# REFERENCE WETLANDS

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# REFERENCE CONCEPT

- Indicators are evaluated against some expectation of condition
- Expectations act as a ***reference*** for comparison
- Reference represents a range of wetland conditions can be correlated with a known set of stressors
- Highest values within this range – ***Reference Standard***
- Provides standard of comparison for describing the highest level of potential or expected wetland condition

# REFERENCE *STANDARD* CONCEPT

- Minimally disturbed – condition in the absence of significant human disturbance
- Least disturbed condition – condition given the best available condition of the landscape
- Best attainable condition – equivalent to least disturbed condition if best management practices are implemented

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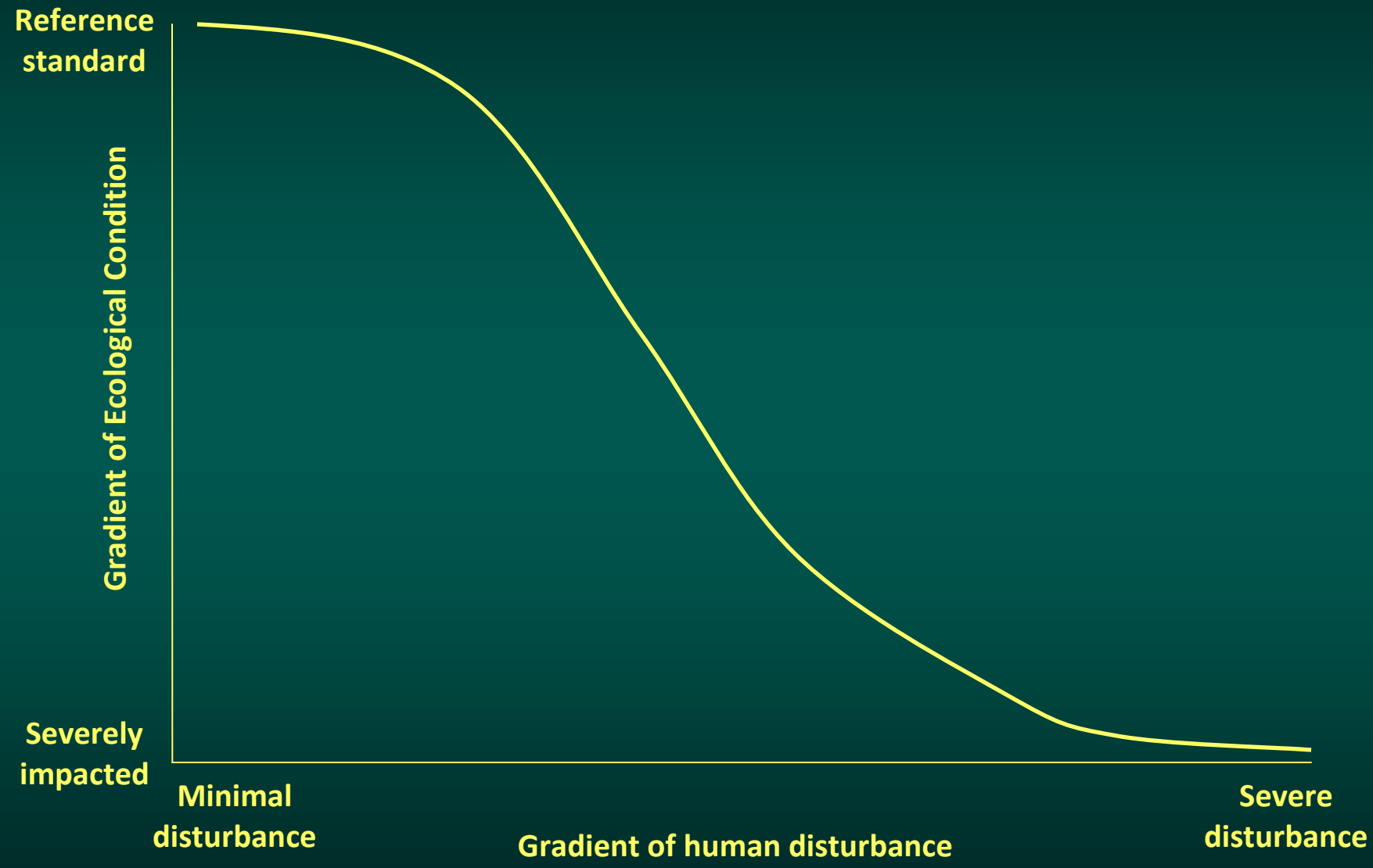
# REFERENCE *STANDARD* CONCEPT

- Defining reference standard provides context for interpreting wetland condition
- Expectations for reference standard are represented by a range of indicator scores
- This range of values represents the natural variability within a wetland system
- Once described, different indicators within that range can be used to classify wetland condition

# WETLAND CONDITION



# Reference Standard Wetland
# -an example from the Prairie Pothole Region

# Impacted Wetland
# -an example from the Prairie Pothole Region

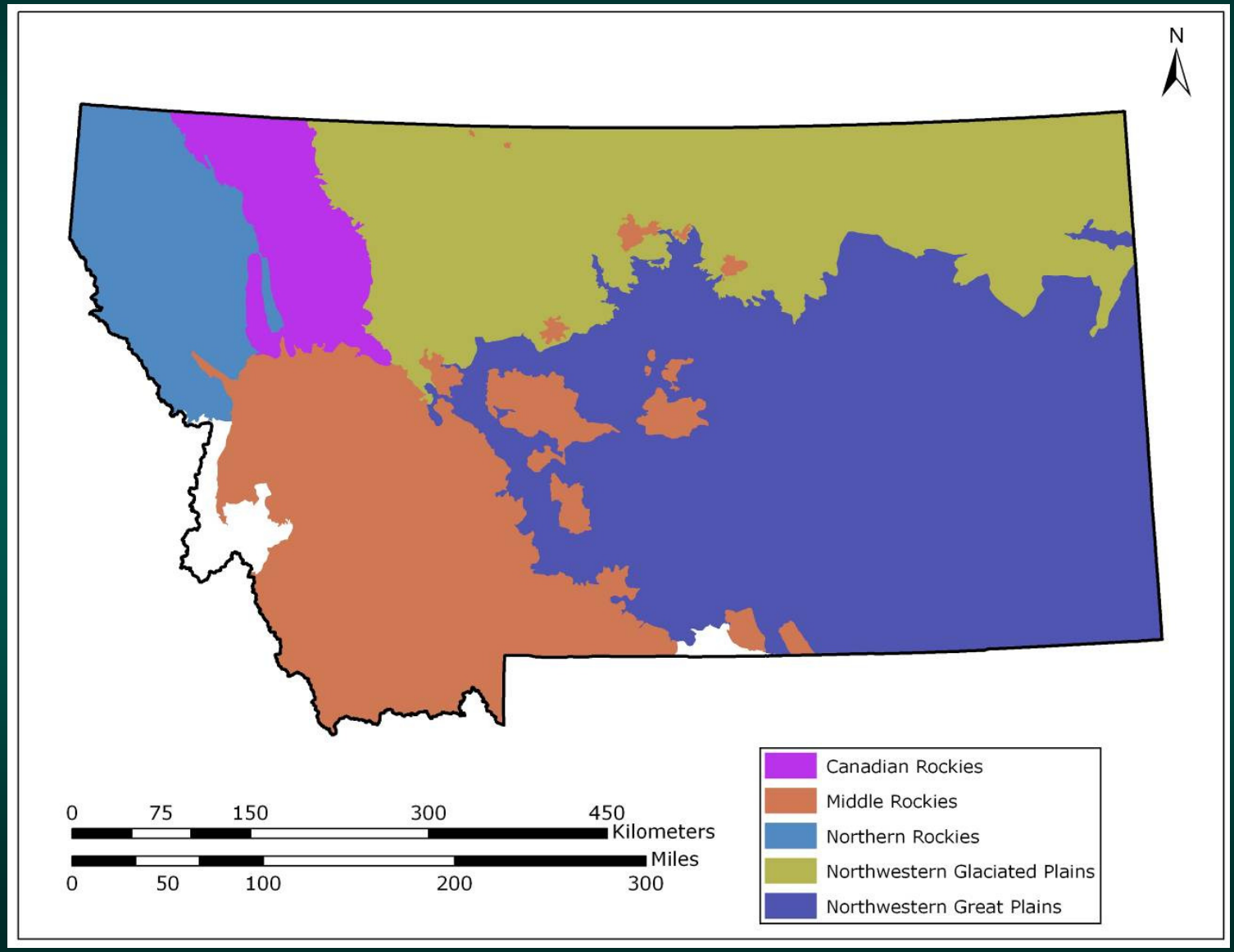
# REFERENCE WETLAND NETWORKS

- Establish a baseline for defining characteristic levels of condition
- Represent a range of condition for monitoring and assessing trends
- Establish range and variability of wetland attributes
- Develop indices of ecological integrity

# MONTANA'S REFERENCE WETLAND NETWORK

- Provide a collection of sites that represent a gradient of condition
- Provides examples of reference standard for multiple wetland systems
- Identifies the variability in wetland attributes
- Identifies human-induced disturbances impacting wetland condition

# STUDY AREA


N
Canadian Rockies
Middle Rockies
Northern Rockies
Northwestern Glaciated Plains
Northwestern Great Plains
0 75 150 300 450
Kilometers
Miles
0 50 100 200 300

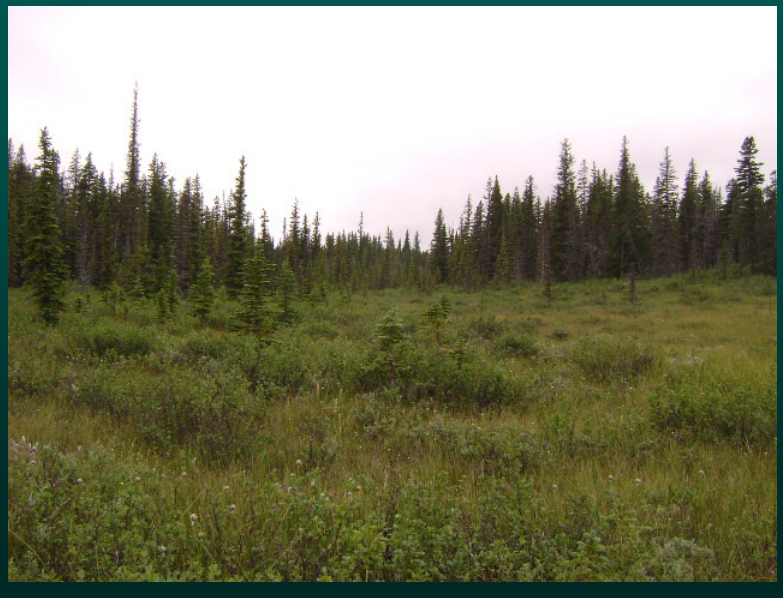
# Northwestern Glaciated Plains Ecoregion

- Great Plains Prairie Pothole
- Western Great Plains Saline Depression
- Western Great Plains Closed Depression
- Western Great Plains Open Freshwater Depression

# Northwestern Great Plains Ecoregion

- Western North American Emergent Marsh
- Western Great Plains Closed Depression
- Western Great Plains Open Freshwater Depression

# Middle Rockies, Northern Rockies, & Canadian Rockies Ecoregions



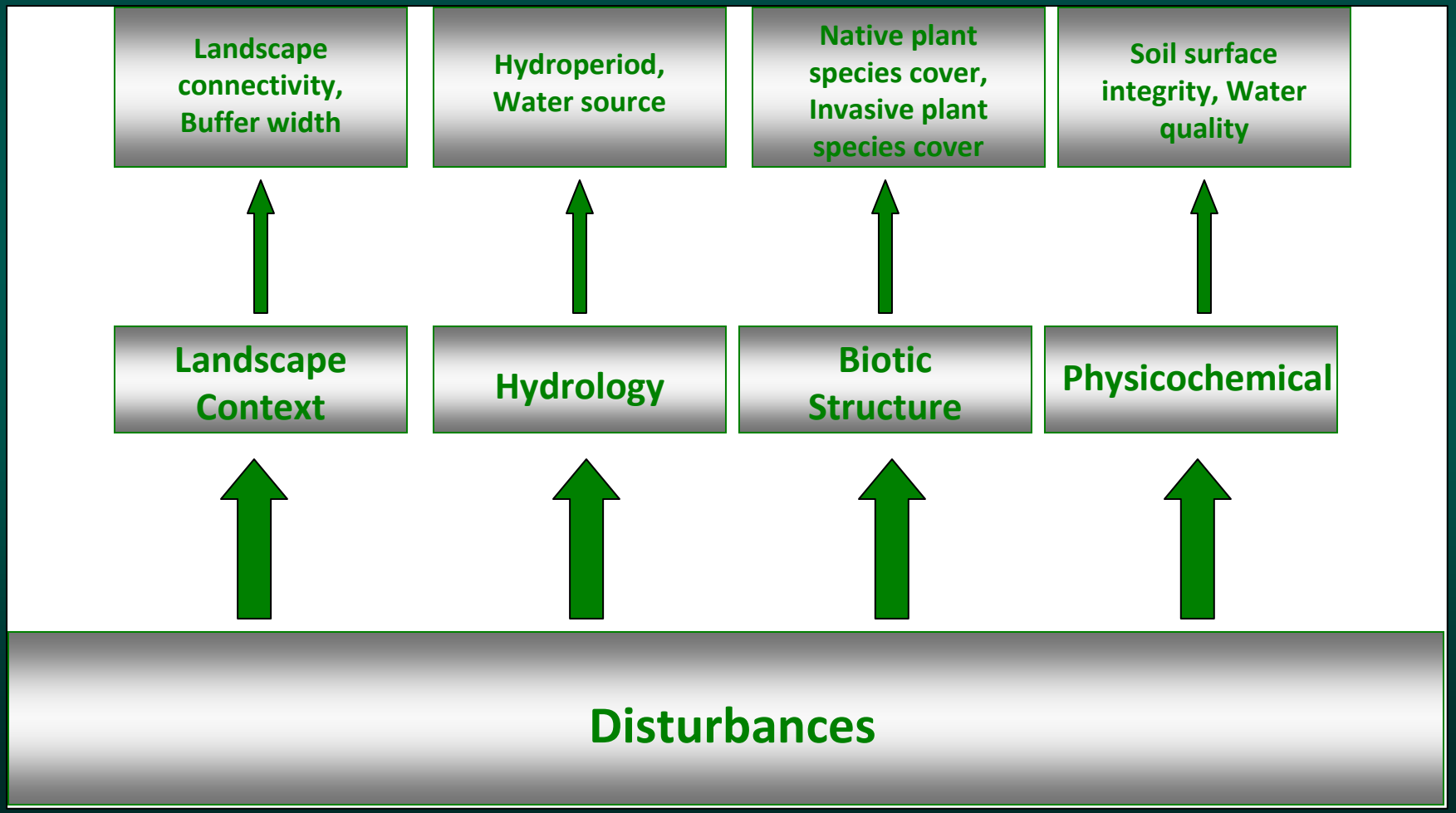
- Western North American Emergent Marsh
- Rocky Mountain Subalpine-Montane Fen
- Rocky Mountain Alpine-Montane Wet Meadow

# METHODS

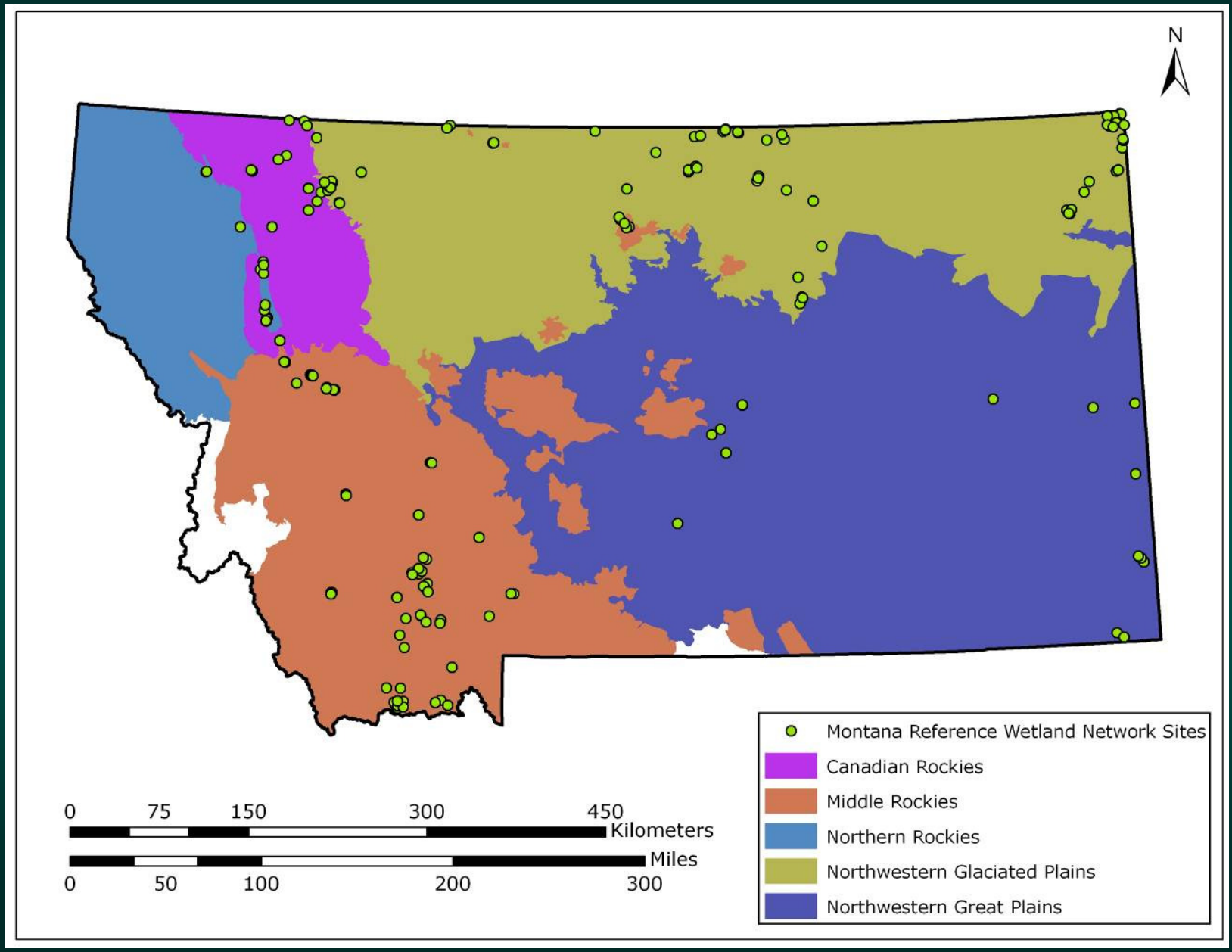
- Selected sites based on wetlands described in the literature and input from other ecologists
- Classified each wetland by:
  - ecological system
  - Cowardin system, class, and water regime
  - hydrogeomorphic features

# METHODS

## Level 2 - Rapid assessment



# RESULTS

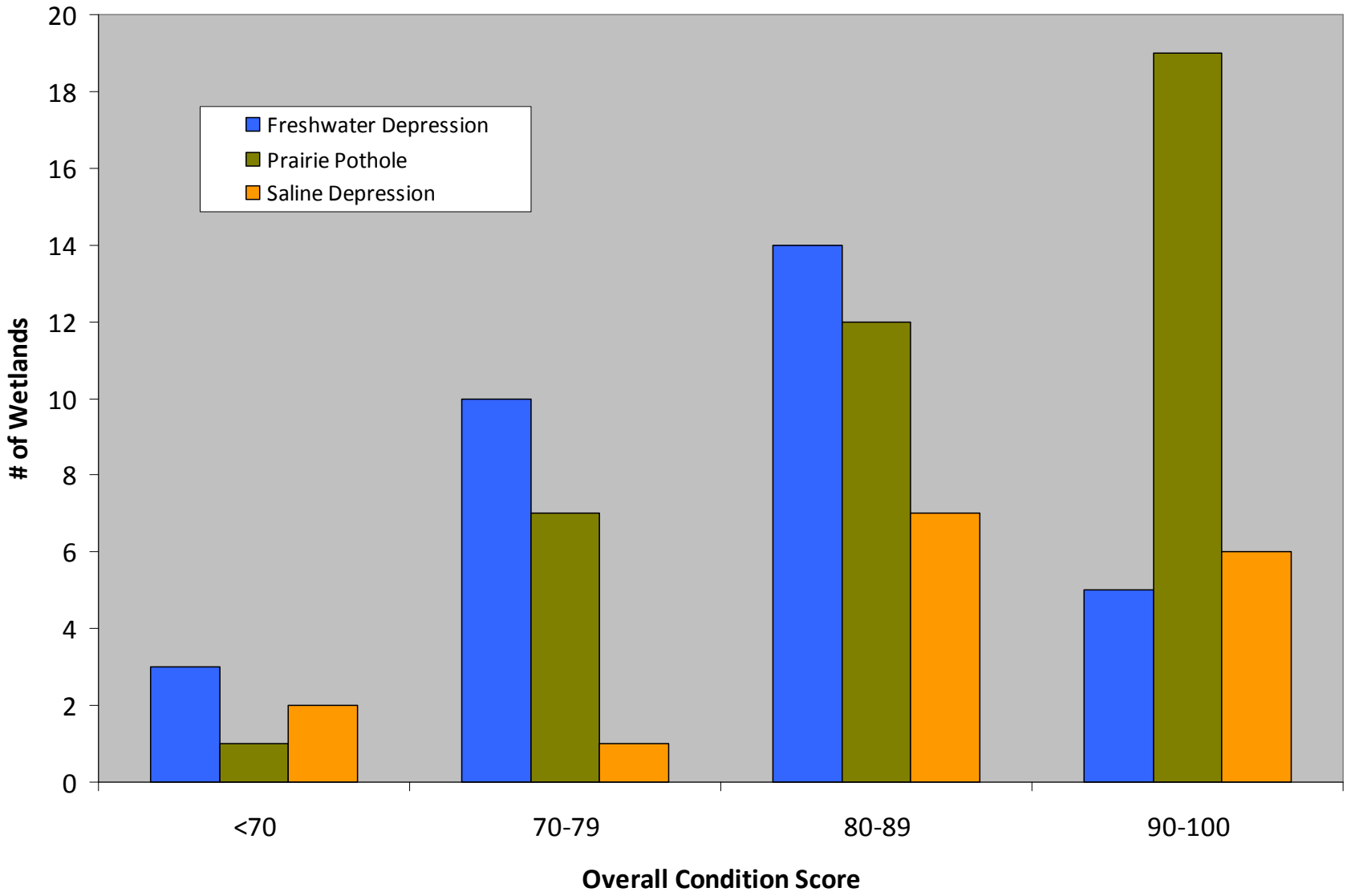

N
0 75 150 300 450
Kilometers
Miles
0 50 100 200 300
Montana Reference Wetland Network Sites
Canadian Rockies
Middle Rockies
Northern Rockies
Northwestern Glaciated Plains
Northwestern Great Plains

# RESULTS

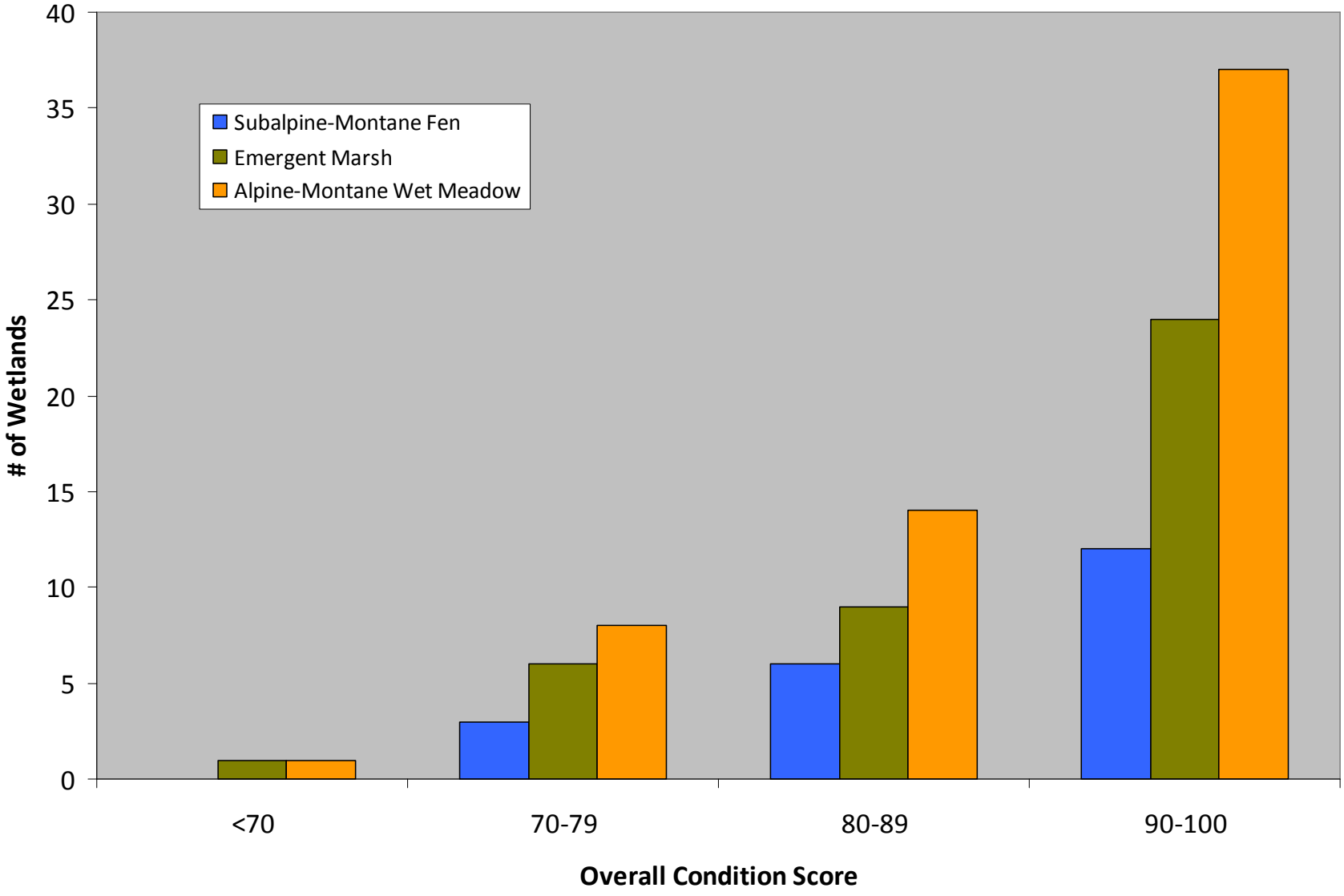
## Wetland Condition Score Categories

- at or near expected reference standard (scores = 90-100)
- least impacted (scores = 80-89)
- moderately impacted (scores = 70-79)
- severely impacted (scores < 70)

# Results – Great Plains Wetlands



# Results – Montane Wetlands



# RESULTS

## Northwestern Glaciated Plains and Northwestern Great Plains Wetlands

Most Common Stressors

- livestock grazing
- roads
- buffer condition
- landscape connectivity
- altered hydrology

# RESULTS

## Middle Rockies, Canadian Rockies, and Northern Rockies Wetlands

Most Common Stressors

- livestock grazing
- altered hydrology
- roads

# WETLAND REFERENCE NETWORK
# Uses and Applications

- Allow for rapid comparison of wetland condition both within and across wetland systems
- Can diagnose potential causes of wetland degradation
- Provide examples of multiple wetland systems in varying levels of condition across Montana
- Highlights areas to focus and prioritize conservation, acquisition, and restoration efforts
- Characterize examples of reference standard
- Validate and calibrate our wetland assessment methods

# WETLAND REFERENCE NETWORK
# Future Work

- Continue adding to network
- Refine disturbance gradient
- Collect more Level 3 data
- Develop regional networks

# Rocky Mountain Regional Monitoring and Assessment Project (REMAP)

**Project Partners:**

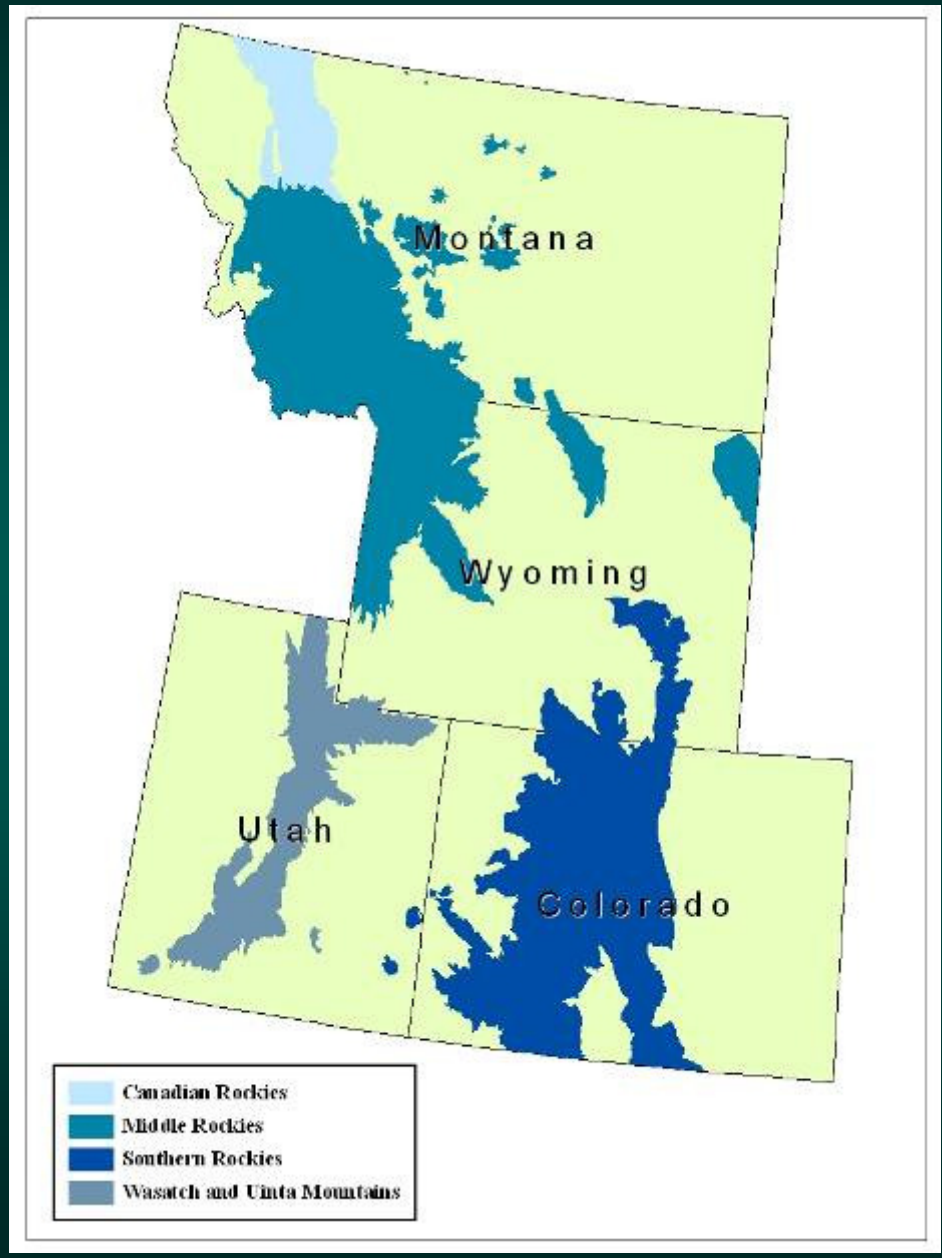
- Montana
- Colorado
- Wyoming
- Funded through EPA ORD

**Project Objectives:**

1. Develop a regional set of reference standard wetlands:
   ~ wet meadows
   ~ marshes
   ~ fens
   ~ riparian shrublands

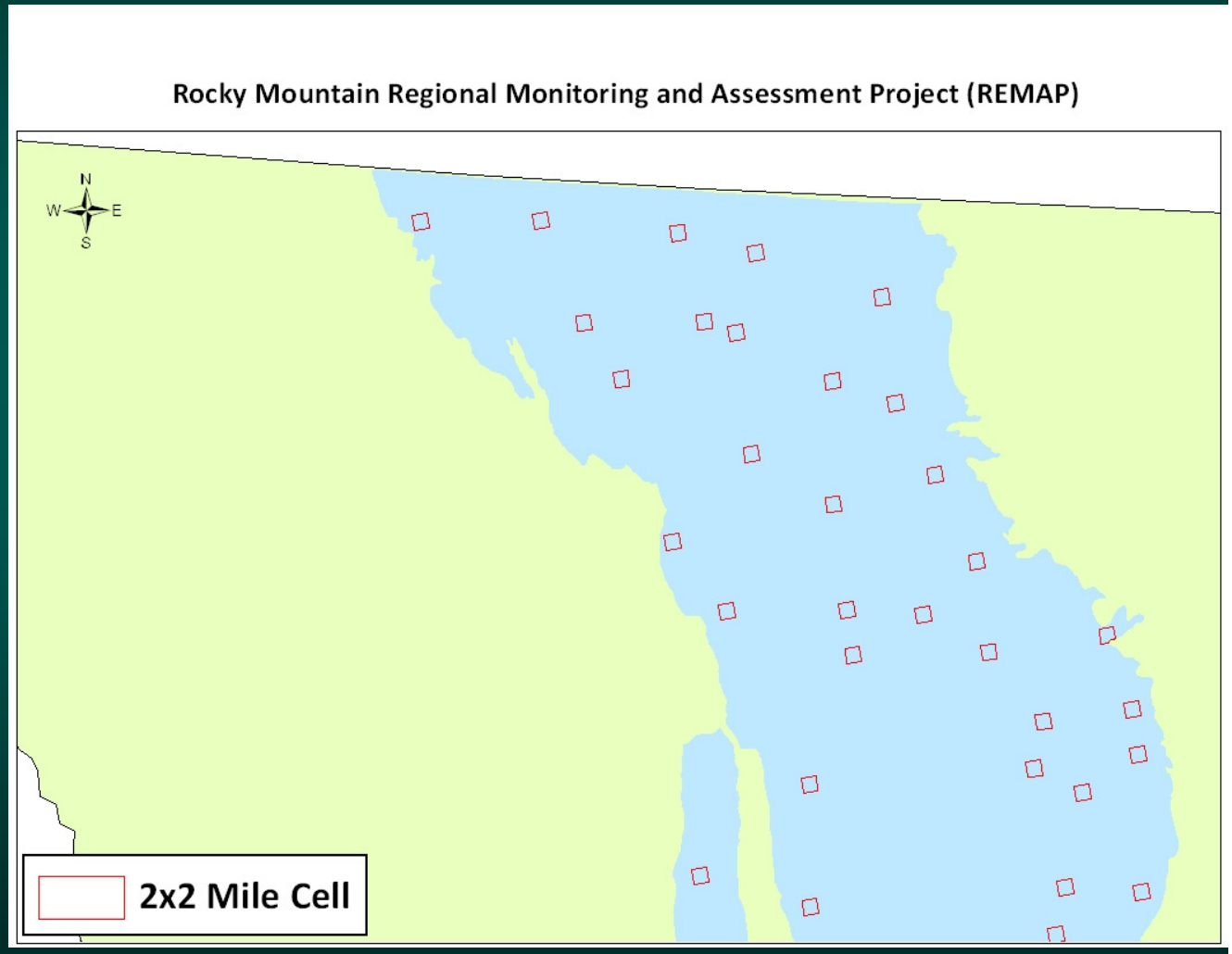
2. Quantify the range of natural variability within reference standard wetlands

3. Develop a regionally standardized Level 1, 2, 3 protocol



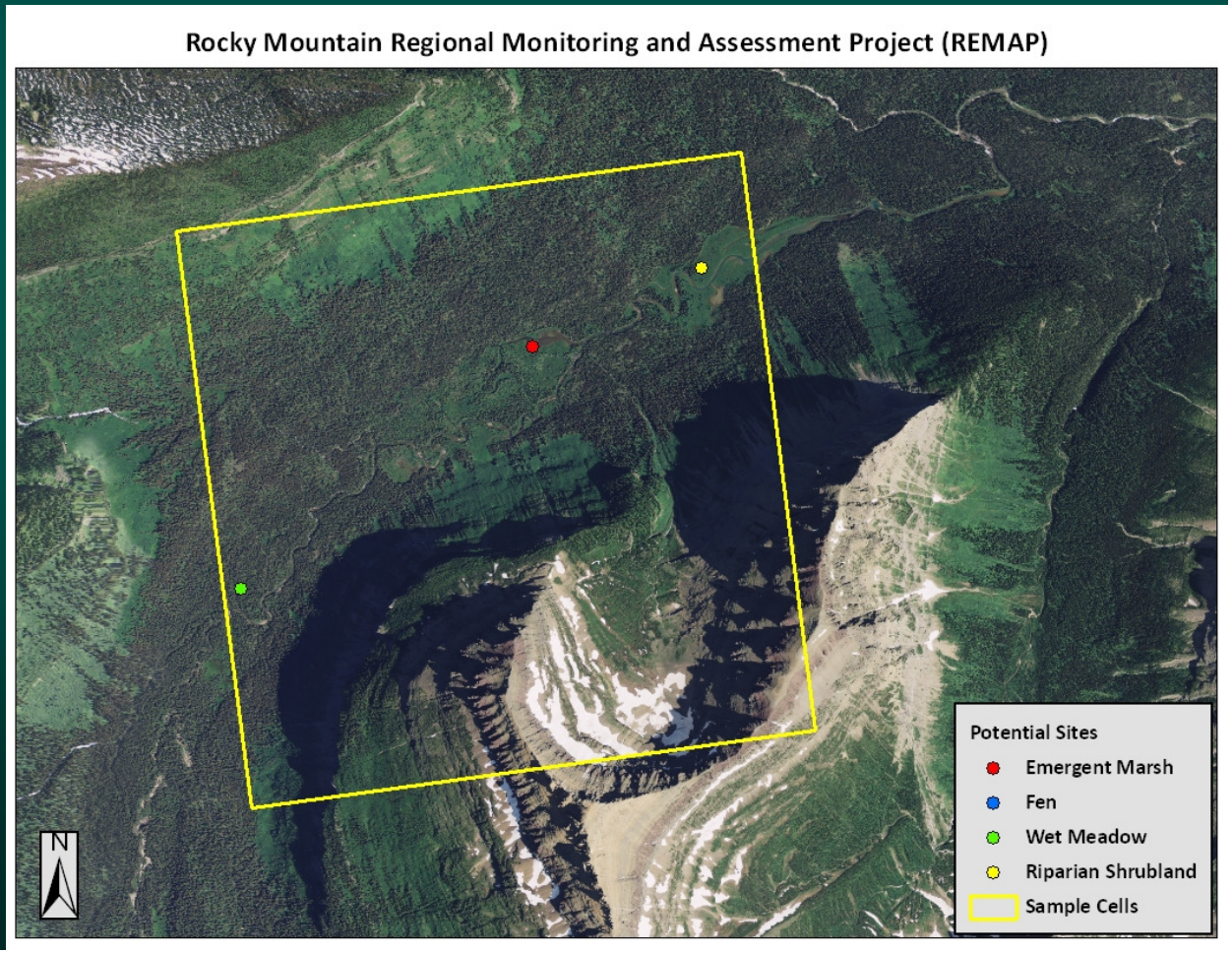
# SITE SELECTION

- Selected 50 2x2 mile grid cells within each Level 3 Ecoregion
- Used a landscape integrity model to guide us towards high integrity areas
- Low integrity landscape excluded from the sample frame



# Site Selection

- Within the high integrity landscape of each 2x2 m cell, laid down a grid of points 100 meters apart
- Points ordered by GRTS in a spatially balanced random sequence
- Identified all potential wetlands through photo-interpretation and NWI
- Selected the first ordered point from each wetland ecological system



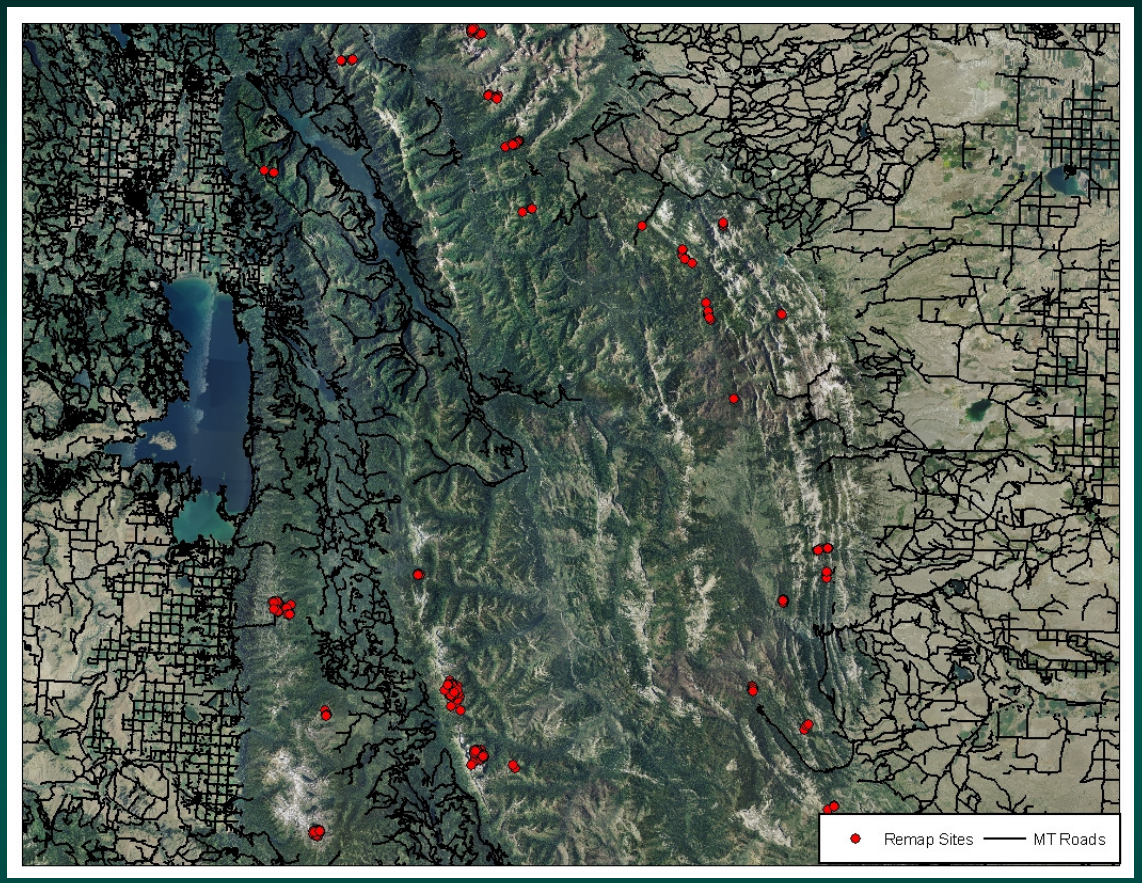
# Field Criteria for Minimally Disturbed Sites

**Distance from Roads:**
>200 m 4x4, dirt road
>300 m local, city road
>500 m highways

**Hydrologic modifications:**
>200 m canals, ditches
>200 m wells, impoundments
>1,000 m upstream reservoirs

**Land Cover:**
>300 m low density residential
>500 m crop agriculture/ hay pastures
>2,000 m high density residential/ timber harvest

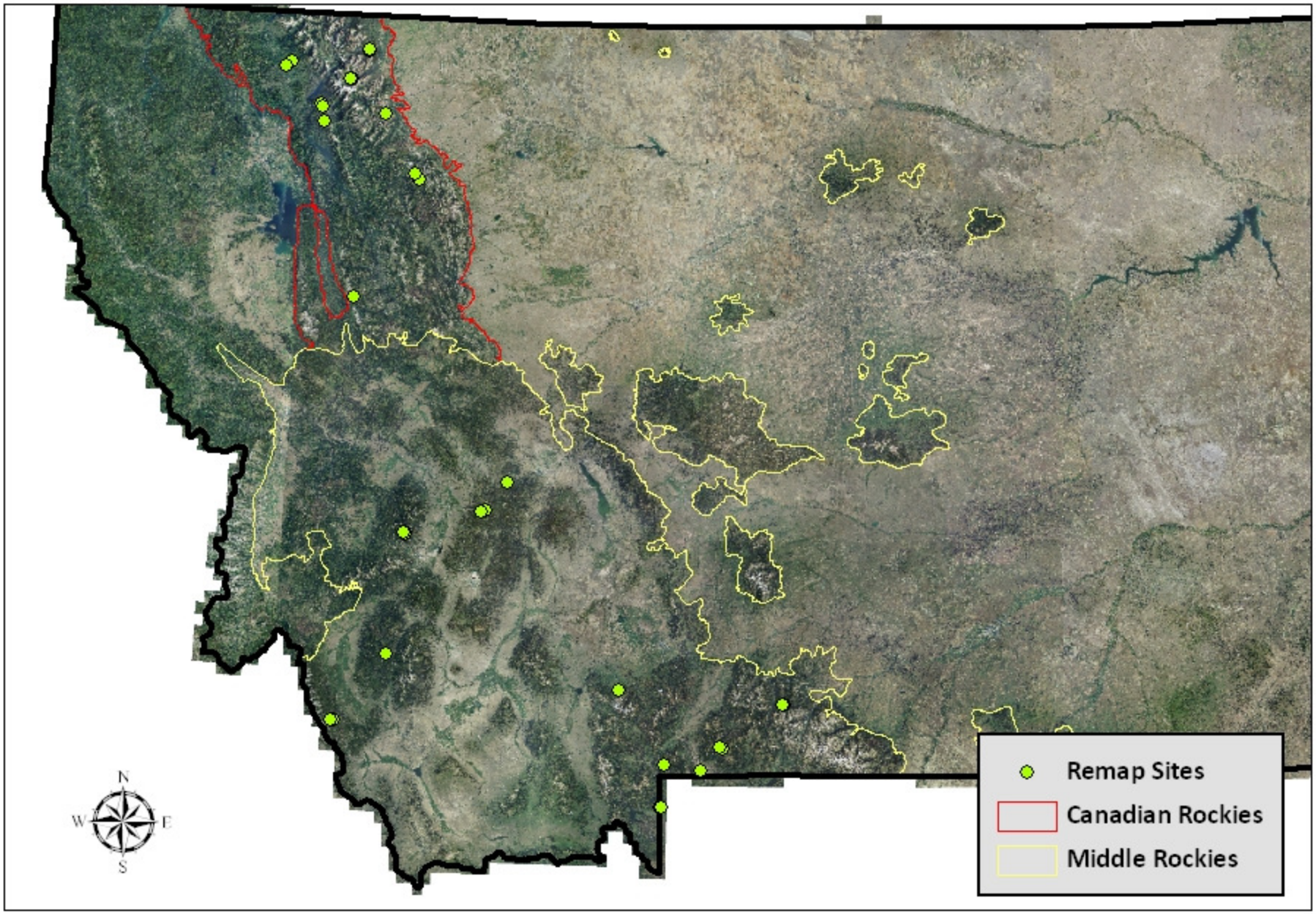
**Land Use:**
>200 m evidence of livestock grazing
>500 m abandoned mines/ tailing piles
>1,000 m active gravel pit, open pit, strip mining



# AA ESTABLISHMENT CRITERIA

- Assess 1 Ecological System
- Ecological system has to be at least 0.1 ha
- Wetlands had to be at least 20 m wide
- AA has to have less than 10% standing water and upland inclusions

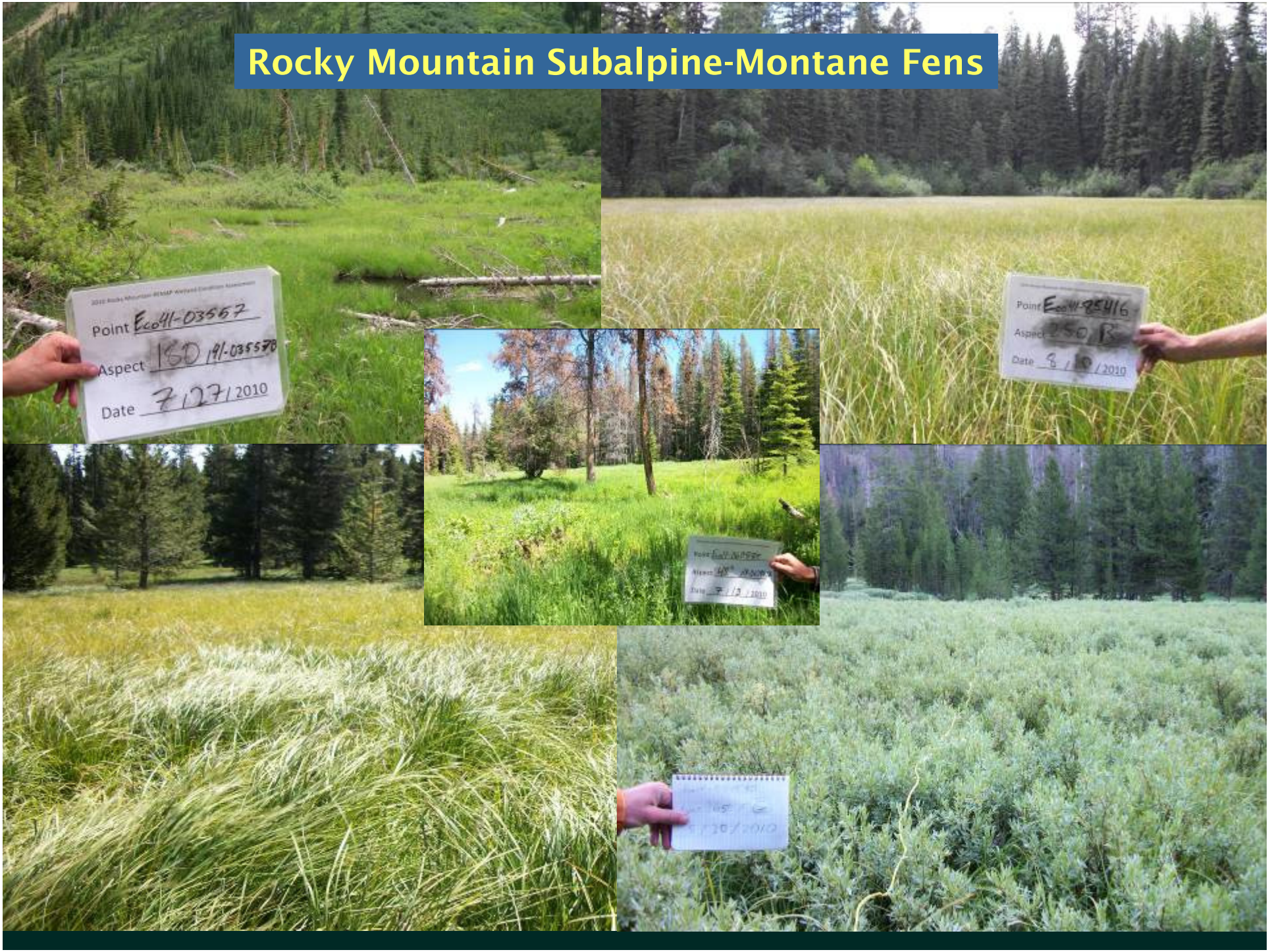
# Rocky Mountain Regional Monitoring and Assessment Project (REMAP)



# Lessons So Far…….

With so many rules a preliminary field season is a must!

# Rocky Mountain Subalpine-Montane Fens



# Wet Meadow vs. Marsh

- Have similar vegetation
- Can have similar soils
- Main difference is water duration

# Questions?

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