

# **Developing a Long-term Rotating Basin Wetland Assessment and Monitoring Strategy for Montana**

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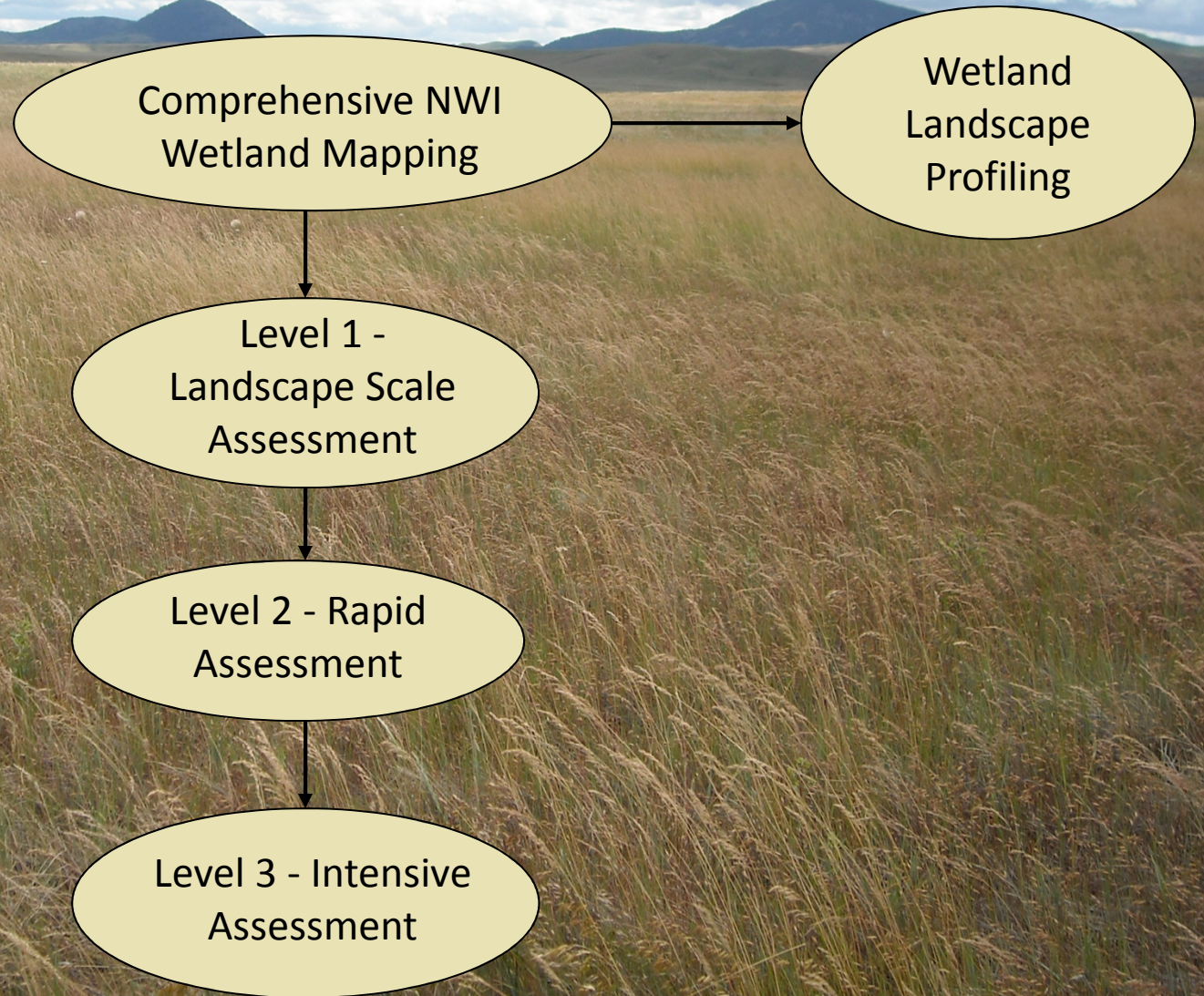
# Rotating Basin Wetland Assessments

- **Conducted first assessments in Milk, Marias, and St. Mary's basins in summer 2009 using historic NWI wetland mapping**
- **Second rotating basin assessment summer 2010 in SW Montana with new NWI mapping.**
- **Completing mapping in SE Montana in preparation for a third rotating basin assessment in 2011**

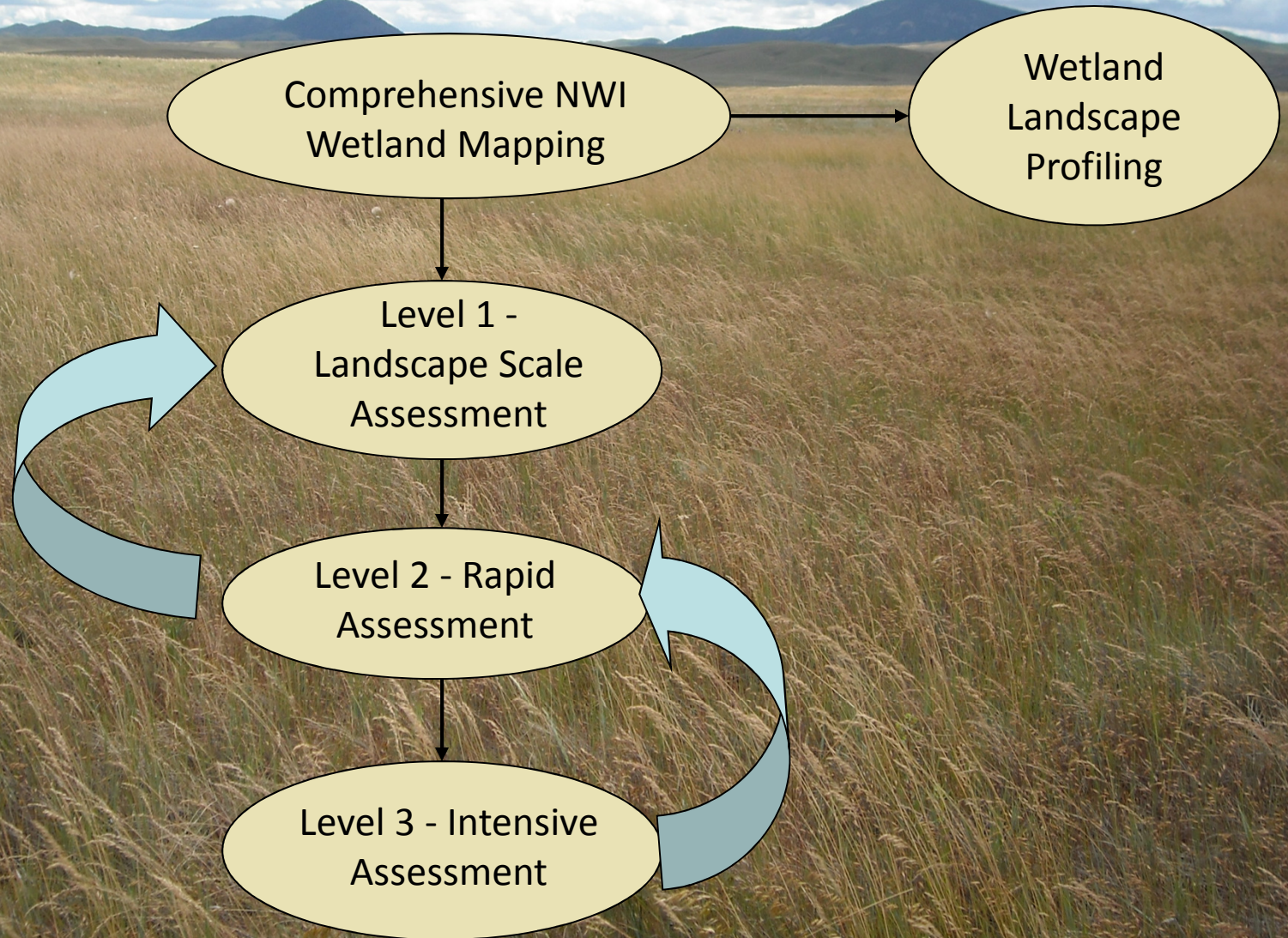
# Assessment and Monitoring Program Objectives

- 1. Develop scientifically valid assessment methods for evaluating the condition of wetlands relative to reference standard.**
- 2. Assess the condition of wetlands and riparian areas by basin and assess changes in condition over time by revisiting sites every 5 years.**
- 3. Identify stressors that are affecting wetland condition.**

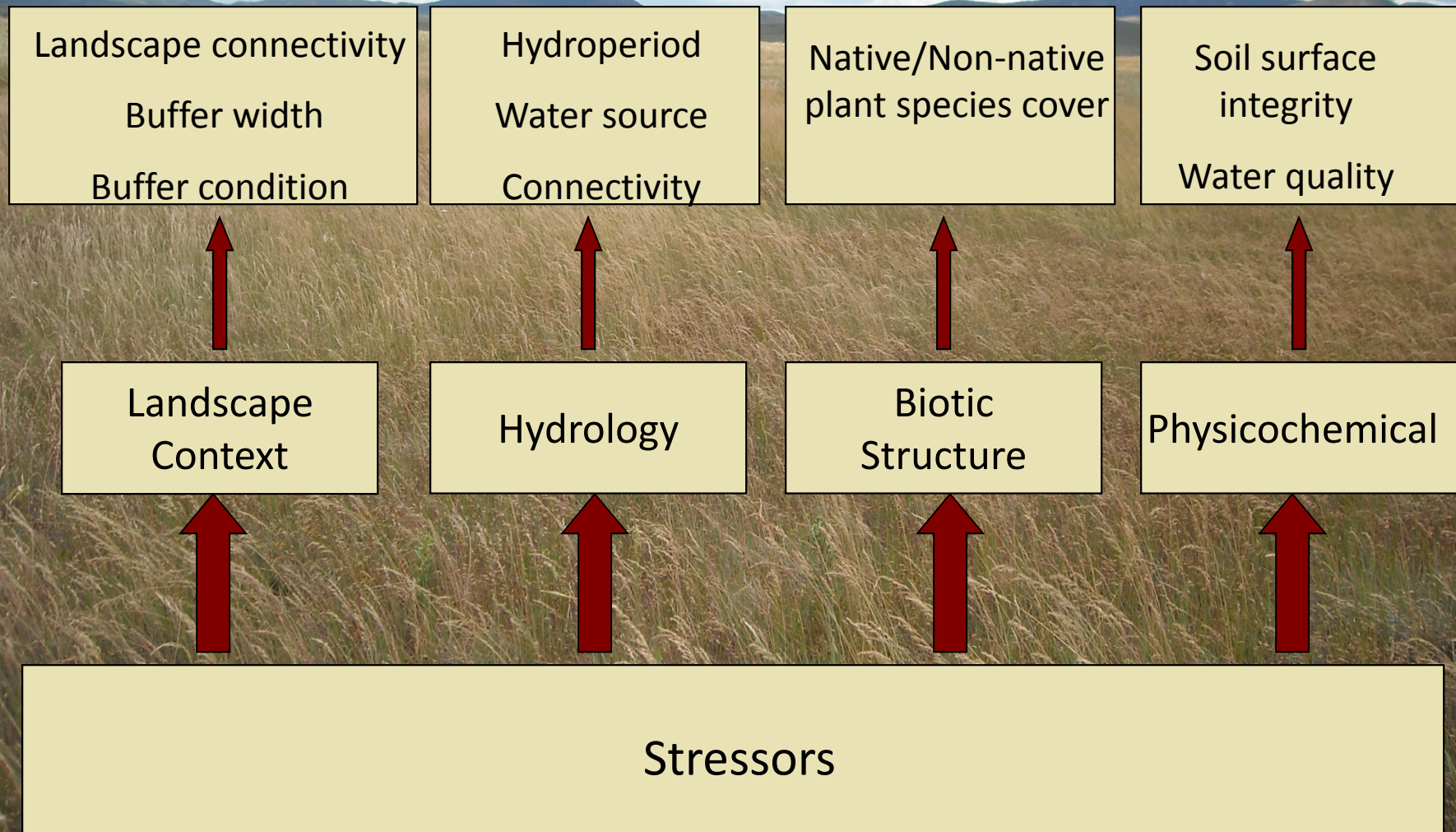
# Conceptual Model of Rotating Basin Wetland Assessment and Monitoring Program



# Conceptual Model of Rotating Basin Wetland Assessment and Monitoring Program



# Overall Level 2 Assessment Structure



# Stressor Checklist

- 1. Land use observed within 500 m of the AA boundary**
  - ~Dryland farming
  - ~Grazing by livestock
  - ~Haying of native grassland
- 2. Land use observed within the AA**
  - ~Grazing by livestock
  - ~Recent old fields
  - ~Vegetation conversion (chaining, plowing, clearcut, etc.)
- 3. Hydrological modifications within 500 m of AA boundary**
  - ~Pumps, diversions, or ditches
  - ~Impoundment
  - ~Upstream spring box

(Miller and Wardrop 2006)

# Level 3 Vegetation Assessment

- Measured within a 20 m x 50 m plot
- Record plant species cover & composition
- Record ground cover
- Use data to calculate a floristic quality assessment index (FQAI)

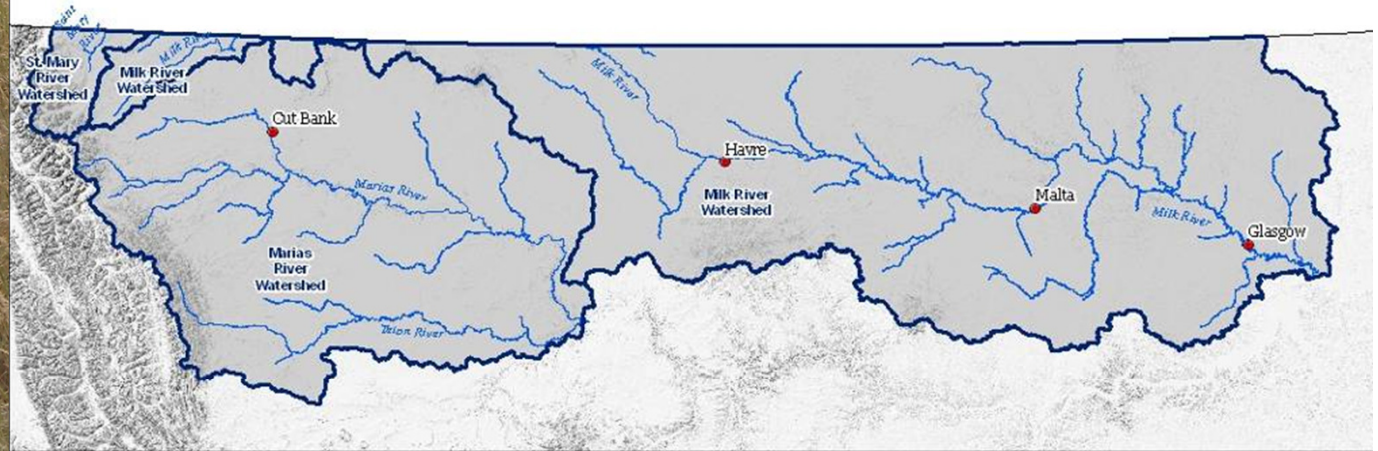
Indices	Formulas
Total species Richness	$N+A$
Native species richness	$N$
Non-native species richness	$A$
Mean C ( $\bar{C}_{all}$ )	$\bar{C} = \sum_{j=1}^{N+A} C_j / N+A$
Mean C of natives ( $\bar{C}_{nat}$ )	$\bar{C} = \sum_{j=1}^N C_j / N$
Cover-weighted Mean C (CW $\bar{C}_{all}$ )	$\bar{C} = \sum_{j=1}^{N+A} p_j C_j / N+A$
Cover-weighted Mean C of natives (CW $\bar{C}_{nat}$ )	$\bar{C} = \sum_{j=1}^N p_j C_j / N$
Floristic Quality Index for natives (FQI)	$FQI = \bar{C} \sqrt{N}$
Floristic Quality Index for all species (FQI <sub>all</sub> )	$FQI_{all} = \bar{C} \sqrt{N+A}$
Cover-weighted FQI for natives (CWFQI)	$CWFQI_{nat} = \left( \sum_{j=1}^N p_j C_j \right) \sqrt{N}$
Cover-weighted FQI for all species (CWFQI <sub>all</sub> )	$CWFQI = \left( \sum_{j=1}^{N+A} p_j C_j \right) \sqrt{N+A}$
Adjusted FQI (AdjFQI)	$adjFQI = \left( \frac{\bar{C}}{10} \right) \left( \frac{\sqrt{N}}{\sqrt{N+A}} \right) * 100$
Adjusted cover-weighted FQI (adjCWFQI)	$adjCWFQI = \left( \frac{CWFQI_{nat}}{10} \right) \left( \frac{\sqrt{N}}{\sqrt{N+A}} \right) * 100$



# Study Area

- Area: 15,794,321 acres
- Private = 10,344,286 acres (66%)
- Public = 5,457,886 acres (34%)
- 22 4<sup>th</sup> code HUC's

The Milk, Marias, and Saint Mary Rivers Project Area



Streams  
Study Area  
Watersheds



# Study Area

Distinct environmental drivers in different parts of the study area:

- Precipitation
- Geology
- Elevation gradient
- Glacial history

The Milk, Marias, and Saint Mary Rivers  
Level III Ecoregions



#### Level III Ecoregions

- 17 - Middle Rockies
- 41 - Canadian Rockies
- 42 - Northwestern Glaciated Plains
- 43 - Northwestern Great Plains

0 25 50 100 150 Miles



# Study Area

**Northwestern Great Plains  
Riparian**



**Great Plains Prairie Pothole**



**Western Great Plains Saline  
Depression**



**Western Great Plains  
Depressional Wetland**



# Study Design

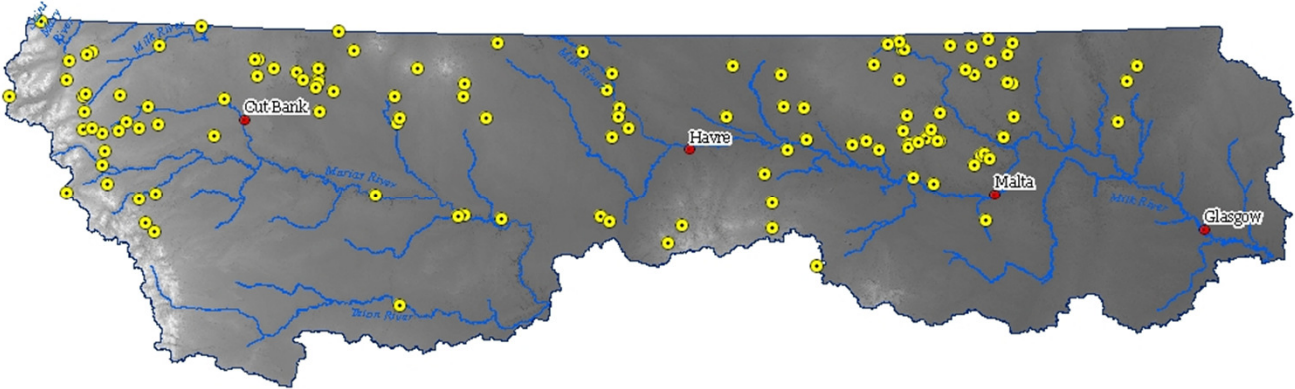
- **Sample frame – all palustrine wetland types mapped by 1980's National Wetland Inventory stratified by Level IV Ecoregion**
- **Sample points selected using a spatially balanced random sample survey design using a Generalized Random Tessellation Stratified (GRTS) approach**

# Results

- Level 1 analysis on 1,314 wetland polygons
- Level 2 field assessments conducted at 123 sites
- Level 3 intensive assessments at 44 sites



The Milk, Marias, and Saint Mary Rivers  
Level Two Wetland Assessments



● Level Two Wetland Assessment Sites  
~ Streams



# Results – Wetland Profile

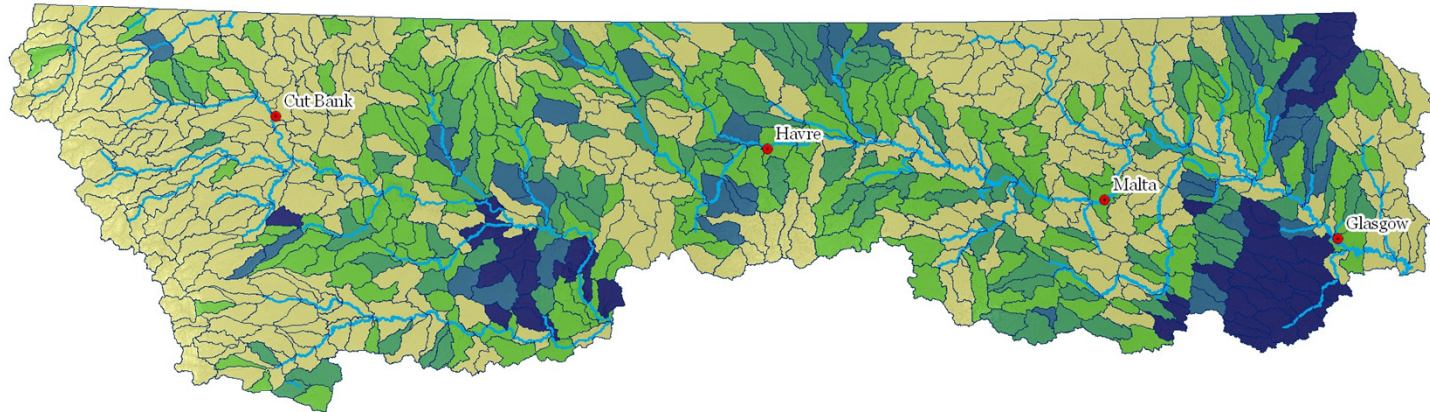
## Number and Acreage of Wetland Type

Water Regime	# Polygons	Acres	% of Total Wetland Acres
Temporarily Flooded	89,944	161,211	53%
Saturated	3,938	23,885	8%
Seasonally Flooded	41,295	78,905	26%
Semipermanently Flooded	19,675	36,357	12%
Intermittently Exposed	6,015	3,441	1%
Class	# Polygons	Acres	% of Total Wetland Acres
Freshwater Emergent Wetland	129,091	246,634	81%
Freshwater Forested/Shrub Wetland	4,036	20,704	7%
Freshwater Pond	24,787	31,227	10%
Freshwater Pond Shore	3,097	5,590	2%
Hydrogeomorphic (HGM) Type	# Polygons	Acres	% of Total Wetland Acres
Depressional	89,105	101,400	33%
Lacustrine	411	3,829	1%
Riverine	55,314	187,350	61%
Slope	16,817	12,195	4%

# Results - Wetland Profile

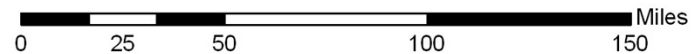
## Acres of Altered Wetlands

The Milk, Marias, and Saint Mary Rivers  
Sixth-code Hydrologic Units



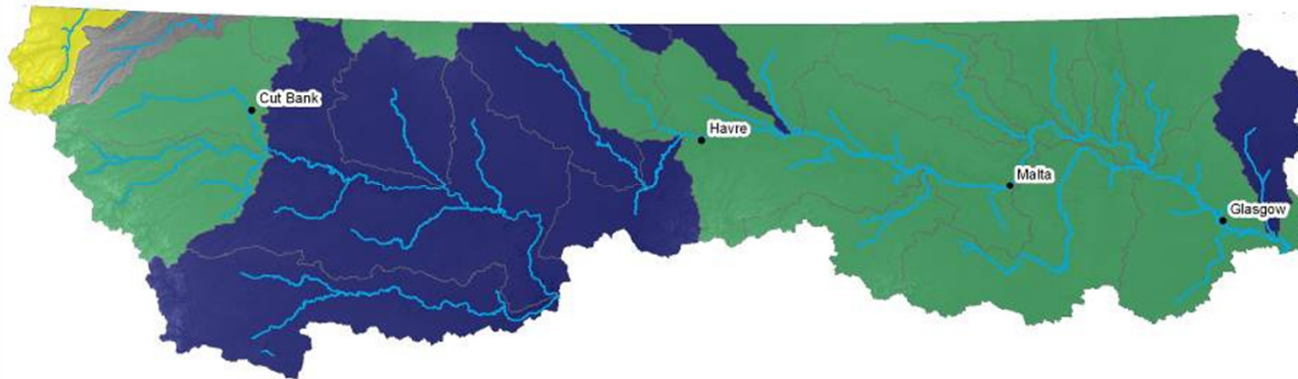
### Percent of Altered Wetlands

- 0% - 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- 81% - 100%
- Streams



# Results - Level 1 Landscape Analysis

Milk-Marias Fourth-code Hydrologic Units



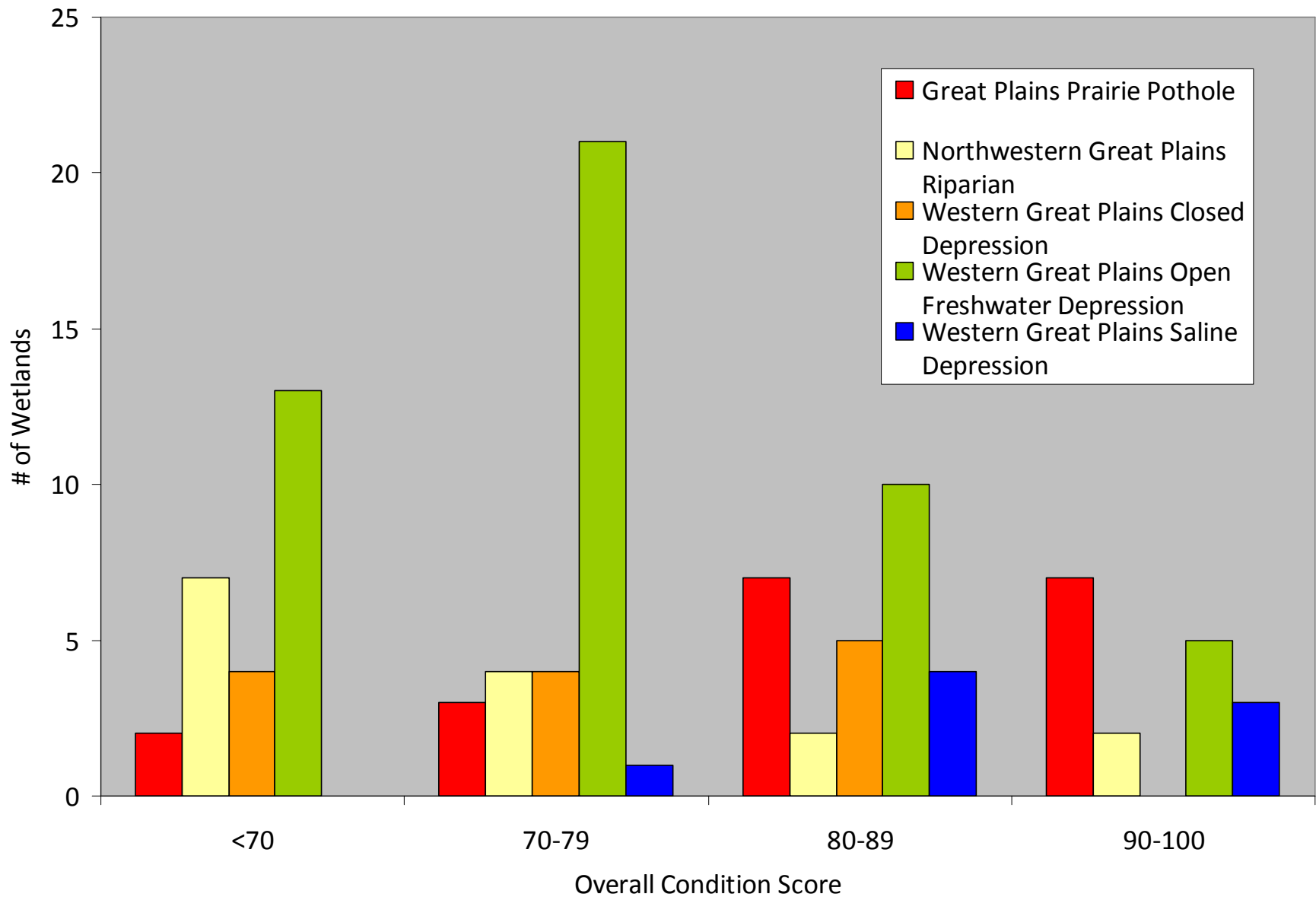
**Level 1 Assessment Condition**

- Minimally disturbed
- Moderately disturbed
- Highly disturbed
- Streams

0 25 50 100 150 Miles

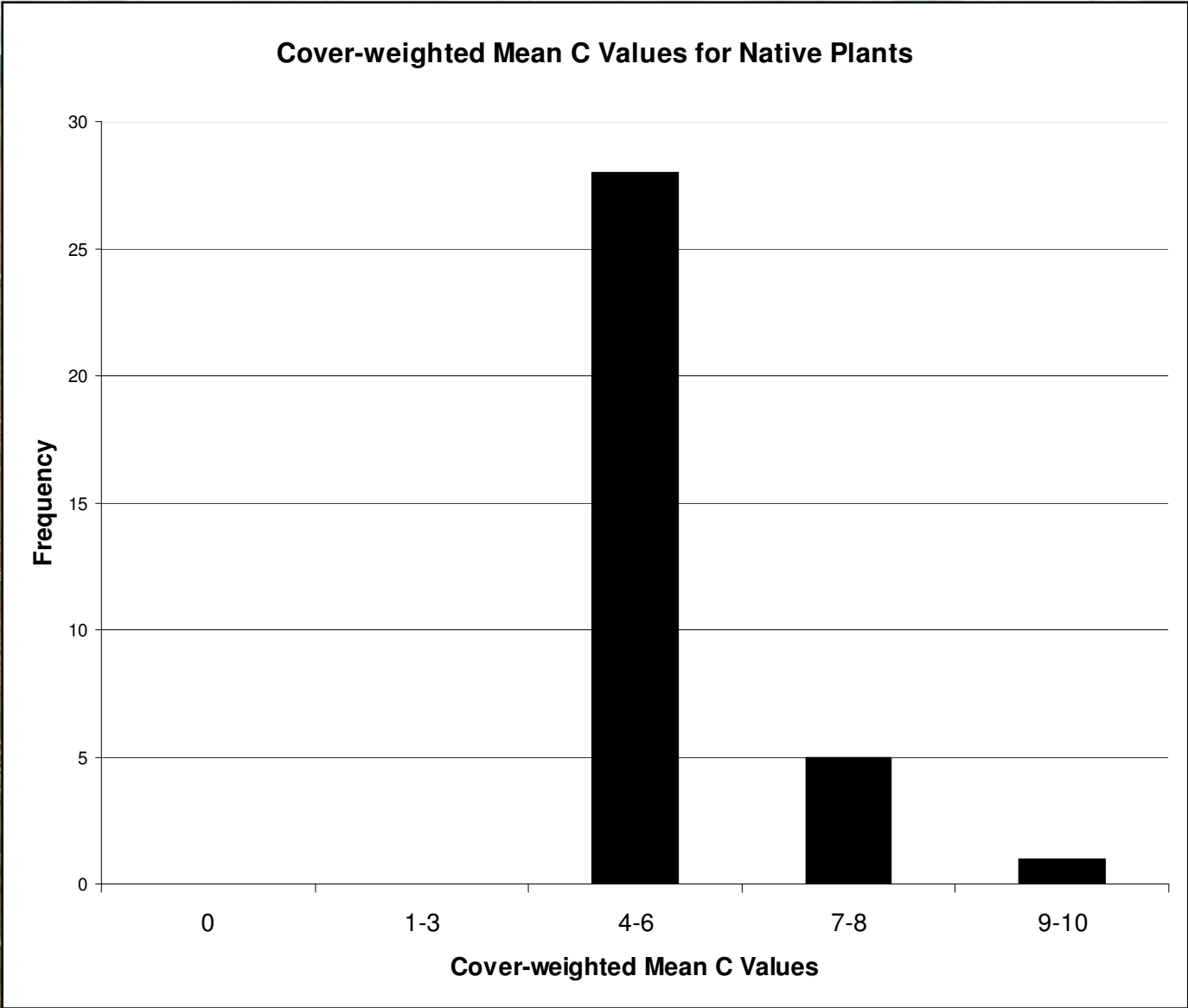


# Results - Level 2 Rapid Assessment

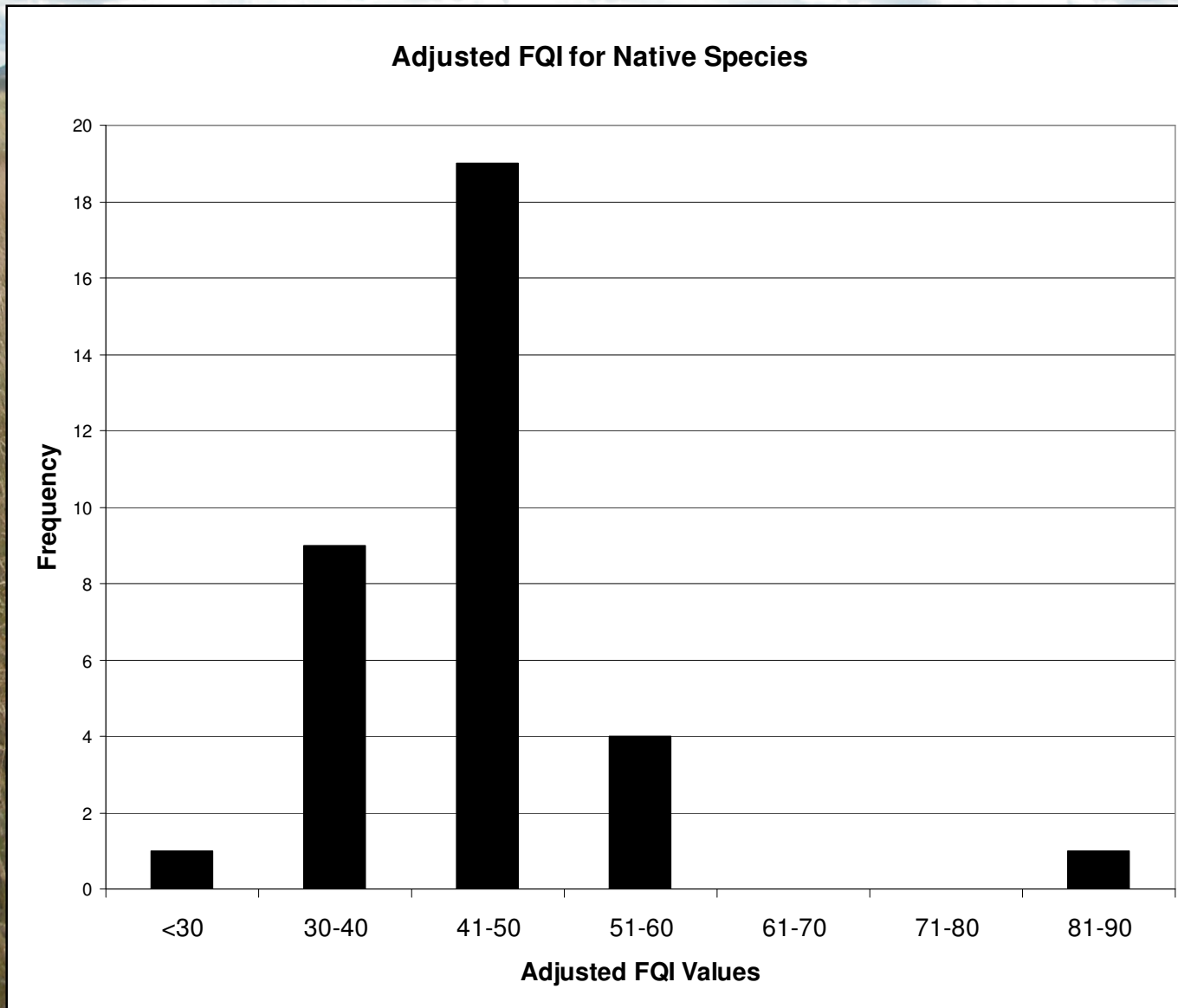




# Results - Level 3 Intensive Assessment



# Results - Level 3 Intensive Assessment



# Most Common Anthropogenic Stressors

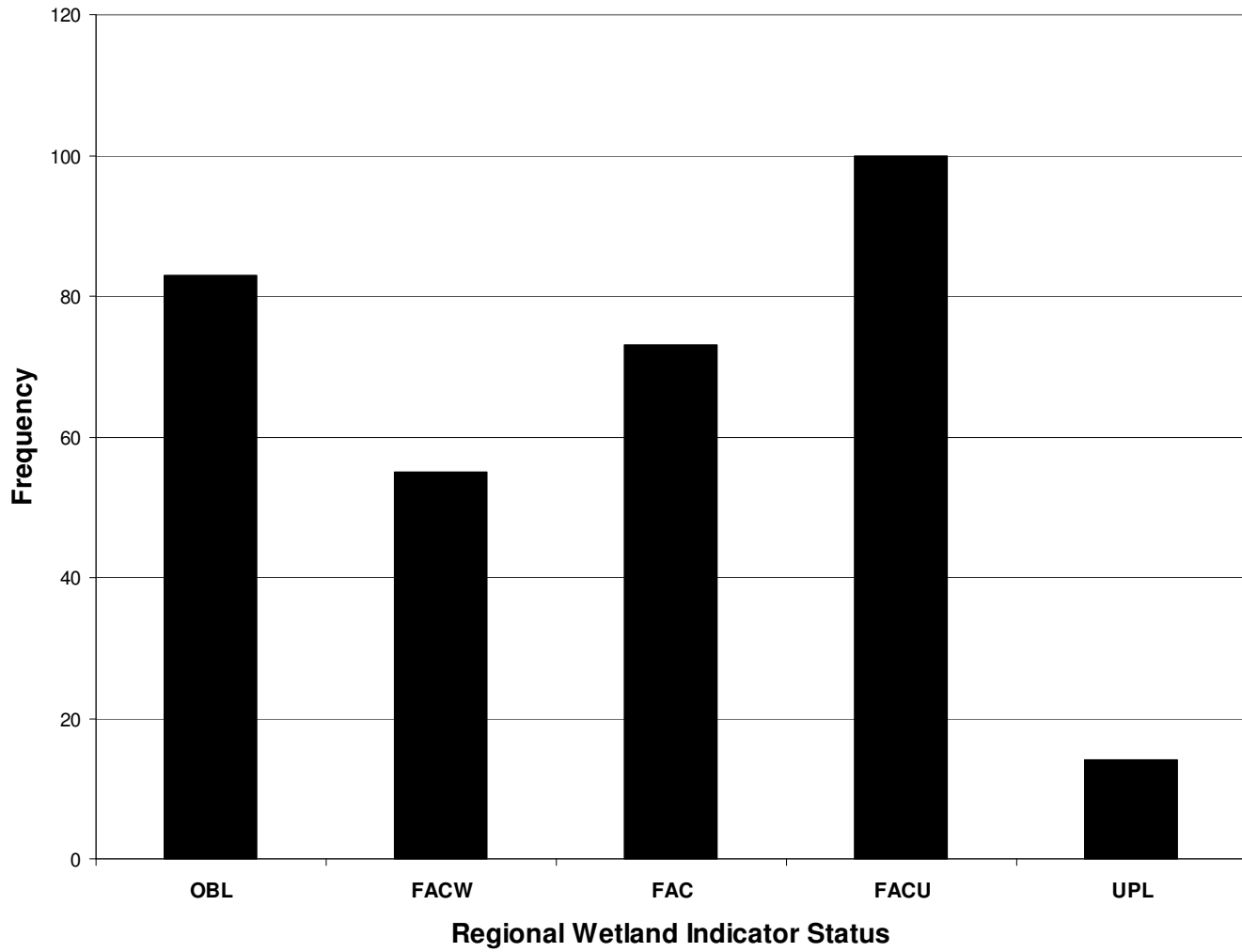


# Drought

- Reduced zonation
- Encroachment by terrestrial species
- Relic hydric soils but no wetland species



**Frequency of Regional Wetland Indicator Status**



# Conclusions: Wetland Condition

- 81% of wetlands are palustrine emergent with temporary or seasonal water regimes
- ~101,400 acres of depressional wetlands with more than half considered isolated
- Open and closed depressions as well as Northwestern Great Plains Riparian are most at risk
- Most common stressors are terrestrial encroachment, livestock grazing, agriculture, and roads.



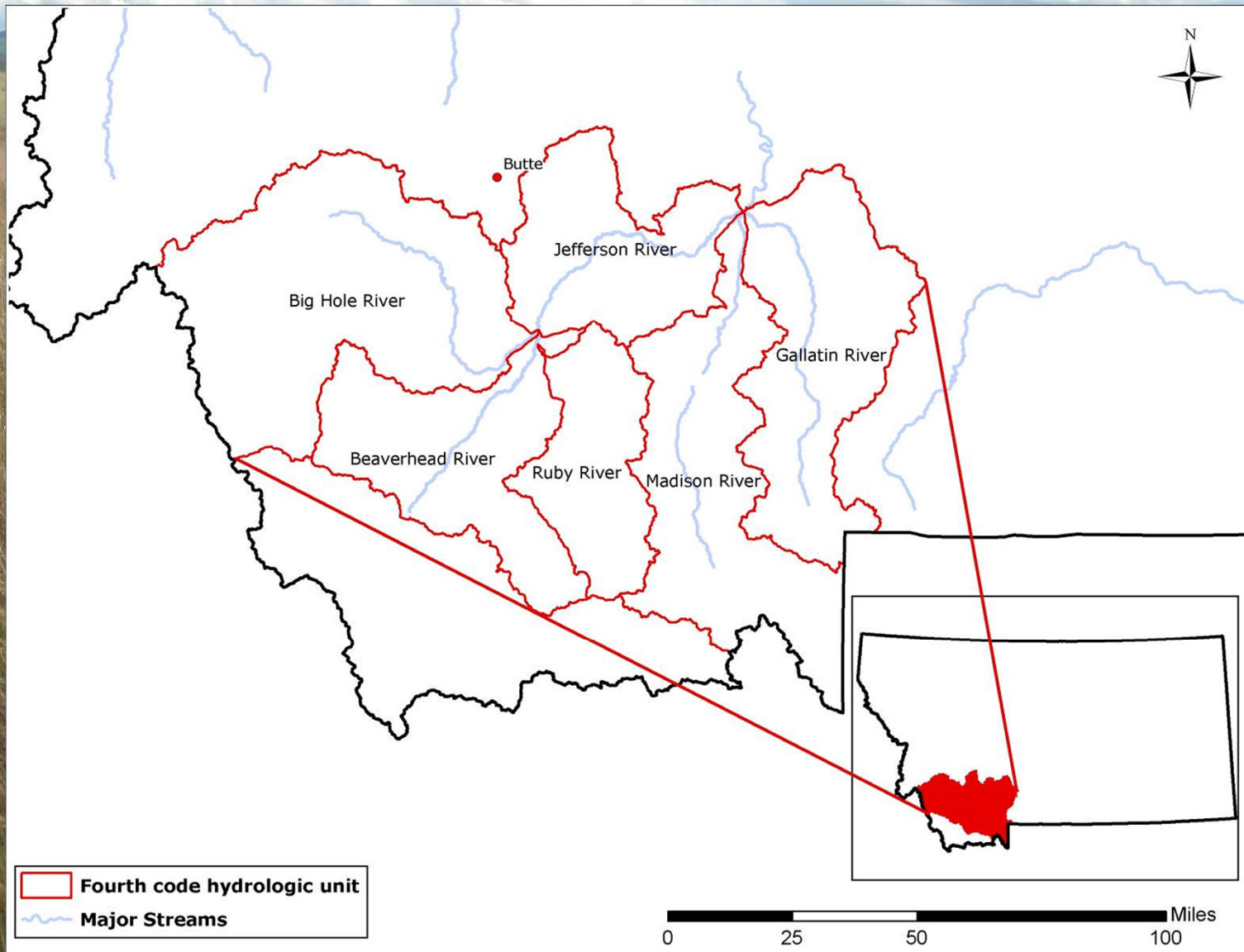
# Conclusions: Assessment Validation

- Landscape metrics are a coarse surrogate for actual disturbances
- Effects of human-induced disturbance may covary with effects of natural disturbances
- Tally of stressors does not work

# Next Steps.....

- **Develop additional Level 1 metrics**
- **Added scope and severity ratings for each stressor**
- **Include other stressors like beetle kill, drought, and fire**
- **Develop additional intensive Level 3 assessments to refine EIA methods**

# Southwest Montana Watersheds – Project Area



# Southwest Montana Watersheds – Ecological Systems Sampled



- Western North American Emergent Marsh
- Rocky Mountain Subalpine-Montane Fen
- Rocky Mountain Alpine-Montane Wet Meadow
- Rocky Mountain Subalpine-Montane Riparian Shrubland



# Southwest Montana Watersheds

- completed 100 Level 2 wetland assessments
- conducted Level 3 assessments at 30% of sites
- most common stressors included livestock and recreation
- examples of reference standard?



A wide-angle photograph of a vast, open landscape. The foreground and middle ground are filled with tall, golden-brown grasses, likely a prairie or steppe. The grasses are dense and appear to be blowing in the wind. In the background, there are several dark, rounded mountains or hills under a sky filled with large, white and grey clouds. The overall scene is a natural, open landscape.

**Questions?**