Moose Lake Legacy Initiative

Final Report ~ April 2010

Wisconsin Department of Natural Resources
Lake Planning Grant Program

Sponsored by the Couderay Waters Regional Land Trust

Document prepared by
Douglas Miskowiak,
GIS Education Specialist

GIS Center
University of Wisconsin - Stevens Point

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Preface

The Moose Lake Legacy Initiative has forged an exceptional partnership between citizens and resource professionals to inventory and analyze landscapes within the West Fork of the Chippewa River watershed. Particular attention has focused on the islands and shorelines of Moose Lake, in Sawyer County, Wisconsin. Throughout this initiative, citizen volunteers have invested generously with their time and energy. With help from professionals, they learned how to inventory coarse woody structure, aquatic macrophytes, aquatic invasive species, shoreline development, natural scenic beauty, ecological reference areas, and wildlife. Equipped with new skills, they inventoried 50 miles of shoreline looking for these ecological and aesthetic characteristics, features, and indicators.

In many instances, the shoreline inventories have verified what residents and recreationalists already knew—Moose Lake is a magnificent place, rich with the Northwood's beauty and teeming with wildlife. More importantly, the inventories provide an objective view of the existing resources and serve as a record-in-time that articulates Moose Lake's bounty.

Description of the Resource

The West Fork of the Chippewa River watershed (WFCR) is located within the Upper Chippewa River Basin, spanning three counties—Ashland, Bayfield, and Sawyer (see Map 1). The watershed covers 182,401 acres and is predominantly forested. The majority of land within the watershed is predominantly held by the United States Forest Service (USFS) with private in-holdings scattered about the watershed, but clustered mainly adjacent to water bodies.

Moose Lake is located within the Town of Round Lake in Sawyer County. The lake has a water area of 1,703 acres, holds 82 islands consisting of 64 acres, and has 50.27 miles of shoreline. The islands account for 24 percent, or 11.87 miles, of the total shoreline. Moose Lake is a high-quality reservoir with a self-sustaining walleye and musky fishery fed mainly by the West Fork of the Chippewa, Big Moose River, and Little Moose River. Moose Lake drains into the West Fork of the Chippewa River and into the Chippewa Flowage. Both are designated Outstanding Resource Waters by the Wisconsin Department of Natural Resources (WDNR).

Moose Lake and the WFCR watershed are also significant components of two Legacy Landscapes recognized by the WDNR. Legacy landscapes are places critical to meet Wisconsin's conservation and outdoor recreation needs. The watershed is predominantly within the Chequamegon National Forest Legacy Landscape. Sixteen miles of Moose Lake shoreline are owned by the USFS. The Chippewa Flowage Legacy Landscape is in close proximity to Moose Lake and is connected by the West Fork of the Chippewa River. From the dam on Moose Lake, the West Fork connects Moose Lake to the Chippewa Flowage, approximately eight miles away if traveling by water, or six miles as the crow flies.

The WFCR watershed and Moose Lake are within the North Central Forest ecological landscape that provides habitat to many important and unique species. Local residents confirm Land Legacy Report findings that this landscape provides habitat for wolves, fishers, elk, and bear as well as birds like loons, eagles, and osprey. Other significant flora and fauna abound here. Moose Lake shorelines largely exist in a natural state, but the tenure of this resource is fragmented. Ownership is dispersed among private, public, and quasi-public ownership. Although the USFS is the single largest landholder—as measured in miles of Moose Lake shoreline—the majority, or 31.96 miles, of shoreline is owned privately.

Overview of the Project

The Moose Lake Legacy Initiative provides an objective record of the ecological and aesthetic characteristics, features, and indicators of Moose Lake shorelines. This information is fundamental to help plan and manage for the unique opportunities and special characteristics that surround the Moose Lake area. Much of Moose Lake's private shoreline remains in a natural state. If managed thoughtfully, these lands could form a linear environmental corridor between the two Legacy Landscapes. A contiguous corridor could protect shorelines in a natural state, maintain large un-fragmented habitats, preserve natural scenic beauty, maintain water quality and a self-sustaining, high-quality fishery. These opportunities coincide with goals outlined in the Land Legacy Report (C1-C4).

This project provides the first known systematic inventory of Moose Lake and the WFCR watershed to determine potential threats and opportunities. These spatial inventories and subsequent analyses are critical for sound lake and watershed planning. They provide useful information for identifying and managing properties that are key for maintaining healthy fish and wildlife habitats, high water quality, and areas of exceptional natural beauty. Information about land use, land cover, topography, impervious surfaces, sensitive features, and natural resources is documented in this report, providing local residents and decision-makers— including the Couderay Waters Regional Land Trust—information in a comprehensive format. The intent is to provide this information for making well-informed lake, land, and watershed management decisions.

Residents and tourists alike acknowledge that the Moose Lake area is unique, with special characteristics and exceptional beauty. This report defines and documents an objective set of characteristics and attributes that add to the area's aesthetic experience and that support ecological productivity. The introduction and spread of aquatic invasive species, such as broad and narrow-leaf cattails, on Moose Lake, is a genuine threat. This report documents the scope of these aquatic macrophytes, which have the potential to degrade recreational and aesthetic opportunities and impact fish spawning and wildlife habitats. The report spatially documents areas where cattails are out-competing other aquatic macrophytes, notably wild rice, and provides a baseline record for monitoring the advancement or regression of invasive cattails.

Map 1.

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The Couderay Waters Regional Land Trust has used the shoreline inventories to identify high-priority shorelines. The process for Moose Lake identifies areas that, if protected or managed, help the trust achieve conservation goals. The process identifies areas that require further management or currently exist in a high-quality aesthetic and ecological condition. Moose Lake's process will guide the CWRLT in refining their conservation strategy to help preserve significant portions of the natural heritage of this region for the benefit of present and future generations. The Couderay Waters Regional Land Trust is also prepared to work with other local stakeholders to identify other management strategies for protecting lake and land resources, which are not outlined in this report.

Citizen contributors of the Moose Lake Legacy Initiative carefully examine Moose Lake maps prior to conducting shoreline inventories.

Couderay Waters Regional Land Trust

The Couderay watershed region of Sawyer and Washburn Counties in northwest Wisconsin has a rich and diverse natural environment that includes forests, wetlands, lakes, and streams. Pressures for development are strong and changes are inevitable. In the face of these influences, a continuing effort to preserve our natural heritage must be mounted and sustained. The continuation of the high quality of life that is possible in such a setting cannot be taken for granted. This is why the Couderay Waters Regional Land Trust was formed and organized in 2002 by the conservation-concerned local landowners in the Couderay watershed region of Sawyer and Washburn counties. Our members all know that without organized and dedicated assistance, the natural heritage of our watershed area could well be permanently lost or destroyed.

The Couderay Waters Regional Land Trust (CWRLT) is a nonprofit 501(c)(3) land conservation organization that works with landowners in the northwest Wisconsin region to protect and preserve the natural resources of their property.

Due to the unique diversity and extensive beauty of the natural resources in the region, the land is under constant pressure from development and acquisition. This pressure has driven up land prices and sales, which have reduced the amount of pristine, undeveloped land in its natural state. Increased sales have also isolated numerous land parcels, thereby fragmenting natural areas.

Unfortunately, once a parcel of land is developed, it is almost always permanently lost. Rarely does developed land get restored back to its pristine state and preserved. Fragmented land parcels provide challenges for both development and preservation efforts because of the limited amount of area.

Our goal is to work with landowners to help preserve significant portions of this region to safeguard the natural heritage for present and future generations. We are particularly interested in protecting land that has exceptional biological diversity and provides green space and natural habitat. We are also interested in protecting forests that have been managed for sustainability, thereby reducing impact on surrounding lands.

Project Partners and Participants

The Moose Lake Legacy Initiative recognizes and appreciates the cooperation and partnership of the following project cooperators and contributors.

Couderay Waters Regional Land Trust Board of Directors

- Louise Heim, President
- Val Barber, Vice President
- Robert Palombi, Secretary
- Mike Outcalt, Treasurer
- Chris Jeffords
- James E. Garvey
- Dale Anderson
- Andy Baltins
- James Burgess
- Tom Heinrich
- Doug Kurtzweil
- Michael Heim. Michael provided his ecological and biological insights and expertise during the ecological shoreline inventory. His insights into the natural world were especially helpful.
- Bruce Paulson. Bruce is Moose Lake Legacy Initiative Project Manager. His enthusiasm for the initiative was contagious, and his support was steadfast throughout the process. All of us who participated in the initiative are indebted to him.

Moose Lake Citizen Contributors

- Jeanie Boyd. Jeanie assisted in the identification of aquatic macrophytes and provided support for project goals and objectives.
- Ken Boyd. Ken provided insight and support in the identification and inventory of aquatic macrophytes. Ken also participated in various inventories of the Moose Lake shoreline.
- Richard Carlson. In addition to participating with several inventories of the Moose Lake shoreline, Richard snapped hundreds of photographs to help document the inventory process.
- Mary Kay Carlson. Mary Kay provided early support for the Moose Lake Legacy Initiative and provided historical insights helpful in understanding changes to Moose Lake.
- Mary Ann Churchill. Mary Ann provided early and sustained support for the initiative. Mary Ann conducted a thoughtful review and provided helpful comments in preparation of this report.
- Ron Churchill. Ron provided initial support for the Legacy Initiative. He helped organize and conduct the initial inventories of Moose Lake islands and shorelines. As

co-chair of the MLIA Ad Hoc Committee on Natural Resources, he participated in the initial drafts of the lake planning grant proposal, presentations to the MLIA, and assisted in the development of supporting written and verbal materials.

- Don Cole. Don provided sustained support for the various shoreline inventories helping to discern, map, and confirm shoreline observations.
- Bill Czeskleba. Bill assisted with all facets of the Initiative and extensively shared his time, ideas, and comments. He participated in each inventory of shoreline characteristics with an eye for quality control of methods and observations. He assumed responsibility for the wildlife observation effort by distributing and collecting the surveys. Additionally, Bill acted as a liaison with the Loon Watch Program at Northland College and with the Rocky Mountain Elk Foundation.
- Chris Czeskleba. Chris provided continuous logistical support and ideas as the project progressed and matured.
- Don Kluxdal. Don assisted in the extensive inventory and mapping of wild rice beds in the West Fork of the Chippewa River from Highway 77 near Clam Lake to the Moose Lake bridge.
- Jan Kluxdal. Jan provided sustained support and encouragement for the duration of the Initiative.
- Wayne Janitschke. Wayne provided access to the family pontoon boat and guided the inventory crew around the 50 miles of Moose Lake shoreline for each inventory. Wayne also assisted in the inventory and mapping of shoreline characteristics, attended meetings, and provided encouragement
- Murial Janitschke. Murial offered enthusiasm for the Initiative and shared her family's pontoon boat for conducting shoreline inventories.
- Cindy New. Cindy provided insight during the initiative and reviewed and commented on various materials as the effort progressed.
- Gary New. Gary provided insight during the initiative and reviewed and commented on various materials as the effort progressed.
- Ben Niemann. Ben helped conceptualize the project scope, acted as liaison with the consultant and the trust, assisted with logistics, and participated in each shoreline inventory. He helped monitor the production and contributions of the consultant including editing and review of Initiative products.
- Sue Niemann. Sue provided leadership and logistical support in organizing contributors for the inventories, public presentations, informal discussions, and liaison with numerous advisors and consultants. She also provided helpful reviews of various documents and proposals and shared her land planning and GIS experience.
- Jackie Olson. Jackie provided her expertise with the identification of aquatic macrophytes and potential invasive species.
- Stan Olson. Stan participated in the process to prioritize Moose Lake shorelines based upon the characteristics of the littoral and riparian areas of Moose Lake.

- Marcia Whaley. Marcia provided logistical support during the initial inventory phase and participated in the inventory and mapping phase of the initiative. She provided helpful reviews of various documents and proposals and has been helpful throughout. Marcia provided use of the family's pontoon boat for conducting inventories and tours.
- Ray Whaley. Ray provided use of the family's pontoon boat for conducting inventories and tours. He participated in each inventory and lent support to observe, map, and verify findings. His extensive history and knowledge of Moose Lake was extremely helpful. Ray has provided long-term support for the initiative.

Project Cooperators

- National Consortium for Rural Geospatial Innovations (RGIS)
- UW-Madison, Land Information and Computer Graphics Facility (LICGF)
- UW-Stevens Point Center for Land Use Education (CLUE)
- Wisconsin Department of Natural Resources
- Rocky Mountain Elk Foundation
- Loon Watch – Sigurd Olson Environmental Institute, Northland College
- Connie Chaney, United States Forest Service
- Stacy Craig, Loon Watch – Sigurd Olson Environmental Institute, Northland College. Stacy provided information representing the Loon Watch program. She shared her knowledge about loon behavior and environmental factors affecting loons. She provided an opportunity to present the findings of the Initiative to members of the Loon Watch program at the annual meeting.
- Brian Devries, Sawyer County Land Records Department. Brian provided technical geographic information system (GIS) data that proved valuable in understanding the resource.
- Laura Herman, Wisconsin Department of Natural Resources and University of Wisconsin – Extension Lakes Program. Laura's expertise in lake and shore land resources, as well as in citizen inventory and monitoring procedures, helped to substantiate Initiative methodologies. Laura's work helped fuel the drive to inventory Moose Lake's aquatic macrophytes, coarse woody structure, and aquatic invaders.
- Kristi Maki, Sawyer County Land and Water Conservation. Kristi provided valuable expertise in identifying aquatic invaders, including the invasive cattails found on Moose Lake.
- David Neuswanger, Wisconsin Department of Natural Resources. David provided initial and sustained support for conducting shore land inventories on Moose Lake. David's knowledge of fisheries as they relate to shore land resources proved invaluable to substantiate methodologies and findings.

- David Sanders, Moose Lake Improvement Association President. David offered the opportunity to present initiative methods and findings at the Moose Lake Improvement Association and its board of directors' annual meeting.
- Steven Spickerman, United States Forest Service. Steven provided valuable information about various environmental topics related to Moose Lake, littoral zones, riparian areas, and forestry resources. He helped guide inventory procedures for aquatic macrophytes, coarse woody structure, and ecological reference areas and refugia.

Project Education and Assistance

- Douglas Miskowiak, GIS Center – University of Wisconsin Stevens Point
- Corinna Neeb, GIS Center – University of Wisconsin Stevens Point
- Dan McFarlane, Center for Land Use Education, University of Wisconsin Stevens Point

Citizen contributors and resource professionals share a shore lunch on Folson Island after a morning of conducting the aquatic macrophyte inventory.

Executive Summary

Analyses conducted for the West Fork of the Chippewa River Watershed and inventories of the Moose Lake littoral and riparian areas reveal the ecological and aesthetic significance of Moose Lake to the larger region. The chapters of this report provide detailed information about inventories, the methodologies used, and findings. The information below summarizes the primary findings of the Moose Lake Legacy Initiative.

General Lake and Watershed Statistics

- Moose Lake encompasses 1,703 acres
- Moose Lake contains 82 islands
- Moose Lake has 49.94 miles of shoreline of which 38.33 miles are along the mainland and 11.61 miles are island frontage.
- The West Fork of the Chippewa River Watershed encompasses 182,401 acres
- The watershed holds 9,019 acres of surface waters
- The watershed holds 173 islands
- Waters designated by the WDNR as Outstanding Water Resources flow into and out of Moose Lake.

Ownership Findings

- The United States Forest Service is the largest single land holder—as measured by perimeter of shoreline—with 15.76 miles of shoreline.
- Xcel Energy and the State of Wisconsin comprise the other public/quasi-public land holders on Moose Lake.

Development Findings

- With tree canopy in full leaf-on condition, 692 manmade structures or objects were documented that were visible from the littoral zone of Moose Lake.

Aquatic Vegetation Findings

- Broad and narrow-leaf cattails and their hybrids, considered invasive species, are the most prevalent aquatic macrophytes along Moose Lake shorelines, encompassing over 11 miles of shoreline.
- Wild rice, significant culturally, comprises over three miles of shoreline.
- Perch use wild rice to attenuate their eggs in the absence of other appropriate aquatic macrophytes. The surface water drawdown emphasizes the importance of wild rice for perch spawning habitat and their predator fish.

Coarse Woody Structure

- 37 percent of Moose Lake shores have a continuous pattern of coarse woody structure that provides habitat for fish and texture to the shorelines aesthetic condition.
- Coarse woody structure provides habitat for fish and ambush sites for predator fish, such as musky.

Ecological Reference Areas and Refugia

- White birch is the predominant riparian tree on Moose Lake, but is succeeding to white pine.
- Sugar maple, yellow birch, and hemlock—the area's climax species—are returning, and over time will likely succeed white pine.
- A stand of tamarack, black spruce, and white cedar trees on Moose Lake's northern shores has existed in this area since pre-settlement.
- White cedar refugia, especially on Moose Lake islands, are the likely result of the vulnerability of deer to wolves on the ice in the winter.

Wildlife

- Moose Lake provides a home for abundant wildlife that includes elk, deer, wolves, owls, eagles, osprey, otters, fishers, black bear, loons, turtles, hummingbirds, ducks, bobcat, and fox, among many other fauna.
- Riparian areas are especially important for wildlife for habitat, migration, and other requirements.

Land Cover

- The watershed is dominated by a mix of deciduous and evergreen forest.
- Herbaceous and wooded wetlands provide the next largest amount of land cover.
- The largely forested condition provides ideal circumstances for water to penetrate and be filtered by the soils.

Land Management

- The USFS holds 80 percent of land within the watershed.
- Private inholdings of land within the Chequamegon National Forest are predominantly located in the riparian areas of surface waters.
- Moose Lake offers a linear environmental corridor between two WDNR designated Legacy Landscapes, the Chequamegon National Forest and the Chippewa Flowage.

Chapter 1. Project Goals and Objectives

First and foremost, this project champions the Wisconsin Public Trust Doctrine, which safeguards navigable waters for all citizens. It recognizes the public's right to use and enjoy these waters for navigation, recreation, fishing, hunting, boating, swimming, and natural beauty. The Wisconsin Public Trust Doctrine provides the guiding principle to achieve the following project goals and corresponding objectives.

Goal 1. Develop a Watershed and Lake Information System (WALIS) appropriate for natural resources and land conservation decision-making, planning, and management.

Related Objectives.

- Delineate the watershed boundary and map existing land uses and acreages. Analyze land uses, impervious surfaces, and forest covers to illustrate the relationship of land use to water quality.
- Inventory the conditions of mainland and island shorelines as an indicator of healthy wildlife and fish habitats.
- Inventory mainland and island shorelines for indicators of threatened, rare, endangered, and invasive species.
- Define and inventory mainland and island shorelines for characteristics that provide a sense of place and natural scenic beauty.
- Identify and delineate environmentally sensitive and ecologically important areas in the watershed including, wetlands, wildlife habitats, steep topography, and riparian buffer zones.
- Inventory and review the adequacy of existing institutional programs, plans, and ordinances affecting land conservation and water quality.

Goal 2. Develop a watershed and lake conservation strategy that prioritizes the most critical, threatened, aesthetic, or ecologically important shoreline and island resources.

Related Objectives.

Prioritize and highlight critical shorelines and islands that:

- Require invasive species management.
- Harbor rare, endangered, and threatened species.
- Provide important wildlife and fish spawning habitats.
- Provide unique or exceptional opportunities to view natural scenic beauty.
- Are appropriate for permanent conservation using conservation agreements, fee simple purchase, or land gifting from willing benefactors.

Goal 3. Build awareness and partnerships among local stakeholders, conservation organizations, professionals, and others regarding project results, methods, issues, watershed conditions, and land conservation strategies.

Related Objectives.

- Include local stakeholders, conservation organizations, professionals, and others in the project whenever appropriate.
- Work with other entities to identify appropriate land and water conservation strategies beyond those typically used by the Couderay Waters Regional Land Trust that will accomplish critical habitat protection.
- Share and widely distribute project results, maps, and other information to local stakeholders, conservation organizations, professionals, and others that leads to a mutual understanding of issues and promotes shared action and implementation.
- Share project methods and results with other land trusts, conservation organizations, professionals, state agencies, and others interested in land and water conservation.
- Share WALIS with all land trusts in Wisconsin, local lake associations, and the Wisconsin Association of Lakes so they have an opportunity to benefit by repeating the process.
- Share WALIS with the Lac Courte Oreilles Band of Lake Superior Chippewa and Lac Courte Oreilles Ojibwe Community College.

Goal 4. Enhance Couderay Waters Regional Land Trust's capacity to conserve and protect critical lands in perpetuity.

Related Objectives.

- Utilize WALIS as a template for future lake and watershed planning efforts conducted by the Couderay Waters Regional Land Trust.
- Identify shoreline and island resources that are appropriate for protection through conservation agreements, fee simple purchase, and gifts from willing benefactors.
- Use the results of this planning effort to support the Couderay Waters Regional Land Trust's ongoing efforts to conserve critical lands, waters, and habitats in perpetuity.

Chapter 2. Overview of Methods, Activities, Products, and Deliverables

The following section provides an overview to the activities and products delivered to satisfy the Moose Lake Legacy Initiative.

Preliminary Education Concerning Lake and Watershed Issues and Opportunities
Preliminary education provided a launching pad to:

1. Build awareness of local lake and watershed issues and opportunities.
2. Build partnerships with local and regional stakeholders, organizations, and professionals.
3. Share project goals and objectives.

Preliminary education included a two-page pamphlet (see Chapter 3) that introduced the project to a broad set of people within the project area and beyond. Over 700 copies of the pamphlet were distributed.

Analyze the West Fork of the Chippewa River Watershed.
The WFCR watershed was systematically analyzed to:

1. Reveal the important landscape patterns that establish this area as a Legacy Landscape.
2. Delineate the watershed boundary and map existing land uses and acreages.
3. Analyze land uses, impervious surfaces, and forest covers to illustrate the relationship of land use to water quality.
4. Identify and delineate environmentally sensitive and ecologically important areas in the watershed including, wetlands, wildlife habitats, steep topography, and riparian buffer zones.

The analysis provided an information foundation to establish a sound rationale for protecting Moose Lake islands and shorelines (see Chapter 4).

Inventory Island and Shoreline Characteristics and Inhabitant Species
Moose Lake shorelines and islands have been systematically inventoried for:

1. Indices of healthy wildlife and fish habitats.
2. Indices of threatened, rare, endangered, native, and invasive species.
3. Characteristics that provide a sense of place and natural scenic beauty.

The shoreline and island inventory electronically documents various shoreline characteristics. Both mainland and island shorelines were documented using 2005, 1-meter resolution orthophotography from the National Agricultural Inventory Program. These data documented additional shorelines and 21 more islands than the WDNR Hydrography V database. The shoreline and island database serves as a framework to compile and maintain a detailed inventory of island and shoreline characteristics for this project.

The consultant, with help from resource experts from various fields, developed a protocol for conducting physical inventories of shorelines. Volunteers from the Moose Lake area conducted the inventories based on tested protocols using hardcopy maps, indelible marking pens, and log books. Shoreline inventories were entered into the GIS shoreline database by the consultant using ArcGIS 9.2. The documented characteristics provide a rich database.

Critical Shorelines and Islands Analysis

Participants utilized information collected from the WFCR watershed analysis and the shoreline inventory to target critical or high-priority shorelines and islands for management and conservation. Using suitability-modeling techniques and ArcGIS weighted-overlay analysis, participants were actively engaged in defining criteria that rank shoreline characteristics. The process resulted in identifying high-priority mainland and islands, shorelines worthy of conservation, and critical shorelines in need of management.

Project Dissemination

Project results were widely disseminated via several events that include an educational open house and workshop. The goal of the events was to build an understanding of the project and build interest in implementing similar procedures elsewhere. Events included:

- Moose Lake Improvement Association Annual Meeting, July 4, 2009.
- Academic presentation at the Wisconsin Land Information Association annual conference, 2009.
- Poster presentation at the Annual Northwest County Lakes Forum at Telemark Lodge, June 2009.
- Academic presentation at the Environmental Systems Research Institute (ESRI) International Users Conference, 2009.
- Open house session at the Town of Round Lake Town Hall, July 2009.
- Presentation for the Department of Natural Resources Board of Directors in Hayward, Wisconsin, August 2009.
- Academic presentation at the Sawyer County Lakes Forum, September 2009.
- Presentation for the WDNR Northwest District Headquarters, September 2009.

Moose Lake and West Fork of the Chippewa River Watershed Atlas

Geographic analyses, along with maps created for Moose Lake and the Chippewa River Watershed, have been compiled into a full-color atlas available for download over the Internet or for purchase in hardcopy format. The atlas includes the following maps:

- Land cover
- Tree cover
- Impervious surfaces
- Water Resources
- Protected and managed lands
- Pre-settlement vegetation
- Environmental corridors
- Glacial deposits

- Shoreline ownership
- Aquatic macrophytes
- Wild rice and cattail interface
- Coarse woody structure
- Ecological reference areas and refugia
- Shoreline development
- Aesthetic shoreline condition
- Wildlife observations
- Priority shorelines

Description of Data Collected

Data for Analysis of the West Fork of the Chippewa River Watershed (WFCR)

Much of the data needed for the watershed analysis was compiled previously during the Moose Lake Island Legacy Initiative in 2007. The Moose Lake Improvement Association, Couderay Waters Regional Land Trust, Land Information and Computer Graphics Facility, and the Center for Land Use Education have compiled the following data for each watershed connected to Sawyer County. These data were made available and accessible to the public at the Sawyer County Land Records Department. These data were extracted to the WFCR watershed.

- Minor civil divisions, 2000. U.S. Department of Commerce.
- County boundaries. Wisconsin Department of Natural Resources.
- Public Land Survey System. Wisconsin Department of Natural Resources.
- Lakes, ponds, and flowages, 2006. Wisconsin Department of Natural Resources.
- Rivers, streams, and shorelines, 2006. Wisconsin Department of Natural Resources.
- Islands and uplands, 2006. Wisconsin Department of Natural Resources.
- Outstanding and exceptional water resources, 2007. Wisconsin Department of Natural Resources and Douglas Miskowiak, Center for Land Use Education.
- Dam locations, 2006. Wisconsin Department of Natural Resources.
- Watersheds, 2003. Wisconsin Department of Natural Resources.
- Native American lands, 2000. Wisconsin Department of Natural Resources.
- Federal lands. Wisconsin Department of Natural Resources.
- National forests, Wisconsin Department of Natural Resources.
- WDNR managed lands, 2002. Wisconsin Department of Natural Resources.
- County forests, 2005. Wisconsin Department of Natural Resources.
- Forest Crop Program, 2005. Wisconsin Department of Natural Resources.
- Managed Forest Program, 2005. Wisconsin Department of Natural Resources.
- Original vegetation. Wisconsin Department of Natural Resources.
- Digital elevation 30 meter. Wisconsin Department of Natural Resources.
- Hillshade. Douglas Miskowiak, Center for Land Use Education.
- Steep slopes. Douglas Miskowiak, Center for Land Use Education.
- Land cover, 2001. Multi-Resolution Land Characteristics Consortium.
- Impervious surface, 2001. Multi-Resolution Land Characteristics Consortium.
- Tree cover, 2001. Multi-Resolution Land Characteristics Consortium.
- Glacial deposits, 1976. Wisconsin Geological and Natural History Survey.
- Railroads. Wisconsin Department of Transportation.
- Roads and highways, 2004. Wisconsin Department of Transportation.
- Orthophotography, 2005. National Agricultural Inventory Program.

- Hydric soils. Natural Resources Conservation Service.

Moose Lake Islands Legacy Initiative

The Moose Lake Islands Legacy Initiative, conducted in 2007, created a unique partnership to begin planning for the coordinated management of the Moose Lake islands. Partners of this project included: the Moose Lake Improvement Association, Couderay Waters Regional Land Trust, UW-Stevens Point, Center for Land Use Education, and UW-Madison, Land Information and Computer Graphics Facility. This effort was organized by Ben Niemann, emeritus professor of Urban and Regional Planning and past director of the Land Information and Computer Graphics Facility at UW-Madison. He is a current member of the Moose Lake Improvement Association.

Geographic information was compiled for each watershed connected to Sawyer County, Wisconsin for use in natural resources or comprehensive planning efforts. Over 30 GIS databases were assembled. The databases were distributed to the Sawyer County Land Records Department for public domain access and the Lac Courte Oreilles Ojibwe Community College for use with their curriculum. These data were extensively used by the Town of Round Lake in their comprehensive planning effort.

These data were also applied to conduct a basic inventory of Moose Lake Islands and Shorelines. The project updated Moose Lake's hydrology data and found 21 additional islands and miles of additional shorelines that the WDNR's Hydrology V database had not documented. Citizens on the Moose Lake Improvement Association's Ad Hoc Committee on Natural Resources have begun using this database to solicit land conservation agreements between private land owners and the Couderay Waters Regional Land Trust or the United States Forest Service. Of notable interest, citizens toured Moose Lake with USFS managers to explore their interest in land transfers. In addition, Association citizens met with Xcel Energy land managers on two occasions to ascertain their interest in shifting their ownership of the Folson Islands Complex to public trust status.

Data from the Island and Shoreline Characteristics and Inhabitant Species Inventory

Volunteers conducted physical observations of island and shoreline characteristics and inhabitant species by boat. They collected the following information based on their observations. Observations logged on hardcopy maps and written journals were digitized and transcribed into a geodatabase by the Center for Land Use Education at UW-Stevens Point. Data include:

- Shoreline ownership
- Aquatic macrophytes
- Aquatic invasive species
- Visible shoreline development (i.e. structures)
- Coarse woody structure
- Ecological reference areas
- Ecological refugia
- Veteran tree specimens
- Aesthetic shoreline condition
- Wildlife observations
- Wild rice stands in the West Fork of the Chippewa River

Chapter 3. Preliminary Education

A two-page pamphlet was crafted and widely distributed to provide preliminary education about the Moose Lake Legacy Initiative. The pamphlet was designed to share information about:

- What the Moose Lake Legacy Initiative is
- Initiative goals
- Why the Couderay Waters Regional Land Trust became engaged
- Why Moose Lake was chosen as a project area
- Project collaborators

On the reverse side of the pamphlet, a map of Moose Lake ownership patterns provided an example of project results. Additionally, the pamphlet provided contact information for people who desired to learn more about the project or share comments (see Figure 3.1).

Results

Over 700 copies of the pamphlet were distributed to landowners within the Sawyer County portion of the West Fork of the Chippewa River Watershed. Sawyer County Land Records Department helped to create the mailing list for landowners within the watershed. The pamphlet had the desirable effect of promoting broad public awareness of the initiative.

Figure 3.1. Preliminary education pamphlet (front) (reverse on next page).

Moose Lake Legacy Initiative

What the Moose Lake Legacy Initiative is

The Moose Lake Legacy Initiative is a grassroots effort to make informed conservation decisions about important natural and scenic landscapes near Moose Lake and the West Fork of the Chippewa River Watershed. The Initiative is sponsored by the Couderay Waters Regional Land Trust, Inc. and is funded by a Wisconsin Department of Natural Resources (WIDNR) Lake Planning Grant.

The Initiative has four primary goals that will result in:

1. ***Becoming Better Informed:*** Information will be gathered from existing sources and by interested citizens so conservation decisions are based on sound information.
2. ***Prioritizing Conservation Choices:*** Information gleaned through the Initiative will be used to identify island and shoreline landscapes where conservation is most vital.
3. ***Building Local Awareness:*** Information collected, methods applied, and project results will be shared among citizens, officials, local stakeholders, conservation organizations, and planning and resource professionals to further develop and promote conservation strategies of vital resources.
4. ***Enhancing Conservation Capacity:*** Becoming better informed, prioritizing choices, and building local awareness will ultimately enhance the Trust's capacity to promote conservation through *voluntary conservation agreements*.

Why Couderay Waters Regional Land Trust is Interested

Couderay Waters Regional Land Trust, Inc. works with landowners to voluntarily preserve significant portions of the region's natural heritage for the benefit of present and future generations.

Why Moose Lake was Chosen

Moose Lake and its watershed is a remarkable place. Moose Lake exhibits characteristics that echo our conservation interests and goals. In particular, Moose Lake and its watershed:

- Is geographically positioned between two Legacy Landscapes, forming an environmental corridor between the Chippewa Flowage and the Chequamegon National Forest.
- Lies within the North Central Forest Ecological Landscape providing critical habitat for elk, wolves, fishers, bear, loons, eagles, osprey, and numerous other important or rare flora and fauna.
- Shares waters with the West Fork of the Chippewa River, Teal Lake, Teal River, and the Chippewa Flowage – all designated Outstanding Resource Waters by the WIDNR.
- Citizens are generous, dedicating their time, expertise and personal resources. Without their interest and action this project is not possible.
- Citizens have already gathered substantial information and developed mapping databases.

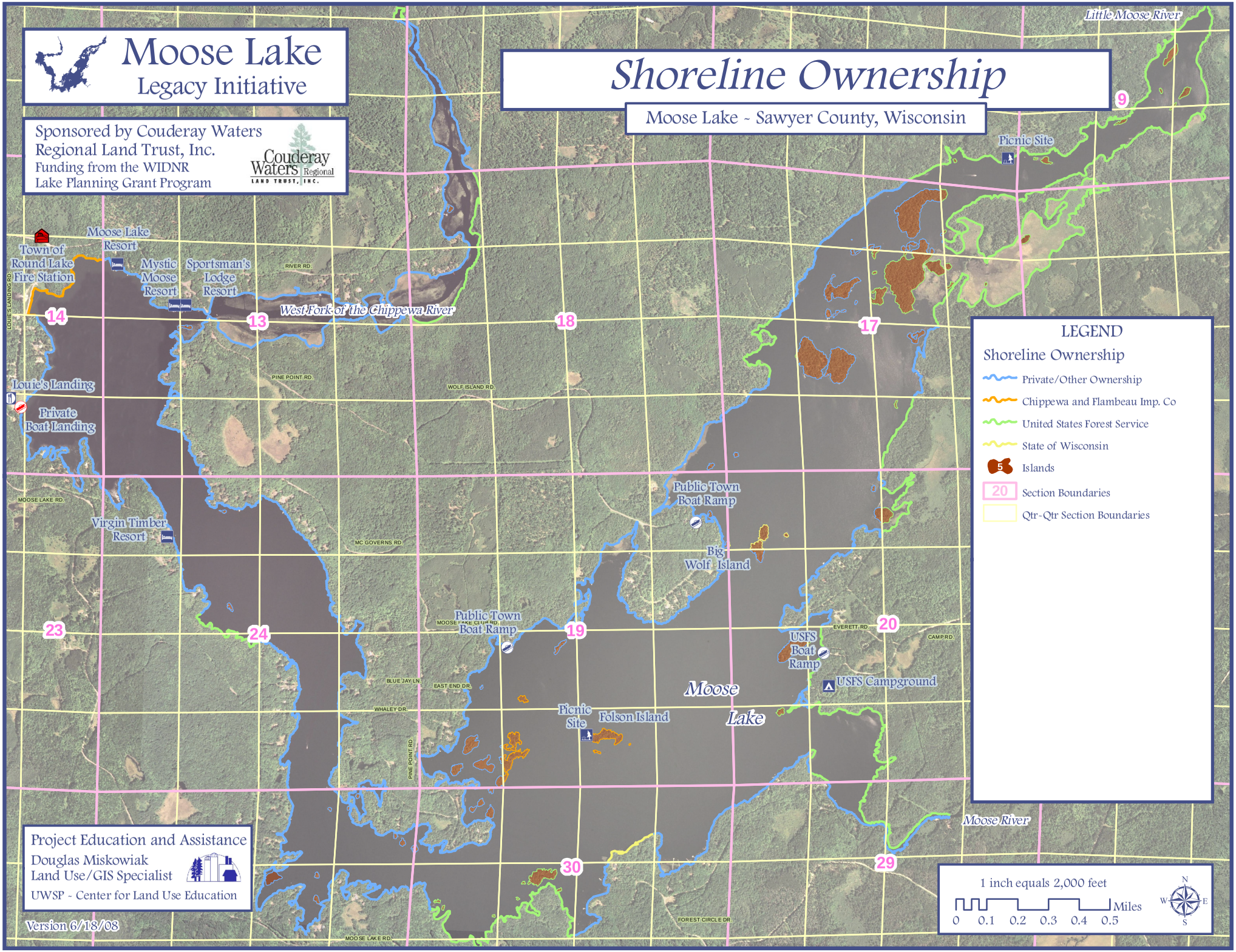
Other Collaborators

The Trust is joined by interested and active citizens that are connected to the Moose Lake environment in Sawyer County, Wisconsin. The Initiative has received written letters of support from the United States Forest Service, the Rocky Mountain Elk Foundation, Loon Watch, and the Wisconsin Department of Natural Resources. Other collaborators include UW-Madison Land Information Center and Computer Graphics Facility (LICGF) and the National Consortium for Rural Geospatial Innovations (RGIS).

The Center for Land Use Education (CLUE) at the University of Wisconsin – Stevens Point is providing educational and professional support. CLUE Specialist and Project Manager, Douglas Miskowiak is providing professional expertise and access to Geographical Information System tools to help facilitate public involvement in land resources planning, management, and conservation.

For more information contact: Louise Heim, President CWRLT at 4Heim@cheqnet.net or at (715)634-5336
Bruce Paulsen at blpaulsen@cheqnet.net or at (715) 634-3618
Ben and Sue Niemann, Project Liaisons at sue.niemann@gmail.com or at (715) 462-3141

Moose Lake Legacy Initiative July 22, 2008


Moose Lake
Legacy Initiative
Shoreline Ownership
Moose Lake ~ Sawyer County, Wisconsin
Sponsored by Couderay Waters
Regional Land Trust, Inc.
Funding from the WIDNR
Lake Planning Grant Program
Couderay Waters Regional Land Trust, Inc.
Little Moose River
Picnic Site
Moose Lake Resort
Town of Round Lake Fire Station
Mystic Moose Resort
Sportsman's Lodge Resort
RIVER RD.
West Fork of the Chippewa River
LOUIES LANDING RD.
14
13
18
17
9
Louie's Landing
Private Boat Landing
PINE POINT RD.
WOLF ISLAND RD.
MOOSE LAKE RD.
Virgin Timber Resort
MC GOVERNS RD.
Public Town Boat Ramp
Big Wolf Island
23
24
19
20
MOOSE LAKE CLUB RD.
EVERETT RD.
CAMP RD.
USFS Boat Ramp
USFS Campground
BLUE JAY LN.
EAST END DR.
WHALEY DR.
Moose Lake
Picnic Site
Folson Island
PINE POINT RD.
30
29
FOREST CIRCLE DR
Moose River
MOOSE LAKE RD.
LEGEND
Shoreline Ownership
Private/Other Ownership
Chippewa and Flambeau Imp. Co
United States Forest Service
State of Wisconsin
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Islands
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Section Boundaries
Qtr-Qtr Section Boundaries
Project Education and Assistance
Douglas Miskowiak
Land Use/GIS Specialist
UWSP - Center for Land Use Education
Version 6/18/08
1 inch equals 2,000 feet
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Chapter 4. West Fork of the Chippewa River Watershed Analysis

Moose Lake's ecological resources and aesthetic character are connected to, shared by, affect, and are affected by a larger landscape. A watershed is a geographic area that is drained by a stream or river and is separated from other watersheds by topographic ridgelines. The area within a watershed's boundary illustrates the connectivity among landscapes, even over great distances.

Moose Lake is contained within the West Fork of the Chippewa River Watershed (WFCR). The WFCR watershed is part of the much larger Chippewa drainage basin. Water that enters into the Chippewa basin flows into the Chippewa River and ultimately flows to the Mississippi River.

The remainder of Chapter 4 will describe individual analyses conducted for the WFCR watershed and how the patterns that emerge from the analysis potentially affect Moose Lake. Eight individual analyses were conducted. They include:

1. Water resources
2. Environmental corridors
3. Pre-settlement vegetation
4. Land cover
5. Publicly managed lands
6. Impervious surfaces
7. Tree canopy density
8. Glacial geology

1. Water Resources

The water resources analysis, illustrated in Map 4.1, displays various hydrologic features within the WFCR watershed. Features include surface waters, the watershed boundary, outstanding and exceptional resource waters, and active/inactive dam locations.

Analysis Summary

Geographic analyses have revealed the following information about water resources within the watershed.

- ***Watershed size:*** The watershed is 182,401 acres in size. In comparison, a Public Land Survey township is approximately 23,040 acres.
- ***Multi-jurisdictional:*** Three counties—Bayfield, Ashland, and Sawyer—have land within the watershed. Policies approved in these counties about water resources or land use hold potential to affect the water resources of Moose Lake.
- ***Surface water:*** According to the WDNR 1:24,000 hydrology open-water database, there are 9,019 acres of surface waters within the watershed. It is important to note that the database does not include acreages of smaller river and stream segments. In comparison, Moose Lake is over 1,700 acres.
- ***Shorelines:*** Bank and stream attributes of the WDNR hydrology database reveal 525 miles of shorelines within the watershed.
- ***Outstanding Resource Waters:*** The watershed contains 52 miles of water-bodies that are designated by the Department of Natural Resources as

- Outstanding Resource Waters (ORW). In all of Wisconsin, only 357 water-bodies retain ORW status.
- ***Islands:*** Based on the WDNR 1:24,000 hydrology database, 173 islands exist in the watershed. Moose Lake has 82 islands, based on field inventories in 2007 and 2008.
- ***Dams:*** According to the WDNR database, 18 dams exist in the watershed. The activity status of these dams is unknown.

Significance to Moose Lake

The unique geography of Moose Lake within the watershed gives it significant, if also fragile, status among the area's waters. The West Fork of the Chippewa River and the Teal River are designated by the WDNR as Outstanding Resource Waters. Moose Lake absorbs and contributes hydrologic flows to these waters. Moose Lake, however, is influenced by water and land uses from a large portion of the watershed. The Moose River, Little Moose River, and the West Fork of the Chippewa River all contribute hydrologic flows into Moose Lake. Pollutants and aquatic invasive species that exist in these contributing hydrologic systems hold potential to influence the quality of Moose Lake waters. Ultimately, land use decisions made in Bayfield and Ashland counties have potential to affect the quality of Moose Lake.

2. Environmental Corridors

Environmental corridors are linear areas that connect sensitive landscape features, including surface waters, wetlands, and steep topography (greater than 12.5 percent). This linear pattern contains upwards of 90 percent of the natural and cultural features that people value (Lewis, 1996). If protected, environmental corridors preserve the ecological quality and the natural aesthetic character of the landscape.

Analysis Summary

- ***Surface water:*** The National Land Cover database from 2001 documents 10,050 acres of surface waters.
- ***Wetlands:*** The National Land Cover database from 2001 documents 4,917 acres of herbaceous wetlands and 34,278 acres of woody wetlands. In total, there are 39,195 acres of wetlands in the watershed.
- ***Steep topography:*** Based on the Wisconsin Department of Natural Resources 30-meter digital-elevation model, 13,791 acres of land are equal to or steeper than 12.5 percent slope.

Significance to Moose Lake

The Environmental Corridor concept establishes a linear passageway between the Chequamegon National Forest and the Chippewa Flowage, both designated Legacy Landscapes by the WDNR (See Map 4.2). Significantly, Moose Lake provides the connecting link between these Legacy Landscapes.

The features of environmental corridors (i.e. surface water, wetlands, steep topography) are also the most sensitive or vulnerable. Surface waters are influenced by and provide a conduit to carry contaminants such as phosphorus, other dissolved solids, thermal

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Map 4.1

Map 4.2

loads, and heavy metals. Wetlands are significant ecological features as they capture and filter contaminants and slow down the flow of water. Wetlands greatly reduce the potential for flooding from rain events. Because areas of steep topography are prone to erosion, efforts to effectively manage these areas in particular hold the greatest potential to sustain high water quality, promote ecological diversity, and enhance natural aesthetic character.

3. Pre-settlement Vegetation

In the mid-1800's when Wisconsin was first surveyed, surveyors documented not only the Public Land Survey System, but also captured notes about the vegetative cover. This work has established a baseline of pre-settlement vegetative conditions throughout Wisconsin (Kassulki, 2009) (See Map 4.3).

Analysis Summary

- Hemlock, sugar maple, yellow-birch, white pine, red pine covered 99,224 acres or 54 percent of the watershed.
- Swamp conifers (white cedar, black spruce, tamarack, hemlock) covered 59,506 acres or 33 percent of the watershed.
- Sugar maple, yellow birch, white pine, red pine covered 14,555 acres or 8 percent of the watershed.

Significance to Moose Lake

In comparison to the Ecological Reference Area and Refugia inventory conducted for the Moose Lake riparian area, we see that Moose Lake is transitioning towards a climax or pre-settlement condition. Currently, Moose Lake is dominated by white birch, but succeeding to white pine. The 2008 inventory also shows areas of hemlock, sugar maple, and yellow-birch that ultimately should succeed the white pine as the dominant species, likely over the period of several hundred years.

Of particular interest is the area of swamp conifers that extends up from Wolf Island. This conifer swamp remains today as shown in the Ecological Reference Area inventory (see maps 4.3 and 5.5). White cedar in particular, especially on the islands, is making a strong comeback. This resurgence on the islands is hypothesized to be linked to the return of wolves to the area. Deer are less inclined to travel to the islands during winter, because they are more vulnerable to wolves on the ice. The age of white cedar on the islands appears to be related to the reemergence of wolves in the region.

4. Land Cover

A land cover inventory documents the physical materials at the surface of the earth, such as grass, snow, deciduous trees, or water. Conversely, a land *use* inventory records how the land is utilized by humans. For example, while a land cover inventory might document 'deciduous trees,' a land use inventory would document uses, such as 'forestry,' 'recreational,' or even 'residential.'

This land cover inventory uses data from the National Land Cover Database from 2001 using remote-sensing methodologies. Although this inventory was conducted with 30-

meter resolution, developed uses might be hidden under forest canopies and are likely underrepresented (See Map 4.4).

Analysis Summary

- Barren land (rock, sand, clay) = 10 acres
- Cultivated crops = 75 acres
- Deciduous forest = 70,828 acres
- Developed – high intensity = 0 acres
- Developed – medium intensity = 21 acres
- Developed – low intensity = 609 acres
- Developed – open space = 2,025 acres
- Emergent herbaceous wetlands = 4,917 acres
- Evergreen forest = 27,670 acres
- Grassland/herbaceous = 130 acres
- Mixed forest = 31,546 acres
- Pasture/hay = 65 acres
- Shrub/scrub = 30 acres
- Woody wetlands = 34,278 acres

Significance to Moose Lake

This dataset provides a snapshot in time of land cover from 2001. It can be used generally to compare land cover change, though is difficult and generally inappropriate to use for land use analysis. Focusing on Moose Lake specifically, we see that this dataset does not record the known low-intensity development along the shoreline.

5. Publicly Managed Lands

The analysis of publicly managed lands illustrates and quantifies the ownership patterns of land within the watershed (See Map 4.5). The following information provides management information from the various public and quasi-public institutions owning land in the watershed. A specific and consistent management strategy for private lands requires a systematic examination of current land use regulations.

Chequamegon National Forest: The Chequamegon National Forest has several management priorities that include: manage wildlife and ecosystems, provide recreational opportunities (active and passive), enhance natural scenic beauty, supply wilderness opportunities, manage the cultural heritage, manage forest and mineral commodities for sustainable harvest, and manage fire, among others (CNNF, 2004).

Lac Courte Oreilles: The mission statement of the Lac Courte Oreilles tribe includes a statement regarding sustaining natural resources as well as their cultural heritage. It states: "We, the Anishinabeg, the people of Odahwah Zaaga'iganing, the Lac Courte Oreilles Tribe, will sustain our heritage, preserving our past, strengthening our present, and embracing our future.

We will defend our inherent sovereign rights and safeguard Mother Earth. We will provide for the educational, health, social welfare, and economic stability of the present and future generations." (LCO, 2009).

Map 4.3

Map 4.4

Map 4.5

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Other publicly managed lands exist in the area, but are not within the boundaries of the WFCR watershed.

Analysis Summary

- National forests = 145,195 acres or 80 percent of the watershed
- La Courte Oreilles = 570 acres or < 0.3 percent of the watershed
- No other publicly owned lands exist within the watershed. WDNR, federal lands, and county forests, however, exist in close proximity to the watershed.

Significance to Moose Lake

The watershed, by a wide margin, is owned by the USFS and managed for a variety of public purposes. Change within the watershed is largely predictable based upon statements and recommendations articulated in the Chequamegon Forest 2004 plan. Land use change on USFS lands takes into account the effects on ecological quality or aesthetic characteristics. In regard to the riparian area of Moose Lake, the management strategy of the USFS, articulated by Steven Spickerman in 2008, is not to harvest within 300 feet of surface waters.

The largest private inholdings of land within the Chequamegon Forest, however, lie within the riparian areas of most water bodies, including Moose Lake. From an ecological and aesthetic standpoint, the riparian areas are also the most sensitive and valuable. Land use change is most likely to occur within these riparian private inholdings.

To determine the actual potential for change on Moose Lake, additional work is recommended to conduct a build-out assessment for the lake. A build-out assessment will determine the location and extent of developable lands. And within the context of shoreline zoning, county zoning, and county subdivision regulations, the assessment can give a rational determination of land use change. With estimates of population change, a build-out analysis can also provide a reasonable estimate of how many years it will take to reach a build-out condition.

6. Impervious Surfaces

Impervious surfaces are surfaces that are impenetrable or impede the flow of water from percolating into the earth to recharge groundwater. Rooftops, roads, parking lots and other surfaces covered by concrete, asphalt, and other hard surfaces are typical impervious surfaces. Compacted soils and even manicured lawns can be considered impervious surfaces; they impede the filtration of water into the soil, especially on steep topography.

Impervious surfaces become especially problematic during large rain events that generate rapid water runoff. Impervious surfaces speed the flow of water that leads to flooding, thermal loading of coldwater streams, non-point pollution, soil erosion, and groundwater diminution, among other problems.

Analysis Summary

The WFCR watershed, consisting mainly of forest cover, is highly permeable to water. Data from the National Land Cover Database reveal that 97 percent of the watershed is pervious to water and only 3 percent of the landscape is impervious or only partially pervious to water (See Map 4.6). It should be noted that this data, based on remote sensing, likely underestimates the amounts of impervious surfaces in the watershed. Tree canopies hide impervious surfaces from satellite sensors.

To get a more accurate estimate of impervious surfaces for the watershed, an impervious surface analysis should be based on orthophotography with leaf-off conditions and field inspections. Leaf-off orthophotography enables photo-interpreters to better see the surfaces below the tree canopy.

Significance to Moose Lake

It is not surprising that Moose Lake possesses high quality surface waters. Rainfall that is allowed to seep through forest soils is filtered from many contaminants. Water then travels underground where it either becomes groundwater or is shared with surface waters.

This analysis, however, underestimates the significance of the riparian area to water bodies. Impervious surfaces hidden under the tree canopy (i.e. driveways, lawns, rooftops) are not accounted for. The proximity of these impervious surfaces to water bodies in riparian areas can more quickly contribute to the problems associated with water runoff. To accurately determine impervious surfaces for Moose Lake and its potential for degrading the water resource, a more detailed analysis is required.

7. Tree Canopy Density

Tree-canopy density measures the fullness of the forest tree canopy. The data do not measure the fullness of individual crowns; rather, they are measurements of the forest canopy at 30-meter resolution. The data provide an estimate and are useful for such things as, but not limited to:

- Characterization of forest conditions
- Estimating the fuel load for wildfire
- Estimating timber harvest
- Locating suitable habitats for wildlife

Analysis Summary

Data reveal that the WFCR watershed is dominated by a dense forest canopy (See Map 4.7). The vast majority of the watershed has a canopy thicker than 66 percent. Locations of surface waters, especially lakes, are evident from these data. Locations of smaller streams and roads are covered by forest canopy and are difficult to detect on this map.

Significance to Moose Lake

The Moose Lake area, like the watershed, is also dominated by a dense forest canopy. This has various implications for wildlife that use forests, timber harvests, and for wildfire control along the interface between urban and wild areas.

8. Glacial Geology

Glaciers have sculpted much of Wisconsin, affecting not only the topography, but soils and water resources. The glacial geology analysis describes the glacial features present within the WFCR watershed (See Map 4.8).

Analysis Summary

The following glacial features are present within the watershed. Definitions are from Ritter (2009).

- Outwash plain
  - An area of flat or gently sloping surfaces where glacial melt waters fed and overloaded streams beyond the glaciers moraine deposits.
- Pitted Outwash Plain
  - An area characterized by many depressions, including shallow pits, kettles, kettle lakes, and potholes.
- Ground Moraine
  - An area where glacial till has been deposited beneath a melting glacier. Till might include an unsorted mix of rocks, boulders, sand, silts, and clay.
- End Moraine
  - A ridge of till found where the glacier stopped its progression.

Significance to Moose Lake

Deposits near Moose Lake include outwash plain, pitted outwash plain, ground moraine, and end moraine. Landscape features today exist largely from the affects of the glaciers on the landscape thousands of years ago. Further analysis comparing glacial geology patterns to Moose Lake soils and hydrology is necessary for further assessment.

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Map 4.6

Map 4.7

Map 4.8

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Chapter 5. Moose Lake Shoreline Inventory

What are the qualities that bestow Moose Lake with ecological significance, aesthetic majesty, and Northwood's character? With maps, text descriptions, tables, and photographs, citizen contributors have objectively documented the various ecological and aesthetic indicators that make the Moose Lake area a special place to live and play.

This chapter describes each indicator inventoried on or near Moose Lake as well as inventory procedures and results. This inventory establishes a baseline of healthy wildlife and fish habitats; threatened, rare, endangered, native, and invasive species; and characteristics that provide a sense of place and natural scenic beauty. Future efforts can utilize this inventory to measure how these indices of ecological health and aesthetic beauty have changed.

Citizen contributors have inventoried the following items detailed in this chapter:

1. Shoreline ownership
2. Aquatic macrophytes
3. Coarse woody structure
4. Shoreline development
5. Ecological reference areas and refugia
6. Veteran tree specimens
7. Aesthetic shoreline condition
8. Wildlife observations

5.1 Shoreline Ownership

A common and shared strategy to manage land and resources effectively is not possible unless ownership of the land and resources is well documented. This is especially evident on Moose Lake's islands and publicly and quasi-publicly owned shorelines. Personal interviews with United States Forest Service and Xcel Energy representatives revealed that land managers did not realize they held Moose Lake islands. The area's Northwoods character may be undermined by invasive species and other ecological threats. In this study, citizen contributors have found evidence of invasive species (broad and narrow-leaf cattail and their hybrids) next to islands— notably near one island owned by Xcel Energy and 11 islands owned by the USFS.

Inventory Methods

Shoreline data for Moose Lake's mainlands and islands were digitized from National Agricultural Imagery Program orthophotography from 2005. Citizen contributors from the Moose Lake Improvement Association, Ad-hoc Committee on Natural Resources verified navigability of the waterways. Island and mainland shorelines were modified based on these citizen field surveys. Mainland and island shorelines were digitized by Douglas Miskowiak, Center for Land Use Education, 2006.

Ownership status of shorelines is based on multiple sources. These include:

- Sawyer County Land Atlas and Plat Book, 2005
- United States Forest Service property maps

Ownership was verified via personal communication with shoreline and island owners. Ownership status was affixed to the shorelines digitally by Douglas Miskowiak, Center for Land Use Education.

Results

Moose Lake holds 50 miles of shoreline and 82 islands. Mainland shorelines total 38.33 miles, and island shorelines total 11.61 miles (See Map 5.1 and Table 5.1).

Table 5.1. Mainland and Island Ownership

Shoreline Ownership	Miles of Mainland Shoreline	Miles of Island Shorelines	Total Miles of Shorelines
Private	25.23	6.35	31.58
Xcel Energy	0.49	1.51	2.00
United States Forest Service	12.37	3.40	15.76
State of Wisconsin	0.25	0.35	0.59
TOTAL	38.33	11.61	49.94

Map 5.1

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5.2 Aquatic Macrophytes

Aquatic macrophytes are plants that live completely or partially in the water and are large enough to be seen with the naked eye. Aquatic macrophytes can be submersed (have most of their leaves underwater), emergent (plants that have leaves that extend above the water's surface), or floating (plants can be free floating or floating, but rooted to the bottom) (Borman, 1997).

Aquatic macrophytes provide building materials, food, and protection for fish, birds, amphibians, and reptiles. Aquatic macrophytes provide important fish spawning and nursery areas, as well as cover for many species of fish. Emergent aquatic plants are used by birds, reptiles, amphibians and even small mammals for cover and habitat. Lack of vegetation reduces available habitats and can decrease the biodiversity of the lake ecosystem.

Inventory Methods

The inventory of aquatic macrophytes records observations of all types of aquatic macrophytes in the littoral zone of Moose Lake. Only aquatic macrophytes that were visible to the naked eye from boats were inventoried. Volunteer contributors stopped near shorelines to document visible aquatic macrophytes. Moose Lake's tannin-stained waters, however, inhibited an inventory of macrophytes that were completely submerged.

Laura Herman from the University of Wisconsin – Lakes Program assisted and trained citizens in inventory methods and plant identification. Only aquatic plants within the littoral zone of Moose Lake were inventoried.

Physical samples of each type of macrophyte were acquired, bagged, and sent to the Robert W. Freckmann Herbarium at the University of Wisconsin–Stevens Point for identification.

Type of aquatic macrophyte was attributed to the shoreline geodatabase. The database recorded dominant species present, and other less-prominent species. The inventory was conducted by drawing a line parallel to the shoreline. Small perpendicular lines marked the beginning and ending points of a particular portion of the inventory—each of which was represented by a line segment. Each line segment is attributed with a PIN, which was recorded in the aquatic macrophyte log book, along with the names of macrophytes present at that line segment.

Results

The inventory documents aquatic macrophytes for the mainland and island shorelines of Moose Lake. Citizen contributors have identified over 16 types of aquatic macrophytes (See Map 5.2.1). Tables 5.2.1 – 5.2.4 document these observations for mainland and island shorelines. Although aquatic plants were specifically identified in some instances, such as pondweed varieties, the plant identification is generalized in the spatial inventory.

Sixteen plant samples were acquired from Moose Lake and identified by biologists at the Robert W. Freckmann Herbarium at the University of Wisconsin – Stevens Point Campus. These plants include:

1. Long-leaf pondweed	Potamogeton americanus (nodosus)
2. Variable pondweed	Potamogeton gramineus
3. Ribbon-leaf pondweed	Potamogeton epihydrus
4. Spiral-fruited pondweed	Potamogeton spirillus
5. Clasping-leaf pondweed	Potamogeton richardsonii
6. Common arrowhead	Sagittaria latifolia
7. Narrow-leaf cattail (invasive)	Typha angustifolia
8. Broad-leaf cattail	Typha latifolia
9. Water horsetail	Equisetum fluviatile
10. Sedge	Carex utricutata
11. Three-way sedge	Dulichium arundinaceum
12. Stalked wool grass (bulrush)	Scirpus pedicellutus
13. Sweetflag	Acorus calamus
14. Slender naiad (bushy pondweed)	Najas flexilis
15. Floating leaf bur reed	Sparganium fluctuans
16. Northern wild rice	Zizania palustrus

The following plants were identified by volunteer contributors, but no samples were verified by the Freckmann Herbarium.

17. Yellow pond lily	Nuphar advena
18. White water lily	Nymphaea odorata
19. Water hemlock	Cicuta maculate
20. Fire weed	Epilobium angustifolium
21. Fox-tail (sedge)	Carex alopecoidea Tuck.
22. Bulrush (unknown variety)	Scirpus
23. Wild Iris	Iris versicolor or pseudacorus L. (suspected)

Laura Herman, Citizen Lake Monitoring Network Coordinator, explains how to differentiate between narrow and broad-leaf cattails.

Table 5.2.1. Dominant aquatic macrophytes inventoried on mainland shorelines

Aquatic Macrophyte	Miles of Shoreline	Percent of Total Observations
Broad-leaf Cattail (Invasive)	6.00	40.13
Wild Rice	3.0277	20.26
Reed	1.77	11.82
Narrow-leaf Cattail (Invasive)	0.97	6.51
Water Horsetail	0.97	6.51
Common Arrowhead (Wide and Narrow-leaf)	0.58	3.86
Unknown Water Lily	0.49	3.26
Bur Reed	0.24	1.61
Sedge	0.32	2.12
Pondweed	0.24	1.61
Bulrush	0.32	2.12
Unknown Cattail	0.01	0.07
White Water Lily	0.01	0.05
Wild Iris	0.01	0.04
Yellow Pond Lily	0.00	0.03
TOTAL	14.94	100

Table 5.2.2. Dominant aquatic macrophytes inventoried on island shorelines

Aquatic Macrophyte	Miles of Shoreline	Percent of Total Observations
Broad-leaf Cattail (Invasive)	1.5696	35.32
Narrow-leaf Cattail (Invasive)	1.2086	27.20
Common Arrowhead (Wide and Narrow-leaf)	0.4074	9.17
Reed	0.2135	4.80
Wild Rice	0.1695	3.81
Sedge	0.1332	3.00
Bulrush	0.1416	3.19
Pondweed	0.1257	2.83
Bur Reed	0.1257	2.83
Water Horsetail	0.2135	4.80
Unknown Cattail	0.0361	0.81
Unknown Water Lily	0.0360	0.81
Mixed	0.0336	0.76
Water Hemlock	0.0301	0.68
TOTAL	4.4441	100

Table 5.2.3 All aquatic macrophytes inventoried on mainland shorelines

Aquatic Macrophyte	Miles of Shoreline	Percent of Total Observations
Broad-leaf Cattail (Invasive)	7.57	46.81
Wild Rice	3.03	18.73
Reed	1.77	10.92
Narrow-leaf Cattail (Invasive)	0.97	6.02
Mixed	0.62	3.82
Common Arrowhead (Wide and Narrow-leaf)	0.58	3.56
Unknown Water Lily	0.49	3.02
Sedge	0.32	1.96
Bur Reed	0.32	1.96
Water Horsetail	0.24	1.48
Pondweed	0.24	1.48
Bulrush	0.01	0.04
Unknown Cattail	0.01	0.07
White Water Lily	0.01	0.04
Wild Iris	0.01	0.04
Yellow Pond Lily	0.00	0.02
Foxtail	0.00	0.02
TOTAL	N/A	100

Table 5.2.4. All aquatic macrophytes inventoried on island shorelines

Aquatic Macrophyte	Miles of Shoreline	Percent of Total Observations
Broad-leaf Cattail (Invasive)	1.5696	32.02
Narrow-leaf Cattail (Invasive)	1.2086	24.66
Common Arrowhead (Wide and Narrow-leaf)	0.5107	10.42
Water Horsetail	0.2727	5.56
Wild Rice	0.2657	5.42
Reed	0.2334	4.76
Bur Reed	0.1742	3.55
Pondweed	0.1688	3.44
Sedge	0.1597	3.26
Bulrush	0.1416	2.89
Unknown Water Lily	0.0405	0.83
Unknown Cattail	0.0361	0.74
Mixed	0.0336	0.69
Water Hemlock	0.0301	0.61

Fire Weed	0.0301	0.61
Wild Iris	0.0265	0.54
TOTAL	N/A	100

Significance

Broad and Narrow-leaf Cattails

The broad and narrow-leaf cattails and their resultant hybrids are often confused with each other and both varieties have tremendous capacity to grow, spread, and become invasive. The broad and narrow-leaf cattails are known to cross-pollinate and hybridize into an equally fertile and invasive Typha x glauca (Spickerman, 2008). Though both species are native to Wisconsin, neither are native to Moose Lake and were not present in the Moose Lake area 100 years ago (Spickerman, 2008). Both species are invasive and can take over shallow areas and other established plants in shallow areas. The broad-leaf cattail grows in moist soil in up to a meter of water. The narrow-leaf cattail grows in disturbed sites with brackish water up to 0.5 meters (Borman, 1997).

Although a suitable habitat for birds and mammals, cattail patches are too dense to be of much use to fish for spawning or protection. Cattails, if crowding out other aquatic macrophytes in shallow areas, could be further detrimental to fish that rely on these macrophytes for cover, food, and spawning. On Moose Lake, the drawdown of water levels could be suspect in assisting cattails to the detriment of other shallow, emergent macrophytes (Spickerman, 2008).

Patches of both broad and narrow-leaf cattails should be monitored for growth and spread of patches. Because they are aggressive, cattails can squeeze out other types of macrophytes, including wild rice (See Map 5.2.2). Currently, and by a wide margin, the broad leaf cattail is the most prevalent aquatic macrophyte on Moose Lake. The narrow-leaf cattail is also widely prevalent and even more so near island shorelines.

Wild Rice

Wild rice grows throughout the eastern half of the United States, but is most common in northern Wisconsin and Minnesota. Wild rice has very specific habitat requirements that include:

- pH of 6.8-8.8
- sulfate concentrations of < 10 parts per million
- alkalinity from 5-250 parts per million
- rooting depth in 10cm to 1 meter of water
- slow changes in water levels

Wild rice is particularly important for fish spawning on Moose Lake. Spickerman (2008) noted that in the absence of other macrophytes in the spring, likely due to the lake's drawdown, species such as perch attenuate their eggs to wild rice. On Moose Lake, perch are the primary food source for walleye and particularly important for walleye success.

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Map 5.2.1

Map 5.2.2

5.3 Coarse Woody Structure

The inventory of Coarse Woody Structure (CWS) documents tree falls, stumps, and logs in the littoral zone of Moose Lake. CWS is important to lake riparian and littoral ecosystems; it creates and provides habitat complexity and species diversity. CWS also contributes to carbon and nutrient flows to aquatic ecosystems (Harmon et al. 1986). Christensen et al. (1986) found a positive correlation between CWS and forested riparian areas, and a negative correlation between CWS and shoreline development.

Inventory Methods

The inventory of CWS documents observations of tree falls, stumps, and logs found within the littoral zone of Moose Lake. Only CWS visible from aboard a boat in the near shoreline area was inventoried. CWS that was completely submerged was not included in the inventory. The inventory conducted on Moose Lake uses procedures modified from the University of Wisconsin Limnology Department (http://lter.limnology.wisc.edu/spatial/source/cwd_web.htm).

Volunteer contributors from the Moose Lake area were trained by Douglas Miskowiak, Land Use/GIS Specialist from the UW–Stevens Point Center for Land Use Education and by Laura Herman, Citizen Lakes Monitoring Program Coordinator, UWEX Lakes Program. The inventory of CWS was classified into the following categories:

1. Continuous (CWS found repeatedly and continually in the littoral zone)
2. Scattered (CWS found consistently, but with less frequency)
3. Isolated (solitary or individual locations of CWS)
4. Absent (no CWS was visible above the water's surface)

Contributors used large-format, hardcopy maps and indelible marking pens to document the locations of CWS. A line, representing the shoreline, was drawn on the maps. Perpendicular lines denote the beginning point and ending point of the line segment. Between the perpendicular lines, an attribute was entered, recording a unique personal identification number (PIN) (see Figure 5.31). The PIN on the map corresponds to the PIN in the CWS inventory log book. Contributors denoted the CWS category for each line segment in the log book.

Figure 5.31. Illustration of CWS Inventory Methods

Contributors recorded observations of CWS by drawing lines parallel to the shoreline. Shorelines with differing CWS characteristics are separated by small perpendicular lines. Each line segment is recorded with a Personal Identification Number (PIN). The PIN is also recorded in a log book and the CWS status is noted.

Results

Tables 5.31 and 5.32 showcase miles of shoreline by CWS category derived from data collected by citizen contributors. Map 5.3 illustrates the spatial character of coarse woody structure on Moose Lake.

Table 5.31. Island Littoral Coarse Woody Structure

Category	Miles of Shoreline
Continuous	3.5
Scattered	5.2
Isolated	0.1
Absent	2.6
Area Not Observed	0.1

Table 5.32. Mainland Littoral Coarse Woody Structure

Category	Miles of Shoreline
Continuous	14.8
Scattered	10.9
Isolated	2.2
Absent	6.9
Area Not Observed	3.6

Significance

On land, trees live an accomplished life. Living upwards of several hundred years, trees provide shelter for wildlife and in riparian areas provide shade and protection for fish and aquatic organisms. Natural decay, often hastened by wind, starts the second life of a tree in the littoral zone. In the water, the tree as coarse woody structure provides countless organisms, including fish, with habitat; as it decays further, it returns nutrients back to life in the lake. *"And use of the tree by a variety of organisms would continue again for much longer than its life on land; remarkably perhaps 300 to 600 years…"(Bozek, 2001).* Hemlocks, native to this area, can live up to 700 years, standing and eventually decaying in the environment over thousands of years (Spickerman, 2008).

Fish Habitat

It is clear that CWS provides habitat for fish and other aquatic organisms. Individual trees provide habitat, but a more complex littoral zone, with a mosaic of many fallen trees, is better. Many species of fish use fallen logs and stumps to incubate and protect their brood. Small mouth bass build their nests adjacent to or under CWS to reduce the perimeter in need of their protection. The young of many species disperse throughout branches for protection; muskellunge use the same branches to ambush prey, while diurnal species, such as walleye, use CWS to seek refuge in the daytime (Bozek, 2001).

CWS in lakes is maintained through a process called the *recruitment cycle.* Trees that grow in riparian areas, mature and fall into the water. Seedlings replace fallen trees, growing and repeating the cycle. Natural factors, such as fire can inhibit or pause the cycle. Human pursuits, such as forestry, also interrupt, but do not stop, the cycle. Saplings continue to grow in the riparian area. The biggest threat to the recruitment cycle is from shoreline developers that alter the riparian area by removing vegetation, and

Map 5.3

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maintain this unnatural state by continually removing young trees and understory (Bozek, 2001). Without younger trees, there is no potential for future recruitment of CWS.

CWS is most abundant on smaller lakes with undeveloped shorelines. Christensen et al. (1996) found that in lakes with no shoreline development, the shorelines averaged 555 logs/km. Developed lakes with undeveloped shorelines averaged 379 logs/km, while developed shorelines average 57 logs/km.

Coarse woody structure is especially evident along undeveloped shores.

5.4 Shoreline Development

This inventory documents observations of development (manmade structures) in the near shoreline area, visible from the littoral zone. Shoreline development is a useful indicator for examining fish spawning habitats, riparian wildlife habitats, and aesthetics.

Inventory Methods

The inventory of shoreline development includes manmade structures visible from the littoral zone of Moose Lake. The tree canopy was at full leaf-on condition during the inventory. The inventory used on Moose Lake was modified from the inventory conducted by the University of Wisconsin Limnology Department as part of the National Science Foundation-sponsored Research Opportunities for Undergraduates program, 1996.

The inventory on Moose Lake denotes manmade objects both in the littoral and riparian areas of Moose Lake. Volunteer contributors from the Moose Lake area, trained in inventory procedures, conducted the inventory by boat from the littoral zone of the lake. Douglas Miskowiak from the University of Wisconsin–Stevens Point, Center for Land Use Education, conducted the training exercise. Manmade structures and objects visible from the littoral zone were documented both on hardcopy maps and in the shoreline development log book. Locations of manmade structures and objects were denoted on hardcopy maps with a dot and a personal identification number (PIN). The PIN is also denoted in the shoreline development log book along with notes describing the object.

Contributors were equipped with the following inventory tools to conduct the inventory:

- large-format hardcopy maps of Moose Lake showing 2005 NAIP orthophotography, 1-meter resolution
- shoreline development log book
- indelible marking pens

Results

Six-hundred ninety-two manmade structures or objects that were visible from the littoral zone of Moose Lake were documented (See Map 5.4). These include:

- 268 residences (houses, cabins, mobile homes, condominiums)
- 41 accessory buildings (garages, sheds, gazebo)
- 33 boat houses (boat slips with a cover, large and small)
- 10 boat launches (private and public, large and small)
- 315 docks, piers, decks (large and small)
- 5 bridges (automobile and pedestrian foot bridges)
- 5 club houses, lodges
- 3 picnic sites
- 1 dam
- 1 gas pump
- 1 sunken boat
- 1 utility line
- 8 miscellaneous (outhouse, diving board, pump house, bench, signs)

Significance

Muskellunge

Moose Lake is currently regarded as a self-sustaining walleye and muskellunge fishery. In regard to muskellunge, lakes characterized as self-sustaining exhibit shorelines with fewer alterations. Lakes that required stocking had extensively developed shorelines (Rust et al., 2002). The study also indicated that development along the shoreline is a more important indicator of fishery health than development within a lake's watershed. According to Rust et al., self-sustaining muskellunge lakes had a significant percentage of undeveloped shorelines (80 percent) as compared to lakes that required stocking (59 percent undeveloped shoreline). Studies conducted by Trautman (1981) and Dombeck et al. (1984) also indicate that human development affects muskellunge reproduction and overall numbers success.

Riparian Areas

Riparian areas serve as an interface between terrestrial and aquatic ecosystems and, if healthy, are home to a wealth of wildlife diversity. Riparian areas supply food, cover, and water, serve as migration routes, and offer connectors between habitats for wildlife. Riparian areas also remove excess nutrients and sediments from water runoff before they enter surface waters. Riparian vegetation is important in slowing down, cooling, and removing excess nutrients from surface water runoff. Riparian areas however are also coveted for their aesthetic beauty, bounty for hunting and fishing, and other recreational opportunities, making them vulnerable to severe alteration (Montgomery, 1996).

Development and human modification can have adverse affects on wildlife and aesthetics in riparian areas. Development can lead to edge and isolation effects that disturb the stability of ecosystems. Edge effects decrease the area of core habitats. Some species, such as whitetail deer, thrive along habitat edges, but detrimental effects include (NRCS, 2004a)(URPL & DNR, 2002):

- Loss of native vegetation
- Greater frequency and severity of wildfire
- Greater predation by native and exotic predators
- Higher probability of nest predation
- Greater windfall potential
- Greater intensity of browsing and grazing
- Greater disturbance that favors growth of exotic invasive species.

As habitat continues to become fragmented, the connectivity of the habitat corridor decreases and it becomes more difficult for species to disperse and migrate between habitat patches. Maintaining habitat connections is important for maintaining the long-term survival of fish and other wildlife. Riparian areas provide some of the most valuable habitat connections (NRCS, 2004a).

Aesthetics

The Moose Lake area is said by residents and visitors to be endowed with Northwood's character and natural scenic beauty. What exactly are the characteristics of Moose Lake that create a Northwood's atmosphere and draw people to live and play here? Can these characteristics be measured, and how does landscape change affect these characteristics?

Considerable research asserts that the characteristics that make a place beautiful *can* be measured. Agreement and predictability of test results have shown that people typically agree about what is considered beautiful. Research also shows that natural-appearing characteristics appeal most and that the public tends to have a common perception of what constitutes natural scenic beauty (Galliana and Loeffler, 2002. Litton and Tetlow, 1978. Lee, 1976. McGuire, 1979. Newby, 1971. Noe, 1988. Zube, 1976).

Gallianna and Loeffler (2002) identify elements of landscape character that can be measured. These elements include: land form, vegetation, aquatic forms, cultural features, and landscape themes that indicate how people perceive landscapes. Landscapes that are perceived as visually whole, meaning that the landscape consistently exhibits the characteristics of a landscape theme—such as Northwood's character—have scenic integrity.

Visible development and modifications to the littoral and riparian areas have potential to dramatically alter the naturally scenic Northwood's character of Moose Lake. Such modifications are shown to significantly alter the aesthetic experience and ultimately affect property values. In 2001, scenic beauty and relaxation was the number one reason tourists cited for spending $11.4 billion in Wisconsin (Simon, 2005). In Minnesota, survey results revealed that over 85 percent of waterfront property owners and lake users cited development as the primary factor altering the aesthetic experience of the lake. Other factors included installation of docks and boat lifts and removal of riparian vegetation (Simon, 2005). These manmade intrusions may also affect water quality—another aesthetic contributor. Related to property values, good water quality can add as much as $200 per foot of shoreline.

An example of shoreline development that maintains riparian vegetation and helps to preserve the scenic and ecological integrity of the riparian and littoral zones of Moose Lake.

Map 5.4

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5.5 Ecological Reference Areas and Refugia (Indicators of Rare or Endangered Species)

"Plants are always on the move," said Steven Spickerman, United States Forest Service (2008). He insists that instead of looking for individual plants, it is more important to map assemblages of healthy ecosystems (See Map 5.5). Ecological Reference Areas are used by the USFS to show good representations of healthy ecosystems. These areas represent sites in which ecological processes are functioning within a normal range of variability, and where the plant community has adequate resistance to, and resiliency from, most disturbances. These areas are not 'pristine,' but historically are unused lands (Spickerman, 2008).

The Moose Lake riparian area is in succession, meaning it is changing from one ecological form to another. Currently, the landscape in many areas is ceding from white birch to white pine. White pine might be reasonably expected to remain as a climax species in the area, but will likely cede to the historical climax species: sugar maple, yellow birch, and hemlock. While white pine can live up to 300 years, hemlock lives 400 to 700 years. Pine transition to climax species unless a disturbance, such as fire or wind, maintains the condition. Wind is the prominent disturbance in this area, at times toppling trees because of loose soils due to moisture (Spickerman, 2008).

Spickerman also explained that Moose Lake provides refugia for species, such as white cedar. Refugia or refugium, according to Dictionary.com are "areas where special environmental circumstances have enabled a species or community of species to survive after extinction in surrounding areas." White cedar, for example, is a rarity in the area because, as Spickerman noted, they are 'candy' to deer. Moose Lake's remaining stands of white cedar on several islands are perhaps one of ten sites in over 400,000 acres that hold significant stands of cedar (Spickerman, 2008). According to Spickerman, the re-introduction of wolves provides a valid hypothesis to explain the white cedar refugia. With wolves present, deer are very vulnerable to wolves on the ice; therefore they are much less inclined to cross the ice to the islands to feed on the white cedar.

Inventory Methods

Ecological reference areas and refugia were inventoried based on procedures described by Spickerman (USFS, 2008). Douglas Miskowiak from the University of Wisconsin-Stevens Point and Ben Niemann of Moose Lake field-tested the inventory procedures. Citizen contributors conducted the inventory of the riparian area by boat from the near shoreline (5 to 20 meters) area of Moose Lake. Predominant and secondary riparian tree species, discernible from the near shoreline area, were inventoried. Individual specimens in stands were not recorded.

Ecological Reference Areas are divided into homogenous units, determined by visual examination of riparian tree species of the same type and relative frequency. Indelible marking pens were used to discern homogenous units on large-format, hardcopy maps. Homogenous units were represented with parallel lines drawn to the shoreline. Small perpendicular lines separated homogeneous units. A PIN was assigned to each unit on

the map as well as in a log book. The log book included the attributes of each homogeneous unit.

Results

Tables 5.51 – 5.56 describe the results of the Ecological Reference Area inventory.

Table 5.51. Dominant riparian tree species on mainland shorelines

Dominant Tree Species	Miles of Shoreline
WHITE BIRCH	20.77
WHITE PINE	7.21
SPRUCE	2.58
RED PINE	0.85
TAMARACK	0.73
HEMLOCK	0.47
OAK	0.45
RED MAPLE	0.32
LARGE TOOTH ASPEN	0.31
BLACK SPRUCE	0.16
SUGAR MAPLE	0.16
JACK PINE	0.14
YELLOW BIRCH	0.12
GRASS	0.07
BALSAM	0.05
BLACK ASH	0.04
Area Not Observed	3.90

Table 5.52. Dominant riparian tree species on island shorelines

Dominant Tree Species	Miles of Shoreline
WHITE PINE	5.47
WHITE BIRCH	2.50
SPRUCE	0.73
HEMLOCK	0.54
WHITE CEDAR	0.38
BOG	0.17
RED PINE	0.13
SUGAR MAPLE	0.09
JACK PINE	0.03
Area Not Observed	1.07

Table 5.53. Riparian succession on mainland shorelines.

Dominant Tree Species	Succession	Sub-species	Miles of Shoreline
White Birch	to	White Pine	10.27
White Pine	from	White Birch	5.01
White Pine	to	Hemlock	2.61
White Pine	to	Sugar Maple	3.21
White Pine	to	Yellow Birch	0.03

Table 5.54. Riparian succession on island shorelines.

Dominant Tree Species	Succession	Sub-Species	Miles of Shoreline
White Birch	to	White Pine	1.83
White Pine	from	White Birch	1.82
White Pine	to	Hemlock	3.17
White Pine	to	Sugar Maple	1.45
White Pine	to	Yellow Birch	0.30

Table 5.55. Observations of unique riparian trees (dominant and sub-species)

Tree Species	Location	Miles of Shoreline
White Cedar	Islands	2.61
White Cedar (none dominant)	Mainland	1.59
Tamarack	Islands	0.66
Tamarack	Mainland	2.34

Table 5.56. Locations of riparian tree refugia.

Refugia Species	Location	Miles of Shoreline
Spruce	Mainland	0.05
Tamarack	Mainland	0.51
White Cedar	Mainland	0.05
White Cedar	Islands	0.49
Large Toothed Aspen	Mainland	0.90

Significance

Moose Lake riparian vegetation is succeeding its way back to its original-climax condition. White birch, currently the primary riparian tree in the Moose Lake area, is largely giving way to white pine. In many instances, sugar maple, yellow birch, and hemlock are making a comeback. Left undisturbed, these species over several hundred years will succeed pine to become the climax species. A tamarack stand also exists on

Moose Lake's north shore, and has likely reached its climax state. Notably, comparing Ecological Reference Areas to map 4.3, pre-settlement vegetation, shows that the tamarack swamp existed in this location in the early 1800's.

Wayne Janitschke documents occurrences of coarse woody structure on the hard copy maps.

Steven Spickerman from the United States Forest Service shares his professional expertise and relates it to resources on Moose Lake. Mike Heim of the Couderay Waters Regional Land Trust makes observations of the ecological condition of Moose Lake shorelines.

This stand of tamarack, documented by citizen contributors in 2008, was also documented in the 1800s by surveyors laying out the public land survey system.

Map 5.5

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5.6 Veteran Tree Specimens

Veteran trees are defined as trees that are of interest biologically, aesthetically, or culturally due to their age, size, or condition relative to the specie (Newton, 2007). Biologically, veteran trees can provide 'micro-habitats' for wildlife and even microorganisms. Aesthetically, veteran trees provide unique and valued landscape experiences to those who view them. All else held equal, landscapes with veteran trees provide a more valued aesthetic experience. Culturally, veteran trees link humans to a different era in human time—some trees date back to European colonization and before.

Inventory Methods

An inventory of veteran trees is not based on a single type of tree characteristic and is unique to the specie inventoried. For example, a veteran white birch—a specimen that lives to 80 years—is different from hemlock, which lives on upward to 700 years.

Inventory procedures were developed and field-tested by Douglas Miskowiak, University of Wisconsin–Stevens Point and Ben Niemann, professor emeritus of landscape architecture and urban and regional planning. The inventory of riparian veteran tree specimens was conducted by citizen contributors in boats along the near shoreline (5 to 20 meters) area of Moose Lake. Individual specimens were compared to other trees of the same species along Moose Lake. Several specimens were examined and measured to gauge examination techniques. Upon close inspection, veteran white pine, for example, were found to be 24 inches or larger at breast height.

Veteran tree specimens were recorded by drawing the location of each specimen on large-format, hardcopy maps using indelible marking pens. The type of specimen was also recorded on the hardcopy maps as well as in a log book, identified by a PIN.

Results

The inventory documents 203 veteran tree specimens of nine different species (see Table 5.61 and Map 5.5.

Table 5.61. Number of Veteran Tree Observations

Specimen	Number
White Pine	179
Red Pine	16
Large Toothed Aspen	2
APS	1
Black Spruce	1
Hemlock	1
Spruce	1
White Cedar	1
Yellow Birch	1
Total	**203**

5.7 Aesthetic Shoreline Condition

Inventory Methods

Aesthetic shoreline condition was inventoried based on degree of a shoreline's natural state, unmodified by manmade contributions. Shorelines are classified into three categories:

1. Natural
2. Modified
3. Highly modified

Natural shorelines exist in a natural condition and are visibly without human modification in the riparian area. Modified shorelines show signs of human modification, including slight to moderate removal of vegetation and/or visual presence of development. Highly modified shorelines show significant signs of human modification, including intensive removal of riparian trees and vegetation and/or prominently visible development.

Shorelines were inventoried by boat in the near shoreline (5 to 20 meters) area. Aesthetic shoreline condition (natural, modified, highly modified) was attributed to mainland and island shorelines of Moose Lake on large-format, hardcopy maps using indelible pens. Individual line segments with a unique attribute were divided using small lines drawn perpendicular to the shoreline. Attributes were affixed directly to hardcopy maps.

Results

The following tables describe the results of the Aesthetic Shoreline Condition inventory. Map 5.7 compiles the spatial results of the inventory.

Table 5.71. Aesthetic condition of mainland shorelines.

Aesthetic Shoreline Condition	Miles of Shoreline
Natural	21.40
Modified	11.77
Highly Modified	1.32
Area Not Observed	3.84

Table 5.72. Aesthetic condition of island shorelines.

Aesthetic Shoreline Condition	Miles of Shoreline
Natural	10.30
Modified	0.65
Highly Modified	0.02
Area Not Observed	0.64

Significance

See section 5.4, Shoreline Development.

Map 5.7

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5.8 Wildlife Observations

This section documents wildlife observations made by residents of Moose Lake in Sawyer County, Wisconsin. Various fauna were observed.
These include:

- Elk
- Wolves
- Fox
- Bear
- Bobcat
- Chipmunks
- Whitetail deer
- Raccoons
- Porcupine
- Ground hogs
- Mink
- Muskrats
- Otters
- Turtles
- Owls
- Bald Eagles
- Hawks (unspecified)
- Osprey
- Raptors (unspecified)
- Buzzards
- Ducks
- Geese
- Loons
- Herons
- Sandhill cranes
- King Fishers
- Woodcock
- Woodpeckers
- Hummingbirds
- Swallows
- Turkey
- Grouse
- Ruffed Grouse

Methods

Hardcopy maps were created illustrating Moose Lake shorelines and islands and depicting various landmarks, such as the United States Forest Service campground. Each map included instructions about:

- how to denote observation locations
- how to record further information about the observation
- how to get information back to the consultant.

Volunteers given hardcopy maps were instructed to record observations throughout the summer. Volunteers could record any type of wildlife observation; they were not expected to differentiate among multiple observations of the same specimen. This strategy allowed investigators to identify spatial patterns, variation, and diversity of species.

Results

Forty-one hardcopy maps were distributed to volunteers to record observations. Thirty-six maps were returned complete with observations and notes. In total, 287 individually recorded observations were inventoried (see Table 5.8) (see Map 5.8). The first observation recorded was on May 25, 2008. The last observation recorded was on October 20, 2008.

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Map 5.8

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Table 5.8. Wildlife Observations and Notes from Participants

Observation	Date Observed	Species	Notes
1	5/25/2008	LOON	Loon nest
2	6/1/2008	FOX	Fox and baby
3	6/1/2008	BEAR	
4	6/1/2008	DEER	Doe and 2 fawns.
5	6/1/2008	TURKEY	
6	6/9/2008	LOON	Mom and dad loon and 4 babies
7	6/24/2008	LOON	With babies.
8	6/25/2008	LOON	In front of Mystic Moose by bridge in late June.
9	7/1/2008	OTTER	
10	7/1/2008	DUCK	Wood ducks
11	7/1/2008	LOON	
12	7/2/2008	BEAR	Black bear crossing Moose Lake Rd.
13	7/2/2008	LOON	
14	7/3/2008	LOON	
15	7/4/2008	OSPREY	Osprey in nest on island 20.
16	7/6/2008	LOON	
17	7/10/2008	LOON	
18	7/10/2008	LOON	
19	7/12/2008	HERON	Great blue heron feeding.
20	7/14/2008	PORCUPINE	Walking along Camp Ground road.
21	7/15/2008	LOON	By boat - heron on shore.
22	7/15/2008	LOON	3 loons swimming
23	7/15/2008	LOON	3 loons swimming.
24	7/15/2008	LOON	3 loons swimming.
25	7/15/2008	LOON	3 loons swimming - heron on shore.
26	7/15/2008	LOON	2 loons swimming.
27	7/17/2008	LOON	Loon diving and catching a fish. Observed on bridge.
28	7/19/2008	DEER	Spike buck.
29	7/19/2008	BEAR	Bear and cub. Mama bear walked centerline of road approximately 200'. Cub 50' ahead and took off in brush.
30	7/19/2008	LOON	2 loons.
31	7/19/2008	LOON	2 loons.

32	7/20/2008	BIRD	Summer of 2008, observed noticeable decline in the number of birds at the feeder, particularly goldfinch and hummers.
33	7/21/2008	FOX	Young fox near Moose Lake Rd.
34	7/21/2008	RAPTOR	Low level raptor fight between osprey and another unidentified large raptor which stayed a couple hundred feet away.
35	7/21/2008	OSPREY	Osprey vs. smaller bird. Dispute including aerial acrobatics.
36	7/21/2008	FOX	Fox crossing Cty Hwy S at Charlies FF restaurant.
37	7/21/2008	OTTER	2 otter by dock.
38	7/23/2008	TURTLE	Two turtles on stump
39	7/23/2008	FOX	2 kit fox near Forest Circle Drive
40	7/24/2008	DEER	2 fawns and 1 doe in yard.
41	7/24/2008	OSPREY	Osprey flying low overhead near island 20.
42	7/25/2008	GEESE	Mother goose and 2 babies (30 geese at Pine Point Bridge).
43	7/25/2008	HERON	Great blue heron in bay near house.
44	7/26/2008	FOX	Red fox.
45	7/26/2008	TURKEY	Wild turkey and ruffed grouse
46	7/26/2008	LOON	Two loons diving near skull.
47	7/26/2008	OSPREY	Two osprey flying over Bill's.
48	7/27/2008	LOON	2 loons up the Little Moose.
49	7/27/2008	DUCK	8 black ducklings with mother black duck.
50	7/27/2008	DUCK	Merganser duck (female) Niemann Bay.
51	7/27/2008	LOON	
52	7/27/2008	LOON	
53	7/27/2008	LOON	
54	7/28/2008	TURKEY	2 adult, 2 young turkeys.
55	7/28/2008	OSPREY	Observed 2 osprey hawks and 2 eagles fighting over a fish that the osprey had caught.
56	7/28/2008	HERON	Saw big blue heron perched atop a tall pine at water's edge (morning)
57	7/29/2008	OTTER	Pair of otters in bay.

58	7/30/2008	BEAR	100' from Pine Point Drive on "S". Yearling black bear.
59	7/30/2008	BEAR	Large bear crossed B by Reed Lake.
60	7/30/2008	BEAR	Small bear in Schuman's driveway.
61	7/31/2008	DEER	2 fawn observed end of Pine Point Rd - seen by visitor to lake.
62	8/1/2008	LOON	Loons practice flying.
63	8/1/2008	HERON	Heron in marsh, north end of lake.
64	8/1/2008	HERON	West side of lake.
65	8/1/2008	DUCK	Woody flying along shoreline.
66	8/1/2008	BUZZARD	Flying - Moose Lake club islands.
67	8/2/2008	BOBCAT	
68	8/2/2008	OTTER	4 otter near next door.
69	8/2/2008	TURKEY	Pair of turkeys and 8 chicks
70	8/3/2008	DEER	Mama, twins, yearling, passed from E to W - skittish after storm. Came back 1/2 hour later - stayed to munch.
71	8/3/2008	DEER	Deer often.
72	8/3/2008	DEER	1 doe
73	8/4/2008	PILEATED WOODPECKER	
74	8/4/2008	FOX	Fox in yard.
75	8/4/2008	HERON	In bay near house.
76	8/4/2008	LOON	Loon in bay - Evening
77	8/4/2008	OTTER	Otter family (5). Canada geese
78	8/4/2008	DEER	1 doe
79	8/4/2008	DEER	Doe and fawn.
80	8/5/2008	DEER	Mom and fawn
81	8/5/2008	LOON	2 loons observed while pontoon boating.
82	8/5/2008	TURTLE	Large snapping turtle in lake - our beach.
83	8/5/2008	LOON	
84	8/6/2008	DUCK	10 ducks near dock. 3 otter off dock.
85	8/6/2008	DEER	Doe
86	8/7/2008	WOLF	Wolf call 4:00 am.
87	8/8/2008	LOON	2 loons
88	8/8/2008	DEER	Fawn and doe
89	8/8/2008	OSPREY	2 in nest, 1 in tree.
90	8/8/2008	DUCK	Female

91	8/8/2008	LOON	
92	8/9/2008	LOON	Swimming - west fork entrance.
93	8/9/2008	LOON	
94	8/9/2008	DUCK	3 mallard ducks flying - west fork entrance.
95	8/9/2008	DUCK	wood duck flying - west fork - rice beds.
96	8/9/2008	DUCK	Mallard flying
97	8/10/2008	LOON	Observed a single loon out in the lake.
98	8/10/2008	PINK LADY SLIPPERS	
99	8/10/2008	OWL	Hear owl
100	8/10/2008	LOON	
101	8/11/2008	OSPREY	Noon - In bay osprey family. Flight training and choir practice.
102	8/11/2008	DEER	Doe
103	8/11/2008	MUSKRAT	Swimming
104	8/11/2008	DUCK	2 diver ducks flying.
105	8/11/2008	OSPREY	On tree chirping.
106	8/11/2008	OSPREY	Flying back to roost.
107	8/12/2008	EAGLE	Downstream of Moose Lake Dam. Fish Refuge - Sitting in a tree.
108	8/12/2008	BEAR	Black bear crossing ML Rd near Lenachen's.
109	8/12/2008	LOON	
110	8/13/2008	DEER	Fawn in yard.
111	8/13/2008	EAGLE	
112	8/13/2008	EAGLE	
113	8/13/2008	OSPREY	2 osprey
114	8/13/2008	LOON	
115	8/13/2008	HERON	Blue heron
116	8/14/2008	OTTER	Parents and young
117	8/14/2008	LOON	
118	8/14/2008	LOON	
119	8/14/2008	LOON	
120	8/14/2008	TURKEY	Turkey in yard.
121	8/14/2008	OTTER	Observed 2 otter playing in the bay.
122	8/14/2008	MINK	Seen in front of Mystic Moose. Seen several times.
123	8/14/2008	OTTER	Seen several days. 4 otter in front of Mystic Moose - throughout summer and fall.

124	8/15/2008	LOON	Loon in front of house
125	8/15/2008	LOON	Loon swimming.
126	8/16/2008	DEER	Doe
127	8/17/2008	LOON	Our neighbor observed a loon being attacked and pulled under water by what was assumed to be an otter. She observed several otter swimming in the area the previous day.
128	8/18/2008	DEER	Twin fawns and mom, playing and running.
129	8/18/2008	GROUND HOG	On deck.
130	8/18/2008	DUCK	Observed a mother wood duck with her brood of young ducklings.
131	8/18/2008	LOON	
132	8/18/2008	EAGLE	In bay by stone houses.
133	8/19/2008	LOON	
134	8/19/2008	LOON	
135	8/19/2008	LOON	
136	8/21/2008	TURKEY	Turkey near Picchetti's
137	8/21/2008	EAGLE	Observed an eagle in our yard eating a fish.
138	8/21/2008	LOON	
139	8/21/2008	LOON	
140	8/21/2008	LOON	
141	8/21/2008	LOON	
142	8/21/2008	DEER	7 deer
143	8/22/2008	FOX	2 young fox - throughout front yard.
144	8/22/2008	TURKEY	Observed a mother turkey with 10 babies.
145	8/23/2008	GROUSE	In driveway
146	8/23/2008	SANDHILL CRANE	3 Sandhill cranes flying.
147	8/23/2008	LOON	
148	8/23/2008	DEER	
149	8/23/2008	DEER	
150	8/24/2008	OTTER	2 otters (adult) lazing and fishing the bay for 20 min. When they appeared to approach the shore, my yellow lab pitched a fit, which drove them back to the main lake.
151	8/25/2008	DEER	2 bucks, 1 with small antlers, other bigger, in driveway.

152	8/25/2008	DEER	2 fawns
153	8/26/2008	PILEATED WOODPECKER	Observed 2 Pileated woodpeckers.
154	8/26/2008	OSPREY	Osprey in air over water.
155	8/26/2008	DUCK	2 wood ducks flying
156	8/28/2008	OTTER	Observed 3 otter playing up the West Fork of the Chippewa River.
157	8/28/2008	LOON	
158	8/29/2008	DUCK	
159	8/29/2008	OSPREY	Osprey in air over Bill's house.
160	8/29/2008	LOON	swimming and diving.
161	8/29/2008	LOON	
162	8/29/2008	LOON	
163	8/31/2008	LOON	Loon call on Moose. Also, numerous loon calls and sightings of loons on Moose across from Dam in early spring.
164	8/31/2008	PILEATED WOODPECKER	In flight
165	9/1/2008	OSPREY	Nesting platform is nearby; therefore osprey sightings are daily.
166	9/1/2008	DEER	We see deer daily/bi-daily.
167	9/1/2008	GEESE	Observed 2 pair of Canada geese and several blue winged teal.
168	9/1/2008	EAGLE	Observed 2 eagle flying along the river.
169	9/3/2008	EAGLE	By the mail boxes
170	9/3/2008	EAGLE	American eagle in flight.
171	9/3/2008	LOON	
172	9/5/2008	DEER	
173	9/5/2008	DEER	3 fawns
174	9/7/2008	BOBCAT	Everett Rd.
175	9/7/2008	OTTER	2 otters (adults, probably the same) were back in bay. As I approached the dock, they both turned to look, bobbing vertically in the water, making clicking sounds. Then they moved to outside of bay.
176	9/7/2008	BOBCAT	
177	9/7/2008	TURKEY	8 turkeys observed
178	9/8/2008	EAGLE	Eagle in flight

179	9/8/2008	WOLF	Wolf pack running and howling. POINT WAS NOT LOCATED ON MAP (23).
180	9/8/2008	SWALLOW	At dusk, returning in my boat from fishing, I sailed through a large flock of swallows feeding on some imperceptible hatch in mid-lake. The dive-bombers avoided the boat, but there were many in number and it took a while to clear the flock.
181	9/8/2008	EAGLE	Observed an eagle sitting in a tree.
182	9/9/2008	PILEATED WOODPECKER	
183	9/9/2008	TURKEY	11 turkeys observed
184	9/13/2008	DEER	
185	9/13/2008	DEER	2 fawns
186	9/14/2008	TURKEY	2 turkeys
187	9/14/2008	DEER	
188	9/14/2008	DEER	
189	9/14/2008	DEER	
190	9/14/2008	DEER	
191	9/14/2008	DEER	
192	9/15/2008	DEER	3 deer drinking water
193	9/15/2008	EAGLE	2 eagles flying
194	9/15/2008	EAGLE	Eagle in flight
195	9/15/2008	LOON	
196	9/15/2008	EAGLE	
197	9/15/2008	TURTLE	Painted turtle
198	9/15/2008	OTTER	Otter swimming.
199	9/15/2008	GROUSE	4 ruffed grouse flying across bay - one at a time.
200	9/16/2008	HAWK	
201	9/17/2008	DUCK	2 Wood ducks on wild rice
202	9/17/2008	OTTER	2 adult otters returned to bay, fishing over a rock bar on the point. Even with 2 boatloads of fishermen in competition within 200 yards.

203	9/17/2008	EAGLE	A bald eagle that had been perched on a stump at the point of our bay, lifted (as I approached the water) taking flight, and wheeling out the bay until veering off and landing in tree near the Mystic Moose resort.
204	9/18/2008	EAGLE	Immature bald eagle
205	9/18/2008	OTTER	
206	9/18/2008	EAGLE	Eagle in tree fishing refuge.
207	9/18/2008	DUCK	4 mergansers flying out of bay.
208	9/19/2008	GEESE	Flock of geese feeding (30)
209	9/19/2008	KING FISHER	
210	9/19/2008	EAGLE	Eagle flying
211	9/19/2008	OTTER	
212	9/19/2008	DUCK	4 ducks
213	9/19/2008	EAGLE	Eagle flying
214	9/19/2008	GEESE	6 Canada geese flying
215	9/19/2008	TURTEL	Painted turtle
216	9/19/2008	PILEATED WOODPECKER	
217	9/19/2008	TURKEY	Turkey flock, young ones - HWY S, 1 mile from 77 HWY.
218	9/20/2008	KING FISHER	
219	9/20/2008	TURTLE	Leatherback turtle
220	9/20/2008	EAGLE	Bald eagle perched in a dead tree just downstream of the dam on the river's south side. The same sighting was made several times throughout the summer by my wife...same tree.
221	9/20/2008	OTTER	3 otter resting in and along emergent stump just several feet offshore. They arose and slipped back into the water when they saw me.
222	9/20/2008	DEER	1fawn
223	9/20/2008	DEER	2 fawns
224	9/20/2008	DEER	2 fawns
225	9/21/2008	HAWK	Hawk of some type.
226	9/22/2008	HUMMINGBIRD	Hummingbirds all summer (May-Sept). One last night on feeder.
227	9/23/2008	WOODCOCK	Timber doodle.
228	9/24/2008	EAGLE	

229	9/24/2008	SANDHILL CRANE	8 Sandhill cranes.
230	9/24/2008	BEAR	Guess about 2-3 years old.
231	9/25/2008	LOON	We see loons daily.
232	9/25/2008	OTTER	4 otters swimming in river by dam.
233	9/25/2008	DUCK	2 black ducks.
234	9/26/2008	GREAT HORNED OWL	2 calling at 2:10 am.
235	9/26/2008	TURKEY	7 turkeys
236	9/27/2008	LOON	
237	9/28/2008	WOLF	Camp Rd.
238	9/28/2008	MINK	Found a mink in my minnow box having a feast.
239	9/28/2008	GEESE	Wounded goose on island by us.
240	9/29/2008	RACCOON	Raccoons in yard at night.
241	9/30/2008	OTTER	3 otters by our dock.
242	9/30/2008	DUCK	4 wood ducks.
243	10/1/2008	EAGLE	Eagle perch summer
244	10/1/2008	EAGLE	Eagle perch in winter
245	10/1/2008	DUCK	One duck
246	10/2/2008	BARRED OWL	Calling. POINT NOT LOCATED ON MAP (31).
247	10/2/2008	PILEATED WOODPECKER	
248	10/3/2008	FOX	My wife and I watched a fox out our front window as it investigated our fire pit and the scattering of seeds resultant from a black bear (apparently) that pulled down and destroyed our bird feeder in the night. The fox looked healthy and well fed.
249	10/3/2008	MINK	Saw a mink in my front yard.
250	10/4/2008	BEAR	Saw bear in woods off Pine Pt Rd
251	10/4/2008	DEER	2 yearlings and 2 fawns running and chasing each other in yard.
252	10/4/2008	GEESE	75-100 Canada Geese
253	10/5/2008	DEER	2 does, 2 fawns
254	10/6/2008	DEER	
255	10/7/2008	DEER	2 does
256	10/7/2008	DUCK	5 wood ducks.
257	10/8/2008	EAGLE	Moose Lake Road.
258	10/9/2008	WOLF	Saw lone off of lake near beaver pond.

259	10/9/2008	PORCUPINE	Crossing Camp Rd, North to South.
260	10/10/2008	FISHER	Saw a fisher cross the road.
261	10/11/2008	EAGLE	American eagle in flight.
262	10/11/2008	GEESE	100 Canada geese on water.
263	10/11/2008	HAWK	
264	10/11/2008	EAGLE	American eagle in flight.
265	10/12/2008	EAGLE	Saw 2 eagles flying near islands 52 & 53.
266	10/12/2008	DUCK	3 wood ducks.
267	10/12/2008	OTTER	3 otter swimming and fishing.
268	10/12/2008	DUCK	5 wood ducks.
269	10/16/2008	DEER	Many deer in yard all summer. Last night, eating acorns.
270	10/18/2008	OTTER	Observed 3 otters playing near island 50.
271	10/20/2008	GEESE	Observed about 75 Canada geese sitting out in the lake.
272	8/15/2008	DEER	Doe and 2 fawns
273	9/18/2008	EAGLE	Eagle flying
274		GEESE	Seen daily.
275		HUMMINGBIRD	Seen daily.
276		EAGLE	Eagle flying.
277		RUFFED GROUSE	4 ruffed grouse flew over winter
278		EAGLE	All summer and Fall, eagle often seen at the dam, perched on tree.
279		DUCK	Female wood duck and chicks crossing Moose Lake Rd.
280		EAGLE	Eagle on Moose Lake Rd.
281		HUMMINGBIRD	See hummingbirds daily.
282		WOODPECKER	See woodpeckers daily.
283		CHIPMUNK	See chipmunks often.
284		FOX	All summer
285		DEER	Doe and 2 fawns all summer.
286		BEAR	Bear in yard. Clawed Paul's truck, trying to get food he left in cab and checked out pop/beer cans bagged in truck bed.
287		ELK	6 bull elk along roadside

Chapter 6. Priority Shorelines Assessment

The Couderay Waters Regional Land Trust works with landowners to protect significant portions of the natural heritage of northwest Wisconsin for the benefit of present and future generations. Prioritizing landscapes helps the trust target the most critical areas that provide the most significant aesthetic and ecological contributions to conservation efforts. Prioritizing landscapes is anticipated to help the trust work with landowners to conserve vital lands using voluntary acquisition of conservations easements, by sale or donation.

The island and mainland shorelines of Moose Lake are prioritized based upon various ecological and aesthetic indicators, inventoried by trained citizen contributors of the Moose Lake Legacy Initiative. These indicators are described in detail in Chapter 5 and include:

1. Shoreline ownership
2. Aquatic macrophytes (including wild rice and aquatic invasive species)
3. Coarse woody structure
4. Shoreline development (in the riparian and littoral zones)
5. Ecological Reference Areas and refugia (in the riparian zone)
6. Veteran tree specimens
7. Aesthetic shoreline condition
8. Wildlife (mammals, birds, reptiles)

Priority Exercise

Participants applied indicators of aesthetic and ecological value to prioritize Moose Lake islands and mainland shorelines on June 11, 2009. Douglas Miskowiak, GIS Education Specialist from the University of Wisconsin–Stevens Point, GIS Center facilitated the event. The event was attended by 25 participants that included members of the trust, citizen contributors of the Moose Lake Legacy Initiative, the Department of Natural Resources, and Sawyer County (see Table 6.1). All participants were invited to contribute to prioritizing Moose Lake shorelines.

Table 6.1. List of Participants

Louise Heim	Marcia Whaley	Sue Niemann
Mike Heim	Dale Anderson	Brian Devries, Sawyer Co.
Dave Sanders	Bruce Paulson	Don Kluxdal
Denny Picchietti	Wayne Janitschke	Stan Olson
Bill Czeskleba	Murial Janitschke	Richard Carlson
Don Cole	Ken Boyd	Mary Kay Carlson
Mary Ann Churchill	Jan Kluxdal	Chris Jeffords
Ray Whaley	Ben Niemann	Kay Wilson
James Kreitlow, WIDNR	Doug Miskowiak, GIS Center, UWSP	Corinna Neeb, GIS Center, UWSP

Overview of the Session

Bruce Paulson initiated the session with an overview of the trust and their interest in prioritizing Moose Lake shorelines. Douglas Miskowiak provided an overview of the Moose Lake Legacy Initiative and described the great commitment made by the citizen contributors to the project. Mr. Miskowiak provided an overview of the exercise and described process procedures (see Appendix A).

The eight ecological and aesthetic indicators were described in detail. Training procedures, methods to collect information, and the spatial analysis of key findings were all shared with participants.

Priority Categories

Participants were introduced to the categories they could use to prioritize shorelines. They could use, ignore, or modify the categories to make them most relevant. The categories included:

A = Absolute Priority Characteristic
Shoreline indicator exhibits exceptionally high ecological or natural scenic value. Shorelines receiving this rating on any one individual indicator attain absolute priority status for conservation.

H = High Priority Characteristic
Shoreline indicator exhibits high ecological or natural scenic value. The characteristic highly contributes to the conservation value of the shoreline.

M = Moderate Priority Characteristic
Shoreline indicator exhibits moderate ecological or natural scenic value. The characteristic moderately contributes to or does not significantly detract from the conservation value of the shoreline.

L = Low Priority Characteristic
Shoreline indicator exhibits little ecological or natural scenic value. The characteristic contributes little or detracts from the conservation value of the shoreline.

T = Threat to Ecological and Aesthetic Conservation Value
Shoreline indicator poses a threat to the ecological or natural scenic value of the shoreline. Shorelines receiving this rating on any one individual indicator attain priority status for conservation management/rehabilitation.

NC = Not Considered for Conservation
Shorelines in this category are those that the trust is not considering or is not able/willing to consider for conservation by direct purchase or conservation easements.

Notably, categories T and NC were not applied by participants.

Participant Ratings

The following section presents the discussion and the decisions applied by participants during the priority exercise, organized by indicator.

1. Shoreline Ownership

Based upon participant discussion, the shoreline ownership indicator will be used to categorize results by ownership category. Ownership status itself is not used to further prioritize the ecological or aesthetic value of shorelines.

2. Aquatic Macrophytes

Participants discussed the value of aquatic macrophytes to wildlife, including fish. The presence of aquatic macrophytes was considered of significant value to wildlife. Patches that held a mix of different aquatic macrophytes were considered more ecologically valuable than patches of monocultures.

Participants also discussed the value or detriment of cattails to the aesthetic and ecological value of Moose Lake shorelines. The aquatic macrophyte inventory clearly indicates the geographic locations where broad and narrow-leaf cattails are present. Participants noted that cattail patches appear to be getting larger. The facilitator shared comments from USFS biologist Steven Spickerman, noting that cattails were not present in northwest Wisconsin 100 years ago. Locations where cattails and wild rice are present together were also noted. Based upon discussions with USFS biologist, Steven Spickerman and Citizen Monitoring Coordinator, Laura Herman, it is reasonable to expect that cattails will out-compete other aquatic macrophytes.

It was also noted that in regard to fish, cattails do not provide good habitat. They are too thick to use as cover. Wild rice, conversely, are used by perch as nurseries. Since Moose Lake waters are drawn down every season, other macrophytes are unavailable to perch so they attenuate their eggs to wild rice instead.

Participants noted that cattails do provide some benefits. Black birds use them for cover while muskrats use them as a food source. It was also noted that patches of cattails can help prevent shoreline erosion.

Additionally, the cultural or economic value of aquatic macrophytes was questioned as a possibility for prioritizing shorelines.

Based upon aquatic macrophytes, participants rated shorelines as follows:

- High = shorelines with populations of mixed varieties of macrophytes
- Mod = shorelines with monocultures of macrophytes
- Low = shorelines where macrophytes are absent

3. Coarse Woody Structure

Participants discussed the ecological and aesthetic value of coarse woody structure. Ecologically, CWS provides habitat and cover for fish as well as a place for predator fish to ambush prey. Aesthetically, CWS adds another visible variable to the shoreline, providing it with additional visible texture. Participants asked whether the cause (i.e. caused by humans or nature) of removal is important to note. Besides not having the data to support exploration of this issue, the absence of CWS still affects habitat for fish and the visible texture of shorelines.

Based upon coarse woody structure, participants rated shorelines as follows:

- High = Shorelines that have CWS in a continuous or scattered condition
- Low = Shorelines that have isolated or absent condition of CWS

4. Shoreline Development

The facilitator asked participants to decide if the shoreline development indicator duplicated the aesthetic shoreline condition indicator. GIS analyses on site indicated a direct relationship between the two indicators. Participants agreed to eliminate shoreline development from the priority analysis in favor of using only the aesthetic shoreline condition indicator (see 7, Aesthetic Shoreline Condition).

5. Ecological Reference Areas and Refugia

Participants discussed the definitions of both Ecological Reference Areas and Ecological refugia. According to Steven Spickerman, USFS, Ecological Reference Areas are good representations of healthy ecosystems where ecological processes are functioning within the normal range of variability and where the plant community has adequate resistance to and resiliency from most disturbances. These areas are not 'pristine,' but historically are unused lands. Refugia or refugium, are areas where special environmental circumstances have enabled a species or community of species to survive after extinction in surrounding areas.

Based on notes from Spickerman, large areas in and around Moose Lake qualify as Ecological Reference Areas, but only a few areas can be considered refugia. Participants noted that white cedar and hemlock are still quite uncommon in this area and merit special status to prioritize shorelines. Participants reasoned that although other climax species, such as sugar maple and yellow birch are present in the area, they are more common than hemlock, and are not worthy of absolute or high quality status.

Based upon ecological reference areas and refugia, participants rated shorelines as follows:

- Absolute = Areas of white cedar and hemlock[1]
- No rating = remaining shorelines

[1] The CWRLT Board of Directors changed the rating for hemlock at a subsequent board meeting. Only dominant stands of hemlock receive 'Absolute' status, while stands containing hemlock as a secondary species is rated 'High.' Scenario 2 maps illustrate the version approved by the Board.

6. Veteran Trees

Veteran trees have ecological value, providing microhabitats for wildlife, and aesthetic value, providing a distinctive and remarkable landscape experience.

Based upon veteran trees, participants rated shorelines as follows:

- High = Shorelines of veteran trees

7. Aesthetic Shoreline Condition

Aesthetic shoreline condition is based on the visual presence of development from the littoral zone and the removal of vegetation in the riparian zone.

Based upon aesthetic shoreline condition, participants rated shorelines as follows:

- High = Shorelines in a natural condition
- Mod = Shorelines moderately modified by development or removal of riparian vegetation
- Low = Shorelines highly modified by development or removal of riparian vegetation

8. Wildlife Observations

Participants closely observed and noted the data-collection methodology used to inventory wildlife. Participants commented that wildlife is continually moving along geographic scales larger than that of Moose Lake shorelines. Participants reasoned that the data, though informative, were not appropriate for prioritizing shorelines.

Conversely, nest locations are considerably more permanent and are reasonable to use for prioritizing shorelines. Loons, it was noted, typically use the same islands for nesting. Loons prefer small islands, with little or no tree cover to protect themselves from potential predators. Additionally, the osprey/eagle nest locations are permanent platforms and are likely locations for future nests.

Based upon wildlife observations, participants rated shorelines as follows:

- High = Locations of loon nests and osprey/eagle nest platforms
- No rating = remaining shorelines

Results

Ratings gleaned from participants during the exercise were analyzed and interpreted by Douglas Miskowiak, University of Wisconsin–Stevens Point, GIS Center. ArcGIS 9.3 was used to add the ratings of each indicator for each geographic segment of island and mainland shoreline. The string of ratings for each shoreline segment was interpreted and the segment was reclassified into one of four categories:

- Absolute Priority (Most ecologically or aesthetically significant shorelines)
- High Priority
- Moderate Priority
- Low Priority (Least ecologically or aesthetically significant shorelines)

Reclassification was based on the following decision rules.

- Shorelines that were unobserved were not rated.
- Any shoreline segment receiving an 'A' rating, received absolute priority, no matter how other indicators were rated.
- Ratings of H and L offset each other to become a 'M' rating
- Segments that are balanced in favor of 'H' are rated 'H'
- Ratings that are balanced in favor of 'L' are rated 'L'
- <null> values indicate the absence of a rating category

Figures 6.1 helps to illustrate the process.

Figure 6.1. Rating Examples

Ownership	Aquatic Macrophytes	Coarse Woody Structure	Ecological Reference Areas/ Refugia	Veteran Trees	Aesthetic Shoreline Condition	Wildlife	Sum of Ratings	Final Priority Score
<null>	H	L	<null>	H	M	<null>	HLHM	H
<null>	M	H	A	H	H	<null>	MHAHH	A
<null>	H	L	<null>	<null>	L	<null>	HLL	L
<null>	M	L	A	H	L	H	MLAHLH	A
<null>	M	L	<null>	H	M	<null>	MLHM	M

The priority scores for scenario 1 are calculated in Table 6.2 and illustrated in Map 6.1. The priority scores for scenario 2, the scenario approved by the CWLRT Board, are calculated in Tables 6.3 and 6.4 and illustrated in Maps 6.2 and 6.3.

Table 6.2. Scenario 1. Miles of Shoreline by Priority Category

Rating	Miles of Mainland Shorelines	Miles of Island Shorelines
Absolute Priority	13.49	5.72
High Priority	11.76	1.89
Moderate Priority	6.07	3.43
Low Priority	2.54	0.43
Not Observed	4.47	0.14

Table 6.3. Scenario 2. Miles of Shoreline by Priority Category

Rating	Miles of Mainland Shorelines	Miles of Island Shorelines
Absolute Priority	2.01	3.13
High Priority	21.46	4.13
Moderate Priority	7.71	3.78
Low Priority	2.67	0.43
Not Observed	4.47	0.14

Table 6.4. Scenario 2. Privately Owned Shorelines by Priority Category

Rating	Miles of Mainland Shorelines	Miles of Island Shorelines
Absolute Priority	1.56	2.31
High Priority	13.39	2.44
Moderate Priority	2.50	2.85
Low Priority	7.13	0.42
Not Observed	1.28	0.00

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Map 6.1

Map 6.2

Map 6.3

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Chapter 7. Project Dissemination Summary

Chapter 7 summarizes the venues where project methodologies and results have been disseminated.

Wisconsin Land Information Association Annual Conference
On February 19, 2009, Douglas Miskowiak from the University of Wisconsin – Stevens Point, GIS Center gave a presentation entitled, "Engaging a Lake Community to Prioritize Shore Land Resources Using GIS—The Moose Lake Legacy Initiative." The 30-minute presentation was attended by approximately 24 to 30 Wisconsin GIS professionals.

Abstract: Who owns the Moose Lake shorelines and how are they being managed? A small group of interested citizens and the Couderay Waters Regional Land Trust set out to utilize GIS to address questions like this. The results were surprising. An inventory of the shoreline revealed 22 miles of additional shoreline and over 20 'lost' islands. Citizens inventoried and attached various indices as attributes to the near shoreline. These included: wildlife, aesthetic beauty, ecological integrity, development, aquatic macrophytes, woody structure, and invasive species.

The value of GIS to map shore land resources was clear: Shore land resources cannot be effectively managed without knowing what resources exist, their condition, and who owns them. Equipped with this information and ArcGIS software, these citizens have 1) outlined the ecological and aesthetic significance of Moose Lake shoreline and island resources, 2) developed a protection strategy for the islands using such tools as conservation agreements, and 3) begun negotiating the management of island resources with Excel Energy and the United States Forest Service.

Annual Northwest Wisconsin Lakes Conference
On June 19, 2009 citizen contributors to the Moose Lake Legacy Initiative presented a poster presentation of maps at the Telemark Lodge in Cable, Wisconsin. The series of watershed maps and lake inventories were on display.

Moose Lake Improvement Association Annual Meeting
On Saturday July 4, 2009 the Moose Lake Improvement Association (MLIA) invited a presentation on the progress of the Moose Lake Legacy Initiative. The event was attended by 50 to 75 participants. After an introduction by MLIA President, Dave Sanders, Bruce Paulson provided an overview of the project and discussed the role of the Couderay Waters Regional Land Trust in the project. Paulson answered questions from the audience about the role of the trust in conservation around the Sawyer County region. Paulson asserted that the trust engages in conservation using voluntary agreements with individual landowners. Conservation agreements and easements are mostly secured through donations made by landowners to the trust. Paulson also stated that the trust's primary funding source for conservation is from individual donations. When asked if the trust would accept lands that didn't make the priority list, Paulson responded, "No, if lands don't help the trust meet our conservation goals and objectives, we wouldn't accept the land or easement donation. Managing easements is costly."

Douglas Miskowiak followed with an overview of the analysis of the West Fork of the Chippewa River Watershed and the inventory of Moose Lake shorelines. Miskowiak described the training and inventory methodologies as well as the results. When asked about the significance of the white cedar on Moose Lake, Miskowiak replied, "According to USFS biologist, Steven Spickerman, the white cedar on Moose Lake islands are perhaps one of ten sites in over 400,000 acres. Moose Lake islands provide a refugia for white cedar, likely due to wolves as deer are less likely to venture out on the ice to reach the islands because of the wolf threat.

Miskowiak was asked about his thoughts on how these data should be used. Miskowiak responded, "Data from the watershed and lake inventories should be distributed as widely as possible so that it can be considered for decision-making on Moose Lake. Advocates and opponents alike should study the data to have informed and public deliberations about the natural resources of Moose Lake." Paulson also replied that individual landowners, too, should study the information and decide if they'd like to approach the trust with the possibility of reaching a conservation agreement.

Town of Round Lake Open House
The Town of Round Lake invited the citizen contributors of the Moose Lake Legacy Initiative in July 2009 to display and present project findings and maps to members of the public. Invitations were distributed at the Moose Lake Improvement Association Annual Meeting.

ESRI International Users Conference – San Diego, CA
On July 15, 2009, Douglas Miskowiak presented the Moose Lake Legacy Initiative at the Annual ESRI International User's Conference in San Diego, California. The presentation was attended by 30 to 40 participants from around the globe. The presentation shared the methodologies and results of the Initiative. Additionally, Miskowiak presented initiative maps for a poster presentation in the ESRI Map Gallery. A series of lake-inventory and watershed analysis maps were on display.

Department of Natural Resources Board Meeting – Hayward, WI
On August 12, 2009 Ben Niemann reported the preliminary findings of the Moose Lake Legacy Initiative to the State of Wisconsin Natural Resources Board. In addition to sharing project findings, he informed the board about the procedures used to engage citizens with access to digital mapping tools.

Sawyer County Lakes Forum, Hayward, WI
Douglas Miskowiak presented the Moose Lake Legacy Initiative at the Sawyer County Lakes Forum in September, 2009. The presentation not only shared the methodologies and results of the Moose Lake Legacy Initiative, but also outlined how other lake districts or organizations can get involved to conduct similar analyses for their lakes.

Wisconsin Department of Natural Resources Northwest District Meeting
Citizen contributors of the Moose Lake Legacy Initiative and Douglas Miskowiak, University of Wisconsin–Stevens Point GIS Center, presented project findings and methodologies to representatives from the Department of Natural Resources Northwest District. Jane Malischke, Bill Smith, Tom Jerow, and Jim Kreitlow from the WDNR were present. Participants discussed the benefits of using citizens as partners with resource professionals to create information. Additionally, participants explored the benefits of providing an institutional home for citizen-created GIS databases and standardizing citizen inventory procedures.

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Appendix A. Priority Shoreline Analysis Agenda

Prioritizing Moose Lake Shorelines for Conservation June 11, 2009

Island and mainland shorelines will be assessed based upon ecological and aesthetic indicators. Various indices have been inventoried by citizen contributors to the Moose Lake Legacy Initiative. These include:

1. Shoreline ownership
2. Aquatic macrophytes (including wild rice and aquatic invasives)
3. Coarse woody structure
4. Shoreline Development (riparian and littoral)
5. Ecological reference and refugia of riparian trees
6. Veteran tree specimens
7. Aesthetic shoreline condition
8. Wildlife (mammals, birds, reptiles)

These indicators of ecological and aesthetic value will be used by participants to prioritize Moose Lake mainland and island shorelines. The outcome will help Couderay Waters Regional Land Trust target critical shorelines that help meet conservation goals through voluntary acquisition of conservation easements, by sale or donation.

Agenda

1. Session background, overview, procedures, and expectations. 10 minutes
2. Description of shoreline indicators and data collection efforts (see chapter 5 handout). 30 minutes
3. Conduct Priority Shorelines Exercise 90 - 120 minutes
    a. Assign value to each set of indicators
    b. Compile individual scores to *prioritize* shorelines
4. Summary, conclusions, comments, and remaining questions 30 minutes

Priority Categories

Each shoreline indicator of ecological or natural scenic value shall be prioritized based upon the following categories. Participants are not required to utilize each category if the category is not applicable.

A = Absolute Priority Characteristic
Shoreline indicator exhibits exceptionally high ecological or natural scenic value. Shorelines receiving this rating on any one individual indicator attain absolute priority status for conservation.

H = High Priority Characteristic
Shoreline indicator exhibits high ecological or natural scenic value. The characteristic highly contributes to the conservation value of the shoreline.

M = Moderate Priority Characteristic
Shoreline indicator exhibits moderate ecological or natural scenic value. The characteristic moderately contributes to or does not significantly detract from the conservation value of the shoreline.

L = Low Priority Characteristic
Shoreline indicator exhibits little ecological or natural scenic value. The characteristic contributes little or detracts from the conservation value of the shoreline.

T = Threat to Ecological and Aesthetic Conservation Value
Shoreline indicator poses a threat to the ecological or natural scenic value of the shoreline. Shorelines receiving this rating on any one individual indicator attain priority status for conservation management/rehabilitation.

NC = Not Considered for Conservation
Shorelines in this category are those that the Trust is not considering or is not able/willing to consider for conservation by direct purchase or conservation easements.

http://www.nrcs.usda.gov/technical/NRI/pubs/wp13text.html

Appendix B. Watershed and Lake Information System

General Information

Projection:
All data are projected using NAD 1983 HARN Wisconsin CRS Sawyer (US feet) projection.

Geographic Extent:
The geographic extent for watershed maps and analyses include the West Fork of the Chippewa River Watershed.

The geographic extent for the Moose Lake shoreline inventories include the mainland and island shorelines of Moose Lake based upon National Agriculture Inventory Program orthophotography, 2005 and field inspections by the citizen contributors of the Moose Lake Legacy Initiative as digitized by Douglas Miskowiak, UW-Stevens Point GIS Center.

Moose Lake Inventories

Data: moose_shoreline.mdb (personal geodatabase)
Description: Personal geodatabase of the Moose Lake mainland and island shorelines digitized by Douglas Miskowiak, UW-Stevens Point GIS Center from 2005 National Agriculture Inventory Program orthophotography and field verifications from citizens of the Moose Lake Legacy Initiative. Shoreline attributes recorded during the summer of 2008 (May through October) with full leaf-on tree canopy conditions from the littoral zone of Moose Lake.

Feature Class: mainland_shoreline
Description: Polyline feature class that identifies mainland features and attributes.
Attributes:

LENGTH: Length of line segment in feet.

Owner: Owner of the shoreline segment.

" "	Private Ownership
"USFS"	United States Forest Service
"Chippewa & Flambeau Imp Co"	Xcel Energy
"WI BCPL"	Wisconsin Board of Commissioners of Public Lands

Miles Length of line segment in miles.

Woody_stru Coarse woody structure along shoreline.

"UO"	Unobserved shoreline
"S"	Scattered condition
"I"	Isolated condition
"C"	Continuous condition
"A"	Absent condition

Macrophyte Dominant aquatic macrophyte by specie
Macrophyte2 Subsequent aquatic macrophyte by specie
Macrophyte3 Subsequent aquatic macrophyte by specie
WRICE Presence of wild rice
Dom_Species Dominant riparian woody vegetation by specie
Sub_Species1 Subsequent riparian woody vegetation by specie
Sub_Species2 Subsequent riparian woody vegetation by specie
Sub_Species3 Subsequent riparian woody vegetation by specie
Sub_Species4 Subsequent riparian woody vegetation by specie
Sub_Species5 Subsequent riparian woody vegetation by specie

Sub_Species6	Subsequent riparian woody vegetation by specie
Sub_Species7	Subsequent riparian woody vegetation by specie
Refugia	Refugia area for woody vegetation by specie
Bog	Presence of a bog
Notes	Notes related to riparian woody vegetation inventory
Aesthetics	Natural scenic qualities
	"H" Shoreline exists in a natural condition, visibly without human modification
	"M" Shoreline shows signs of human modification with visual presence of development or slight to moderate removal of vegetation
	"L" Shoreline shows significant signs of human modification including intensive removal of riparian vegetation and/or prominently visible development.
	" " Shoreline not observed
Cattails	Cattails present at location
	"NLC" Narrow Leaf Cattail
	"BLC" Broad Leaf Cattail
WR_CAT	Wild Rice and Cattails exist within the same patch

Feature Class: island_shoreline
Description: Polyline feature class that identifies island features and attributes.
Attributes: See mainland_shoreline feature class

Feature Class: Priority_Mainland_Identity
Description: Polyline feature class that identifies and prioritizes mainland features for conservation.
Attributes: (unique to this feature class)(see chapter 6 for ratings criteria and description)

P_Owner	Priority rating based upon ownership (none used)
P_CWS	Priority rating based upon coarse woody structure condition
P_Macro	Priority rating based upon condition of aquatic macrophytes
P_ERA	Priority rating based upon condition of riparian woody vegetation (first set of criteria)
P_ERA2	Priority rating based upon condition of riparian woody vegetation (second set of criteria)
P_Vet_Trees	Priority rating based upon presence of veteran trees
P_Aesthetics	Priority rating based upon natural scenic condition
Priority_Shores	Sum of priority ratings (first set of criteria)
Priority_Shores2	Sum of priority ratings (second set of criteria)
ps1	Final rating based on sum of scores (first set of criteria)
ps2	Final rating based on sum of scores (second set of criteria)

Feature Class: Priority_Islands_Identity
Description: Polyline feature class that identifies and prioritizes island features for conservation.
Attributes: (see Priority_Mainland_Identity Feature Class)

Feature Class: structures
Description: Point feature class that identifies the location of structures visible from the littoral zone of Moose Lake during full leaf-on tree canopy condition.
Attributes:

Type	Type of structure
Notes	Notes about the structure

Feature Class: tree_specimens
Description: Point feature class that identifies the location of veteran tree specimens visible from the Moose Lake littoral zone.
Attributes:

Type	Type of riparian woody vegetation

Feature Class: wildlife_observations
Description: Point feature class that identifies the location of wildlife observations made by citizens of Moose Lake in 2008. Wildlife observations made by citizens were initially recorded on hardcopy maps. Locations and attributes were digitized by Dan McFarlane, UW-Stevens Point.
Attributes:

Observation_date	The date that wildlife was observed.
Species	The type of wildlife observed
Notes	Additional observations made by citizens about the wildlife

Jurisdictional/Locational Boundaries

Minor Civil Divisions
Data: mcd_extent.shp
Description:
This data layer is a polygon shapefile representing minor civil divisions (towns, cities, villages) in the year 2000. Data is derived from the 2000 TIGER line files.
More Information:
- U.S. Department of Commerce. 2000. TIGER Line Files: Technical Documentation. U.S. Census Bureau.
- Metadata. http://dnr.wi.gov/maps/gis/documents/municipalities.pdf

County Boundaries
Data: adjacent_counties.shp and sawyer_co.shp
Description:
These data layers are polygon shapefiles delineating Sawyer County and counties adjacent to Sawyer County. Data is from the Wisconsin Department of Natural Resources, derived from 1:24,000-scale sources.
More Information:
- Metadata. http://dnr.wi.gov/maps/gis/documents/county_boundaries.pdf

Public Land Survey System Section and Quarter/Quarter Section Boundaries
Data: PLSS_sections.shp and PLSSqtrqtr.shp
Description:
These data layers are polygon shapefiles delineating the Public Land Survey System (PLSS) section and quarter-quarter boundaries. Data is from the Wisconsin Department of Natural

Resources 24K Landnet. The original sources for the majority of data incorporated in the 24K Landnet are the USGS 7.5 minute topographic map series, and 1:100,000 scale. Approximately 73% of section corner coordinates have been provided by Chequamegon National Forest, Nicolet National Forest, Northern States Power Company, United States Geological Survey, and Wisconsin Power and Light Company. DNR has digitized standard PLSS corners from USGS 7.5' maps where no data were provided by cooperators. Data in a few areas were obtained from resurvey maps, plat maps, or digital county data.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/plss_sections.pdf
- Metadata. http://dnr.wi.gov/maps/gis/documents/plss_qq_sections.pdf

Water Resources

Lakes, Ponds and Flowages

Data: lakes_ponds_flowages.shp

Description:

This data layer is a polygon shapefile delineating lakes, ponds, and flowages. Data is from the Wisconsin Department of Natural Resources 1:24,000 hydrology database version IV, 2006. This data includes information about hydrology features represented on the US Geological Survey's 1:24,000-scale topographic map series.

More Information:

- Website. http://dnr.wi.gov/maps/gis/datahydro.html.

Rivers, Streams and Shorelines

Data: rivers_shorelines.shp

Description:

This data layer is a line shapefile delineating rivers, streams, shorelines, and water body centerlines. Data is from the Wisconsin Department of Natural Resources 1:24,000 hydrology database version IV, 2006. This data includes information about hydrology features represented on the US Geological Survey's 1:24,000-scale topographic map series.

More Information:

- Website. http://dnr.wi.gov/maps/gis/datahydro.html.

Islands and Uplands

Data: islands_uplands.shp

Description:

This data layer is a polygon shapefile delineating islands and upland resources. Data from the Wisconsin Department of Natural Resources 1:24,000 hydrology database version IV, 2006. This data includes information about island and upland features represented on the US Geological Survey's 1:24,000-scale topographic map series.

More Information:

- Website. http://dnr.wi.gov/maps/gis/datahydro.html.

Outstanding and Exceptional Water Resources

Data: oew_2007.shp

Description:

This data layer is a line shapefile delineating Outstanding and Exceptional Resource Waters (NR102) a Natural Resource Designation codified in law. Data is from the Wisconsin Department of Natural Resource Water Division based on various sources. If the water body

showed up at 100K the arc was copied from 100K Digital Line Graphs. If it didn't show up at that scale, it was digitized from 24K sources, or taken from air photo interpretation. Development of this data mainly occurred in 1994-1995 with edits in 1996 and 1999 after a final review. Additions reflecting 2007 OERW status appended to data by Douglas Miskowiak, Center for Land Use Education, with data from the Wisconsin Department of Natural Resources Water Division.
Wisconsin's Outstanding and Exceptional Resource Waters Program is designed to maintain the water quality in Wisconsin's cleanest waters. An outstanding resource water is defined as a lake or stream having excellent water quality, high recreational and aesthetic value, high quality fishing and is free from point source or non-point source pollution. An exceptional resource water is defined as a stream exhibiting the same high quality resource values as outstanding waters, but may be impacted by point source pollution or have the potential for future discharge from a small sewer community.

More Information:

- Metadata. http://dnr.wi.gov/org/water/wm/wqs/orwerw/.
- Contact. Bob Masnado, WIDNR, (608) 261-4385

Dam Locations

Data: dams_2006.shp

Description:

This data layer is a point shapefile identifying the locations for large and small dams, including abandoned or removed dams. Data is from the Wisconsin Department of Natural Resources, Bureau of Watershed Management. The original geographic reference for dams was Public Land Survey System (PLSS) township, range, section, and quarter-quarter section. The GIS data layer was originally created from a download of this locational data from the Dam Safety Program's database in 2002. Each point was then visited individually and moved to a more accurate location using the 1:24k Hydrography layer. Some dam points were not moved from the original PLSS location if there was no matching water feature on the 24K hydro layer.

More Information:

- Contact. Meg Galloway, State Dam Safety Engineer, WT/2 gallom@dnr.state.wi.us or (608) 266-7014.

Watersheds

Data: watersheds.shp

Description:

This data layer is a polygon shapefile delineating watershed boundaries. Data is from the Wisconsin Department of Natural Resource, Bureau of Watershed Management, 2003. The data are compiled from 1:24,000-scale topographic maps. DNR watershed delineations generally indicate areas that drain into a common river system or lake, but may also be based on DNR basin management criteria.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/dnr_watersheds.pdf

Land Ownership/Management

Native American Lands

Data: nat_am_lands.shp

Description:

This data layer is a polygon shapefile delineating tribal lands. Data is from the U.S. Census Bureau, Wisconsin Office of Land Information Services, 2000.

Federal American Indian reservations are areas that have been set aside by the United States for the use of tribes, the exterior boundaries of which are more particularly defined in the final tribal treaties, agreements, executive orders, federal statutes, secretarial orders, or judicial determinations. The U.S. Census Bureau recognizes federal reservations as territory over which American Indian tribes have primary governmental authority. Federal reservations may cross state boundaries, and federal and state reservations may cross county, county subdivision, and place boundaries. For reservations that cross state boundaries, only the portions of the reservations in a given state are shown in the data products for that state.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/native_american_lands.pdf

Federal Lands

Data: federal_lands.shp

Description:

This data layer is a polygon shapefile delineating federally owned lands, excluding national forests. Data is from the Wisconsin Department of Natural Resources. The WIDNR is not the custodian and is not responsible for the maintenance of this data.

This data is known to be incomplete and may also be in error. There are federal lands not represented in this layer which should be added as part of a comprehensive review and upgrade of this layer.

More Information:

- Contact John Laedlein, WIDNR laedlj@dnr.state.wi.us.

National Forests

Data: national_forest.shp

Description:

This data layer is a polygon shapefile delineating national forests. Data is believed to be from U.S. Forest Service, 1:24,000 sources. It appears to include the boundaries of in-holdings (i.e., privately-owned lands within the forest).

More Information:

- Contact. John Laedlein, WIDNR laedlj@dnr.state.wi.us.

WIDNR Managed Lands

Data: dnr_managed_lands.shp

Description:

This data layer is a polygon shapefile delineating the boundaries of land managed by the Wisconsin Department of Natural Resources, whether through ownership, easement, or lease rights. Data is from the Wisconsin Department of Natural Resources. The data is a spatial representation of all real estate transactions in Facilities and Lands' (LF) Oracle Land Records System as of February 28, 2002. The data should not be interpreted as a legal representation of legal ownership boundaries.

Users should note that this data set does not differentiate between lands that are open or closed to the public for hunting and/or general public access. This data set is not intended for use as a land management tool, but rather as a listing of all real estate transactions that have occurred on these lands over time.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/dnr_managed_lands.pdf

County Forests
Data: county_forest.shp
Description:
This data layer is a polygon shapefile delineating the generalized locations of Wisconsin's County Forests. Data is from the Wisconsin Department of Natural Resources. It was created by extracting quarter-quarter sections from the 1:24,000-scale Landnet data layer. An ORACLE database identifies PLSS quarter-quarter sections containing county forests. The minimum area represented is 40 acres. Due to the fact that fractional and government lots are not identified by quarter-quarter section in the ORACLE database, it was not possible to include them in this layer. Excluded areas account for approximately 2% of the total county forest areas statewide. Enrollments to the County Forest program may occur at any time during the year. The GIS layer was last updated on March 9, 2005.
More Information:
- Metadata. http://dnr.wi.gov/maps/gis/documents/county_forests.pdf.
- Contact. Janel Pike, WIDNR Forestry Services Bureau, (608) 266-2050
- Contact. Jeff Barkley, WIDNR Forest Lands Section, (608) 264-9217

Land Enrolled in Forest Crop Law Tax Program
Data: forest_crop.shp
Description:
This data layer is a polygon shapefile delineating the generalized locations of lands enrolled by landowners in the Forest Crop Law program. Data is from the Wisconsin Department of Natural Resources. Parcels smaller than 40 acres are not delineated in this layer, but are represented by the 40-acre quarter-quarter they lie within. A PLSS quarter-quarter section indicator (from Tax Law ORACLE database) was used to select quarter-quarter section polygons from the PLSS grid. This process results in polygons of 40 acres, minimum. However, the actual size of the enrolled property may be as small as 10 acres.

Certain government lots or fractional lots, that cannot be represented by a PLSS quarter-quarter section, are not included in this data layer. Excluded areas account for approximately 3% of the FCL lands statewide. Enrollments to the Tax Law program are effective once per year, at the beginning of the calendar year. The data layer was last updated on *March 9, 2005* to reflect all enrollments through calendar year 2005.
More Information:
- Metadata. http://dnr.wi.gov/maps/gis/documents/forest_crop_law.pdf
- Contact. Janel Pike, WIDNR Forestry Services Bureau, (608) 266-2050
- Contact. Kathy Mather, WIDNR Tax Law database administrator, (608) 266-6982

Land Enrolled in Managed Forest Law Tax Program
Data: managed_forest.shp
Description:
This data layer is a polygon shapefile delineating the generalized locations of lands enrolled by landowners in the Managed Forest Law program. Data is from the Wisconsin Department of Natural Resources. Parcels smaller than 40 acres are not delineated in this layer, but are represented by the 40-acre quarter-quarter they lie within. A PLSS quarter-quarter section indicator (from Tax Law ORACLE database) was used to select quarter-quarter section polygons from the PLSS grid. This process results in polygons of 40 acres, minimum. However, the actual size of the enrolled property may be as small as 10 acres. Certain government lots or fractional lots, that cannot be represented by a PLSS quarter-quarter number, are not included in this GIS layer. Excluded areas account for approximately 5% of the MFL lands statewide.

Enrollments to the Tax Law program are effective once per year, at the beginning of the calendar year. The GIS layer was last updated on *March 9, 2005* to reflect all enrollments through calendar year 2005.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/managed_forest_law.pdf
- Contact. Janel Pike, WIDNR Forestry Services Bureau, (608) 266-2050
- Contact. Kathy Mather, WIDNR Tax Law database administrator, (608) 266-6982

Natural Resources

Original Vegetation

Data: orig_veg.shp

Description:

This data layer is a polygon shapefile derived from a 1:500,000-scale map showing the original, pre-settlement vegetation cover in Wisconsin. The original vegetation cover data was digitized from a 1976 map created from land survey notes written in the mid-1800s when Wisconsin was first surveyed. Line work representing lakes and other hydrographic areas in other data sets were subsequently merged with the original vegetation cover data set to more closely match the source map. This digital version of the original vegetation cover map can be used to identify regional changes in land cover since the time when the state was first surveyed. This data is not intended for landscape-scale analysis.

Data originated by the University of Wisconsin – Madison, published by the Wisconsin Department of Natural Resource, 1990.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/orig_vegetation_cover.pdf

Elevation

Data: dem30m

Description:

This data layer is an ESRI GRID delineating elevation. Data is from the Wisconsin Department of Natural Resources 30 meter Digital Elevation Model. The DEMs were obtained from USGS as 1:24K quad or quarter-quad tiles.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/digital_elevation_model.pdf
- Contact. John Laedlein, laedlj@dnr.state.wi.us
- Contact Mitch Moline, molinm@dnr.state.wi.us

Hillshade

Data: hillshade (grid)

Description:

This data layer is an ESRI GRID showing the hillshade pattern. Data was derived using the 30 meter digital elevation model from the WIDNR and the ArcGIS 9.2 spatial analyst, surface analysis, hillshade tool; Azimuth = 315, Altitude = 45 degrees. Douglas Miskowiak, Land Use/GIS Specialist from the University of Wisconsin – Stevens Point, conducted the analysis, August, 2007.

Steep Slopes
Data: slopes12_5.shp and slopes20.shp
Description:
These data layers are polygon shapefiles delineating areas of steep topography. Data was derived using the 30 meter digital elevation model from the WIDNR and the ArcGIS 9.2 spatial analyst, surface analysis, slope tool. The result was a ESRI GRID data layer. The slope GRID was reclassified to only delineate slopes greater or equal to 12.5 percent and again for slopes greater than or equal to 20 percent. The reclassified GRIDs were then converted to polygon shapefiles. Wisconsin Transverse Mercator projection was used to conduct the analysis. Resulting shapefiles were re-projected using Sawyer County coordinates. Douglas Miskowiak, Land Use/GIS Specialist from the University of Wisconsin – Stevens Point, conducted the analysis, August, 2007.

Land Cover
Data: landcover (grid)
Description:
This data layer is an ESRI GRID delineating land cover types using 30 meter square cells. Data is from the National Land Cover Database 2001 and produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS).
More Information:
- Website. http://www.mrlc.gov/mrlc2k_nlcd.asp

Impervious
Data: impervious (grid)
Description:
This data layer is an ESRI GRID delineating percent surface imperviousness (1-100%) using 30 meter square cells. The National Land Cover Database 2001 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS).
More Information:
- Website. http://www.mrlc.gov/mrlc2k_nlcd.asp

Tree Cover
Data: treecover (grid)
Description:
This data layer is an ESRI GRID delineating percent tree cover (1-100%) using 30 meter square cells. The National Land Cover Database 2001 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the

U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS).

More Information:

- Website. http://www.mrlc.gov/mrlc2k_nlcd.asp

Glacial Deposits

Data: glacial_deposits.tif (image)

Description:

This data layer is a tiff image that delineates the boundaries of glacial deposits.
Image scanned from the following hardcopy source by Douglas Miskowiak. Glacial Deposits of Wisconsin: Sand and Gravel Resource Potential. Land Resources Analysis Program. Wisconsin Geological and Natural History Survey, University of Wisconsin – Extension, and State Planning Office, Department of Administration. 1976. Compiled from various sources.

Railroads

Data: rail.shp

Description:

This data set is a line shape file delineating railroad centerlines. Data is from the Wisconsin Department of Transportation. Metadata for the Rails Chain Data compiled from the 100K Digital Line Graph produced by the US Geological Survey and from rail industry track charts and timetables. This data set includes all main track and sidings identified in railroad timetables. It does not include abandonments.

This data set was created to support comprehensive state-wide rail and intermodal system planning in the Bureau of Planning, and is a component of the Rail Infrastructure Database System and the Commodity Information Management System. This data set is intended for planning purposes only at 1:100,000 scale. This data set is not designed for use as a primary regulatory tool in permitting and citing decisions, but may be used as a reference source.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/WisDOT_railroads.pdf

Roads and Highways

Data: wislr_roads03.shp and wislr_hwy03.shp

Description:

These data layers are line shapefiles delineating roads and highways. Data are from the Wisconsin Local Roads (WISLR) database received from the Wisconsin Department of Transportation (WisDOT) in February 2004. The WISLR data represent roads in Wisconsin completed through the end of 2003. Some of the WISLR data has not been finalized and should be considered preliminary or pre-production.

More Information:

- Metadata. http://dnr.wi.gov/maps/gis/documents/WisDOT_local_roads.pdf
- Contact. Jonathan (J.J.) Du Chateau, GeoSpatial/Engineering Systems Unit Wisconsin Dept. of Transportation. (608) 266-6975. Jonathan.Duchateau@dot.state.wi.us

Orthophotography
Data: county'05_NAIP.sid
(orthophotography for Sawyer County and surrounding counties.
Description:
These data layers are compressed images in *.sid format showing ortho-rectified color images of the landscape with leaf on condition. Data are from the United States Department of Agriculture National Agricultural Imagery Program, 2005. The intended display scale is 1:12,000. Ground resolution is 1-meter pixels. Accuracy of data is + or – 15 meters. Rectification source is USGS National Elevation Dataset.
More information:
- Website. http://www.fsa.usda.gov/Internet/FSA_File/naip_final_2006_updatep.pdf

Soils
Hydric Soils
Data: hydricsoils.shp
Description:
This data layer is a polygon shapefile delineating the hydric status of soils by soil mapping unit. Data is from the United States Department of Agriculture, Natural Resources Conservation Service downloaded from the Soil Data Mart (http://soildatamart.nrcs.usda.gov/). Soil Data Viewer 5.1 extension to ArcMap 9.x was used to query soils database for hydric status. Result was exported to shapefile, merged with soils data derived for adjacent counties, and clipped to the project extent.

The hydric rating provides an indication of the proportion of the map unit that meets the criteria for hydric soils. Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).
More information:
Website.
http://soildatamart.nrcs.usda.gov/SSURGOMetadata.aspx