Development and Use of the Vegetation Index of Biotic Integrity for Ohio Wetlands

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Reasons for VIBI Development

- Measure wetland ambient condition
  - Across Ohio – all ecoregions
  - All wetland types – plant community, HGM classes
- Place wetlands into appropriate categories for antidegradation reviews
  - Cat. 1 – low services, poor condition
  - Cat. 2 – moderate services, fair to good condition
  - Cat. 3 – superior services, excellent condition
- Set performance standards for mitigation and other restorations

IBI (condition-based) Approach

- The goal of an IBI is to assess the ecological integrity (condition) of the wetland
  - But see Smith et al. (1995) where integrity is considered the integrating super-function
- Resident biological communities inhabit wetlands continuously or for significant portions of their life cycles, and are integrators of the prevailing and past chemical, physical and biological history of the wetland
- The IBI approach has a proven record of being able to measure restoration and improvement of other aquatic resources like streams, lakes, and reservoirs

Developing a Vegetation-based Biological Assessment Method

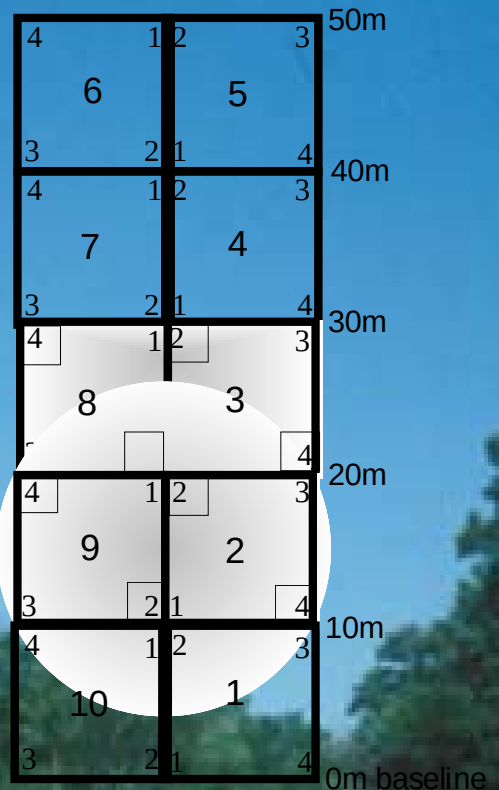
- Used well established index development approaches outlined in 3 decades of IBI literature
- Site selection
  - targeted selection of least to most impacted sites used
- “Reference” sites
  - sites lacking obvious or discernible human cultural influence or least-impacted systems available in a particular landscape

Vegetation Index of Biotic Integrity (VIBI)

- Procedure for scoring and categorizing wetlands based on the vegetative structure.
- Calculates score based on series of “metrics” derived from field data (plant identification and cover values within a standard plot).
- Actually 3 separate VIBIs
  - VIBI-E (Emergent), VIBI –F (Forested), and VIBI-S (Shrub)

Overview of Method

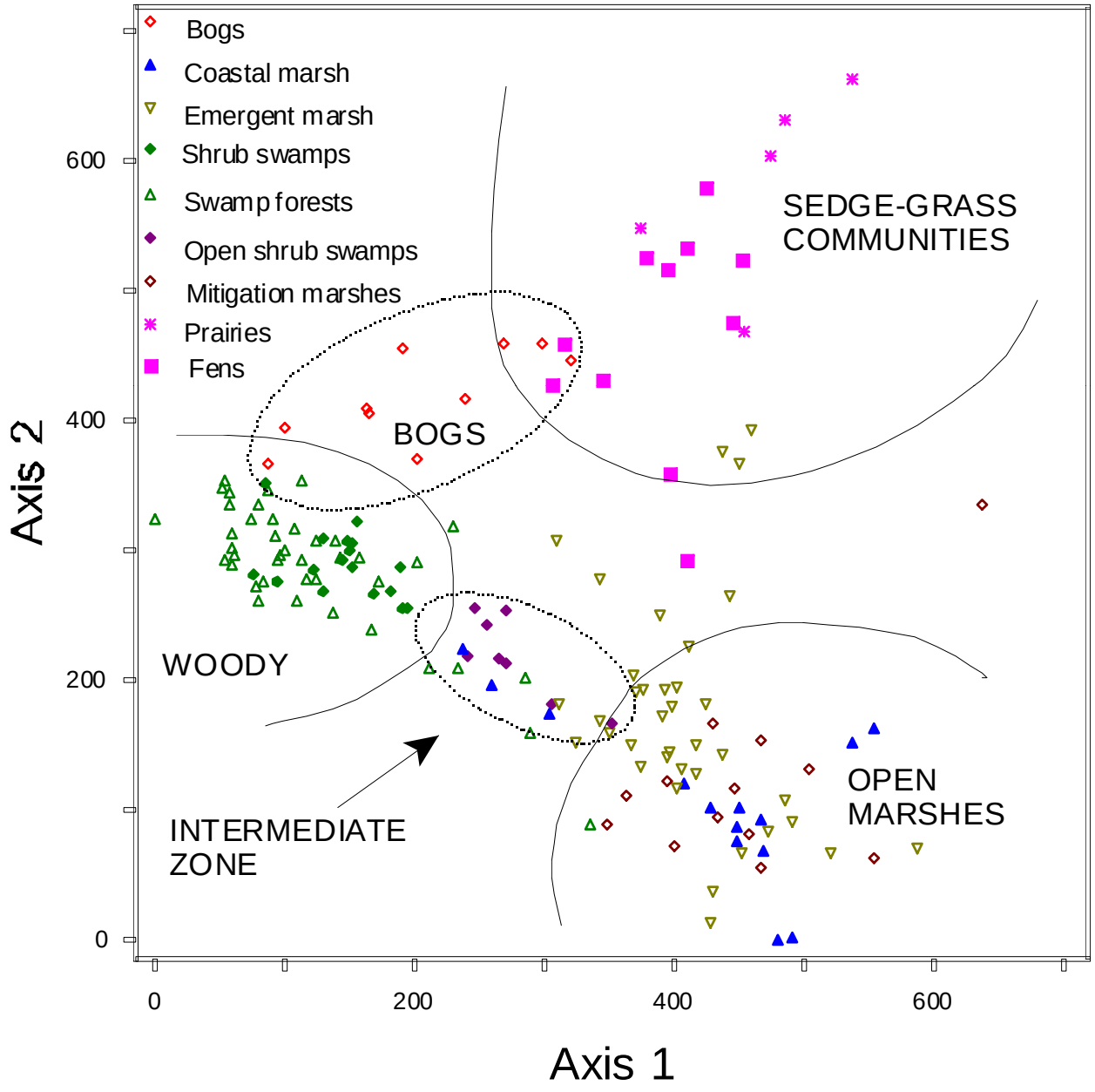
- Developed by Robert Peet et al. (1998) for the North Carolina Vegetation Survey
- Flexible multipurpose method for diverse plant communities
- "modular" approach with 10 x 10m "modules" as building block for plot
  - locate plots in areas most representative of plant community of interest
  - minimize environmental heterogeneity



Selecting the Location of a Plot

- General considerations:
- Need familiarity with site esp. its plant communities and HGM class
- More than one plot may be necessary but goal to have fewest possible
- A plot is located qualitatively in locations which are most representative of plant community of interest
- Focused (fixed) plot standard sampling design
- Random plot variation for very large sites

Ordination of Wetland Data



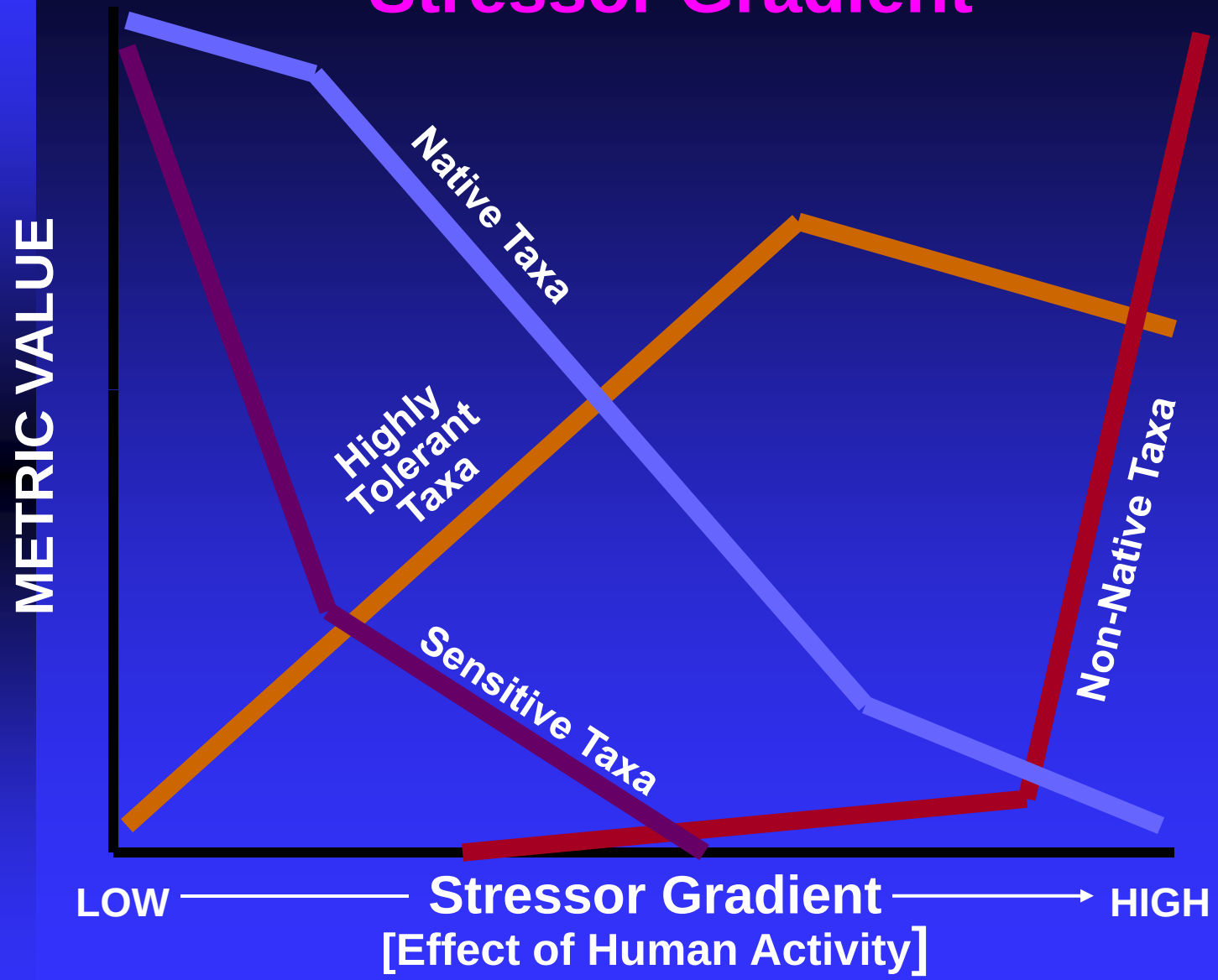
Wetland Classification

- Two classification schemes used when conducting a VIBI:
- Dominant plant community
  - based on Anderson (1982), Cowardin et al. (1979), Ohio EPA data
- Dominant landscape position
  - hydrogeomorphic (HGM) scheme (Brinson 1993)

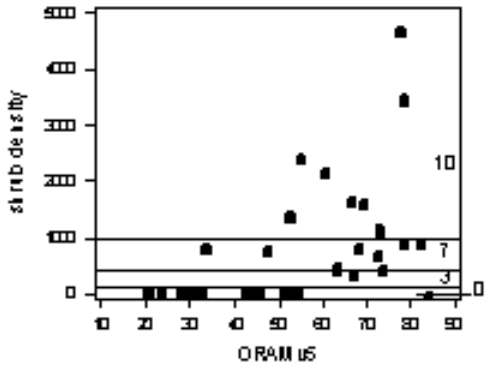
Floristic Quality Assessment Index (FQAI)

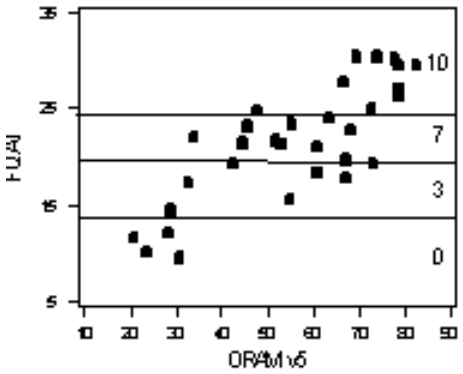
- Numeric score from 1 to 10 assigned to each Ohio vascular plant species.
- Called “Coefficient of Conservatism” (C of C). Refers to the affinity of each species to a particular habitat type.
- “Tolerant” species that occur in a wide variety of habitats have a low score.
- “Sensitive” species have a higher number.

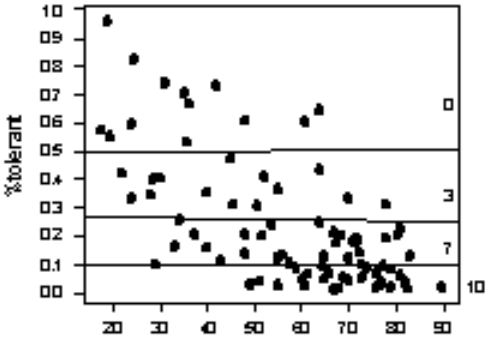
Metric Behavior Along the Stressor Gradient



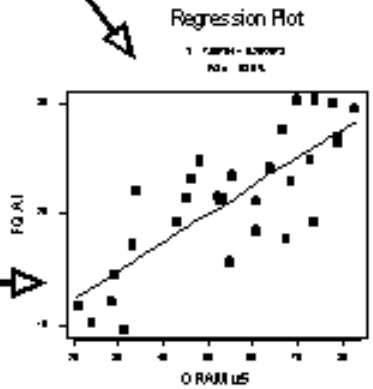
Identify characteristics indicator taxa group that vary predictably with the disturbance gradient. Each metric's relationship to gradient can be mathematically described.



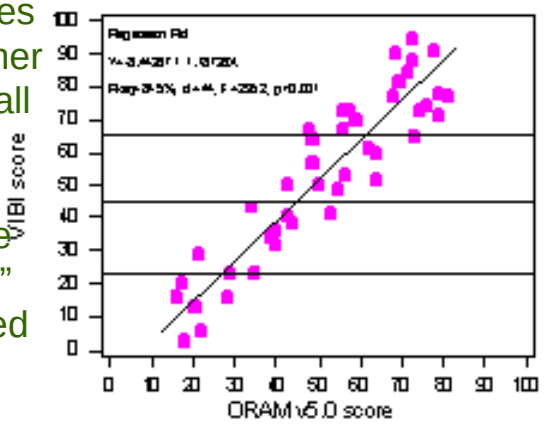


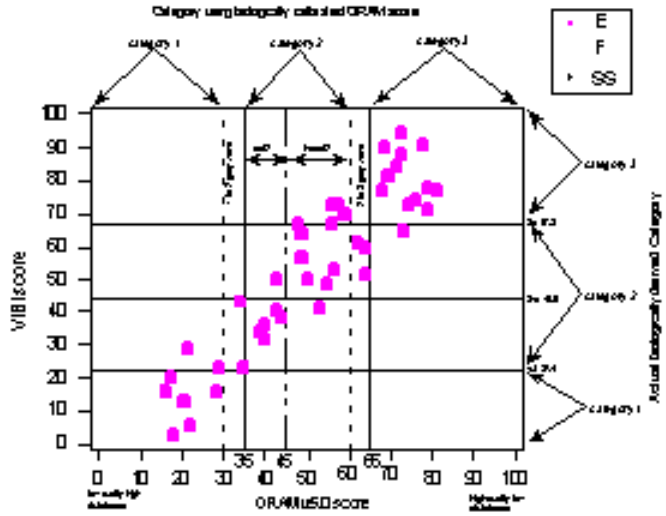


Convert metric values to standard scores of 0, 3, 7, 10 to account for different scales of individual metric values, e.g. density, index scores, %cover, etc.



By standardizing scores using IBI scoring techniques you can sum or add together all 10 metrics into an overall composite score. Underlying correlations of each metric to disturbance scale are maintained and "noise" reduced and data linearized

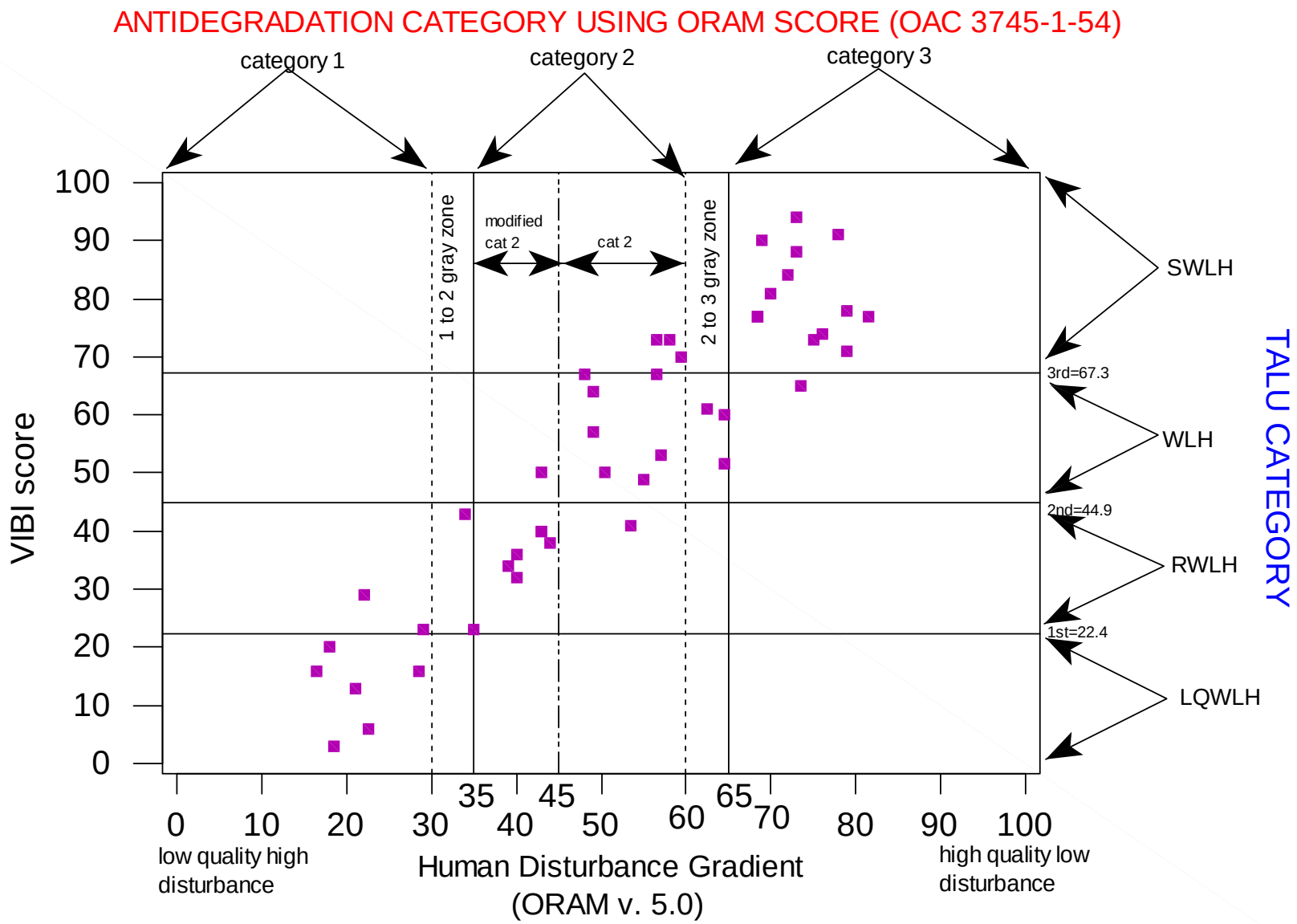




Metrics for VIBI-E, -F, -Sh

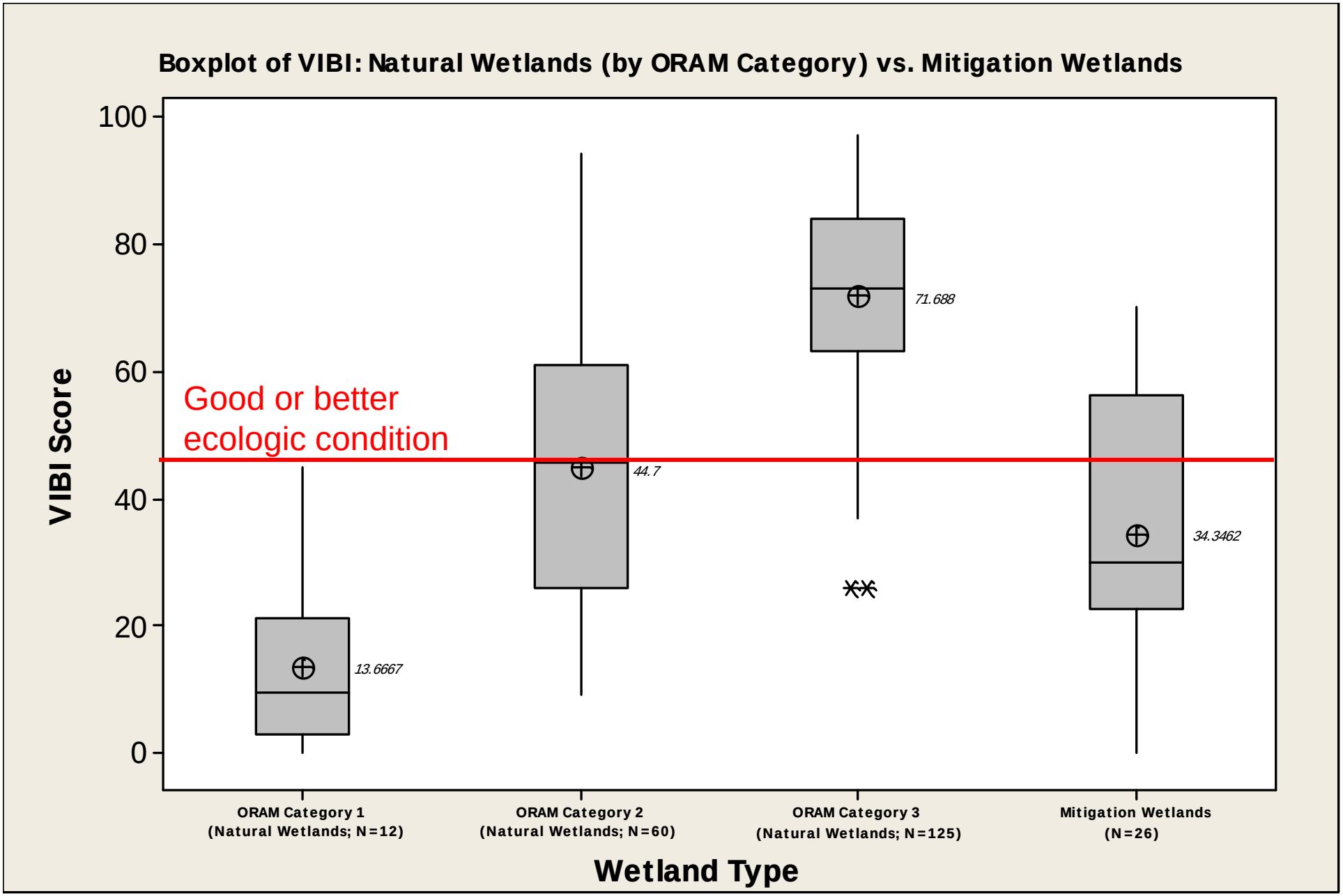
metric	type	E	F	Sh
carex	richness	X		X
dicot	richness	X		X
shrub	richness	X	X	X
hydrophyte	richness	X	X	X
shade species	richness		X	
seedless vascular plants	richness		X	X
FQAI	index	X	X	X
%tolerant	community	X	X	X
%intolerant	community	X	X	X
%invasive graminoids	community	X		
%bryophyte	community		X	X
subcanopy IV	community/productivity		X	X
canopy IV	index		X	
std biomass	productivity	X		

Correlation Between VIBI and ORAM

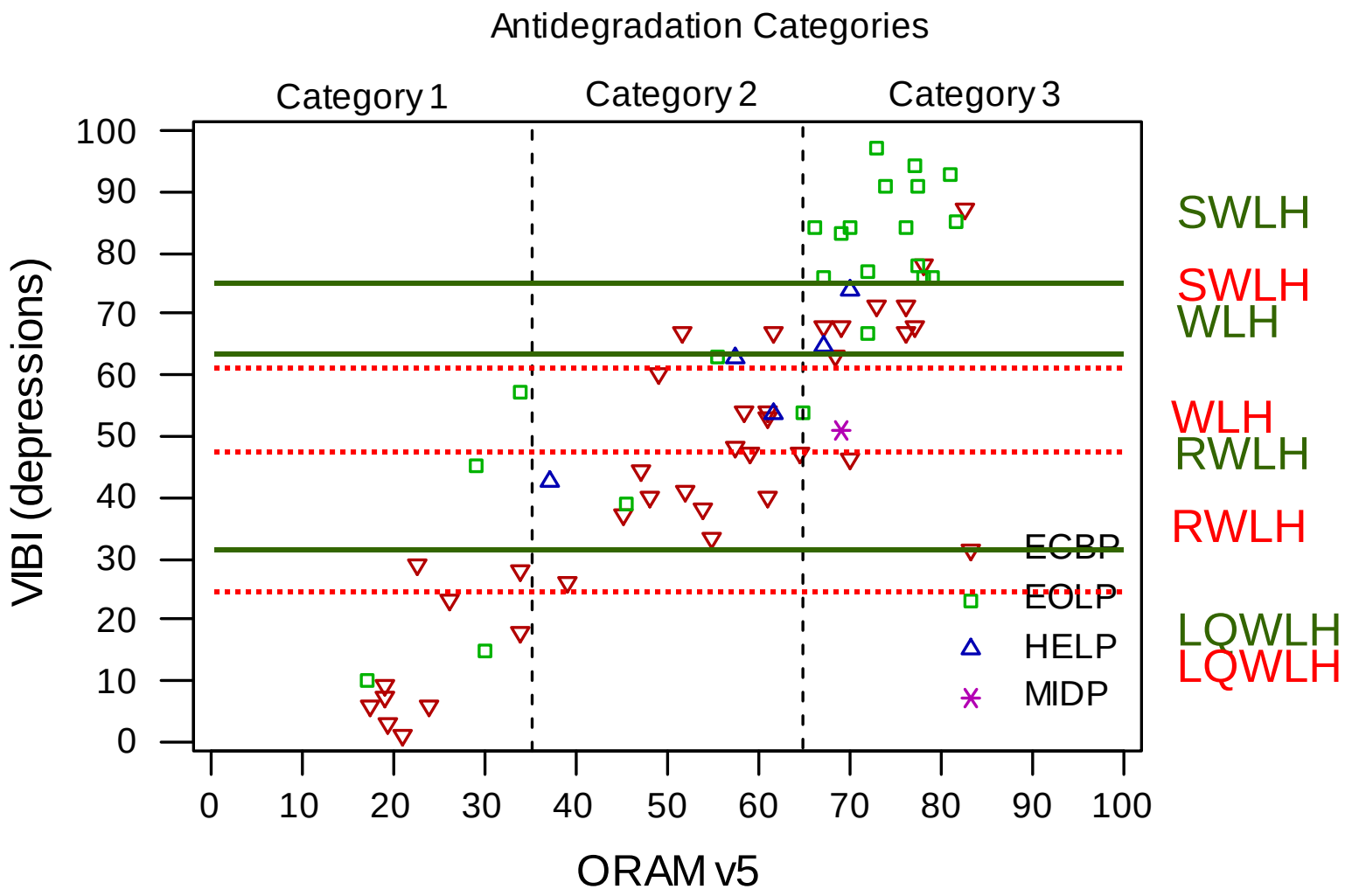


Numeric TALU table (excerpt)

HGM class	HGM sub-class	plant community	eco-regions	95th	LQWLH (Category 1)	RWLH (modified Cat 2)	WLH (Category 2)	SWLH (Category 3)
depression	all	sw. forest shrub sw. marsh	EOLP	91	0 -30	30-60	61-75	76-100
			all other regions	75	0-24	25-50	51-62	63-100
	all	wet meadow	all regions	91	0-29	30-59	60-75	76-100
bog	weakly ombro-trophic	tamarack-hardwood, tall shrub bog	all regions	100	0-32	33-65	66-82	83-100
	strongly ombro-trophic	tamarack, leatherleaf, sphagnum bog	all regions	72	0-23	24-47	48-59	60-100


Boxplot of VIBI: Natural Wetlands (by ORAM Category) vs. Mitigation Wetlands
VIBI Score
100
80
60
40
20
0
Good or better
ecologic condition
13.6667
44.7
71.688
34.3462
ORAM Category 1
(Natural Wetlands; N=12)
ORAM Category 2
(Natural Wetlands; N=60)
ORAM Category 3
(Natural Wetlands; N=125)
Mitigation Wetlands
(N=26)
Wetland Type

Developing Numeric Biocriteria Ecoregional Calibration




Thank You!