Pleasant and Irogami Lakes: Background and Lake Study Results November 2013
N. Turyk, Water Resource Scientist
Presentation Highlights

- Lakes and Land Use
  - Watersheds to Shorelines
- Water Quality
- Fisheries
- Aquatic Plants
Pleasant Lake

Surface Area: 120 acres
Maximum Depth: 30 feet

About Pleasant Lake
About Irogami Lake

Irogami Lake

Surface Area: 289 acres

Maximum Depth: 5 feet
Where is water coming from?

- Near shore runoff and groundwater
- Surface watershed
- Groundwater

- Water flows from higher to lower elevations
  - Above ground
  - Below ground
Watersheds: Where the water Originates

- Surface Watershed: 703 acres
- Surface Watershed: 955 acres
What influences water quality?

- Land use management within groundwater and surface watersheds
- Near shore activities
- Lake type
- Natural geology, soil, and topography
- Seasonal and environmental changes
Watersheds: Where the water Originates

Pleasant Lake Surface watershed

<table>
<thead>
<tr>
<th>Map Color</th>
<th>Land Use</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>Developed</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Herbaceous/Barren</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Forest</td>
<td>277</td>
</tr>
<tr>
<td></td>
<td>Cultivated Crops</td>
<td>204</td>
</tr>
<tr>
<td></td>
<td>Wetland</td>
<td>47</td>
</tr>
</tbody>
</table>

Irogami Lake Surface watershed

<table>
<thead>
<tr>
<th>Map Color</th>
<th>Land Use</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>320</td>
</tr>
<tr>
<td></td>
<td>Developed</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Herbaceous/Barren</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Forest</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td>Hay/Pasture/Grassland</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cultivated Crops</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Wetland</td>
<td>111</td>
</tr>
</tbody>
</table>
Groundwater Flow Direction

Groundwater flow to Pleasant Lake

Groundwater flow to Irogami Lake
More Impervious Surface = More Runoff

In a forest, rain soaks into the ground and is taken up by tree roots or moves down through the soil into the groundwater.

When rain falls on impervious surfaces, it cannot soak into the ground and instead becomes runoff.

Water (runoff) carries sediments and nutrients to the lake.
1940s development

IMPACT ON LAKE (April - Oct.)
- 1,000 ft$^3$ runoff to lake
- 0.03 lbs. phos. to lake
- 20 lbs. sediment to lake

7% impervious within carrying capacity

1990s development

IMPACT ON LAKE (April - Oct.)
- 5,000 ft$^3$ runoff to lake
- 0.20 lbs. phos. to lake
- 90 lbs. sediment to lake

20% impervious beyond carrying capacity
**Figure 3**

**Increasing Impervious Surface in Watershed**

<table>
<thead>
<tr>
<th>Fish found in streams when impervious surface in the watershed was:</th>
<th>Less than 8%</th>
<th>8 - 12%</th>
<th>Greater than 12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Iowa darter</td>
<td>Golden shiner</td>
<td>Creek chub</td>
</tr>
<tr>
<td></td>
<td>Black crappie</td>
<td>Northern pike</td>
<td>Fathead minnow</td>
</tr>
<tr>
<td></td>
<td>Channel catfish</td>
<td>Largemouth bass</td>
<td>Green sunfish</td>
</tr>
<tr>
<td></td>
<td>Yellow perch</td>
<td>Bluntnose minnow</td>
<td>White sucker</td>
</tr>
<tr>
<td></td>
<td>Rock bass</td>
<td>Johnny darter</td>
<td>Brook stickleback</td>
</tr>
<tr>
<td></td>
<td>Hornyhead chub</td>
<td>Common shiner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sand shiner</td>
<td>Common shiner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Southern redbelly dace</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden shiner</td>
<td>Golden shiner</td>
<td>Creek chub</td>
</tr>
<tr>
<td></td>
<td>Northern pike</td>
<td>Northern pike</td>
<td>Fathead minnow</td>
</tr>
<tr>
<td></td>
<td>Largemouth bass</td>
<td>Largemouth bass</td>
<td>Green sunfish</td>
</tr>
<tr>
<td></td>
<td>Bluntnose minnow</td>
<td>Bluntnose minnow</td>
<td>White sucker</td>
</tr>
<tr>
<td></td>
<td>Johnny darter</td>
<td>Johnny darter</td>
<td>Brook stickleback</td>
</tr>
<tr>
<td></td>
<td>Common shiner</td>
<td>Common shiner</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Shoreline Vegetation

- Reduces runoff
- Filters contaminants (sediment, nutrients, etc.)
- Provides habitat
Vegetated “Buffers”
Native Plants

- Have deeper roots that stabilize soil
- Lessen raindrop impact & erosion
- Stay upright in runoff to filter sediment
- Provide food & shelter for wildlife
Types of Lakes

- Where/how are water, sediments, and nutrients moving in/out?
- How long does water stay in the lake?
- What kind of water quality can be expected?
Lake Type & Residence time

Pleasant Lake: 17 months
Irogami Lake: 33 months
Water Quality

- Temperature and Oxygen
- Water Clarity and Color
- Nutrients (fertilizer)
- Minerals
Lake Aging Process

Oligotrophic

Mesotrophic

Eutrophic
Nutrients

- Nitrogen and Phosphorus
- Grow plants and algae
- Occurs naturally
- Can be significantly increased by
  - Exposing soil
  - Lawn/garden/agricultural fertilizer
  - Animal waste
  - Septic systems
  - Re-suspending bottom sediments
Impacts of phosphorus

- More rough fish, less game fish
- More algae & vegetation
- Obstructed navigation
- Less attractive for swimming
- Less oxygen

Phosphorus added here
Pleasant Lake
2010-2012 TP Overturn Average

Irogami Lake
2010-2012 TP Overturn Average
Water Clarity

- Measure of light penetration in water

- Effected by
  - Sediment
  - Color
  - Algae

- Controls depth
  aquatic plants can grow
Water Clarity

Pleasant Lake Secchi Depth

Irogami Lake Secchi Depth
<table>
<thead>
<tr>
<th></th>
<th>GOOD</th>
<th>FAIR</th>
<th>POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total P (Spring Overturn)</td>
<td>14.8 ppb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inorganic N (spring overturn)</td>
<td></td>
<td>0.14 ppm</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a (Summer)</td>
<td></td>
<td></td>
<td>4 ppm</td>
</tr>
<tr>
<td>Clarity</td>
<td></td>
<td></td>
<td>11 feet</td>
</tr>
</tbody>
</table>
## Irogami Lake “Trophic Scorecard”

<table>
<thead>
<tr>
<th></th>
<th>GOOD</th>
<th>FAIR</th>
<th>POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total P</strong></td>
<td>4.2 ppb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Spring Overturn)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inorganic N</strong></td>
<td></td>
<td>1.23 ppm</td>
<td></td>
</tr>
<tr>
<td>(spring overturn)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chlorophyll a</strong></td>
<td></td>
<td>2.6 ppm</td>
<td></td>
</tr>
<tr>
<td>(Summer)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clarity</strong></td>
<td></td>
<td></td>
<td>4.1 feet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Pleasant Lake Other Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate</td>
<td></td>
<td></td>
<td>6.4 mg/L</td>
</tr>
<tr>
<td>Chloride</td>
<td></td>
<td>1.6 mg/L</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td>0.47 mg/L</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td></td>
<td>1.3 mg/L</td>
<td></td>
</tr>
<tr>
<td>Atrazine</td>
<td>&lt;0.10 µg/L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Irogami Lake Other Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate</td>
<td></td>
<td></td>
<td>8 mg/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrazine</td>
<td></td>
<td></td>
<td>0.11</td>
</tr>
</tbody>
</table>
Aquatic Invasive Species

Eurasian Water Milfoil

Curly Leaf Pondweed
Eurasian Water Milfoil (non-native)  
Northern Milfoil (native)
Acknowledgements

Waushara County Citizens and Lake Groups
Waushara County

Wisconsin Dept. of Natural Resources
UWSP Water and Environmental Analysis Lab

Aquatic Plants - Jen McNelly, Golden Sands RC&D, Onterra
Paleolimnology - Dr. Samantha Kaplan and Paul Garrison (Wisconsin DNR)
Shoreland Assessments and Build Outs - Dan McFarlane
Water Quality and Watersheds - Nancy Turyk and Dr. Paul McGinley

UW-Stevens Point Graduate and Undergraduate Students
Questions?
Water Quantity

Groundwater availability

Water levels
Pleasant Lake: FQI = 31.2  Highest of lake studies in Waushara County so far!
- 5 sps. >8 C-Value
- 1 species of special concern: Hill’s pondweed

No plant data for Irogami yet

Plants

Increasing C-Value indicates decreasing ecosystem disturbance

Found in area of high disturbance

Found in area of low disturbance

Invasive Species

C-Value

0

1

2

3

4

5

6

7

8

9

10