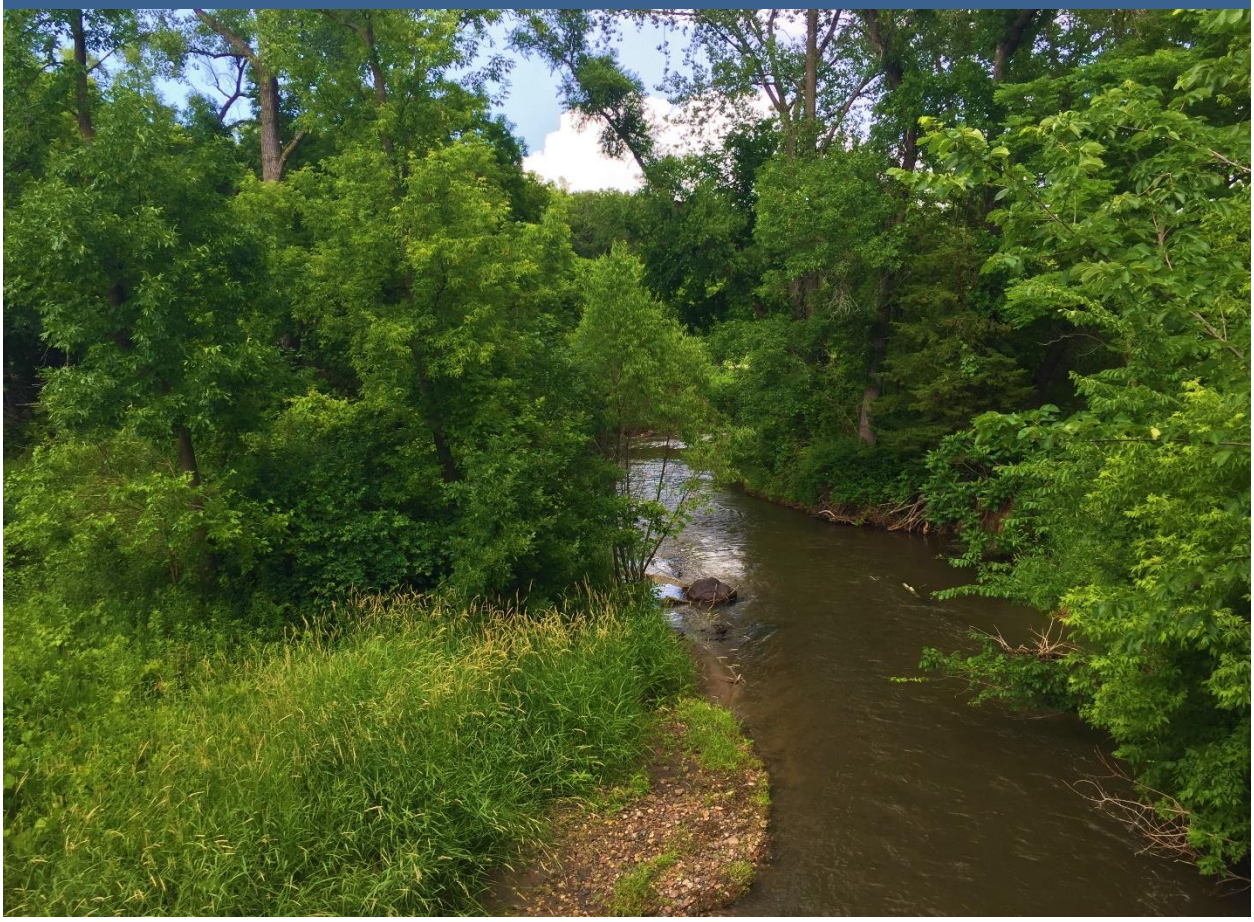
Cannon River Watershed Landscape Stewardship Plan



June 25, 2017

A vision for healthy waters, ecosystems, and human experiences in the Cannon River watershed.

The Nature Conservancy

Minnesota Forest Resources Council

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The Cannon River Watershed Landscape Stewardship Plan can be found online at:
https://mn.gov/frc/southeast-committee.html

The Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR) provided funding for this project. The Trust Fund is a permanent fund constitutionally established by the citizens of Minnesota to assist in the *protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources.* Currently 40% of net Minnesota State Lottery proceeds are dedicated to growing the Trust Fund and ensuring future benefits for Minnesota's environment and natural resources.

The Northeastern Area State and Private Forestry division of the U.S. Forest Service also provided funding for this project.

Table of Contents

Plan Overview

Healthy Lands, Healthy Waters

This plan focuses on protecting water quality by maintaining and enhancing the health of land in the watershed. It is based on the premise that the quality of a water body reflects the integrity of its watershed. Stewardship efforts that maintain forests, wetlands, and other natural communities benefit the biodiversity and ecological health of the region. They also weaken floods, improve infiltration, and remove nutrients from runoff as it makes its way to our streams. Implementing best management practices and expanding perennial cover in agricultural and residential areas will benefit both the natural habitat of the landscape and the water quality in the watershed. This plan proposes a vision, desired future conditions, and strategies that utilize a landscape approach to natural resources stewardship.

Landscape Approach to Natural Resources Stewardship

This Landscape Stewardship Plan (LSP) is based on the recognition that many, if not all, of our conservation and environmental challenges are interrelated. Yet, practicality requires a division of activities and expertise in addressing them. As a result, private landowners, city planners, and experts in hydrology, forests, game and non-game wildlife management all work to achieve diverse, but interrelated, goals from their own specialized angle. For example, additional perennial cover in an upland agricultural area can improve soil health while also reducing erosion on the forested hillside below it, and improved conditions in both areas will benefit the hydrology, water quality, and associated biodiversity in the stream below them. Recognizing how these efforts can reinforce each other, and identifying areas where coordination will add the most benefit, will allow greater synthesis of all our efforts, making all our goals for the landscape easier to achieve. To do so, the LSP embraces an "all lands" approach that identifies shared objectives across public and private natural areas as well as urban and agricultural areas.

While there are many ways to divide a region into landscapes, using watersheds as the organizing feature emphasizes the link between natural resource management and water. It also parallels other state planning trends, such as the move to One Watershed One Plan (1W1P) plans to replace local water plans. Planning natural community stewardship by watersheds increases the value of Landscape Stewardship Plans as resources for other water planning exercises.

Project Area Background

This landscape stewardship plan covers the 1,460 square mile Cannon River Watershed in southeastern Minnesota (Figure 1). This landscape includes over 800 linear miles of streams in Dakota, Goodhue, Le Sueur, Rice, Steele, and Waseca counties. The Cannon and Straight Rivers are the two largest rivers in the watershed and flow through the cities of Owatonna, Fairbault,

Northfield, and Red Wing. These rivers drain a diverse landscape that ranges from glacial derived lakes, moraines, and drumlin fields in the rolling farm fields of their headwaters, to the steep bluffs overlooking deep river valleys, sinkholes, caverns, and cold-water spring-fed streams before empting into the Mississippi River near Red Wing.

This southeastern Minnesota watershed has seen significant change in the last 150 years. Today, only 18% of the landscape remains as forest, wetland, or grassland and many of these areas have been degraded in some fashion. Despite these changes, the watershed retains relatively high water quality and areas of outstanding biodiversity significance that warrant special protection, maintenance, and restoration to sustain their function on the landscape.

This area is also home to the only federally endangered plant found exclusively in Minnesota: the dwarf trout lily. This three-inch tall spring ephemeral's entire wild population is restricted to 600 acres in Rice, Goodhue, and Steele counties; primarily in the moist maple-basswood forests along the Cannon River and its tributaries. More contextual information on the watershed is included in Section 5.

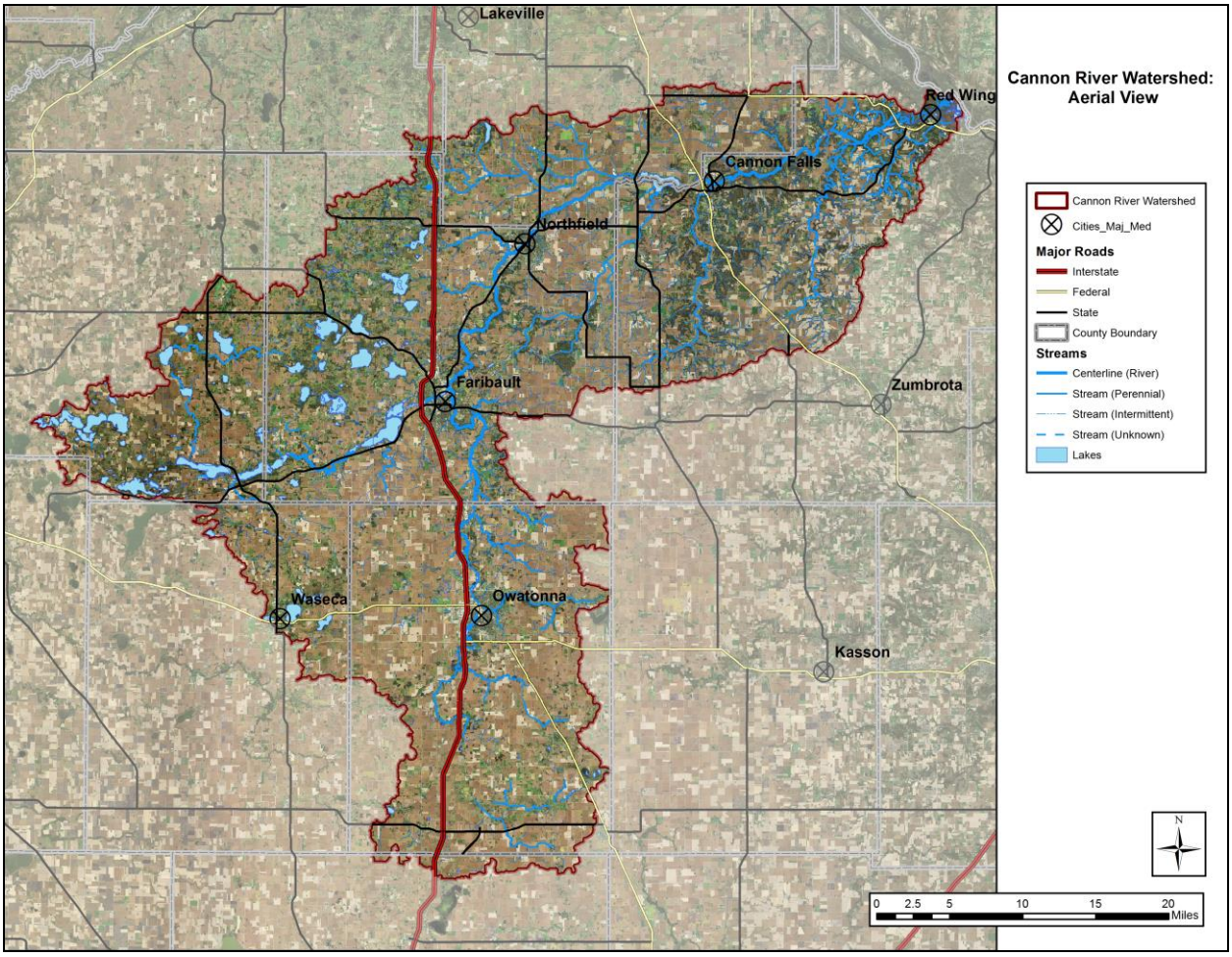


Figure 1. Aerial view of the Cannon River Watershed.

Organization of Plan

The Cannon River Watershed Landscape Stewardship Plan is organized into seven sections. Individuals unfamiliar with the landscape are encouraged to review Section 5 for context on the state of the watershed prior to Section 1.

- Section 1. Landscape Vision and Strategies
- Section 2. Implementing the Plan
- Section 3. Action Plan Template
- Section 4. Monitoring and Evaluation
- Section 5. Landscape Context
- Section 6: Implementation Resources
- Section 7: Conservation Opportunity Area Plans

Plan Audience

This landscape stewardship plan is intended to benefit:

- Local Water Resource Management Plans and Implementation, including the Cannon River One Watershed One Plan (1W1P).
- Forest Stewardship Plans and Implementation
- Fish & Wildlife Management Plans
- Community Land Use Planning and Implementation
- Collaborative Project and Funding Development
- Connections to Forest and Water Resource Policy Decision Makers

These are just a few of the plan's applications and uses. This plan is not intended to incorporate other planning efforts; it is meant to supplement and inform those efforts in a manner that promotes increased and improved collaboration among current and future partners and stakeholders to achieve plan's vision for the watershed.

Process

The Nature Conservancy of Minnesota and the Forest Stewards Guild lead the development of the Cannon River Watershed Landscape Stewardship Plan with input and review from several local stakeholders throughout the process (Table 1). These partners represented a variety of specialties and interests, from both the county and state level.

Table 1. Cannon River Watershed Landscape Stewardship Advisory Committee

Name	Organization	Email
Beth Kallestad	Former Cannon River Watershed Partnership, current U of M Extension	bckall@umn.edu
Steven Pahs	Rice County SWCD	steven.pahs@mn.nacdnet.net
Glen Roberson	Goodhue County SWCD	groberson@goodhueswcd.org
Nicole Schaffer	Natural Recourses Conservation Service	nicole.schaefer@mn.usda.gov
John Stelzner	Dakota County SWCD	john.stelzner@co.dakota.mn.us
Jeanine Vorland	MN DNR Wildlife	jeanine.vorland@state.mn.us
Justin Watkins	MN Pollution Control Agency	justin.watkins@state.mn.us
Jeff Weiss	MN DNR Water Resources	jeffrey.weiss@state.mn.us

Additionally, this plan was developed concurrently with the Minnesota Pollution Control Agency's Watershed Restoration and Protection Strategies (WRAPS) process (see below). Plan developers participated in the WRAPS process, and the stakeholder feedback from that advisory group was also considered in the development of this plan.

Why a Landscape Stewardship Plan

There are a variety of plans and planning efforts in the Cannon River. This plan is unique because it focuses on achieving and maintaining healthy water and biodiversity through land stewardship. While this plan was being written, the Minnesota Pollution Control (MPCA) was concurrently developing a Watershed Restoration and Protection Strategies (WRAPS) plan for the Cannon River Watershed. The focus of the two planning processes were not identical, however they shared several key goals and they helped inform each other in several ways.

With the diverse array of stakeholders in the Cannon River Watershed, a wide variety of plans and planning efforts also cover the region (see Section 2). This plan is not intended to replace those. Instead, it serves as a reference for future and concurrent planning efforts, and to set a framework for coordinated implementation of the multiple conservation efforts those plans represent. For example, the Landscape Stewardship Plan (LSP) was developed at the same time as the Minnesota Pollution Control Agency (MPCA) was developing their Watershed Restoration and Protection Strategies (WRAPS). The two efforts were similar in many ways: both were organized on the watershed boundary, both involved input from multiple stakeholders, and both contained goals for water quality. The WRAPS, however, gives stronger consideration than the LSP to the restoration needs of the watershed, with a strong focus on nutrient load reductions in heavily farmed portions of the watershed. The LSP meanwhile focuses on providing a framework for protecting landscape features like native plant communities that help maintain healthy water.

The WRAPS process provided strong input from multiple partners that was helpful in developing this LSP, and the LSP has been referenced in the WRAPS as a useful tool in developing and coordinating water protection strategies for the in the Cannon River Watershed.

Section 1. Landscape Vision and Strategies

Landscape Vision

The Basin Alliance for the Lower Mississippi in Minnesota (BALMM) is a locally led alliance of land and water resource agencies that coordinates efforts to protect and improve water quality in the Lower Mississippi River Basin. As a key watershed in this region, the Cannon River Watershed Landscape Stewardship Plan adopts the BALMM Vision as the overarching landscape guidance for the watershed.

The BALMM envisions the following to sustain water health and support vibrant rural communities:

- Water resources with safe drinking water from its aquifers and surface water supporting thriving aquatic ecosystems.
- Land uses supporting healthy, resilient, and diverse terrestrial ecosystems and abundant outdoor recreational opportunities.
- Productive and sustainable agricultural resources including ruminant livestock, local food production, managed woodlands, and biomass production.

Desired Future Conditions

The following Desired Future Conditions (DFCs) focus the overarching BALMM landscape vision on the Cannon River Watershed. Many of these DFCs closely align with those of other regional plans and highlight the confluence of objectives between stakeholders in the watershed. Like the rest of the plan, these DFCs are subject to revision and refinement by partner organizations but serve as an overall unifying vision. They include:

- High quality streams and healthy groundwater resources
- Stabilized and increasing populations of rare and threatened species
- Streams with rehabilitated banks and native floodplain vegetation
- Large habitat buffers and corridors around and between core biodiversity areas
- Fire is used as a management tool in appropriate ecosystems
- Consistent funding for cost share assistance associated with various landowner activities such as invasive species control and native plant community restoration
- A more robust hardwood timber market supporting sustainable private timber management
- Improved landowner education
- Active comprehensive conservation planning on priority sites
- Regional land use plans recognize and protect rare features

Achieving the Landscape Vision

This plan was not created to be the guiding document of any organization and its implementation is based on the coordination of voluntary efforts by a wide range of stakeholders that are trying to accomplish their own organizational or individual goals. Therefore, this plan focuses on a list of strategies that can be used by implementing organizations instead of developing goals and objectives that do not have a specific entity accountable for their achievement. The strategies outlined below can be used by individuals and organizations to move the landscape towards the overall vision and desired future conditions. This plan recognizes that not all strategies will work for all organizations but that organizations need to work together in a coordinated effort to accomplish the overall watershed vision. We have organized strategies for achieving the landscape vision around three primary areas of focus: Public Land, Private Land, and Education/Outreach. There is considerable opportunity for overlap between these categories and many activities will take advantage of strategies in multiple categories.

Category	Summary	Principle Actors
Public Land	Strategies under this heading are primarily focused on the region's state and conservancy owned and managed lands. These areas are generally the most protected from conversion threats but often still face the risk of habitat degradation. When well maintained, these areas often provide a tremendous effect on regional biodiversity and water quality. Strategies under this heading include actions that can be done to restore these protected lands or expand these public spaces by acquiring private lands and adding them to the regional public land management portfolio. Permeant conservation easements also fall in this category.	Minnesota DNR Divisions, The Nature Conservancy, MN Land Trust, Trust for Public Land
Private Land	The majority of land in the Cannon River Watershed is in private ownership and only in rare situations are these lands candidates for public land acquisition. Private landowners will manage the rest of this land and their actions will be key to increasing and maintaining regional water quality. This section outlines steps that can be taken to support these landowners in successful stewardship of their lands.	DNR Forestry, Soil and Water Conservation Districts, Board of Water and Soil Resources, Natural Resources Conservation Service, Farm Service Agency
Education & Outreach	Strategies under this heading focus on efforts to increase both the knowledge base and stewardship ethic of landowners, citizens, and whole communities in the region. It recognizes that the foundation of all conservation efforts is the value placed on natural resources by the community.	Cannon River Partnership, UMN Extension

Public Land Strategies

- Hold, manage, and restore currently protected blocks of native habitats. Utilize management tools that, to the extent possible, approximate natural disturbance regimes and strengthen these natural communities. Use public and conservation lands as an anchor point to initiate functional landscape management across ownerships. Utilize sound management on public lands to demonstrate ecological management principles and catalyze improved management on private lands. In addition to standard land management practices, this plan encourages public land managers to expand the following land management tools:
    - Utilize prescribed fire as a key tool in the management and restoration of protected lands. This form of management should imitate pre-suppression era fire-disturbance patterns and increase the presence, and competitiveness, of fire dependent communities.
    - Increase forest cover and forest health through sustainable forest management practices and site and climate appropriate plantings.
    - Integrate climate change projections into management planning. Demonstrate forest management for forest resiliency with a changing climate.
    - Control invasive species through management, monitoring, and outreach.

- Support and pursue opportunities for increased protection through conservation easements and public acquisition in strategically important areas. Focus future acquisitions within targeted Conservation Opportunity Areas (COAs) but continue to look for key opportunities throughout the watershed. Focus acquisition efforts on:
    - The rarest or highest quality natural areas and opportunities to develop natural community buffers around these sites.
    - Protection of karst features and other key water resource areas. Couple these efforts with the installation of native plant community buffers to reduce pollutant run-off entering groundwater.
    - Sites that increase connectivity between natural areas, such as habitat corridors and riparian areas.
    - Sites that expand upon currently protected areas to fully include functioning habitat complexes.

- Agencies and nongovernment conservation organizations engage in productive coordination and collaboration to accomplish the goals and visions outlined in this plan.
    - Seek funding for enhancement projects that will be economical to maintain after completion (e.g. bluff prairie enhancement, forest understory improvement).
    - Seek funding for projects that can be carried out across public land boundaries with cooperation of neighboring landowners.

Private Land Strategies

- Increase the extent of perennial vegetation focusing on critical areas, while improving the condition and function of existing perennial vegetation for the benefit of water quality, quantity, and wildlife habitat.

- Identify opportunities to work with landowners to increase habitat corridors and connectivity. Focus efforts on landowners around publicly owned natural areas to ensure

greater connectivity of native plant communities into a larger matrix of well-managed private forest and grasslands.
    - Contact landowners near important natural areas to assess interest in conservation easements and agricultural set-aside programs such as the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), and Reinvest in Minnesota (RIM).

- Encourage landowner participation in programs that promote the restoration and maintenance of native habitats.
    - Increase CRP acreage availability and landowner enrollment. Work with local seed suppliers to produce and distribute native perennial grass and forb seed that can be utilized on CRP and other conservation planting acres.
    - Increase awareness and funding for cost share programs focused on the management of natural communities on private land. Particular focus is needed on cost share opportunities for invasive species management.
    - Support and promote annual tree sale. Encourage landowners to plant seedlings from appropriate seed zones.

- Ensure professional assistance is readily available to landowners for resource management. This results in management that optimizes resources, meets landowner objectives, and maintains ecological and habitat benefits.
    - Coordinate technical assistance from multiple agencies and stakeholders.
    - Promote consulting businesses who have local forestry and natural community knowledge that can develop forest management plans for landowners.

- Work with area producers to expand the use of low-intensity conservation grazing. Encourage the addition of lightly grazed perennial cover on the upslope woodlands to reduce the rate at which overland flow reaches wooded ravines.
    - Seek funding for enhancement projects that will be economical to maintain after completion (e.g. bluff prairie enhancement, forest understory improvement).
    - Seek funding for projects that can be carried out across public land boundaries with cooperation of neighboring landowners.

- Identify areas and funding for engineering projects that will improve the region's water quality and groundwater recharge.
    - Wetland restoration
    - Water and sediment basins at the wooded bluff edge to reduce ravine head cutting
    - Farm pond improvements
    - Stream bank restoration
    - Grassed waterways
    - Floodplain reconnection and restoration

- Encourage producers to implement best management practices to improve soil health and reduce runoff.

- Collaboration between partners on funding applications.

Education and Outreach Strategies

- Use outreach and education to foster a 'land ethic' about the value of natural resources in the watershed among land managers, landowners, community and citizen groups, and local communities.

- Integrate information on social benefits of sustainable forestry, prairies, buffers, and pastures in outreach documents.

- Educate landowners on, and encourage proper management of, their native plant communities as well as Best Management Practices (BMPs) agricultural and residential areas.

- Inform local officials and elected representatives of the benefits of perennial vegetation for water quality, flood retention, and local quality of life.

- Increase understanding for the role fire once played, and can continue to play, as a land management tool.

- Early identification and management techniques for forest health issues and invasive species.

- Work with local forest products businesses to identify new technologies for under-utilized species and potential markets

- Increase awareness about cost-share, incentive, and tax break programs that provide economically viable options to promote sustainable forest and natural community management by private landowners in priority areas for water quality or habitat enhancement.

- Recognize outdoor recreation and tourism as economic priorities in the landscape.

- Hold annual stakeholder meetings to coordinate completed, ongoing, and planned activities.

- Encourage community and citizen group participation in resource management, monitoring, and restoration.

Section 2. Implementing the Plan

Effective implementation of this plan will take a combination of efforts by an assortment of organizations and individuals at a diversity of spatial and temporal scales. This section outlines the process used to select focal areas for the implementation of this plan called Conservation Opportunity Areas (COAs). It also highlights the wealth of government agencies, non-profit organizations, conservation groups, and stakeholders working in the watershed and their assorted plans. These partners and related conservation plans will be key to implementing the strategies outlined in Section 1. Additional information on implementation resources and funding opportunities can be found in Section 6.

Scaling Project Implementation

The potential strategies and techniques for protecting and managing natural communities and associated waterways are broad and varied. Options on private lands range from providing information and advice to interested landowners all the way to full fee title acquisition and management by a state or non-governmental conservation organization. The "Private Land Stewardship Implementation Tool Box" illustrates how many of these options fall along a spectrum from least to most permanent and beneficial.

Private Land Stewardship Implementation Tool Box

Range of Options

#1	#2	#3	#4	#5	#6	#7	#8
Technical Advice and Assistance	**Stewardship Plans**	**Cost Share Programs**	**Property Tax Programs**	**Construction Projects**	**Conservation Easements**	**Land Trades and Exchanges**	**Fee Title Acquisition**
– Information – Site Visits – Tree Sales – Equipment	– Forest – Agricultural – Grazing	– Federal – State – Local	– Credit – Deferral	– Wetland Restorations – Stream Bank Restoration – Floodplain Reconnection	– Donated – Purchased	– Public – Industrial	– Federal – State – Local

Costs and Benefits

Generally…
- Lower cost
- Less permanent
- Fewer social benefits

Generally…
- Higher cost
- More permanent
- Greater social benefits

Adapted from the "PFM Implementation Tool Box: Foundation to Service Delivery to Private Woodland Owners" originally developed by Dan Steward, Minnesota Board of Water and Soil Resources

As the diagram suggests, services provided to landowners on the left tend to be less costly, but are also less permanent and less explicitly connected with societal benefits. In contrast, techniques listed further to the right side of the spectrum, while more costly, generally tend to be more permanent and produce more easily recognized benefits to society. While less permanent, the options on the left can be implemented at broader scales across the landscape, while the expense of the more permanent solutions requires them to be much more targeted. An efficient strategy recognizes that different options will be appropriate on different scales and in different places, depending on the human, economic, and natural communities involved. This is especially true in a landscape like the Cannon River, where the majority of the land is privately owned.

Conservation Opportunity Areas

To help direct conservation efforts within the watershed in strategic and cost effective ways, several Conservation Opportunity Areas (COAs) have been identified to focus efforts on to have the greatest impact protecting habitat and water quality. In general, these areas have not been seriously degraded or developed, and support quality natural communities and habitat, but lack a significant amount of long-term protection or management planning. Landforms most closely connected to the rivers and streams are particularly important to protect and improve, as these areas will play a larger role in maintaining water quality in the watershed. Identification of these areas relied on a combination of data analysis and the firsthand knowledge of local natural resource professionals and stakeholders.

Overview- What to look for in a COA

Across a landscape, the quality of local areas in terms of habitat and ecosystem function is likely to be spread across a general continuum ranging from high-functioning intact ecosystems to heavily altered and degraded ones. In the most seriously degraded systems, their condition is practically irreversible, and mitigation of broader landscape impacts (e.g. pollution, energy use, water consumption) should be the focus of environmental policies. There will also be highly degraded areas for which restoration to functioning native plant community states could be possible, but would take unreasonably large investments. In the Cannon River watershed, many areas of agricultural row crops fall into this category. When these lands exist in places of remarkable importance in the landscape, restoration efforts may be appropriate. Over a large scale, however, restoration is not practical, and efforts should focus on sustainable practices to maintain soil fertility and prevent pollution and erosion.

On the other end of the spectrum, high functioning ecosystems exist which have avoided serious degradation or alteration from human activities, and which are most commonly publicly managed and protected from future development or degradation. The historical reasons for their preservation can vary. In the Cannon River watershed, such areas are often found on steep forested hillsides along the region's rivers and lakes which would have been impractical to plow,

and where fire would not have been a crucial part of the disturbance regime prior to suppression. After several waves of renewed national and state interest in conservation over the past century, many of these areas have been protected in some manner. Their impressive natural condition has made them preferred targets of conservation and enhancement activities, which has increased their overall quality relative to nearby areas. Continued protection and proper management is important to preserve these special areas. However, the added benefit to the overall ecology of the landscape of additional funding or enhancement efforts is likely to be less than work done in areas with more room for improvement.

Between these two extremes will be the areas for which routine conservation efforts will have the greatest impact on the landscape scale. Examples could include existing high quality habitat that is not sufficiently protected from development, areas where natural conditions have recovered from historical damage but important plant or animal populations have not yet returned, or areas that have not been degraded, but require additional management to maintain high levels of ecosystem function.

Prioritization Methodology

GIS analysis was used to determine priority areas for conservation focus within the Cannon River Watershed. Several spatial data layers were used to quantify the water and habitat quality, and conservation assets, priorities, and threats that exist within each of the 45 HUC-12 sub-watersheds in the CRW. An analysis of development and agricultural conversion risk was also used to quantify which HUC-12s were most likely to experience habitat loss or water quality degradation.

Habitat and Water Quality:

These layers were selected to rate HUC12 sub-watersheds based on the presence and abundance of features likely to be a focus of multi-benefit protection efforts.

Data Set	Scoring Method
MBS Biodiversity Significance Rankings	A raster was created scoring cells of "Outstanding" biodiversity significance 4 points, "High" 3 points, "moderate" 2 points, and "Below" 1 point. All "No Data" areas were 0 points. The zonal mean for each HUC12 sub-watershed was calculated, and scores were standardized to 10 points by dividing each sub-watershed by the max score and multiplying by 10.
Public Ownership (GAP Stewardship 2008)	Total area of public and conservation land in each sub-watershed was calculated. Scores were standardized to 10 points as follows: Less than 500 acres = 2 points; 500-1,000 acres = 4 points, 1,000-1,500 acres = 7 points, more than 1,500 acres = 10 points. [selection of these thresholds was based on visual histogram analysis]
Stream Quality Thresholds	Monitoring stations reporting values within the Minnesota Pollution Control Agency's confidence interval of relevant water quality thresholds were given the following points: Above threshold, but within CI: 10 Points Below threshold, and within ½ of the CI: 4 points More than ½ the CI below threshold, within one CI: 2 points

EBI Habitat Quality Index	The zonal mean of each sub-watershed was calculated for the EBI Habitat Quality layer. Sub-watersheds were then classified into quintiles, with the top quintile receiving 10 points, the 2nd highest 8 points, the third highest 6, etc.
Perennial Cover in Critical Areas (EBI Water Quality; NLCD 2011)	Overlapped National Land Cover Database (NLCD) 2011 land cover data and the EBI Water Quality layer to pick out areas scoring over 60 in the EBI data for their impact on water quality that were mapped as having perennial landcover in the NLCD data. The total area in each HUC12 was calculated and standardized to 10 points.

The **Biodiversity Significance Rankings** from the Minnesota Biological Survey (MBS) provide categorical assessments of a sites importance in sustaining the natural biodiversity of Minnesota. A site's biodiversity significance rank is based on the presence of rare species populations, the size and condition of native plant communities within the site, and the landscape context of the site. Sites are ranked as either "Outstanding," "High," "Moderate," or "Below." (http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html)

The **GAP Stewardship 2008** data layer is a map of land ownership in Minnesota. Attributes are available for both ownership and administrator. It was used to determine what percentage of each minor watershed is under private ownership, not counting non-governmental conservation organizations. (http://www.mngeo.state.mn.us/chouse/land_own_general.html)

Minnesota Pollution Control Agency's (MPCA) **Index of Biological Integrity** assesses biological communities, specifically invertebrate or fish communities, to measure the health of those communities as they reflect the integrity of the stream ecosystem. Populations are sampled at monitoring stations along streams, and the community health is scored based on the relative tolerances of the organisms found. Different stream types have thresholds for acceptable quality, along with confidence intervals surrounding those thresholds. (https://www.pca.state.mn.us/water/index-biological-integrity)

The **EBI Habitat Quality Index** is one of three component parts of the Environmental Benefits Index (EBI) compiled by the MN Board of Water and Soil Resources (BWSR) and the University of Minnesota. It is developed using data from several datasets mapping habitat for biodiversity, game species, birds, and species of greatest conservation need.

(http://www.bwsr.state.mn.us/ecological_ranking/)

The **EBI Water Quality Risk Index** is one of three component parts of the Environmental Benefits Index (EBI) compiled by the MN Board of Water and Soil Resources (BWSR) and the University of Minnesota. It uses an area's Stream Power Index (SPI) and its proximity to water to assess the likelihood of it contributing runoff from overland flow.

(http://www.bwsr.state.mn.us/ecological_ranking/)

The **National Land Cover Database** was created through a cooperative project conducted by a partnership of federal agencies called the Multi-Resolution Land Characteristics (MRLC) Consortium. NLCD 2011 is the most up-to-date iteration of the National Land Cover Database and provides 30-meter resolution land cover for the entire country. (www.mrlc.gov)

Conversion Risk:

The **Agricultural Conversion Risk Layer** and **Development Risk Layer** were developed by Kristin Blann, Freshwater Ecologist for The Nature Conservancy. The Agricultural Conversion layer uses soil type, slope class, cover type, and distance from other agricultural land to determine the likelihood of a parcel or field being converted from perennial cover to row crops. The development risk layer predicts likelihood of conversion from perennial cover for development based on township growth projections and proximity to major roads. Both layers are raster data on a 1 to 100 scale. The zonal mean for each sub-watershed was standardized to a 10-point scale.

Watershed Health Assessment Framework (WHAF):

A subset of the layers available from the WHAF was also included in the analysis (all scores standardized to 10 points for each HUC12 for each of the main categories below):

The Watershed Health Assessment Framework was developed by the Minnesota DNR as a set of statewide metrics that measure various components of watershed health. HUC-12 sub-watersheds are ranked on 100-point scales on a number of criteria. A subset of those criteria was included in this analysis. The criteria used were separated by WHAF component, and the component scores for each sub-watershed were divided by 10, resulting in a 10-point scale.

Component	Scoring Method
Hydrology	– Perennial cover index (2011) – Impervious cover index (2011) – Storage, straightened-meandering stream ratio index
Biology	– Aquatic invertebrate IBI – Fish IBI – Mussel score
Connectivity	– Riparian connectivity – Aquatic connectivity
Water Quality Metric	– Non-point sources: phosphorous risk – Wastewater treatment plants – Superfund sites – Septic systems – Potential contaminants – Animal units

Analysis and Results

Final scores for each sub-watershed were calculated by taking the sum of the average component score within each scoring category (Protection Value, Conversion Risk, and WHAF Metrics). Since each component within the categories had a max score of 10, this resulted in combined scores for each HUC12 having a max of 30. Each sub-watershed was then ranked by percentile. Figure 2 shows those sub-watersheds that scored in the top four deciles (60th percentile and above).

Based on those combined rankings, COAs were designated to capture contiguous, high scoring sub-watersheds that contained recognizable ecological complexes. COA boundaries were primarily based on sub-watersheds, with the edges expanded in places to fully capture ecologically significant natural communities (as mapped by either the Minnesota Biological

Survey's Biodiversity Significance layer or DNR Wildlife's Wildlife Action Network) that straddle a watershed divide. The final COA shapes are shown in Figure 3.

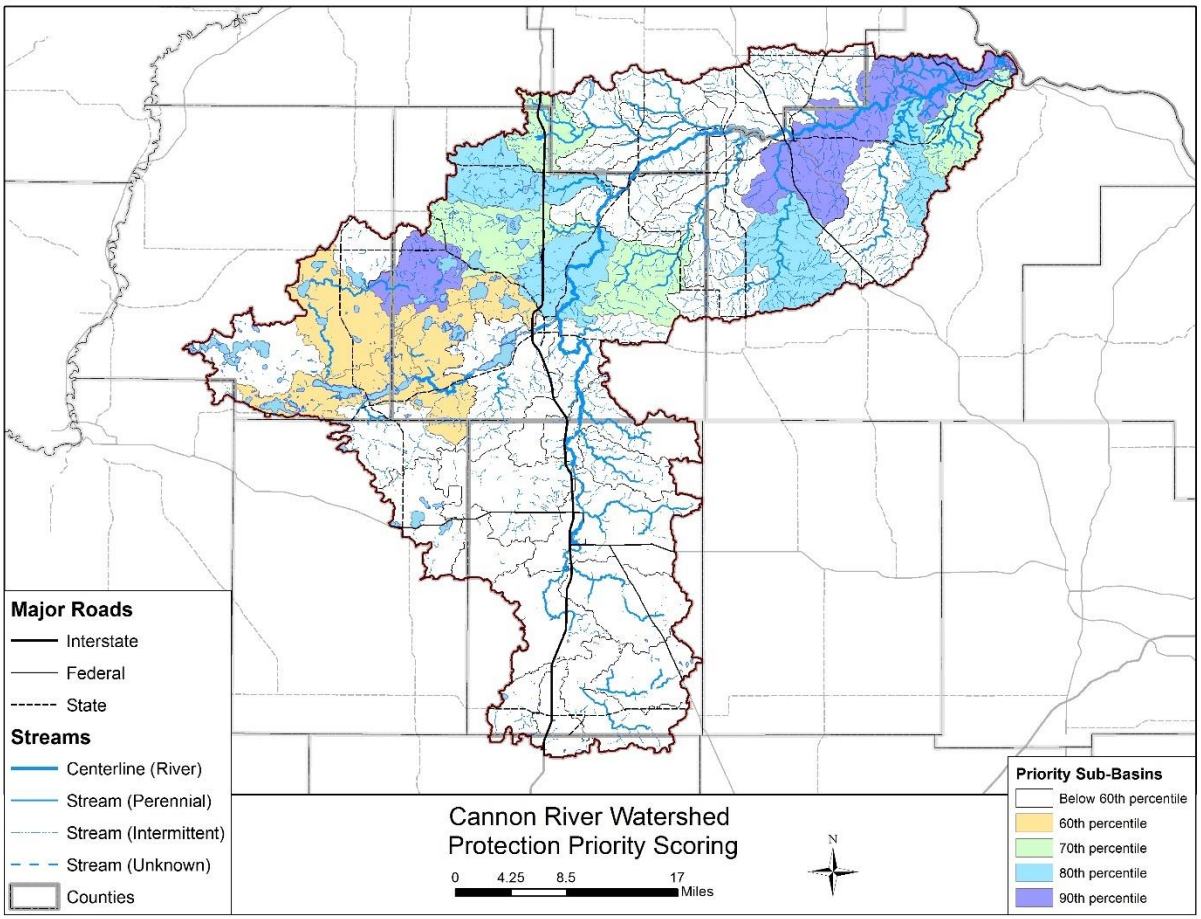


Figure 2. Combined priority-ranking scores for the Cannon River Watershed.

Selected Conservation Opportunity Areas

Four COAs were selected in the Cannon River Watershed based on the assessment information (Figure 3).

- The Big Woods COA covers 51,053 acres in the headwaters of Prairie Creek and the Crystal Lake section of the Cannon River north and east of Faribault and south of Northfield. The Big Woods COA includes several key natural areas such as Nerstrand Big Wood State Park, Cannon River Trout Lily State Scientific and Natural Area, Rice County's Cannon River Wilderness, and The Nature Conservancy's Trout Lily Preserve. It also includes several privately owned tracts protected through the Forest Legacy easement program.

- The Headwater Lakes COA is the largest COA in the Cannon River Watershed at 98,306 acres. It covers the Cannon River's headwaters northwest of Faribault, east of Lonsdale, and west of Northfield. This area features rolling topography that is pocketed with numerous small lakes, wetlands, and patches of forest.

- The Little Cannon COA lies south of Cannon Falls encompassing 51,163 acres in the Little Cannon watershed. The COA is entirely privately owned and contains several high quality natural areas. The lack of public-land in this COA puts and even higher onus on the need to support private landowner stewardship for the maintenance of these natural areas and associated water quality.

- The Lower Cannon COA encompasses the bottom 76,673 acres of the watershed between Cannon Falls and the Cannon River's confluence with the Mississippi River near Red Wing. In addition to the Cannon main stem, the COA includes all or portions of the Lower Belle Creek, Pine Creek, Spring Creek, and Trout Brook watersheds that support cold-water fisheries. Key natural areas in the Lower Cannon COA include Cannon River Turtle Preserve SNA, Spring Creek Prairie SNA, portions of the Richard J. Dorer Memorial Hardwood State Forest, and Dakota County's Miesville Ravine Regional Park.

These four COAs represent places of emphasis for the conservation actions outlined in Section 1 of the plan. Individual stewardship plans for each COA are found in Section 7. These plans focus on specific resources and needs, as well as strategies that are appropriate to the different social resources and ownership patterns within each COA.

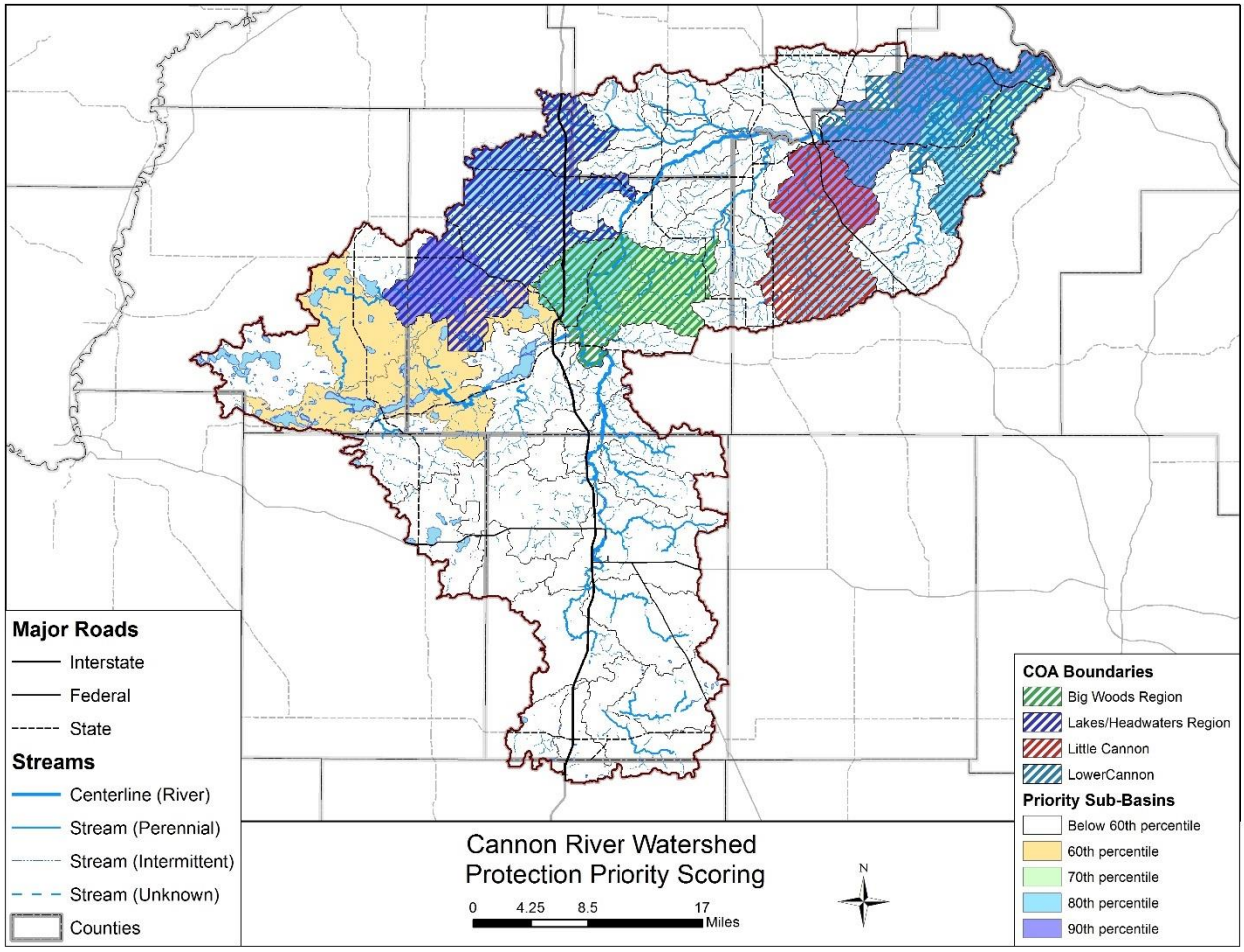


Figure 3. Conservation Opportunity Areas shown with the combined priority-ranking scores in the Cannon River Watershed.

Partners and Partnerships

With the wealth of government agencies, non-profit organizations, conservation groups, and stakeholders working in the watershed, coordinating efforts can make efficient use of time and resources. Thus increasing the impact each group makes on the ecological health of the watershed. These coordination efforts are important across the entire watershed and within the focal COAs. Experience has taught us that focusing coordination for healthy lands and waters within, and between, these COAs often has higher viability and can be a crucial step in achieving buy-in for coordination efforts across the landscape.

Achieving the goals of this plan will require a wide variety of groups and agencies to provide seamless service to private landowners interested in managing their land, while also performing public land management in a manner and sequence that makes the biggest impact. All agencies involved should complement each other's efforts towards the common goal of implementing sustainable natural resource management.

Conservation and stewardship of natural communities, ecosystem health, and water quality require sustainable behaviors and attitudes from numerous private individuals and public agencies that affect economic, cultural, and recreational resources of the community. As such, it is an inherently collaborative effort. The potential partners for conservation in the Cannon River watershed include a number of state and federal agencies, as well as non-governmental conservation groups. The adjacent list includes many, but not necessarily all, such partners.

State Agencies:
- Board of Water and Soil Resources
- DNR Ecological & Water Resources
- DNR Fish and Wildlife
- DNR Forestry
- DNR Parks and Trails
- MN Dept. of Agriculture
- MN Forest Resources Council
- MN Pollution Control Agency
- University of Minnesota

Local Government:
- County and City
- SE MN Water Resource Board
- Soil and Water Conservation Districts

Federal Agencies:
- Natural Resources Conservation Service
- U.S. Fish and Wildlife Service
- U.S. Forest Service

Non-governmental Organizations:
- Basin Alliance for the Lower Mississippi in Minnesota
- Cannon River Watershed Partnership
- Land Management Consultants
- Minnesota Land Trust
- Pheasants Forever
- The Nature Conservancy
- Trout Unlimited
- Trust for Public Land

Related Conservation Plans

Minnesota has a long history of taking this "landscape" approach to natural resource planning and this plan builds off efforts by the Minnesota Forest Resource's Council's Landscape Program and previous watershed based landscape stewardship plans developed for the Kettle, Root, Zumbro, and Mississippi River – Winona watersheds. While there are many ways to divide a region into landscapes, using watersheds as the organizing feature emphasizes the link between natural resource management and water. It also parallels other state planning trends, such as the move to One Watershed One Plan (1W1P) plans to replace local water plans. Planning natural community stewardship by watersheds increases the value of Landscape Stewardship Plans as resources for other water planning exercises.

The list below highlights several conservation or development plans covering portions of the watershed whose goals or actions may overlap and influence conservation efforts outlined in this Landscape Stewardship Plan.

- MPCA Cannon River Watershed Restoration and Protections Strategies (WRAPS)
- Cannon River One Watershed, One Plan
- Dakota, Goodhue, Le Sueur, Rice, Steele, and Waseca Counties' Comprehensive Plans and Water Management Plans
- MFRC Southeast Landscape Plan
- MN DNR Blufflands/Rochester Plateau Subsection Forest Resource Management Plan (SFRMP) and Extension
- MN DNR State Wildlife Action Plan, 2015-2025
- MN DNR Minnesota Scientific and Natural Areas (SNA) Program Strategic Land Protection Plan
- MN DNR Aquatic Management Area Acquisition Plan
- MN DNR Division of Fisheries Strategic Plan for Coldwater Resources Management in Southeast Minnesota
- Northern Cannon River Watershed Management Organization
- Basin Alliance for the Lower Mississippi in Minnesota 2001 Basin Plan Scoping Document

Watershed Restoration and Protection Strategies (WRAPS)

This plan is intended to support the efforts outlined in the 2016 Cannon River WRAPS Plan. The WRAPS plan was developed concurrently with the development of the Landscape Stewardship Plan and should be referenced along with this plan for projects in the watershed. The WRAPS process occurs on a 10-year cycle for each HUC8 watershed in the state with the Cannon River effort concluding in 2016. Periods of elevated water quality monitoring lead to analysis of collected data to determine the stressors and impairments of watershed streams. That information is then incorporated into a table and document outlining the water quality issues facing the watershed and necessary strategies to both restore impaired areas and protect healthy areas. Data collected during this WRAPS process were used in the development of this plan, and it is intended that the objectives and strategies it lists will inform the protection strategies outlined in the WRAPS process.

One Watershed One Plan

Stakeholders began developing a One Watershed One Plan (1W1P) for the Cannon River Watershed while the Landscape Stewardship Plan was being developed. The vision of the 1W1P program is to align local water planning on major watershed boundaries with state strategies towards prioritized, targeted and measurable implementation plans. The Cannon River is one of the first watersheds in the state to go through this Minnesota Board of Water and Soil Resources (BWSR) coordinated process. This approach to local government water management implementation plans focused watershed boundaries helped lead the Landscape Stewardship Plan to base its boundaries on the watershed and it is intended that these two plans can inform each other in their development and implementation.

Cannon River Watershed Partnership

The Cannon River Watershed Partnership (CRWP) is a nonprofit organization that strives to engage people to protect and improve the water quality and natural systems of the Cannon River watershed. The organization focuses on improving water-quality, reducing sedimentation and flooding, and improving habitat for all plants and animals through their three main program areas: Agriculture, Community Engagement, and Small Community Wastewater. A 25 member Board of Directors governs the CRWP. Twelve are public officials (six county commissioners and six Soil and Water Conservation District Supervisors from the six counties of the watershed) and thirteen are citizen members.

CRWP will be a valuable partner in efforts moving forward, for both their outreach and educational capacity and their ability to convene important stakeholders in the watershed. Additionally they have a diversity of plans, reports, and publications that will be useful in any future efforts in the watershed.

Minnesota Forest Resources Council Southeast Landscape Plan

The MFRC Landscape Program fulfills the MFRC's charge to "encourage cooperation and collaboration between public and private sectors in the management of the state's forest resources." This grass-roots effort builds relationships, strengthens partnerships, and identifies collaborative forest management projects that address local needs and represent concrete steps in determining and reaching citizen-identified short-term and long-term goals for broad landscape regions. Committee members represent forest industry, natural resource agencies, individual landowners, non-profit organizations, educational institutions and concerned citizens. The Southeast Landscape Committee completed a revised landscape plan, Southeast Landscape Plan: A Regional Plan to Guide Sustainable Forest Management, in November 2014.

Future Plan and Policy Integration

Land and water resources can be directly impacted by management plans and policies that govern land use, economic development, transportation, utilities, water resources, forest resources and other natural resources. To better influence future policy and minimize issues, partners and key stakeholders must be aware of existing and proposed plans and policies and how they may impact natural resources stewardship planning efforts. They must also be engaged early in policy discussions to integrate sustainable resource management into the planning process. Landscape stewardship can provide reliable and relevant information for local officials to help define the context and value of natural resources in a community.

Section 3. Action Plan Template

The purpose of this section is to outline steps that would be required to accomplish the vision outlined in Section 1 of the plan. This section delineates a generalized action plan for those items that call for measurable on-the-ground actions to be taken in the watershed with targets for the levels of action to be taken after five and ten years (Table 2). These targets are based off information on what is currently happening in the landscape, and what may be possible under a realistic growth scenario. Targets are listed either as 5- or 10-year totals or as annual averages for the first five years and second five years. These general targets set measureable goals for the landscape with the caveat that individuals and organizations will set their own targets that, when combined, will move the entire landscape towards these targets. No one entity will be responsible for attaining all of these targets. With any effort, there is year-to-year variability and annual values are expected to fluctuate.

Other strategies are not as conducive to measureable targets but are no less important to achieving the landscape vision. Many of these will be implemented through structures of collaboration and data management that are not listed in this table. Additionally, several strategies refer to social or legislative changes for which measurable actions are not immediately apparent, but which the plan nevertheless wishes to endorse as positive directions for the future health of native communities and water quality in the region.

Table 2. Benchmark targets for implementing the Cannon River Watershed LSP.

Strategy to Achieve the Landscape Vision	5-Year Target	10-Year Target
Utilize prescribed fire as a tool in management and restoration.	600 acres of natural areas burned annually	600 acres of natural areas burned annually
Increase forest cover through site and climate appropriate plantings.	1,000 new acres of forestland	2,000 new acres of forestland
	50,000 seedlings sold by SWCDs annually	50,000 seedlings sold by SWCDs annually
Control invasive species through management, monitoring, and outreach.	2,000 acres treated	5,000 acres treated
Pursue opportunities for increased protection through conservation easements and public acquisition in strategically important areas.	600 acres acquired	1,500 acres acquired
Protection of karst features and other key water resource areas. Focus these efforts through installation of native plant community buffers to reduce pollutant run-off entering groundwater.	80% of karst features protected with	100% of karst features protected with

	appropriate buffers	appropriate buffers
Identify opportunities to work with landowners to increase habitat corridors and connectivity. Focus efforts on landowners around publicly owned natural areas to ensure greater connectivity of native plant communities into a larger matrix of well-managed private forest and grasslands.	100 landowners contacted	200 landowners contacted
Encourage landowner participation in programs that promote the restoration and maintenance of native habitats. Increase CRP acreage availability and landowner enrollment.	3,000 acres added to conservation programs	9,000 acres added to conservation programs
Promote consulting businesses who have local forestry and natural community knowledge that can develop forest management plans for landowners	50 new stewardship plans	100 new stewardship plans
Work with area producers to expand the use of rotational or conservation grazing. Encourage the addition of sustainably grazed perennial cover on the upslope woodlands to reduce the rate at which overland flow reaches wooded ravines.	500 new acres of conservation grazing	3,000 new acres of conservation grazing
Identify areas and funding for engineering projects such as wetland restorations and farm pond improvements that will improve the region's water quality and groundwater recharge.	30 new projects implemented	60 new projects implemented
Identify areas and funding for engineering projects such as water and sediment basins at the wooded bluff edge to reduce ravine head cutting.	10 new projects implemented	20 new projects implemented
Identify areas and funding for engineering projects such as stream bank restoration.	10 new miles of streambank stabilization	20 new miles of streambank stabilization
Encourage producers to implement best management practices to improve soil health and reduce runoff	BMPs implemented on 5,000 new acres in COAs through programs like EQIP	BMPs implemented on 10,000 new acres in COAs through programs like EQIP
Use outreach and education to foster a 'land ethic' among land managers, landowners, community and citizen groups, and local communities	3 outreach events per year	3 outreach events per year

Agency and Organization Recommendations

Outreach and Community Engagement Organizations

Examples: Cannon River Watershed Partnership, SWCDs, U of M Extension

1. Host General and Targeted Outreach Events. The majority of landowners and the public value healthy natural communities, but may not be informed about the full benefits they provide to society, or the ways they can help protect and enhance them. Educating landowners on sustainable forest management, invasive species control methods, and best management practices for forestry and agriculture can help them take measures to protect and enhance the ecological health of their property. Informing the broader public on the value of natural communities, and ways to prevent the spread of invasive species can also be helpful.

2. Natural Area Management Techniques. Develop online content and host events showcasing natural area management techniques. Often landowners would like to undertake land stewardship projects but often lack the confidence to do them or awareness of the best techniques. Information on vegetation selection, planting techniques, and ways to limit herbivore damage are topics to consider.

3. Connections with Elected Officials. Encourage the connection of elected officials with their constituent groups through education programs. Promote and support sustainable resource education programs that connect informed citizens with elected officials.

Technical and Financial Assistance Organizations

Examples: SWCDs, Private Consultants, DNR Forestry, NRCS, FSA, BWSR

1. One-on-one Technical Assistance. The adoption of sustainable natural area practices and best management practices are improved when landowners are provided with technical assistance needed to properly implement them. This can be done directly by professionals within agencies, such as DNR Forestry and SWCDs, or through local consultants and contractors with the necessary skills.

2. Financial Assistance. Incentive programs provide technical and financial assistance that is designed to help achieve goals and policies established by Federal, State, and local agencies. Incentive programs have long been the foundation for promoting land stewardship among landowners. Examples include the EQIP program from NRCS and CRP from FSA. BWSR also provides financial assistance programs through local SWCDs. These and other financial assistance programs should be maintained or expanded.

3. Increase Awareness of Technical Assistance Options. Many landowners may not be aware of the numerous programs and resources to help them with their land stewardship. Increased

advertising and awareness should increase the utilization of the great services offered by consultants, agencies, and non-profit organizations.

Natural Resource Agencies

Examples: DNR Fish and Wildlife, DNR Forestry, US Fish and Wildlife Service, County Land Departments

1. Commitment to Sustainable Natural Resources Management. Many private landowners will look to public lands as a model for land management, and when done well, management on these lands often provides a tremendous effect on regional biodiversity and water quality. Natural Resource Agencies should be aware of this and undertake efforts to expand prescribed burning, invasive species control, sustainable silviculture, and other activates that will benefit local biodiversity and water quality as well as serving as a model for private landowners.

2. Service to Landowners. Continue to improve the delivery of technical and financial assistance on forest and prairie management to private landowners. Continue to promote native plant communities using the Ecological Classification System (ECS) as a guide to developing land management strategies when working with landowners and local officials. Refer to this Landscape Plan and its COA Plans.

3. Important and Critical Areas. Continue to identify and protect important or critical ecological areas in the landscape, particularly focused within the COAs, though conservation easements or strategic acquisition. Put an emphasis on NPCs, identified biodiversity sites, and impacts on water quality in these areas.

4. Public Investments. Local, State, and Federal investments are made in all communities on a regular basis. Public investments are made to construct public facilities and support public lands, but their location and operation across the watershed can significantly impact, positively or negatively, private land use decisions. Roads, bridges, and waterways support public good but also encourage and support private investment. Partners and stakeholders concerned about conserving natural communities should consider strategies that help shape relevant decision-making processes related to public investments.

5. Data Gathering. Support the collection, organization and evaluation of data collected relating to natural resources at the local level on private lands. Encourage the coordination and sharing of data with other resource agencies and local officials.

6. Fund Restoration Projects. Natural resource management is a long-term commitment and requires long term funding to reach the desired future conditions. Contribute staff time or direct funding to support projects.

Board of Water and Soil Resources

1. Support healthy watershed protection easements in Southeast Minnesota. Healthy Watershed RIM easement programs are being piloted in other areas of Minnesota. Similar programs targeting managed grassland and forestland on key landforms in the Southeast would be a powerful tool to help protect both water quality and existing native plant communities. One possible example would be a CREP style arrangement providing CRP payments for 10 years and placing a permanent RIM easement on highly erodible or moderately steep cropland converted to grassland that slopes towards hillside forest communities.

Clean Water Fund Advisory Council

1. Healthy Forests for Healthy Waters. Continue to support programs that target natural community protection for water quality benefits. The Healthy Forests for Healthy Waters (HFHW) program managed by DNR Forestry's CFM program provides a good example. These programs enable stewardship specifically targeted for multiple benefits on the landscape.

Conservation and Non-governmental Organizations

Examples: The Nature Conservancy, Minnesota Land Trust, Pheasants Forever, Trust for Public Land

1. Commitment to Sustainable Natural Resources Management. Many private landowners will look to public lands as a model for land management, and when done well, management on these lands often provides a tremendous effect on regional biodiversity and water quality. Conservation organizations should be aware of this and undertake efforts to expand prescribed burning, invasive species control, sustainable silviculture, and other activates that will benefit local biodiversity and water quality as well as serving as a model for private landowners.

2. Important and Critical Areas. Continue to identify and protect important or critical ecological areas in the landscape, particularly focused within the COAs, though conservation easements or strategic acquisition. Put an emphasis on NPCs, identified biodiversity sites, and impacts on water quality in these areas.

3. Reference Document. Conservation groups and NGOs are encouraged to use this Plan as a reference document when developing their plans and strategies.

4. Collaboration. Encourage the partnering of conservation and non-governmental organizations to address major resource management issues.

5. Fund Restoration Projects. Natural resource management is a long-term commitment and requires long term funding to reach the desired future conditions. Contribute staff time or direct funding to support projects.

6. Connections. Connect members and citizens with resources on sustainable natural resource management topics.

Local Officials

1. Reference Document. Local officials are strongly encouraged to use this Plan as a reference document when developing their resource management plans including county water plans, local land use plans, and state resource plans. They are further encouraged to adopt this landscape stewardship plan as an appendix to their plans to provide more detailed guidance on sustainable natural resource management and support more proactive and collaborative funding development.

2. Consider Forests, Prairies and Riparian Areas in Local Land Use Decisions. Local officials are encouraged to consider the values and benefits that natural areas can bring to their communities. Healthy and sustainable forests and prairies promote a high quality of life for citizens and can support increased economic opportunities as well. Forests, prairies, and streams should be included in the land use decision making process.

3. Resource-Based Planning. Local officials are encouraged to incorporate a more comprehensive consideration of natural resources into their land use planning process.

4. Alternative Development Options. There are alternative ways that land can be developed to provide for both economic growth and the protection of natural resources. Local officials are encouraged to use forestry as a way to improve their communities and their future development. Zoning should take into account impacts on natural areas and water quality.

DNR Forestry Cooperative Forest Management Program

1. Local CFM Foresters. Maintain support and funding for local CFM foresters. Continue to provide cost share services to private landowners for appropriate forestry activities. Direct local CFM foresters to engage in direct outreach with key landowners in COAs identified in this plan.

2. Target Cost Share Funding. Place priority on funding cost share programs targeted to strategic locations within watersheds, including the COAs identified in this plan. Emphasize funding for activities that will maximize the multiple benefits of forests.

Minnesota Forest Resources Council

1. Convening Body. Serve as a convening body for data and accomplishment sharing though the Southeast Landscape Committee. Support the increased sharing of ideas and experiences between the individuals and organizations involved with implementing the plan. Provide updates on sustainable natural resource management activities taking place with other watersheds.

2. Staff Support to the SE Committee. Provide additional staff support to the efforts of the Southeast Committee that can help in the ongoing implementation of this plan and coordination of its recommended activities.

3. PFM Funding. Find ways to increase funding support for the private forest management program administered by the DNR to serve more landowners.

Forestry and Natural Area Consultants

1. Reference Document. Private land consultants are encouraged to use this plan as a reference document when developing Forest Stewardship Plans and other landowner materials. Reference the connection between the actions landowners take on their land and the larger landscape in written and verbal communication with clients.

2. Engage with Public Land Managers. Stay connected with public land managers and see if there are cross-boundary projects that can benefit public and private landowners while moving towards the overall landscape vision.

Private Landowners

1. Become Informed. The organizations mentioned in this document have numerous programs and resources to help landowners become more informed about sustainable forestry and the benefits of forests and natural areas to our communities. All landowners are encouraged to become more knowledgeable about natural resources. Learning about best management practices (BMPs) is one easy way to get started. Recognize that forestry and natural area management is a long-term endeavor and that changes on the land will generally take several years to become realized.

2. Seek Technical Assistance. While there are numerous sources of information available, landowners are encouraged to seek technical assistance to help manage their forestlands. Often a landowner may need assistance from many technical service providers.

3. Get Involved. All citizens and landowners are encouraged to get involved in their communities and help promote sustainable forestry and natural area management. Voicing your concerns and sharing your ideas will help generate many new opportunities to improve forests, waters, and the quality of life in the region.

Section 4. Monitoring and Evaluation

The purpose of this section is to provide an initial outline for monitoring and evaluating the implementation of this Plan over the next ten to twenty years. The Southeast Landscape Committee will work with partner agencies and conservation organizations to develop this monitoring program. They will periodically review progress made towards the implementation of this plan based on information provided by partners in the watershed and report their findings to the Minnesota Forest Resources Council.

Overview

A critical portion of any management plan is the effort to monitor what has been accomplished as well as evaluate the effectiveness of the project's approach to natural area stewardship over time. The effects of plan implementation on ecological, economic, and social goals should all be tracked in an iterative process of assessing/identifying problems and recommending a series of solutions. Monitoring effects and adapting recommendations accordingly allows a plan to remain relevant in responding to the changes in landscape condition, scientific knowledge, and social needs over time.

The monitoring framework of this plan is based on the Desired Future Conditions and Strategies outlined in Section 1. Short-term efforts will focus on the strategies, and these will provide the basis for monitoring success in implementing the plan. Long-term monitoring will focus on how effective implemented plan projects are at bringing the condition of the watershed close to meeting the overall Desired Future Conditions.

Short-Term: Monitor Performance and Evaluate Process

Annual monitoring should focus on rates of implementation for recommended programs and actions. Different measurements and criteria will be appropriate for different activities. For some activities, especially those focused on creating data management networks or building community engagement, narrative descriptions will be the best reporting method. Management or restoration activities are best measured by acres affected or landowners assisted. The Southeast Landscape Committee will coordinate the tracking of annual results for each strategy. A sample of a few metrics is included in the table below.

Strategy to Achieve the Landscape Vision	Metric
Utilize prescribed fire as a tool in management and restoration.	Acres burned
Increase forest cover and forest health through sustainable forest management practices and site and climate appropriate plantings.	Trees planted
Control invasive species through management, monitoring, and outreach.	Acres treated
Pursue opportunities for increased protection through conservation easements and public acquisition in strategically important areas.	Acres acquired, Easements added

Protection of karst features and other key water resource areas. Focus these efforts through installation of native plant community buffers to reduce pollutant run-off entering groundwater.	Percent of karst features with adequate vegetation buffers
Identify opportunities to work with landowners to increase habitat corridors and connectivity. Focus efforts on landowners around publicly owned natural areas to ensure greater connectivity of native plant communities into a larger matrix of well-managed private forest and grasslands.	Landowners contacted
Encourage landowner participation in programs that promote the restoration and maintenance of native habitats. Increase CRP acreage availability and landowner enrollment.	Acres added to conservation programs
Promote local consulting businesses who meet CEU requirements and have local forest resource knowledge to develop forest management plans for local landowners	Number of new stewardship plans
Work with area producers to expand the use of low-intensity conservation grazing. Encourage the addition of lightly grazed perennial cover on the upslope woodlands to reduce the rate at which overland flow reaches wooded ravines.	Acres of conservation grazing
Identify areas and funding for engineering projects such as wetland restorations, sediment basins, farm pond improvements, stream bank restorations, grassed waterways, and floodplain reconnections that will improve the region's water quality and groundwater recharge.	Number of new projects implemented and miles of streambank stabilized
Encourage producers to implement best management practices to improve soil health and reduce runoff	Acres added to EQIP BMPs
Use outreach and education to foster a 'land ethic' among land managers, landowners, community and citizen groups, and local communities	Number of outreach events and number of attendees

Long-Term: Assess Results and Evaluate Effectiveness

As the strategies outlined in this plan are being implemented, periodic assessment of the progress toward the long-term vision for the watershed is also necessary. At least twice during the intended 10-year life of this plan, the Southeast Landscape Committee should convene regional stakeholders to discuss the state of the watershed relative to those desired future conditions, and determine what progress has been made, and what improvements could be made to the plan strategies or their implementation. Below are a few initial assessment questions. The committee will want to add to and refine these questions as well as evaluate whether the data necessary to assess watershed conditions are being collected; and if not, what additional data are needed? All of this information will be useful in determining what can be done to improve this plan, and conservation efforts overall within the watershed.

Desired Future Condition	**Assessment Questions:**
High quality streams and healthy groundwater resources	Is surface water quality improving or degrading? Is groundwater quality improving or degrading?

Populations of rare and threatened species are stabilized and increasing	What is the status of species and communities of concern within the watershed?
Streams that have rehabilitated banks and native floodplain vegetation	What is the status of floodplain forests? Have 50-foot stream buffers been applied to all streams in the watershed?
Large habitat buffers and corridors around and between core biodiversity areas	How has connectivity of natural communities improved across the watershed
Fire is used as a management tool in appropriate ecosystems	To what degree is fire being utilized in the watershed?
Consistent funding for cost share assistance associated with various landowner activities such as invasive species control and native plant community restoration	Are landowners receiving the financial support they need to implement conservation activities?
A more robust hardwood timber market supporting sustainable private timber management	Have markets in the area improved? Are landowners able to sell the wood they have grown? What new industries have become established?
Improved landowner education	How has landowner engagement changed or improved? Do landowners have access to necessary information, and do they know where to get it? How are we tracking landowner involvement and reaching out to those with interest in conservation?
Active comprehensive conservation planning on priority sites	How has collaboration improved between agencies and stakeholders within the watershed? How has communication and collaboration helped make conservation efforts more effective? How has the identification of priority areas improved conservation planning?
Regional land use plans recognize and protect rare features	Are rare features being protected in the watershed? How has the approach to protecting these rare features changed?

Section 5. Landscape Context

This southeastern Minnesota watershed has seen significant change in the last 150 years. Today, only 18% of the landscape remains as forest, wetland, or grassland and many of these areas have been degraded in some fashion. Despite these changes, the watershed retains relatively high water quality and areas of outstanding biodiversity significance that warrant special protection, maintenance, and restoration to sustain their function on the landscape.

This section provides an overview of the ecological, geological, and social aspects of the watershed. The information included here is intended to be a contextual starting point for interpreting the landscape but plan users are encouraged to also refer to other regional plans and reports for a more detailed exploration of this material.

Ecological Setting

The Ecological Classification System (ECS) developed by the Minnesota DNR provides a system for classifying plant communities in the state, as well as broad geographic ranges for those communities. It recognizes ecological regions at three nested scales: Provinces, Sections, and Subsections. The Cannon River Watershed lies entirely with in the Eastern Broadleaf Forest Province and contains portions of the Minnesota and NE Iowa Morainal (MIM) and the Paleozoic Plateau sections (Figure 4). The portion of the MIM occupied by the watershed includes areas of the Big Woods and Oak Savanna subsections while the Rochester Plateau and the Blufflands are the subsections found in the Paleozoic Plateau.

Big Woods (MIM): (Adapted from: http://www.dnr.state.mn.us/ecs/222Mb/index.html)

The Big Woods subsection coincides with a large block of deciduous forest present at the time of Euro-American settlement, lying predominantly on a loamy mantled end moraine from the Des Moines lobe of the Late Wisconsin glaciation. The topography is commonly gently to moderately rolling, with the typical landscape consisting of level topped hills bounded by smooth sides interspersed with closed depressions containing lakes and peat bogs. Oak woodland and maples-basswood forest were the most common vegetation types prior to Euro-American settlement. Today, more than 75% of the subsection is cropland, with an additional 5 to 10% in pasture. Unlike many surrounding subsections, fire likely played a smaller role in the disturbance regime, likely due to the topography and presence of lakes.

Oak Savanna (MIM): (Adapted from: http://www.dnr.state.mn.us/ecs/222Me/index.html)

The Oak Savanna subsection lies generally south and east of the Big Woods subsection on a rolling loess plain over bedrock or till. The hydrology is relatively mature, with the few lakes in the subsection occupying end moraines that extend from the Big Woods subsection, but are generally smaller. Fire has been the dominant disturbance, with landforms that disrupted prairie fires from the South, West, and East, but not enough to allow the development of mature forest. As a result, prior to Euro-American settlement, bur oak savanna was the primary vegetation, with areas of

tallgrass prairie and maple-basswood forest also common. Today most of the area is farmed, though urban development is accelerating along the northern boundary.

Rochester Plateau: (Adapted from: http://www.dnr.state.mn.us/ecs/222Lf/index.html)

The Rochester Plateau subsection is a level to gently rolling plateau of bedrock overlain by loess in the east and pre-Wisconsin age glacial till in the central and west. Tallgrass prairie and bur oak savanna were the major pre-settlement vegetative communities. Presently the majority of the unit is heavily farmed. Before its suppression, fire was an important component of the disturbance regime. Tornados and ice storms also had local impacts on forested communities.

The Blufflands: (Adapted from: http://www.dnr.state.mn.us/ecs/222Lc/index.html)

The Blufflands subsection is a transition area between the Rochester Plateau and the Mississippi River. The loess-covered Plateau is deeply dissected by dendritic stream networks that cut down through bedrock on their way to the Mississippi River, forming bluffs and deep stream valleys. Pre-settlement vegetation varied by landform. On ridge-tops and dry upper slopes, burr oak savanna and tallgrass prairie were major vegetation types. Moister slopes supported Red oak-white oak-shagbark hickory-basswood forests, and red oak-basswood-black walnut forests occupied protected valleys. Presently, roughly 30% of the Blufflands is cropped, 20% is in pasture, and 50% is woodland.

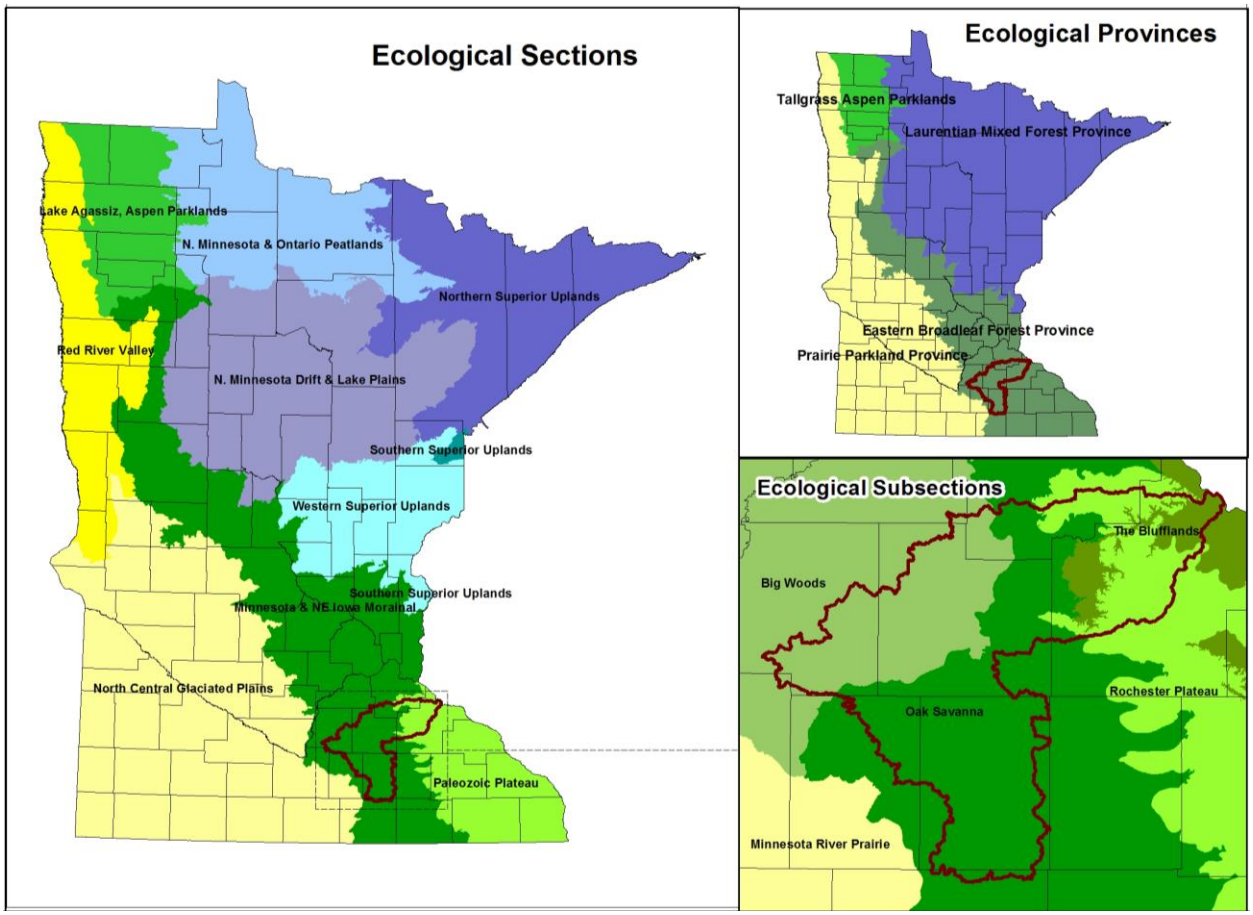


Figure 4. The Cannon River Watershed lies in two sections of the Eastern Broadleaf Forest Province: the Minnesota and NE Iowa Morainal (MIM) and Paleozoic Plateau. It covers portions of the Big Woods and Oak Savanna subsections of the MIM section and the Blufflands and Rochester Plateau subsections of the Paleozoic Plateau.

Hydrology

The Cannon River Watershed is large and diverse, with hydrological characteristics that vary across the watershed. It is made up of two river systems: The Cannon River, which runs 112 miles roughly east-to-west and empties into the Mississippi River near Red Wing; and the Straight River, which runs 56 miles south-to-north, meeting the Cannon River in Fairbault. In describing the watershed, it is helpful to break it into sections, or lobes, with roughly similar characteristics (Figure 5). The upper portion of the Cannon River (Upper Lobe) contains far more lakes than the rest of the watershed, with the river passing through an alternating chain of streams and lakes leading to the Cannon lake reservoir in Fairbault. The Straight River (Straight River Lobe) passes through flat to rolling fields, collecting water from many small streams before it meets the Cannon just below the reservoir dam. The stretch of the Cannon River between Fairbault and the Byllesby Reservoir (Middle Cannon Lobe) continues through relatively gentle topography, but receives water from some larger tributary networks, including Wolf Creek, Heath Creek, Chub Creek, and Prairie Creek. Below the dam at Byllesby Reservoir (Lower Cannon Lobe), the River enters the steeper and more dissected topography of the blufflands, where spring fed coldwater streams feed into the river before it meets the Mississippi.

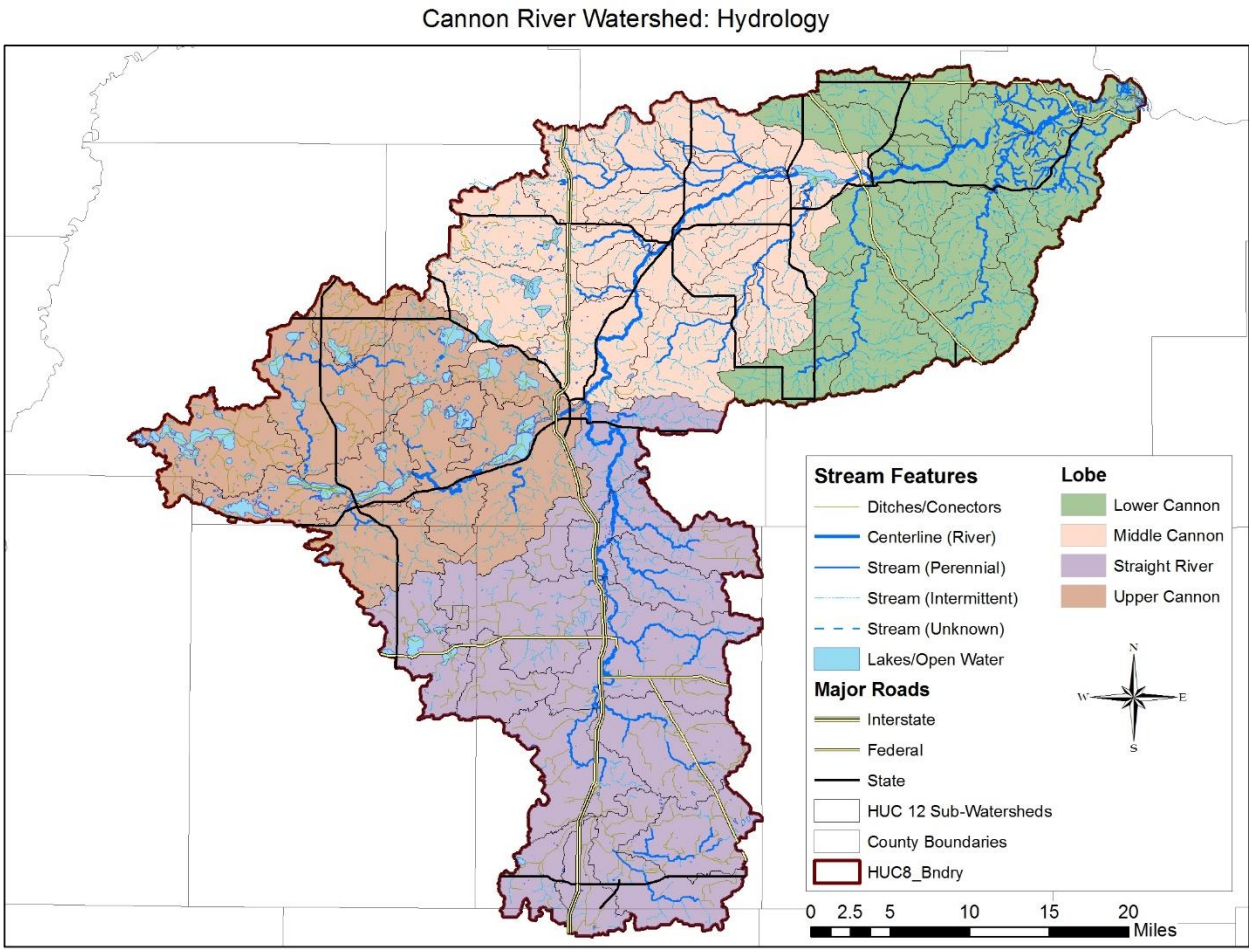


Figure 5. Stream network and major lobes of the Cannon River Watershed.

The Active River Area conservation framework provides a conceptual and spatially explicit basis for the assessment, protection, management, and restoration of freshwater and riparian

ecosystems (Figure 6). The active river area framework is based upon dominant processes and disturbance regimes to identify areas within which important physical and ecological processes of the river or stream occur (*Active River Area (ARA) Three-Stream Class (3SC) Toolbox Documentation*, 2011, Analie Barnett, TNC Eastern Division). It defines wet flat zones, base riparian areas, and material contribution zones for streams from small first order perennial to large rivers. It provides a method of identifying the historically active floodplain, where meander belts, closed oxbows, and other floodplain features are likely to be found. It also identifies flat areas where water is likely to accumulate, presenting opportunities for wetland restoration or other practices to increase storage and mitigate flooding.

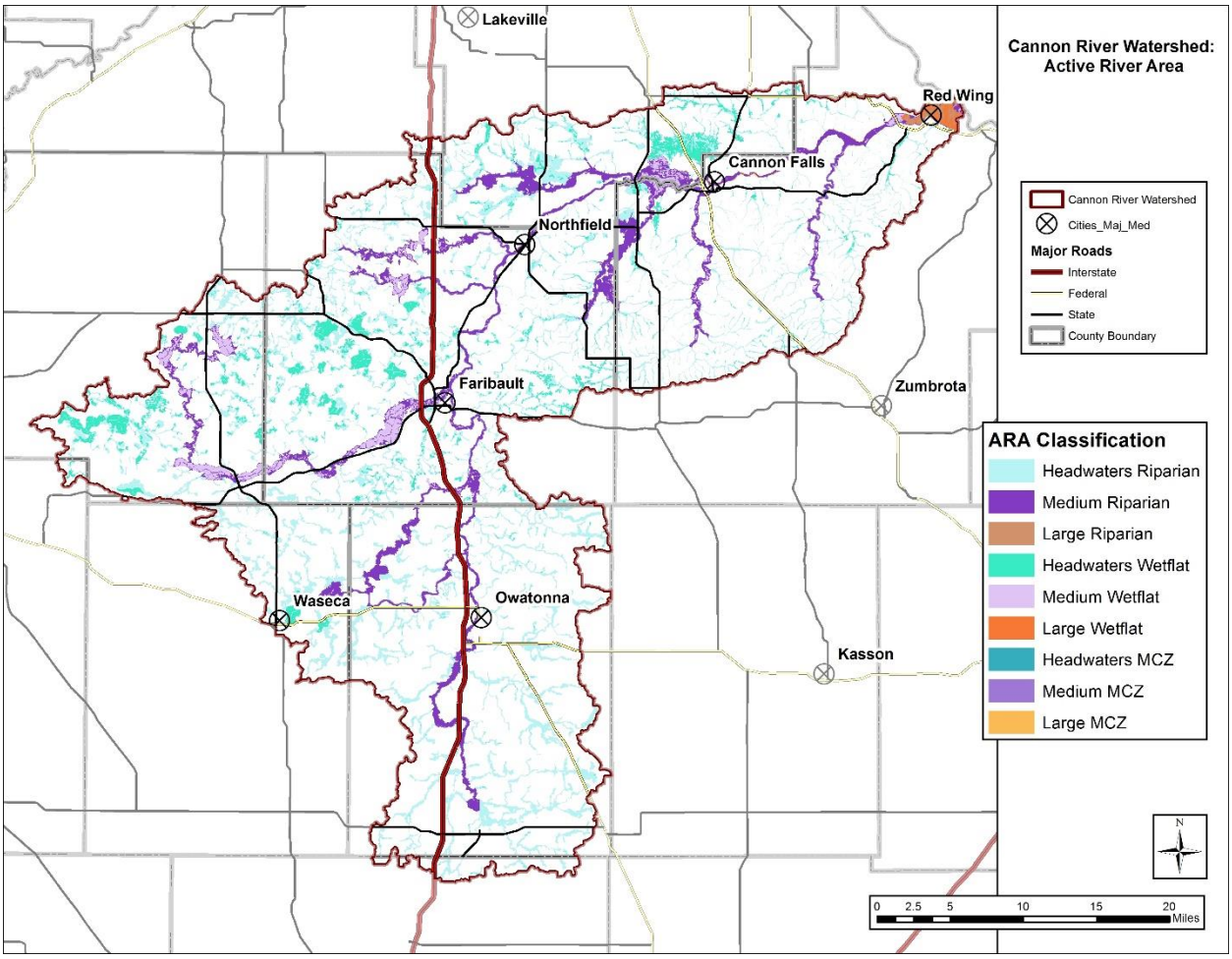


Figure 6. Active River Area analysis showing areas of historical river interaction, which includes the historic floodplain and meander belt.

Geology and Soils

The geology of the Cannon River Watershed varies from the rolling landscape of the headwaters to steep valleys where it meets the Mississippi. Overall the geology of the region is characterized by loess deposits which are a very fine glacial material that is easily erodible. Loess thickness is variable across the watershed with deposits ranging from 30 feet thick on broad ridgetops, to less than a foot on valley walls with less erodible sedimentary rock such as sandstone and limestone exposed along rivers and road cuts (Cannon WRAPS 2016).

The CRW has three major geological areas (Figure 7):

- *Central Iowa and Minnesota Till Prairies.* Predominantly found in the Straight River, Upper Cannon and western half of the Middle Cannon lobes. Soils in are generally very deep, loamy, and range from well drained to very poorly drained. Predominantly derived from glacial till as part of the Des Moines Lobe of the Wisconsin ice sheet that once covered the region.

- *Eastern Iowa and Minnesota Till Prairies.* A mix of glacial till and outwash deposits with clay, silt, sand, and gravel filling the major river valleys characterizes the eastern half of the Middle Cannon lobe around Northfield and Cannon Falls. Karst features exist in this area with shallow depth of soils and glacial material covering limestone. Soils range from well drained to very poorly drained.

- *Northern Mississippi Valley Loess Hills.* The southern two thirds of the Lower Cannon lobe are considered part of the "Driftless Area" because the area underwent limited landscape formation by glacial ice. The resulting landscape is mostly gently sloping to rolling summits that create scenic landscapes of deep valleys, abundant rock outcrops, high bluffs, caves, crevices, and sinkholes (Cannon WRAPS 2016). Limestone and sandstone outcrops are observed along some streams and rivers in the area. Loess deposits cover bedrock in many areas. Some karst areas exist where carbonate rocks are near the surface. Soils are generally moderately deep to very deep, loamy, and well drained to moderately well drained.

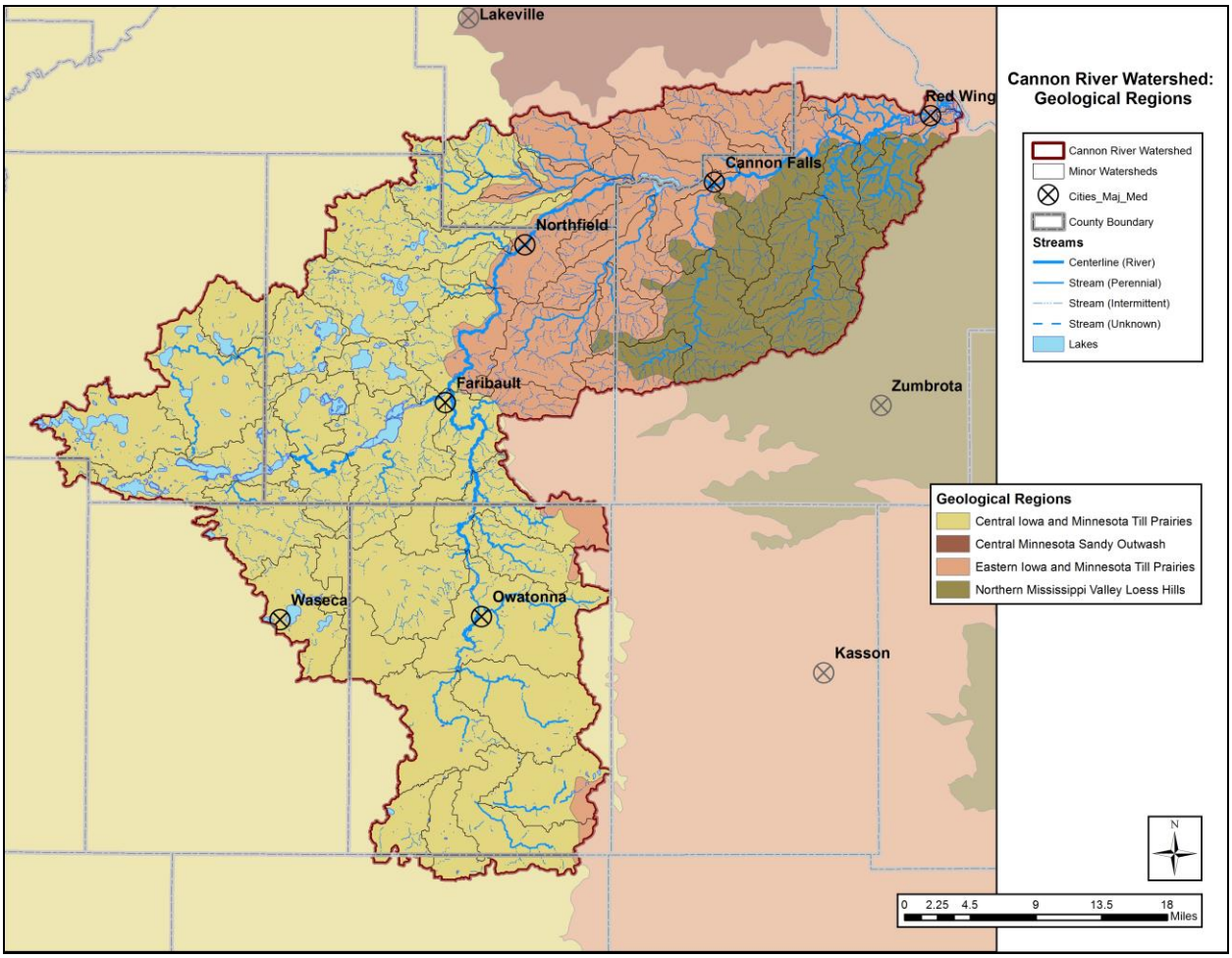


Figure 7. Major land resource areas in the Cannon River Watershed.

Key Geological Feature: Parts of the CRW contain karst features (Figure 8). Karst describes a landscape underlain by limestone that is being slowly dissolved by infiltrating rainwater, producing ridges, towers, fissures, sinkholes, and other characteristic landforms. This landscape can be challenging to protect because there are often hidden, rapid pathways from pollution release points to drinking water wells or surface water. In these areas, contaminants can enter the ground and move miles per day through cracks and crevices. The MPCA karst web page (https://www.pca.state.mn.us/water/karst-minnesota) discusses the process leading to the formation of Minnesota's karst, karst landforms and environmental problems that occur in karst landscapes.

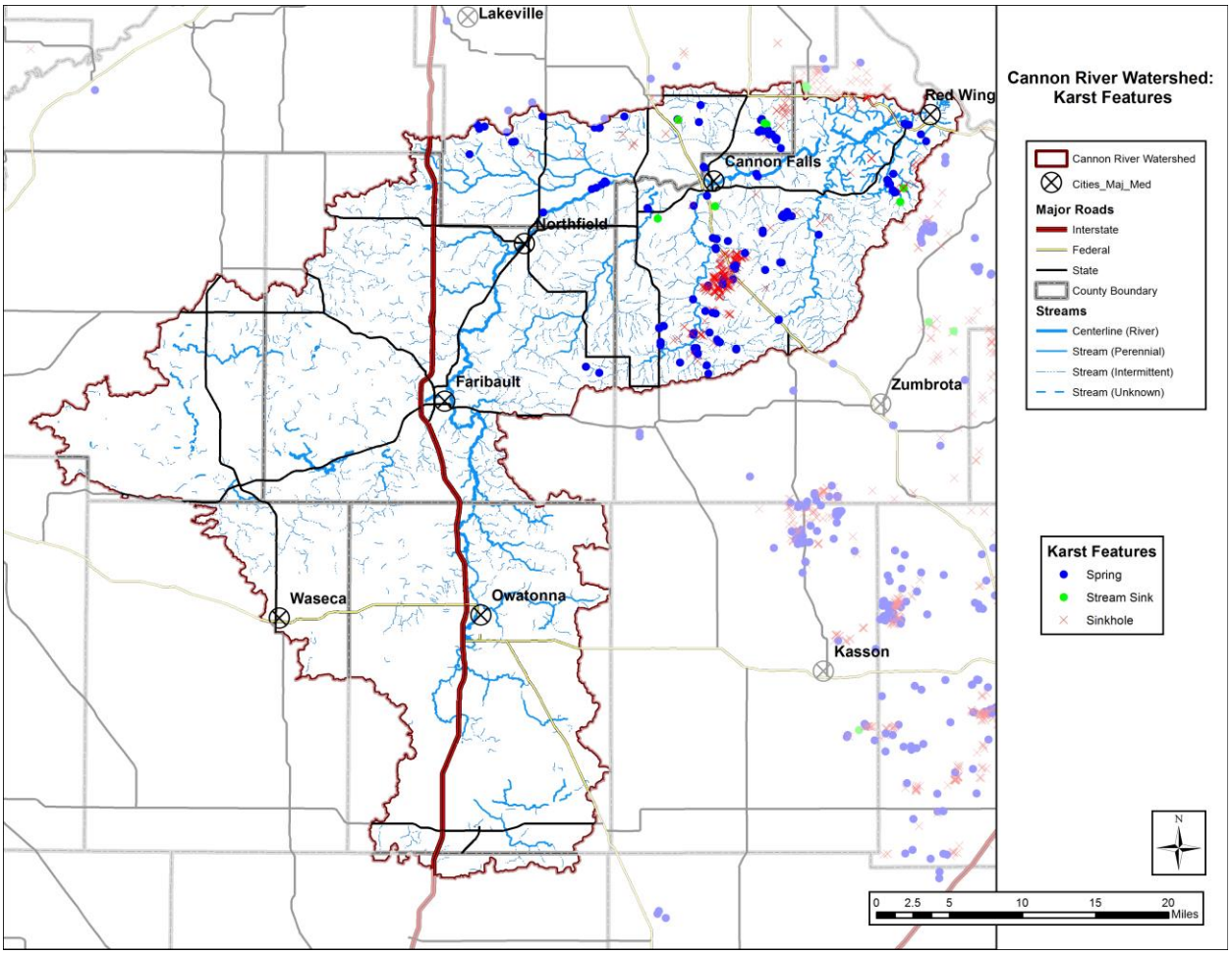


Figure 8. Known karst features in the Cannon River Watershed.

Vegetation

Land Cover Change

Prairie communities dominated much of the Cannon River Watershed prior to European arrival (Figure 9). Wet Prairies occupied moister areas near streams or wetlands. Where trees were present, they were often scattered in Oak Openings and Barrens communities. The largest exception to this trend is the Big Woods area that occupied much of the Upper Cannon Lobe. Here hardwood stands of maple, basswood, oak, and hickory, along with associated minor species and

shrubs, were the dominant vegetation. River bottom and Big Woods forest communities were also found in the lowest end of the watershed near the outlet to the Mississippi.

Today, the watershed is dominated by agriculture (Figure 10). The cities of Red Wing, Cannon Falls, Northfield, Fairbault, Owatonna, and Waseca, represent most of the developed land, though some suburban development is occurring in areas north and east of Northfield and Fairbault. Although greatly reduced, areas of natural land cover can be found around some of the lakes in the Upper Cannon Lobe, and along the steeply dissected valley slopes of the Lower Cannon Lobe. Additionally, portions of riparian forest vegetation remain along the main stem of the Cannon River between Fairbault, Northfield, and Cannon Falls and a block of the Big Woods ecosystem is preserved as Nerstrand Big Woods State Park.

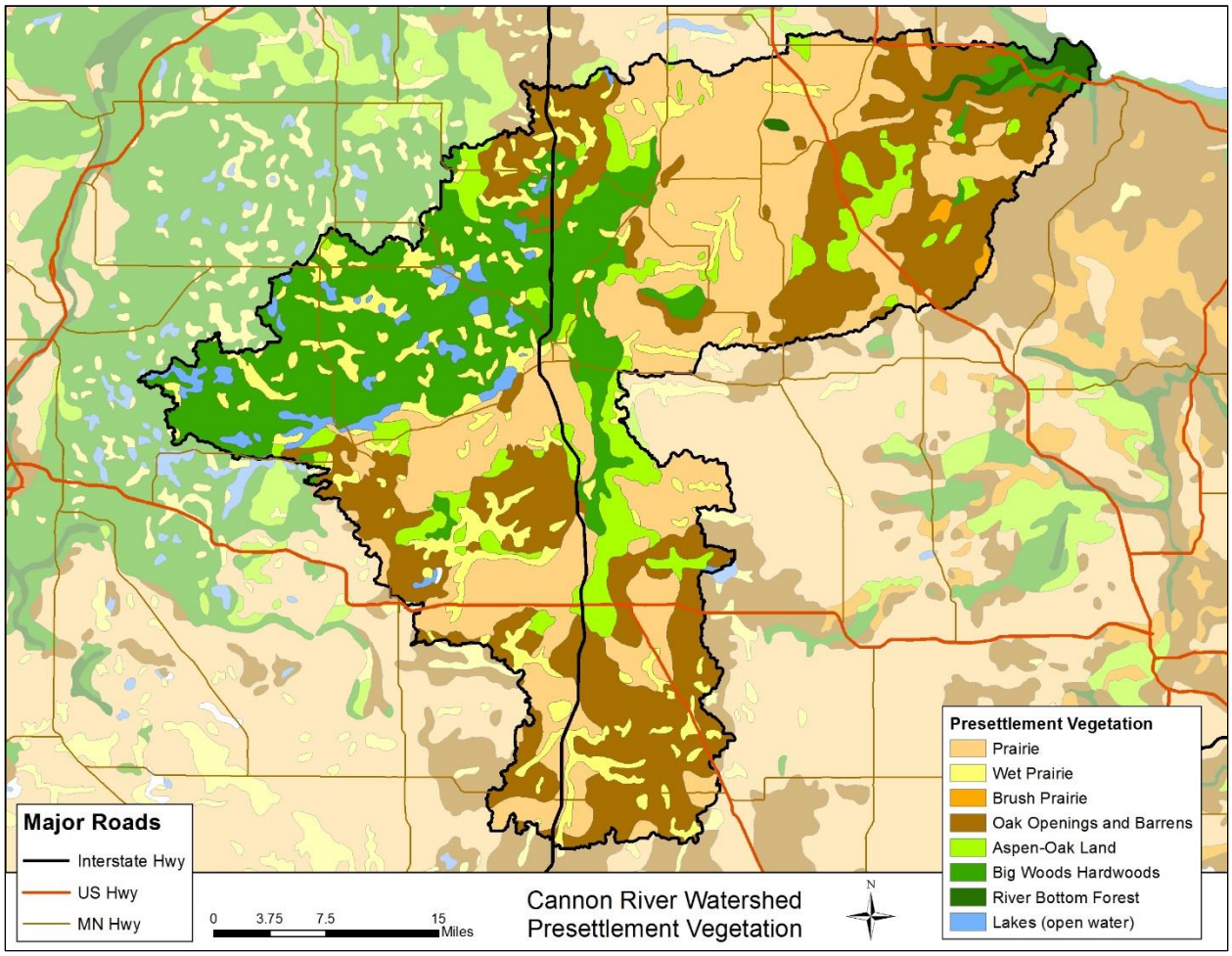


Figure 9. Pre-settlement land cover in the Cannon River Watershed based on Marschner's interpretation of the Public Land Survey.

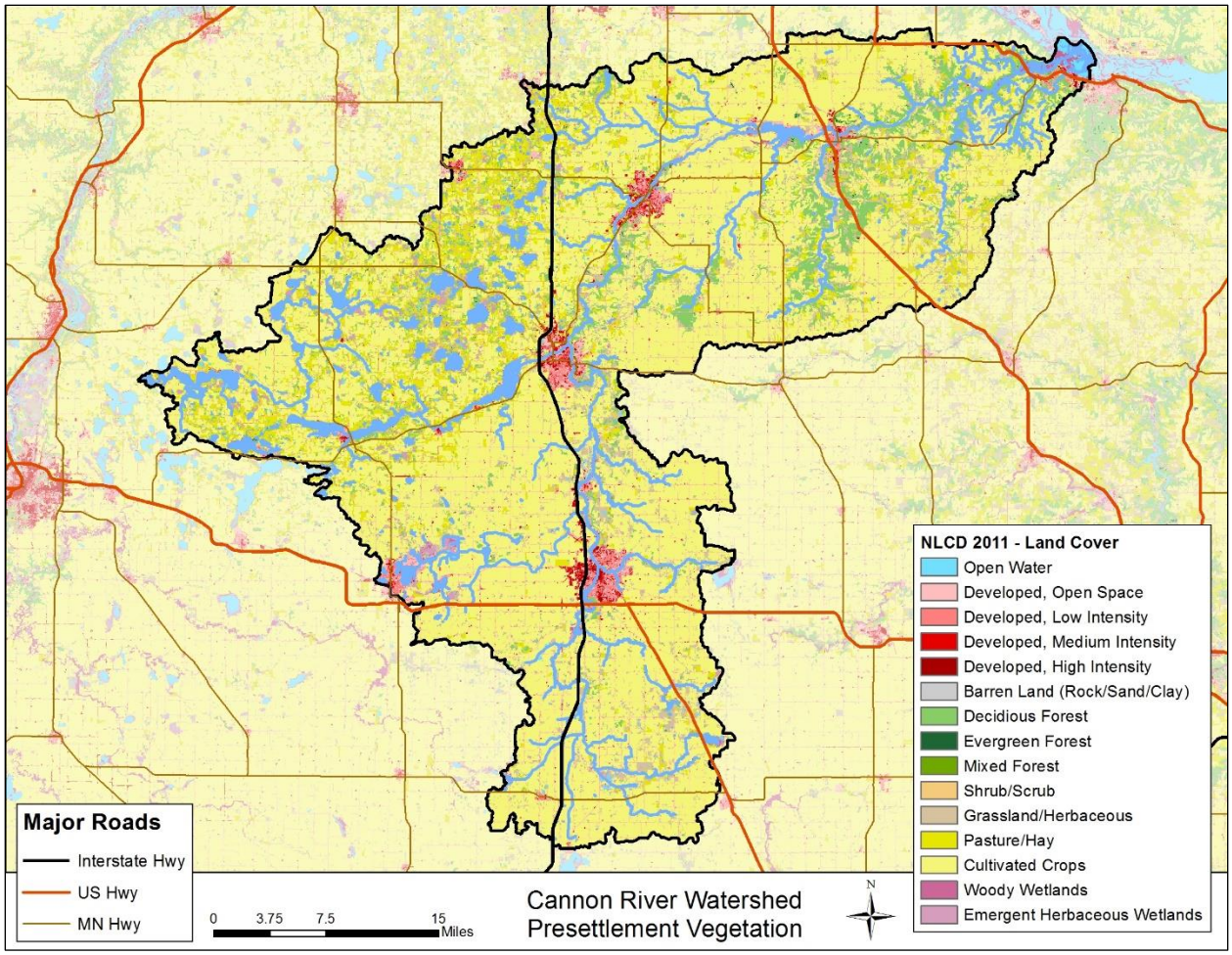


Figure 10. Current land cover in the Cannon River Watershed based on the National Land Cover Database.

Even in areas that retain natural land cover, the disturbance regime has changed significantly. Cessation of fire, extensive logging, and conversion to agriculture during the settlement era (mid-1800's) led to dramatic changes in the local ecosystems. The primary disturbance regime in many of these natural communities such as prairies, savannahs, and oak woodlands was fire. With modern fire suppression these communities are under pressure from native and non-native invasive woody vegetation that would have been controlled by fire. Additionally, forest structure has become much more homogenous, with many of the stands in the same growth stage. The shift away from fire dependent species like oaks and structural homogeneity will likely make forests more vulnerable to the suite of emerging stressors including climate change, invasive species, pests and pathogens.

Native Plant Communities

Ecologists in Minnesota have developed a system to classify land into Native Plant Communities (NPCs) based on native vegetation, landforms, and other local conditions such as amount of rainfall and soil richness. This system is used in combination with the Ecological Classification System (see above) to more precisely describe patterns on the landscape.

The Native Plant Community system describes an area's specific land types or ecosystems. A single community might cover a large area, or exist in scattered pockets. Sometimes very different native plant communities exist near each other. For example, notice the differences

between the types of trees growing along a river from those growing several hundred feet uphill. Native plant communities are also a useful tool for telling the story of the land's history. Forests are constantly changing under the influence of time and other factors. The trees and other plants that emerge 20 years after a fire will differ from those growing in the same area a hundred years later. You can also notice variations as you move from north to south or east to west within a region

The Minnesota Biological Survey has mapped and identified NPCs in several sites throughout the Cannon River watershed (Figure 11). A list of the NPC ecological systems identified in the watershed is presented in Table 3 and more detailed descriptions can be found in the Field Guide to the Native Plan Communities of Minnesota: The Eastern Broadleaf Forest Province produced by the Minnesota DNR and available at: http://www.dnr.state.mn.us/npc/index.html.

These Native Plant Communities can significantly reduce sediment and nutrient loads entering regional water resources. According to work done by Kevin Benck and Reed Fry at St. Mary's University of Minnesota, total nitrogen and total phosphorus (lbs/yr) would increase by 31% and 41% respectively if woody natural areas were converted to row crops in the Cannon River Watershed (see *Examining the Relationship between Land Cover and Water Quality Protection: The Blufflands Region of the Cannon and Zumbro River Watersheds*, 2017, Saint Mary's University of Minnesota - GeoSpatial Services, 700 Terrace Heights, Box #7, Winona, MN 55987).

Table 3. Native Plant Community Systems in the Cannon River Watershed.

System Name	Acres
Mesic Hardwood	15,354
Floodplain Forest	4,960
Marsh	4,246
Fire Dependent Woodland	1,862
Upland Prairie	1,349
Wet Meadow/Carr	1,152
Open Rich Peatland	91
Forested Rich Peatland	34
Lakeshore	27
Wetland Prairie	16
Wet Forest	10
River Shore	7
Cliff/Talus	5
N/A	30

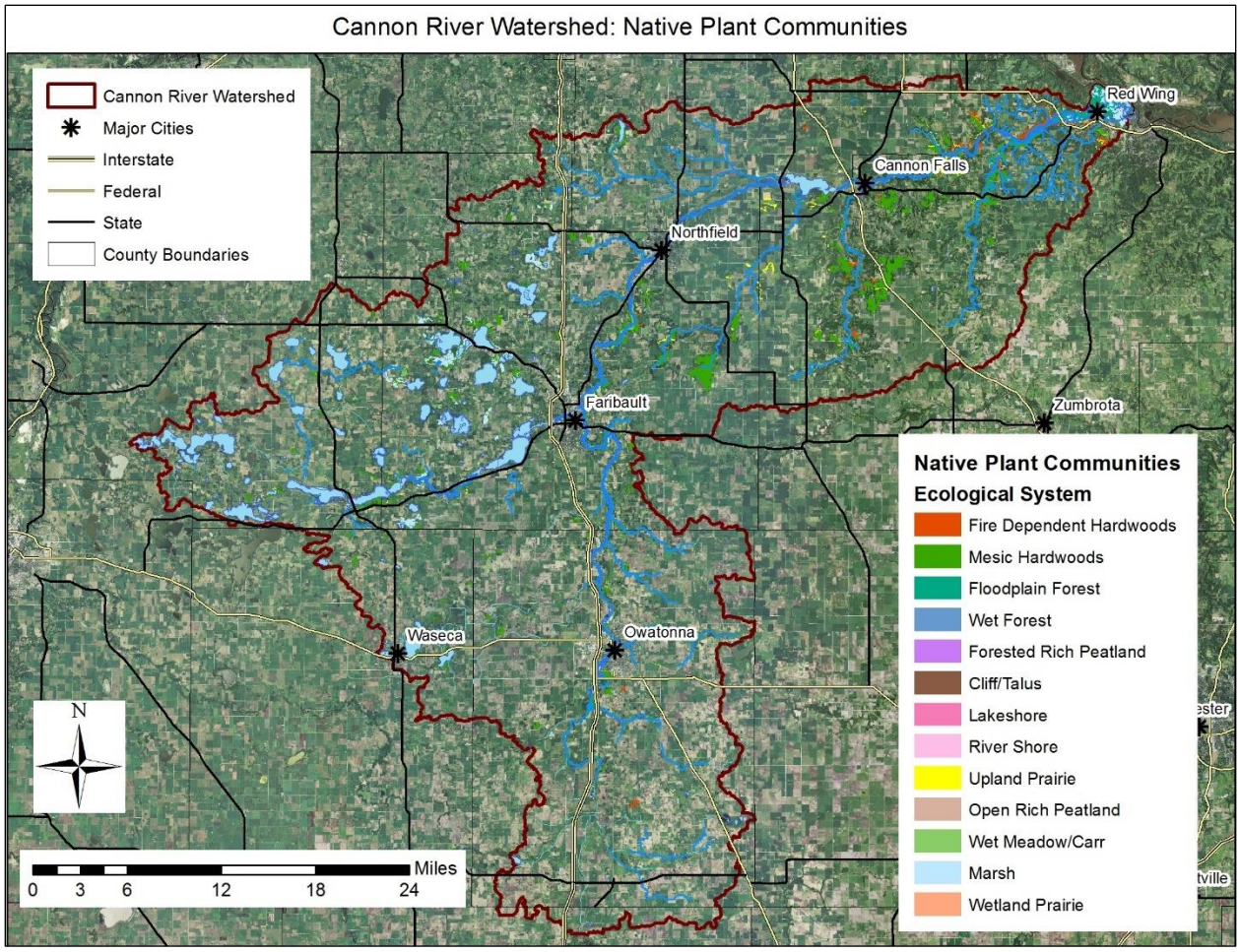


Figure 11. Native Plant Communities in the Cannon River Watershed

Invasive Species


Riparian area dominated by garlic mustard.

Non-native invasive species are becoming an increasing challenge for natural area management in the Cannon River Watershed and throughout Minnesota. Many areas has shifted from a healthy natural community to degraded systems dominated by invasive species. This is perhaps most noticeable in oak savannas with an overstory of mature bur oak and understory dominated by European buckthorn and honeysuckle. Widespread fire suppression has further complicated this issue in many of these fire-dependent communities. Forest pests also have a significant impact on the forest composition of the region. American elm was one of the most significant species in many of the watershed's forest ecosystems but an introduced disease (Dutch elm) has decimated this species. Invasive plants of note in the

watershed include garlic mustard, reed canary grass, wild parsnip, Canada thistle, exotic honeysuckle, and buckthorn. Several invasive insect pests also pose a risk to the area such as emerald ash borer. Monitoring and early detection will be of vital importance in slowing the spread and impact of these non-native species on the landscape. It is important for management of both private and public lands to address the control of these problem species that do not recognize property boundaries.

Rare Natural Features

The mix of headwater lakes, Big Woods remnants, karst geology, and steep valleys of the Driftless Area provide conditions for a diverse array of plant communities and habitats. The Cannon River watershed contains over 57,000 acres of land that the Minnesota Biological Survey (MBS) has delineated as potential sites of biodiversity significance (Table 4, Figure 12). Field assessments of those sites ranked roughly 14,000 acres as Outstanding and 16,000 acres as High. These rankings are based on presence of rare species populations, size and condition of native plant communities, and the landscape context of the site. Additional information about the process, as well as descriptions of the four biodiversity significance ranks can be found at: http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html

Table 4. Minnesota Biological Survey delineated areas of biodiversity significance in the Cannon River Watershed.

MBS Biodiversity Significance Rank	Acres
Outstanding	13,911
High	16,080
Moderate	13,426
Below	13,833
Total	57,249

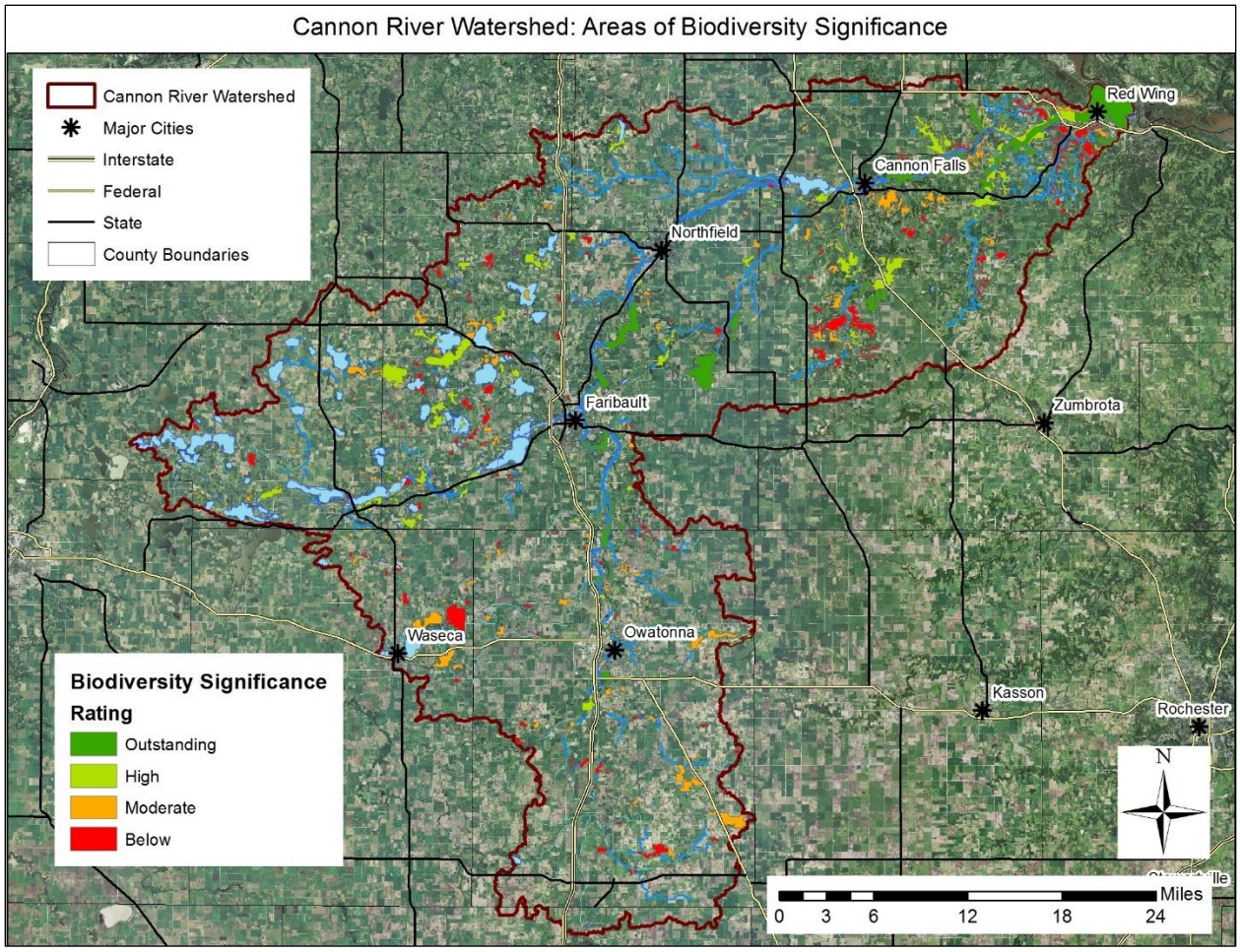


Figure 12. Sites of biodiversity significance in the Cannon River Watershed, as mapped by the Minnesota Biological Survey.

Wildlife

Interaction with wildlife through hunting, fishing, and wildlife watching is important to many Minnesota residents and visitors and a number of popular game and non-game wildlife species can be found in the Cannon River Watershed. The specific make-up of wildlife varies from place to place throughout the watershed but includes common species such as white-tailed deer and turkey and rare species such as Acadian flycatchers. The Cannon River, its tributaries, and the assortment of lakes found throughout the watershed support a variety of warm-water (walleye, northern pike, bass, catfish, sunfish, and crappies) and cold-water (brook and brown trout) species.

The 2015-2025 Minnesota DNR Wildlife Action Plan focuses a habitat approach that prioritizes conservation for Species of Greatest Conservation Need (SGCN) and other wildlife within a mapped Wildlife Action Network (Table 5, Figure 13). Over 145,000 acres were identified in this process. These areas

represent quality habitats for terrestrial and aquatic Species of Greatest Conservation Need (SGCN). Large core areas and connections that facilitate species movement will support the biological diversity already present in the network. Targeting conservation within the network will increase the effectiveness and efficiency of actions to reduce the primary causes of population declines. The lower portion of the Cannon River watershed was identified in the Wildlife Action Plan as a priority Conservation Focus Area. This area was identified for its importance to rare species and overall biodiversity. Specific species of conservation focus in this area include Acadian flycatcher, cerulean warbler, prothonotary warbler, wood thrush, mudpuppy, smooth softshell, wood turtle, six-lined racerunner, timber rattlesnake, Arogos skipper, Leonard's skipper, and regal fritillary.

Table 5. Wildlife Action Network Scores for the Cannon River Watershed.

Wildlife Action Network Score	Acres
High	3,639
Medium-High	18,322
Medium	40,243
Low-Medium	76,246
Low	6,710

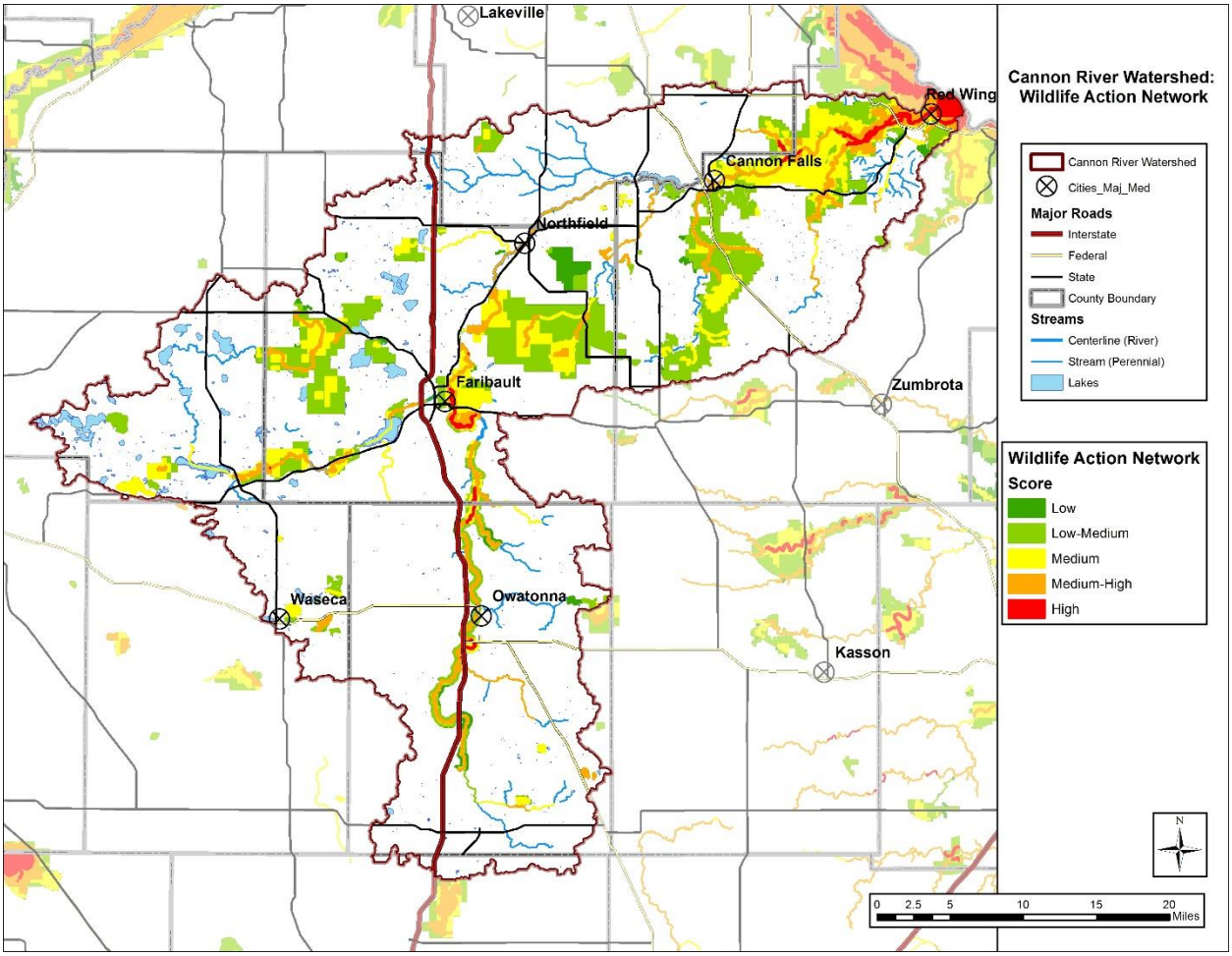


Figure 13. Wildlife Action Network in the Cannon River Watershed.

Land Use History and Cultural Resources

The Cannon River and its watershed have a long history of human activity dating back thousands of years. The river was used extensively as a travel corridor long before the appearance of Europeans on the American continent and several sites of archeological importance have been discovered in the watershed. Prior to European settlement, Native American settlements existed predominantly in the river valleys where they farmed the rich alluvial soil of the terraces, gathered fruits, nuts, and other forest products from the forested blufflands. They would also use the Cannon River to access the upland prairies that they frequently burned to maintain open characteristics so they could hunt bison, elk and deer.

Initial European contact was with explorers and fur traders. The mouth of the Cannon River was a major cultural center and Native Americans frequently hid their canoes near the river's mouth. When French fur traders arrived in the area and saw the number of stored canoes they called the river “La Riviere aux Canots” meaning "the river of canoes." This name eventually morphed into the Cannon River.

In 1851, treaties opened up most of Southern Minnesota to European American settlement. The earliest settlers in the region originally exploited the abundant timber resources followed quickly by pioneer farmers lured to the area by the region’s the fertile soils. Wheat production in the area quickly lead to the region’s timber mills being converted to gristmills. These early grist millers developed a series of innovations that changed milling throughout the world and remnants of the earliest mill companies live on through the Northfield Malt-O-Meal mill and in textile milling at the Faribault Woolen Mill.

During the settlement years, trees were seemingly so plentiful in the Big Woods and Lower Cannon regions that much usable timber was simply burned where it was felled to clear land for farming. The extensive forests also provided farmers and homesteaders with wood for heating, fence posts, and lumber. Many of today’s farmhouses, barns, and outbuildings are framed or sheathed with rough sawn lumber from trees that were harvested and milled within a short wagon ride of where they now stand. The disappearance of these forests and intensive farming methods used by early settlers were very damaging to the region’s precious topsoil, and lead to significant erosion. Conservation actions taken in the twentieth century have helped to reduce these negative impacts.

Archeological resources can be found throughout the area due to its long history as a travel corridor and cultural center, however, they are more likely to be found along the river valleys and tops of ridges with good vantage points from which ancient hunters would spot and wait for prey.

Current Land Use and Socio-economic Context

In the western portion of the watershed, cultivated crops dominate the landscape (**Error! R eference source not found.**). The most common are corn, soybeans, and forage for livestock. Rangeland is also common in this area. Towards the east of the watershed, rangeland and forests increase. Outdoor recreation is popular in forested areas and on streams. Hiking, canoeing, kayaking, biking, cross-country skiing, and snowshoeing are all popular, as well as hunting and fishing. Many private lands are also kept for outdoor recreation and hunting, with occasional timber harvesting. The Minnesota DNR added the Cannon River to its Wild & Scenic Rivers Program in 1980 in recognition of the natural beauty and recreational opportunities in the area. The designated stretch extends from Faribault to its confluence with the Mississippi River. Other popular outdoor recreation areas include the Cannon Valley Trail and Nerstrand Big Woods State Park.

The Cannon River watershed falls primarily within Dakota, Goodhue, Le Sueur, Rice, Steele, and Waseca counties. These semi-rural counties had a combined population of 592,292 residents at the 2010 US Census. This population total is somewhat misleading because Dakota County alone accounts for 398,552 of these residents and many of them live in northern Dakota County, which is part of the Minneapolis-St. Paul metropolitan area but outside the watershed. The largest communities in the watershed include Faribault (23,352), Northfield (20,007), Owatonna (25,599), and Red Wing (16,459). Today, roughly 97% of the Cannon River watershed is privately owned with public ownership spread between county, state, federal and non-profit ownership (Figure 14).

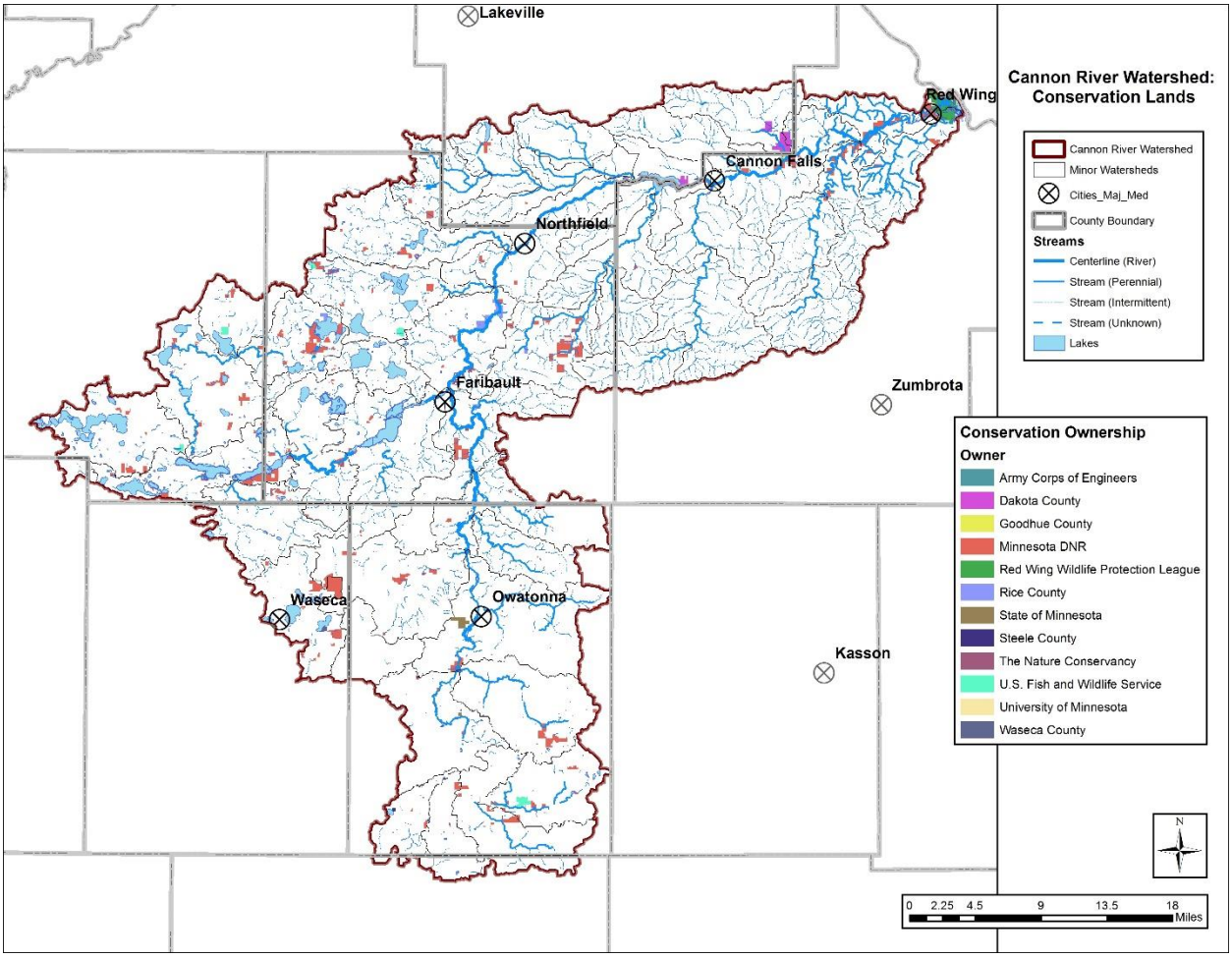


Figure 14. Public land in the Cannon River Watershed. Although not visible at this scale, all organizations listed in the legend have land in the watershed.

Section 6: Implementation Resources

The following is a list of potential resources to pursue in the project and funding development stage. This inventory of administrative, technical, financial, and political resources should be maintained and grown to foster increased success in the implementation of the Plan.

Administrative Resources

- Cannon River Watershed Partnership
- Southeast Landscape Committee
- Landowners
- County Soil and Water Conservation Districts
- County Boards
- County Planning and Zoning
- MN DNR Forestry, Fish and Wildlife, Ecological and Water Resources, Parks and Trails
- Board of Water and Soil Resources
- MN Pollution Control Agency
- Township Officials
- Basin Alliance for the Lower Mississippi in Minnesota (BALMM)

Technical Resources

- GIS mapping – plan maps, other sources
- State agency personnel - DNR Division of Forestry, Division of Fish and Wildlife, etc.
- County staff – planning & zoning staff, county water planners, SWCD technicians, etc.
- Consulting foresters and Loggers.

Financial Resources

- MFRC seed money
- Clean Water Land & Legacy Amendment funds
- Costs Share programs
- State agency programs
- County Water Plans projects and programs
- Foundations and organizations
- Landowners - private investments
- Federal and State agency budgets - staff assistance

Political Resources

- Private landowners
- Townships
- Soil and Water Conservation Districts - supervisors and staff
- County boards and staff and county water plan committees
- MFRC

Funding Strategies and Opportunities through Collaboration

We anticipate this, like many other landscape-scale forest stewardship initiatives, will be funded through a variety of synergistic funding efforts. Historically, partners that get involved in a landscape-scale project area do so because it meets some of their own resource or public relations goals and they work together to support efforts throughout the project area. Landscape-scale, multi-partner, coordinated efforts often carry increased weight with foundations, trusts, and government agencies when it comes to applying for grants. Federal and state funding agencies as well as private foundations tend to look favorably on multi-partner project applications. There is a considerable amount of money available through grants and other programs that landscape stewardship approaches can facilitate.

Landscape stewardship projects also seek to encourage and promote greater levels of private investments to leverage public investments. Many private woodland owners make significant investments in their own lands. These investments may not end up on the balance sheets of service provider agencies, but they are no less important in the health and integrity of the natural landscape of the region.

Individual Financial Assistance Programs Available to Landowners

Farm Service Agency Programs:
Conservation Reserve Program (CRP): CRP offers annual payments to landowners who set aside cropland or pasture adjacent to water, for the purpose of reducing erosion, increasing wildlife habitat, improving water quality, and increasing forestland. Cost-share for tree planting, grass cover, small wetland restoration, or prairie and oak savanna restoration may also be available.

NRCS Programs:
Environmental Quality Incentives Program (EQIP): EQIP provides financial and technical assistance to landowners for management practices. All properly implemented forest management practices are eligible, including timber stand improvement (TSI), site preparations, culverts, stream crossings, water bars, planting, prescribed burns, hazard reduction, fire breaks, silvopasture, fence, grade stabilization, plan preparation and more. Contracts last from one to 10 years.

Conservation Stewardship Program (CSP): CSP encourages agricultural and forestry producers to maintain existing conservation activities and adopt additional ones in their operations. Annual payments per acre for five years are available for installing new activities and maintaining existing ones.

State Programs:
Reinvest in Minnesota (RIM) Reserve Program: RIM is run by the Board of Water and Soil Resources (BWSR). The program compensates landowners willing to give the state a conservation easement to permanently protect, restore, and manage critical natural resources, in the interest of improving water quality. The RIM program is the primary land acquisition program for state-held conservation easements and restoration of wetlands and native grasslands. It is coordinated statewide by BWSR and administered and implemented locally by county Soil & Water Conservation Districts (SWCDs). There are currently 230 RIM tracts in the Cannon River watershed totaling over 6,350 acres.

Erosion Control and Water Management Program: More commonly known as the State Cost Share Program, this program provides funds to SWCDs to share the cost of conservation practices for erosion control, sedimentation control, or water quality improvements with the land occupier.

The primary purpose of activities is to assist with structural or vegetative practices to correct existing problems.

Grant Programs for Local Governmental Units or Non-Governmental Organizations

Clean Water Fund: Clean water fund grants are funded through Minnesota's 2008 Legacy Amendment. It provides funding for local governments or local government joint powers boards for projects that restore, enhance, and protect water quality. A non-state match of at least 25% of funds is required.

Lessard-Sams Outdoor Heritage Council (LSOHC): The LSOHC is charged with making annual funding recommendations to the Minnesota Legislature on appropriations from the Outdoor Heritage Fund. Through these recommendations, funds raised through Minnesota's Legacy Amendment are provided to support programs to restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife.

Legislative-Citizen Commission on Minnesota Resources (LCCMR): In 1988, Minnesota voters approved a constitutional amendment establishing the Environment and Natural Resources Trust Fund - a constitutionally dedicated fund that originates from a combination of Minnesota State Lottery proceeds and investment income. Applications for this funding are due every May. The purpose of this fund is to provide a long-term, consistent, and stable source of funding for activities that protect, conserve, preserve, and enhance Minnesota's "air, water, land, fish, wildlife, and other natural resources" for the benefit of current citizens and future generations.

Section 319 Nonpoint Source Management Program: The 1987 amendments to the federal Clean Water Act established the Section 319 Nonpoint Source Management Program. This Environmental Protection Agency administered program addresses the need for greater federal leadership to help focus state and local nonpoint source efforts. Under Section 319, states, territories and tribes receive grant money that supports a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring to assess the success of specific non-point source implementation projects.

Landscape Stewardship Plan Conclusion

This Landscape Stewardship Plan for the Cannon River Watershed presents a blueprint for protecting the biodiversity and natural resources of the watershed, while also helping to improve water quality by maintaining and enhancing the natural integrity of the watershed. These goals will not be achieved by any single stakeholder or department, nor can they be met with a single strategy. Widespread adjustments to intense land uses that reduce the impacts of agriculture on water will be needed, but so will increased protection of natural areas at key places in the watershed. An expanded footprint of public conservation land will be needed to achieve that level of protection, but it will not be sufficient alone. Private landowners and communities will need to remain engaged in managing, and, just as important, valuing the wild places of the region.

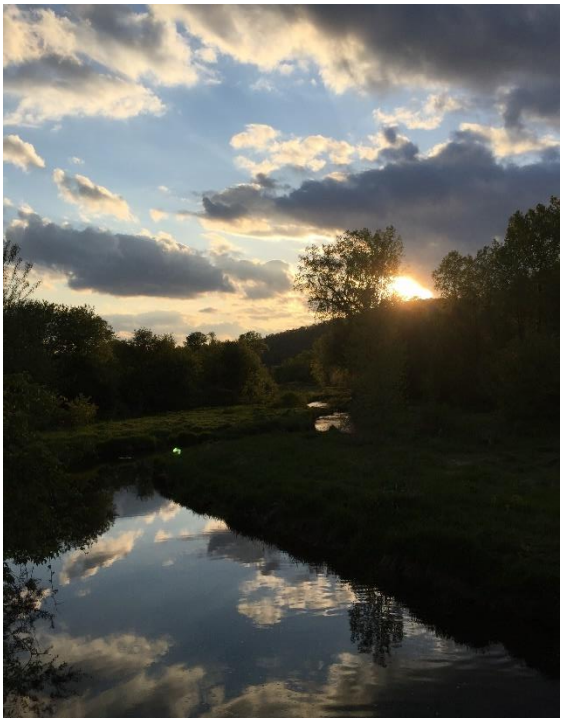
To help engage the variety of partners and stakeholders that will be required to achieve the goals of this plan, several supplemental materials have also been prepared. They include a brochure to distribute widely as an introduction to this effort to a general audience, as well as a multi-page summary document to help familiarize both the general public and important partners to its goals and strategies. Additionally, a reflection document that describes the process and lessons learned has been developed as a resource for future landscape stewardship planning efforts in other watersheds.

While many actions described in this plan will need to be carried out across the watershed, a major watershed such as the Cannon River is too large an area to effectively address in a single effort. To maximize the effectiveness of our efforts, we will need to prioritize. This plan has identified several areas within the watershed where protection strategies are most important and will benefit multiple conservation interests. The following section contains more detailed protection plans for these four priority areas.

Section 7: Conservation Opportunity Area Plans

Conservation Opportunity Area Overview

As discussed in the plan above, GIS analysis of potential protection targets in the Cannon River Watershed identified four priority areas, called Conservation Opportunity Areas (COAs). These COAs represent areas where the local watershed (HUC12 level) is relatively intact when compared to the rest of the region (Figure 15). Water quality in these areas is either above average for the larger watershed, or near thresholds for water quality standards. They also contain important terrestrial features that warrant protection, such as areas of biodiversity significance, publicly owned conservation lands, and higher than average proportions of perennial vegetative cover in the most important areas for water quality protection.



Because these COAs were identified through an additive process, where desirable landscape features were added up within each sub-watershed, they primarily represent places with significant overlap of different stakeholder's priorities. They are places of importance to multiple state agencies and environmental interests. That indicates they are logical focal points for collaboration and coordination of protection efforts between the multiple conservation professionals who work in the region. Effort and investment from one agency (e.g. DNR Wildlife) will also benefit the efforts of water quality professionals by enhancing the integrity of natural communities to better slow run-off and increase infiltration. It will also benefit public and private forestland owners in the area if it reduces the regional presence of invasive species, cutting down on potential seed sources and making further infestations less likely.

Ultimately, COAs represent regions where conservation actions are likely to provide the greatest number of benefits, and where coordination and communication between conservation professionals will be most beneficial.

The stewardship plans for each COA focus on specific resources and needs, as well as strategies that are appropriate to the different social resources and ownership patterns within each COA. The four COAs are:

- Big Woods COA: Covers 51,053 acres in the headwaters of Prairie Creek and the Crystal Lake section of the Cannon River north and east of Faribault and south of Northfield. The Big Woods COA includes several key natural areas such as Nerstrand Big Wood State Park, Cannon River Trout Lily State Scientific and Natural Area, Rice County's Cannon River Wilderness, and The Nature Conservancy's Trout Lily Preserve.

- Headwater Lakes COA: This is the largest COA in the Cannon River Watershed at 98,306 acres. It covers the Cannon River's headwaters northwest of Faribault, east of Lonsdale,

and west of Northfield. This area features rolling topography that is pocketed with numerous small lakes, wetlands, and patches of forest.

- Little Cannon COA: This COA lies south of Cannon Falls encompassing 51,163 acres in the Little Cannon watershed. The COA is entirely privately owned and contains several high quality natural areas. The lack of public-land in this COA puts and even higher onus on the need to support private landowner stewardship for the maintenance of these natural areas and associated water quality.

- Lower Cannon COA: This COA encompasses the bottom 76,673 acres of the watershed between Cannon Falls and the Cannon River's confluence with the Mississippi River near Red Wing. In addition to the Cannon River main stem, the COA includes all or portions of the Lower Belle Creek, Pine Creek, Spring Creek, and Trout Brook watersheds which support cold-water fisheries. Key natural areas in the Lower Cannon COA include Cannon River Turtle Preserve SNA, Spring Creek Prairie SNA, portions of the Richard J. Dorer Memorial Hardwood State Forest, and Dakota County's Miesville Ravine Regional Park.

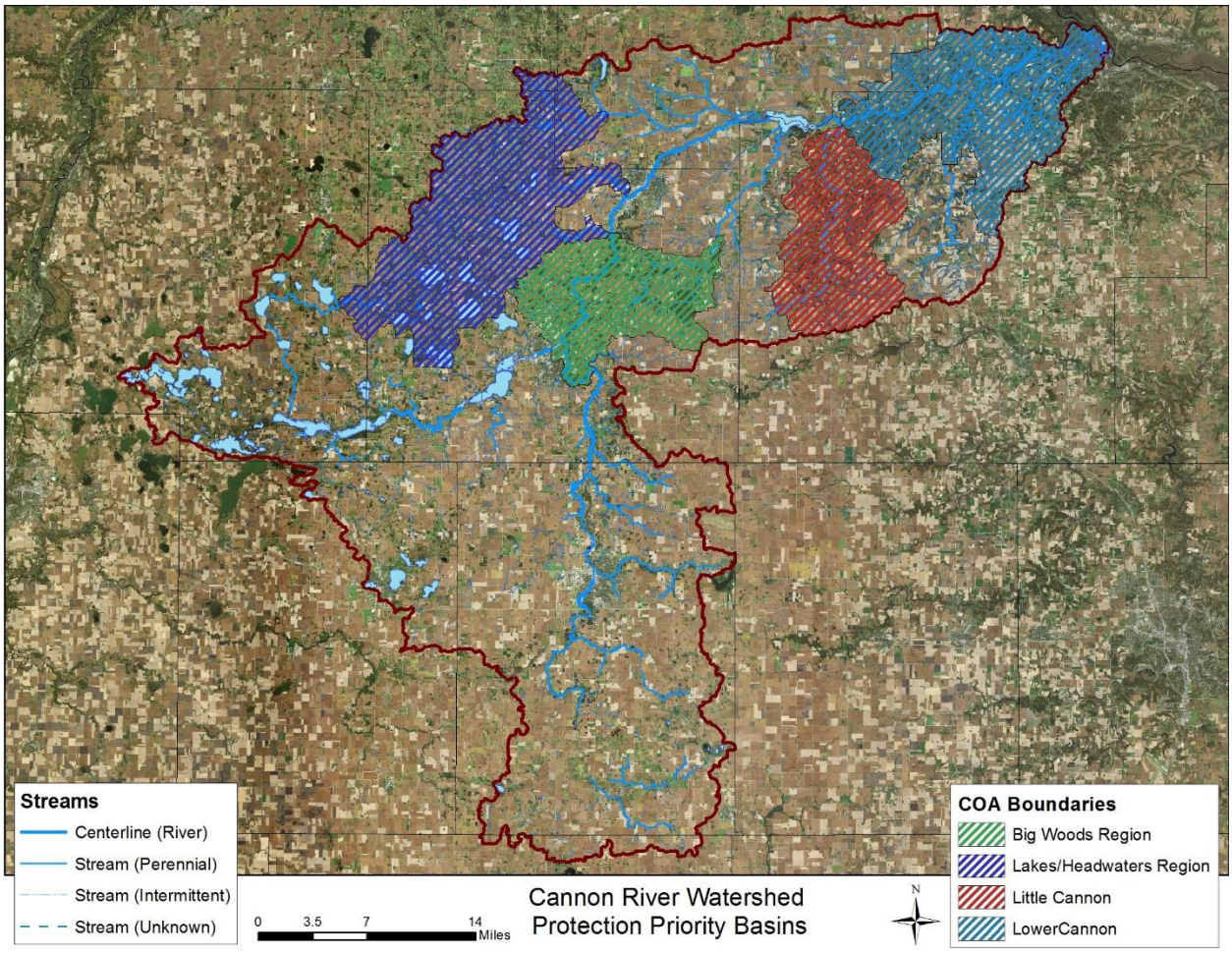


Figure 15. Conservation Opportunity Areas within the Cannon River Watershed.

Big Woods Conservation Opportunity Area

Overview

The Big Woods COA lies north and east of Faribault and south of Northfield encompassing over 51,000 acres primarily in the headwaters of Prairie Creek and the Crystal Lake section of the Cannon River (Figure 16). Key natural areas in the Big Woods COA include Nerstrand Big Wood State Park, Cannon River Trout Lily State Scientific and Natural Area, Rice County's Cannon River Wilderness, and The Nature Conservancy's Trout Lily Preserve. Additionally, a number of privately owned parcels in the vicinity of Big Woods State Park have been protected through the Forest Legacy conservation easement program, making this area a good example of combined public and private landscape protection.

According to data from the Public Land Survey, this region north and west of Nerstrand Big Woods State Park was dominated by an impressive mesic hardwood forest of maple and basswood. Much of this area has been converted to agriculture however; the remnants of the big woods ecosystem represent a conservation opportunity within the matrix of agriculture to build from.

The remaining areas of the big woods ecosystem represent a hotspot for biodiversity as identified in the Wildlife Action Network and State Wildlife Action Plan. The area along the Cannon River and the State Park at the headwaters of Prairie Creek offer a large block of forested conditions that are no longer common in the area and home to numerous native plant community types. The mesic hardwoods and floodplain forests are host to a number of spring ephemeral wildflowers that often grow and bloom before the canopy trees leaf out. This includes species such as false rue anemone, wild ginger, spring beauty, cut-leaved toothwort, Dutchman's breeches, sharp-lobed hepatica, bloodroot and violets, as well as the only federally endangered plant in Minnesota: the dwarf trout lily. This three-inch tall spring ephemeral's entire wild population is restricted to a mere 600 acres in Rice, Goodhue, and Steele counties. The maple-basswood forests of the Big Woods COA offer ideal habitat for dwarf trout lilies, which prefer the moist woods of river bottoms and ravines along the Cannon River and its tributaries. This delicate plant typically grows on the fragile banks of streams so managing upstream hydrology of these streams is important in addition to protecting the forested communities so their habitat is not subject to extensive erosion or inundation.

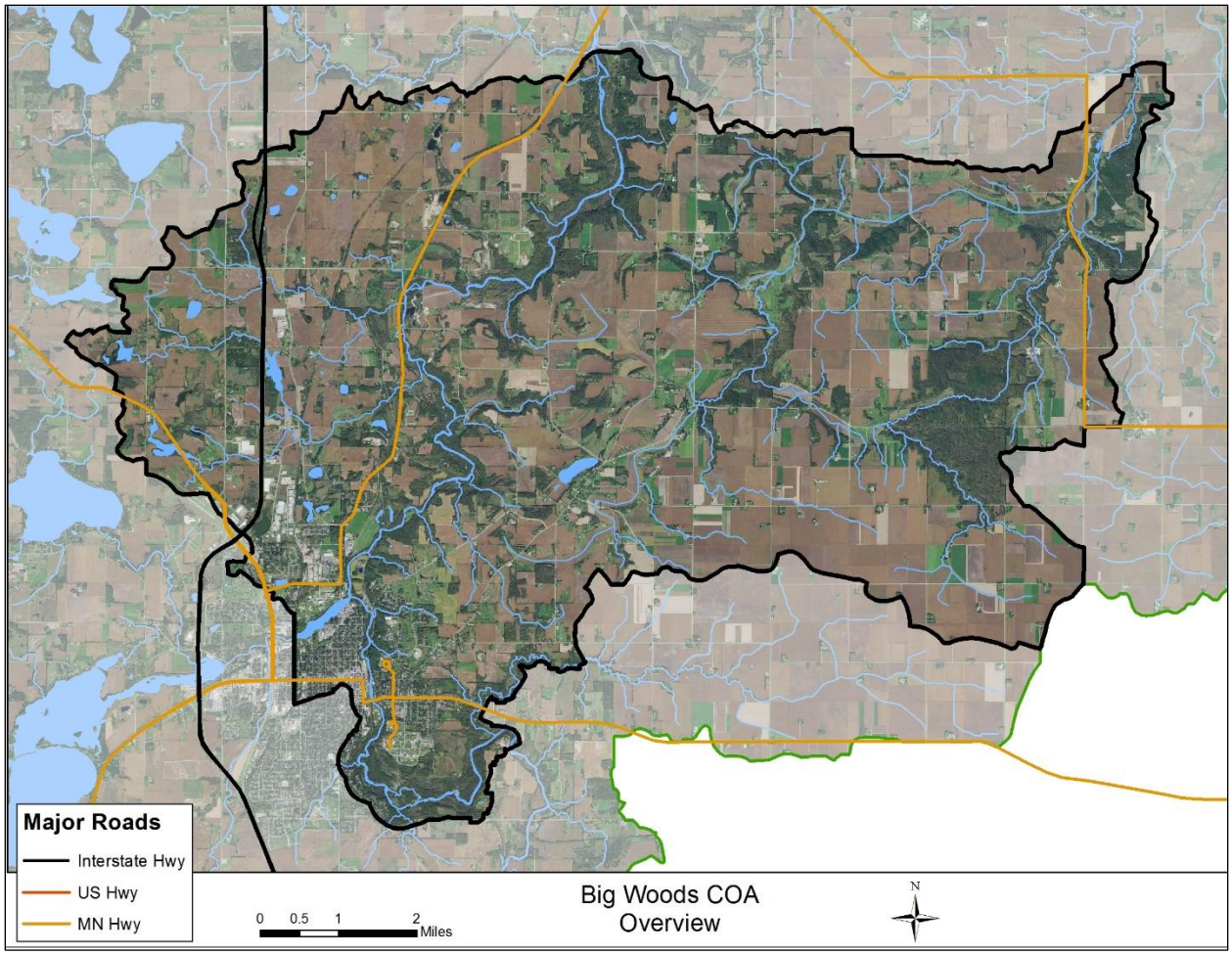


Figure 16. Big Woods COA in the Cannon River Watershed.

Natural Resource Assessment

Hydrology

The dominant hydrological features of the Big Woods COA are the headwaters of Prairie Creek, the confluence of the Cannon and Straight Rivers, and the Crystal Lake section of the Cannon River. Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed these major hydrological features (Figure 17). Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system.

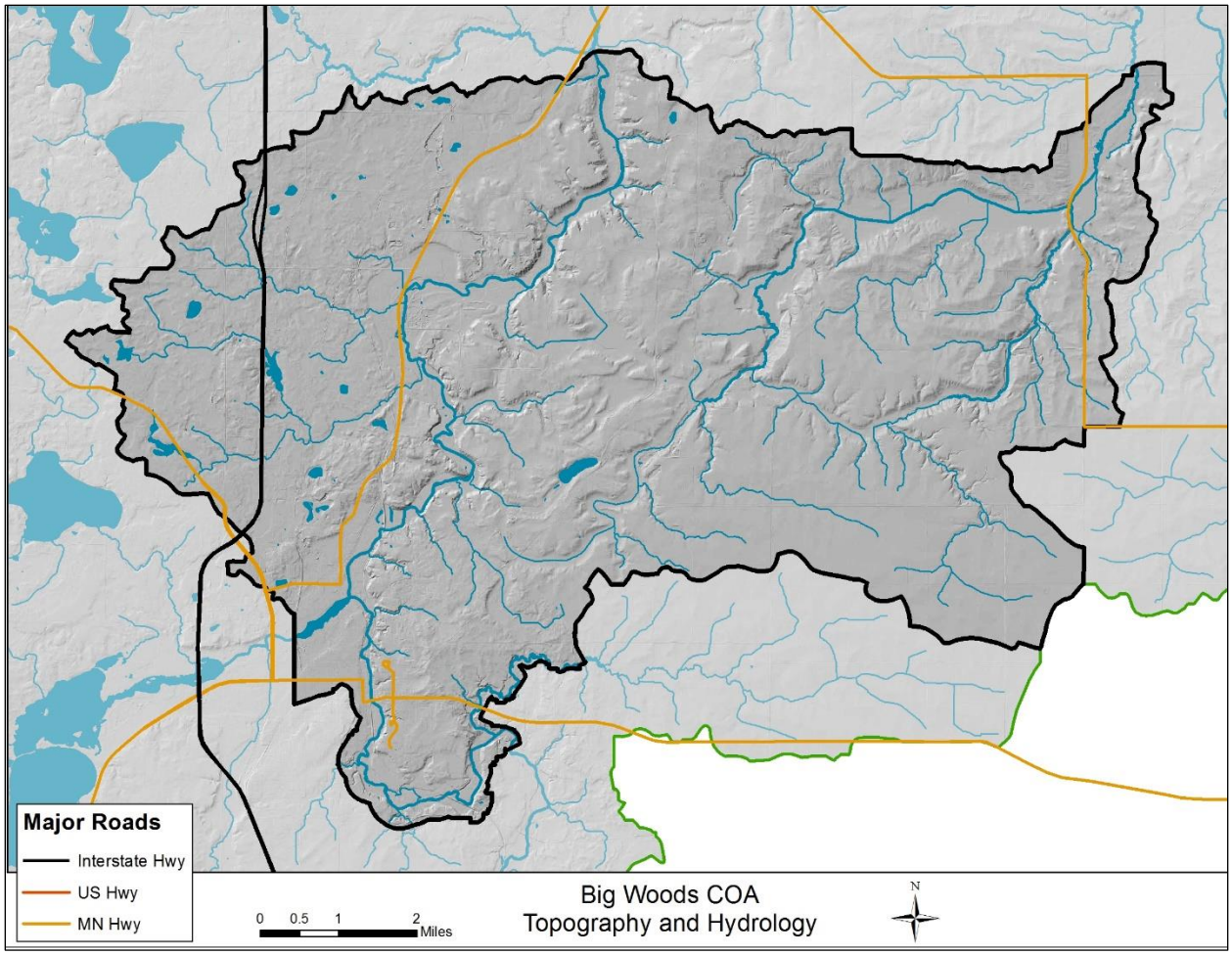


Figure 17. Hydrology of the Big Woods COA.

Plant Communities

Big Woods COA contains over 4,000 acres of Native Plant Communities (NPC) in nine different systems (Figure 18) and 25 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 6). Mesic hardwoods make up 73% of the identified NPC acres with floodplain forest (14%) and wet meadow (8%) systems also making a significant portion of the total acreage. Full descriptions of native plant community types and their associated ecological systems can be found in *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*, produced and distributed by the MN DNR.

Approximately 36 percent of the NPCs in the Big Woods COA are on publicly owned land with the majority of privately owned NPCs on parcels near the blocks of public land. Private parcels containing NPCs, especially those bordering publicly managed areas, represent an important priority for increased protection and private conservation efforts.

Table 6. Native Plant Communities of the Big Woods COA.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Cliff & Talus	CTs53a	Wet Sandstone Cliff (Southern)	1	0%
Fire Dependent Forest or Woodland	FDs37	Southern Dry-Mesic Oak (Maple) Woodland	35	1%
	FDs38a	Oak - Shagbark Hickory Woodland	63	1%
Floodplain Forest	FFs59	Southern Terrace Forest	92	2%
	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	182	4%
	FFs59c	Elm - Ash - Basswood Terrace Forest	287	7%
	FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	22	1%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	44	1%
	MHs38	Southern Mesic Oak-Basswood Forest	273	6%
	MHs38c	Red Oak-Sugar Maple-Basswood-(Bitternut Hickory) Forest	571	13%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	1,350	31%
	MHs39c	Sugar Maple Forest (Big Woods)	866	20%
	MHs49	Southern Wet-Mesic Hardwood Forest	8	0%
	MHs49a	Elm - Basswood - Black Ash - (Hackberry) Forest	33	1%
Marsh	MRn93	Northern Bulrush-Spikerush Marsh	3	0%
Open Rich Peatland	OPp93c	Calcareous Fen (Southeastern)	10	0%
Upland Prairie	UPs13a	Dry Barrens Prairie (Southern)	2	0%
	UPs13c	Dry Bedrock Bluff Prairie (Southern)	12	0%
	UPs14a2	Dry Barrens Oak Savanna (Southern): Oak Subtype	33	1%
	UPs14c	Dry Hill Oak Savanna (Southern)	72	2%
Wet Forest	WFs57a	Black Ash - (Red Maple) Seepage Swamp	4	0%
Wet Meadow or Carr	WMn82a	Willow - Dogwood Shrub Swamp	66	2%
	WMn82b	Sedge Meadow	157	4%
	WMn82b2	Sedge Meadow: Tussock Sedge Subtype	64	1%
	WMs83a1	Seepage Meadow/Carr Tussock: Sedge Subtype	38	1%

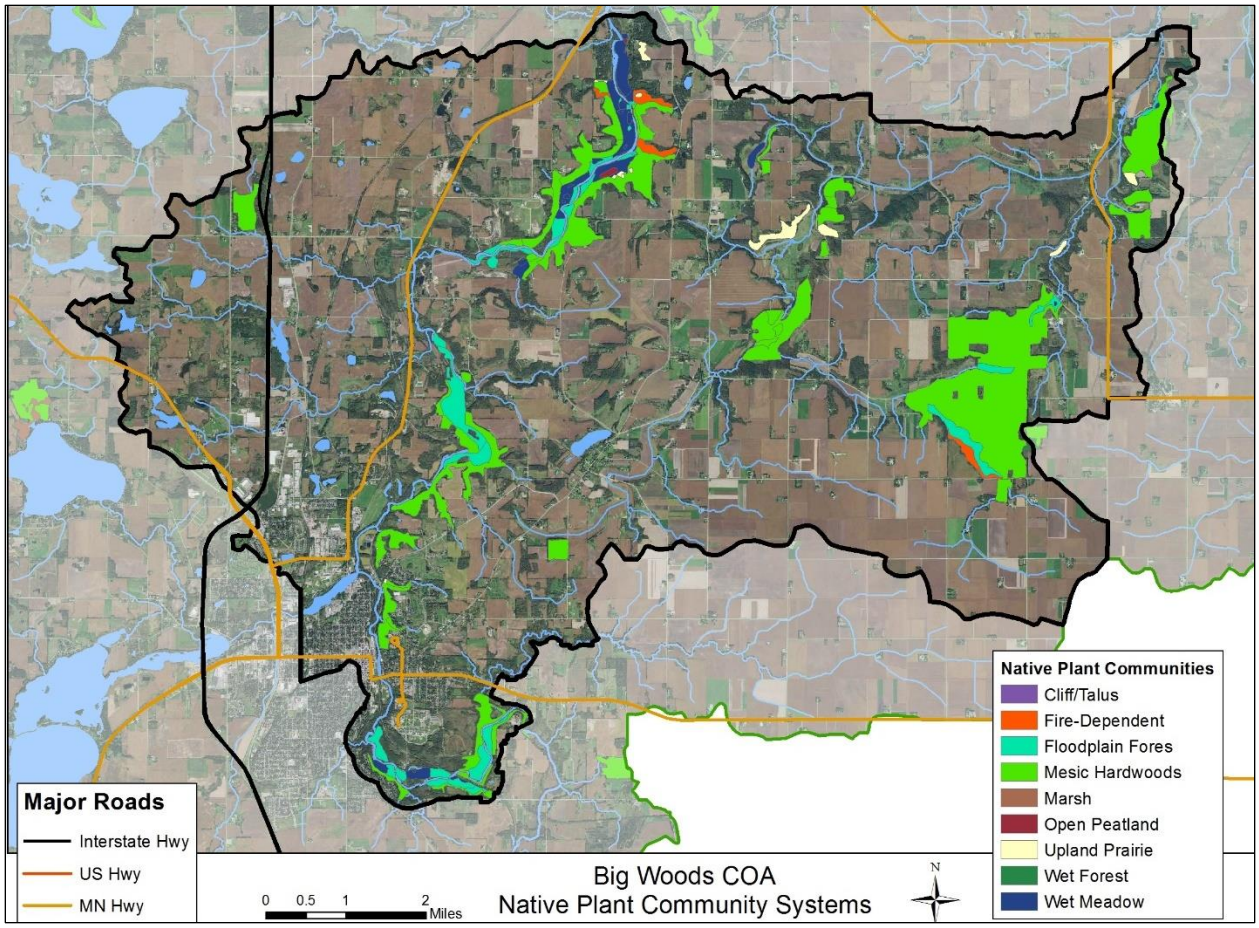


Figure 18. Native plant communities in the Big Woods COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 241 different occurrences of rare plants, animals, or communities in Big Woods COA (Table 7). Rare species are those listed as either endangered, threatened, or of special concern. Endangered species are those facing extinction throughout all or a significant portion of its range within Minnesota. Threatened species are likely to become endangered in the foreseeable future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota.

Forty-one rare terrestrial communities are listed in Big Woods COA. Rare terrestrial communities are collections of plant species growing together, whose presence on the landscape is rare or severely diminished. These communities are monitored, but not given designations as endangered, threatened, or of special concern.

Table 7. Number of rare species and community occurrences in the Big Woods COA.

Organism Type	Observations
Animal Assemblage	1
Fungus	2
Vascular Plant	200
Invertebrate Animal	17
Vertebrate Animal	21
Terrestrial Community	41

The Minnesota Biological Survey has delineated over 5,200 acres of the Big Woods COA based on their significance to biodiversity in the state (Figure 19). Of that area over 4,200 acres were given the highest level of 'Outstanding'. The outstanding areas are concentrated along the Cannon and Straight Rivers and Nerstrand Big Woods State Park.

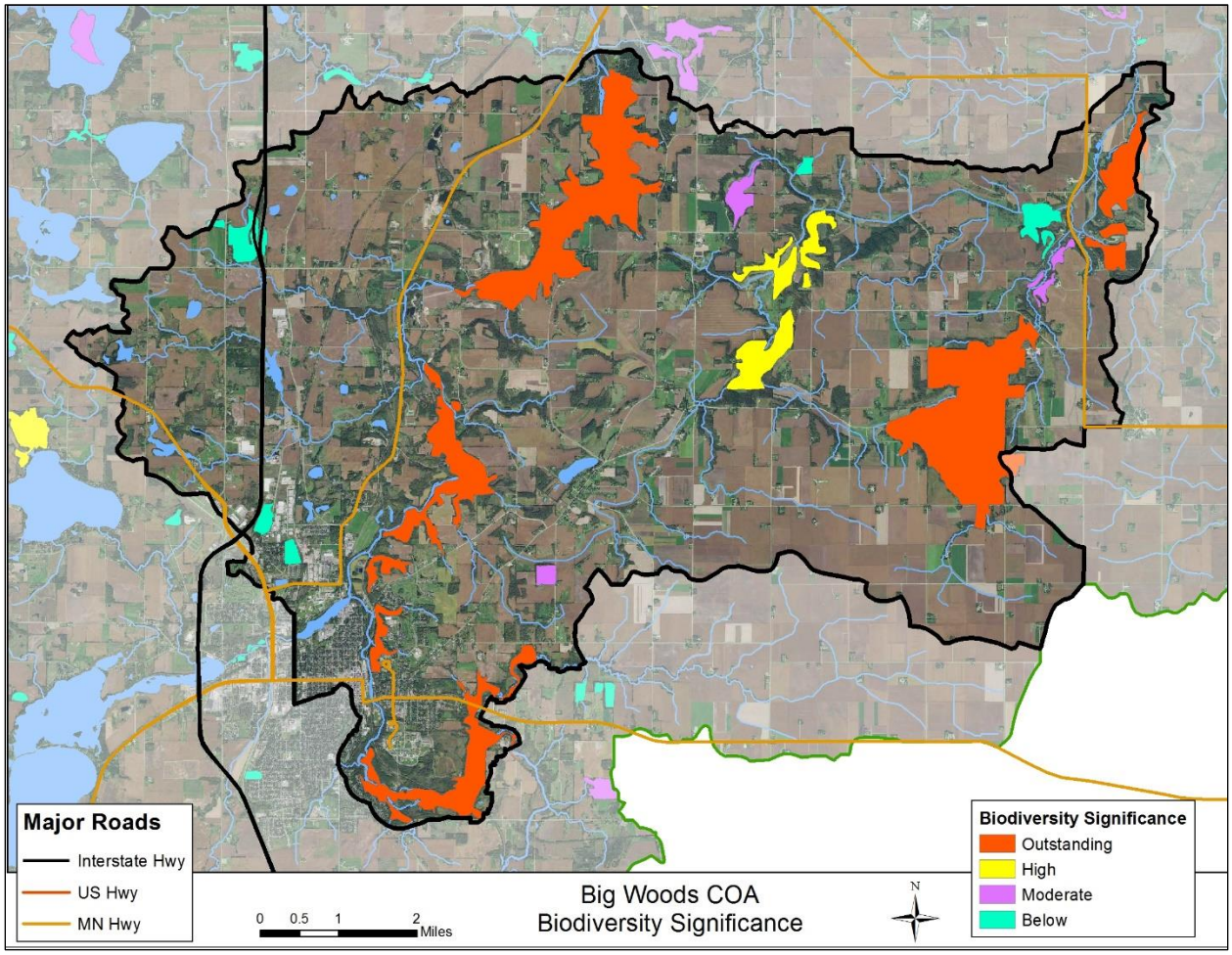


Figure 19. Sites of biodiversity significance in the Big Woods COA.

Recreation

There are a number of important outdoor recreation areas in the Big Woods COA that contribute to the well-being of residents and support the local economy. Nerstrand Big Woods State Park offers individual and group campsites, picnic areas, a playground, and an extensive network of hiking, cross-country skiing, and snowmobiling trails. The state park also offers a special permit deer hunt in the fall. Hunting is a popular outdoor recreational activity throughout the area on public and private land. Additionally, the Cannon and Straight Rivers are designated state water trails that are very popular canoe and kayak routes in the summer. Both rivers offer fishing opportunities. Many people are also introduced to the outdoors at the River Bend Nature Center at the southern edge of the COA.

Environmental Threats

Development pressures:
The City of Faribault is located in the southwestern corner of the Big Woods COA and is expected to grow in population in the coming years. This economic and population growth can lead to increased parcellization, fragmentation, and conversion of rural lands. This disrupts wildlife movement and migration, reduces available habitat, and increased water quality concerns from the added impervious surface area. The demand for dispersed rural residences places less-disturbed parts of the landscape under pressure for development. This is compounded by the likelihood of population growth in the region.

Industrial silica sand mining:
Southeast Minnesota has significant deposits of industrial silica sand bedrock at or near the surface. The increased demand for this material in the hydrological fracturing (fracking) process for oil and gas development has created an ongoing policy debate about appropriate use and regulations of this resource. There currently are not any mines operating in the Cannon River Watershed but a significant portion of the Big Woods COA has quartz-rich sandstone within 50 ft. of the land surface. Potential impacts of mining include removal of vegetation and underlying substrates, habitat destruction, chemical contamination of karst hydrology, and water contamination from high volume dispersals from water processing facilities and dewatering pits.

Mismanagement of forest resources:
The forests of Southeast Minnesota support a number of high value timber species, and many sites exist containing high quality timber stock. This represents an important resource for the region, but is also a target for exploitative harvesting practices. Timber harvests that remove all of the most valuable trees in a stand, and leave behind a patchy, irregular forest of poor quality trees do serious harm to the health and productive potential of that site, and severely limit management options in the future. The high value of the timber resource enables sustainable timber management to produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest. Unsustainable harvesting practices can seriously impair a stand's ability to do so in the future.

Nutrient, sediment, and contaminants from upstream agricultural areas:
A significant portion of the Big Woods COA, and areas upstream, are heavily farmed, often with practices that have the potential to impair water quality. This has large impacts on downstream reaches. Best management practices are available to farmers to protect their soil from erosion, and help prevent excess nutrients and sediment from washing into the streams. Riparian buffer strips help slow run-off and increase infiltration, allowing nutrients to be filtered and removed by soil processes. Increased adoption of agricultural BMPs to protect water quality in upstream areas will help protect the water quality of downstream reaches in the COA.

Land Ownership

Nearly 3,300 acres of the Big Woods COA are in public ownership (Table 8, Figure 20). The DNR Division of Parks and Recreation's ownership in Nerstrand Big Woods State Park is the largest public land holding followed closely by Rice County's Cannon River Wilderness Area.

Despite the relatively large area of public land for the region, private lands still make up over 93% of the COA. Since private lands make up such a large portion of the COA it is clear that private landowners will play a crucial role in conservation. Much of the forested area occurs in places with dispersed residential development, and finding programs that will appeal to these landowners will be necessary to encourage the necessary private conservation.

Private conservation programs have demonstrated some success in the area. The DNR Forest Stewardship Program is an excellent first step in landowner involvement and concern for the ecological health of the landscape and 673 acres have a registered stewardship plan in the Big Woods COA. This voluntary program provides technical advice and long-range forest management planning to interested landowners. Plans are designed by professional foresters to meet the landowner's goals while maintaining the sustainability of the land.

The Reinvest in Minnesota (RIM) program has easements in the COA covering 235 acres. This program purchases conservation easements on privately owned lands to retire environmentally sensitive lands from agricultural production. Conservation practices are established by planting native vegetation, and restoring wetlands with the goal of protecting and improving water quality, reducing soil erosion, and enhancing fish and wildlife habitat. Additionally, the Big Woods area in Rice County has been designated as an active Forest Legacy Area by the State of Minnesota. The Minnesota Forest Legacy Program protects environmentally important private forests threatened by conversion to non-forest uses. Landowners apply to participate in the program. If they are accepted, federal funds and local matching funds are used to purchase development rights and conservation easements to keep these forests intact and continuing to provide forest benefits. The landowner retains ownership and can continue activities such as timber management, recreation, hunting, and hiking as long as they do not conflict with the terms of the easement. All easements are perpetual, and any new owner is bound by the terms of the easement.

Table 8. Land ownership in the Big Woods COA.

Ownership	Acres	Percent of Public	Percent of COA
Private	47,754		93.5%
Division of Parks and Recreation	1,069	32.4%	2.1%
County	981	29.8%	1.9%
Division of Forestry	586	17.8%	1.1%
The Nature Conservancy	267	8.1%	0.5%
Division of Fish and Wildlife	216	6.5%	0.4%
Division of Ecological Services	179	5.4%	0.4%

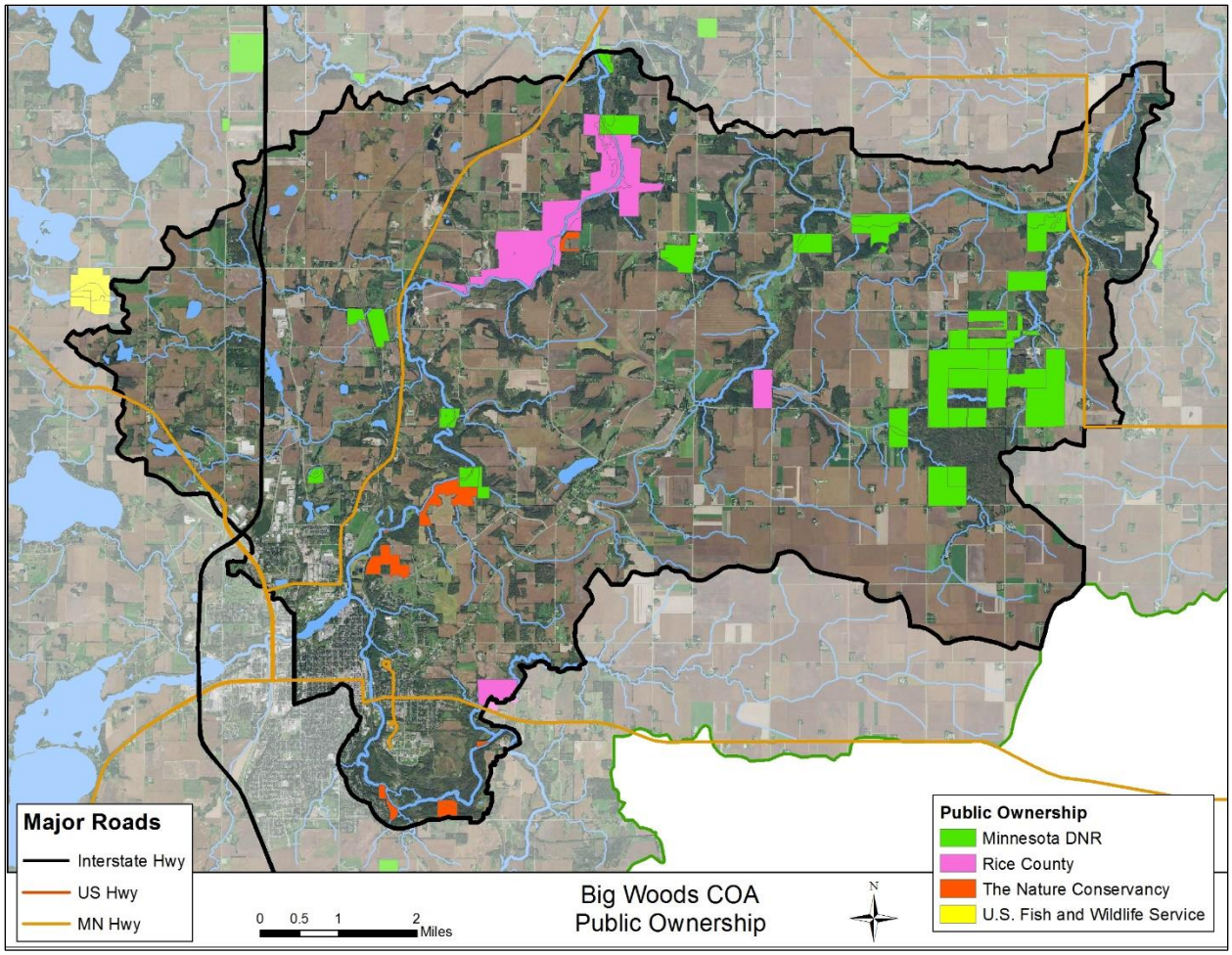


Figure 20. Public land in the Big Woods COA.

Land Cover and Use

Nearly half of the Big Woods COA was covered by a hardwood forest at the time of European settlement (Table 9, Figure 21). The core of this forest existed on the western portion of the COA with the area now protected as Nerstrand Big Woods State Park representing an island of this forest type surrounded by prairie.

Today the land use patterns in the Big Woods COA follow the general pattern for the broader watershed. The predominantly flat, upland areas are mostly cropland or pasture. The hillsides are dominated by forests, and the valley floors and floodplain areas contain a mix of cropland, pasture, forests, and wetlands (Figure 22). Major cover types are cultivated crops (52.1%) and deciduous forest (16.8%). Pasture/hay (7.7%), developed open space (6.8%) and grassland/herbaceous (6.6%) cover are also significant.

Table 9. Presettlement land cover in the Big Woods COA

Land Type	Acres	Percent
Aspen-Oak Land	5,554	11%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	22,161	43%
Oak openings and barrens	3,309	6%
Prairie	16,673	33%
Wet Prairie	3,356	7%

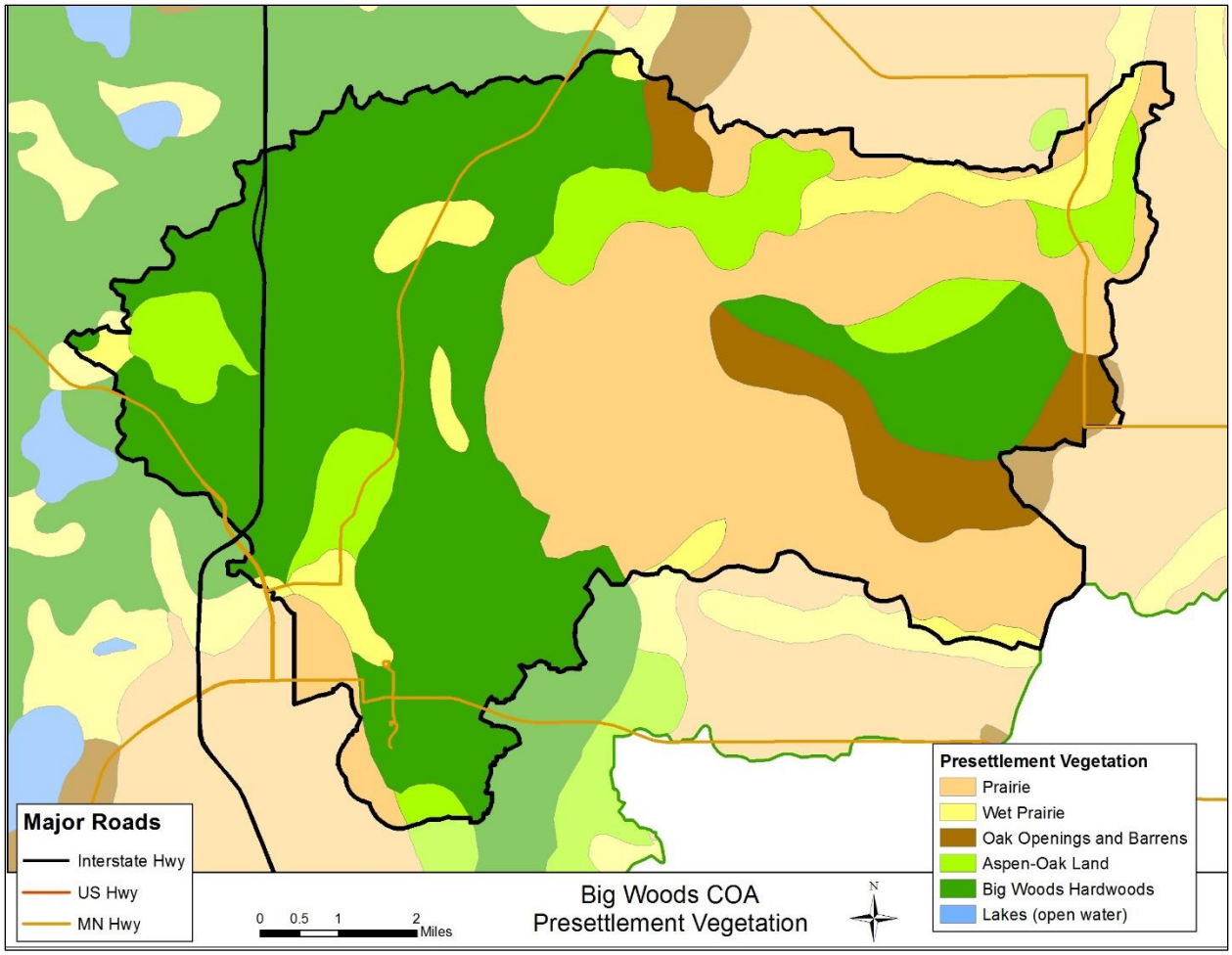


Figure 21. Presettlement land cover in the Big Woods COA based on the work of Francis J. Marschner.

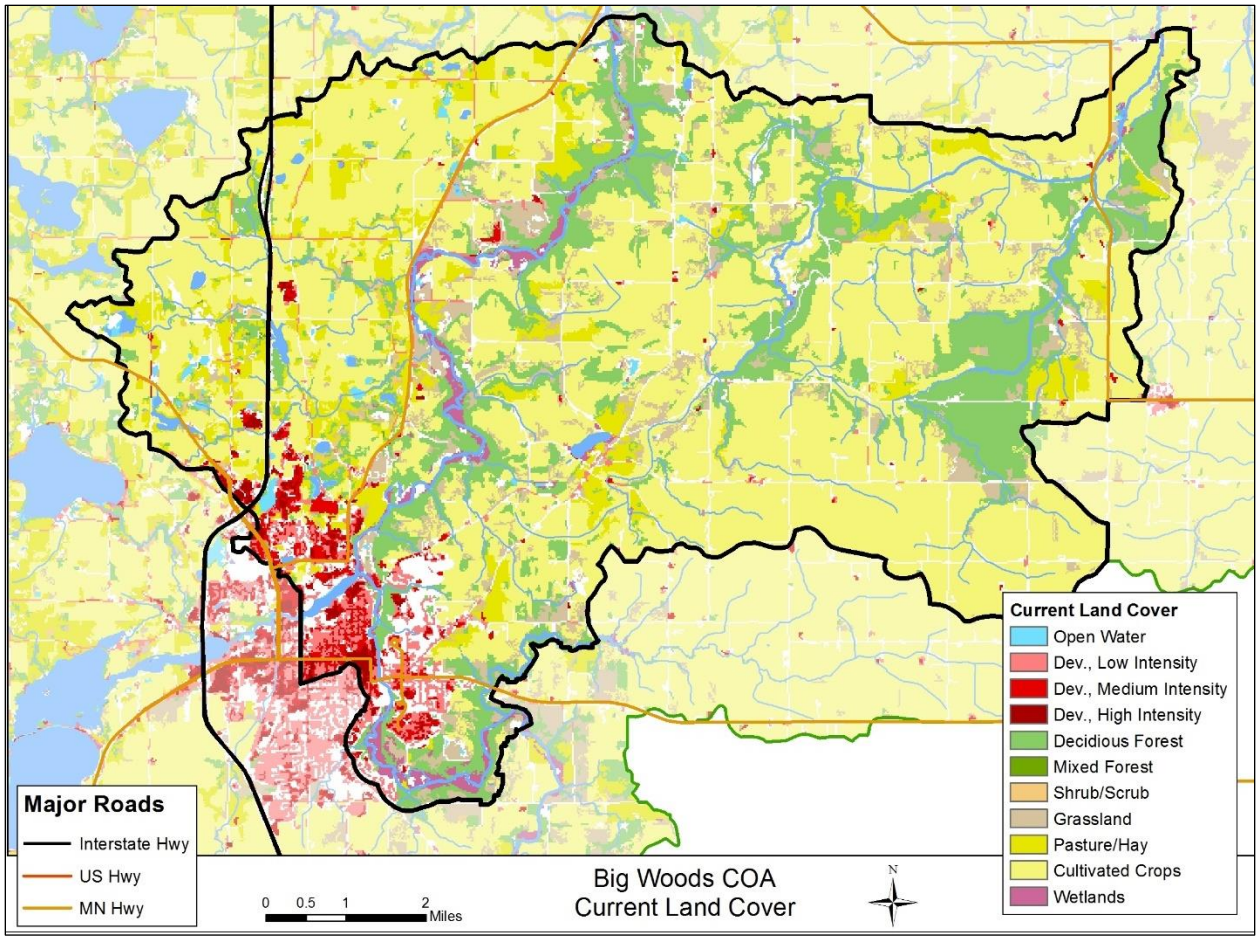


Figure 22. Current land cover in the Big Woods COA based on the 2011 National Land Cover Database.

Desired Future Conditions

- Native plant community remnants have expanded, especially remaining examples of the Big Woods ecosystem.
- 100% of riparian areas are covered by native vegetation, returning a host of ecological services for water quality, habitat quality, and connectivity.
- Dwarf trout lily populations are increasing.
- Biotic integrity of all streams within the COA is restored, resulting in healthy aquatic species and de-listing of impaired waters.
- Human activity in riparian areas follows best management practices to protect water quality and sensitive shorelines.
- Agricultural practices within the COA follow best management practices to protect soil from erosion, and streams from sedimentation and nutrient loading.
- A natural fire regime is restored through prescribed burning on all appropriate native plant communities.
- Large blocks of native habitat exist across ownership lines.
- Habitat corridors link patches of biodiversity habitat, supporting migration and travel, especially in riparian areas.
- Rare plants and animal habitat are protected from degradation
- Invasive species are monitored and controlled

Key Stewardship Parcels

Acquisition efforts can only go so far and stewardship efforts on private parcels will be crucial to protecting the natural resources of the area. Conservation efforts in the Big Woods COA will be most effective in places where they protect existing native plant communities, and enhance habitat on public lands by increasing their size and/or connectivity. Working with larger parcels is preferable, because more stewardship options are available on larger tracts, and stewardship planning will impact a greater area. To make the most efficient use of conservation resources, it is useful to target parcels where those resources will have the most impact. A GIS analysis by The Nature Conservancy identified 106 key stewardship parcels in the Big Woods COA that met the following conditions (Figure 23):

- Larger than 40 acres in size, AND
- That contain at least one native plant community mapped by the MBS
- And are with a quarter mile of publicly owned conservation lands. Intersect areas of medium rank or higher in the Wildlife Action Network

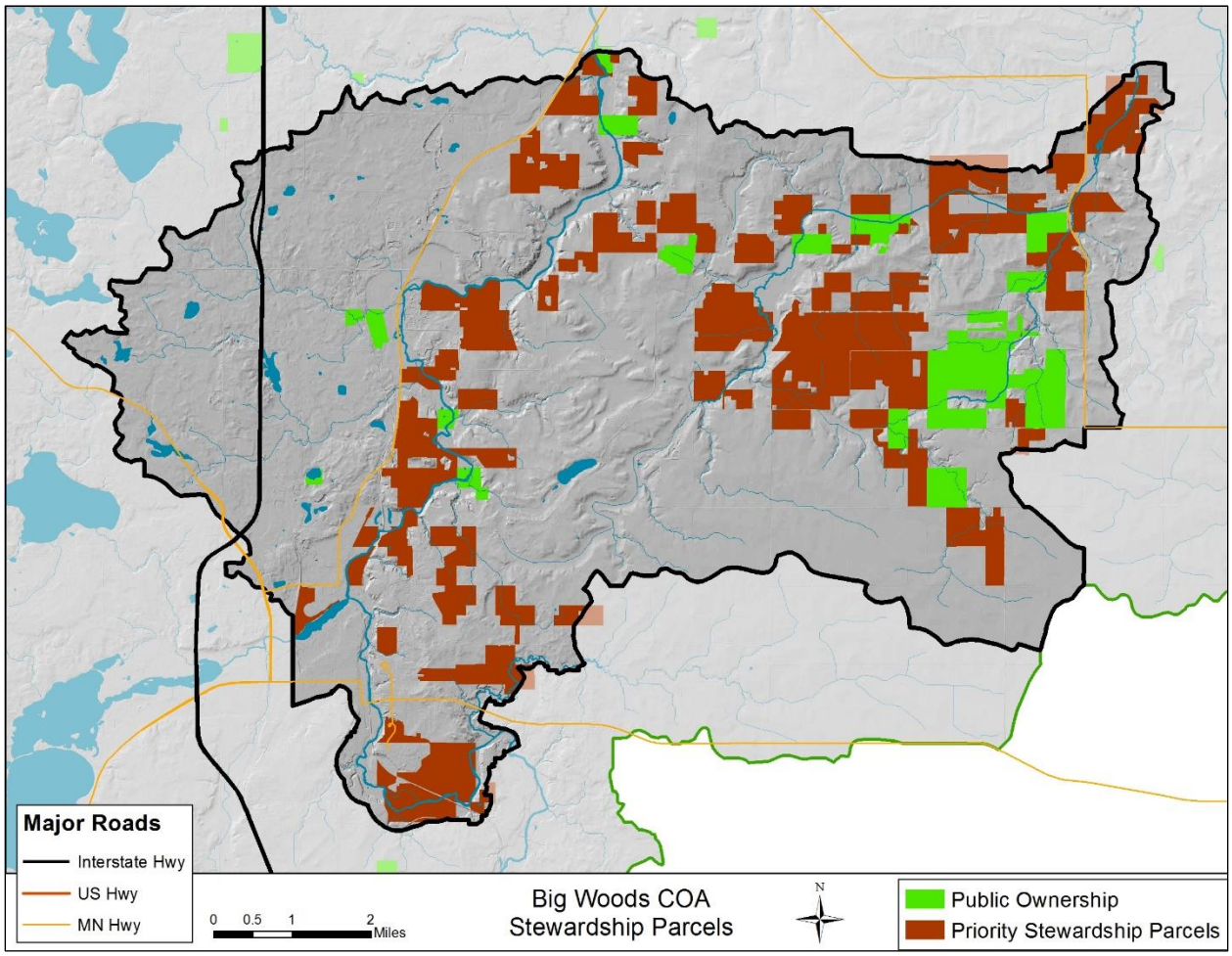


Figure 23. Priority stewardship parcels in the Big Woods COA.

Stewardship Activities

There is a variety of tools and strategies available for enacting stewardship activities on the landscape (see Section 1). Different strategies and actions will be appropriate for different types of parcels, natural resources, and landowners. This section provides a summary of strategies appropriate for the natural resources present in this COA.

Core Forest Areas

Large, continuous stretches of forest communities represent core forest habitat in the Big Woods COA. In addition to providing quality habitat to a number of species, including dwarf trout lily, these areas represent favorite places for recreation and scenery, making them important for the tourism industry in the region. They also provide a great benefit to water quality, as forests help prevent erosion, slow and filter water run-off, and shade streams in riparian areas.

Stewardship Activities:

On all lands:

- Control invasive species
- Burn where appropriate
- Manage according to sustainable silvicultural and ecological principles
- Where possible, increase size and connectivity of forest habitat through reforestation / afforestation of connecting patches

On Private lands:

- Prepare comprehensive forest stewardship plans
- Assist landowner in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)

Prairies, Savannas, and Fire-Associated Native Plant Communities

The suppression of fire and mass conversion to agriculture that came with Euro-American settlement drastically reduced the amount of native prairie and savannas in both Minnesota, and the US as a whole. These communities offer important habitat for a number of animals, and many flowering plants and grasses.

Stewardship Activities:

On all lands:

- Restore a natural fire regime through prescribed burns
- Remove brush as needed
- Control invasive species
- Expand grassland habitat as buffer areas around other NPCs.

Wet meadow/carr communities

The Prairie Creek Watershed contains many scattered examples of seepage meadows, or carrs, where groundwater seeping back to the surface on the edge of aquifers or near riparian creates wetlands frequently dominated by sedges and/or shrubs. These small, distinct communities add

diversity to the landscape, but can be greatly affected by changes in surface or groundwater hydrology. They are also vulnerable to conversion to agriculture when drained.

Stewardship Activities:

On public lands:

- Identify, map, and maintain small patches of carr communities.
- Control invasive species near these communities.

On private lands:

- Attempt to document and protect these wetlands to discourage drainage and conversion where those risks are present.
- Encourage landscape scale BMPs to maintain groundwater and surface hydrology.

Riparian Area Restoration

Riparian areas are those nearest, and most connected to streams and rivers. They have an important impact on water quality either, positively by slowing and filtering run-off, or negatively, by contributing to sediment and nutrient loads brought to streams through erosion and run-off. Implementing best management practices and other conservation actions in these areas can have significant water quality and wildlife benefits.

Stewardship Activities:

On public lands:

- Reconnect waterways with their floodplains.
- Maintain and/or establish appropriate plant communities for the hydrology of the site.

On private lands:

- Support SWCDs in implementing and enforcing the state buffer law and other best management practices. Help interested landowners apply for the various cost-share or easement programs available for water quality protection (e.g. CRP, RIM).
- Work with landowners to reconnect streams to their floodplains.
- Maintain and restore natural vegetation along stream and riverbanks.

Key Stewardship Parcels

These parcels were identified based on their geographical size and proximity to areas of biodiversity significance (see above). They are areas where conservation effort can be most beneficial to the overall health of the landscape.

Stewardship Activities:

- Work to engage the owners of these parcels in a targeted manner.
- Target strategic parcels for potential acquisition or conservation easements.
- Tailor outreach and assistance to each landowner individually based on characteristics of their parcel and its geographical and ecological characteristics
- Prioritize stewardship efforts affecting these parcels

Headwater Lakes Conservation Opportunity Area

Overview

The Headwater Lakes COA lies northwest of Faribault, east of Lonsdale, and west of Northfield encompassing nearly 100,000 acres in the Cannon River headwaters. Significant portions of the Devil Creek, Dutch Creek, Heath Creek, Roberds Lake, and Wolf Creek watersheds fall within the Headwater Lakes COA.

The rolling topography of the Headwaters Lakes COA is pocketed with numerous small lakes, wetlands, and forest (Figure 24). Today much of this region has been converted to agriculture, but according to data from the Public Land Survey, over half of this area was dominated by an impressive mesic hardwood forest of maple and basswood. Although greatly reduced, the remnants of the big woods ecosystem represent a conservation opportunity from which to build within the agriculture matrix. So far, over 3,000 acres of these forests and wetlands have been protected as Wildlife Management Areas and other public land designations.

The wetlands and remaining areas of the big woods ecosystem represent hotspots for biodiversity as identified in the Wildlife Action Network and State Wildlife Action Plan. The southern portion of the COA between Shields and Cedar Lakes in particular contains a relatively large block of forest and wetland conditions that offers good wildlife habitat that is no longer common in the area. The wetlands are particularly important to waterfowl and other water birds while the mesic hardwoods forests are host to a number of spring ephemeral wildflowers that often grow and bloom before the canopy trees leaf out. This includes species such as false rue anemone, wild ginger, spring beauty, cut-leaved toothwort, Dutchman's breeches, sharp-lobed hepatica, bloodroot and violets. The Minnesota Biological Survey has designated substantial portions of the COA as having moderate or high significance to biodiversity, and an opportunity exists for successful private land conservation efforts. With the prevalence of publicly owned land in the COA, the priority for private parcels should be placed on those in close proximity to protected land, in order to enhance to size and connectivity of those habitats.

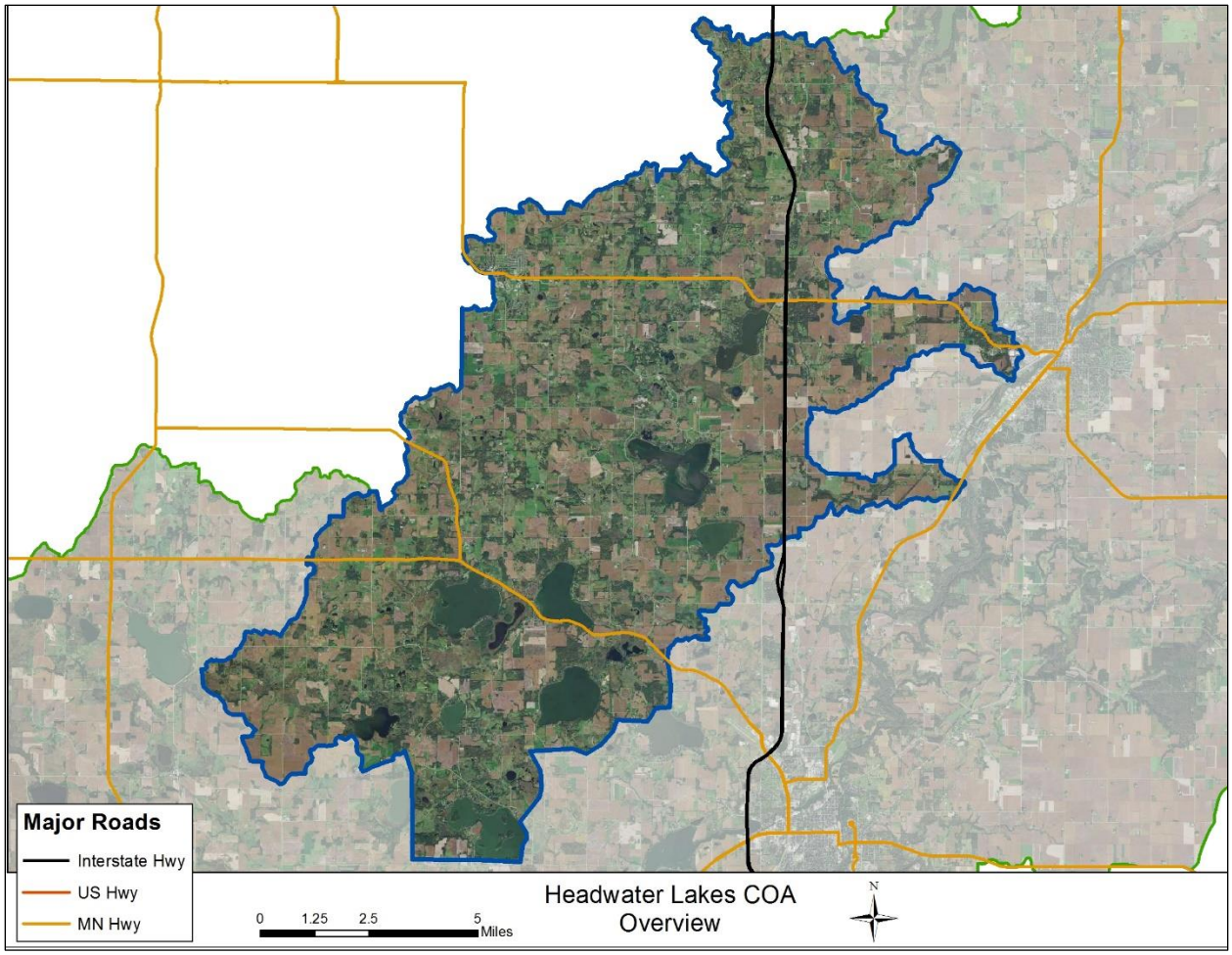


Figure 24. Headwater Lakes COA.

Natural Resource Assessment

Hydrology

The dominant hydrological features of the Headwater Lakes COA are the numerous lakes, wetlands and headwater streams in this rolling topography. Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed these hydrological features (Figure 25). Water in the northern portion of the COA travels east to the main stem of the Cannon River, while the southern lakes and wetlands eventually coalesce into the beginning of the Cannon River and head west before the Cannon eventually flows to the northeast. Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system.

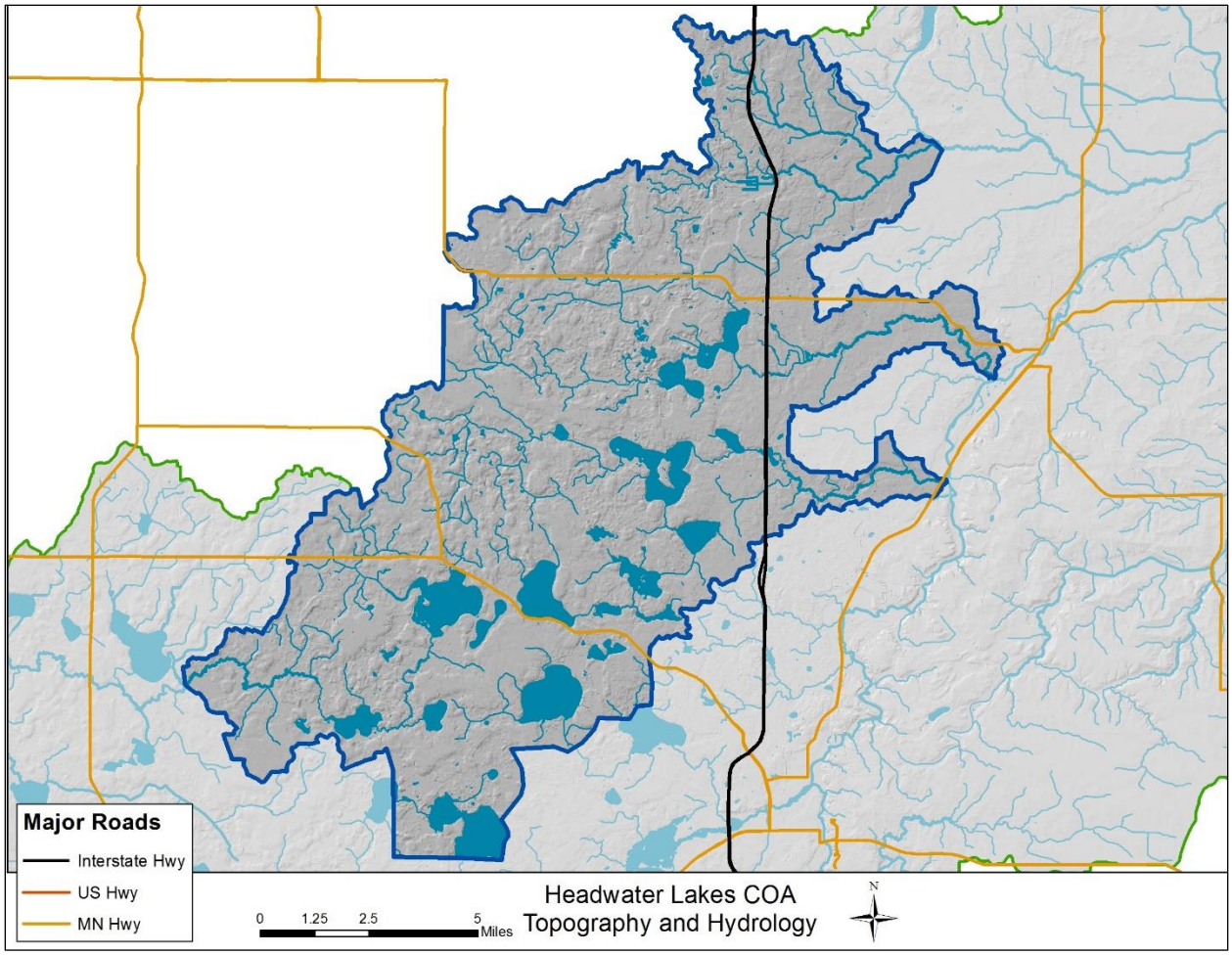


Figure 25. Hydrology of the Headwater Lake COA.

Plant Communities

Headwater Lakes COA contains almost 4,500 acres of Native Plant Communities (NPC) in six different systems and 16 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 10). Marsh (50%) and mesic hardwoods (39.5%) make up the majority of the identified NPC acres (Figure 26). Full descriptions of native plant community types and their associated ecological systems can be found in *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*, produced and distributed by the MN DNR.

Approximately 20 percent of the NPCs in the Headwater Lakes COA are on publicly owned land with the many of the privately owned NPCs on parcels near the blocks of public land. Private parcels containing NPCs, especially those bordering publicly managed areas, represent an important priority for increased protection and private conservation efforts.

Table 10. Native Plant Communities of the Headwater Lakes COA.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Floodplain Forest	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	8	0.2%
Forested Rich Peatland	FPs63a	Tamarack Swamp (Southern)	34	0.8%
Lakeshore	LKi32	Inland Lake Sand/Gravel/Cobble Shore	8	0.2%
	LKi32b	Gravel/Cobble Beach (Inland Lake)	18	0.4%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	109	2.4%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	11	0.2%
	MHs38	Southern Mesic Oak-Basswood Forest	21	0.5%
	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	258	5.7%
	MHs39	Southern Mesic Maple-Basswood Forest	945	21.1%
	MHs39c	Sugar Maple Forest (Big Woods)	346	7.7%
	MHs49a	Elm - Basswood - Black Ash - (Hackberry) Forest	81	1.8%
Marsh	MRn83	Northern Mixed Cattail Marsh	1653	36.8%
	MRn83a	Cattail - Sedge Marsh (Northern)	378	8.4%
	MRn93	Northern Bulrush-Spikerush Marsh	211	4.7%
Wet Meadow	WMn82a	Willow - Dogwood Shrub Swamp	342	7.6%
	WMn82b1	Sedge Meadow: Bluejoint Subtype	64	1.4%

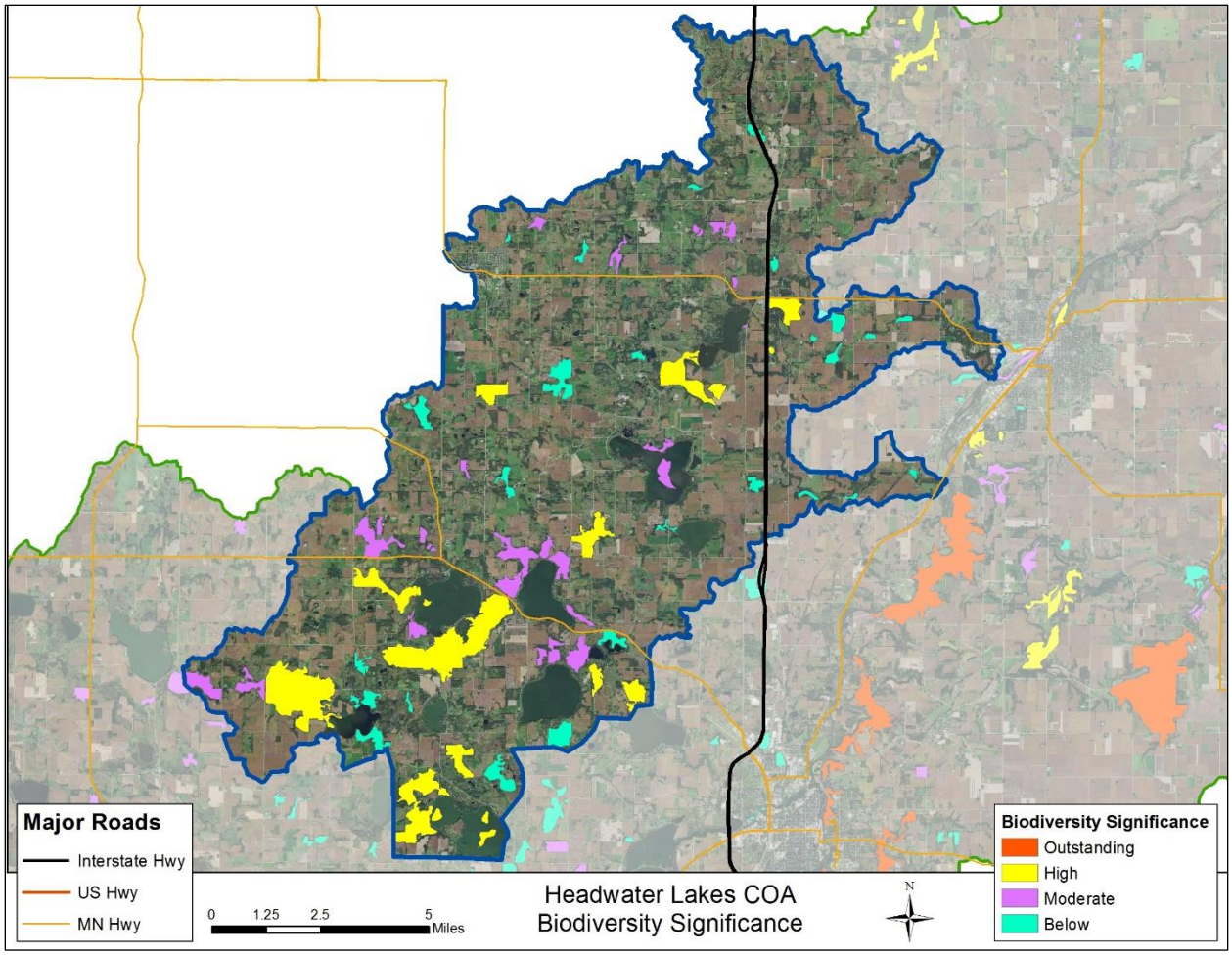


Figure 26. Native plant communities in the Headwater Lakes COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 13 different occurrences of rare plants, animals, or communities in Headwater Lakes COA (Table 11). Rare species are those listed as either endangered, threatened, or of special concern. Endangered species are those facing extinction throughout all or a significant portion of its range within Minnesota. Threatened species are likely to become endangered in the foreseeable future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota.

Forty-four rare terrestrial communities are listed in Headwater Lakes COA. Rare terrestrial communities are collections of plant species growing together, whose presence on the landscape is rare or severely diminished. These communities are monitored, but not given designations as endangered, threatened, or of special concern.

Table 11. Number of rare species and community occurrences in the Headwater Lakes COA.

Organism Type	Observations
Animal Assemblage	2
Vascular Plant	3
Invertebrate Animal	1
Vertebrate Animal	7
Terrestrial Community	44

The Minnesota Biological Survey has delineated over 8,150 acres of the Headwater Lakes COA based on their significance to biodiversity in the state (Figure 27). Of that area, 4,600 acres were designated as having 'High' biodiversity significance. No acres were given the highest level of 'Outstanding' biodiversity significance.

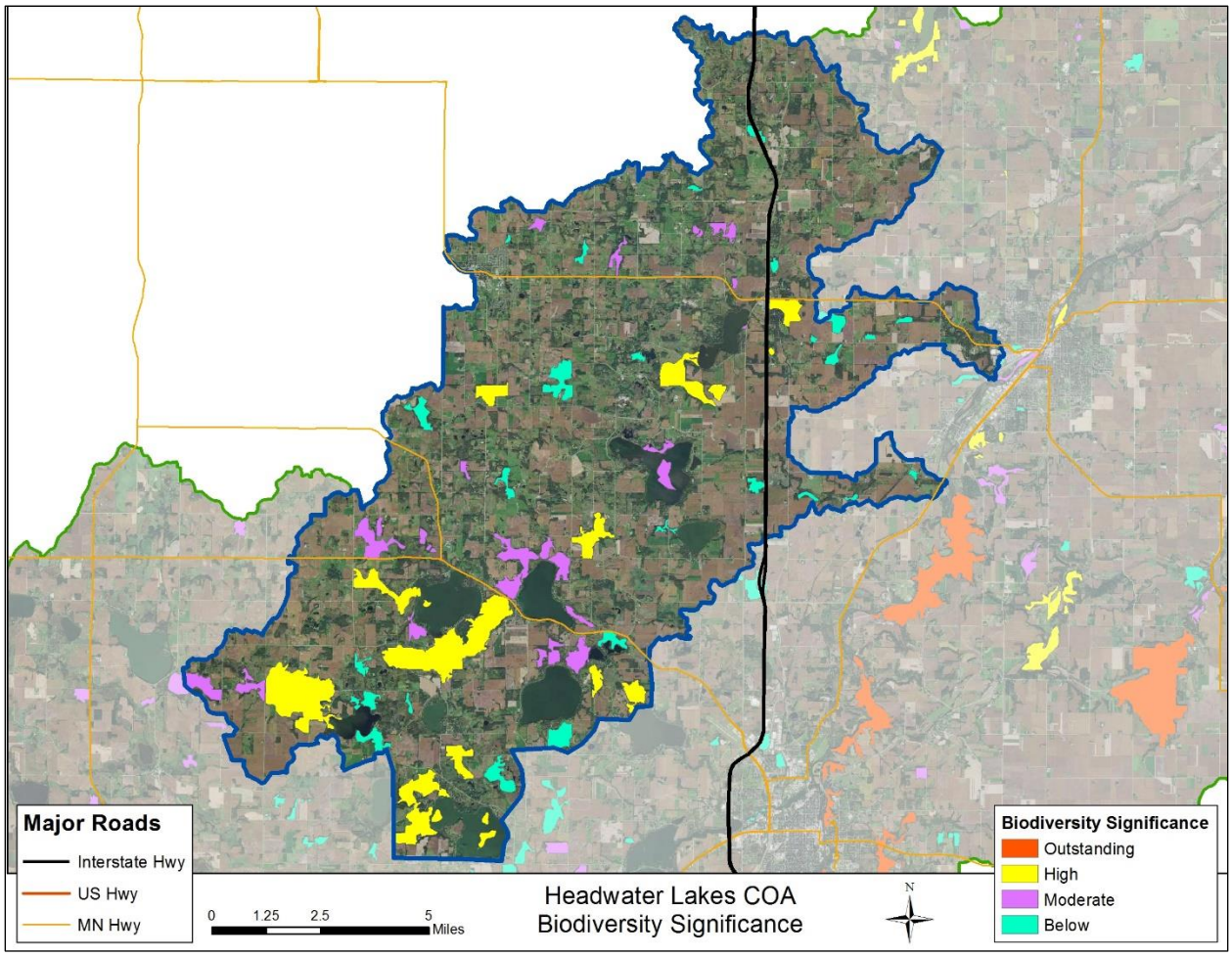


Figure 27. Sites of biodiversity significance in the Headwater Lakes COA.

Recreation

Outdoor recreation areas in the Headwater Lakes COA contribute to the well-being of residents and support the local economy. The region's lakes are popular fishing and recreating destinations. Hunting is a popular outdoor recreational activity throughout the area on public and private land. A network of snowmobile trails also winds through the COA.

Environmental Threats

Development pressures:
There are no significant population centers in the Headwaters COA but the lakes are popular recreation destinations and there is significant development pressure along their shorelines. Additionally, this area is relatively close to the expanding Minneapolis-Saint Paul metropolitan area and there will likely be increasing parcellization, fragmentation, and conversion of rural lands in the COA. This disrupts wildlife movement and migration, reduces available habitat, and increased water quality concerns from the added impervious surface area. The demand for

dispersed rural residences places less-disturbed parts of the landscape under pressure for development.

Mismanagement of forest resources:
The forests of Southeast Minnesota support a number of high value timber species, and many sites exist containing high quality timber stock. This represents an important resource for the region, but is also a target for exploitative harvesting practices. Timber harvests that remove all of the most valuable trees in a stand, and leave behind a patchy, irregular forest of poor quality trees do serious harm to the health and productive potential of that site, and severely limit management options in the future. The high value of the timber resource enables sustainable timber management to produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest. Unsustainable harvesting practices can seriously impair a stand's ability to do so in the future.

Nutrient, sediment, and contaminants from upstream agricultural areas:
A significant portion of the Headwater Lakes COA are heavily farmed, often with practices that have the potential to impair water quality. This has large impacts on downstream reaches. Best management practices are available to farmers to protect their soil from erosion, and help prevent excess nutrients and sediment from washing into the streams. Riparian buffer strips help slow run-off and increase infiltration, allowing nutrients to be filtered and removed by soil processes. Increased adoption of agricultural BMPs to protect water quality in upstream areas will help protect the water quality of downstream reaches in the COA.

Land Ownership

Over 3,000 acres of the Headwaters COA are in public ownership (Table 12, Figure 28). The DNR Division of Fish and Wildlife manages the largest amount of this public land in their Wildlife Management Area system.

The vast majority of the COA, however is in private ownership. Since private lands make up such a large portion of the COA it is clear that private landowners will play a crucial role in conservation. Much of the forested area occurs in areas with dispersed residential development, and finding programs that will appeal to these landowners will be necessary to encouraging the necessary private conservation.

Table 12. Estimated land ownership in the Headwater Lakes COA.

Ownership	Acres	Percent of Public	Percent of COA
Private	95,245		96.9%
Division of Fish and Wildlife	2,379	77.7%	2.4%
U.S. Fish and Wildlife Service	262	8.6%	0.3%
Division of Forestry	258	8.4%	0.3%
Rice County	120	3.9%	0.1%
Division of Ecological Services	41	1.4%	0.0%

To date, private conservation programs have demonstrated a fair amount of success in the COA. The DNR Forest Stewardship Program is an excellent first step in landowner involvement and concern for the ecological health of the landscape and 1,381 acres have a registered stewardship plan in the Headwater Lakes COA. This voluntary program provides technical advice and long-range forest management planning to interested landowners. Plans are designed by professional foresters to meet the landowner's goals while maintaining the sustainability of the land.

The Reinvest in Minnesota (RIM) program has easements in the COA covering 1,023 acres. This program purchases conservation easements on privately owned lands to retire environmentally sensitive lands from agricultural production. Conservation practices are established by planting native vegetation, and restoring wetlands with the goal of protecting and improving water quality, reducing soil erosion, and enhancing fish and wildlife habitat. Additionally, this portion of Rice County has been designated as an active Forest Legacy Area by the State of Minnesota to protect the remaining examples of the big woods ecosystem. The Minnesota Forest Legacy Program protects environmentally important private forests threatened by conversion to non-forest uses. Landowners apply to participate in the program. If they are accepted, federal funds and local matching funds are used to purchase development rights and conservation easements to keep these forests intact and continuing to provide forest benefits. The landowner retains ownership and can continue activities such as timber management, recreation, hunting, and hiking as long as they do not conflict with the terms of the easement. All easements are perpetual, and any new owner is bound by the terms of the easement.

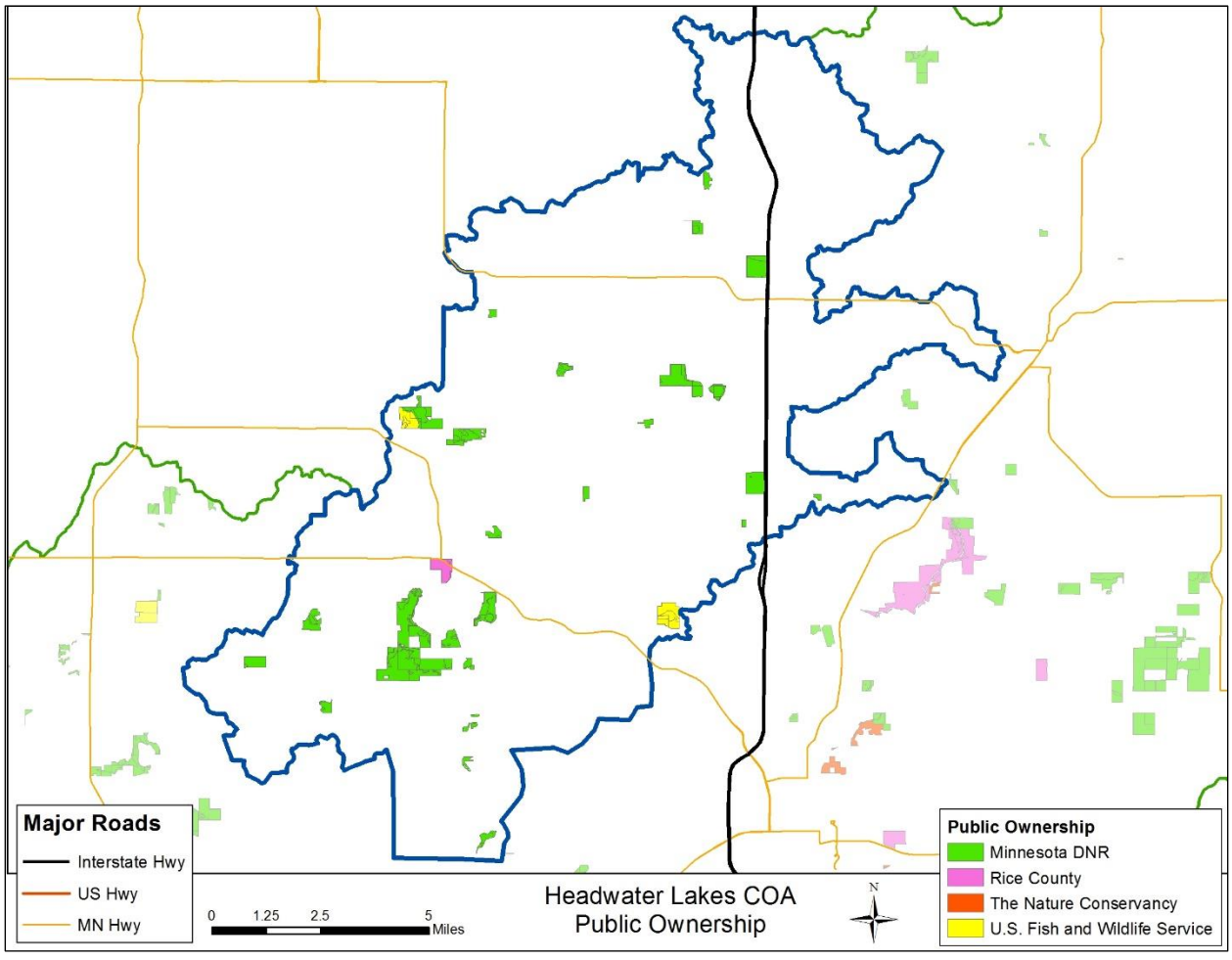


Figure 28. Public land in the Headwater Lake COA.

Land Cover and Use

Over half of the Headwater Lakes COA was covered by a hardwood forest at the time of European settlement (Table 13, Figure 29). Today, the rolling topography of the COA is largely agriculture, pocketed with numerous small lakes, wetlands, and patches of forest. In general, the area surrounding lakes and wetlands tends to be forested with the surrounding uplands supporting agriculture (Figure 30). Major cover types are cultivated crops (35.0%) and pasture/hay (27.8%). Deciduous forest (11.9%), open water (7.3%) and emergent herbaceous wetlands (5.7%) cover are also significant.

Table 13. Presettlement land cover in the Headwater Lakes COA.

Land Type	Acres	Percent
Aspen-Oak Land	5,843	6%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	50,544	51%
Lakes (open water)	6,580	7%
Oak openings and barrens	19,043	19%
Wet Prairie	16,297	17%

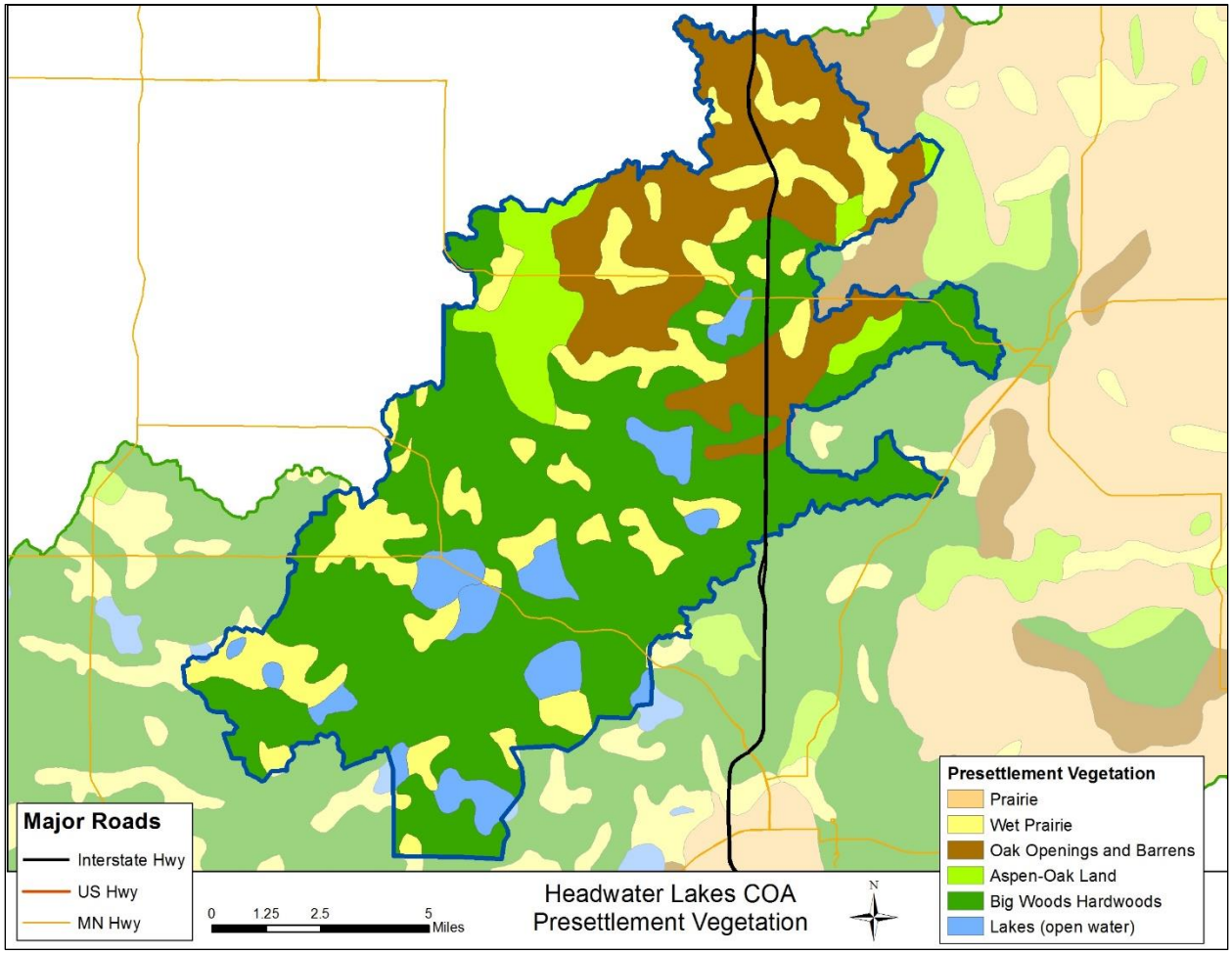


Figure 29. Presettlement land cover in the Headwater Lakes COA based on the work of Francis J. Marschner.

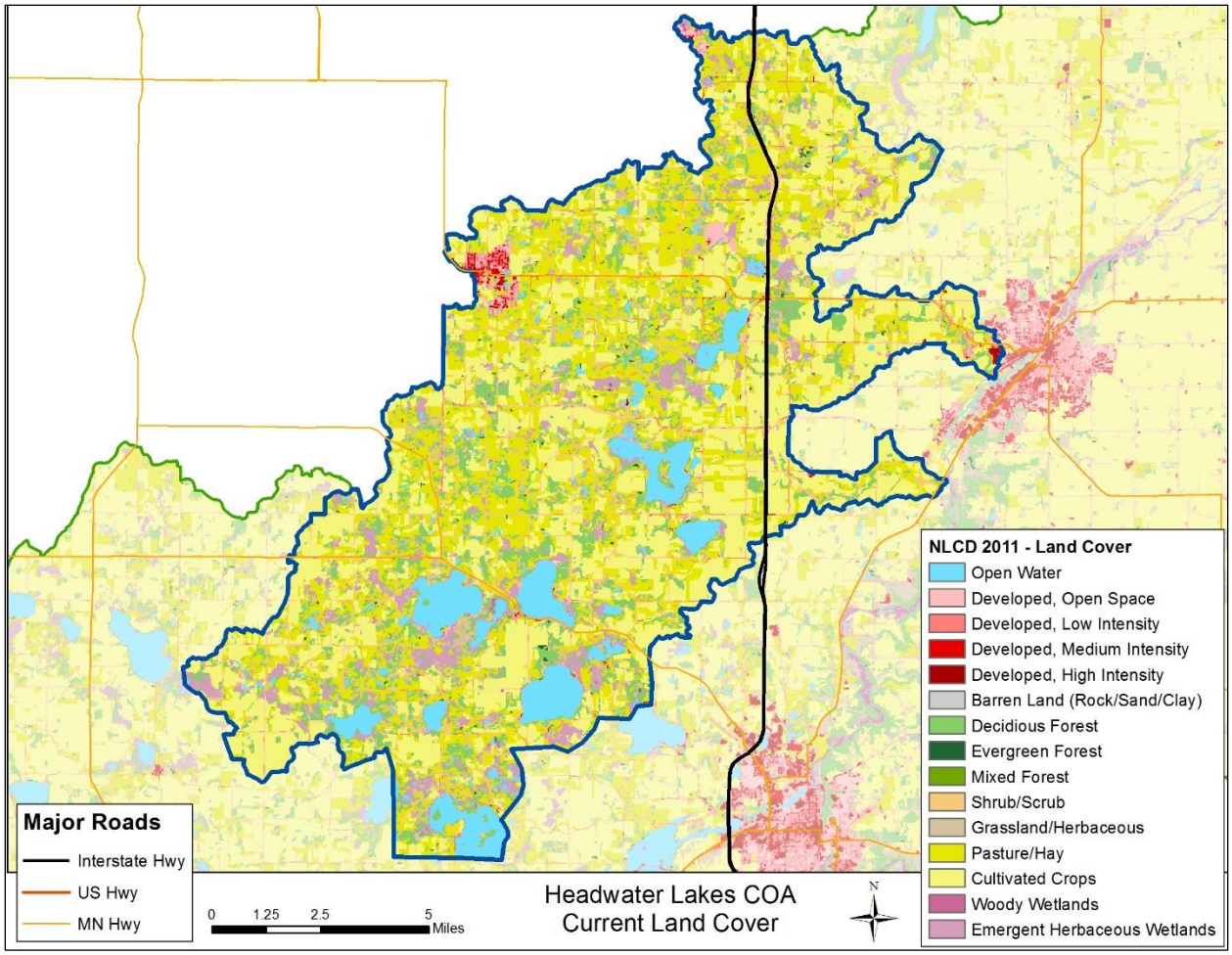


Figure 30. Current land cover in the Headwater Lakes COA based on the 2011 National Land Cover Database.

Desired Future Conditions

- Human activity in riparian and lakeshore areas follows best management practices to protect water quality and sensitive shorelines.
- Biotic integrity of all streams and lakes within the COA is restored, resulting in healthy aquatic species and de-listing of impaired waters.
- 100% of riparian areas are covered by native vegetation, returning a host of ecological services for water quality, habitat quality, and connectivity.
- Agricultural practices within the COA follow best management practices to protect soil from erosion, and streams from sedimentation and nutrient loading.
- A natural fire regime is restored through prescribed burning on all appropriate native plant communities.
- Large blocks of native habitat exist across ownership lines.
- Habitat corridors link patches of biodiversity habitat, supporting migration and travel, especially in riparian areas.
- Native plant community remnants have expanded
- Rare plants and animal habitat are protected from degradation
- Invasive species are monitored and controlled

Key Stewardship Parcels

With nearly 97% of the Headwater Lakes COA in private ownership, stewardship efforts on private parcels will be crucial to protecting the natural resources of the area. Residential development along the lakes and in many of the stream valleys has led to smaller average parcel sizes in forested areas. Conservation efforts in the COA will be most effective in places where they protect existing native plant communities, and enhance habitat on public lands by increasing their size and/or connectivity. Working with larger parcels is preferable, because more stewardship options are available on larger tracts, and stewardship planning will impact a greater area. To make the most efficient use of conservation resources, it is useful to target parcels where those resources will have the most impact. A GIS analysis by The Nature Conservancy identified 233 key stewardship parcels in the Headwater Lakes COA that met the following conditions (Figure 31):

- Larger than 40 acres in size, AND
- Intersect areas of low-medium rank or higher in the Wildlife Action Network or Moderate or higher Biodiversity Significance according to the Minnesota Biological Survey.

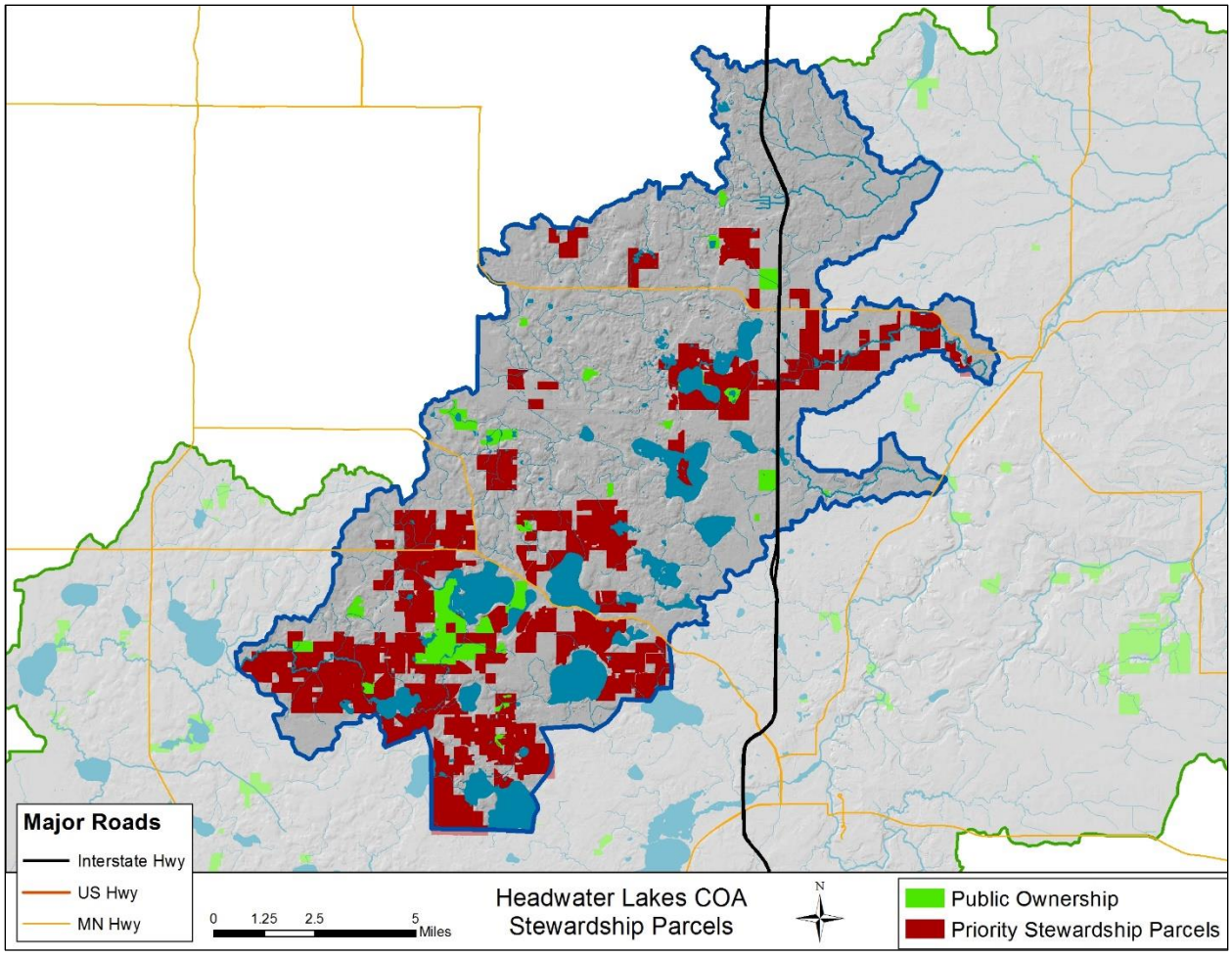


Figure 31. Priority stewardship parcels in the Headwater Lakes COA.

Stewardship Activities

There is a variety of tools and strategies available for enacting stewardship activities on the landscape (see Section 1). Different strategies and actions will be appropriate for different types of parcels, natural resources, and landowners. This section provides a summary of strategies appropriate for the natural resources present in this COA.

Wetland, Riparian, and Lakeshore Best Management Practices

A large portion of the Headwater Lakes COA is in close proximity to open water, wetland, or streams and rivers. These areas have a large important impact on water quality by slowing and filtering run-off. Development in these areas can reduce the effectiveness of these areas at protecting water quality. Additionally, croplands in these areas that involve tilling soil and applying nutrients can pose a risk to water quality.

Stewardship Activities:

On public lands:

- Maintain and/or establish appropriate plant communities for the hydrology of the site.
- Reconnect waterways with their floodplains.
- Where possible, restore wetlands to increase storage and improve hydrology.

On private lands:

- Support SWCDs in implementing and enforcing the state buffer law and other best management practices. Help interested landowners apply for the various cost-share or easement programs available for water quality protection (e.g. CRP, RIM).
- Work with landowners to reconnect streams to their floodplains.
- Seek opportunities to decommission drainage ditches, or implement design practices such as two-stage ditches that improve nutrient removal and increase flood storage high in the watershed.
- Seek opportunities to restore wetlands on marginal cropland to increase floodwater storage and ground water infiltration.
- Work with landowners around developed lakes, through lake associations or similar landowner groups where possible, to maintain and restore natural vegetation along shorelines.

Core Forest Areas

Large, continuous stretches of forest communities represent core forest habitat. In addition to providing quality habitat to a number of species, these areas represent favorite places for recreation and scenery, making them important for the tourism industry in the region. They also provide a great benefit to water quality, as forests help prevent erosion, slow and filter water run-off, and shade streams in riparian areas.

Stewardship Activities:

On all lands:

- Control invasive species
- Burn where appropriate
- Manage according to sustainable silvicultural and ecological principles

- Where possible, increase size and connectivity of forest habitat through reforestation / afforestation of connecting patches

On Private lands:

- Prepare comprehensive forest stewardship plans
- Assist landowner in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)

Prairies, Savannas, and Fire-Associated Native Plant Communities

The suppression of fire and mass conversion to agriculture that came with Euro-American settlement drastically reduced the amount of native prairie and savannas in both Minnesota, and the US as a whole. These communities offer important habitat for a number of animals, and many flowering plants and grasses.

Stewardship Activities:

On all lands:

- Restore a natural fire regime through prescribed burns
- Remove brush as needed
- Control invasive species
- Expand grassland habitat as buffer areas around other NPCs.

Key Stewardship Parcels

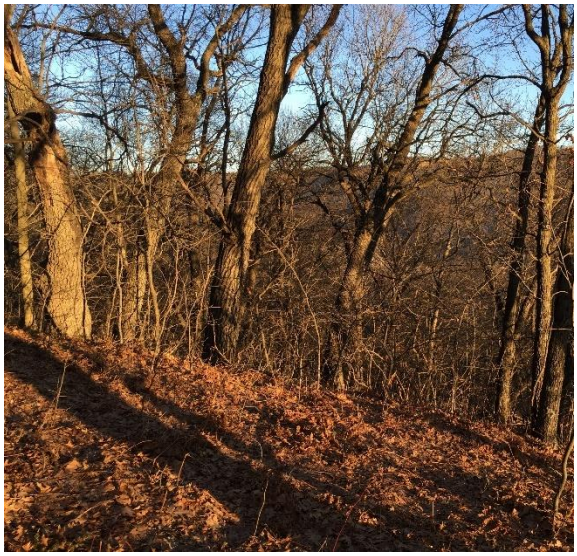
These parcels were identified based on their geographical size and areas of biodiversity significance (see above). They are areas where conservation effort can be most beneficial to the overall health of the landscape.

Stewardship Activities:

- Work to engage the owners of these parcels in a targeted manner.
- Tailor outreach and assistance to each landowner individually based on characteristics of their parcel and its geographical and ecological characteristics
- Prioritize stewardship efforts affecting these parcels

Little Cannon Conservation Opportunity Area

Overview



The Little Cannon COA lies south of Cannon Falls encompassing over 51,000 acres in the Little Cannon River watershed (Figure 32). The Little Cannon COA contains some high quality natural areas but unlike the COAs to the west and east, this area has no public land. According to data from the Public Land Survey, oak forests and savannas dominated this area. Significant forested tracks remain in the watershed; however, much of the region has been converted to agriculture. The remaining forested areas represent a hotspot for biodiversity as identified in the Wildlife Action Network and State Wildlife Action Plan. The area along the Little Cannon River and Butler Creek offers a large block of forested conditions that is home to numerous native plant community types.

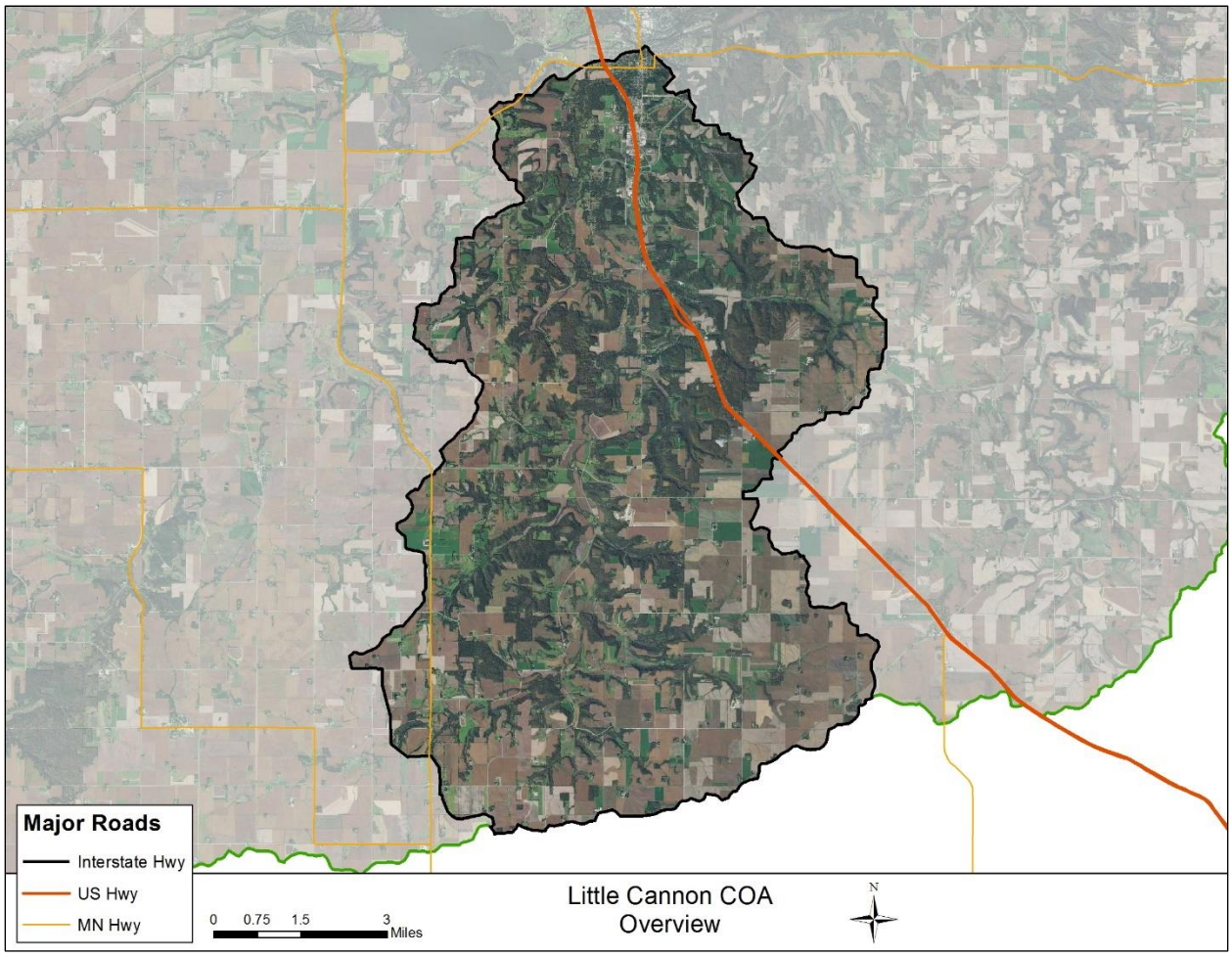


Figure 32. Little Cannon COA.

Hydrology

The dominant hydrological features of the Little Cannon COA is the Little Cannon River and its tributaries. The river valley for the main stem of the Little Cannon cuts through the center of the COA, and the entire area lies in its watershed (Figure 33). Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed the Little Cannon, which is a designated trout stream. Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system.

There are almost 300 karst features in the area including abundant sinkholes and springs that feed several of the COA's streams. These geological features can complicate the understanding of local hydrology and be challenging to protect because there are often hidden, rapid pathways from pollution release points to drinking water wells or surface water.

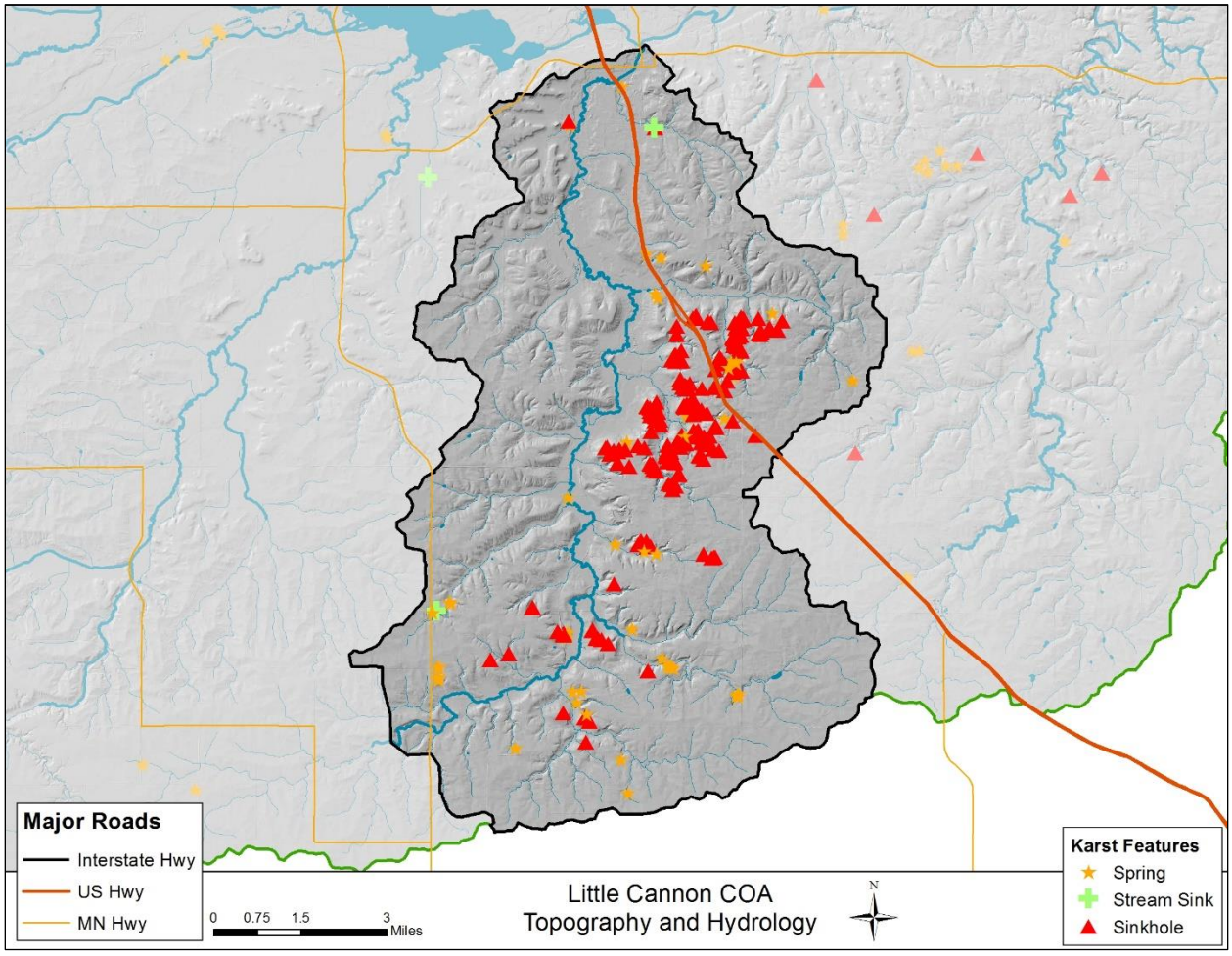


Figure 33. Hydrology and karst features of the Little Cannon COA.

Plant Communities

The Little Cannon COA contains over 3,600 acres of Native Plant Communities (NPC) in six different systems and 13 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 14; Figure 34). Mesic hardwoods make up 78.5% of the identified NPC acres with floodplain forest (11.2%) and fire dependent forests and woodlands (6.5%) also making a significant portion of the total acreage. Full descriptions of native plant community types and their associated ecological systems can be found in *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*, produced and distributed by the MN DNR.

As the COA is entirely privately owned, engaging with landowners to manage and conserve these communities will be crucial to protect them.

Table 14. Native Plant Communities of the Little Cannon COA.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Cliff/Talus	CTs12a	Dry Sandstone Cliff (Southern)	3	0.1%
Fire Dependent Forest or Woodland	FDs38a	Oak - Shagbark Hickory Woodland	238	6.5%
Floodplain Forest	FFs59c	Elm - Ash - Basswood Terrace Forest	408	11.2%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	57	1.6%
	MHs37a	Red Oak - White Oak Forest	66	1.8%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	160	4.4%
	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	223	6.1%
	MHs39	Southern Mesic Maple-Basswood Forest	241	6.6%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	1,275	35.0%
	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	813	22.3%
	MHs49b	Elm - Basswood - Black Ash - (Blue Beech) Forest	22	0.6%
Open Rich Peatland	OPp93c	Calcareous Fen (Southeastern)	6	0.2%
Upland Prairie	UPs13c	Dry Bedrock Bluff Prairie (Southern)	128	3.5%

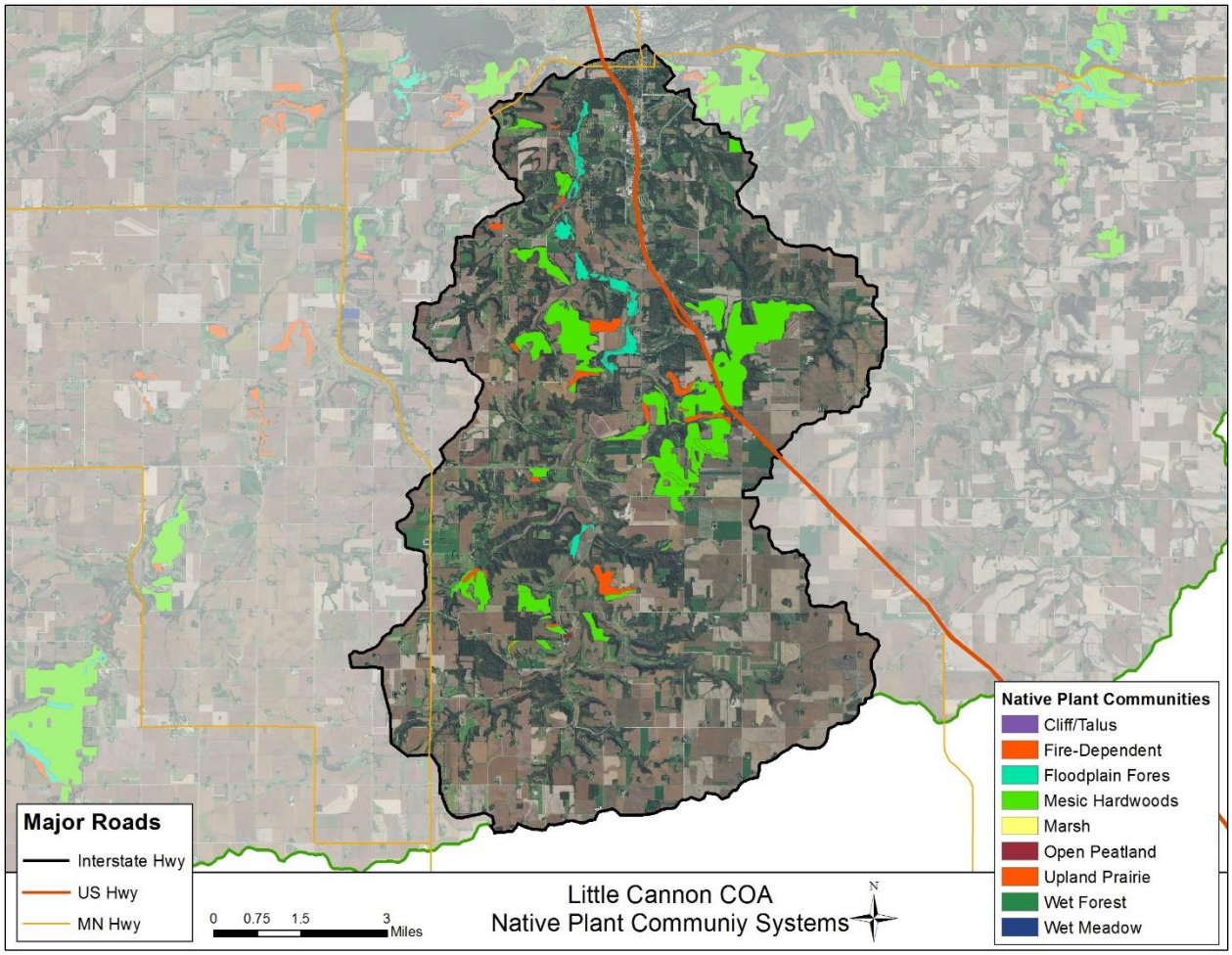


Figure 34. Native plant communities of the Little Cannon COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 61 different occurrences of rare plants, animals, or communities in Little Cannon COA (Table 15). Rare species are those listed as either endangered, threatened, or of special concern. Endangered species are those facing extinction throughout all or a significant portion of its range within Minnesota. Threatened species are likely to become endangered in the foreseeable future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota.

Thirty-three rare terrestrial communities are listed in Little Cannon COA. Rare terrestrial communities are collections of plant species growing together, whose presence on the landscape is rare or severely diminished. These communities are monitored, but not given designations as endangered, threatened, or of special concern.

Table 15. Number of rare species and community occurrences in the Little Cannon COA.

Organism Type	Observations
Vascular Plant	36
Vertebrate Animal	25
Terrestrial Community	33

The Minnesota Biological Survey has delineated nearly 9,000 acres of the Little Cannon COA based on their significance to biodiversity in the state (Figure 35). Areas that warranted assessment included the forested bluffsides and other natural areas. Of the assessed area, 52 percent was designated as having 'High' or 'Outstanding' biodiversity significance.

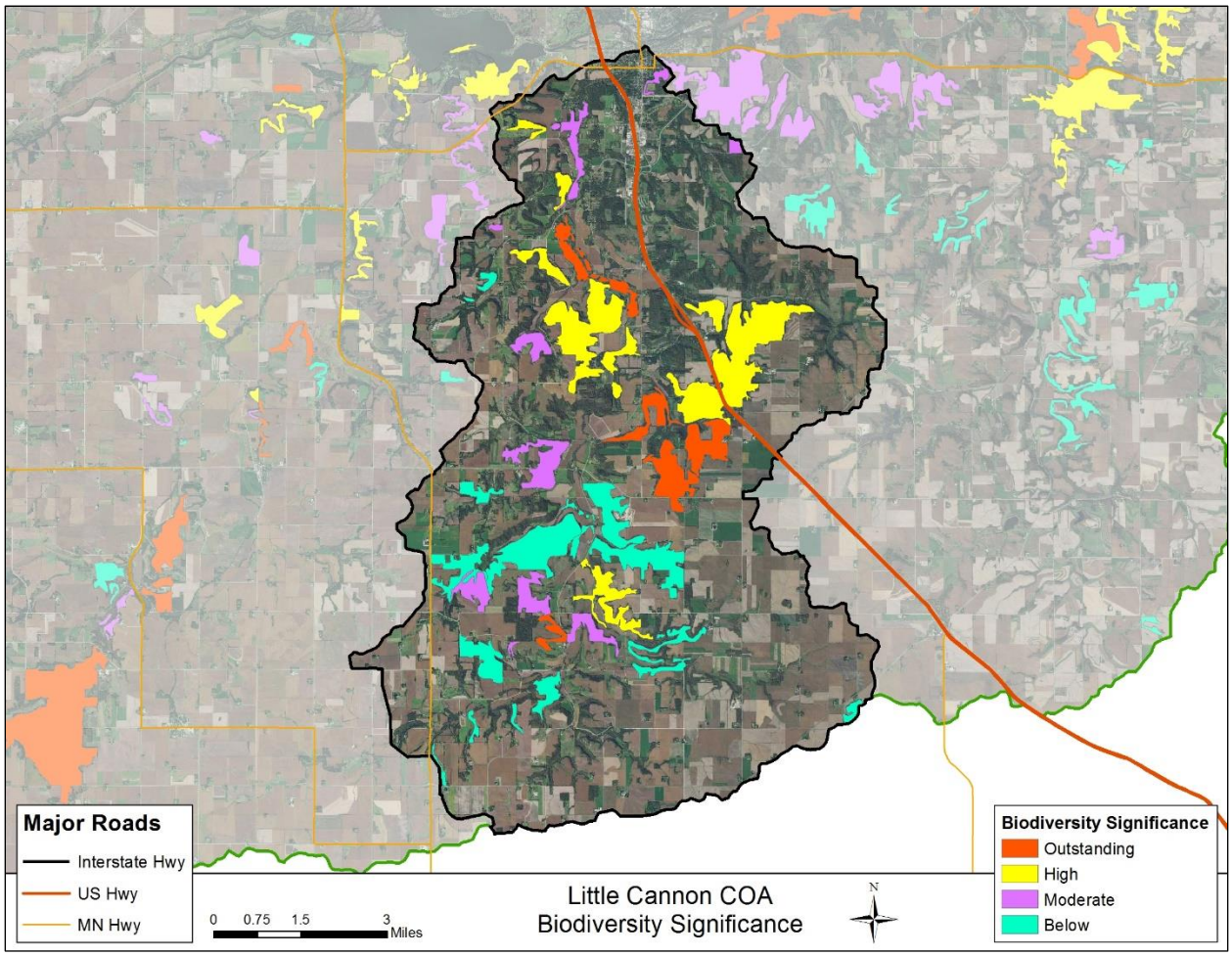


Figure 35. Sites of biodiversity significance in the Little Cannon COA.

Recreation

The Little Cannon COA is entirely privately owned, and therefore, public access for outdoor activities is much more limited than in other COAs. Trout fishing is popular where access is allowed. Several of the State and County Highways winding through the COA are popular biking and sightseeing routes. Hunting is a popular outdoor recreational activity throughout the area. A network of snowmobile trails also winds through the COA.

Environmental Threats

Mismanagement of forest resources:
The forests of Southeast Minnesota support a number of high value timber species, and many sites exist containing high quality timber stock. This represents an important resource for the region, but is also a target for exploitative harvesting practices. Timber harvests that remove all of the most valuable trees in a stand, and leave behind a patchy, irregular forest of poor quality trees do serious harm to the health and productive potential of that site, and severely limit

management options in the future. The high value of the timber resource enables sustainable timber management to produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest. Unsustainable harvesting practices can seriously impair a stand's ability to do so in the future.

Nutrient, sediment, and contaminants from upstream agricultural areas:
A significant portion of the Little Cannon COA, and areas upstream, are heavily farmed, often with practices that have the potential to impair water quality. This has large impacts on downstream reaches. Best management practices are available to farmers to protect their soil from erosion, and help prevent excess nutrients and sediment from washing into the streams. Riparian buffer strips help slow run-off and increase infiltration, allowing nutrients to be filtered and removed by soil processes. Increased adoption of agricultural BMPs to protect water quality in upstream areas will help protect the water quality of downstream reaches in the COA.

Development pressures:
There are no significant population centers in the Little Cannon COA but it is part of the U.S. Highway 52 corridor connecting Minneapolis-Saint Paul to Rochester. Both metropolitan areas are expected to see significant population and economic expansion in the coming years. This economic and population growth can lead to increased parcellization, fragmentation, and conversion of rural lands. This disrupts wildlife movement and migration, reduces available habitat, and increased water quality concerns from the added impervious surface area. The demand for dispersed rural residences places less-disturbed parts of the landscape under pressure for development.

Industrial silica sand mining:
Southeast Minnesota has significant deposits of industrial silica sand bedrock at or near the surface. The increased demand for this material in the hydrological fracturing (fracking) process for oil and gas development has created an ongoing policy debate about appropriate use and regulations of this resource. There currently are not any mines operating in the Cannon River Watershed but a significant portion of the Little Cannon COA has quartz-rich sandstone within 50 ft. of the land surface. Potential impacts of mining include removal of vegetation and underlying substrates, habitat destruction, chemical contamination of karst hydrology, and water contamination from high volume dispersals from water processing facilities and dewatering pits.

Land Ownership

Unlike other COAs, the Little Cannon is entirely privately owned. As such, it is clear that private landowners will play a crucial role in conservation. In other COAs, efforts will be targeted to enhance habitat on public lands by increasing their size and/or connectivity; however in the Little Cannon, efforts will likely focus primarily on private land stewardship and easement acquisition due to the current lack of public land. Finding programs that will appeal to these landowners will be necessary to encouraging the necessary private conservation.

To date, private conservation programs have demonstrated some success in the COA. The DNR Forest Stewardship Program is an excellent first step in landowner involvement and concern for the ecological health of the landscape and 655 acres have a registered stewardship plan in the Little Cannon COA. This voluntary program provides technical advice and long-range forest management planning to interested landowners. Plans are designed by professional foresters to meet the landowner's goals while maintaining the sustainability of the land.

The Reinvest in Minnesota (RIM) program has easements in the COA covering 212 acres. This program purchases conservation easements on privately owned lands to retire environmentally

sensitive lands from agricultural production. Conservation practices are established by planting native vegetation, and restoring wetlands with the goal of protecting and improving water quality, reducing soil erosion, and enhancing fish and wildlife habitat.

Land Cover and Use

Nearly 75 percent of the Little Cannon COA was covered by oak ecosystems at the time of European settlement (Table 16, Figure 36). The core of this oak forest existed in the Little Cannon valley with prairie on the edges and a transitional ecosystem in between. Today the land use patterns in the Little Cannon COA follow the general pattern for the broader watershed. The predominantly flat, upland areas are mostly cropland or pasture. The hillsides are dominated by forests, and the valley floors and floodplain areas contain a mix of cropland, pasture, forests, and wetlands (Figure 37). Major cover types are cultivated crops (47.4%) and deciduous forest (25.3%). Grassland/herbaceous (11.0%) and pasture/hay (8.3%) cover is also significant.

Table 16. Presettlement land cover in the Little Cannon COA

Land Type	Acres	Percent
Aspen-Oak Land	10,783	21%
Oak openings and barrens	27,279	53%
Prairie	13,102	26%

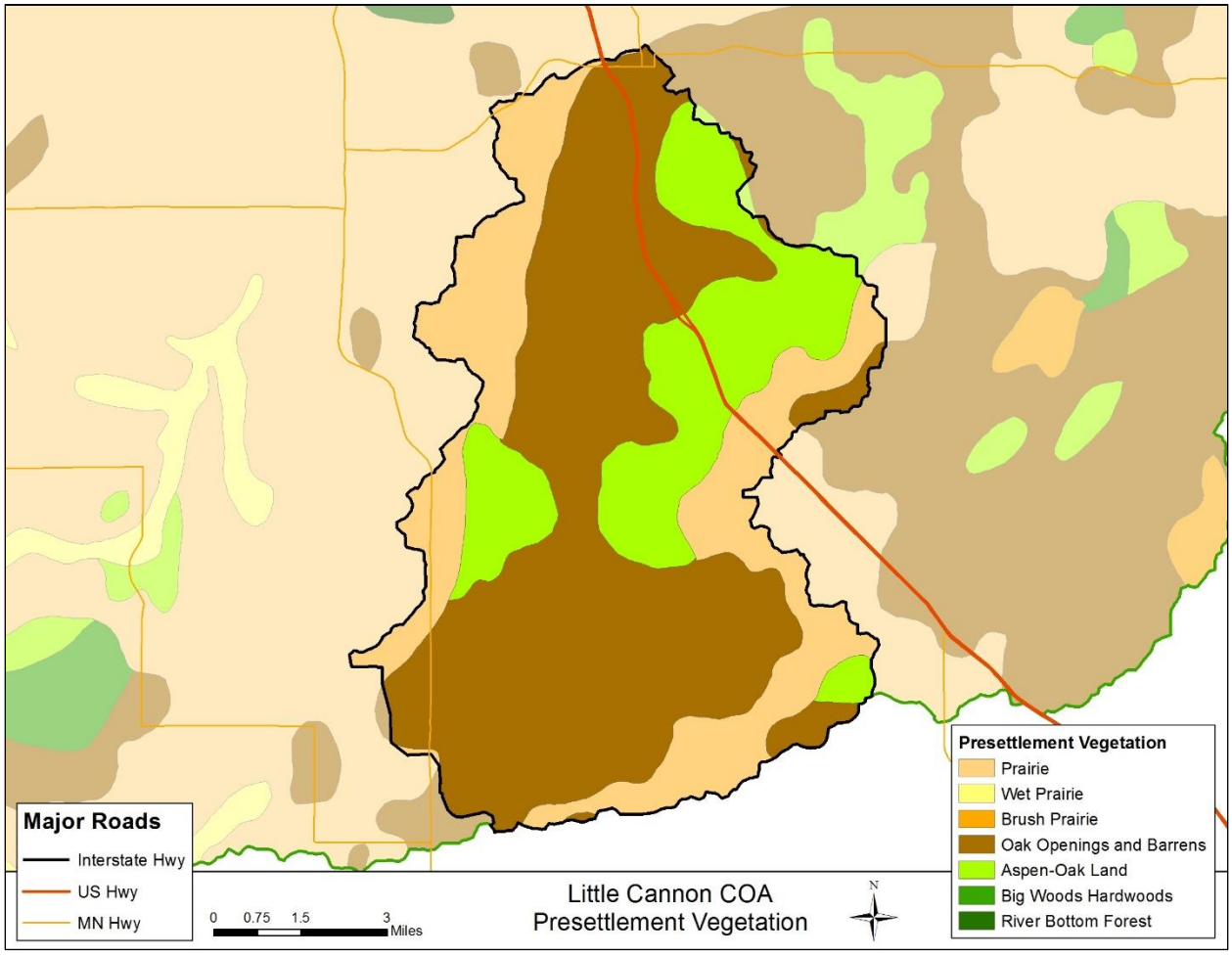


Figure 36. Presettlement land cover in the Little Cannon COA based on the work of Francis J. Marschner.

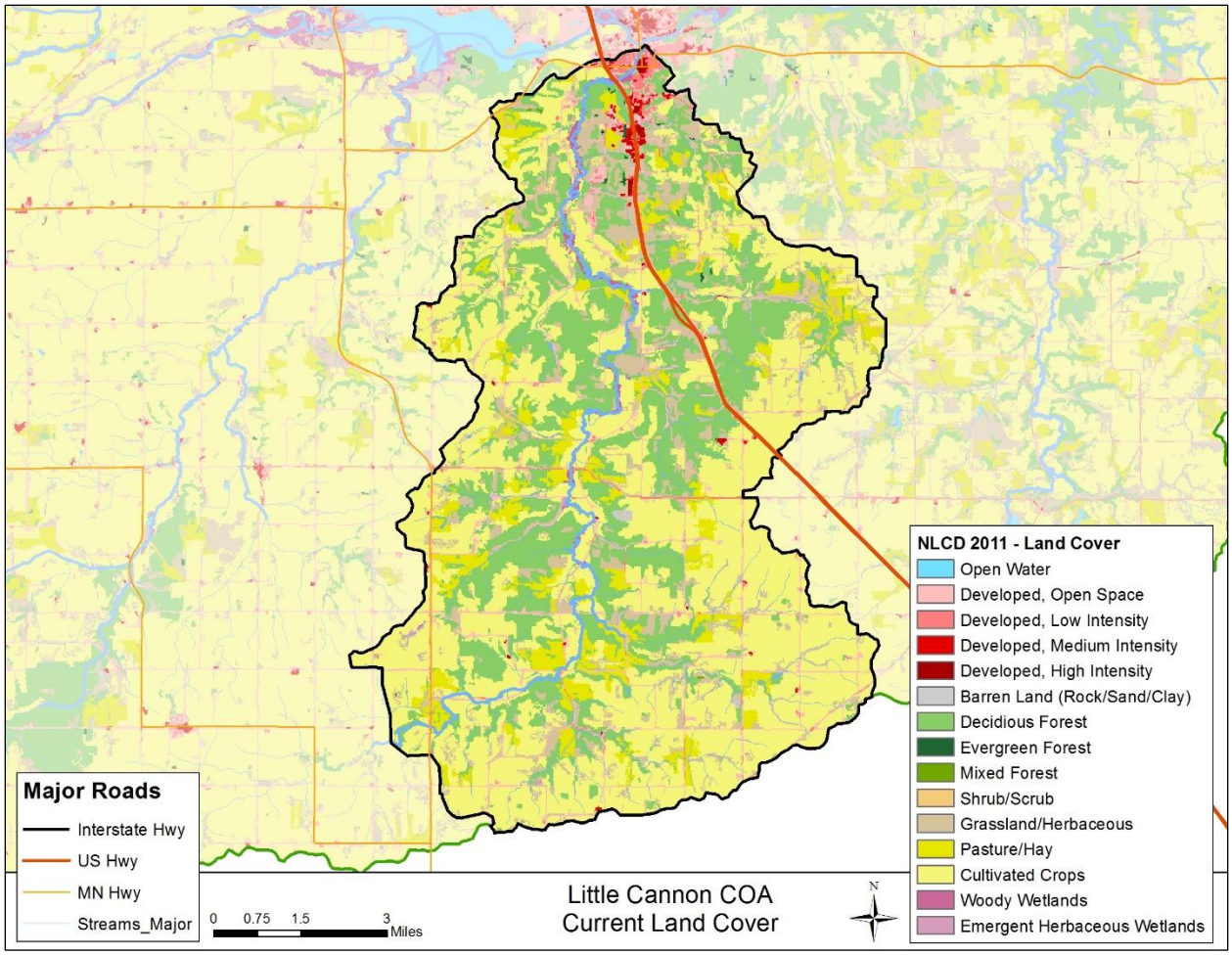


Figure 37. Current land cover in the Little Cannon COA based on the 2011 National Land Cover Database.

Desired Future Conditions

- 100% of riparian areas are covered by native vegetation, returning a host of ecological services for water quality, habitat quality, and connectivity.
- Biotic integrity of all streams within the COA is restored, resulting in healthy aquatic species and de-listing of impaired waters.
- Human activity in riparian areas follows best management practices to protect water quality and sensitive shorelines.
- Agricultural practices within the COA follow best management practices to protect soil from erosion, and streams from sedimentation and nutrient loading.
- A natural fire regime is restored through prescribed burning on all appropriate native plant communities.
- Large blocks of native habitat exist across ownership lines.
- Habitat corridors link patches of biodiversity habitat, supporting migration and travel, especially in riparian areas.
- Native plant community remnants have expanded
- Rare plants and animal habitat are protected from degradation
- Invasive species are monitored and controlled

Key Stewardship Parcels

With the entire Little Cannon COA in private ownership, stewardship efforts on private parcels will be crucial to protecting the natural resources of the area. Conservation efforts will be most effective in places where they protect existing native plant communities, and increase natural community size and/or connectivity. Working with larger parcels is preferable, because more stewardship options are available on larger tracts, and stewardship planning will impact a greater area. To make the most efficient use of conservation resources, it is useful to target parcels where those resources will have the most impact. A GIS analysis by The Nature Conservancy identified 121 key stewardship parcels in the Headwater Lakes COA that met the following conditions (Figure 38):

- Larger than 40 acres in size; AND
- Contain an area ranked as medium priority in the Wildlife Action Network or as moderate or above significance for biodiversity according to the Minnesota Biological Survey.

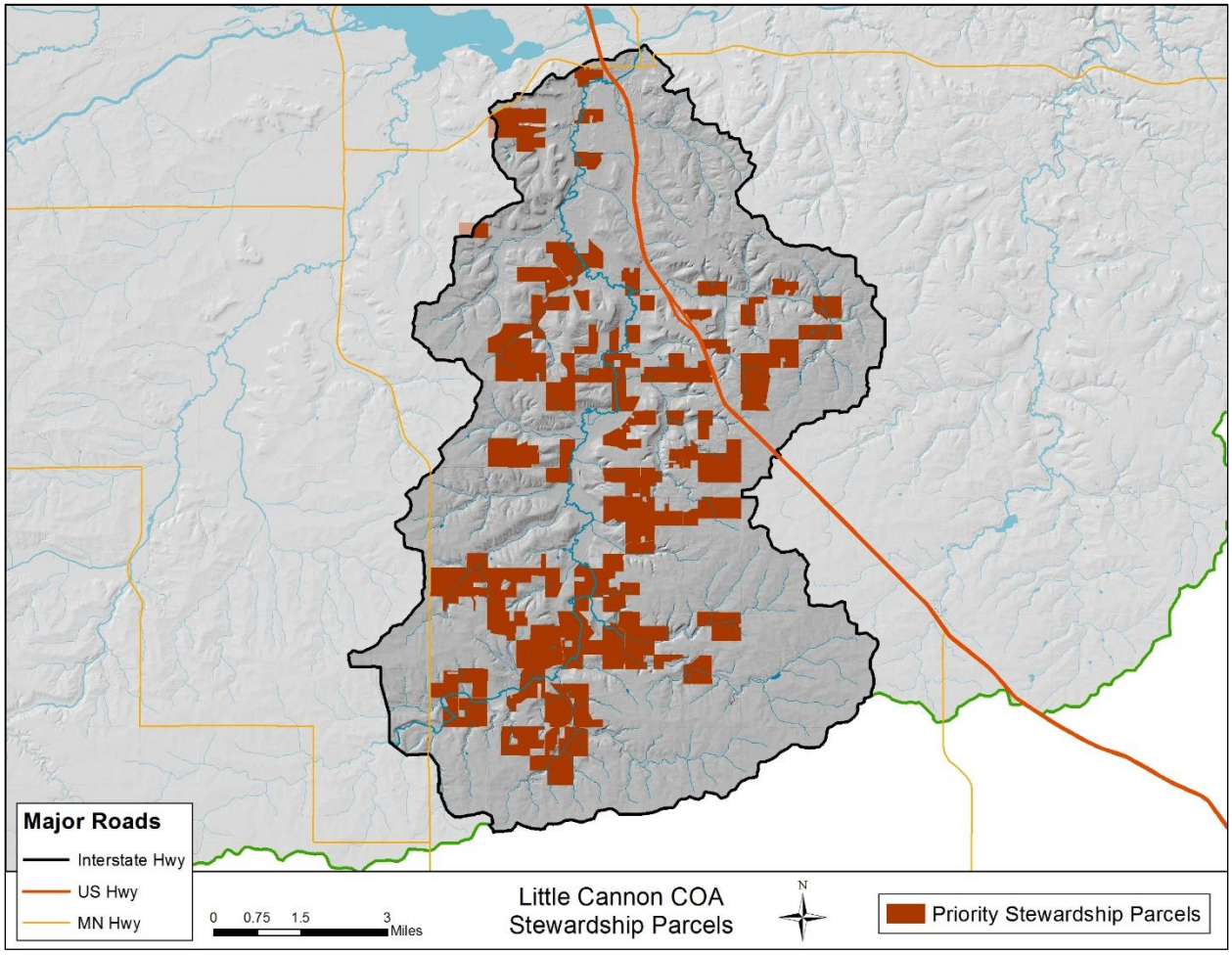


Figure 38. Priority stewardship parcels in the Little Cannon COA.

Stewardship Activities

There is a variety of tools and strategies available for enacting stewardship activities on the landscape (see Section 1). Different strategies and actions will be appropriate for different types of parcels, natural resources, and landowners. This section provides a summary of strategies appropriate for the natural resources present in this COA.

Core Forest Areas

Large, continuous stretches of forest communities represent core forest habitat. In addition to providing quality habitat to a number of species, these areas represent favorite places for recreation and scenery, making them important for the tourism industry in the region. They also provide a great benefit to water quality, as forests help prevent erosion, slow and filter water run-off, and shade streams in riparian areas.

Stewardship Activities:

On all lands:

- Control invasive species
- Burn where appropriate
- Manage according to sustainable silvicultural and ecological principles
- Where possible, increase size and connectivity of forest habitat through reforestation / afforestation of connecting patches

On Private lands:

- Prepare comprehensive forest stewardship plans
- Assist landowner in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)

Karst Features

Karst features are locations where cracks or fissures in the bedrock create sinkholes and other direct connections between surface water and ground water aquifers. Springs and seeps are places where groundwater reemerges onto the land or streams. Pollution in these areas can quickly enter groundwater reservoirs and also affect surface water quality. They are crucial areas to protect in order to preserve the water quality of the COA.

Stewardship Activities:

- Protect sinkholes and springs with buffers of native vegetation
- Limit pesticide applications in the vicinity of sinkholes

Prairies, Savannas, and Fire-Associated Native Plant Communities

The suppression of fire and mass conversion to agriculture that came with Euro-American settlement drastically reduced the amount of native prairie and savannas in both Minnesota, and the US as a whole. These communities offer important habitat for a number of animals, and many flowering plants and grasses.

Stewardship Activities:

On all lands:

- Restore a natural fire regime through prescribed burns
- Remove brush as needed
- Control invasive species
- Expand grassland habitat as buffer areas around other NPCs.

Riparian Best Management Practices

Riparian areas are those nearest, and most connected to streams and rivers. They have an important impact on water quality either, positively by slowing and filtering run-off, or negatively, by contributing to sediment and nutrient loads brought to streams through erosion and run-off. Implementing best management practices and other conservation actions in these areas can have significant water quality and wildlife benefits.

Stewardship Activities:

On public lands:

- Reconnect waterways with their floodplains.
- Utilize the delineation of critical cropland areas from Benck and Fry (Examining the Relationship between Land Cover and Water Quality Protection: The Blufflands Region of the Cannon and Zumbro River Watersheds, 2017, Saint Mary's University of Minnesota - GeoSpatial Services, 700 Terrace Heights, Box #7, Winona, MN 55987)
- Maintain and/or establish appropriate plant communities for the hydrology of the site.

On private lands:

- Support SWCDs in implementing and enforcing the state buffer law and other best management practices. Help interested landowners apply for the various cost-share or easement programs available for water quality protection (e.g. CRP, RIM).
- Work with landowners to reconnect streams to their floodplains.
- Maintain and restore natural vegetation along stream and riverbanks.

Key Stewardship Parcels

These parcels were identified based on their geographical size and proximity to areas of biodiversity significance (see above). They are areas where conservation effort can be most beneficial to the overall health of the landscape.

Stewardship Activities:

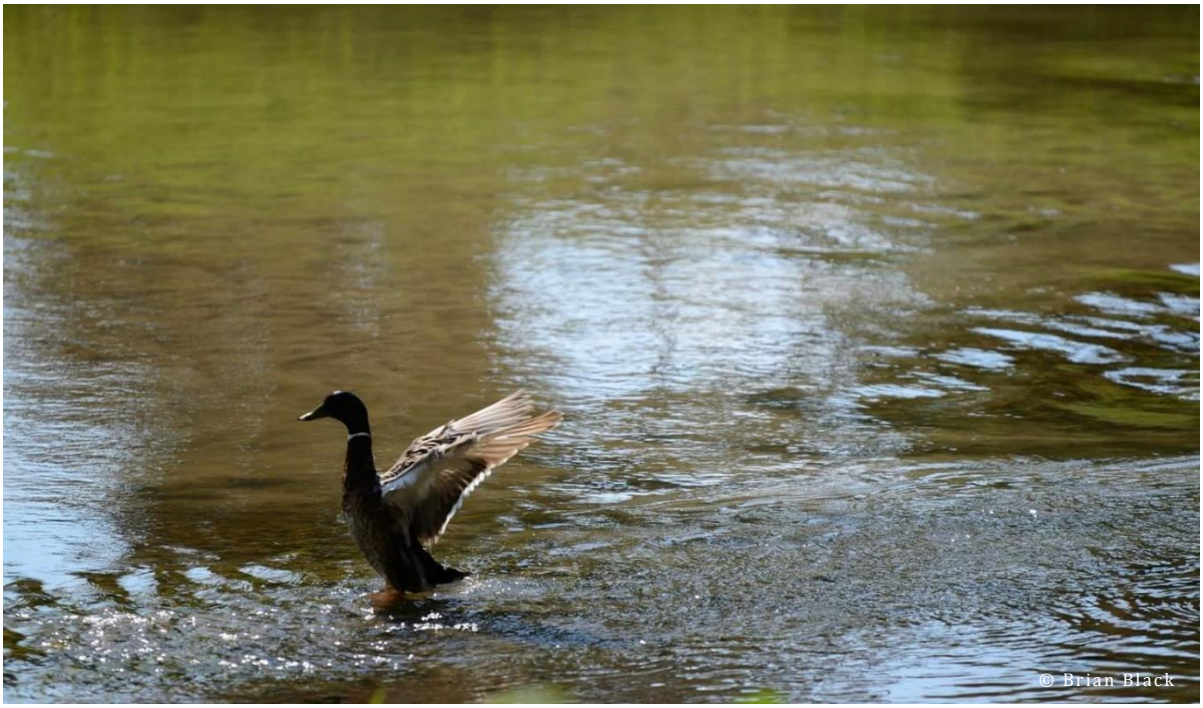
- Work to engage the owners of these parcels in a targeted manner.
- Tailor outreach and assistance to each landowner individually based on characteristics of their parcel and its geographical and ecological characteristics
- Prioritize stewardship efforts affecting these parcels

Lower Cannon Conservation Opportunity Area

Overview

The Lower Cannon COA encompasses nearly 76,700 acres in the bottom of the watershed between Cannon Falls and Red Wing (Figure 39). In addition to the Cannon main stem, the COA includes all or portions of the Lower Belle Creek, Pine Creek, Spring Creek, and Trout Brook watersheds. Key natural areas in the Lower Cannon COA include Cannon River Turtle Preserve State Scientific and Natural Area, Spring Creek Prairie State Scientific and Natural Area, portions of the Richard J. Dorer Memorial Hardwood State Forest, and Dakota County's Miesville Ravine Regional Park.

According to data from the Public Land Survey, this area contained a mix of hardwood forests, oak woodlands, savannas, and prairies. Much of this region has been converted to agriculture, however; the remnants of these historic ecosystems represent a conservation opportunity within the matrix of agriculture to build from. The remaining natural areas represent a hotspot for biodiversity as identified in the Wildlife Action Network and State Wildlife Action Plan. The habitat along the Cannon River from just above the confluence with Belle Creek, downstream to the Mississippi has some particularly high conservation value. In addition, several areas in this COA offer a large block of forested conditions that is no longer common in the area and home to numerous native plant community types. The mesic hardwoods and floodplain forests are host to a number of spring ephemeral wildflowers that often grow and bloom before the canopy trees leaf out. This includes species such as false rue anemone, wild ginger, spring beauty, cut-leaved toothwort, Dutchman's breeches, sharp-lobed hepatica, bloodroot and violets. Additionally, the wetland complex that formed at the mouth of the Cannon and associated floodplain forests within the valley of the Mississippi River provides habitat for an incredible diversity of birds that migrate along the Mississippi flyway every year. The region's oak forests and prairies are also important to regional wildlife.



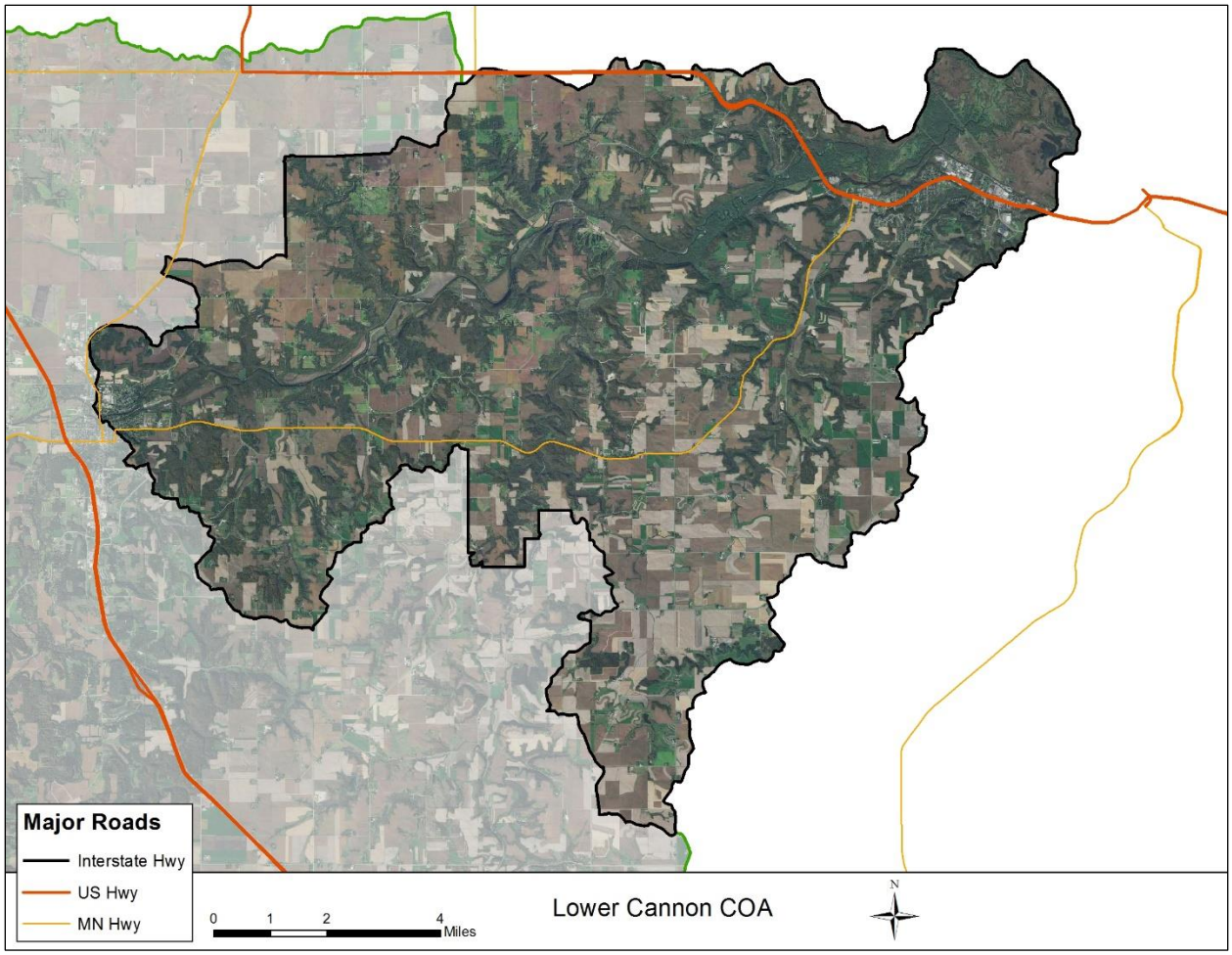


Figure 39. Lower Cannon COA.

Natural Resource Assessment

Hydrology

The dominant hydrological feature of the Lower Cannon COA is the Cannon River and its tributaries. The river valley for the main stem of the Cannon cuts through the center of the COA from the confluence with the Little Cannon in Cannon Falls to the mouth at the Mississippi in Red Wing. In addition to the Cannon main stem, the COA includes all or portions of the Lower Belle Creek, Pine Creek, Spring Creek, and Trout Brook watersheds (Figure 40). Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed these larger streams. There are also several popular trout streams fed by springs and seeps.

There are almost 112 karst features in the area including sinkholes and springs that feed several of the streams. These geological features are primarily in the Trout Brook and Spring Creek areas and can complicate the understanding of the local hydrology and be challenging to protect because there are often hidden, rapid pathways from pollution release points to drinking water wells or surface water.

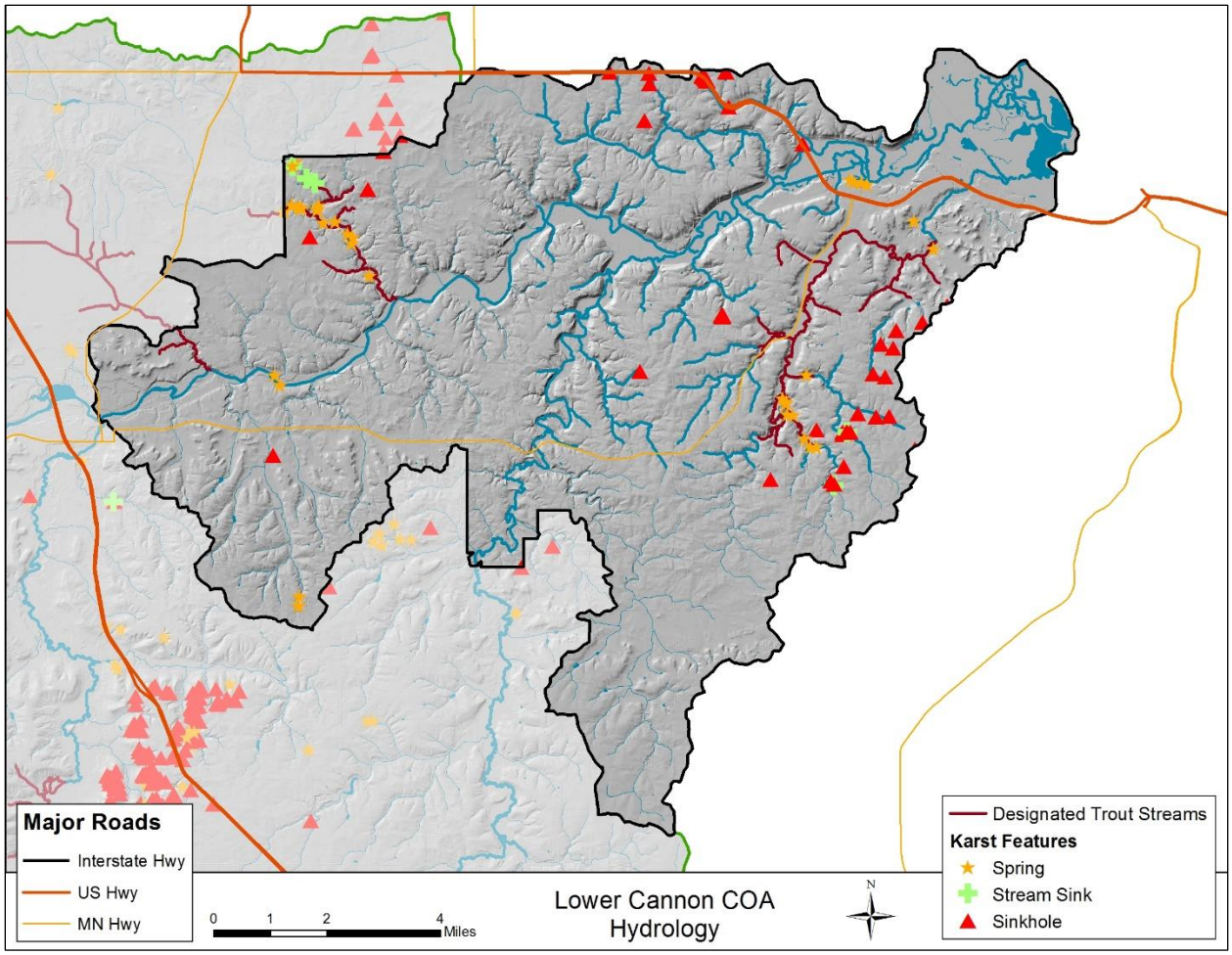


Figure 40. Hydrology and karst features of the Lower Cannon COA.

Plant Communities

Lower Cannon COA contains nearly 9,700 acres of Native Plant Communities (NPC) in eight different systems and 26 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 17). Mesic hardwoods make up 40% of the identified NPC acres with floodplain forest (30%), fire dependent forest or woodland (13%), and marsh (12%) systems also making a significant portion of the total acreage (Figure 41). Some of these native plant communities are rare and sensitive community types unique to Southeastern Minnesota. Full descriptions of native plant community types and their associated ecological systems can be found in *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*, produced and distributed by the MN DNR.

Approximately 41 percent of the NPCs in the Lower Cannon COA are on publicly owned land with the majority of privately owned NPCs on parcels near the blocks of public land. Private parcels containing NPCs, especially those bordering publicly managed areas, represent an important priority for increased protection and private conservation efforts.

Table 17. Native Plant Communities of the Lower Cannon COA

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Fire Dependent Forest or Woodland	FDs27b	White Pine - Oak Woodland (Sand)	18.1	0.2%
	FDs27c	Black Oak - White Oak Woodland (Sand)	118.6	1.2%
	FDs38a	Oak - Shagbark Hickory Woodland	1,138.7	11.7%
Floodplain Forest	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	1,728.4	17.8%
	FFs59c	Elm - Ash - Basswood Terrace Forest	290.3	3.0%
	FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	868.1	9.0%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	1,074.9	11.1%
	MHs37a	Red Oak - White Oak Forest	697.5	7.2%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	849.8	8.8%
	MHs38a	White Pine - Oak - Sugar Maple Forest	29.4	0.3%
	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	333.4	3.4%
	MHs39	Southern Mesic Maple-Basswood Forest	214.1	2.2%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	392.4	4.0%
	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	233.9	2.4%
	MHs49	Southern Wet-Mesic Hardwood Forest	3.5	0.0%
	MHs49b	Elm - Basswood - Black Ash - (Blue Beech) Forest	57.2	0.6%
Marsh	MRn93	Northern Bulrush-Spikerush Marsh	676.6	7.0%
	MRn93b	Spikerush - Bur Reed Marsh (Northern)	438.3	4.5%
Open Rich Peatland	OPp93c	Calcareous Fen (Southeastern)	32.8	0.3%
River Shore	RVx32b2	Sand Beach/Sandbar (River): Permanent Stream Subtype	6.5	0.1%
Upland Prairie	UPs13a	Dry Barrens Prairie (Southern)	3.2	0.0%
	UPs13b	Dry Sand - Gravel Prairie (Southern)	43.9	0.5%
	UPs13c	Dry Bedrock Bluff Prairie (Southern)	417.8	4.3%
	UPs14c	Dry Hill Oak Savanna (Southern)	10.9	0.1%
Wet Meadow or Carr	WMn82b	Sedge Meadow	2.6	0.0%
	WMs83a	Seepage Meadow/Carr	18.0	0.2%

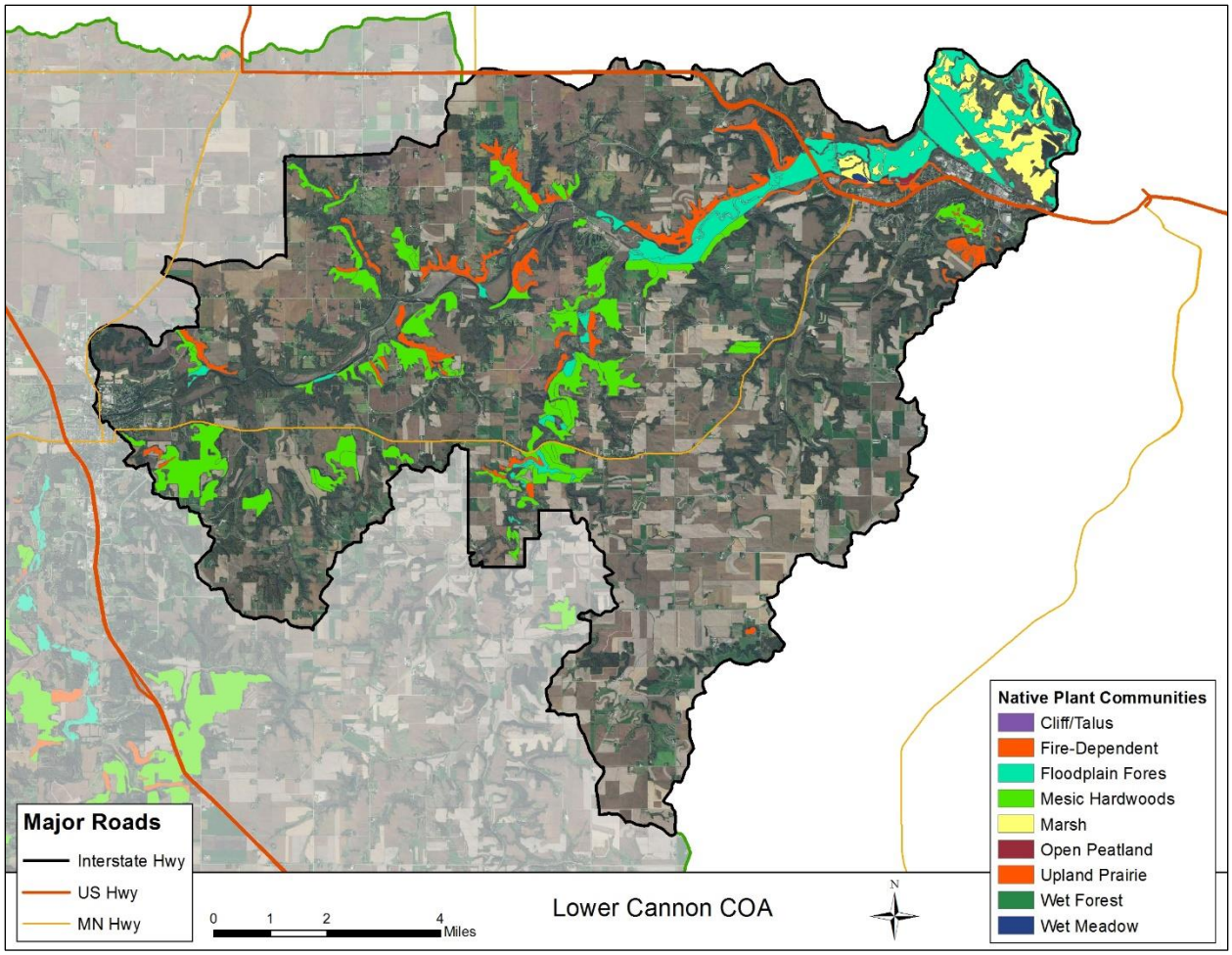


Figure 41. Native plant communities of the Lower Cannon COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 141 different occurrences of rare plants, animals, or communities in Lower Cannon COA (Table 18). Rare species are those listed as either endangered, threatened, or of special concern. Endangered species are those facing extinction throughout all or a significant portion of its range within Minnesota. Threatened species are likely to become endangered in the foreseeable future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota.

Eighty-five rare terrestrial communities are listed in Lower Cannon COA. Rare terrestrial communities are collections of plant species growing together, whose presence on the landscape is rare or severely diminished. These communities are monitored, but not given designations as endangered, threatened, or of special concern.

Table 18. Number of rare species and community occurrences in the Lower Cannon COA.

Organism Type	Observations
Animal Assemblage	1
Vascular Plant	63
Invertebrate Animal	12
Vertebrate Animal	65
Terrestrial Community	85

The Minnesota Biological Survey has delineated over 17,600 acres of the Lower Cannon COA based on their significance to biodiversity in the state (Figure 42). Of that area, nearly 7,500 acres were given the highest level of 'Outstanding'. The 'Outstanding' areas are predominately found along the main stem of the Cannon River, lower Belle Creek, and the Mississippi River Valley.

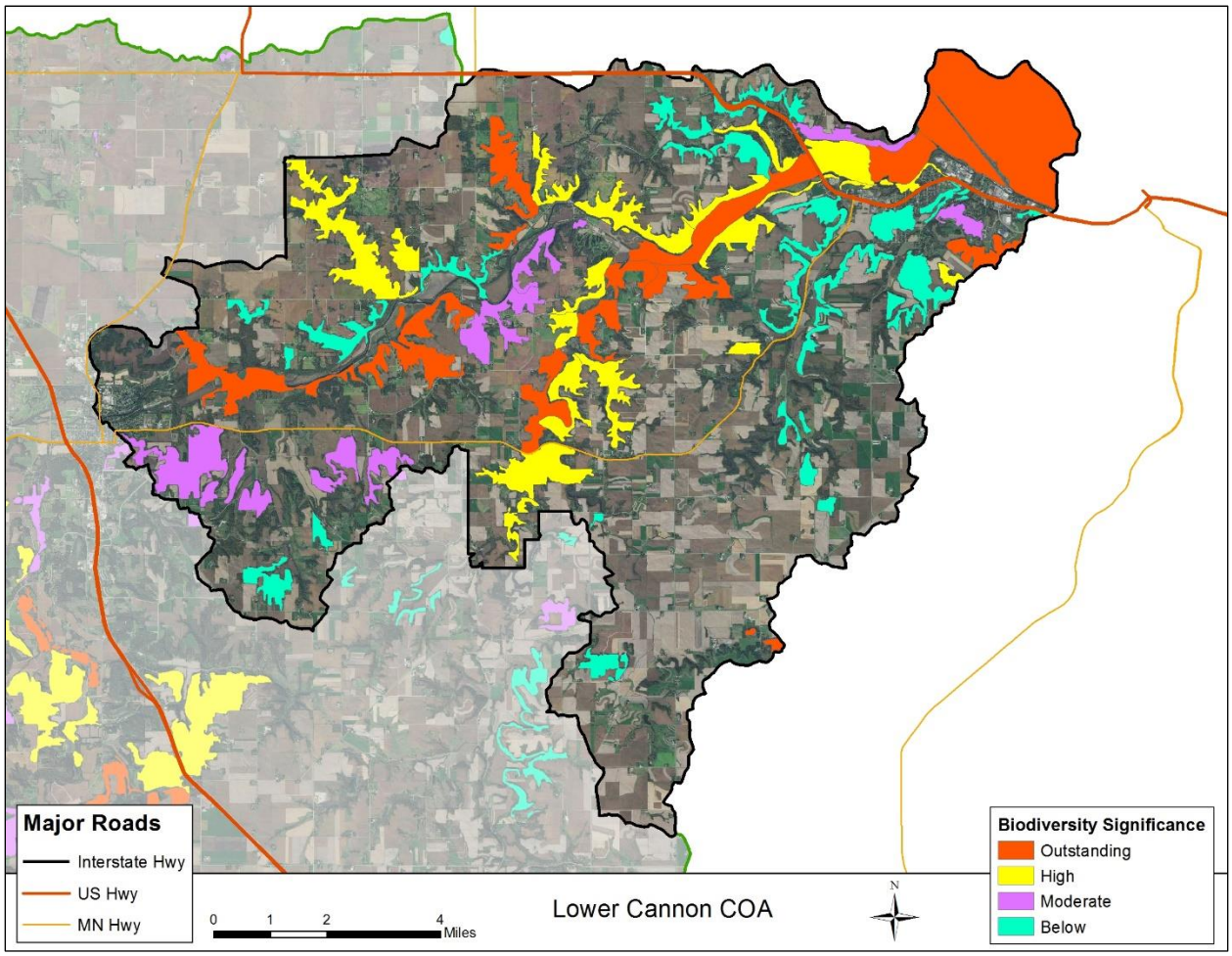


Figure 42. Sites of biodiversity significance in the Lower Cannon COA.

Recreation

There are a number of important outdoor recreation areas in the Lower Cannon COA that contribute to the well-being of residents and support the local economy. Miesville Ravine Park Reserve offers picnic and hiking areas at the confluence of Trout Brook and the Cannon River. Hunting is a popular outdoor recreational activity throughout the area on public and private land. Additionally, the Cannon River is a designated state water trail that is a very popular canoe, kayak, and inner-tube route in the summer. This stretch of river was added to the Minnesota DNR Wild & Scenic Rivers Program in 1980 in recognition of the natural beauty and recreational opportunities in the area. Fishing opportunities abound for both cool and cold water fish species. The Cannon Valley Trail parallels this stretch of the Cannon River, offering glimpses and panoramas of the valley. It is open year round for bicycling, in-line skating, skateboarding, similar wheeled recreational devices, hiking, walking and cross country skiing. A network of snowmobile trails also winds through the COA.

Environmental Threats

Development pressures:
The City of Red Wing is located at the eastern edge of the Lower Cannon COA and is expected to grow in population in the coming years. Additionally, this area is relatively close to the expanding Minneapolis-Saint Paul metropolitan area and there will likely be increasing parcellization, fragmentation, and conversion of rural lands in the COA. This disrupts wildlife movement and migration, reduces available habitat, and increased water quality concerns from the added impervious surface area. The demand for dispersed rural residences places less-disturbed parts of the landscape under pressure for development. This is compounded by the likelihood of population growth in the region.

Mismanagement of forest resources:
The forests of Southeast Minnesota support a number of high value timber species, and many sites exist containing high quality timber stock. This represents an important resource for the region, but is also a target for exploitative harvesting practices. Timber harvests that remove all of the most valuable trees in a stand, and leave behind a patchy, irregular forest of poor quality trees do serious harm to the health and productive potential of that site, and severely limit management options in the future. The high value of the timber resource enables sustainable timber management to produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest. Unsustainable harvesting practices can seriously impair a stand's ability to do so in the future.

Nutrient, sediment, and contaminants from upstream agricultural areas:
A significant portion of the Lower Cannon COA, and areas upstream, are heavily farmed, often with practices that have the potential to impair water quality. This has large impacts on downstream reaches. Best management practices are available to farmers to protect their soil from erosion, and help prevent excess nutrients and sediment from washing into the streams. Riparian buffer strips help slow run-off and increase infiltration, allowing nutrients to be filtered and removed by soil processes. Increased adoption of agricultural BMPs to protect water quality in upstream areas will help protect the water quality of downstream reaches in the COA.

Industrial silica sand mining:
Southeast Minnesota has significant deposits of industrial silica sand bedrock at or near the surface. The increased demand for this material in the hydrological fracturing (fracking) process for oil and gas development has created an ongoing policy debate about appropriate use and regulations of this resource. There currently are not any mines operating in the Cannon River Watershed but a significant portion of the Lower Cannon COA has quartz-rich sandstone within 50 ft. of the land surface. Potential impacts of mining include removal of vegetation and underlying substrates, habitat destruction, chemical contamination of karst hydrology, and water contamination from high volume dispersals from water processing facilities and dewatering pits.

Land Ownership

Nearly 6,750 acres of the Lower Cannon COA are in public ownership (Table 19, Figure 43). The DNR Division of Forestry's Richard J. Dorer Memorial Hardwood State Forest and the Red Wing Wildlife Protection League are the largest public land holdings in the Lower Cannon COA. The majority of the COA, however is in private ownership. Since private lands make up such a large portion of the COA it is clear that private landowners will play a crucial role in conservation. Much of the forested area occurs in areas with dispersed residential development, and finding programs that will appeal to these landowners will be necessary to encouraging the necessary private conservation.

To date, private conservation programs have demonstrated some success in the COA. The DNR Forest Stewardship Program is an excellent first step in landowner involvement and concern for the ecological health of the landscape and 220 acres have a registered stewardship plan in the Lower Cannon COA. This voluntary program provides technical advice and long-range forest management planning to interested landowners. Plans are designed by professional foresters to meet the landowner's goals while maintaining the sustainability of the land.

The Reinvest in Minnesota (RIM) program has easements in the COA covering 141 acres. This program purchases conservation easements on privately owned lands to retire environmentally sensitive lands from agricultural production. Conservation practices are established by planting native vegetation, and restoring wetlands with the goal of protecting and improving water quality, reducing soil erosion, and enhancing fish and wildlife habitat.

This portion of the Cannon River is also designated as a Wild and Scenic River. This designation includes authorization for the State of Minnesota to purchase conservation easements to protect the wild and scenic nature of the river. Properties with stream frontage, or that are visible from the river could potentially qualify for this program.

Table 19. Estimated land ownership in the Lower Cannon COA.

Ownership	Acres	Percent of Public	Percent of COA
Private	69,926.7	--	91.2%
Division of Forestry	2,064.1	30.6%	2.7%
Red Wing Wildlife Protection League	2,055.2	30.5%	2.7%
Dakota County	1,162.9	17.2%	1.5%
Division of Ecological Services	989.2	14.7%	1.3%
Division of Trails and Waterways	273.1	4.0%	0.4%
Goodhue County	135.5	2.0%	0.2%
Division of Fish and Wildlife	51.5	0.8%	0.1%
Army Corps of Engineers	16.2	0.2%	0.0%

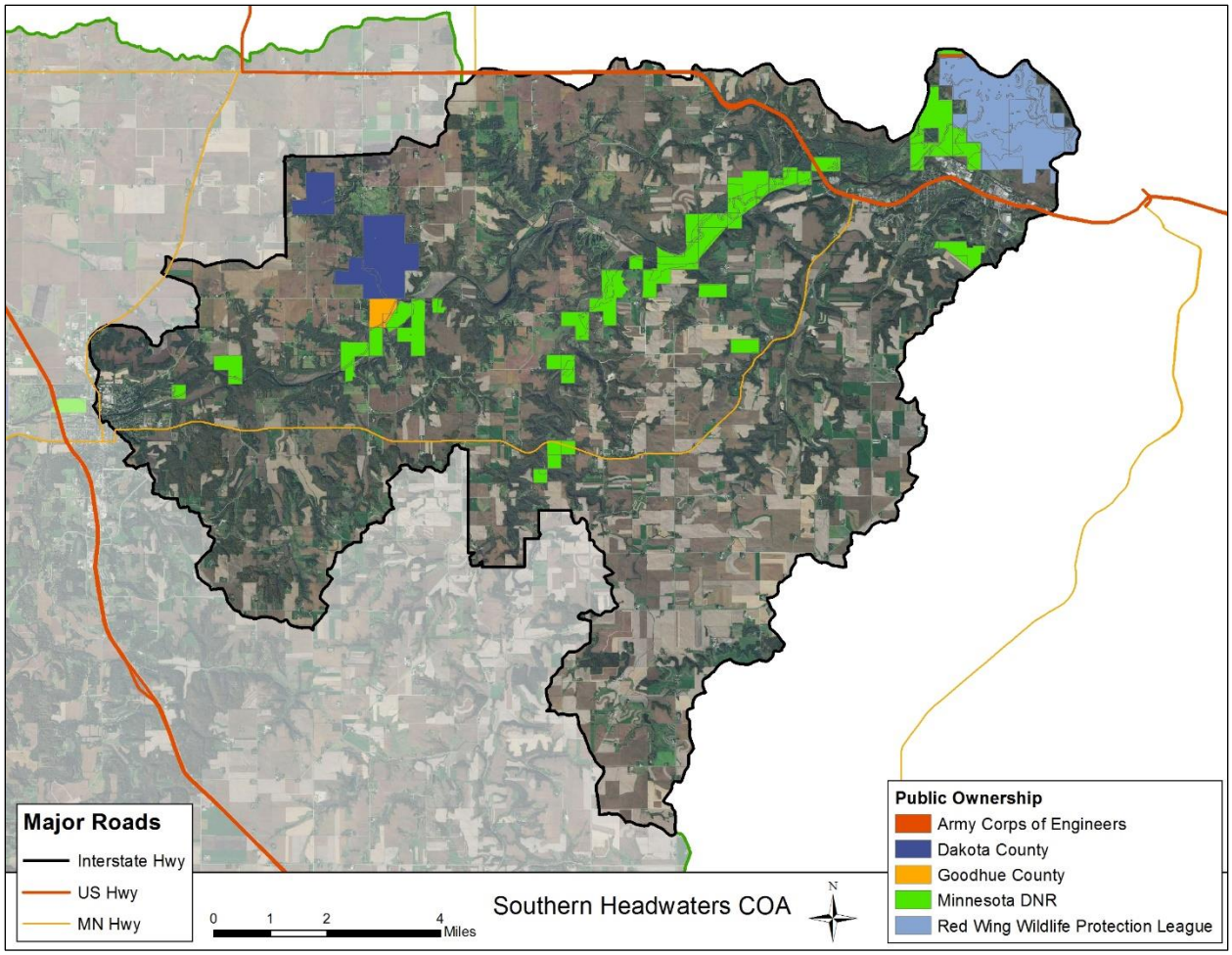


Figure 43. Public land in the Lower Cannon COA.

Land Cover and Use

About 20 percent of the Lower Cannon COA was covered by prairie at the time of European settlement and the rest existed in some type of forest ranging from oak savanna type openings to dense mesic hardwood forests (Table 20, Figure 44). Today the land use patterns in the Lower Cannon COA follow the general pattern for the broader watershed. The predominantly flat, upland areas are mostly cropland or pasture. The hillsides are dominated by forests, and the valley floors and floodplain areas contain a mix of cropland, pasture, forests, and wetlands (Figure 45). Major cover types are cultivated crops (43.3%) and deciduous forest (25.0%). Grassland / herbaceous (11.6%) and pasture / hay (7.1%) and cover is also significant.

Table 20. Presettlement land cover in the Lower Cannon COA

Land Type	Acres	Percent
Aspen-Oak Land	3,670	4.8%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	6,746	8.8%
Brush Prairie	13	0.0%
Oak openings and barrens	42,971	56.0%
Prairie	15,772	20.6%
River Bottom Forest	7,501	9.8%

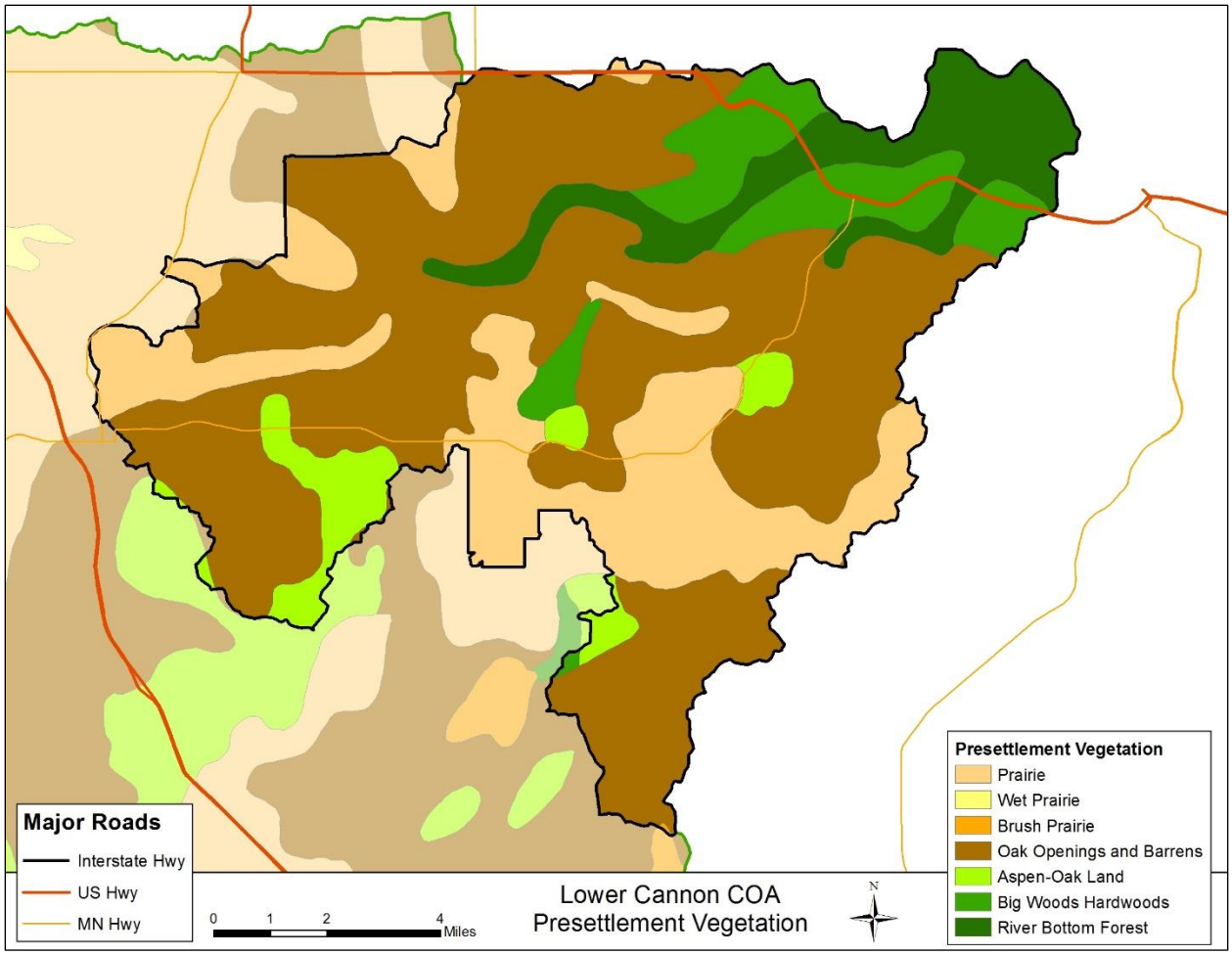


Figure 44. Presettlement land cover in the Lower Cannon COA based on the work of Francis J. Marschner.

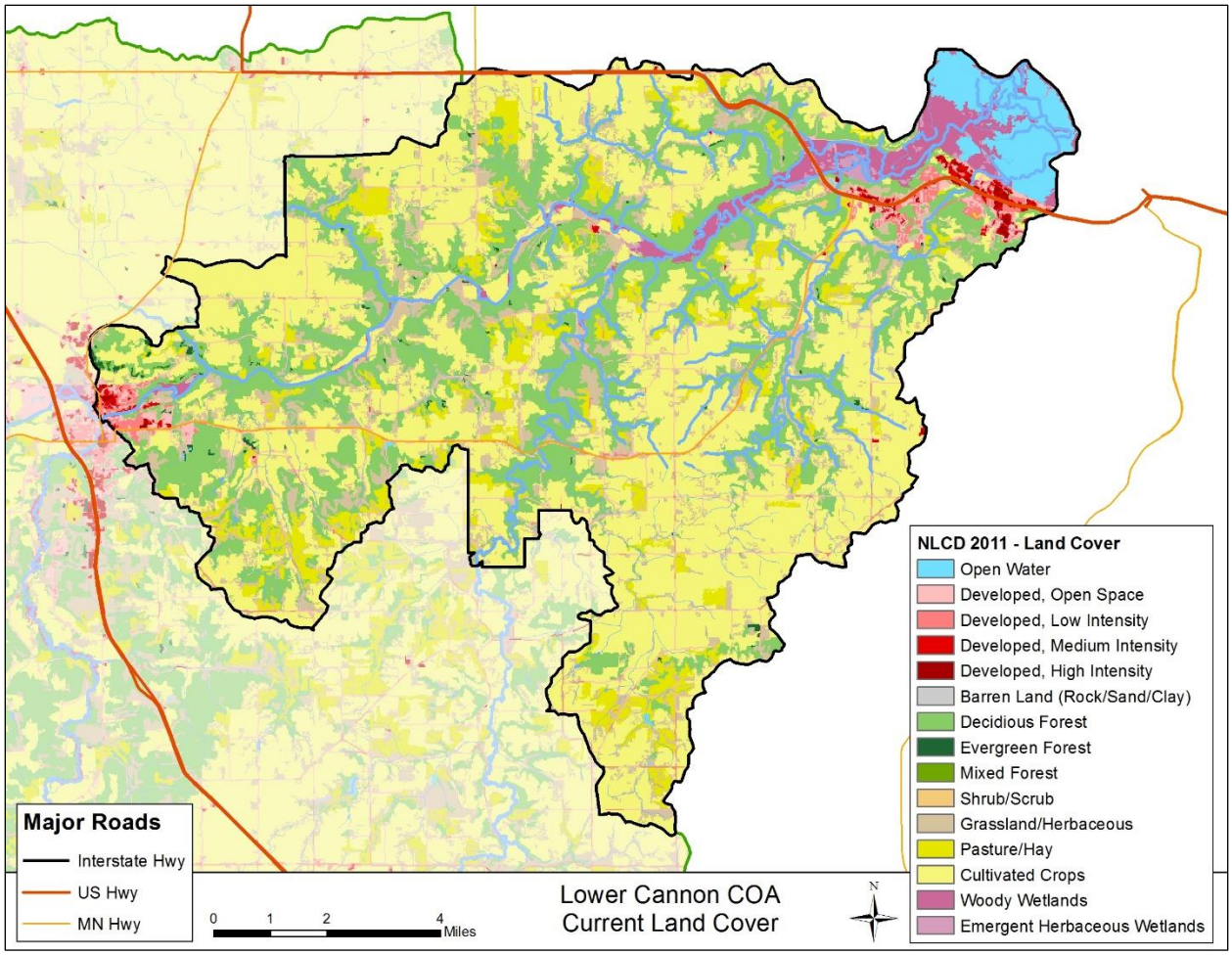


Figure 45. Current land cover in the Lower Cannon COA based on the 2011 National Land Cover Database.

Desired Future Conditions

- 100% of riparian areas are covered by native vegetation, returning a host of ecological services for water quality, habitat quality, and connectivity.
- Biotic integrity of all streams within the COA is restored, resulting in healthy aquatic species and de-listing of impaired waters.
- Human activity in riparian areas follows best management practices to protect water quality and sensitive shorelines.
- Agricultural practices within the COA follow best management practices to protect soil from erosion, and streams from sedimentation and nutrient loading.
- A natural fire regime is restored through prescribed burning on all appropriate native plant communities.
- Large blocks of native habitat exist across ownership lines.
- Habitat corridors link patches of biodiversity habitat, supporting migration and travel, especially in riparian areas.
- Native plant community remnants have expanded
- Rare plants and animal habitat are protected from degradation
- Invasive species are monitored and controlled

Key Stewardship Parcels

Acquisition efforts can only go so far and stewardship efforts on private parcels will be crucial to protecting the natural resources of the area. Conservation efforts in the Lower Cannon COA will be most effective in places where they protect existing native plant communities, and enhance habitat on public lands by increasing their size and/or connectivity. Working with larger parcels is preferable, because more stewardship options are available on larger tracts, and stewardship planning will affect a greater area. To make the most efficient use of conservation resources, it is useful to target parcels where those resources will have the most impact. A GIS analysis by The Nature Conservancy identified 213 key stewardship parcels in the Lower Cannon COA that met the following conditions (Figure 46):

- Larger than 40 acres in size; AND
- Contain an area ranked as medium priority in the Wildlife Action Network or as moderate or above significance for biodiversity according to the Minnesota Biological Survey; AND
- Within a mile of publicly owned conservation lands.

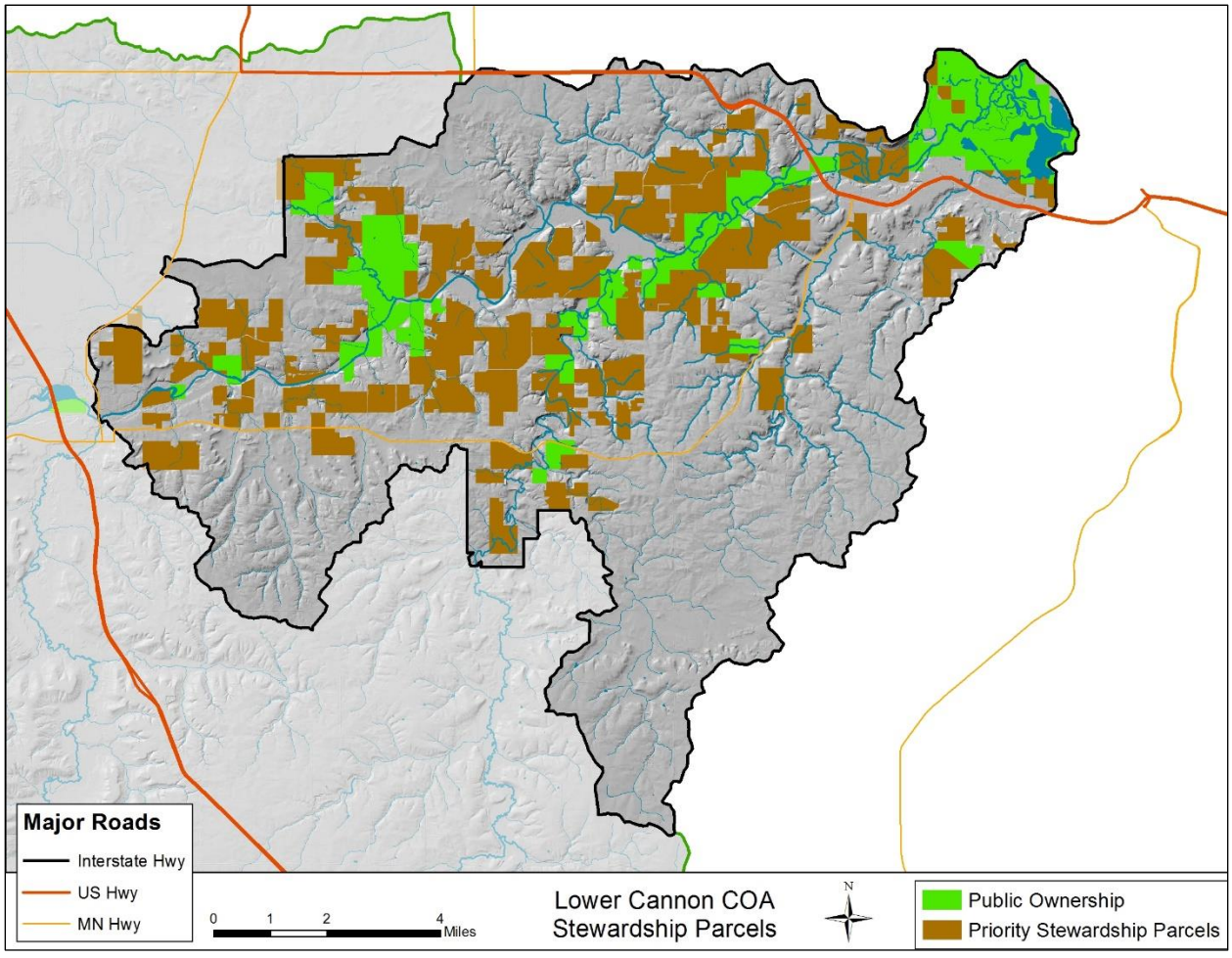


Figure 46. Priority stewardship parcels in the Lower Cannon COA.

Stewardship Activities

There is a variety of tools and strategies available for enacting stewardship activities on the landscape (see Section 1). Different strategies and actions will be appropriate for different types of parcels, natural resources, and landowners. This section provides a summary of strategies appropriate for the natural resources present in this COA.

Core Forest Areas

Large, continuous stretches of forest communities represent core forest habitat. In addition to providing quality habitat to a number of species, these areas represent favorite places for recreation and scenery, making them important for the tourism industry in the region. They also provide a great benefit to water quality, as forests help prevent erosion, slow and filter water run-off, and shade streams in riparian areas.

Stewardship Activities:

On all lands:

- Manage according to sustainable silvicultural and ecological principles
- Control invasive species
- Burn where appropriate
- Target strategic parcels for potential acquisition or conservation easements.
- Where possible, increase size and connectivity of forest habitat through reforestation / afforestation of connecting patches

On Private lands:

- Prepare comprehensive forest stewardship plans
- Assist landowner in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)

Prairies, Savannas, and Fire-Associated Native Plant Communities

The suppression of fire and mass conversion to agriculture that came with Euro-American settlement drastically reduced the amount of native prairie and savannas in both Minnesota, and the US as a whole. These communities offer important habitat for a number of animals, and many flowering plants and grasses.

Stewardship Activities:

On all lands:

- Restore a natural fire regime through prescribed burns
- Remove brush as needed
- Control invasive species
- Expand grassland habitat as buffer areas around other NPCs.

Riparian Area Restoration and Maintenance

Riparian areas are those nearest, and most connected to streams and rivers. They have an important impact on water quality either, positively by slowing and filtering run-off, or negatively, by contributing to sediment and nutrient loads brought to streams through erosion

and run-off. Implementing best management practices and other conservation actions in these areas can have significant water quality and wildlife benefits.

Stewardship Activities:

On public lands:

- Reconnect waterways with their floodplains.
- Utilize the delineation of critical cropland areas from Benck and Fry (Examining the Relationship between Land Cover and Water Quality Protection: The Blufflands Region of the Cannon and Zumbro River Watersheds, 2017, Saint Mary's University of Minnesota - GeoSpatial Services, 700 Terrace Heights, Box #7, Winona, MN 55987)
- Maintain and/or establish appropriate plant communities for the hydrology of the site.

On private lands:

- Support SWCDs in implementing and enforcing the state buffer law and other best management practices. Help interested landowners apply for the various cost-share or easement programs available for water quality protection (e.g. CRP, RIM).
- Work with landowners to reconnect streams to their floodplains.
- Maintain and restore natural vegetation along stream and riverbanks.

Key Stewardship Parcels

These parcels were identified based on their geographical size, areas of biodiversity significance, and proximity to public land (see above). They are areas where conservation effort can be most beneficial to the overall health of the landscape.

Stewardship Activities:

- Work to engage the owners of these parcels in a targeted manner.
- Target strategic parcels for potential acquisition or conservation easements.
- Tailor outreach and assistance to each landowner individually based on characteristics of their parcel and its geographical and ecological characteristics
- Prioritize stewardship efforts affecting these parcels.