

# Macrophytes as Bioindicators of Freshwater Marshes in Florida

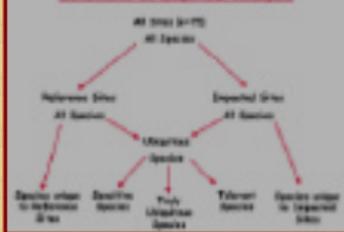
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## Project Goal:

To determine the applicability of macrophytes as bioindicators of isolated herbaceous wetland condition along a gradient of agricultural disturbance (cattle, crops, & citrus).



## Schematic of Empirical Analysis



## Definitions (see example, below):

- Unique Species:** occurring only in Reference Sites or in Impacted Sites
- Sensitive Species:** occur in more Reference Sites than Impacted Sites
- Tolerant Species:** occur in more Impacted Sites than Reference Sites.
- Truly Ubiquitous Species:** occur equally in Reference and Impacted Sites.

## Collection Procedures:

- Four transects: N,S,E,W
- Elongated 5m x 1m quadrants
- Start at wetland/upland boundary
- Note **presence** in each quadrant
- Sample from upland edge to wetland center

## Analysis Parameters:

- 75 marshes sampled
- Species Composition
- Annual or perennial
- Invasive exotics

**Unique Reference:** the presence of these plants indicates very low disturbance

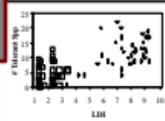
Species	Total Sites	% of all sites	% Reference sites
<i>Gratiola ramosa</i>	10	13.3	27.8
<i>Rhynchospora filifolia</i>	8	10.7	22.2
<i>Stillingia aquatica</i>	5	6.7	13.9
<i>Brasenia schrobleri</i>	4	5.3	11.1
<i>Drosera brevifolia</i>	4	5.3	11.1
<i>Drosera capillaris</i>	4	5.3	11.1

**Unique Impacted:** the presence of these plants indicates high disturbance

Species	Total Sites	% of all sites	% Impacted sites
<i>Cyperus polydactylos</i>	18	24	46.2
<i>Cyperus thymoides</i>	17	22.3	43.6
<i>Eleocharis prostrata</i>	12	16	30.8
<i>Ruppia maritima</i>	12	16	30.8
<i>Setaria pumila</i>	10	13.3	25.6
<i>Alternanthera philoxeroides</i>	8	10.7	20.5

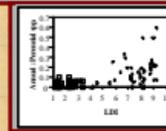
**Tolerant Species:** these increase with increasing disturbance. The smaller the R/I ratio, the more likely the plant was found in disturbed conditions.

Species	# Impacted Sites	# Reference Sites	R/I Ratio	Relative Tolerance
<i>Gratiola ramosa</i>	27	8	0.22	21
<i>Eleocharis acicularis</i>	17	7	0.26	18
<i>Hydrocotyle</i>	14	1	0.06	15
<i>Polygonum persicaria</i>	10	4	0.25	22
<i>Panicum capillare</i>	14	1	0.07	13



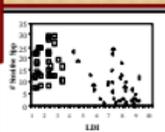
## Annual/Perennial Ratio:

the anticipated response of wetlands to disturbance is an increase in opportunistic "weedy" annual species.



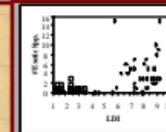
**Sensitive Species:** these decrease with increasing disturbance. The smaller the I/R ratio, the more likely the plant was found in reference conditions.

Species	Impacted Sites	# Reference Sites	I/R Ratio	Relative Sensitive
<i>Hydrocotyle pinnatifida</i>	1	22	0.04	16
<i>Panicum capillare</i>	4	25	0.20	14
<i>Andropogon virginicus</i>	1	22	0.05	14
<i>Lachnanthes caroliniana</i>	7	19	0.27	12
<i>Eleocharis acicularis</i>	4	16	0.25	11
<i>Proserpinaca perfoliata</i>	11	22	0.50	11



## Invasive Exotics:

exotics are indicative of anthropogenic disturbances.



## SUMMARY

- Macrophytes are potentially useful bioindicators
  - No. Sensitive & Tolerant Plants
  - No. Unique Reference & Impact
- No. Invasive & Exotic Species
- Annual : Perennial Ratio
- Additional analysis includes plant abundance within each wetland.