

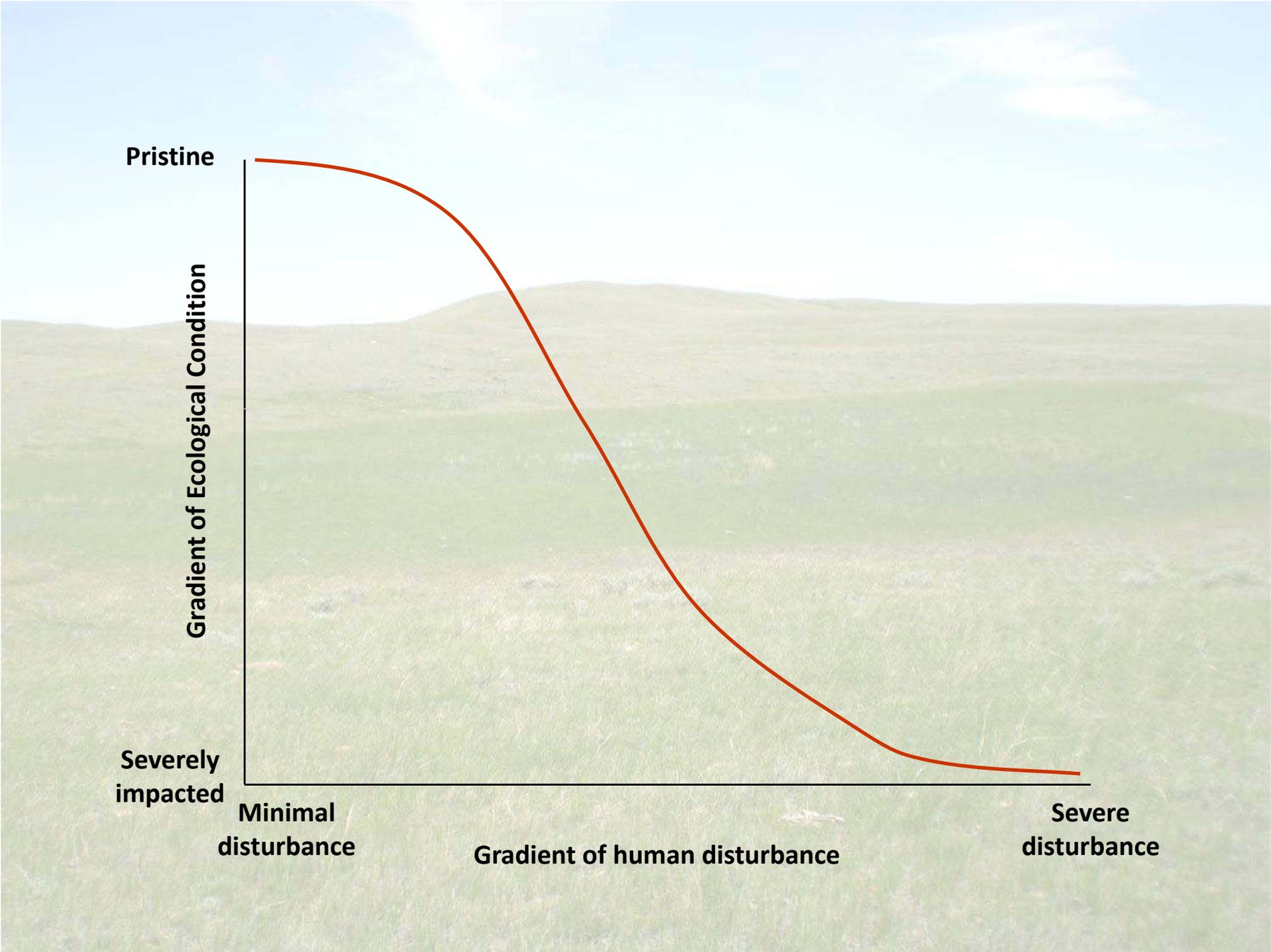
Developing a Level 1-2-3 Approach to Wetland Assessment and Monitoring in Montana

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Basin-wide Wetland Assessments

- Under the Clean Water Act 305 (b) States are required to monitor and report on the quality of waters within their states, **including wetlands**
- Wetland assessments provide information on ecological condition
- Wetlands occur along an ecological continuum
- Wetland assessments should occur within a watershed context



Pristine

Gradient of Ecological Condition

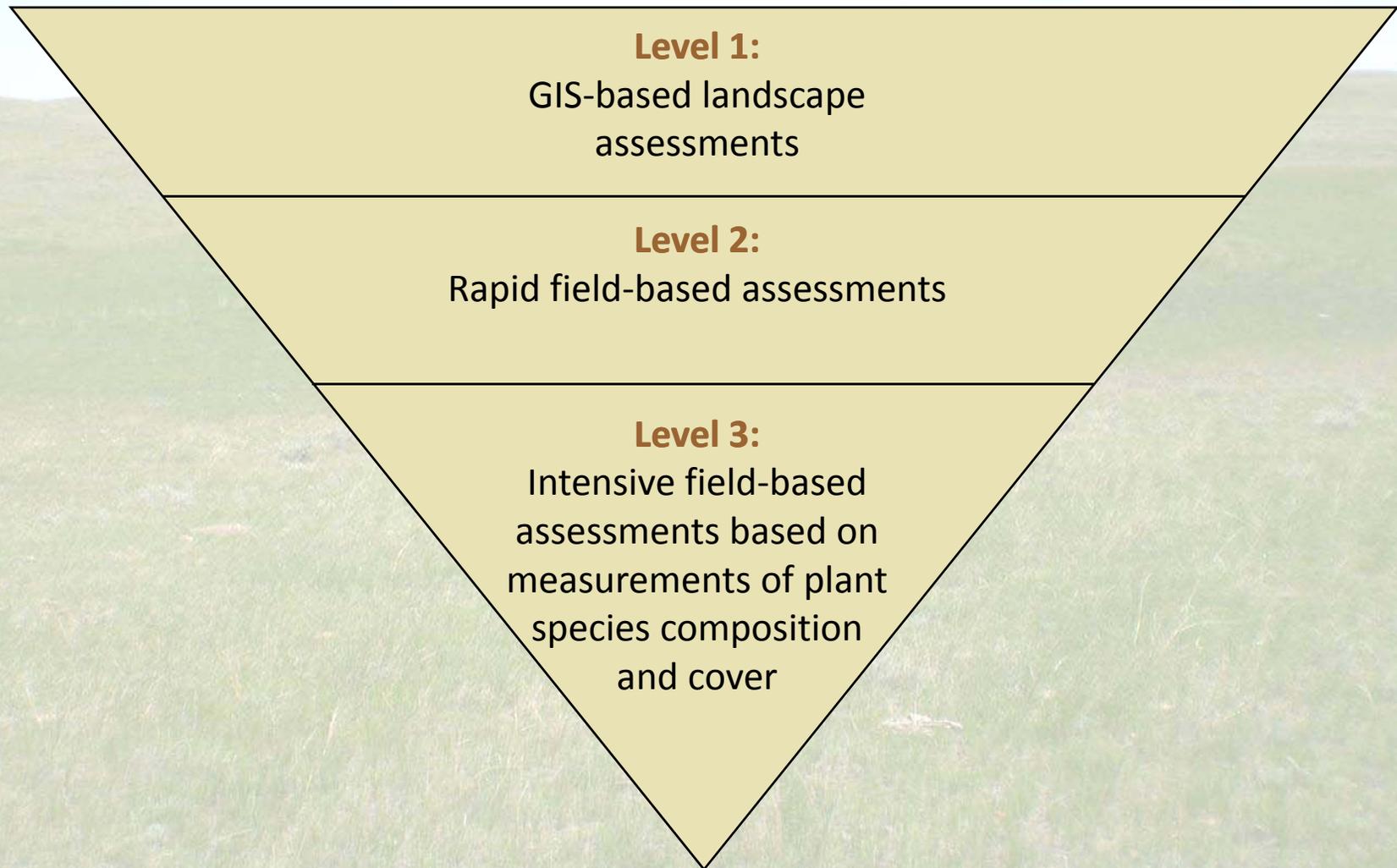
Severely impacted

Minimal disturbance

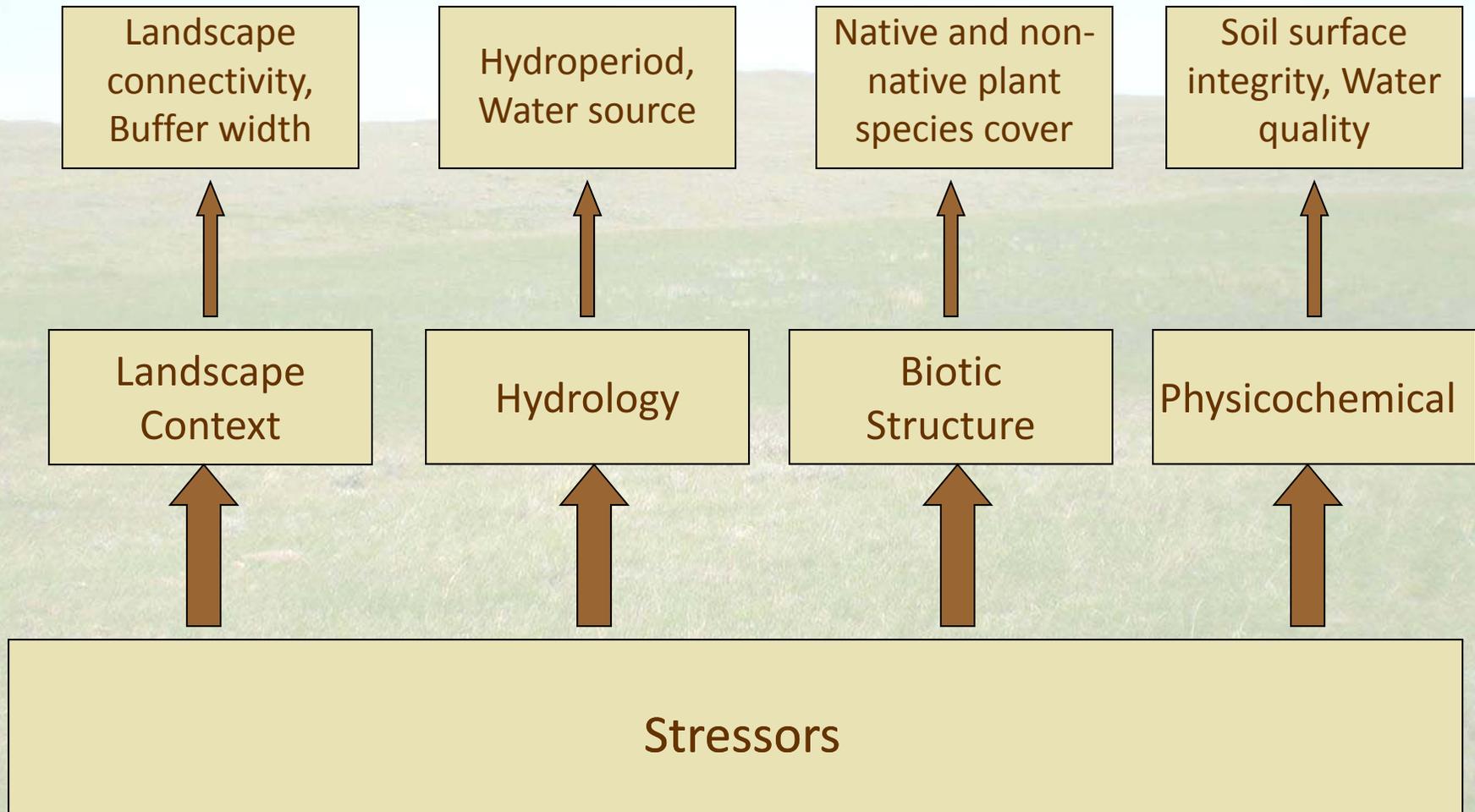
Gradient of human disturbance

Severe disturbance

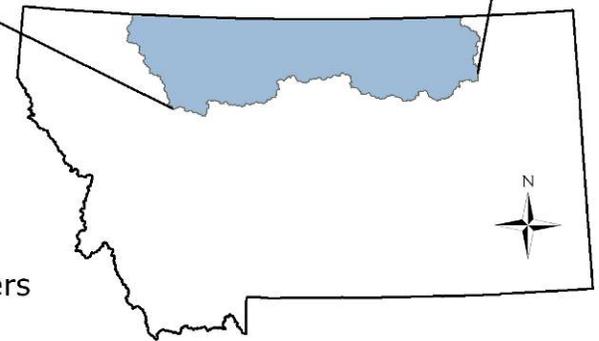
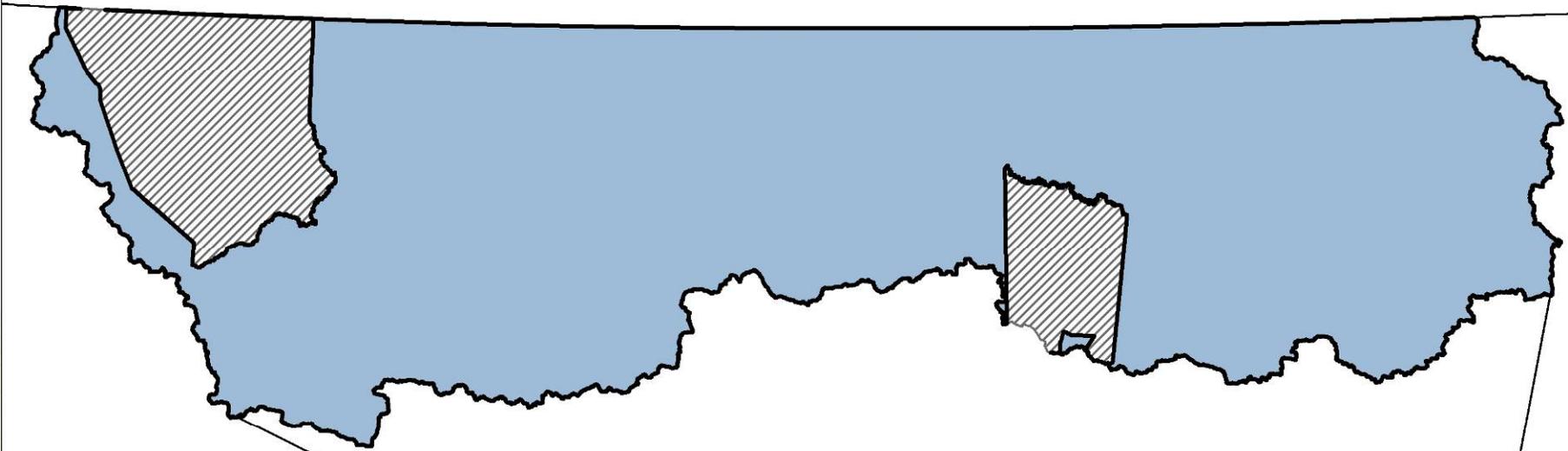
U.S. Environmental Protection Agency's Recommended Three-tiered Framework for Wetland Assessments



Overall Assessment Structure



Milk and Marias Project Area



 Milk Marias Survey Area
 Tribal Lands (excluded)



Study Area



Most common wetland ecological systems:

Great Plains Prairie Pothole

Western Great Plains Depressional Wetland

Western Great Plains Saline Depression



Study Design

- Target population – all wetlands in the St. Mary's, Milk, and Marias river basins
- Sample frame – all wetland types mapped by National Wetland Inventory (NWI)

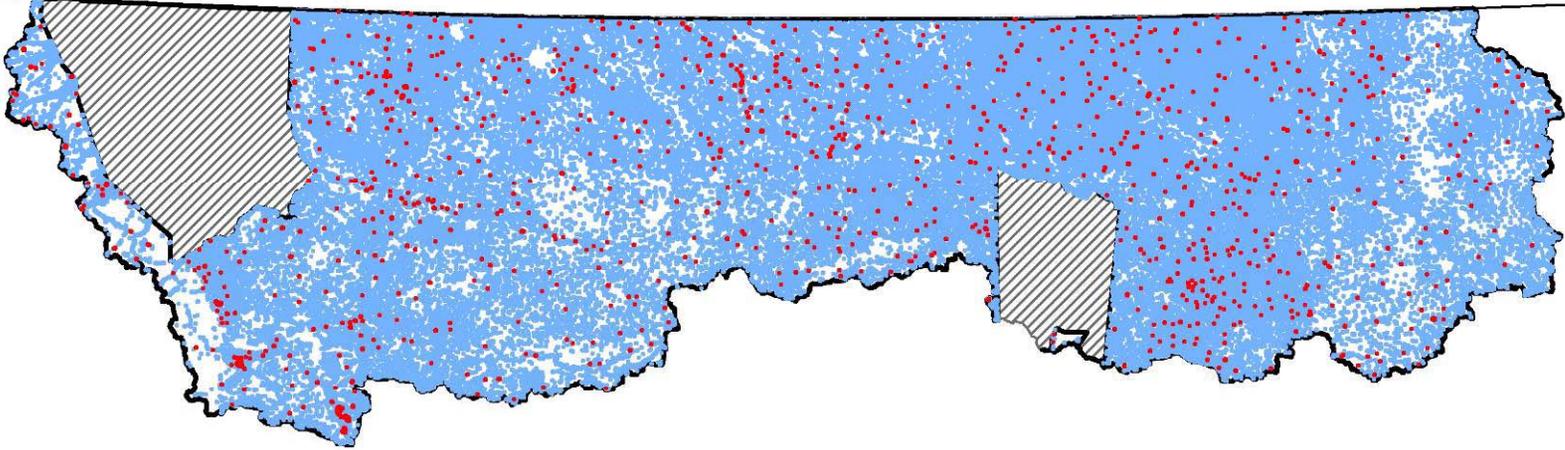
Study Design

- Used a Generalized Random Tessellation Stratified (GRTS) approach
- Selected a spatially balanced random sample
 - accounts for spatial pattern of ecological systems (close sites are more similar)
 - more (statistically) efficient – avoids redundant information
 - avoid sampling bias

Study Design

- Unequal probability stratified design - stratified by Level IV Ecoregion (Omernik 1987)
- Wetland subpopulations – private vs. public lands
- Assumption – wetlands selected represent range of condition

Wetlands Selected for Assessment in the Milk and Marias Project Area



-  Milk Marias Survey Area
-  Tribal Lands (excluded)
-  NWI Wetlands
-  Selected Wetlands

0 25 50 100 Miles



0 37.5 75 150 Kilometers



Methods

Level 1 - Multi-scale Wetland Assessment

100 meters, 300 meters, 1,000 meters around the wetland perimeter

- Roads – distance to roads
- Land Cover – percent of altered vegetation (e.g., cropland, developed areas)
- Hydrology – distance to canals/ditches, wells, reservoirs
- Land Use – evidence of livestock grazing, resource extraction

Methods

Level 2 - Rapid assessment

**Attributes assessed within a 0.5 hectare assessment area
or its 500 meter buffer**

- Landscape context
- Physicochemical
- Vegetation structure
- Hydrology

Stressor checklist: list of anthropogenic stressors that correspond to field indicators

Methods

Level 3 - Intensive assessment

Measured within a 20 m x 50 m plot:

- Plant species cover and composition
- Ground cover
- Use data to calculate a floristic quality assessment index (FQAI)

Data Analysis

Validation

Range – ability of method to capture the distribution of conditions

- Examination of frequency histograms of metric and attribute ratings

Data Analysis

Validation

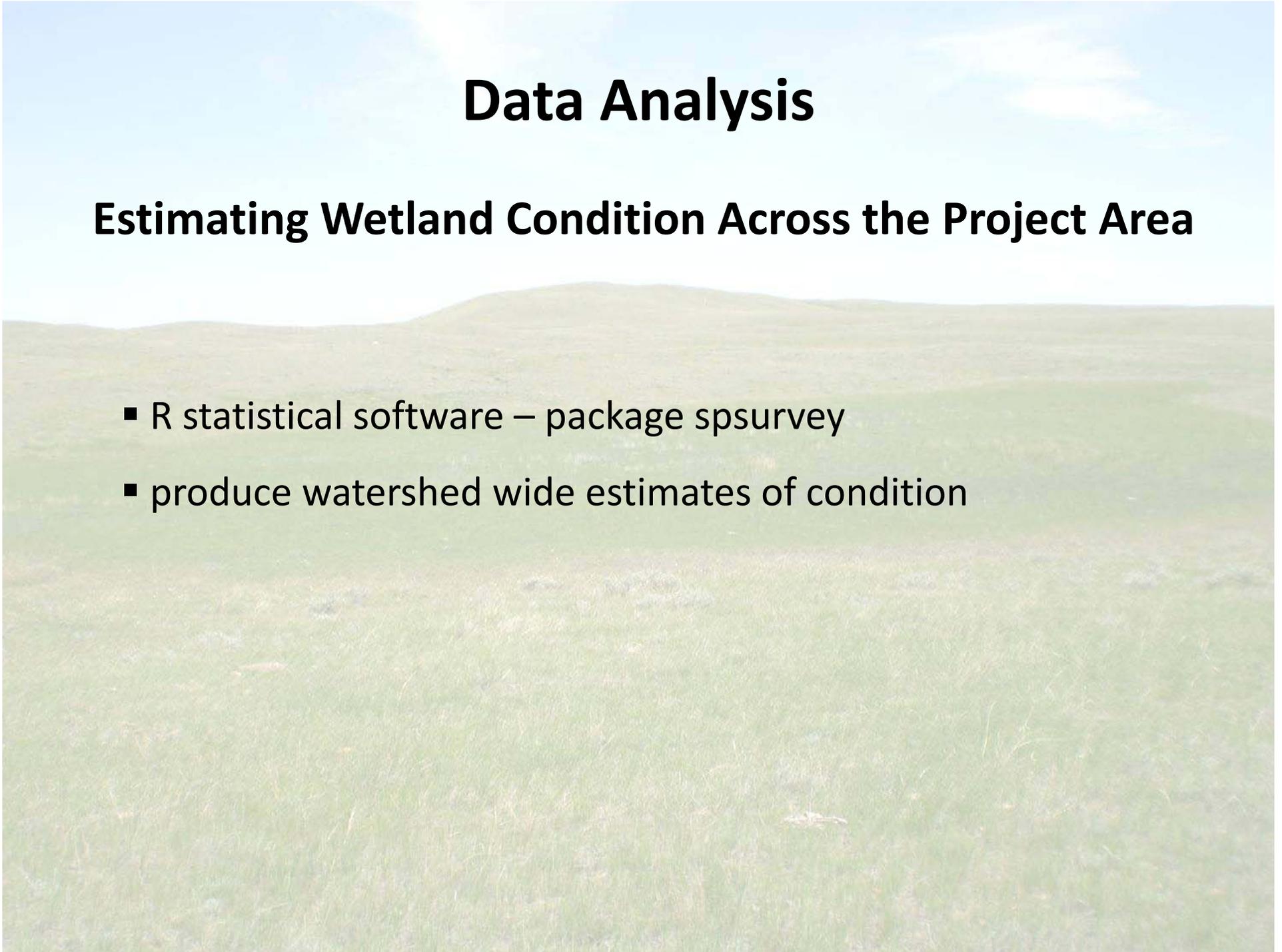
Responsiveness – ability of method to distinguish among conditions

- Spearman's correlation analysis
 - Level 1 and Level 2 overall, attribute, and metric scores
 - Level 2 scores and Level 3 data

Data Analysis

Estimating Wetland Condition Across the Project Area

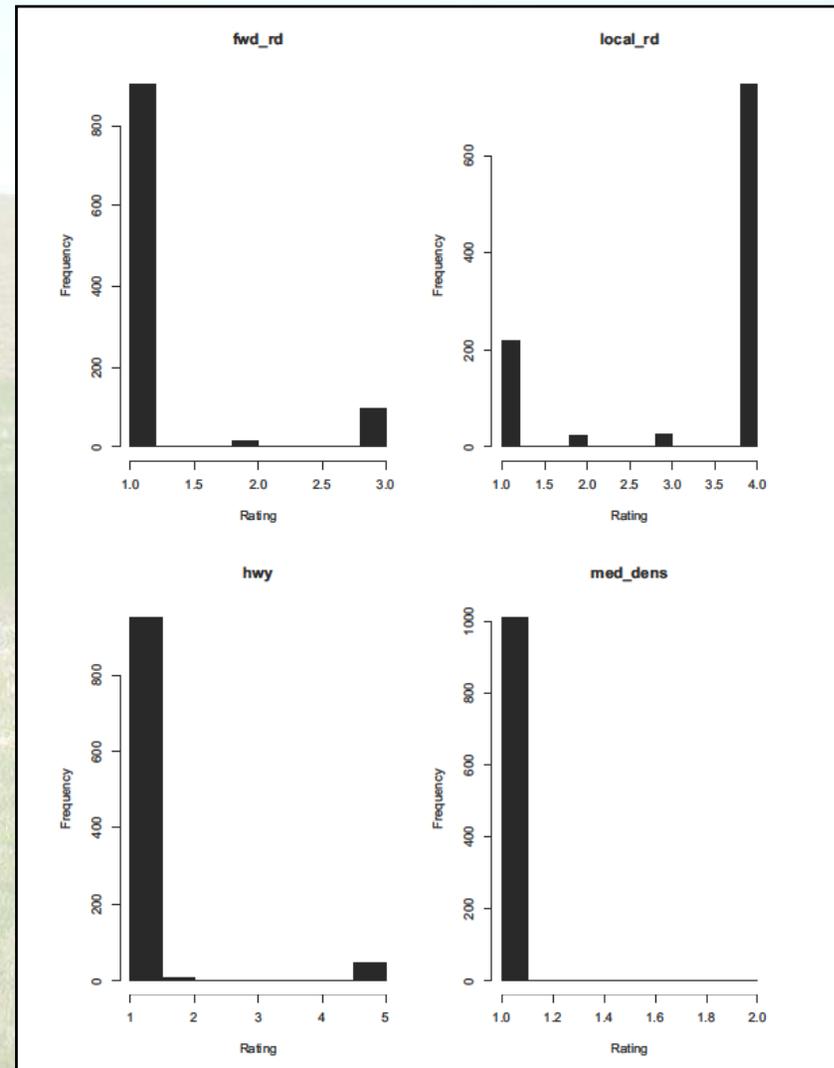
- R statistical software – package spsurvey
- produce watershed wide estimates of condition



Level 1 Wetland Assessment Results

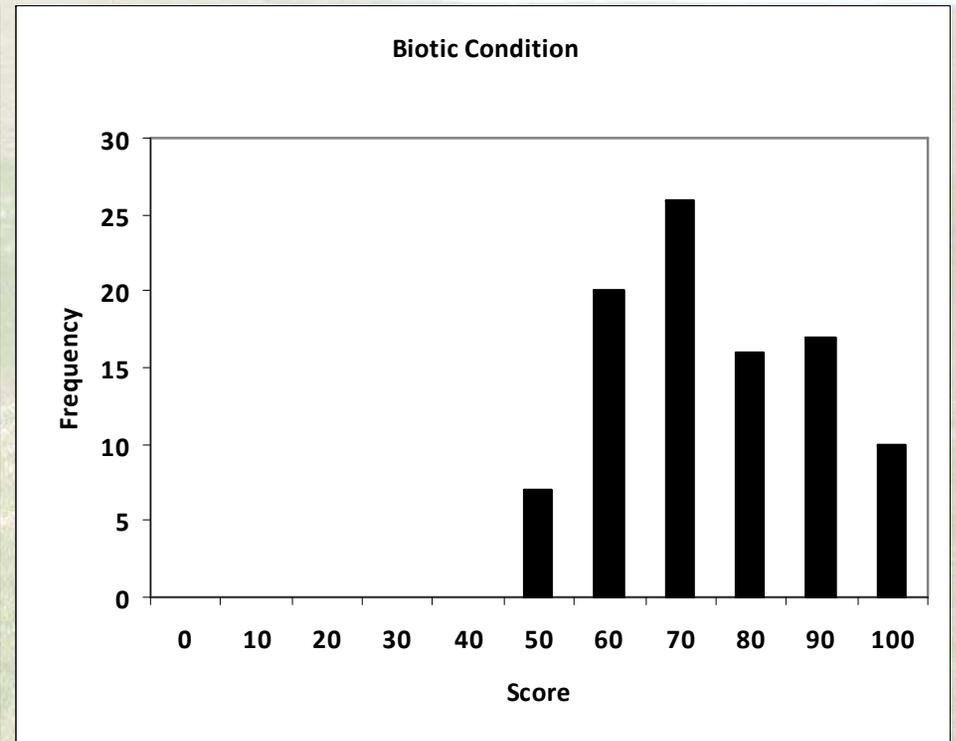
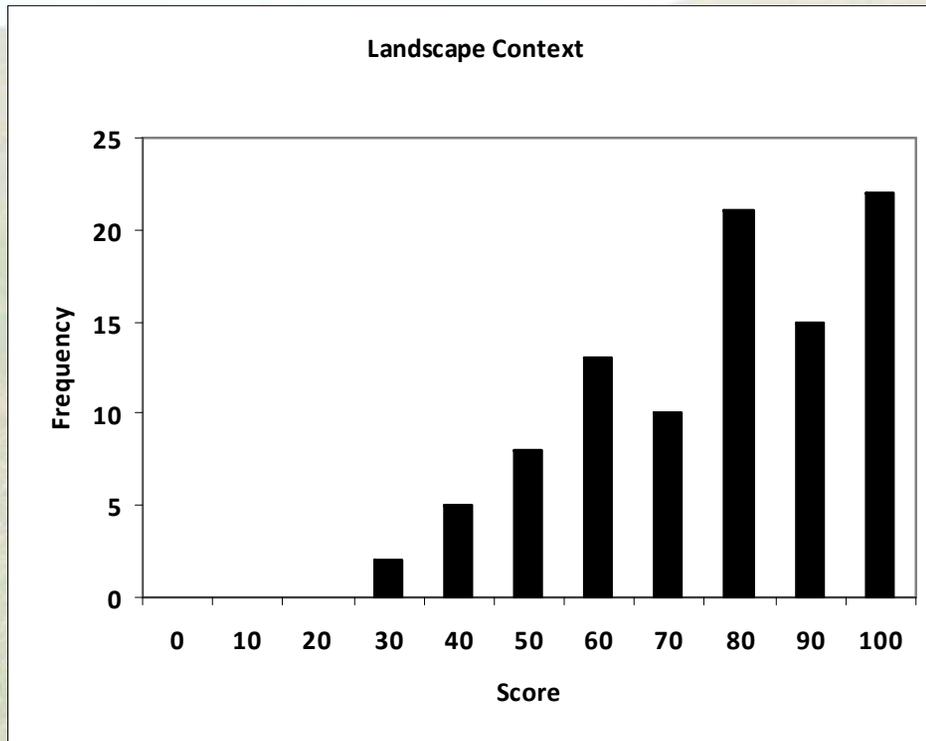
Validation Analysis: Range

- Little variability among Level 1 landscape metrics
- Skewed towards lowest score (little to no disturbance) OR
- Skewed towards highest score (high disturbance)



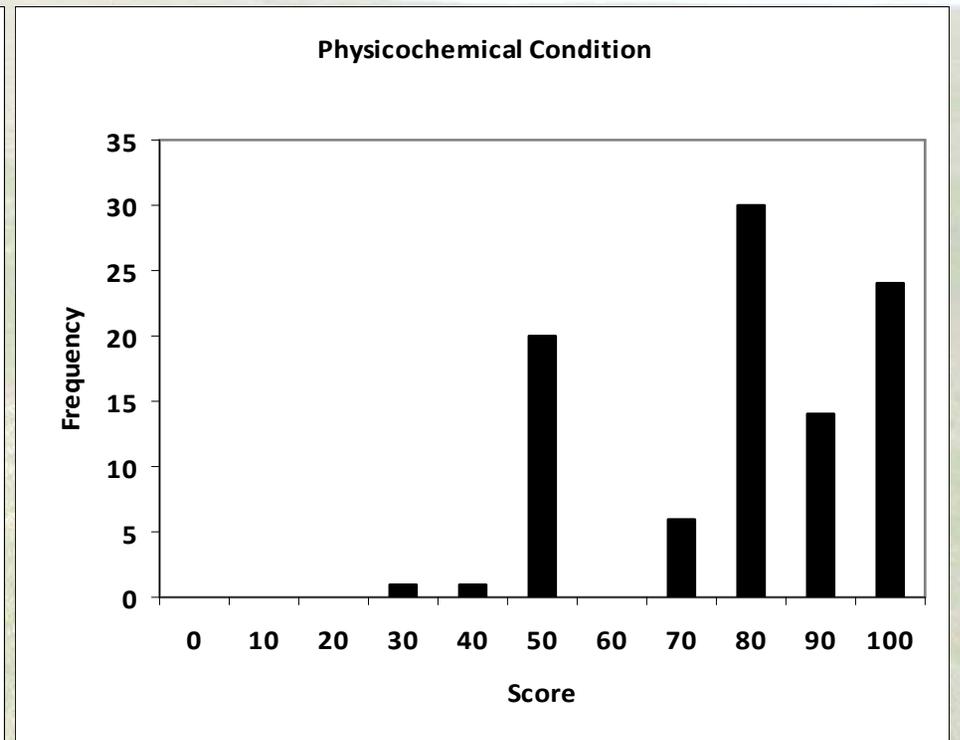
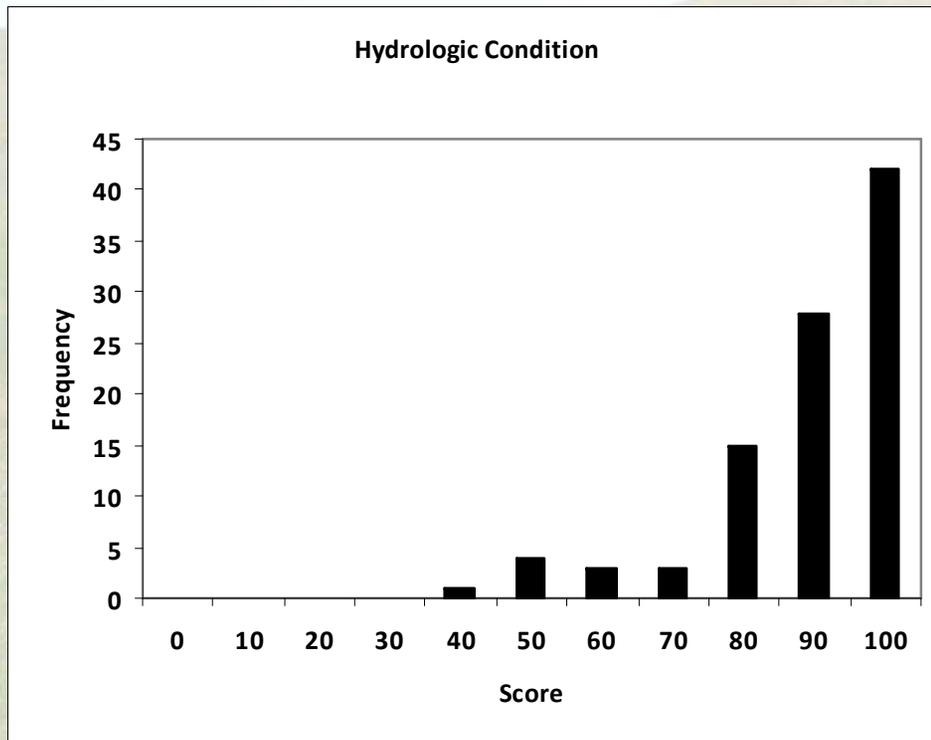
Level 2 Wetland Assessment

Validation Analysis: Range of Level 2 Attribute Scores



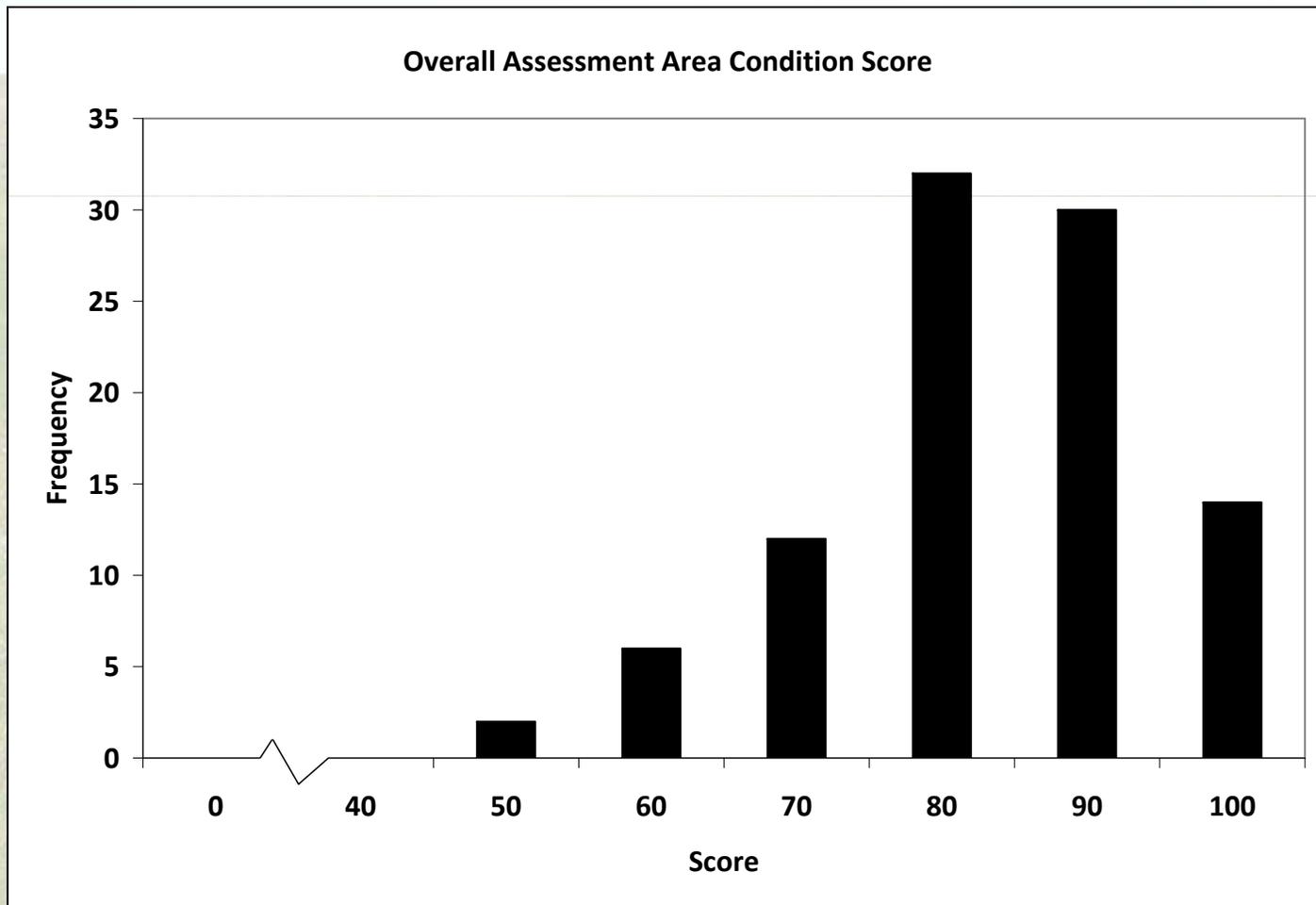
Level 2 Wetland Assessment

Validation Analysis: Range of Level 2 Attribute Scores



Level 2 Wetland Assessment

Validation Analysis: Range of Overall Level 2 Assessment Scores



Spearman's Correlation Results: Level 1 and Level 2 Assessments

Validation Analysis: Responsiveness

Level 2 Attribute Score ~ Level 1 Metric	Spearman's correlation coefficient	P-value
1,000 meter buffer		
Landscape Context ~ Secondary Roads	-0.28	0.01
Overall Condition Score ~ Secondary Roads	-0.22	0.04
300 meter buffer		
Landscape Context ~ Secondary Roads	-0.33	<0.01
Hydrologic Condition ~ Secondary Roads	-0.20	0.05
100 meter buffer		
Landscape Context ~ Overall Level 1 Score	-0.33	≤0.001
Hydrologic Condition ~ Overall Level 1 Score	-0.26	0.01
Overall Condition Score ~ Overall Level 1 Score	-0.21	0.04

Level 2 and Site Stressors

Spearman's Correlation Results

Validation Analysis: Responsiveness

Level 2 ~ Site Stressors	Spearman's Correlation Coefficient	P-value
Landscape Context Score ~ Site Stressors	-0.27	0.01
Biotic Condition Score ~ Site Stressors	-0.12	0.23
Hydrologic Condition Score ~ Site Stressors	-0.20	0.05
Physicochemical Condition Score ~ Site Stressors	-0.24	0.02
Overall Condition Score ~ Site Stressors	-0.28	0.01

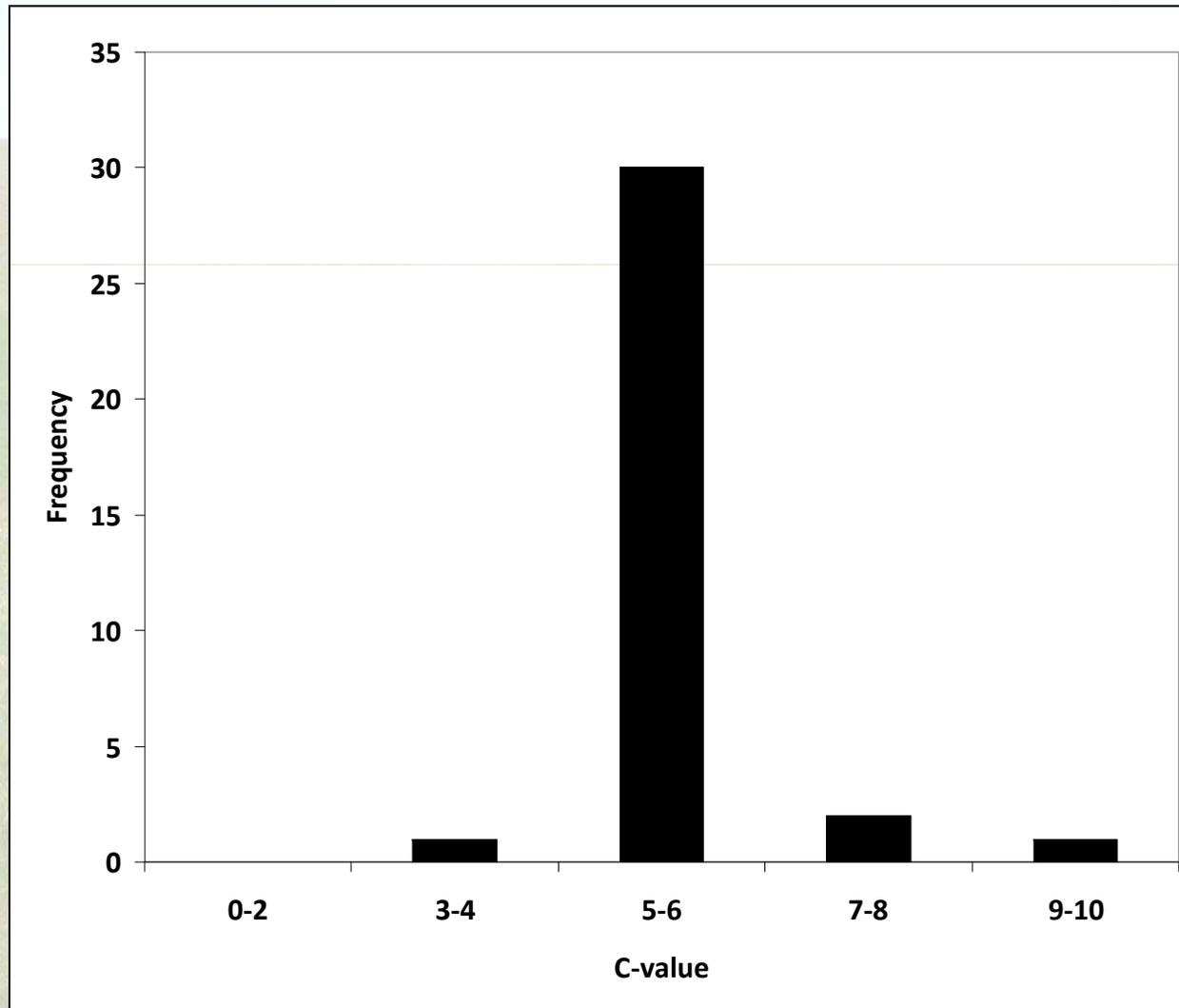
Spearman's Correlation Results: Level 2 and Level 3 Assessments

Validation Analysis: Responsiveness

	Spearman's Correlation Coefficient	P-value
Adjusted Cover Weighted FQAI ~ Physicochemical Condition Score	0.39	0.02

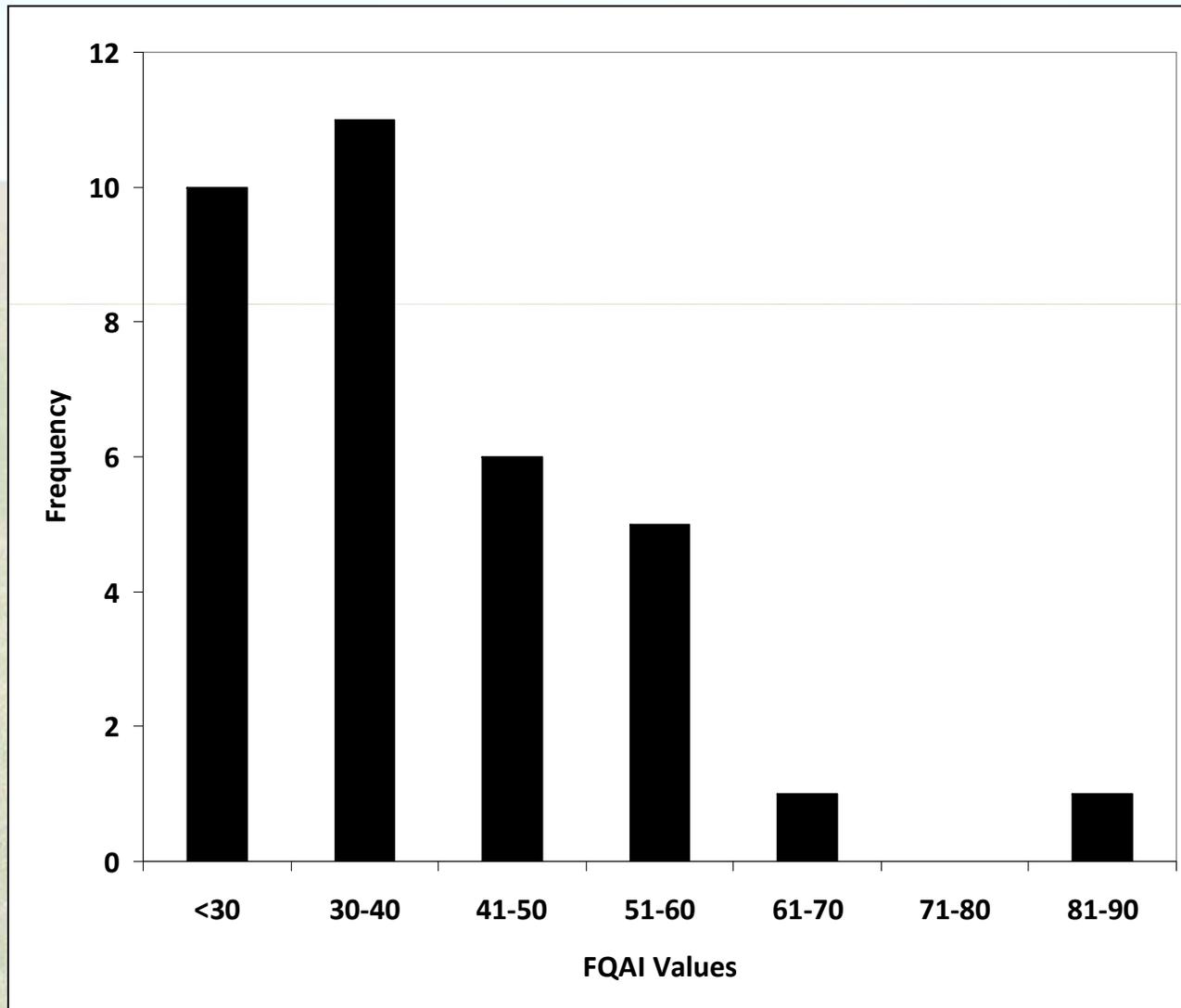
Level 3 Wetland Assessment Results

Mean C-value of Native Species



Level 3 Wetland Assessment Results

Adjusted FQAI Values



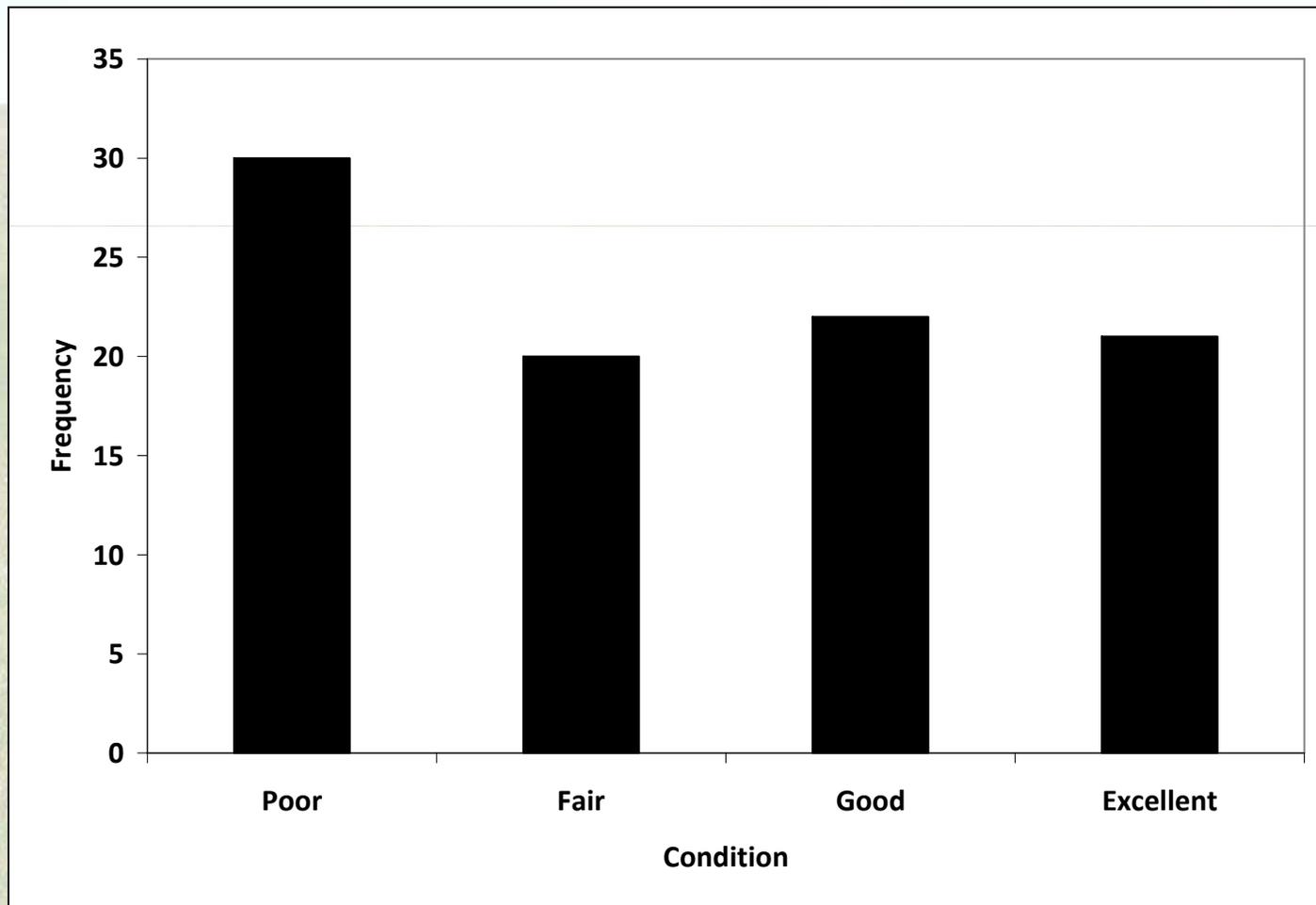
Level 2 Wetland Assessment Results

Defining Condition Thresholds

- calculated condition thresholds based on percentiles
 - Below 25th percentile = Poor
 - 25th to 50th percentile = Fair
 - 50th to 75th percentile = Good
 - Above 75th percentile = Excellent

Level 2 Wetland Assessment Results

Overall Level 2 Assessment Area Scores



Conclusions

Level 1 and Level 2

- Site-specific stressors may have a stronger influence on wetland condition
- Out-of-date or inaccurate digital data layers
- Time lag between disturbance and effect on condition
- Landscape metrics are a coarse surrogate for actual disturbances
- Need to develop landscape metrics in relatively “undisturbed” areas

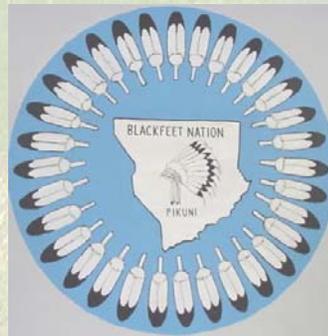
Conclusions

Level 2 and Level 3

- Vegetation not responding predictably to anthropogenic disturbance
- May be responding to natural or drought-induced hydrologic changes
- Effects of human-induced disturbance may covary with effects of natural disturbances
- Develop vegetation indicators responsive to anthropogenic stress
- Particularly important in the face of climate change

Acknowledgments

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Questions?

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<http://mtnhp.org/>