DOI National NRDAR Workshop: Restoration Monitoring Session

APPLYING A SYSTEMATIC APPROACH TO FRESHWATER WETLAND RESTORATION

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Outline

1. NatureServe Network
2. Ecological assessment framework for wetlands
3. Selecting indicators for monitoring
4. Perspectives from sites in Great Lakes (WI and MI)

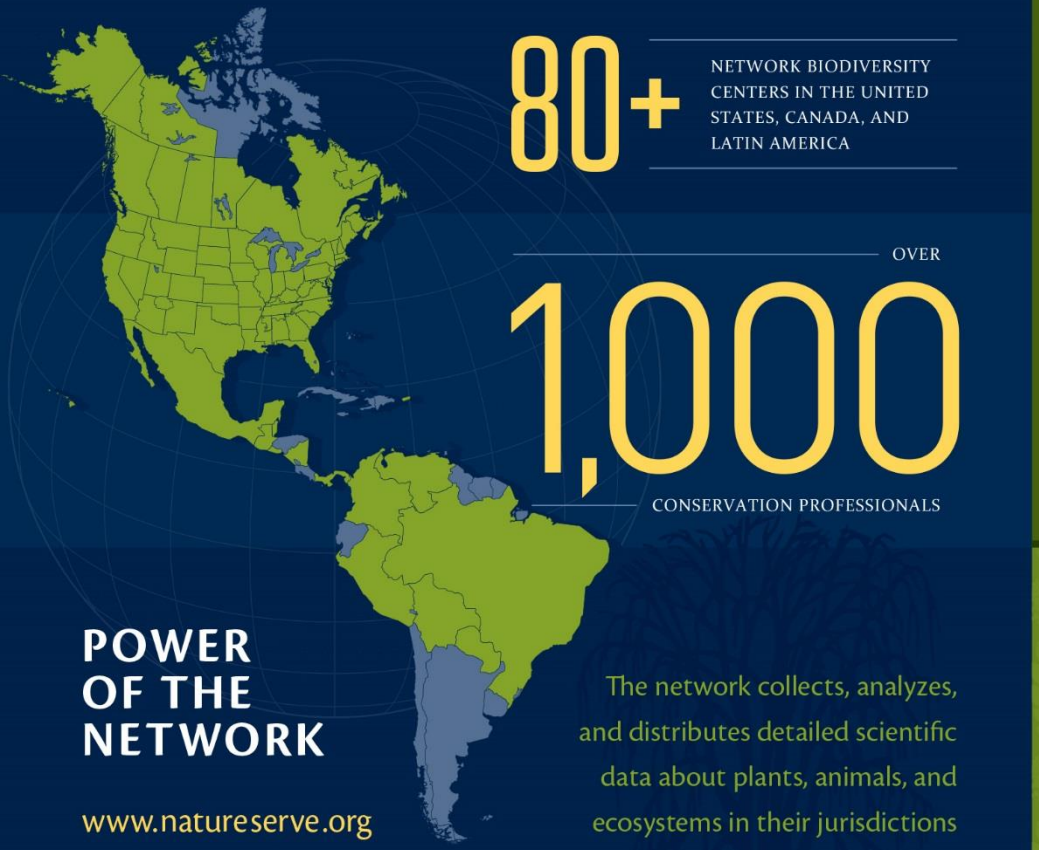
Who are we?

WISCONSIN DEPT. OF NATURAL RESOURCES

Michigan Natural Features Inventory

NatureServe

A Network Connecting Science with Conservation



80+ NETWORK BIODIVERSITY CENTERS IN THE UNITED STATES, CANADA, AND LATIN AMERICA

OVER **1,000** CONSERVATION PROFESSIONALS

POWER OF THE NETWORK

www.natureserve.org

The network collects, analyzes, and distributes detailed scientific data about plants, animals, and ecosystems in their jurisdictions

70,000 Species Assessed

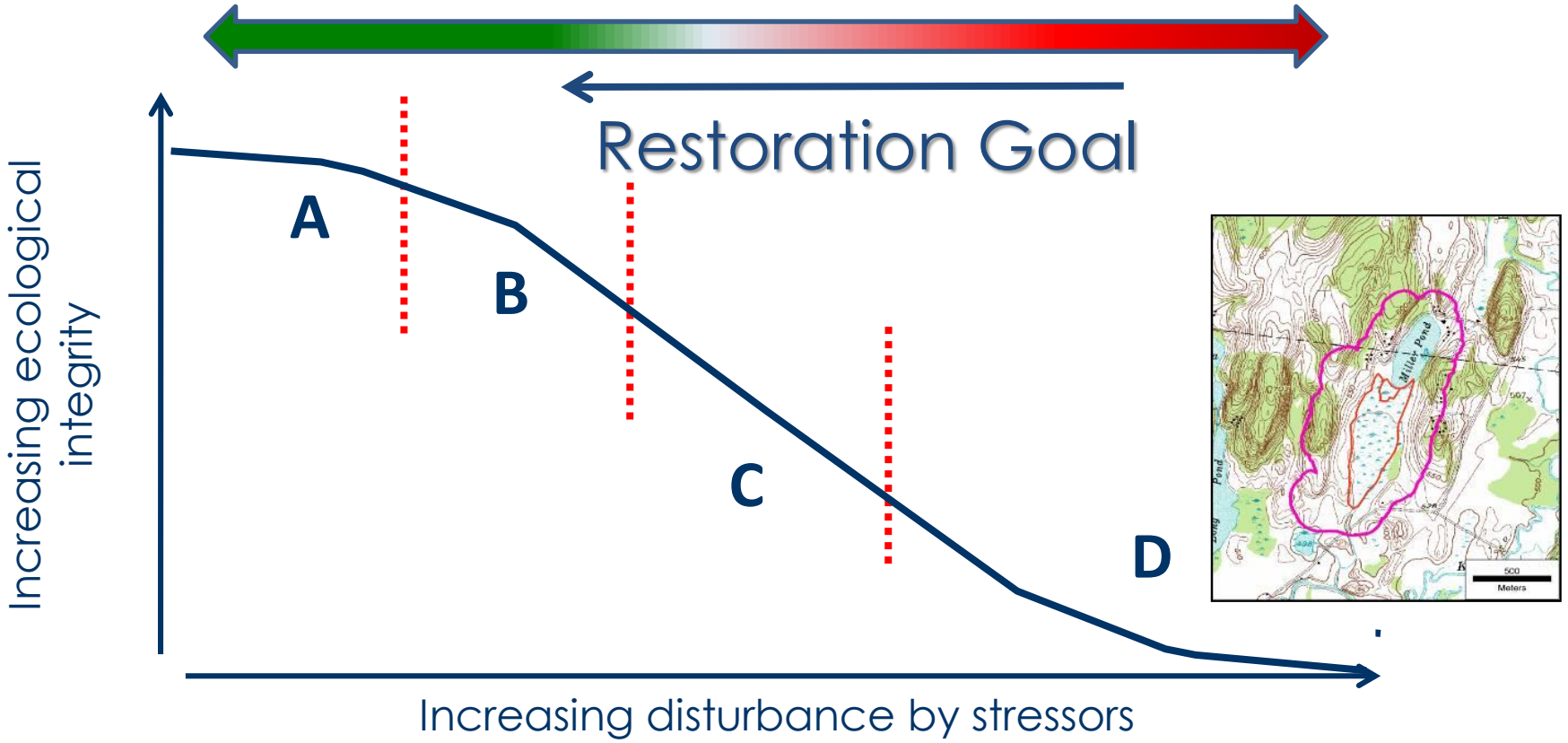
1,600+ Ecosystems Mapped

OVER **6 MILLION** ANNUAL DATA REQUESTS	**9** INTERACTIVE ONLINE DATA TOOLS	OVER **1 MILLION** MAPPED LOCATIONS OF AT-RISK SPECIES	OVER **2,000** SCIENTIFIC PUBLICATIONS
OVER **5,000** PARTNER ORGANIZATIONS	NETWORK-WIDE BUDGET OF OVER **$60 MILLION**	**0** LOBBYISTS	**0** LAWYERS

WINNER OF THE MACARTHUR AWARD FOR CREATIVE AND EFFECTIVE INSTITUTIONS

Ecological Integrity Assessment

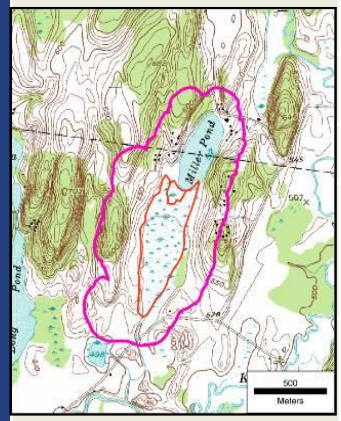
*EI = The ability of an ecological system to support and maintain a community of organisms that has the biotic **composition, diversity, and functional organization** comparable to those of natural habitats within a region*[1]



[1] Parrish, J.D., D. P. Braun, and R.S. Unnasch. 2003. Are we conserving what we say we are? Measuring ecological integrity within protected areas. BioScience 53: 851-860.

Ecological Integrity Assessment Framework

For a given type of habitat….

Site Score	**Rating Category**	**Key Ecological Attribute** *(from type description)*	Indicator *("condition" vs. "stressor")*
A,B,C,D	Landscape Context	Landscape Structure	e.g., Mosaic Structure
…or an index score of 0.0 – 1.0		Landscape Dynamics	e.g., Disturbance size and return interval
...or "Good" "Fair" "Poor"	Condition	Stand Development / Maturity	e.g., Woody Vegetative Cover
"Potential Concern" vs. "imminent Loss"		Biotic Composition	e.g., Native vs. Invasive Plants & Animals
		Functions and Processes	e.g., Herbivory/ Utilization
		Abiotic Physical/Chemical Attributes	e.g., Nutrient input
	Size	Area supporting patch dynamics	e.g., Minimum dynamic area

ASSESSMENT SCORECARD

Grey shaded cells indicate the current scoring for a given indicator

Key Ecological Attribute	Indicator	Indicator Definition	*Metric Rating Criteria* Acceptable	Potential Concern	Imminent Loss
LANDSCAPE CONTEXT					
Landscape Composition	Adjacent Land Use	intensity of human dominated land uses within 100 m of the wetland.	Use Score = 0.80-1.0	Use Score = 0.4-0.80	Use Score = < 0.4
	Buffer Width	Natural (non-anthropogenic) areas that surround a wetland.	Wide > 50 m	Narrow. 25 m to 50 m	Very Narrow. < 25 m
	Landscape Predictors of Hydrologic Alteration	Onsite or adjacent land uses and water uses that could result in changes to wetland hydrology.	Low intensity alteration such as roads at/near grade, small diversion or ditches (< 1 ft. deep) or small amount of flow additions	Moderate intensity alteration such as 2-lane road, low dikes, roads w/culverts adequate for stream flow, medium diversion or ditches (1-3 ft. deep) or moderate flow additions.	High intensity alteration such as 4-lane Hwy., large dikes, diversions, or ditches (>3 ft. deep) able to lower water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions.
Landscape Pattern	Percentage of unfragmented landscape within 1 km.	Extent to which landscape lacks barriers to the movement of species, water, nutrients, etc.	Embedded in 60-100% unfragmented natural landscape; internal fragmentation minimal	Embedded in 20-60% unfragmented natural landscape; Internal fragmentation moderate	Embedded in < 20% unfragmented natural landscape. Internal fragmentation high
CONDITION					
Plant Species Composition	Percent of Cover of Native Plant Species	Percent cover of the plant species that are native, relative to total cover (sum by species)	85-< 100% cover of native plant species	50-85% cover of native plant species	<50% cover of native plant species
	Invasive Species – Plants	Percent of marsh dominated by invasive, aggressive plants.	Native species such as *Typha* and *Phragmites* and/or other non-native invasive species occupy < 10% of wetland.	Native species such as *Typha* and *Phragmites* and/or other non-native invasive species occupy 10-50% of wetland.	Native species such as *Typha* and *Phragmites* and/or other non-native invasive species occupy >50% of wetland.
Hydrologic Regime	Flashiness Index	Measures the variability in water depth fluctuations it compared to reference data.	Flashiness Index = 1.0 - 2.0	Flashiness Index = between 2.0 -3.0 if wetland is NOT associated with riverine	Flashiness Index = > 3.0 if wetland is NOT associated with riverine environment
SIZE					
Absolute Size	Size Relative to Type	The current size of the wetland relative to other examples of this type	> 25 acres (10 ha)	1 to 25 acres (0.4 to 10 ha)	< 1 acre (<0.4 ha)
Relative Size	Size Relative to Site Potential/Historic	The current size of the wetland divided by the total potential size of the wetland multiplied by 100.	Wetland area < Abiotic Potential; Relative Size = 90 – 100% ; (< 10% of wetland has been reduced, destroyed or severely disturbed due to roads, impoundments, development, human-induced drainage, etc.	Wetland area < Abiotic Potential; Relative Size = 75 – 90%; 10-25% of wetland has been reduced, destroyed or severely disturbed due to roads, impoundments, development, human-induced drainage, etc	Wetland area < Abiotic Potential; Relative Size = < 75%; > 25% of wetland has been reduced, destroyed or severely disturbed due to roads, impoundments, development, human-induced drainage, etc

Indicators and Level of Effort

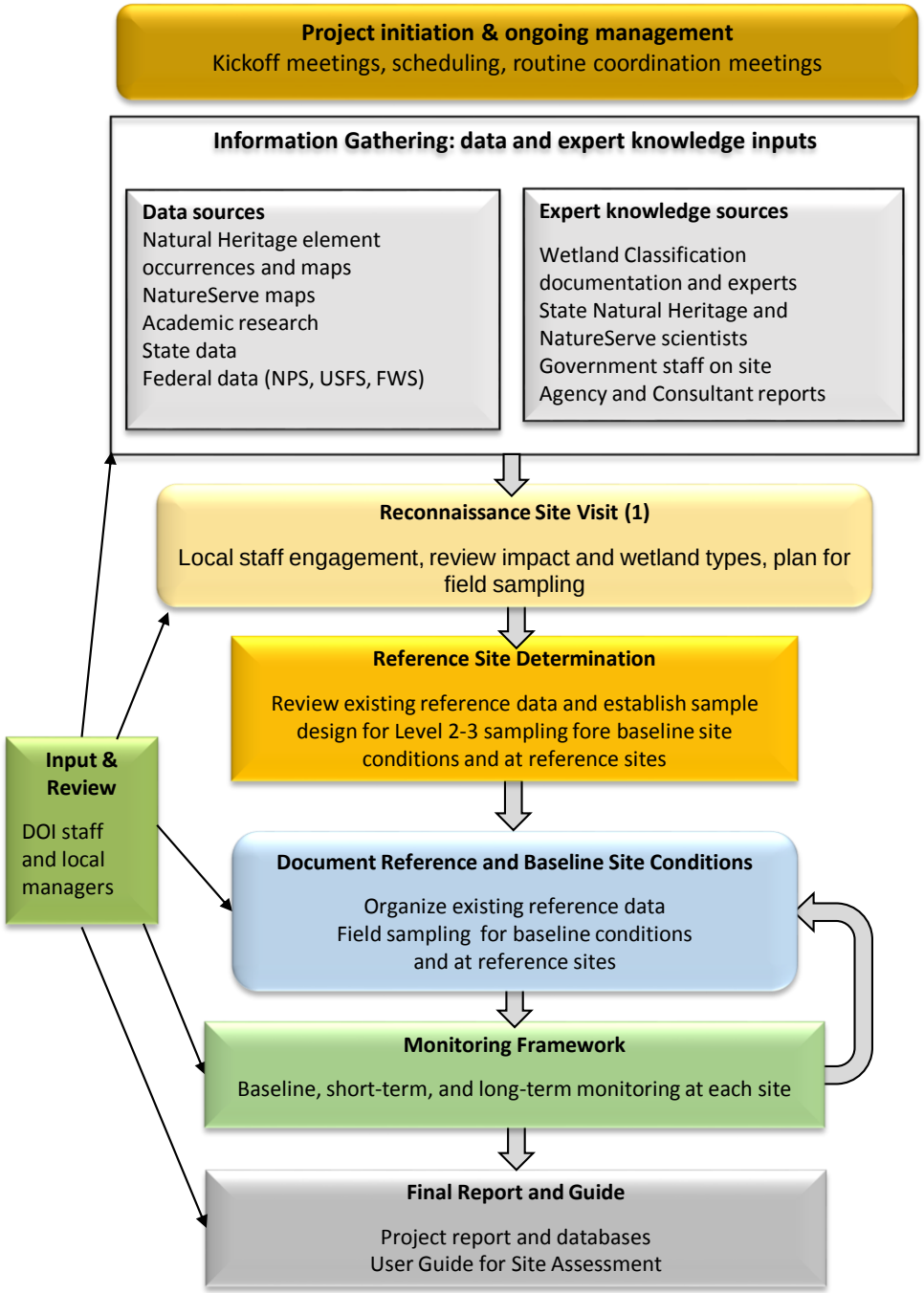
		Indicators	Applications
Level 1 –	**Remote Sensing**	Landscape patterns On-site indicators visible remotely	➢ Support Status and Trends ➢ Regional conservation assessment & planning ➢ Multi-site monitoring
Level 2 -	**Rapid Field Observation**	Field indicators (stressor vs. ecological condition metrics)	➢ Site assessment ➢ Restoration, management monitoring progress
Level 3 -	**Intensive sampling**	Detailed quantitative field indicators. Calibrated indicators (e.g., indices of condition or integrity, FQA).	➢ Reference sites for specific indicators ➢ Rigorous performance measures for restoration

Faber-Langendoen, D., J. Rocchio, G. Kittel, C. Hedge, M. Kost, S. Thomas, K. Walz, B. Nichols, S. Menard, J. Drake, E. Muldavin, and P. Comer. 2012. NatureServe Ecological Integrity Assessment. Wetlands Rapid Assessment Method (Level 2). NatureServe, Arlington, VA. + Appendices.

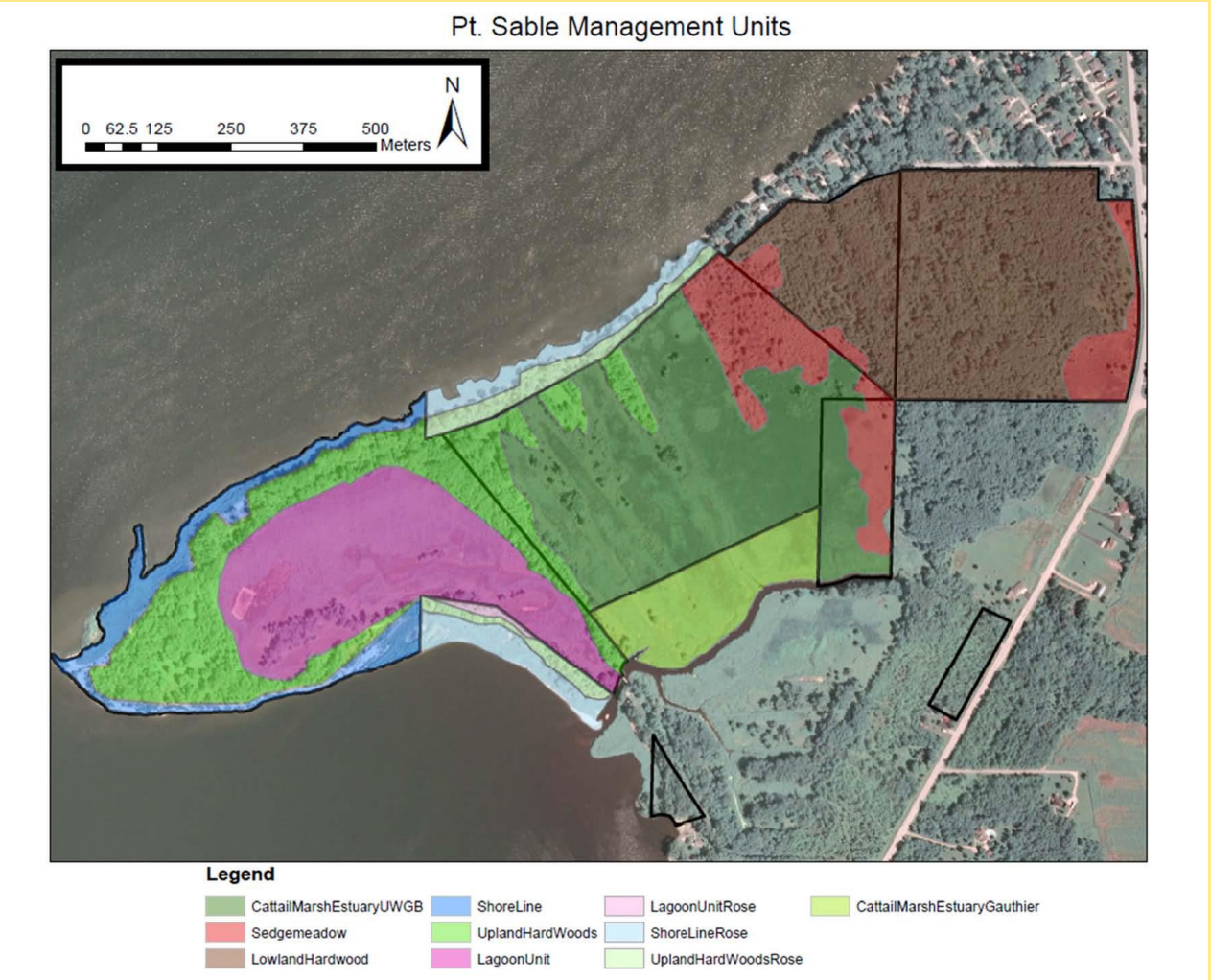
Restoration Project Workflow

Stepwise process

1) Evaluate site
2) Establish reference conditions
3) Select & measure indicators
4) Analyze and report

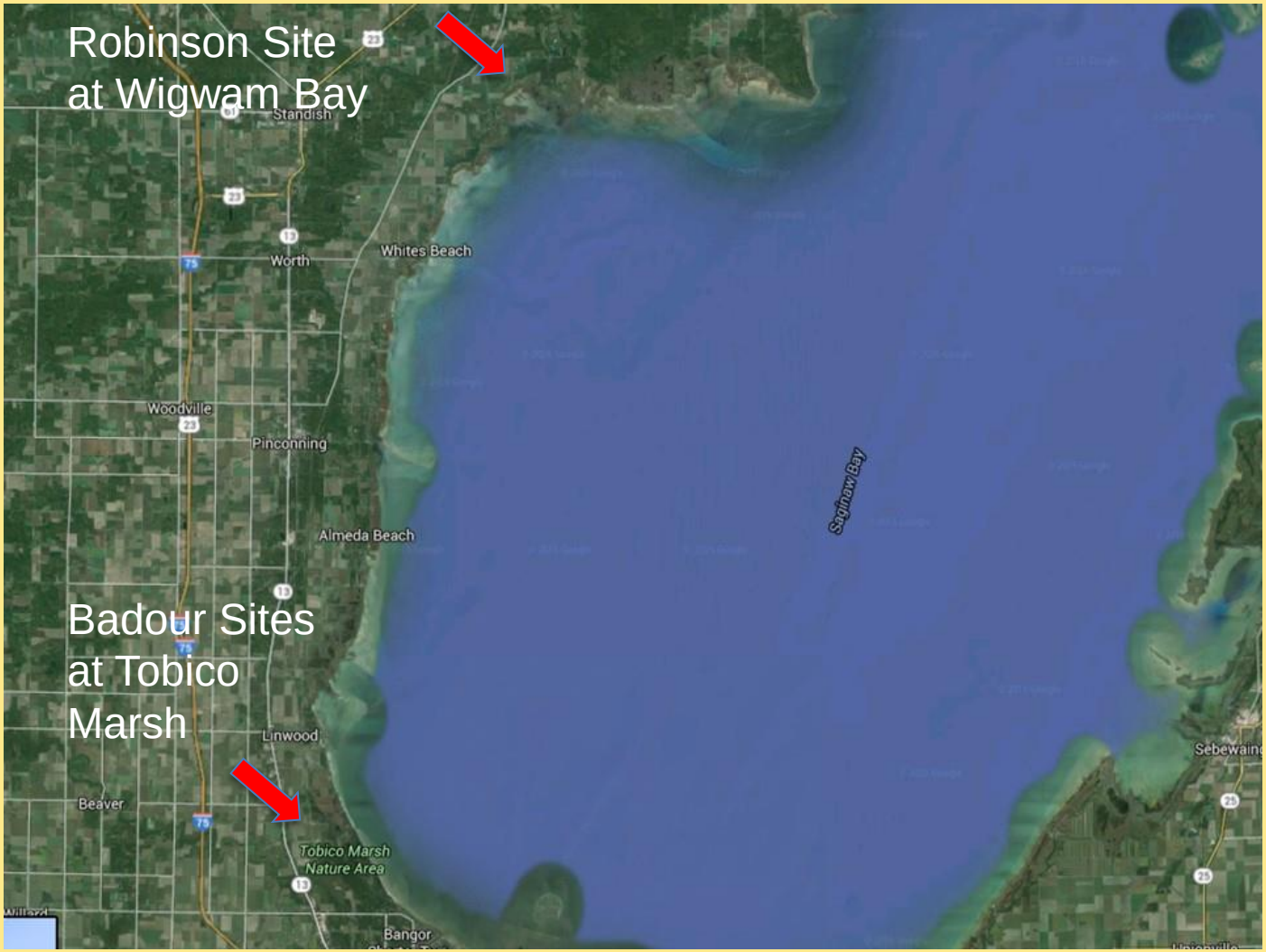


Green Bay Sites



- Damages occurred elsewhere, we are supporting restoration in this location
- Restoration goals are:
  - Migratory bird habitat
  - Restore marsh to native plant dominance and diversity, and animal diversity
- Great Lakes coastal and inland emergent marsh
- No established monitoring plan

Saginaw Bay Sites



- Damages occurred elsewhere, we are supporting restoration in these locations
- Restoration goals are:
  - Migratory bird and fish habitat
  - Restore hydrology and native vegetation
  - Limit invasive plants
- Great Lakes coastal marsh and forested swamp
- No established monitoring plans

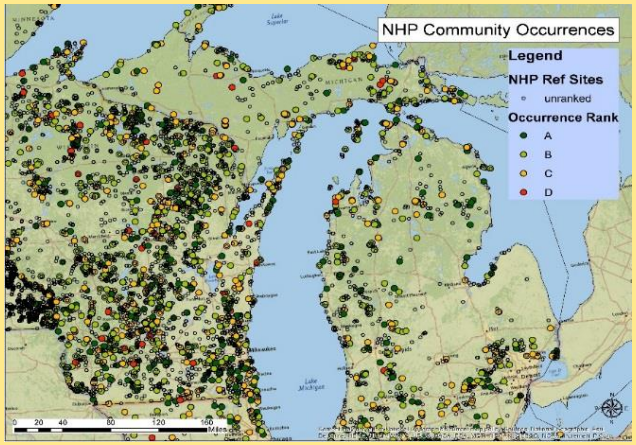
Reference Conditions and Sites

Data Discovery

- Habitat Classifications for descriptive models
- Selection of reference sites tied to wetland type, current condition, and restoration goal
- For coastal marshes, we located prior assessment data from 2002-2003 for several adjacent sites or on site!

http://explorer.natureserve.org/

Online access to species and ecosystem descriptions, reports, and maps…with custom query options…



Field Sites documented by Natural Heritage Programs

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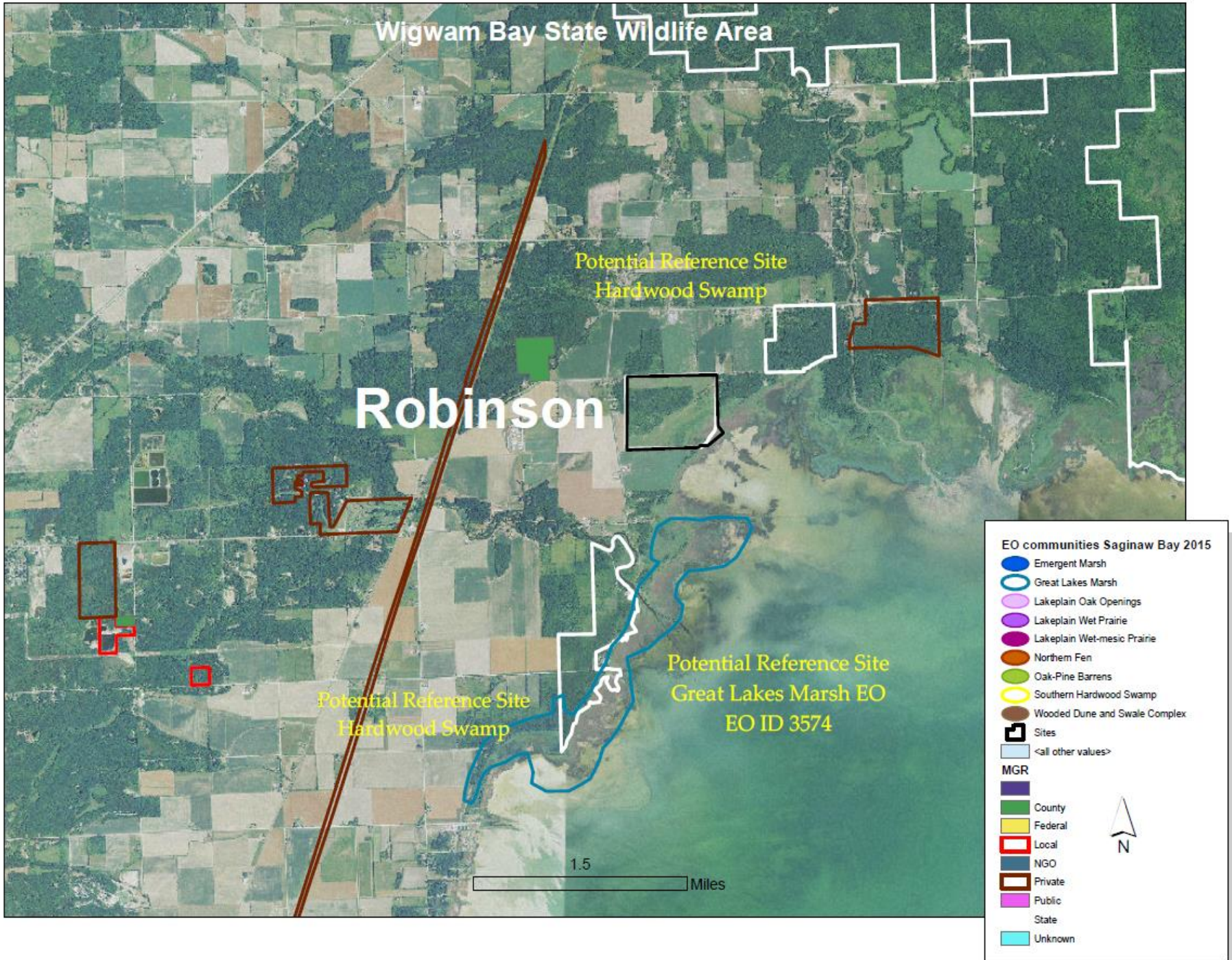
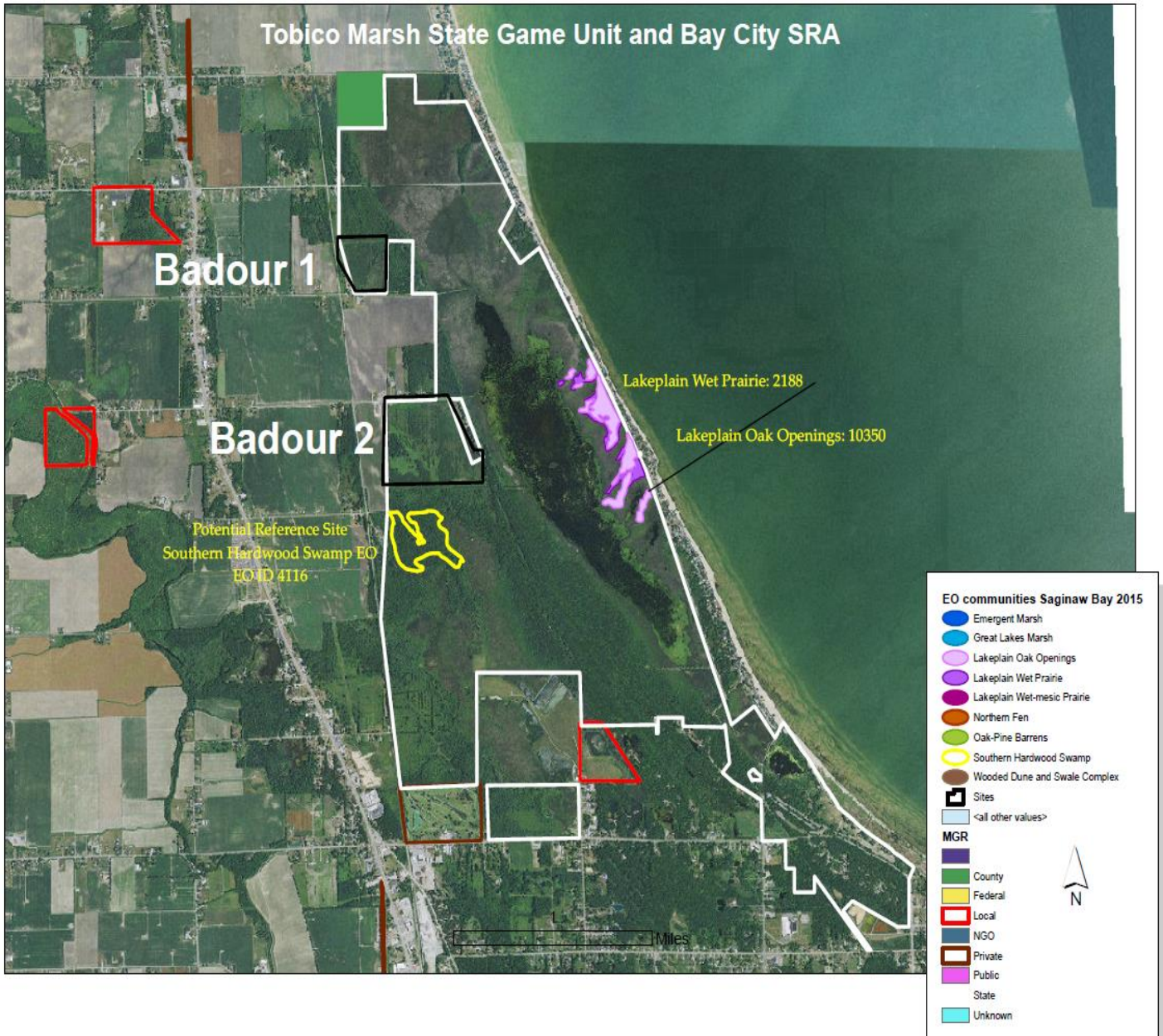
Michigan Natural Features Inventory

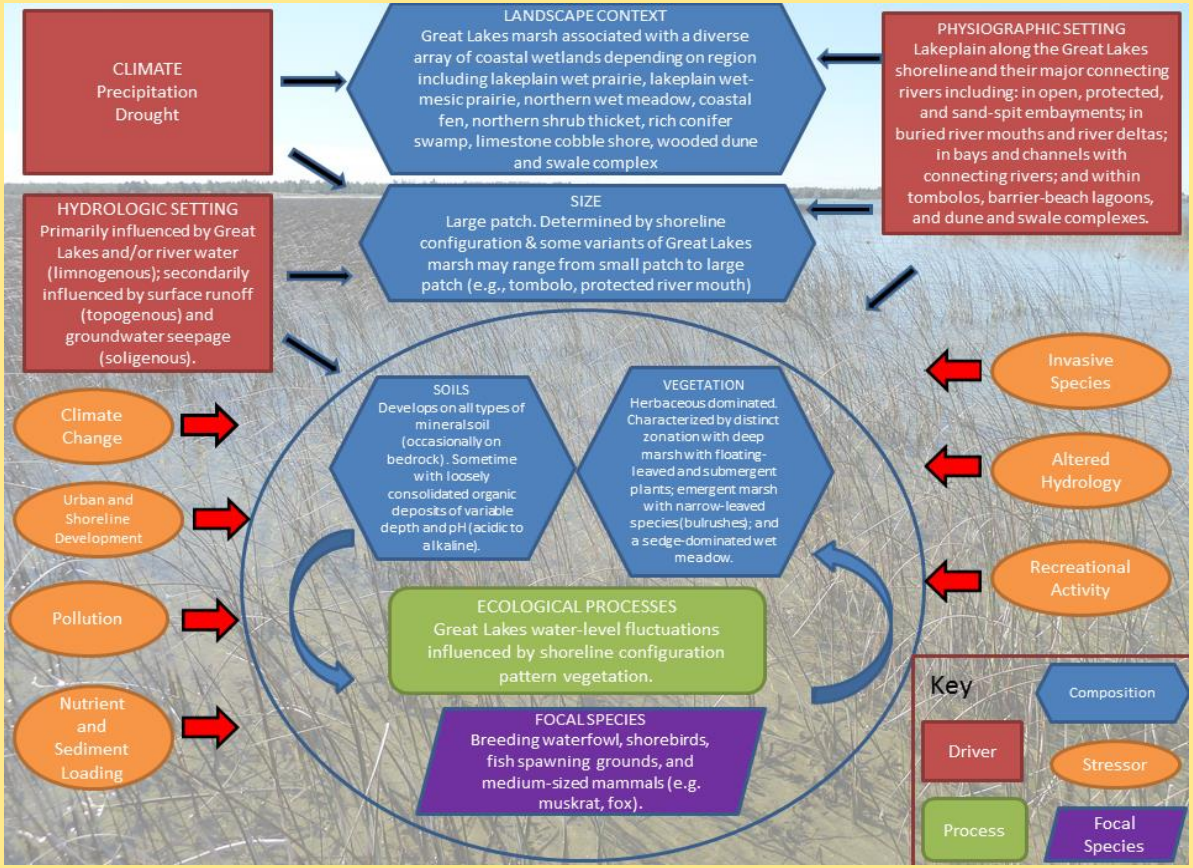

Wigwam Bay State Wildlife Area
Potential Reference Site
Hardwood Swamp
Robinson
Potential Reference Site
Great Lakes Marsh EO
EO ID 3574
Potential Reference Site
Hardwood Swamp
1.5
Miles
EO communities Saginaw Bay 2015
Emergent Marsh
Great Lakes Marsh
Lakeplain Oak Openings
Lakeplain Wet Prairie
Lakeplain Wet-mesic Prairie
Northern Fen
Oak-Pine Barrens
Southern Hardwood Swamp
Wooded Dune and Swale Complex
Sites
<all other values>
MGR
County
Federal
Local
NGO
Private
Public
State
Unknown
N

Saginaw Bay Sites



- Historically a hardwood swamp
- Farmed since the 1930s
- State restored natural flooding
- Now cottonwood-willow shrub swamp
- Restoration goals are:
  - Restore hydrology and native swamp
  - Limit invasive plants
- No established monitoring plans

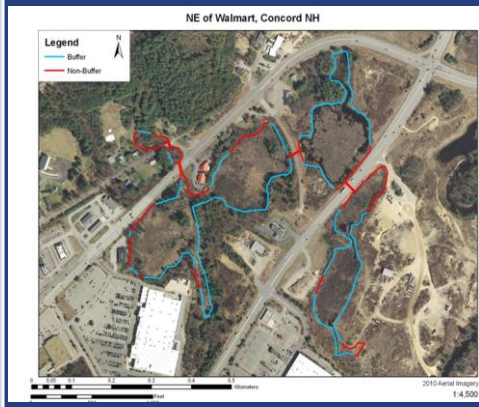
Conceptual Models to Focus Indicator Selection



- **Documents basic understanding** of what matters for the wetland type relative to **conditions at the site** and **restoration goals**.
- Forms the basis for indicator selection, indicator data discovery, and sampling effort.

WETLAND ASSESSMENT METRICS

Metric	Justification
Contiguous Natural Land Cover	Less fragmentation allows for natural exchange of species, nutrients, and water.
Land Use Index	The intensity of human activity in the landscape has a proportionate impact on the fragmentation effects.
Perimeter w/ Natural Buffer	The intactness of the buffer or edge allows for natural exchange of species, nutrients, and water.
Width of Natural Buffer	
Condition of Natural Buffer	



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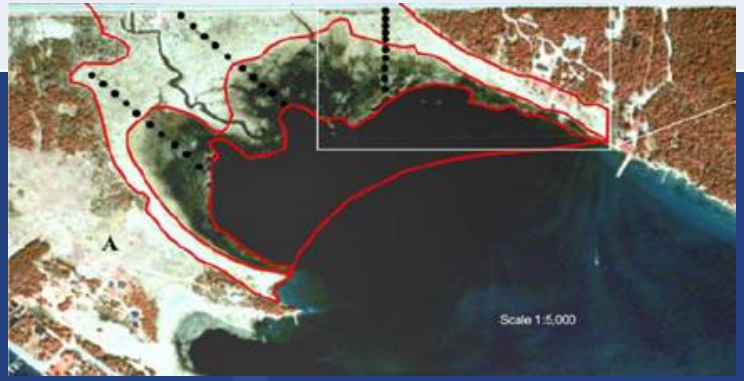
WETLAND ASSESSMENT METRICS

Metric	Justification
Native Plant Species Cover	Native species dominate an ecosystem when invasive species are limited or absent
Invasive Nonnative Plant Species Cover	Invasive species displace native composition, altered soils, hydrology, and nutrient cycling.
Native Plant Species Composition	Characteristic native plant species composition affect expected interactions between plants, animals, and some physical processes.
Overall Vegetation Structure: e.g., mosaic of freshwater marsh, wet meadow & shrub swamp	Expected vegetation structure is strongly correlated with expected species composition, and dynamic processes (e.g., flooding cycles)



WETLAND ASSESSMENT METRICS

Metric	Justification
Water Source	Natural inflows of water to a wetland regulate persistence of a wetland.
Hydroperiod	Hydroperiod regulates sediment storage, import, and export, and affects soil development, and plant recruitment and maintenance
Hydrologic Connectivity	Hydrologic connectivity between wetlands and uplands (surface flow) and wetlands and Great Lakes supports key ecological processes, such as exchange of water, sediment, nutrients, and organic carbon.
Soil Surface Condition	Soils store water and carbon, and provide media for plant establishment and growth

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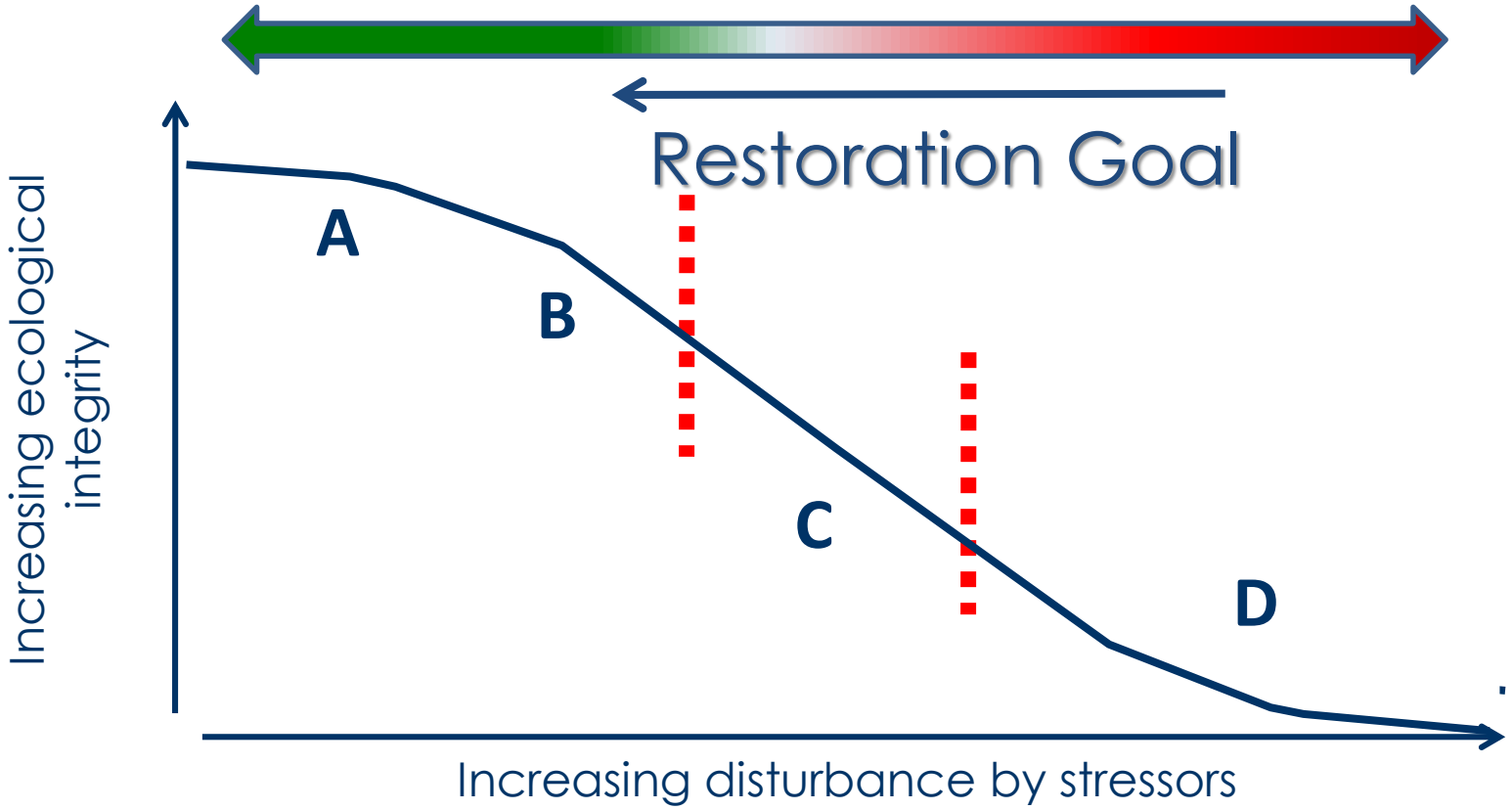

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Next Steps

1. 2016 sampling at restoration and reference sites
2. Data analysis and characterization of condition and trends
3. Finalizing monitoring plans
4. Documenting steps and data requirements for other wetland applications

Perspectives

- Specify restoration goals
- Fully utilize existing data related to habitat types, reference sites, and sampling
- Prioritize indicators to monitor

  i.e., those with greatest information benefit relative to cost

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Thank you!

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