

Zumbro River Watershed Landscape Stewardship Plan



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



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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 resource stewardship.



Landscape Approach to Natural Resources Stewardship

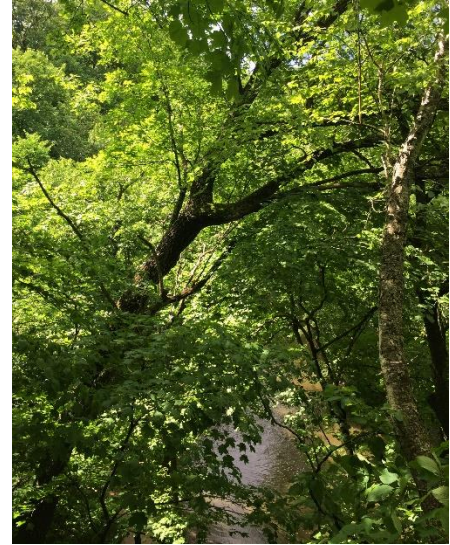
This Landscape Stewardship Plan (LSP) is based on the recognition that many, if not all, of our conservation and environmental challenges are interrelated. Yet, practicality requires a division of activities and expertise in addressing them. As a result, private landowners, city planners, and experts 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 1,428 square mile Zumbro River Watershed in Southeast Minnesota (Figure 1). The watershed, which includes portions of Dodge, Goodhue,

Olmsted, Rice, Steele, and Wabasha counties, drains roughly West-to-East through three main forks (South Fork, Middle Fork, and North Fork) which join north of Rochester to form the main stem. Rochester is by far the largest city in the watershed. It drains a diverse landscape ranging from deep fertile glacial tills in the upper reaches to sandy soils and steep bluffs in the lower portion of the watershed as it nears the Mississippi River at Kellogg. Much of the watershed is underlain by karst, with exposed bedrock and complex groundwater systems predominant in the eastern half of the region. Landforms common to this area are steep bluffs overlooking deep river valleys, sinkholes, caverns, and cold-water spring-fed streams. Landscape features such as lake and outwash plains, moraines, and drumlin fields that were created by glaciers and associated meltwater drainage characterize the western part of the watershed.



This southeastern Minnesota watershed has seen significant change in the last 150 years. Today, only 23% 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.

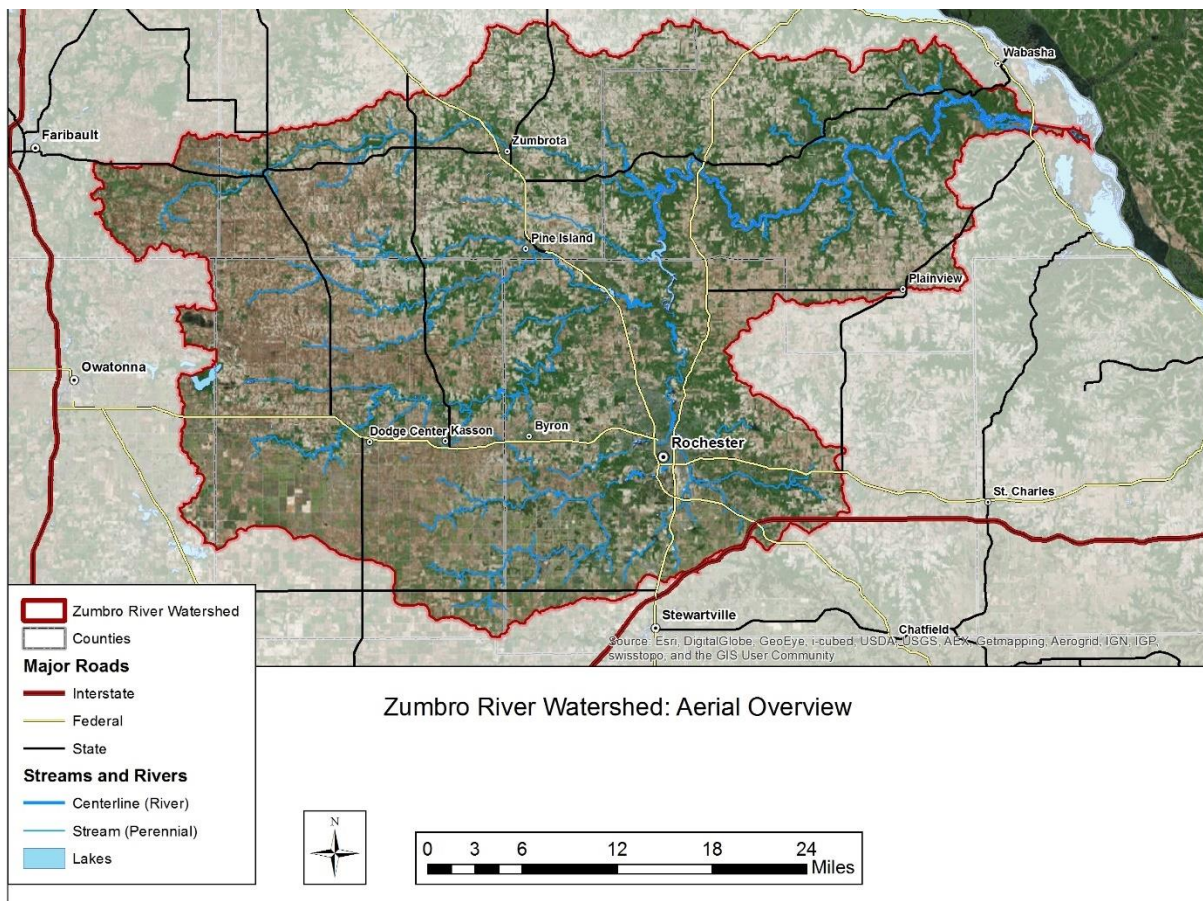


Figure 1. Aerial view of the Zumbro River Watershed.

Organization of Plan

The Zumbro 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 a potential Zumbro 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 led the development of the Zumbro 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. Zumbro River Watershed Landscape Stewardship Advisory Committee.

Name	Organization	Email
Terry Lee	Olmsted County	lee.terry@co.olmsted.mn.us
Skip Langer	Olmsted SWCD	langerskip@co.olmsted.mn.us
John Harford	Olmsted County	harford.john@co.olmsted.mn.us
Gretchen Miller	MN DNR Wildlife	gretchen.miller@state.mn.us
Mark Miller	MN DNR Forestry	mark.dnr.miller@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 Zumbro 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 Zumbro 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 Zumbro 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 Zumbro 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 Zumbro 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 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 Zumbro 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
- ❖ Adequately buffered karst features including springs, fens, sinkholes and the Decorah Edge
- ❖ 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 landowner activities such as invasive species control and native plant community restoration
- ❖ A more robust 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 Zumbro 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 Soil and Water 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	Zumbro Watershed Partnership, UMN Extension

	conservation efforts is the value placed on natural resources by the community.	
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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 the 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.
 - Promote farmer-to-farmer networks for knowledge sharing related to grazing management and practices.
 - Seek opportunities to improve market options for grass fed or pasture raised beef.
- 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.

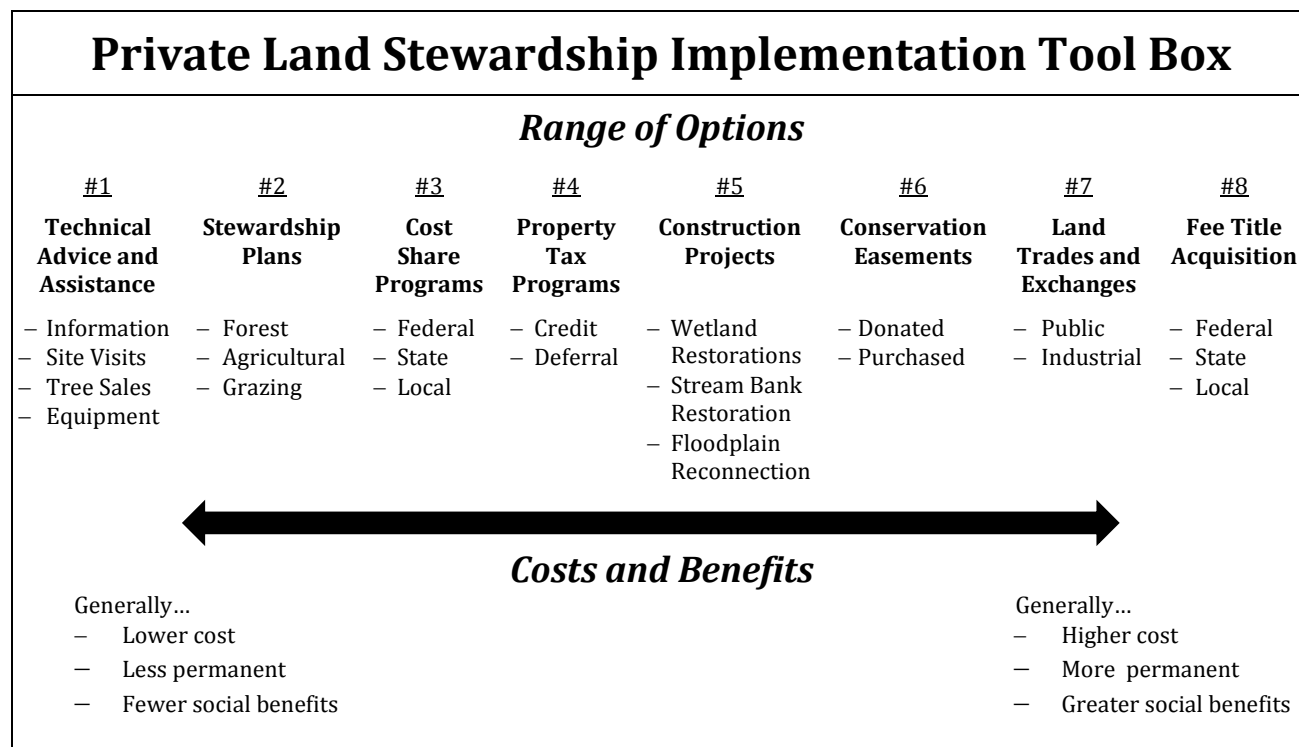
Section 2. Implementing the Plan

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 costly and least to most permanent and beneficial.



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 Zumbro 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 Zumbro 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 Zumbro 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 Zumbro 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 39 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 site's 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	<ul style="list-style-type: none">○ Perennial cover index (2011)○ Impervious cover index (2011)○ Storage, straightened-meandering stream ratio index
Biology	<ul style="list-style-type: none">○ Aquatic invertebrate IBI○ Fish IBI○ Mussel score
Connectivity	<ul style="list-style-type: none">○ Riparian connectivity○ Aquatic connectivity
Water Quality Metric	<ul style="list-style-type: none">○ 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 the combined scores for each sub-watershed.

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.

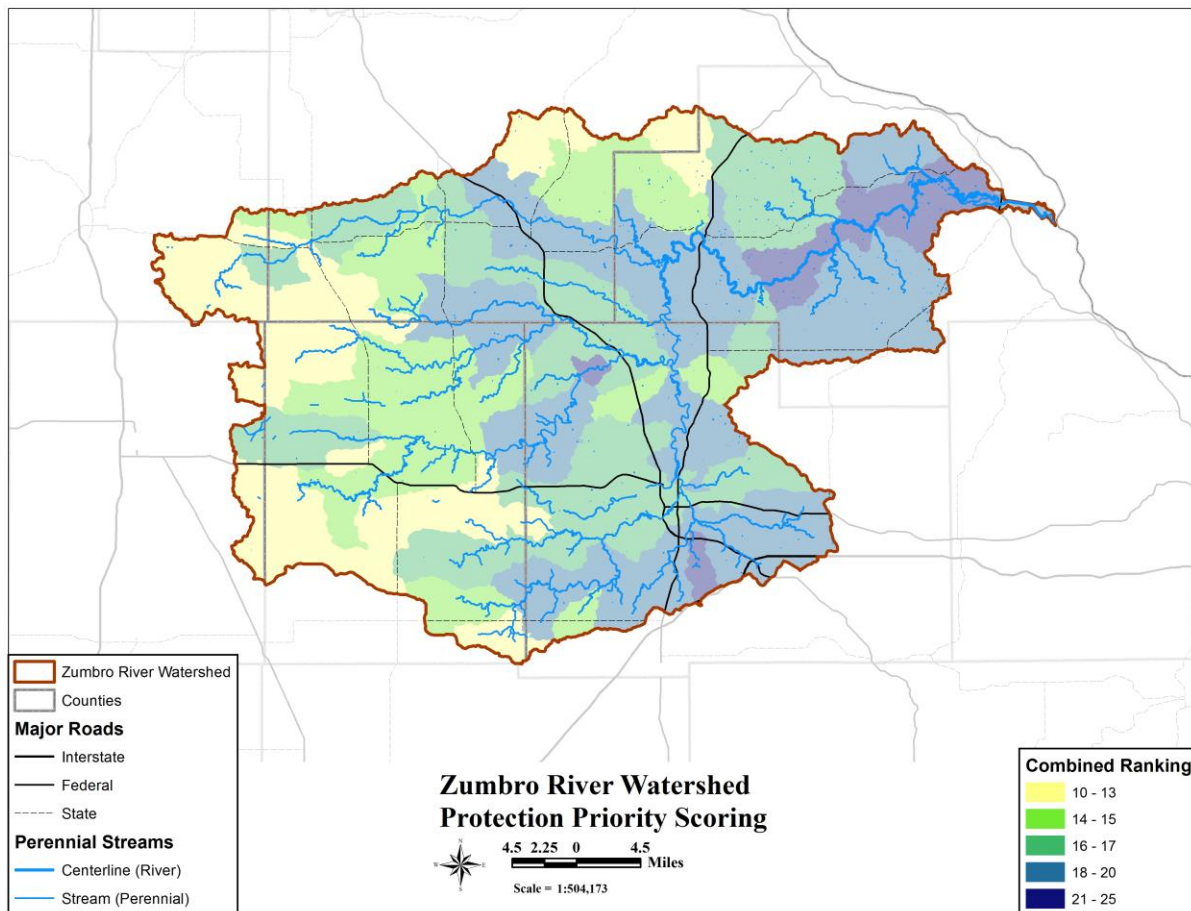


Figure 2. Combined priority ranking scores for the Zumbro River Watershed.

Selected Conservation Opportunity Areas

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

- The Zumbro Falls COA includes Lake Zumbro and the area around the small towns of Hammond, Mazeppa, and Zumbro Falls. This COA encompasses nearly 61,500 acres in the watersheds of Dry Run Creek, Lake Zumbro, Mazeppa Creek, North Fork of the Zumbro River, and the main stem of the Zumbro River after it merges with the North Fork. Topography in this area leads to a diversity of riparian areas and forested ecosystems that represent hotspots for biodiversity and water quality protection.
- The Lower Zumbro COA This nearly 60,000 acre COA includes forested bluffs, floodplain forests, and cold-water streams that have been identified as particularly important for regional biodiversity. The COA lies in the lowest reach of the watershed between Millville and Kellogg. In addition to the Zumbro main stem, the COA includes all or portions of the Trout Brook, Silver Spring Creek, Spring Creek, and the lowest reaches of West Albany Creek. Key public natural areas include several tracts of the Richard J. Dorer Memorial

Hardwood State Forest, most notably the Zumbro Bottoms unit. Public lands and acquisition strategies will have a larger role in this COA than the rest of the watershed.

- The Bluffland Tributaries COA contains a series of cold-water trout streams and forested bluffs that provide important habitat to a wide variety of plants and animals. Notable streams in this 49,640-acre COA are West Indian Creek, Long Creek, and Middle Creek. MN DNR's Blufflands/ Rochester Plateau Subsection Forest Resource Management Plan includes a High Biodiversity Site Plan for the West Indian Creek Watershed due to its importance to the biodiversity of the state.
- The Southern Headwaters COA consists of two separate units around the City of Rochester. These two areas are important areas for protecting the drinking water of Rochester and feature rare calcareous fens. The eastern unit occupies the US Highway 14 corridor east of Rochester near Chester Woods. The western unit extends southwest from Rochester along the South Fork of the Zumbro towards the town of Rock Dell. These two units encompass nearly 55,000 acres in the watersheds of Goose Creek, Bear Creek and the South Fork of the Zumbro. Much of this region has been converted to agriculture or residential development however; the remnants of the region's natural communities represent a conservation opportunity to build from.
- The Oxbow Park COA occupies nearly 26,000 acres along the South Branch of the Middle Fork of the Zumbro River with its most notable feature being Oxbow Park, a forested area outside Rochester that has been identified as having outstanding biodiversity significance. This stretch of river is also regarded as one of the best smallmouth bass fisheries in the state.
- The Rice Lake COA occupies 19,462 acres in a nearly entirely agricultural part of the Zumbro River watershed. The key feature of this COA is Rice Lake State Park at the headwaters of the South Branch of the Middle Fork of the Zumbro River. Rice Lake is one of the few natural lakes in the Zumbro River Watershed, conservation efforts in this area will focus on this lake, and agricultural best management practices in the surrounding landscape. This COA's position as a headwaters area for the Middle Fork makes it an especially important place to focus on water quality and hydrology.
- The Middle Fork COA (43,261 acres) contains a variety of biologically rich valleys that are almost entirely privately owned. The low proportion of public-land in this COA highlights the need to support private landowner stewardship in the maintenance of these natural areas and associated water quality.

These COAs represent places of emphasis for the conservation actions outlined in Section 1 of the plan. Individual stewardship plans for three of these areas (Zumbro Falls, Lower Zumbro-Bluffland Tributaries, and Southern Headwaters) 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.

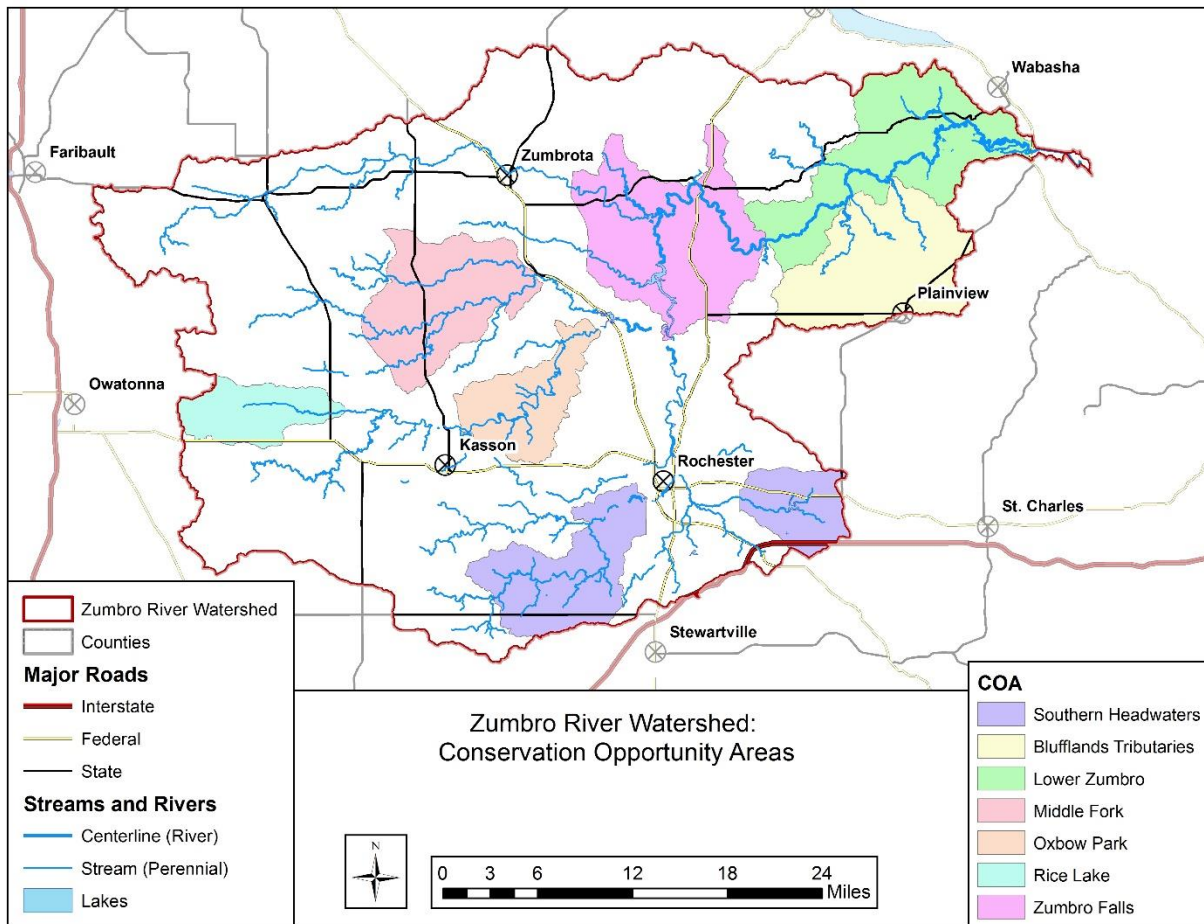


Figure 3. Conservation Opportunity Areas within the Zumbro River Watershed.

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 Zumbro 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:

<u>State Agencies:</u> <ul style="list-style-type: none">- 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 <u>Local Government:</u> <ul style="list-style-type: none">- County and City- SE MN Water Resource Board- Soil and Water Conservation Districts	<u>Federal Agencies:</u> <ul style="list-style-type: none">- Natural Resources Conservation Service- U.S. Fish and Wildlife Service- U.S. Forest Service <u>Non-governmental Organizations:</u> <ul style="list-style-type: none">- Basin Alliance for the Lower Mississippi in Minnesota- Zumbro Watershed Partnership- Land Management Consultants- Minnesota Land Trust- Pheasants Forever- The Nature Conservancy- Trout Unlimited- Trust for Public Land
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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, Cannon, 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 Zumbro River Watershed Restoration and Protections Strategies (WRAPS)
- Potential One Watershed, One Plan efforts in the Zumbro Watershed
- Dodge, Goodhue, Olmsted, Rice, Steele, and Wabasha Counties' Comprehensive Plans and Water Management Plans
- City of Rochester Water and Development 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
- 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 parallel efforts to develop a 2017 [Zumbro River WRAPS](#) Plan. The WRAPS plan was being 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 Zumbro River effort scheduled to conclude in 2017. 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 neighboring Cannon River Watershed while the Zumbro River Landscape Stewardship Plan was being developed. There is no definitive timeline for undertaking a similar effort in the Zumbro River; however, it will likely happen in the coming years. 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 was one of the first watersheds in the state to go through this Minnesota Board of Water and Soil Resources (BWSR) coordinated process. This watershed focused approach to local government water management implementation plans helped lead the Landscape Stewardship Plan to base its boundaries on the watershed and it is intended that any future 1W1P efforts in the Zumbro can inform, and be informed by, efforts outlined in the Landscape Stewardship Plan.

[Zumbro Watershed Partnership](#)

The [Zumbro Watershed Partnership](#) (ZWP) is a member-based, nonprofit organization dedicated to creating a watershed where everyone can swim and fish in the rivers and drink clean water from the wells. The organization focuses on educating the public about how they can take care of water resources by making better choices at home and work. Demonstrating how to slow the flow of water and prevent pollution. Implementing on-the-ground projects to protect our water, stimulating data sharing and project coordination in the watershed, and inspiring residents to clean and protect area lakes and rivers. A 25-member Board of Directors governs the Zumbro Watershed Partnership. Twelve members 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.

ZWP 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. 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.

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
	70,000 seedlings sold by SWCDs annually	70,000 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 appropriate buffers	100% of karst features protected with 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	75 new stewardship plans	150 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: Zumbro 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 activities 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, through 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 activities 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 through 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?
Adequately buffered karst features including springs, fens, sinkholes and the Decorah Edge	Are policies in place to protect these important areas to biodiversity and water quality? What is the overall state of buffering and protection?
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, sixty-five percent of the watershed has been converted to row-crop agriculture or residential/urban development and many of the remaining forests, wetlands, and prairies have been degraded in some fashion. Yet, 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 Zumbro River Watershed lies entirely within the Eastern Broadleaf Forest Province and contains portions of the Minnesota and NE Iowa Morainal (MIM) and the Paleozoic Plateau sections (Figure 4). All of the MIM area in the watershed is considered part of the Oak Savanna subsection while the Paleozoic Plateau contains both the Rochester Plateau and the Blufflands subsections.

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

The Oak Savanna subsection lies 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 to the north, 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. Tornadoes 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.

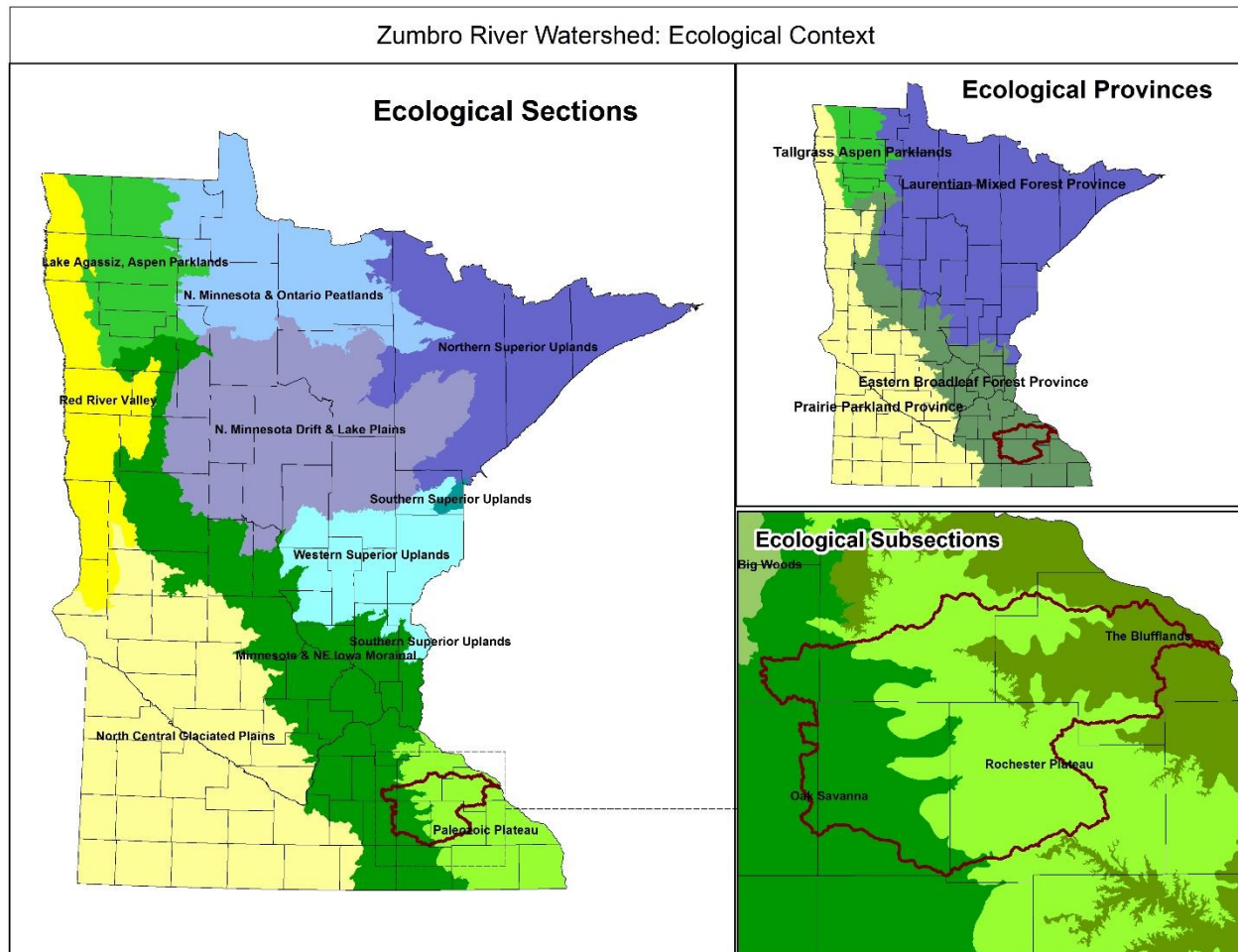


Figure 4. The Zumbro River Watershed lies in two sections of the Eastern Broadleaf Forest Province: the Minnesota and NE Iowa Morainial (MIM) and Paleozoic Plateau. All of the MIM in the watershed is part of the Oak Savanna subsection while the Paleozoic Plateau contains both the Rochester Plateau and the Blufflands subsections.

Hydrology

The Zumbro River Watershed is large and diverse, with hydrological characteristics that vary across the watershed (Figure 5 and Figure 6). In describing the watershed, it is helpful to break it into sections, or lobes, with roughly similar characteristics. The watershed has five primary lobes: South Fork, Middle Fork, North Fork, Lake Zumbro, and Lower Zumbro.

- The South Fork of the Zumbro River flows east and then north through Rochester to the point at which it meets the Middle Fork near Lake Zumbro. This lobe is dominated by the city of Rochester and accounts for approximately one quarter of the Zumbro River watershed (232,574 acres; 26% of total drainage). Cascade Creek, Salem Creek and Bear Creek are significant tributaries in this lobe.
- The Middle Fork of the Zumbro River encompasses much of the western part of the basin. Three branches of this fork converge in Oronoco at the former Lake Shady and join the South Fork near the south end of Lake Zumbro. The Middle Fork is the largest general lobe of the watershed (277,816 acres; 31% of total drainage) and contains several cities, including Pine Island, Oronoco, Dodge Center and Mantorville.
- The North Fork of the Zumbro River is the smallest of the three forks (153,149 acres; 17% of total drainage). This fork merges with Mazeppa Creek just before it joins the main stem of the river downstream of Lake Zumbro. The North Fork flows through the cities of Kenyon, Wanamingo, Zumbrota and Mazeppa.
- The Lake Zumbro Immediate Watershed includes the smallest area of land (34,881 acres; 4% of total drainage) that drains directly to the lake and its tailwater. This land is situated downstream of the confluence of South and Middle Forks and upstream of the confluence of the North Fork. Pine Island Creek flows directly into Lake Zumbro from the west and is the only large, named stream in this lobe.
- The Lower Zumbro River starts at the confluence of the three forks of the Zumbro River, and ends where the river joins the Mississippi. It includes 211,903 acres (23% of total drainage), but does not contain any large cities. In this lobe the River descends through the steeper and more dissected topography of the bluffs, where spring fed coldwater streams such as Cold Spring Brook and West Indian Creek feed into the river before it meets the Mississippi.

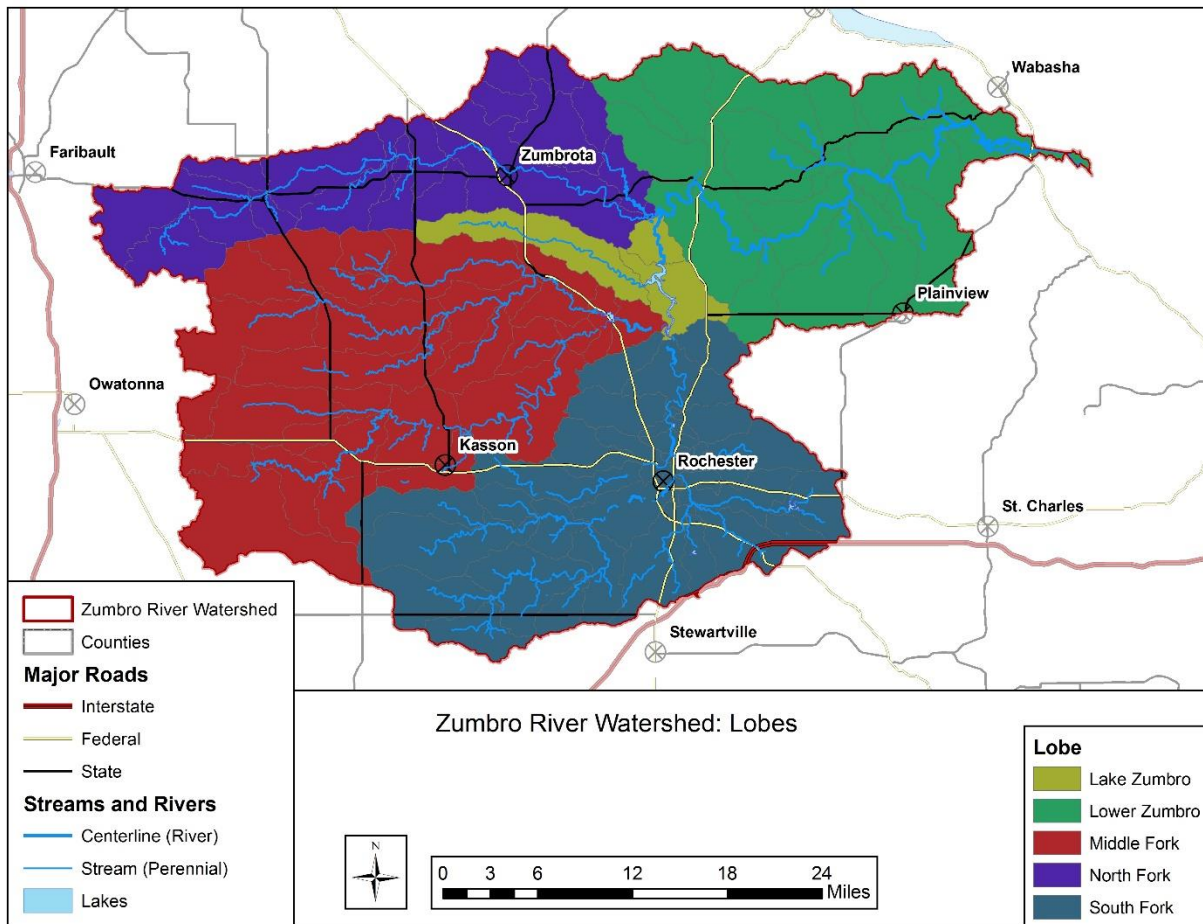


Figure 5. Stream network and lobes of the Zumbro River Watershed.

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.

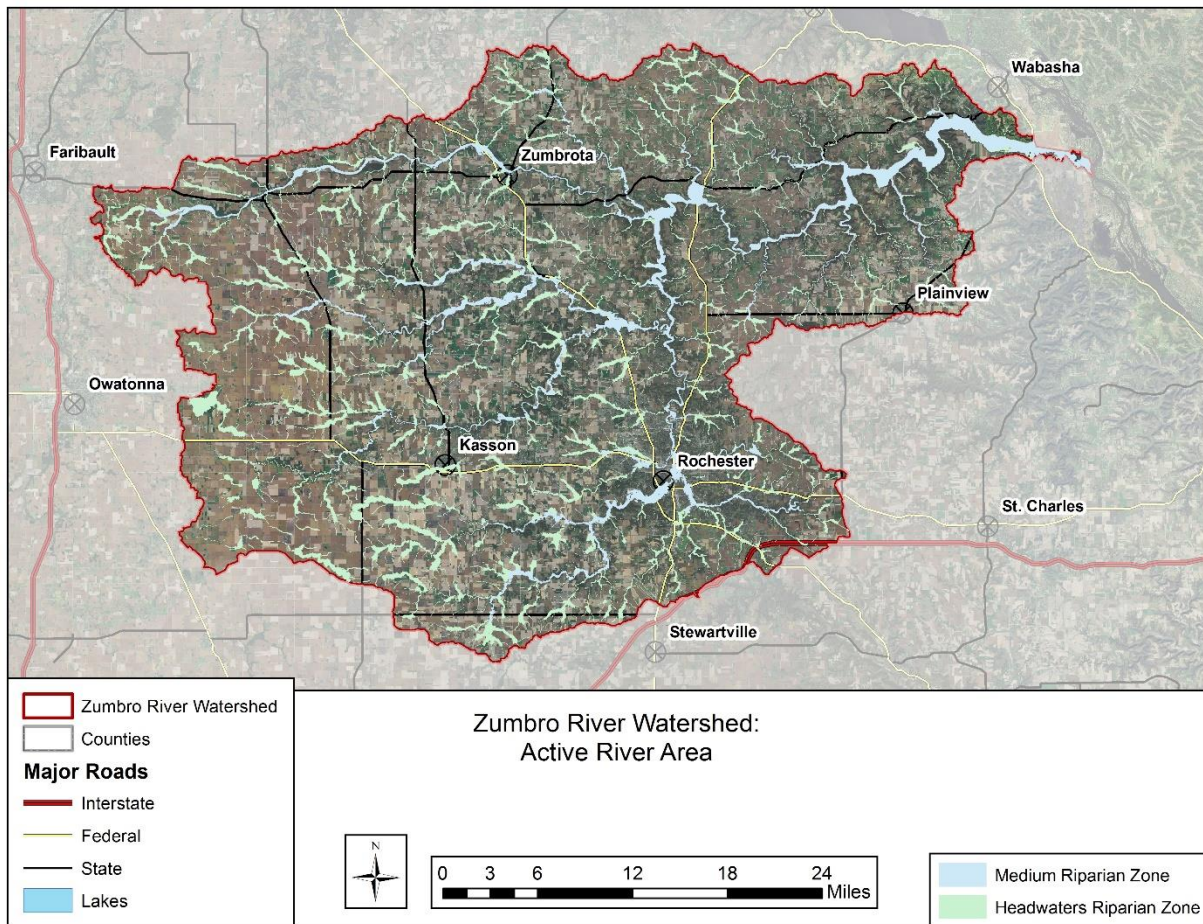


Figure 6. Active River Area analysis showing areas of historical river interaction which includes the historic floodplain and meander belt.

Geology and Soils

The geology of the Zumbro River Watershed varies from the largely flat landscape of the headwaters to the steep valleys where it meets the Mississippi. Major landforms in the western part of the watershed include lake plains, outwash plains, end and ground moraines, and drumlin fields, all remnant landscapes of past glacial activities and the melt water drainage associated with it. The eastern half of the watershed is included in what is called the “driftless area.” This portion of the watershed contains much older glacial deposits, and well-weathered and eroded landscapes featuring many areas of exposed karst bedrock. Landforms common to this area are steep bluffs overlooking deep river valleys, sinkholes, caverns and cold-water spring-fed streams. Soils of the region include Alfisol, Entisol, Histosol or Mollisol orders, which lead to variation in the overlying vegetation.

The Zumbro River Watershed exists primarily in two major geological areas (Figure 7):

- *Eastern Iowa and Minnesota Till Prairies.* A mix of glacial till and outwash deposits with clay, silt, sand, and gravel characterizes this geological area in the western half of the watershed around Dodge Center, Byron, and Kenyon. 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 eastern half of the watershed is 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. 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.

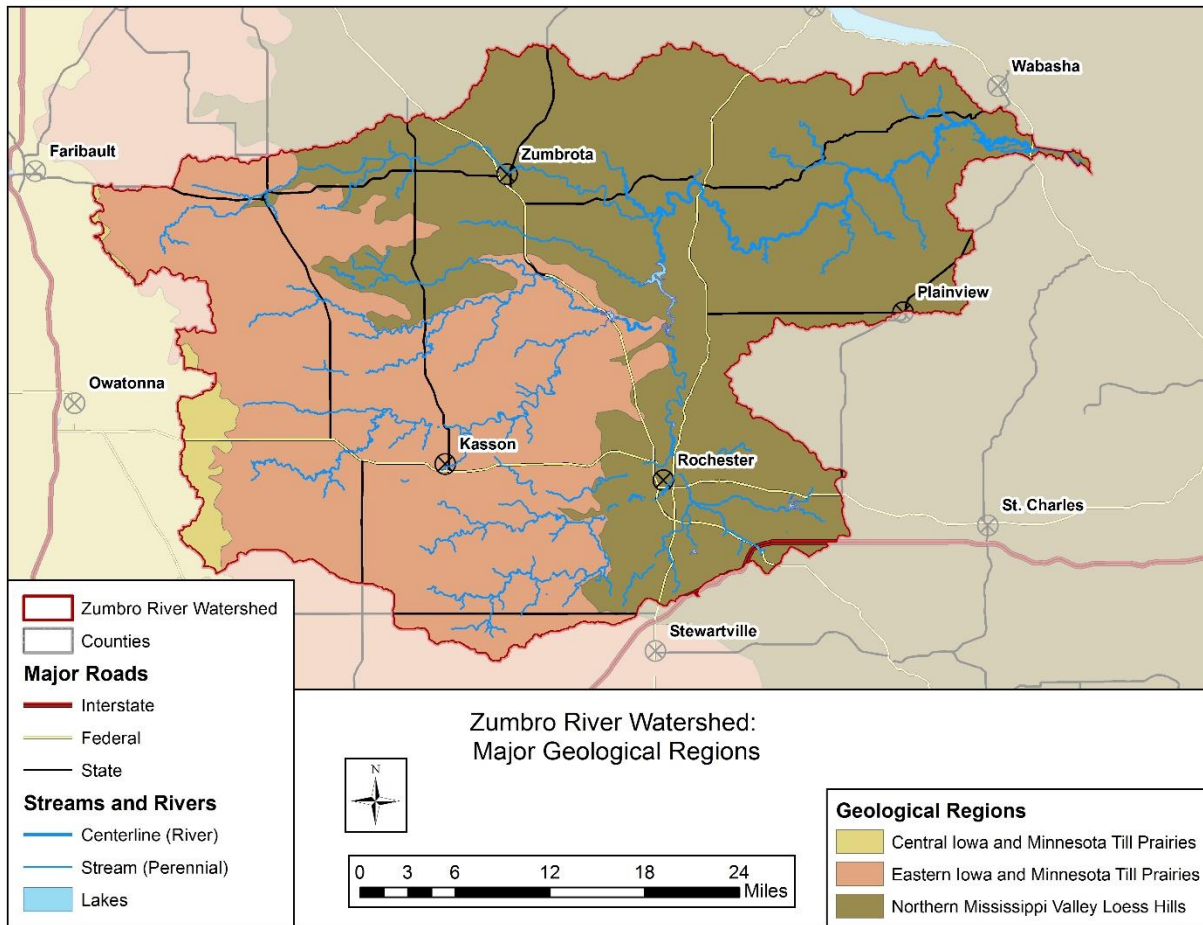


Figure 7. Major land resource areas in the Zumbro River Watershed.

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, caves, 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.

One key aspect of conservation concern in the karst landscape in Southeastern Minnesota is the Decorah Edge. It is formed where groundwater that has been slowly flowing atop the impermeable Decorah shale reaches a sidehill where it spills over this impermeable surface and then reenters the groundwater below. This "edge" sustains a biologically diverse ecosystem and naturally filters the groundwater that supplies drinking water for the region's cities and farms. These flowing waters are most evident during wet periods when seeps and springs discharge along hillsides. They can also be seen in excavations and in basements of homes located on the hillsides. Agriculture dominates much of the upland area that drains to the Decorah Edge. While the groundwater above the Decorah shale is often polluted with fertilizers, pesticides, manure and sewage, water immediately below the Decorah Edge generally has few of these pollutants. The Decorah Edge works as a natural filter removing pollutants from water as it flows through the soils, vegetation, and wetlands that overlie the shale bed. This filtration is a valuable economic asset for the region. Replacing this natural drinking water filtration in the Rochester area may cost as much as \$5 million per year. In addition to removing pollutants from groundwater, filtration processes at the Decorah Edge also purify seep and spring water discharges that form the headwaters of the Cannon, Root, Whitewater, and Zumbro Rivers. In the urbanizing areas around Rochester, the Decorah Edge is under increasing development pressure. Disturbance of groundwater flows and removal of vegetation associated with development may jeopardize the ability of this important natural resource to both supply groundwater and to purify it.

In southeastern Minnesota, the Decorah Edge extends from Rice County through Goodhue, Dodge, Olmsted, Winona, Fillmore, and Houston Counties. It continues winding through northeastern Iowa through its namesake city and ends in Dubuque. Its total length is close to 200 miles and if stretched straight it would extend nearly 1,000 miles. There are also discontinuous areas of Decorah Edge found in the Twin Cities and in Southwestern Wisconsin.

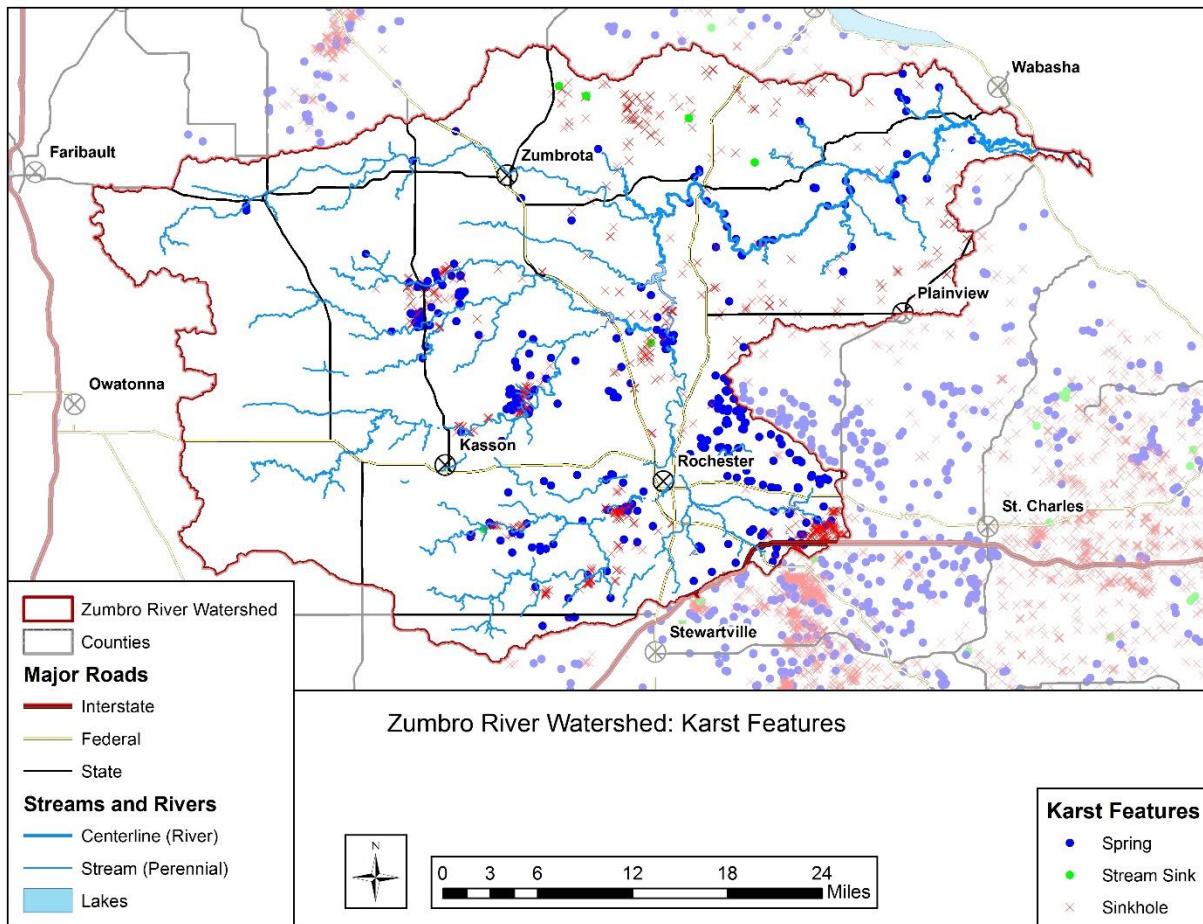


Figure 8. Known karst features in the Zumbro River Watershed.

Vegetation

Land Cover Change

Prairie and oak savanna communities dominated much of the Zumbro River Watershed prior to European arrival (Table 2, Figure 9). Fire was the primary ecosystem level disturbance and the presence of trees on the landscape depended on fire frequency and intensity. The most fire prone areas remained treeless while areas that were protected by landscape position often included scattered oak openings and barrens communities. True forested communities were most common in the center of the watershed between Pine Island, Mantorville, and Oronoco. These forested communities were typically found in relatively close proximity to a river, stream, or steep slope. Here hardwood stands of oak, maple, basswood, 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 River.

Today, the vast majority of the watershed is in agricultural production (Table 3, Figure 10). The City of Rochester and the surrounding communities represent most of the developed land and indications are that will continue. Although greatly reduced, areas of natural land cover can be found along the river and steeply dissected valley slopes.

Table 2. Estimated presettlement vegetation in the Zumbro River Watershed.

Marschner Presettlement Vegetation	Acres	Percent
Prairie	416,143	46 %
Oak openings and barrens	284,987	31 %
Brush Prairie	89,965	10 %
Aspen-Oak Land	49,688	5 %
Big Woods - Hardwoods (oak, maple, basswood, hickory)	31,682	3 %
River Bottom Forest	22,830	3 %
Wet Prairie	12,715	1 %
Lakes (open water)	1,355	0 %

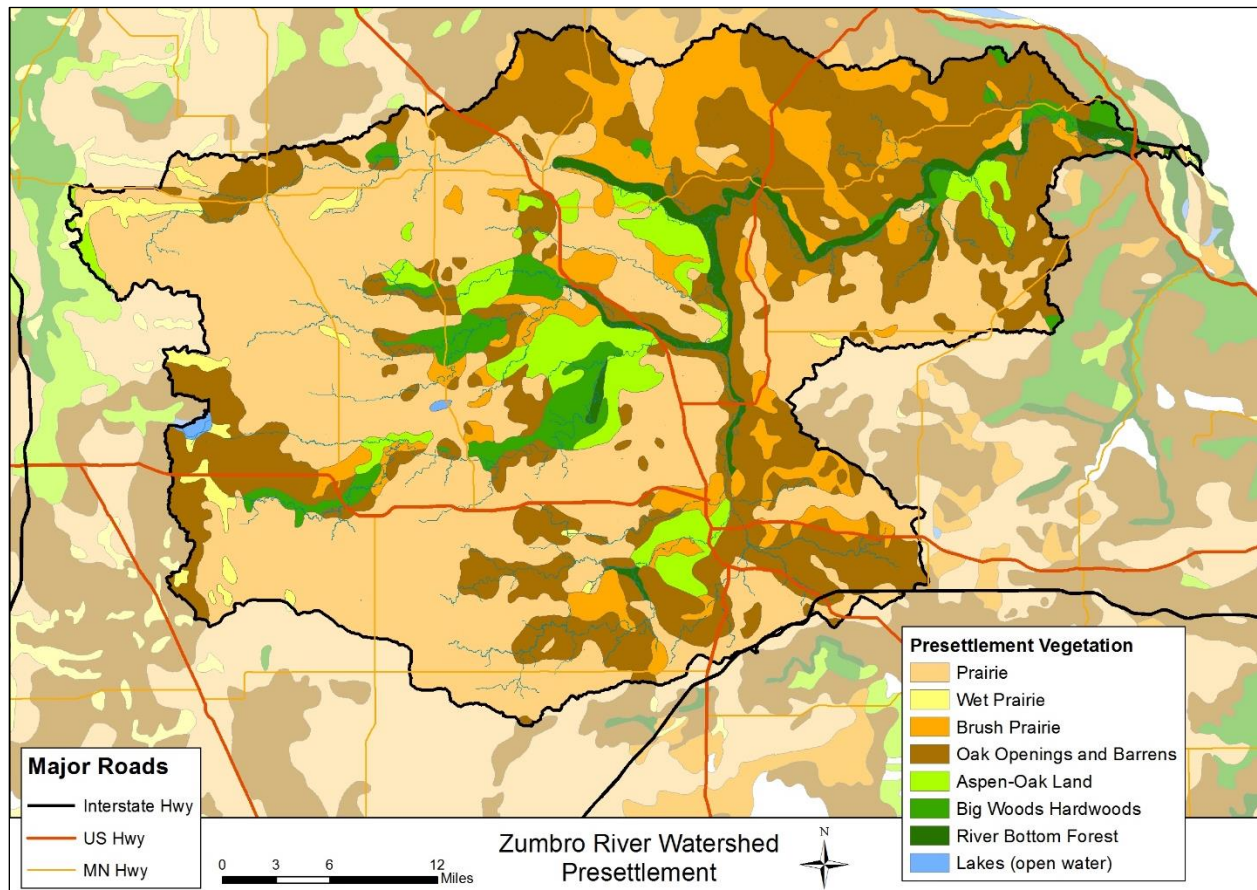


Figure 9. Pre-settlement land cover in the Zumbro River Watershed based on Marschner's interpretation of the Public Land Survey.

Table 3. Current land cover in the Zumbro River Watershed.

Land Cover Class	Acres	Percent of Watershed	Land Cover Class	Acres	Percent of Watershed
Cultivated Crops	509,121	56.0%	Open Water	4,204	0.5%
Herbaceous	107,049	11.8%	Emergent Herb. Wetlands	3,255	0.4%
Hay/Pasture	104,984	11.5%	Developed, High Intensity	2,543	0.3%
Deciduous Forest	87,036	9.6%	Evergreen Forest	977	0.1%
Developed, Open Space	47,923	5.3%	Barren Land	687	0.1%
Developed, Low Intensity	22,459	2.5%	Shrub/Scrub	167	0.0%
Woody Wetlands	10,380	1.1%	Mixed Forest	44	0.0%
Developed, Med. Intensity	8,530	0.9%			

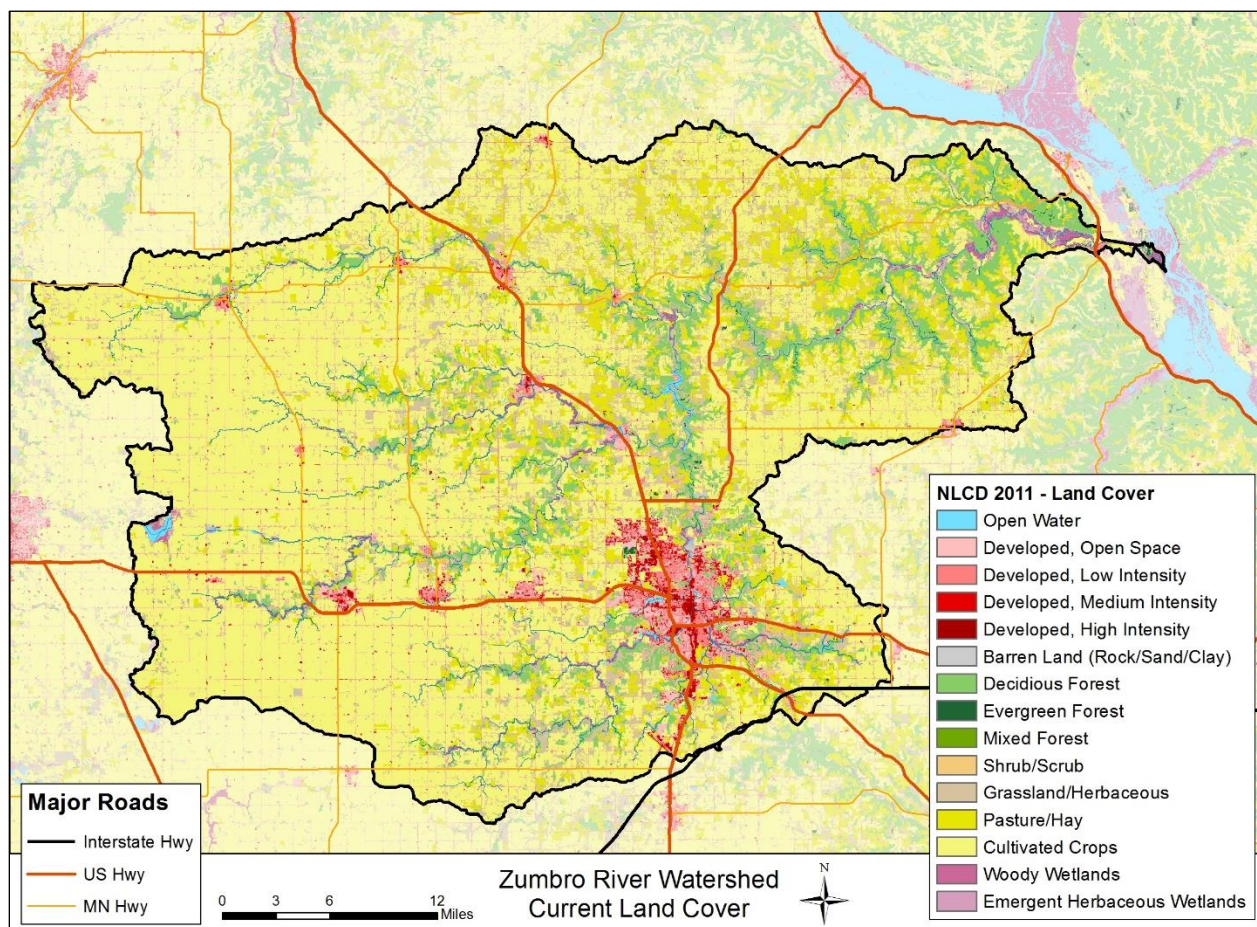


Figure 10. Current land cover in the Zumbro River Watershed based on the National Land Cover Database

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 ECS 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 Zumbro River watershed (Figure 11). A list of the general NPC ecological systems identified in the watershed is presented in Table 4 and more detailed descriptions can be found in the Field Guide to the Native Plant 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 4. Native Plant Community Systems in the Zumbro River Watershed.

System Name	Area (ac)
Mesic Hardwood	10,882
Floodplain Forest	3,843
Fire Dependent Woodland	1,098
Upland Prairie	740
Wet Meadow/Carr	573
Marsh	175
Cliff/Talus	149
Wetland Prairie	92
Open Rich Peatland	23
Wet Forest	12
N/A	707

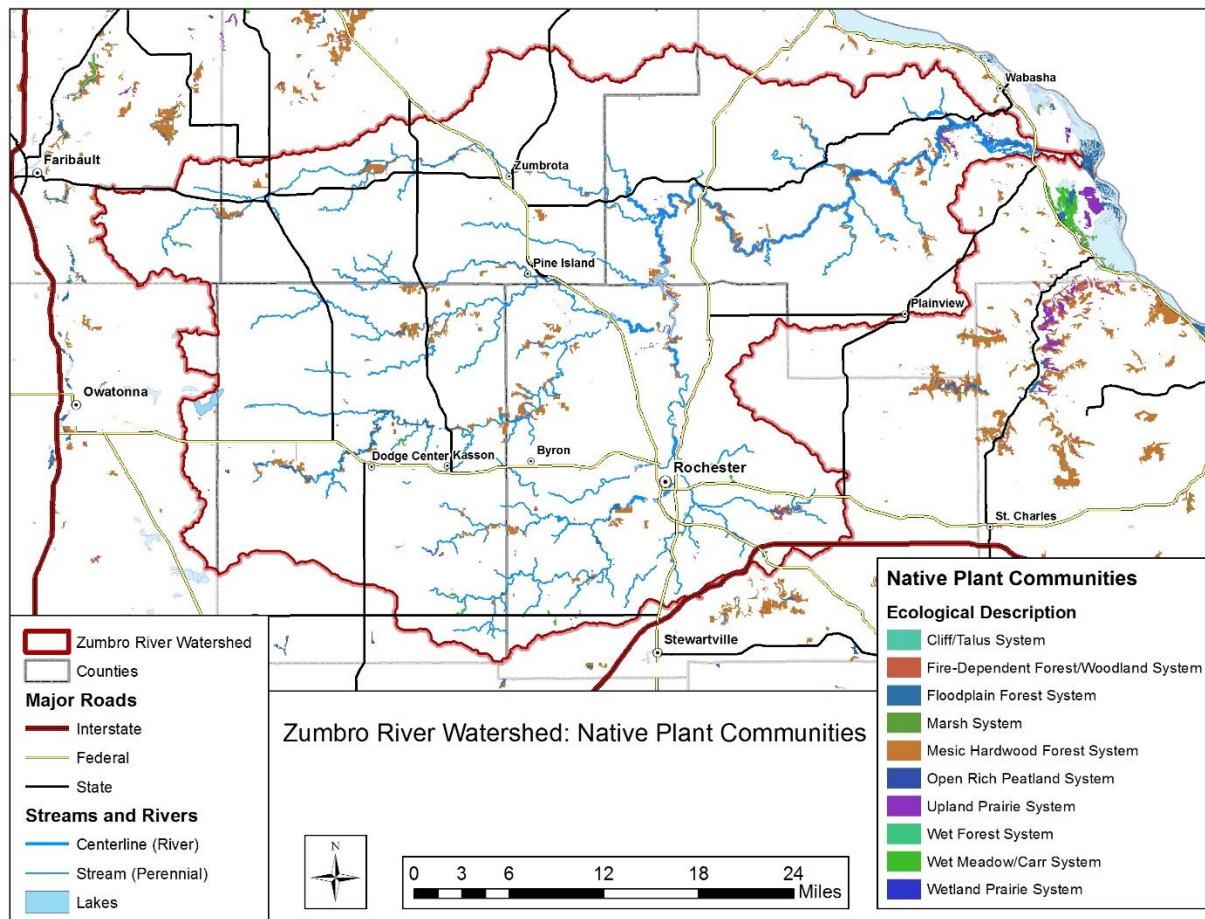


Figure 11. Native Plant Communities in the Zumbro River Watershed

Invasive Species

Non-native invasive species are becoming an increasing challenge for natural area management in the Zumbro 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



Riparian area dominated by garlic mustard.

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, 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 oak savanna and big woods remnants, karst geology, and steep valleys of the Driftless Area provide conditions for a diverse array of plant communities and habitats. The Zumbro River watershed contains nearly 50,000 acres of land that the Minnesota Biological Survey (MBS) has delineated as potential sites of biodiversity significance (Table 5, Figure 12). Field assessments of those sites ranked 4,806 acres as Outstanding and an additional 9,413 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 5. Minnesota Biological Survey delineated areas of biodiversity significance in the Zumbro River Watershed.

MBS Biodiversity Significance Rank	Acres
Outstanding	4,806
High	9,413
Moderate	23,132
Below	12,454
Total	49,805

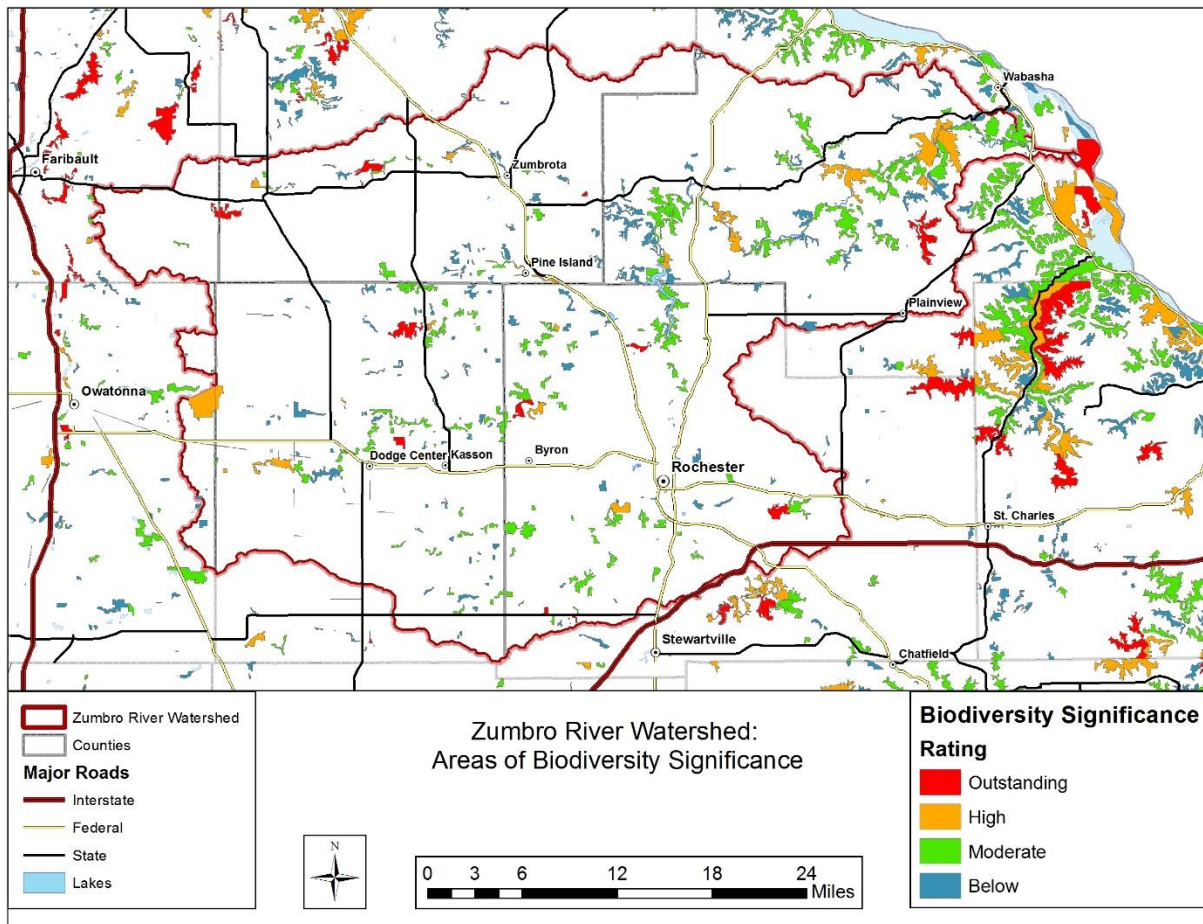


Figure 12. Sites of biodiversity significance in the Zumbro Watershed, as mapped by the Minnesota Biological Survey.

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 Zumbro 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. Additionally the Zumbro River, tributaries, and the handful of lakes and impoundments in 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 recent revision to the State Wildlife Action Plan (2015-2025 Wildlife Action Plan) did not specifically identify any areas in the Zumbro River Watershed as priority Conservation Focus Area but the areas is generally regarded as important to rare species and overall biodiversity. Over 81,000 acres were



identified in the Wildlife Action Network (Table 6, Figure 13). 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.

Table 6. Wildlife Action Network Scores for the Zumbro River Watershed.

Wildlife Action Network Score	Acres
High	1,875
Medium-High	13,110
Medium	16,562
Low-Medium	38,908
Low	10,794

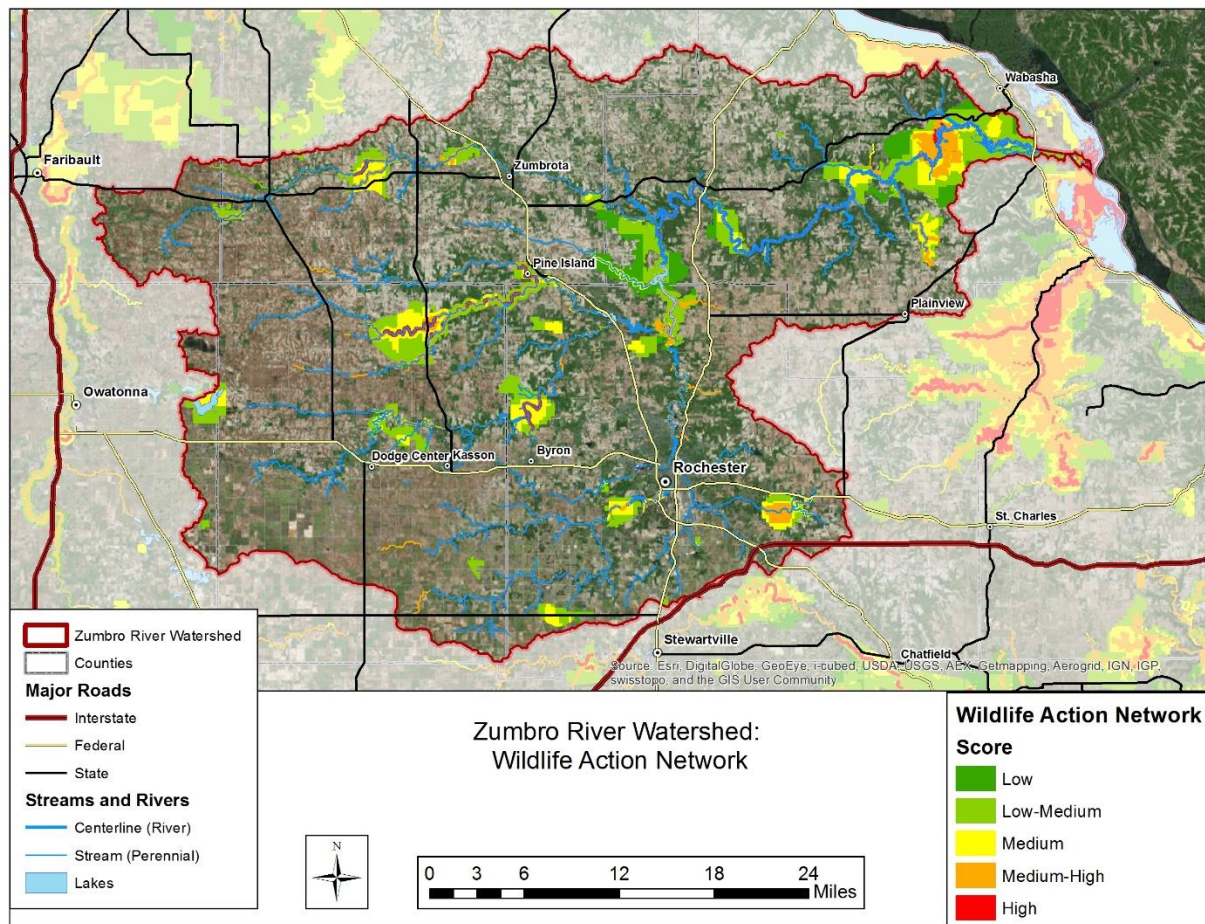


Figure 13. Wildlife Action Network in the Zumbro River Watershed.

Land Use History and Cultural Resources

The Zumbro River and its watershed has a long history of human activity dating back thousands of years. Like rivers everywhere, the Zumbro River, was used as a travel corridor prior to the modern road network 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 bluffs. They would also use the Zumbro River and its numerous tributaries to access the upland prairies which they frequently burned to maintain open characteristics so they could hunt bison, elk and deer.

Unlike other rivers in the area such as the Cannon, which had significant cultural centers at their mouth (Red Wing), the Zumbro was noted by early explores and fur traders as having an expansive delta that stretched for miles. According to some of the oldest European accounts, the Zumbro River joined the Whitewater River before entering the Mississippi. The mouths of these two rivers are now miles apart.

When these early Europeans arrived, the area was inhabited by the Mdewakanton Dakota who referred to the river as 'Wazi Oju' which means 'pines planted'. The French however focused on the snags, caused by widespread bank erosion that hindered their canoes and called it 'Riviere d'Embarrass' meaning river of difficulties. History is unclear on how English-speaking immigrants transformed Embarrass into Zumbro.

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 regions the fertile soils. The region's forests 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 leading 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, 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. These prominent lookouts were also occasionally used as burial mound sites.

Current Land Use and Socio-economic Context

Today, cultivated crops dominate much of the landscape (Figure 10). The most common are corn, forage for livestock, and soybeans. Rangeland is also common this area, particularly on steep slopes that are difficult to operate row crop machinery or areas with shallow soils. As one moves eastward through the watershed rangeland and forests tend to increase, particularly near rivers, streams, or areas with deeply incised topography. 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 occurring as well.

The Zumbro River watershed falls primarily within Dodge, Goodhue, Olmsted, and Wabasha counties with a small part extending into the eastern portions of Rice and Steele counties. The four primary counties had a combined estimated population of 239,197 residents in 2015. Overall,

these are semi-rural counties, however, Olmstead County contains the growing city of Rochester and accounts for 151,436 of these residents; 112,225 of which live in Rochester which is by far the largest community in the watershed. Today, over 98% of the land in the Zumbro River watershed is privately owned with public ownership spread between county, state, federal and non-profit ownership (Figure 14).

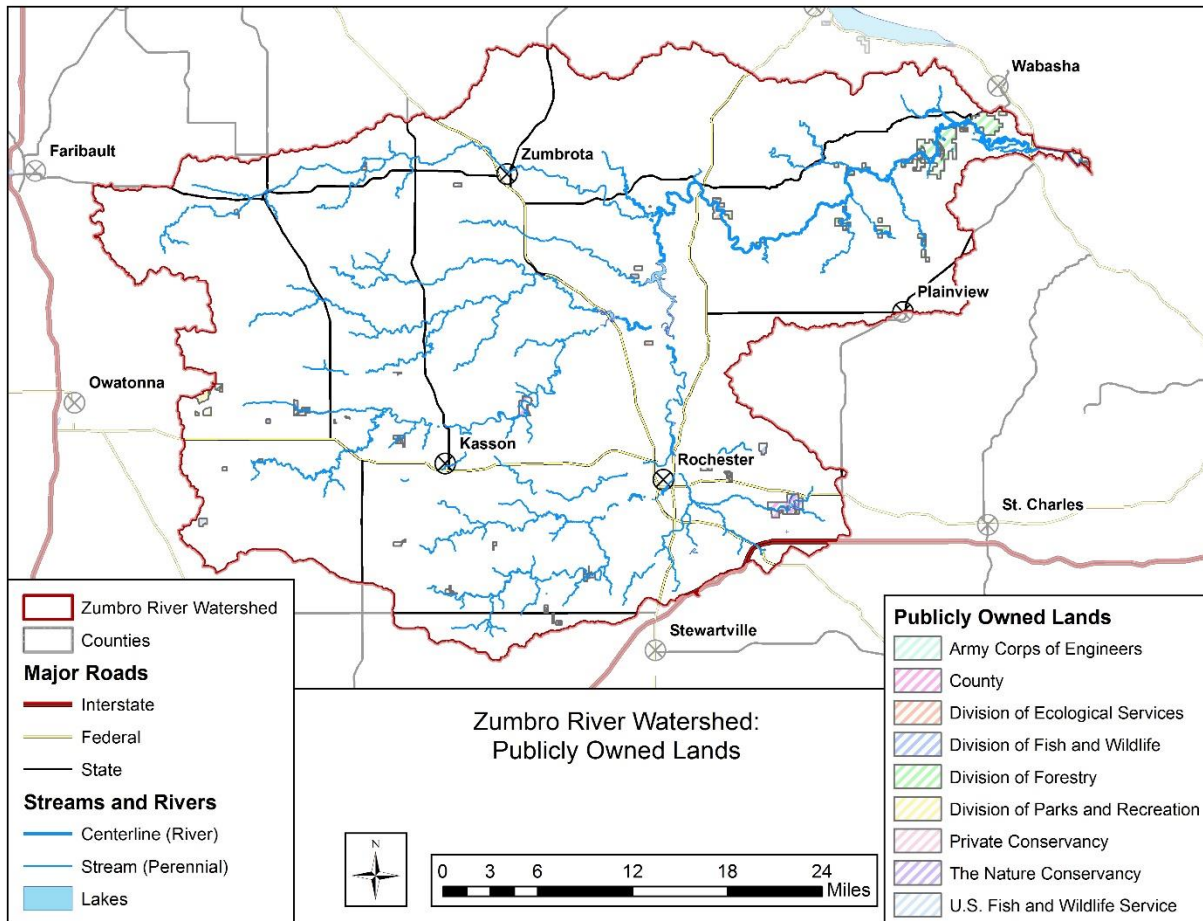


Figure 14. Public land in the Zumbro River Watershed. Although not visible at this scale, all organizations listed in the legend have land in the watershed.

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

- Zumbro 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 117 RIM tracts in the Zumbro River watershed totaling over 3,218 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 Zumbro 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 Zumbro 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 three of these 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 Zumbro River Watershed identified seven 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. 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.

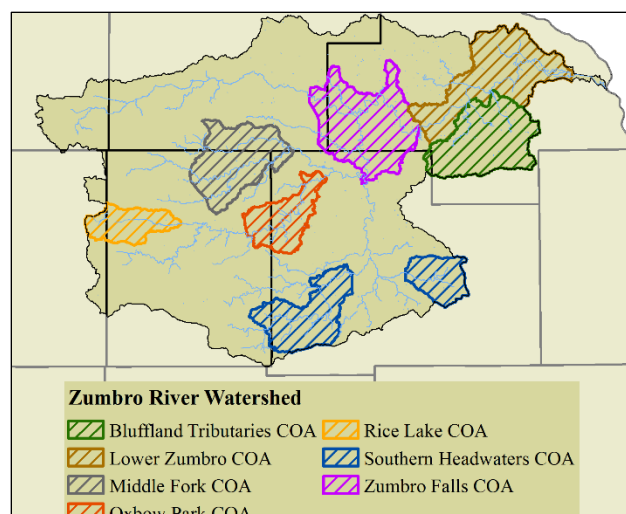
Because these COAs were identified through an additive process, where desirable landscape features were added up within each sub-watershed, they primarily represent places with significant overlap of different stakeholder's priorities. They are places of importance to multiple state agencies and environmental 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.

This section provides three COA summaries: Lower Zumbro – Bluffland Tributaries, Southern Headwaters, and Zumbro Falls. The stewardship plans for each of these COAs focus on specific resources and needs, as well as strategies that are appropriate to the different social resources and ownership patterns within each COA. Highlighting these three COAs should not diminish the importance of the other three. The seven COAs identified in the Zumbro watershed are:

- **Zumbro Falls COA:** Includes Lake Zumbro and the area around the small towns of Hammond, Mazeppa, and Zumbro Falls. This COA encompasses nearly 61,500 acres in the watersheds of Dry Run Creek, Lake Zumbro, Mazeppa Creek, North Fork of the Zumbro River, and the main stem of the Zumbro River after it merges with the North Fork. Topography in this area leads to a diversity of riparian areas and forested ecosystems that represent hotspots for biodiversity and water quality protection.
- **Lower Zumbro COA:** This nearly 60,000 acre COA includes forested bluffs, floodplain forests, and cold-water streams that have been identified as particularly important for regional biodiversity. The COA lies in the lowest reach of the watershed between Millville and Kellogg. In addition to the Zumbro main stem, the COA includes all or portions of the Trout Brook, Silver Spring Creek, Spring Creek, and the lowest reaches of West Albany Creek. Key public natural areas include several tracts of the Richard J. Dorer Memorial Hardwood State Forest, most notably the Zumbro Bottoms unit. Public lands and acquisition strategies will have a larger role in this COA than the rest of the watershed.

- **Bluffland Tributaries COA:** Contains a series of cold-water trout streams and forested bluffs that provide important habitat to a wide variety of plants and animals. Notable streams in this 49,640-acre COA are West Indian Creek, Long Creek, and Middle Creek. MN DNR's Blufflands/ Rochester Plateau Subsection Forest Resource Management Plan includes a High Biodiversity Site Plan for the West Indian Creek Watershed due to its importance to the biodiversity of the state.
- **Southern Headwaters COA:** Consists of two separate units around the City of Rochester. These two areas are important areas for protecting the drinking water of Rochester and feature rare calcareous fens. The eastern unit occupies the US Highway 14 corridor east of Rochester near Chester Woods. The western unit extends southwest from Rochester along the South Fork of the Zumbro towards the town of Rock Dell. These two units encompass nearly 55,000 acres in the watersheds of Goose Creek, Bear Creek and the South Fork of the Zumbro. Much of this region has been converted to agriculture or residential development however; the remnants of the region's natural communities represent a conservation opportunity to build from.
- **Oxbow Park COA:** Occupies nearly 26,000 acres along the South Branch of the Middle Fork of the Zumbro River with its most notable feature being Oxbow Park, a forested area outside Rochester that has been identified as having outstanding biodiversity significance and a highly regarded smallmouth bass fishery.
- **Rice Lake COA:** Occupies 19,462 acres in a nearly entirely agricultural part of the Zumbro River watershed. The key feature of this COA is Rice Lake State Park at the headwaters of the South Branch of the Middle Fork of the Zumbro River. Rice Lake is one of the few natural lakes in the Zumbro River Watershed, conservation efforts in this area will focus on this lake, and agricultural best management practices in the surrounding landscape. This COA's position as a headwaters area for the Middle Fork makes it an especially important place to focus on water quality and hydrology.
- **Middle Fork COA:** This 43,261 acre COA contains a variety of biologically rich valleys that are almost entirely privately owned. The low proportion of public-land in this COA highlights the need to support private landowner stewardship in the maintenance of these natural areas and associated water quality.



Lower Zumbro and Bluffland Tributaries Conservation Opportunity Areas

Overview

The Lower Zumbro and Bluffland Tributaries COAs encompass over 107,500 acres in the lowest reaches of the watershed between Millville and Kellogg (Figure 15). In addition to the Zumbro main stem, the COAs include all or portions of the Trout Brook, West Indian Creek, Middle Creek, Long Creek, Silver Spring Creek, Spring Creek, and the lowest reaches of West Albany Creek. Key public natural areas include several tracts of the Richard J. Dorer Memorial Hardwood State Forest, most notably the Zumbro Bottoms unit. Multiple easement programs also have a presence in the COA. Several parcels have been protected through the Forest Service's Forest Legacy program and trout stream easements held by Minnesota DNR Division of Fisheries cover portions of the area's coldwater streams.

According to data from the Public Land Survey, this area contained a mix of prairies, oak savannas and woodlands, mesic hardwood forests, and river bottom forests. Like the surrounding landscape, much of this region has been converted to agriculture, particularly in the southern portion of the COA. There are however, several areas in the COA that offer large blocks of forested conditions that are no longer common in the area and home to numerous native plant community types. These areas represent hotspots for biodiversity as identified in the State Wildlife Action Plan and Wildlife Action Network that offer a conservation opportunity to build from.

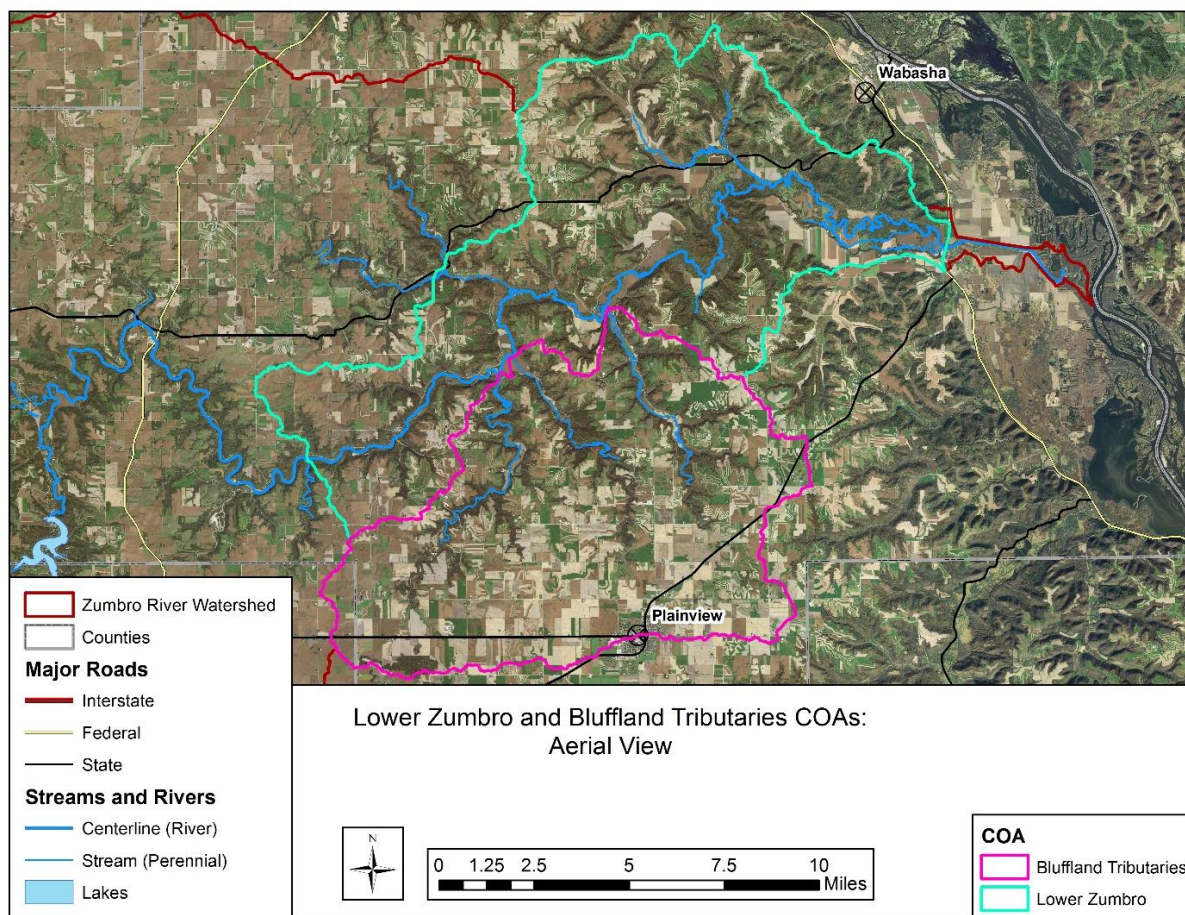


Figure 15. Lower Zumbro and Bluffland Tributaries COAs in the Zumbro River Watershed.

Natural Resource Assessment

Hydrology

The dominant hydrological feature of the Lower Zumbro and Bluffland Tributaries COAs is the lower Zumbro River in addition to all or portions of the Trout Brook, West Indian Creek, Middle Creek, Long Creek, Silver Spring Creek, Spring Creek, and lowest reach of West Albany Creek watersheds. All of these watersheds feature deep valleys with rather significant relief changes from the surrounding uplands (Figure 16). Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system.

Karst features are not as abundant in this COA as other parts of Southeastern Minnesota, yet there are 72-recorded features in the area including sinkholes and springs that feed several of the streams (Figure 17). These geological features 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.

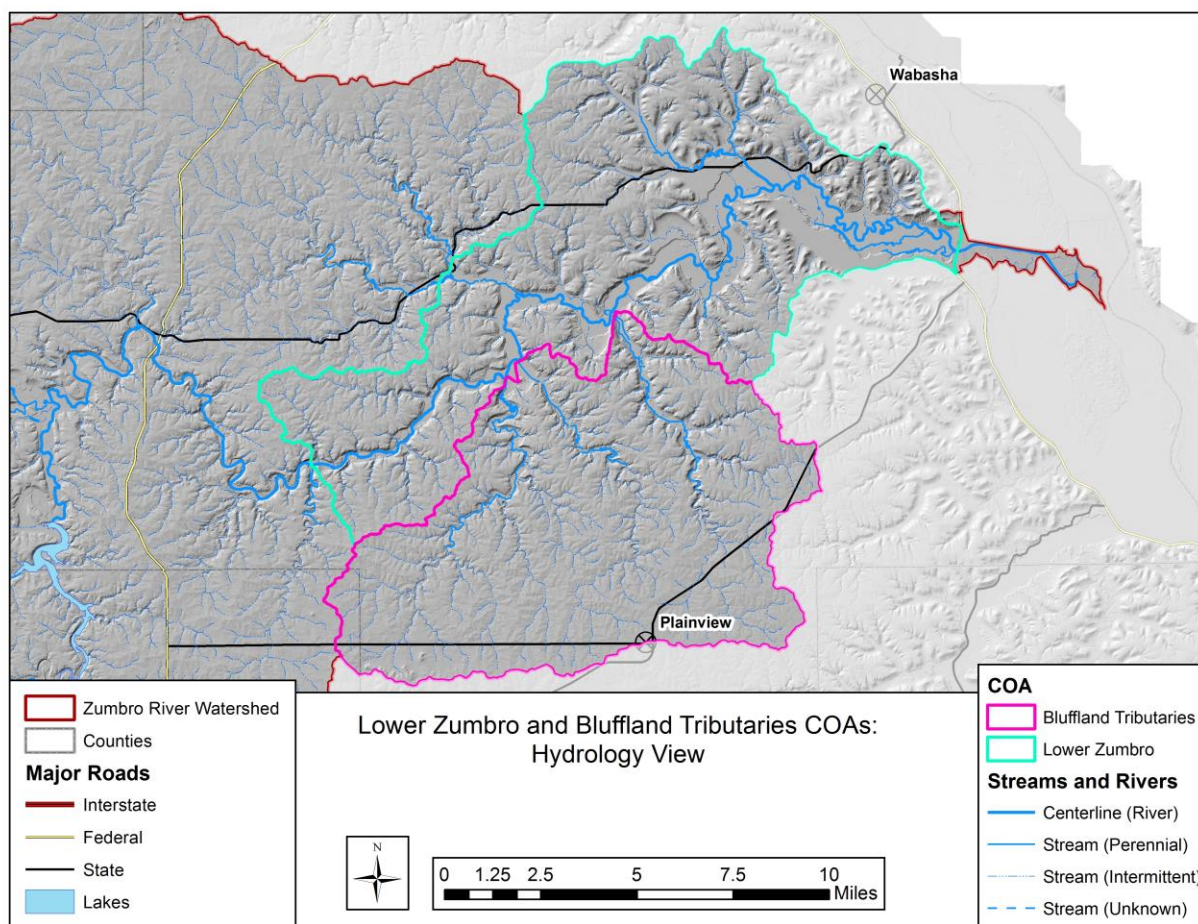


Figure 16. Hydrology of the Lower Zumbro and Bluffland Tributaries COAs.

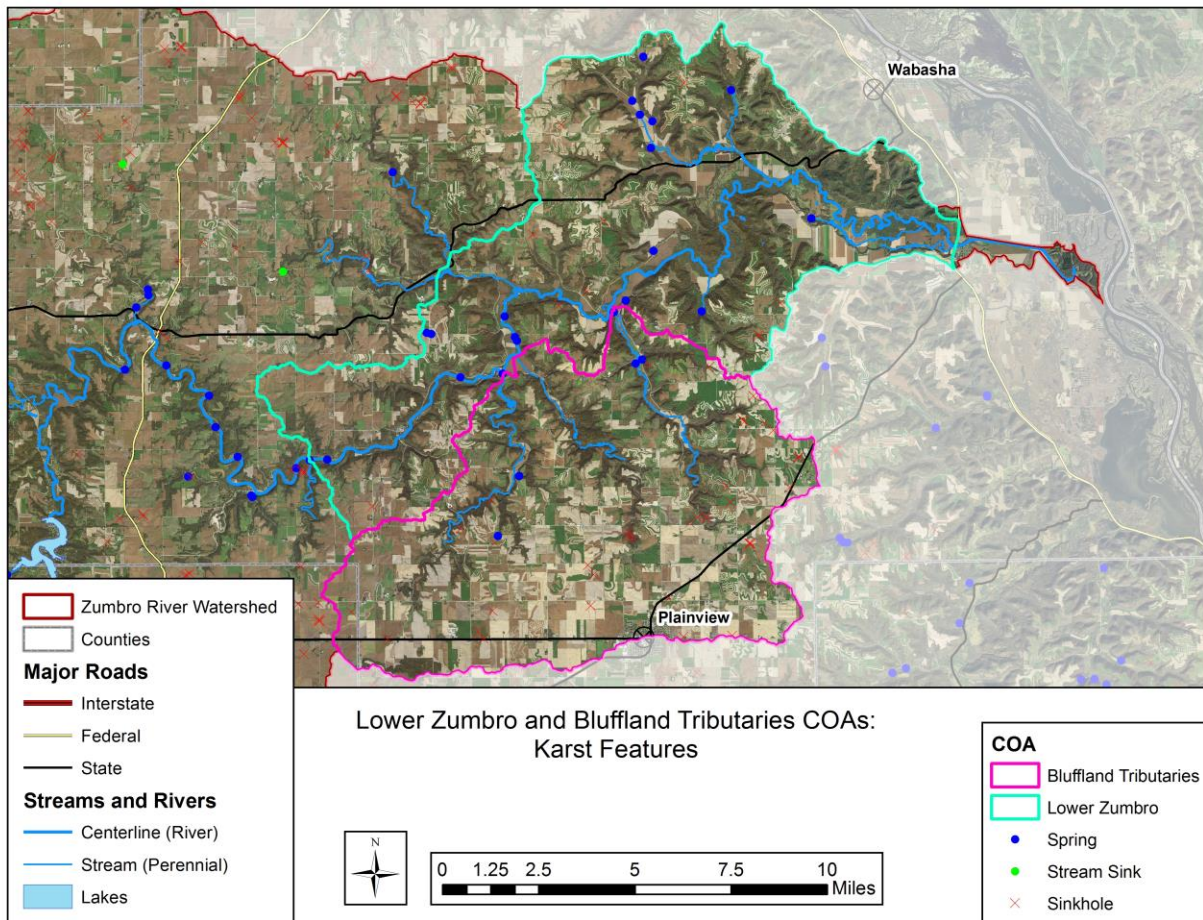


Figure 17. Karst features in the Lower Zumbro and Bluffland Tributaries COAs.

Plant Communities

The Lower Zumbro and Bluffland Tributaries COAs contains over 3,405 acres of Native Plant Communities (NPC) in six different systems and 23 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 7). Mesic hardwoods make up 48% of the identified NPC acres with floodplain forest (33%), fire dependent forest or woodland (9%), and upland prairie (9%) systems also making a significant portion of the total acreage. 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 37 percent of the NPCs in the Lower Zumbro and Bluffland Tributaries COAs are on publicly owned land with many of the privately owned NPCs on parcels near blocks of public land (Figure 18). Private parcels containing NPCs, especially those bordering publicly managed areas, represent an important priority for increased protection and private conservation efforts.

Table 7. Native Plant Communities of the Lower Zumbro and Bluffland Tributaries COAs.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Cliff and Talus	CTs12	Southern Dry Cliff	22	0.6%
	CTs12b	Dry Limestone - Dolomite Cliff (Southern)	4	0.1%
	CTs33a	Mesic Sandstone Cliff (Southern)	1	0.0%
	CTs46a2	Algific Talus: Dolomite Subtype	2	0.1%
Fire Dependent Forest or Woodland	FDs27b	White Pine - Oak Woodland (Sand)	45	1.3%
	FDs38a	Oak - Shagbark Hickory Woodland	250	7.4%
Floodplain Forest	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	563	16.5%
	FFs59c	Elm - Ash - Basswood Terrace Forest	553	16.2%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	98	2.9%
	MHs37a	Red Oak - White Oak Forest	490	14.4%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	274	8.0%
	MHs38a	White Pine - Oak - Sugar Maple Forest	56	1.7%
	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	102	3.0%
	MHs39	Southern Mesic Maple-Basswood Forest	70	2.1%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	174	5.1%
	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	316	9.3%
	MHs49	Southern Wet-Mesic Hardwood Forest	18	0.5%
	MHs49b	Elm - Basswood - Black Ash - (Blue Beech) Forest	46	1.4%
Upland Prairie	UPs13b	Dry Sand - Gravel Prairie (Southern)	39	1.2%
	UPs13c	Dry Bedrock Bluff Prairie (Southern)	101	3.0%
	UPs14b	Dry Sand - Gravel Oak Savanna (Southern)	171	5.0%
	UPs23a	Mesic Prairie (Southern)	6	0.2%
Wet Forest	WFs57b	Black Ash - Sugar Maple - Basswood - (Blue Beech) Seepage Swamp	3	0.1%

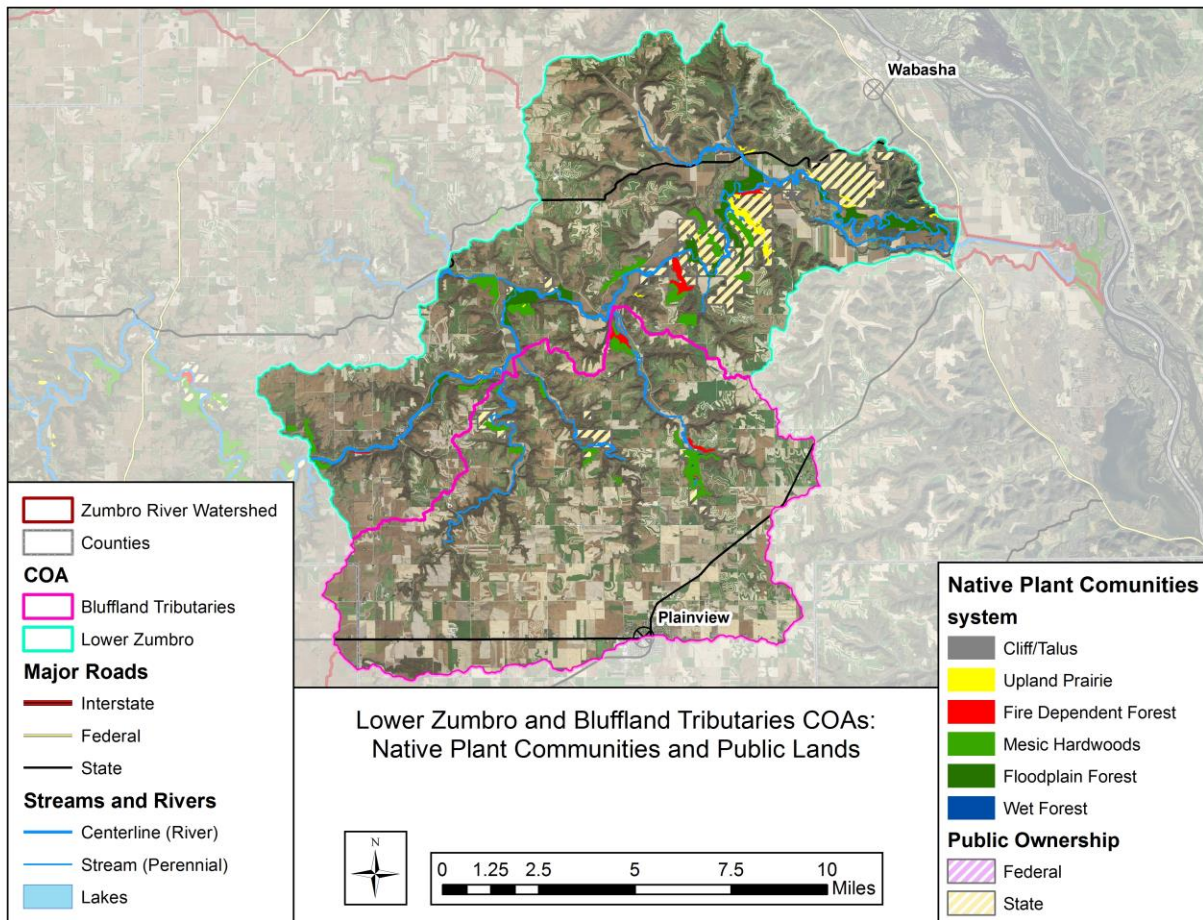


Figure 18. Native Plant Communities on and off public lands in the Lower Zumbro and Bluffland Tributaries COAs.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 67 different occurrences of rare plants, animals, or communities in Lower Zumbro and another 57 in the Bluffland Tributaries (Table 8). 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. Additionally, 36 rare terrestrial communities listed in the Lower Zumbro and 22 listed in the Bluffland Tributaries 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 8. Number of rare species and community occurrences in the Lower Zumbro and Bluffland Tributaries COAs.

Organism Type	Lower Zumbro COA Observations	Blufflands Tributaries COA Observations
Animal Assemblage	2	1
Fungus	0	0
Vascular Plant	28	48
Invertebrate Animal	3	0
Vertebrate Animal	34	8
Terrestrial Community	36	22

Over 15,900 acres of the Lower Zumbro and Bluffland Tributaries COAs have been assessed by the Minnesota Biological Survey for significance to biodiversity in the state (Figure 19). Of that area, nearly 5,700 acres were assigned one of the two highest levels of ‘Outstanding’ or ‘High’ biodiversity significance. The ‘High’ biodiversity areas were scattered throughout the Lower Zumbro river valley however the only area designated as ‘Outstanding’ is along West Indian Creek.

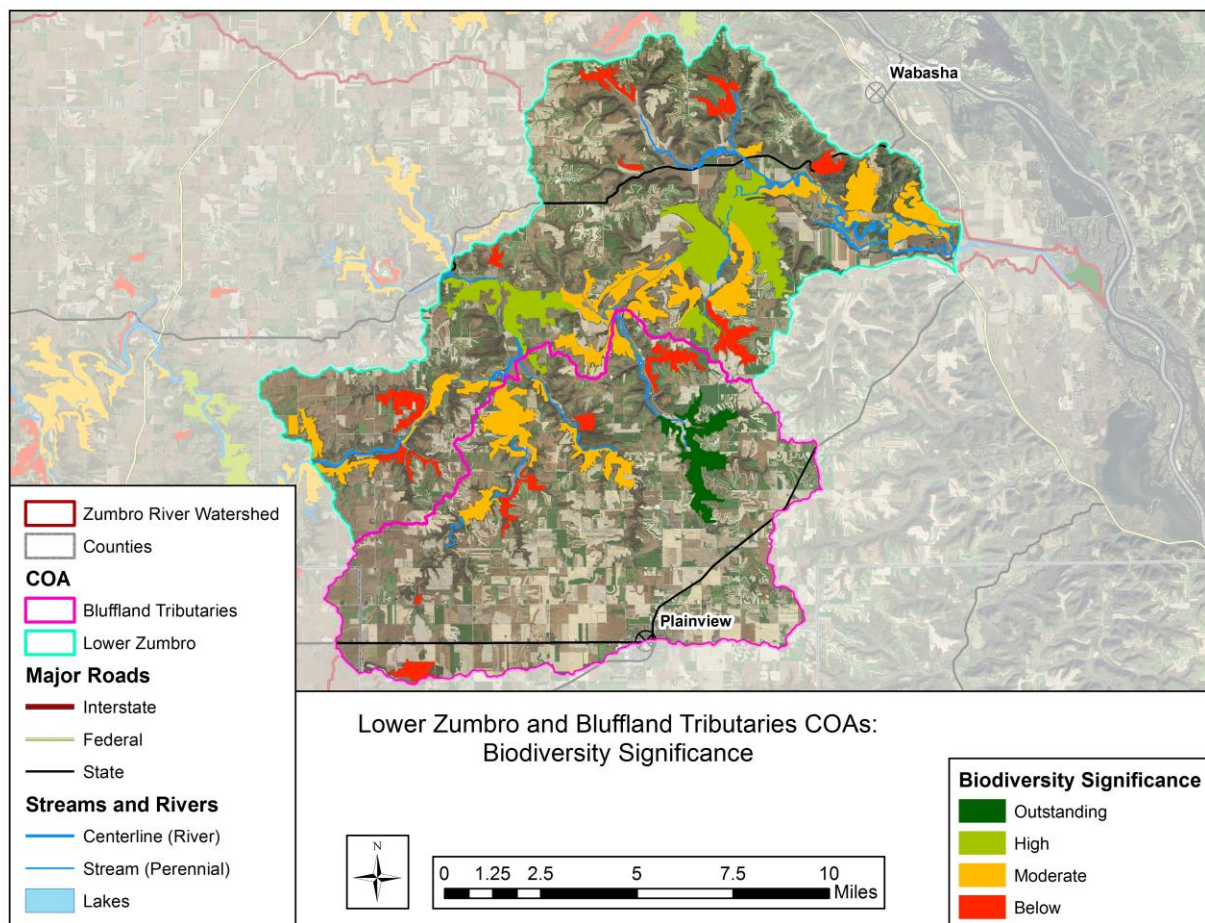


Figure 19. Areas identified by the Minnesota Biological Survey as having biodiversity significance.

Recreation

The Lower Zumbro and Bluffland Tributaries COAs offers opportunities to bike, watch birds, fish, hike, hunt, snowmobile, or ride dirt bike. These outdoor recreation activities contribute to the well-being of residents and support the local economy. A key hub for outdoor recreation in the area is the Zumbro Bottoms which offers 44 miles of horseback riding trails and three equestrian campgrounds. These campgrounds have 72 campsites specifically designed for horses with a hand-pumped well, picket lines, tie rails, and manure disposal areas. This special equestrian area is unique in the state and very popular with horse owners. Hunting is a popular outdoor recreational activity throughout the area on public and private land. Additionally, the Zumbro River is a designated state water trail that is a very popular canoe, kayak, and inner-tube route in the summer. Fishing opportunities abound for both cool and cold-water fish species. 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 portion of the 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:

Although the Lower Zumbro and Bluffland Tributaries COAs are currently relatively rural, the area is within 45 minutes of the City of Rochester which is in the early stages of a multi-billion dollar economic development project called the "Destination Medical Center" (DMC). The DMC is projected to create between 26,800 to 32,200 new jobs directly. 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 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 Zumbro River Watershed but a significant portion of the Lower Zumbro and Bluffland Tributaries COAs have 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 5,900 acres of the Lower Zumbro and Bluffland Tributaries COAs are in public ownership (Table 9, Figure 20). All of this public land is managed by the Minnesota DNR Division of Forestry as part of the Richard J. Dorer Memorial Hardwood State Forest. Despite the relatively large area of public land for the region, private lands still make up nearly 95% 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 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 2,040 acres have a registered stewardship plan in the Zumbro 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 616 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.

Table 9. Estimated land ownership in the Lower Zumbro and Bluffland Tributaries COAs.

Ownership	Acres	Percent of Public	Percent of COA
Private	101,707	--	94.5%
MN DNR Division of Forestry	5,867	100%	5.5%

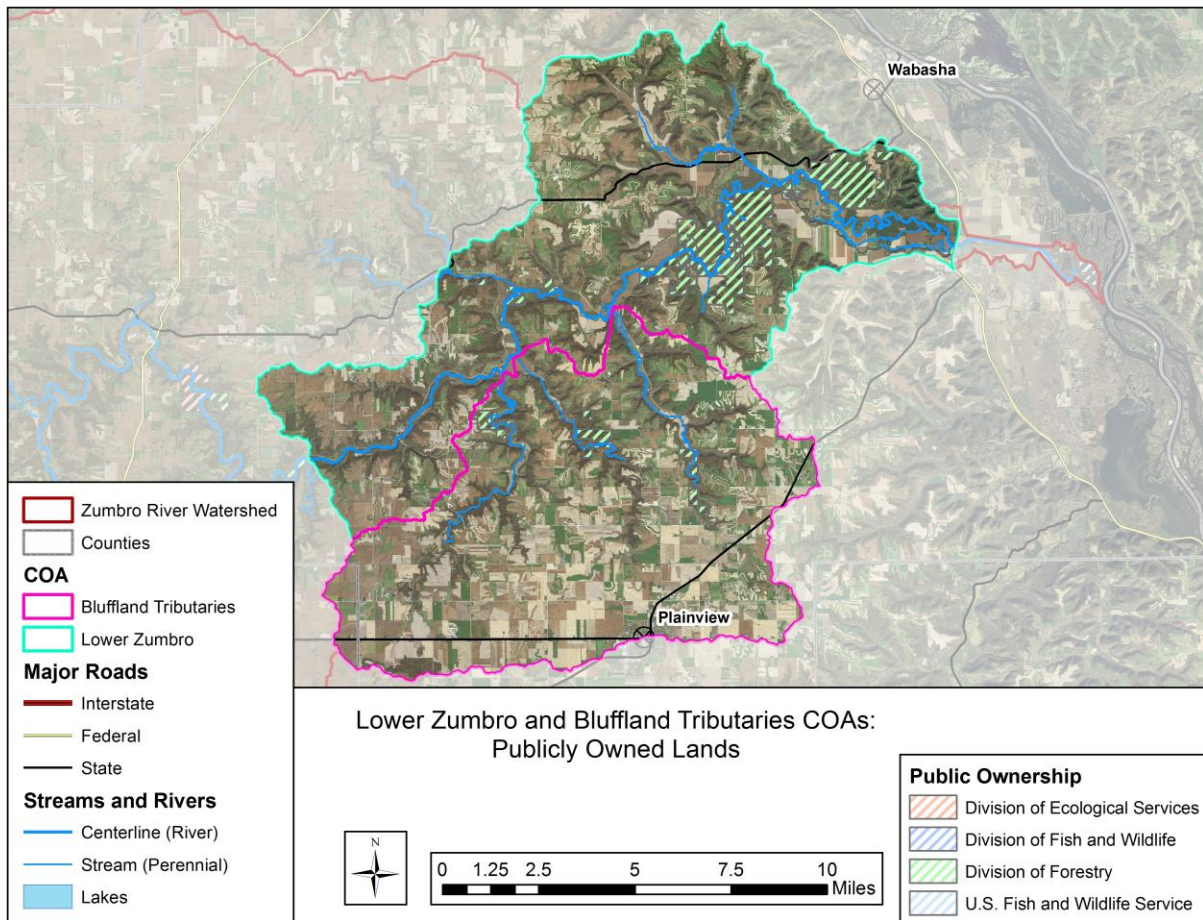


Figure 20. Public land in the Lower Zumbro and Bluffland Tributary COAs.

Land Cover and Use

About 24 percent of the Lower Zumbro and Bluffland Tributaries COAs was covered by prairie at the time of European settlement and the rest existed in some type of forest ranging from oak savanna openings to dense mesic hardwood forests (Table 10, Figure 21). Today the land use patterns in the COAs follows 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 (35.6%), deciduous forest (23.3%), pasture/hay (19.0%), and grassland/herbaceous (13.8%) cover is also significant (Table 11).

Table 10. Presettlement land cover in the Lower Zumbro and Bluffland Tributaries COAs.

Land Type	Acres	Percent
Aspen-Oak Land	4,600	4%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	5,644	5%
Brush Prairie	5,825	5%
Oak openings and barrens	58,441	54%
Prairie	25,825	24%
River Bottom Forest	7,239	7%

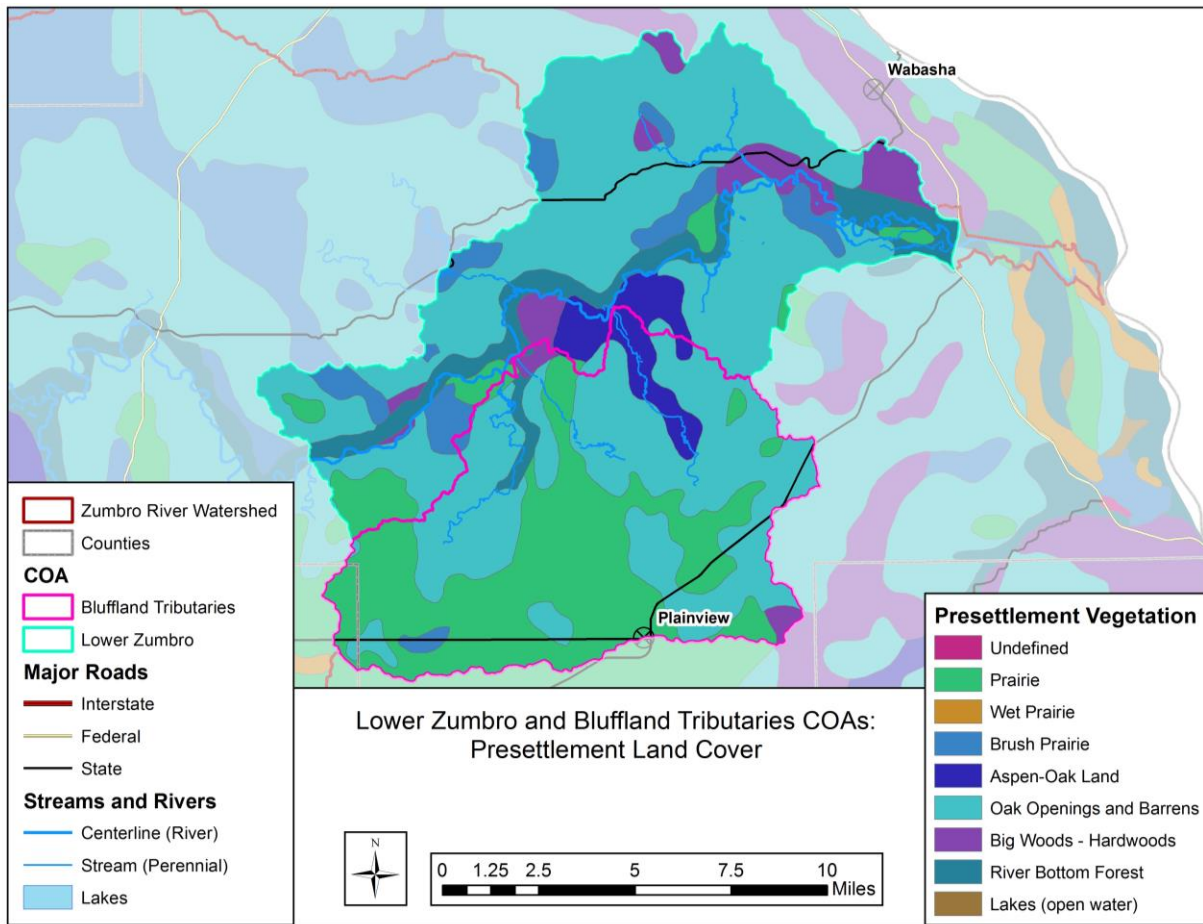


Figure 21. Presettlement land cover in the Lower Zumbro and Bluffland Tributaries COAs based on the work of Francis J. Marschner.

Table 11. Current land cover in the Lower Zumbro and Bluffland Tributaries COAs.

Land Cover Class	Acres	Percent of COAs
Cultivated Crops	38,329	35.6%
Deciduous Forest	25,096	23.3%
Hay/Pasture	20,418	19.0%
Herbaceous	14,816	13.8%
Developed, Open Space	3,216	3.0%
Woody Wetlands	2,524	2.3%
Emergent Herbaceous Wetlands	1,129	1.0%
Developed, Low Intensity	834	0.8%
Open Water	669	0.6%
Developed, Medium Intensity	202	0.2%
Evergreen Forest	178	0.2%
Barren Land	50	0.0%
Mixed Forest	41	0.0%
Developed, High Intensity	38	0.0%
Shrub/Scrub	36	0.0%

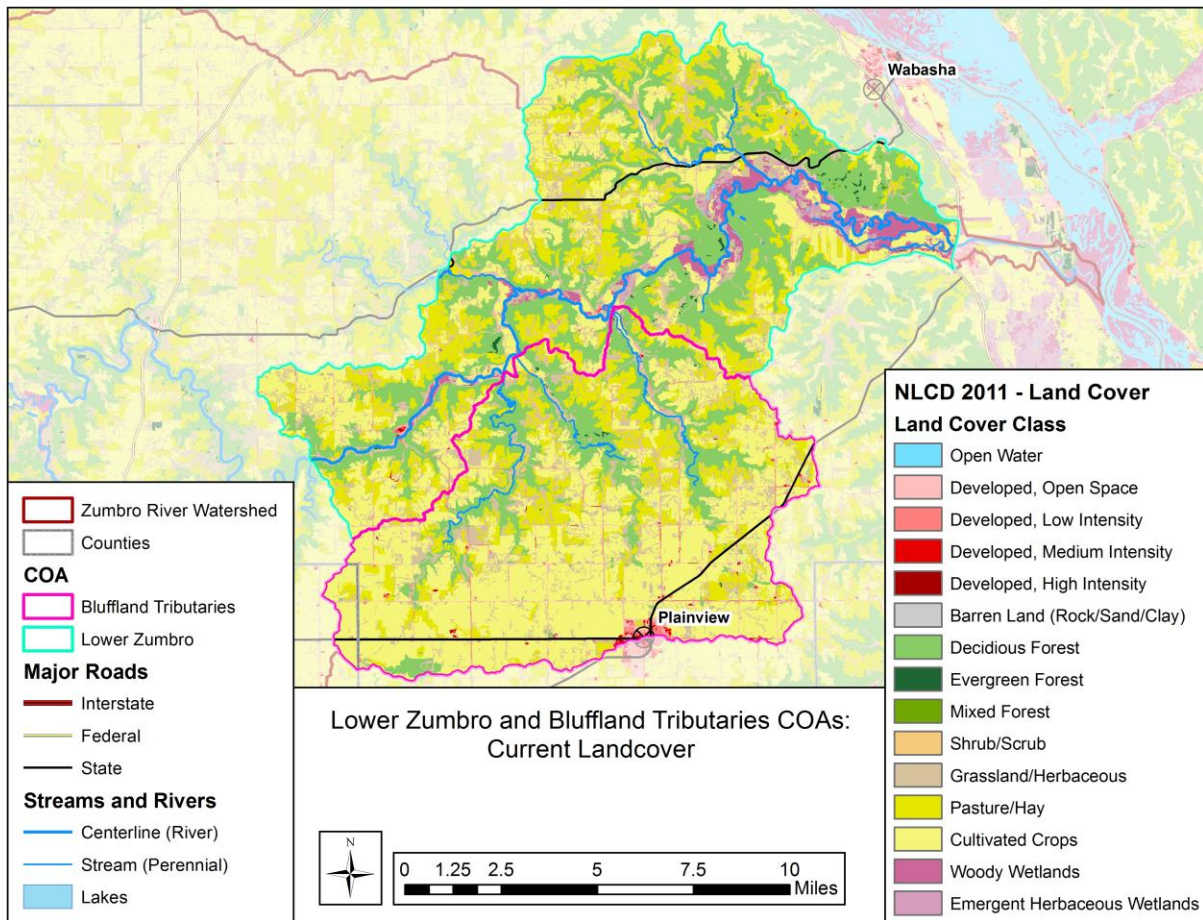


Figure 22. Current land cover in the Lower Zumbro and Bluffland Tributaries COAs based on the 2011 National Land Cover Database.

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 Zumbro and Bluffland Tributaries COAs 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 identified key stewardship parcels in the COA that met the following conditions:

- Parcels larger than 40 acres in size
- Include an area of moderate, high, or outstanding biodiversity significance as delineated by the MBS

There were 134 such parcels within Lower Zumbro and Bluffland Tributaries COAs, covering over 14,800 acres, with 90 unique owners listed (Figure 23). Average size among priority parcels was 110 acres.

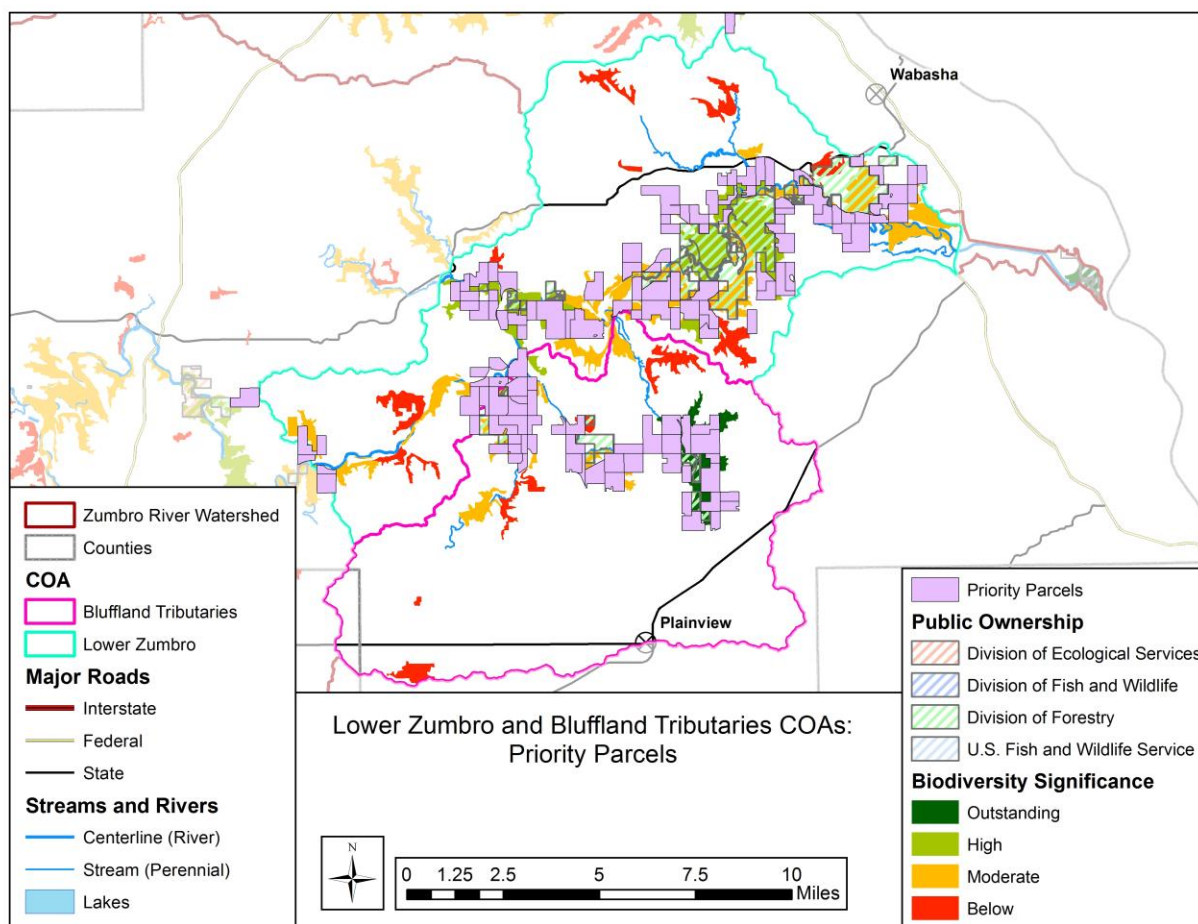


Figure 23. Priority parcels in the Lower Zumbro and Bluffland Tributaries COAs.

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 Area Maintenance and 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.
- 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.
- 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.

Southern Headwaters Conservation Opportunity Area

Overview

The Southern Headwaters COA is composed of two areas near Rochester (Figure 24). The eastern unit occupies the US Highway 14 corridor east of Rochester near Chester Woods. The western unit extends southwest from Rochester along the South Fork of the Zumbro towards the town of Rock Dell. These two units encompass nearly 55,000 acres in the watersheds of Goose Creek, Bear Creek and the South Fork of the Zumbro. Key natural areas in the Southern Headwaters COA include Chester Woods County Park, Keller WMA, Marian Marshall WMA, Nelson Fen WMA, and Suess WMA. According to data from the Public Land Survey, 92% of this area was covered by either open prairie or oak savanna type habitat. Much of this region has been converted to agriculture however; the remnants of the region's natural communities represent a conservation opportunity to build from.

A primary focus in this COA is to protect the water quality of the Zumbro River and local groundwater supply, especially as it pertains to the drinking water of Rochester. Riparian areas, calcareous fens, and forested ecosystems in this COA represent hotspots for biodiversity as identified in the Wildlife Action Network and represent opportunities to protect regional drinking water. The Minnesota Biological Survey has designated substantial portions of the COA as having biodiversity significance, and an opportunity exists for successful private land conservation efforts. Acquisition efforts should focus on landscape features that impact local groundwater quality. Efforts should also be made to avoid commercial and residential development along the Decorah Edge.

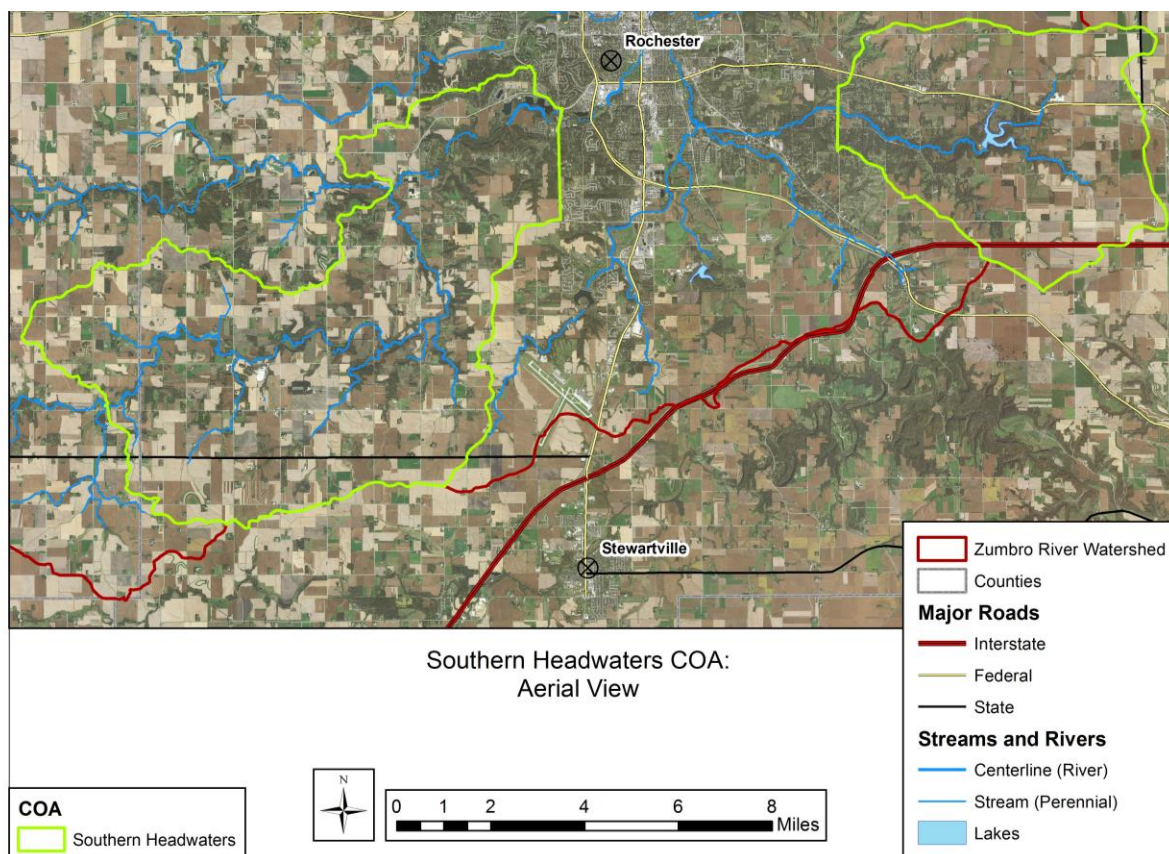


Figure 24. Southern Headwaters COA in the Zumbro River Watershed.

Hydrology

The dominant hydrological features of the Southern Headwaters COA are the South Fork of the Zumbro River and two significant tributaries: Bear and Goose Creek. Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed these major hydrological features (Figure 25). Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system. Additionally, this COA contains a series of karst features (Figure 26) that 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.

A landscape feature known as the Decorah Edge plays a significant role in the hydrology of this COA and the surrounding area. The Decorah Edge is formed where groundwater that has been slowly flowing atop the impermeable Decorah shale reaches a sidehill where it spills over this impermeable surface and then reenters the groundwater below. This “edge” sustains a biologically diverse ecosystem and naturally filters the groundwater that supplies drinking water for the region’s cities and farms. These flowing waters are most evident during wet periods when seeps and springs discharge along hillsides. They can also be seen in excavations and in basements of homes located on the hillsides. This feature works as a natural filter removing pollutants from water as it flows through the soils, vegetation, and wetlands that overlie the shale bed. This filtration is a valuable economic asset for the region. In addition to removing pollutants from groundwater, filtration processes at the Decorah Edge also purify seep and spring water discharges that form the surrounding waterways.

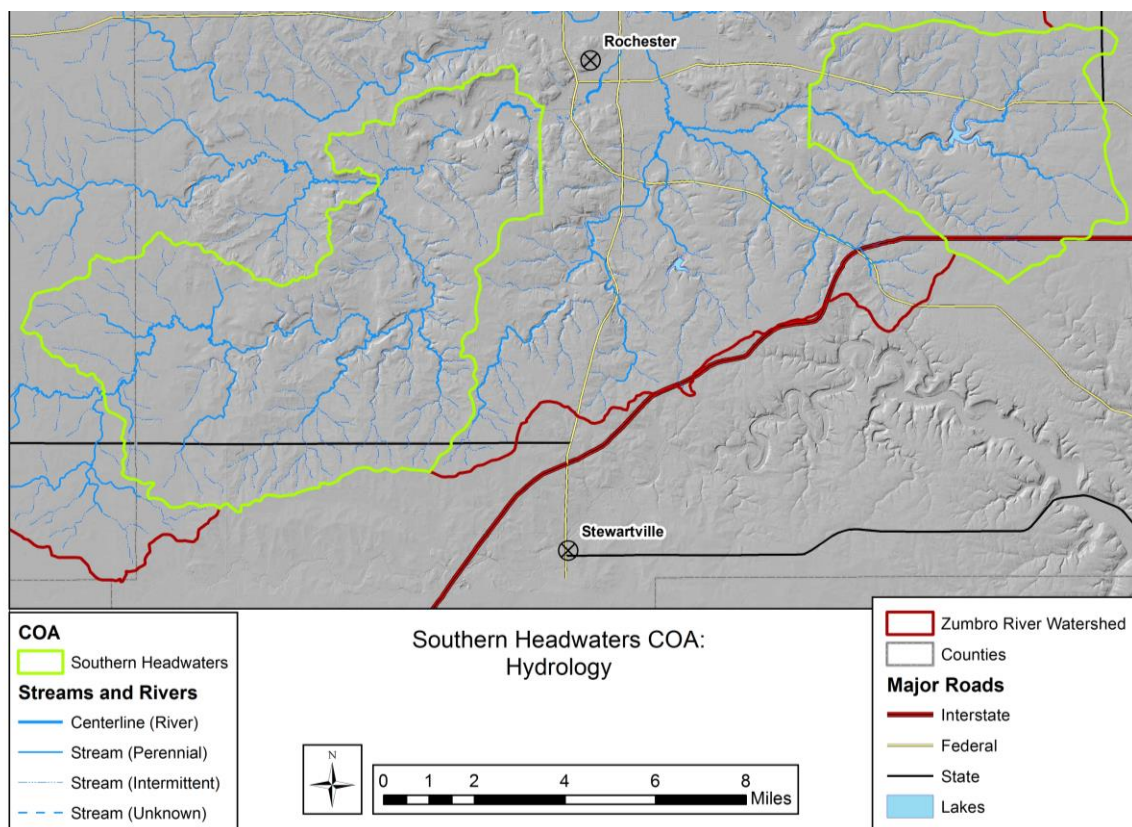


Figure 25. Hydrology of the Southern Headwaters COA.

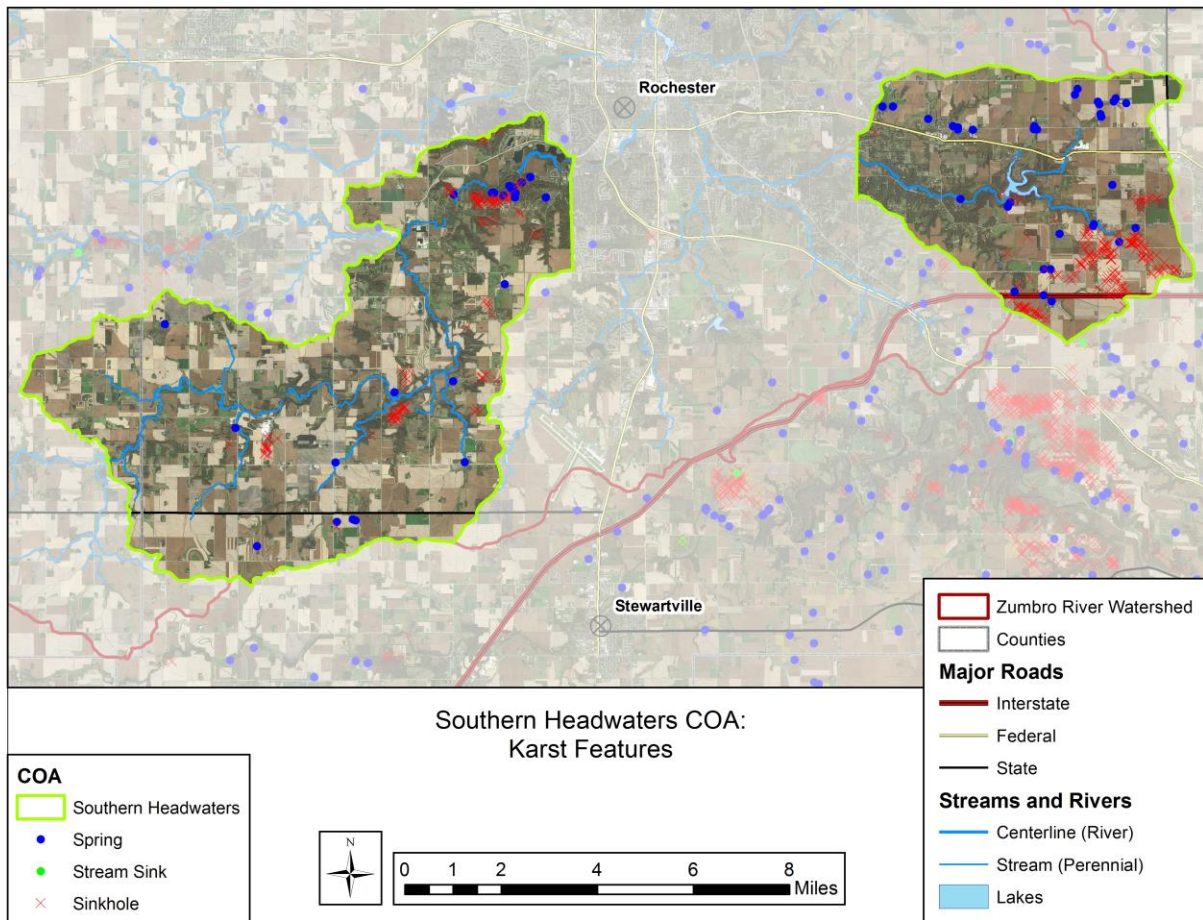


Figure 26. Karst features in the Southern Headwaters COA.

Plant Communities

The Southern Headwaters COA contains almost 1,150 acres of Native Plant Communities (NPC) in six different systems and 18 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 12). Floodplain forest make up 35% of the identified NPC acres with mesic hardwoods (31%) and fire dependent forest or woodland (18%) 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 68 percent of the NPCs in the Southern Headwaters COA are on publicly owned land, with many of the privately owned NPCs on parcels near the blocks of public land (Figure 27). Private parcels containing NPCs, especially those bordering publicly managed areas, represent an important priority for increased protection and private conservation efforts.

Table 12. Native Plant Communities of the Southern Headwaters COA.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Fire Dependent Forest or Woodland	FDs27b	White Pine - Oak Woodland (Sand)	23.1	2.0%
	FDs27c	Black Oak - White Oak Woodland (Sand)	148.3	13.0%
	FDs38a	Oak - Shagbark Hickory Woodland	30.8	2.7%
Floodplain Forest	FFs59	Southern Terrace Forest	51.1	4.5%
	FFs59c	Elm - Ash - Basswood Terrace Forest	346.6	30.4%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	107.6	9.4%
	MHs37a	Red Oak - White Oak Forest	117.1	10.3%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	23.3	2.0%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	10.3	0.9%
	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	79.5	7.0%
	MHs49	Southern Wet-Mesic Hardwood Forest	20.2	1.8%
Open Rich Peatland	OPp93c	Calcareous Fen (Southeastern)	18.1	1.6%
Upland Prairie	UPs13a	Dry Barrens Prairie (Southern)	29.8	2.6%
	UPs13b	Dry Sand - Gravel Prairie (Southern)	4.6	0.4%
	UPs13c	Dry Bedrock Bluff Prairie (Southern)	22.2	1.9%
	UPs14a2	Dry Barrens Oak Savanna (Southern): Oak Subtype	6.3	0.6%
Wet Meadow or Carr	WMn82b	Sedge Meadow	31.2	2.7%
	WMs83a1	Seepage Meadow/Carr Tussock: Sedge Subtype	71.6	6.3%

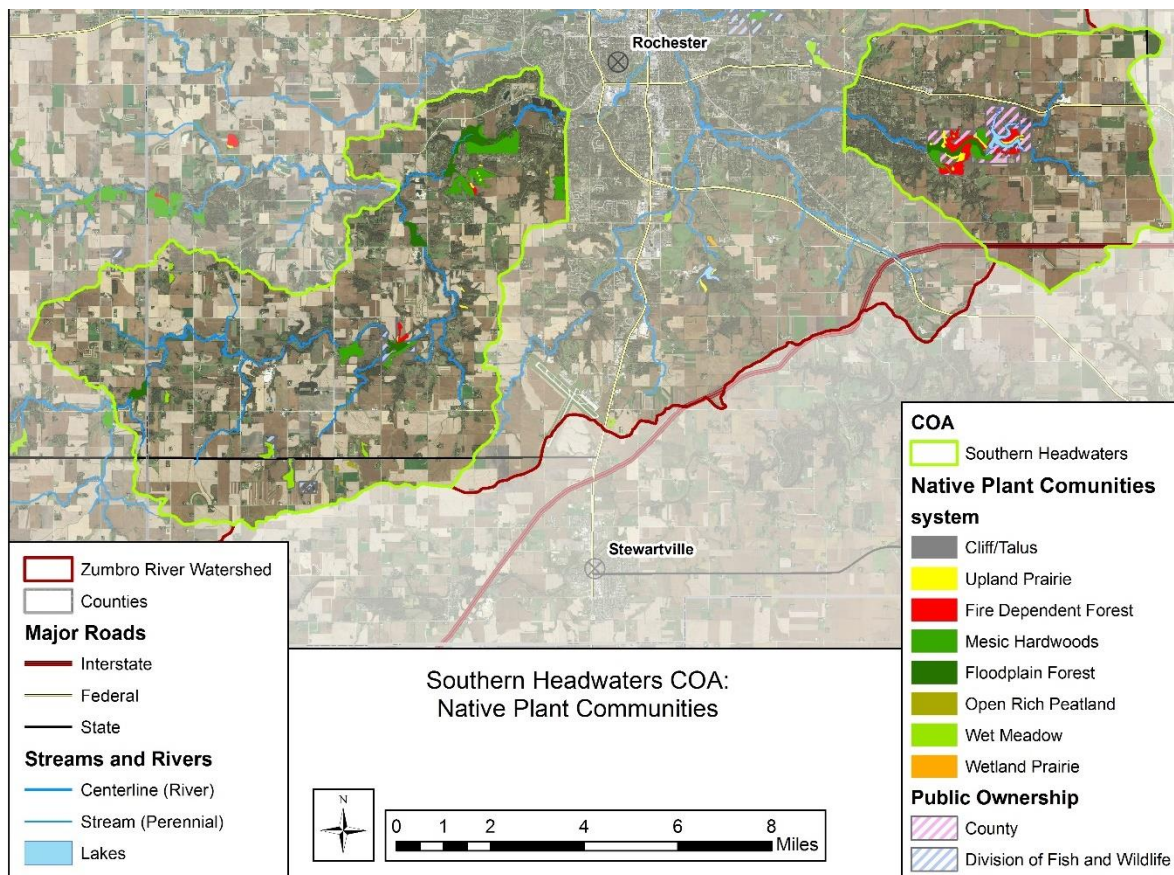


Figure 27. Native Plant Communities on and off public lands in the Southern Headwaters COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 69 different occurrences of rare plants, animals, or communities in the western unit of the Southern Headwaters COA and another 19 in the eastern unit (Table 13). 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 near future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota. Eight rare terrestrial communities are listed in each unit of the Southern Headwaters 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 13. Number of rare species and community occurrences in the Southern Headwaters COA.

Organism Type	Eastern Unit Observations	Western Unit Observations
Vascular Plant	12	19
Invertebrate Animal		7
Vertebrate Animal	7	43
Terrestrial Community	8	8

Over 3,200 acres of the Southern Headwaters COA have been assessed by the Minnesota Biological Survey for its significance to biodiversity in the state (Figure 28). Of that area, nearly 650 acres were given the highest level of 'Outstanding'. The outstanding areas are concentrated around Chester Woods in the eastern unit and the calcareous fens in the western unit.

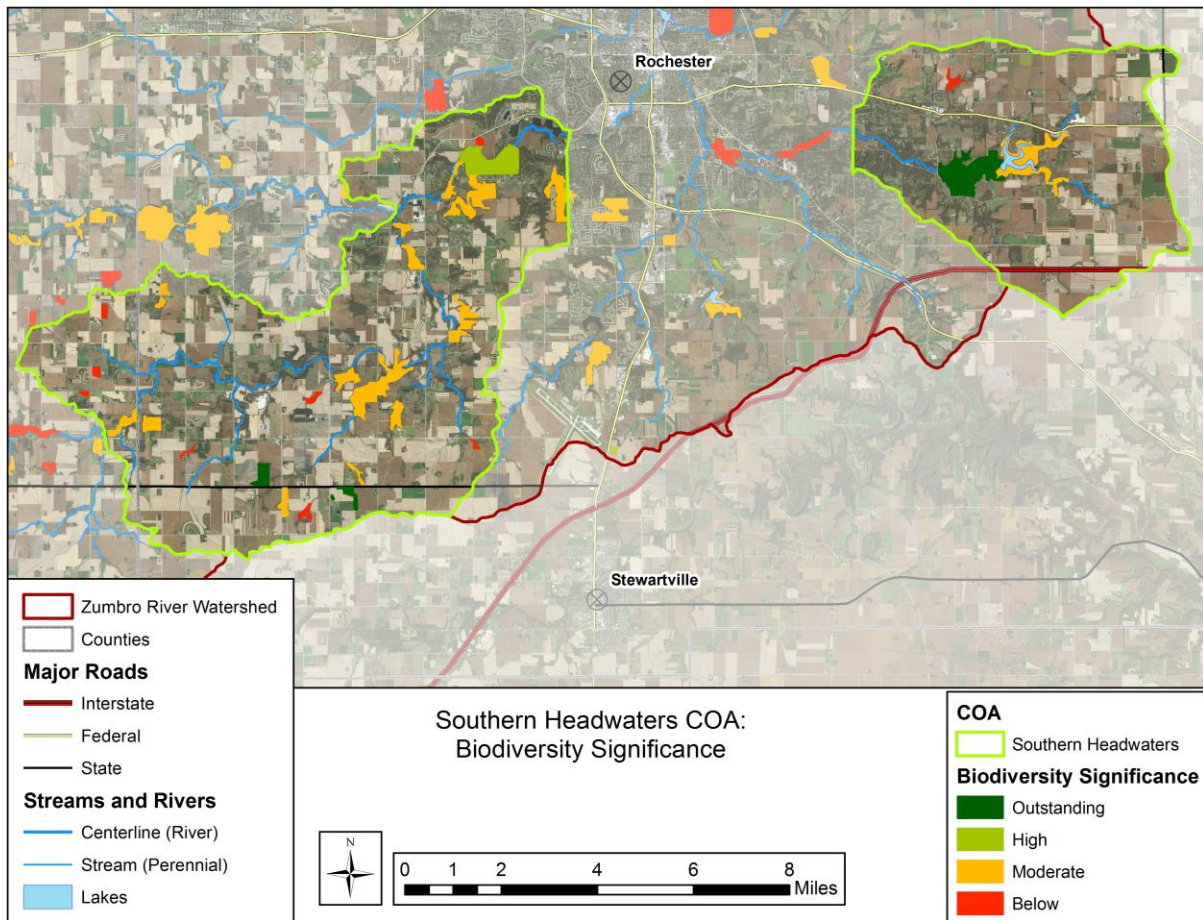


Figure 28. Areas identified by the Minnesota Biological Survey as having biodiversity significance in the Southern Headwaters COA.

Recreation

There are a number of important outdoor recreation areas in the Southern Headwaters COA that contribute to the well-being of residents and support the local economy. Chester Woods County Park offers a 52-unit campground and approximately 12 miles of primitive trails winding through a variety of natural habitats. In addition, a mile long hard surfaced trail links the campground, boat launch, fishing pier, and picnic areas. The western unit has several Wildlife Management Areas (WMA) that are popular locations for hunting, hiking and birdwatching. Hunting is a popular outdoor recreational activity throughout the area on public and private land. Additionally, the Zumbro River is a designated state water trail that is a popular canoe and kayak route in the summer. Both units offer fishing opportunities.

Environmental Threats

Development pressures:

The City of Rochester is located on the edge of both units of this COA and is in the early stages of a multi-billion dollar economic development project called the “Destination Medical Center” (DMC). The DMC is projected to create between 26,800 to 32,200 new jobs directly. 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.

Development in the Decorah Edge:

In the urbanizing areas around Rochester, the Decorah Edge is under increasing development pressure. Disturbance of groundwater flows and removal of vegetation associated with development may jeopardize the ability of this important natural resource to both supply groundwater and to purify it.

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 Zumbro River Watershed but a significant portion of the Southern Headwaters 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 Southern Headwaters 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

Over 1,700 acres of the Southern Headwaters COA are in public ownership (Table 14, Figure 29). Much of this public land exists in one parcel, Olmstead County's Chester Woods (1,300 acres). The remaining 97% of the COA 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 in this COA. 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 432 acres have a registered stewardship plan in the Southern Headwaters 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 195 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.

Table 14. Land ownership in the Southern Headwaters COA.

Ownership	Acres	Percent of Public	Percent of COA
Private	1,300	--	96.9%
Olmstead County	52,811	76.3%	2.4%
Division of Fish and Wildlife	404	23.7%	0.7%

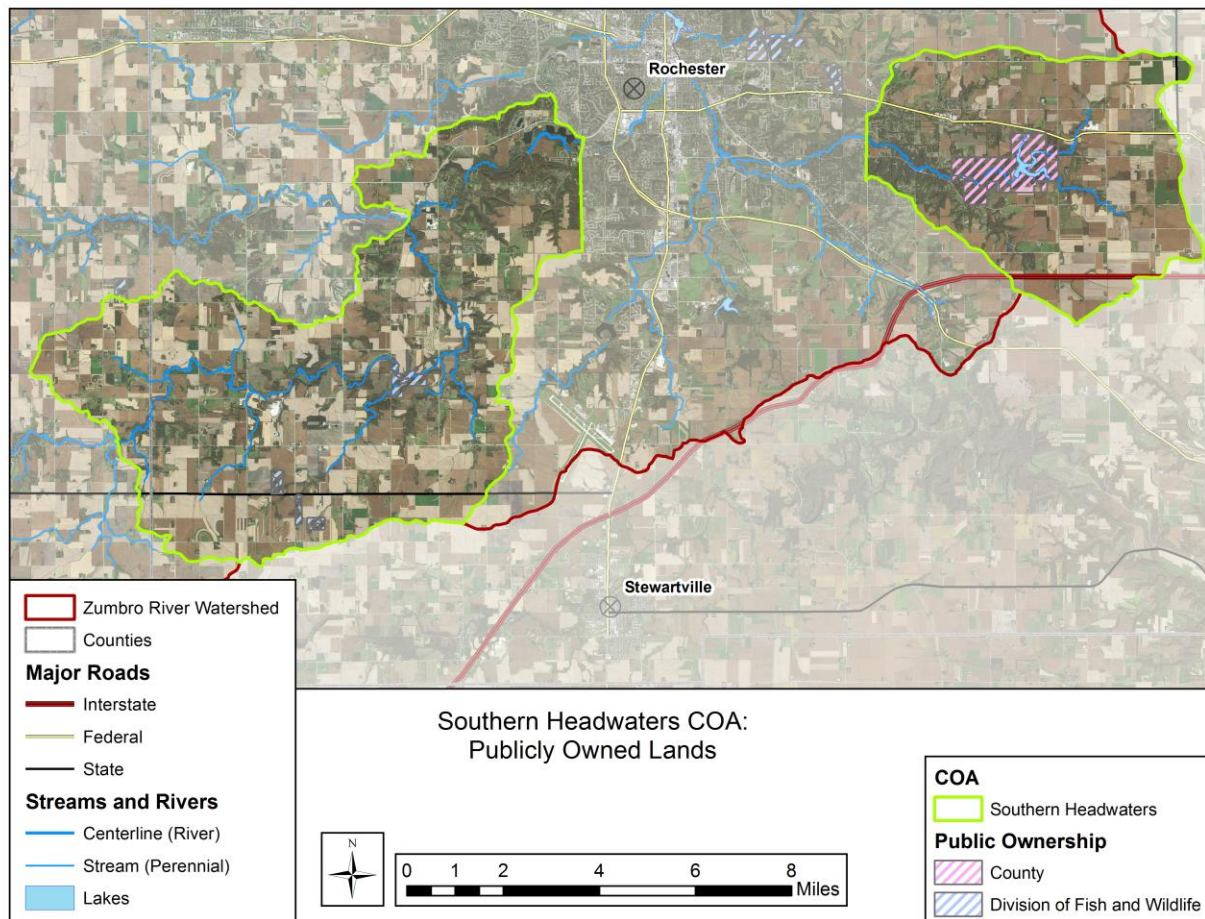


Figure 29. Public land in the Southern Headwaters COA.

Land Cover and Use

Ninety-two percent of the Southern Headwaters COA was covered in prairie or semi-open oak savanna habitat at the time of European settlement (Table 15, Figure 30). Exceptions included floodplain forest along the Zumbro River and a more closed canopy forest on the outskirts of present day Rochester.

Today the land use patterns in the Southern Headwaters 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 31). Residential and commercial development is scattered throughout this COA due to its proximity to Rochester. Major cover types are cultivated crops (49.4%) and grassland/herbaceous (20.7%). Pasture/hay (11.5%) and deciduous forest (11.4%) cover are also significant in this landscape (Table 16).

Table 15. Presettlement land cover in the Southern Headwaters COA

Land Type	Acres	Percent
Oak openings and barrens	26,822	49%
Aspen-Oak Land	4,086	7%
Brush Prairie	7,190	13%
River Bottom Forest	490	1%
Prairie	15,928	29%

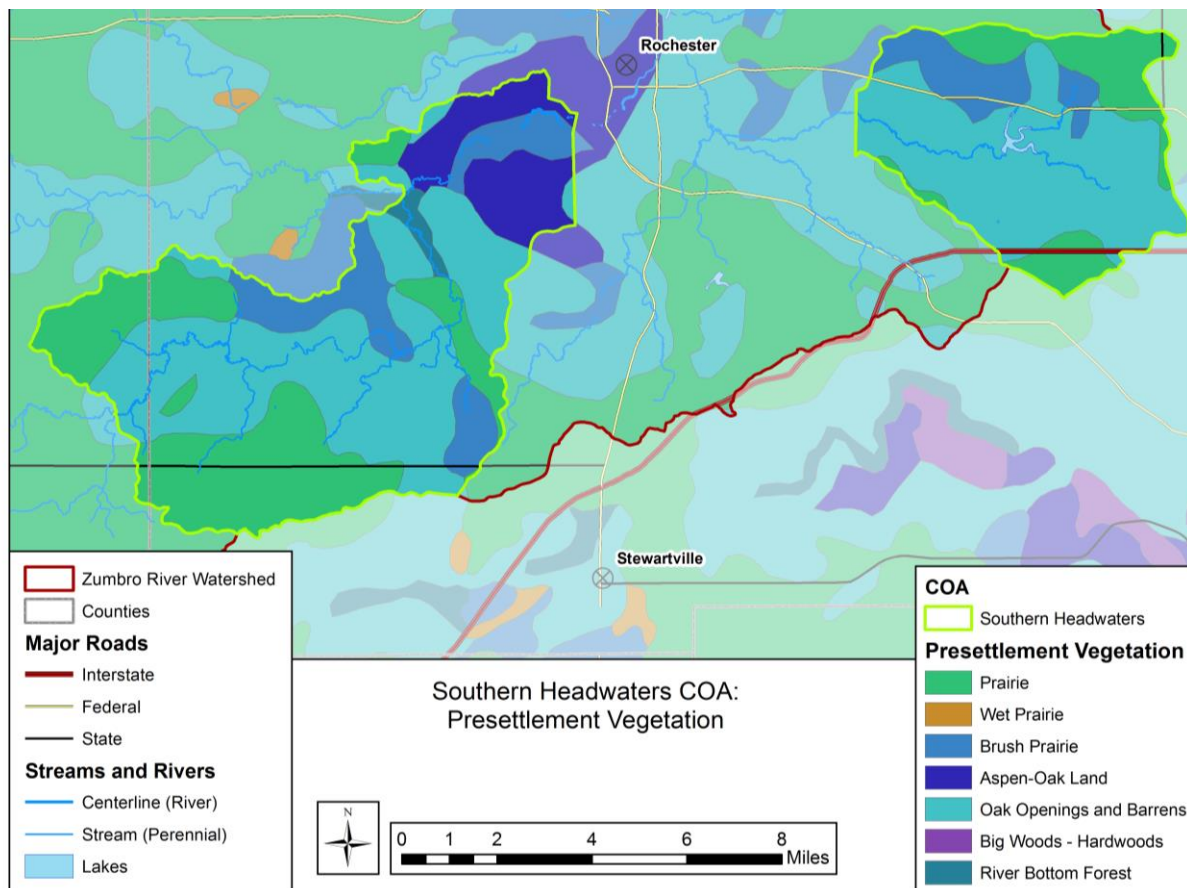


Figure 30. Presettlement land cover in the Southern Headwaters COA based on the work of Francis J. Marschner.

Table 16. Current land cover in the Southern Headwater COA.

Land Cover Class	Acres	Percent of COAs
Cultivated Crops	26,918	49.4%
Herbaceous	9,504	17.4%
Hay/Pasture	6,264	11.5%
Deciduous Forest	6,232	11.4%
Developed, Open Space	2,818	5.2%
Developed, Low Intensity	1,098	2.0%
Woody Wetlands	932	1.7%
Open Water	247	0.5%
Developed, Medium Intensity	171	0.3%
Emergent Herbaceous Wetlands	163	0.3%
Barren Land	76	0.1%
Evergreen Forest	60	0.1%
Developed, High Intensity	28	0.1%
Shrub/Scrub	8	0.0%

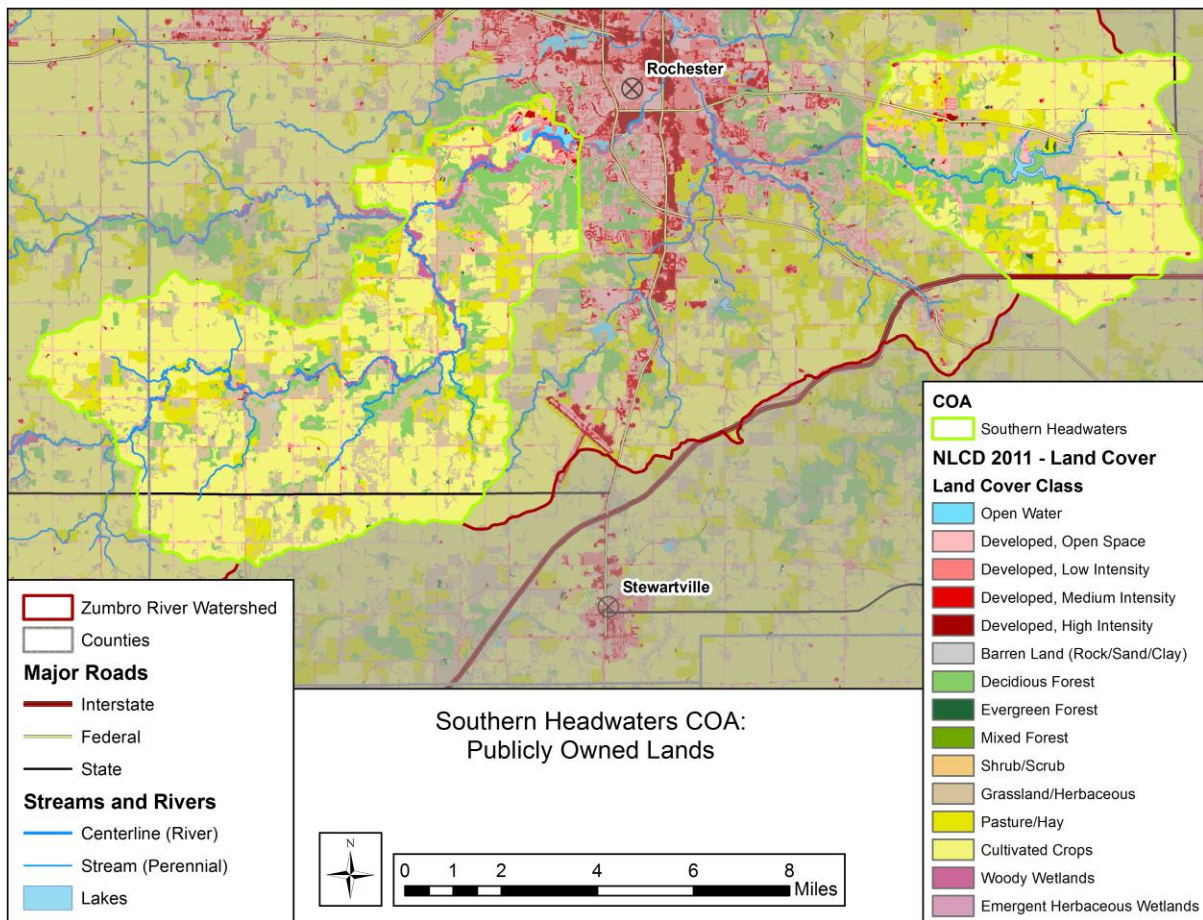


Figure 31. Current land cover in the Southern Headwaters COA based on the 2011 National Land Cover Database.

Desired Future Conditions

- Key areas associated with producing high quality drinking water such as fens and the Decorah Edge are protected with native vegetation. These areas continue to provide high quality plant and wildlife habitat as well as protecting area groundwater quality.
- Residential and commercial development take into account underlying hydrology and avoid areas such as the Decorah Edge.
- The watershed's hydrology is restored by increasing storage through wetland restoration and watershed wide improvements to soil health and reduced drainage, as well as installation of small retention ponds.
- 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 Southern Headwaters 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 identified key stewardship parcels in the COA that met the following conditions:

- Parcels larger than 40 acres in size
- Include an area of moderate, high, or outstanding biodiversity significance as delineated by the MBS

There were 57 such parcels within Southern Headwaters COA, covering nearly 6,000 acres, with 49 unique owners listed (Figure 32). Average size among priority parcels was 105 acres. In addition to these larger parcels, efforts should be particularly focused on and around area fens.

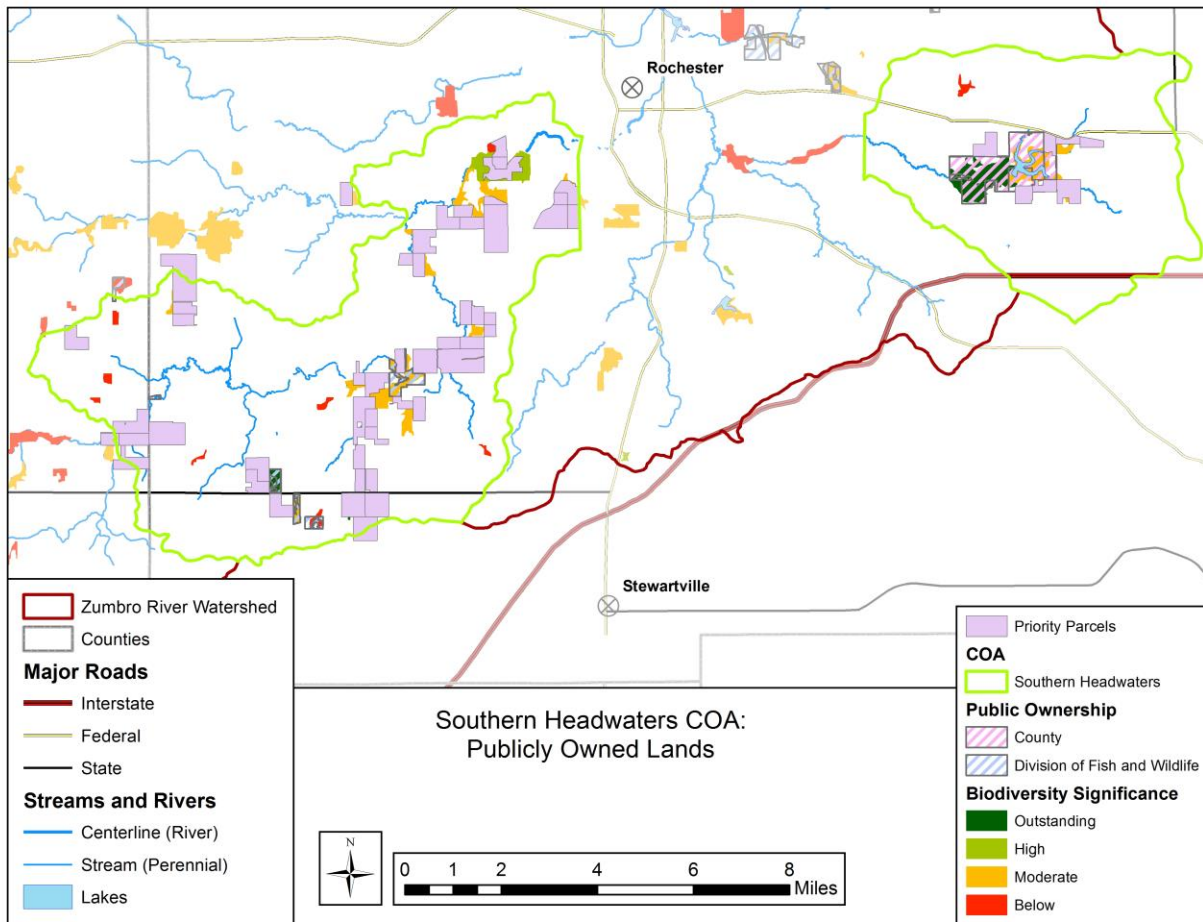


Figure 32. Priority parcels in the Southern Headwaters COA.

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.

Protection of Calcareous Fens

Calcareous fens are rare and distinctive wetlands characterized by a substrate of non-acidic peat and dependent on a constant supply of cold, oxygen-poor groundwater rich in calcium and magnesium bicarbonates. This calcium-rich environment supports a rare plant community. These fens typically occur on slight slopes where upwelling water eventually drains away and where surface water inputs are minimal. These fens are highly susceptible to disturbance.

Stewardship Activities:

On all lands:

- Control invasive species, particularly reed canary grass in and around these communities
- Reduce shrubs that can compete with the rare native vegetation.

- Reduce or eliminate human and livestock activity in fens. The soft, saturated character of the peat makes almost any level of activity within them, by humans or domestic livestock, highly disruptive.
- Where possible, increase size and connectivity of natural habitat around fens.

Protection of the Decorah Edge

Development in and around the Decorah Edge may jeopardize its ability to both supply groundwater and to purify it. Additionally, buildings in this area often suffer from excess water issues.

On all lands:

- Limit development in and around the Decorah Edge.
- Maintain native vegetation in this area
- Map the extent of this feature
- Work with regional planning and zoning to control development in and around this feature.
- Pursue strategic conservation easements.
- Where possible, increase size and connectivity of natural habitat around the Decorah Edge.

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.

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.
- 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.
- Find opportunities to restore wetland storage areas in riparian zones to help improve stream hydrology.

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.
- 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.

Zumbro Falls Conservation Opportunity Area

Overview

The Zumbro Falls COA includes Lake Zumbro and the area around the small towns of Hammond, Mazeppa, and Zumbro Falls (Figure 33). This COA encompasses nearly 61,500 acres in the watersheds of Dry Run Creek, Lake Zumbro, Mazeppa Creek, North Fork of the Zumbro River, and the main stem of the Zumbro River after it merges with the North Fork. Key public natural areas in the Zumbro Falls COA include the Isaac Walton League WMA, Zumbro Falls Woods WMA, and a few parcels of the Richard J. Dorer Memorial Hardwood Forest.

According to data from the Public Land Survey, 73% of this area was covered by either open prairie or oak savanna type habitat. Much of this region has been converted to agriculture however; the remnants of the region's natural communities represent a conservation opportunity to build from.

A primary focus in this COA is to protect the areas of biodiversity significance that exist in the river valley. Riparian areas and forested ecosystems represent hotspots for biodiversity in this COA as identified in the Wildlife Action Network. The Minnesota Biological Survey has designated substantial portions of the COA as having biodiversity significance, and an opportunity exists for successful private land conservation efforts. With the low percentage of publicly owned land in the COA, priority should be placed on private land stewardship efforts. Parcel acquisition should focus on sites of high or outstanding biodiversity significance and those in close proximity to protected land, in order to enhance to size and connectivity of those habitats.

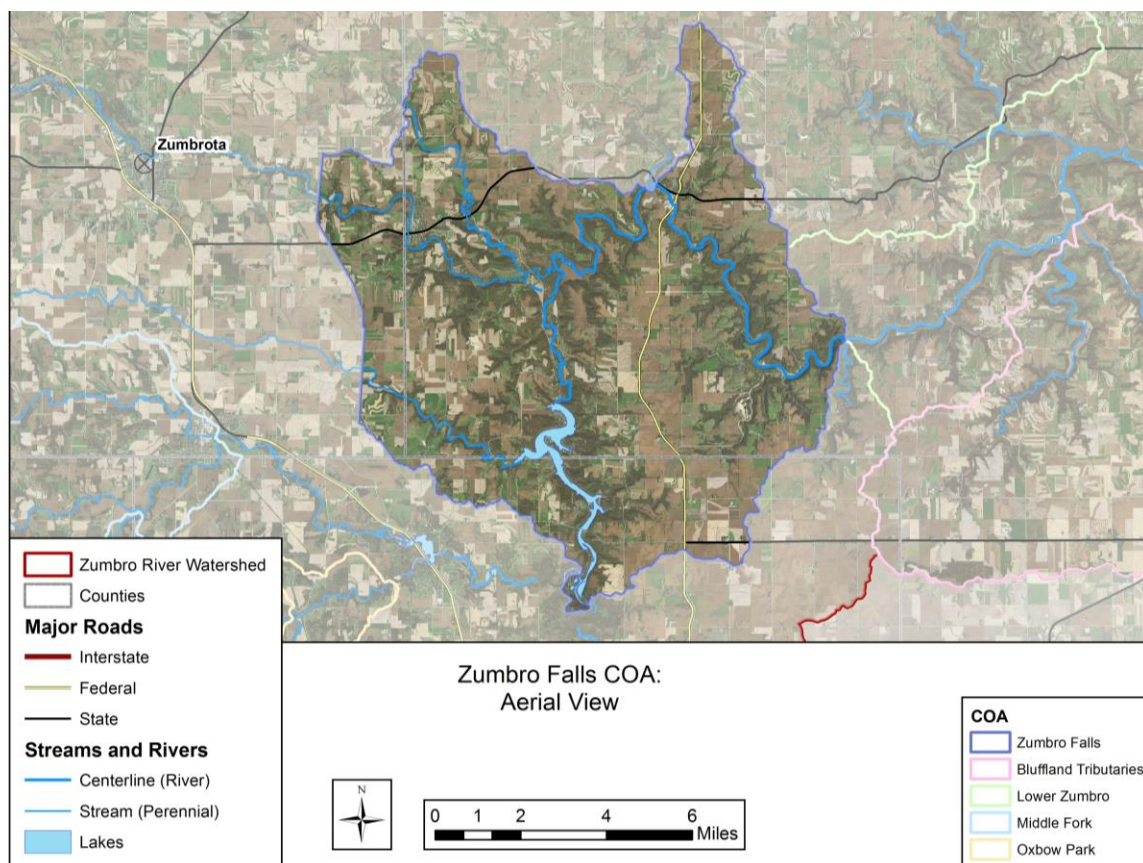


Figure 33. Zumbro Falls COA in the Zumbro River Watershed.

Hydrology

The dominant hydrological features of the Zumbro Falls COA are Lake Zumbro and the confluences of the Zumbro River with Dry Run Creek, Mazeppa Creek, and the North Fork (Figure 34). Numerous unnamed perennial or intermittent streams originating in the agricultural uplands feed these major hydrological features. This COA has a number of karst features which often have hidden pathways that can rapidly take pollution from a release point to drinking water wells or surface water (Figure 35). Extensive agricultural tile lines and a reduction in perennial cover have changed the hydrology in the COA to move water faster through the system.

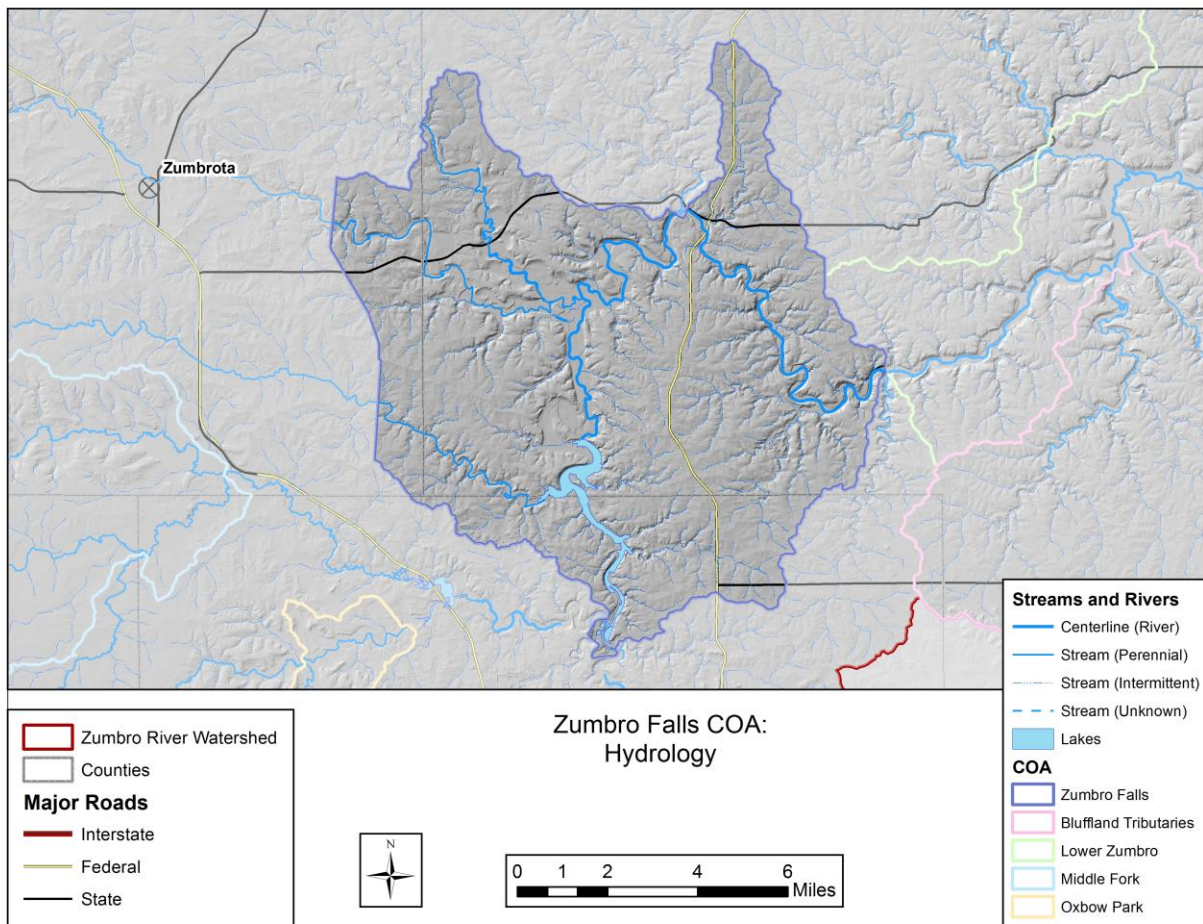


Figure 34. Hydrology of the Zumbro Falls COA.

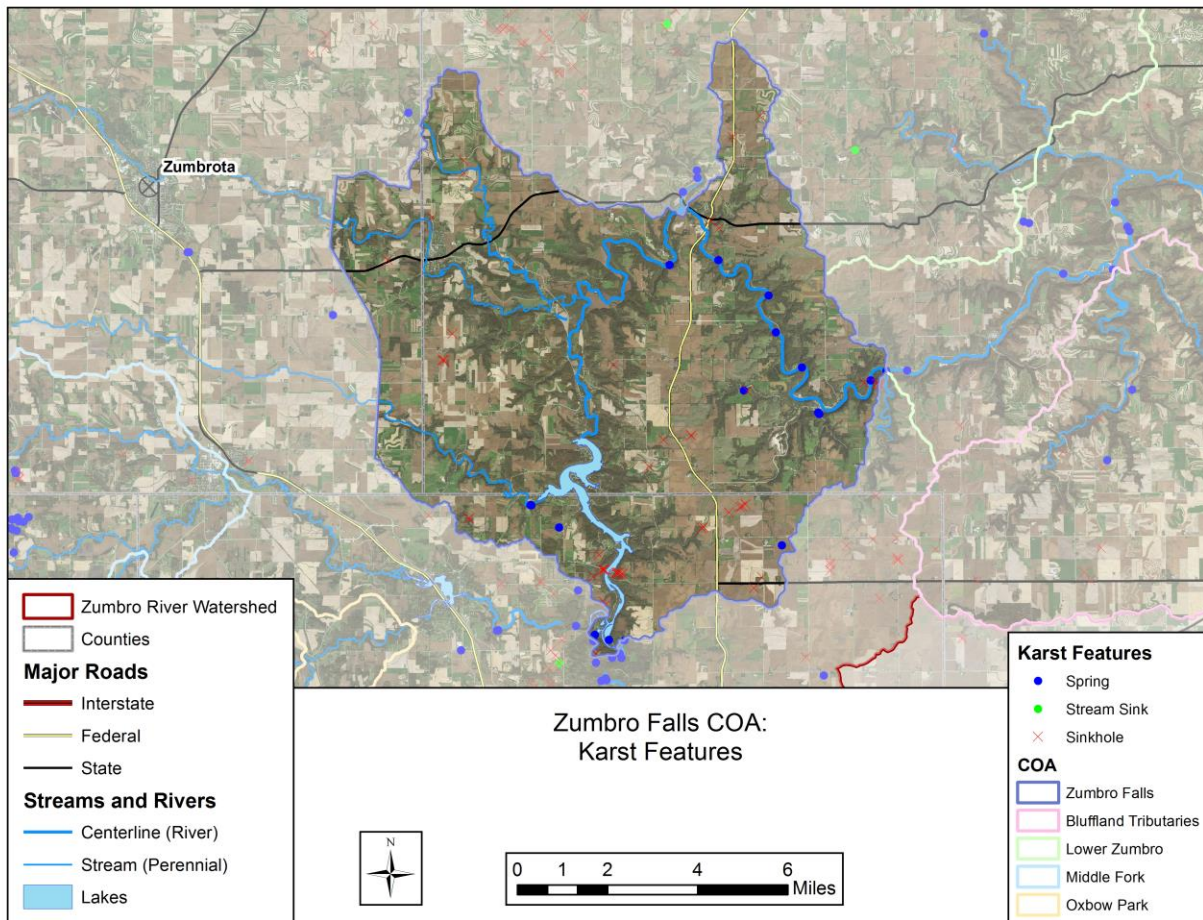


Figure 35. Karst features in the Zumbro Falls COA.

Plant Communities

Zumbro Falls COA contains almost 1,700 acres of Native Plant Communities (NPC) in five different systems and 18 different types and subtypes as identified by the Minnesota Biological Survey (MBS) (Table 17). Mesic hardwood forests make up 86% of the identified NPC acres with upland prairie (7%) and fire dependent forest or woodland (6%) systems also making up a 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 16 percent of the NPCs in the Zumbro Falls COA are on publicly owned land. Some of the privately owned NPCs are on parcels near blocks of public land, and nearly all are in relatively close proximity to the river valley (Figure 36). 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 Zumbro Falls COA.

System	NPC Code	Native Plant Community	Acreage	% of NPC Acreage
Cliff and Talus	CTs12	Southern Dry Cliff	1.8	0%
Fire Dependent Forest or Woodland	FDs27b	White Pine - Oak Woodland (Sand)	20.0	1%
	FDs38a	Oak - Shagbark Hickory Woodland	80.9	5%
Floodplain Forest	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	7.9	0%
	FFs59c	Elm - Ash - Basswood Terrace Forest	10.7	1%
Mesic Hardwood Forest	MHs37	Southern Dry-Mesic Oak Forest	114.2	7%
	MHs37a	Red Oak - White Oak Forest	556.1	33%
	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	211.1	13%
	MHs38	Southern Mesic Oak-Basswood Forest	52.9	3%
	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	52.6	3%
	MHs39	Southern Mesic Maple-Basswood Forest	32.2	2%
	MHs39a	Sugar Maple - Basswood - (Bitternut Hickory) Forest	64.3	4%
	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	321.9	19%
	MHs49	Southern Wet-Mesic Hardwood Forest	34.4	2%
Upland Prairie	UPs13b	Dry Sand - Gravel Prairie (Southern)	15.8	1%
	UPs13c	Dry Bedrock Bluff Prairie (Southern)	91.9	5%
	UPs14b	Dry Sand - Gravel Oak Savanna (Southern)	6.2	0%
	UPs23a	Mesic Prairie (Southern)	9.0	1%

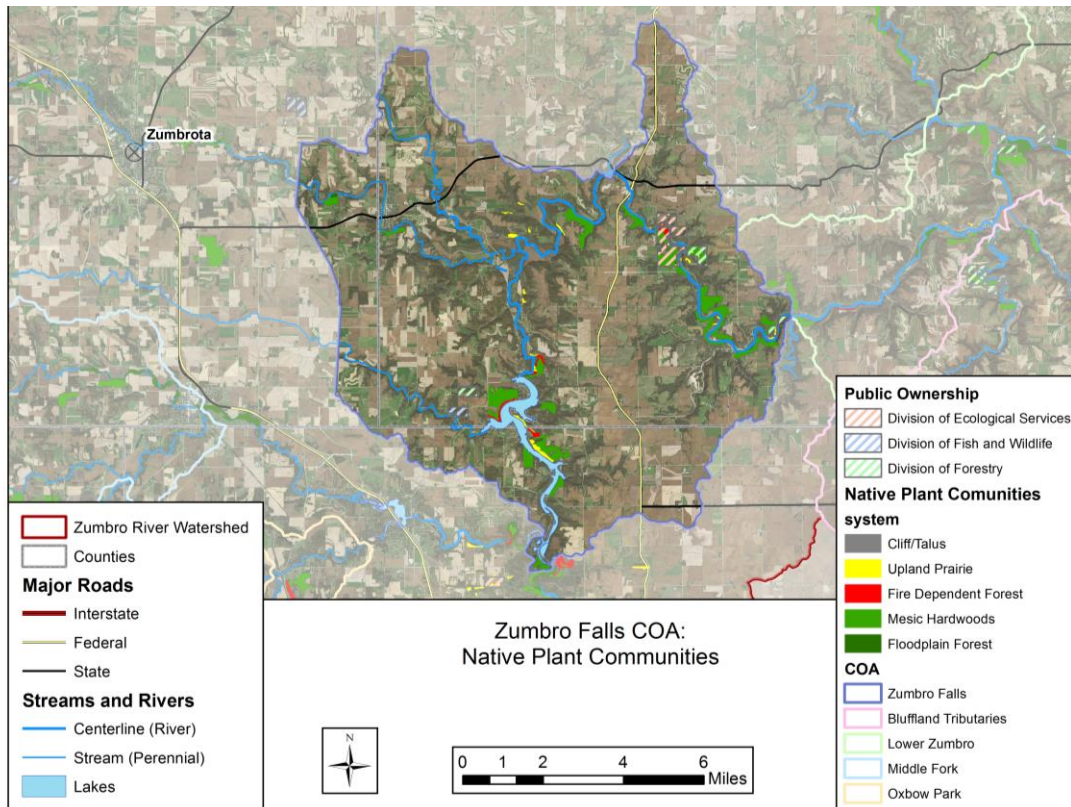


Figure 36. Native Plant Communities on and off public lands in the Zumbro Falls COA.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 59 different occurrences of rare plants, animals, or communities in the Zumbro Falls 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 near future. Species of Special Concern, though not endangered or threatened, are extremely uncommon in Minnesota.

Twenty-three rare terrestrial communities have been identified in the Zumbro Falls 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 Zumbro Falls COA.

Organism Type	Observations
Animal Assemblage	3
Fungus	1
Vascular Plant	25
Invertebrate Animal	7
Vertebrate Animal	23
Terrestrial Community	23

Nearly 7,200 acres of the Zumbro Falls COA have been assessed by the Minnesota Biological Survey for its significance to biodiversity in the state (Figure 37). Only one percent of that area was given the highest level of 'Outstanding' but over 1,200 acres were designated as having 'High' biodiversity significance. These areas of 'high' biodiversity significance are near Lake Zumbro and in the river valley between Zumbro Falls and Hammond.

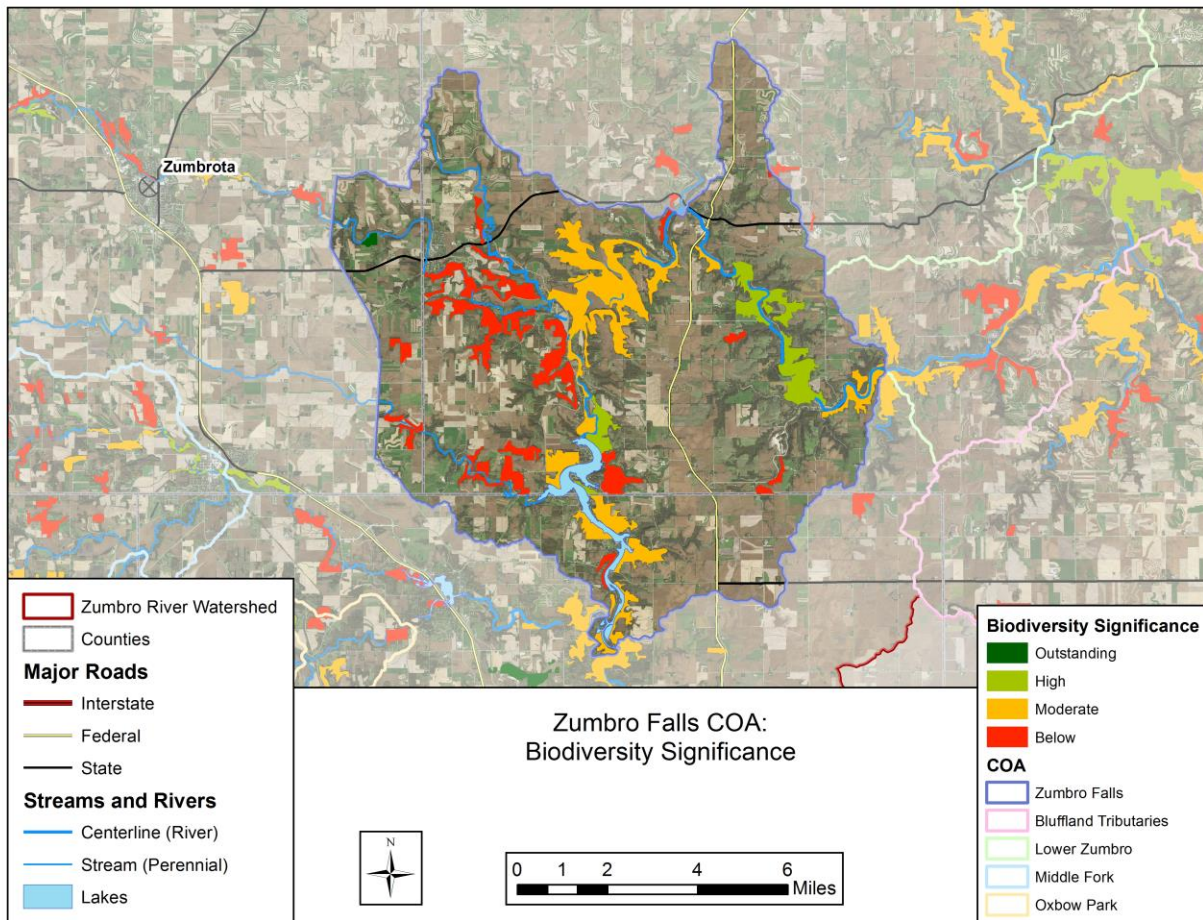


Figure 37. Areas identified by the Minnesota Biological Survey as having biodiversity significance in the Zumbro Falls COA.

Recreation

Outdoor recreation areas in the Zumbro Falls COA contribute to the well-being of residents and support the local economy. There is a relatively small amount of public land in the COA but the existing Wildlife Management Areas (WMA) are popular locations for hunting, hiking and birdwatching. Hunting is a popular outdoor recreational activity throughout the area on public and private land. The Zumbro River is a designated state water trail that is a popular canoe and kayak routes in the summer. Lake Zumbro is also a popular recreation destination. Fishing opportunities exist throughout the COA.

Environmental Threats

Development pressures:

Although the Zumbro Falls COA is currently relatively rural, it is within 30 minutes of the City of Rochester, which is in the early stages of a multi-billion dollar economic development project called the “Destination Medical Center” (DMC). The DMC is projected to create between 26,800 to 32,200 new jobs directly. 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

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 Zumbro River Watershed but a significant portion of the Zumbro Falls 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 Zumbro Falls 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

Only 1.4% (887 acres) of the Zumbro Falls COA is publicly owned (Table 19, Figure 38). Over half of this public land is in one property, the Zumbro Falls Woods SNA. This Scientific and Natural Area includes steep bluffs, loess-covered uplands, narrow river valleys and broad floodplains on both sides of the Zumbro River. The remaining 98.6% of the COA 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 in this COA. 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 1,620 acres have a registered stewardship plan in the Zumbro Falls 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 287 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.

Table 19. Land ownership in the Zumbro Falls COA.

Ownership	Acres	Percent of Public	Percent of COA
Private	60,577		98.6%
Zumbro Falls Woods SNA	451	50.9%	0.7%
R J D Memorial Hardwood Forest	274	30.9%	0.4%
County Miscellaneous	80	9.0%	0.1%
Isaac Walton League WMA	78	8.8%	0.1%
Mazeppa WMA	4	0.4%	0.0%

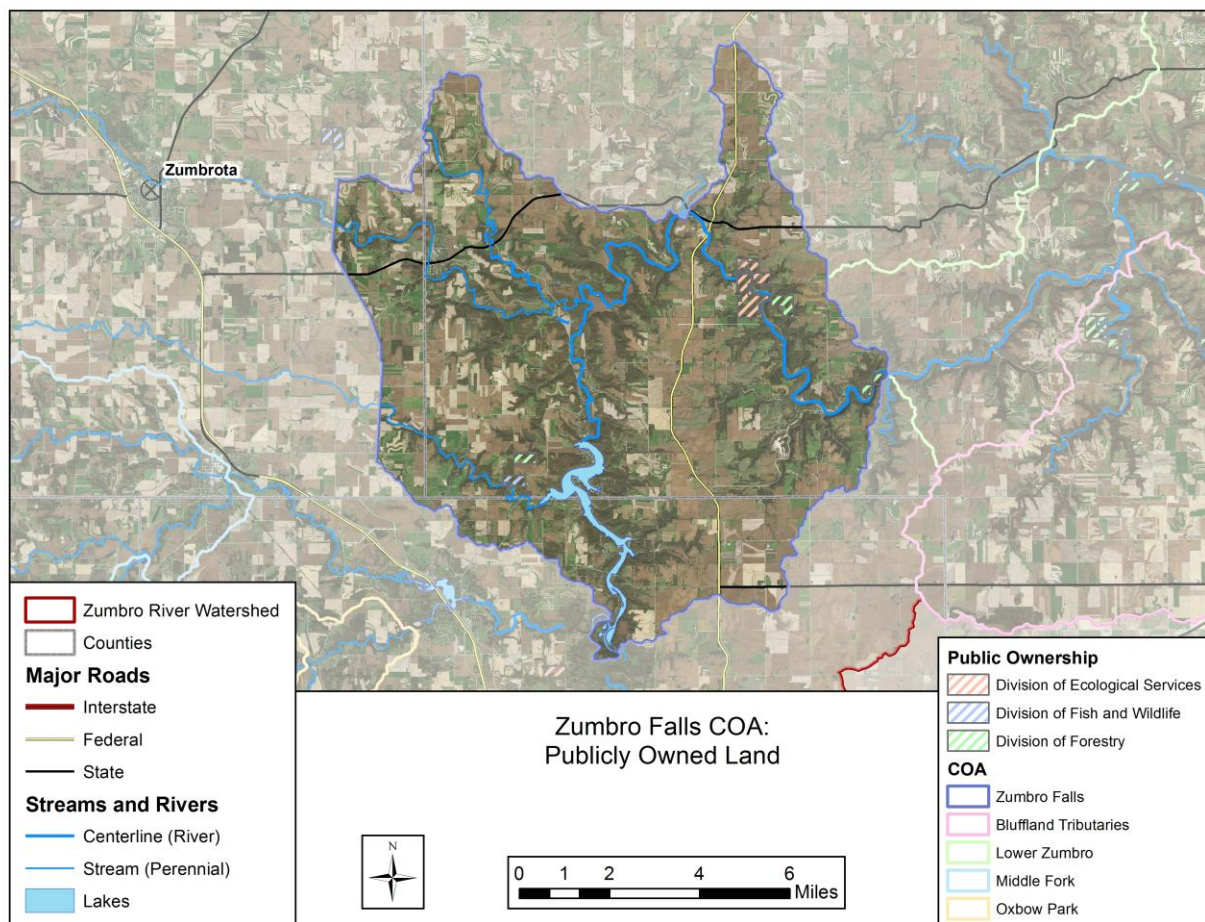


Figure 38. Public land in the Zumbro Falls COA.

Land Cover and Use

Seventy-three percent of the Zumbro Falls COA was covered in prairie or semi-open oak savanna habitat at the time of European settlement (Table 20, Figure 39). The rest of the landscape was classified as either oak dominated upland forest or floodplain forests along the river.

Today the land use patterns in the Zumbro Falls 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 40). Some areas have also seen residential and commercial development. Major cover types are cultivated crops (31.8%), deciduous forest (20.7%), pasture/hay (19.9%) and grassland/herbaceous (18.9%) (Table 21).

Table 20. Presettlement land cover in the Zumbro Falls COA.

Land Type	Acres	Percent
Aspen-Oak Land	8,335	13.6%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	59	0.1%
Brush Prairie	9,038	14.7%
Oak openings and barrens	22,141	36.0%
Prairie	13,586	22.1%
River Bottom Forest	8,305	13.5%

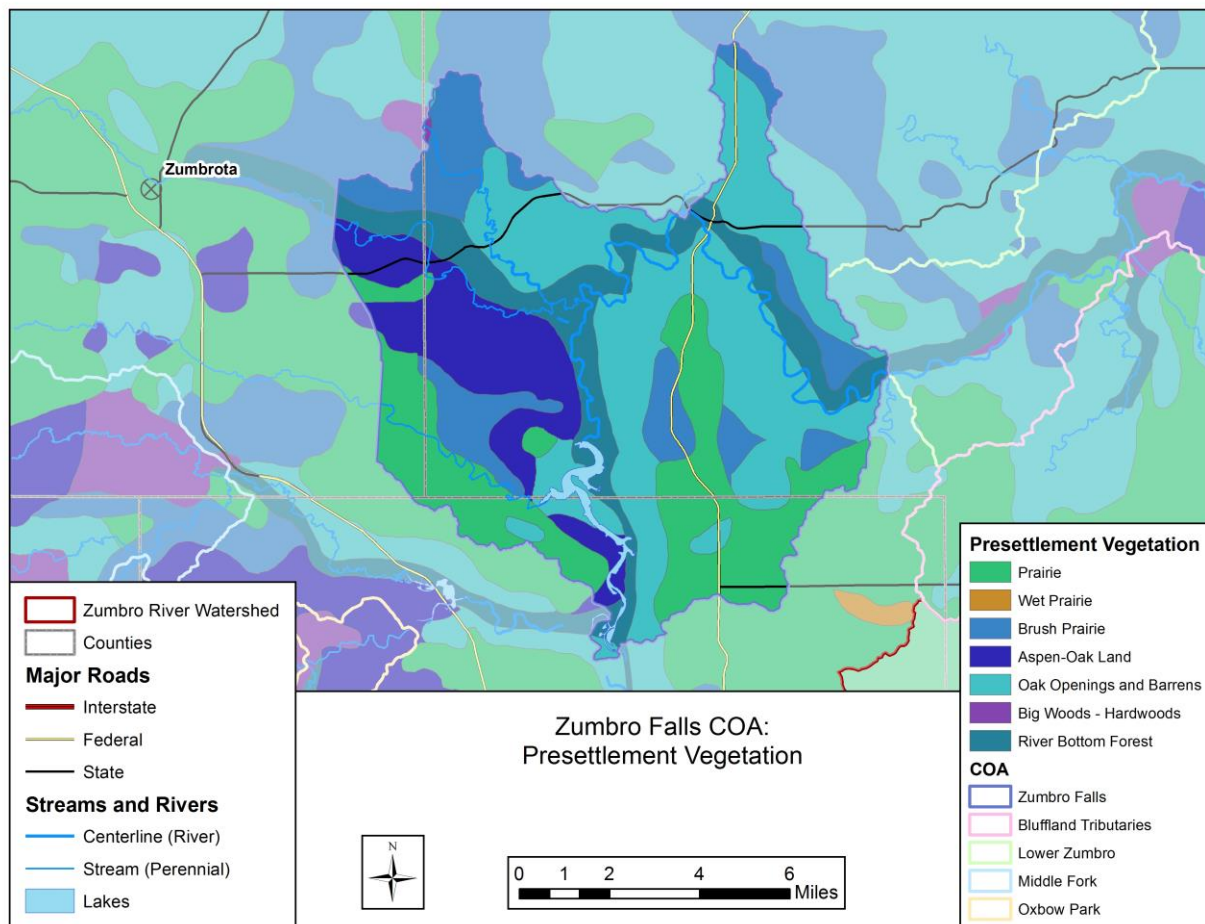


Figure 39. Presettlement land cover based on the work of Francis J. Marschner.

Table 21. Current land cover in the Zumbro Falls COA.

Land Cover Class	Acres	Percent of COAs
Cultivated Crops	19,533	31.8%
Deciduous Forest	12,732	20.7%
Hay/Pasture	12,238	19.9%
Herbaceous	11,622	18.9%
Developed, Open Space	2,631	4.3%
Open Water	1,128	1.8%
Developed, Low Intensity	719	1.2%
Woody Wetlands	433	0.7%
Emergent Herbaceous Wetlands	183	0.3%
Evergreen Forest	125	0.2%
Developed, Medium Intensity	57	0.1%
Barren Land	47	0.1%
Developed, High Intensity	12	0.0%
Shrub/Scrub	11	0.0%

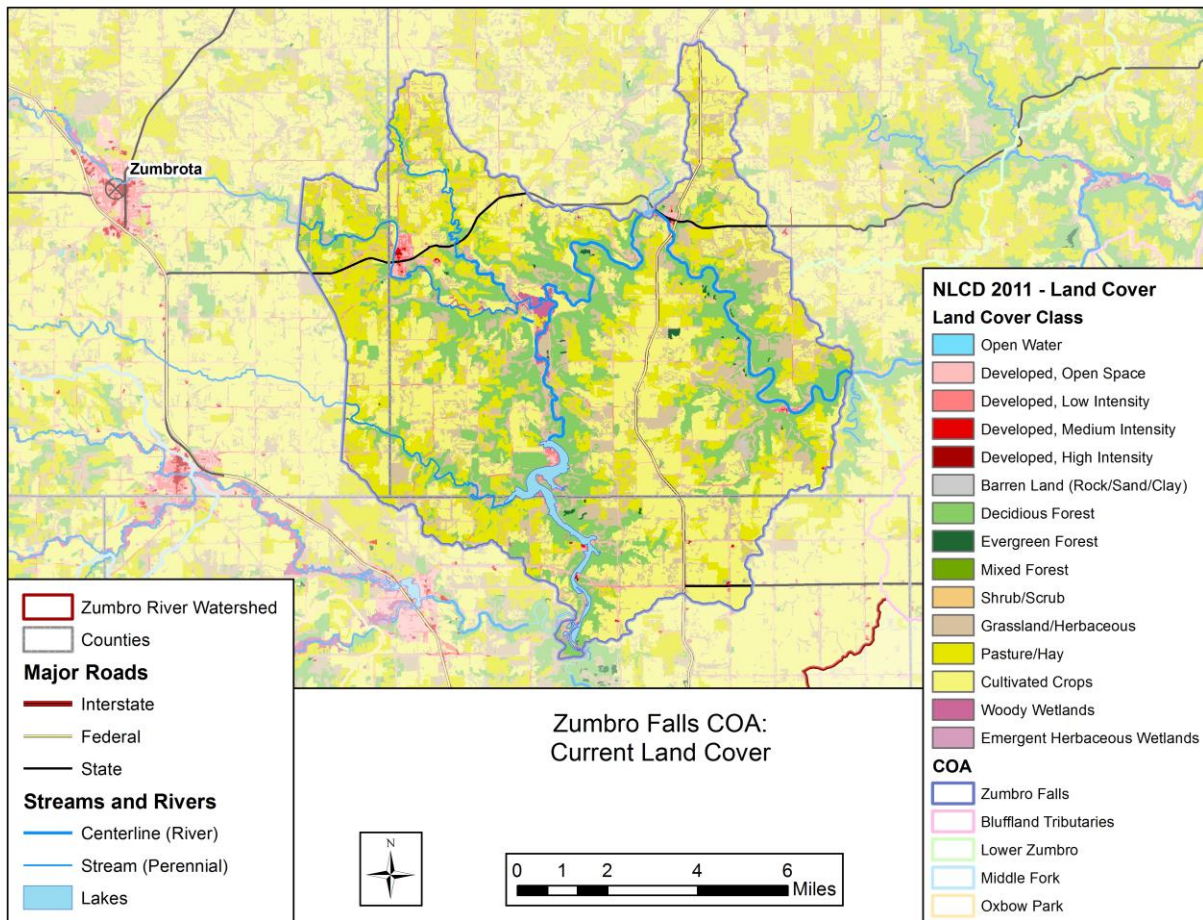


Figure 40. Current land cover based on the 2011 National Land Cover Database.

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 Zumbro Falls 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 identified key stewardship parcels in the COA that met the following conditions:

- Parcels larger than 40 acres in size
- Include an area of moderate, high, or outstanding biodiversity significance as delineated by the MBS

There were 106 such parcels within Zumbro Falls COA, covering nearly 10,000 acres, with 78 unique owners listed (Figure 41). Average size among priority parcels was 94 acres.

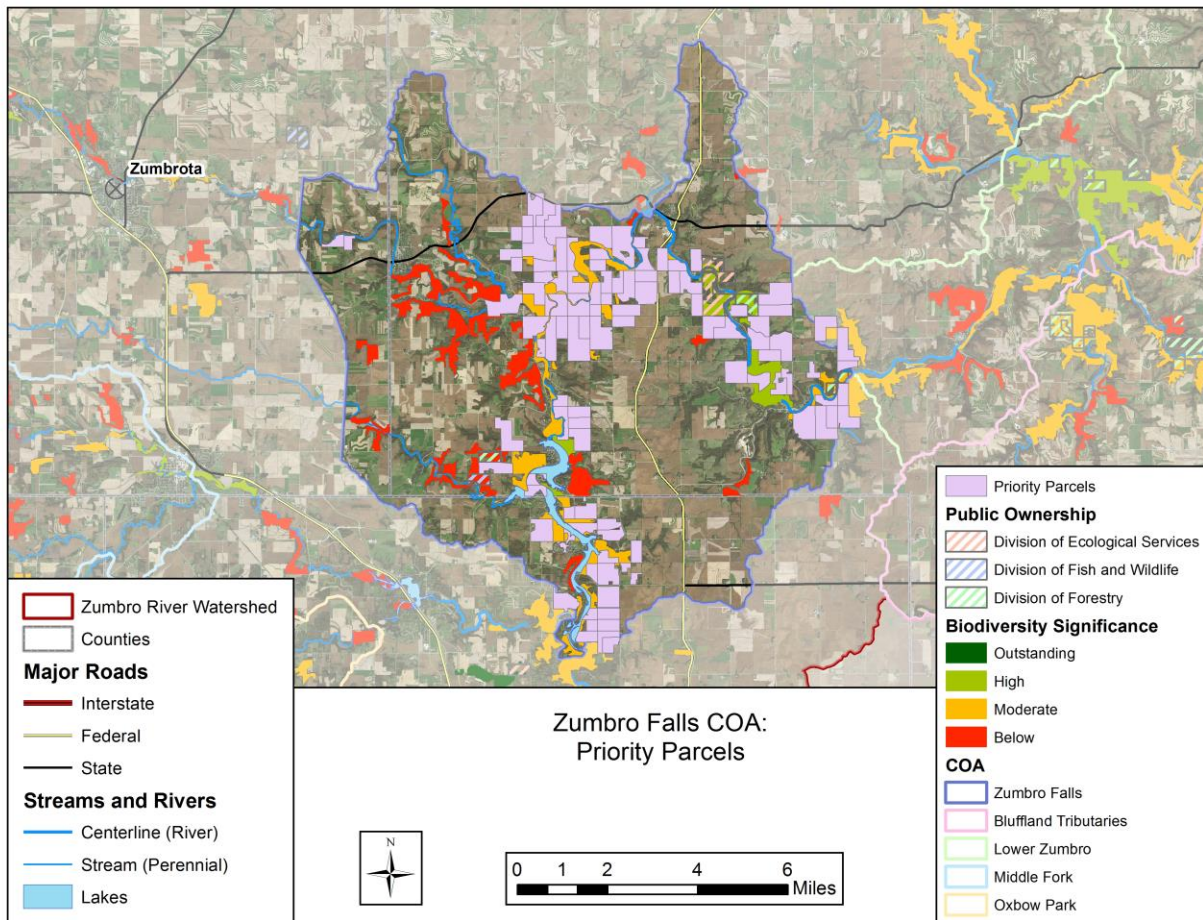


Figure 41. Priority parcels in the Zumbro Falls COA.

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.

Lakeshore and 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:

- Work with landowners around Lake Zumbro, through lake associations or similar landowner groups where possible, to maintain and restore natural vegetation along shorelines.
- 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.

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, 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.
- 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.