Using Wetland Functional Data to Support Watershed Level Planning

Douglas County Lake Superior Basin Watershed Wetland Functional Assessment Project

Esri User Conference

July 12, 2017
Watershed Plan Elements

Project background
• Community engagement
• Development of criteria and prioritization process

Lake Superior Basin Description
• Major rivers, watersheds, land cover, land use

Priority wetland preservation and restoration areas
• Assess current wetland functions and historic locations

Recommendations
• Priority locations for wetland restoration and protection projects
Wetland Restoration Priorities

• Amount of wetland loss in watershed

• Amount of open land cover in subwatersheds

• Areas where wetlands were located historically
  • Potentially restorable wetlands (PRW)

• Transitional agricultural areas
  • Agricultural land that is reverting to native vegetation
Applied Science Project Goals

• Map present day wetlands

• Correlate wetland functions to mapped wetlands

• Identify and map historic wetlands

• Identify potential opportunities for wetland restoration

• Create spatial geodatabase and map output

• Provide wetland education and training.
Applied Science Project Goals

• Provide an enhanced wetland spatial database to stakeholder groups in Lake Superior basin of Douglas County for watershed planning.

• Work with updated Wisconsin Wetland Inventory (2012) and other classification systems (NWI and LLWW) to characterize wetland resources in the project area.

• Correlate wetland types using “Best Professional Judgment” of the project technical committee to a range of ecological functions for each wetland.

• Work with enhanced wetland data and existing/new techniques to identify potential opportunities for wetland restoration.
Some Points to Remember

• First and foremost this is a mapping exercise:
  • A wetland assessment that is landscape based
  • Not designed to be a field delineation process
  • Result is a planning tool, not a watershed plan

• Delineation and characterization of wetlands from remote imagery is an interpretive and subjective process

• Dependent on image quality and supporting collateral data

• Functional correlations are based on best professional judgment and require some field validation
Wetland Inventory to Implementation

- Prioritize wetland restoration and rehabilitation sites based on:
  - functional assessment,
  - ecological and social needs,
  - opportunities,
  - local input etc.
Major Steps of Assessment Process

• Map Present-Day Wetlands
  - Convert existing WWI data to
  - NWI & refine
  - LLWW Interpret/Attribute

• Assign wetland functions to NWIplus data

• Identify Potential Restorable Wetlands (PRWs)

• This creates data that allows planners to prioritize wetland restoration and rehabilitation sites.
3 Wetland Classifications

- Wisconsin Wetland Inventory (WWI)
- WI DNR (1992)
- National Wetland Inventory (NWI)
- Cowardin (1976)

- Landscape Position, Landform,
- Waterbody, Water Flow Path (LLWW)
- Tiner (2003, 2011)

- NWI and LLWW (NWIplus) data are correlated with ecological functions that each wetland provides.
LLWW

Based on Tiner (2003, 2011)

*similar to other hydrogeomorphic classification (Brinson 1993)

Landscape Position - relationship between a wetland and an adjacent waterbody or not

Landform - shape or physical form
  (island, basin, floodplain, etc.)

Water Flow Path - directional flow of water (outflow, inflow, isolated, etc.)

Water Body Type – lake, pond, river, stream
Landscape Position

LLWW continued

- **Lotic** – in or along rivers and streams and in floodplains
- **Lentic** – in or along lakes
- **Terrene** – completely surrounded by upland or nearly so; not flooded by river or streams
Landforms
LLWW continued

• Slope
• Island
• Fringe
• Floodplain (basin, flat)
• Interfluve (basin, flat)
• Basin
Water Flow Path

LLWW continued

• Bidirectional

• Through-flow

• Outflow

• Inflow

• Isolated

• Others (outflow intermittent and through-flow intermittent)
Waterbody Types

LLWW continued

• River and Stream Gradients (low)

• Lakes (natural, reservoir)

• Ponds (e.g. natural, beaver, farm, residential)
Functional Correlations

- Functions
  - Surface Water Detention
  - Streamflow Maintenance
  - Shoreline Stabilization
  - Nutrient Transformation
  - Carbon Sequestration
  - Sediment Retention
  - Fish and Wildlife Habitat
Surface Water Detention

Highly Functional
- Vegetated wetlands along streams, rivers, lakes, and islands
- Isolated wetlands with inlet and outlet

Moderately Functional
- Isolated or outflow vegetated wetlands
- Wetlands adjacent to lakes not already included in High
Streamflow Maintenance

Highly Functional
• All Headwater Wetlands (1st and 2nd order streams)
• Include 3rd order streams when organic soils present?

Moderately Functional
• River Floodplains
• Ponds
• Isolated wetland with outflow
• Wetlands adjacent to open water lakes
Identify Potentially Restorable Wetlands (PRWs)

• Model potentially historic wetlands based on extended SSURGO queries and image interpretation

• Add derived flow networks, basins and additional derivative elevation datasets

• Review with existing hydrology and imagery in order to identify sites with high potential for restoration, rehabilitation or development.

• Potential Future Phase – orthorectify historic (1938) aerial photos and interpret wetlands
Identify Potentially Restorable Wetlands (PRWs)

• Identify sites with high potential for rehabilitation, restoration or wetland development:
  
  • Local history and knowledge
  
  • Best professional judgment and local experts
  
  • Review of data layers and aerial imagery
  
  • Initial visual key by soil type and site drainage
  
  • Opportunities for land purchase
Wetland restoration priorities

• Amount of wetland loss in watershed

• Amount of open land cover in subwatersheds

• Areas where wetlands were located historically
  • Potentially restorable wetlands (PRW)

• Transitional agricultural areas
  • Agricultural land that is reverting to native vegetation
<table>
<thead>
<tr>
<th>HU12 Watershed</th>
<th>HU12 Area</th>
<th>Current Wetland</th>
<th>DNR PRWs</th>
<th>Clay Plain PRWs</th>
<th>Sum PRWs</th>
<th>Historic Wetlands</th>
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</table>

a: HUC 12 Area: Watershed layer from the National Hydrography Dataset, areas were recalculated to remove waterbodies. For example, Allouez Bay was included as part of the area of its watershed.
b: Current Wetlands: Wisconsin DNR 2012 Wetland Inventory
c: DNR PRWs: Potentially Restorable Wetland 2012 version 2. The DNR defines a PRW as polygon that is the result of a hydrologic soil map unit (65% or higher hydrologic percent) higher, minus areas already mapped as wetlands and areas mapped as incompatible land uses.
d: Clay Plain PRWs: These PRWs were determined by the 2014 Science Collaborative study by St. Mary's University in the clay plain area of the Lake Superior Basin of Douglas County. Areas considered to represent a potential opportunity for wetland reestablishment meet a set of soil criteria (wetland indicators) and topographic criteria (CTI values) and are within compatible land use. The process for identifying these polygons is specific to the clay plain area of the DCLS.
Wetland restoration priorities

• Watersheds with the highest amount of wetland loss
Wetland restoration priorities

Watersheds that are more than 40% open land cover

Open land cover includes agriculture, forest stands less than 16 yrs. old and urban areas
• Priority locations for future wetland restoration projects

<table>
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<tr>
<th>Watershed</th>
<th>Wetland Loss (%)</th>
<th>Number sub watersheds &gt; 40% open land</th>
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<td>Poplar River</td>
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<td>Lower Brule River</td>
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Wetland preservation priorities

- Functions and services provided by *surface water detention* wetlands
  - Retain surface water on the land to allow it to soak into the ground
  - Reduces volume of runoff into rivers, reducing erosion and sediment
  - Reduces flooding during large storm events
Restoration/Preservation Prioritization Matrix

• Integration

• Site selection

• Scenario planning

• Establish regional priorities

• Cumulative effects
Development of Matrix Criteria and Thresholds/Scoring

Example criteria

- Need a method for prioritization of restoration opportunities
- Criteria include: ecological, societal and economic
- Ecologic: proximity to existing wetlands, proximity to a waterway, isolation from roads, connectivity to other natural areas, impact on surface hydrology
- Societal: Landowner engagement, proximity to development, location within a headwaters
- Economic: role in managing peak flows and flooding; proximity to previous flood damage sites importance for water management; proximity to timber harvest; agricultural designation; zoning
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assumptions, Datasets Used, Scoring Protocol</th>
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</thead>
<tbody>
<tr>
<td><strong>Ecological Criteria</strong></td>
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<tr>
<td><strong>Biologic</strong></td>
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</table>
| Proximity to current wetlands with significant\(^1\) streamflow maintenance function | **Assumption:** A wetland restoration is more likely to positively impact watershed objectives for functional uplift if it is connected to, or located close to, an existing wetland performing the same function at a significant level (EPA 2013).  
**Datasets Used:** Wetland Functional Assessment and updated NWI datasets developed for Douglas County by Saint Mary’s University of Minnesota GeoSpatial Services  
**Scoring:** Potential restoration opportunities directly adjacent or located within 100 ft of an existing wetland performing the streamflow maintenance function at a “High” or “Moderate” level is assigned a score of 5, those within 200 ft are assigned a score of 3, and those greater than 200 ft are assigned a score of 0.  
**Weight:** Assumed to be 1 |
| Proximity to current wetlands with significant\(^1\) sediment retention function | **Assumption:** A wetland restoration is more likely to positively impact watershed objectives for functional uplift if it is connected to, or located close to, an existing wetland performing the same function at a significant level (EPA 2013).  
**Datasets Used:** Wetland Functional Assessment and updated NWI datasets developed for Douglas County by Saint Mary’s University of Minnesota GeoSpatial Services  
**Scoring:** Potential restoration opportunities directly adjacent or located within 100 ft of an existing wetland performing the sediment retention function at a “High” or “Moderate” level is assigned a score of 5, those within 200 ft are assigned a score of 3, and those greater than 200 ft are assigned a score of 0.  
**Weight:** Assumed to be 1 |
Next Steps

• Within the watersheds that meet the selection criteria,
  determine best sites for restoration and preservation that
  meet watershed needs and are consistent with land use
  plans.

• Compile a list of willing landowners

• Coordinate with county planning efforts including farmland
  preservation, hazard mitigation, forestry and transportation.

• Explore additional opportunities to utilize watershed-based
  plan
Questions

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