A Users Guide to Floristic Quality Assessment

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ILLINOIS NATURAL HISTORY SURVEY
Outline

• Intro Floristic Quality Assessment (FQA)

• Philosophy, Definitions, & Terms
  • species Conservatism & Floristic Quality

• Sampling & Methods

• Comparing site scores & Analysis

• Do’s & Don’ts
Floristic Quality Assessment (FQA)

• Every plant in a state 0-10, species Conservatism
  • Coefficients of Conservatism (C-values)
  • Expert botanists panel
  • Non-natives 0 or ignored

• Mean Conservatism (Mean C)
  • 3.5 - 4.5

• Floristic Quality Index (FQI) = mean C * √N
  • 35 – 45

• Anthropogenic disturbance/degradation -> Conservation value
Floristic Quality Assessment (FQA)

- Every plant in a state 0-10
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- Mean Conservatism (Mean \(C\))
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- Floristic Quality Index (FQI) = mean \(C \times \sqrt{N}\)
  - 35 – 45
- Anthropogenic disturbance -> Biological degradation -> Conservation value
Use of FQA

- Identify & rank natural areas purchase or protection
- Management & restoration
- Legal & regulatory (Federal, State, County, Municipal, etc.)
- Research
Definitions = **DANGER!!**

site “Floristic Quality”

species “Conservatism”
• *Oxalis stricta*  
• Common yellow sorrel  
• Everywhere  
• $C = 0$

• *Oxalis illinoensis*  
• Illinois wood sorrel  
• Rich mesic forest  
• $C = 10$
**Solidago speciosa**

*C* = 7

Prairie, savanna

**Solidago canadensis**

*C* = 0

Everywhere
Species Conservatism is...?
Species Conservatism IS NOT*

- Phylogeny (closely related species)
- Successional status/habitat maturity (*habitat stability*)
- Species rarity or range (*cosmopolitan, widespread, restricted*) Plant traits/life-history/functional groups, (r/K),
  - longevity, fecundity, dispersal, leaf traits, mode of reproduction
- Specialist vs. generalist
- Habitat Breadth/Habitat specificity/Ecological amplitude-- # or range of habitats
- Environmental niche breadth
- Habitat fidelity or faithfulness— types of habitat
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“All too frequently, areas where legally protected species are absent are considered expendable under current formal environmental evaluations. It is precisely because Floristic Quality Assessment is not based on species rarity or legal status that it is a useful tool for assessing the natural quality of an area.”

Herman et al. 2001
Rare & Protected

- 3,500 plants
- 2,500 native
- 340 T & E’s
  - 75 threatened
  - 265 endangered
- 1 threatened (*Cyperus greyoides*)
Species Conservatism IS NOT*

Illinois species’ C-values and Range (# counties occur in)

N = 1987 (natives only)

- $p < 0.0001$, $r^2_{adj} = 0.50$

Spyreas, in prep
Species C-values are Accurate

Spearman rank correlation ($\rho$) = 0.55

Matthews, Spyreas, Long, 2015
Site Level Metrics Work Very Well

- Mean C vs. ranked anthropogenic disturbance levels of 47 emergent wetlands in Illinois
- Explained variation 60-90%
Floristic Quality is Floristic Quality

<table>
<thead>
<tr>
<th>Richness</th>
<th>Introduced richness</th>
<th>Native richness</th>
<th>Shannon diversity</th>
<th>Introduced cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean C</td>
<td>0.15</td>
<td>-0.62**</td>
<td>0.45**</td>
<td>0.14</td>
</tr>
</tbody>
</table>

** P< 0.0001, * P<0.001

Spyreas, in prep
Prairie Grass

Larry Kanfer • Middle America
Cirsium arvense (field thistle) Europe-Asia

Glycine max (soybean) China

Rumex crispus (curly dock) Europe-Asia

Barbarea vulgaris (bittercress) Europe-Asia

Lactuca serriola (prickly lettuce) Europe-Asia

Mean $C = 0$

FQI = 0
Terminology = **DANGER!!**

Use the terms religiously and no others

- Floristic Quality Assessment (FQA)
- Coefficient of Conservatism (C of C, or C, or CC)
- Mean C
- Floristic Quality Index (FQI, or I)
Sampling & Methods Considerations
Area Effects

Homogenous relatively undisturbed tallgrass prairie

Continuously sample 20 plots over 11 years by the same botanist

Nested plots

Spyreas & Beas, in prep
Species will be Missed

Time of year
Time of day
Botanist
Size of plot/quadrat
Vegetation type/density
Species Detectability

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Year Effects

Mean C

Climax habitats

Natural, interannual cycles & variation should not change scores, if there is no human disturbance

Drought, fire, bison, grazing affects species apparency

Spyreas & Beas, in prep
Year Effects

FQI

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Sampling & Methods Considerations

• Species misidentification

• Within year (seasonal) variability

• Non-native species

• Abundance
“This ordinance requires the protection of wetlands in a development in such a way that the Floristic Quality Index (FQI) calculated two years after development cannot be more than two points less than the original FQI. If the wetland has a lower FQI, the developer must provide wetland mitigation for the impacted wetland.”

Chu and Molano-Flores 2013
Comparing Scores

• Assumed that a score tells us with a high level of precision about a site Floristic Quality → biological degradation, human disturbance levels.

• A site FQI score 20 or Mean $C = 4$ anywhere means the same thing:
  Region
  Vegetation type

Laws & agency policies assume that a score in place & habitat means the same as another.
Floristic Quality & Vegetation types

- Random wetlands and forests across Illinois
- Reference grassland, wetland, or forest
Vegetation Types

Random sites

Site Mean C
Vegetation Types

Reference

Site Mean C

Spyreas, in prep
Distribution of Mean C scores

light grey columns-- randomly selected sites
dark gray column-- reference sites

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Vegetation Types

Random & reference

Upland vs floodplain

Mean C

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Floristic Quality & Region

All sites

Mean C by latitude

$r^2_{adj} = 0.09$

$p < 0.001$

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Floristic Quality & Vegetation types

Forests
Mean C
$r^2_{adj} = 0.29$, $p < 0.001$

FQI
$r^2_{adj} = 0.25$, $p < 0.001$

Richness
$r^2_{adj} = 0.08$, $p < 0.001$

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Floristic Quality & Vegetation types

Wetlands
Mean C

\[ r^2_{adj} = 0.03, \ p = 0.03 \]

Quadratic- \[ r^2_{adj} = 0.11, \ p < 0.001 \]

FQI

\[ r^2_{adj} = 0.00, \ p = 0.36 \]

Quadratic \[ r^2_{adj} = 0.06, \ p = 0.002 \]

Spyreas, in prep
Plant Richness North America

Qian 1998
Protected Wetlands & Public Land
Regions and Vegetation Types

- Among vegetation-types or across regions natural variation—invalidate score comparisons?
- Floodplain forest Mean C, Marsh FQI/richness
- North to south forest
- Low explained variation & effect size compared to human disturbance

\[ r^2 = 0.61 \]

Spyreas & Matthews, in prep
Time & Floristic Quality

High Floristic Quality sites has been characterized with respect to site defined:

- “mature”
- “late-successional”
- “climax”
- “successionally-stable”

Simple & predictable increase over time?
Buell-Small Succession (BSS) Study Site

- A 50+ yr successional study (New Jersey)
- 10 fields
- No disturbances, no management
**Old growth forest**

FQA scores at equilibrium, Assumed Mean C < 4.5 based on similar remnant habitats

**Farming (1701 to ≈1960)**

Fields Cleared & Farmed, no Floristic Quality

**Abandoned (1960 to present)**

Fields gradually increase in Floristic Quality after abandonment from Farming

Year

Mean C

Forest Succession & Species Richness

Peet & Christensen 1988
Mean $C = 0$

$FQI = 0$
Reminders, Do’s, and Don’ts

1. Terms, metrics, formulas, abbreviations
   Keep it simple & “Original” “Standard” texts

2. Definitions
   Conservatism = occurrences
   Floristic Quality values = disturbance/degradation
   Natural vs. Anthropogenic disturbance

3. Record & Report methods
   (sample intensity, sample layout- whole site or quadrat, ecotones, sample date, metric calculation, exotic species, etc.)

4. Mean C vs. FQI/Richness- sample area size, sample intensity, vegetation type......

5. Do not compare scores among states

6. Comparing scores different ages (successional areas)– plot treatments
Unkowns

1. Vegetation type?
   specific habitats- floodplain forests, marsh, pristine sites

2. Region?
   large latitudinal gradient vs within Chicagoland

3. Intra-annual variation?- within calendar year

4. Beware of recreations, restorations, and novel habitats
   Site FQA values
   Species C-values
Open Question

Is it better for a community to have a high floristic quality index?

If a community has a high floristic index, does it mean that it is healthy or is it the opposite?

1 day ago - 3 days left to answer.
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• Pictures
  • Michael Jeffords
  • The internet (apologies if I didn’t credit your image)

• Spyreas@Illinois.edu