployed a minimum of 5 times during belt transect
- Unknowns are collected, placed on ice, and identified in the lab with reference herbarium, or sent to expert
- Metrics and Index calculated per DEP SOP LVI 2200

![Diagram showing LVI Field Methods with sections marked as Emergent Zone, Submersed Zone, 5m Belt Transect, and Frotus deployment drive-by.](image-url)
LVI Field Methods

Frotus in action
**LVI Field Methods**

<table>
<thead>
<tr>
<th>Waterbody:</th>
<th>County:</th>
<th>Date:</th>
<th>Analyst:</th>
<th>Signature:</th>
<th>STORET:</th>
</tr>
</thead>
</table>

**DEP FORM FD 9000-27 LAKE VEGETATION INDEX FIELD SHEET**

*Except where noted as "sp." species level identification required. *Genera that may require lab verification* Plants in bold= FLEPPC invasive exotic.*

It is important to note dominant or co-dominant taxa (by areal extent) for each unit. Use "D" to denote dominant taxon, or "C" for the 2 co-dominant taxa.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>Collect ed? (√)</th>
<th>SPECIES</th>
<th>Collect ed? (√)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer rubrum</td>
<td>Habenaria repens</td>
<td>Alternanthera philoxeroides</td>
<td>Hydrilla verticillata</td>
</tr>
<tr>
<td>Andropogon sp.</td>
<td>Hydrocotyle sp.</td>
<td>Azolla filiculoides (A. caroliniana)</td>
<td>Hygrophila polysperma</td>
</tr>
<tr>
<td>Baccharis sp.</td>
<td>*Hypericum fasciculatum</td>
<td>Bacopa caroliniana</td>
<td>*Hypericum hypericoides</td>
</tr>
<tr>
<td>Bacopa monnieri</td>
<td>*Hypericum myrtifolium</td>
<td>Bidens laevis</td>
<td>Ilex cassine</td>
</tr>
<tr>
<td>Bidens mitis</td>
<td>Ipomoea aquatica</td>
<td>Blechnum serrulatum</td>
<td>Ipomoea sagittata</td>
</tr>
<tr>
<td>Boehmeria cylindrica</td>
<td>Itea virginica</td>
<td>Brasenia schreberi</td>
<td>Juncus effusus</td>
</tr>
<tr>
<td>Brasenia caroliniana</td>
<td>*Juncus marginatus</td>
<td>Centella asiatica</td>
<td>*Juncus megacephalus</td>
</tr>
<tr>
<td>Casuarina equisitifolia</td>
<td>*Juncus megacephalus</td>
<td>Cephalanthus occidentalis</td>
<td>*Juncus scirpoides</td>
</tr>
<tr>
<td>Centella asiatica</td>
<td>Juncus repens</td>
<td>Ceratophyllum demersum</td>
<td>Lachnanthes caroliniana</td>
</tr>
<tr>
<td>Chara sp.</td>
<td>Leersia hexandra</td>
<td>Cladium jamaicense</td>
<td>Landoltia punctata (Spirodela punctata)</td>
</tr>
<tr>
<td>Cladium jamaicense</td>
<td>Landoltia punctata (Spirodela punctata)</td>
<td>Cliftonia monophylla</td>
<td>Lemna sp.</td>
</tr>
<tr>
<td>Colocasia esculenta</td>
<td>Leucothoe racemosa (Eubotrys racemosa)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assignment of Dominance/Codominance

• One dominant taxon is assigned if it is twice as abundant as each of the other taxa.

• Two co-dominant taxa are chosen if there are two taxa that are abundant and it is unclear that one taxon is definitively more abundant than the other.
  • When in doubt, codominance is chosen.

• If no taxon is abundant, or taxa are so evenly distributed that assignment is not possible, dominance is not assigned.

• Dominance is by areal extent, and all strata considered.
Calculation of LVI

- Calculate each metric for each sampling section
  - % Natives (can include genus-level, if genus is native)
  - % Sensitives (C of C ≥ 7)
  - % FLEPPC Cat 1 taxa
  - C of C of Dominant/Co-dominant taxa

- Metrics are averaged for section LVI score
- Section LVI scores are averaged for final LVI score
- Calculations specific to north and south regions

  South Index period-April 1-November 30
  North Index period-May 1-October 30
A C of C score is assigned to a plant species based on its degree of fidelity to a specific set of ecological conditions, using an expert group.

- **0** Alien and invasive native taxa
- **1.0 - 3** Tolerant taxa
- **3.1 - 6** Ubiquitous taxa
- **6.1 - 9** Intolerant (sensitive) taxa
- **9.1 – 10** Taxa that exhibit high degree of fidelity to a narrow set of ecological conditions.

Extensive review of C of C scores in Feb 2011
Select FLEPPC Investigation

• LVI data collected from 2005-2016 (888 lakes, 1744 samples) for water quality monitoring and assessment purposes (some probabilistic, some targeted)

• These data provide a wealth of information on aquatic plant species, their attributes, as well as associated water quality (physical, nutrients, bacteriological)

• DEP investigated select FLEPPC taxa presence and dominance in lakes sampled for the LVI
**Select FLEPPC Investigation**

Select FLEPPC Taxa

<table>
<thead>
<tr>
<th>CATEGORY 1</th>
<th>CATEGORY 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Colocasia esculenta</em></td>
<td><em>Alternanthera philoxeroides</em></td>
</tr>
<tr>
<td><em>Eichhornia crassipes</em></td>
<td><em>Cyperus involucratus</em></td>
</tr>
<tr>
<td><em>Hydrilla verticillata</em></td>
<td><em>Landoltia punctata</em></td>
</tr>
<tr>
<td><em>Hymenachne amplexicaulis</em></td>
<td><em>Limnophila sessiliflora</em></td>
</tr>
<tr>
<td><em>Ipomoea aquatica</em></td>
<td><em>Myriophyllum spicatum</em></td>
</tr>
<tr>
<td><em>Ludwigia peruviana</em></td>
<td><em>Panicum maximum</em></td>
</tr>
<tr>
<td><em>Nymphoides cristata</em></td>
<td><em>Sphagneticola trilobata</em></td>
</tr>
<tr>
<td><em>Panicum repens</em></td>
<td><em>Xanthosoma sagittifolium</em></td>
</tr>
<tr>
<td><em>Pistia stratiotes</em></td>
<td></td>
</tr>
<tr>
<td><em>Salvinia minima</em></td>
<td><em>Oxycaryum cubense</em>*</td>
</tr>
<tr>
<td><em>Sapium sebiferum</em></td>
<td></td>
</tr>
<tr>
<td><em>Schinus terebinthifolia</em></td>
<td></td>
</tr>
<tr>
<td><em>Urochloa mutica</em></td>
<td></td>
</tr>
</tbody>
</table>

**Basis for selected taxa:**

1. Species is aquatic or has wetland status (Obligate, Faculatative Wetland, or Facultative), requirement for LVI)

2. Occurred in at least 10 LVI samples (2005-2016)

3. ***Oxycarum cubense* (syn of *Cyperus blepharoleptos*) not FLEPPC, but of concern because of recent apparent spread in North FL**
Florida Lakes sampled for the LVI, 2005-2016
LVI Lakes with Select FLEPPC Taxa Present

Target Taxa Counts

Number per Lake
- 1 - 3
- 4 - 6
- 7 - 9
- 10 - 14

Zone
- North A
- North B
- Central A
- Central B
- South

For display only
Map content: Ashley.O'Neal@dep.state.fl.us
Map Copies: Janis.Morrow@dep.state.fl.us
Date: 3/21/2018
North A Region
LVI Lakes with Select FLEPPC Taxa Present

Target Taxa Counts

Zone - North A
Number per Lake
- 1 - 3
- 4 - 6
- 7 - 9
- 10 - 14

LVI Lakes 2005-2016

- Zone - North A
  - Lakes

North A Region
All LVI Lakes
Central A Region
LVI Lakes with Select FLEPPC Taxa Present

Target Taxa Counts
Zone - Central A
Number per Lake
- 1 - 3
- 4 - 6
- 7 - 9
- 10 - 14

Central A Region
All LVI Lakes
Central B Region
LVI Lakes with Select FLEPPC Taxa Present

Target Taxa Counts

Zone - Central B Number per Lake
- 1 - 3
- 4 - 6
- 7 - 9
- 10 - 14

Central B Region
All LVI Lakes
LVI Lakes with Select FLEPPC taxa Dominant or Co-dominant

Lakes with Dominant and Codominant Target Taxa

Number per Lake
- 1
- 2
- 3
- 4

Zone
- North A
- North B
- Central A
- Central B
- South

For display only.
Map content: Ashley.O'Neal@dep.state.fl.us
Map Copies: Janis.Morrow@dep.state.fl.us

Date: 3/21/2018
North A Region
LVI Lakes with Select FLEPPC Taxa Dominant or Co-dominant

LVI Lakes 2005-2016
Zone - North A
- Lakes

Lakes with Dominant and Codominant Target Taxa

Zone - North A
Number per Lake
- 1
- 2
- 3
- 4

North A Region
All LVI Lakes
North B Region
LVI Lakes with Select FLEPPC Taxa *Dominant or Co-dominant*

Lakes with Dominant and Codominant Target Taxa

Zone - North B
Number per Lake
- 1
- 2
- 3
- 4

LVI Lakes 2005-2016

Zone - North B
- Lakes

North B Region
All LVI Lakes
Central A Region
LVI Lakes with Select FLEPPC Taxa *Dominant or Co-dominant*
Central B Region
LVI Lakes with Select FLEPPC Taxa Dominant or Co-dominant

Lakes with Dominant and Codominant Target Taxa

Zone - Central B
Number per Lake
1
2
3
4

LVI Lakes 2005-2016
Zone - Central B
• Lakes

Central B Region
All LVI Lakes
<table>
<thead>
<tr>
<th>Taxon</th>
<th>Frequency of Dom/Co-dom by Lake, 2005-2016 (N=888)</th>
<th>% of Lakes with Taxon as Dom/Co-dom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panicum repens</td>
<td>204</td>
<td>23.0</td>
</tr>
<tr>
<td>Hydrilla verticillata</td>
<td>79</td>
<td>8.9</td>
</tr>
<tr>
<td>Ludwigia peruviana</td>
<td>72</td>
<td>8.1</td>
</tr>
<tr>
<td>Oxycaryum cubense</td>
<td>39</td>
<td>4.4</td>
</tr>
<tr>
<td>Eichhornia crassipes</td>
<td>36</td>
<td>4.1</td>
</tr>
<tr>
<td>Alternanthera philoxeroides</td>
<td>23</td>
<td>2.6</td>
</tr>
<tr>
<td>Schinus terebinthifolia</td>
<td>22</td>
<td>2.5</td>
</tr>
<tr>
<td>Colocasia esculenta</td>
<td>12</td>
<td>1.4</td>
</tr>
<tr>
<td>Salvinia minima</td>
<td>8</td>
<td>0.9</td>
</tr>
<tr>
<td>Pistia stratiotes</td>
<td>6</td>
<td>0.7</td>
</tr>
<tr>
<td>Urochloa mutica</td>
<td>6</td>
<td>0.7</td>
</tr>
<tr>
<td>Sphagneticola trilobata</td>
<td>5</td>
<td>0.6</td>
</tr>
<tr>
<td>Hygrophila polysperma</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Hymenachne amplexicaulis</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>Myriophyllum spicatum</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>Nymphoides cristata</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Sapium sebiferum</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Top 5 most frequently Dominant/Co-dominant Select Taxa, by Percentage of Samples</td>
<td>Period of Record, 2005-2016 (N=1744)</td>
<td>2005-2008 (N=438)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Panico repens</td>
<td>19.0%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Hydrilla verticillata</td>
<td>7.3%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Ludwigia peruviana</td>
<td>5.4%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Oxycaryum cubense</td>
<td>2.9%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Eichhornia crassipes</td>
<td>2.4%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>
Conclusions

Key findings:

1. A very high percentage (89%) of LVI-sampled lakes had at least one select FLEPPC species present, and nearly half (48%) had 5 or more select FLEPPC species present, particularly in the Central A and Central B Regions.

2. 45% of lakes had at least one select FLEPPC species as a dominant or co-dominant, and 11% had 2 or more FLEPPC species as a dominant or co-dominant.

3. The most frequently dominant or co-dominant select taxa were Panicum repens (23% of lakes), Hydrilla verticillata (9%), Ludwigia peruviana (8%), Oxycaryum cubense (4%), and Eichornia crassipes (4%).