Comparison of Three Tiered Wetland Assessment Methods for use on Wetlands in the Prairie Pothole Region

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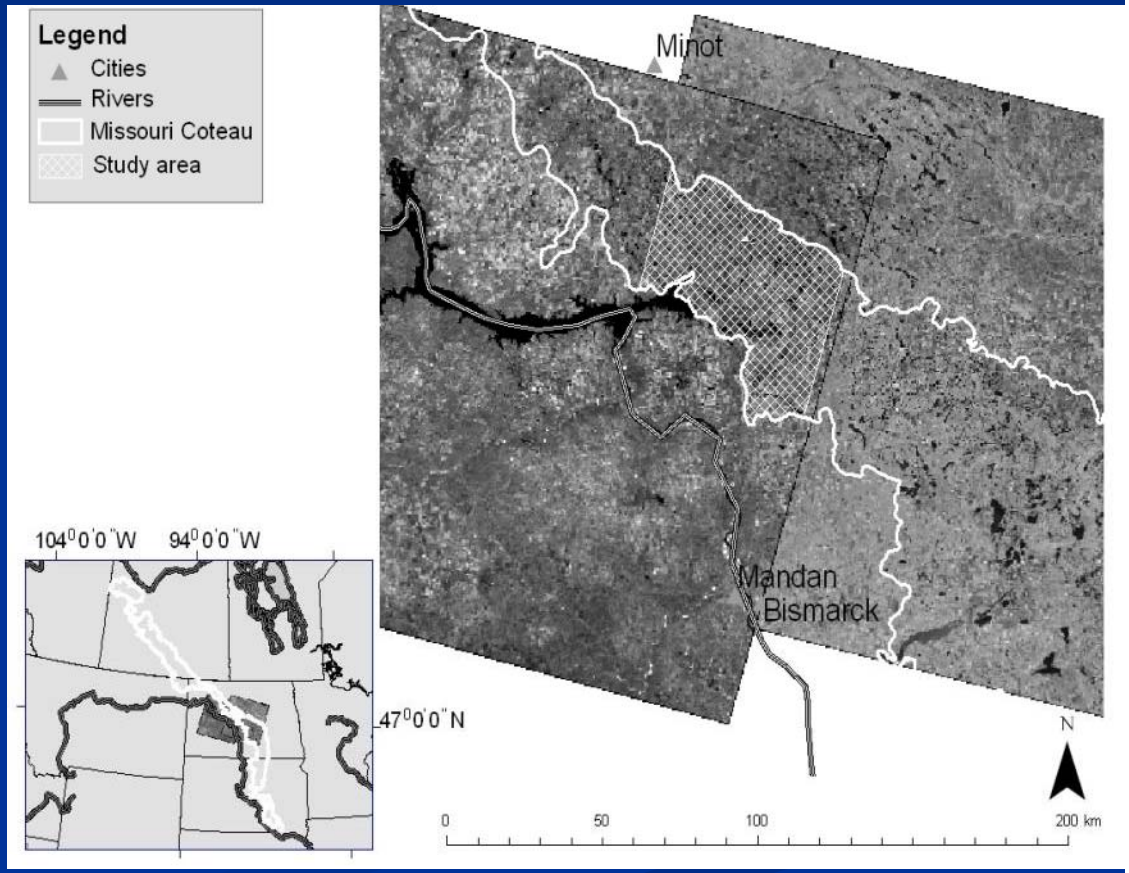
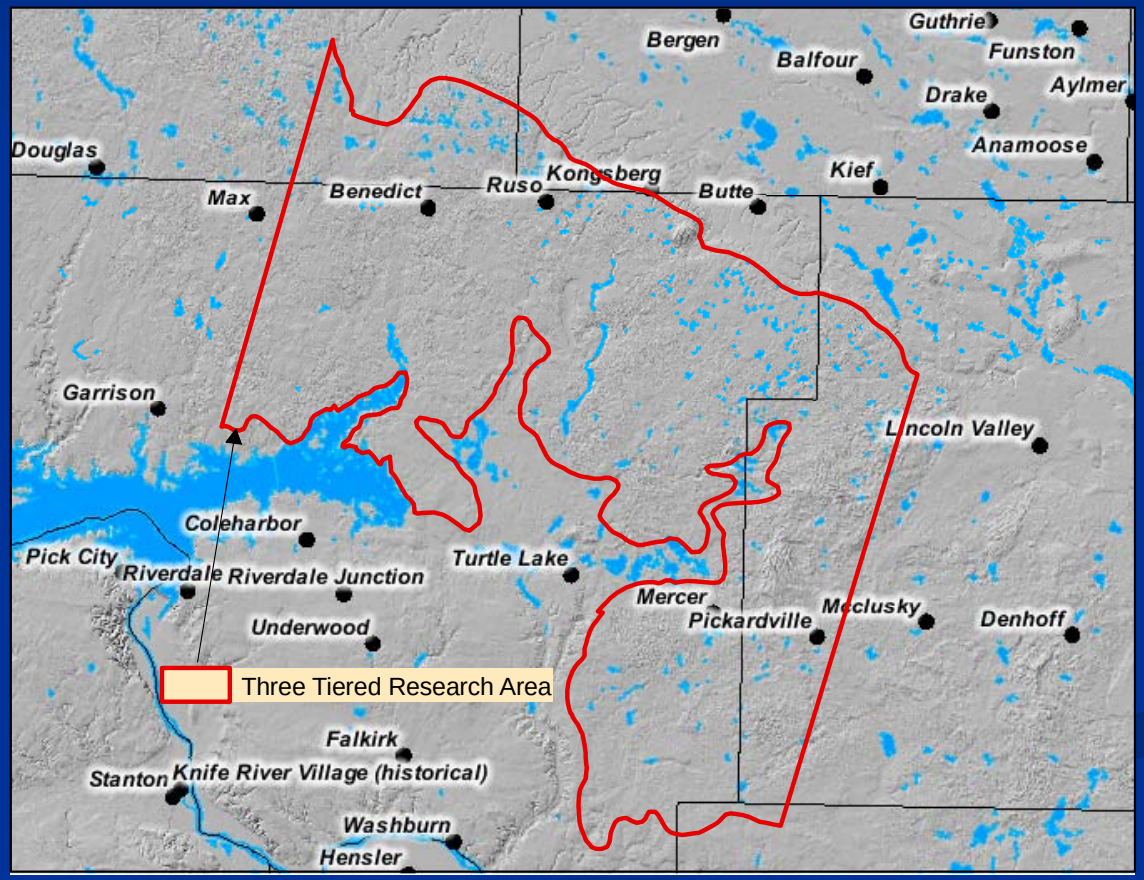
Study Area

- Designated area of the Missouri Coteau Ecoregion
- Central North Dakota



Site Selection

- Used a probabilistic sampling design
  - Stevens and Olsen 2004
  - Stevens and Jensen 2007
- Randomly selected points
- 750m X 750m quadrats

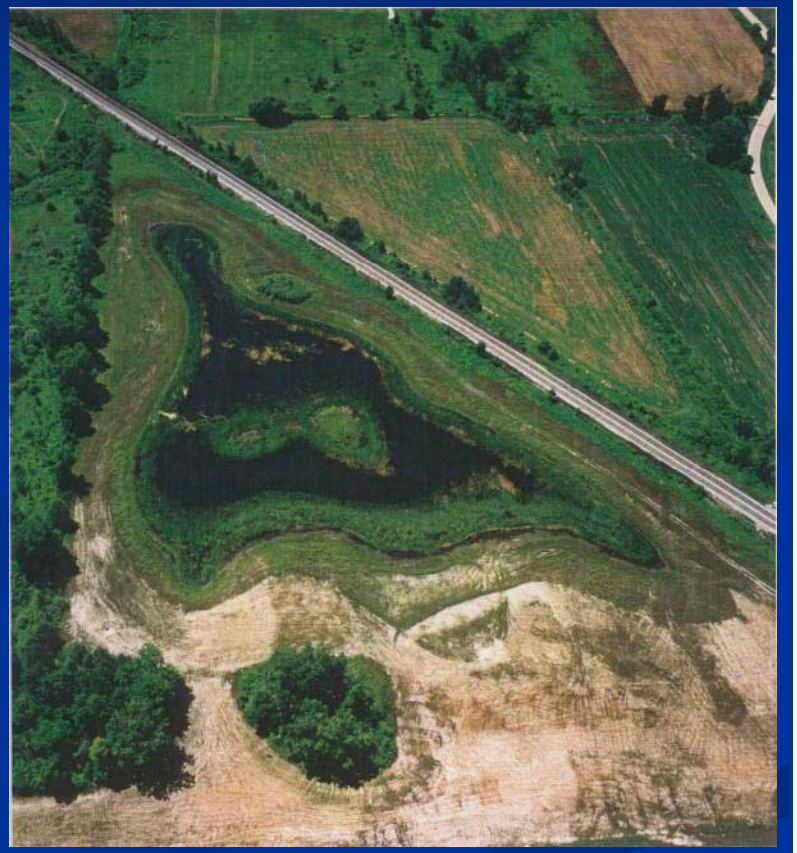


Landowner Information

- Legal description and landowners were identified
  - Using plat maps
  - Looking through county courthouse tax/land information
- Verbal permission was received from all landowners and/or renters
- Written permission for all land managed by local, state, or federal agencies

Level 1 - Remote Assessment

- Uses GIS software and satellite/aerial imagery to assess wetland
- Done in the office
- Costs vary
- Use in this study:
  - Landscape Wetland Condition Assessment Model (LWCAM)

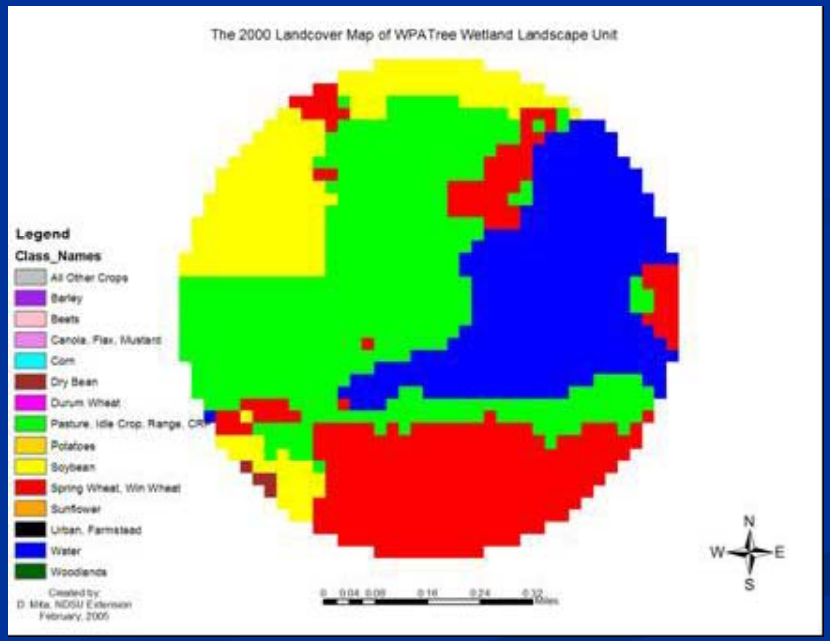


Landscape Wetland Condition Assessment Model (LWCAM)

- Uses remote sensing and habitat fragmentation to predict wetland condition
- Developed on seasonal wetlands in ND (Mita et al. 2007)

LWCAM Model

- 300 m buffer created around wetlands
- Land use data is overlaid with wetland buffer
- Model assesses
  - Total area of grassland
  - Number of patches
  - Largest patch of grassland
- Categorizes wetlands as Good, Intermediate, or Poor condition



Level 2 - Rapid Assessment

- Rapidly assesses wetland condition/function
- On the ground assessment
- Minimal time spent at site
- Used in this study:
  - North Dakota Rapid Assessment Method (NDRAM)

North Dakota Rapid Assessment Method (NDRAM)

- Rapidly assesses wetlands based on plant and landscape characteristics
- Developed based on
  - Other rapid assessment methods
    - Ohio (Mack 2001)
    - California (Collins et al. 2007)
  - Wetland characteristics specific to Prairie Pothole Region wetlands

North Dakota Rapid Assessment Model (NDRAM)

- Approximately 20 minutes to conduct survey
- Final scores on a scale of 0-100
- Groups wetlands based on final score
- 3 metric system used
- Results intended to be similar to the IPCI

Level 3 - Intense Assessment

- On the ground survey
- More time intensive (exact time varies)
- Larger amount of information gained
- Used in this study:
  - Index of Plant Community Integrity (IPCI)
  - Hydrogeomorphic (HGM) model

Index of Plant Community Integrity (IPCI): a form of IBI

- Developed on temporary, seasonal and semi-permanent wetlands within ND, SD, and MT (DeKeyser et al. 2003, Hargiss et al. 2008)
- Evaluates health of Prairie Pothole Region wetlands based on plant community
- Final scores on a scale of 0-99
- Groups wetlands based on final score

Index of Plant Community Integrity (IPCI)

Seasonal Metric Value Ranges

Metric	Value Range for 0	Value Range for 4	Value Range for 7	Value Range for 11
Sp. Rich.[1]	0-19	20-31	32-41	42+
# Genera[2]	0-14	15-24	25-32	33+
Grass-like[3]	0-6	7-10	11-17	18+
% of intro.[4]	41.1+	30.8-41.0	21.1-30.7	0-21.0
# Nat. in WMZ[5]	0-8	9-16	17-24	25+
# C $\geq$ 5[6]	0-7	8-17	18-26	27+
# C $\geq$ 4 in WMZ[7]	0-4	5-9	10-16	17+
Avg. C[8]	0.00-2.60	2.61-3.12	3.13-3.52	3.53+
FQI[9]	0.00-10.00	10.01-16.10	16.11-22.99	23.00+

[1] Species richness of native perennial plant species.
[2] Number of genera of native perennial plant species.
[3] Number of grass and grasslike species (Poaceae, Juncaceae, Cyperaceae).
[4] Percentage of the total species list that are annual, biennial, and introduced.
[5] Number of native perennial plant species found in the wet meadow zone.
[6] Number of plant species with a C-Value $\geq$ 5.
[7] Number of plant species with a C-Value $\geq$ 4 found in the wet meadow zone.
[8] Average C-Value of all species present.
[9] Floristic Quality Index = Average C-Value multiplied by the square root of the total number of species.

IPCI

- Scores for each metric are added together
- Total score between 0-99
- Condition categories based on final score
  - Very Good (80-99)
  - Good (60-79)
  - Fair (40-59)
  - Poor (20-39)
  - Very Poor (0-19)

Hydrogeomorphic (HGM) Model

- **Assesses the physical attributes and functional characteristics of each wetland**
  - Synthesized physical characteristics, land-use information, biological data, soil data, and GPS and GIS information
  - Calculated six Functional Capacity Indices (FCI) for each wetland

    (Gilbert et al. 2006)

HGM FCI's

- FCI's scaled from 0 to 1.0
  - 1 = reference sites for the area

- FCI 1 = Water Storage
- FCI 2 = Groundwater Recharge
- FCI 3 = Retention of Particulates
- FCI 4 = Removal, Conversion, and Sequestration of Dissolved Substances
- FCI 5 = Plant Community Resilience and Carbon Cycling
- FCI 6 = Ability to Provide Faunal Habitat

Results: Contacting Landowners

- 390 landowners were contacted
- Approximately 8-9 months to get all permission needed (Whigham et al. 2003)
- In person responses were between 95-97% yes!
- Phone calls estimated at 50% or less yes rate
- Letters estimated at 50% or less response rate
  - Rate of yes in those that responded was very low

Wetlands tested

- Total of 106 quadrats tested (750m X 750m)
- 25% of total wetlands were seasonal wetlands tested using three tiered design
  - 255 wetlands

Condition Conclusions

- Wetland condition is based on land use
  - Topography/geology is the main factor affecting land use
- Smaller wetlands were more disturbed than larger wetlands
- More wetlands in Poor condition than in Good condition

Statistical Analysis

- Nonmetric Multidimensional Scaling
  - Reduced multi-metric systems to significant axes to rank against IPCI final score
- Kendall Coefficient of Concordance Test
  - Determined if methods ranked wetlands similarly

Similarity of Models

Model	IPCI	HGM
LWCAM	75%*	77%*
NDRAM	87%*	89%*
HGM	92%*	

*p-value = .0001

**Significant p-value indicates that methods were similar

- Techniques rank sites similarly but measure different attributes

Comparison of Models

- Differences between the IPCI and LWCAM is due to:
  - Specificity in the data
    - LWCAM broad categorization
    - IPCI on the ground specific data
- Differences between the IPCI and NDRAM is due to:
  - Timing of sampling
    - Sample only after mid June
  - Differences in metrics
  - Area sampled
- Differences between the IPCI and HGM overall
  - HGM relies heavily on physical criteria and landscape characteristics
    - Scores for HGM are much higher than IPCI
    - Biological differences may exist that could be overlooked by the HGM model

Sample Size Adequacy

- Determined two different ways
  - New areas that have not been sampled before
    - Modified species area curve (species accumulation curve)
      - McCune and Grace (2002)
  - Returning to an area to determine change over time
    - 10% and 20% change tested
    - At .8 and .9 power

Sample Size Adequacy

- Sampling a new area

	Number of Wetlands
LWCAM	25-75
IPCI	25-75
NDRAM	35-90
HGM	35-90

- Return sampling to assess change

	10% Change		20% Change	
	.8 Power	.9 Power	.8 Power	.9 Power
LWCAM	14	17	5	6
IPCI	79	105	22	28
NDRAM	50	66	14	18
HGM	38	50	11	14

Conclusions

- All models studied are valuable in indicating wetland condition in different capacities
  - LWCAM as first indication of land use in an area
  - NDRAM as overall condition assessment
  - IPCI used for in-depth assessment and for indicating condition trends
  - HGM indicates general function and physical condition
- A combination of all models is best to indicate overall condition at a site

Management Implications

- Repeat assessment can indicate the trend in relation to the present and future predominant land practices
- Information from this study can be used as a model for determining appropriate wetland sampling methods based on:
  - Project needs
  - Time
  - Finances

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Questions?

Citations

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