Biological Components of Compensatory Mitigation Wetlands

Mick Micacchion
Wetland Ecologist, PWS
Midwest Biodiversity Institute &
The Nature Conservancy

Midwest Biodiversity Institute

The Nature Conservancy

Importance of Site Selection

Select sites that:

- Have all the important abiotic components needed for the specific wetland type being replaced – soils, hydrology, water chemistry, topography, etc.
- Allow for adequately wide buffers to be established around the entire wetland
- Have low intensity surrounding land uses

Important Wetland Abiotic Elements that Provide Habitat for Biotic Elements

Soils

- Texture/compactness
- Nutrients and chemical composition
- Slopes, depths, and microtopography

Hydrologic Regime

- Hydrology sources – rainfall, runoff, rivers and streams, groundwater
- Water depths
- Continuous duration of inundation/saturation

Water Quality/Chemistry

- pH, DO, conductivity, turbidity, nutrient levels, other
- salt water vs. fresh water

Target Species Only Occur When All Habitat Needs Have Been Met

- Soils need to be able to hold water for the period of times and at depths that match species habitat needs and have appropriate microtopographic features
- For plants – the hydrologic regime must met their growing needs (OBL, FACW, FAC)
- For animals - the plants and animals that make up their diets must be present in or near the wetland
- Many species will not appear unless there are adequate buffers and low intensity surrounding land uses to reduce limiting environmental stressors
- This association between the abiotic and biotic health of wetlands means taxa groups can serve as excellent indicators of wetland quality/conditions

Characterizing Reference Condition

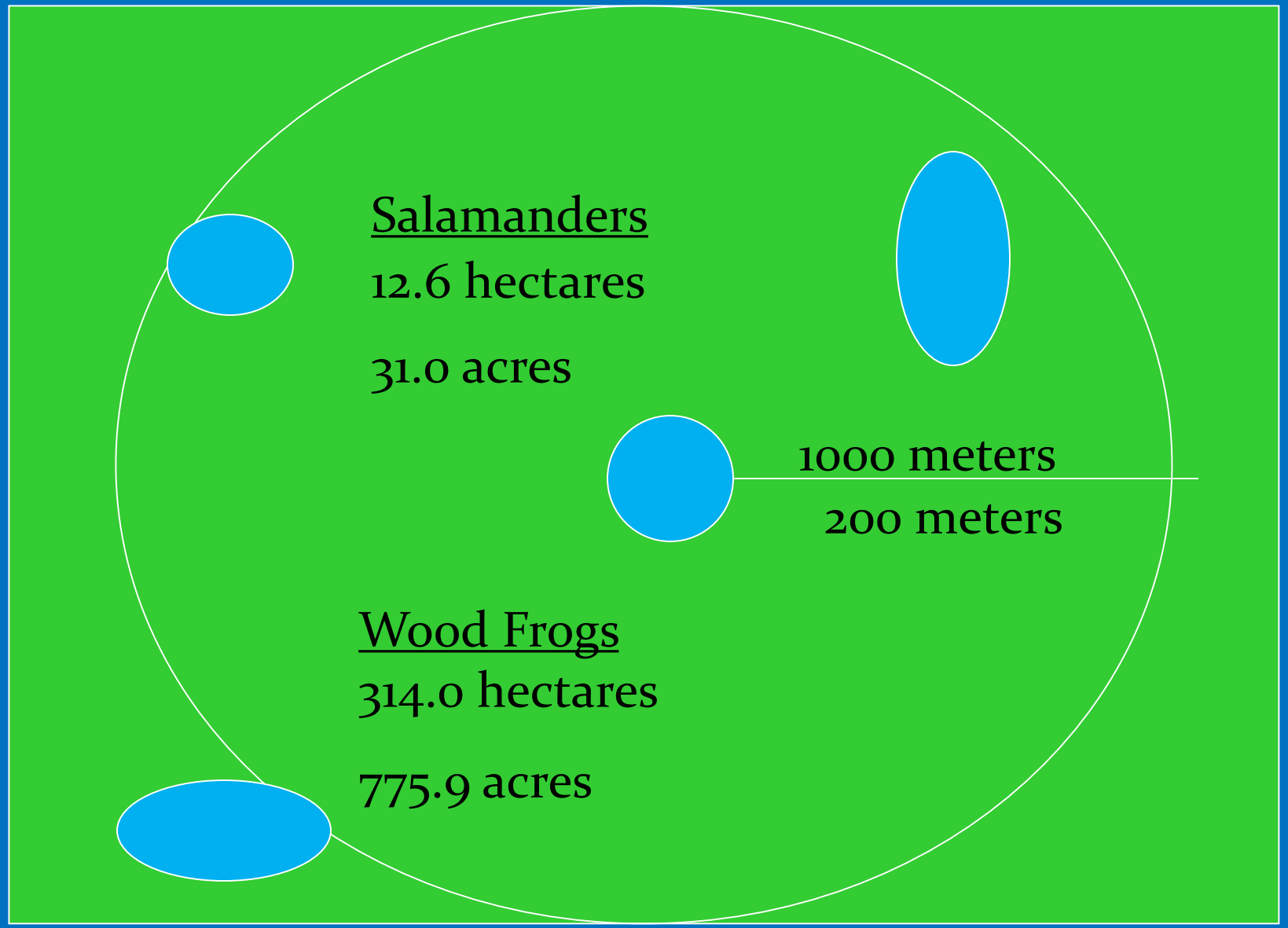
- Critical element in planning/approving projects and setting performance standards
- Ecological understanding gained from defining reference condition leads to development of reasonably achievable and quantifiable performance standards
- Steps to characterize reference condition include:

1. Understanding expectations change with differing classes of wetlands, ecoregions, plant community classes, and watersheds of project
2. Select and verify indicators/measures to assess wetland mitigation condition based on the above differences
3. Establish reference network of wetlands that a) reflect gradient of human-induced disturbance and b) can be sampled to verify the level of performance desired on a trajectory to reaching reference condition

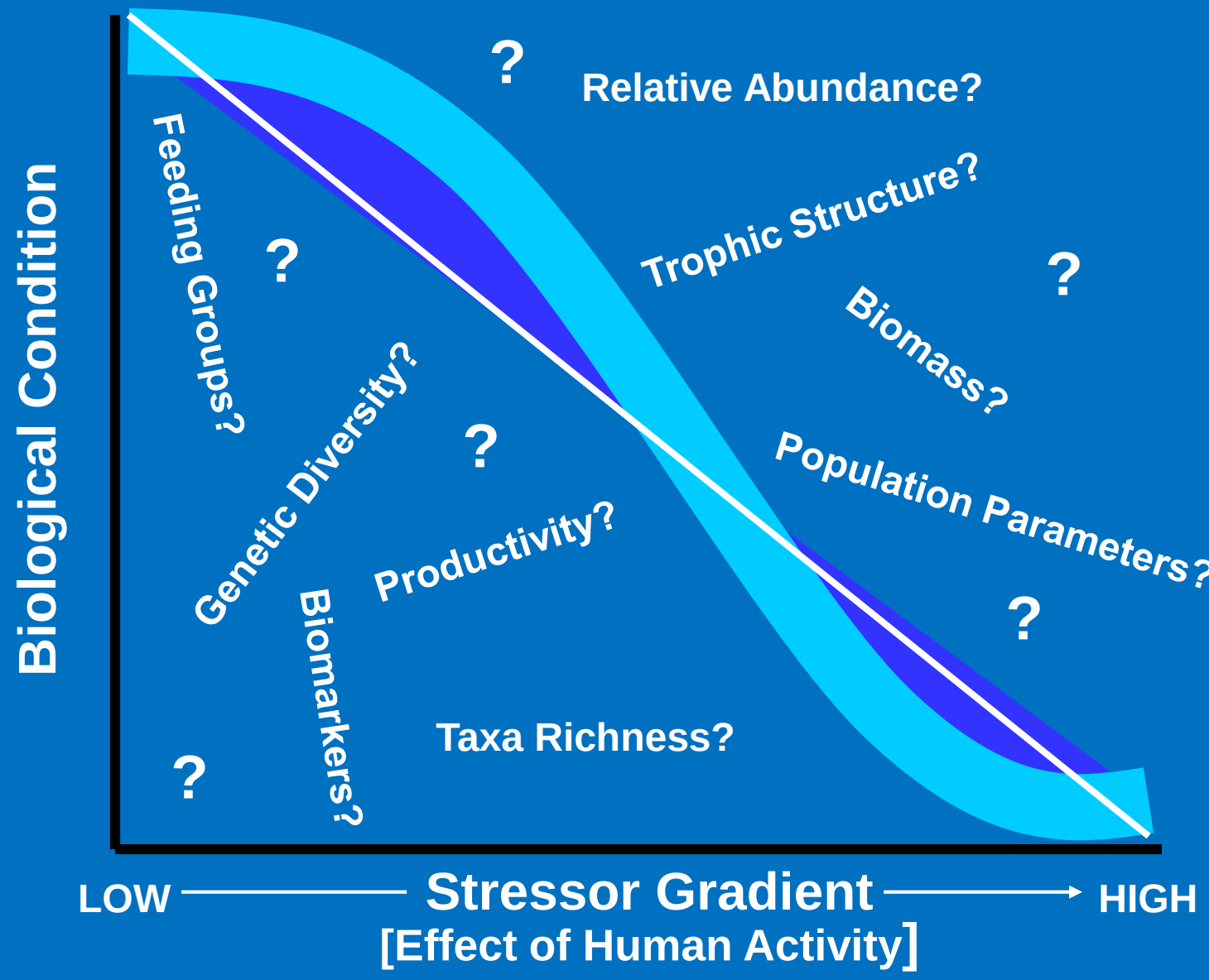
Vernal Pool Amphibians Habitat Needs

- Seasonal hydrology - March-June, at a minimum, with continuous inundation
- Fish-free – bass, sunfish, pike, others (all predatory species)
- Leaf litter/ woody debris on substrates
- Microtopographic features
- Predominately forested landscape – especially important within 200m radius
- Other viable breeding pools within in migration distance

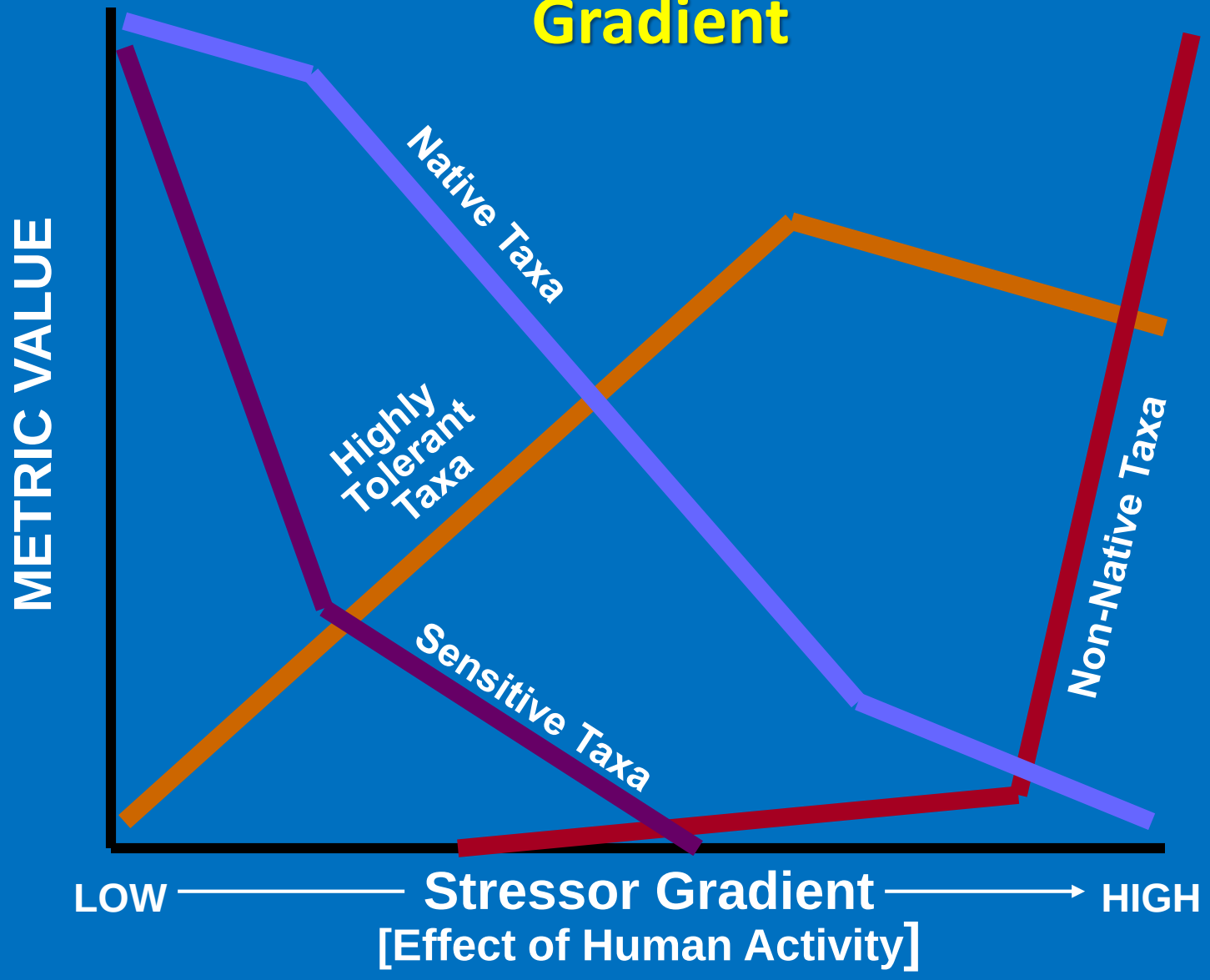
Vernal Pool Amphibian Habitat Needs



What to Measure? How to Decide?

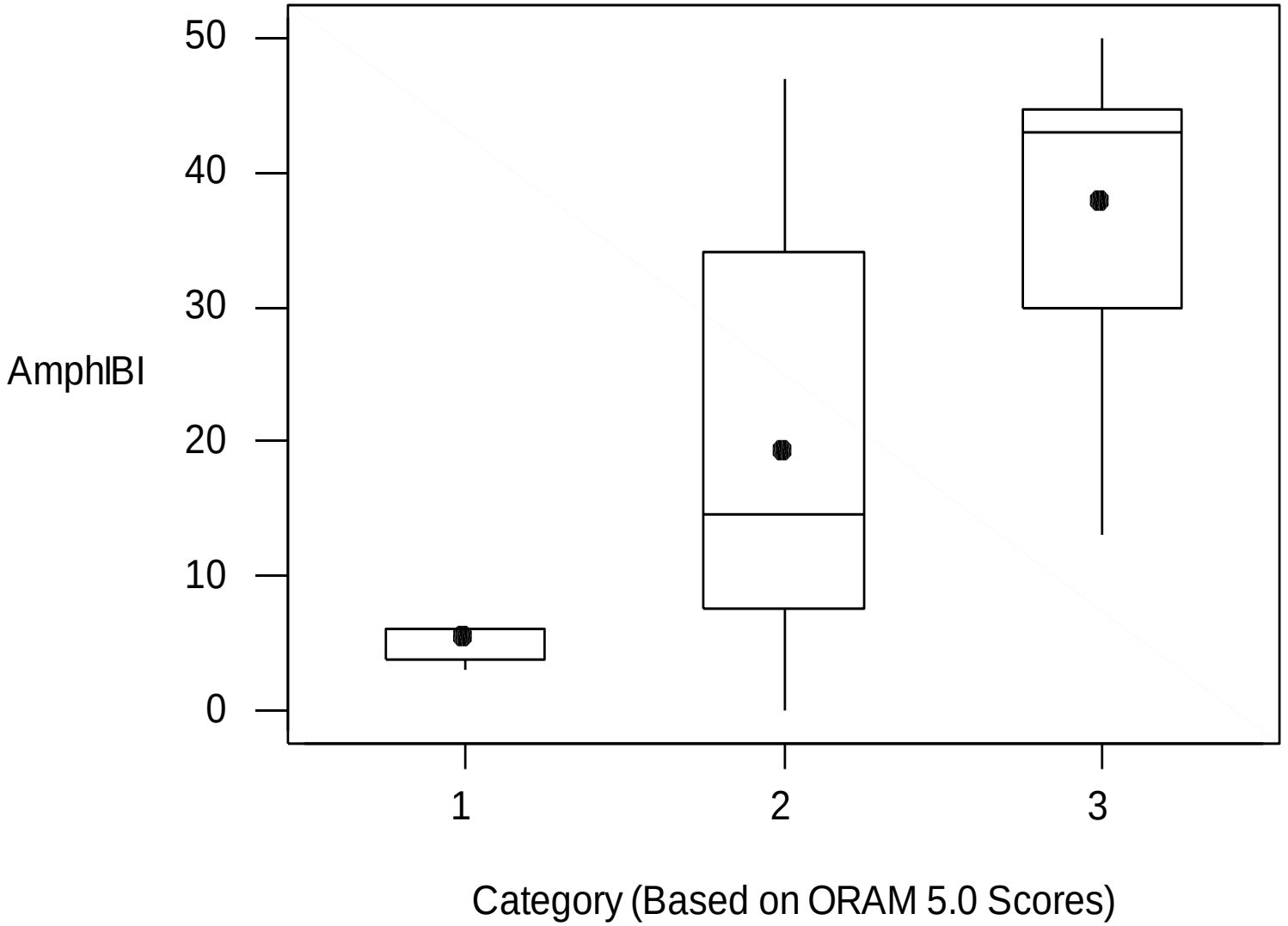


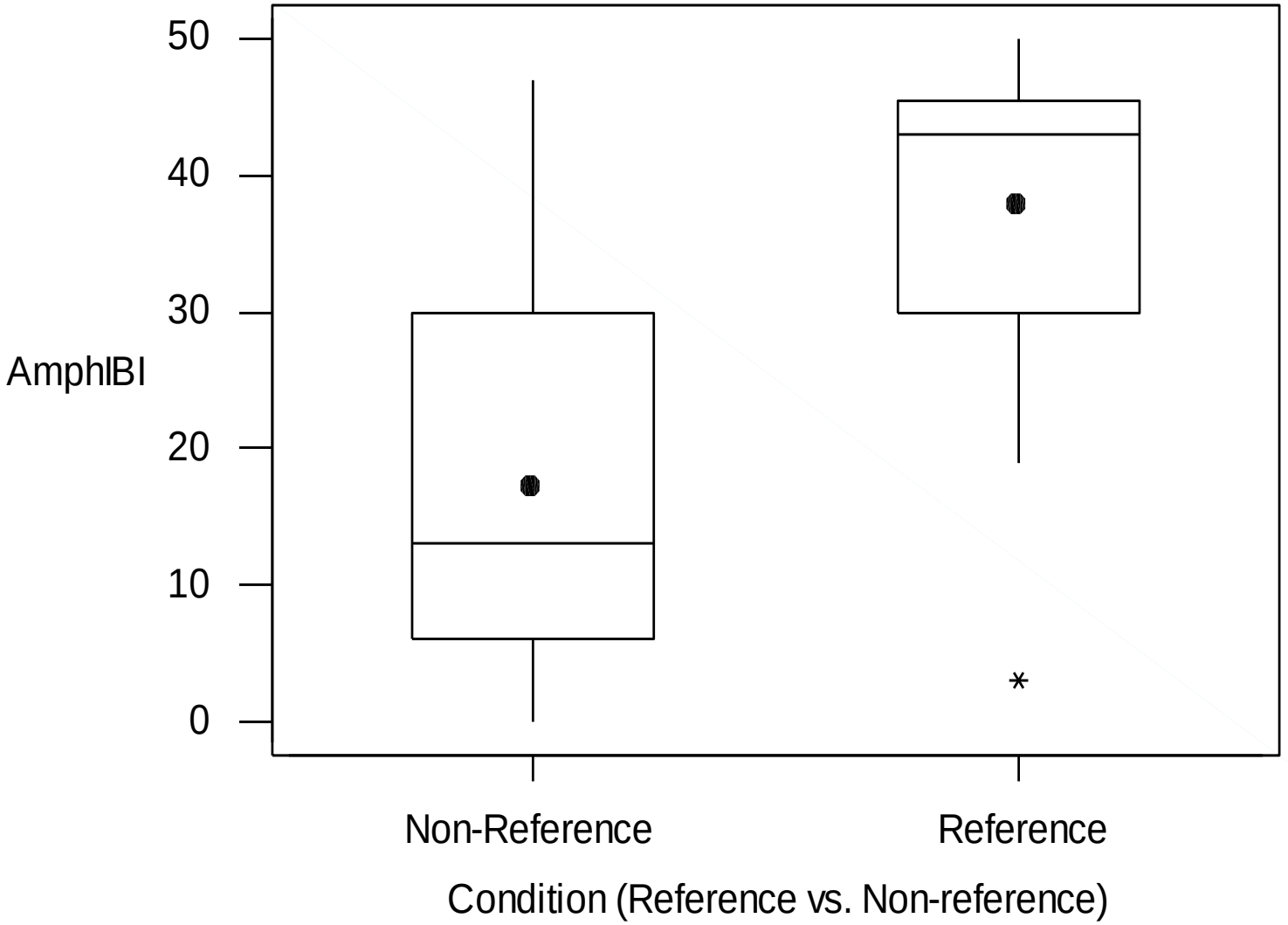
Metric Behavior Along the Stressor Gradient



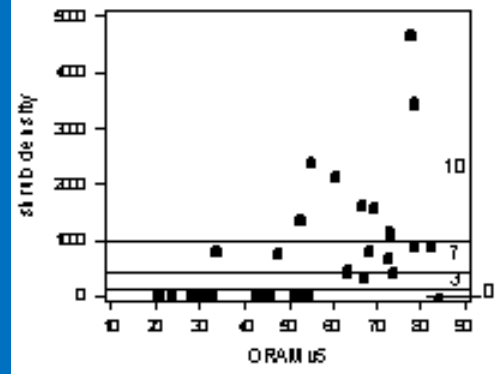
Amphibian IBI Metrics

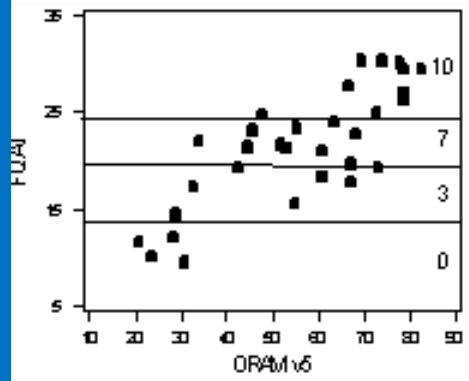
Metric	Type
Number of pond breeding salamander species	richness
Amphibian Quality Assessment Index (AQAI)	index
% tolerant species	community
% sensitive species	community
Presence of Spotted Salamanders and/or Wood Frogs	reference condition

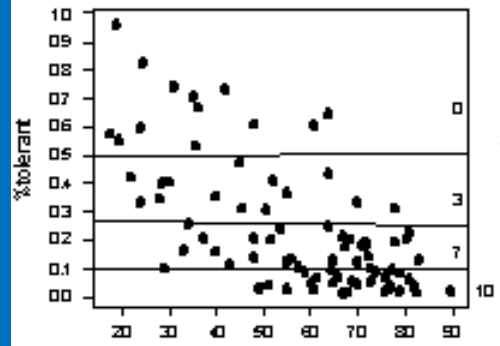

50
40
30
20
10
0
AmphIBI
1
2
3
Category (Based on ORAM 5.0 Scores)


50
40
30
20
10
0
AmphIBI
Non-Reference
Reference
Condition (Reference vs. Non-reference)

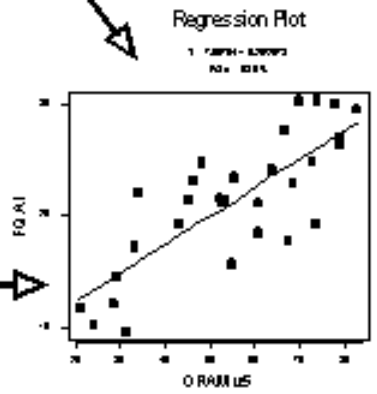
Identify characteristics of indicator taxa group that vary predictably with the disturbance gradient. Each metric's relationship to gradient can be mathematically described.



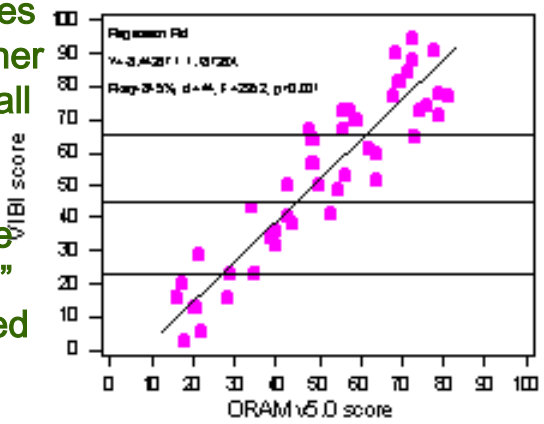




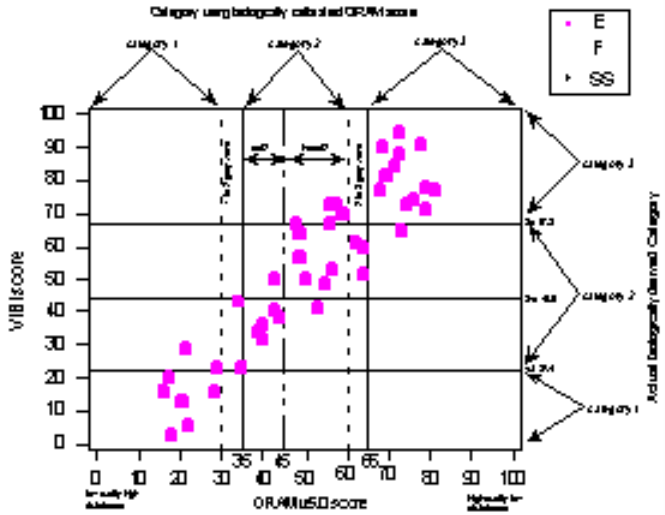
Convert metric values to standard scores of 0, 3, 7, 10 to account for different scales of individual metric values, e.g. density, index scores, %cover, etc.



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

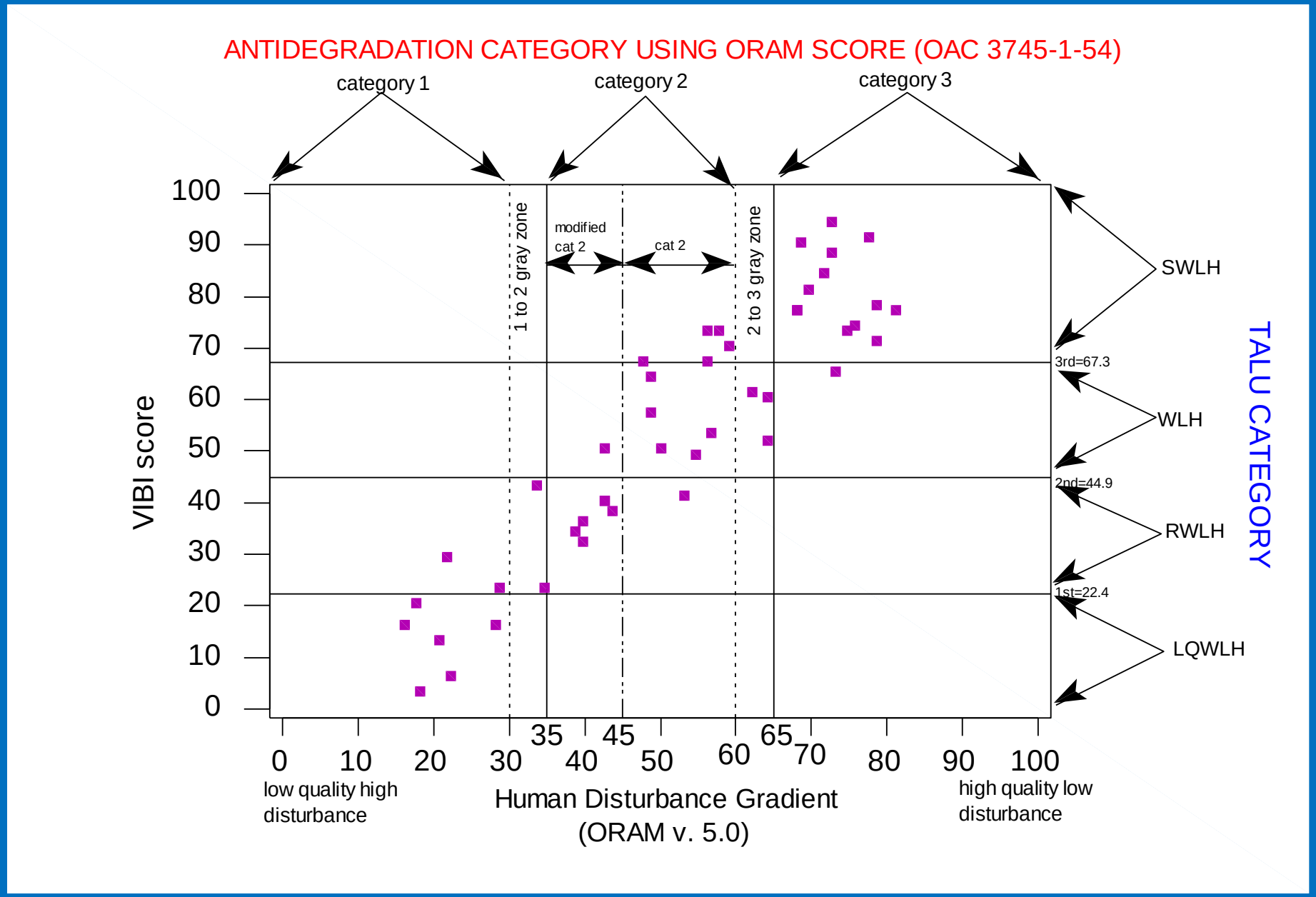


Final step is to decide if you can rely upon disturbance scale (Level 2 rapid method) in lieu of sampling to calculate VIBI (Level 3 method). Fit scoring ranges to disturbance scale



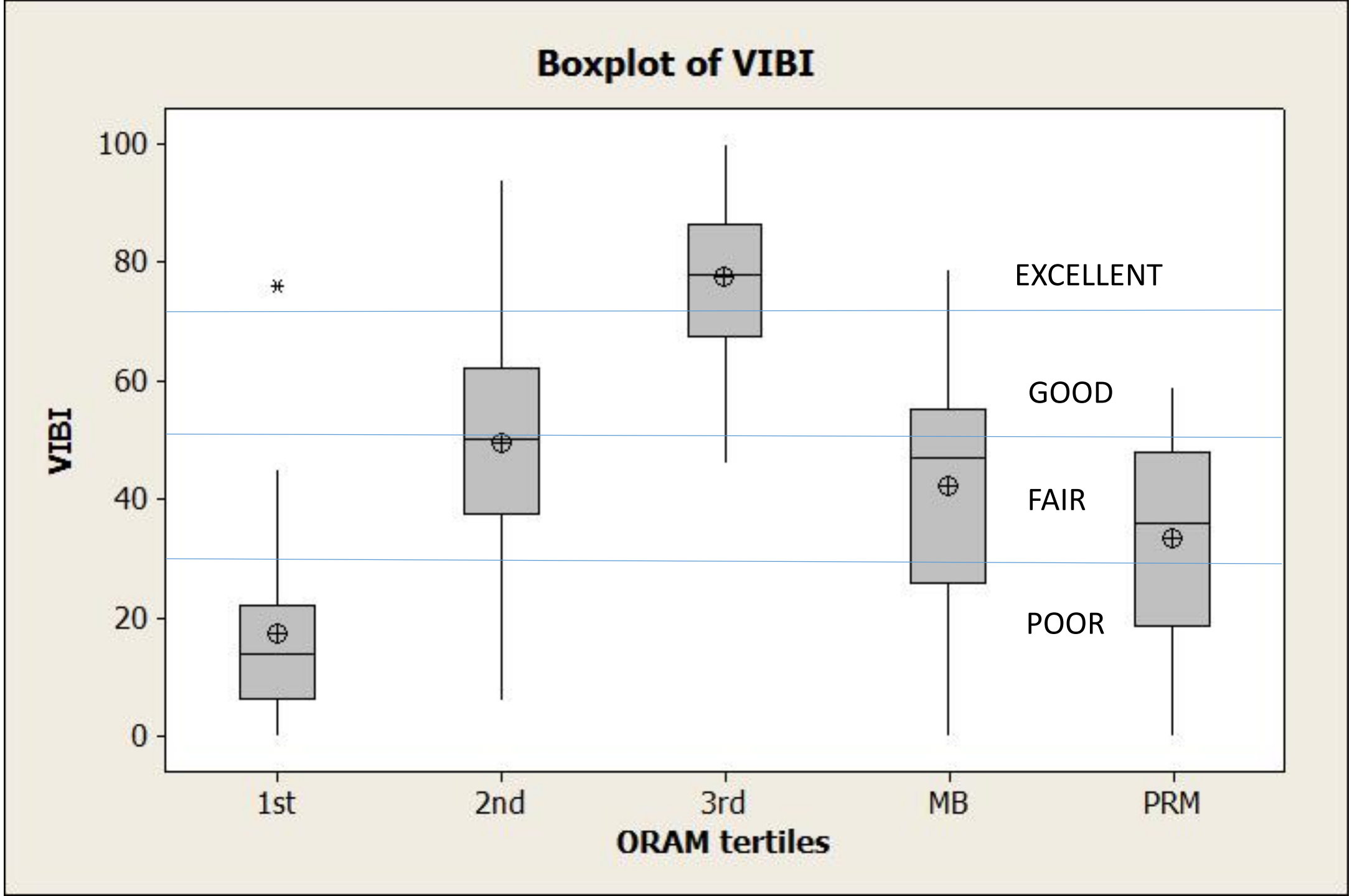
Vegetation Index of Biotic Integrity (VIBI)

Development of VIBI Break Points



Vegetation IBI Emergent Metrics

Metric	Type
number of Carex species	richness
number of native dicotyledon species	richness
number of native wetland (FACW, OBL) shrub species	richness
number of vascular wetland (FACW, OBL) plants	richness
ratio of non-woody species- annual versus perennial	richness
Floristic Quality Assessment Index (FQAI)	index
% tolerant species	community
% sensitive species	community
% invasive graminoids	community
standing biomass	productivity


Boxplot of VIBI
VIBI
100
80
60
40
20
0
EXCELLENT
GOOD
FAIR
POOR
1st
2nd
3rd
MB
PRM
ORAM tertiles

Sample Biology Based Performance Standards

- A numerical VIBI score indicating an ecological condition at the median of "GOOD" or better (higher score)
- At least 75% relative cover of native perennial hydrophytes (OBL, FACW, FAC)
- Establishment of a minimum of 400 healthy woody plants per acre, representing at least 8 tree and at least 8 shrub species, of which 50% are sensitive species, & ≥ 200 are tree species
- Less than 10% relative cover of all non-native invasive plant species, of which non-Typha species do not exceed 5% relative cover
- An AmphIBI score of 30 or higher indicating "EXCELLENT" ecological condition

Summary

- The biological species of wetlands are dependent on the abiotic features which shape their habitat
- The long term goals for a compensatory mitigation project should be based on abiotic and biotic reference conditions for that specific wetland type
- The biological species of wetlands and how they respond to stressors can be used to develop IBIs and set quantitative ecologic performance standards that are achievable and reasonable
- Monitoring of compensatory mitigation wetlands and correctly interpreting the data collected is needed to take any adaptive management actions required to ensure that wetlands are meeting their performance standards and developing into high quality wetlands
- Site selection is the most critical step in the compensatory wetland mitigation process and mistakes cannot be cured through adaptive management

Thank You!

Mick Micacchion, Wetland Ecologist, PWS
The Nature Conservancy and
Midwest Biodiversity Institute
mick.micacchion@tnc.org
614-403-2085

MBI Midwest Biodiversity Institute

The Nature Conservancy