Potential vegetation criteria for reference-quality wetlands in Oklahoma

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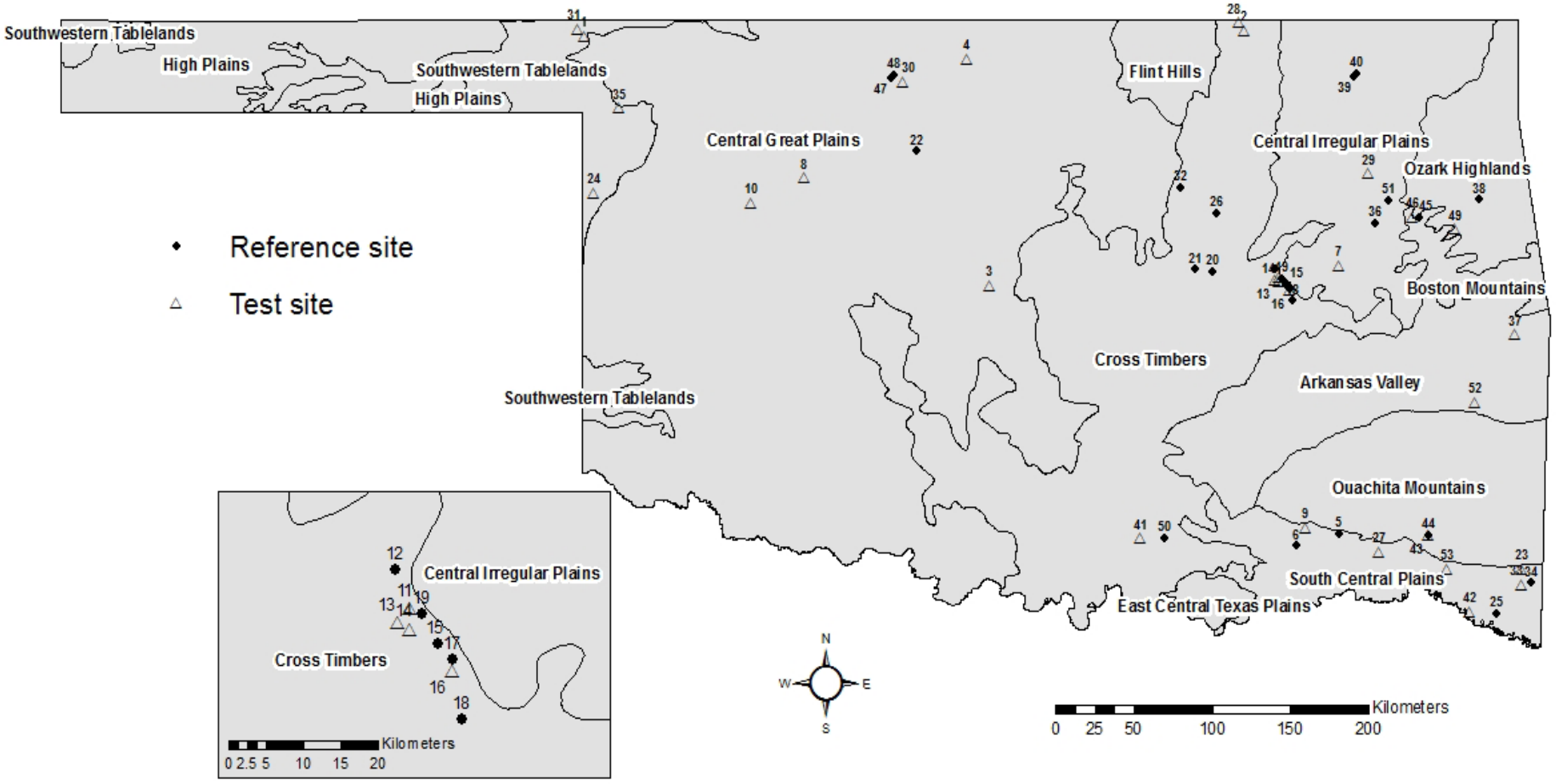
Project motivation

- Monitoring and Assessment, Action 2
  - "develop field-based assessment"
  - "identify unique and pristine wetlands"
- **Goal:** Establish vegetation criteria to help designate reference sites
- Funded by EPA Region 6

Site selection

- OK Reference Wetlands Guide (by OCC)
- OBS wetland inventory reports
- previous wetland studies by OSU
- field visits to 3 TNC preserves, 5 NWRs, 22 WMAs
- 24 initial reference sites
- 29 test sites


Reference site
Test site
Southwestern Tablelands
High Plains
Southwestern Tablelands
High Plains
Central Great Plains
Flint Hills
Central Irregular Plains
Ozark Highlands
Boston Mountains
Cross Timbers
Arkansas Valley
Southwestern Tablelands
Ouachita Mountains
South Central Plains
East Central Texas Plains
N
W
E
S
Kilometers
0 25 50 100 150 200
Central Irregular Plains
Cross Timbers
Kilometers
0 2.5 5 10 15 20

Wetland types

- prairie, agricultural, or forested surroundings
- non-forested emergent or scrub-shrub patches
- mostly riverine and depressional HGM classes

riverine beaver complex near Antlers

seep at Drummond Flats WMA

Data collection

- One-time surveys during 2012–2013
- Followed NWCA protocol
- Sampled vegetation in five 100-m^2 plots
- Identified vascular species and estimated cover

Data collection (buffer zone)

- Measured veg structure in 12 plots (25-m^2)
- Cover classes (absent, <10, 10-40, 40-75, >75%)
  - trees (<0.3 or >0.3 m diameter)
  - shrubs and saplings (<0.5 or 0.5-5 m tall)
  - forbs and grasses
  - litter and duff
  - bare ground
- Stressor tallies and mean buffer width

Analysis

1. Preliminary verification and metric selection
2. Fine-tuning the reference sample
3. Setting benchmarks and indicator species

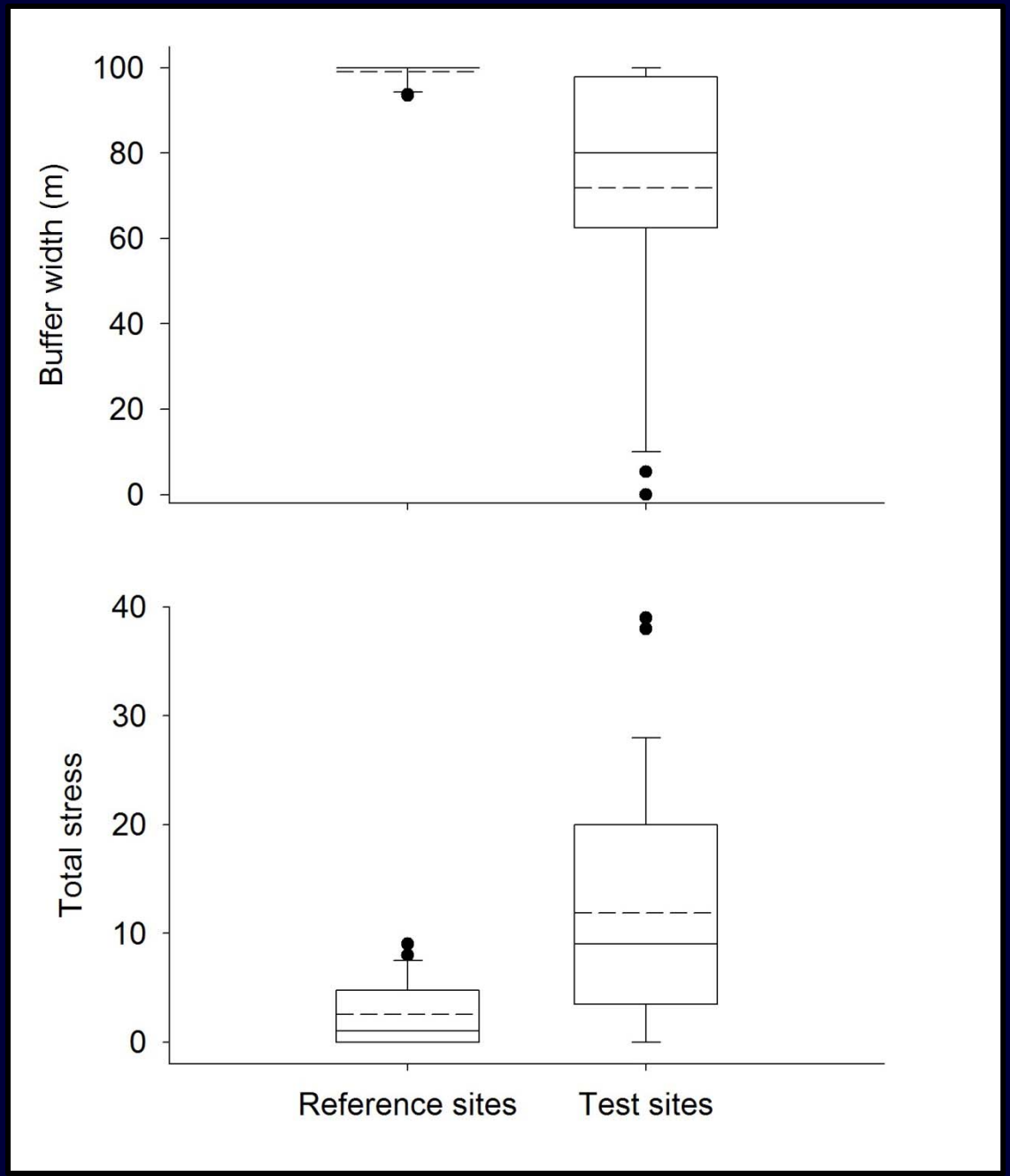
Analysis

1. Preliminary verification (box plots, randomization tests) and metric selection (standardized effect size)

2. Fine-tuning the reference sample (Test Site Analysis)

3. Setting benchmarks (BCA bootstrap CIs) and indicator species (new algorithm for species combos)

1.


Buffer width (m)
100
80
60
40
20
0
Total stress
40
30
20
10
0
Reference sites
Test sites

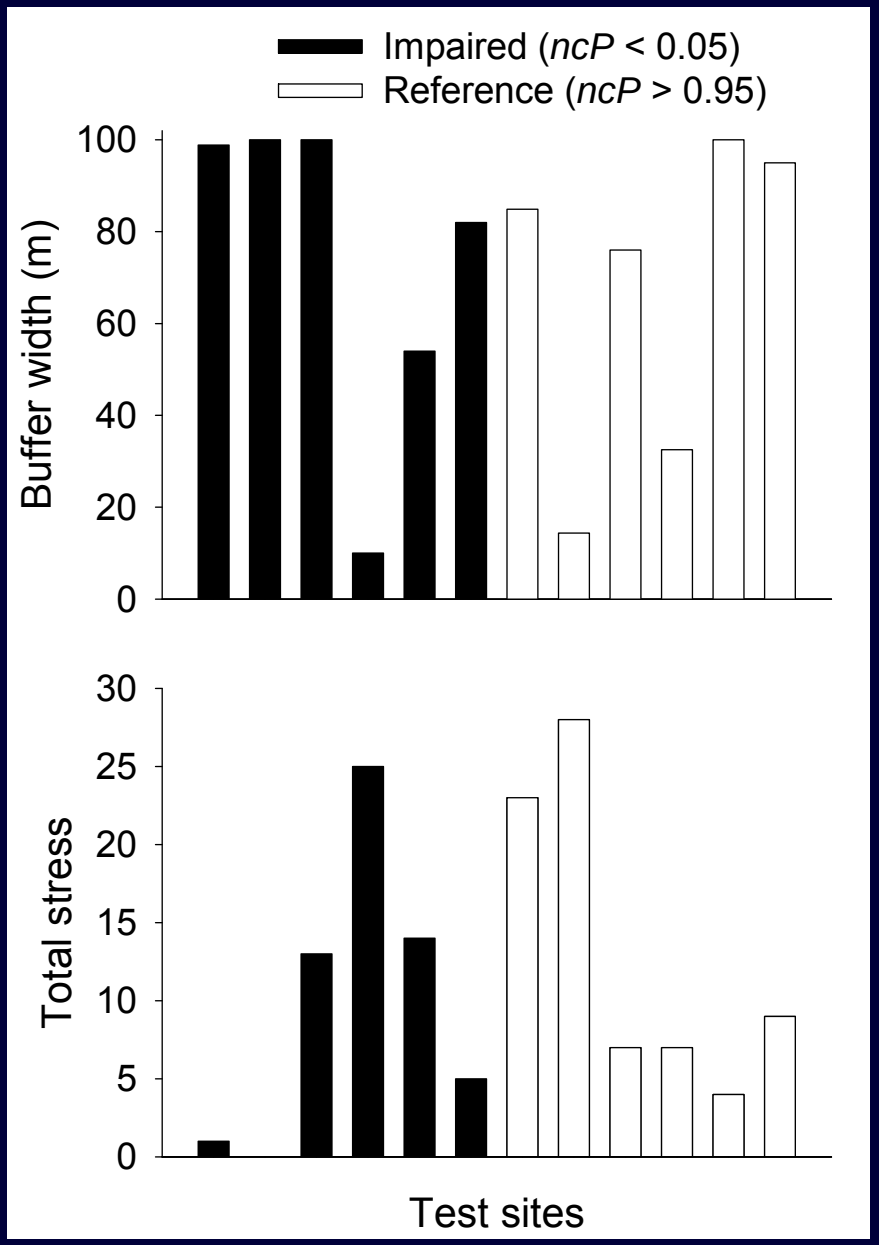
1. Standardized effect sizes

Metric	$ES_{unbiased}$	95% low	95% high	Greater mean value
FQAI	1.03	0.45	1.60	Reference group
CoC	0.76	0.20	1.33	Reference group
Bare	0.76	0.19	1.32	Test group
%Tolerant	0.74	0.19	1.30	Test group
BigTree	0.71	0.15	1.27	Reference group
NativeRich	0.69	0.13	1.25	Reference group
TotRich	0.65	0.09	1.20	Reference group
%Sensitive	0.60	0.05	1.16	Reference group
TallShrub	0.51	-0.04	1.06	Reference group
Litter	0.49	-0.06	1.03	Reference group

2.

Test Site Analysis

Test site	*D*	*ncP*	Status
A	16.16	<0.001	**Impaired**
B	7.08	0.044	**Impaired**
C	7.69	0.006	**Impaired**
D	29.61	<0.001	**Impaired**
E	12.08	<0.001	**Impaired**
F	10.18	0.001	**Impaired**
G	3.02	0.998	**Reference**
H	3.14	0.996	**Reference**
I	1.66	1.000	**Reference**
J	1.96	0.984	**Reference**
K	1.62	0.999	**Reference**
L	1.37	1.000	**Reference**


Impaired (ncP < 0.05)
Reference (ncP > 0.95)
Buffer width (m)
100
80
60
40
20
0
Total stress
30
25
20
15
10
5
0
Test sites

3.

Benchmark criteria

Scenario	Group	*n*	FQAI	Bare ground
All sites	Reference	29	18.03 , 20.94	2.21 , 4.50
	Non-reference	24	9.20 , 13.41	6.02 , 12.82
Forest	Reference	16	18.37 , 21.21	2.17 , 5.37
	Non-reference	8	12.17, 19.08	2.66 , 8.62
Prairie	Reference	13	16.45 , 21.99	1.71 , 5.12
	Non-reference	16	7.25 , 11.80	6.81 , 15.82
Depression	Reference	8	15.47 , 21.23	1.35 , 3.65
	Non-reference	16	8.50 , 12.67	4.76 , 13.61
Riverine	Reference	17	18.25 , 21.12	2.44 , 5.91
	Non-reference	6	6.81 , 19.15	5.43 , 18.00

Conservative reference-quality thresholds

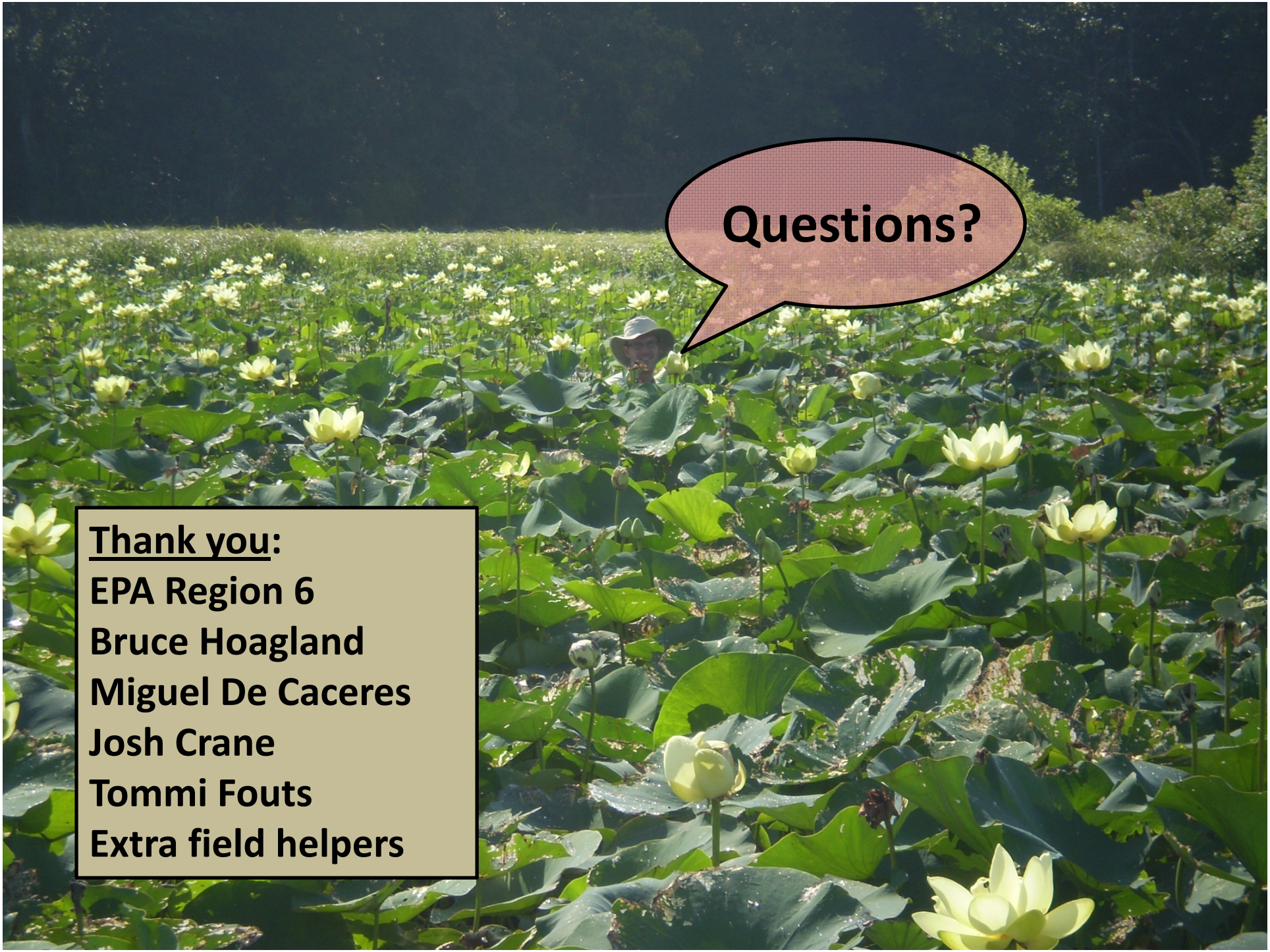
FQAI ≥ 20 and bare ground < 3-5%

3. Indicator species

Scenario	Final indicators	False-positive rate
Forest	*Carex lupulina*	0.12
	C. occidentalis & Juncus effusus & T. canadense	0
	Fraxinus pennsylvanica & Leersia oryzoides	0.21
	Glyceria striata	0.36
Prairie	*Scirpus cyperinus*	0
	C. occidentalis & Lemna valvidiana	0.25
Depression	NONE	n/a
Riverine	*J. effusus & T. canadense*	0.03
	Carex lupulina	0.12
	Carex crus-corvi	0.20
Forest-Riverine	*J. effusus & T. canadense*	0.19

Conclusions

- FQAI ≥ 20 may work best
- max of 3-5% bare ground cover in buffer zone
- other criteria
  - fewer than 10% of species are tolerant (CoC ≤ 2)
  - mean CoC > 5
- potential indicator species
  - *C. occidentalis* + *J. effusus* + *T. canadense* (forest ecoregions)
  - *Scirpus cyperinus* (prairie ecoregions)
  - *Carex lupulina* **or** *J. effusus* + *T. canadense* (riverine wetlands)



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