Floristic Quality Assessment in the Mid-Atlantic Region

Riparia at Penn State

mawwg mid-atlantic wetland workgroup

Floristic Quality Assessment

- Measures “quality” of site based on individual species fidelity to specific habitats and ecological tolerances
- Developed initially in Chicago region by Swink and Wilhelm to determine “nativity”
- Suite of metrics; most well known is Floristic Quality Index
- Metrics shown to be good predictors of anthropogenic disturbance

Floristic Quality Index

- FQI can be conceptualized as a weighted richness metric
- Plants are weighted based on the breadth of their ecological tolerances
- Weighting factor called a coefficient of conservatism (CoC or C value)

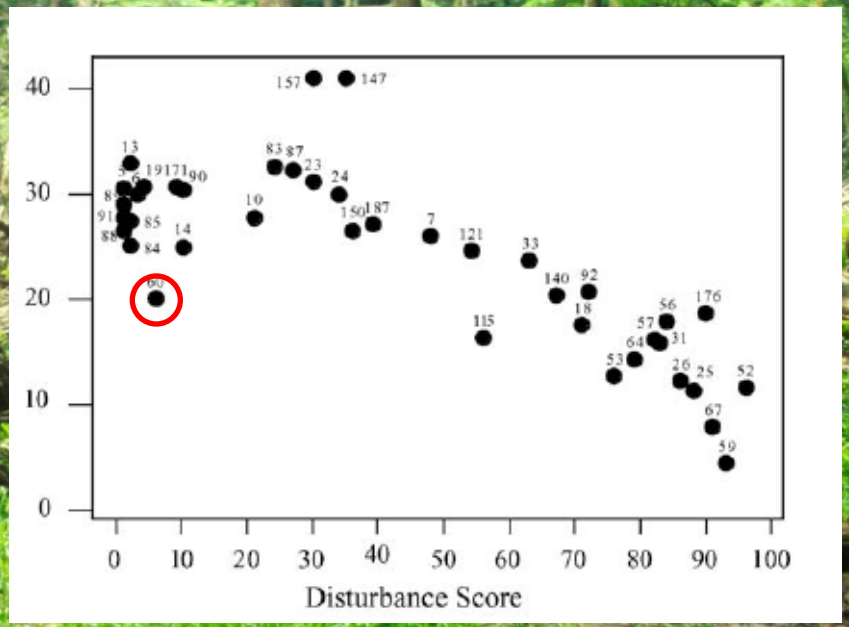
Coefficients of Conservatism

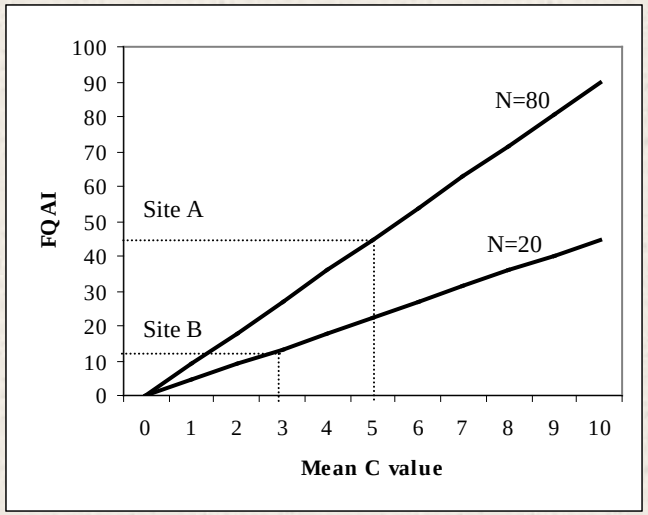
- Number between 0 and 10
  - Plants with broad ecological tolerances = 0
  - Plants with narrow ecological tolerances = 10
- Assigned on a regional or statewide basis
- Non-native species are not assigned value (or assigned assigned 0) and not used to calculate index

Floristic Quality Index

$$I = \overline{C} \times \sqrt{N}$$

$\overline{C}$ = Mean coefficient of conservatism
N = Number of native species

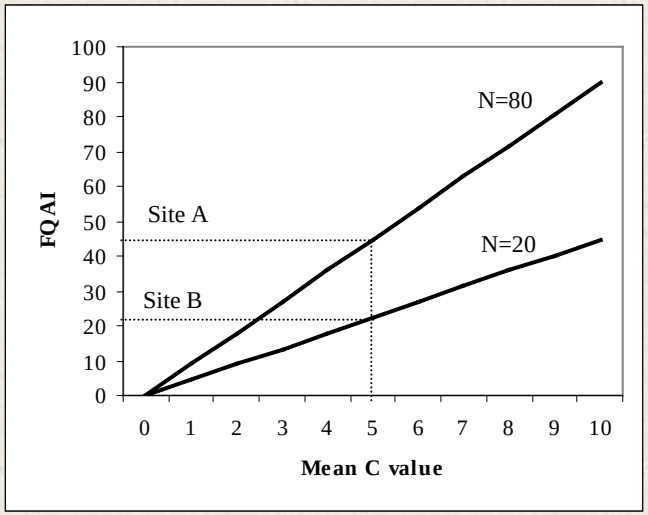




$\uparrow \uparrow$

$\overline{C}$ N

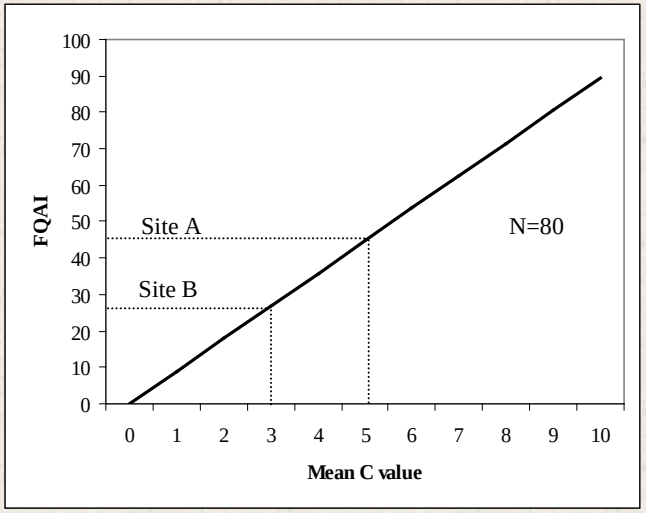
Scenario 1: Site A has higher $\overline{C}$ and greater species richness than Site B.



$= \uparrow$

$\overline{C}$ N

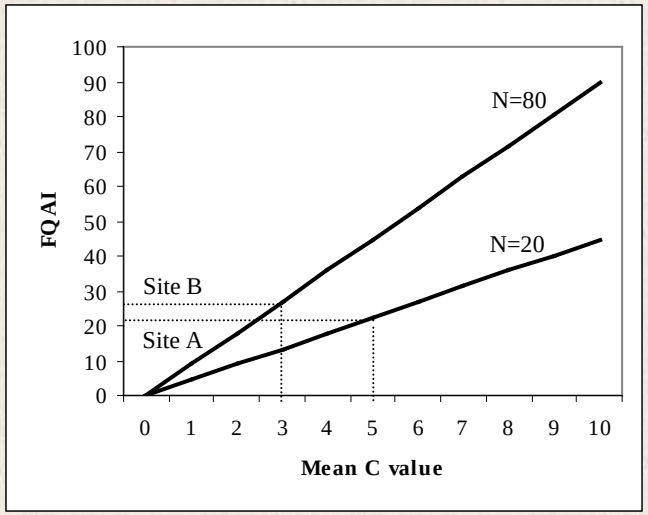
Scenario 2: Site A has equivalent $\overline{C}$ and greater species richness than Site B.



$\uparrow =$

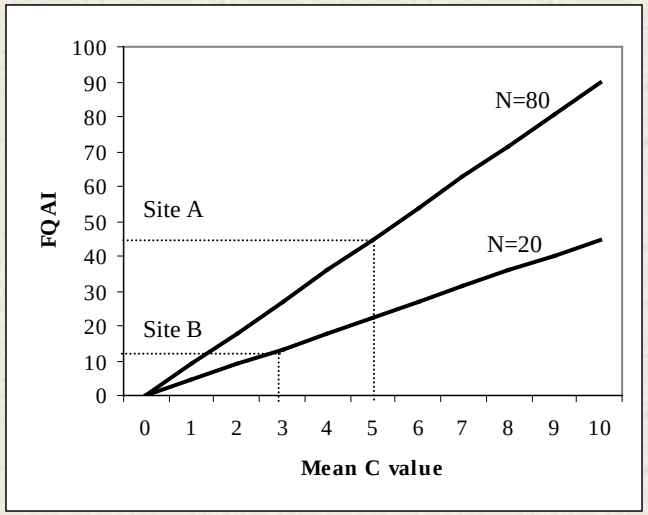
$\overline{C}$ N

Scenario 3: Site A has higher $\overline{C}$ and equivalent species richness to Site B.



Scenario 4: Site A has higher $\overline{C}$ and lower species richness than Site B.

Figure 3. Four observed FQAI outcomes based on $\overline{C}$ value and species richness (adapted from Taft et al. 1997).



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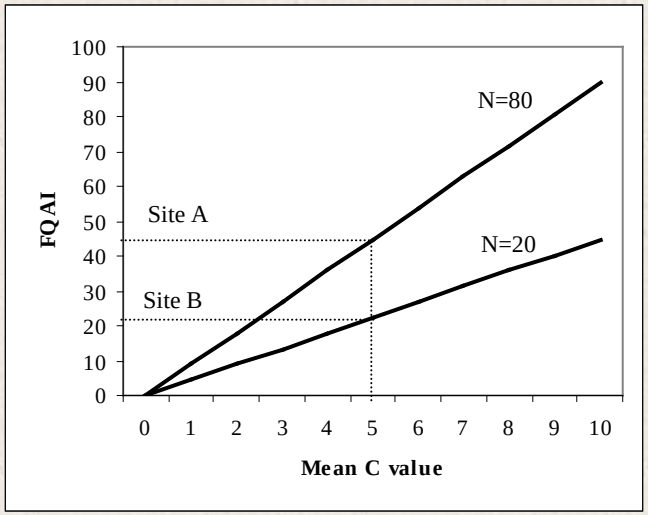
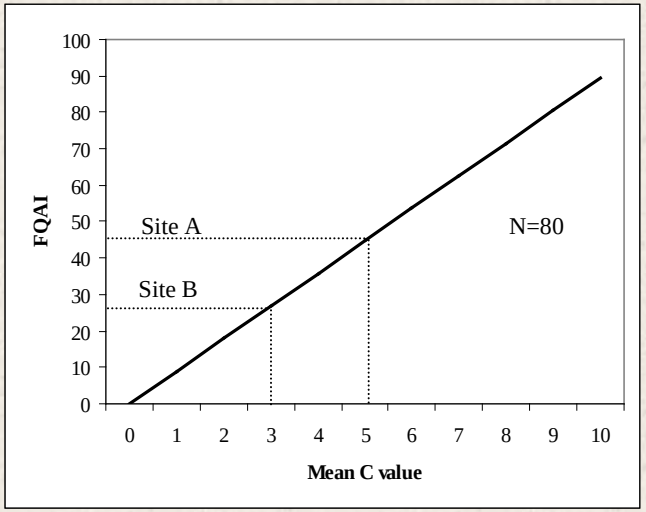
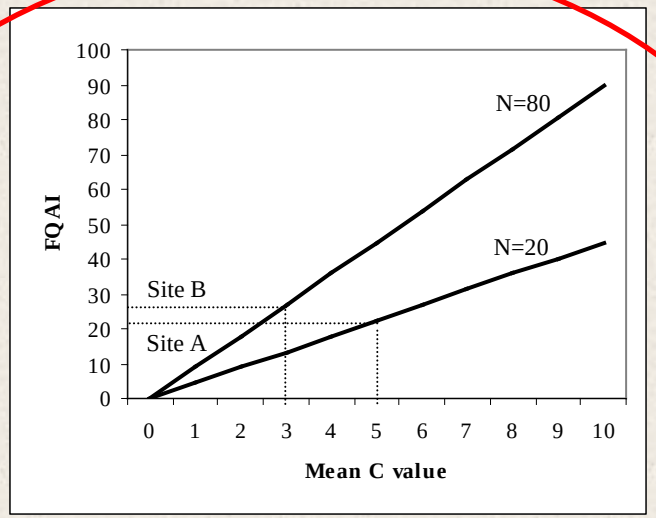


Scenario 2: Site A has equivalent $\overline{C}$ and greater species richness than Site B.



Scenario 3: Site A has higher $\overline{C}$ and equivalent species richness to Site B.

$\uparrow \overline{C}$ $\downarrow N$



Scenario 4: Site A has higher $\overline{C}$ and lower species richness than Site B.

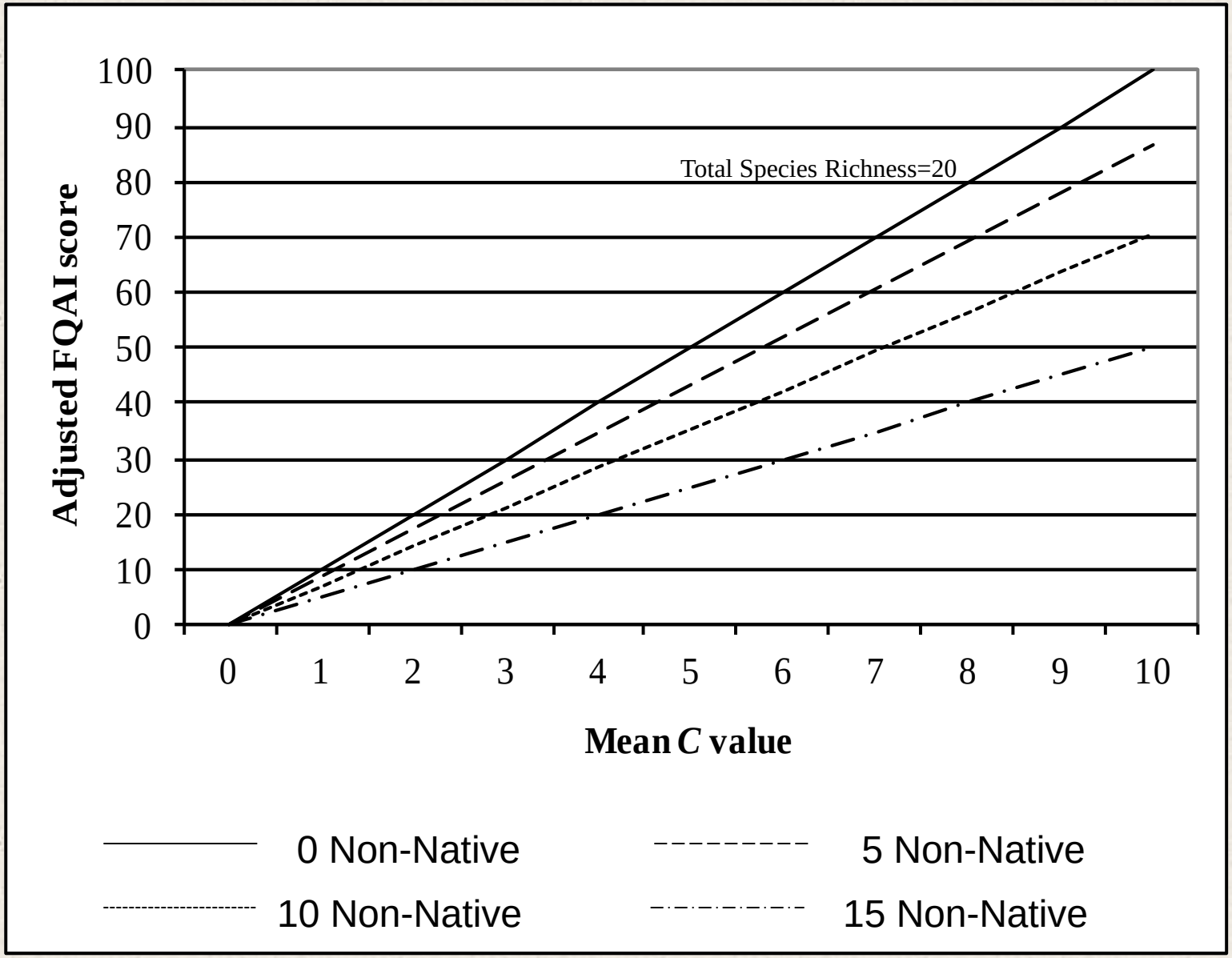
Figure 3. Four observed FQAI outcomes based on $\overline{C}$ value and species richness (adapted from Taft et al. 1997).

Adjusted Floristic Quality Index

$$I' = \left(\frac{\overline{C}}{10} \frac{\sqrt{N}}{\sqrt{N + A}} \right) * 100$$

$\overline{C}$ = Mean coefficient of conservatism
N = Number of native species
A = Number of non-native species

(Miller and Wardrop 2006)


Total Species Richness=20
Adjusted FQAI score
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
Mean C value
0 Non-Native
5 Non-Native
10 Non-Native
15 Non-Native

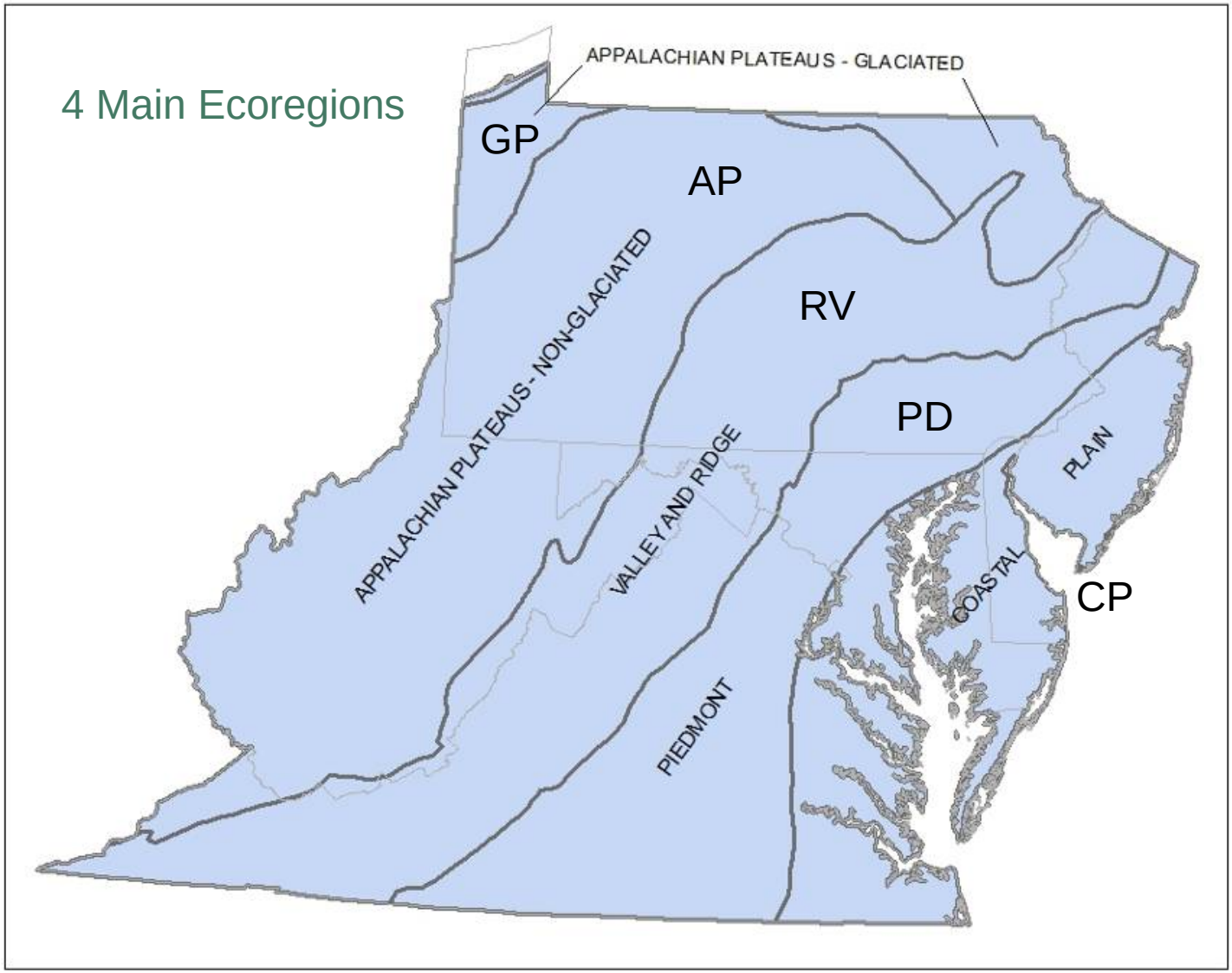
Regional Floristic Quality Assessment Project

- Assign coefficients to 4 main ecoregions in the Mid-Atlantic
  - Create regional plant list by ecoregion
  - Assemble botanical panel
- State involvement through MAWWG
  - Identify potential botanists
  - Identify existing sources of information
- User-friendly database with FQAI calculator

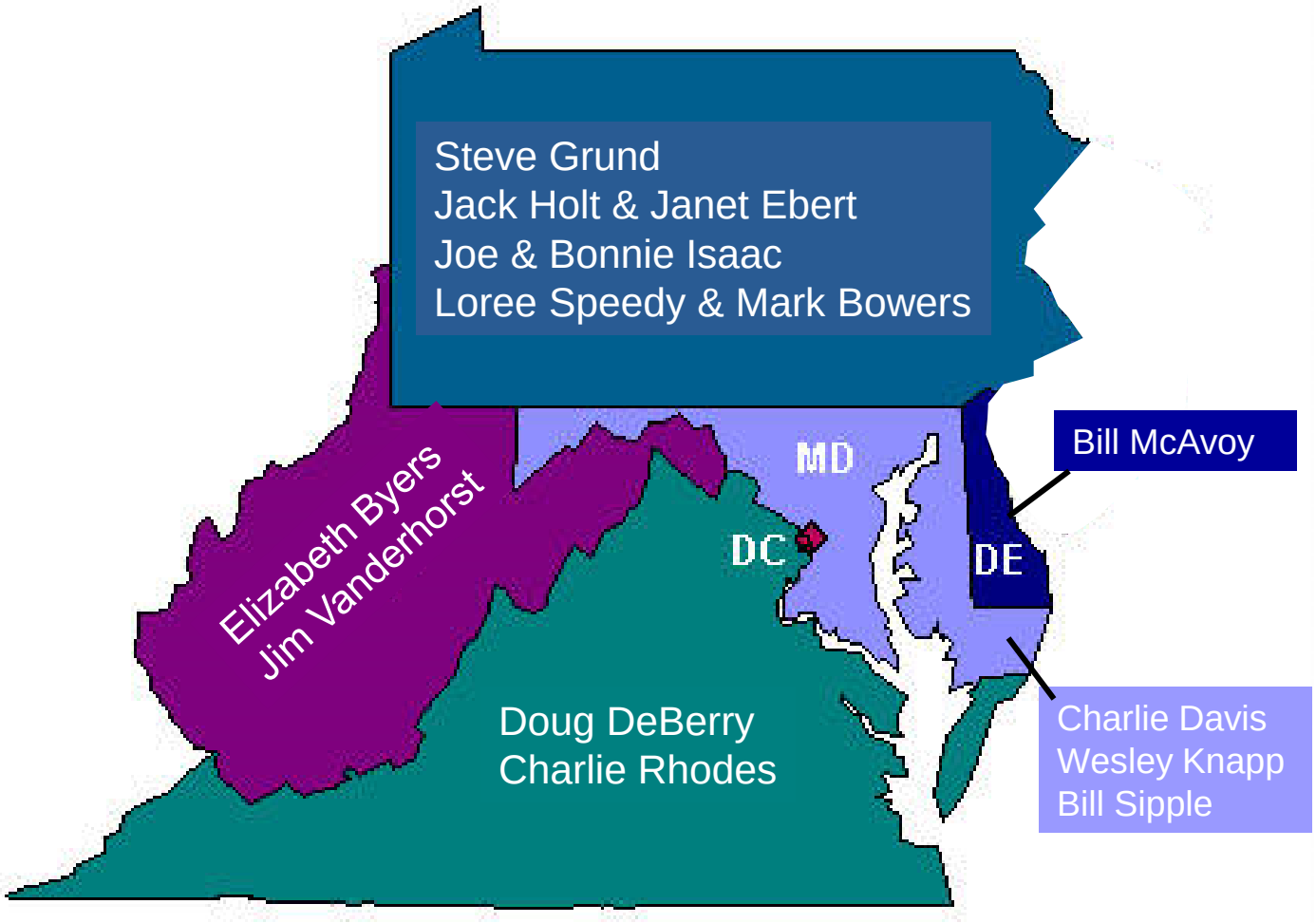
Assigning C Values

- USDA PLANTS database for initial list
- 13 botanists from 4 Mid-Atlantic states
- Meeting in Davis, WV November 13-16, 2009
- Follow-up via email

4 Main Ecoregions



Botanical Panel



Decision Rules

- C Value of:
- 0-3 -- Plants with a broad range of ecological tolerances/found in a variety of plant communities
- 4-6 -- Plants with an intermediate range of ecological tolerances/associated with a specific plant community
- 7-8 -- Plants with a narrow range of ecological tolerances/associated with advanced successional stage
- 9-10 -- Plants with a high degree of fidelity to a narrow range of pristine habitat

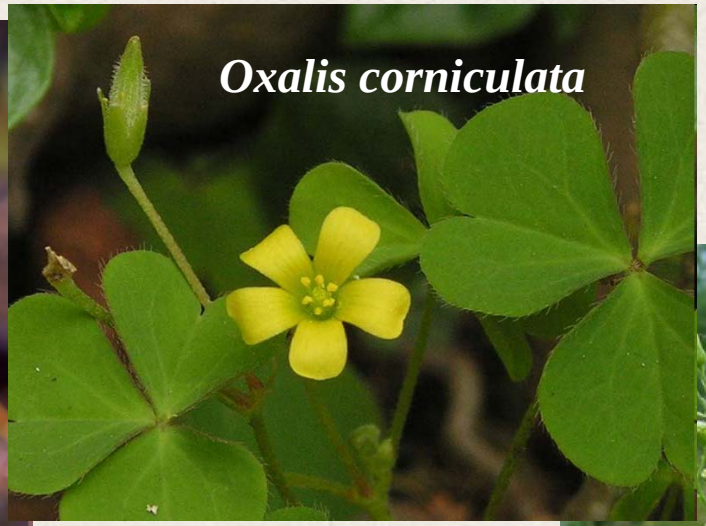
generalists

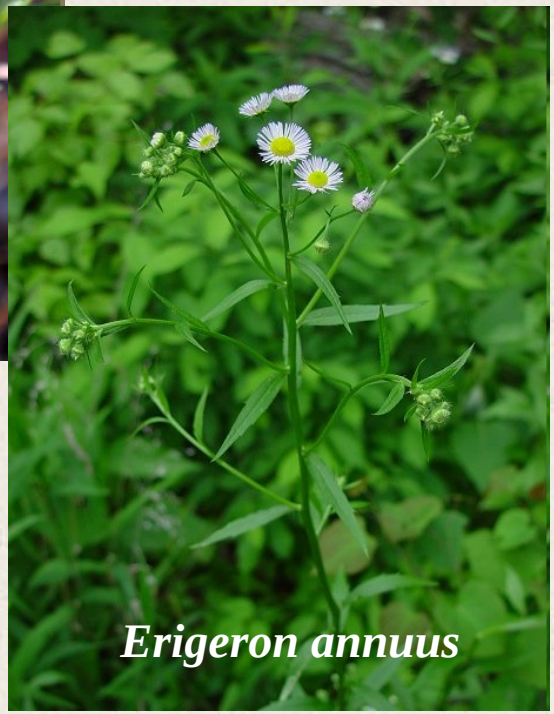
specialists

Project Overview

- Identified 4208 unique taxa
- Assigned C Values to 2794
- 1414 non-native
- Assigned by ecoregion
  - Most given single value across region
  - More than one value to account for ecoregional differences
- Did not assign C values to most hybrid taxa – only those that behave like true taxa

Chenopodium berlandieri


Oxalis corniculata

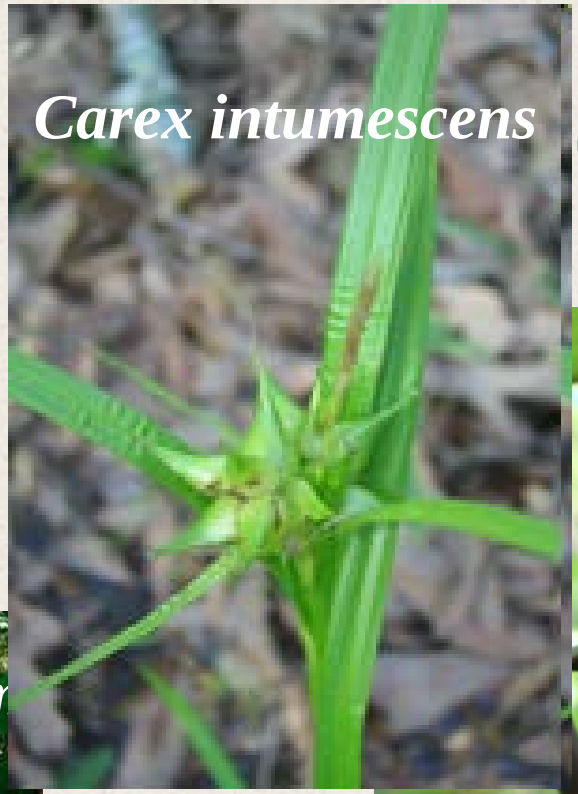

Erigeron annuus

Conyza canadensis

C Value = 0

C Value = 5

Asclepias incarnata


Carex intumescens

Botrychium virginianum

Arisaema triphyllum

Agalinis paupercula

Mitella nuda

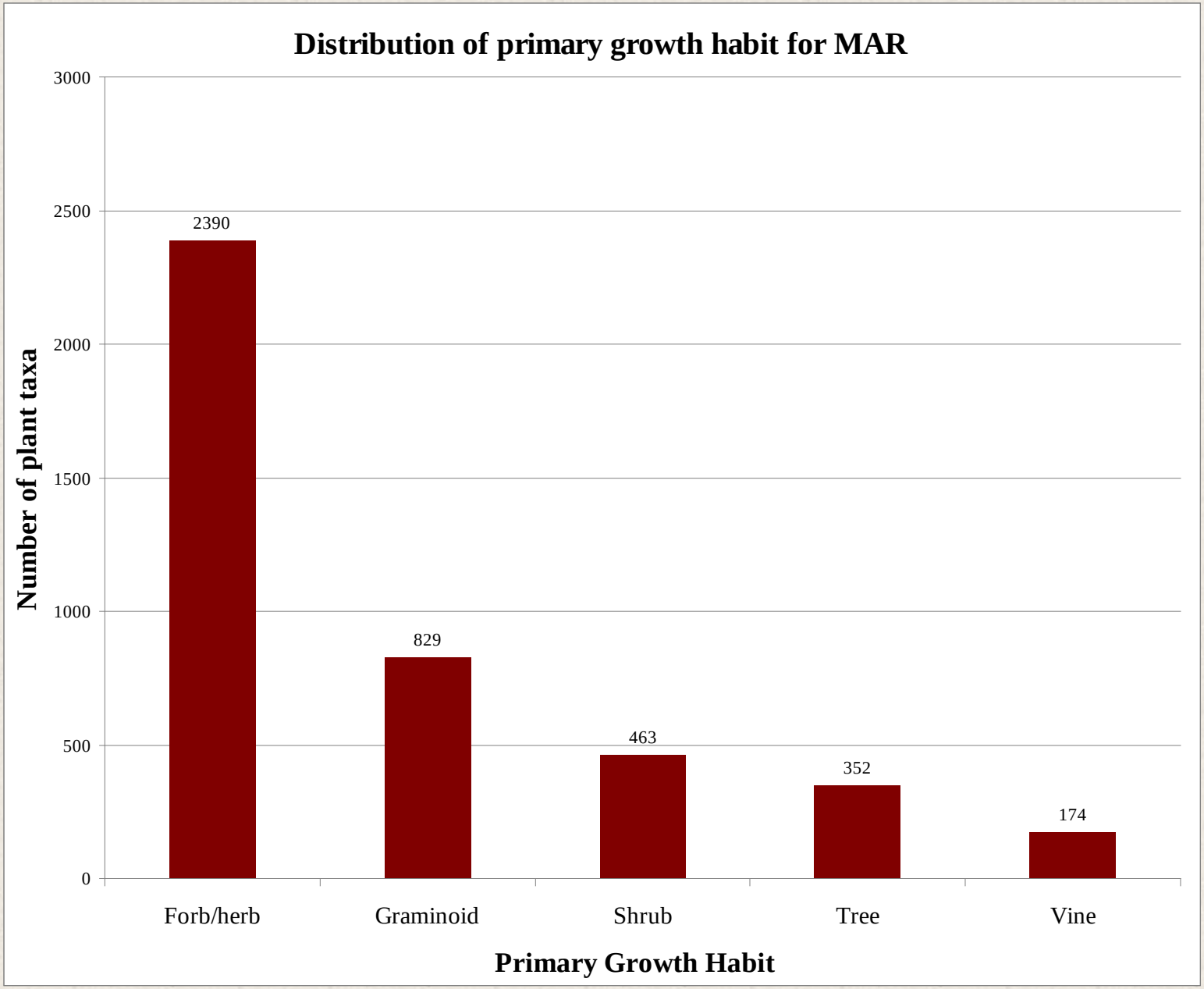
Goodyera repens

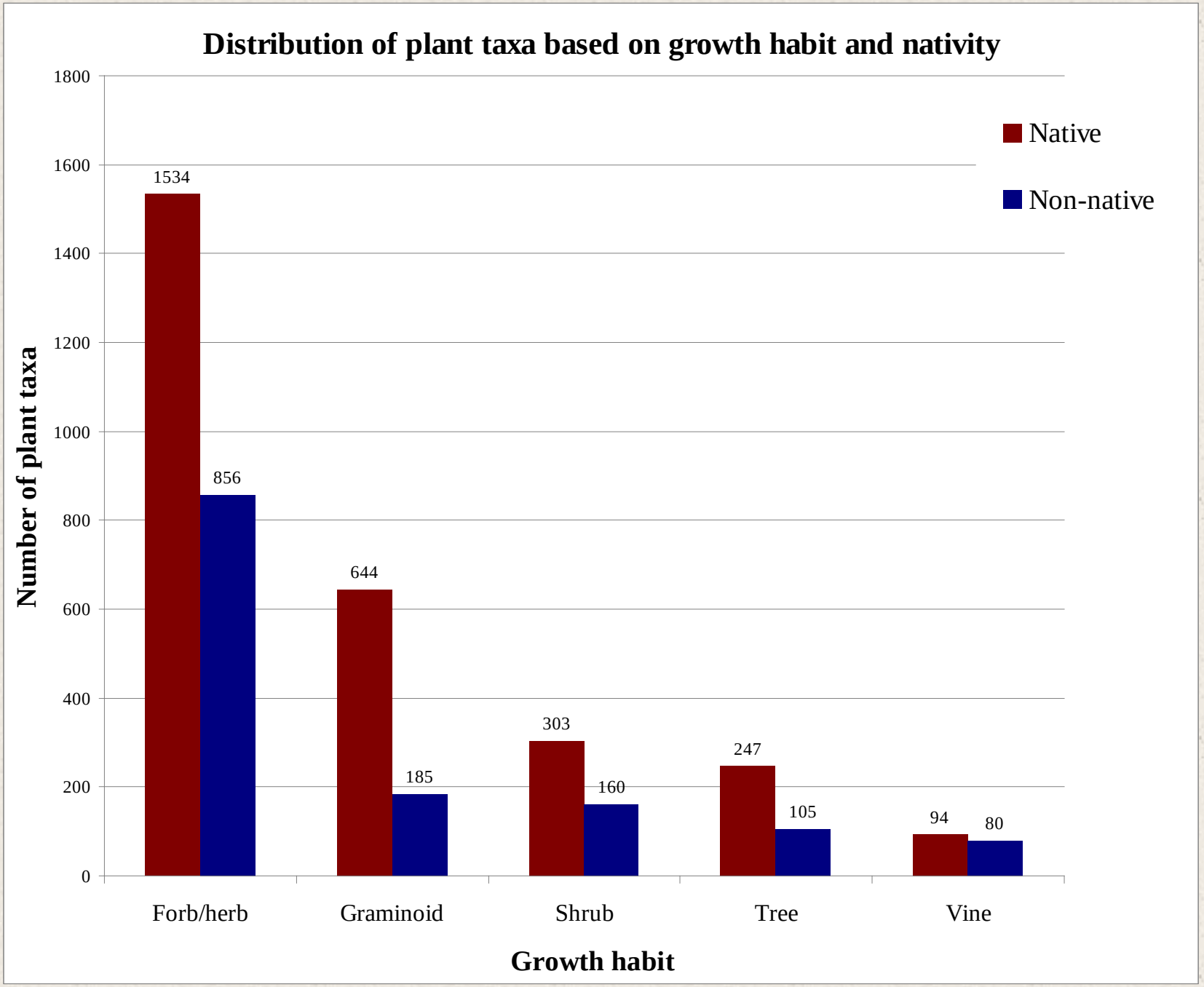
Thuja occidentalis

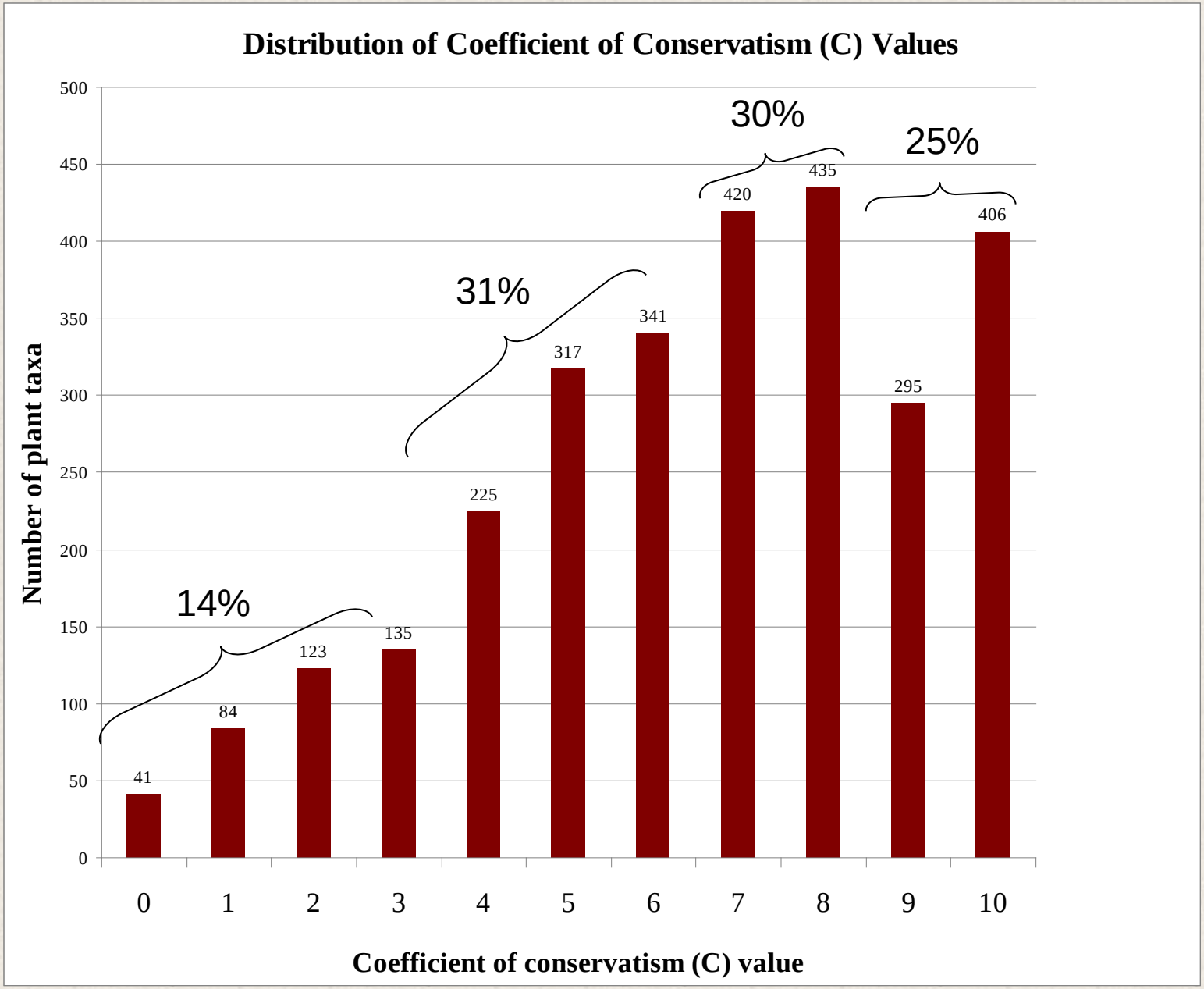
Solidago simplex

Ammophila breviligulata

C Value = 10


Distribution of primary growth habit for MAR
Number of plant taxa
3000
2500
2000
1500
1000
500
0
2390
829
463
352
174
Forb/herb
Graminoid
Shrub
Tree
Vine
Primary Growth Habit


Distribution of plant taxa based on growth habit and nativity
Number of plant taxa
1800
1600
1400
1200
1000
800
600
400
200
0
1534
856
644
185
303
160
247
105
94
80
Native
Non-native
Forb/herb
Graminoid
Shrub
Tree
Vine
Growth habit


Distribution of Coefficient of Conservatism (C) Values
Number of plant taxa
Coefficient of conservatism (C) value
0
50
100
150
200
250
300
350
400
450
500
0
1
2
3
4
5
6
7
8
9
10
41
84
123
135
225
317
341
420
435
295
406
14%
31%
30%
25%

Validity

- Validity – measure of how well plant's conservatism value matches what we see in the field

$$\frac{\text{\# of times taxa found in disturbance category}}{\text{\# of times taxa found in all disturbance categories}}$$

  - Plant lists from sites in four Mid-Atlantic states: DE, PA, VA, WV (N = 862)
  - Low validity = C Value doesn't match disturbance category
  - High validity = C Value matches disturbance category

Percent of flora in each coefficient category

condition category	coefficient category 0-3	4-6	7-8	9-10
low	32	47	18	3
mod	27	48	20	5
high	22	46	23	9
highest	18	45	25	12

Exclusivity

	% of flora found exclusively in respective disturbance category	% flora found in all disturbance categories
low	< 1	35
moderate	3	36
high	13	16
highest	34	4

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FEATURED TOOLS

Tools listed here were created by the Mid-Atlantic Wetland Work Group as a regional effort funded by EPA Region III.

- Floristic Quality Assessment Index (FQAI)
  General information and developments for the Mid-Atlantic region.
- Wetlands Mitigation Design and Performance Database
  On-going compiling reference wetlands data to be interpreted and used to inform the design and performance evaluation of restored and mitigated wetlands.

Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

Poa nemoralis
Potentilla canadensis
Ranunculus hispadus
Rubus pensilvanicus
Rumex acetosella
Scirpus georgianus
Sonchus asper
Trifolium dubium
Vinca minor

Enter up to 500 scientific names in the box at left--one name per line. You may type the names or copy and paste from a text editor or spreadsheet column.

Submit List

My Plant List

clear selected

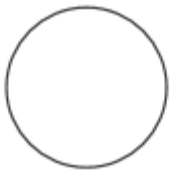
	Scientific Name	Family	Native	C

Results

FQI	0.0
Adjusted FQI	0.0
Total Mean C	0.0
Total N	0
Native Mean C	0.0
Native N	0

Report

Tolerance | Natives | WIS



- high
- intermediate
- poor
- very poor
- not applicable

Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

Enter up to 500 scientific names in the box at left--one name per line. You may type the names or copy and paste from a text editor or spreadsheet column.

Submit List

My Plant List

clear selected

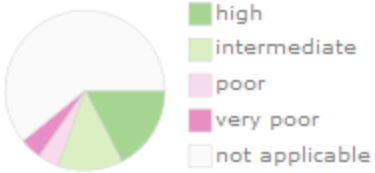
	Scientific Name	Family	Native	C
	Agrostis canina	Poaceae	N	
	Alliaria petiolata	Brassicaceae	N	
	Artemisia vulgaris	Asteraceae	N	
	Symphyotrichum ericoides	Asteraceae	Y	9
	Cardamine impatiens	Brassicaceae	N	

Results

FQI	14.3
Adjusted FQI	11.7
Total Mean C	1.9
Total N	23
Native Mean C	4.8
Native N	9

Report

Tolerance | Natives | WIS



Plant list match results

Total plants added: 23

Synonyms translated (1)

Submitted	Accepted
Aster ericoides	Symphyotrichum ericoides

Plants not found (2)

Carya x laneyi (cordiformis x ovata)
Ranunculus hispadus

Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

Plant Ranunculus hispidus Add

Add plants individually. Type any part of the scientific name or symbol and search-assist will provide selectable suggestions.

My Plant List

clear selected

Scientific Name	Family	Native	C
Agrostis canina	Poaceae	N	
Alliaria petiolata	Brassicaceae	N	
Artemisia vulgaris	Asteraceae	N	
Symphyotrichum ericoides	Asteraceae	Y	9
Cardamine impatiens	Brassicaceae	N	

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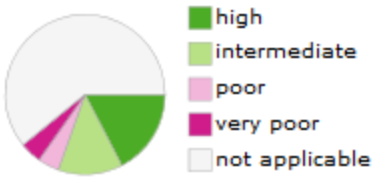
Tolerance | Natives | WIS



Report

Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

Plant [ ] Add

Add plants individually. Type any part of the scientific name or symbol and search-assist will provide selectable suggestions.

My Plant List clear selected

Scientific Name	Family	Native	C
Scirpus georgianus	Cyperaceae	Y	3
Sonchus asper	Asteraceae	N	
Trifolium dubium	Fabaceae	N	
Vinca minor	Apocynaceae	N	
Ranunculus hispidus	Ranunculaceae	Y	5

Results

FQI	15.2
Adjusted FQI	12.9
Total Mean C	2.0
Total N	24
Native Mean C	4.8
Native N	10

Tolerance | Natives | WIS

Report

Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

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Tolerance | Natives | WIS

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Floristic Quality Assessment Calculator

Region Glaciated Plateau

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Tolerance | Natives | WIS

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Floristic Quality Assessment Calculator

Region Glaciated Plateau

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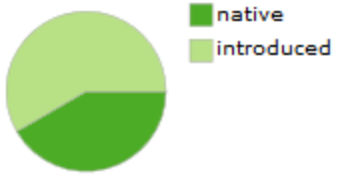
Report

Tolerance | Natives | WIS



Penn State Riparia
Floristic Quality Assessment Calculator

Region Glaciated Plateau

List | Search

Plant [ ] Add

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My Plant List clear selected

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Sonchus asper	Asteraceae	N	
Trifolium dubium	Fabaceae	N	
Vinca minor	Apocynaceae	N	
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Results

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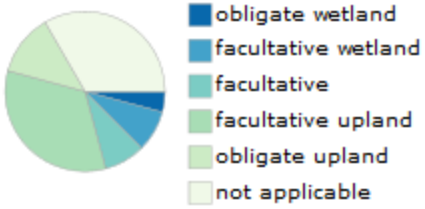
Report

Tolerance | Natives | WIS



Floristic Quality Assessment Report

Site name: BioBlitz
Ecoregion: Glaciated Plateau

RESULTS

FQI	15.2
Adjusted FQI	12.9
Total Mean C	2.0
Total Count	24
Native Mean C	4.8
Native Count	10

Tolerance	Count
high	4
intermediate	4
poor	1
very poor	1
not applicable	14

WIS	Count
OBL	1
FACW	2
FAC	2
FACU	8
UPL	3
NA	8

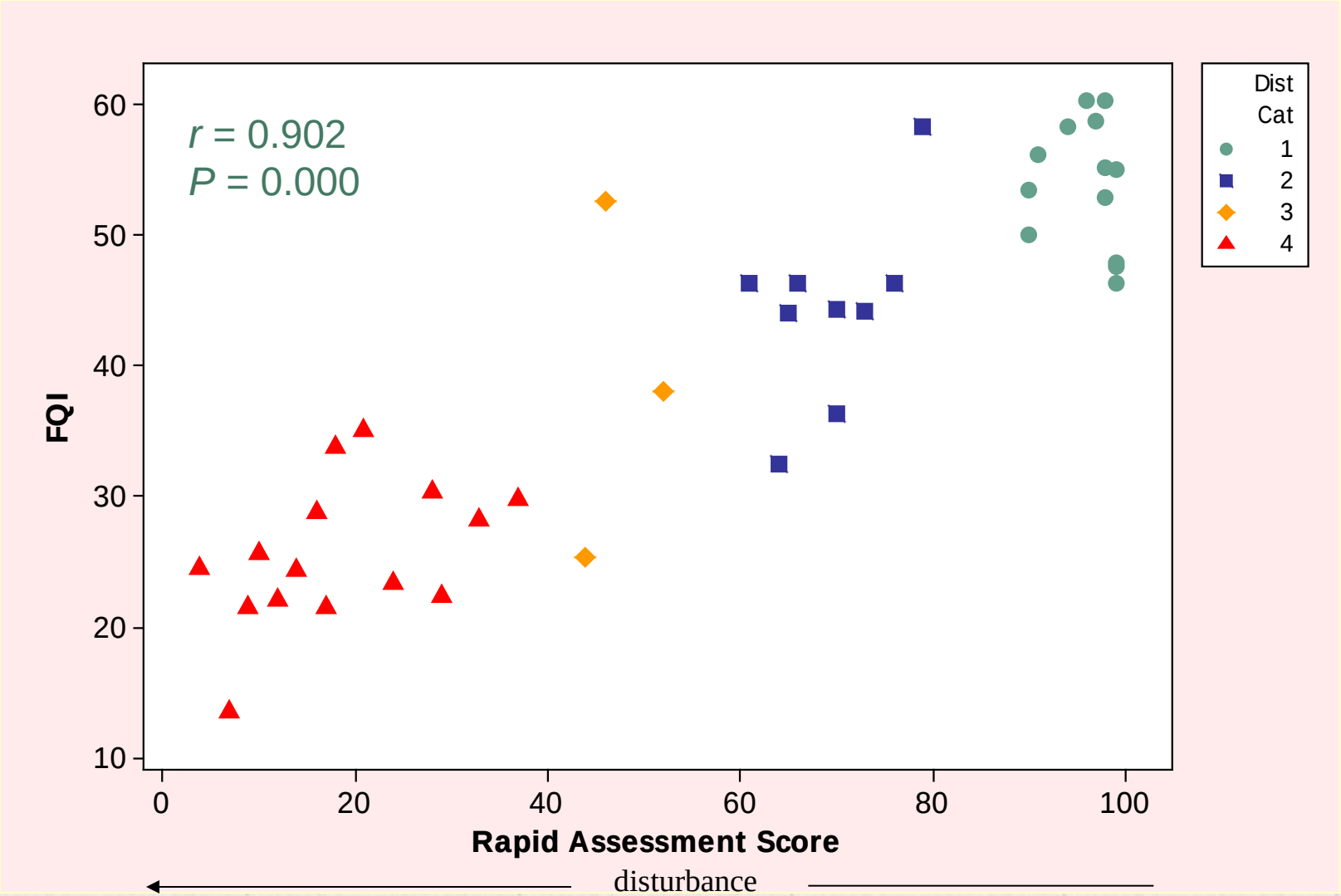
PLANT LIST

Scientific Name	Native	C	WIS
Agrostis canina	N		UPL
Alliaria petiolata	N		FACU
Artemisia vulgaris	N		UPL
Symphyotrichum ericoides	Y	9	FACU
Cardamine impatiens	N		
Carex festucacea	Y	5	FAC
Elaeagnus umbellata	N		
Euonymus alatus	N		
Fraxinus pennsylvanica	Y	5	FACW
Lactuca hirsuta	Y	5	
Leersia virginica	Y	3	FACW
Lespedeza cuneata	N		UPL
Lonicera tatarica	N		FACU
Picea abies	N		
Poa cuspidata	Y	8	
Poa nemoralis	N		FACU
Potentilla canadensis	Y	3	
Rubus pensilvanicus	Y	2	FACU
Rumex acetosella	N		FACU
Scirpus georgianus	Y	3	OBL
Sonchus asper	N		FACU
Trifolium dubium	N		FACU
Vinca minor	N		
Ranunculus hispidus	Y	5	FAC

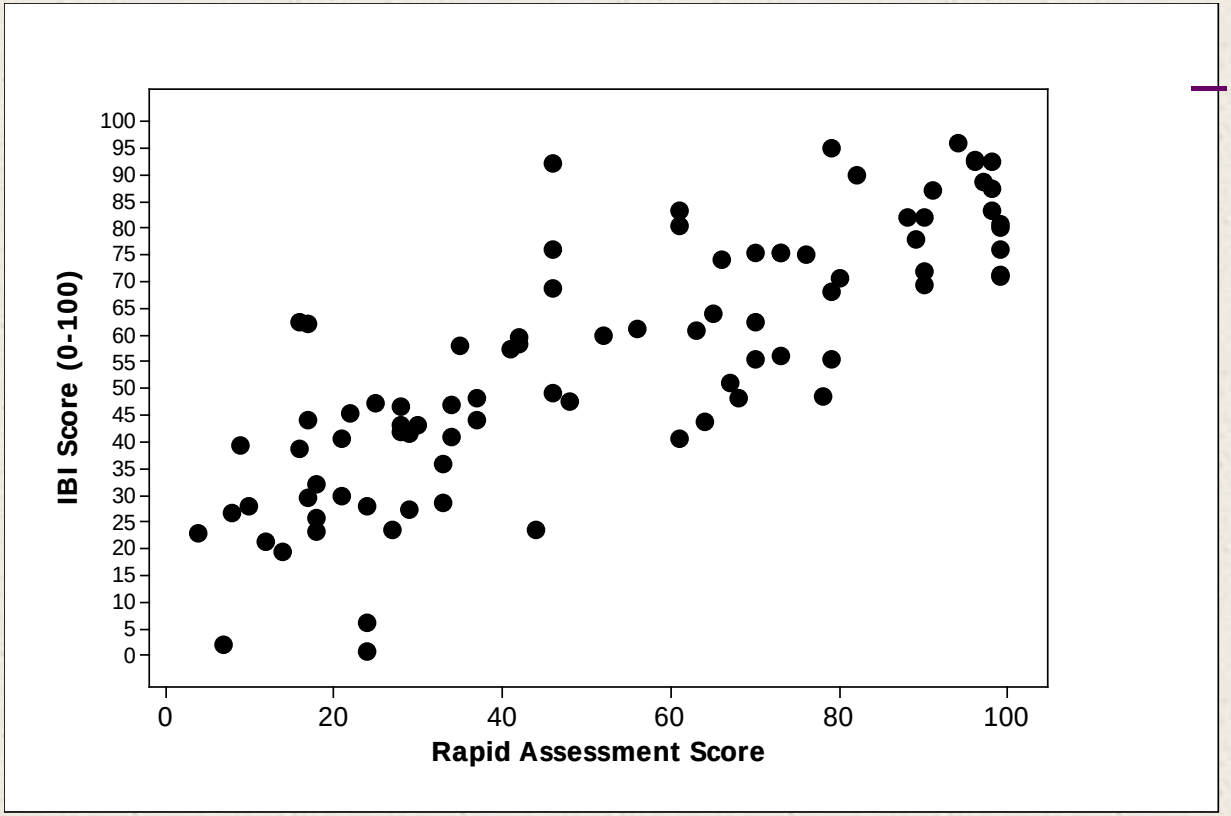
Using FQA in the Mid-Atlantic Region

- Monitoring and Assessment
  - Dose-response curves
  - IBI
- Wetland Water Quality Standards (TALUs)
- Other (Penn’s Creek Study)

Monitoring and Assessment



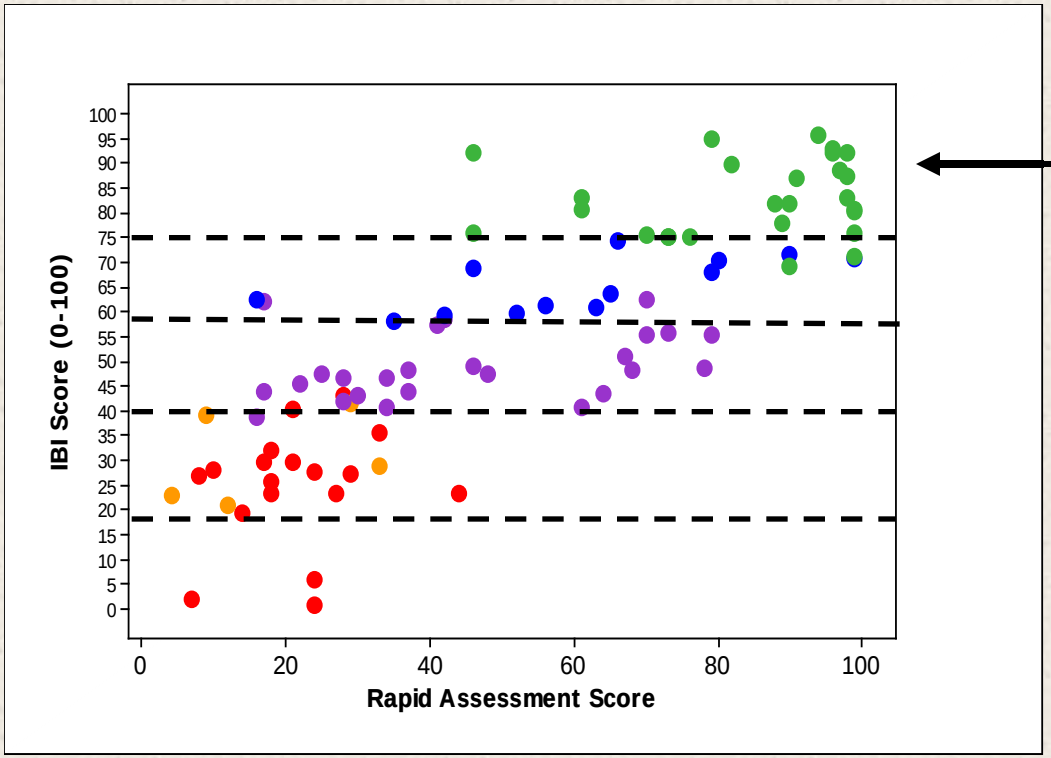
Monitoring and Assessment



- Plant-based IBI
  - Adjusted FQI
  - % annuals
  - % non-natives
  - % invasives
  - % trees
  - % cryptogams
  - % cover tolerant plants % cover (*Phalaris arundinacea*)

(Miller et al. 2006)

Wetland WQ Standards

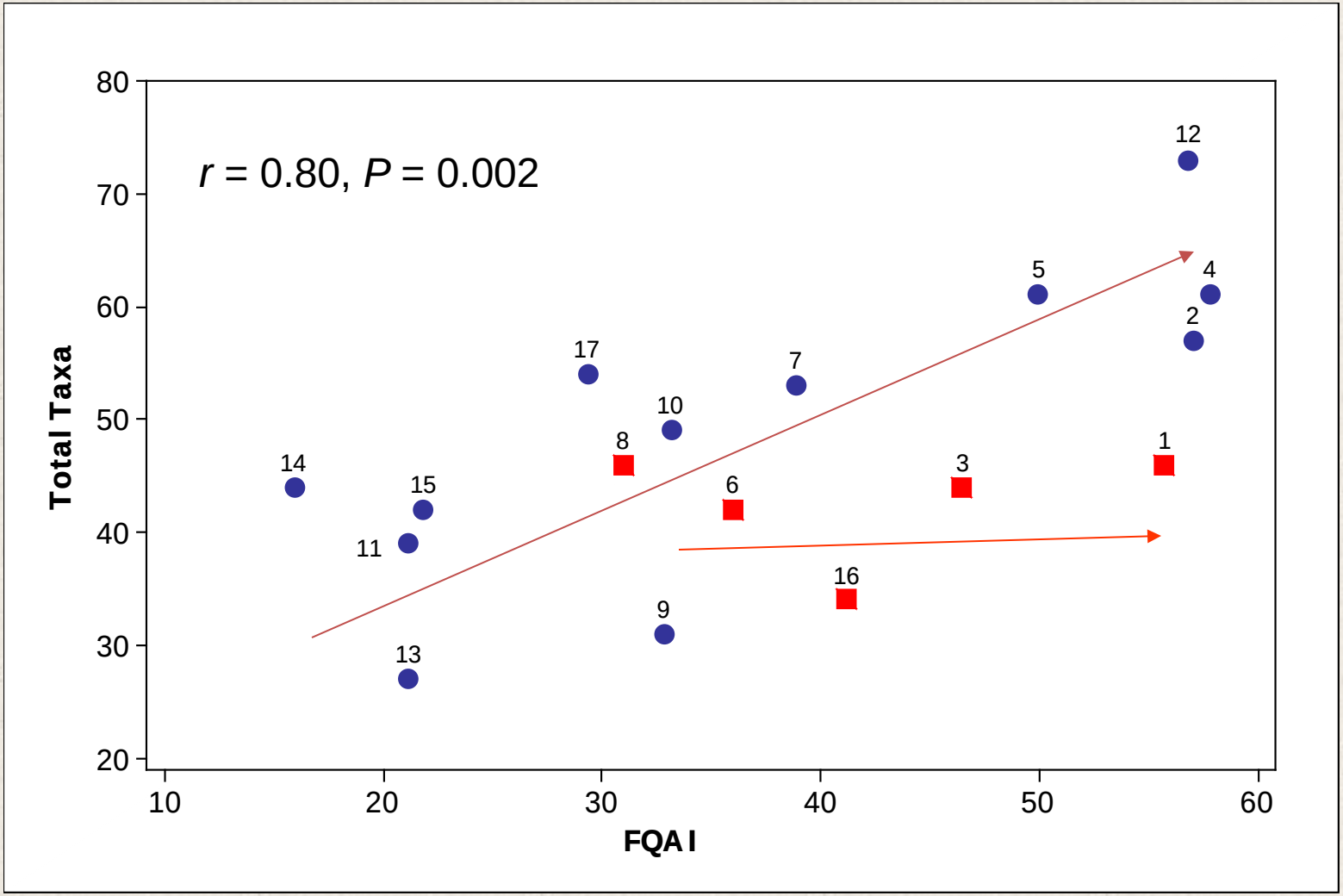


Tier 1
Superior Wetland Habitat

- Annuals, non-native, and invasive sp typically < 10%
- FQAI score ≥ 40
- Predominately forested/Forested setting
- Tolerant cover < 30%
- Diverse assemblage of vascular cryptogams with high (≥ 6) coefficients
- No *Phalaris arundinacea*

Tier 1 wetlands are those that are capable of supporting and maintaining a high quality plant community in terms of species composition, diversity, and functional organization. Although not pristine, wetlands in this category are typically thought of as reference wetlands and can be used to establish performance criteria for mitigation sites.

Upper Penns Creek Study



Thanks!

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  - Elizabeth Byers
  - Doug Deberry
  - Jim Vanderhorst
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