A Lake Classification and Conservation Portfolio for Wisconsin

Based on development of the lake classification and conservation portfolio for MN, ND, and SD

2008-2009

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Freshwater ecologist
The Nature Conservancy
The Nature Conservancy in Wisconsin

Nonprofit conservation organization

Since 1960, the Conservancy has protected more than 230,000 acres of critical land and water habitats in Wisconsin, including:

- **Border Lakes Area**
- **Catherine Wolter Wilderness Area**
- **Cardine Lake** (North Central Wisconsin)
- **Wild Rivers Legacy Forest** (Northeast Wisconsin)

[www.nature.org](http://www.nature.org)
Why a lake portfolio?

How to protect “the best of the best?”

TNC ecoregional plans...
but these focused on terrestrial habitats, rivers, and watersheds
Lake Classification

What makes a lake a lake?

How many unique lake types are there?

What do we need to protect?
Step 1: Classification

Which variables really matter?

From literature review & analysis

- Lake Size
  - Max
  - Mean
  - Average

- Aquatic plant communities

- Watershed land use

- Drainage basin size & landscape position

- Connectivity

- Fish communities

- Water chemistry

- Lakes substrate & geology

- Water quality
What do we already know about lake classification?

Oligotrophic  Mesotrophic  Eutrophic  Hypereutrophic

Trophic State Index

<table>
<thead>
<tr>
<th>Trophic State Index</th>
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</thead>
<tbody>
<tr>
<td>Oligotrophic</td>
</tr>
<tr>
<td>20 25 30 35 40 45 50 55 60 65 70 75 80</td>
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</table>

Transparency (Secchi disk)

<table>
<thead>
<tr>
<th>Transparency (m)</th>
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<tbody>
<tr>
<td>Oligotrophic</td>
</tr>
<tr>
<td>15 10 8 7 6 5 4 3 2 1.5 1 0.5 0.3</td>
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Chlorophyll-a

<table>
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<th>Chlorophyll-a (ppb)</th>
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<tr>
<td>Oligotrophic</td>
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<tr>
<td>0.5 1 2 3 4 5 7 10 15 20 30 40 60 80 100 150</td>
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Total Phosphorus

<table>
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<th>Total Phosphorus (ppb)</th>
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<tr>
<td>Oligotrophic</td>
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<tr>
<td>3 5 7 10 15 20 25 30 40 50 60 80 100 150</td>
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A lake is influenced by its watershed

- Geologic origin and history
- Climate & runoff
- Geology and Soils
- Topography & position
- Land use & vegetation cover
- Impervious Surface

Diagrams showing origin of different kinds of glacial lakes. 1) basin formed by irregular deposition of till; 5) ice-block basins in outwash plain; 7) ice block basin in till; 8) ice block basin in till and outwash.
Biological communities (fish, aquatic plants) strongly respond to water quality, ecoregion, and lake morphology.
Fish communities also relate strongly to ecoregion …
Ecological Types of Minnesota Waters

(3) Distribution of fisheries (Schupp) lake classes in MN
So do Aquatic Plant Communities...

- North Central Glaciated Plains
- Red River Valley
- Minnesota & NE Iowa Morainal
- Paleozoic Plateau
- Lake Agassiz, Aspen Parklands
- N. Minnesota & Ontario Periglacial Plains
- Northern Superior Uplands
- N. Minnesota Drift & Lake Plains
- Western Superior Uplands
- Southern Superior Uplands
- N. Minnesota & Ontario Peatlands
- North Central Glaciated Plains
- Yellow water lily
(1) Hierarchical lake macrohabitat classification

<table>
<thead>
<tr>
<th>Ecoregion</th>
<th>Macrohabitat</th>
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<tbody>
<tr>
<td>Size</td>
<td>Depth</td>
</tr>
<tr>
<td>Large</td>
<td>Shallow</td>
</tr>
<tr>
<td>Medium</td>
<td>Deep</td>
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<td>Very deep</td>
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(2) Biological Classifications

- Fish community class
- Aquatic plant community class
Step 2: Assessing Condition & Viability

Condition:
Undeveloped land use, high public/conservation ownership, groundwater, water quality indicators and criteria, IBI, intolerant and sensitive taxa/species

Viability
High natural cover, low vulnerability based on connections & drainage position, depth, volume, watershed: lake ratio, lake class

Threats
Threat indicators: exotic species, boat ramps, cropland and agriculture in the buffer, population growth and density, vulnerability to climate change
Step 3 Portfolio Priorities

Selected top 10% (Representativeness)
“The Best of the Best”
Step 3 Portfolio Selection

Identified top 10% of each by:

- Lake hydrogeomorphic types
- Fish community classes
- Aquatic plant community classes
- Species (including SGCN)
- Wild rice

Final based on multiple top 10% criteria
Minnesota Lake Conservation Portfolio: Products

Priorities for Lake Conservation
A Portfolio for Minnesota

Known as the Land of 10,000 Lakes, Minnesota actually has more than 12,000 lakes larger than 10 acres. The lakes range in size from 0.5 acres to more than 300,000 acres.

Lakes are critical components of the state’s $10 billion-a-year tourism economy. They are very much in demand by residents for summer cabins and year-round home stays, fishing, water and wind sports, recreation including boating, swimming, fishing and hunting. Minnesota values our lakes for reasons beyond money and sport. More than 75 percent of residents surveyed by the Minnesota Department of Natural Resources and Sea Grant believe freshwater lakes are an indicator of water quality and clean drinking water, whether they use them or not. The state’s lakes are important and should be maintained for their scenic beauty and the habitats they provide for fish and wildlife.

It is hardly surprising that Minnesota’s official state bird and fish—the common loon and the walleye—are two animals most at home in the lakes. But the state’s tremendous number and diversity of natural lakes are also crucial to many other native plants and animals. Lakes provide habitat for a range of aquatic and terrestrial species and influence the structure and function of native communities on and near the shore. Aquatic plants, which serve as important

http://www.nature.org/wherewework/northamerica/states/minnesota/science/
Applications - Conservation

• “Traditional” Tools & Strategies
  – Easements & Acquisition
  – Shoreland protection/restoration
  – Adaptive assessment & monitoring
Implementing the Portfolio: Supporting partners in identifying & protecting critical lands & shoreland

Lake Alexander – ½ mile of shoreline as part of TNC Lake Alexander Preserve in central Minnesota + a recent 80 acre acquisition

Recent “assists” in central Minnesota
• **SNA acquisition** between Lake Alexander and Fishtrap Lake
• **Egg Lake** – 1446 feet of shoreline transferred to Cass County (thru TNC & anonymous donor) in February 2010
• **Sunfish Lake** project
• Twin Lakes project east of Camp Ripley
MN Forest Legacy Partnership
$Millions for conservation easements on 1000s of acres in Itasca, Cass, Koochiching
- eg. Pillsbury State Forest on Gull Lake, lots of small lakes

Partnerships
• Wild rice protection, NW Itasca county portfolio lakes & basins
• BWSR CWF grant for Crow Wing County on Gull and Big Trout lakes
• Agate Lake/Lk Margaret grant app.

Implementing the Portfolio:
Watershed protection

Cont’d
Applications

- Setting goals and priorities
  - What should my lake look like?
  - What are ecologically appropriate / realistic goals?
  - “Protect” vs. “Enhance” vs. “Restore”
Assessing condition and viability to inform priority lakes and strategies

Example: Minnesota DNR's Lake Fish Habitat Strategic Plan

“Protect” vs. “Enhance” vs. “Restore”
Assessing condition and viability to inform priority lakes and strategies.

Example: Minnesota DNR's Lake Fish Habitat Strategic Plan.

Healthy Lakesheds Lacking Protection.
Applications – Conservation

Guide partnership work
  – Water Quality restoration & improvement projects
  – Lake protection priorities

Targeted education / outreach

Climate change vulnerability assessment and adaptation strategies
We want your ideas and input!

- What should be included in a lake classification and conservation portfolio for Wisconsin?

- How could this be useful to you?

- Sign up to fill out a SurveyMonkey survey for us
  kblam@tnc.org
Acknowledgments

Carol Schaal, Water Quality, WI DNR
Wisconsin TNC
Darby Nelson, Author, For Love of Lakes
Everyone who shared datasets and advice
Any Photographers whose photos appear brazenly unacknowledged in this presentation
A lake is the landscape's most beautiful and expressive feature; it is the earth's eye. Looking into which the beholder measures the depth of his own nature.

Henry David Thoreau
Growing threats

- Development & shoreline alteration
- Aquatic plant removal & management
- Exotic Species
- Nutrient loading
- Water use / management
- Climate change
Assessing condition and viability to inform priority lakes and strategies

Resilience

Action: Protection
High viability, low threat, high condition, high resilience

Action: Restore/Enhance

Low (future) threat

Stressed current condition

Healthy current condition

Vulnerability

Low viability/probability of protection success
High threat, low condition, high vulnerability

High (future) threat