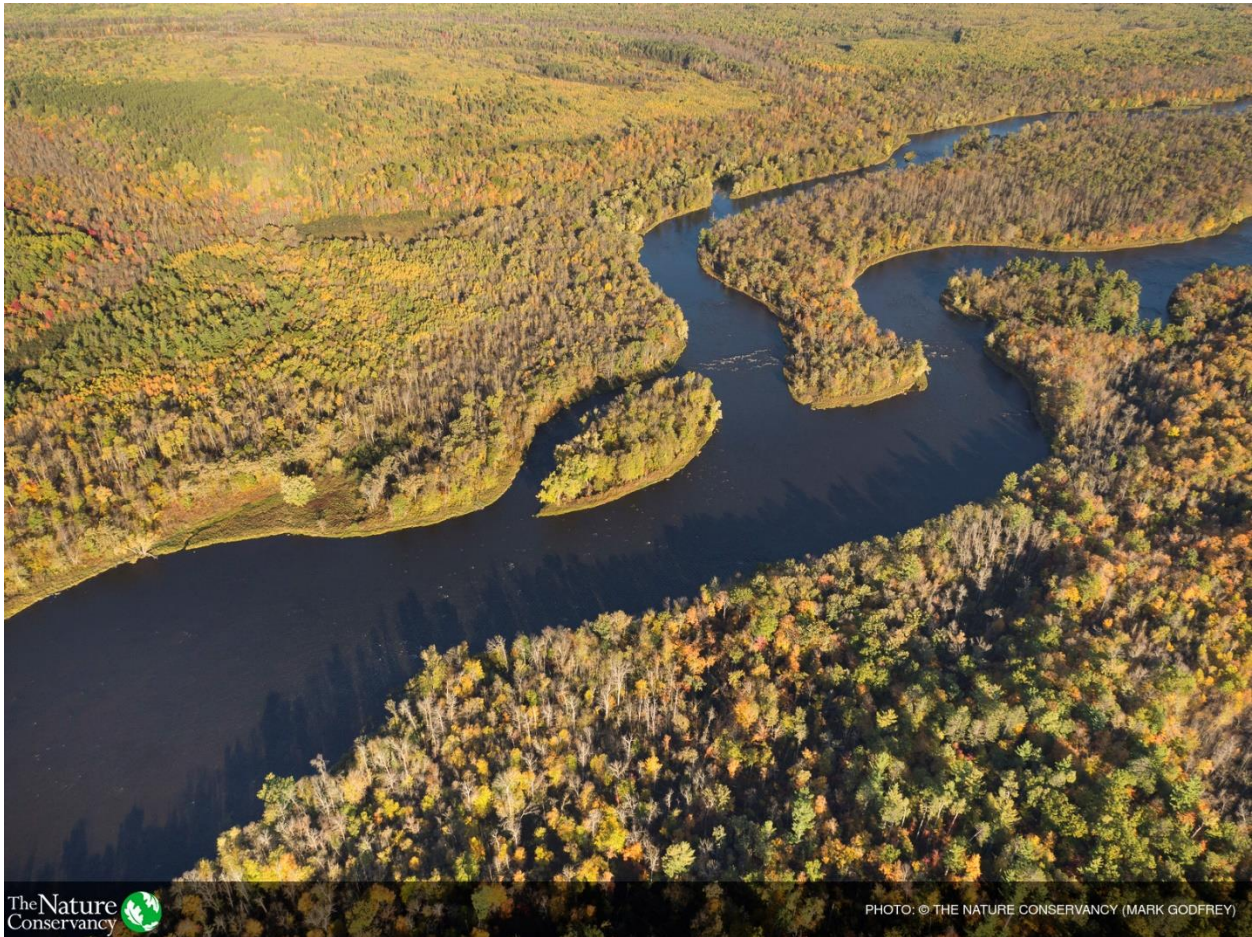


Snake River Watershed Landscape Stewardship Plan



December 2018

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

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The Snake River Watershed Landscape Stewardship Plan can be found online at:
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Plan Overview

This plan provides a vision for the lands and waters of the Snake River Watershed and a framework to facilitate collaboration between landowners, resource managers, local officials, and other stakeholders to voluntarily implement landscape stewardship practices that protect and enhance the region's water quality, natural areas, and biodiversity.



Guiding Philosophy

This plan is based on the philosophy that healthy waters depend on healthy lands and vice versa. Stewardship efforts that maintain forests, wetlands, and other natural communities benefit the biodiversity and ecological health of the region. They also attenuate flooding risks, improve infiltration, and remove nutrients from runoff as it makes its way to our streams. Actions such as building climate resilience in the region's forests, implementing best management practices, and expanding forest stewardship will not only benefit the immediate resource concern, but cumulatively impact the entire landscape. This plan proposes a vision, desired future conditions, and strategies that utilize a landscape approach to natural resources stewardship.

Landscape Approach to Natural Resources Stewardship

This Landscape Stewardship Plan (LSP) is based on the recognition that many, if not all, of our conservation and environmental challenges are interrelated. Yet, practicality requires a division of activities and expertise in addressing them. As a result, private landowners 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, managing forested cover in an upland area can improve wildlife habitat while also reducing erosion in the riparian area adjacent to it, and improved conditions in both areas will benefit the hydrology, water quality, and associated biodiversity downstream. 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. 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 986 square mile Snake River Watershed in east central Minnesota (Figure 1). This landscape includes over 1,050 linear miles of streams in Aitkin,

Kanabec, Mille Lacs, Pine, and small portions of Isanti and Chisago counties. The Snake is a relatively gentle river that falls 560 feet from its headwaters in Aitkin County to its confluence with the Saint Croix River near the Chengwatana State Forest. The river drains a diverse, glacial derived, landscape that ranges from forests and wetlands in the north, to a largely agricultural landscape in the south, before descending through sandstone bluffs as it approaches the Saint Croix River at the Minnesota-Wisconsin border.

The degree of human alteration varies across this watershed. Roughly 32% of the landscape has been converted to alternative uses such as agriculture or human development while the remaining 68% of the landscape remains as forest, wetland or grassland, although some of these areas have been altered or degraded in some fashion. Overall, 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. More information on the watershed is available in [Section 2](#).

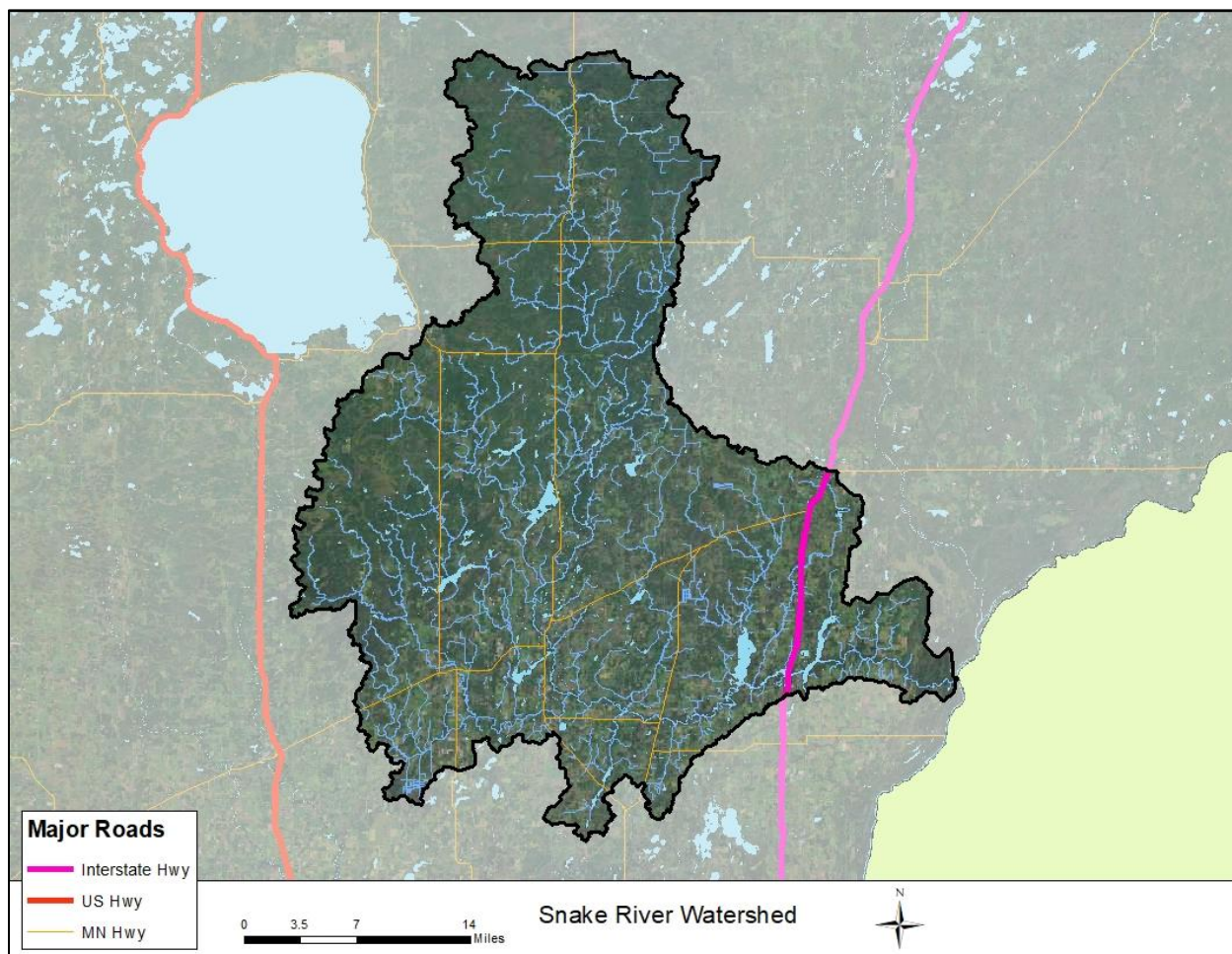


Figure 1. Aerial view of the Snake River Watershed.

Organization of Plan

The Snake River Watershed Landscape Stewardship Plan is organized into seven sections. Individuals unfamiliar with the landscape are encouraged to review Section 2 for context on the state of the watershed prior to Section 1.

[Section 1](#). Landscape Vision and Strategies

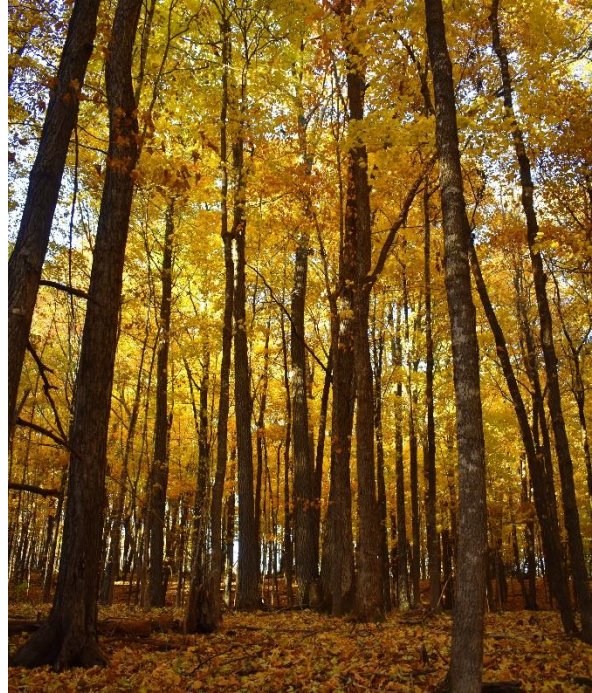
[Section 2](#). Landscape Context

[Section 3](#). Targets and Recommendations

[Section 4](#). Implementing the Plan

[Section 5](#). Monitoring and Evaluation

[Section 6](#). Conservation Opportunity Area Plans



Plan Audience

This landscape stewardship plan is intended to benefit:

- ❖ Water Resource Management Plans and Implementation
- ❖ Forest Stewardship Plans and Implementation
- ❖ Fish & Wildlife Management Plans
- ❖ Community Land Use Planning and Implementation
- ❖ Collaborative Project and Funding Development
- ❖ Connections with 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 the plan's vision for the watershed.

There are a variety of plans and planning efforts in the Snake River (see [Section 4](#)). 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. This plan is unique because it focuses on achieving and maintaining healthy water and biodiversity through land stewardship.

Process

The Nature Conservancy and the Forest Stewards Guild led the development of the Snake River Watershed Landscape Stewardship Plan with input and review from several stakeholders throughout the process (Table 1). This Planning Team included partners representing a variety of specialties and interests, from local, county, state, and federal levels. A second group of stakeholders provided periodic draft reviews and feedback on the plan before it was finalized.

Table 1. Snake River Watershed Landscape Stewardship Planning Team.

Name	Title	Organization
Eric Alms	Environmental Specialist	MN Pollution Control Agency
Andrea Brandon	Forest Watershed Restoration Specialist	The Nature Conservancy
Jill Carlier	District Manager	Pine SWCD
Casey Field	Technician	Mille Lacs SWCD
Kris Hennig	Asst. Regional Ecologist	DNR Eco. and Water Resources
Steve Hughes	District Manager	Aitkin SWCD
Mitch Lundeen	North Region Forester	Aitkin SWCD
Michael Lynch	Lake States Coordinator	Forest Stewards Guild
Tony Miller	CFM Forester	DNR Forestry
Doug Odegard	Board Supervisor	Pine SWCD
Deanna Pomije	District Manager	Kanabec SWCD
Jodie Provost	Private Lands Habitat Coordinator	DNR Wildlife
Shannon Rasinski	District Conservationist	Natural Res. Conservation Service
Susan Shaw	District Manager	Mille Lacs SWCD
Jeff Wilder	CFM Forester	DNR Forestry
Monica Zachey	Land and Water Program Director	St Croix River Association



Section 1. Landscape Vision and Strategies

Landscape Vision

The Snake River Landscape Plan envisions the following to sustain healthy lands and waters and support vibrant rural communities in the watershed:

- ❖ Surface waters support thriving aquatic ecosystems and aquifers provide safe drinking water.
- ❖ Land uses supporting a connected network of healthy, resilient, and diverse forestland, brushland, grassland, and wetland ecosystems and abundant outdoor recreational opportunities.
- ❖ Productive and sustainable forest and agricultural resources that support a vibrant rural economy and community while integrating the needs of healthy water, soil, and the full suite of native wildlife.

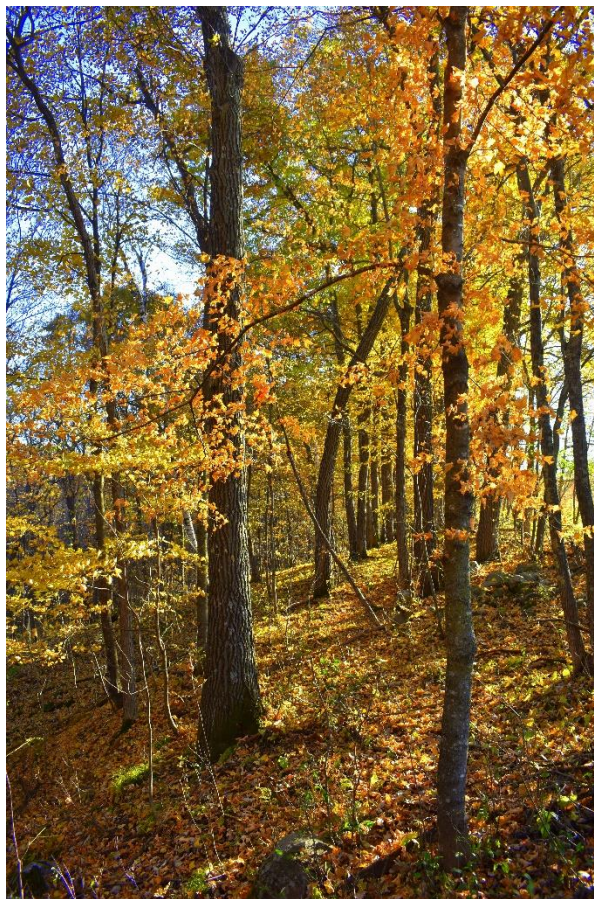
Desired Future Conditions

The Snake River Planning Team reviewed several regional plans in developing their Desired Future Conditions (DFCs). Many of the DFCs that the Planning Team developed closely align with those of other regional plans and highlight the confluence of objectives between stakeholders in the watershed. These DFCs, like the whole plan, are subject to refinement by partner organizations but serve as an overall unifying vision for the watershed.

- **High Quality Surface and Groundwater Resources.** The watershed contains clean and safe water for people and thriving aquatic, riparian, and wetland ecosystems.
- **Connected Network of Climate Resilient Natural Communities.** A network of healthy, resilient, and diverse native plant communities is maintained in a way that supports the flora and fauna that depend upon them.
- **Healthy and Intact Forestlands.** Forests are: 1) structurally, functionally, and compositionally diverse; 2) maintained or increased in spatial extent; and 3) support communities of plant and animal species native to the watershed.
- **Multiple Uses of Forest Resources.** A full range of forest products will be produced in the watershed in a sustainable manner that protects and improves existing ecological resources and allows for a balance between economic and recreational interests.
- **Engaged Private Forest Landowners.** Consistent funding is available to provide tools, education, technical assistance, and incentives that will contribute to engaged private forestland owners and stewardship of the breadth of native plant communities on their land.
- **Productive and Sustainable Agriculture.** Cropping and grazing conservation practices and soil health principles are adopted that support a vibrant agricultural economy while integrating the needs of healthy water, soil, and the full suite of native wildlife.
- **Protection of Ecologically Sensitive Sites.** The highest priority sites for biodiversity and water resources are protected via public ownership, conservation easements, or private landowner stewardship programs.
- **Stabilized and Increasing Populations of Rare Species.** Habitat conservation efforts support maintenance or recovery of rare species populations.

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. An underlying principle throughout these strategies is that well managed lands in the watershed will lead to increased water quality and biodiversity benefits. 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.



Public Land Strategies

Lands under public or conservation ownership, or permanent conservation easements, are generally the most protected from conversion threats, however, they often still need to be soundly maintained and face the risk of habitat degradation. When well maintained, these areas can provide a tremendous effect on regional biodiversity and water quality. Strategies under this heading include actions that can be done to maintain or restore these public and conservation owned lands or expand these spaces by acquiring fee-title or conservation easements on private lands.

Key Groups: Minnesota DNR Divisions, County Land Departments, The Nature Conservancy, MN Land Trust, Trust for Public Land

- Hold, manage, and restore blocks of native habitats currently in public or conservation ownership.
- Utilize science-based natural community management techniques that demonstrate sound ecological management principles. Stewardship of public lands that demonstrates a balance of environmental, economic, and social needs can further catalyze improved management on private lands.
- Improve forest health and increase climate change resiliency through a commitment to sustainable forest management.

- Support and pursue opportunities for increased protection through conservation easements and public acquisition in strategically important areas. Focus acquisition efforts on: 1) Opportunities to increase connectivity between existing public lands; or 2) The protection of the rarest or highest quality natural areas.
- Follow strategies outlined in the Watershed Restoration and Protection Strategy (WRAPS) report and accompanying Total Maximum Daily Load (TMDL) benchmarks for all public waters in the watershed.
- Assess tax forfeit parcels for retention or divestiture. Develop and implement natural resources management plans for all lands that will be retained in public ownership.
- Collaborate across ownerships to initiate functional landscape management.
- Control invasive species through early-detection monitoring, management, and outreach.
- Connect projects with the local economy to maintain public support.
- Agencies and conservation organizations engage in productive coordination and collaboration to accomplish the goals and visions outlined in this plan.

Private Land Strategies

Seventy-five percent of the Snake River Watershed is owned and managed by private landowners. The actions undertaken by these property owners will be key to increasing and maintaining regional biodiversity and water quality. This section outlines steps that can be taken to support these landowners in successful stewardship of their lands.

Key Groups: Private Landowners, Private Forestry Consultants, DNR Forestry, Soil and Water Conservation Districts, Board of Water and Soil Resources, Natural Resources Conservation Service, Farm Service Agency, US Fish and Wildlife Services – Partners for Fish and Wildlife, and non-profit conservation partners.

- Work with landowners to increase or maintain large blocks of forest, habitat corridors, and riparian buffers. Focus on opportunities to increase water quality and ensure connectivity of native plant communities into a larger matrix of well-managed public and private forestlands, brushlands, wetlands, and grasslands.
- Emphasize the importance of a forest stewardship plan and implementing its recommendations.
- Encourage landowner participation in programs that help landowners implement habitat restoration and maintenance activities through cost-share, tax incentive, rental payment, technical advice, and local tree sales.
- Offer a variety of conservation easement options like Reinvest in Minnesota (RIM) and the Healthy Forest Reserve Program for landowners interested in permanently protecting their land.
- Ensure professional assistance to landowners is readily available from public entities and private businesses for natural resource management that meets landowner objectives and maintains ecological and habitat benefits.
- Work with agricultural producers to expand the use of sustainable cropping and grazing practices and soil health principles.

Education and Outreach Strategies

Strategies under this heading focus on efforts to increase both the knowledge base and stewardship ethic of landowners, citizens, and whole communities in the region. It recognizes

that the foundation of all conservation efforts is the value placed on natural resources by the community.

Key Groups: Saint Croix River Association, Minnesota Forest Resources Council (MFRC), Snake River Watershed Management Board, Snake River Citizens Advisory Committee, Audubon Center of the North Woods, DNR Divisions, Public Schools, UMN Extension, Sustainable Forestry Education Cooperative, Minnesota Forestry Association, 4H, conservation and agriculture organizations.

- Use outreach and education to foster a 'land ethic' about the value of natural resources in the watershed among land managers, landowners, citizen groups, and local communities.
- Maintain regular contact with stakeholders in the watershed through print and digital newsletters.
- Promote peer-to-peer networks for sharing information on their experiences with conservation agriculture and natural resource management practices.
- Increase awareness about cost-share, incentive, and tax break programs that provide economically viable options to sustainably manage forests and other natural areas.
- Inform local officials and elected representatives of the benefits of the region's natural areas for water quality, flood retention, and local quality of life.
- Offer continuing education opportunities that encourage information exchange between the watershed's natural resources professionals.
- Hold annual stakeholder meetings to coordinate completed, ongoing, and planned activities.



Section 2. Landscape Context

The Snake River Watershed has over 1,050 linear miles of streams and covers 986 square miles in Aitkin, Kanabec, Mille Lacs, Pine, and small portions of Isanti and Chisago counties. The Snake is a relatively gentle river that falls 560 feet from its headwaters in Aitkin County to its confluence with the Saint Croix River near the Chengwatana State Forest. The river drains a diverse, glacially derived landscape that ranges from forests and wetlands in the north, to a largely agricultural landscape in the south, before descending through sandstone bluffs as it approaches the Saint Croix River at the Minnesota-Wisconsin border.



This largely rural area had a total population of only 29,253 residents at the last census and contains only two cities with over 3,000 people (Mora and Pine City). As a result, the degree of human alteration varies across the watershed. Roughly 32% of the landscape has been converted to uses such as agriculture or human development while the remaining 68% of the landscape remains as forest, wetland or grassland, although some of these areas have been altered or degraded in some fashion. Overall, 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. Additional resources for the contextual information include the [Watershed Health Assessment Framework](#) and the associated [Snake River Watershed Context Report](#) and [Snake River Watershed Report Card](#). These resources will highlight aspects like soils, groundwater, climate, and landscape alteration in wetlands and streams that we did not have space for in this report. Plan users are encouraged to also refer to other regional plans for further exploration of this material. Some of these reports are summarized in [Section 4](#).

Ecological Setting – Mille Lacs Uplands

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. Many watersheds the Snake's size will straddle several subsections, but the Snake lies entirely in the Mille Lacs Uplands Subsection which is nested within the Western Superior Uplands Section and the Laurentian Mixed Forest Province (Figure 2).

The [Mille Lacs Uplands](#) covers a large area of ground moraines and end moraine in east-central Minnesota. The subsection contains extensive wetlands and 100 lakes greater than 160 acres. Gently rolling till plains and drumlin fields are the dominant landforms in this ecoregion.

Glaciation has had a major influence on the landscape, and the resulting moraines provide excellent wildlife habitat today. The subsection is named after Lake Mille Lacs, well known for its walleye and other cool water species fishery. Several other major rivers run through the area, including the Kettle, Rum, and Saint Croix.

Before settlement by people of European descent, northern red oak, sugar maple, basswood, and aspen-birch forests were prevalent in the south, and the north was a mix of conifer and hardwood forests. Because of its proximity to the Twin Cities, this subsection is under increasing pressure from human activities and residential development. Agriculture is concentrated in the western and southern portions, and forestry and recreation are more common in the central and eastern portions. Large areas are still heavily forested, although few significant examples of once common white pine stands are present. The once common oak and jack pine barrens are all but gone in this subsection.

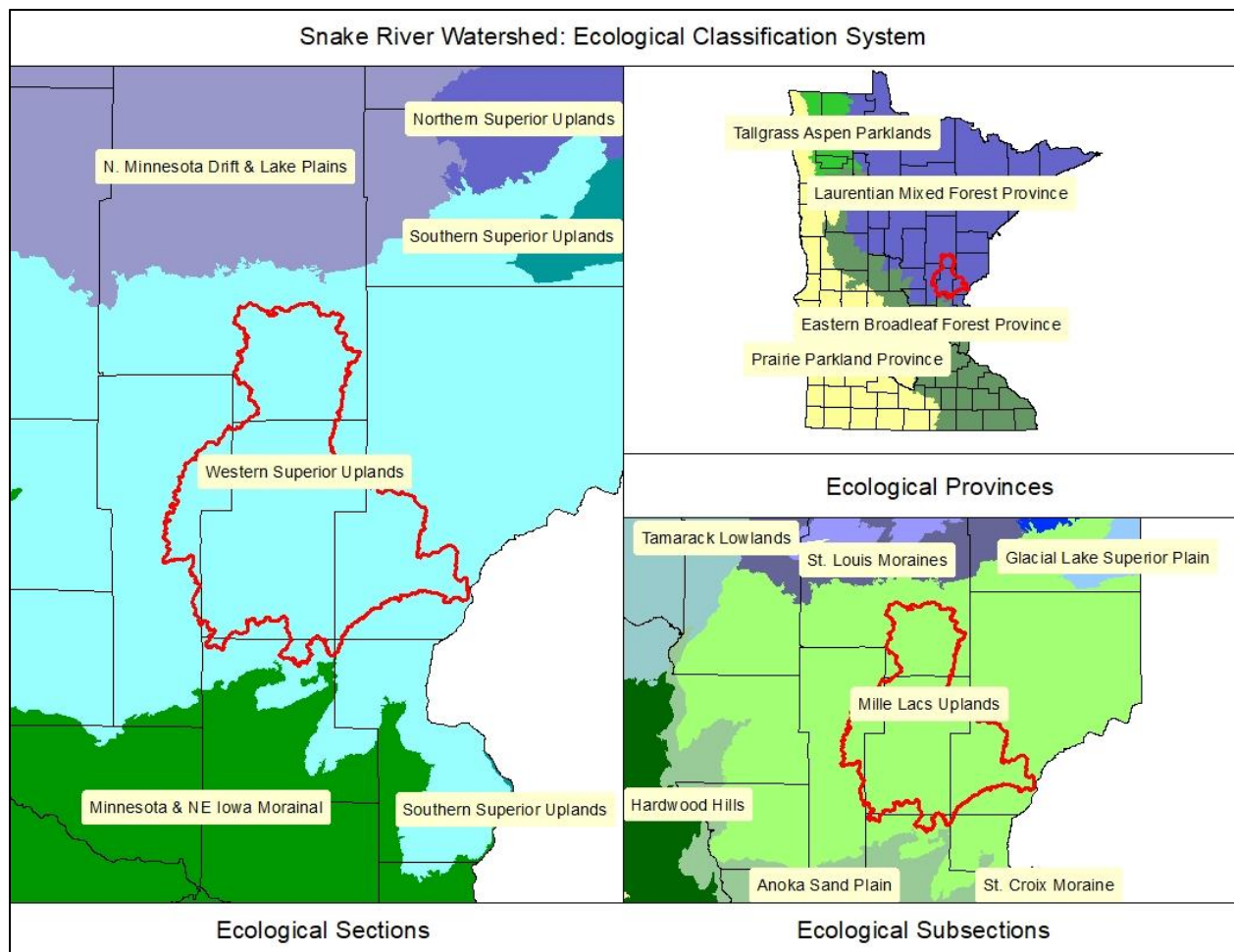


Figure 2. The Snake River Watershed lies in the Mille Lacs Uplands Subsection within the Western Superior Uplands Section and Laurentian Mixed Forest Province.

Hydrology

The Snake River is an 8-digit hydrologic unit (HUC-8) watershed located in the Saint Croix River Basin that flows south from its headwaters in southeastern Aitkin County and then east to its confluence with the Saint Croix River in Pine County. The watershed is further subdivided into eight 10-digit HUC watersheds: Upper Snake, Middle Snake, Knife River, Mud Creek, Groundhouse River, Pokegama Creek, Ann River and Lower Snake River (Figure 3).

The wetland and forest dominated headwater regions are characterized by good water quality and mostly natural hydrology. The hydrologic alterations that do exist in this region, are the result of efforts in the early part of the 20th century to drain some of the headwater wetlands for agriculture. This effort was largely unsuccessful at creating additional agricultural land, but many of the ditches remain and have changed the regional hydrology.

The region's water quality and hydrology change as the dominant land uses change in the middle and southern part of the watershed. These changes begin near the Knife River and the City of Mora where the land use transitions from forestland to a pasture and cropland dominated landscape. Many of these cropland areas contain extensive agricultural tile lines which have changed the hydrology of the area to move water faster through the system.

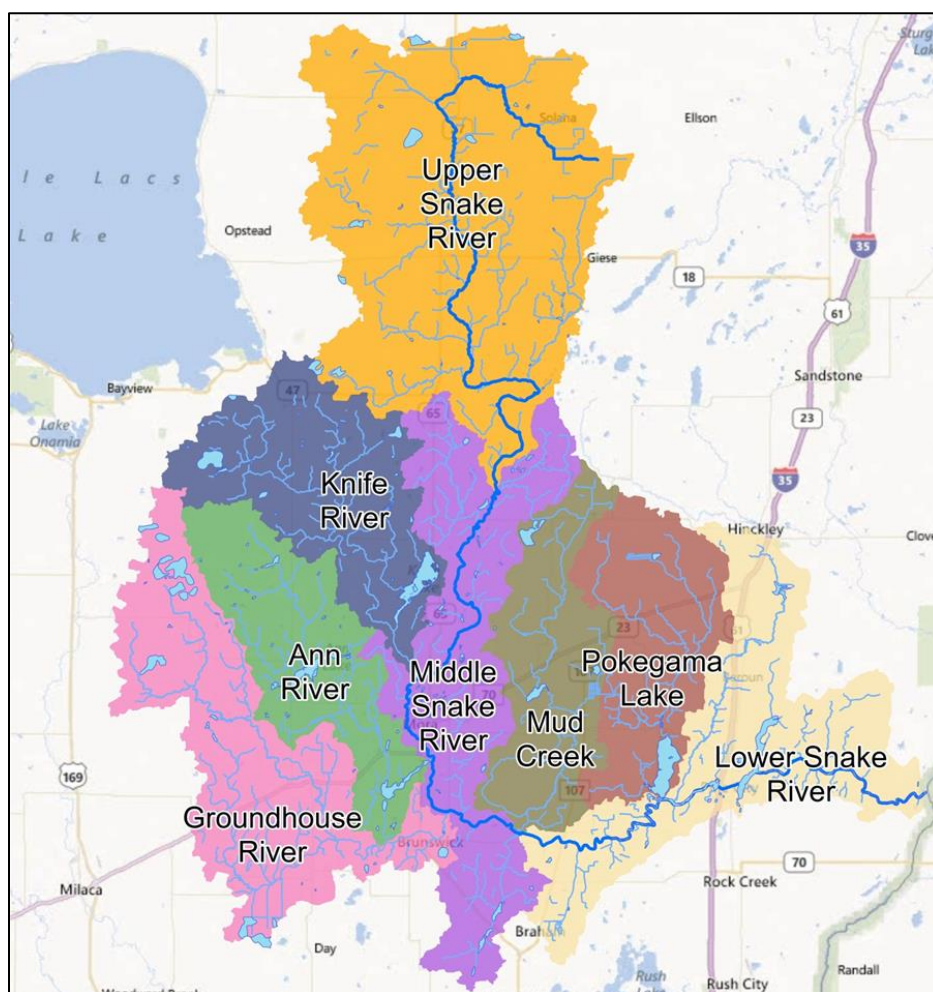


Figure 3. Subwatersheds in the Snake River Watershed. Figure reprinted from 2013 Snake WRAPS Report.

Another tool for interpreting the region's hydrology and riparian areas is the Active River Area (ARA). The ARA is a conservation framework designed to provide a conceptual and spatially explicit basis for the assessment, protection, management, and restoration of freshwater and riparian ecosystems (Smith et al. 2008). The ARA 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 (Figure 4). The framework identifies five key subcomponents of the active river area: 1) material contribution zones, 2) meander belts, 3) riparian wetlands, 4) floodplains and 5) terraces. These areas are defined by the major physical and ecological processes as explained by the ARA framework paper (Smith et al. 2008) in the context of the continuum from the upper, mid, and lower watershed. The framework provides a spatially explicit manner for accommodating the natural ranges of variability to system hydrology, sediment transport, processing and transport of organic materials, and key biotic interactions.

In practice, the ARA, delineated based on the 30m digital elevation model, represents a more ecologically and topographically defined riparian and floodplain area of influence, as compared to common approach of analyzing a simple "buffer" around lakes and streams.

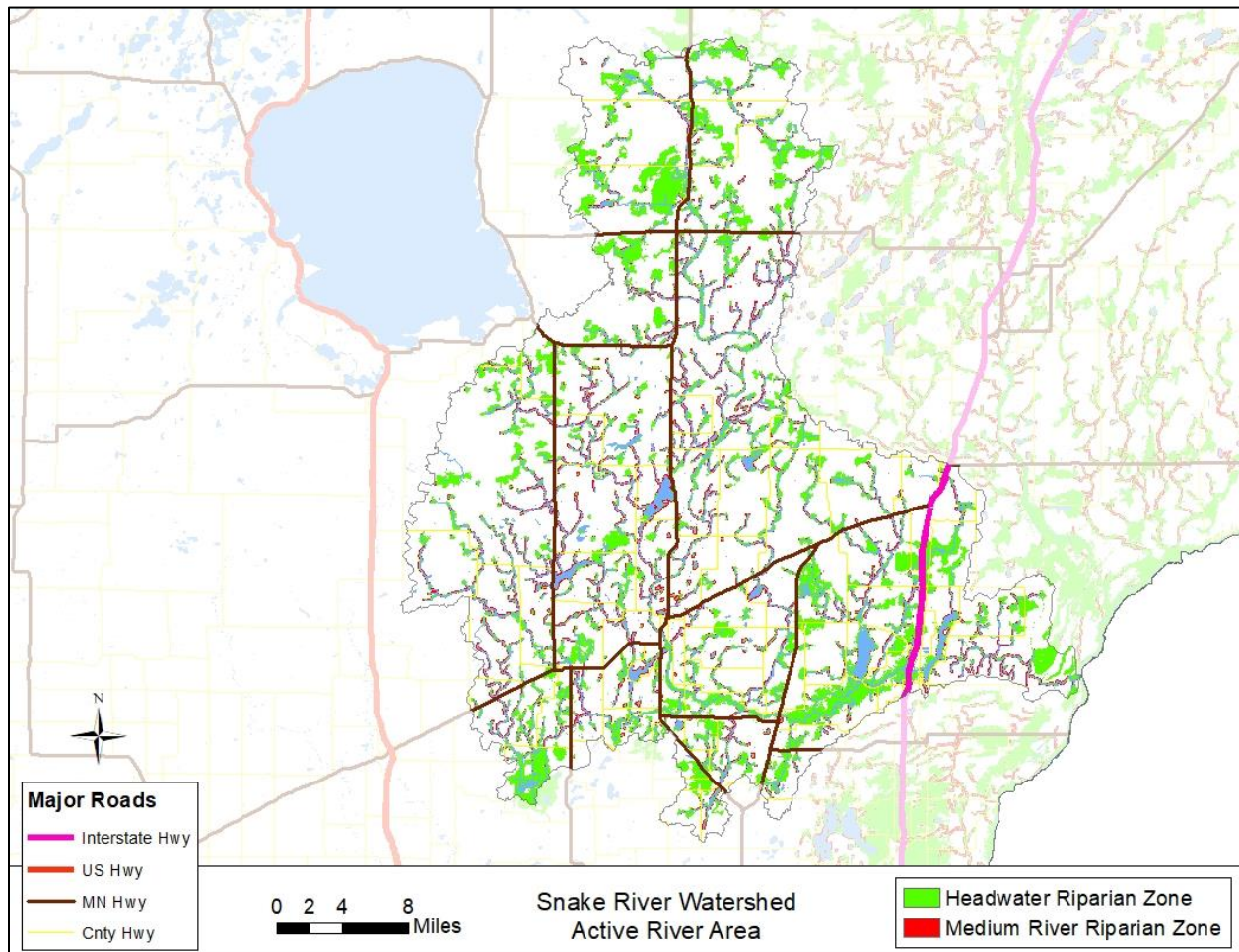


Figure 4. Active River Area analysis for the Snake River showing areas of historical river interaction which includes the historic floodplain and meander belt.

Water Quality

Stream conditions throughout the watershed were assessed by the Minnesota Pollution Control Agency (MPCA) using a range of parameters including fish and invertebrate index of biotic integrity (IBI), fecal coliform and *E. coli*, dissolved oxygen and turbidity. These water quality measurements were then compared to state water quality standards. Stream conditions and impairment assessment for the Snake River Watershed can be found in the [Snake Watershed Restoration and Protection Strategy Report](#). In general, stream and lake quality decreases from north to south in the Snake River Watershed. All stream and lake water quality impairments are concentrated in the middle and south portions of the watershed. Whereas the headwaters of the watershed are unimpaired and support both aquatic life and aquatic recreation.

The MPCA's 2018 Impaired Waters list was pending US Environmental Protection Agency (EPA) approval at the time of printing but is considered an accurate source of impairment information based on MPCA inventories. There are currently 49 impaired waterbodies in the Snake River Watershed, 34 of which have an approved TMDL for the pollutant/stressor (Figure 5). More information can be found at the [MN PCA's Impaired Waters](#) site.

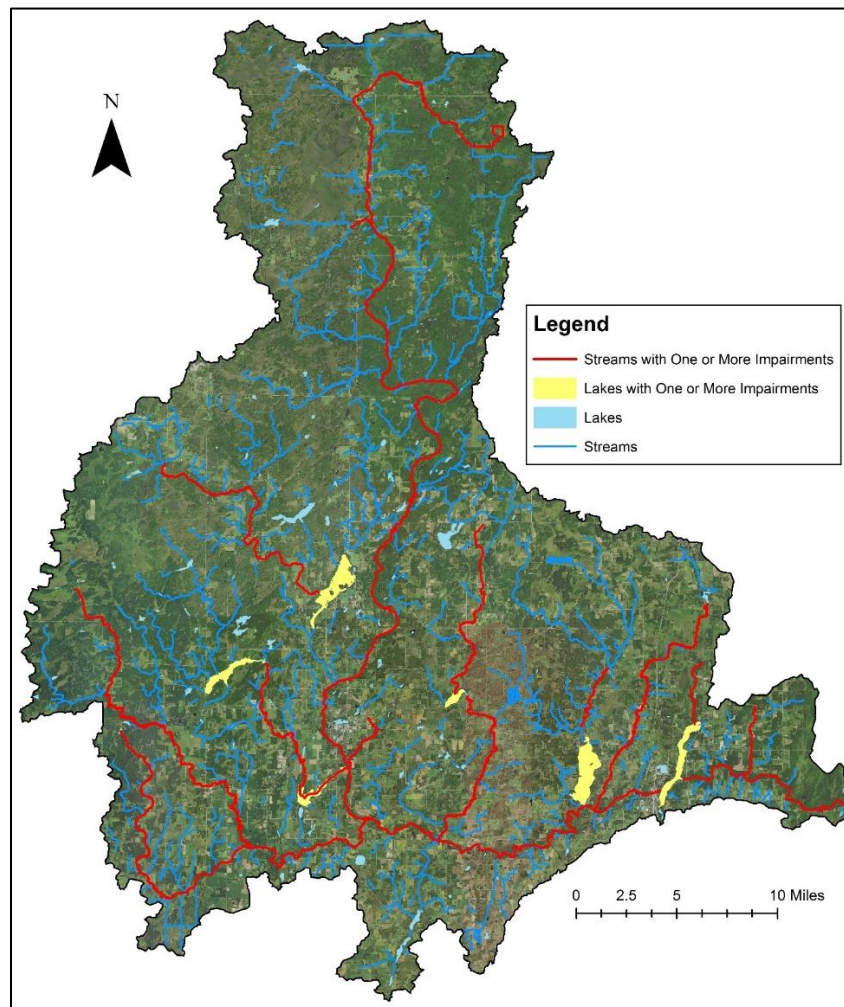


Figure 5. Impaired waterbodies in the Snake River Watershed based on MPCA inventories. Note: this image was shared as a 2018 MPCA draft and was pending US EPA approval at the time of this printing.

Geology

Glaciation has had a major influence on this landscape. The Snake River Watershed has been covered with ice several times, most recently during the Early Wisconsin Ice Age. Most of the region's glacial drift dates to this time and was likely deposited 790,000 to 16,000 years ago predominately from a Superior Basin origin. This geology is primarily defined as the Wisconsin and Minnesota Thin Loess and Till and covers a large area of east-central Minnesota and northern Wisconsin. Gently rolling till plains and drumlin fields along with ground and end moraines are the dominant landforms in this ecoregion. These features have led to the formation of the extensive network of wetlands, ponds, and lakes.

Vegetation

Land Cover

Conifer bogs and aspen-birch communities dominated much of the Snake River Watershed prior to European arrival (Table 2, Figure 6). Windthrow and fire were the primary ecosystem level disturbance and the age of trees on the landscape depended on the frequency and intensity of these events.

Today, deciduous forest are still the most common land cover type but over thirty percent of the watershed exists in a converted cover type ranging from hay/pasture up to high intensity development (Table 3, Figure 7). The communities of Mora and Pine City represent most of the developed land.

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

Marschner Presettlement Vegetation	Acres	Percent
Conifer Bogs and Swamps	186,662	29%
Aspen-Birch (trending to Conifers)	185,279	29%
Big Woods - Hardwoods (oak, maple, basswood, hickory)	103,636	16%
Mixed Hardwood and Pine (Maple, White Pine, Basswood, etc)	71,339	11%
Mixed White Pine and Red Pine	31,663	5%
Wet Prairie	19,281	3%
White Pine	16,798	3%
Oak openings and barrens	11,057	2%
Aspen-Birch (trending to hardwoods)	9,348	1%
River Bottom Forest	6,037	1%
Lakes (open water)	2,442	0%

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

Land Cover Class	Acres	Percent of Watershed	Land Cover Class	Acres	Percent of Watershed
Deciduous Forest	220,138	34.2%	Open Water	11,268	1.8%
Hay/Pasture	124,660	19.4%	Evergreen Forest	4,706	0.7%
Woody Wetlands	95,275	14.8%	Developed, Low Intensity	3,327	0.5%

Emergent Herb. Wetlands	77,433	12.0%	Mixed Forest	1,970	0.3%
Cultivated Crops	53,695	8.3%	Developed, Medium Intensity	957	0.1%
Developed, Open Space	22,035	3.4%	Developed, High Intensity	319	0.0%
Herbaceous	14,940	2.3%	Barren Land	212	0.0%
Shrub/Scrub	12,609	2.0%			

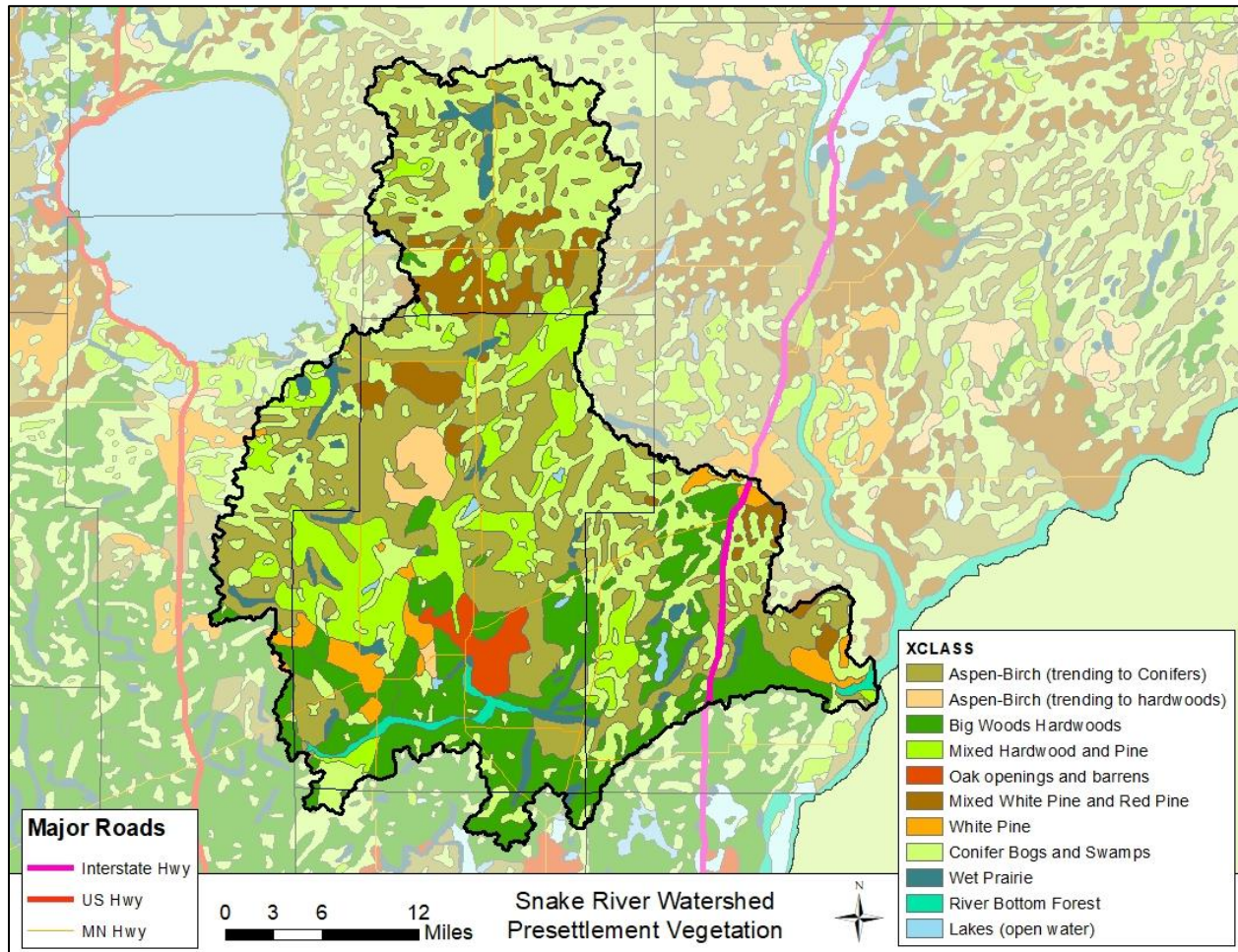


Figure 6. Pre-settlement land cover in the Snake River Watershed based on Marschner's interpretation of the Public Land Survey.

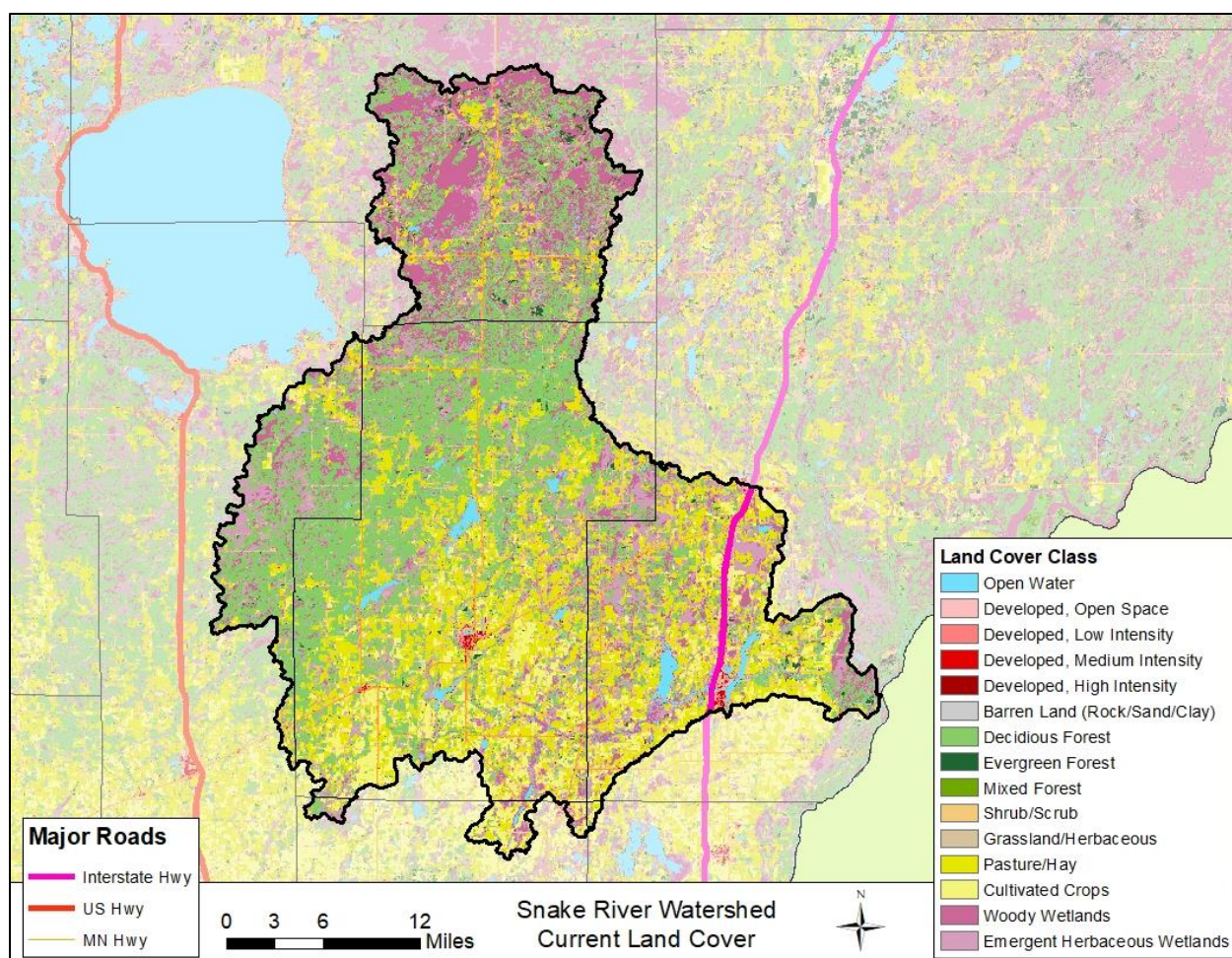


Figure 7. Current land cover in the Snake River Watershed based on the 2011 National Land Cover Database

[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 NPC system describes an area's specific land type or ecosystem and 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 Natural Resources Research Institute integrated a series of geospatial data layers to create rough estimates of the extent and distribution of potential NPCs in the Snake River Watershed (Figure 8). 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 Laurentian Mixed Forest Province produced by the Minnesota DNR and available at: <http://www.dnr.state.mn.us/npc/index.html>.

This information highlights the importance of mesic hardwood forests in this watershed, as they account for over 55 percent of the modeled potential native plant communities. These data also showcase the importance of water in this region, as all but six percent of the watershed was classified as a mesic or wet community.

Table 4. Native Plant Community Systems in the Snake River Watershed.

System Name	Area (acres)	Percent of Watershed
Mesic Hardwood	357,750	56%
Wet Meadow/Carr	115,696	18%
Wet Forest	80,442	12%
Fire Dependent Woodland	40,261	6%
Acid Peatland	22,041	3%
Forested Rich Peatland	19,486	3%
Open Water	7,868	1%

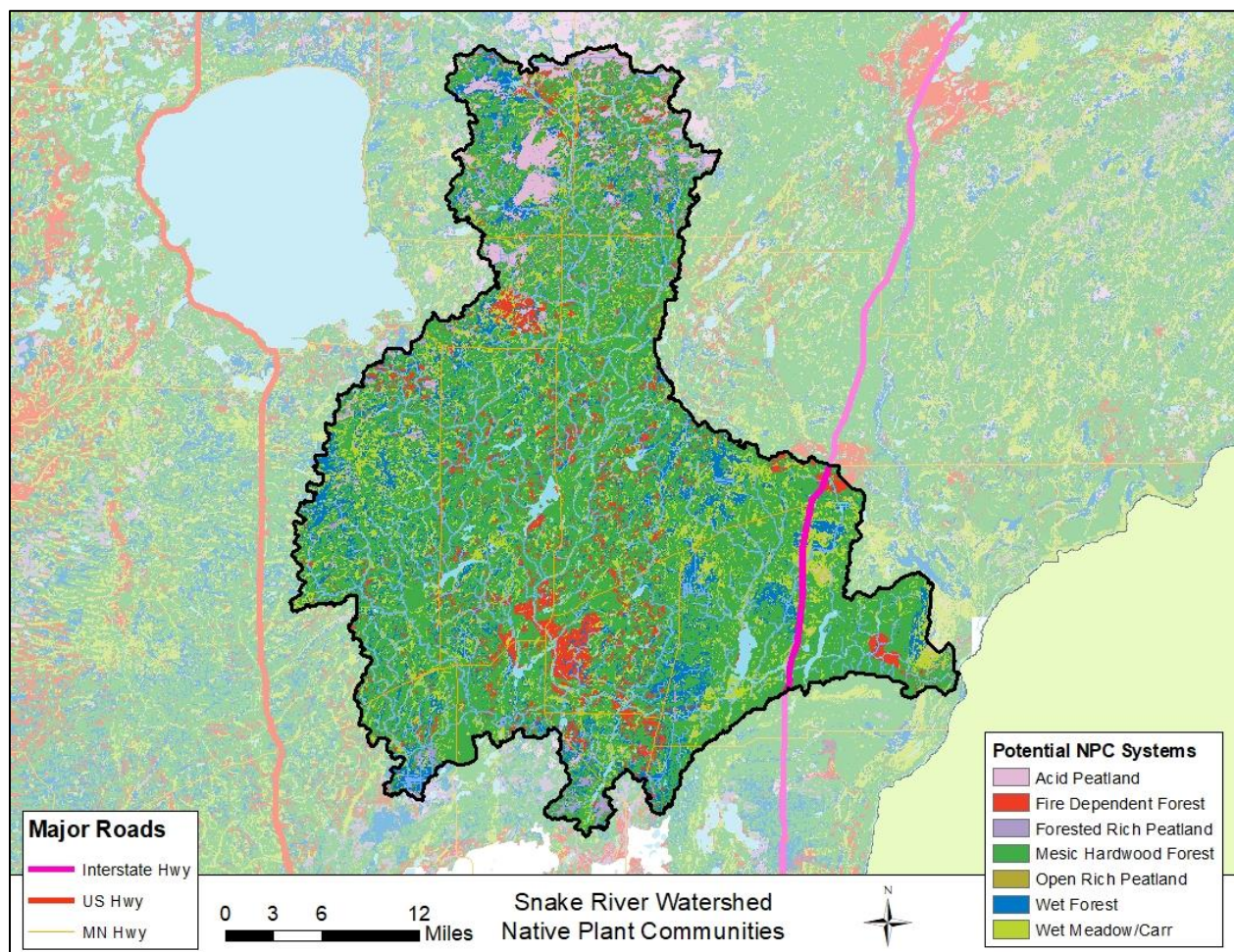


Figure 8. Native Plant Communities in the Snake River Watershed

Invasive Species

Non-native invasive species pose increasing challenges for natural area management throughout Minnesota and the Snake River Watershed is no exception. Many areas have shifted from healthy natural communities to degraded systems dominated by invasive species. This change is most noticeable in areas of high to moderate disturbance.



Riparian area dominated by garlic mustard.

Forest pests have also impacted the forest composition of the region. American elm was one of the most significant species in many of the watershed's forest ecosystems before being decimated by an introduced disease (Dutch elm). 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. There are over 80,000 acres of wet forest in the Snake River Watershed representing 12 percent of the land area. These wet forests often feature a high percentage of ash and are at risk of being significantly altered in species composition and hydrology if emerald ash borer invasion results in the loss of ash in these native plant communities. 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 Snake River Watershed contains a diverse array of plant communities and habitats. Over 200,000 acres have been delineated by the Minnesota Biological Survey (MBS) as potential sites of biodiversity significance in the surveyed counties (Table 5, Figure 9). Field assessments of those sites ranked 9,662 acres as Outstanding and an additional 79,116 acres as High. Most of these sites are found in the large areas of connected forest ecosystems in the northern and western portions of the watershed. 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 the [MBS site](#). MBS data was unavailable from Pine County at the time of this analysis, so the reported acres do not represent the entire watershed.

Table 5. Minnesota Biological Survey delineated areas of biodiversity significance in the Snake River Watershed. Note this table does not include MBS data from Pine County.

MBS Biodiversity Significance Rank	Acres
Outstanding	9,662
High	79,116
Moderate	64,815
Below	52,440
Total	206,034

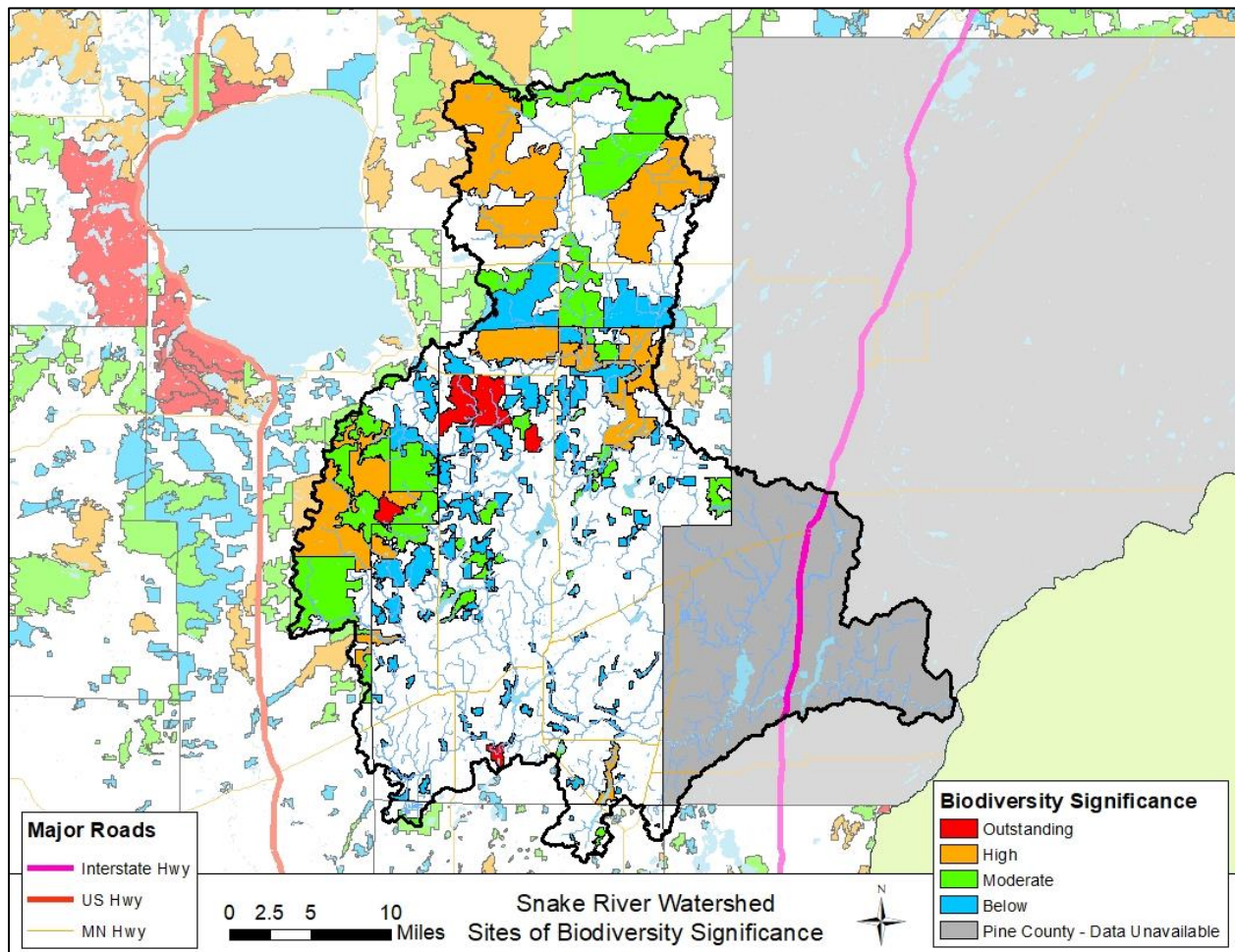


Figure 9. Sites of biodiversity significance in the Snake Watershed, as mapped by the Minnesota Biological Survey. Note: Pine County data was not available when this map was created.

Wildlife

Interaction with wildlife through hunting, fishing, and wildlife watching is important to many Minnesota residents and visitors. Several popular game and non-game wildlife species can be found in the Snake River Watershed. The specific wildlife assemblages vary from place to place throughout the watershed, but generally include common species such as white-tailed deer and turkey and rare species such as red-shouldered hawks. Additionally, the rivers and lakes in the watershed support as many as 65 fish species such as walleye, sturgeon, northern pike, bass, catfish, sunfish, crappies, and brook trout.

The Snake River is particularly important to a variety of mussels and contains all historically known species. The river system harbors relatively intact and regionally significant mussel beds that support at least 15 species of freshwater mussels, including abundant and viable populations of several species listed in Minnesota and Wisconsin as state species of concern. This includes the S1 (State Rare) Purple Wartyback. Other species of note include the State rare (S1) Butternut, and the globally rare (G1) and federally threatened northern long eared bat (Table 6).

Table 6. Number of rare species and community occurrences recorded in the Natural Heritage Information System for the Snake River Watershed.

Organism Type	Observation
Animal Assemblage	8
Invertebrate Animal	733
Other - Ecological	1
Terrestrial Community	9
Vascular Plant	52
Vertebrate Animal	111
Total	914

The recent revision to the State Wildlife Action Plan (2015-2025) identified three Conservation Focus Areas in or near the Snake River Watershed: Aitkin Hardwoods, Mille Lacs Moraines, and Saint Croix River Watershed. These areas are generally regarded as important to rare species and overall biodiversity. More information on the Conservation Focus Areas can be found in the [Wildlife Action Plan](#).

The Wildlife Action Network (WAN) was developed from a variety of spatial data to represent quality aquatic and terrestrial habitats across the state as part of the State Wildlife Action Plan revision. The WAN identified nearly 180,000 acres in the Snake River Watershed that represent quality habitats for terrestrial and aquatic Species of Greatest Conservation Need (SGCN) (Table 7, Figure 10). In general, the WAN highlighted large core habitat areas and connections between them as the most important areas in the Snake River Watershed. Targeting conservation within areas identified in the network will increase the effectiveness and efficiency of efforts to support biological diversity.

Table 7. Wildlife Action Network Scores for the Snake River Watershed.

Wildlife Action Network Score	Acres
High	2,528
Medium-High	27,959
Medium	63,863
Low-Medium	84,552
Low	43,324
Total	178,902

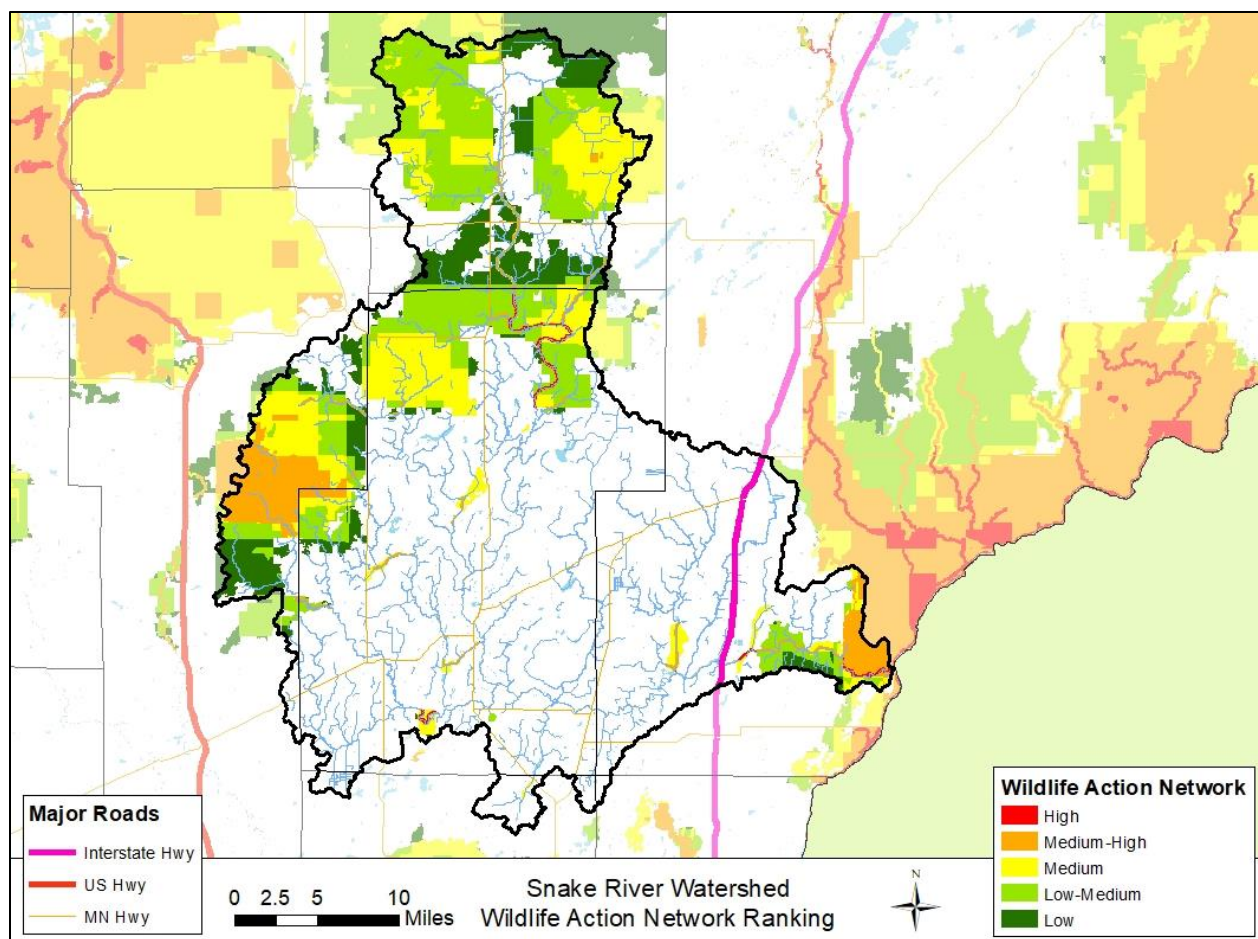


Figure 10. Wildlife Action Network in the Snake River Watershed.

Land Ownership and Forest Stewardship

The Snake River Watershed falls primarily within Aitkin, Kanabec, Mille Lacs, and Pine counties with a small part extending into the northern part of Isanti and Chisago counties. Land use and ownership patterns vary throughout the watershed with a predominantly forested and wetland covered headwaters and a mixture of natural areas, development, and agriculture in the southern reaches. Roughly twenty-five percent of the watershed is in public ownership, primarily in the forested headwaters regions (Figure 11). The primary public land management organizations are the Forestry and Wildlife Divisions of the Minnesota DNR and Aitkin County (Table 8). Aitkin County manages nearly 46,000 of the 54,000 acres of county land in the watershed. The Minnesota DNR Division of Forestry manages 56,500 acres primarily in the Chengwatana, Rum River, Snake River, and Solana State Forests in addition to scattered forestry lands not included in the state forest system. The Division of Fish and Wildlife manages and additional nearly over 42,500 acres as Wildlife Management Areas in the watershed including over 34,000 acres of the Mille Lacs WMA.

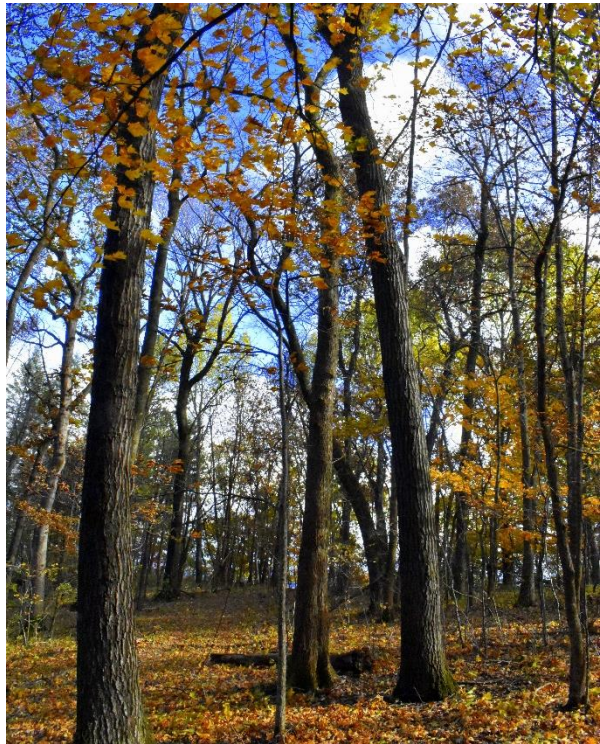


Table 8. Estimated land ownership in the Snake River Watershed.

Ownership	Acres	Percent of Watershed	Percent of Public
Private Land	480,085	75%	--
State Forests	56,486	9%	35%
Other Forestry	10,377	2%	6%
Wildlife Management Areas	42,561	7%	26%
County	54,033	8%	33%

The other 75% of the watershed is owned and managed by private landowners and over 58% of this area is covered in forests, grasslands, brushlands, or wetlands (Table 9). One method to evaluate the current management of these natural areas is to look at existing forest stewardship plans registered with the state [Forest Stewardship Program](#). There are currently 90,400 acres with registered stewardship plans in the watershed and, depending on whether woody wetlands are included, this represents 45 to 61 percent of the private forest lands in the watershed (Figure 11).

Nearly 25,000 of these acres with stewardship plans were enrolled in the [Sustainable Forest Incentive Act](#) (SFIA) as of February 2018. This program provides incentive payments to encourage sustainable use of forest lands. Property owners with qualifying lands are eligible to enroll in this program and receive a payment for each acre of qualifying forest land they enroll in SFIA. In return, they agree not to develop the land and to follow a forest management plan while

they are in the program. All enrolled land must remain in SFIA for at least 8, 20, or 50 years depending on their recorded covenant length.

Alternatively, 52 landowners in Kanabec County enrolled their forest land in the [2-c forestry](#) property classification program in 2017. This alternative to SFIA provides a reduced tax classification rate to forested properties of 20 acres or more that follow a forest management (stewardship) plan and other requirements. Watershed wide data on 2-c enrollment was not available but these 52 enrolling owners accounted 3,800 acres or five percent of the nearly 70,000 acres of forestland with a Stewardship Plan in Kanabec County.

Table 9. Land cover on private land in the Snake River Watershed.

Land Cover	Acres	Percent of Private
Forests and Brushlands	201,335	42%
Hay and Pasture	122,290	25%
Grasslands and Herbaceous Wetlands	69,448	14%
Cultivated Crops	52,910	11%
Developed	25,032	5%
Open Water	9,069	2%

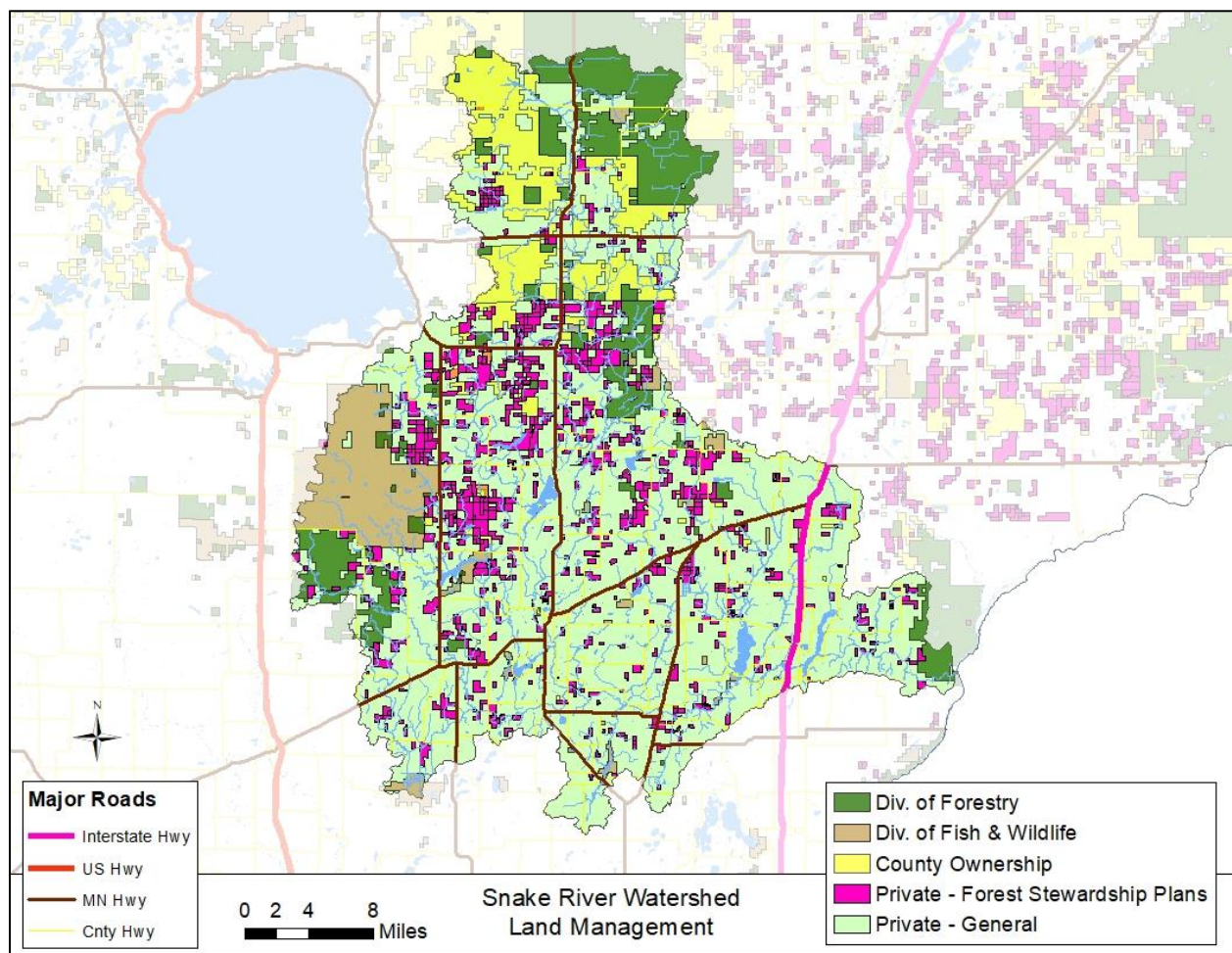


Figure 11. Land ownership in the Snake River Watershed.

Section 3. Targets and Recommendations

Implementation Targets

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 outlines general targets for those items that call for measurable on-the-ground actions to be taken in the watershed (Table 10). These targets propose levels of action to be taken after five and ten years. These targets are benchmarked 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 accumulated 5- or 10-year totals or as annual averages for the first five years and second five years. These targets set measurable 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 these targets. The Planning Team also acknowledges that with any effort, there is year-to-year variability and annual values are expected to fluctuate.

Other strategies are not as conducive to measurable targets but are no less important to achieving the landscape vision. Many of these strategies 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 plant communities and water quality in the region.

Table 10. Snake River LSP implementation targets.

Strategy to Achieve the Landscape Vision	Current	5-Year Target	10-Year Target
Commitment to sustainable forest management on public and private lands.	90,413 acres with a Forest Stewardship Plan	3,000 additional acres with Forest Stewardship Plans	6,000 additional acres with Forest Stewardship Plans
	Data Not Currently Available	100% BMP Implementation	100% BMP Implementation
Pursue opportunities for increased natural area protection through SFIA enrollment, conservation easements, and public acquisition in strategically important areas for water quality and biodiversity.	24,396 acres enrolled in SFIA	1,000 additional acres in SFIA	2,000 additional acres in SFIA
	690 acres in easements	500 additional acres of easements	1,000 additional acres of easements
	160,316 acres of public land	500 additional acres of public land	1,000 additional acres of public land
Develop and implement natural resources management plans for all tax forfeit lands that will be retained in public ownership.	Data not currently available	85% with plans	100% with plans
Identify opportunities to work with landowners on conservation projects with a focus on forest blocks, increasing habitat corridors, and riparian buffers.	Contact rate is not currently compiled between organizations	100 landowners contacted	200 landowners contacted
	1 non-compliant parcel within the watershed	Full and on-going compliance with the State's buffer law	Full and on-going compliance with the State's buffer law
Emphasize the importance of a forest stewardship plan and implementing its recommendations.	786 properties with a Stewardship Plan	75 new Stewardship Plans	75 new Stewardship Plans

Encourage participation in programs that promote the restoration and maintenance of native habitats through cost-share, rental payments, technical advice, and local tree sales.	1,020 acres of NRCS Conservation Projects in Kanabec Co. – Annual Average 2012-17	2,000 acres of Conservation Projects added annually across the watershed	2,500 acres of Conservation Projects added annually across the watershed
	50,000 native seedlings sold by SWCDs annually	60,000 native seedlings sold by SWCDs annually	70,000 native seedlings sold by SWCDs annually
Work with agricultural producers to expand the use of sustainable cropping and grazing practices and soil health principles.	49 cropping, grazing, soil health practices funded by Mora NRCS 2012-17	75 cropping, grazing, soil health practices funded by NRCS across the watershed	150 cropping, grazing, soil health practices funded by NRCS across the watershed
Control invasive species.	4 invasive species outreach events annually	6 invasive species outreach events annually	6 invasive species outreach events annually
Agencies and nongovernment conservation organizations engage in productive coordination and collaboration to accomplish the goals and visions outlined in this plan	4 MFRC East Central Landscape meetings annually	4 MFRC East Central Landscape meetings annually	4 MFRC East Central Landscape meetings annually
Improve water quality as outlined in the TMDL	49 impaired waterbodies, 34 with approved TMDL	Achieve TMDL targets on 5 waterbodies	Achieve TMDL targets on 15 waterbodies
Use outreach and education to foster a 'land ethic' among land managers, landowners, community and citizen groups, and local communities	12 events annually	12 events annually	12 events annually
Promote peer-to-peer networks	1 meeting annually	4 meeting annually	4 meeting annually

Agency and Organization Recommendations

This section lays out a series of recommendations from the Planning Committee to specific organizations or groups. These recommendations highlight opportunities for each interest group to contribute to the overall vision of the watershed. This section can help implementers evaluate their role in the watershed.

Outreach and Community Engagement Organizations

Examples: Saint Croix River Association, SWCDs, Minnesota Forest Resources Council (MFRC), Snake River Watershed Management Board, Snake River Citizens Advisory Committee, Audubon Center of the North Woods, DNR Divisions, Public Schools, UMN Extension, 4H, and agriculture organizations.

1. Host General and Targeted Outreach Events. Most landowners and the broader 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 the value of natural communities, 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 and the greater landscape.

2. Natural Area Management Techniques. Develop online content and host events showcasing natural area management techniques. Many landowners would like to undertake land stewardship projects but often lack confidence or awareness of the best techniques. Peer-to-peer learning opportunities are especially effective exercises in this setting as landowners can learn from what has, or has not, worked for their fellow landowners. 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, MPCA, DNR Cost-Share Assistance

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. MPCA manages Federal 319 Grants and Clean Water Partnership Grants and Loans. 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 services offered by consultants, agencies, and non-profit organizations.

Natural Resource Agencies

Examples: DNR Divisions, 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 sustainable silviculture, invasive species control, 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 as a guide to developing land management strategies when working with landowners and local officials. Refer to this Landscape Plan and its COA Plans when talking with landowners and developing their 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. Data Gathering. Support the collection, organization and evaluation of data collected relating to natural resources on all lands. Encourage the coordination and sharing of data with other resource agencies and local officials.
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.

Board of Water and Soil Resources

1. Support healthy watershed protection easements in East Central Minnesota. Healthy Watershed RIM (Reinvest in Minnesota) easement programs are being piloted in other areas of Minnesota. Similar programs targeting managed grassland and forestland on key landforms in the region would be a powerful tool to help protect both water quality and existing native plant communities. Conservation easements like RIM can be a great option for conserving areas of high water quality or biodiversity significance without increasing public landholdings.

Clean Water Fund Advisory Council

1. Healthy Forests for Healthy Waters. Continue to support programs that target natural community maintenance and 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, Trust for Public Land, Pheasants Forever, Ruffed Grouse Society, and other sportsmen's groups.

1. Commitment to Sustainable Natural Resources Management. Many private landowners will look to conservation organizations as a model for land management. Conservation Organizations should be aware of this and undertake efforts to expand sustainable silviculture, invasive species control, 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, through 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 and Adopt this Plan. County and 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 part of their vision for land management in the watershed. Attaching this as an appendix to their plans can provide a 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 to improve their communities and their future development. Zoning should consider 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. SFIA Management. Continue to increase the effectiveness of the SFIA program by working with the Minnesota Department of Revenue to administer the program within the watershed.

3. 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 East Central 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 EC Committee. Provide additional staff support to the efforts of the East Central 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 and Citizens

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 and other natural areas.
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. 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](#).

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 (Figure 12).

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 Snake River, where 75% of the land, and 64% of the natural areas, are privately owned.

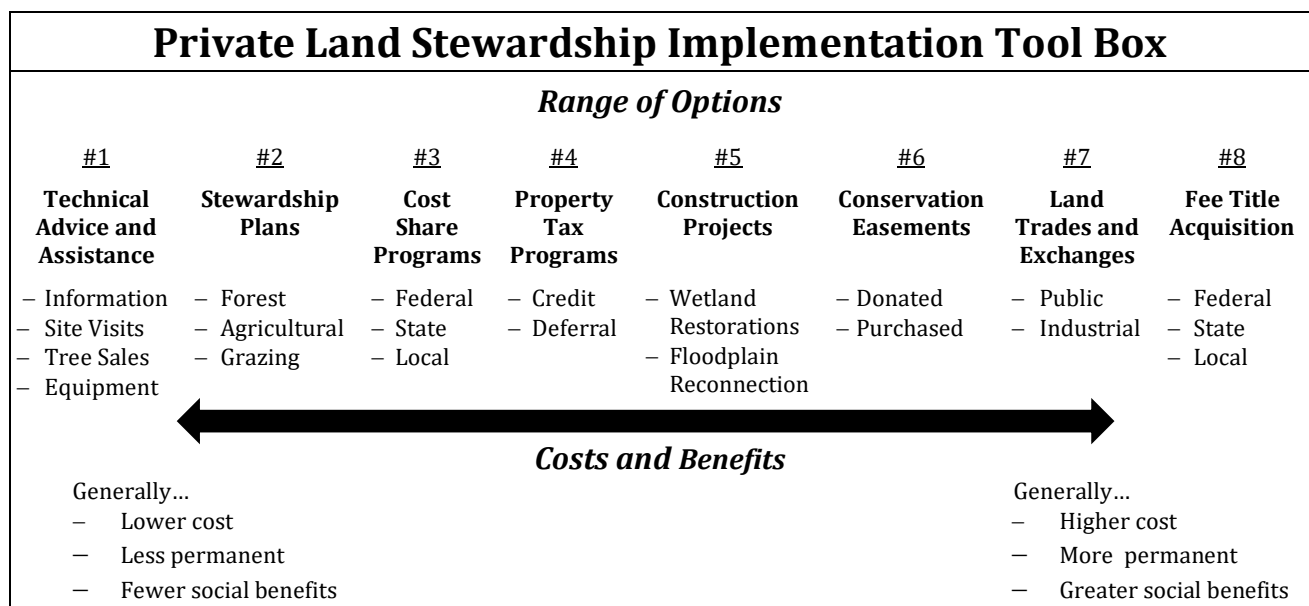


Figure 12. Private Land Stewardship Implementation Tool Box. Adapted from the “PFM Implementation Tool Box: Foundation to Service Delivery to Private Woodland Owners” originally developed by Dan Steward, Minnesota Board of Water and Soil Resources

Conservation Opportunity Areas

To help direct conservation efforts within the watershed in strategic and cost-effective ways, four Conservation Opportunity Areas (COAs) have been identified to focus efforts in ways that will have the greatest impact on protecting habitat and water quality. In general, these areas have not been seriously degraded or developed, and support quality natural communities and habitat. 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

The quality of local areas in terms of habitat and ecosystem function across a landscape is likely to be spread along a continuum 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 Snake 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, the highest functioning ecosystems are often already well protected from future development or degradation and efforts should focus on continued protection and proper management to preserve their special attributes.

Between these two extremes are the areas for which conservation efforts will have the greatest impact at 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 exploitive logging practices, but the full suite of plant or animal communities may 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 with a focus within the Snake River Watershed. Several spatial analyses were developed to quantify terrestrial habitat value, aquatic habitat value, resilient and connected landscapes analysis, groundwater recharge hotspots, and areas of importance for drinking water. The composite of these five analyses can be seen in Figure 15.

Terrestrial Habitat Analysis

The terrestrial habitat analysis represents areas across the Snake River Watershed of highest importance for a diversity of terrestrial species. This analysis is a combination of the original module produced in 2012 for the Saint Croix HabSCAT analysis (90%), and the updated Marxan and Wildlife Action Network priority maps produced for the 2015 update to the state Wildlife Action Plan (10%) (Figure 14).

Data Product	Description
Habitat Quality	Habitat Quality Scores are defined by MBS Biodiversity Significance polygons (Outstanding, High, and Moderate).
Target Communities	Target communities came from two sources: 1) Communities identified in The Nature Conservancy's (TNC) Conservation Action Plans for the Saint Croix Watershed, 2) Locations of specific seepage community species identified by the Minnesota Biological Survey
Habitat Complexes	Score is based on the overall size and the ratio of interior to exterior for each complex, as well as whether the individual cell is located in the interior of a complex
<p>The above three datasets were used to calculate a Natural Resource Location Score for each 30 m pixel. This score was used as both an input to the Protection Opportunity Model and to calculate the more generalized <i>Natural Resource Score</i>. The <i>Location Score</i> of each cell were assigned as follows:</p> <p><i>Habitat Quality Score</i> * .50 <i>Target Community Score</i> * .30 <i>Habitat Complex Score</i> * .20</p> <p>The resulting scores were normalized so cells with the lowest values = 0 and the highest = 100. This is the score used to calculate the overall <i>Terrestrial Habitat Score</i>. The <i>Natural Resource Score</i> is based on the average values of the <i>Location Scores</i> of cells within a 200m radius. These scores are normalized so the cells with the lowest scores = 0 and the highest = 100. A score of 100 represents the cells with the highest average natural resource value in the surrounding 200m.</p>	

Aquatic Habitat Analysis

The Aquatic Habitat Analysis is a combination of the original Aquatic Habitat module produced in 2015 for the Saint Croix HabSCAT analysis and the 2017 methodology developed by The Nature Conservancy for aquatic-focused biodiversity module. The module incorporates available data layers designed to represent parts of the watershed where protection will have the highest benefits to fish and wildlife and their habitats, focusing on aquatic habitat.

The revised Aquatic Habitat Analysis combines Mussel habitat protection score (20%), the original Aquatic HabSCAT module (40%); and the aquatic biodiversity multiple benefits module (40%) (Figure 14).

Mussel Habitat Protection

Data Product	Description
Mussel Protection Value	Based on both SGCN/state-listed mussel species diversity, overall species diversity, and CPUE derived from the statewide mussel survey data for the Saint Croix Basin (Sietmann, pers.comm., 2012)

Aquatic HabSCAT components (original Saint Croix model) (40%)

A raster layer with 30m grid cells, each assigned a value between 0-100 with 100 representing the highest potential aquatic biodiversity significance score and 0 representing the lowest. Using the methodology below, scores were assigned to cells within the Active River Area footprint derived for the Saint Croix River Basin, plus non-ARA grid cells occurring within 1500 meters of a surface water feature in the Saint Croix Basin. Upland grid cell scores were based on interpolation of scores of downstream grid cell values in each catchment in conjunction with cost-distance and flow paths.

Data Product	Description
Fish Protection Value Scores (15%)	Based on Fish Index of Biological Integrity scores, species richness, and SGCN species richness
Aquatic Conservation/protection value score (other)(10%)	Macroinvertebrate IBI scores where available
Riparian Condition	Perennial cover of Active River Area in DNR catchment and Perennial cover at local reach scale.
Connectivity	Connectivity represents a combination of two data sets 1) Proportion of open mainstem. Calculated by dividing the distance to mainstem dams in the upstream and/or downstream direction. If no mainstem dams exist, then this field is given a value of 1. 2) Upstream dam density. This field represents the upstream density of all dams along the stream network. Calculated by dividing the total number of upstream dams by total upstream network length. Represents a penalty score.
Local Watershed Condition	Used analysis obtained from MN DNR Watershed Health Assessment Framework
Cumulative Upstream Watershed Condition	Used analysis obtained from MN DNR Watershed Health Assessment Framework

Aquatic Biodiversity Module Components (2014) (40%)

Data Set	Description
RWI Benefit to Species Value	The <i>Species benefits</i> layer developed by UMN-D, NRRI as a component of the Restorable Wetlands Prioritization Tool using a subset of the individual habitat components from the Ecological Benefits Index (EBI) including sites of biodiversity significance, Species of greatest conservation need (SGCN) (number of species of greatest conservation need for which the land may provide suitable habitat); Potential bird habitat (probable number of birds from a modeled set of 17 that might use that habitat); and weighted habitat protection
Biodiversity Significance Score	Biodiversity significance rank to surveyed sites based on landscape context and ecological function, existing native plant community quality and rarity, and species quality and rarity (Minnesota Biological Survey). Rankings: outstanding, high, moderate, and below.
Lakes of Biological Significance	This layer is based on the lake catchment for lakes designated as Lakes of Biological Significance (LBS) based on four community types (aquatic plants, fish, amphibians, birds); or if the lake is included in the Conservancy's lake portfolio.
Index of Biological Integrity	This layer includes lake catchments with outstanding IBI scores based on the preliminary fisheries lake IBI. Lake catchments are scored based on the highest scoring lake meeting the IBI standard: meeting standard (1 pt), above standard (2 pts) and exceptional (3 pts), plus (+1 pt) if catchment contains a lake in the TNC lake portfolio.
Wild rice catchments	Lake catchments identified as having significant wild rice.

Coldwater refuge: cisco	Level 8 DNR lake catchments for lakes identified by the Minnesota DNR to be the most resilient, likely refugia for ciscoes (tullibee, <i>Coregonus artedii</i>), identified as priorities for protection in the Minnesota DNR Fisheries Aquatic Habitat Strategic Plan.
High Conservation Value Forests	We used Forest Legacy Ecological Evaluation Tool results (ecological value) for the Superior Mixed Forest ecoregion; for the southern part of the basin that is part of the Prairie Forest Border we rescaled the USFWS Upper Mississippi River Forest Partnership Priority Forest for Drinking Water (USFS 2009).
Ecological Patches or Connections	We created a layer representing landscape habitat connectivity for both aquatic and terrestrial species based on perennial lands within the Active River Area (ARA) layer.
Proximity to protected lands	This layer is scaled 0-100 based on inverse distance to protected lands, on the assumption that all else being equally, lands more closely connected to an existing network of protected lands are of relatively higher conservation value.
Proximity to water	This layer is scaled 0-33 based on inverse distance to water features, on the assumption that the value of lands to fish and wildlife is in direct proportion to their distance from water.

Drinking Water Quality

The Drinking Water module was developed to represent priority areas for protection **and/or** restoration, weighted on the relative potential impact on estimated actual users where they obtain their drinking water (Figure 14).

Data Set	Description
Drinking Water Management Supply Area Vulnerability (DWSMA)	This is a delineation of areas of concern for and relative risk for a potential contaminant source within the drinking water supply management area to contaminate a public water supply well based on the aquifer's inherent geological sensitivity; and the chemical and isotopic composition of the ground water. Source: MDH
Wellhead Protected Areas:	WPA is the surface and subsurface area surrounding a public water supply well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field. Source: MDH.
Groundwater Contamination Susceptibility:	A broad, generalized interpretation of ground water contamination susceptibility for the state, based on modeling relying on data inputs from the MLMIS40 (40-acre raster) soils and geology data, with additional geology inputs. The parameters that control ground water susceptibility to contamination are quite varied and overlapping, and include: soil media, topography, depth to water, aquifer media, vadose zone materials, net recharge, hydraulic conductivity of aquifer, hydraulic gradient, distance to nearest drinking water supply, depth to bedrock, unsaturated zone permeability and thickness, and net precipitation.
Proximity to mainstem	(Mainstem and Major Tributaries) Lands within the Active River Area (ARA) are assigned zonal values.

Private well density	This layer summarizes the County Well Index (CWI) layer (Source: MDH) by Huc12 watershed to summarize the number of private domestic water supply wells in each 12-digit watershed that are located in a vulnerable or highly vulnerable groundwater area, and is converted to 10 density classes by Huc12. The CWI layer is known to be dated and incomplete, but represents an accurate representation of the population density relying on private domestic groundwater wells.
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Groundwater Recharge

This analysis reflects areas important for groundwater recharge (Figure 14).

Data Set	Description
Groundwater Recharge (inches/year) (Smith et. al 2015) and Groundwater recharge (inches/year) (Lorenz and Delin 2007)	The two layers are averaged together to yield a long term potential average recharge (in inches / year of rainfall that recharges groundwater and supports streamflow).
Water use vulnerability Index, Predicted Vulnerability	DNR Watershed Health Assessment Framework (WHAF) Catchment Score. The index is based on the sum of permitted withdrawal from surface water and groundwater. Using the State Water Use Database (SWUD), total potential consumption was calculated by summing permitted use and comparing to annual runoff. The “water use vulnerability index” is scaled as the greater the amount of water used as percent of runoff, the lower the score. The Catchment Predicted Vulnerability is the five year trend in reported use as a percentage of runoff.

Resilient and Connected Landscapes Analysis

This analysis focuses of identifying climate resilient sites across the landscape that may serve as strongholds for biodiversity and landscape resilience into the future (Figure 13).

Analysis Component	Description
	For Details of Analysis See: www.NATURE.ly/TNCResilience Note: the following descriptions are taken from Resilience Concepts Document at the above link.
Landscape Diversity	Refers to the microhabitats and climatic gradients available in one’s immediate neighborhood. Topographic diversity buffers against climatic effects because the persistence of species in an area increases in landscapes with a wide variety of microclimates. In this study, we measure microclimates by counting the variety of landforms, measuring elevation range, and the density and configuration of wetlands in a 100-acre neighborhood around every point on the landscape.
Local Connectedness	Refers to the number of barriers and the degree of fragmentation within a landscape. A highly connected landscape promotes resilience by allowing species to move around the landscape and find suitable microclimates where they can persist. In this study, we measure local connectedness by

	measuring the amount of natural land cover and configuration of human-created barriers like major roads, developments, and agricultural land.
Final Resilience Scores	A site's Resilience Score estimates its capacity to maintain species diversity and ecological function as the climate changes. The score is relative to all other sites with the same geophysical setting and is described on a relative basis as above or below average. Our goal was to identify the places most resilient to climate change for each type of setting. A site's final resilience score was determined by evaluating physical characteristics that foster resilience, particularly the site's landscape diversity and local connectedness.

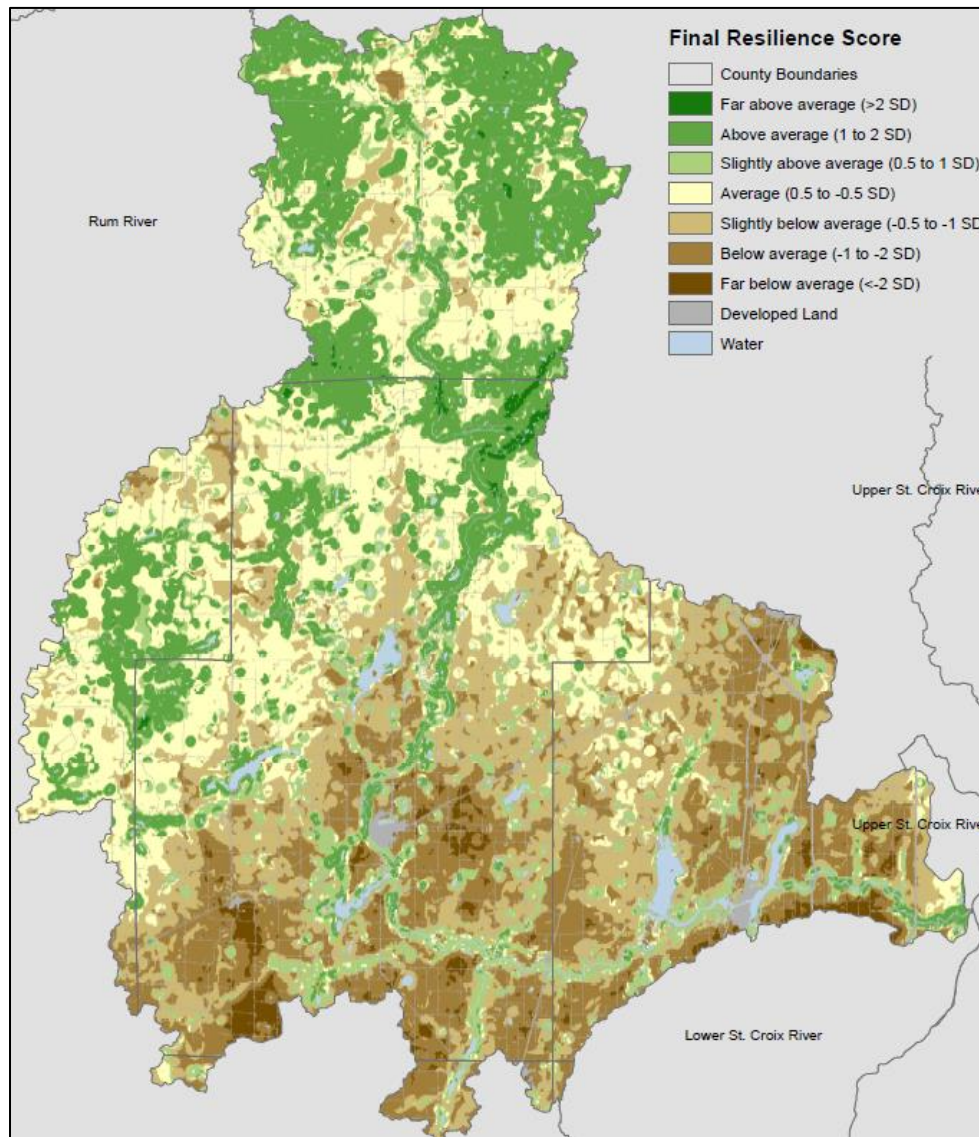


Figure 13. Resilient and connected landscapes in the Snake River Watershed. This is one of five analyses used to identify COAs in the Watershed.

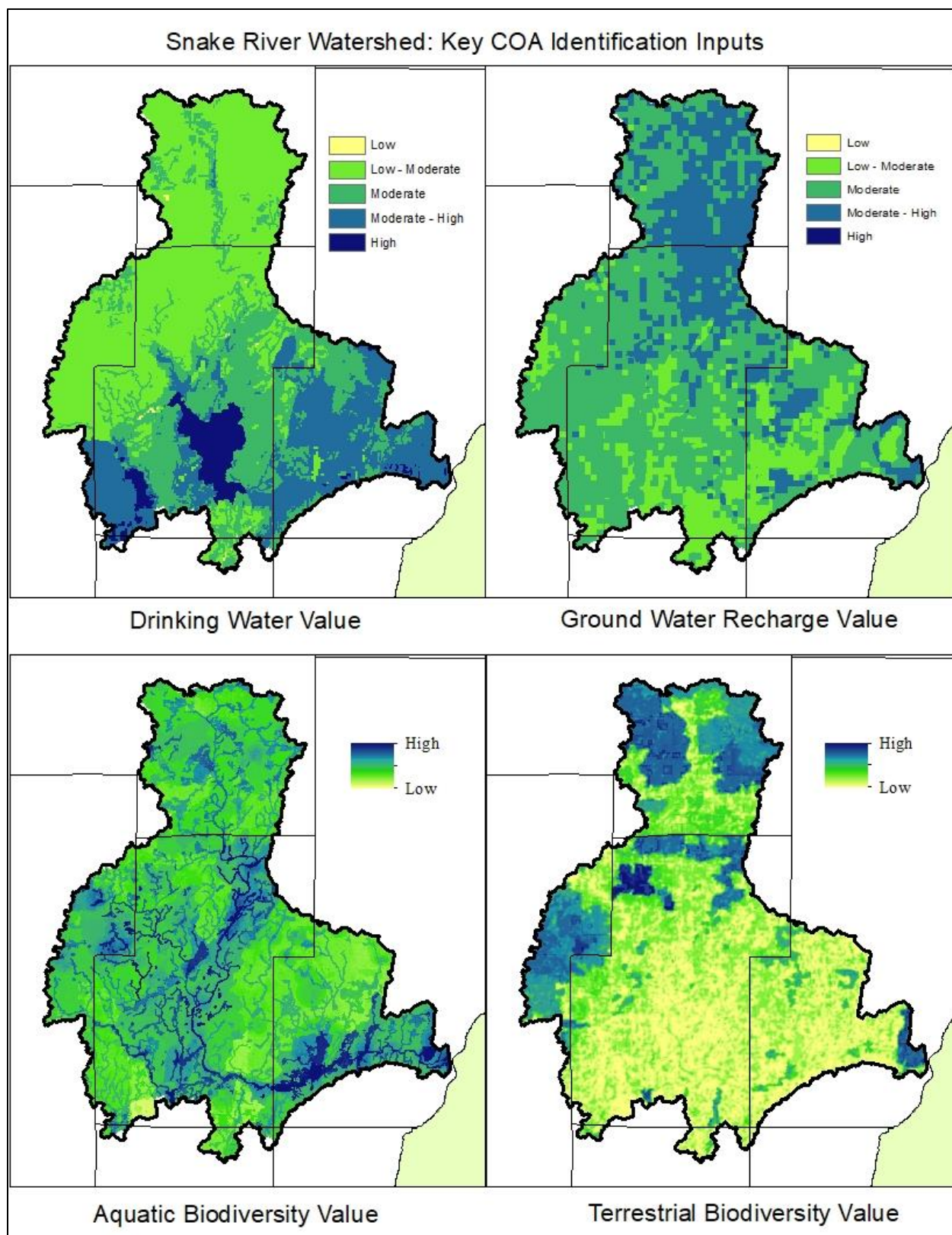


Figure 14. Maps of four of the five spatial analyses used to identify COAs in the Snake River Watershed. Groundwater recharge hotspots, areas of importance for drinking water, terrestrial habitat value, and aquatic habitat value are represented here. The fifth analysis – resilient and connected landscapes appears above.

Conservation Opportunity Area Delineation

The Planning Team participated in a collaborative prioritization process using the above spatial prioritization analyses, combined with best professional judgement, to identify Conservation Opportunity Areas of focus. Based upon overlapping priorities of the above listed analyses (Figure 15), COAs were designated to capture contiguous, high-scoring sub-watersheds that contained recognizable ecological complexes across both public and private lands. COA boundaries were primarily based on sub-watersheds or clusters of sub-watersheds except for the Lower Snake River COA. The Planning Team strongly believed a riparian-focused COA was needed to capture the unique ecological and conservation needs within an approximate ½ mile buffer along the lower portion of the Snake River. The final COA shapes are shown in Figure 15.

Four COAs were selected in the Snake River Watershed based on the assessment information.

- Headwaters COA: This COA encompasses nearly 67,000 acres in the northern part of the watershed. This rural area has no incorporated communities and is nearly 75 percent publicly managed by the Minnesota DNR and Aitkin County Land Department. The area retains the wet forest conditions that were observed in the Public Land Survey with very little conversion to residential or agricultural land use. This area's position in the Snake River's headwaters and its large blocks of intact forests and wetlands make it a priority for regional biodiversity and downstream water quality.
- Lower Snake COA: This nearly 28,000-acre COA includes all of the land within a ½ mile buffer of the lower 35 miles of the Snake River and the lower 5 miles of Rice Creek. Unlike the other Conservation Opportunity Areas, the Lower Snake includes a few residential communities, notably Pine City and Mora. Prior to settlement, this area consisted of a variety of riparian forest and wetland communities. Many of these communities remain however nearly 50% of the COA has been converted to agriculture or residential/commercial uses. Despite this partial conversion, the Lower Snake remains one of the most important areas in the state for native mussel biodiversity.
- Mille Lacs COA: This 55,000-acre area contains a series of forests and wetlands that provide important habitat to a wide variety of plants and animals. The area is 63% private but only about 15% of the COA has been converted to agriculture, residential, or commercial development. Effective stewardship of the COA's private forests will help maintain this area's high value to regional biodiversity. This area also includes a large portion of the Mille Lacs Wildlife Management Area.
- River Bend COA: This is the smallest COA at just over 15,000 acres. This COA is nearly entirely deciduous forest and wetlands with scattered hay or pasture lands. The Snake River State Forest follows the river in this COA and this block of forested cover creates a valuable corridor through the region.

These COAs represent places of emphasis for the conservation actions outlined in [Section 1](#). Individual stewardship plans for each COA are found in [Section 6](#). 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.

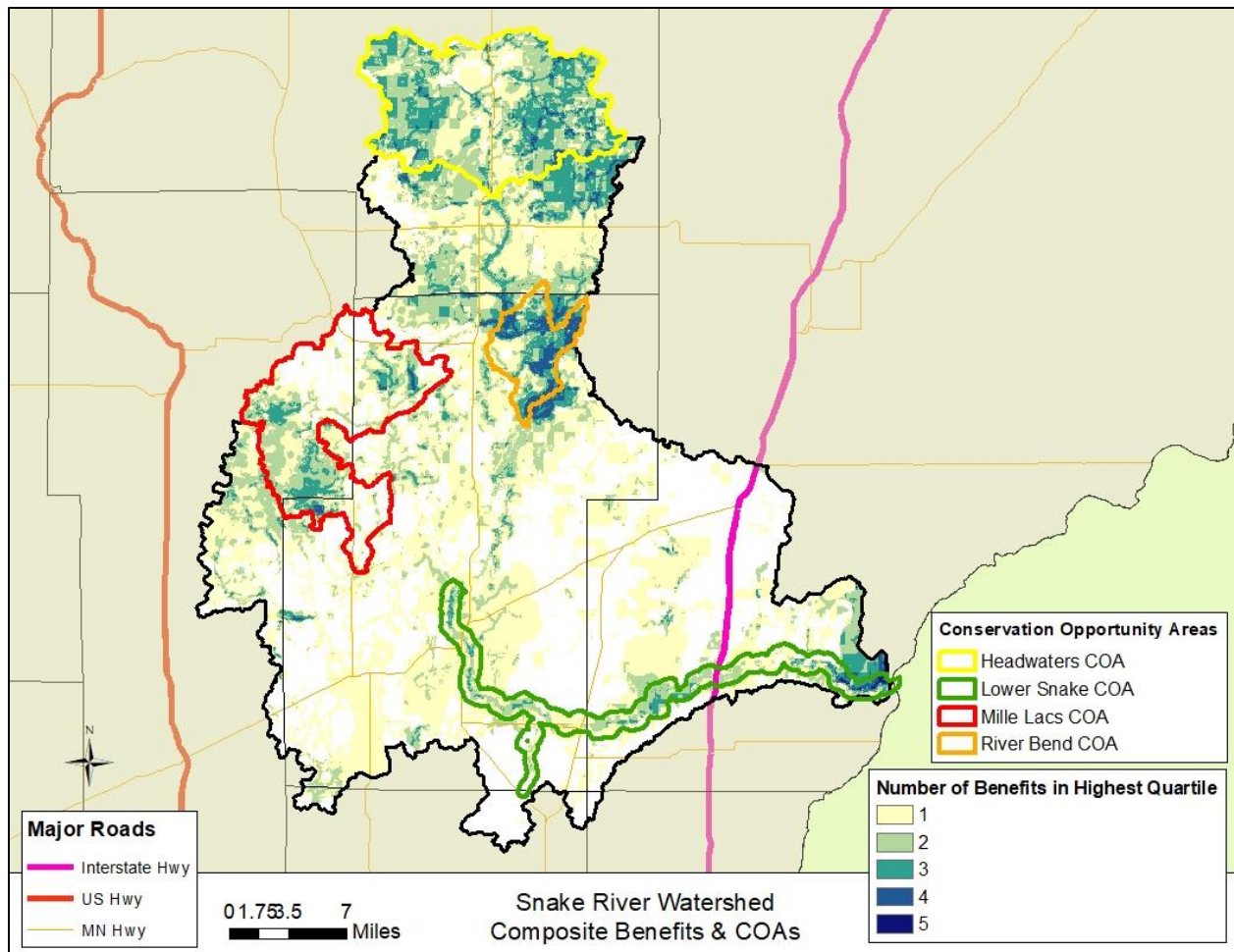


Figure 15. Composite map of five spatial analyses in the Snake River Watershed and the Conservation Opportunity Areas the Planning Team decided upon. The composite map includes analyses developed to quantify terrestrial habitat value, aquatic habitat value, resilient and connected landscapes analysis, groundwater recharge hotspots. All five sources for the composite map can be seen above.

Partners and Partnerships

There is a wealth of government agencies, non-profit organizations, conservation groups, and stakeholders working in the watershed and coordinating efforts between organizations can make for more 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 entire watershed.

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 Snake River watershed include state and federal agencies, as well as non-governmental conservation groups. The adjacent list includes many, but not necessarily all, such partners.

State Agencies:

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

Local Government:

- County and City
- Soil and Water Conservation Districts
- Watershed Districts

Tribal Governments

Federal Agencies:

- National Park Service
- Natural Resources Conservation Service
- Farm Service Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service

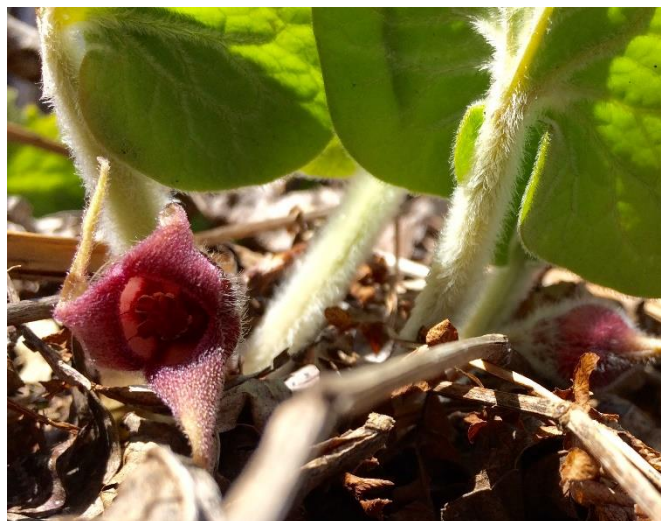
Non-governmental Organizations:

- Land Management Consultants
- Minnesota Land Trust
- Pheasants Forever
- Ruffed Grouse Society
- St. Croix River Association
- The Nature Conservancy
- Trout Unlimited
- Trust for Public Land

Priority Parcels for Conservation

In addition to identifying Conservation Opportunity Areas, the Planning Team wanted to identify Priority Private Parcels for Stewardship Action. A GIS analysis done by The Nature Conservancy identified highest priority parcels for key stewardship activities. These parcels were identified using an overlay of the top quartile scores for each of the above analyses (Aquatic, terrestrial, drinking water, ground water, and resilience). Parcels over 40 acres in size not already in public (state, federal, or county) ownership AND in the highest quartile ranking were identified as key parcels for stewardship outreach / assessment.

These are parcels where private land stewardship actions should have the greatest impact on regional biodiversity and water quality. The resulting map of priority stewardship parcels were spread throughout the watershed with a few concentration centers, notably in northern Kanabec County near the Snake River State Forest (Figure 16).



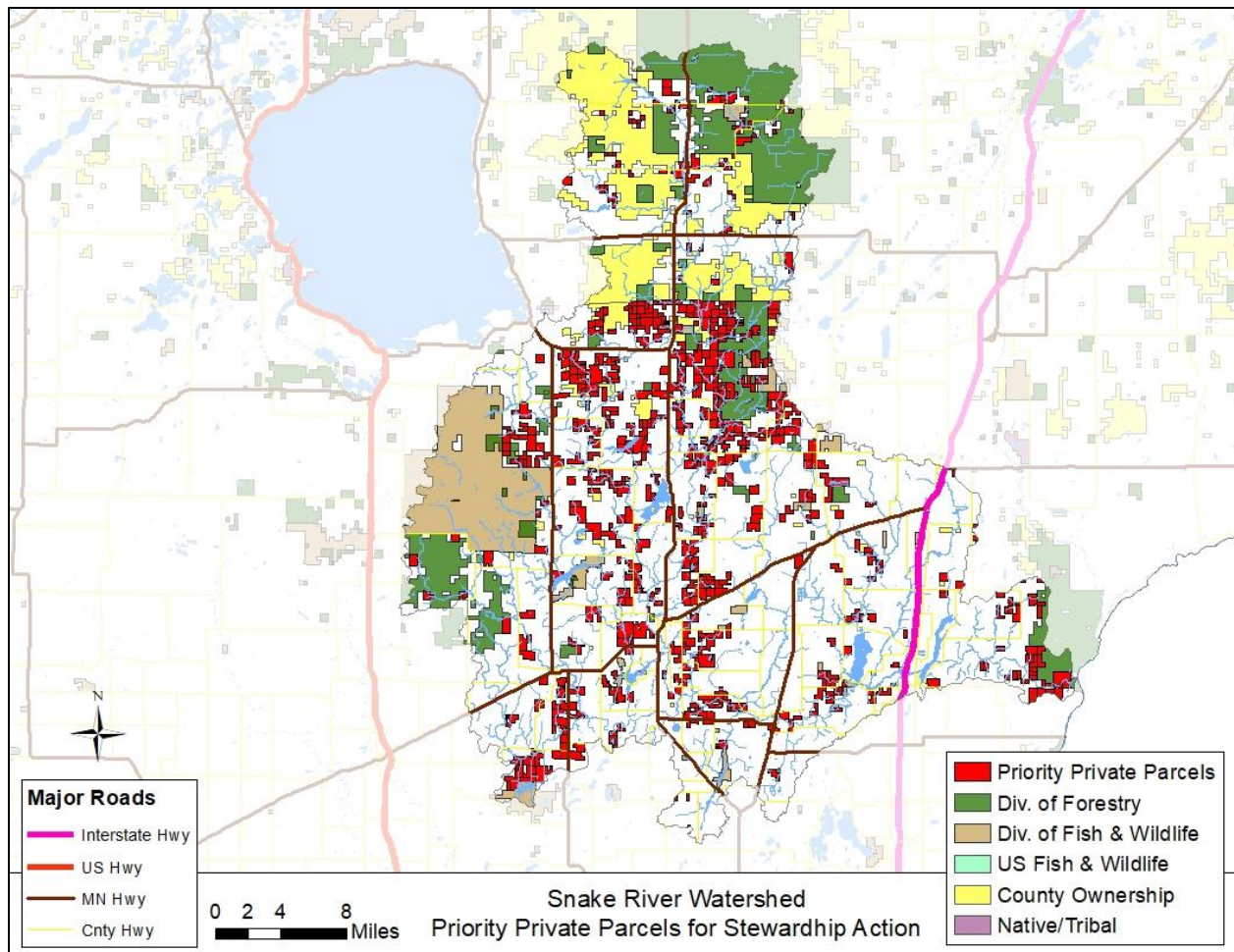


Figure 16. Priority Private Parcels for Stewardship Action in the Snake River Watershed.

[Related Conservation Plans](#)

Minnesota has a long history of taking a “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 Cannon, Kettle, Mississippi River – Winona, Root, and Zumbro 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 Snake River Watershed Restoration and Protections Strategies (WRAPS)
- Future One Watershed, One Plan efforts in the Snake Watershed
- County Comprehensive Plans and Water Management Plans
- MFRC East Central Landscape Plan

- MN DNR Mille Lacs Uplands 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
- The Nature Conservancy's 2009 Conservation Action Plan for the Snake River Watershed
- Saint Croix Basin Water Resources Planning Team Strategic Plan 2017

[Watershed Restoration and Protection Strategies \(WRAPS\)](#)

This plan is intended to support the parallel efforts of the Minnesota Pollution Control Agency's (MPCA) [Watershed Restoration and Protection Strategies](#) (WRAPS) efforts in the Snake River Watershed. The WRAPS report for the Snake River is part of a statewide "watershed approach" to address the "major" watersheds (denoted by 8-digit hydrologic unit code or HUC-8). This watershed approach incorporates water quality assessment, watershed analysis, civic engagement, planning, implementation, and measurement of results into a 10-year cycle that addresses both restoration and protection. Periods of elevated water quality monitoring and analysis lead to a determination of 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 restore impaired areas and protect healthy areas. The Snake River was one of the first watersheds in the state to go through this process and is now in the process of becoming one of the first watersheds to have a second-generation plan. The early stages of this second-generation WRAPS plan were being initiated during the development of the Landscape Stewardship Plan and the Planning Team stayed in close contact with MPCA staff throughout the process. The plans serve different functions, but the Planning Team feels they are very complementary, and should both be referenced for projects in the watershed. Data collected during this WRAPS process were used in the development of this plan, and it is intended that the objectives and strategies in this plan will inform the protection strategies outlined in the WRAPS process.

Further, the original [Snake WRAPS](#) identifies specific strategies, scales of necessary adoption, and suggested timelines to meet water quality standards for HUC-10 Watersheds within the Snake River Watershed (Pg. 28-38). These strategies were referenced during the development of this plan and implementation of these strategies, could be particularly valuable to explore under a landscape stewardship lens. These strategies may be adjusted during the development of a second-generation WRAPS but they highlight the confluence of interests between these plans and provide additional measures to meet this landscape stewardship plan's vision and desired future conditions for the Snake River Watershed.

[One Watershed One Plan](#)

Stakeholders plan to apply for funding to develop a One Watershed One Plan (1W1P) for the Snake River Watershed in 2019. 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. This program is coordinated through this Minnesota Board of Water and Soil Resources (BWSR). 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 Snake can inform, and be informed by, efforts outlined in the Landscape Stewardship Plan.

[Saint Croix Basin Water Resources Planning Team Strategic Plan](#)

The [Saint Croix Basin Water Resources Planning Team](#) (Basin Team) is made up of the National Park Service, Wisconsin Department of Natural Resources, Minnesota Pollution Control Agency, Minnesota Department of Natural Resources and a variety of other agencies and associations within the Saint Croix River basin. The Basin Team uses a basin-wide approach to water resource management that meets the group's mission to share science and policy to guide partners and citizens who restore, manage, and protect the land and water resources of the Saint Croix Basin. In 1994, the Basin Team was created and has leveraged hundreds of thousands of dollars in funding for water quality standards since then. To support the Basin Team's work into the future, they developed a strategic plan in 2012, and updated it in 2017, that unites their efforts under a shared vision, mission, and goals.

[Minnesota Forest Resources Council East-central 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 [East Central Landscape Committee](#) completed its original landscape plan in March 2005. This plan is scheduled to be updated in 2019.

[Conservation Action Plan for the Snake River Watershed](#)

The Nature Conservancy prepared a Conservation Action Plan for the Snake River Watershed in 2009 that provides a complete assessment of terrestrial and aquatic ecosystems within the watershed and identifies conservation targets and potential threats to those targets.

[Integration with Future Plans and Policies](#)

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.

[Resources for Implementation](#)

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

- Saint Croix Basin Water Resources Planning Team
- Snake River Watershed Management Board
- East Central MFRC 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

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 funding. 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. Goals of this program are to reduce erosion, increase wildlife habitat, improve water quality, and increase 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, prescribed grazing, 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 are available per acre for five years.

State Programs:

Reinvest in Minnesota (RIM): 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. There are currently only seven RIM tracts in the Snake River Watershed dating from the late 1980's and early 1990's and totaling only 412 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.

Section 5. Monitoring and Evaluation

The purpose of this section is to provide an initial outline for monitoring and evaluating the implementation of this Plan. The East Central Landscape Committee will work with partner agencies and conservation organizations to refine 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 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 MFRC East Central 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
Hold, manage, and restore blocks of native habitats currently in public or conservancy ownership.	Public Land Acreage
Utilize science-based natural community management techniques that demonstrate sound ecological management principles, maintain or increase water quality and rare species, and catalyze improved management on private lands through demonstration.	Sustainable Management Techniques, Demonstration Sites
Support and pursue opportunities for increased protection through conservation easements and public acquisition in strategically important areas. Focus acquisition efforts on: 1) Opportunities to increase connectivity between existing public lands; or 2) The protection of the rarest or highest quality natural areas.	Easements added, Acres acquired
Follow strategies outlined in the Watershed Restoration and Protection Strategy (WRAPS) report and accompanying Total Maximum Daily Load (TMDL) benchmarks for all public waters in the watershed.	Implementation of WRAPS and TMDL benchmarks achieved
Assess tax forfeit parcels for retention or divestiture. Develop and implement natural resources management plans for all lands that will be retained in public ownership.	Management Plans for Public Lands
Control invasive species through early-detection monitoring, management, and outreach.	Acres Treated
Work with landowners to increase habitat corridors and protected riparian buffers. Focus on opportunities to increase water quality and ensure connectivity of native plant communities into a larger matrix of well-managed private forestlands, brushlands, wetlands and grasslands.	Landowners Contacted
Emphasize the importance of a forest stewardship plan and implementing its recommendations.	New Stewardship Plans
Encourage landowner participation in programs that help landowners implement native habitat restoration and maintenance activities through cost-share, tax incentive, rental payment, technical advice, and local tree sales.	Conservation Practices Implemented
Ensure professional assistance to landowners is readily available from public entities and private businesses for natural resource management that meets landowner objectives and maintains ecological and habitat benefits.	Landowner Interactions

Work with agricultural producers to expand the use of sustainable cropping and grazing conservation practices and soil health principles.	Conservation Practices Implemented
Use outreach and education to foster a 'land ethic' about the value of natural resources in the watershed among land managers, landowners, citizen groups, and local communities.	Outreach Events
Maintain regular contact with stakeholders in the watershed through print and digital newsletters.	Newsletter Offerings
Promote peer-to-peer networks for sharing information on their experiences with conservation agriculture and natural resource management practices.	Peer-to-peer Events, Attendance
Inform local officials and elected representatives of the benefits of the region's natural areas for water quality, flood retention, and local quality of life.	Officials Contacted
Offer continuing education opportunities that encourage information exchange between the watershed's natural resources professionals.	Professional Training Workshops
Hold annual stakeholder meetings to coordinate completed, ongoing, and planned activities.	Stakeholder Meetings

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 East Central 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 this information will be useful in determining what can be done to improve this plan, and the state of conservation efforts overall within the watershed.

Desired Future Condition	Assessment Questions:
High Quality Surface and Groundwater Resources.	Is surface water quality improving or degrading? Is groundwater quality improving or degrading?
Connected Network of Climate Resilient Natural Communities.	How connected are the region's natural areas? What is the region's forest health status?
Healthy and Intact Forestlands.	Are forests in the region generally: <ul style="list-style-type: none"> – Structurally, functionally, and compositionally diverse? – Maintained or increased in spatial extent? – Supporting communities of plant and animal species native to the watershed?
Multiple Uses of Forest Resources.	Are the forests offering a full range of forest products? Are these products being produced in a sustainable manner that protects and improves existing ecological

	resources and allows for a balance between economic and recreational interests?
Engaged Private Forest Landowners.	Are landowners receiving the financial support they need to implement conservation activities?
Productive and Sustainable Agriculture.	Are cropping and grazing conservation practices and soil health principles being adopted?
Protection of Ecologically Sensitive Sites.	Are the highest priority sites for biodiversity and water resources are protected via public or private stewardship?
Stabilized and Increasing Populations of Rare Species.	Are conservation efforts underway to maintain the habitats that support rare species populations?

Section 6: Conservation Opportunity Area Plans

Conservation Opportunity Area Overview

GIS analysis was used to determine priority areas for conservation within the Snake River Watershed. Several spatial analyses were developed to quantify terrestrial habitat value, aquatic habitat value, resilient and connected landscapes analysis, groundwater recharge hotspots, and areas of importance for drinking water. The Planning Team used this information to identify four priority areas, called Conservation Opportunity Areas (COAs). These COAs represent areas where there is a strong confluence of aquatic and terrestrial values in the local watershed (HUC-12 level). In general, these areas have high water quality and contain features that warrant special attention, such as areas of biodiversity significance. Section 4 includes more details on the [prioritization methodology](#).

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 stakeholder priorities. They are places of importance to multiple state agencies and environmental interests and are logical focal points for collaboration and coordination of protection efforts between conservation professionals. This way effort and investment can be more efficient.

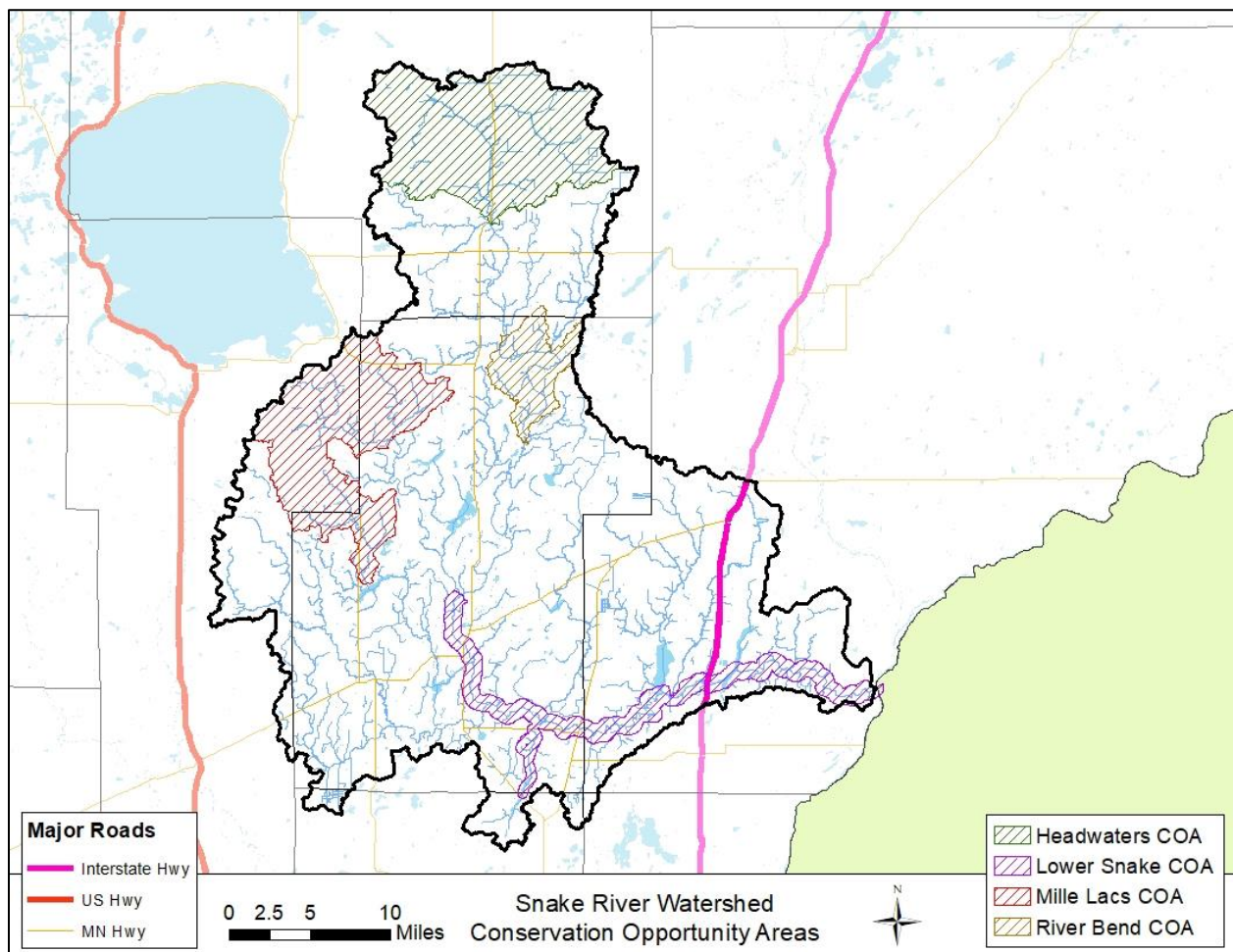
Ultimately, COAs represent regions where conservation actions are likely to provide the greatest number of benefits, and where coordination and communication between conservation professionals will be most beneficial.

This section provides summaries for the four Snake River COAs: Headwaters, Lower Snake, Mille Lacs, and River Bend. 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. The COAs identified in the watershed are:

- **Headwaters COA:** This COA encompasses nearly 67,000 acres in the northern part of the watershed. This rural area has no incorporated communities and is nearly 75 percent publicly managed by the Minnesota DNR and Aitkin County Land Department. The area retains the wet forest conditions that were observed in the Public Land Survey with very little conversion to residential or agricultural land use. This area's position in the Snake River's headwaters and its large blocks of intact forests and wetlands make it a priority for regional biodiversity and downstream water quality.
- **Lower Snake COA:** This nearly 28,000-acre COA includes all of the land within a ½ mile buffer of the lower 35 miles of the Snake River and the lower 5 miles of Rice Creek. Unlike

the other Conservation Opportunity Areas, the Lower Snake includes a few residential communities, notably Pine City and Mora. Prior to settlement, this area consisted of a variety of riparian forest and wetland communities. Many of these communities remain however nearly 50% of the COA has been converted to agriculture or residential/commercial uses. Despite this partial conversion, the Lower Snake remains one of the most important areas in the state for native mussel biodiversity.

- Mille Lacs COA: This 55,000-acre area contains a series of forests and wetlands that provide important habitat to a wide variety of plants and animals. The area is 63% private but only about 15% of the COA has been converted to agriculture, residential, or commercial development. Effective stewardship of the COA's private forests will help maintain this area's high value to regional biodiversity. This area also includes a large portion of the Mille Lacs Wildlife Management Area.
- River Bend COA: This is the smallest COA at just over 15,000 acres. This COA is nearly entirely deciduous forest and wetlands with scattered hay or pasture lands. The Snake River State Forest follows the river in this COA and this block of forested cover creates a valuable corridor through the region.



Headwaters Conservation Opportunity Area

Overview

The Headwaters COA encompass nearly 67,000 acres in the northern part of the watershed. This rural area lies entirely within Aitkin County and has no incorporated communities. State Highway 65/27 bisects this area as it travels from McGrath to McGregor (Figure 17). County Highways 2 and 26 cut east to west across the area along with a few other minor roads. State Highway 27 and County Road 2 meet at the only named area in the COA. This area is called Dad's Corner which refers to a former general store and saloon that burned down in 1988. Nearly 75 percent of the COA is in county or state ownership as parts of the Solana State Forest and Pliny Wildlife Management Area.

This area retains the wet forest conditions that were observed in the Public Land Survey with very little conversion to residential or agricultural land use. This area's position in the watershed's headwaters and its large blocks of intact forests and wetlands make it a priority for regional biodiversity and water quality. Key focuses for conservation action here are on promoting and practicing sustainable management of the region's forest, wetland and brushland communities.

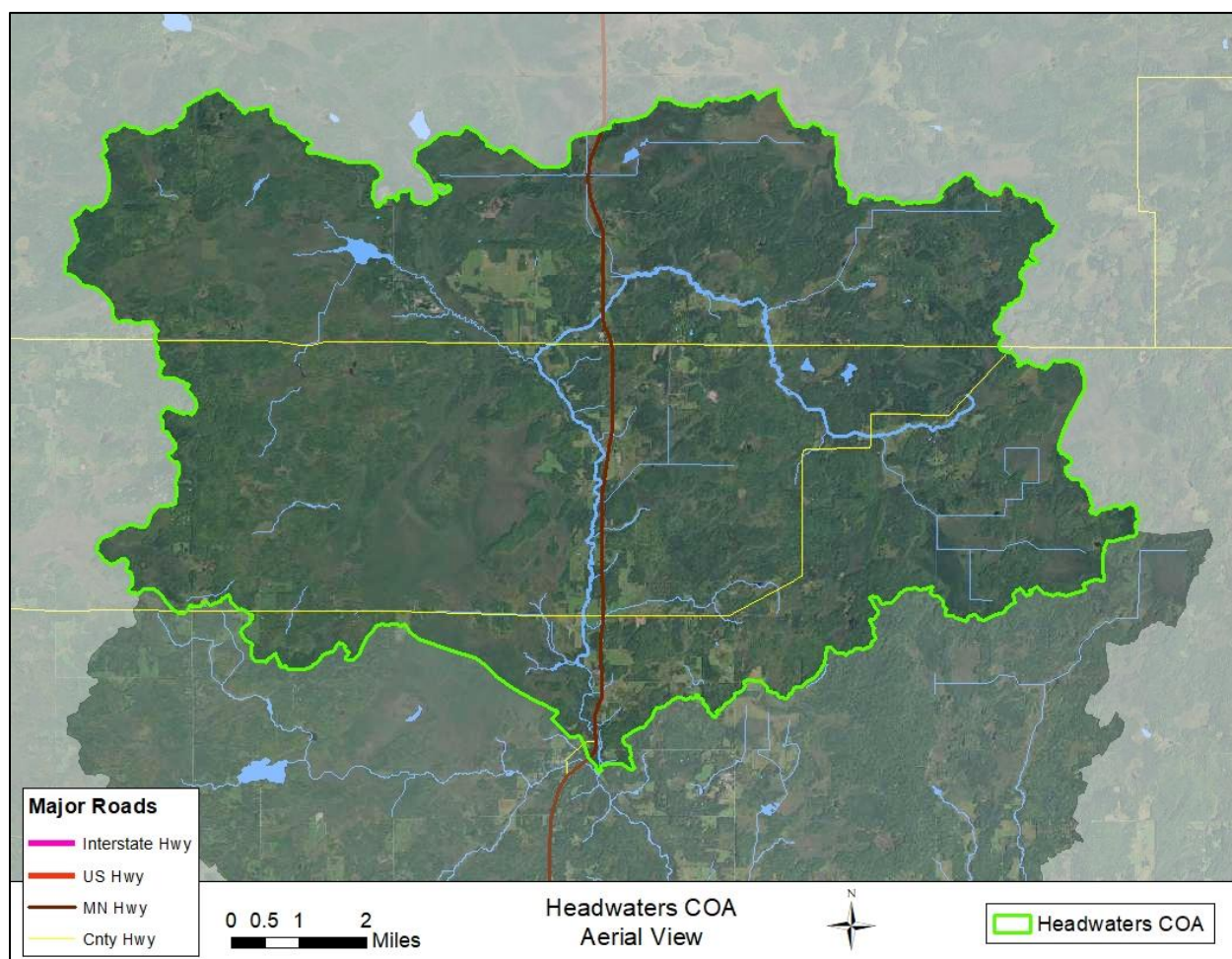


Figure 17. Headwaters Conservation Opportunity Area in the Snake River Watershed.

Natural Resource Assessment

Hydrology

The dominant hydrological feature of the Headwaters COA is the Upper Snake River and the associated extensive network of wetlands. This portion of the watershed features very little topographic relief (Figure 18) which is indicative of the widespread wet and peaty communities (Figure 20). Efforts were undertaken in the early part of the 20th century to drain some of these wetlands for agriculture. This effort was largely unsuccessful at creating additional agricultural land but many of the ditches remain and have changed the hydrology in the COA. Despite these hydrological changes, the area remains very wet and many of the forest management projects are limited to frozen ground conditions.

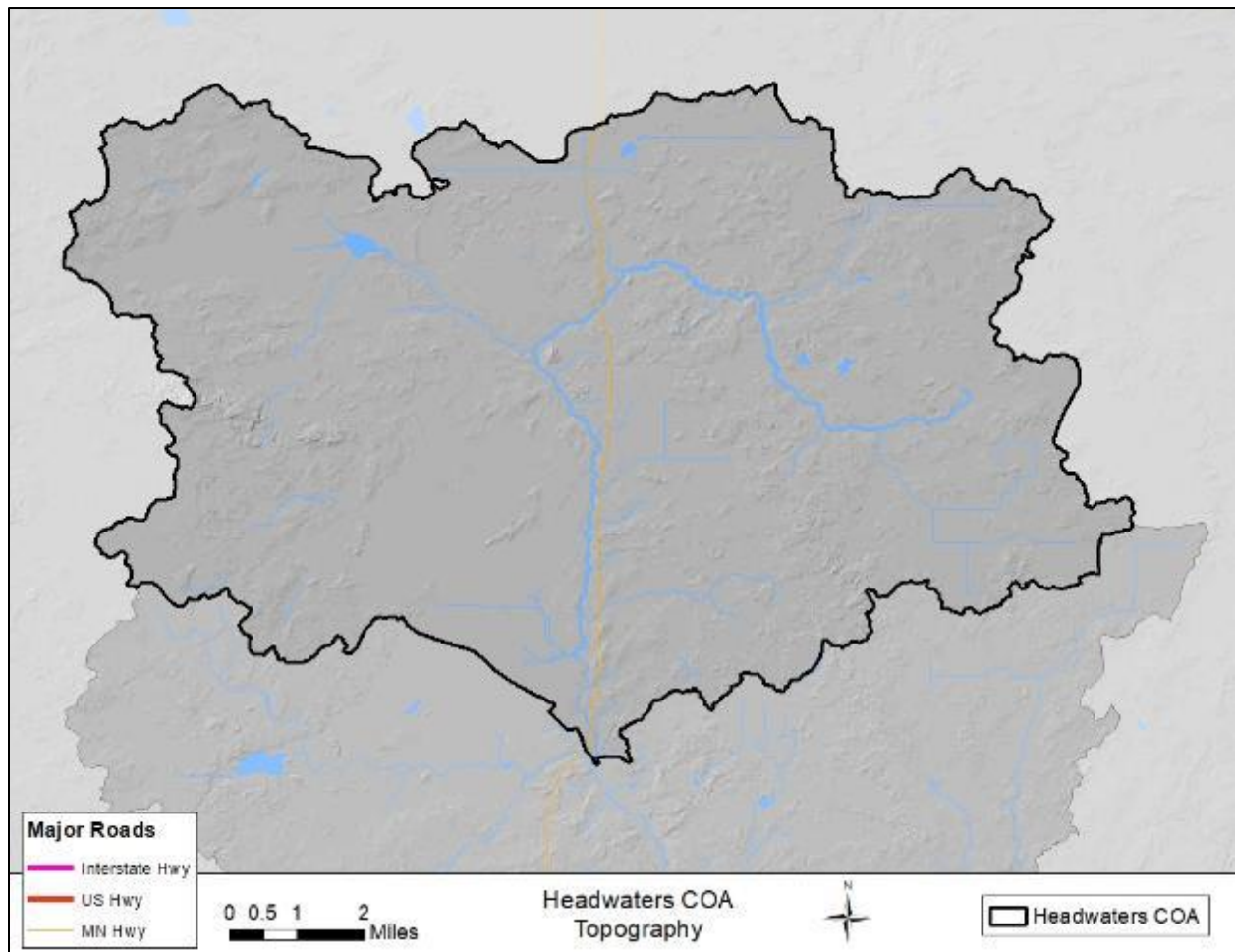


Figure 18. Hillshade topographic model of the Headwaters COA.

Land Cover and Use

Ninety-four percent of the Headwaters COA was forested at the time of European settlement with the only exception being a roughly 1,500-acre wet prairie along the river. (Table 11, Figure 19). This land cover pattern has largely remained unchanged today. Less than two percent of the COA is currently considered developed and there has been very little agriculture conversion (Figure 20). The agriculture that does exist in the Headwaters COA is largely hay or pasture land and

primarily exists in the historic wet prairie along the river. Both data sets highlight the wet nature of this region; major cover types are woody wetlands (43.9%), deciduous forest (32.0%), and emergent herbaceous wetlands (10.3%) (Table 11).

The wet nature of this area is further highlighted by the Native Plant Community modelling done by the Natural Resources Research Institute, showing over 40% of the COA as a Mesic Hardwood plant community with Acid Peatland, Wet Meadow/Carr, and Wet Forest also playing a significant roles in the watershed (Figure 21). In fact, all but six percent of the watershed was classified as a mesic or wet community. This six percent comes as small scattered fire dependent woodlands occupying uplands within the wet-mesic matrix of the COA. This COA has seen very little development and land alterations indicating that the potential Native Plant Communities modeled here are likely quite representative of the current plant communities.

Table 11. Land Cover based on Marschner’s presettlement data and the 2011 National Land Cover Data in the Headwaters COA.

Presettlement Land Cover		
Classification	Acres	Percent of COA
Conifer Bogs and Swamps	42,230	63%
Aspen-Birch (trending to Conifers)	19,067	29%
Wet Prairie	3,929	6%
Mixed Hardwood and Pine (Maple, White Pine, Basswood)	1,430	2%
Mixed White Pine and Red Pine	6	0%
Current Land Cover		
Classification	Acres	Percent of COA
Woody Wetlands	29,267	43.9%
Deciduous Forest	21,362	32.0%
Emergent Herbaceous Wetlands	6,890	10.3%
Hay/Pasture	3,044	4.6%
Shrub/Scrub	1,961	2.9%
Evergreen Forest	1,460	2.2%
Developed, Open Space	1,026	1.5%
Herbaceous	589	0.9%
Mixed Forest	431	0.6%
Open Water	406	0.6%
Cultivated Crops	199	0.3%
Developed, Low Intensity	21	0.0%
Developed, Medium Intensity	6	0.0%

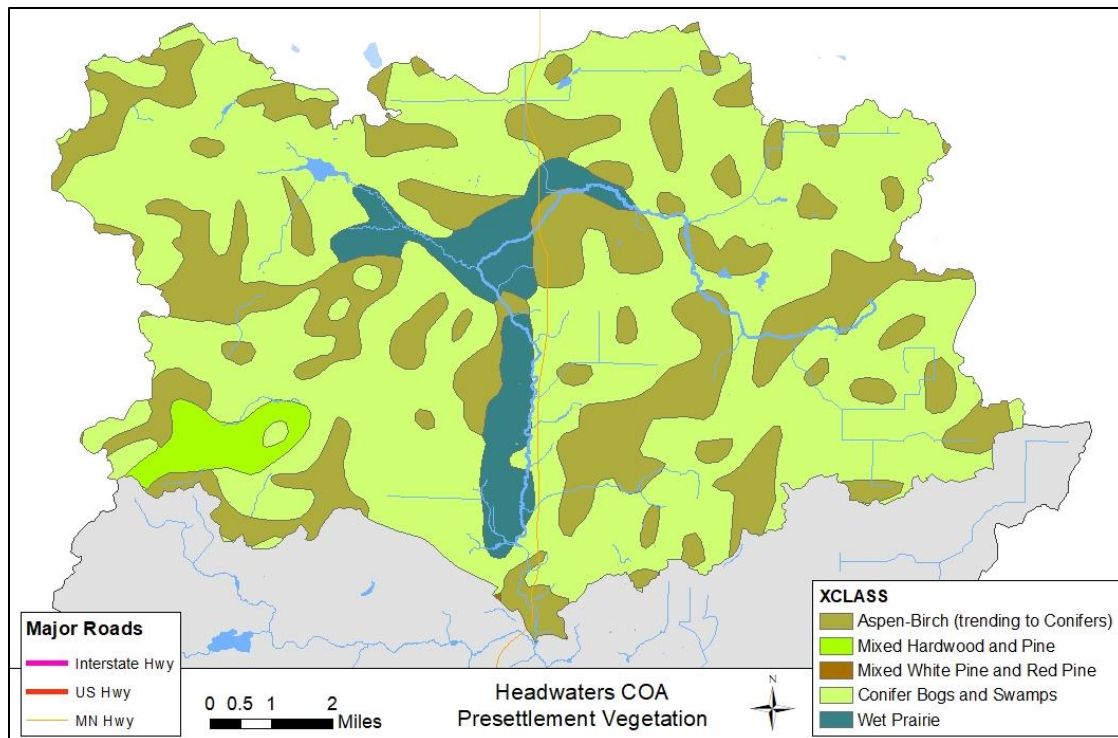


Figure 19. Presettlement land cover in the Headwaters COA based on the work of Francis J. Marschner.

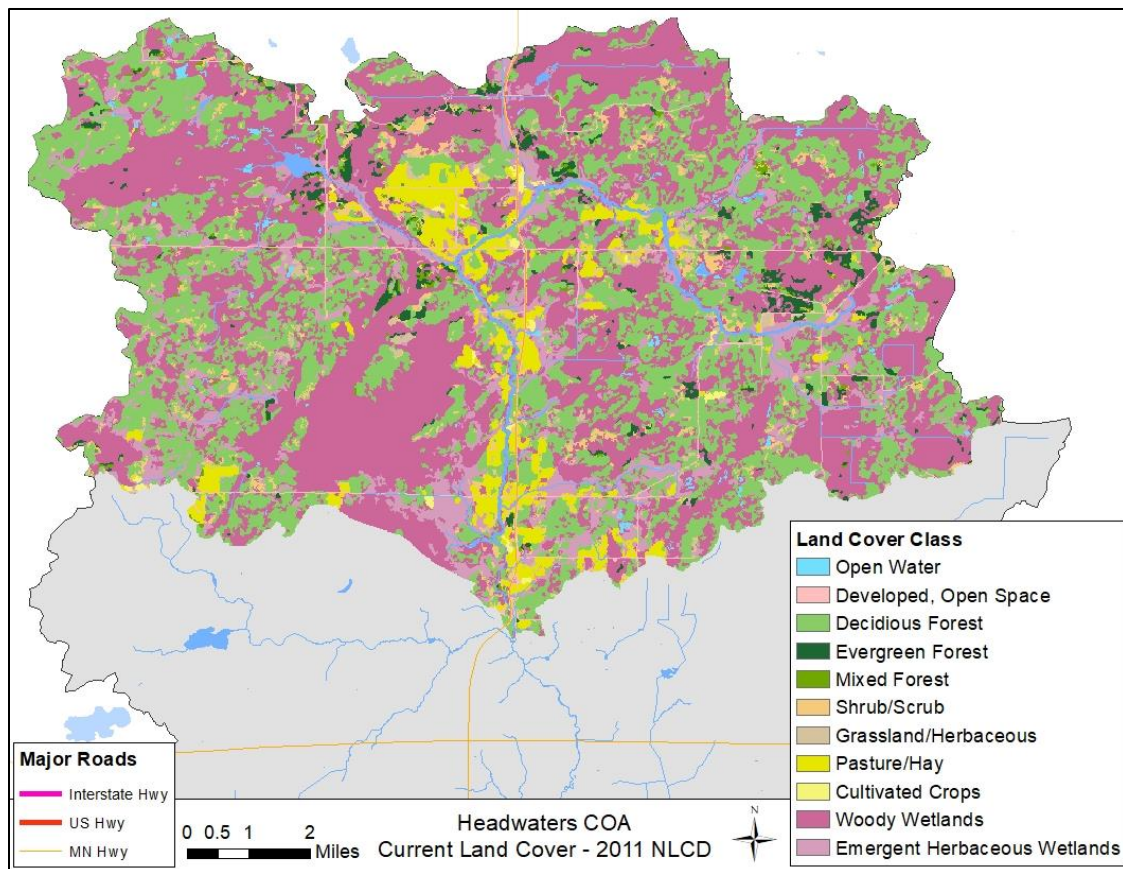


Figure 20. Current land cover in the Headwaters COA based on the 2011 National Land Cover Database.

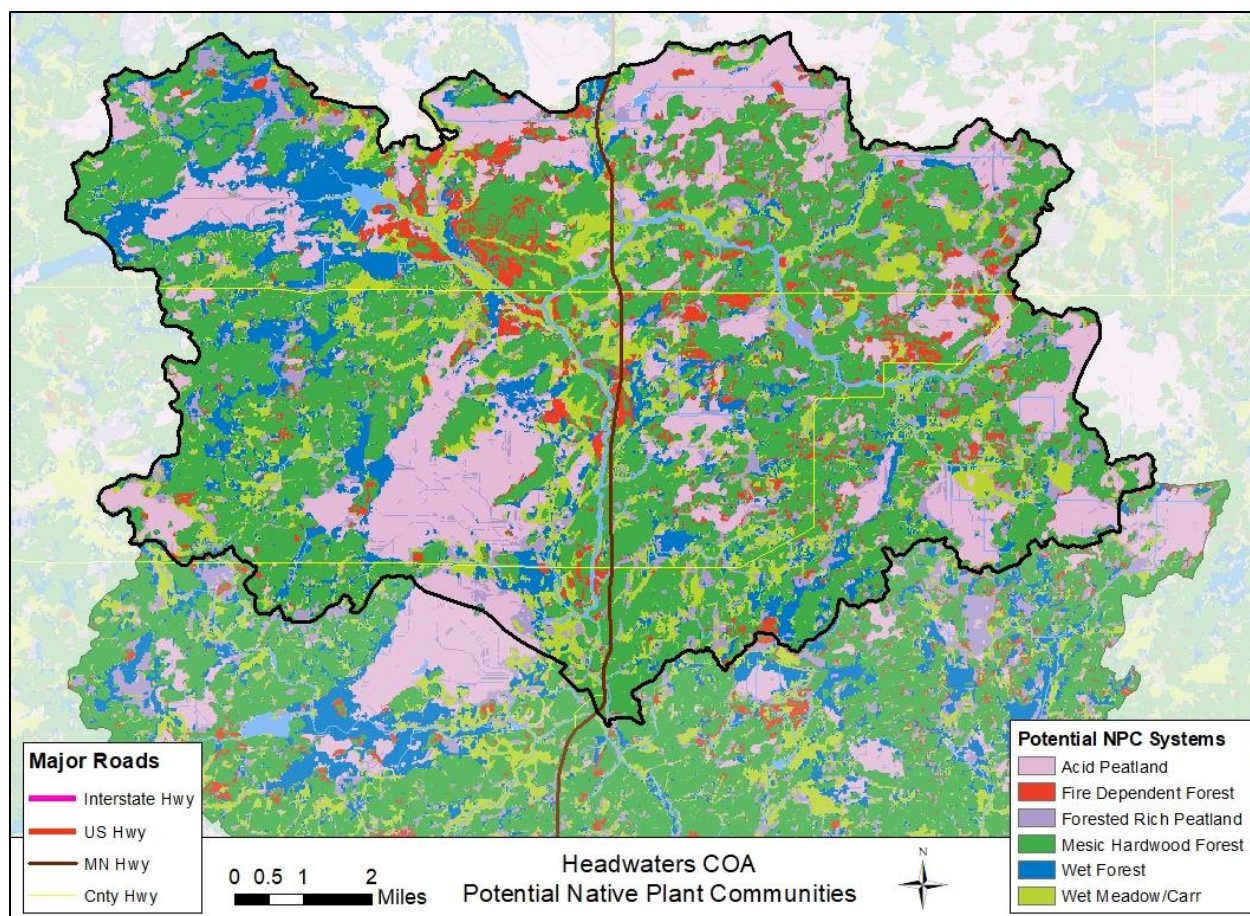


Figure 21. Native Plant Community Systems in the Headwaters COA (Natural Resources Research Institute, 2013).

Biodiversity and Rare Species

Over 45,000 acres of the Headwaters COA have been assessed by the Minnesota Biological Survey as have significance to the state's biodiversity (Figure 22). Of that area, nearly 27,500 acres were assigned as having 'High' biodiversity significance.

Additionally, the Natural Heritage Information System (NHIS) has recorded 44 occurrences of rare plants and animals in the Headwaters COA (Table 12); including seven known occurrences of the globally rare, and federally threatened northern long-eared bat. In general, 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.

Table 12. Number of rare species and community occurrences in the Headwaters COA.

Organism Type	Observation
Animal Assemblage	1
Invertebrate Animal	10
Vascular Plant	11
Vertebrate Animal	22
TOTAL	44

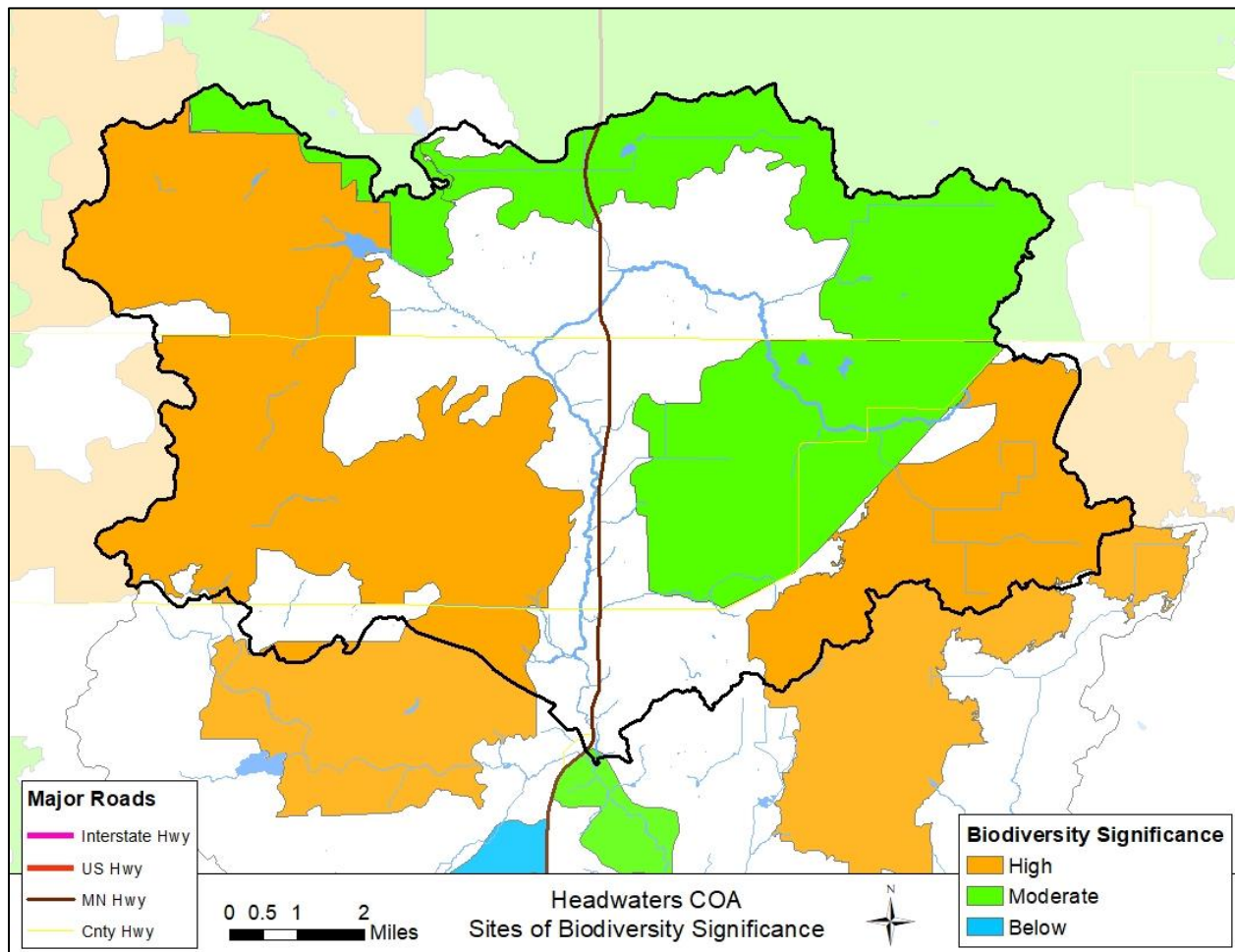


Figure 22. Areas identified by the Minnesota Biological Survey as having biodiversity significance in the Headwaters COA.

Recreation

The Headwaters COA is a remote and lightly populated area. There is not much in the way of established recreation infrastructure in this area. The exception is the Soo Line Trail – Southern Route. The converted railway crosses through the eastern portion of this COA along its 105.6 mile route between Royalton and the Minnesota–Wisconsin state line. The entire route is open to motorized use and is popular with ATV and snowmobile enthusiasts. The area is also popular for other seasonal outdoor activities like hunting and nature viewing in the COA’s public and private land.

Environmental Threats

This area of the watershed does not face the threats of residential and agricultural development that some of the other areas do, but the wet nature of this area presents potential environmental risks associated with poorly planned or executed forest management. The forests of this area produce relatively high value products, but the wet soils will often require the implementation of frozen ground restrictions. This can impact the value of the timber sale and creates seasonal

bottlenecks but in many of these mesic and wet sites it is the best way to minimize the ecological threat of rutting, soil compaction, and soil erosion. Sustainable timber management practices can produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest while unsustainable harvesting practices can seriously impair a stand's ability to do so in the future – especially in the wet and mesic soils of the Headwaters COA.

Land Ownership

Nearly 50,000 acres (74%) of the Headwaters COA is in public ownership (Table 13, Figure 23). Over half of this public land is managed by the MN DNR Division of Forestry as the Solana State Forest. Aitkin County also manages a large portion (31%) of the Headwaters COA through their land department. These large public land holdings are relatively consolidated with most of the state land in the east and the county land in the west. Private lands primarily follow the highway corridors.

Table 13. Estimated land ownership in the Headwaters COA.

Ownership	Holding Type	Acres	Percent of Public	Percent of COA
Private		17,421	--	26%
State	Solana State Forest	26,353	54%	40%
	Other Division of Forestry Land	1,315	3%	2%
	Pliny Wildlife Management Area	703	1%	1%
County	Aitkin County	20,870	42%	31%

Private Forest Stewardship

To date, private conservation programs have demonstrated moderate 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. 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. To date, only ten landowners covering 1,230 acres have a registered stewardship plan on the COA (Figure 23). This represents only 12% of the over 10,000 acres of private forests and brushlands in the COA. Four of these landowners have also enrolled in the State's [Sustainable Forest Incentives Act](#) (SFIA). More information is available on this program earlier in the plan.

As part of the planning process the Planning Team identified additional priority areas for stewardship efforts. The priority parcels were identified using an overlay of the top quartile scores for each of the COA analyses (see [Section 4](#) for methodology) on parcels over 40 acres in size not already in public ownership. Stewardship actions on all private parcels, in combination with the work done by the public land agencies, will be crucial to protecting the natural resources of the area and the priority parcels are a starting point where private land stewardship actions should have the greatest impact on regional biodiversity and water quality. There were 57 such parcels within Headwaters COA, covering over 4,000 acres, with 46 unique owners listed (Figure 23). Average size among priority parcels was 71 acres. Three of these priority parcels already have a Forest Stewardship Plan and one is enrolled in SFIA.

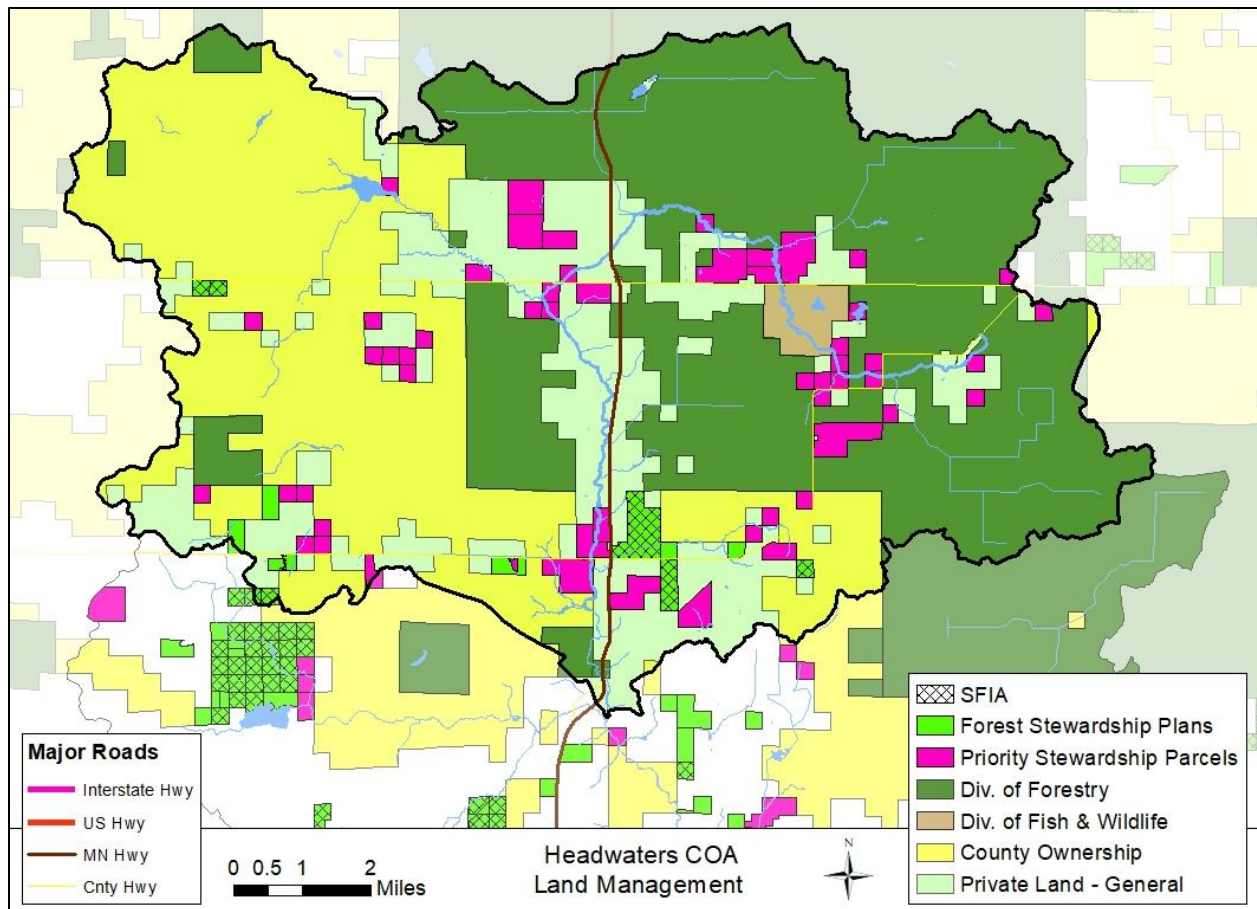


Figure 23. Public and private land in the Headwaters COA including private parcels with existing Forest Stewardship Plans and parcels the Planning Team identified as Priority Stewardship Parcels.

Desired Future Conditions

- Retain large contiguous blocks forested cover.
- Sustainably managed forest resources.
- 100% of riparian areas are covered by native vegetation.
- Human activity in riparian areas follows best management practices to protect water quality and sensitive shorelines.
- Biotic integrity of all streams within the COA is maintained.
- Brushlands are managed in a way that protects their unique ecological role.
- Coordinated land management across ownership lines.
- Peatlands are healthy and recognized for their important role as a carbon sink
- Rare plants and animal habitat are protected from degradation.

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 Area

This large, continuous stretch of forest mixed with brushland and wetland communities represents a core forest habitat area in this part of the state. These forest areas provide quality habitat to many species as well as providing a great benefit to water quality through erosion prevention, slowing and filtering run-off, and shading. Additionally, the sustainable harvest of timber from these forested areas supports the local economy and encourages the retention of current parcel sizes.



Stewardship Activities:

- Manage according to sustainable silvicultural and ecological principles
- Support the utilization of a variety of forest products
- Control invasive species
- Limit habitat fragmentation by maintaining or increasing the size and connectivity of natural habitats
- Prepare comprehensive forest stewardship plans. There are over 9,000 acres of private forest and brushlands without a registered stewardship plan in this COA.
- Assist landowner in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)

Openland, Brushland, and Woody Wetland Communities

This region includes a variety of openland, brushland, and woody wetland communities. Management of these communities is often overlooked in favor of higher value forest management activities, but these areas provide very important habitat for a suite of plants and animals that are dependent upon very large, open, early successional habitats.

Stewardship Activities:

- Limit habitat fragmentation and prevent further habitat loss by maintaining and restoring the size and connectivity of these habitats.
- Manage according to sustainable ecological principles using tools such as prescribed burning, mowing, haying practices (delayed, flushing bar, hay from inner to outer field), rotational grazing, and timber harvest (shorter rotations in larger patches with no snag or leave trees).
- Identify and protect dancing grounds or leks of sharp-tailed grouse, an indicator and umbrella species for healthy openland and brushland habitats.
- Increase education on the ecological value of these communities and their role as carbon sinks.
- Control invasive species.

- Maintain brushland habitat as buffer areas around other natural communities.
- Prepare comprehensive stewardship plans that consider all habitats on a parcel.
- Assist landowners in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)
- Use an “All-lands” approach that considers what neighboring landowners are doing on their land.

Key Stewardship Parcels

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

- Work to engage the owners of these parcels in a targeted manner. Tailor outreach and assistance based on the geographical and ecological characteristics of the parcel and their interests and goals.
- Engage with landowners that have an interest in long-term conservation action about opportunities to permanently protect these sites through conservation easements and fee acquisitions.
- Prioritize stewardship efforts affecting these parcels.



Lower Snake Conservation Opportunity Area

Overview

The Lower Snake COA is composed of a ½ mile buffer along the final 35 miles of the Snake River and a portion of Rice Creek (Figure 24). This nearly 28,000-acre COA includes the communities of Pine City and Mora. Prior to settlement this area consisted of a variety of riparian forest and wetland communities and was long used as a trade route between the Saint Croix River and Lake Mille Lacs. Many natural areas remain along this stretch of the river however nearly 50% of the COA has been converted to agriculture or residential/commercial uses. Despite this partial conversion, the Lower Snake remains one of the State's most important areas for native mussel biodiversity.

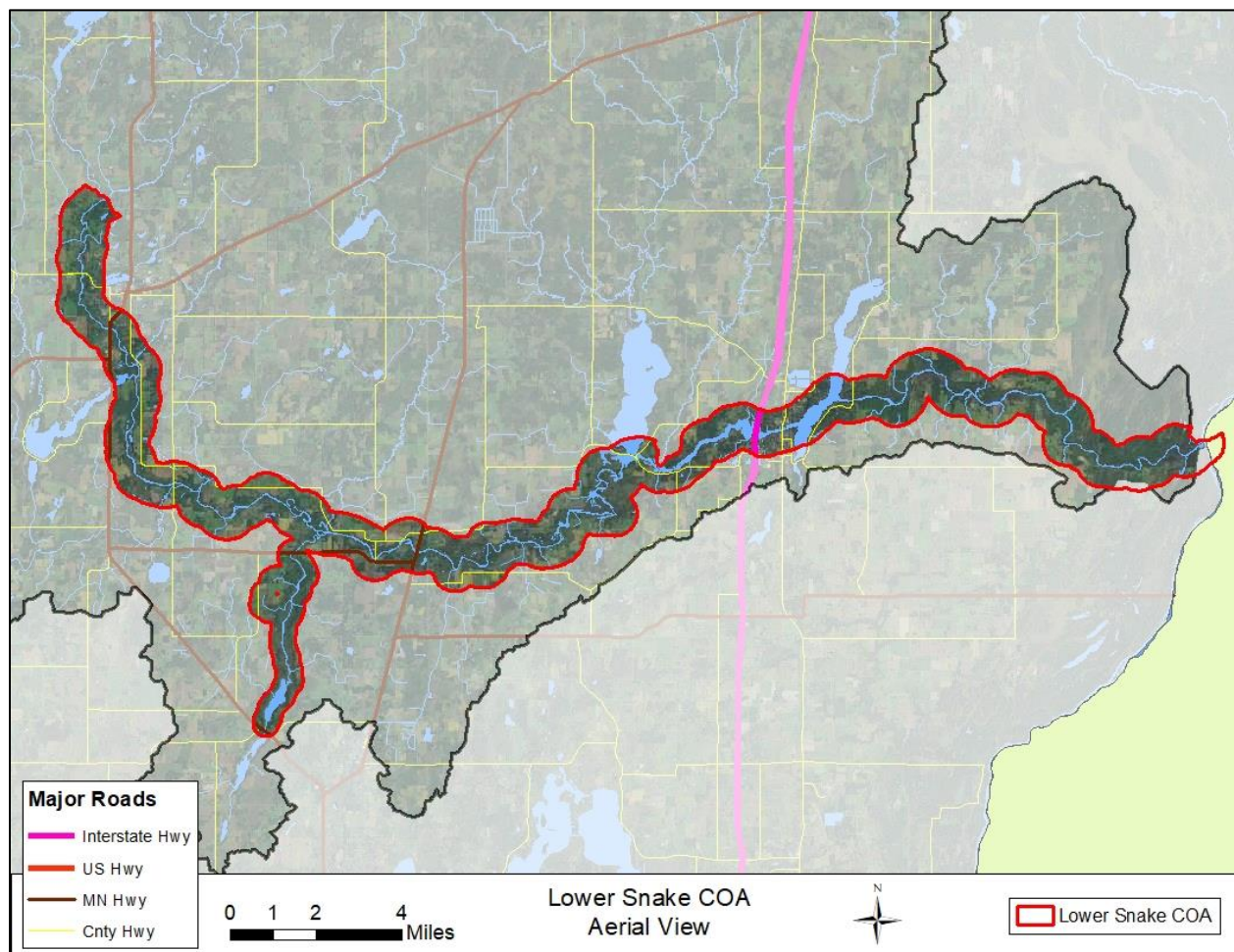


Figure 24. Aerial image of the Lower Snake COA.

Natural Resource Assessment

Hydrology

The dominant hydrological feature of the Lower Snake COA is the Snake River and its associated floodplain and tributaries. Since the COA lies at the bottom of the watershed, the hydrology is strongly influenced by upstream effects. These upstream effects include water originating in the

forested headwaters as well as water from the numerous perennial and intermittent streams originating in the surrounding agricultural uplands. Nearly 14,000 acres, or 50%, of this COA is identified as part of the Active River Area (ARA). This includes almost 100% of the area between Grasston and Pine City (Figure 25). The ARA conservation framework described in [Section 2](#) identifies five key subcomponents of an active river area: 1) material contribution zones, 2) meander belts, 3) riparian wetlands, 4) floodplains and 5) terraces.

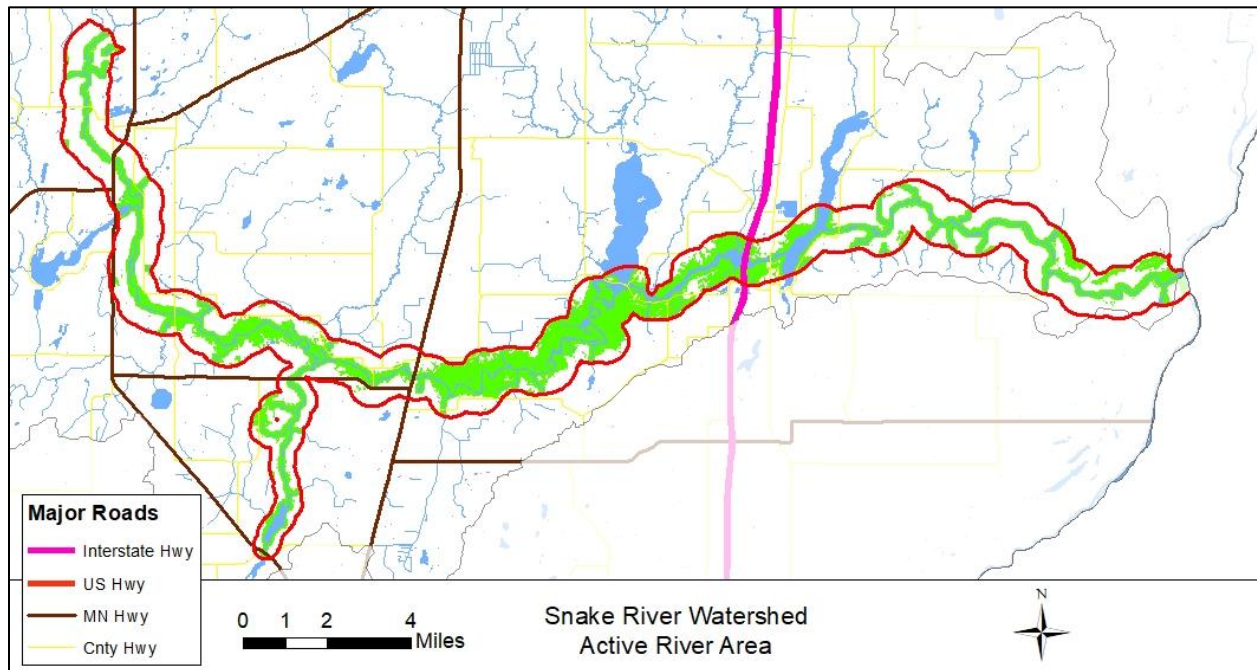


Figure 25. Active River Area in the Lower Snake COA.

Land Cover and Use

Ninety percent of the Lower Snake COA was covered in some form of forest at the time of European settlement (Table 14). The only non-forested communities were scattered wet prairies along the Snake River and tributaries (Figure 26).

Today, the land use patterns in the Lower Snake COA follow the general pattern for the surrounding landscape. The predominantly flat, upland areas are mostly cropland or pasture, while the wet or frequently flooded areas retain forest and wetland cover (Figure 27). Residential and commercial development is scattered throughout the COA but is concentrated around Mora, Grasston, and Pine City. The topography becomes more variable as the Snake approaches its confluence with the Saint Croix and this area retains a significant deciduous forest. Major cover types are pasture/hay (24%), deciduous forest (19%), cultivated crops (12%) and woody wetlands (12%) (Table 14).

Table 14. Land Cover based on Marschner's presettlement data and the 2011 National Land Cover Data in the Lower Snake COA.

Presettlement Land Cover		
Land Type	Acres	Percent of COA
Big Woods - Hardwoods	8,904	32%
Aspen-Birch (trending to Conifers)	5,524	20%
Oak openings and barrens	3,083	11%

Wet Prairie	2,738	10%
River Bottom Forest	2,531	9%
Conifer Bogs and Swamps	2,435	9%
White Pine	1,722	6%
Mixed Hardwood and Pine	924	3%
Current Land Cover		
Land Type	Acres	Percent of COA
Hay/Pasture	6,580	24%
Deciduous Forest	5,224	19%
Cultivated Crops	3,481	12%
Woody Wetlands	3,471	12%
Emergent Herbaceous Wetlands	2,580	9%
Open Water	1,929	7%
Developed, Open Space	1,706	6%
Shrub/Scrub	773	3%
Developed, Low Intensity	650	2%
Evergreen Forest	495	2%
Herbaceous	480	2%
Developed, Medium Intensity	233	1%
Mixed Forest	173	1%
Developed, High Intensity	85	0%

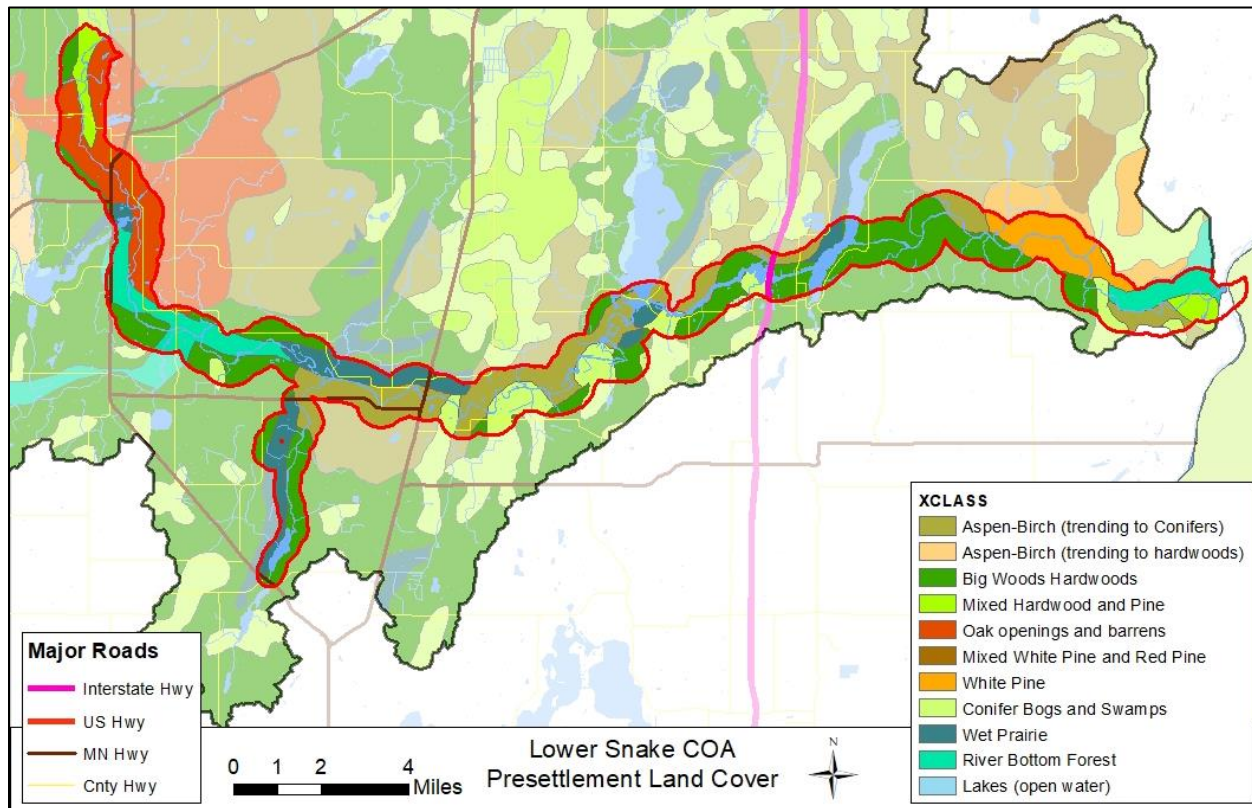


Figure 26. Presettlement land cover in the Lower Snake COA based on the work of Francis J. Marschner.

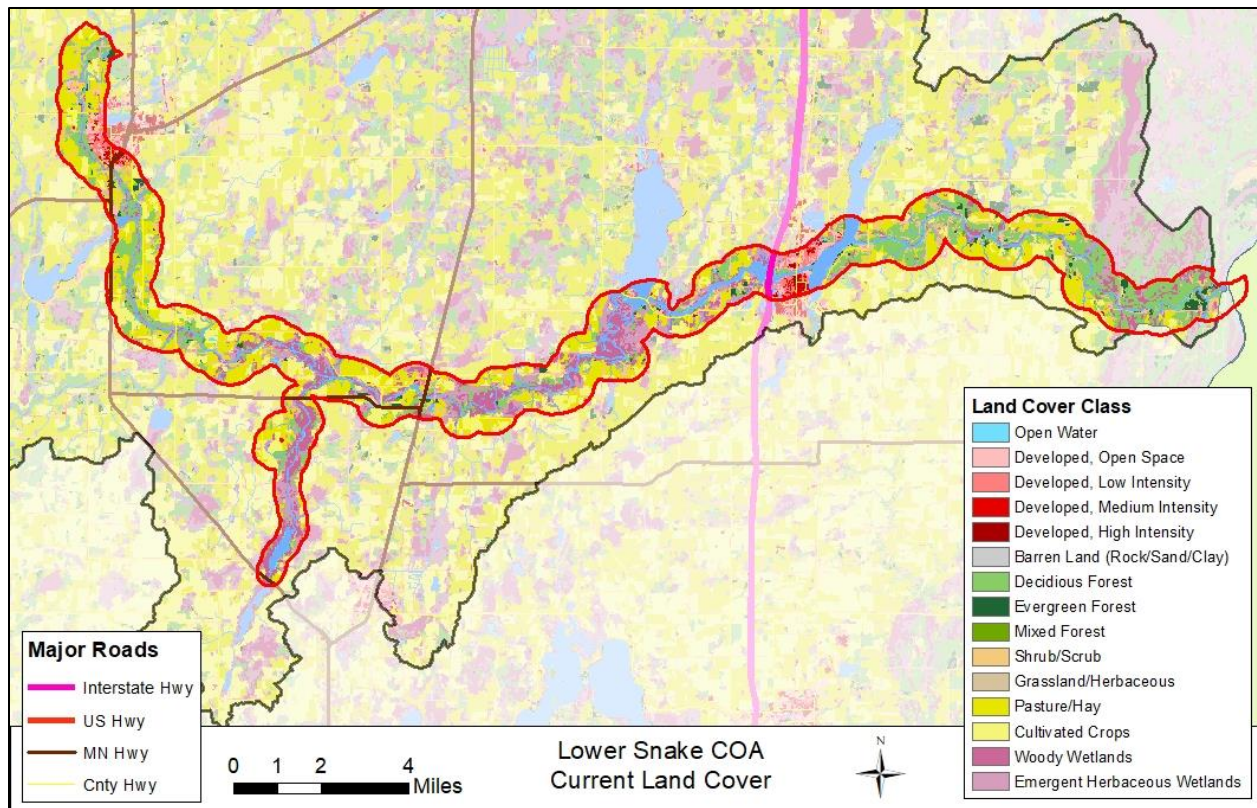


Figure 27. Current land cover in the Lower Snake COA based on the 2011 National Land Cover Database.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 454 occurrences of rare plants and animals in the Lower Snake COA most of which are invertebrate mussels (Table 15). This region boasts a high degree of mussel richness and has maintained mussel species richness [OB] historical data (MNDNR, Statewide Mussel Survey). Yet, there is evidence of a lack of mussel recruitment within the Lower Snake River. A long-term mussel monitoring site, established on the Snake River in 2009, has shown that little to no recruitment has occurred for nearly a decade (MNDNR, Statewide Mussel Survey). Despite these issues, the Snake River still represents some of the State's best remaining habitat for a number of these species and maintenance and improvement of these communities is a priority for the region.



Table 15. Number of rare species and community occurrences in the Lower Snake COA.

Organism Type	Observation
Animal Assemblage	1
Invertebrate Animal	420
Vascular Plant	6
Vertebrate Animal	28
TOTAL	455

Over 2,300 acres of the Lower Snake COA have been assessed by the Minnesota Biological Survey as having significance to the state's biodiversity (Figure 28). Of that area, over half the acres were assigned as having 'High' biodiversity significance. All the 'High' biodiversity significance is captured in the Rice Creek spur of the Lower Snake COA. At the time of this printing, data was not available on biodiversity significance in Pine County (eastern part of COA), so these totals are not representative of the entire COA.

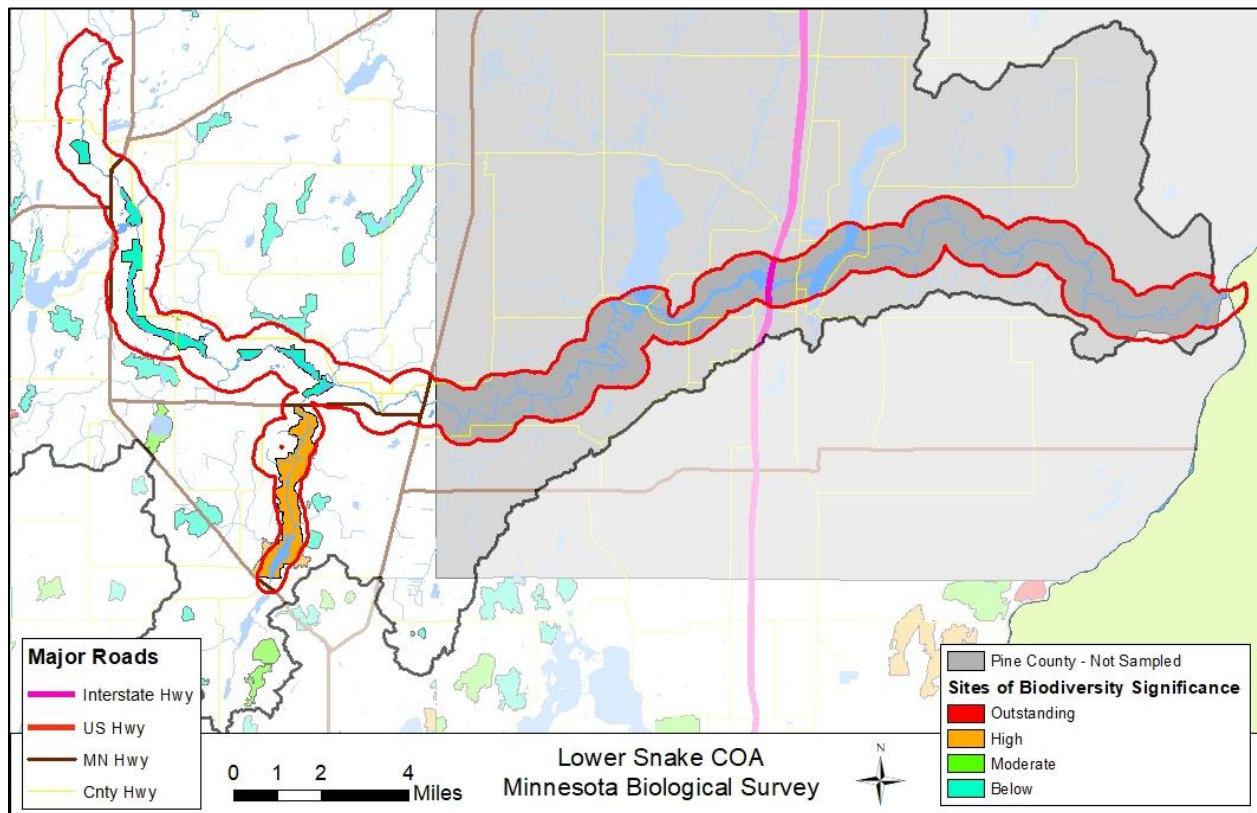
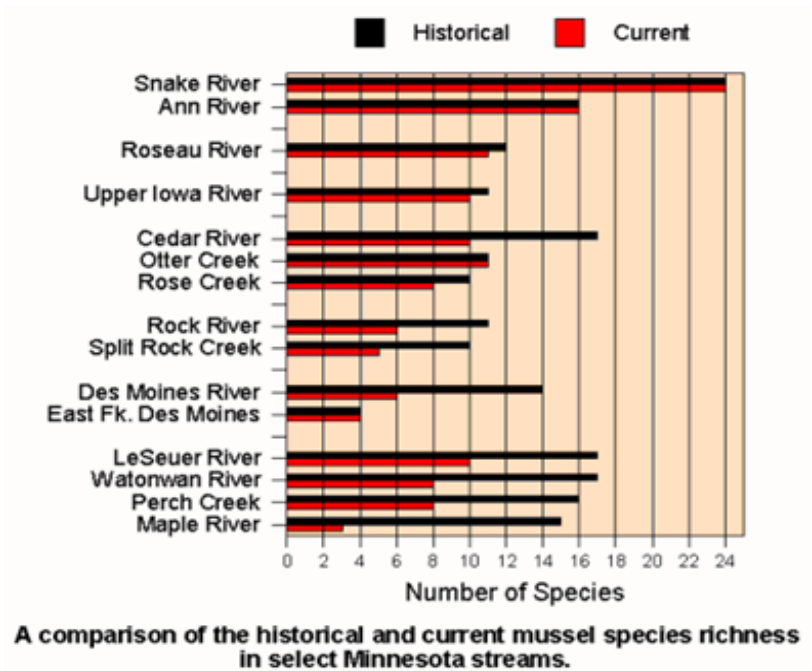


Figure 28. Areas identified by the Minnesota Biological Survey as having biodiversity significance in the Lower Snake COA. Note that biodiversity significance was not available for Pine County (eastern part of COA) at the time of printing.

Recreation

There are several important outdoor recreation areas along the Lower Snake. Most notably, the [Snake River State Water Trail](#) which is popular with day and overnight paddlers as it includes some nice campsites along the river. Paddlers can choose from the gentle, rapid less, stretch from Mora to Pine City or the stretch below Cross Lake, where the pace picks up as the river descends 136 feet in its last 12 miles through a series of Class I-III rapids and pools. The area also has a few campgrounds, trails, boat launches, fishing piers, and picnic areas that are popular with residents and visitors alike and support the local economy.

Environmental Threats

Development pressures:

This area is less than 1 hour from the Minneapolis-St. Paul metropolitan area and is bisected by Interstate-35. Although this area is not anticipated to grow as much as areas closer to the Twin Cities, there is a risk of 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.

Nutrient, sediment, and contaminants from agricultural areas:

The Lower Snake COA is surrounded by agricultural lands with the potential to impair water quality. Contamination from these areas could have large impacts on downstream water quality and the region's biologically important mussel populations. 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 will help protect the water quality of the COA. Figure 29 shows the public waters and ditches in the Snake River Watershed that are subject to Minnesota's buffer law. This law requires perennial vegetation buffers of up to 50 feet along public waters and 16.5 feet along public ditches. The law provides flexibility for landowners to install alternative practices with equivalent water quality benefits that are based on the Natural Resources Conservation Service Field Office Technical Guide. Implementation of these practices has been very good in the Snake River Watershed.

Streambank sloughing:

Much of the instream sediment, is not coming from the agricultural uplands, but from the sloughing banks along the Lower Snake. Extreme rain events, along with hydrology that has been altered for agricultural, commercial, or residential development has led to some very flashy and erosive instream conditions. These conditions can lead to tremendous erosion as trees and banks slough into the river and create high degrees of turbidity and large log jams. These conditions degrade the instream habitat for a variety of species as well as posing a significant threat to properties and infrastructure along the river.

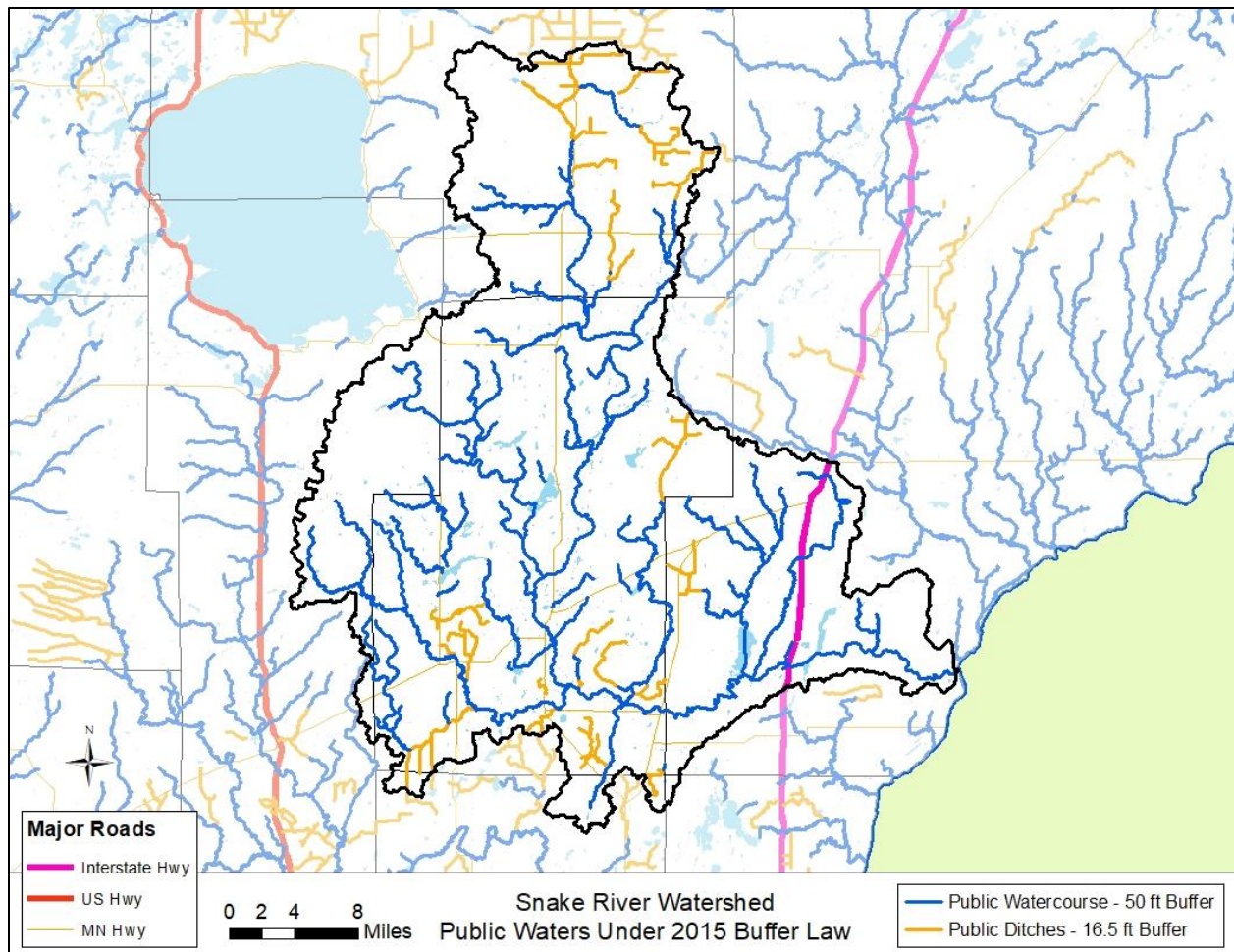


Figure 29. Public waters in the Snake River Watershed subject to the 2015 Buffer Law.

Land Ownership

In stark contrast to the Headwaters COA, nearly 93 percent of the Lower Snake COA is in private ownership. Stewardship by private landowners will clearly play a crucial role in the conservation of this COA given they make up such a large portion of the land base. 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. Of the roughly 2,000 acres of public land in the Lower Snake COA, most of it is scattered along the river in relatively small parcels with the largest blocks being the Rice Creek Wildlife Management Area and the southern 1,000 acres of the Chengwatana State Forest at the confluence of the Snake and Saint Croix Rivers (Table 16).

Table 16. Public lands in the Lower Snake COA.

Ownership	Holding Type	Acres	Percent of Public	Percent of COA
Private		25,838	--	92.7%
State	Chengwatana State Forest	929	46.0%	3.3%
	Other Division of Forestry Land	81	4.0%	0.3%
	Kraft WMA	95	4.7%	0.3%

	Pine City WMA	11	0.5%	0.0%
	Pine County WMA	212	10.5%	0.8%
	Rice Creek WMA	594	29.4%	2.1%
	Wire Tree WMA	33	1.6%	0.1%
County	Kanabec County	39	1.9%	0.1%
	Pine County	28	1.4%	0.1%

Private Forest Stewardship

To date, private forest conservation programs like the DNR [Forest Stewardship Program](#) have demonstrated a surprising amount of success given that only about twenty-five percent of the COA is forested. Other agricultural or grassland-based conservation programs were more difficult to track but thirty-eight landowners representing 1,880 acres or 37% of the private forestland (excluding woody wetlands) in the COA have a registered stewardship plan (Figure 30). Four of these landowners have also enrolled in the State's [Sustainable Forest Incentives Act](#) (SFIA).

As part of the planning process the Planning Team identified additional priority areas for stewardship efforts. The priority parcels were identified using an overlay of the top quartile scores for each of the COA analyses (see [Section 4](#) for methodology) on parcels over 40 acres in size not already in public ownership. Stewardship actions on all private parcels, in combination with the work done by the public land agencies, will be crucial to protecting the natural resources of the area and the priority parcels are a starting point where private land stewardship actions should have the greatest impact on regional biodiversity and water quality. There were 69 such parcels within Lower Snake COA, covering over 8,000 acres, with 65 unique owners listed (Figure 30). Average size among priority parcels was 116 acres. Nine of these priority parcels already have a Forest Stewardship Plan and two are enrolled in SFIA. Others may also be enrolled in some type of agriculture conservation program.



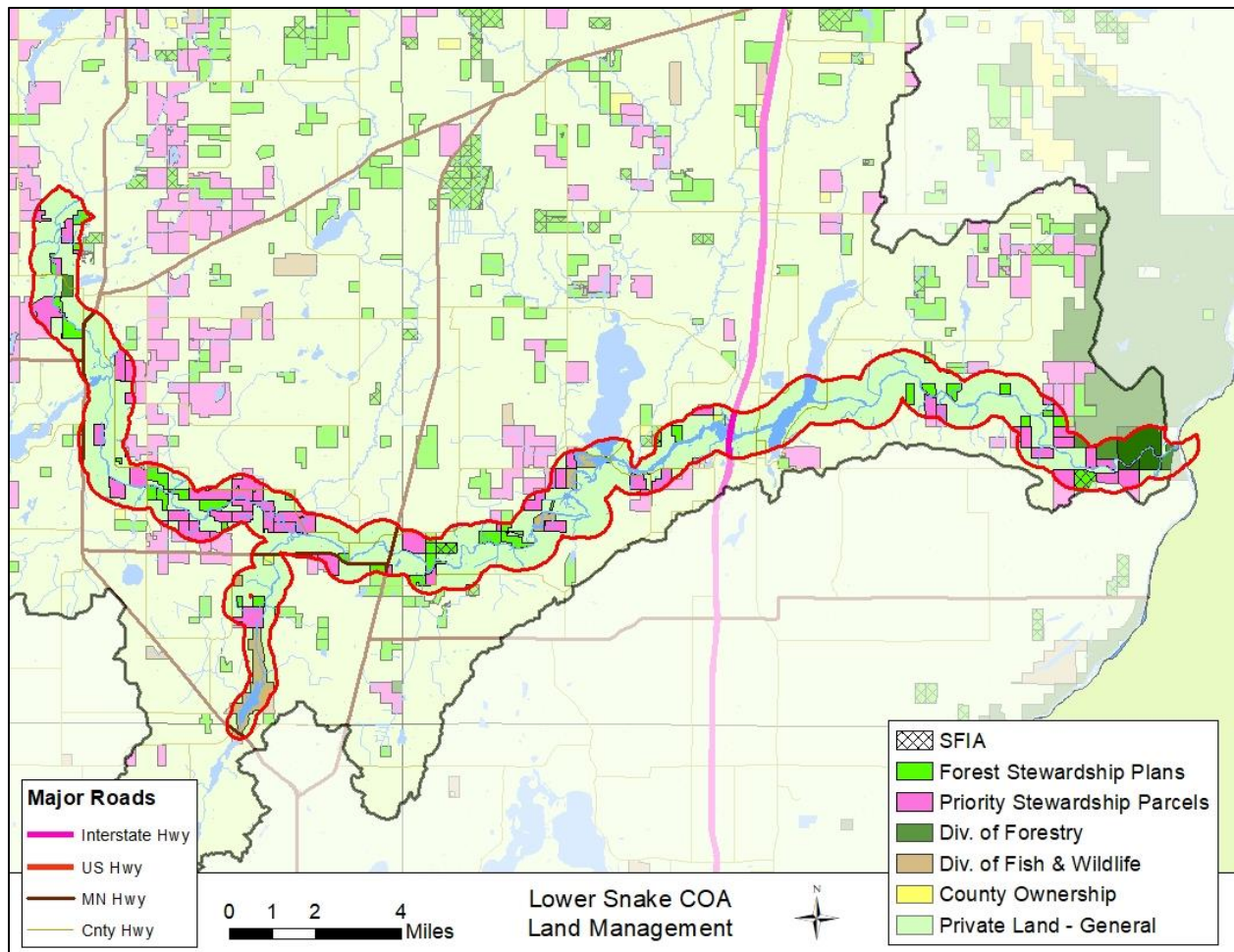


Figure 30. Public and private land in the Lower Snake COA including private parcels with existing Forest Stewardship Plans and parcels the Planning Team identified as Priority Stewardship Parcels.

Desired Future Conditions

- Mussel beds support healthy populations of native mussel species.
- The watershed's hydrology is restored by increasing storage through wetland restoration and watershed wide improvements to soil health and reduced drainage.
- River bank sloughing is reduced or eliminated.
- 100% of riparian areas are covered by native vegetation, returning a host of ecological services for water quality, habitat quality, and habitat connectivity.
- Maintain and enhance recreational opportunities on this stretch of the Snake River.
- Biotic integrity of all streams within the COA is restored, resulting in healthy aquatic species and de-listing of impaired waters.
- Agricultural producers follow best management practices to protect soil from erosion, and streams from sedimentation and nutrient loading.
- Invasive species are monitored and controlled

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.

Riparian Forest and Natural Area Management

A continuous stretch of native plant communities along the Lower Snake would provide quality habitat for many aquatic and terrestrial species. It will also provide a great benefit to water quality, as forests and natural areas help prevent erosion, slow and filter run-off, and provide shade. In addition, these riparian areas represent favorite places for recreation and scenery, making them important for the tourism industry in the region.

Stewardship Activities:

- Maintain and restore natural vegetation along stream and riverbanks
- Prepare for the loss of ash in these riparian forests
- Where possible, increase size and connectivity of forest habitat through reforestation / afforestation of connecting patches
- Prepare comprehensive forest stewardship plans and manage all forests according to sustainable silvicultural and ecological principles
- Monitor mussel beds and follow adaptive management to address population changes
- Reconnect waterways with their floodplains
- Identify areas that are, or have the potential to, slough into the river and evaluate stabilization options.
- Control invasive species
- Support SWCDs in implementing and enforcing the state buffer law and other best management practices.
- Find opportunities to restore wetland storage areas in riparian zones to help improve stream hydrology.
- Assist landowner in researching and applying for relevant cost-share or easement programs available (e.g. EQIP, CSP, CRP, RIM)

Agricultural Stewardship

The instream conditions of the Lower Snake are influenced by land use throughout the watershed. While the upper stretches are buffered by a network of forests and wetlands, the lower part of the watershed is largely agricultural. Agriculture is important to the region's economy and sound stewardship of this agricultural land will be key to maintaining and improving its ability to support farm families as well as instream conditions and the health of the surrounding landscape by helping to prevent erosion and slow/filter run-off.

Stewardship Activities:

- Promote peer-to-peer learning exchanges
- Assist landowners in researching and applying for relevant cost-share programs available (e.g. EQIP, CSP)
- Work with producers on their options to adopt stewardship practices such as no-till, conservation tillage, cover cropping, conservation grazing, and others. Acknowledging that each producer's operation is different, and finding ways to tailor options accordingly.

Key Stewardship Parcels

These parcels were identified based on their geographical size, areas of biodiversity significance, and proximity to public land (see methodology and parcel map 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
- Engage with landowners that have an interest in long-term conservation action about opportunities to permanently protect these sites through conservation easements and fee acquisitions.
- Prioritize stewardship efforts affecting these parcels.



Mille Lacs Conservation Opportunity Area

Overview

The Mille Lacs COA encompasses nearly 55,000 acres in the western part of the watershed and contains a series of forests and wetlands that provide important habitat to a wide variety of plants and animals (Figure 31). This area is 63 percent private but only about 15 percent of the COA has been converted to agriculture or residential/commercial development. Effective stewardship of these private forests will help maintain this area's high value to regional biodiversity. This COA also encompasses a large portion of the Mille Lacs Wildlife Management Area which accounts for over 30 percent of the COA.

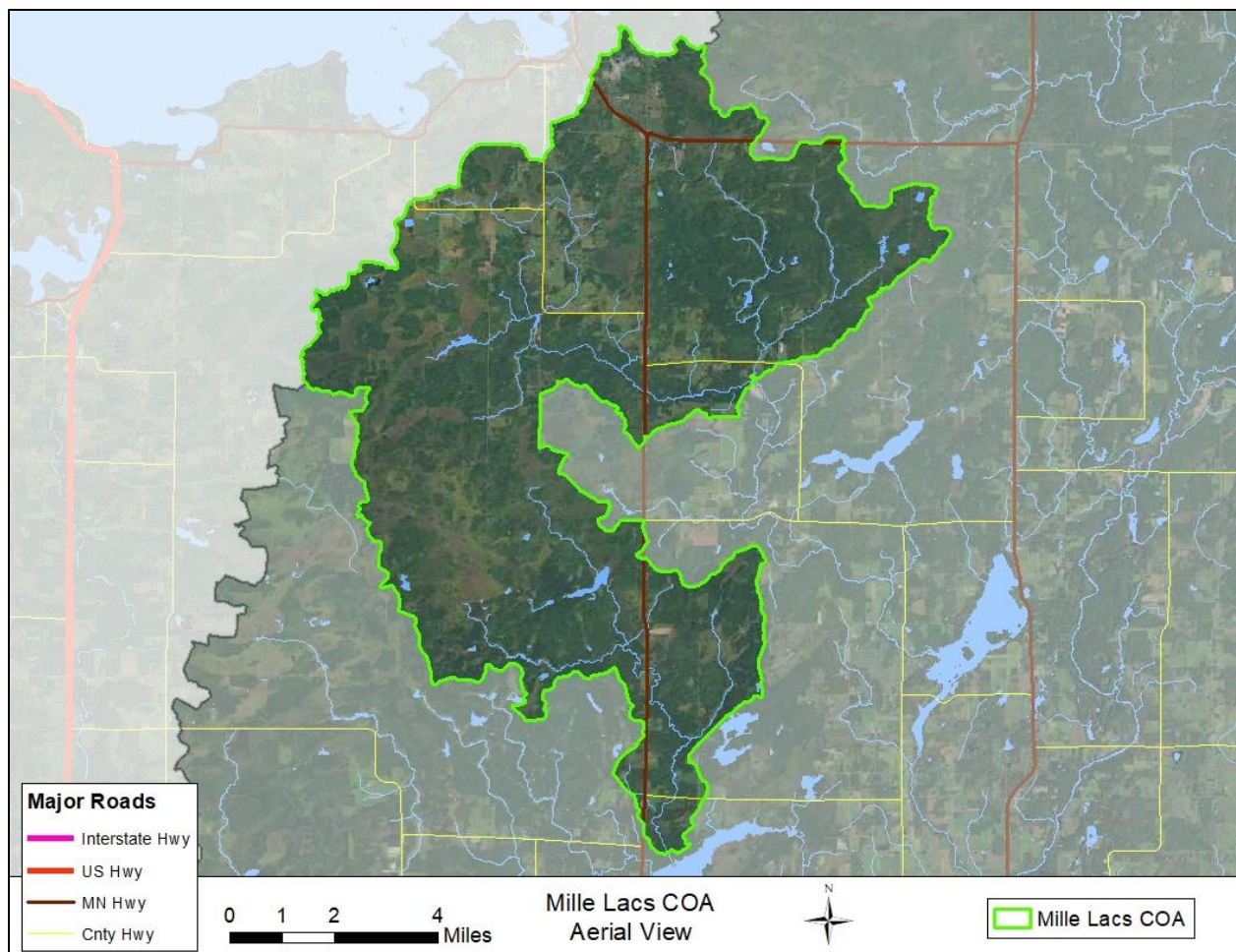


Figure 31. Mille Lacs Conservation Opportunity Area in the Snake River Watershed.

Natural Resource Assessment

Hydrology

Like the Headwaters COA, the dominant hydrological feature of the Mille Lacs COA is the extensive network of streams and wetlands. This portion of the watershed features relatively little topographic relief which is indicative of the scattered wetland communities. The Knife and Ann Rivers make their headwaters in the Mille Lacs COA.

Land Cover and Use

At the time of European settlement, 94 percent of the Headwaters COA was forested with roughly 3,000 acres of wet prairie scattered throughout (Table 17, Figure 32). This land cover pattern has remained largely unchanged today. Less than 15 percent of the COA is currently considered developed and there has been very little agriculture conversion (Figure 33). The agriculture that does exist in the Mille Lacs COA is largely hay or pasture land (83%) and primarily exists in a pocket outside Isle, MN and in a corridor along the Knife River. Both data sets highlight the mixture of forest and wetland communities in this region; major cover types are deciduous forest (58.6%), emergent herbaceous wetlands (11.8%), and woody wetlands (11.2%).

Table 17. Land Cover based on Marschner's presettlement data and the 2011 National Land Cover Data in the Mille Lacs COA.

Presettlement Land Cover		
Classification	Acres	Percent of COA
Aspen-Birch (trending to Conifers)	25,383	46%
Conifer Bogs and Swamps	12,174	22%
Mixed Hardwood and Pine (Maple, White Pine, Basswood)	8,242	15%
Mixed White Pine and Red Pine	5,497	10%
Wet Prairie	3,057	6%
Aspen-Birch (trending to hardwoods)	276	1%
White Pine	223	0%
Current Land Cover		
Classification	Acres	Percent of COA
Deciduous Forest	32,145.96	58.6%
Emergent Herbaceous Wetlands	6,446.50	11.8%
Woody Wetlands	6,116.89	11.2%
Hay/Pasture	5,344.02	9.7%
Herbaceous	1,702.09	3.1%
Developed, Open Space	1,366.03	2.5%
Cultivated Crops	1,127.16	2.1%
Open Water	241.09	0.4%
Shrub/Scrub	114.10	0.2%
Evergreen Forest	84.29	0.2%
Developed, Low Intensity	70.95	0.1%
Barren Land	64.50	0.1%
Developed, Medium Intensity	13.79	0.0%
Mixed Forest	13.34	0.0%
Developed, High Intensity	2.67	0.0%

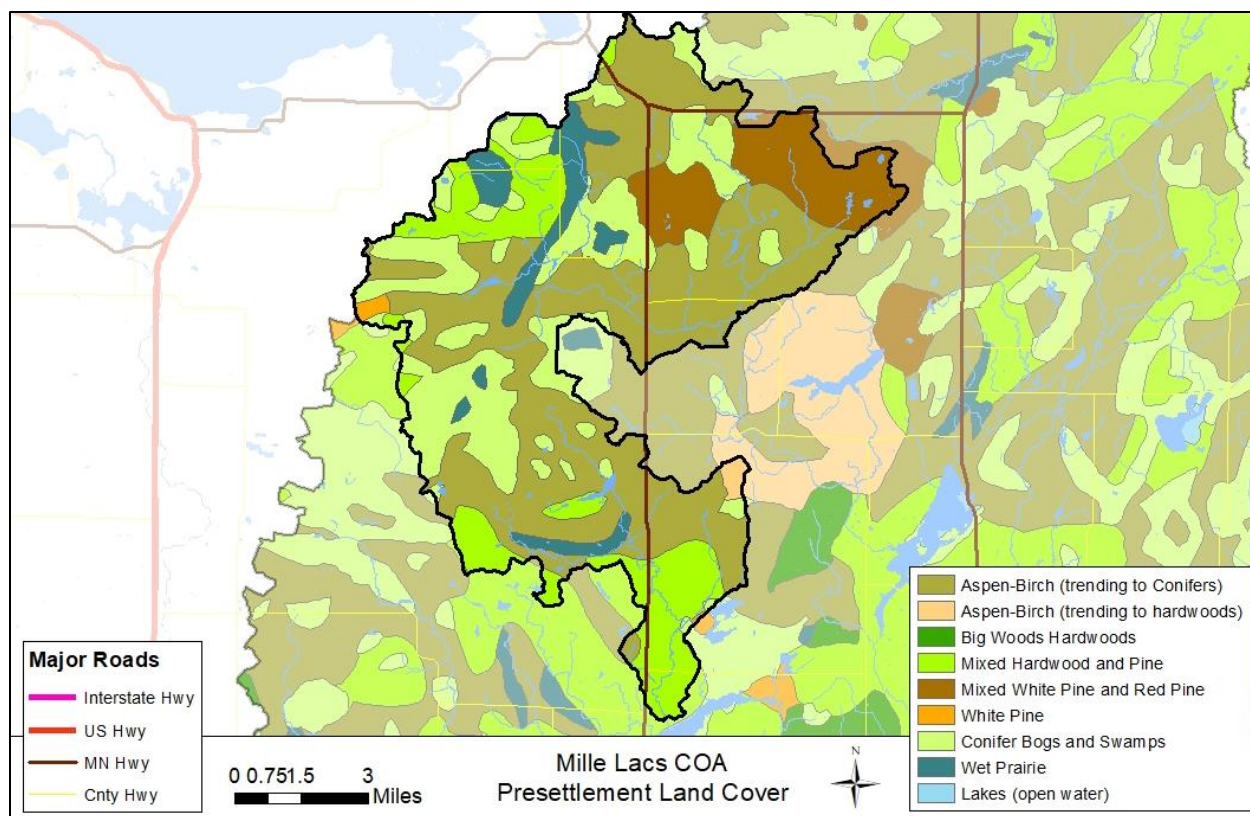


Figure 32. Presettlement land cover in the Mille Lacs COA based on the work of Francis J. Marschner.

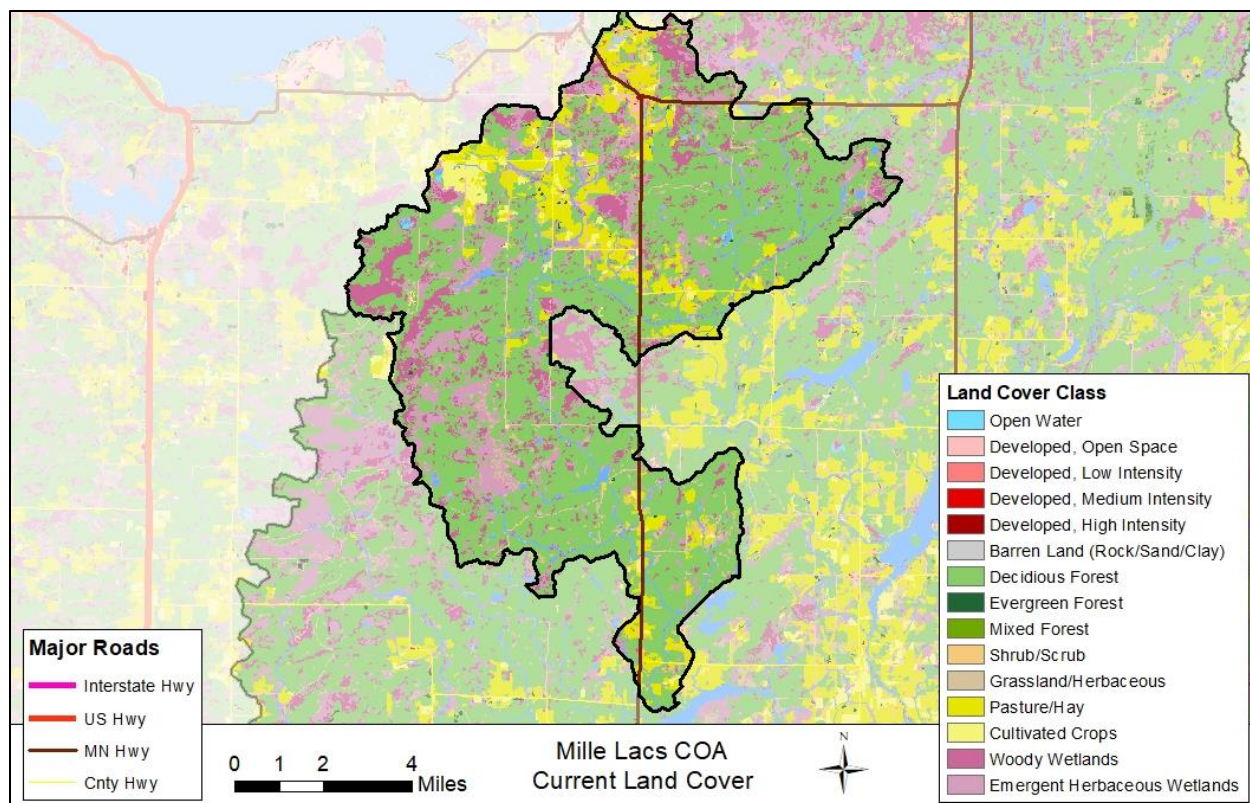


Figure 33. Current land cover in the Mille Lacs COA based on the 2011 National Land Cover Database.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 36 occurrences of rare plants and animals in the Mille Lacs COA (Table 18). Among these rare species is the state-endangered butternut (*juglans cinerea*); this tree, also known as white walnut, is at its northern extent in the Snake River valley and is currently threatened by a disease called butternut canker that is caused by an introduced fungus. This disease has killed 80-90% of wild butternuts across the eastern United States and southern Canada. In general, the rare species identified by the NHIS survey 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.



Table 18. Number of rare species and community occurrences in the Mille Lacs COA.

Organism Type	Observation
Animal Assemblage	2
Invertebrate Animal	16
Terrestrial Community	4
Vascular Plant	16
Vertebrate Animal	4
Total	42

Over 36,500 acres of the Mille Lacs COA have been assessed by the Minnesota Biological Survey as having significance to the state's biodiversity (Figure 34). Nearly forty percent, over 14,000 acres were assigned as having 'Outstanding' or 'High' biodiversity significance.

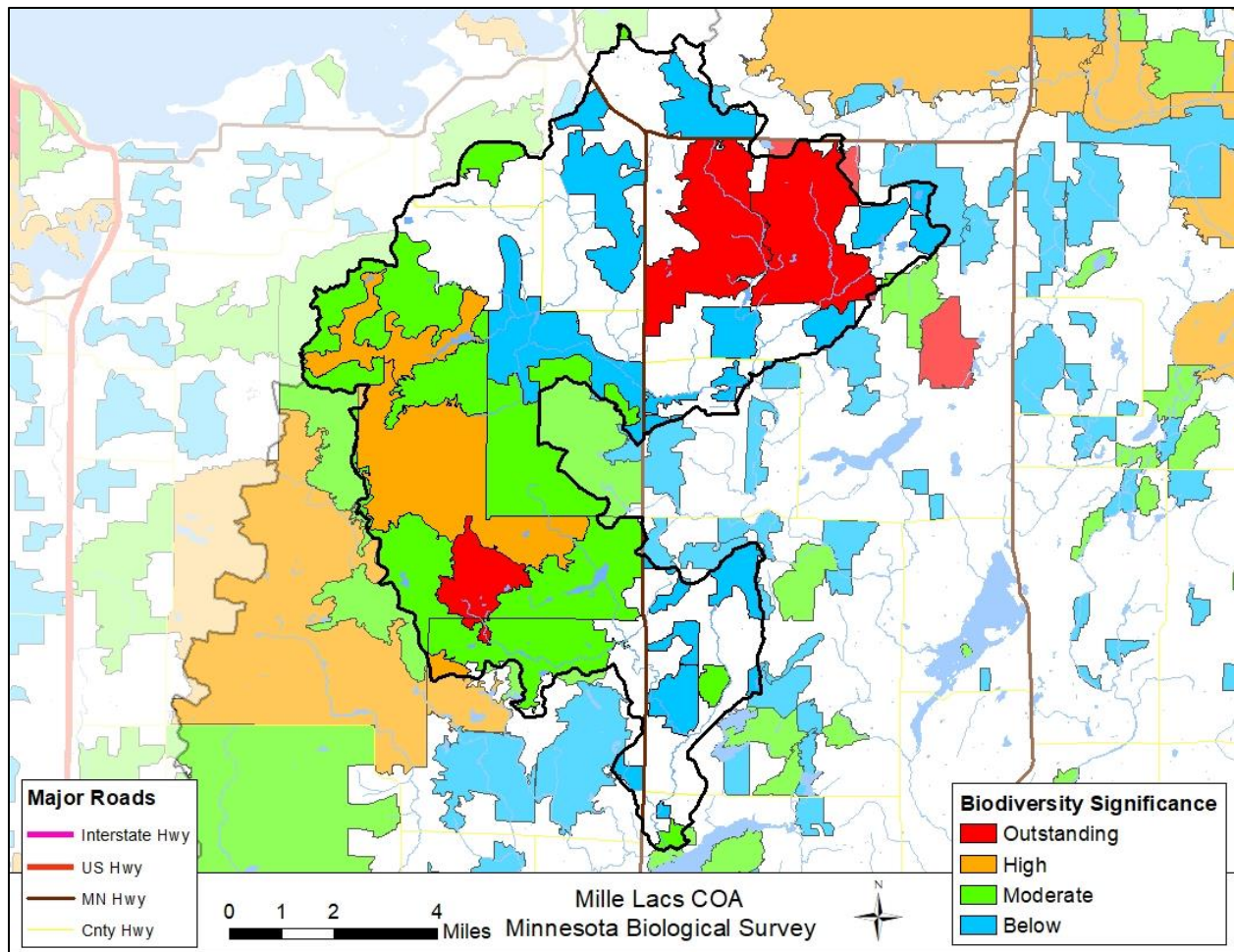


Figure 34. Areas identified by the MN Biological Survey as having biodiversity significance in the Mille Lacs COA.

Recreation

The Mille Lacs COA is lightly populated but its proximity to the Twin Cities, Lake Mille Lacs, and the Mille Lacs Wildlife Management Area make this a relatively popular destination seasonally for outdoor recreational pursuits like hunting and wildlife watching. Data was not readily available to the Planning Team on the percentage of properties owned by area residents compared to vacation destinations. However, personal experience by a few of the Planning Team members indicated that a large portion of the private parcels in this COA are owned as recreational properties by individuals living elsewhere.

Environmental Threats

This area of the watershed does not face the threats of residential and agricultural development that some of the other areas do but the wet nature of this area presents potential environmental risks associated with poorly planned or executed forest management. The forests of this area produce relatively high value products, but the wet soils will often require the implementation of frozen ground restrictions. This can impact the value of the timber sale and creates seasonal bottlenecks but in many of these mesic and wet sites it is the best way to minimize the ecological threat of rutting, soil compaction, and soil erosion. Sustainable timber management practices can

produce valuable economic products while also providing the habitat and ecosystem services of a healthy forest while unsustainable harvesting practices can seriously impair a stand's ability to do so in the future – especially in the wet and mesic soils of the Mille Lacs COA.

Land Ownership

Over 20,000 acres (37%) of the Mille Lacs COA is in public ownership (Table 19, Figure 35). Over eighty percent of this public land is managed by the MN DNR Division of Wildlife as the Mille Lacs WMA. This 38,000-acre (not all in Snake River Watershed) tract of public land includes large unbroken stretches of forest and wetland that are ideal for a variety of wildlife. Situated just 90 north of the Twin Cities, this area is heavily used by hunters, birders and others. The DNR Division of Forestry and Kanabec and Mille Lacs Counties also manage portions of the COA. The remaining 35,000 acres of private land includes a mix of rural farms and forestlands that are owned both locally and as vacation properties.

Table 19. Estimated land ownership in the Mille Lacs COA.

Ownership	Holding Type	Acres	Percent of Public	Percent of COA
Private		34,593	--	63.1%
State	Division of Forestry	2,182	10.8%	4.0%
	Mille Lacs WMA	16,532	81.6%	30.1%
County	Kanabec County	1,506	7.4%	2.7%
	Mille Lacs County	40	0.2%	0.1%

Private Forest Stewardship

To date, private forest conservation programs like the DNR [Forest Stewardship Program](#) have demonstrated relatively good success with 141 parcels representing 14,300 acres having a registered stewardship plan (Figure 35). This means that forty-one percent of the private land in the COA has a plan and that 74% of the natural habitat (includes wetlands and grasslands but excludes agriculture and developed space) is either in public ownership or is managed under a private forest stewardship plan. The 14,300 acres with registered stewardship plans represent 64 to 74% of all private forestlands depending on whether brushlands and woody wetlands are included. Thirty-nine of these owners, representing 58 parcels have also enrolled their land in the State's [Sustainable Forest Incentives Act](#) (SFIA).

As part of the planning process the Planning Team identified additional priority areas for stewardship efforts. The priority parcels were identified using an overlay of the top quartile scores for each of the COA analyses (see [Section 4](#) for methodology) on parcels over 40 acres in size not already in public ownership. Stewardship actions on all private parcels, in combination with the work done by the public land agencies, will be crucial to protecting the natural resources of the area and the priority parcels are a starting point where private land stewardship actions should have the greatest impact on regional biodiversity and water quality. There were 68 such parcels that fall at least partially within Mille Lacs COA, covering nearly 10,000 acres, with 55 unique owners listed (Figure 35). Average size among priority parcels was nearly 150 acres. Thirty-two of these priority parcels (47%), already have a Forest Stewardship Plan and 19 are enrolled in SFIA.

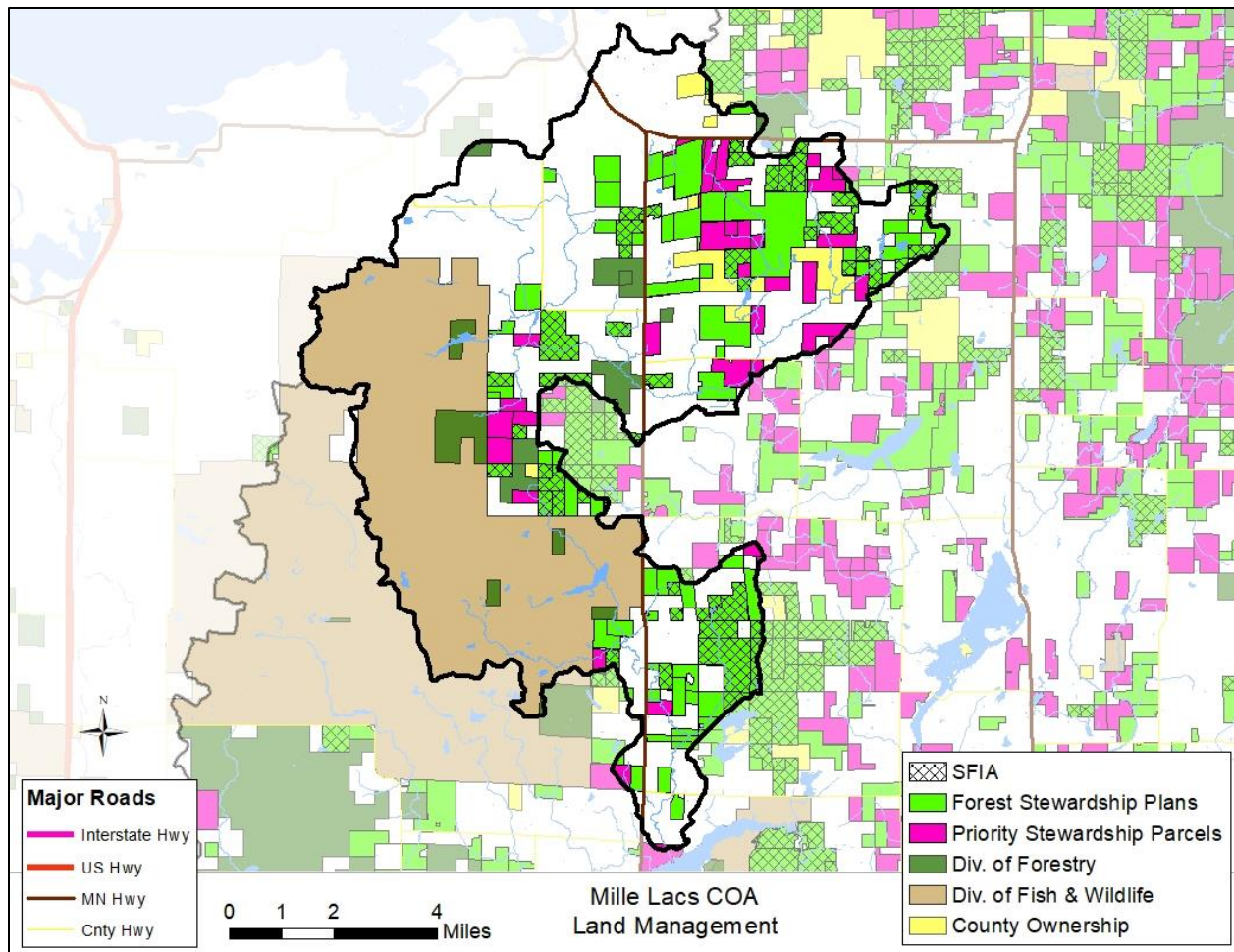


Figure 35. Public and private land in the Mille Lacs COA including private parcels with existing Forest Stewardship Plans and parcels the Planning Team identified as Priority Stewardship Parcels.

Desired Future Conditions

- Sustainably managed forest resources
- Stewardship plans support the management of private forestlands.
- Coordinated land management across ownership lines.
- Rare plants and animal habitat are protected from degradation

Stewardship Activities

There are 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.

Forest Stewardship

Aside from the hay and pasture land along the Knife River corridor, this COA is nearly entirely forested. These large, continuous stretches of forest with scattered wetland communities

represent important wildlife habitat as well as an important timber resource for the area's economy.

Stewardship Activities:

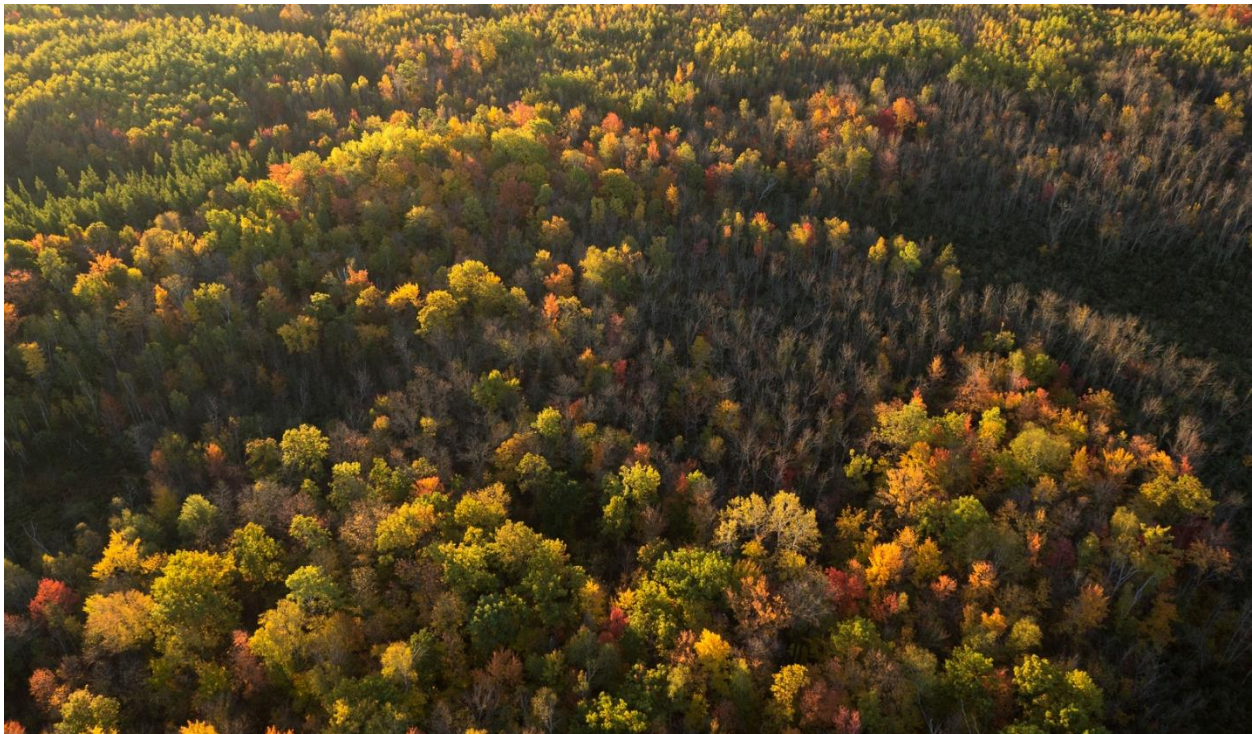
- Manage according to sustainable silvicultural and ecological principles. Public land managers have a good opportunity to demonstrate sound management practices on the Mille Lacs WMA that can be transferred to adjoining private property owners.
- Use an "All-lands" approach to forest management that considers what the neighboring landowners are doing on their land.
- Outreach to landowners about the importance of sustainably managed forestlands and work with them to prepare comprehensive forest stewardship plans
- Assist landowner in researching and applying for relevant cost-share programs

Key Stewardship Parcels

These parcels were identified based on their geographical size, areas of biodiversity significance, and proximity to public land (see methodology and parcel map 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.
- Engage with landowners that have an interest in long-term conservation action about opportunities to permanently protect these sites through conservation easements and fee acquisitions.
- Prioritize stewardship efforts affecting these parcels.



River Bend Conservation Opportunity Area

Overview

The River Bend COA encompasses over 15,000 acres in the northern part of Kanebec County. This COA is nearly entirely deciduous forest and wetlands with scattered hay or pasture lands (Figure 36). The Snake River State Forest follows the main channel of the river and this forested cover creates a valuable corridor through the region. This stretch of the Snake River features some of the regions finest paddling opportunities with a series of rapids and falls ranging from Class I-IV, depending on water levels.

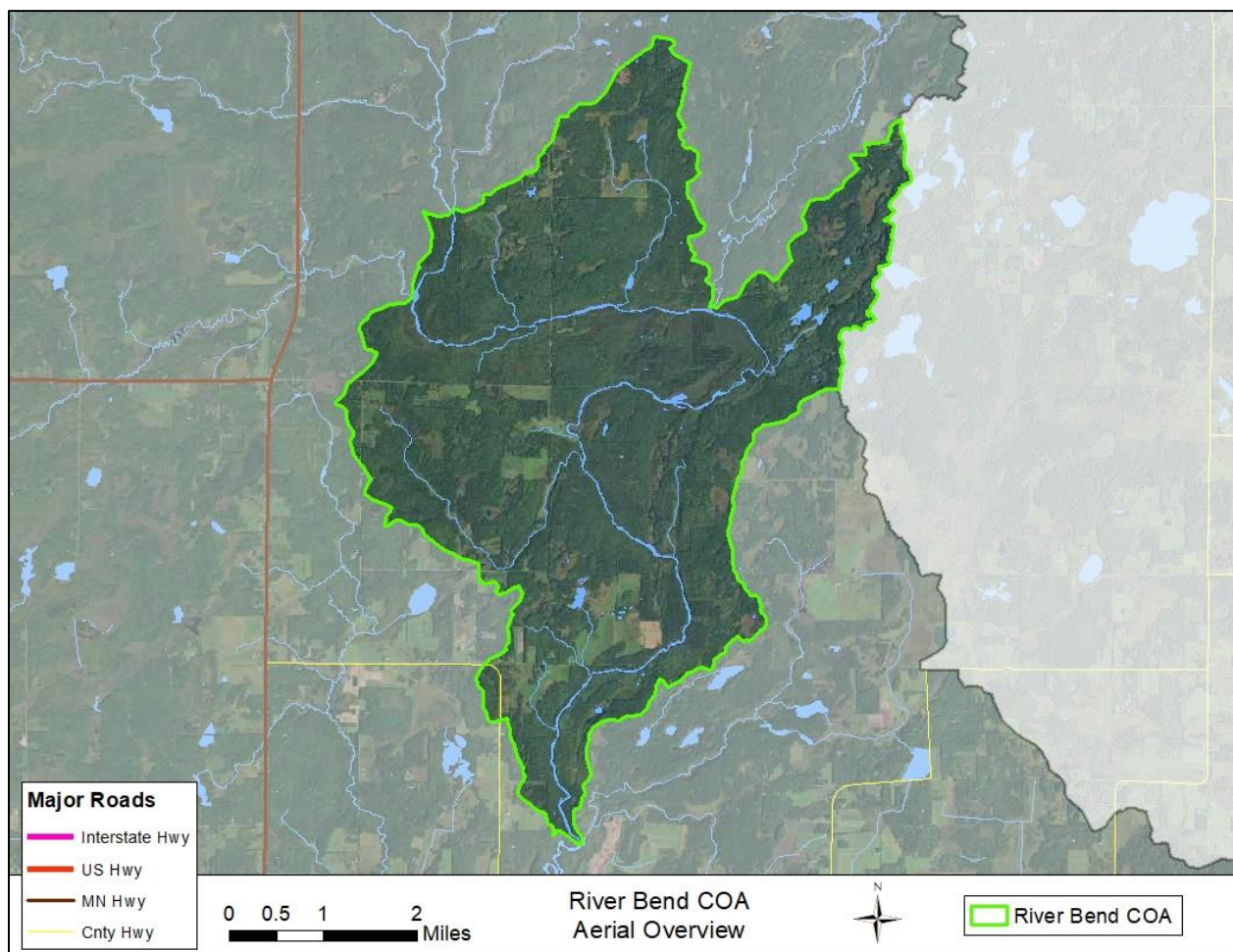


Figure 36. River Bend Conservation Opportunity Area in the Snake River Watershed.

Natural Resource Assessment

Hydrology

The dominant hydrological feature of the River Bend COA is the Upper Snake River. This portion of the watershed features a little more topographic relief than other areas (Figure 37) which is highlighted in the more uniform deciduous forest of this COA compared to the forest and wetland matrix that is more common in other parts of the watershed (Figure 39). This stretch of the Snake River also contains some more dynamic conditions with a series of rapids and falls ranging from Class I-IV, depending on water levels. There are rock remnants of an old dam built by the Bean Logging Company in the center of this COA. The dam is no longer operational, but it still holds back a three foot head of water creating a large pool above the old dam.

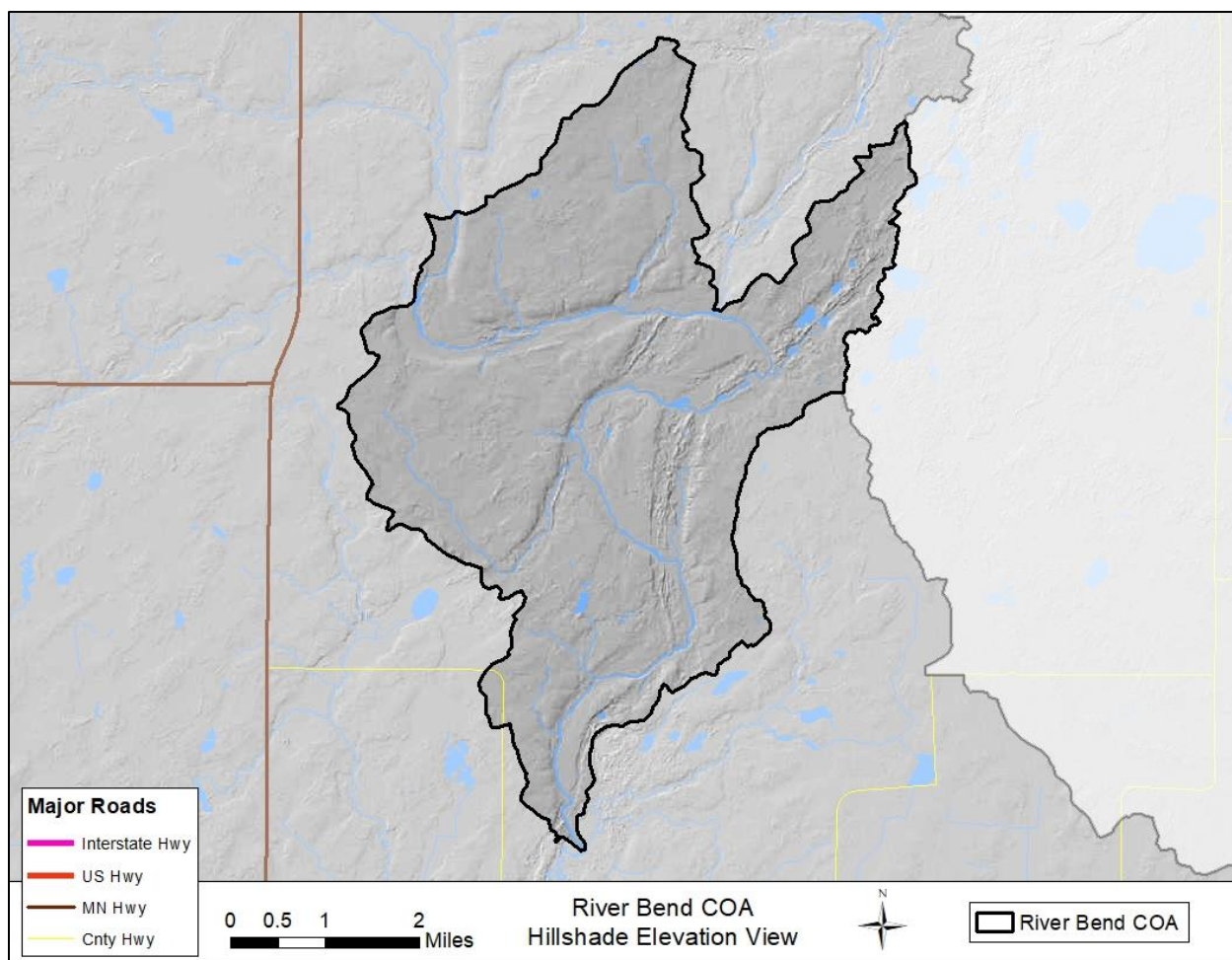


Figure 37. Hillshade topographic model of the River Bend COA.

Land Cover and Use

Nearly 100 percent of the River Bend COA was forested at the time of European settlement (Table 20, Figure 38). This land cover pattern has largely remained unchanged today except for roughly 1,100 acres or hay and pasture land in the southern part of the COA (Figure 39).

Table 20. Land Cover based on Marschner's presettlement data and the 2011 National Land Cover Data in the River Bend COA.

Presettlement Land Cover		
Classification	Acres	Percent of COA
Aspen-Birch (trending to Conifers)	7,226	48%
Mixed Hardwood and Pine (Maple, White Pine, Basswood)	5,397	36%
Conifer Bogs and Swamps	2,454	16%
Wet Prairie	29	0%
Current Land Cover		
Classification	Acres	Percent of COA
Deciduous Forest	10,261	68%
Woody Wetlands	1,494	10%
Hay/Pasture	1,110	7%
Emergent Herbaceous Wetlands	656	4%
Herbaceous	484	3%
Shrub/Scrub	399	3%
Developed, Open Space	218	1%
Open Water	183	1%
Mixed Forest	172	1%
Evergreen Forest	104	1%
Cultivated Crops	26	0%

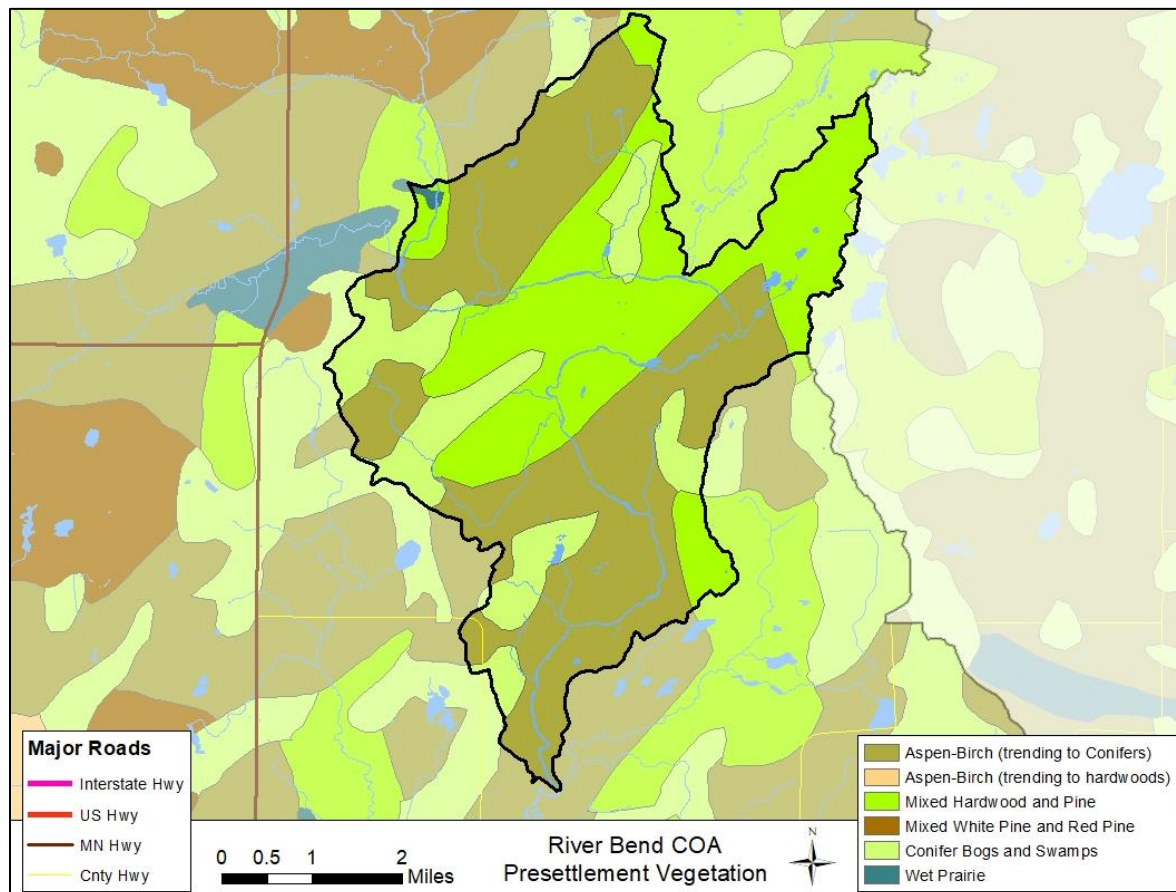


Figure 38. Presettlement land cover in the Headwaters COA based on the work of Francis J. Marschner.

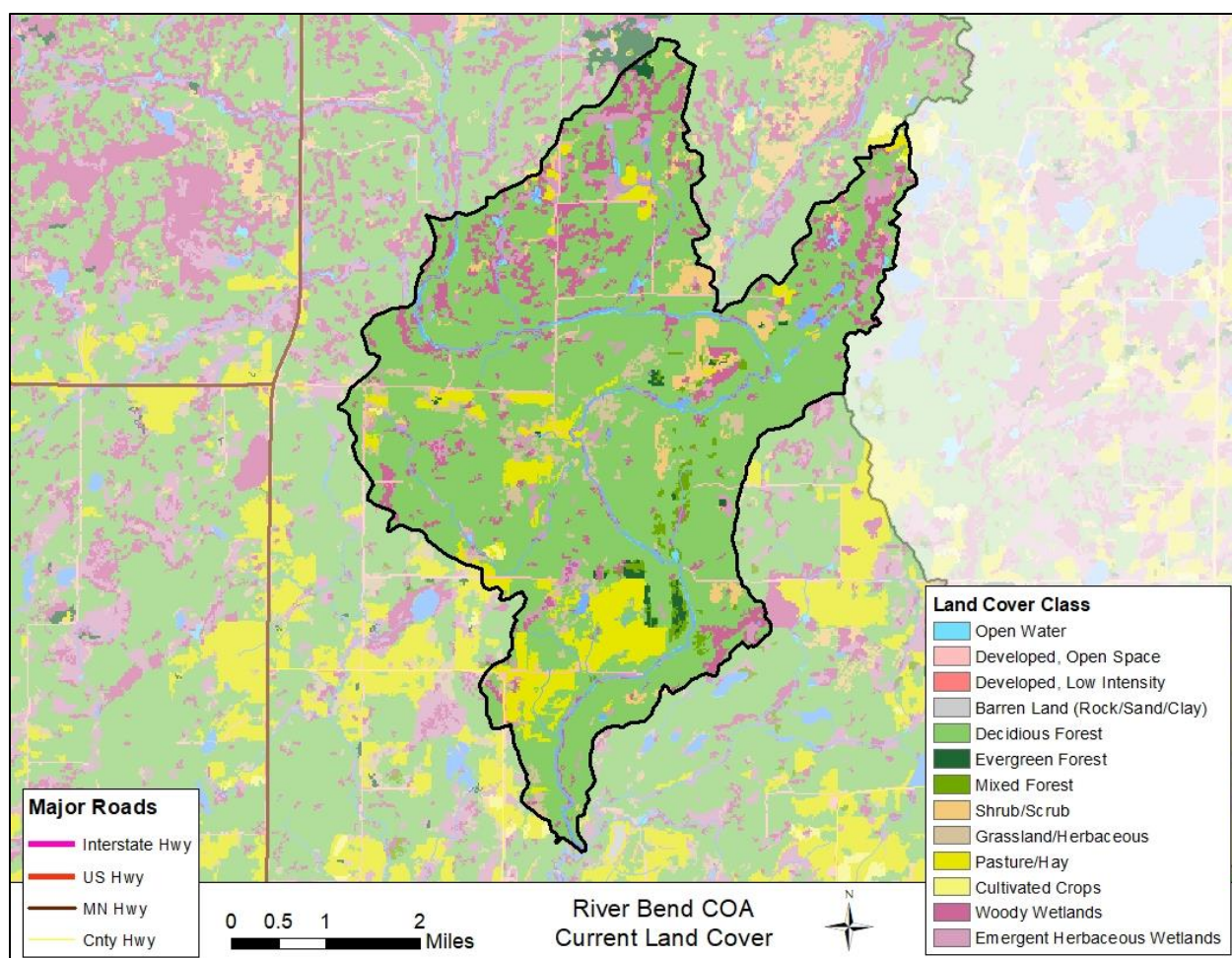


Figure 39. Current land cover in the River Bend COA based on the 2011 National Land Cover Database.

Biodiversity and Rare Species

The Natural Heritage Information System (NHIS) has recorded 39 occurrences of rare plants and animals in the River Bend COA; the majority of which are invertebrate mussels (Table 21). The River Bend COA does not have the same mussel beds found in the Lower Snake River but this area is also very important for mussel conservation in the state and represents some the best remaining habitat. In general, species identified as ‘rare’ by the NHIS are those listed as either endangered, threatened, or of special concern.

Table 21. Number of rare species and community occurrences in the River Bend COA.

Organism Type	Observation
Invertebrate Animal	30
Vascular Plant	1
Vertebrate Animal	8
TOTAL	39

Seventy percent of the River Bend COA has been assessed by the Minnesota Biological Survey as have significance to the state’s biodiversity (Figure 40). Of that area, nearly 6,400 acres was assigned as having ‘High’ biodiversity significance which highlights the importance of this COA.

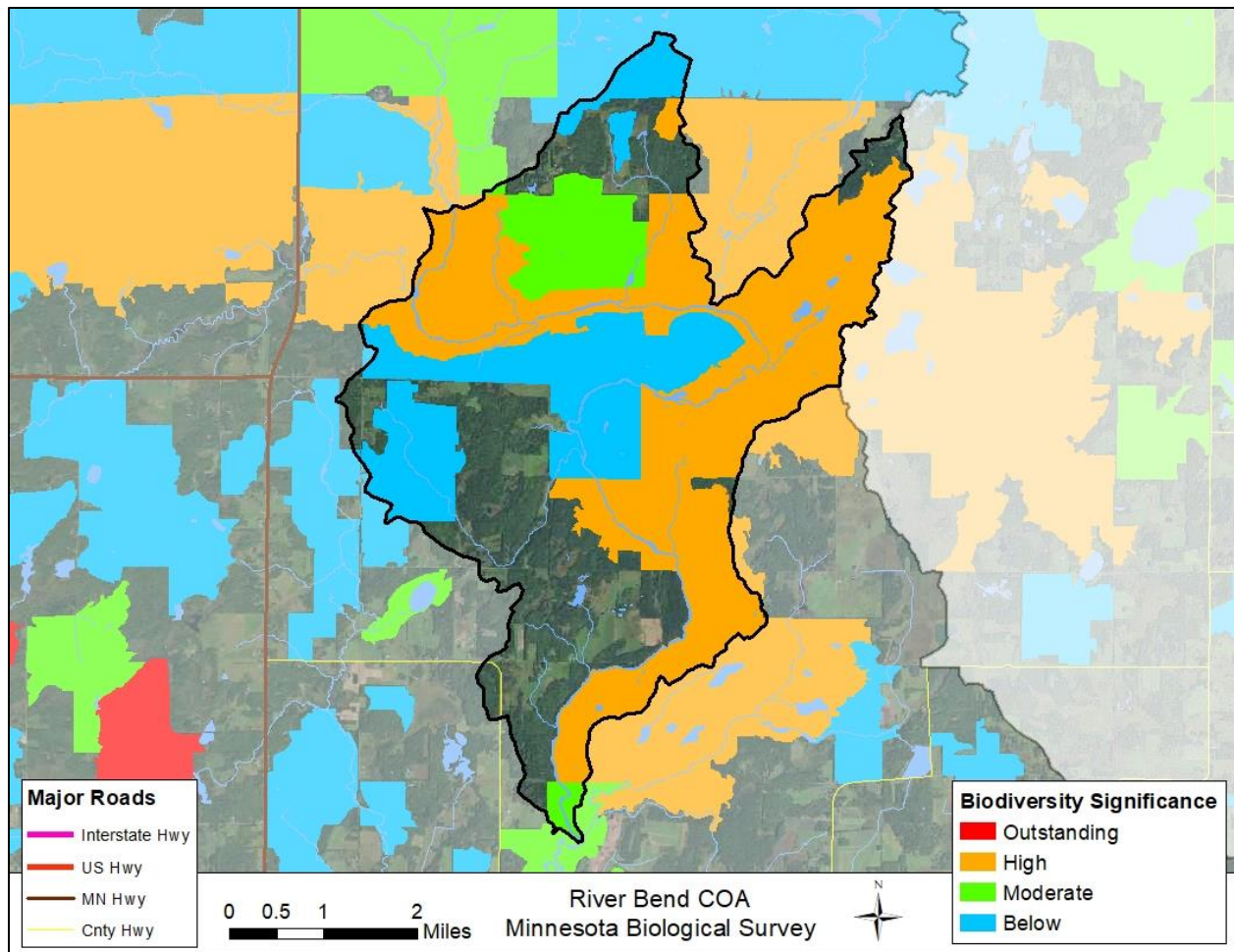


Figure 40. Areas identified by the Minnesota Biological Survey as having biodiversity significance in the River Bend COA.

Recreation

This region of the watershed is very lightly populated and contains few permanent residences. Over thirty-five percent of the watershed is owned and managed by the DNR as the Snake River State Forest or Wildlife Management Areas. These areas are seasonally popular for hunting and other forms of outdoor recreation. Additionally, this stretch of the river offers some of the region's finest paddling opportunities with a wilderness feel, spectacular scenery, and a series of exciting rapids and falls. Many of the private parcels in this COA are owned by absentee landowners who utilize the area for recreational getaways.

Environmental Threats

There is relatively little threat of large-scale residential and agricultural development in this COA but this stretch of river is remarkably undeveloped and there is the risk that further shoreline development could threaten the ecology and overall wilderness feel of this stretch. Other potential threats to the region include poorly planned or executed forest management. Care should be taken to reduce the potential for rutting, soil compaction, and soil erosion. Using sustainable timber management practices can produce valuable economic products while also providing the habitat and ecosystem services.

Land Ownership

Over 6,200 acres (41%) of the River Bend COA is in public ownership (Table 22, Figure 41). Over eighty percent of this public land is managed by the MN DNR Division of Forestry, most of which is in the Snake River State Forest. This State Forest largely follows the Snake River which means a significant portion of the riparian area is publicly managed. Kanabec County has a few parcels in the COA, including one that straddles both sides of the Snake River. Only 277 acres of this COA fall in Aitkin County but all 277 acres are managed in the public interest by the county or state land management departments.

Table 22. Estimated land ownership in the River Bend COA.

Ownership	Holding Type	Acres	Percent of Public	Percent of COA
Private		8,891	--	59%
State	Snake River State Forest	4,445	72%	29%
	Other Div. of Forestry	624	10%	4%
	Bean Dam WMA	245	4%	2%
	Lake Five WMA	39	1%	0%
County	Aitkin	127	2%	1%
	Kanabec	735	12%	5%

Private Forest Stewardship

To date, private forest conservation programs like the DNR [Forest Stewardship Program](#) have demonstrated a high degree of success with 47 parcels representing 5,280 acres having a registered stewardship plan in the COA (Figure 41). This means that that 77% of the COA is either in public ownership or is managed under a private forest stewardship plan. The 5,280 acres with registered stewardship plans represent 80 to 93% of all private forestlands in the COA depending on whether brushlands and woody wetlands are included. Thirteen of these owners, representing 16 parcels have also enrolled their land in the State's [Sustainable Forest Incentives Act](#) (SFIA).

As part of the planning process the Planning Team identified additional priority areas for stewardship efforts. The priority parcels were identified using an overlay of the top quartile scores for each of the COA analyses (see [Section 4](#) for methodology) on parcels over 40 acres in size not already in public ownership. Stewardship actions on all private parcels, in combination with the work done by the public land agencies, will be crucial to protecting the natural resources of the area and the priority parcels are a starting point where private land stewardship actions should have the greatest impact on regional biodiversity and water quality.

There were 79 such parcels that fall at least partially within Mille Lacs COA, covering over 10,000 acres, with 69 unique owners listed (Figure 41). Average size among priority parcels was 130 acres.

This methodology was used to identify high priority parcels throughout the Saint Croix Watershed, and a testament to the value of this COA, is that only 18 private parcels without an existing stewardship plan were not identified as priorities this entire COA. Many of those simply missed due to the 40-acre threshold. Further, 34 of the 79 priority parcels (42%), already have a Forest Stewardship Plan and six are enrolled in SFIA.

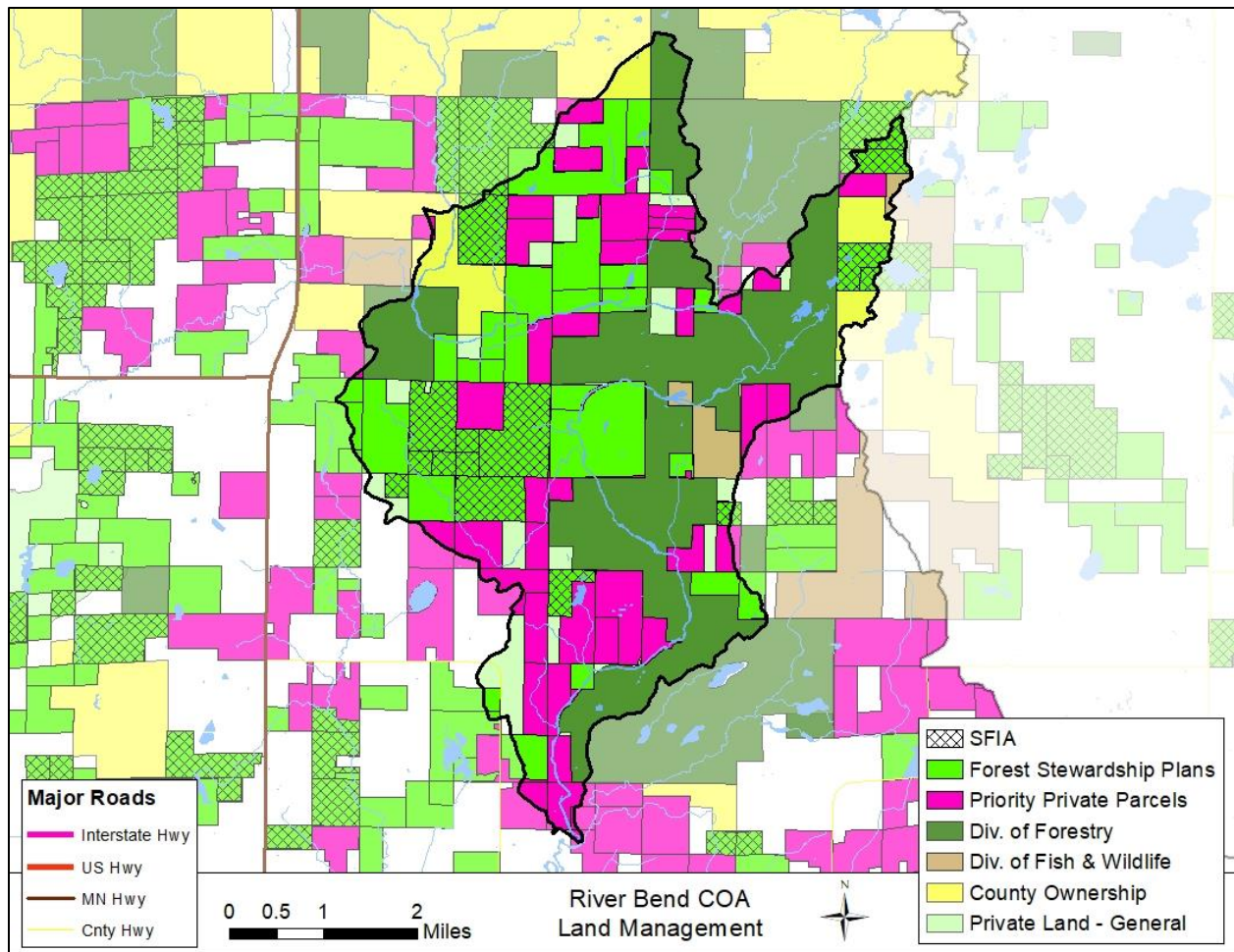


Figure 41. Public and private land in the River Bend COA including private parcels with existing Forest Stewardship Plans and parcels the Planning Team identified as Priority Stewardship Parcels.

Desired Future Conditions

- Retain forested cover and promote sustainable management of forest resources across all-lands.
- Resources are available to ensure private forestlands have, and are following, management plans
- Maintain and enhance recreational opportunities along the Snake River. Including maintaining the wild and forested nature of this river corridor.
- Rare plants and animal habitat are protected from degradation

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.

Forest Management

The River Bend COA is primarily forested and contains large tracts of continuous forest communities creating core forest habitat for a variety of species. In addition to providing quality habitat, these areas represent favorite places for recreation and scenery where the river bisects the forested blocks, making them important for the tourism industry in the region. They also provide a great benefit to water quality and the regional economy. Sustainable forestry practices will be critical to maintaining and improving these forest resources in the River Bend COA.

Stewardship Activities:

- Manage according to sustainable silvicultural and ecological principles that consider the full suite of site conditions including Native Plant Communities, past management, human and wildlife needs.
- Manage for the restoration of ecological functions and conditions within the range of natural variability.
- Outreach to landowners that do not have a comprehensive forest stewardship plan and support their involvement in the forest stewardship process
- Work with landowners who have management plans to make sure they are being implemented and meet their goals for the property
- Assist landowner in researching and applying for relevant cost-share programs.

Riparian Area Maintenance

Riparian areas are those nearest, and most connected to streams and rivers. They have an important impact on water quality, wildlife, and recreation.

Stewardship Activities:

- Evaluate the recreational use of this stretch of the river and ensure its sustainability.
- Work with any development along the river to respect private property rights but also ensure the wild nature of this stretch of river.
- 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 methodology and parcel map above). They are areas where conservation effort can be most beneficial to the overall health of the landscape. This basin wide process to identify priority parcels identified nearly all of the private land in this COA as priorities, highlighting the importance of this area to the overall 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.
- Engage with landowners that have an interest in long-term conservation action about opportunities to permanently protect these sites through conservation easements and fee acquisitions.
- Prioritize stewardship efforts affecting these parcels.

Landscape Stewardship Plan Conclusion

This Landscape Stewardship Plan for the Snake 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. This plan has laid out a vision, goals, and strategies for stewarding the Snake River Watershed and it will be up to the professionals, private landowners, and communities to remain engaged in managing, and, just as important, valuing the wild places of the region.

Beyond the completion of this plan, ongoing communication between members of the Planning Team will be crucial to the implementation and monitoring of this plan. Ongoing outreach from the professional community will be needed to help engage the variety of partners and stakeholders that will be required to achieve the vision and goals outlined in this plan.

While many actions described in this plan will need to be carried out across the watershed, a major watershed such as the Snake River is often too large an area to effectively address in a single effort. To maximize the effectiveness of our efforts, the Planning Team identified several areas within the watershed to prioritize where protection strategies are most important and will benefit multiple conservation interests.

