Wetland Bioassessment Using Landscape, Rapid, and Intensive Methods: the 1, 2, 3 approach

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What's the immediate problem?

- Not all decisions call for the same level of information
- Need multi -level assessment methodology
- Need representative sample

Questions

- How do we find the wetlands? (Inventory)

- How do we assess their ecological integrity? (Condition)

- How do we use this information to improve condition? (Restoration)

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│  Inventory   │ ───> │  Condition   │ ───> │ Restoration  │
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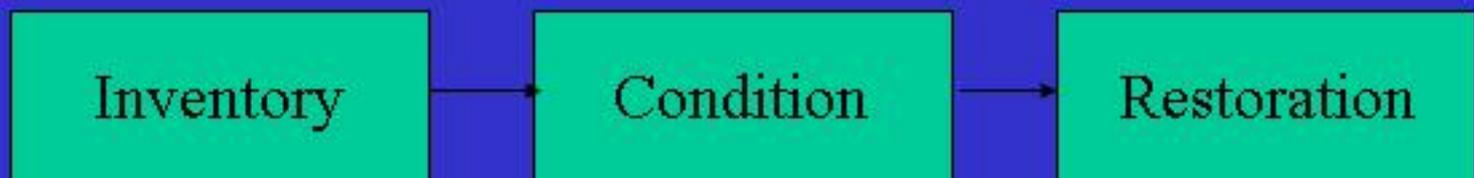
Wetland Assessment

- Current wetland bioassessment thought outlines 3 levels of assessment:
- Level 1: landscape level assessments using remote data and <u>without</u> site visit
- Level 2: "rapid" assessments with habitat, function, and stressor checklists <u>with</u> site visit
- Level 3: detailed biological and/or biogeochemical surveys with quantitative data collection of floral, faunal, physical, and/or chemical characteristics of wetland

INVENTORY

CONDITION

RESTORATION

Landscape Level Assessment

Utilize existing resources (NWI)

Map landuse in watershed; calculate preliminary landscape measures

Synoptic map of restoration potential (existing wetlands, landuse, roads & streams)

Rapid Assessment

Develop and apply landscape-based approach to obtain abundance map

Add site observational data

Map depicting overlay of wetland abundance zones, levels of potential threat, and landuse, roads & streams

Quantitative Assessment

Map of abundance zones with verified inventory

Apply IBIs w/ HGM classification or HGM models to targeted or probability based sampling locations

Map depicting abundance zones, verified inventory, and probable condition

Performance criteria matrices provide restoration standards
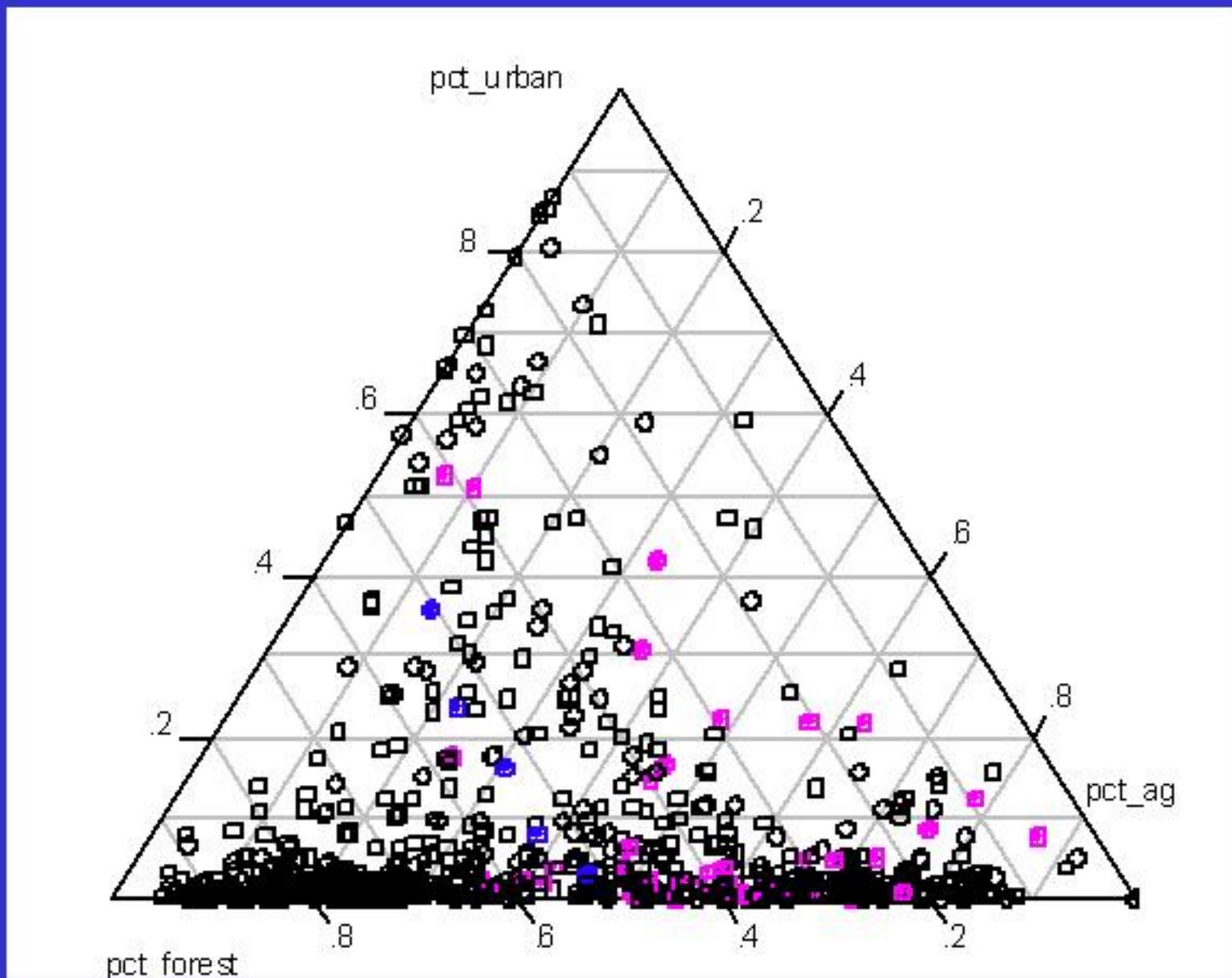
Level 1:
Landscape Level Assessment

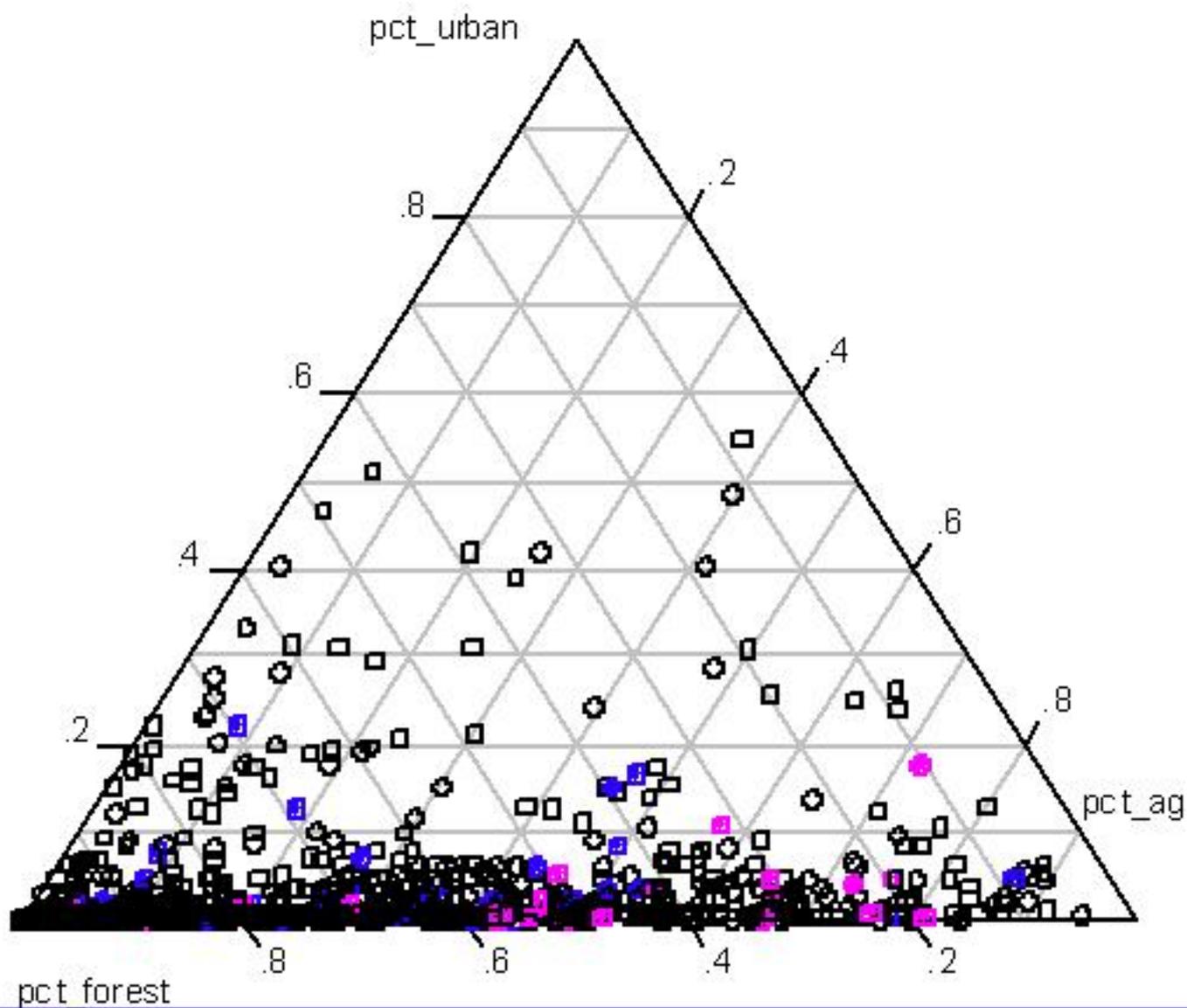# Forested is our reference standard

Agricultural Use is a Major Activity
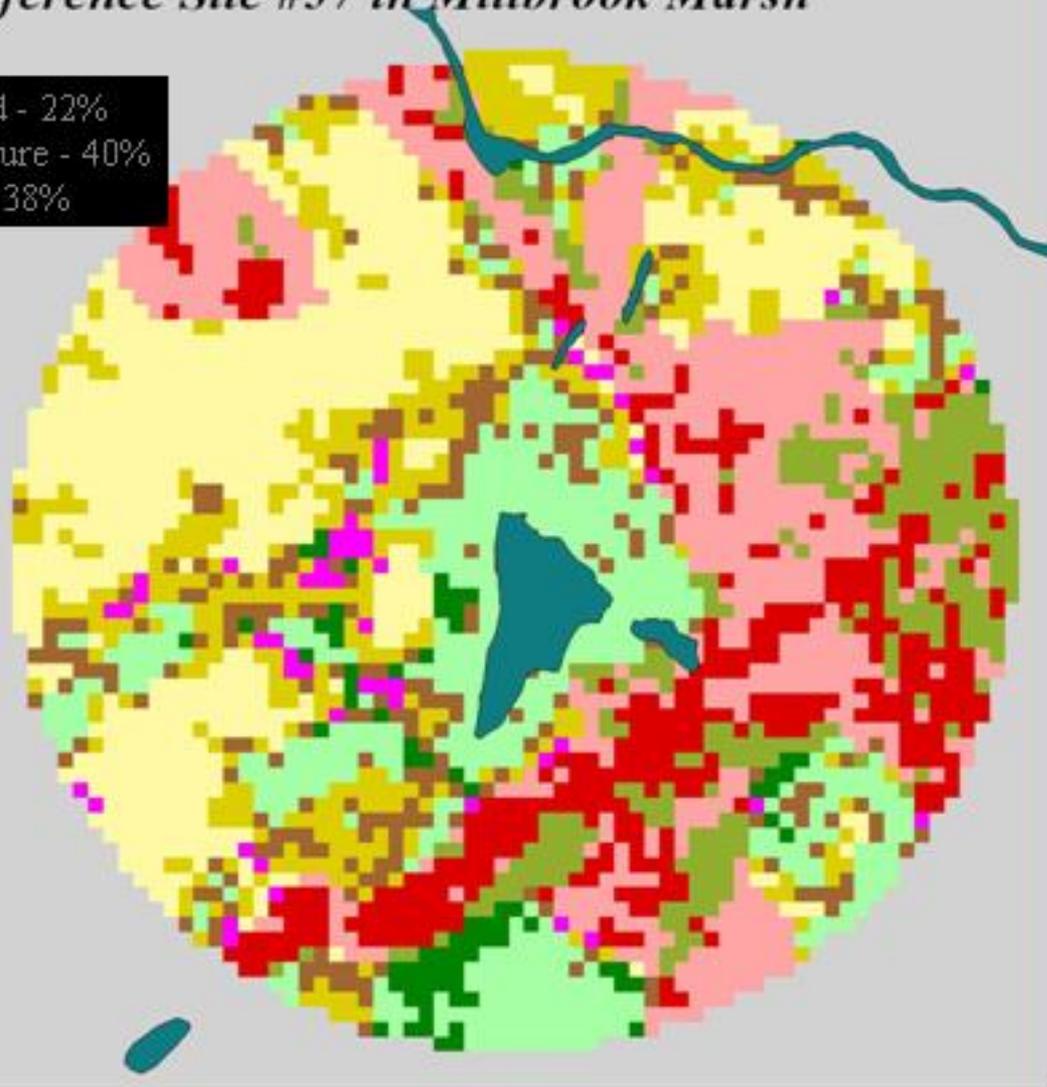
Piedmont Watersheds

Ridge and Valley Watersheds

Reference Site #57 in Millbrook Marsh

Forested - 22%
Agriculture - 40%
Urban - 38%

Land Use Patterns

%For=96
MFPS=302
SDI=0.2
RD=8

%For =25
MFPS=3
SDI=1.1
RD=8

%For =41
MFPS=55
SDI=1.6
RD=24

%For =17
MFPS=3
SDI=1.7
RD=47

Human disturbance scales

- Most wetland IBIs have developed and used semiquantitative, quantitative, or qualitative human disturbance scales to select metrics and develop IBIs

- develop and refine at same time as IBI data collection and development

- Examples from OH, PA, FL

Quantitative scales

- Single parameter chemical scales
  - e.g. turbidity, P, Zn

- Quantified landscape variables
  - GIS based, %landuse covers within x distance from wetland

FL Landscape Development Intensity (LDI) Index

- Quantifies disturbance gradients
- Independent measure of disturbance using land use/land cover, aerial photographs, and ground observations
- LDI multiplies land use percents by weighting factors
- Weighting factors based on calculation of supplemental "emergy" needed to maintain non-natural landscapes

$$LDI = \Sigma \, (LDI_j * \%LU_j)$$

Where,

LDI = Landscape Development Intensity Index

LDI_j = LDI coefficient for land use "j"

$\%LU_j$ = Percent area of the wetland drainage basin occupied by land use "j"

LDI based on surrounding land uses

Four different buffers tested...

18 meters
100 meters
150 meters
500 meters

Rangeland, 3.03

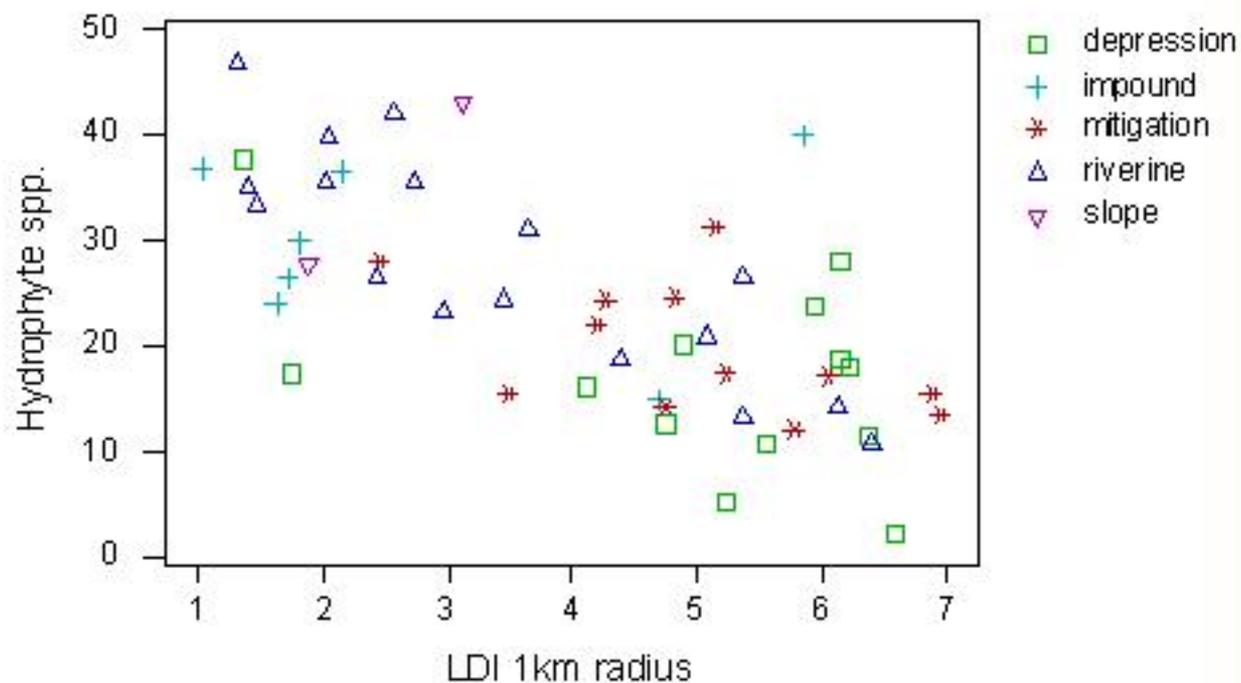Upland Forest or Wetland, 1.0
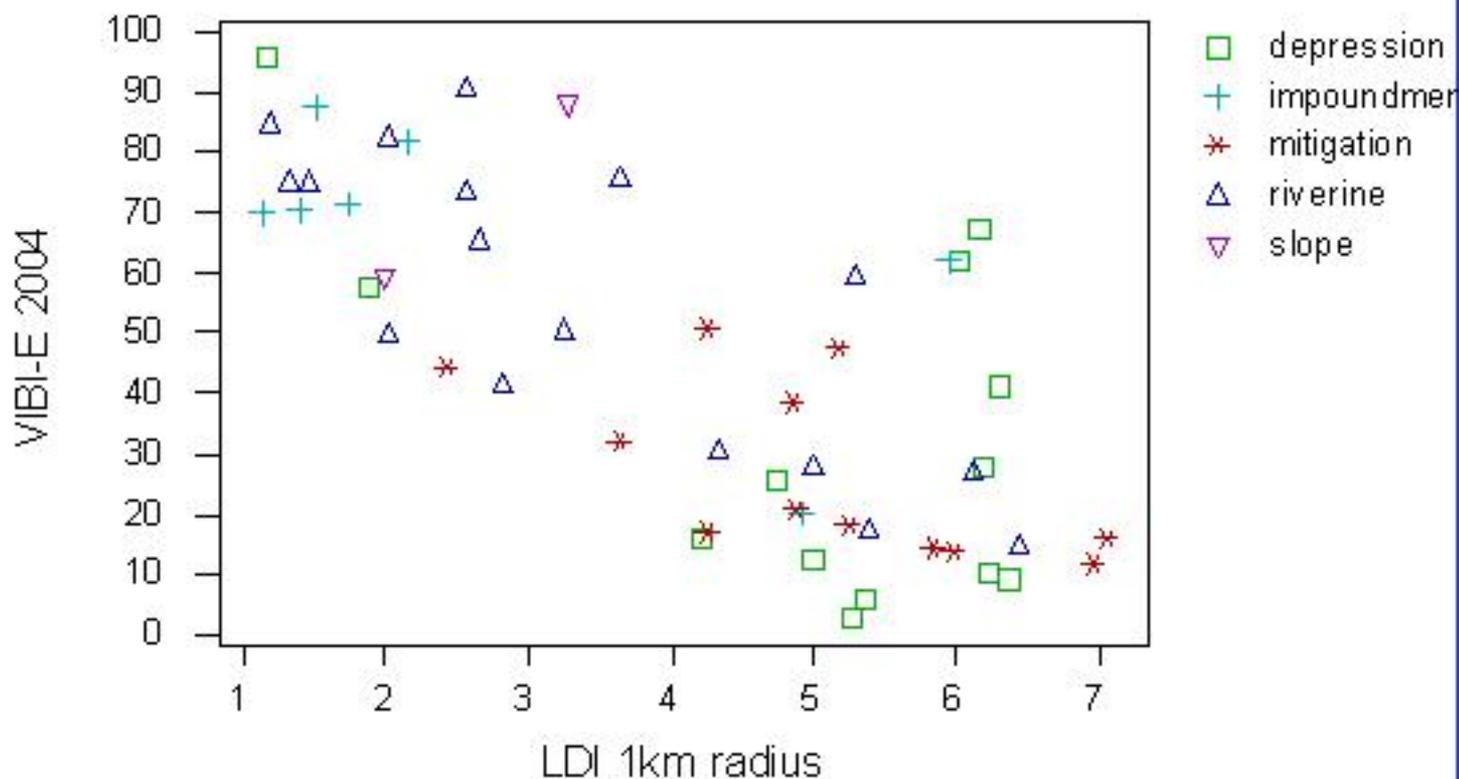
Citrus, 5.73

Intense Row Crops, 6.84

Study Wetland

100 m buffer

Hydrophyte richness v. LDI at 1km radius circle from wetland center

Vegetation IBI v. LDI at 1km radius circle from wetland center

Level 1 Assessment: Worksheet

Break into small groups

Using aerial photos, topo maps and land use percents (NLCD data) make a determination of expected wetland condition for three sites

Assign sites to one of five categories: poor, fair, good, very good, excellent

Report LDI score and assessment to full group

Level 2:
Rapid Assessment

Semi-quantitative scales

- OH and PA disturbance scales

- some type of stressor checklist

- on site stressors (hydrology or habitat alterations)

- landscape stressors (buffers, intensity of surrounding landuse

STRESSOR CHECKLIST

Stressor Score: _____

Site Name: _____ Site Number: _____ Date: _____

Buffer Type*:	Buffer Width:				
	>100	30-100	10-30	3-10	0-3
Natural Forest	14	12	10	8	6
Shrub/Sapling	12	10	8	6	4
Perennial Herb	10	8	6	4	2
Other	0	0	0	0	0

*If exactly one-half of two buffer types, take half the sum

Buffer Width _____ (m) Buffer Score _____

Buffer Type

☐ Natural Forest   ☐ Perennial Herb

☐ Shrub/Sapling   ☐ Other (list) _____

Hydrologic Modification   Score: _____

(Score = the number of checked boxes)

☐ Ditch
☐ Tile Drain
☐ Dike
☐ Weir/dam   Type: _____
☐ Stormwater inputs/culvert
☐ Point source (non-stormwater)
☐ Filling, grading, dredging (of wetland/waterbody or immediate buffers)
☐ Road bed/railroad
☐ Dead/dying trees
☐ Other _____

Vegetation Alteration   Score: _____

☐ Mowing
☐ Grazing
☐ Tree cutting (> 50 % canopy removal)
☐ Brush cutting (mechanized removal of shrubs/saplings)
☐ Removal of woody debris
☐ Aquatic weed control (mechanical or herbicide)
☐ Excessive herbivory (deer, muskrat, geese, carp, etc.)
☐ Dominant presence (>50% of the vegetation) of exotic or aggressive plant species (see list)
☐ Evidence of chemical defoliation
☐ Other _____

Sedimentation   Score: _____

☐ Sediment deposits/plumes
☐ Eroding banks/slopes
☐ Active/recently active adjacent construction, plowing, heavy grazing, or forest harvesting
☐ Siltlines on ground or vegetation
☐ Urban/road stormwater input/culvert
☐ Dominant presence (>50% of vegetation) of sediment tolerant plants (see list)
☐ Other _____

Eutrophication   Score: _____

☐ Direct discharges from agricultural feedlots, manure pits, etc.
☐ Direct discharges from septic or sewage treatment systems
☐ Heavy or moderately heavy formation of algal mats
☐ Dominant presence (>50% of vegetation) of nutrient tolerant species (e.g., uniform stands of exotic/aggressive species - see list)
☐ Other (e.g., signs of excess nutrients - methane odor, dead fish, etc.)

Dissolved Oxygen   Score: _____

☐ Excessive density of aquatic plants or algal mats in water column
☐ Excessive deposition or dumping of organic waste (e.g., leaves, grass clippings, woody debris, etc.)
☐ Direct discharges of organic wastewater or material (e.g., milkhouse waste, food-processing waste, other wastewater sources)

Acidification   Score: _____

☐ AMD discharges
☐ Adjacent mined lands/spoil piles
☐ Excessively clear water
☐ Absence of expected biota
☐ Other (e.g., abnormally low pH measure) _____

Turbidity (if high conc, check both boxes)   Score: _____

☐ High concentration of suspended solids in water column
☐ Moderate concentration of suspended solids in water column

Contaminant Toxicity   Score: _____

☐ Severe vegetation stress
☐ Obvious spills, discharges, plumes, odors
☐ Wildlife impacts (e.g., tumors, abnormalities, etc.)
☐ Adjacent industrial sites, proximity of railroad
☐ Other _____

Thermal Alteration (if high temp, check both boxes)   Score: _____

☐ Significant increase water temperture
☐ Moderate increase in water temperature
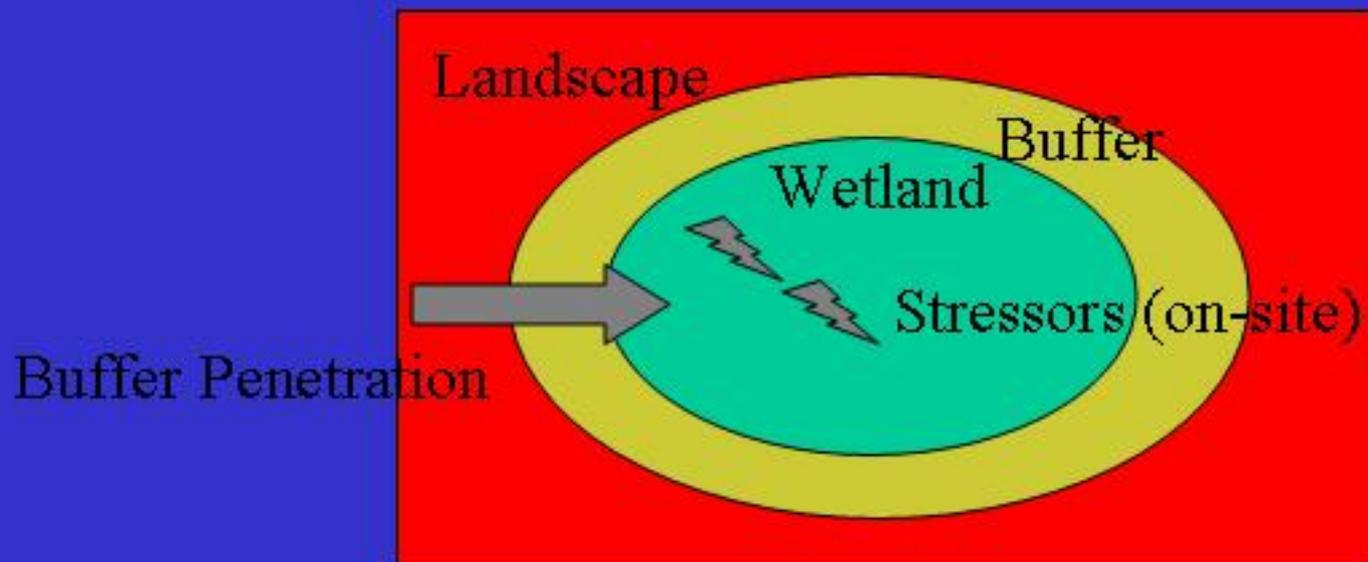
Salinity   Score: _____

☐ Obvious increase in concentration of dissolved salts

Stressor Checklist

- Hydrologic Modification
- Sedimentation
- Dissolved oxygen
- Contaminant toxicity
- Vegetation alteration

- Eutrophication
- Acidification
- Turbidity
- Thermal Alteration
- Salinity

Rapid Assessment Score

- Combination of landscape, buffer, and site-specific stressors
- **Score=Buffer+(%For*WF)-Buffer Hits**

Juniata Stressors
All Sites

Contaminant Toxicity 10%
Acidification 2%
Turbidity 1%
Dissolved Oxygen 2%
Eutrophication 3%
Hydrologic Modifications 38%
Sedimentation 21%
Vegetation Alteration 23%

Legend:
- Hydrologic Modifications
- Vegetation Alteration
- Sedimentation
- Eutrophication
- Dissolved Oxygen
- Acidification
- Contaminant Toxicity
- Turbidity
- Thermal Alteration
- Salinity
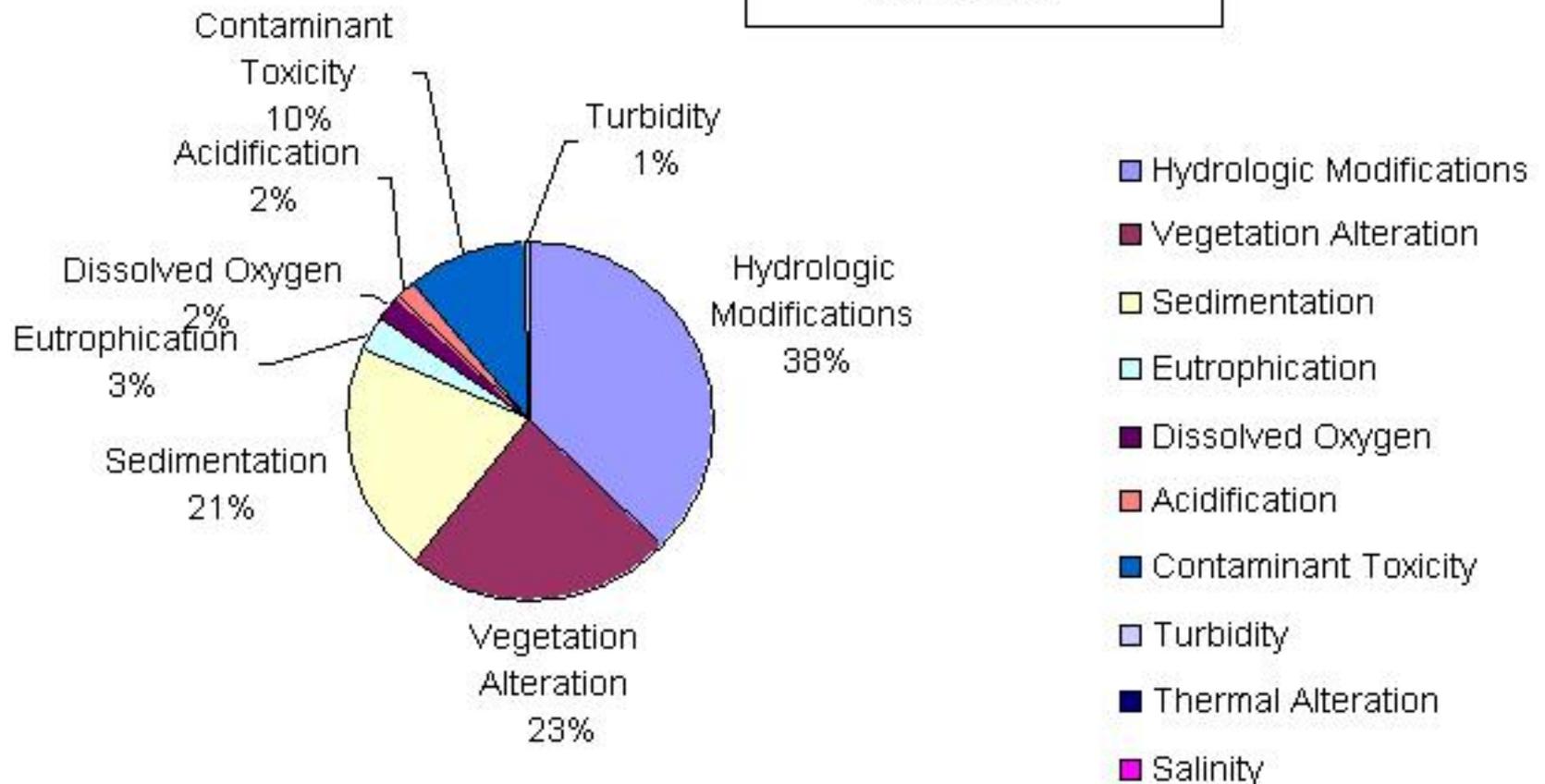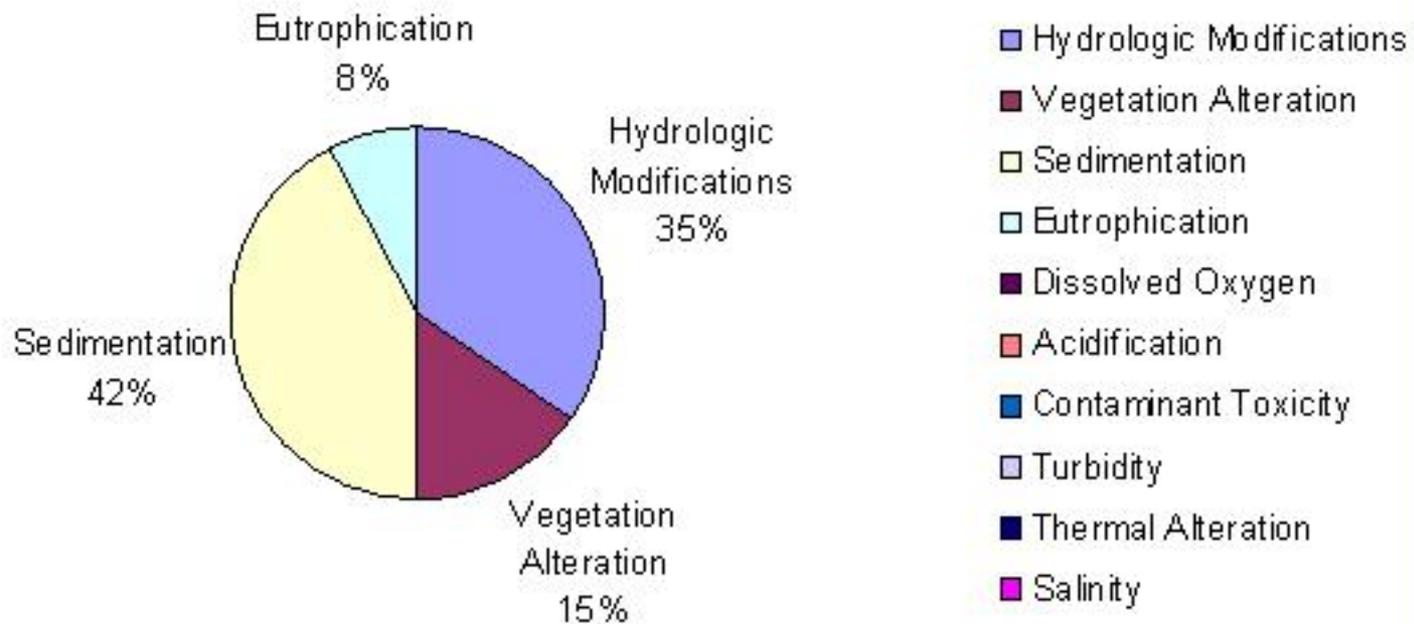
Developing a rapid assessment tool (level 2)

- BACKGROUND. With adoption of Ohio's wetland water quality standards (WWQS), there was a need to rapidly assign a wetland to one of three regulatory categories

- The WWQSs require applicants to use "an appropriate wetland evaluation methodology acceptable to the director…"

- Need to calibrate breakpoints for level 2 rapid method with level 3 (IBI) data

Purpose and use of ORAM

- ORAM primarily a tool for performing regulatory categorization of wetlands
- Also developed to be used as wetland disturbance/ecological integrity scale
- ORAM internalizes HGM classes

ORAM not a functional assessment *per se*

- Focus is on overall wetland condition and ecological integrity as integrating "super" function

- However, component questions of ORAM can be "deconstructed" and related back to function by function assessment

- Each ORAM question is grounded in hydrologic, habitat, ecosystem, watershed or other functions

ORAM internalizes HGM and plant community classes

- Some questions "neutral" as to class, e.g. size, buffer width, %cover of invasive plants

- ORAM expressly requires Raters to evaluate wetlands in relation to other wetlands in the same landscape position and dominant plant community

Parts of the ORAM

- Five main parts to the ORAM:
  - BACKGROUND INFORMATION SECTION
  - SCORING BOUNDARY SECTION
  - NARRATIVE RATING QUESTIONS
  - QUANTITATIVE RATING QUESTIONS
  - CATEGORIZATION WORKSHEET
- ORAM designed to be completed in linear fashion although each section can stand alone also

Scoring boundaries:

determining what the assessment unit is
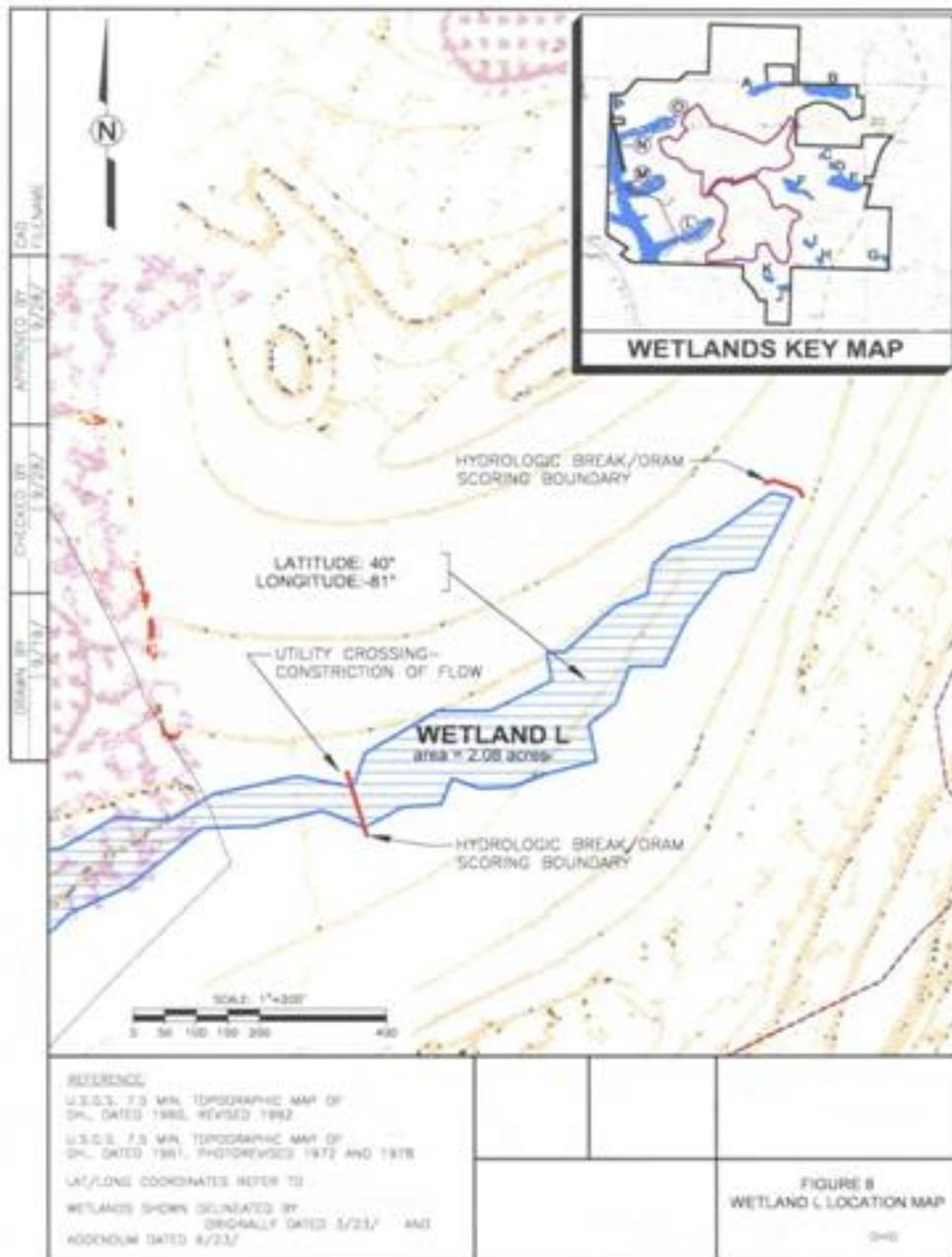
Narrative Rating Section

- Eleven questions designed to determine whether a wetland is a category 1 or 3 wetland or to alert Rater that the wetland <u>may</u> be a category 3 wetland

- First four questions "literature review" questions
    - Primarily based on consultation of Heritage Database maintained by ODNR-DNAP

- Remaining questions focus on rare wetland types

Threatened or Endangered Species

- *Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?*

- Consult Heritage Database by submitting data services request

- Consult any other published literature and accounts available to the Rater

Prairie fringed orchid (*Platanthera leucophea*) Killbuck Valley, Wayne Co.

Quantitative Rating Section

- Section most focused on when people think the ORAM, but only one part of a complete system for categorization

- Semi-quantitative or semi-qualitative

- Some questions (wetland size, buffer width, depth of water, % invasive plant cover) clearly quantifiable

- Other questions qualitative with ordinal ranking

Metric 1

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland. Select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts   ≥50 acres (≥20.2ha)

5pts   25 – <50 acres (10.1 – <20.2ha)

4pts   10 – <25 acres (4.0 – <10.1ha)

3pts   3 – <10 acres (1.2 – <4.0ha)

2pts   0.3 – <3 acres (0.12 – <1.2ha)

1pt   0.1 – <0.3 acres (0.04 – <0.12ha)

0pts   < 0.1 acres (0.04ha)

Metric 2a

**2a Average Buffer Width (abw).** Calculate the average buffer width and select only one score. DO NOT DOUBLE CHECK

7pts   WIDE >50m (164ft) or more around perimeter.

4pts   MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.

1pt   NARROW 10m to <25m (32 to <82ft) around the perimeter.
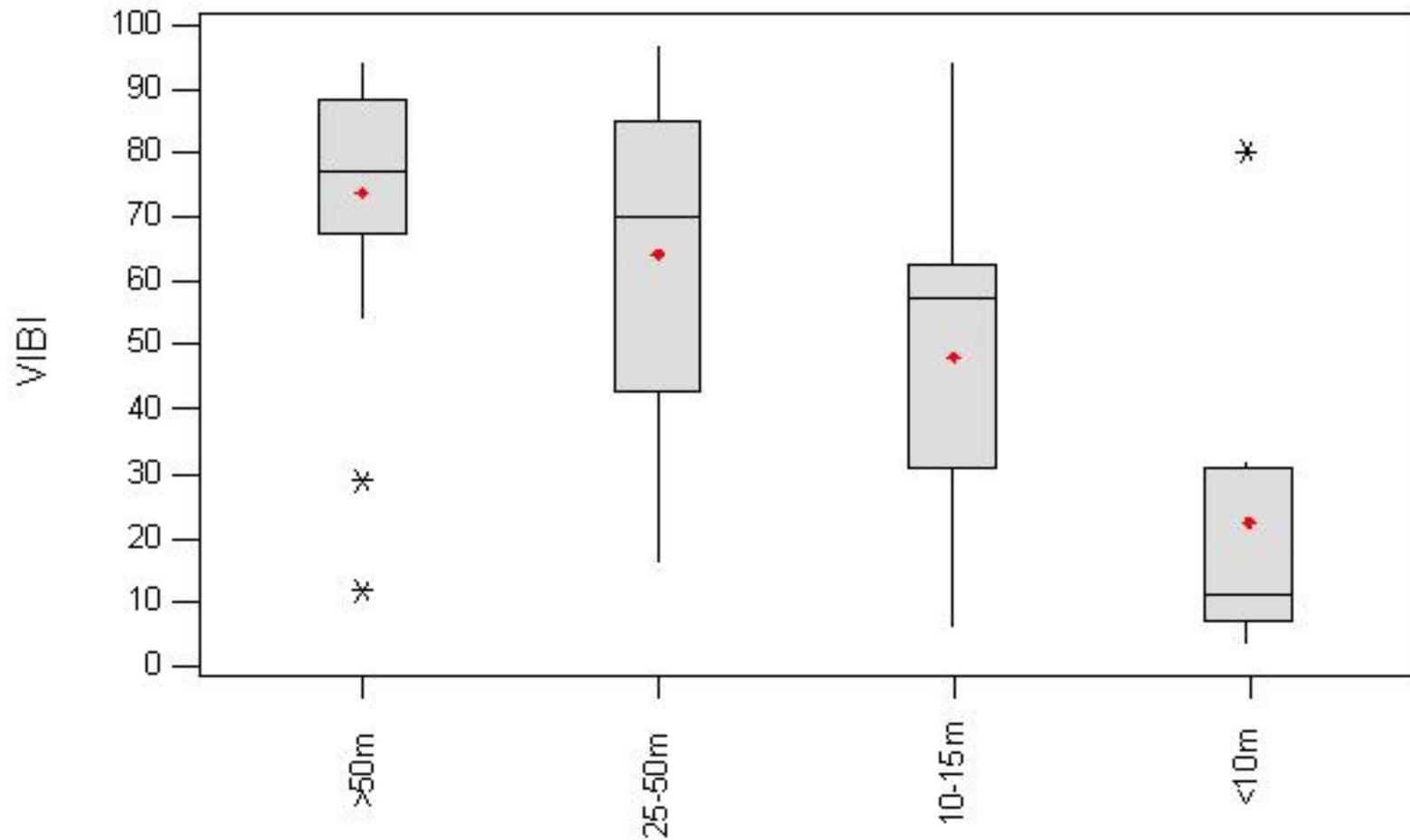
0pts   VERY NARROW <10m (<32ft) around perimeter.

Two-lane paved road

corn

Forested woodlot

100m

corn

60m

WETLAND

0m

0m

corn
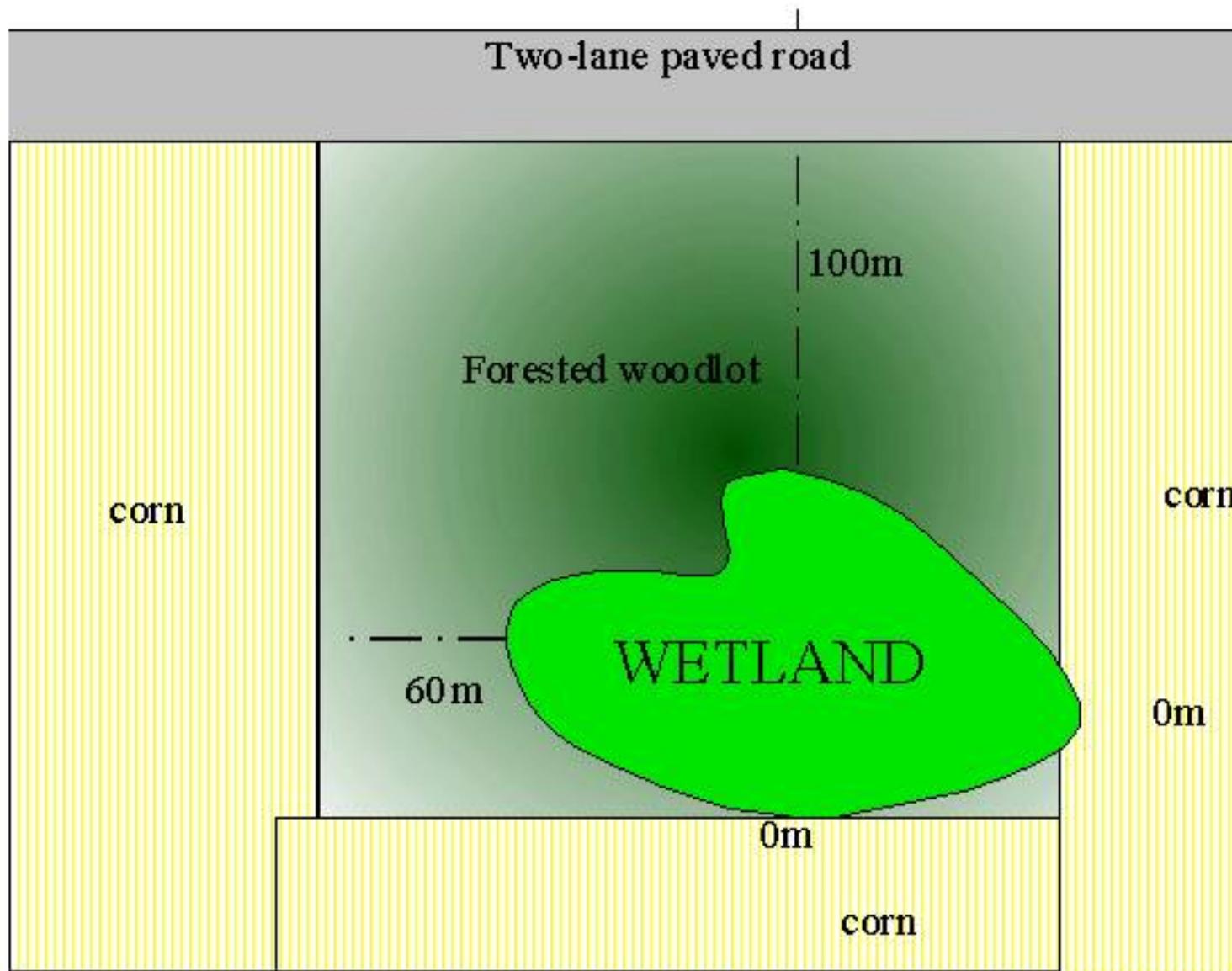
Average buffer width = (50+50+0+0)/4 = 25m = medium buffer

Boxplots of VIBI by buffer class

df=82, F=12.00, p<0.001 all means significantly different

Metric 2b

2b. Intensity of predominant surrounding land use(s). Select one, or double check up to two and average score, for the intensity of the predominant land use(s) outside the wetlands buffer zone (if any).

7pts   VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc.

5pts   LOW. Old field (>10 yrs), shrubland, young 2nd growth forest, etc.

3pts   MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field, etc.

1pt   HIGH. urban, industrial, open pasture, row cropping, mining, construction, etc.

Boxplots of VIBI by intensity of land use

df=79, F=13.22, p<0.001 low>medium>high=very high
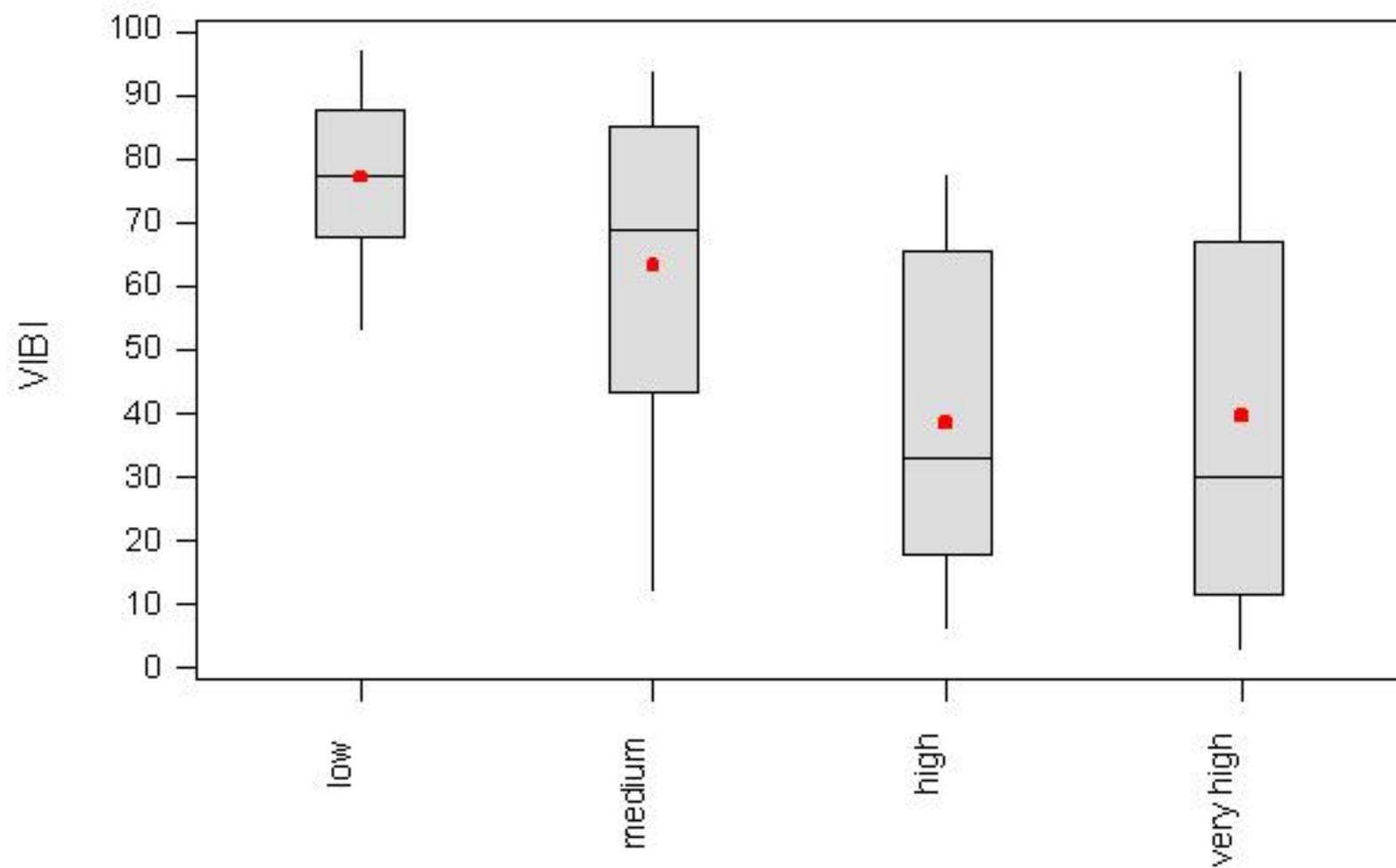
Metric 3 Hydrology

- **Asks questions about**
  - sources of water (3a)
  - permanence of inundation/saturation (3d)
  - depth of water (3c)
  - connectivity to other waters or habitats (3b)
  - intactness of hydrologic regime for that type of wetland (3e)

  WE WILL FOCUS MOST ON METRIC 3e

Metric 3a Sources of Water

3a. Sources of Water. Select all that apply and sum score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.	
5pts High pH groundwater (7.5-9.0)	
3pts Other groundwater	
1pts Precipitation	
3pts Seasonal surface water	
5pts Perennial surface water (lake or stream)	

Metric 3b Connectivity

3b. Connectivity. Select all that apply and sum score.	
1pt **100 year floodplain.** "Floodplain" is defined in OAC Rule 3745-1-50(P) as "...the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt **between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt **part of wetland or upland (e.g. forest, prairie) complex.** Both this and the next question ask whether the wetland is in physical proximity to, or a part of other nearby wetland or upland natural areas. The difference is whether the area the wetland is "long and narrow" like a river, or more "squarish" like a large forest or woodlot. If the latter is the case, this question applies; if the former, the next question applies. In a few instances, both may apply	
1pt **part of riparian or upland corridor.** See description above.	

Metrics 3c and 3d (water depth and duration)

3c. Maximum water depth. Select only one and assign score. The Rater *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.	
3pts >0.7m (27.6in)	
2pts 0.4 to 0.7m (15.7 to 27.6in)	
1pt <0.4m (<15.7in)	
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of secondary indicators is necessary and expected in order to properly answer this Question. Categories correspond to Zones II, III, and IV of 1987 Manual (Table 5). Zone IV subdivided into seasonally inundated and seasonally saturated.	
4pts Semipermanently to permanently inundated or saturated.	
3pts Regularly inundated or saturated.	
2pts Seasonally inundated.	
1pt Seasonally saturated in the upper 30cm (12in) of soil.	

Metric 3e: Intactness of Natural Hydrology

Step 1: List all possible disturbances

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

You may check disturbances yet still find hydrology intact

Step 2: Answer focusing questions

Circle one answer. Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime, or have they occurred so far in the past that current hydrology should be considered to be "natural."?	**YES** Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	**NO** Assign a score of 12 since there are no or no apparent modifications.	**NOT SURE** Double check "none or none apparent" and "recovered" and assign a score of 9.5.

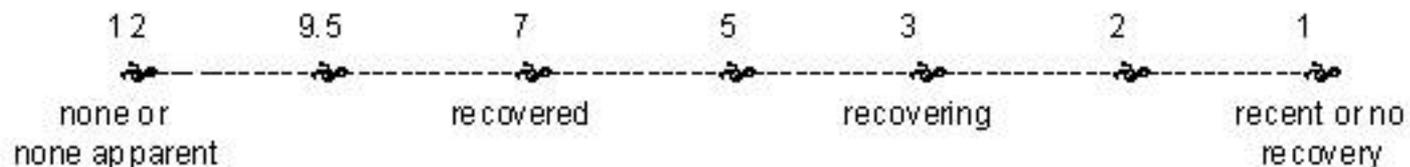| Select one or double check adjoining numbers and average the score.		score
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the rater.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

Typical hydrologic disturbances

- depressions and riverine depressions
  - disturbances: removing water by ditches, tiles; adding water by stormwater or impoundment (sometimes)
  - not disturbances (usually): minor filling, small access roads separating pools, mechanical disturbances to soil, mowing, grazing
- riverine channel, riverine depressions
  - channelization of stream, inundation by impoundment
- slope
  - ditches, tiles (works sometimes)
- fringing (lakes)
  - raising water levels to inundate wetlands

Metric 3e cont.

- ## STEP 3: assign score based on intactness of natural hydrologic regime

Select one or double check adjoining numbers and average the score.		score
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the rater.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

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  12          9.5          7            5           3           2           1
  |------------|------------|------------|-----------|-----------|-----------|

  none or                recovered              recovering          recent or no
 none apparent                                                        recovery
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Metric 4a Substrate disturbance

- Identical "logic" to question as in Metric 3e

- Determine whether "more than trivial" physical disturbances have occurred to the substrate (soil, sediment) in the wetland

- Focus on mechanical and sedimentation type disturbances

Metric 4a

Circle one answer. Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils or substrates, or have they occurred so far in the past that current conditions should be considered to be "natural."?	**YES** Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	**NO** Assign a score of 4 since there are no or no apparent modifications.	**NOT SURE** Double check "none or none apparent" and "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.	score
4pts NONE OR NONE APPARENT. There are no disturbances, or no disturbances apparent to the Rater.	
3pts RECOVERED. The wetland appears to have recovered from past disturbances.	
2pts RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

Metric 4b Habitat development

4b. Habitat development. Select only one and assign score. This question asks the Rater to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically or hydrogeomorphically similar wetlands. This question presumes a good sense of the types of wetlands and the range in quality typical of the region, watershed, or state.	
7pts EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt POOR. Wetland appears to not be a good example of its type or class because of past or present disturbances, successional state, etc.	

Metric 4c Habitat intactness

- Again, identical "logic" to question as in Metric 3e and 4a

- Determine whether "more than trivial" disturbances have occurred to the natural of <u>habitat</u> characteristic to that type of wetland

Possible disturbances

Check all that are observed present in or near the wetland.

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, sheep, pigs, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify)
	Shrub/sapling removal		Other (specify)

Metric 6a Wetland Vegetation Communities

Metric 6. Vegetation, Interspersion, and Microtopography. Maximum 20 points.	
6a. Wetland Vegetation Communities. Check each community present <u>both vertically and horizontally</u> within the wetland with an area of at least 0.1 hectares or 1000m² (0.2471 acres). Assign a score of 0 to 3 using Tables 3, Table 4 or Table 5. Sum the scores for the classes present.	
Aquatic Bed. Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
Emergent. Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, fens, prairie pothole, and bluejoint slough.	
Shrub. Includes areas of wetlands dominated by woody vegetation less than 6m (20 ft) tall. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
Forested. Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are defined as "vernal pools" in OAC Rule 3745-1-50.	
Mudflats. The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB₁) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
Open water. The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas re 1) inundated, 2) unvegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	
Other (See User's Manual)	

Assigning a "1" score

- The vegetation community only comprises a <u>small part</u> of the wetland's <u>entire</u> vegetation and is of <u>moderate</u> quality, OR

- The vegetation community comprises a <u>significant part</u> of the wetland's vegetation, and this community is of <u>low quality</u>

Assigning a "2" Score

- The vegetation community comprises a significant part of the wetland's vegetation and is of moderate quality, OR

- The vegetation community comprises a small part of the wetland's vegetation and is of high quality

Assigning a "3" score

- The vegetation community is of <u>high quality</u>, and it comprises a <u>significant part</u> or more of the wetland's vegetation

- "significance" means the community is "ecologically significant" part of the entire wetland

Metric 6b Horizontal interspersion

| 6b. Horizontal (plan view) interspersion. Select only one and assign score. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.	
5pts HIGH. Wetland has a high degree of interspersion.	
4pts MODERATELY HIGH. Wetland has a moderately high degree of interspersion.	
3pts MODERATE Wetland has a moderate degree of interspersion.	
2pts MODERATELY LOW. Wetland has a moderately low degree of interspersion.	
1pt LOW. Wetland has a low degree of interspersion.	
0pts NONE. Wetland has no plan view interspersion.	
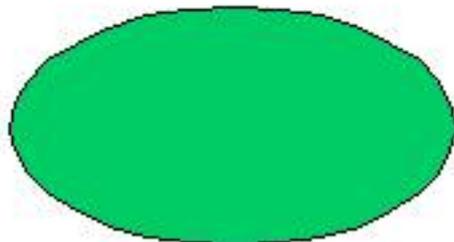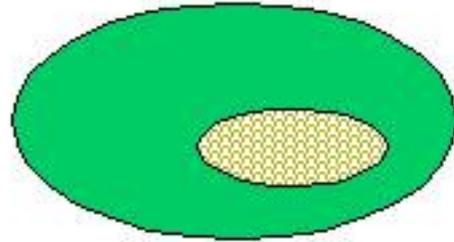
low
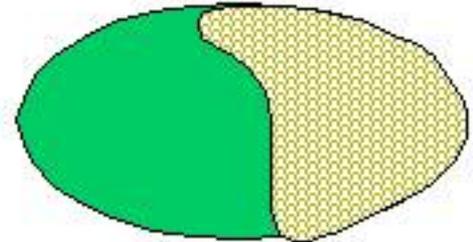
low
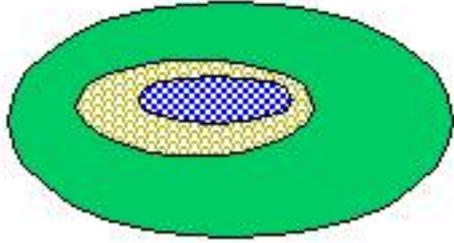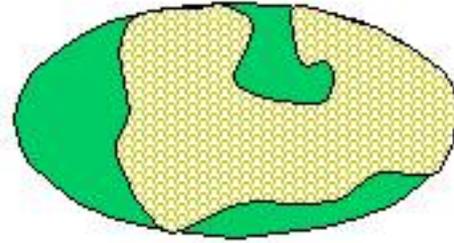
moderate

moderate
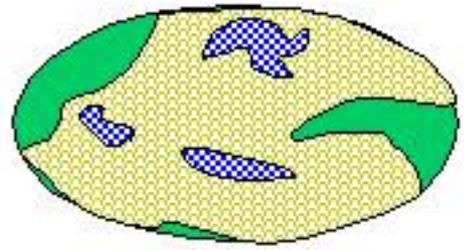
high

Metric 6c Presence of invasive plants

- Deduct points for amount of areal coverage of invasive plants

6c. Coverage of Invasive Plant Species. Refer to Table 1 on Page 7 for list. Select only one and assign score.	
-5pts Extensive. >75% areal cover of invasive species	
-3pts Moderate 25-75% areal cover of invasive species	
-1pt Sparse. 5-25% areal cover of invasive species	
0pts Nearly absent. <5% areal cover of invasive species	
1pt Absent.	

Metric 6d Microtopography

- Evaluate microtopographic features using similar 0 to 3 quality scale as in Metric 6a
- "0" feature is absent or functionally absent
- "1" feature is present in <u>small</u> amounts or if more common of <u>low</u> quality
- "2" feature is present in <u>moderate</u> amounts but <u>not</u> of highest quality, or in small amounts of highest quality
- "3" present in <u>moderate or greater</u> amounts and of <u>highest</u> quality

Vegetated hummocks/tussocks

hummock at edge of buttonbush swamp

Carex stricta tussocks

Standing dead
Towners Woods Park
Portage County

Coarse woody debris
Slate Run Buttonbush Swamp

Level 2 Assessment: Worksheet

Break into small groups

Using on site information and photographs make a determination of expected wetland condition for three sites using the Ohio Rapid Assessment Method scoring sheets

Assign sites to one of five categories: poor, fair, good, very good, excellent

Report ORAM score and assessment to full group

Wetland assemblages

- *vascular plants (MN, OH, PA, MA, FL, MN, ND, MI, plus others)

- algae (FL, ME)

- *macroinvertebrates (MN, ME, OH, MI, plus others)

- amphibians (OH)

- birds (PA)

- mammals

* = most commonly selected

Types of metrics

- richness
  - no. of species

- richness ratios (proportions)
  - no. of species divided by all species

- abundance, relative abundance
  - no. of ind., % cover, stem density

- productivity
  - grams/unit area or volume biomass

- diversity indices
  - Shannon-Wiener, Simpsons D, Floristic Quality Index

- tolerant or sensitive taxa
  - abundance, richness, proportions

- anomalies

Types of relationships

- type of relationship to disturbance can vary within and between assemblages
  - threshold
  - linear
  - curvilinear

Index development

- **attribute selection**
  - what attributes to select as metrics
  - select attributes that have meaningful ecological relationships to disturbance, that cross community levels (taxa, taxa groups, communities, ecosystem processes, etc.)

- **Metric scoring**
  - trisection 1, 3, 5
  - quadrisection 0, 3, 7, 10
 - graphical fitting
  - sliding scale

Summary of numbers of sites by major hydrogeomorphic and plant community classes 1996-2001.

Hydrogeomorphic Classes	N	Plant Community Classes	N
depression	71	various bog communities	7
riverine mainstem depression	12	various fen communities	11
riverine headwater depression	8	marshes (all types)	36
slope	17	wet meadow communities	6
fringing	3	shrub swamps	23
impoundment	2	swamp forests	38
coastal	5		
TOTAL	**121**		**121**

Ohio Vegetation IBI Sampling methods

- plot based sampling method
- combines aspects of releves and transects and quadrats
- flexible multipurpose method for diverse plant communities
- locate plots in areas most representative of plant community of interest
- minimize environmental heterogeneity
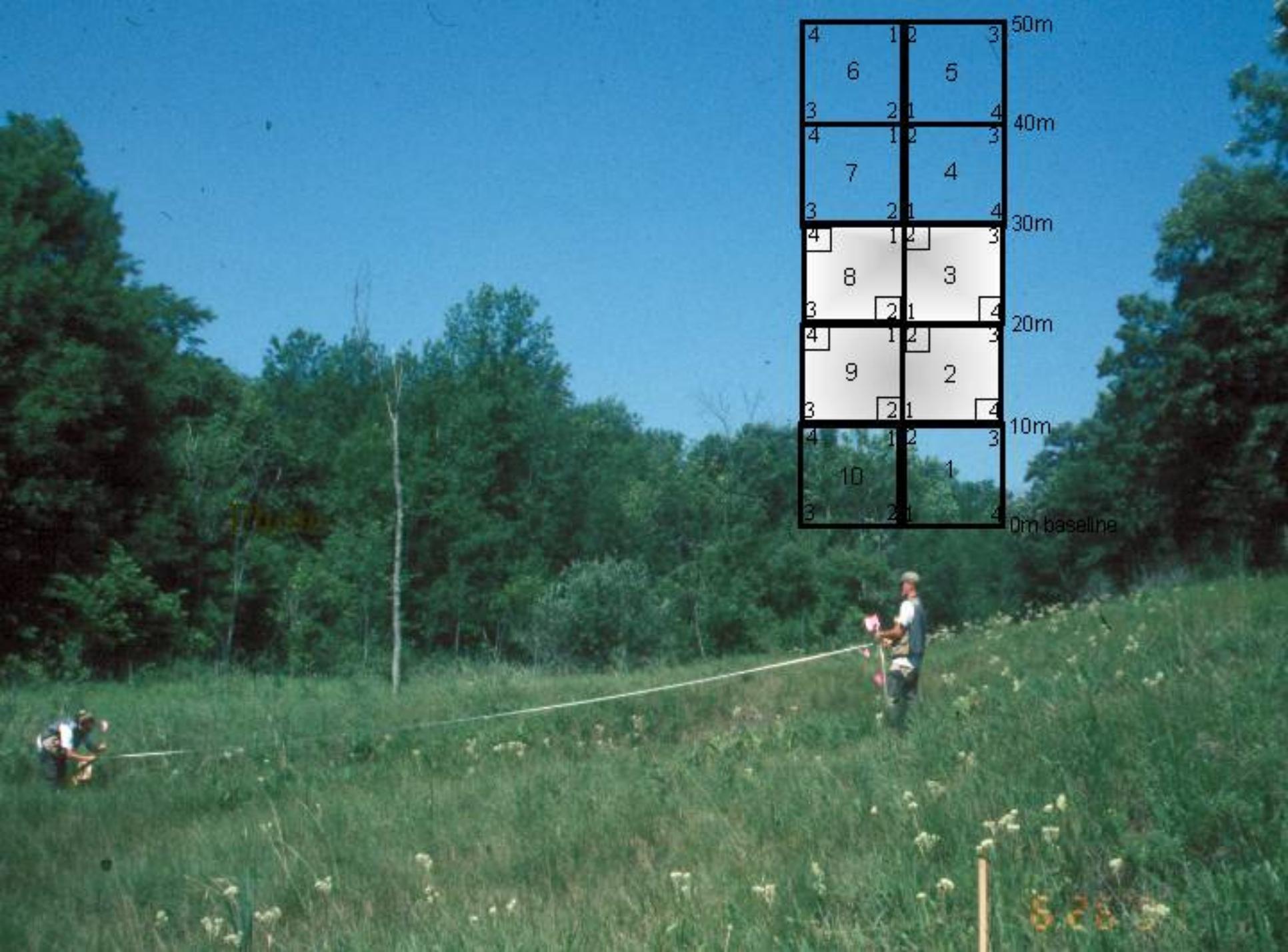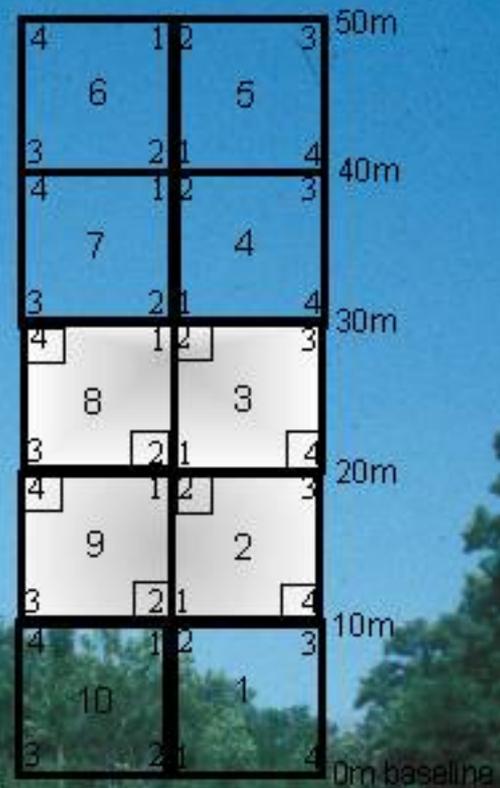
Parameters measured

- presence/absence (~2500 vouchers collected 1996-2002, avg ~16 per plot)
- % cover herb and shrub stratum
- stem density and basal area shrub and tree stratum (shrub and forest only)
- standing biomass (emergent only)
- soil nutrients
- water chemistry
- physical parameters: water depth, depth to saturated soils, coarse woody debris, hummocks and tussocks, standing dead, etc.

Metrics for VIBI-E, -F, -Sh

| metric	type	E	F	Sh
Carex spp.	richness	X		X
dicot spp.	richness	X		X
shade spp.	richness		X	
shrub spp., native wetland	richness	X		X
hydrophyte spp.	richness	X		X
fern and fern ally spp.	richness		X	X
Annual spp./Perennial spp.	richness ratio	X		
FQAI	index	X	X	X
%hydrophyte cover	community		X	
%bryophyte cover	community		X	X
%tolerant spp. cover	community	X	X	X
%sensitive spp. cover	community	X	X	X
%invasive graminoid spp. cover	community	X		
pole timber density	community/productivity		X	
subcanopy importance value	index of comm./productivity		X	X
canopy importance value	index of comm./productivity		X	
std biomass	productivity	X		
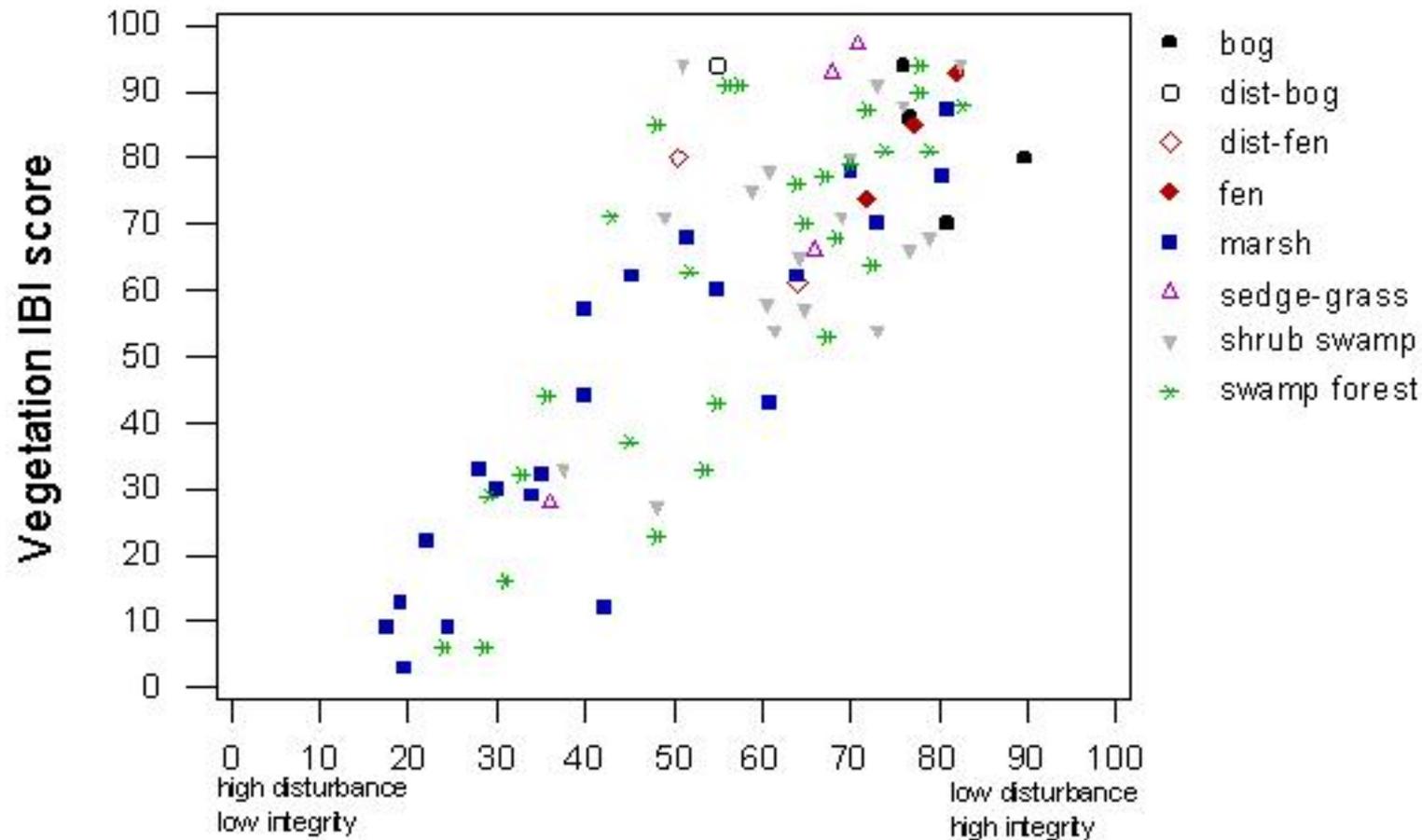
Using IBIs to evaluate mitigation wetland success

Boxplots of VIBI by ALUS category

(means are indicated by solid circles)
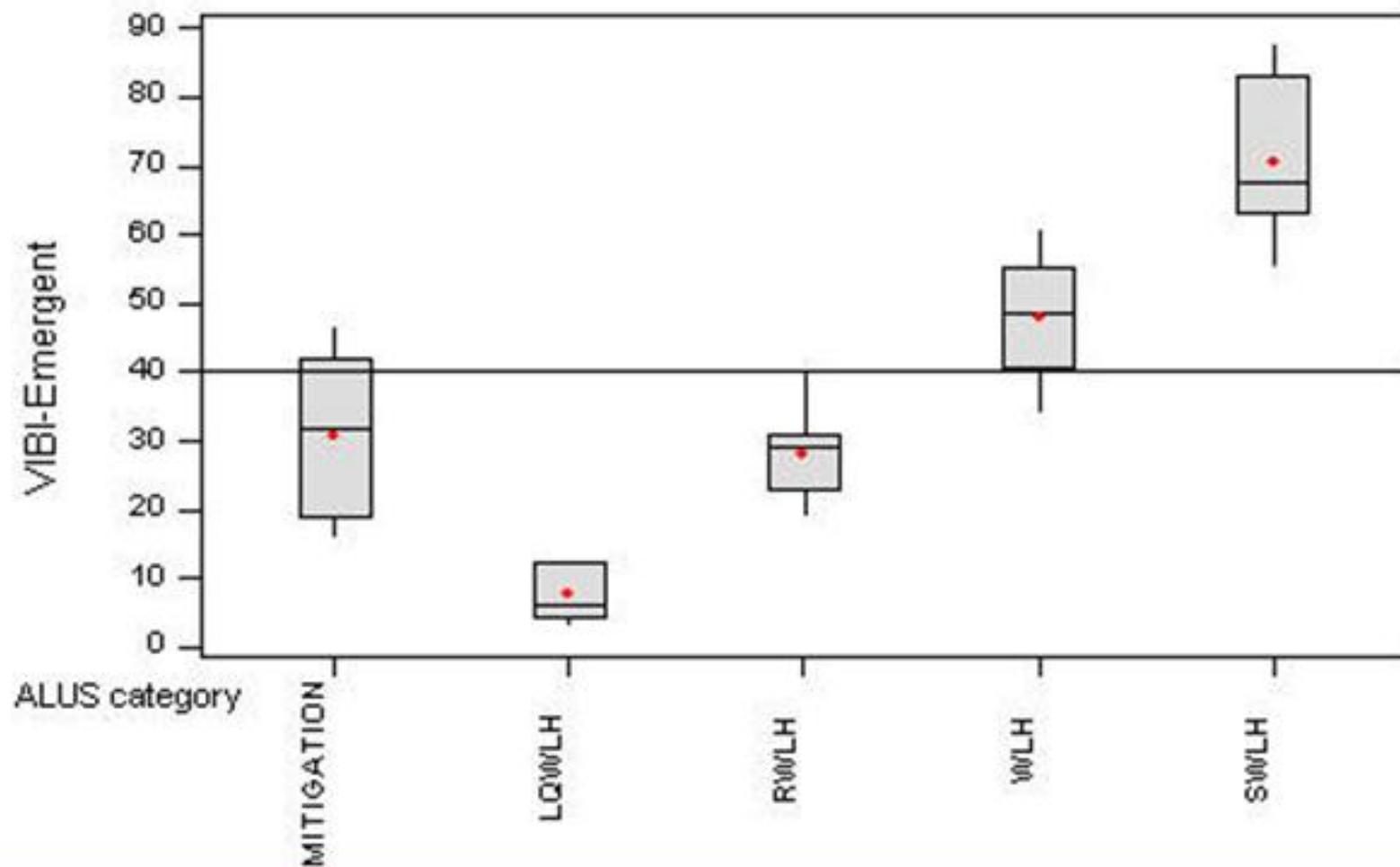
Level 3 Assessment: Worksheet

Break into small groups

Using Vegetation IBI data from intensive assessment, calculate an IBI score for the sites and make a determination of expected wetland condition for three sites

Assign sites to one of five categories: poor, poor, fair, good, very good, excellent

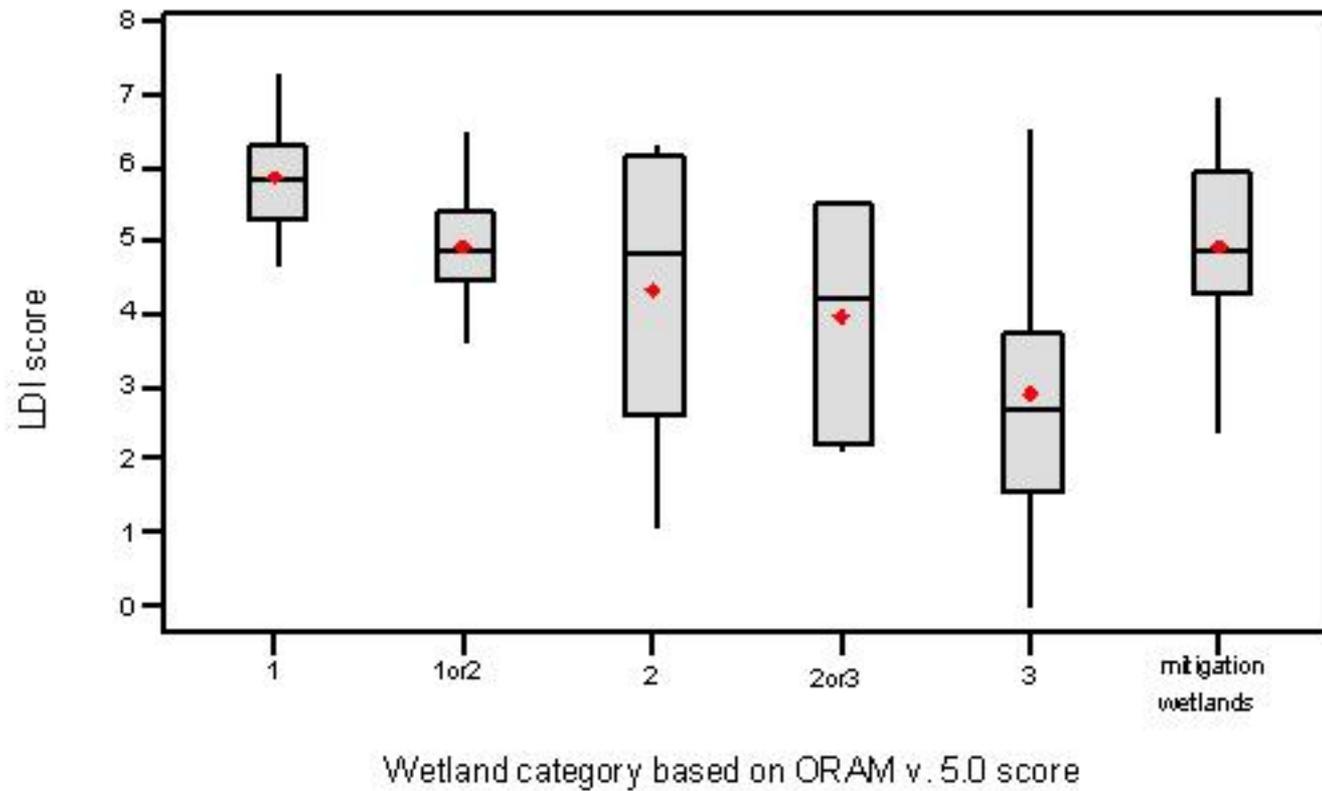Report IBI score and assessment to full group

ACTUAL RESULTS

SITE	LEVEL 1 (LDI)	LEVEL 2 (ORAM)	LEVEL 3 (VIBI)
MORGAN SWAMP	1.31	77	94
STAGES POND	5.93	32 (42)	6
CALAMUS SWAMP	6.10	77	68

How do the results compare?

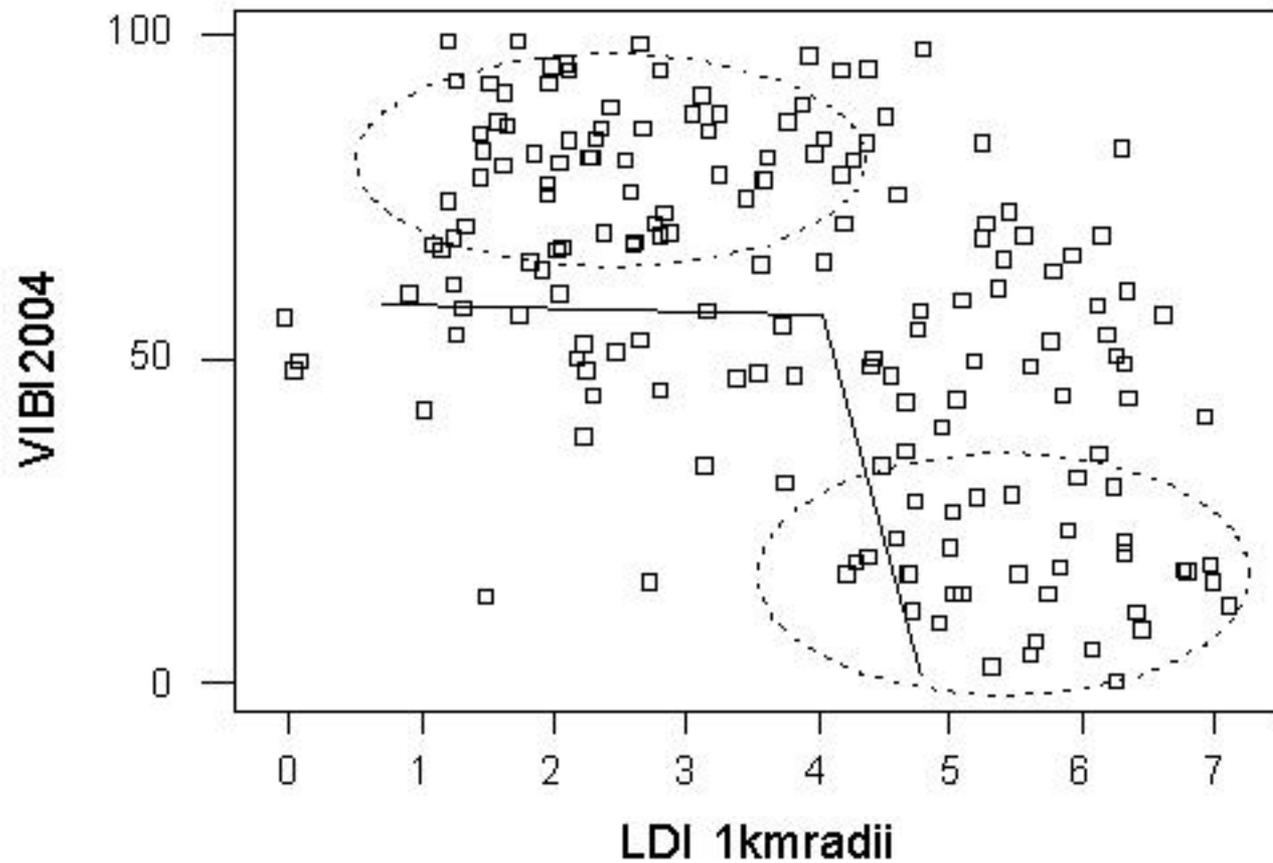| Correlation Categories	PA Sites (n=83)	OH Sites (n=168)
Landscape/Rapid	0.95	0.25
Landscape/IBI	0.48	0.27
Rapid/IBI	0.53	0.65

How do the results compare?

How do the results compare?
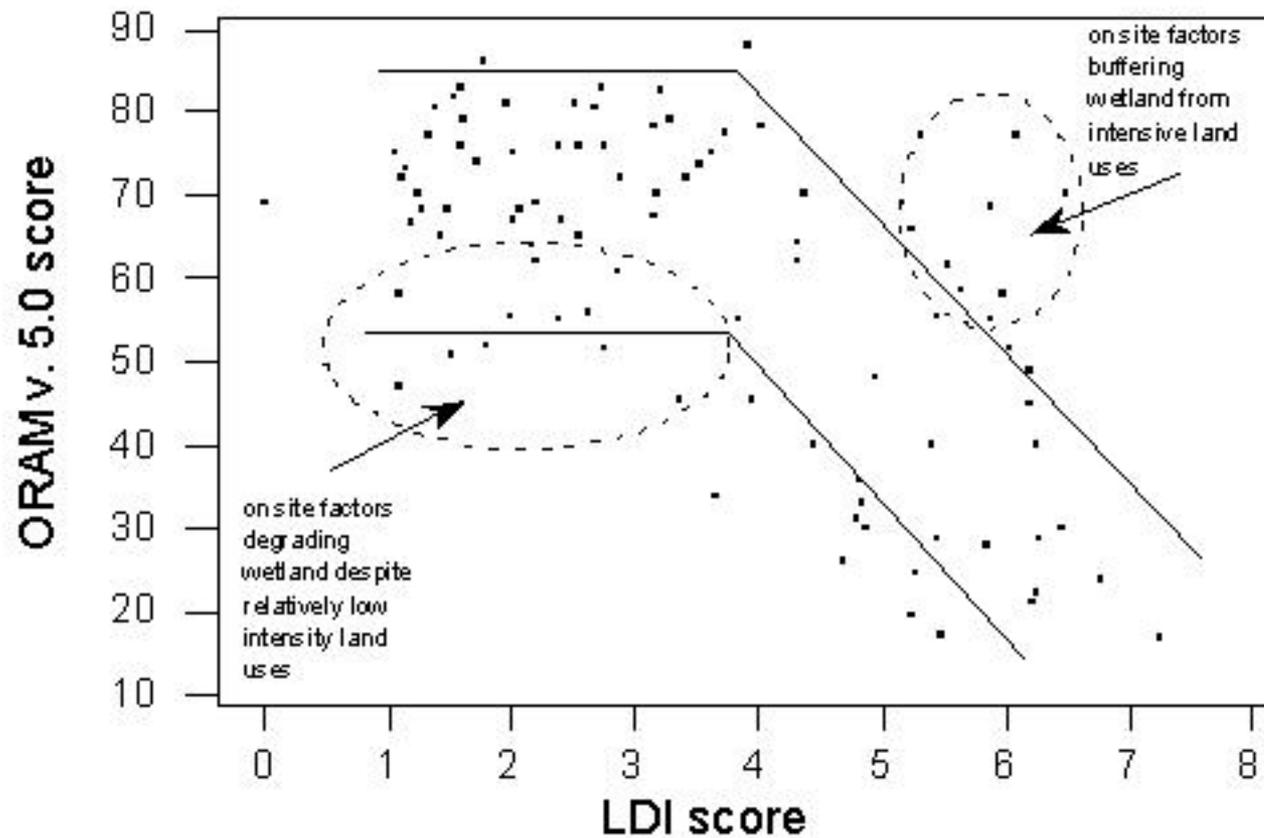
How do the results compare?

Acknowledgments

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- Denise Wardrop, Rob Brooks, Pennsylvania State University

- Mick Micacchion, Ohio EPA

Thank You...

Any Questions?